Columbia River Project Water Use Plan

Kinbasket and Arrow Recreation Management Plan

Boat Ramp Use Study

Implementation Year 2

Reference: CLBMON-14

Study Period: 2011

Lees + Associates

August 14, 2012

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CLBMON 14 Boat Ramp Use Study

Year 2 Progress Report
Study Period: 2011

August 14, 2012

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Citation

Lees+Associates. (2012). *CLBMON-14 Boat Ramp Use Study (CLBMON 14): 2011 (Year 2) Progress Report*. Vancouver, BC. BC Hydro, Water License Requirements.

Table 1. CLBMON 14 STATUS of OBJECTIVES, MANAGEMENT QUESTIONS and HYPOTHESES after Year 2

Objectives	Management Questions	Management Hypotheses	Year 2 (2011) Status
The objective of this study is to monitor trends in public use of boat ramp facilities where access improvements have been made as part of the Columbia River WUP, and assess the effectiveness of these projects in providing benefits to recreational interests in the area.	1) Does public use of boat ramps increase on Kinbasket and Arrow Lakes reservoirs after installation and upgrading of the WUP boat ramp facilities?	H1: The volume of public use of existing boat ramps where improvements have been undertaken increases over time following implementation of the Water Use Plan.	Year 2 results do not provide sufficient data to measure changes in volume of public use or effectiveness of new access facilities. Expecting more data in 2013.
	2) If there is an increasing use of new or improved facilities, is it due to existing users visiting more often or new users being attracted to the area?	H2: The volume of public use of new boat ramps increases with the availability of new access opportunities. H2A: The volume of public use of new boat ramps does not reduce the usage of nearby existing boat ramps negatively. H2B: The volume of public use increases due to new users being attracted.	Year 2 results do not provide sufficient data to measure changes in volume of public use or effectiveness of new access facilities. Expecting more data in 2013.
	3) Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?	H3: User satisfaction of the new and upgraded boat ramps is greater than that experienced by users of the older facilities.	Year 2 results do not provide sufficient data to measure changes in volume of public use or effectiveness of new access facilities. Expecting more data in 2013.
	4) Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?	H4: There are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket and Arrow Lakes reservoirs.	Year 2 results do not provide sufficient data to measure changes in volume of public use or effectiveness of new access facilities. Expecting more data in 2013.

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1. Executive Summary

During the Columbia River Water Use Planning (WUP) process, the Consultative Committee recognized an opportunity to improve access for water-based recreation on the Arrow Lakes and Kinbasket Reservoirs through physical improvements to existing boat ramps and the construction of new ramps (BC Hydro 2007). Since that time, BC Hydro has planned or completed boat ramp facility improvements at eight locations – six locations on the Arrow Lakes and two locations on Kinbasket Lake. The CLBMON 14 Boat Ramp Use Study was ordered by the Comptroller of Water Rights to monitor use levels and user satisfaction at the boat launch improvement sites to inform future operational decisions.

Information gained through this monitoring program will assist future decision making during the next WUP review about the effectiveness of the boat launch works and their maintenance, the value of implementing additional physical works to improve access to the reservoirs, and any potential unintended impacts associated with improved boat access.

To address CLBMON 14's management questions and supporting hypotheses (Table 1), specific parameters were measured through a combination of monitoring (traffic count and observational data collection) and interviews (on-site and online surveys). The study has a 10 year horizon (2010-2019), with sampling occurring in Years 1 – 4 inclusive, and in Year 10.

Year 2 results show there were a total of 6,138 boat launches on the Arrow Lakes at monitoring sites included in this study. A total of 3,997 visitors were encountered at Arrow sample sites in Year 2. Field staff asked 863 visitors to participate in the survey; 631 completed questionnaires were returned, which represents an overall response rate of 83.9%

On the Kinbasket Reservoir, a total of 560 boat launches were recorded at monitoring sites included in this study. A total of 221 visitors were encountered at Kinbasket sample sites in Year 2. Field staff asked 112 visitors to participate in the survey (35 of whom had already completed a questionnaire in the current sampling year); 66

completed questionnaires were returned, which represents an overall response rate of 85.7%.

Preliminary results (2010-2011) from the CLBMON 41 study indicate that proximity and convenience to other recreation facilities are the strongest motivations for visitors choosing a ramp facility. Visitors least like crowding and problems with docks and dock ramps at boat ramp facilities. Although preliminary, these results provide an indication of what might be important to consider in developing and maintaining reservoir access points.

Further data will indicate if daily distributions normalize during regular (non-construction) years, and whether increased use is due to improved ramp conditions.

The first two years have been a successful and productive start to an informative and progressive initiative. Year 2 of the Boat Ramp Use study captured further pre-improvement, and some post-improvement data, at the study sites. More data is needed in order to measure changes in volume of public use or effectiveness of new access facilities. The full implementation of the ten year study will provide much more reliable information, interpretations and conclusions on which to base future management decisions.

2. Introduction

2.1 Background

During the Columbia River Water Use planning process, the Consultative Committee (CC) recognized an opportunity to improve access for water-based recreation on the Arrow Lakes and Kinbasket Reservoirs through physical improvements to existing boat ramps and the construction of new ramps (BC Hydro 2007). Since that time, BC Hydro has initiated or planned boat ramp facility improvements[1] at eight locations – six locations on the Arrow Lakes and two locations on Kinbasket Lake, and some projects have been completed (see Table 2).

While the CC recognized the value of these projects, they also highlighted a need for a public use measurement study to monitor use levels and user satisfaction at the boat launch improvement sites to inform future operational decisions. CLBMON 14 Boat Ramp Use Study was ordered by the Comptroller of Water Rights as one of a series of monitoring programs that fulfills BC Hydro's obligations under the Columbia River Water Use Plan[2].

CLBMON 14 is a 10-year study that will establish a link between levels of use and boat access improvements. Information gained through this monitoring program will assist future decision making during the next WUP review about the effectiveness of the boat launch works and their maintenance, the value of implementing additional physical works to improve access to the reservoirs, and any potential unintended impacts associated with improved boat access. This report summarizes and synthesizes results from the 2011 (Year 2) season. Study results are presented by geographic area, *i.e.*, Arrow Lakes and Kinbasket Lake.

[1] Recreational boat access improvements may include ramp extensions, breakwaters, debris booms, docking floats, parking and other site changes.
[2] Concurrent to CLBMON 14, BC Hydro is conducting the Arrow Lakes Recreation Demand Study (CLBMON 41), a 5-year study focusing on the relationship between reservoir levels and intensity of recreational use on the Arrow Lakes. Due to significant similarities and overlaps between the two studies they have been combined into one delivery model.

2.2 Management Questions and Objectives

The key management questions addressed by this study are:

1. Does public use of boat ramps increase on Kinbasket and Arrow Lakes reservoirs after installation and upgrading of the WUP boat ramp facilities?
2. If there is an increasing use of new or improved facilities, is it due to existing users visiting more often or new users being attracted to the area?
3. Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?
4. Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?

The main objective of the study is to monitor trends in public use of boat ramp facilities where access improvements have been made as part of the Columbia River WUP, and assess the effectiveness of these projects in providing benefits to recreational interests in the area.

2.3 Management Hypotheses

Four primary management hypotheses frame this monitoring program:

"The first hypothesis is associated with evaluating whether increasing the usability of the existing ramps over a wider range of reservoir water elevations results in increased public use relative to pre-WUP conditions, at times when water levels are low. Testing of this hypothesis is informed directly by observed trends in usage obtained through ongoing monitoring of these sites.

H1: The volume of public use of existing boat ramps where improvements have been undertaken increases over time following implementation of the Water Use Plan.

The second hypothesis is associated with determining whether construction of new ramp facilities results in increased access to the reservoir, or a shift in use away from existing boat ramps because of accessibility to the area (i.e., proximity to the boat ramp) or safer launch conditions. Testing of this hypothesis is informed both directly through use data collected during the monitoring, as well as through survey questionnaires related to user characteristics and level of user satisfaction.

H2: The volume of public use of new boat ramps increases with the availability of new access opportunities.

H2A: The volume of public use of new boat ramps does not reduce the usage of nearby existing boat ramps negatively.

H2B: The volume of public use increases due to new users being attracted.

A third hypothesis addresses possible changes to the recreation experience offered to the users of the boat ramps. The simplest indicator of a quality recreation experience is user satisfaction, which is investigated as part of the survey questionnaires. Satisfaction analysis s also considers related information that is collected during the monitoring study. Other changes to the users, such as socio-demographic characteristics or reservoir recreation behaviour related variables, are also used as indicators.

H3: User satisfaction of the new and upgraded boat ramps is greater than that experienced by users of the older facilities.

Finally, satisfaction alone does not provide any insights about changes to user groups characteristics. Therefore, it is important to monitor if user characteristics change over time.

H4: There are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket and Arrow Lakes reservoirs."

(Terms of Reference, BC Hydro, 2009 p.6)

One of the key issues with the CLBMON 14 management questions and management hypotheses is the timing of improvements at each of the boat launch ramps. Ramp locations that are improved early in the study period will not have much, if any, pre-improvement data against which the post-improvement data can be compared. Conversely, ramps that are improved later in the study period (after year 4) will not have as much post-improvement data, except that gathered in year 10. This will mean that H_{2B}, H_3 *and* H_4 hypotheses may not be uniformly tested over every boat launch ramp location.

3. Methods

To address the management questions and supporting hypotheses, specific parameters are being measured through a combination of monitoring (traffic counters, spots counts and observational data collection) and interviews (on-site intercept and online surveys). The study period is over a 10 year horizon, with sampling occurring in spring, summer, and fall seasons in Years 1 – 4, inclusive, and in Year 10. Sampling intensity is higher during the summer due to the proportional increase in volume, the diversity of recreational activities during this period, and the longer season (as spring and fall on-water recreation seasons are limited by snow, cold weather and daylight hours). At the end of each sampling year, the data is summarized in an interim report format. A comprehensive report will be prepared at the conclusion of the study, including a detailed summary of the findings as they relate to the management questions and hypotheses.

This section is presented under the following headings:

- Sampling Sites;
- Traffic Data Collection;
- Observational Data Collection;
- Sampling Design;
- Survey Delivery;
- Survey Design, and
- Sampling Analyses.

3.1 Sampling Sites

The ten sampling sites included in this study (see Table 2; Figure 1, Figure 2) include those eight sites that have been approved by the Comptroller of Water Rights for access improvement work, such as the construction of new boat ramps and improvements to existing ramps, as well as two control sites.

Table 2. Locations and actions of boat ramp improvement projects[3].

Location	Upgrade Action	Status
Kinbasket Lake		
Valemount Marina	Ramp Extension, dock and breakwater	Major extension done but not fully completed.
Bush Harbour	Complete new ramp, dock and breakwater	Ramp completed. No dock or breakwater yet installed
Esplanade Bay	No upgrades planned	Control site
Arrow Lakes		
Nakusp	Replace ramp and dock	Not yet initiated
MacDonald Creek	Ramp extension, dock and breakwater	Completed
Burton	No upgrades planned	Control site
Burton South	Complete new ramp, dock and breakwater	Substantially complete
Fauquier	Ramp extension, dock and breakwater	Completed
Edgewood	Ramp extension, dock and breakwater	Not yet initiated
Anderson Point	Complete new ramp, dock and breakwater	Not yet initiated

[3] Traffic counters were installed at Esplanade Bay and Burton South boat ramps on August 24, 2011 as additional control sites. No environmental monitoring or interviews were conducted.

Figure 1. Sampling locations map – Arrow Lakes.

Figure 2. Sampling locations map – Kinbasket Lake.

3.2 Traffic Data Collection

Vehicle counters were installed year round at all sampling locations (Table 2). Vehicle counters are a reliable tool for monitoring public recreation use and have been found to be very useful in identifying use trends and patterns to better manage public access. TRAFx G3 magnetic field controlled vehicle counters were selected for use in this study, as they are the preferred and recommended traffic counter of BC Parks, Parks Canada and the US National Parks Service. They have many benefits applicable to the Boat Ramp Use Study including:

- Ideal for rural, rugged and remote roads (can be installed at roadside, above or below ground);
- Advanced microelectronic design (self-contained, without external wires or tubes);
- Can be used as a permanent or portable counter;
- Small and easy to hide — reduces theft and vandalism risk;
- Low operating, maintenance, and installation costs;
- Long battery life (approximately 1 year);
- Large memory capacity (> 400 million counts);
- Field-proven design (8 year history);
- Well suited to boat launch locations (variable speed and sensitivity to suit situation);
- Quick and effective systems support;
- Can be obtained at a local supplier;
- Less expensive than many competitors, and
- Sophisticated online data analysis and reporting software.

Vehicle counters were configured and installed at each boat access monitoring site as per the manufacturer's specifications to monitor the number of vehicles using the ramp facilities. Traffic counters remain in place year-round and will continue to collect vehicle counts in years 1-4, inclusive, and in year 10 of the study. Counters remained in-situ during construction periods for applicable boat ramps; however these periods have been excluded from the data (Table 3). Annual Traffic Counts are collected and automatically compiled by the TRAFx DataNet system for each full calendar year. This is

done to standardize the calculation and application of average daily use to missing data. The system then enables the selection of any time period across years for calculating and reporting daily, weekly and monthly counts, averages and comparisons. Further discussion of annual traffic count calculations and how the counters work can be found in Appendix A: TRAFx Vehicle Counters.

Table 3. Construction periods - Year 2.

Location	Construction Period		
Valemount	2011-04-01	to	2011-06-27
Bush Harbour	2010-04-12	to	2010-08-09
McDonald Creek	2010-05-16	to	2010-07-01
Fauquier	2010-05-31	to	2010-09-21

Note: the above dates are excluded in the current data but were not excluded in the 2010 (Year 1) report. Future reports will exclude all traffic data during construction periods.

3.2.1 Arrow Lakes Traffic Counters

Traffic counters are in place at boat access sites at Nakusp, MacDonald Creek, Burton, Fauquier, and Edgewood and Anderson Point. An additional traffic counter was installed at the new Burton south boat launch on August 24, 2011 once it was substantially complete, in order to capture post-construction data (Figure 3, Figure 4). In general, the traffic counters will remain in place at old boat ramps until the construction of new boat ramp locations is completed. The Fauquier and MacDonald Creek boat ramp and breakwater upgrades were completed in 2010. No work has yet been initiated at the Nakusp, Edgewood or Anderson Point locations.

Figure 3. Burton South under construction.

Figure 4. Burton South substantially completed with traffic counter installed.

Counter sensitivity and delay settings were configured to most accurately record traffic at each site, in order to achieve a level of accuracy that will permit conclusive answers to the hypotheses. The current settings at the Arrow Lakes sites are as follows:

Table 4. Traffic counter settings at Arrow Lakes.

Location	Mode	Period	Delay	Threshold	Rate
Nakusp	VEH_4d	000	96	16	S
MacDonald Creek	VEH_2s	000	120	16	S
Burton	VEH_2s	000	120	16	S
Burton South	VEH_2s	000	120	16	S
Fauquier	VEH_2s	000	120	16	S
Edgewood	VEH_2s	000	120	16	S
Anderson Point	VEH_2s	000	120	16	S

Notes:
Mode: Veh_2s = single lane traffic; Veh_4d = double lane traffic
Period = 000: means timestamps
Delay: 8 = 1 sec; 96 = 12 sec; 120 = 15 sec
Threshold: Range is 3-16; 16 is least sensitive[4]
Rate: S is slow (<50 km/h)

[4] Counter thresholds were adjusted to the least sensitive setting that would still trip the counter when a vehicle passes through. This also prevented the count of bicycles, and smaller metal objects.

3.2.2 Kinbasket Lake Traffic Counters

Traffic counters at the Bush Harbour and Valemount Marina boat ramps have been in place since the beginning of the study in April 2010. In August 2011, a new traffic counter was installed at Esplanade Bay, a Forest Service campground with private cottages nearby (Figure 5). Esplanade will act as a control site to compare data at improved launches with a nearby existing boat launch, and to assist in addressing Management Hypothesis H_2 (Table 1). The Esplanade Bay counter was installed on August 24, 2011 so counts are shown only from that date.

Traffic counter sensitivity and delay settings were configured to most accurately record traffic at each site. The current settings at Kinbasket Lake sites are as follows:

Table 5. Traffic counter settings at Kinbasket Lake.

Location	Mode	Period	Delay	Threshold	Rate
Bush Harbour	VEH_2s	000	120	16	S
Esplanade Bay	VEH_2s	000	120	16	S
Valemount	VEH_2s	000	120	16	S

Notes:
Mode: Veh_2s = single lane traffic; Veh_4d = double lane traffic
Period = 000: means timestamps
Delay: 8 = 1 sec; 96 = 12 sec; 120 = 15 sec
Threshold: Range is 3-16; 16 is least sensitive
Rate: S is slow (<50 km/h)

Bush Harbour had its first full year of traffic counts this season. There was still 0.5m of snow on the ground when the spring traffic counter check and battery replacement occurred on April 20, 2011 (Figure 6).

Figure 5. Traffic counter at Esplanade Bay

Figure 6. Bush Harbour April 20, 2011

Figure 7 and Figure 8. Completed ramp at Bush Harbour.

The Valemount Boat Launch received major construction upgrades this year which made it inaccessible to the public until June 28, 2011 (Figures 9 and 10). The traffic counter was able to remain in-situ while construction took place but all data during the construction phase (April 1 to June 27, 2011), has been excluded from the traffic counts.

Figure 9. Prepping the ground for construction, Valemount Boat Launch

Figure 10. Construction at Valemount 2011

3.3 Observational Data Collection

Field surveyors collected observational data about the visitors that they encountered, photographs of site conditions and natural conditions (Table 6). These observations consider information on visitors including number of people seen, gender and age range, recreational activities, and number and origin of cars in the parking lot. They also consider information on natural conditions that can affect the level and nature of boat ramp usage, such as weather and reservoir conditions such as waves, precipitation, wind, percent cloud cover, and air temperature. The observational data were assessed using standardized forms developed for this purpose (Appendix C). Definitions used to record observed weather, waves, wind, cloud cover, air and water temperatures are included in Appendix D.

Table 6. Observational data collection: variables collected each field day.

Observation	Description
Number of people seen	• This information provides an overall sense of the level of activity that day, and recording the number of people approached provides a basis for calculating a response rate for the on-site survey. • Party size was recorded where possible to compare with established Park stats[5].
Gender and age range	• Total male or female • Age range (1-10, 11-15, 16-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71+)
Activities	• Type of recreational activity observed
Number of cars in parking lot (and origin)	• The number and origin of license plates was recorded through continuous observation to provide information about the number of parties using the facilities, visitors' place of residence and rough travel distance.
Site photography	• Photographic records of sample sites to capture site conditions.
Weather*	• General descriptions to supplement individual measurements
Presence of waves*	• Wave height and formation.
Wind*	• Wind direction and an estimate of speed (Beaufort Scale).
Percent cloud cover*	• An assessment of the amount of sky/sun obscured by clouds.
Air temperature*	• Recorded in Celsius.
Water temperature*	• Recorded in Celsius.

* Note: environmental data is collected each field day at 13h00.

3.4 Sampling Design

This section outlines the sampling design including details about the methods of data collection: observational data collection, traffic counter installation, on-site survey, and online survey.

Sampling periods were designed to maximize the response to the user survey and to capture a broad selection of outdoor recreation participants.

[5] BC Parks party size data are determined by number of people in group divided by the number of groups. Averages have been developed over years of surveys.

3.4.1 Arrow Lakes Sampling Strategy

Sampling of the CLBMON 14 boat ramp sites on the Arrow Lakes was synchronized with the sampling days already scheduled for CLBMON 41 Arrow Reservoir Recreational Demand Study. Survey days at sample sites were randomly selected (Gregoire & Buhyoff, 1999). The random sample was stratified by four factors: (1) section of the Arrow Lakes; (2) season (the number of sample days in each season is proportional to the number of days in that season); (3) type of day (*i.e.*, weekends, week days, holidays); and (4) the time of day that sampling occurs (*i.e.*, morning or afternoon). Over the course of the sampling horizon, this approach provides a representative sample of visitors to boat ramp sites on the Arrow Lakes.

Data collection for the 2011 season commenced Saturday April 9, 2011 and finished Wednesday, October 19, 2011 (Tables 7-9). As a further step to ensure the representation of a wide range of respondents, surveyors were on site during randomly selected six-hour periods (8:30 am to 2:30 pm or 10:30 am to 4:30 pm). The six hour sampling period is based on successful application in previous recreational studies undertaken by the study team. An overlap of morning and afternoon periods ensures surveyors capture the higher use time over lunch hour.

Adoption of the CLBMON 41 sampling design meant that the Lower Arrow boat ramp site (Anderson Point) averaged 10 sampling days during the year while each of the Middle Arrow boat ramp sites averaged 5 sampling days during the year.

Boat ramp sites included in the CLBMON 14 study are highlighted in the following tables in **bold**:

Table 7. Spring 2011 sampling locations and dates - Arrow Lakes.

Date	Upper Arrow Lakes	Middle Arrow Lakes	Lower Arrow Lakes
Saturday April 9	Shelter Bay	**MacDonald Creek Park**	**Anderson Point**
Monday April 11	Revelstoke Boat Launch	**Burton Historic Park**	Syringa Boat Launch
Saturday April 16	Eagle Bay	**Edgewood Park**	**Anderson Point**
Tuesday April 19	Revelstoke Boat Launch	Nakusp Beach	**Anderson Point**
Friday April 22	Shelter Bay	**Nakusp Boat Launch**	Syringa Boat Launch
Wednesday May 4	Eagle Bay	**Edgewood Park**	**Anderson Point**
Tuesday May 10	Revelstoke Boat Launch	**Fauquier Boat Launch**	**Anderson Point**

Table 8. Summer 2011 sampling locations and dates - Arrow Lakes.

Date	Upper Arrow Lakes	Middle Arrow Lakes	Lower Arrow Lakes
Saturday June 4	Revelstoke Boat Launch	**Nakusp Boat Launch**	Syringa Creek Day Use
Sunday June 12	Shelter Bay	**Fauquier Boat Launch**	Syringa Boat Launch
Tuesday June 14	Eagle Bay	**Nakusp Boat Launch**	Syringa Boat Launch
Friday July 1	Revelstoke Boat Launch	**Edgewood Park**	**Anderson Point**
Thursday July 7	Shelter Bay	**Edgewood Park**	Syringa Boat Launch
Saturday July 9	Eagle Bay	Nakusp Beach	Syringa Creek Day Use
Saturday July 23	Revelstoke Boat Launch	**Edgewood Park**	Syringa Boat Launch
Friday July 29	Shelter Bay	**MacDonald Creek Park**	**Anderson Point**
Tuesday August 2	Revelstoke Boat Launch	**Fauquier Boat Launch**	Syringa Creek Day Use
Friday August 5	Shelter Bay	**Nakusp Boat Launch**	Syringa Boat Launch
Monday August 8	Eagle Bay	**Burton Historic Park**	Syringa Creek Day Use
Monday August 15	Revelstoke Boat Launch	**MacDonald Creek Park**	Syringa Boat Launch
Saturday August 27	Eagle Bay	Nakusp Beach	**Anderson Point**
Sunday September 4	Shelter Bay	**Fauquier Boat Launch**	Syringa Creek Day Use
Monday September 5	Eagle Bay	**Burton Historic Park**	**Anderson Point**
Sunday September 11	Revelstoke Boat Launch	**MacDonald Creek Park**	**Anderson Point**
Thurs September 22	Eagle Bay	**Burton Historic Park**	Syringa Creek Day Use
Sunday September 25	Shelter Bay	Nakusp Beach	**Anderson Point**

Table 9.Fall 2011 sampling locations and dates - Arrow Lakes.

Date	Upper Arrow Lakes	Middle Arrow Lakes	Lower Arrow Lakes
Sunday October 9	Revelstoke Boat Launch	**Nakusp Boat Launch**	**Anderson Point**
Monday October 10	Shelter Bay	**Fauquier Boat Launch**	Syringa Boat Launch
Wednesday October 12	Shelter Bay	**Edgewood Park**	Syringa Boat Launch
Saturday October 15	Eagle Bay	**MacDonald Creek Park**	**Anderson Point**
Wednesday October 19	Eagle Bay	**Burton Historic Park**	Syringa Creek Day Use

3.4.2 Kinbasket Sampling Strategy

The sampling strategy adopted for Kinbasket Lake provides that survey days at sample sites were randomly selected (Gregoire & Buhyoff, 1999). The random sample was stratified by three factors: (1) season (the number of sample days in each season is proportional to the number of days in that season); (2) type of day (*i.e.*, weekends, week days, holidays), and (3) the time of day that sampling occurs (*i.e.*, morning or afternoon).

During 2011, each sample site on Kinbasket Lake was sampled eight times. Data collection for the 2011 season commenced Monday May 30, 2011 and finished Saturday, October 29, 2011 (Table 10). As a further step to ensure the representation of a wide range of respondents, surveyors were on site during randomly selected six-hour periods (8:00 am to 2:00 pm or 1:00 pm to 7:00 pm).

Table 10. 2011 sampling locations and dates - Kinbasket Lake.

Date	Location	
Spring Season		
None due to snow and water levels.		
Summer Season		
Monday May 30	Valemount Marina	Bush Harbour
Friday July 1	Valemount Marina	Bush Harbour
Thursday July 28	Valemount Marina	Bush Harbour
Sunday August 7	Valemount Marina	Bush Harbour
Thursday August 11	Valemount Marina	Bush Harbour
Saturday September 3	Valemount Marina	Bush Harbour
Thursday September 22	Valemount Marina	Bush Harbour
Fall Season		
Saturday October 29	Valemount Marina	Bush Harbour

3.5 Survey Delivery

The visitor survey is designed to be delivered in two formats over the course of this project: (1) an on-site survey, administered to visitors at sample sites; and (2) an online survey, administered to regional residents to capture a broader range of attitudes and opinions about boat ramp use (or non-use) on the Arrow and Kinbasket Lakes.

3.5.1 On-site Survey

All parties at a sample site were approached for inclusion in this study. People were approached *after* using a boat ramp facility so that their responses would be based on their use of the facilities that day. A representative from each party was asked to participate in the survey; however, if other members of the party wished to participate they were welcomed to do so. Respondents completed the questionnaires on-site. The number of people approached for inclusion in the study was recorded to permit the calculation of response rate. Number of parties and total number of people on site was also recorded. People who refused to participate were thanked for their time and were not engaged further. A standard introduction statement was made to all prospective

participants that summarized the cover letter that accompanied the questionnaire. If asked what the surveys would be used for, people were told that the information would be used to inform the development of strategies to guide the management of water flows and recreational access points on the Arrow and Kinbasket Lakes. Contact information for the project team was provided in the event that anyone had questions or concerns about the project.

3.5.2 Online Survey

In addition to the on-site survey, information about the use (or non-use) of the Kinbasket and Arrow Lakes (and reasons for non-use) was assessed through on online survey. This sample was a convenience sample that was solicited through local media such as local newspapers, television, and radio (see Appendix E). This self-selected sample was invited to participate in the online survey in order to capture a broader range of attitudes and opinions about boat ramp use (or non-use) on the Kinbasket and Arrow Lakes.

The online version of the survey was also available for on-site visitors that preferred to provide their information online. The online survey is identical to the on-site survey and is available at www.arrow-kinbasket-recreation-survey.ca.

3.6 Survey Design

Questions that specifically address the usage of boat ramp facilities were added to the visitor questionnaire already in use for the Arrow Reservoir Recreational Demand Study (CLBMON 41). By combining questions onto one questionnaire the need for multiple interviews and the potential for survey fatigue was minimized.

The Visitor Survey questionnaire was developed using the principles of the *Tailored Design Method*. This method identifies procedures to maximize survey return rates and minimize survey error (Salant & Dillman, 1994; Dillman, 2000), including questionnaire layout considerations. The questionnaire was designed to ensure a logical flow of the questions, and that the wording of the questions and instructions to the respondents be clear and as brief as possible. A key requirement of the questionnaire was that it be

suitable for repeated delivery at multiple locations in order that a better understanding of recreation and boat ramp use on the Kinbasket and Arrow Lakes be identified.

Prior to the beginning of the Boat Ramp Use Study, drafts of the additional survey questions specific to boat ramp use were circulated in order to promote discussion around question ordering, question wording, answer options, and/or question instructions. Reviewers included the ELAC team, the BC Hydro team, and members of the *Collaborative for Advanced Landscape Planning* at the *University of British Columbia*. The resulting final questionnaire includes four questions pertaining specifically to boat ramp usage, in Section 6. The other sections remain the same. The questionnaire has retained the same format – a four-page booklet (two 8.5" by 11" sheets printed on both sides, stapled in the top left corner) that comprehensively measures people's use of, and attitudes about, recreation on the Kinbasket and Arrow Lakes. A distinct version of the questionnaire was used for Kinbasket sampling and Arrow Lakes sampling to avoid confusion about which lake users were being asked about (Appendix B – Visitor Survey).

The questions permitted the isolation of variables to characterize boat ramp use on the Kinbasket and Arrow Lakes. Recreationists are not a homogeneous group (Bryan, 1977; Manning, 1999; Salz *et al*., 2001; Rollins & Robinson, 2002), as participants differ in their values, the activities that they pursue, preferred settings, desired experiences, and motivations for participating (Choi *et al*., 1994); however, the variation among preferences, attitudes, and behaviours can be explained by the recreation specialization framework (Bryan, 1977; McFarlane *et al*., 1998). Understanding the desires and needs of recreationists is important for the management of recreational access points (McFarlane, 1994). As the recreation specialization framework can provide a basis for the differentiation of recreationists holding various goals, preferences, and behaviors (McFarlane, 2001), it was used to frame the collection of recreation data, as it provides a coherent and comprehensive approach, which can violate statistical assumptions about independent samples (Jackson, 1986). These

measurement protocols follow standard practices and are appropriate for a project of this type. The questionnaire was composed of seven sections:

Section 1: Arrow/Kinbasket Lakes Outdoor Recreation Activities.

Section 2: Important Outdoor Recreation Activities.

Section 3: Arrow/Kinbasket Lakes Outdoor Recreation Experiences.

Section 4: Use and Familiarity of Arrow/Kinbasket Lakes.

Section 5: Arrow/Kinbasket Lakes Outdoor Recreation Management.

Section 6: Arrow/Kinbasket Lakes Outdoor Recreation Experiences.

Section 7: Demographics.

Given that visitor satisfaction is multidimensional, data collection in this study takes advantage of the different elements of this study (*i.e.*, traffic counter and observational data and questionnaire-elicited data). Table 11 illustrates the links between the specific monitoring parameters and the management hypotheses.

Table 11. Relationship of monitoring components to management hypotheses.

Management Hypothesis	Related Data or Questionnaire Subsection
H_1: The volume of public use of existing boat ramps where improvements have been undertaken increases over time following implementation of the Water Use Plan.	Traffic Counters and Observational Data
H_2: The volume of public use of new boat ramps increases with the availability of new access opportunities. H_{2A}: The volume of public use of new boat ramps does not reduce the usage of nearby existing boat ramps negatively. H_{2B}: The volume of public use increases due to new users being attracted.	Traffic Counters and Observational Data Section 1: Outdoor Recreation Activities Section 2: Important Outdoor Recreation Activities
H_3: User satisfaction of the new and upgraded boat ramps is greater than that experienced by users of the older facilities.	Section 3: Outdoor Recreation Experiences Section 4: Use and Familiarity Section 5: Arrow Lakes Outdoor Recreation Management Section 6: Outdoor Recreation Experiences
H_4: There are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket and Arrow Lakes.	Section 7: Demographics

The following sections demonstrate how the data captured by the questionnaire will further inform the management questions being examined in CLBMON 14, and how the questions address the theoretical framework of the study. Figure illustrations are taken from the Arrow Lakes version of the questionnaire.

3.6.1 Section 1: Outdoor Recreation Activities

The questions in this section (Figure 11) ask about the recreation activities done on the water or onshore of the reservoir. The questions provide an assessment of the different activities that each respondent engages in. This can help to inform the

likelihood of visitors substituting activities *vs*. opportunities (*i.e.*, location) if satisfaction is not achieved. These questions address H_2 by measuring the frequency of use by season.

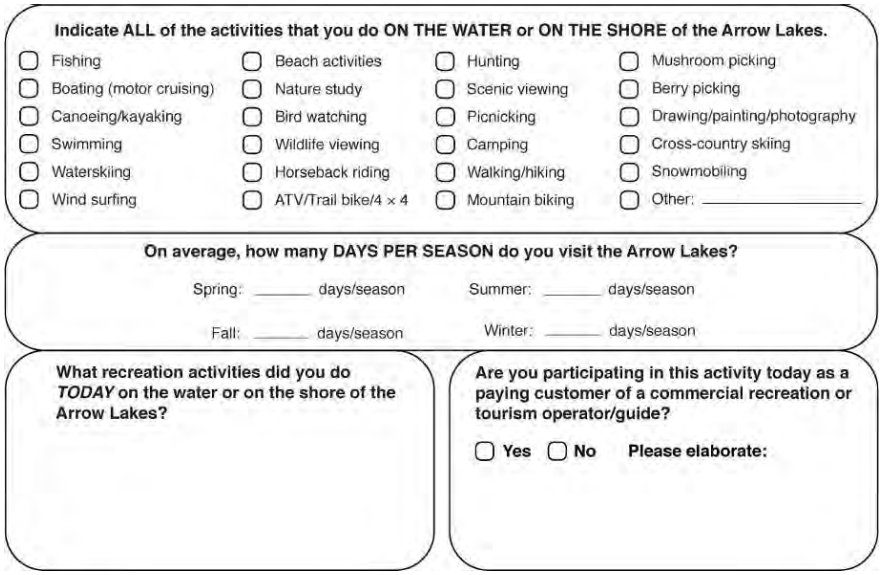
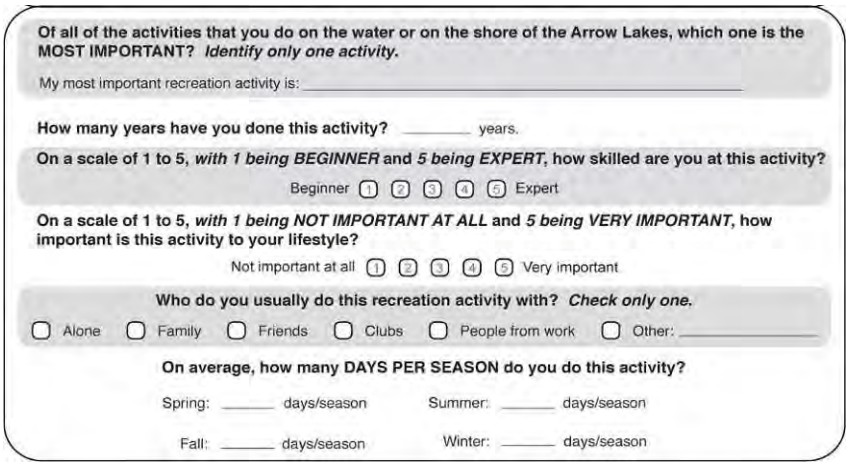


Figure 11. Section 1 questions.

3.6.2 Section 2: Important Outdoor Recreation Activities

Section 2 asks about respondents' most important outdoor recreation activities (Figure 12). These questions inform H_2 by providing information about the type of user, their degree of specialization and how long they have been engaged in an activity.



Of all of the activities that you do on the water or on the shore of the Arrow Lakes, which one is the MOST IMPORTANT? ***Identify only one activity.***

My most important recreation activity is: _____

How many years have you done this activity? _____ years.

On a scale of 1 to 5, ***with 1 being BEGINNER*** **and** ***5 being EXPERT*****, how skilled are you at this activity?**

Beginner (1) (2) (3) (4) (5) Expert

On a scale of 1 to 5, ***with 1 being NOT IMPORTANT AT ALL*** **and** ***5 being VERY IMPORTANT*****, how important is this activity to your lifestyle?**

Not important at all (1) (2) (3) (4) (5) Very important

Who do you usually do this recreation activity with? ***Check only one.***

☐ Alone ☐ Family ☐ Friends ☐ Clubs ☐ People from work ☐ Other: _____

On average, how many DAYS PER SEASON do you do this activity?

Spring: _____ days/season Summer: _____ days/season

Fall: _____ days/season Winter: _____ days/season

Figure 12. Section 2 questions.

3.6.3 Section 3: Outdoor Recreation Experiences.

This section has two parts. The first part (Figure 13) asks about some of the experiences that respondents may have had while visiting the reservoir for recreation activities. These two questions provide information about social settings by eliciting individual's encounter norms to provide an assessment of crowding (Manning, 1999; Vaske & Donnelly, 2002).

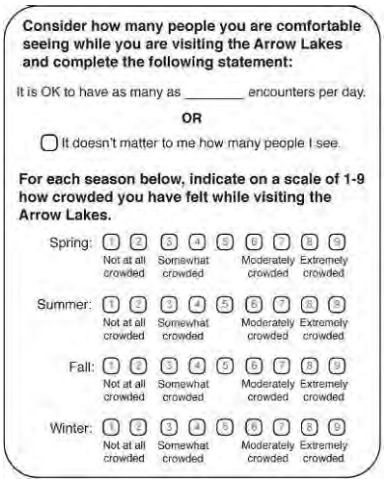


Figure 13. Section 3 questions, part 1.

The second part addresses recreation conflicts (Figure 14). Recreation conflict occurs when the presence, behaviour, or values of an individual or group interferes with another individual or group (Vaske, *et al.*, 2007). This question provides information about the social setting by asking whether individuals have encountered any conflicts with other recreation visitors.

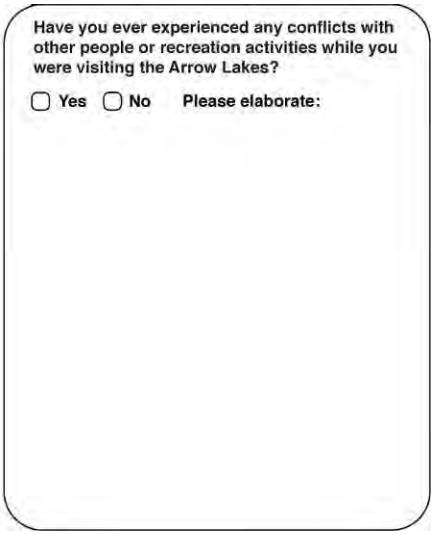


Figure 14. Section 3 questions, part 2.

3.6.4 Section 4: Use and Familiarity of Arrow Lakes/Kinbasket Lake.

This section includes two questions. The first question (Figure 15) asks about respondents' use of, and familiarity with, the reservoir. People can have multiple motivations for engaging in recreation activities, which may include enjoyment from the activity itself, socialization, as well as other benefits (Driver *et al.*, 1991). An understanding of people's motivations for pursuing recreation activities on the Arrow and Kinbasket Lakes helps to inform the attitudes and preferences element of the *subjective evaluation* component of statisfaction in addressing H_3.

Figure 15. Section 4 questions, part 1.

The second question (Figure 16) addresses respondents' knowledge about the management goals of the Arrow and Kinbasket Lakes. People engage in outdoor recreation activities with the expectation that this engagement will fulfill particular needs, motivations, or other desires (Fishbein & Ajzen, 1975; Manning, 1999). Understanding individual's expectations informs their recreation satisfaction. If people are not aware of the management goals for the Arrow and Kinbasket Lakes, their expectations may not be realistic, and their satisfaction affected.

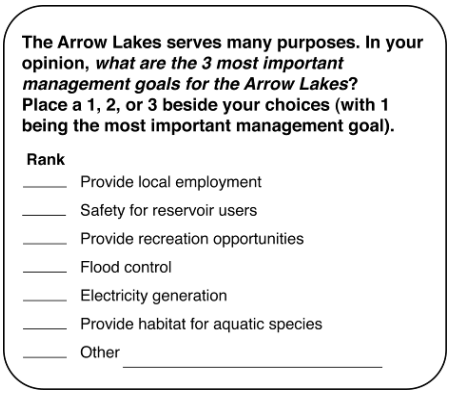


Figure 16. Section 4 questions, part 2.

3.6.5 Section 5: Outdoor Recreation Management.

This section has two parts. The first part of this section (Figure 17) asks about how respondents feel about the management of recreation on the reservoir. Although there are not any standardized measures of visitor satisfaction, a common approach is to gauge overall satisfaction through the use of multiple-item measures of satisfaction that are context specific (Manning, 1999). This question provides an overall assessment of visitor satisfaction, which will be used to test H_3.

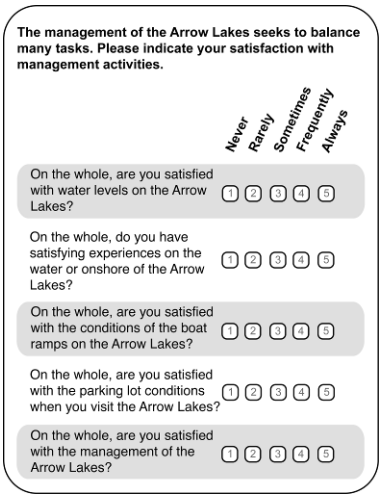


Figure 17. Section 5 questions, part 1.

The second part of this section (Figure 18) addresses H_3 as it explicitly asks whether respondents will return based on the water levels that they have experienced. This question informs the conceptual model of satisfaction by examining the link between Resource Setting and likelihood of returning (*i.e.*, achieved satisfaction).

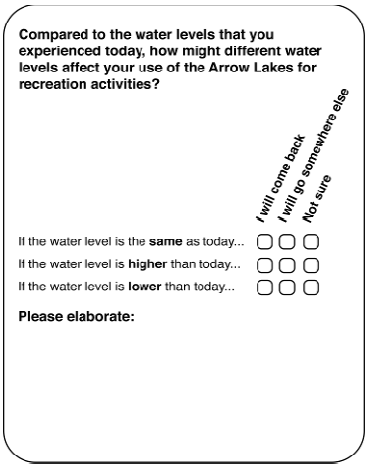


Figure 18. Section 5 questions, part 2.

3.6.6 Section 6: Arrow Lakes Outdoor Recreation Experiences.

This section has three parts (Figure 19) which ask about respondents' recreation experiences on the reservoir. The first part of this section establishes respondents' familiarity with the reservoir by asking about the length of time that they have used the area for outdoor recreation. The degree of familiarity influences visitors' expectations, which has an effect on their degree of satisfaction.

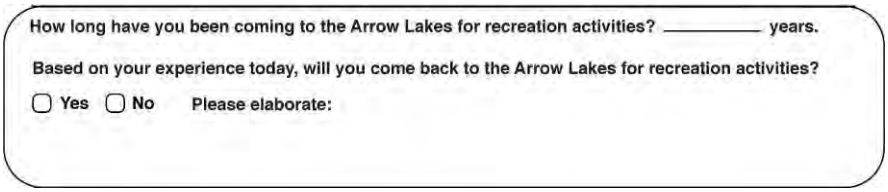


Figure 19. Section 6 questions, part 1.

The second part includes 4 questions related to respondents' experience while using boat ramp facilities (Figure 20). These questions address H_3 by asking about people's motivations, and their degree of satisfaction.

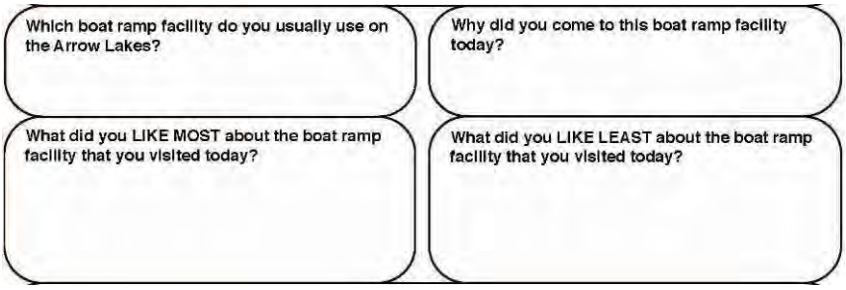


Figure 20. Section 6, part 2, questions pertaining to boat ramp use.

Respondents are also asked where they first heard about recreation opportunities near and on the reservoir (Figure 21).

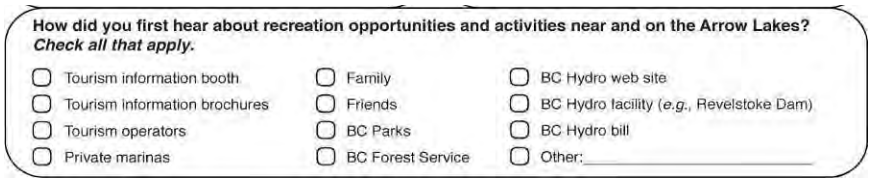


Figure 21. Section 6 questions, part 3.

Section 7: Demograhics.

Section 7 (Figure 22) collects basic information about respondents' demographic characteristics. These questions provide explicit information about individuals' place of residence, which informs the user classification as either resident or tourist (*i.e.,* travelled more than 80km (Murphy, 1991)). They also provide information about user socioeconomic characteristics, which addresses H_4. This question provides data about socioeconomic characteristics, which addresses the *subjective evaluation* component of the conceptual model of satisfaction.

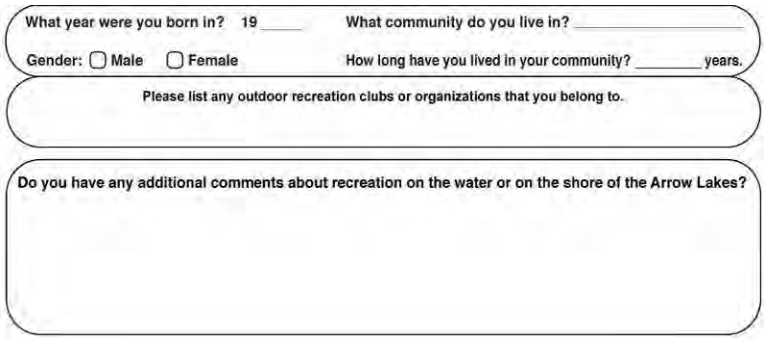


Figure 22. Section 7 questions.

3.7 Sampling Analyses

Descriptive statistics were tabulated for each question. For those questions that ask respondents to indicate their level of agreement, satisfaction, or importance, the proportion of responses was calculated for each interval. The mean response, standard deviation, and standard error was calculated for questions that use an interval scale. These statistics will be presented in a future report.

3.7.1 Data Entry QA/QC

The data from all completed questionnaires were entered (twice) into two SPSS databases to facilitate the verification of data for keying errors, and accuracy and consistency in data coding (Salant & Dillman, 1994). Each completed questionnaire was compared among the two datasets such that each cell (each answer to a question) was verified using the Identify Duplicate Cases function is SPSS (if two cases are identified as being duplicates, then it is assumed that they have been entered correctly). When discrepancies were identified, the appropriate questionnaire was consulted and the necessary correction was made. The resultant dataset can be considered to be free of errors from data entry. The data were checked for "protest votes" (*i.e.,* outliers or obvious patterns such as multiple responses from the same IP address); when these were identified they were checked against the corresponding questionnaire. No obvious "protest votes" were identified.

4. Arrow Lakes Results

4.1 Traffic Count Results

A significant amount of boating use occurred on the Arrow Lakes sampling sites in the past year as counters recorded approximately 6,138 boat launches from October 1, 2010 to September 30, 2011 (Table 12). Table 13 summarizes traffic counts from 2009 through 2011 at the boat ramps monitored on the Arrow Lakes.

Table 12. Arrow Lakes Traffic Summary – October 1, 2010 to September 30, 2011

Site	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Anderson Pt	83	44	34	29	31	34	50	82	120	203	172	124	**1006**
Burton	19	9	2	0	9	2	11	32	72	121	144	56	**477**
Burton South†											35	22	**57**
Edgewood	34	21	15	12	10	42	51	66	68	140	123	53	**635**
Fauquier	37	12	2	2	0	0	4	2	3	3	2	3	**70**
McDonald Cr	185	90	150	0	0	0	36	33	55	101	148	52	**850**
Nakusp	174	64	32	183	114	125	198	202	318	643	724	266	**3043**
Total													**6138**

† Burton South traffic data collection began August 24, 2011 so does not represent full years of data collection.

Table 13. Arrow Lakes – Traffic Summary

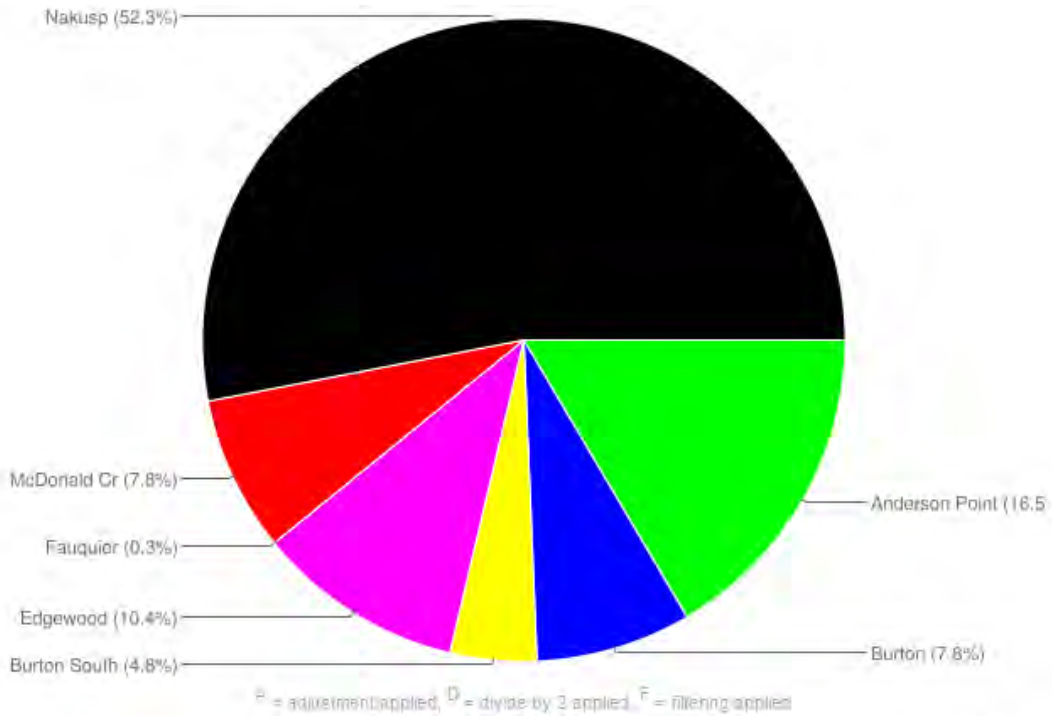
Year	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AADT†	Days with data	Totals
2009	Burton[ADF]									*62**	*19**	8	0	0.604	106	*220***
	Edgewood[ADF]									*84**	51	48	37	1.726	113	*630***
	Fauquier[ADF]									33*	7*	6	3	0.351	111	*128***
	McDonald Cr[ADF]									*71**	26	15	7	0.867	113	*317***
	Nakusp[ADF]									*245**	178	144	149	5.661	112	*2,066***
2010	Anderson Point[DF]				66	100	196	197	190	107	83	44	34	3.698	275	*1,350***
	Burton[ADF]	0	3	*2**	*8**	*32**	83	106	123	15	19	9	2	1.134	351	*414***
	Edgewood[ADF]	96	100	*136**	64	61	88	174	103	26	*34**	21	15	2.524	361	*921***
	Fauquier[ADF]	3	17	*18**	12	*35**				*3**	*0**	0	0	0.340	244	*124***
	McDonald Cr[ADF]	4	19	*16**	*32**	*124**		*300**	215	87	*37**	12	2	2.530	328	*924***
	Nakusp[ADF]	152	162	*170**	192	247	330	748	*529**	161	185	90	150	8.530	362	*3,114****
2011	Anderson Point[DF]	29	31	34	*50**	82	120	203	172	124	*113**			3.139	288	*1,146****
	Burton[ADF]	0	9	2	*11**	32	72	121	*144**	56	*8**			1.556	286	*568****
	Burton South[ADF]								*35**	22	*2**			0.564	55	*206****
	Edgewood[ADF]	12	10	42	*51**	66	68	140	123	53	*24**			1.997	288	*729****
	Fauquier[ADF]	2	0	0	*4**	2	3	*3**	2	3	*0**			0.066	274	*24****
	McDonald Cr[ADF]	0	0	0	*36**	33	55	101	148	52	*4**			1.476	288	*539****
	Nakusp[ADF]	183	114	125	*198**	202	318	643	724	266	*172**			9.883	290	*3,607****

† AADT = Annual Average Daily Traffic, the total whole day counts for the given year, divided by the number of whole days with data in that year.

* Some monthly totals are estimated when there is only partial data for the month. The values shown are calculated based on the daily average for the available data, multiplied by the number of days in that month.

** Totals in years where data is incomplete are calculated by multiplying the AADT by the number of days in that year.

[A] = adjustment applied, [D] = divide by 2 applied, [F] = filtering applied

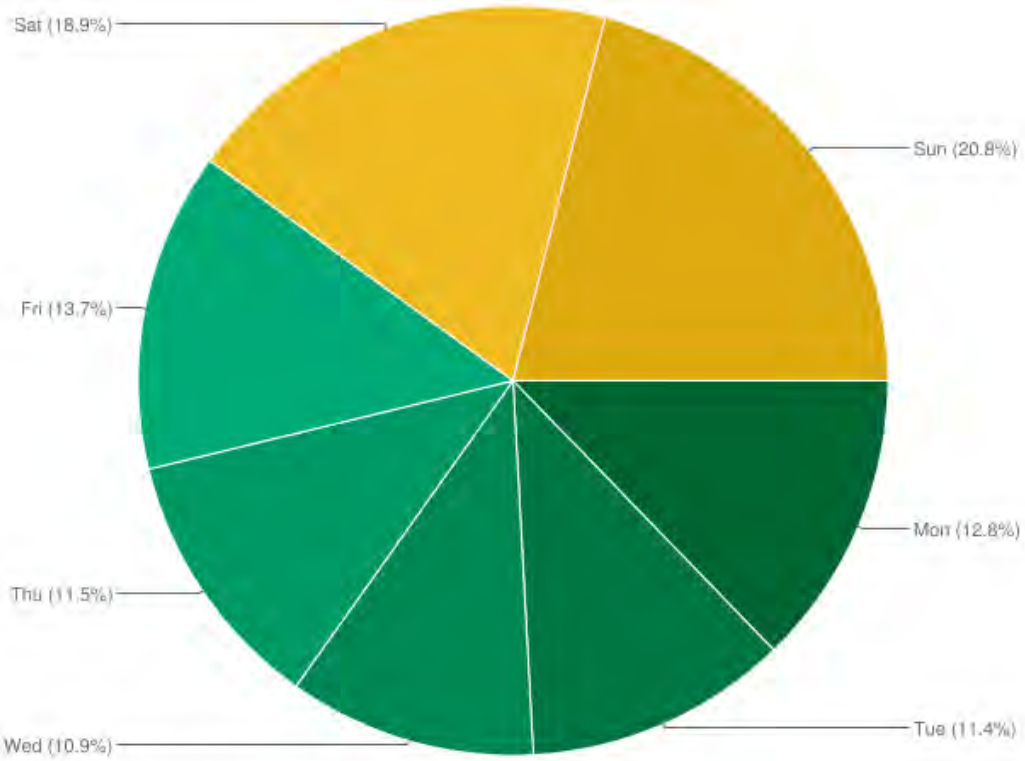


Site name	Daily average
Anderson Point[ADF]	2.8 (16.5%)
Burton[ADF]	1.3 (7.8%)
Burton South[ADF]	0.8 (4.8%)
Edgewood[ADF]	1.7 (10.4%)
Fauquier[ADF]	0.1 (0.3%)
McDonald Cr[ADF]	1.3 (7.8%)
Nakusp[ADF]	8.8 (52.3%)

Figure 23. Arrow Lakes – Traffic by site

In 2011, Nakusp boat ramp accounted for 52% of the recorded traffic at the selected boat ramp locations (Figure 23) on the Arrow Lakes.[6] Burton South was only installed in late August so the reported values would be higher in a full year. Fauquier had unexpectedly low use. The Fauquier counter was checked and tested to determine if a faulty counter was the cause for such low use rates, but the counter functioned appropriately during testing. This site will be monitored closely in future years to determine the cause.

[6] This percentage reflects boat ramp locations monitored for this study only and does not represent the overall percentage of boat ramp use on the Arrow Lakes. The Arrow Reservoir Recreational Demand Study results indicate that Nakusp Boat Launch accounts for about 28% of the overall recorded boat ramp counts on the Arrow Lakes.



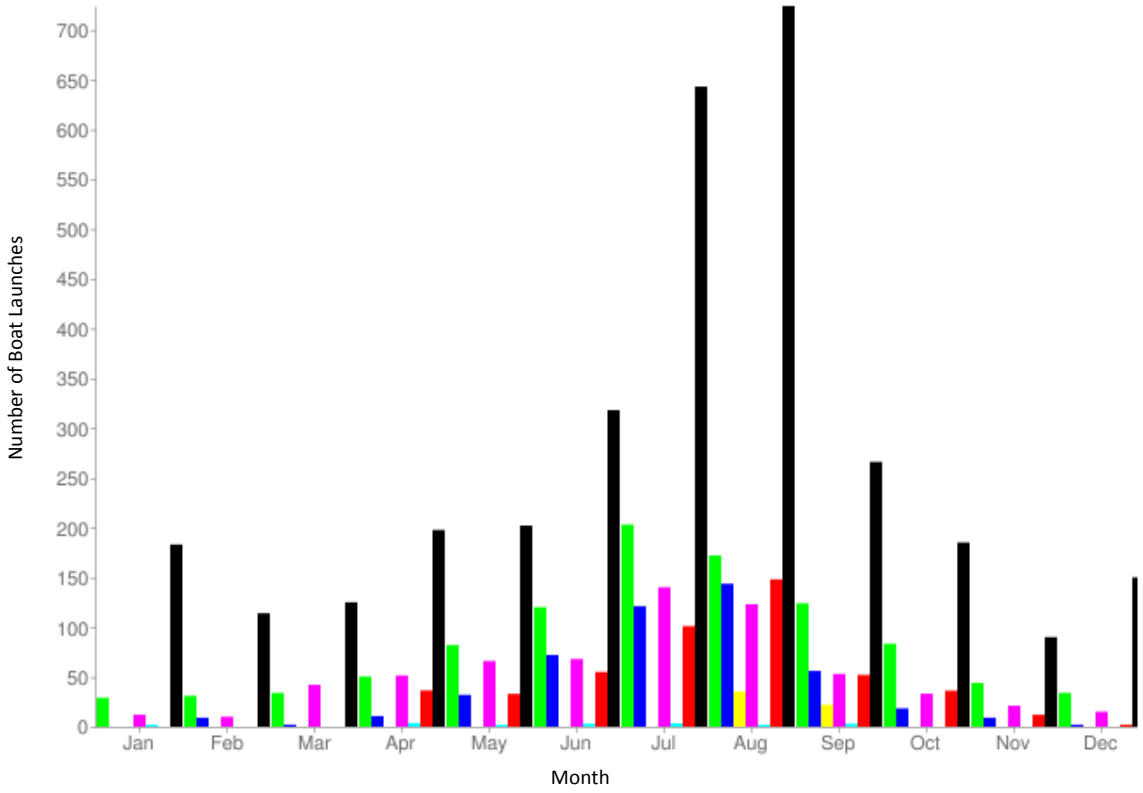
site name	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Anderson Point[DF]	2.5	2.2	2.0	2.5	3.3	3.0	3.8
Burton[ADF]	1.3	1.2	1.0	1.2	1.3	1.4	1.7
Burton South[ADF]	1.2	1.4	0.6	0.5	0.0	1.0	1.2
Edgewood[ADF]	1.6	1.5	1.4	1.5	1.7	2.2	2.4
Fauquier[ADF]	0.0	0.1	0.0	0.0	0.1	0.1	0.1
McDonald Cr[ADF]	1.0	0.8	1.1	1.2	1.2	2.0	1.7
Nakusp[ADF]	7.5	6.2	6.5	6.7	8.5	12.5	13.5
daily averages	2.1	1.9	1.8	1.9	2.3	3.2	3.5

[A] = adjustment applied, [D] = divide by 2 applied, [F] = filtering applied

Figure 24. Arrow Lakes – Traffic by Days of the Week

Nakusp, Burton, McDonald Creek, Edgewood and Anderson Point boat launches had an expected relationship of greater weekend than weekday use, *i.e.,* Saturdays and Sundays received about 1.5 – 2.0 times as much traffic as weekdays (Figure 24). Anderson Point had a higher percentage of weekday use (especially Fridays) than other locations. This may be attributed to a higher component of commuter rather than

recreational traffic. Fauquier and Burton South had more consistent use throughout the week but the overall counts were very low at Fauquier. Burton South had only about one month of data for 2011. Thus, one would expect that overall numbers at these two launches might increase and daily distributions normalize during regular operating years.



Site Name	Average	Median	STDV (σpop)	Min	Max
Anderson Point[DF]	83.9	66.2	56.5	29.0	203.0
Burton[ADF]	39.6	14.6	46.9	2.0	143.6
Burton South[ADF]	19.1	22.0	14.6	22.0	35.4
Edgewood[ADF]	52.9	46.7	40.2	10.0	140.0
Fauquier[ADF]	1.6	2.0	1.4	2.0	3.8
McDonald Cr[ADF]	39.6	34.6	43.6	2.0	148.0
Nakusp[ADF]	266.5	191.3	196.7	90.0	724.0

[A] = adjustment applied, [D] = divide by 2 applied, [F] = filtering applied

Figure 25. Arrow Lakes - Traffic by Months of the Year

Seasonal use patterns (Figure 25) show increasing activity in the summer months with most locations peaking in July or August, and tapering off in the fall. Nakusp, Edgewood and Anderson Point receive more relative use over the winter months (November – March) than other locations. Nakusp showed an increase in December and January over adjacent months but the reason for this is not readily evident from the traffic count data. Questionnaire results may show that these are the best months for catching fish, or that boats normally kept in the marina are not left there over winter thus need to be launched each time a person wants to use them.

4.2 Survey Results

A total of 3,997 visitors were encountered at sample sites on the Arrow Lakes between April 9 and October 19, 2011. Field staff asked 863 visitors to participate in the survey; 631 completed questionnaires were returned, which represents an overall response rate of 83.9% (Table 14). The frequencies of completed questionnaires by season are illustrated in Figures 26-28; the frequencies of completed returns by sample site are illustrated in Figure 29. A total of 26 web-based surveys were completed.

Table 14. Visitor encounters and survey response rates.

Season	# Visitors Encountered	# Visitors Asked to Participate	# Previously Completed[†]	# Completed Questionnaires[‡]	Response Rate
Spring	404	116	5	98	88.3%
Summer	3360	649	64	486	83.1%
Fall	233	71	15	47	83.9%
ARROW TOTAL	**3997**	**836**	**84**	**631**	**83.9%**

[†] People who have previously completed the survey in this sampling year.
[‡] A total of 638 questionnaires were retuned; however, only 631 were completed.

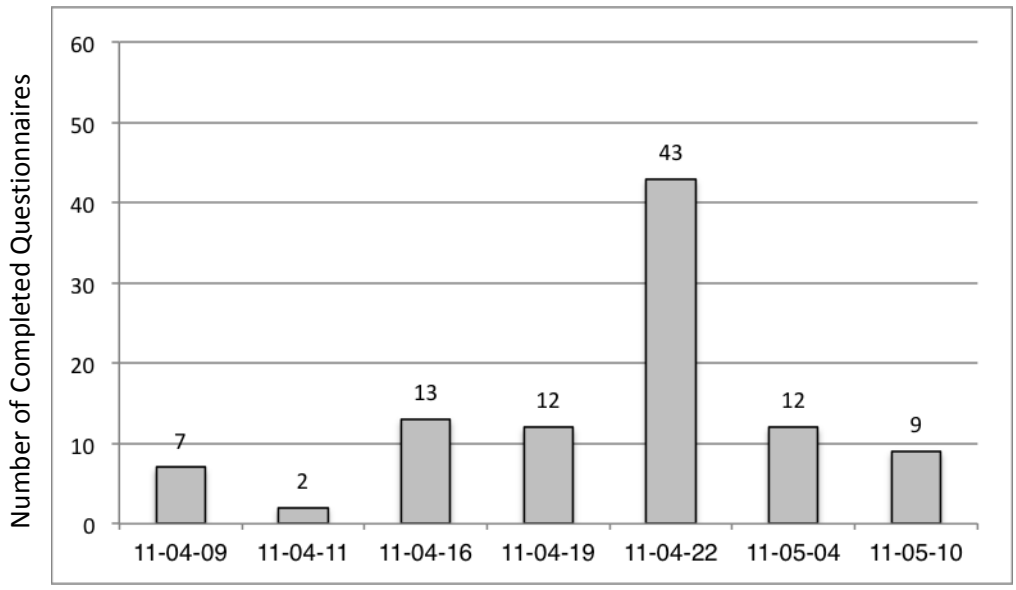


Figure 26. Completed spring questionnaires by sample date, April-May (n = 98).

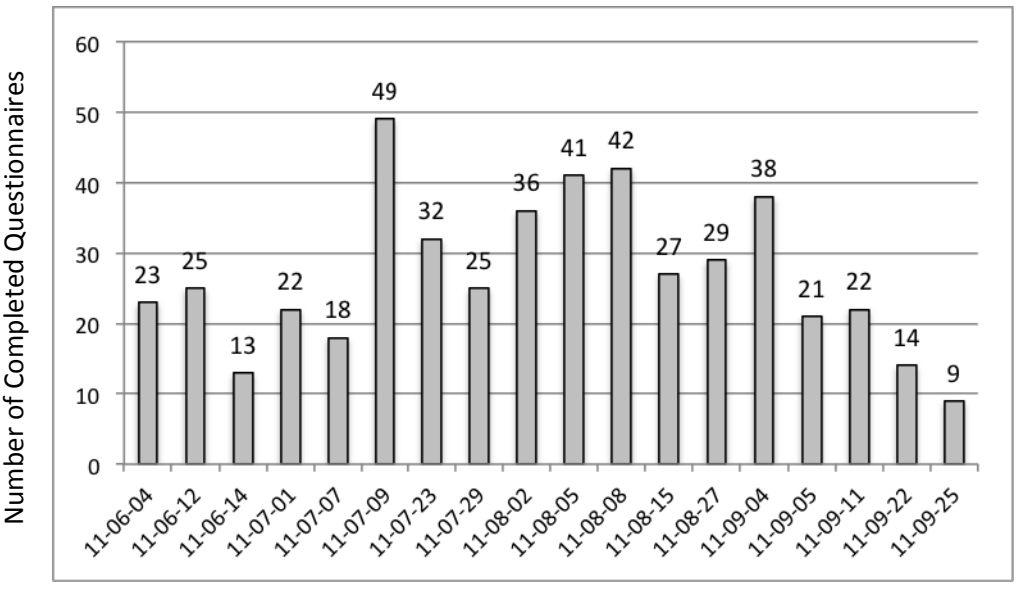


Figure 27. Completed summer questionnaires by sample date, June-September (n=486).

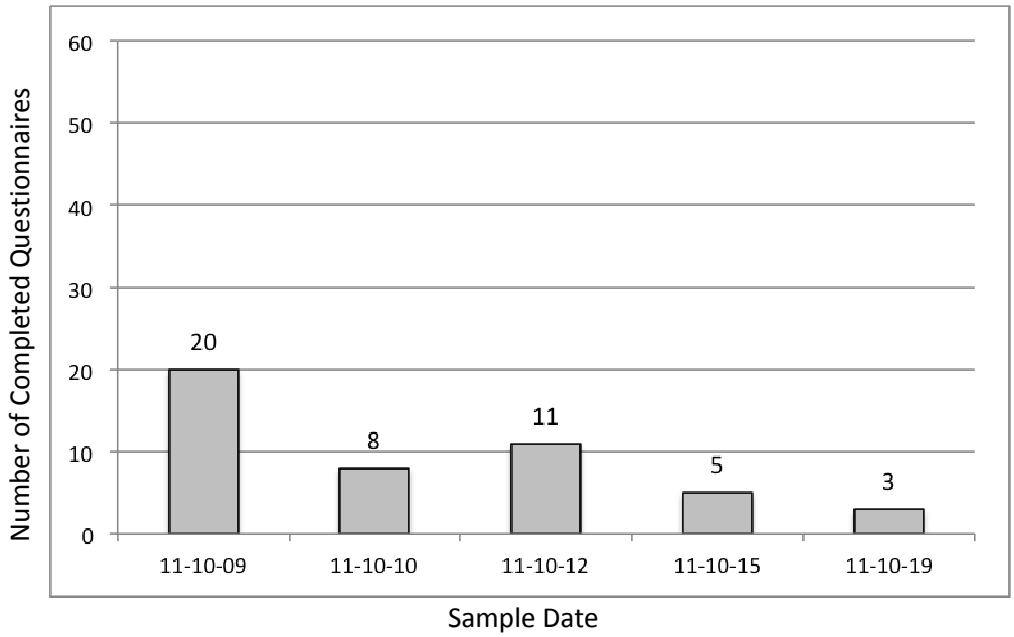


Figure 28. Completed fall questionnaires by sample date, October (n = 47).

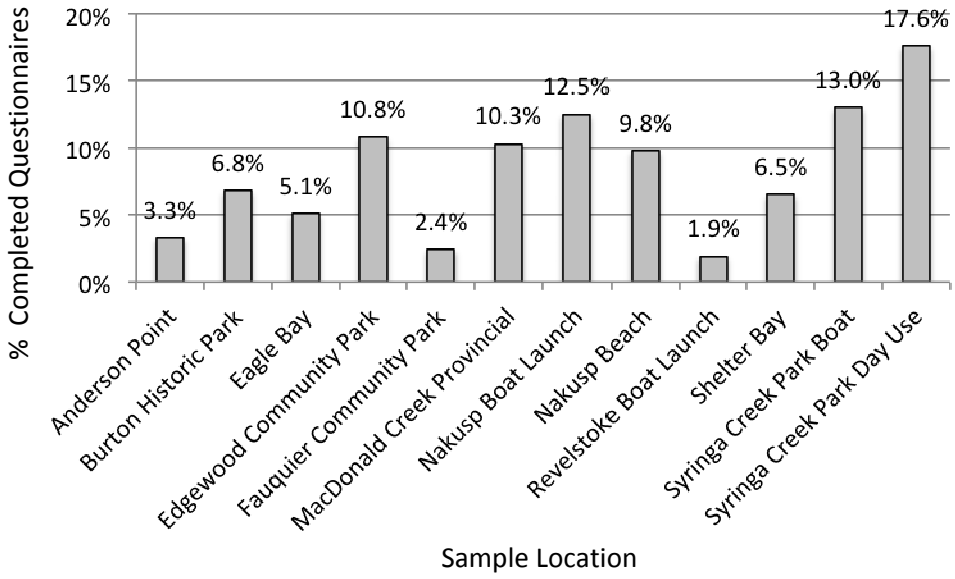


Figure 29. Completed questionnaires by sample location (n = 631).

In preliminary (2011) results from the CLBMON 41 study, Arrow Lakes visitors cited proximity and convenience to other recreation facilities as the most common motivations for using the boat ramp facility that they did on the day that they were surveyed. Not crowded was the element that respondents liked most about the boat ramp facility that they visited on the day that they were surveyed. Problems with dock and dock ramp was identified most frequently as the element that they liked least about the boat ramp facility that they visited on the day that they were surveyed (LEES+Associates 2012).

5. Kinbasket Lake Results

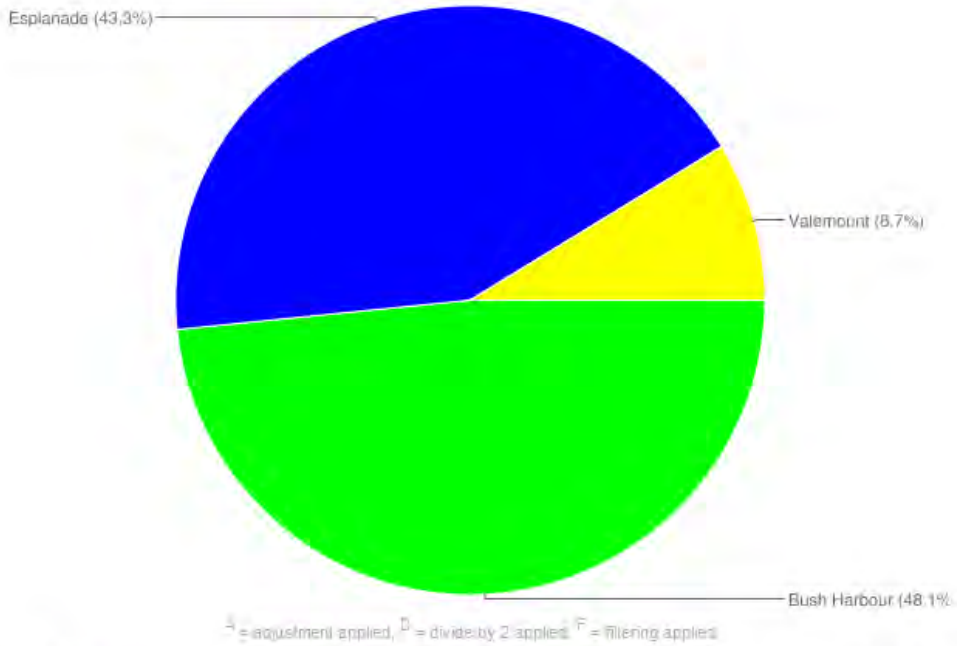
5.1 Traffic Count Results

A significant amount of boating use occurred on Kinbasket Lake sampling sites in the past year as counters recorded approximately 560 “boat launches” from October 1, 2010 to September 30, 2011. The following Table summarizes traffic counts at the boat ramps monitored on Kinbasket Lake from 2010 through 2011.

Year	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AADT†	Days with data	Totals
2010	Bush Harbour ADF				2*	5	2*		86*	37	38*	6	0	0.710	207	259**
	Valemount ADF				12*	6	13*	61	28	23	3*	0	0	0.554	258	202**
2011	Bush Harbour ADF	0	0*		0*	39	43	102*	82	60	43*			1.509	228	551**
	Esplanade ADF								67*	26	7*			0.811	53	296**
	Valemount ADF	0	0	2			40*	30*	12	10	0*			0.282	195	103**

† AADT = Annual Average Daily Traffic, the total whole day counts for the given year, divided by the number of whole days with data in that year.
* Some monthly totals are estimated when there is only partial data for the month. The values shown are calculated based on the daily average for the available data, multiplied by the number of days in that month.
** Totals in years where data is incomplete are calculated by multiplying the AADT by the number of days in that year.
A = adjustment applied, D = divide by 2 applied, F = filtering applied

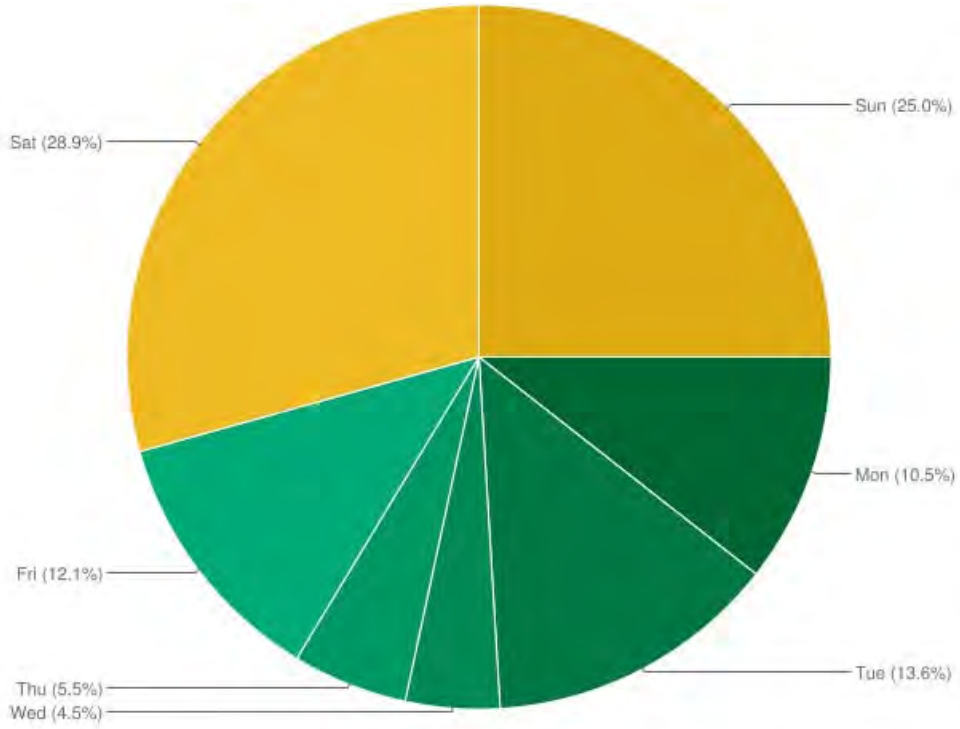
Table 15. Kinbasket Lake - Traffic Summary



Site name	Daily average
Bush Harbour ADF	1.2 (48.1%)
Esplanade ADF	1.1 (43.3%)
Valemount ADF	0.2 (8.7%)

Figure 30. Kinbasket Lake - Traffic by Site

The above chart is based on daily averages rather than total use, thus Esplanade Bay shows a greater daily average than Valemount even though Valemount's total use was greater.

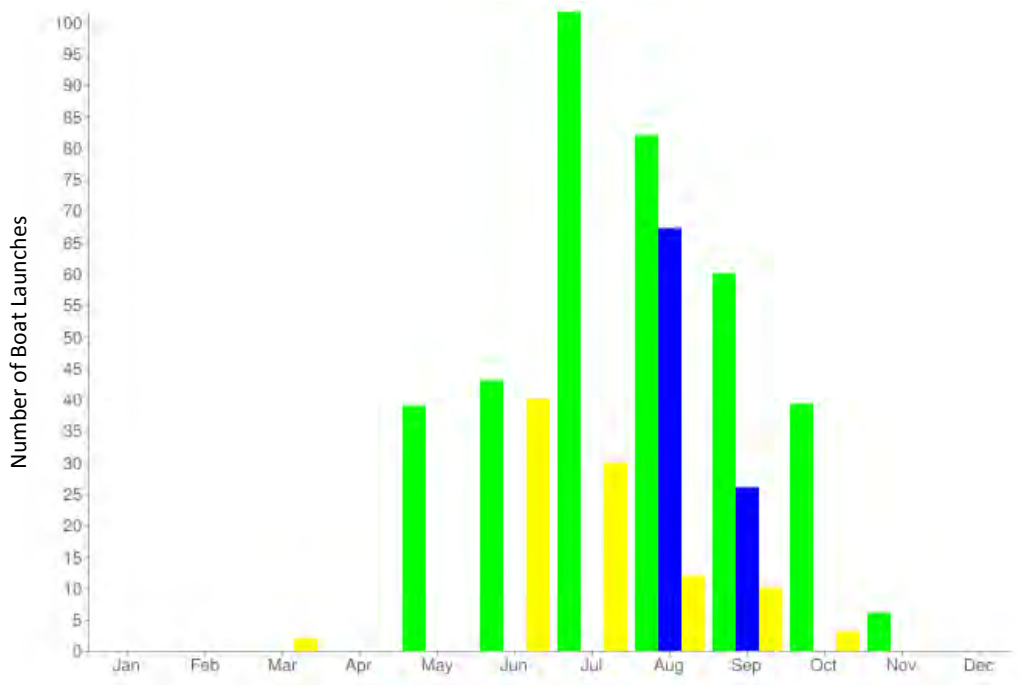


site name	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Bush Harbour ADF	1.1	0.5	0.7	0.5	1.0	2.3	2.2
Esplanade ADF	0.4	1.8	0.0	0.4	0.8	2.4	1.8
Valemount ADF	0.3	0.1	0.1	0.1	0.2	0.4	0.4
daily averages	0.6	0.8	0.3	0.3	0.7	1.7	1.5

A = adjustment applied, D = divide by 2 applied, F = filtering applied

Figure 31. Kinbasket Lake – Traffic by Days of the Week

As expected, most recorded use occurs on the weekends with over 50% of use attributed to those days. Saturdays and Sundays get two to four times as much use as other days of the week. Fridays get about 1.5 – 2.0 times as much use as other week days. Saturdays get the heaviest use in Bush Harbour and Esplanade Bay while Saturdays and Sundays get equal use in Valemount. Boats are kept at the Valemount marina and there are several Forest Service campgrounds close by so there may be more boating activity than the recorded traffic indicates.



Site Name	Average	Median	STDV (σpop)	Min	Max
Bush Harbour[ADF]	33.7	39.0	34.5	6.0	101.6
Esplanade[ADF]	31.1	26.0	27.7	26.0	67.2
Valemount[ADF]	9.7	2.6	13.5	2.0	40.0

[A] = adjustment applied [D] = divided by 2 applied [F] = filtering applied

Figure 32. Kinbasket Lake – Traffic by Months of the Year

The Bush Harbour boat launch provided its first full year of traffic counter data this season but a very cold and wet summer may have been a deterrent to boating use this year. The months of June, July and August, 2011 were 1°C cooler and 71mm wetter than the previous year (Environment Canada 2012). The Valemount boat launch received major construction upgrades this year and was not available to the public from April 1 until June 27, 2011. Data collected at that boat launch during that time has been excluded from this report.

Heaviest boat launch use occurred in June in Valemount and in July at Bush Harbour. Esplanade Bay data for the month of August may be misleading as it is based on only one week of data collection and then averaged over the month.

5.2 Survey Results

A total of 221 boat launch visitors were encountered at sample sites on Kinbasket Lake between May 30 and October 29, 2011. Field staff asked 112 visitors to participate in the survey (35 of whom had already completed a questionnaire in the current sampling year); 66 completed questionnaires were returned, which represents an overall response rate of 85.7% (Table 16). The frequency of completed questionnaires by date is illustrated in Figure 33; the frequency of completed returns by sample site is illustrated in Figure 34. Visitors completed one web-based survey.

Table 16. Kinbasket Lake visitor encounters and survey response rates.

# Visitors Encountered	# Visitors Asked to Participate	# Previously Completed[†]	# Completed Questionnaires	Response Rate
221[‡]	112	35	66	85.7%

[†] People who have previously completed the survey in this sampling year.
[‡] Visitor encounters at Valemount may be underreported.

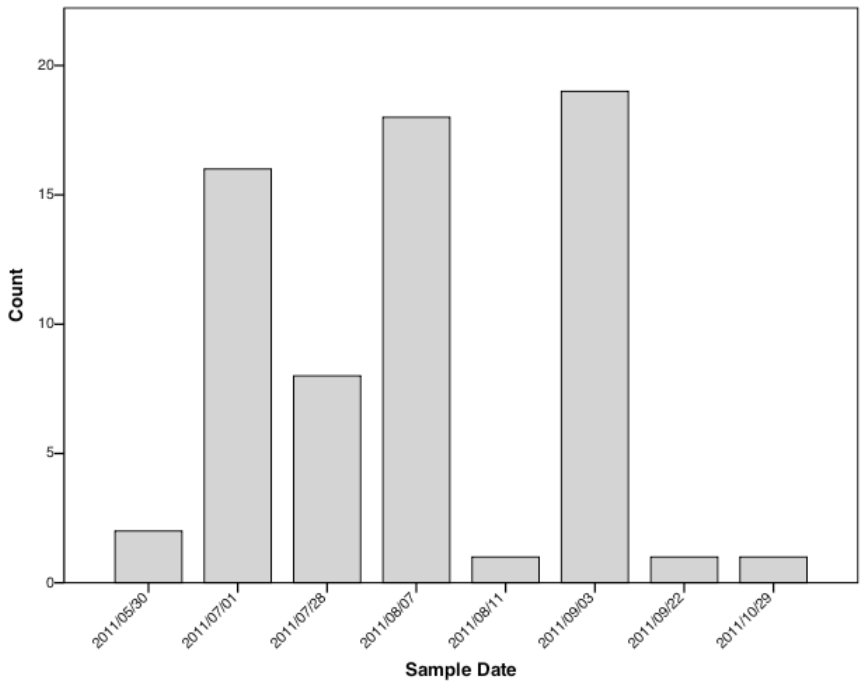


Figure 33. Completed questionnaires by sample date (n = 66).

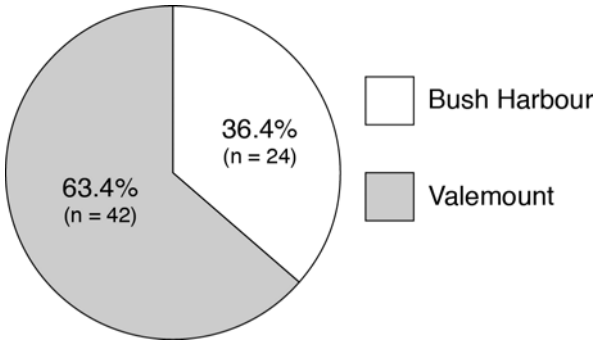


Figure 34. Completed questionnaires by sample site (n = 66).

6. Discussion

Year 2 of the study has been successful in capturing data in all seasons and gathering additional pre-improvement and post-improvement data on the Arrow and Kinbasket Lakes. As of 2011, five ramp improvement projects have been completed or substantially completed, and three have yet to be initiated.

On the Arrow Lakes, a total of 6,138 “boat launches” were recorded in the past year at monitoring sites included in the study. Nakusp boat ramp accounted for about 52% of the recorded traffic. Weekly use patterns varied, with some sites receiving greater use on the weekends, and other sites receiving consistent traffic throughout the week. Anderson Point had a higher percentage of weekday use (especially Fridays) than other locations. This may be attributed to a higher component of commuter rather than recreational traffic. Fauquier and Burton South had more consistent use throughout the week but the overall counts were very low at Fauquier. Yearly use patterns are as expected with increasing activity in the summer months with most locations peaking in July, and then tapering off in the fall.

On Kinbasket Lake, a total of 560 “boat launches” were recorded in the past year at monitoring sites included in the study. The Bush Harbour ramp accounted for about 48% of the recorded boat ramp use on the Lake. As there is a marina associated with the Valemount boat ramp, there is likely significant repeated boating use that does not require the use of the ramp.

Preliminary (2010-2011) results from the CLBMON 41 study indicate that proximity and convenience to other recreation facilities are the strongest motivations for choosing a boat ramp facility. Visitors least like crowding and problems with dock/dock ramps at boat ramp facilities. Although preliminary, these results provide an indication of what might be important to consider in developing and maintaining reservoir access points.

The comprehensive results of this 10-year study will be used to generate year round use characteristics to determine the effectiveness of boat access improvement projects

in providing benefits to recreational interests in the area. Further data will indicate if daily distributions normalize during regular (non-construction) years, whether total volume of public use has increased, whether increased use is due to improved ramp conditions, and whether improvements have resulted in increased user satisfaction.

7. Conclusions

The first two years have been a successful and productive start to an informative and progressive initiative. Year 2 sampling captured further pre-improvement, and some post-improvement data, at the study sites. More data is needed in order to measure changes in volume of public use or effectiveness of new recreational access facilities. At the end of the 10-year study horizon, pre- and post-improvement data will be gathered at all the eight improvement sites, as well as two control sites. Information gained through this monitoring program will assist future decision making during the next WUP review regarding the effectiveness of the boat ramp improvement works and their maintenance, the value of implementing additional physical works to improve access to the reservoirs, and any potential unintended impacts associated with improved boat access.

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APPENDIX A – TRAFx Vehicle Counters

How were traffic counters used in this study?

Traffic counters were configured and installed at 8 boat launch facilities that were slated for construction upgrades and improvements. This includes two on Kinbasket Lake (Valemount Marina and Bush Harbour) and six on the Arrow Lakes (Nakusp, MacDonald Creek, Burton, Edgewood, Fauquier, and Anderson Point). In 2011, two additional traffic counters were installed at control sites at Esplanade Bay and Burton South. The TRAFx G3 magnetic field controlled vehicle counters were selected for use in this study as they are the preferred and recommended traffic counter of BC Parks, Parks Canada and the US National Parks Service.

How does the traffic counter work?

Ferrous metal (*i.e*., metals with iron content) objects distort the earth's magnetic field as they move through it. Pure aluminum (non-alloy aluminum) will not be detected. Moving the counter (*i.e*., pointing it in different compass directions, tilting it, jiggling or jolting it) will also cause counts to occur. This is because the earth's magnetic field has different strengths for different directions and tilts, and the counter senses this.

As vehicles move, they disturb the earth's magnetic field. The TRAFx Vehicle Counter digitizes and analyzes these disturbances using highly sophisticated hardware and software. Thus, as a vehicle passes within the detection zone it changes the earth's magnetic field in that area which triggers a count. Different modes are used to meet the particular needs and traffic pattern of a given site. That is why the modes and sensitivity settings were selected at each site to best reflect the local conditions.

Can the vehicle counter be buried? Does it perform differently when buried?

Yes it can be buried. Because it responds to changes in the earth's magnetic field, the TRAFx Vehicle Counter functions the same whether the counter is buried or installed above ground.

Will the counter still function if a vehicle parks over or near the counter?

Yes. Unlike most other types of vehicle counters, the TRAFx Vehicle Counter will

automatically adjust to the presence of a vehicle parked over top or nearby, and continue to function properly. Likewise, if the counter is placed near a metal pole (*e.g*., signpost) or similar static metal object (*e.g.*, guard rail, cattleguard, bridge beam *etc*.) it will automatically adjust to its presence.

How are annual traffic counts calculated?

TRAFx DataNet traffic count estimates follow the most widely accepted vehicle traffic calculation methods used in North America. This system is used by the US Army Corps of Engineers, US Bureau of Land Management, US Fish and Wildlife, US Forest Service, US National Parks Service, Parks Canada, most Canadian provicincial and territorial governments, and numerous countries in Europe and the South Pacific.

Annual Traffic Counts are collected and automatically compiled by the TRAFx DataNet system for each full calendar year. This is done to standardize the calculation and application of average daily use to missing data. The system then enables the selection of any time period across years for calculating and reporting daily, weekly and monthly counts, averages and comparisons.

The Annual Traffic Summary shows estimated total yearly counts by recording the total daily counts and calculating the average daily count for that month, then applying that average daily count to missing data periods (such as partial months due to mid-month start date or interruptions due to data downloads, dead batteries or missing data). Thus, if a given counter has at least one day of counts in a month but is also missing at least one day of counts that month, the TRAFx Datanet will apply the monthly average daily count to only those days where data has been interrupted or is missing. If the counter had been operating without interruption during a day or month and there was absolutely no traffic recorded, the TRAFx DataNet calculates a '0' traffic count for that day or month. For years with complete months of missing data (not zero counts, but actually missing data) an annual average daily traffic count (AADT) is applied to all days within a missing month. The total estimate for the year is generated by adding the recorded and calculated counts.

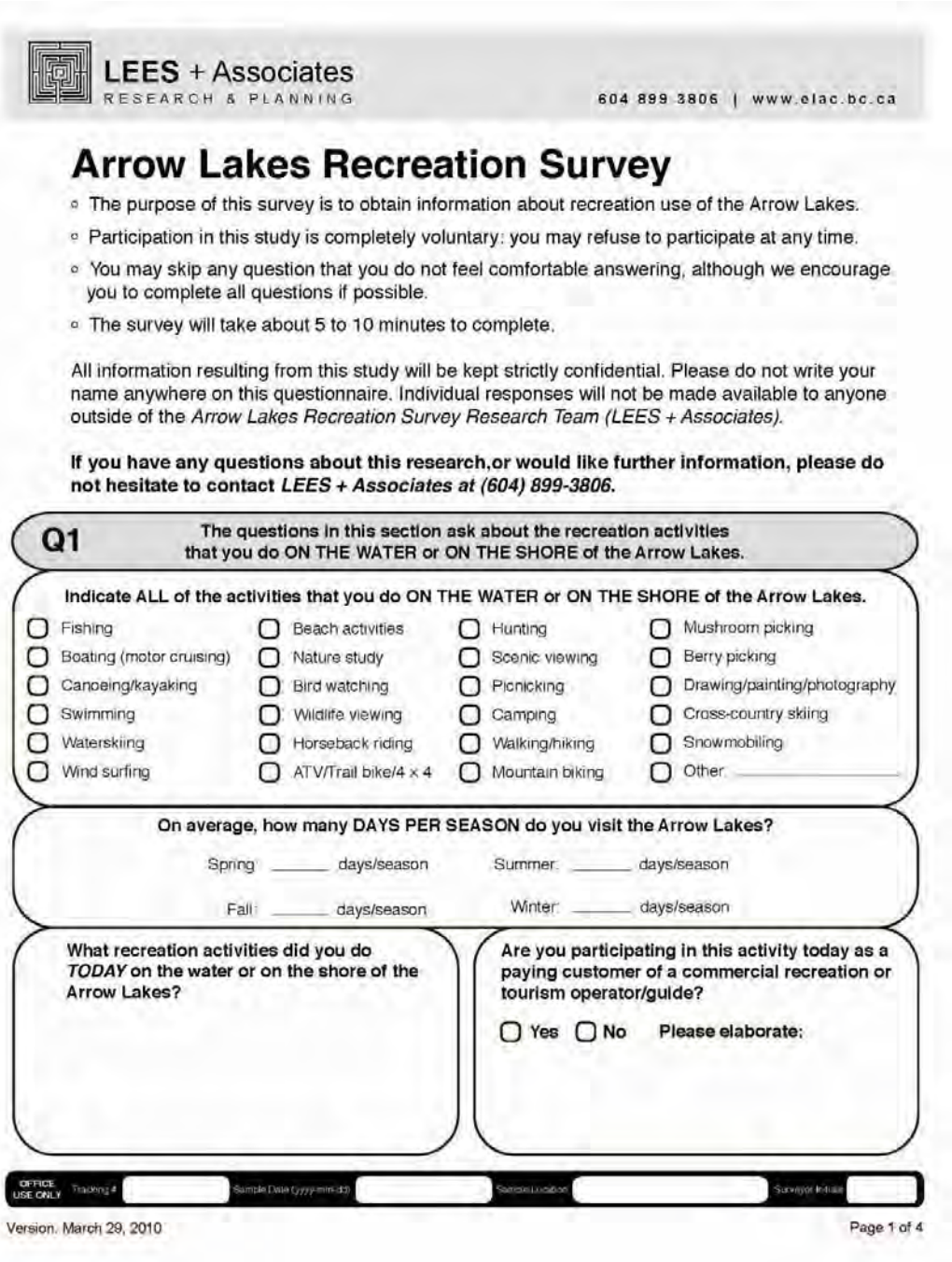
How are boat launch counts calculated?

To get an accurate count at a boat launch it is necessary to apply additional factors, including:

- Filter – a 12-17 second delay is applied (12 seconds on double lane ramps and 17 seconds on single lane ramps) to remove any multiple counts within those intervals to reduce the possibility of multiple counts for a single launch.
- Divide by two – as a vehicle must pass the counter twice to launch a boat (going into the water loaded and coming out empty) the count is divided by two.
- Adjustment Factor of '0.5' – as a vehicle must make two trips per boating experience (one to launch the boat and another to load the boat) the count is again multiplied by 0.5 (or in other words again divided by two).

APPENDIX B – Visitor Survey

(Arrow Lakes Version)



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Arrow Lakes Recreation Survey

- The purpose of this survey is to obtain information about recreation use of the Arrow Lakes.
- Participation in this study is completely voluntary: you may refuse to participate at any time.
- You may skip any question that you do not feel comfortable answering, although we encourage you to complete all questions if possible.
- The survey will take about 5 to 10 minutes to complete.

All information resulting from this study will be kept strictly confidential. Please do not write your name anywhere on this questionnaire. Individual responses will not be made available to anyone outside of the *Arrow Lakes Recreation Survey Research Team (LEES + Associates).*

If you have any questions about this research,or would like further information, please do not hesitate to contact *LEES + Associates at (604) 899-3806.*

Q1 **The questions in this section ask about the recreation activities that you do ON THE WATER or ON THE SHORE of the Arrow Lakes.**

Indicate ALL of the activities that you do ON THE WATER or ON THE SHORE of the Arrow Lakes.

☐ Fishing	☐ Beach activities	☐ Hunting	☐ Mushroom picking
☐ Boating (motor cruising)	☐ Nature study	☐ Scenic viewing	☐ Berry picking
☐ Canoeing/kayaking	☐ Bird watching	☐ Picnicking	☐ Drawing/painting/photography
☐ Swimming	☐ Wildlife viewing	☐ Camping	☐ Cross-country skiing
☐ Waterskiing	☐ Horseback riding	☐ Walking/hiking	☐ Snowmobiling
☐ Wind surfing	☐ ATV/Trail bike/4 x 4	☐ Mountain biking	☐ Other: _____

On average, how many DAYS PER SEASON do you visit the Arrow Lakes?

Spring: _____ days/season Summer: _____ days/season

Fall: _____ days/season Winter: _____ days/season

What recreation activities did you do *TODAY* on the water or on the shore of the Arrow Lakes?

Are you participating in this activity today as a paying customer of a commercial recreation or tourism operator/guide?

☐ Yes ☐ No **Please elaborate:**

OFFICE USE ONLY Tracking # | Sample Date (yyyy-mm-dd) | Survey Location | Surveyor Initials

Version. March 29, 2010

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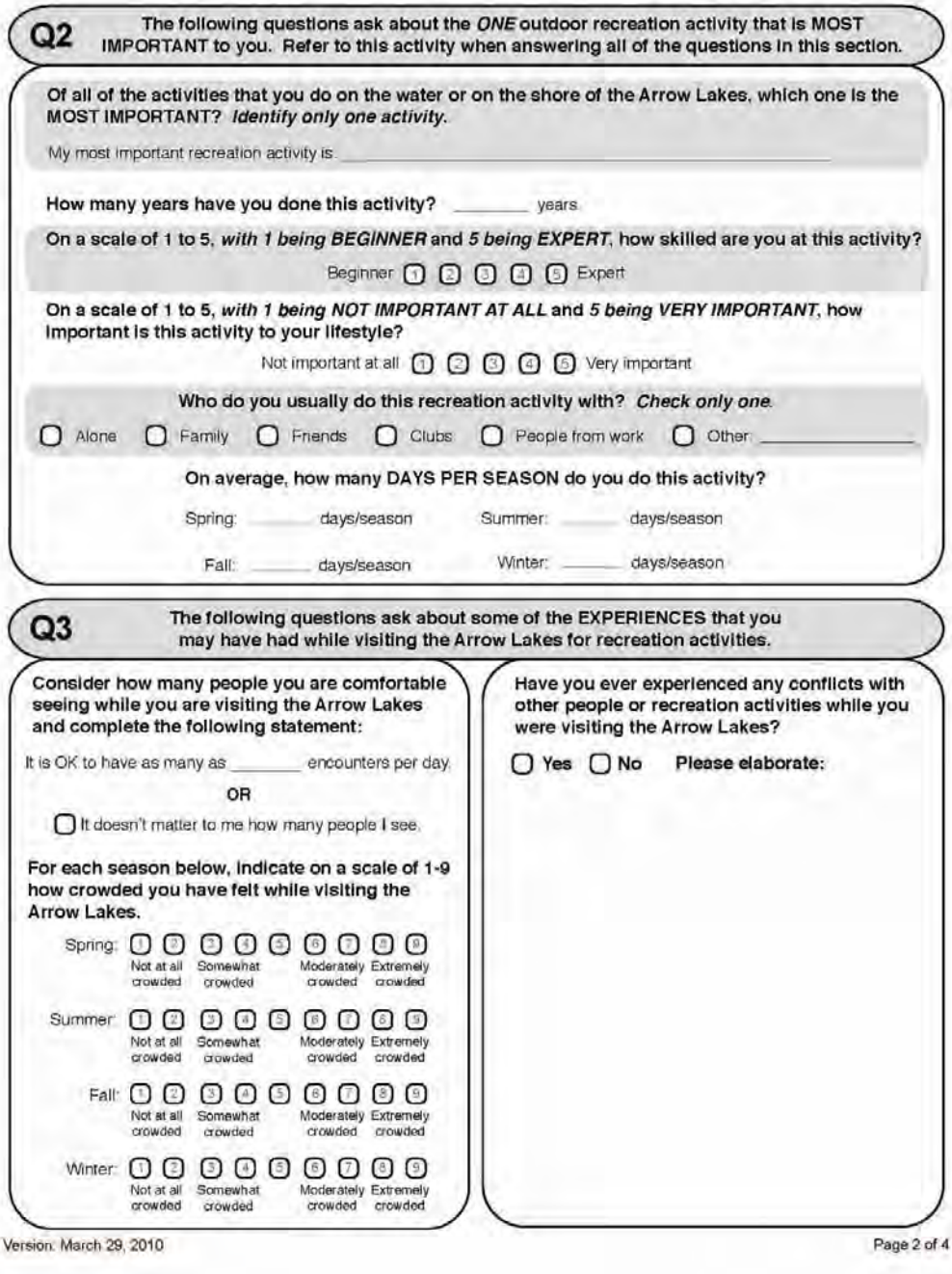

Q2 The following questions ask about the *ONE* outdoor recreation activity that is MOST IMPORTANT to you. Refer to this activity when answering all of the questions in this section.

Of all of the activities that you do on the water or on the shore of the Arrow Lakes, which one is the MOST IMPORTANT? ***Identify only one activity.***

My most important recreation activity is: _____

How many years have you done this activity? _____ years

On a scale of 1 to 5, *with 1 being BEGINNER* and *5 being EXPERT*, how skilled are you at this activity?

Beginner ① ② ③ ④ ⑤ Expert

On a scale of 1 to 5, *with 1 being NOT IMPORTANT AT ALL* and *5 being VERY IMPORTANT*, how important is this activity to your lifestyle?

Not important at all ① ② ③ ④ ⑤ Very important

Who do you usually do this recreation activity with? ***Check only one.***

☐ Alone ☐ Family ☐ Friends ☐ Clubs ☐ People from work ☐ Other: _____

On average, how many DAYS PER SEASON do you do this activity?

Spring: _____ days/season Summer: _____ days/season

Fall: _____ days/season Winter: _____ days/season

Q3 The following questions ask about some of the EXPERIENCES that you may have had while visiting the Arrow Lakes for recreation activities.

Consider how many people you are comfortable seeing while you are visiting the Arrow Lakes and complete the following statement:

It is OK to have as many as _____ encounters per day.

OR

☐ It doesn't matter to me how many people I see.

For each season below, indicate on a scale of 1-9 how crowded you have felt while visiting the Arrow Lakes.

Spring: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Not at all crowded — Somewhat crowded — Moderately crowded — Extremely crowded

Summer: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Not at all crowded — Somewhat crowded — Moderately crowded — Extremely crowded

Fall: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Not at all crowded — Somewhat crowded — Moderately crowded — Extremely crowded

Winter: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Not at all crowded — Somewhat crowded — Moderately crowded — Extremely crowded

Have you ever experienced any conflicts with other people or recreation activities while you were visiting the Arrow Lakes?

☐ **Yes** ☐ **No** **Please elaborate:**

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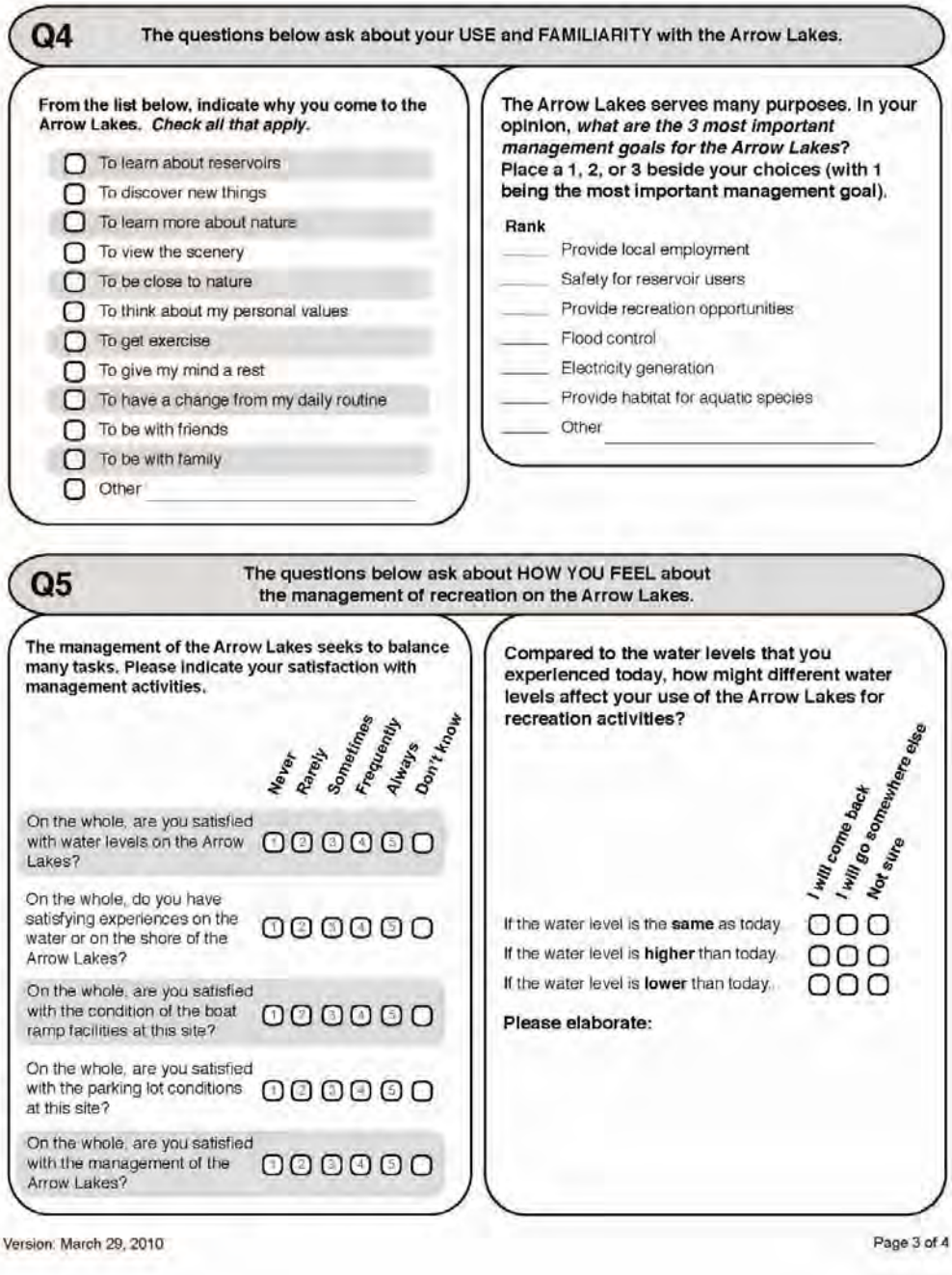

Q4 The questions below ask about your USE and FAMILIARITY with the Arrow Lakes.

From the list below, indicate why you come to the Arrow Lakes. *Check all that apply.*

- ☐ To learn about reservoirs
- ☐ To discover new things
- ☐ To learn more about nature
- ☐ To view the scenery
- ☐ To be close to nature
- ☐ To think about my personal values
- ☐ To get exercise
- ☐ To give my mind a rest
- ☐ To have a change from my daily routine
- ☐ To be with friends
- ☐ To be with family
- ☐ Other _____

The Arrow Lakes serves many purposes. In your opinion, *what are the 3 most important management goals for the Arrow Lakes*? Place a 1, 2, or 3 beside your choices (with 1 being the most important management goal).

Rank

- ____ Provide local employment
- ____ Safety for reservoir users
- ____ Provide recreation opportunities
- ____ Flood control
- ____ Electricity generation
- ____ Provide habitat for aquatic species
- ____ Other _____

Q5 The questions below ask about HOW YOU FEEL about the management of recreation on the Arrow Lakes.

The management of the Arrow Lakes seeks to balance many tasks. Please indicate your satisfaction with management activities.

	Never	Rarely	Sometimes	Frequently	Always	Don't know
On the whole, are you satisfied with water levels on the Arrow Lakes?	1	2	3	4	5	☐
On the whole, do you have satisfying experiences on the water or on the shore of the Arrow Lakes?	1	2	3	4	5	☐
On the whole, are you satisfied with the condition of the boat ramp facilities at this site?	1	2	3	4	5	☐
On the whole, are you satisfied with the parking lot conditions at this site?	1	2	3	4	5	☐
On the whole, are you satisfied with the management of the Arrow Lakes?	1	2	3	4	5	☐

Compared to the water levels that you experienced today, how might different water levels affect your use of the Arrow Lakes for recreation activities?

	I will come back	I will go somewhere else	Not sure
If the water level is the **same** as today	☐	☐	☐
If the water level is **higher** than today	☐	☐	☐
If the water level is **lower** than today	☐	☐	☐

Please elaborate:

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Q6 The following questions ask about YOUR RECREATION EXPERIENCES on the Arrow Lakes.

How long have you been coming to the Arrow Lakes for recreation activities? _____ years.

Based on your experience today, will you come back to the Arrow Lakes for recreation activities?

☐ Yes ☐ No Please elaborate:

Which boat ramp facility do you usually use on the Arrow Lakes?

Why did you come to this boat ramp facility today?

What did you LIKE MOST about the boat ramp facility that you visited today?

What did you LIKE LEAST about the boat ramp facility that you visited today?

How did you first hear about recreation opportunities and activities near and on the Arrow Lakes? *Check all that apply.*

☐ Tourism information booth	☐ Family	☐ BC Hydro web site
☐ Tourism information brochures	☐ Friends	☐ BC Hydro facility (*e.g.*, Revelstoke Dam)
☐ Tourism operators	☐ BC Parks	☐ BC Hydro bill
☐ Private marinas	☐ BC Forest Service	☐ Other: _____

Q7 These questions below ask about you. We use this information only to assist us in compiling the survey results.

What year were you born in? 19____ What community do you live in? _____

Gender: ☐ Male ☐ Female How long have you lived in your community? _____ years.

Please list any outdoor recreation clubs or organizations that you belong to.

Do you have any additional comments about recreation on the water or on the shore of the Arrow Lakes?

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APPENDIX C – Observational Data Forms

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Arrow Lakes Recreation Study
Site and Survey Log

Date (dd/mm/yr)	Location	Time of env record	Sky Cond (1-14)	Wind (0-12)	Wind Dir (from)	Water Surface Cond (1-5)	Air Temp (°C)	Water Temp (°C)	# BC Plates	# Other Canada Plates	# Intn'l Plates	# Parties	Total # People visiting site	# invited to take survey	# prev taken survey this yr	# who decline taking survey	# completed surveys	# surveys to be mailed in	Staff Initials	Comment

#509 318 Homer Street Vancouver, BC V6B 2V2 | fax: 604 899 3805 | email: elees@elac.bc.ca

Page ____

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Arrow Lakes Recreation Study – Detailed Daily Sample Summary

Date: Sample Site: Surveyor: Page ____ of ____

Total # in Group	Gender Total M/F	Age Range 1 – 10	11 – 15	16 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 +	Activities	Comments

Version: September 7, 2009

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APPENDIX D – Observational Data Definitions

1 - Wind Condition Definitions

2 - Water Surface Condition Definitions

3 - Forecasting Terminology

4 - Sky Conditions Definitions

5 - Air and Water Temperature Data Collection Procedures

Boat Ramp Use Study
Wind Condition
Definitions

International Description	Specifications	Beaufort Number	MPH	Knots
Calm	• Calm, smoke rises vertically	0	< 1	< 1
Light air	• Direction of wind shown by smoke drift but not by wind vanes	1	1 - 3	1 - 3
Light Breeze	• Wind felt on face • Leaves rustle • Vanes moved by wind	2	4 - 7	4 - 6
Gentle Breeze	• Leaves and small twigs in constant motion • Wind extends light flag	3	8 - 12	7 - 10
Moderate	• Raises dust, loose paper • Small branches moved	4	13 - 18	11 - 16
Fresh	• Small trees in leaf begin to sway • Crested wavelets form on inland waters	5	19 - 24	17 - 21
Strong	• Large branches in motion • Whistling heard in telegraph wires • Umbrellas used with difficulty	6	25 - 31	22 - 27
Near Gale	• Whole trees in motion • Inconvenience felt walking against wind	7	32 - 38	28 - 33
Gale	• Breaks twigs off trees • Impedes progress	8	39 - 46	34 - 40
Strong Gale	• Slight structural damage occurs	9	47 - 54	41 - 47
Storm	• Trees uprooted • Considerable damage occurs	10	55 - 63	48 - 55
Violent Storm	• Wide Spread Damage	11	64 - 72	56 - 63
Hurricane	• Wide Spread Damage	12	73 - 82	64 - 71

Source: Oregon Emergency Management Net – Net Protocol

Boat Ramp Use Study
Water Surface Condition Definitions

Water Condition	Description
1. Calm	Flat surface – some ripples, no noticeable breeze
2. Gentle	Noticeable breeze; low gentle waves
3. Small waves	Light winds – larger waves but no white caps
4. Moderate waves	Moderate winds; choppy water; white caps
5. Stormy	Strong winds; steep waves

Boat Ramp Use Study
Forecasting Terminology

Condition	Description
Duration of Precipitation	• Brief - short, sudden showers or periods of rain • Intermittent - on and off intervals, not continuous • Occasional - irregular, infrequent intervals of precipitation • Frequent - persistent short intervals, happening regularly and often • Periods of precipitation - rain or snow falling most of the time with breaks
Distribution of Precipitation, as in showers	• Isolated - showers separated during a given period of time • Few - indicated in time, not over an area • Local - restricted to a smaller area • Patchy - irregularly occurring in an area • Scattered - not widespread but of greater occurrence than isolated showers
Precipitation Intensity	• Light - each drop or small flake of precipitation can be easily seen, puddles form slowly, some water flow in gutters • Moderate - water puddles quickly, roads and other surfaces collect water, rain streams down windows • Heavy - numerous flakes or sheets of rain, large puddles form, flooding can occur, visibility reduced
Cloud Cover	• Clear or sunny - free of clouds or less than one tenth cloudy • Partly cloudy or partly sunny - three tenths to six tenths of the sky is clouded • Mostly cloudy - the sky is predominantly clouded or seven tenths to eight tenths of the sky has clouds • Cloudy or overcast - the sky is covered with clouds from nine tenths to a hundred percent cloud covered
Showers vs. Rain: A Difference of Duration and Intensity	• Rain - forms from stratus clouds, more widespread over larger area, uniformly steady, less intense • Showers - forms from cumulus clouds, more isolated, short-lived, affects a smaller area, sometimes more intense
Partly Cloudy vs. Partly Sunny	According to the National Oceanic and Atmospheric Administration there is no official difference between the two terms. One or the other may be emphasized, to help clarify the meaning of the term used.

Read more: http://weatherforecasting.suite101.com/article.cfm/meteorologist_forecasting_terms#ixzz0QBMaiiTT

Boat Ramp Use Study
Sky Condition
Definitions

Sky Condition	Description
1. Clear (Sunny)	< 10% cloud cover
2. Partly Cloudy (mostly sunny)	30 - 60% cloud cover
3. Mostly Cloudy (partly sunny)	70-80 % cloud cover
4. Overcast	≥ 90% cloud cover
5. Fog	Report visibility in tenths of a kilometer (*e.g.*, 100m, 200m, etc.)
6. Trace of Rain or Snow	Not enough to measure
7. Light Rain	from stratus (layers/blanket) clouds, more widespread, steady, less intense; each drop of precipitation can be easily seen, puddles form slowly, some water flow in gutters
8. Moderate Rain	water puddles quickly, roads and other surfaces collect water, rain streams down windows
9. Heavy Rain	numerous sheets of rain, large puddles form, flooding can occur, visibility reduced
10. Showers	forms from cumulus clouds, more isolated, short-lived, affects a smaller area, sometimes more intense
11. Drizzle	Fine consistent light rain, <1mm droplet size (no wind)
12. Light Snow	Visibility is > 1 km; often very little accumulation results
13. Moderate Snow	Visibility between 400m - 1km; < 10 cm in 12 hours
14. Heavy Snow	Numerous flakes, visibility <400m; 10 cm in 12 hrs or 15 cm in 24 hrs

Source: http://weatherforecasting.suite101.com/article.cfm/meteorologist_forecasting_terms

Boat Ramp Use Study
Air and Water Temperature
Data Collection Procedures

Field staff should take air and water temperature readings any time between 11:00 am and 2:00 pm on each survey day. First collect air temperatures then water temperatures.

Summary of procedure for air temperature readings

1. Expose the thermometer to the air yet suspended away from any other material that may affect an accurate air temperature reading. The thermometer should be sheltered from direct solar radiation and other weather related influences.
2. Allow the thermometer to equilibrate before reading.
3. Read temperature.
4. Record temperature in the field form, along with ancillary information such as site, date, and time.

Summary of procedure for near surface water temperature readings

1. Select a representative area of the water body 2m from shore and hold the thermometer directly in the water 10 cm below the surface (*e.g.,* attach thermometer to a fishing line and pole and hang so as to have thermometer bulb about 10cm below surface).
2. Allow the immersed thermometer to equilibrate before reading (hold in water about 2 minutes).
3. Read temperature. If the thermometer is unreadable while it is immersed in the water, pull the thermometer out and check the reading quickly. Do this multiple times until an accurate reading is achieved (the lowest reading for a reading from cold water when the air is hot and still, or the highest reading if the water is warm and a wind is cooling the wet thermometer).
4. Record temperature in the field form, along with ancillary information such as site, date, and time.
5. If temperature readings are unstable (which can occur in lakes or poorly mixed streams), take multiple readings.

Suggested tips for taking the water-temperature measurements

Be careful not to break your thermometer and keep it in the shade at all times. While reading temperature, avoid warming the thermometer bulb or water sample with your hands or by the sun. Read the temperature measurements to the nearest ½ degree C.

Source: Adapted from SFU Water Studies (http://www.educ.sfu.ca/nbcr/tempprot.html), and Washington State Department of Ecology Environmental Assessment Program Standard Operating Procedures for Instantaneous Measurements of Temperature in Water http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP-SOP_011InstantMeasureofTempinWater.pdf
Note: Thermometers used in study: waterproof pocket thermometer (-30/+50c), not calibrated.

APPENDIX E – News Articles

- BC Hydro online survey to understand recreational use of Arrow Lakes Reservoir and Kinbasket boat ramp use. (2011, March 31). *Revelstoke Current.*
- BC Hydro online survey studies recreational use of Arrow Lakes Reservoir. (2011, April 6). *Revelstoke Times Review*.
- BC Hydro survey seeks input on Arrow Lakes boat ramp use. (2011, April 6). *The Valley Voice*.
- BC Hydro launches revised recreation survey. (2011, April 6). *Arrow Lakes News.*

BC Hydro online survey to understand recreational use of Arrow Lakes Reservoir and Kinbasket boat ramp use | Revelstoke Current

http://www.revelstokecurrent.com/2011/03/31/bc-hydro-online-survey-to-understand-recreational-use-of-arrow-lakes-reservoir-andkinbasket-boat-ramp-use/
Posted by editor on March 31, 2011

Harry Anderson and Dave Fitchett are two of the LEES and Associates surveyors finding out what people hope to see done with boat ramps on the Kinbasket and Arrow Lakes. *Photo courtesy of BC Hydro*

BC Hydro has announced an improved online survey now available at www.arrow-kinbasket-recreationsurvey.ca as part of its studies to understand water and shore-based recreational use of Arrow Lakes Reservoir and boat ramp use of Kinbasket Reservoir.

The online survey asks questions about reservoir recreation including boat ramp use, frequency of recreational activity, location, infrastructure requirements, user demographics, and level of familiarity with Arrow and Kinbasket Lakes reservoirs.

"BC Hydro wants to better understand current recreational use of Arrow Lakes Reservoir and use of Kinbasket Reservoir boat ramps as recommended by the Columbia River Water Use Plan," Alan Chan-McLeod, Hydro's Columbia River Water Use Plan Physical Works Lead, said in a statement Thursday. "This information will help guide future decision-making on recreational improvements."

The studies are being delivered by LEES and Associates. Data on recreational use is being collected at established recreation sites on Arrow Lakes Reservoir through traffic counters, face-to-face surveys with reservoir users, and online surveys. Kinbasket boat ramp use data is being collected through face-to-face surveys, online surveys and traffic counters installed at existing boat ramps.

"Last year, traffic counters installed at established boat launch locations recorded close to 24,000 boat launches at Arrow Lakes Reservoir ramps between October 1, 2009 and September 30, 2010," said Erik Lees from LEES and Associates, "and a total of 1,354 boat launches were recorded at Kinbasket Reservoir ramps between April 9, 2010 and Sep 30, 2010.

Study staff will be at randomly selected Arrow Lakes and Kinbasket reservoir access points from spring to fall this year to continue face-to-face surveys with reservoir users. To date a total of 641 face-to-face surveys have been completed as well as 39 responses to the pilot online survey that operated last year.

The Columbia River Water Use Plan, now in its fifth year of implementation, recommends a large number of monitoring programs and projects over 12 years to provide benefits to a variety of nonpower interests along the Columbia River mainstem including recreation, fish and fish habitat, wildlife, vegetation, and heritage. The plan calls for debris management, boat ramp improvements, and recreation demand studies on Arrow Lakes and Kinbasket reservoirs to benefit boat recreation.

Revelstoke Times Review - News

BC Hydro online survey studies recreational use of Arrow Lakes Reservoir

By Aaron Orlando - Revelstoke Times Review
Published: **April 06, 2011 12:00 PM**

BC Hydro has announced an improved online survey is now available at www.arrow-kinbasket-recreation-survey.ca as part of studies to understand water and shore-based recreational use of Arrow Lakes Reservoir and boat ramp use of Kinbasket Reservoir.

The online survey asks questions about reservoir recreation including boat ramp use, frequency of recreational activity, location, infrastructure requirements, user demographics and level of familiarity with Arrow and Kinbasket Lakes reservoirs.

“BC Hydro wants to better understand current recreational use of Arrow Lakes Reservoir and use of Kinbasket Reservoir boat ramps as recommended by the Columbia River Water Use Plan,” said Alan Chan-McLeod, BC Hydro’s Columbia River Water Use Plan Physical Works Lead. “This information will help guide future decision-making on recreational improvements.”

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The survey will run through until mid-2014 and results of the survey and other study activities will be made available in a recreation demand report around at the end of 2014.

Find this article at: http://www.bclocalnews.com/kootenay_rockies/revelstoketimesreview/news/119294809.html

The Valley Voice (April 6th, 2011)
Serving every home between Edgewood,
Kaslo and South Slocan (on the Arrow Lakes)

BC Hydro survey seeks input on Arrow Lakes boat ramp use

submitted by BC Hydro

BC Hydro has recently posted an improved online survey as part of studies to understand water and shore-based recreational use of Arrow Lakes Reservoir and boat ramp use of Kinbasket Reservoir.

The online survey asks questions about reservoir recreation including boat ramp use, frequency of recreational activity, location, infrastructure requirements, user demographics, and level of familiarity with Arrow and Kinbasket Lakes reservoirs. Alan Chan-McLeod, BC Hydro's Columbia River Water Use Plan Physical Works Lead, said the information will help guide future decision-making on recreational improvements.

Data on recreational use is being collected at established recreation sites on Arrow Lakes Reservoir through traffic counters, face-to-face surveys with reservoir users, and online surveys. Kinbasket boat ramp use data is being collected through face-to-face surveys, online surveys and traffic counters installed at existing boat ramps.

"Last year, traffic counters installed at established boat launch locations recorded close to 24,000 boat launches at Arrow Lakes Reservoir ramps between October 1, 2009 and September 30, 2010," said Erik Lees from LEES and Associates, which is conducting the study. "A total of 1,354 boat launches were recorded at Kinbasket Reservoir ramps between April 9, 2010 and September 30, 2010."

Study staff will be at randomly selected Arrow Lakes and Kinbasket reservoir access points from spring to fall this year to continue face-to-face surveys with reservoir users. To date a total of 641 face-to-face surveys have been completed as well as 39 responses to the pilot online survey that operated last year.

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To participate visit www.arrow-kinbasket-recreation-survey.ca.

Arrow Lakes News

BC Hydro launches revised recreation survey

By Staff Writer - Arrow Lakes News
Published: **April 06, 2011 5:00 PM**
Updated: **April 07, 2011 12:09 PM**

BC Hydro has announced an improved online survey is now available at www.arrow-kinbasket-recreation-survey.ca as part of studies to understand water and shore-based recreational use of Arrow Lakes Reservoir and boat ramp use of Kinbasket Reservoir.

The online survey asks questions about reservoir recreation including boat ramp use, frequency of recreational activity, location, infrastructure requirements, user demographics and level of familiarity with Arrow and Kinbasket Lakes reservoirs.

"BC Hydro wants to better understand current recreational use of Arrow Lakes Reservoir and use of Kinbasket Reservoir boat ramps as recommended by the Columbia River Water Use Plan," said Alan Chan-McLeod, BC Hydro's Columbia River Water Use Plan Physical Works Lead. "This information will help guide future decision-making on recreational improvements." Boat ramp use data is being collected through face-to-face surveys, online surveys and traffic counters installed at existing boat ramps.

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The survey will run through until mid-2014 and results of the survey and other study activities will be made available in a recreation demand report around at the end of 2014.

Find this article at: http://www.arrowlakesnews.com/news/119367584.html