Columbia River Project Water Use Plan

Kinbasket and Arrow Recreation Management Plan

Boat Ramp Use Study

Implementation Year 7

Reference: CLBMON-14

Progress Report Year 7

Study Period: 2016

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CLBMON-14
Boat Ramp Use Study

Progress Report (Implementation Year 7)
Study Period: 2016
June, 2018

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Table 1. CLBMON 14 STATUS of OBJECTIVES, MANAGEMENT QUESTIONS and HYPOTHESES after Year 7

Objectives	Management Questions	Management Hypotheses	Year 7 (2016) 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?	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.	Results show changes in volume of public use where improvements have been undertaken is mixed. Some sites experienced an increase in volume of public use while other site saw a decrease or no change in volume. Expecting more data in 2017.
	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?	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.	Results to date suggest that the volume of reported use of new or improved facilities does not reduce the usage of nearby existing boat ramps, or result in an increase in new users. Expecting more data in 2017.
	3) Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?	H_3: User satisfaction of the new and upgraded boat ramps is greater than that experienced by users of the older facilities.	Results to date show a significant increase in user satisfaction following improvements to existing boat ramps and parking lot conditions. Expecting more data in 2017.
	4) Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?	H_4: There are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket and Arrow Lakes reservoirs.	Results to date suggest there are no changes in the socio-demographic characteristics of users of boat ramps on Kinbasket and Arrow Lakes reservoirs. Results suggest that boat ramp improvements have satisfied the majority of boat users needs. Expecting more data in 2017.

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We would like to thank the following people for their contributions to this project.

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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 completed boat ramp facility construction or improvements at ten locations – eight locations on the Arrow Lakes Reservoir and two on Kinbasket Reservoir. 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 the management questions and supporting hypotheses specific parameters are measured through a combination of monitoring (traffic count and observational data collection) and interviews (on-site surveys). The study has a 10 year horizon (2010 to 2019), with sampling occurring in Years 1 to 4 inclusive, and in Years 7 to 10. Year 7 included a full program of vehicle counts, but with no intercept surveys being administered.

Results to date suggest changes in daily visitor volume are mixed following boat ramp improvements. Improvements did not result in reduced usage of nearby existing boat ramps, or an increase in new users, or a change in the type of user group. Visitor satisfaction was the factor most affected post-construction, suggesting these projects have been effective in providing benefits to recreational interests in the area. Year 7 is the first sampling year after all ramps have been fully constructed. More robust conclusions may be made after more visitors have been able to use the improved sites in sampling Years 8 to 10.

The status of CLBMON 14 after Year 7 (2016) with respect to the management questions and management hypotheses is summarized in Table 1.

Table 1. CLBMON 14 STATUS of OBJECTIVES, MANAGEMENT QUESTIONS and HYPOTHESES after Year 7

Objectives	Management Questions	Management Hypotheses	Year 7 (2016) 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?	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.	Results show changes in volume of public use where improvements have been undertaken is mixed. Some sites experienced an increase in volume of public use while other site saw a decrease or no change in volume. Expecting more data in 2017.
	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?	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.	Results to date suggest that the volume of reported use of new or improved facilities does not reduce the usage of nearby existing boat ramps, or result in an increase in new users. Expecting more data in 2017.
	3) Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?	H_3: User satisfaction of the new and upgraded boat ramps is greater than that experienced by users of the older facilities.	Results to date show a significant increase in user satisfaction following improvements to existing boat ramps and parking lot conditions. Expecting more data in 2017.
	4) Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?	H_4: There are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket and Arrow Lakes reservoirs.	Results to date suggest there are no changes in the socio-demographic characteristics of users of boat ramps on Kinbasket and Arrow Lakes reservoirs. Results suggest that boat ramp improvements have satisfied the majority of boat users needs. Expecting more data in 2017.

2. Introduction

2.1 Background

During the Columbia River Water Use planning (WUP) 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 completed boat ramp facility improvements[1] at ten locations – eight locations on the Arrow Lakes Reservoir and two locations on Kinbasket Reservoir (see Tables 3, 4).

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 assesses the effectiveness of the boat ramp facility improvements that have been made as part of the Columbia River WUP, by monitoring the ten sites where access improvements have been made. Sampling was also undertaken at two control sites. 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 progress report summarizes the results from Year 7 (2016).

[1] Recreational boat access improvements may include ramp extensions, breakwaters, debris booms, docking floats, parking and other site changes.
[2] Concurrent to Years 1-4 of CLBMON 14, BC Hydro conducted the Arrow Lakes Recreational Demand Study (CLBMON 41). Due to significant overlaps, the two studies were combined into one delivery model; however, data collection for CLBMON-41 concluded in 2013.

2.2 Management Questions and Objectives

The key management questions addressed by this study are:

MQ1: Does public use of boat ramps increase on Kinbasket and Arrow Lakes reservoirs after installation and upgrading of the WUP boat ramp facilities?

MQ2: 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?

MQ3: Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?

MQ4: 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.

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.

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.

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.

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 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.

H_3: 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 group characteristics. Therefore, it is important to monitor if user characteristics change over time.

H_4: 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 were improved early in the study period do not have much, if any, pre-improvement data against which the post-improvement data can be compared. Conversely, ramps that were improved later in the study period will have less post-improvement data. This will mean that hypotheses *H_{2B}, H_3 and H_4* may not be uniformly tested over every boat launch ramp location.

3. Methods

To address the management questions and supporting hypotheses, specific parameters were measured through a combination of monitoring (traffic counters, spots counts and observational data collection) and interviews (on-site intercept and online surveys). This study has a 10 year horizon, with sampling occurring in spring, summer, and fall seasons (Terms of Reference, BC Hydro 2009, p.9). In order to meet scheduling and budget criteria, (gained though integration with CLBMON 41), sampling has occurred in Years 1 to 4 inclusive, and Years 7 to 10 (Table 2). 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 has been summarized in report format.

Table 2. Activities and reporting by monitoring year.

Year	CLBMON 14	Activities	Annual Report
2010	Year 1	• Survey development • First field season (surveys and vehicle counters at all sites)	Progress Report
2011	Year 2	• Full field season • Two new sites added	Progress Report
2012	Year 3	• Full field season • All sites sampled	Progress Report
2013	Year 4	• Full field season • All sites sampled	Mid-Term Report
2014	Year 5	• No sampling	-
2015	Year 6	• No sampling	-
2016	Year 7	• Vehicle counters at all sites • No surveys	Progress Report
2017	Year 8	• Vehicle counters at all sites • Surveys at three sites	Progress Report
2018	Year 9	• Vehicle counters at all sites • No surveys	Progress Report
2019	Year 10	• Full field season • All sites to be sampled	Final Comprehensive Report

Year 7 (2016) included a full program of vehicle counters at all sites, with no on-site survey. This report provides a summary of Year 7 results. A comprehensive report will be prepared at the conclusion of the study. The final report will include a detailed summary of the study findings as they relate to the management questions and hypotheses.

This methods section is presented under the following headings:

- Sampling Sites;
- Traffic Data Collection;
- Survey Delivery and Design;

3.1 Sampling Sites

The sampling sites used in this study (see Tables 3, 4 and Figures 1, 2) include the ten sites that were 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. Burton was used as a control site on the Arrow Lakes Reservoir. Esplanade Bay was used as a control site on the Kinbasket Reservoir in Years 2 through 4; however, Esplanade Bay was found to be a low-use site with limited value as a control site, and measurement of traffic counts was discontinued at this site after Year 4. Nixon Creek was not included as a sample site as roads were inaccessible during the sampling period. The status of improvements and ramp elevations at sampling sites used in this study is summarized in Tables 3 and 4 (Monitoring Program and Physical Works Annual Report: BC Hydro 2017).

Table 3. Locations and status of boat ramp improvements on Arrow Lakes Reservoir.

CLBMON 14 Study Site	Boat Ramp	Year Completed	Elevation of ramp toe (m)	Lowest operational water level (m)	Comments
Arrow Lakes Reservoir					
√	Nakusp	2016	420.50	421.50	Construction began in 2013, completed February 2016.
√	McDonald Creek	2015	426.00	427.00	Construction in 2014 and 2015.
√	Burton	Control site	n/a	n/a	n/a
√	Burton South[†]	2015	425.40	426.40	Construction occurred between 2010 and 2015.
√	Fauquier	2011	424.66	425.66	Construction in 2010 and 2011. Some adjustments to the breakwater in 2015.
√	Edgewood	2015	425.76	426.76	Construction occurred between 2013 and 2015.
√	Anderson Point	2015	425.00	426.00	Construction began in 2013, completed in 2015.
√	Shelter Bay	2016	422.86	423.86	Construction began in 2015, completed April 2016.
√	Syringa	2015	421.87	422.87	Construction in 2015.

Table 4. Location and status of boat ramp improvements on Kinbasket Reservoir.

CLBMON 14 Study Site	Boat Ramp	Year Completed	Elevation of ramp toe (m)	Lowest operational water level (m)	Comments
Kinbasket Reservoir					
√	Valemount Marina	2013 (Except walkway)	727.59	728.59	Majority of construction completed in 2011. Further ramp extension in 2013. Boarding floats (walkway) replacement completed in 2016.
√	Bush Harbour	2013	724.60	725.60	Construction occurred between 2011 and May 2013.
√	Esplanade Bay[†]	Used as a control site in Years 2 to 4	n/a	n/a	n/a
-	Nixon Creek	n/a	n/a	n/a	Not included in study. NB: While Nixon was identified as a potential ramp for improvement, it was not possible to guarantee the Forest Service Road would remain open throughout the recreation season. Therefore, this site was eliminated from consideration.

Figure 1. Sampling locations map – Arrow Lakes Reservoir.

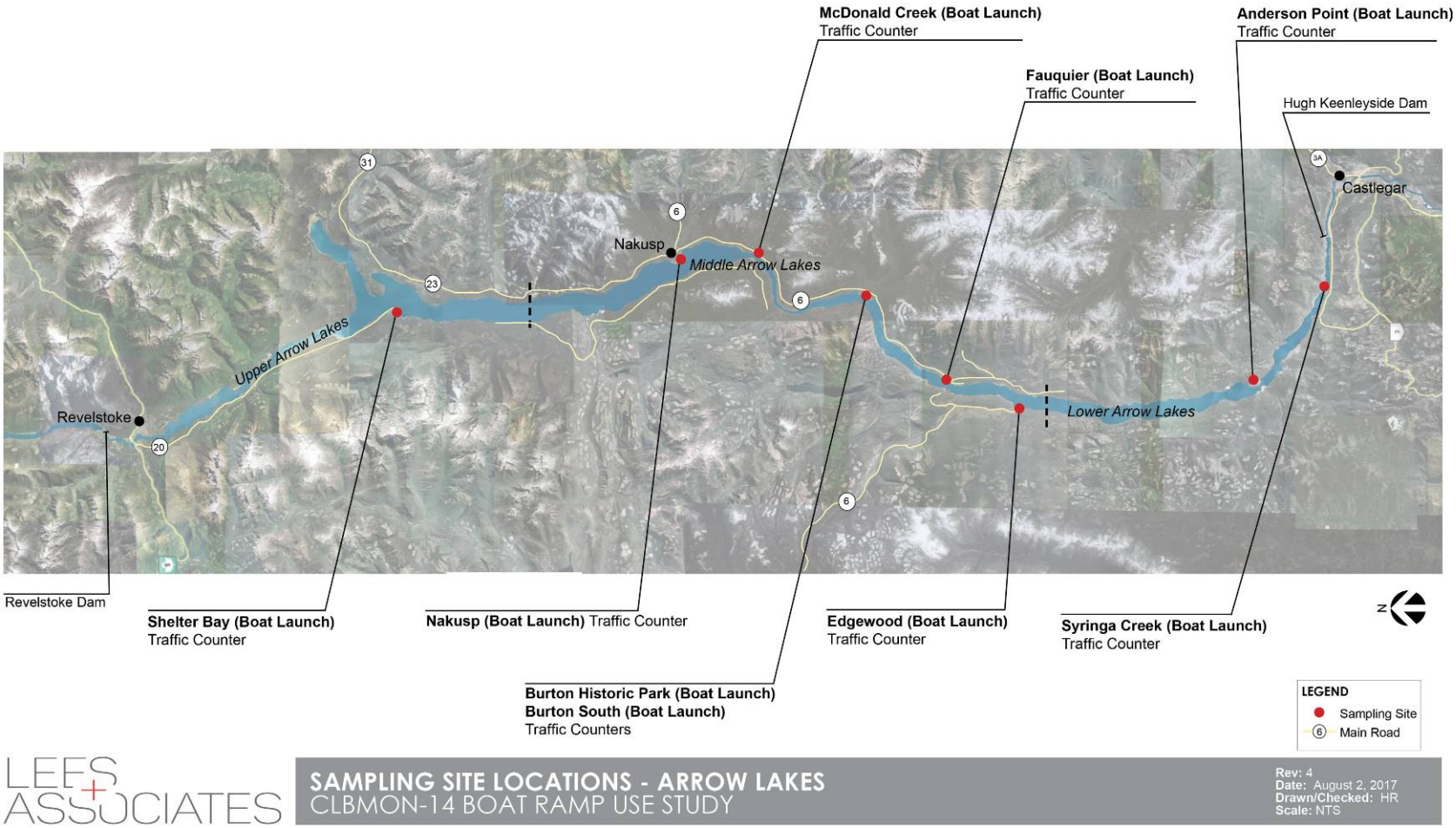
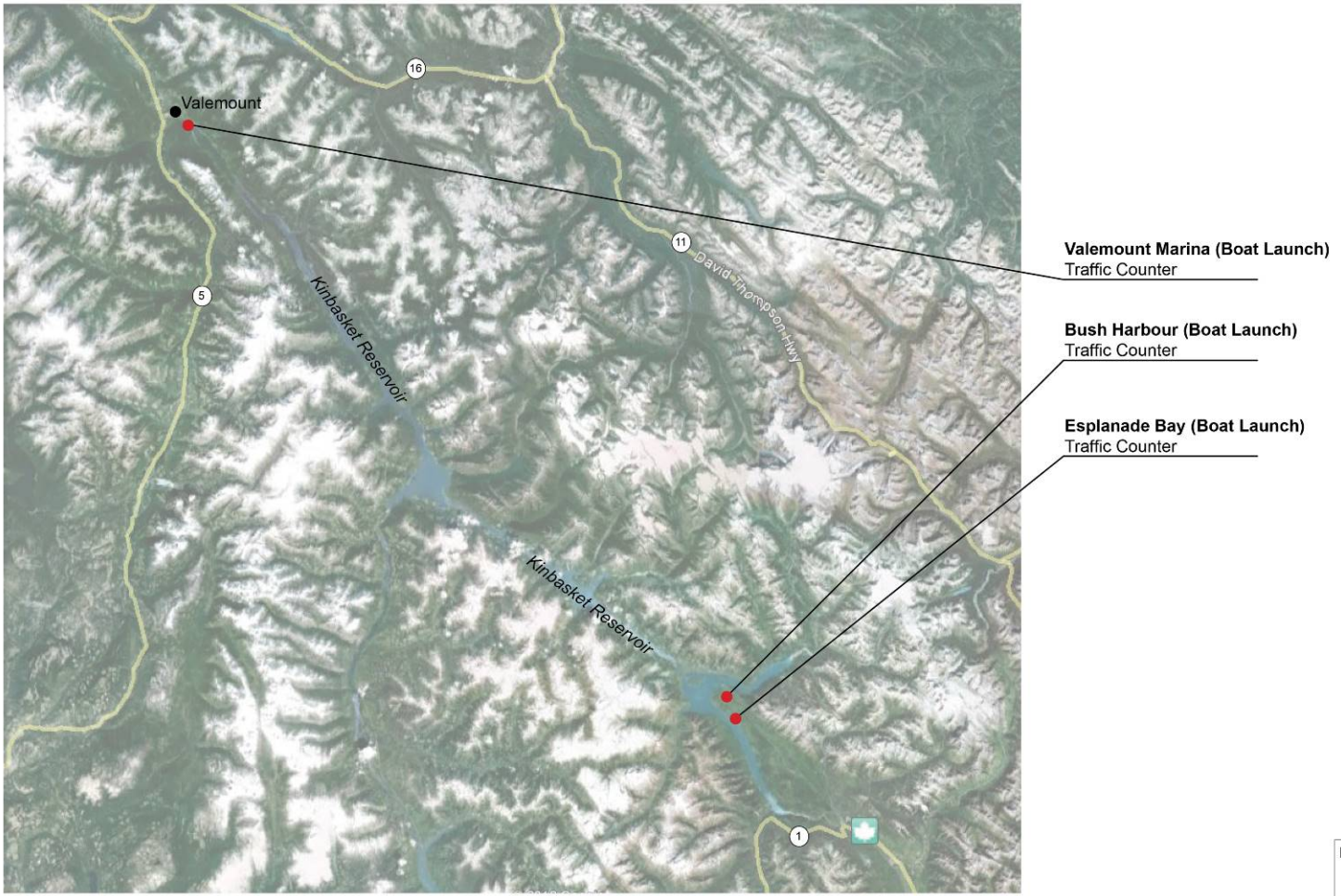


Figure 2. Sampling locations map – Kinbasket Reservoir.



3.2 Traffic Data Collection

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 (Terms of Reference, BC Hydro 2009, p.8). 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.

Vehicle counters were configured and installed at each sampling location as per the manufacturer's specifications to monitor the number of vehicles using the ramp facilities. Vehicle counters remained in place year-round to collect vehicle counts in Years 1-4, inclusive. Vehicle counters were re-installed in Year 7 of the study, once all planned boat ramp improvements were completed. Counter installation for the Year 7 period took place between May 10 and May 12, 2016, as soon as all boat launches were accessible after winter snow and ice conditions. Once installed, continuous traffic counts were taken through December 31, 2016.

Annual vehicle counts were collected and automatically compiled by the TRAFx DataNet system for each full calendar year. This was 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 vehicle count calculations can be found in Appendix A. Vehicle counter results are presented in Appendix B.

3.2.1 Arrow Lakes Reservoir Vehicle Counters

Vehicle counters were installed at boat access sites at Nakusp, McDonald Creek, Burton, Burton South, Fauquier, Syringa, Shelter Bay, Edgewood and Anderson Point.

Counter sensitivity and delay settings were configured to most accurately record traffic at each site, in order to achieve a level of accuracy that would permit conclusive answers to the management questions. Thresholds were adjusted to the least sensitive setting that would still pick up a vehicle passing through but not smaller or more distant metal objects; there is a 17 second delay between counts on single lane ramps and 15 second delay on double lane ramps to reduce multiple counts of same vehicle.

Settings were monitored and adjusted during the first year of study (2010) and inspected three times each study year to ensure counters were configured to most accurately record traffic at each site. In 2013, Nakusp counter settings were adjusted to accommodate placement of the counter in the middle of the new cement ramp. Other than at Nakusp, the counter sensitivity and delay settings remain unchanged since Year 2 (2011). Traffic counter settings used at Arrow Lakes sites are included in Appendix A.

3.2.2 Kinbasket Reservoir Vehicle Counters

Vehicle counters were installed at the Bush Harbour and Valemount Marina boat ramps. Vehicle counter sensitivity and delay settings used at Kinbasket Reservoir sites are included in Appendix A. The counter sensitivity and delay settings at Kinbasket sites have remained unchanged since Year 2 (2011).

3.3 Special Operational Conditions

Initial counter installation for the Year 7 period began between May 10 and May 12, 2016, as soon as all boat launches were accessible after winter snow and ice conditions. Once installed, continuous traffic counts were taken through December 31, 2016.

To best reflect actual use for all locations, Average Daily Traffic (ADT) estimates were used for missed days in partial months of counts. No data on traffic usage was collected from January to April 2016.

3.4 Survey Delivery and Design

There was no collection of observational data or on site surveys in Year 7 (2016).

4. Results

4.1 Kinbasket Reservoir – Traffic Results

Below is a summary of adjusted traffic counts for the Year 7 (2016) period as collected and automatically compiled by the TRAFx DataNet system.

The table presents traffic counts adjusted to best reflect actual use. This means TRAFx Datanet applies the average daily traffic count to 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. The application of average daily traffic counts is described further in Appendix A.

The "A = adjustment applied" referred to in the legend means that traffic counts are multiplied by 0.5 to account for the fact that vehicles must make two trips per boating experience (one to launch the boat and another to load the boat). Further explanation regarding traffic counter settings and how annual traffic counts are calculated is included in Appendix A.

As discussed in section 3.3, in Year 7 (2016) counters were installed between May 10 and May 12 and remained in place through December 31. Therefore, no counts are shown for January through April 2016.

Table 5. Kinbasket Lake - Traffic Summary 2016 (Adjusted).

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ADT†	ADT† x365	Days with data
Bush Harbour ADF	--	--	--	--	*111**	129	171	191	114	*74**	45	2	**3.416**	**1,250**	**231**
Valemount ADF	--	--	--	--	*15**	26	38	31	13	*0**	*2**	0	**0.539**	**197**	**217**

Notes:

ADT† = Average Daily Traffic

* = based on that month's ADT

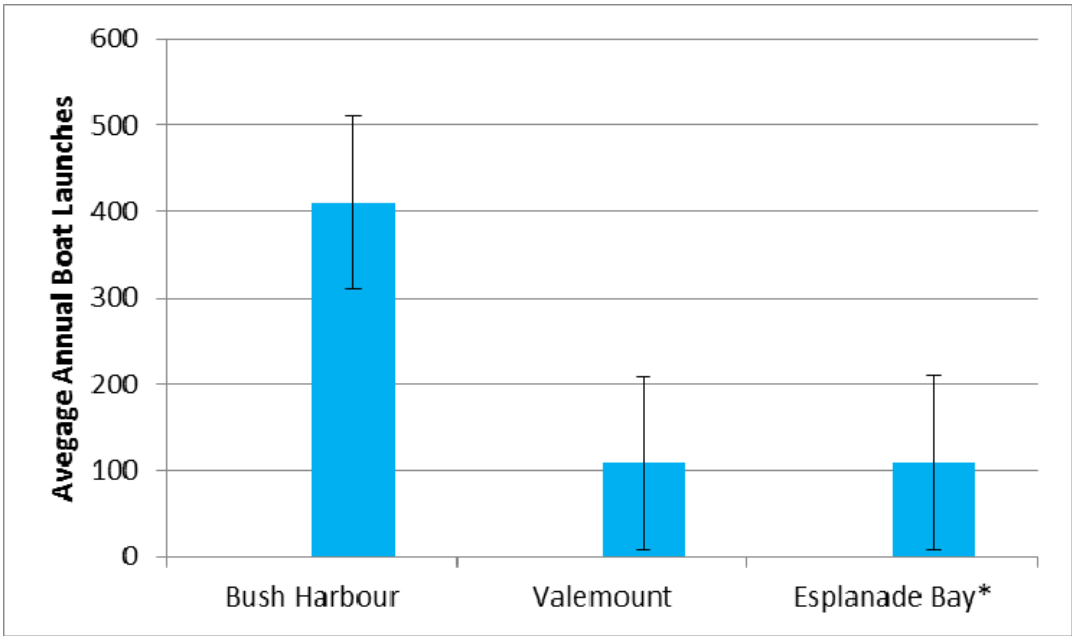
A = adjustment applied D = divide by 2 applied F = filtering applied

-- = no counts collected for this month

The following presents a summary of vehicle counts for Years 1 to 4, and Year 7 (Table 6, Figures 3, 4).

Table 6. Kinbasket Reservoir Boat Launches – Annual Traffic Summary (Adjusted)

Year	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Annual Total
2010	Bush Harbour	--	--	--	--	--	--	--	86	37	38	6	0	**167**	
	Valemount	0	0	0	12	6	13	61	28	23	3	0	0	**146**	**313**
2011	Bush Harbour	0	0	0	0	39	43	102	82	60	33	4	0	**363**	
	Esplanade Bay	--	--	--	--	6	8	27	67	26	6	0	0	**140**	
	Valemount	0	0	2	0	3	40	30	12	10	0	0	0	**97**	**600**
2012	Bush Harbour	0	0	0	0	40	61	98	80	2	1	0	0	**294**	
	Esplanade Bay	0	0	0	0	7	7	31	67	9	1	0	0	**105**	
	Valemount	1	0	0	0	1	25	10	20	10	2	0	0	**70**	**469**
2013	Bush Harbour	0	0	0	0	39	52	83	99	84	25	10	0	**392**	
	Esplanade Bay	0	0	0	0	6	8	22	32	8	6	0	0	**82**	
	Valemount	0	0	0	2	4	33	26	27	14	0	0	0	**106**	**580**
2016	Bush Harbour	-	-	-	-	111	129	171	191	114	74	45	2	**837**	
	Valemount	-	-	-	-	15	26	38	31	13	0	2	0	**125**	**962**



*Esplanade Bay counts were 2011 – 2013 only

Figure 3. Kinbasket Boat Launches – Average Annual Total by Site (2010-2013, 2016)

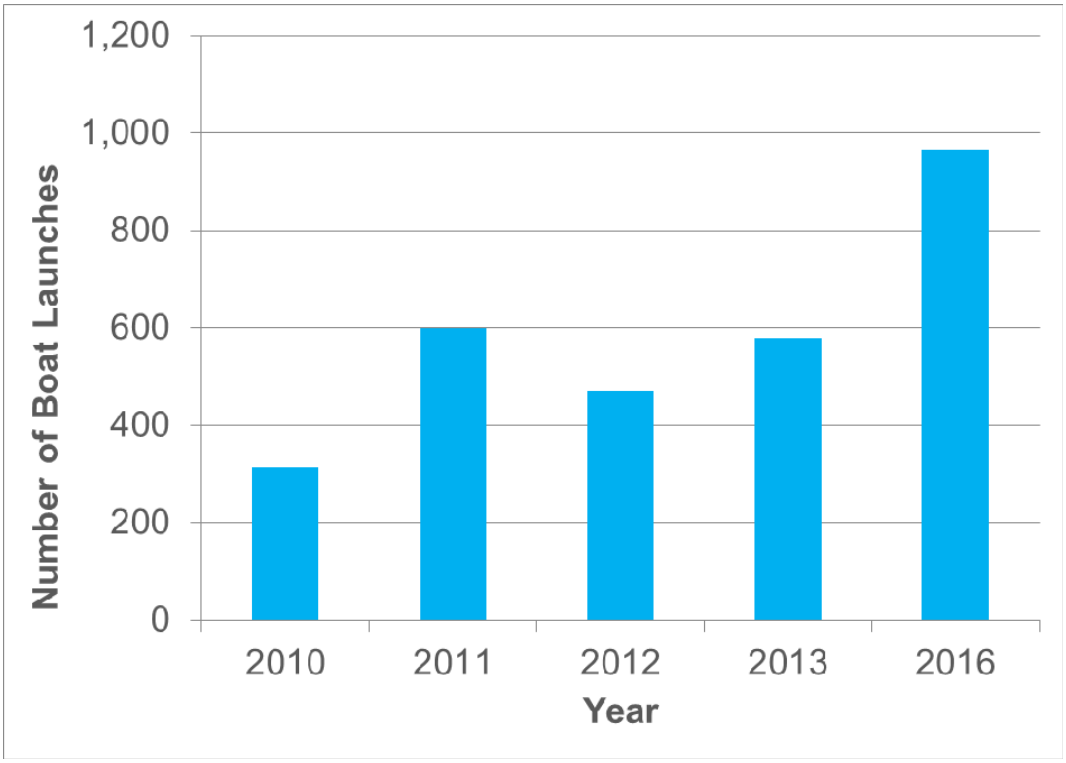


Figure 4. Kinbasket Reservoir – Total Number of Boat Launches by Year (2010-2013, 2016)

Over the four full years of data collection (2011-2013 and 2016) the average annual boat launch use on Kinbasket Reservoir was 654 launches per year. Year 1 (2010) was a partial year as Bush Harbour was not available to the public until August. There was a marked reduction in boat launch use in 2012 compared with the preceding and following years. This may have been due to it being an excessively high water year with a resulting increase in floating debris and reduction in accessible beach area. Year 7 (2016) saw the highest use with a total of 962 launches. Year 7 was the first full sampling year post-improvements, with boat ramp construction at both Bush Harbour and Valemount reaching completion in 2013.

Kinbasket Reservoir – Traffic by Site

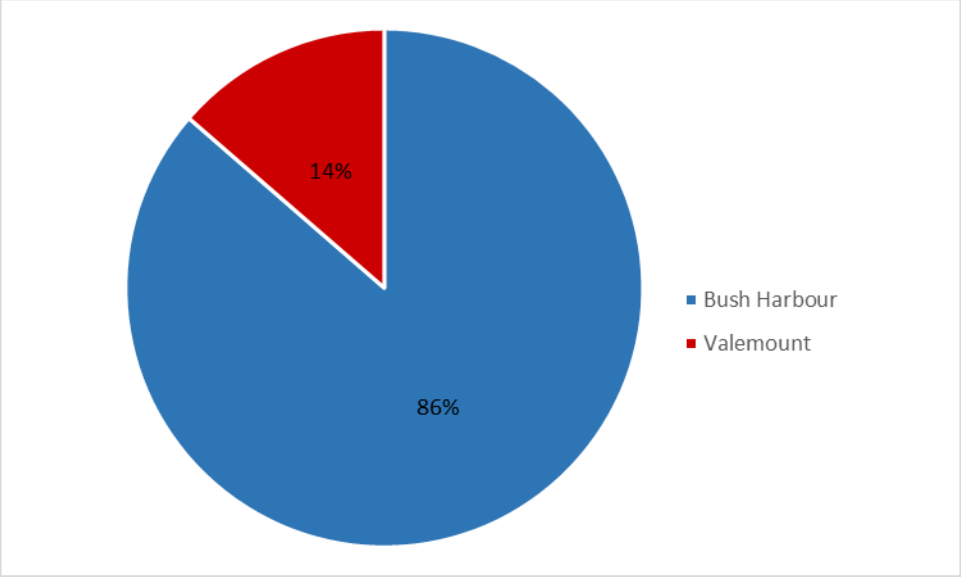


Figure 5. Kinbasket Reservoir - Traffic by Site.

On average, in Year 7 (2016), Bush Harbour generated 86% of the recorded (adjusted) boat launch use on Kinbasket Reservoir, while Valemount produced 14%. However, the actual amount of boating use at Valemount may be higher than shown due to the onsite marina and nearby recreation sites and Trails BC campgrounds where people can moor their boat rather than removing it each time they use it.

Kinbasket Reservoir – Traffic by Months of the Year

Monthly Averages

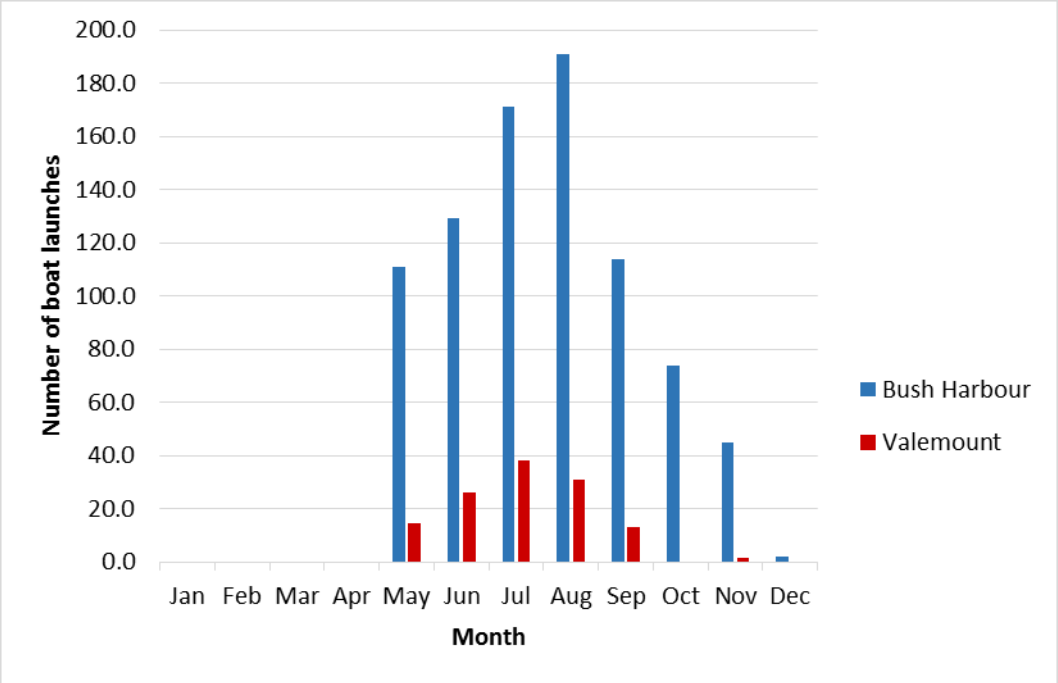


Figure 6. Kinbasket Reservoir - Traffic by Months of the Year.

According to adjusted figures, in Year 7 (2016) the heaviest boat launch use occurred in August in Bush Harbour and in July in Valemount. As each of these sites is snow bound for five or six months, virtually all recorded activity occurs during the late spring, summer and early fall. A few recorded uses in winter were likely an anomaly where a snowmobile may have been recorded using the boat ramp to access the frozen lake.

Kinbasket Reservoir – Traffic by Days of the Week

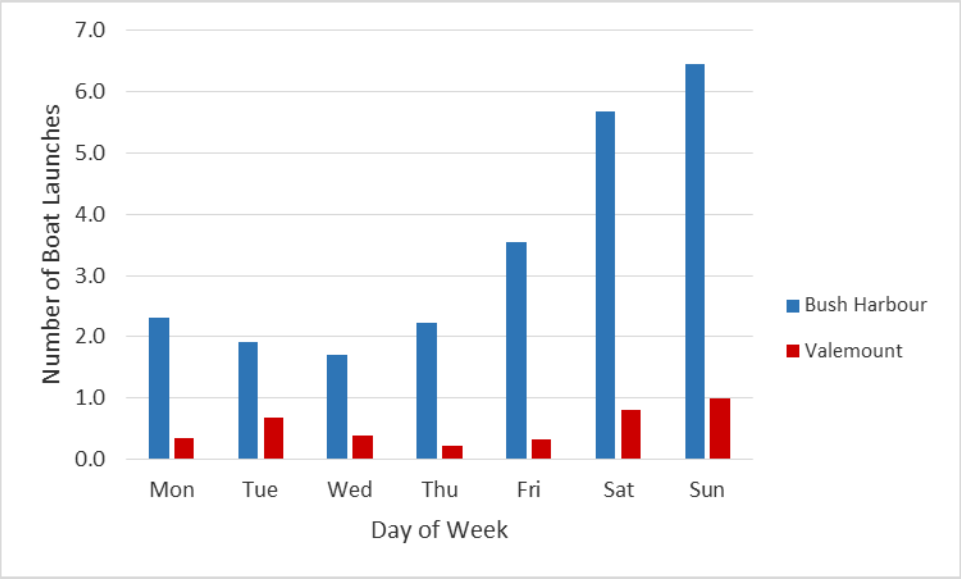


Figure 7. Kinbasket Reservoir - Traffic by Days of the Week.

As expected, most recorded use occured on the weekends. At Bush Harbour over 50% of use was attributed to Saturdays and Sundays. Sundays got the heaviest use overall. At Bush Harbour, Fridays and Mondays saw the most week day use, with Fridays recording 60% more use than other week days. At Valemount, Tuesdays saw more use than other week days. Because boats are kept at the Valemount Marina and there are several Forest Service campgrounds close by there may be more boating activity (i.e., total "boater/days" on the reservoir), than the recorded traffic indicates.

4.2 Arrow Lakes Reservoir – Traffic Results

Below is a summary of adjusted traffic counts for the Year 7 (2016) period as collected and automatically compiled by the TRAFx DataNet system (Table 7). The table presents traffic counts adjusted to best reflect actual use as described in Appendix A. In Year 7 (2016), counters were installed between May 10 and May 12 and remained in place through December 31. Therefore, no counts are shown for January through April 2016.

Table 7. Arrow Lakes - Traffic Summary 2016 (Adjusted).

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ADT†	ADT† x365	Days with data
Anderson Point[ADF]	--	--	--	--	*42**	49	70	61	25	18	17	1	**1.888**	**435**	**234**
Burton[ADF]	--	--	--	--	*34**	41	*160**	168	5	*0**	3	0	**1.703**	**623**	**229**
Burton South[ADF]	--	--	--	--	*31**	60	*80**	89	29	*14**	11	4	**1.323**	**484**	**229**
Edgewood [ADF]	--	--	--	--	*47**	28	87	100	25	*16**	19	14	**1.373**	**503**	**233**
Fauquier [ADF]	--	--	--	--	*2**	3	18	8	0	*0**	2	2	**0.150**	**55**	**227**
McDonald Cr[ADF]	--	--	--	--	*42**	60	140	185	46	*52**	23	4	**2.307**	**844**	**231**
Nakusp[ADF]	--	--	--	--	*154**	258	396	411	153	*129**	113	90	**7.064**	**2,586**	**233**
Shelter Bay[ADF]	--	--	--	--	*127**	62	103	194	129	*98**	45	12	**3.099**	**1,134**	**232**
Syringa Cr. [ADF]	--	--	--	--	*246**	351	617	573	147	74	71	38	**8.675**	**3,175**	**234**

Notes:

ADT† = Average Daily Traffic

* = based on that month's ADT

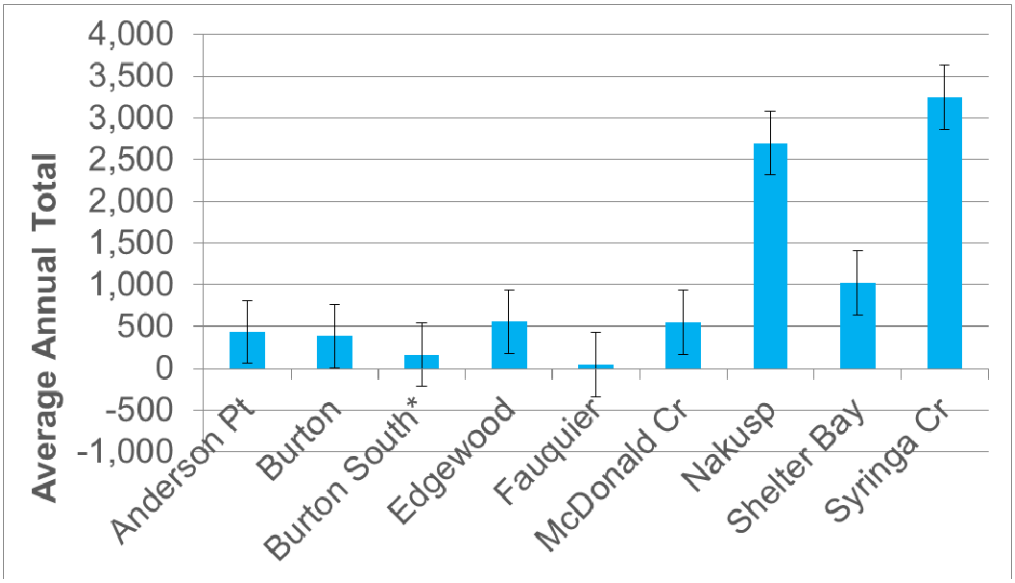
[A] = adjustment applied [D] = divide by 2 applied [F] = filtering applied

-- = no counts collected for this month

The following presents a summary of vehicle counts for Years 1-4, and Year 7 (Table 8, Figures 8, 9).

Table 8. Arrow Lakes Reservoir – Annual Traffic Summary (Adjusted)

Year	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Grand Total
2010	Anderson Point	--	--	--	32	49	99	97	96	55	43	20	14	**505**	10,608
	Burton	0	3	2	8	32	83	106	123	15	19	9	2	**402**	
	Burton South	--	--	--	--	--	--	--	--	--	--	--	--	**0**	
	Edgewood	96	100	136	64	61	88	174	103	26	34	21	15	**918**	
	Fauquier	3	17	18	12	35	--	--	--	3	0	0	0	**88**	
	McDonald Cr	4	19	16	32	124	--	300	215	87	37	12	2	**848**	
	Nakusp	152	162	170	192	247	330	748	529	161	185	90	150	**3,116**	
	Shelter Bay	0	41	100	89	165	85	142	148	118	179	31	0	**1,098**	
	Syringa Cr	106	130	181	164	307	565	997	738	175	174	64	32	**3,633**	
2011	Anderson Point	12	12	12	21	42	61	104	86	60	56	30	4	**500**	10,065
	Burton	0	9	2	11	32	72	121	144	56	6	2	2	**457**	
	Burton South	--	--	--	--	--	--	--	8	22	5	0	1	**36**	
	Edgewood	12	10	42	51	66	68	140	123	53	29	7	11	**612**	
	Fauquier	2	0	0	4	2	3	3	2	3	0	0	0	**19**	
	McDonald Cr	0	0	0	36	33	55	101	148	52	3	0	7	**435**	
	Nakusp	183	114	125	198	202	318	643	724	266	165	90	161	**3,189**	
	Shelter Bay	0	0	22	102	171	119	116	174	174	129	24	17	**1,048**	
	Syringa Cr	44	77	97	147	241	495	1,066	1,004	381	112	54	51	**3,769**	
2012	Anderson Point	12	13	32	49	64	63	71	92	90	50	25	9	**570**	9,518
	Burton	1	0	0	1	13	44	101	128	30	6	2	0	**326**	
	Burton South	0	0	2	8	4	13	8	37	24	5	0	3	**104**	
	Edgewood	14	12	33	52	50	52	68	126	76	35	16	4	**538**	
	Fauquier	0	0	2	2	4	7	0	4	0	2	0	0	**21**	
	McDonald Cr	2	0	0	11	37	47	70	110	57	13	2	3	**352**	
	Nakusp	171	112	209	213	231	225	524	697	320	224	132	135	**3,193**	
	Shelter Bay	4	0	7	88	181	70	87	205	223	132	39	8	**1,044**	
	Syringa Cr	48	46	87	144	239	266	873	1,008	341	149	87	82	**3,370**	
2013	Anderson Point	--	--	--	--	40	49	76	72	26	25	12	9	**309**	8,755
	Burton	0	0	0	5	27	26	106	132	28	5	0	1	**330**	
	Burton South	0	79	70	14	23	24	72	54	12	2	3	2	**355**	
	Edgewood	10	44	--	--	60	32	60	85	31	25	28	17	**392**	
	Fauquier	0	2	3	0	3	1	4	11	4	2	2	1	**33**	
	McDonald Cr	4	0	31	29	43	73	145	164	52	10	10	5	**566**	
	Nakusp	175	15	--	--	115	257	530	487	242	192	114	149	**2,276**	
	Shelter Bay	1	8	107	95	202	116	133	168	152	120	51	9	**1,162**	
	Syringa Cr	80	118	147	174	275	459	916	724	229	109	46	55	**3,332**	
2016	Anderson Point	--	--	--	--	42	49	70	61	25	18	17	11	**293**	6,536
	Burton	--	--	--	--	34	41	160	168	5	0	3	0	**411**	
	Burton South	--	--	--	--	31	60	80	89	29	14	11	4	**318**	
	Edgewood	--	--	--	--	47	28	87	100	25	16	19	14	**336**	
	Fauquier	--	--	--	--	2	3	18	8	0	0	2	2	**35**	
	McDonald Cr	--	--	--	--	42	60	140	185	46	52	23	4	**552**	
	Nakusp	--	--	--	--	154	258	396	411	153	129	113	90	**1,704**	
	Shelter Bay	--	--	--	--	127	62	103	194	129	98	45	12	**770**	
	Syringa Cr	--	--	--	--	246	351	617	573	147	74	71	38	**2,117**	



* Burton South counts began in 2011

Figure 8. Arrow Lakes Boat Launches – Average Annual Total by Site (2010-2013, 2016)

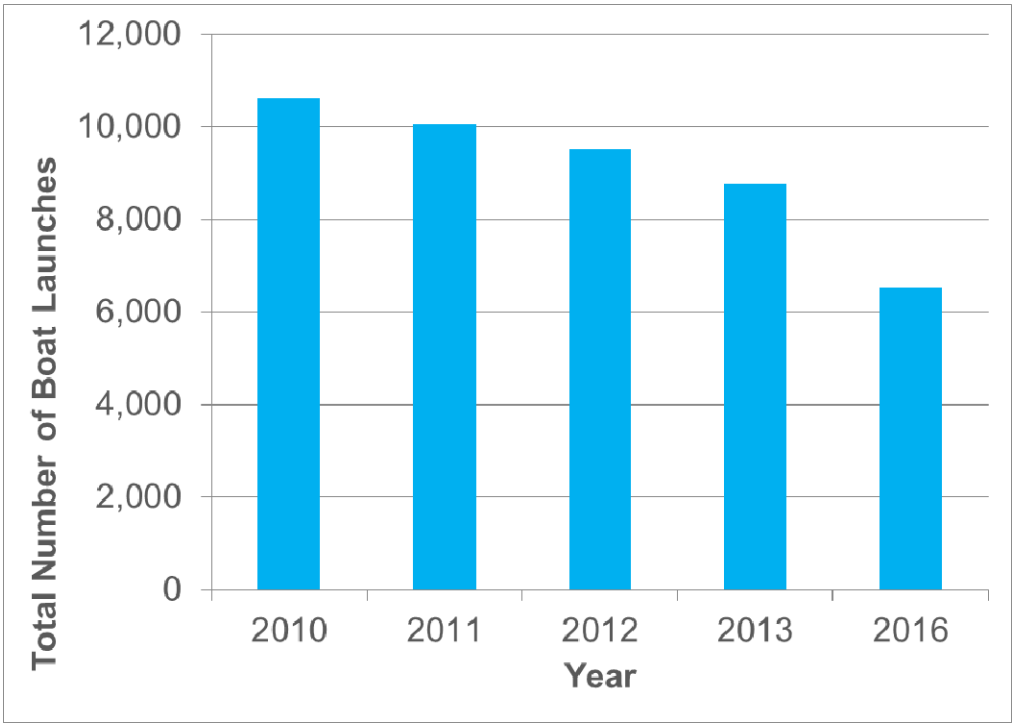


Figure 9. Arrow Lakes – Total Number of Boat Launches by Year (2010-2013, 2016)

Arrow Lakes Reservoir – Traffic by Site

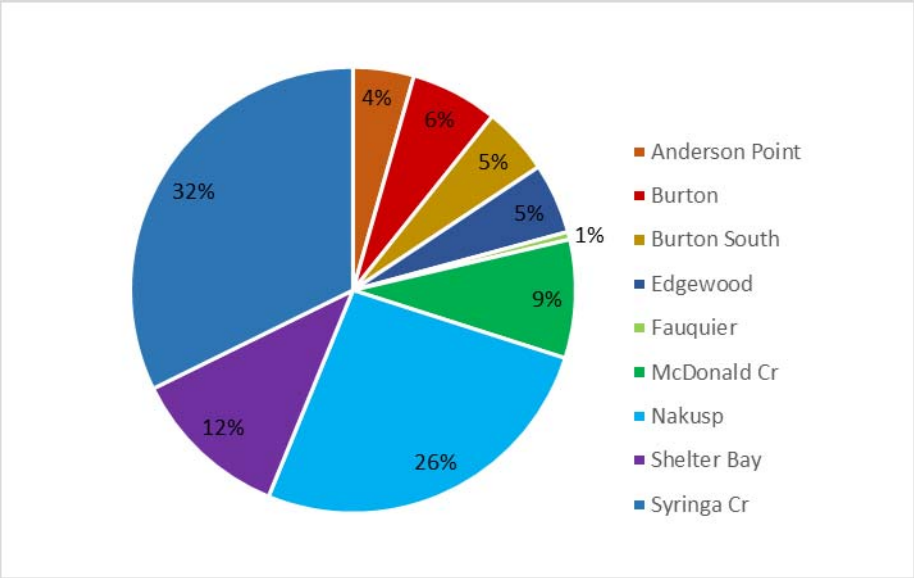


Figure 10. Arrow Lakes Reservoir - Traffic by Site.

In Year 7 (2016), the Syringa Creek Boat Launch and Nakusp were the most active boat launch locations and constituted 50% of the daily recorded traffic at the selected boat launch locations on the Arrow Lakes in this study[3]. Fauquier Boat Launch generated only about 1% of total boat launch traffic. The Fauquier counter was monitored during this period and is functioning normally.

[3] This percentage is for the locations used in this study only and does not represent the overall percentage of boat launch use on the Arrow Lakes.

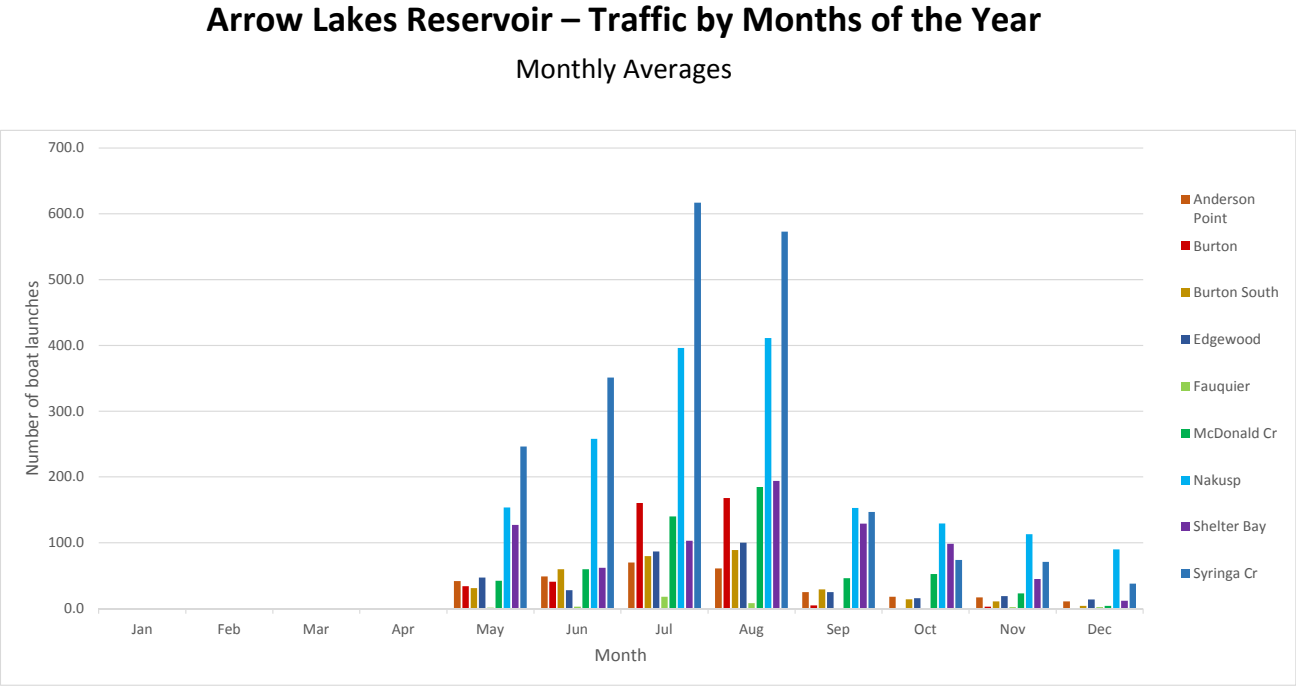


Figure 11. Arrow Lakes Reservoir - Traffic by Months of the Year.

Use patterns are as expected with increasing activity in the summer months with most locations peaking in July or August, then tapering off in the fall. Nakusp generates significant use throughout the winter months and exceeds use at Syringa Creek for eight months of the year. Nakusp and Syringa received more relative use in winter months than at other locations. It may be 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, or that these are the best months for catching fish in that area of the Arrow Lakes.

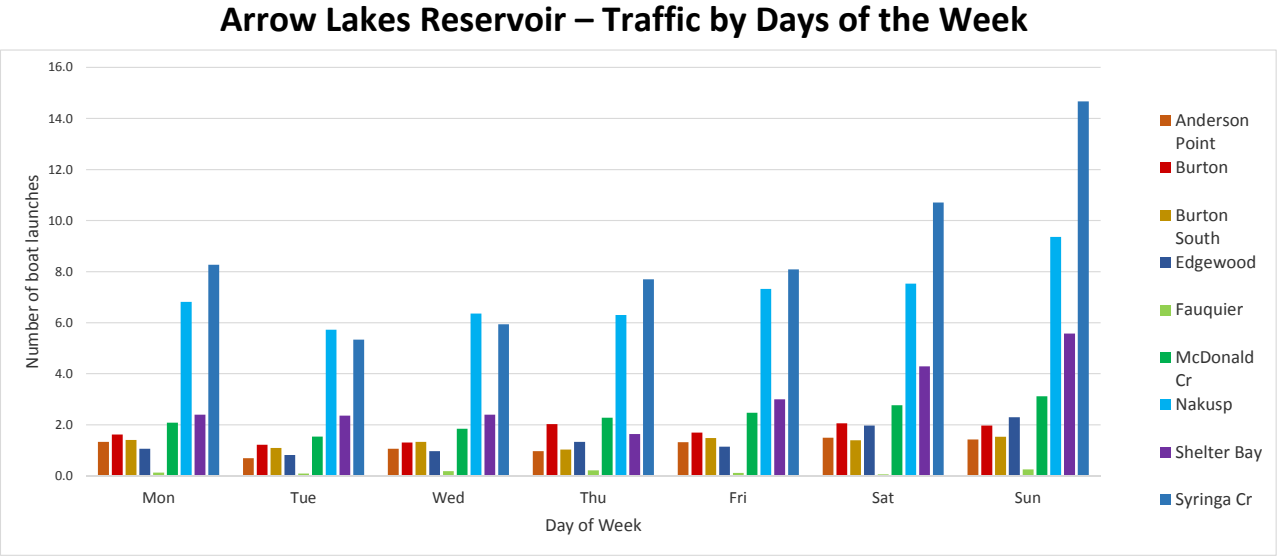


Figure 12. Arrow Lakes Reservoir - Traffic by Days of the Week.

Anderson Point, Burton, Edgewood, McDonald Creek, Nakusp, Shelter Bay and Syringa Creek 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. Boat launch use at Fauquier was very consistent throughout the week, with slightly higher use on Thursdays and Sundays. Burton South is another anomaly, receiving greatest use on Fridays, Mondays and Sundays, followed by slightly less use on Saturdays.

5. Discussion

5.1 Management Question 1:

MQ 1. Does public use of boat ramps increase on Kinbasket and Arrow Lakes reservoirs after installation and upgrading of the WUP boat ramp facilities?

The impact of boat ramp improvements on volume of public use at sites on Kinbasket Reservoir and Arrow Lakes Reservoir was mixed. Total vehicle counts across study sites suggest that the total number of visitors in the Kinbasket decreased from 2011 (600 visitors) to 580 visitors in 2013 and increased to 962 visitors in 2016. In the Arrow, the total number of visitors decreased from 10,608 visitors in 2010, to 8,755 in 2013 to 6,536 visitors in 2016. Study Year 10 will include a comprehensive comparison of volume between years including a comparison of mean pre-construction and post-construction visitation at all improved boat ramp sites.

5.2 Management Question 2

MQ2. 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?

Results to date suggest the volume of public use of new or improved boat ramps does not reduce the usage of nearby existing boat ramps (see LEES+Associates, 2015). Expecting more data through on-site survey results in 2017.

5.3 Management Question 3

MQ3. Does user satisfaction increase with improvements made to the existing boat ramps and construction of the new boat ramps?

Results to date suggest visitor satisfaction with boat ramp facilities and with parking lot conditions has increased following improvements made to the existing facilities. This suggests that the improvements made were effective in addressing visitor expectations (see LEES+Associates, 2015). Expecting more data through on-site survey results in 2017.

5.4 Management Question 4

MQ4. Is there a need for installation of additional facilities to satisfy the needs of boat users on Kinbasket Reservoir and Arrow Lakes Reservoir?

Results to date show support for Management Hypothesis #4: there are no changes in the socio-demographic or trip behavior characteristics of users of boat ramps on Kinbasket Reservoir and Arrow Lakes Reservoir. This suggests the improved boat launches are attracting the same demographic of user, rather than a demographic that is more satisfied in general, or has different recreation behaviours (see LEES+Associates, 2015). We are expecting more data through on-site survey results in Year 8 (2017).

6. Limitations and Opportunities for Further Study

A variety of unexpected situations have arisen during the study that affected measurement of use, particularly with regard to construction periods and high water curtailment of vehicle counts. Construction exclusion dates (*i.e.,* starts and finishes) represented best estimates based on information provided to the study team by BC Hydro, Columbia Power Corporation and on-site observations by project field staff. There is some uncertainty as to exact dates of construction activity that impacted the use of the boat ramps (either construction vehicle traffic increasing counts or construction activity not allowing public access to ramp). For example, there was likely a fair amount of construction activity on either side of the official McDonald Creek construction period that affected traffic counts. In some cases construction took place in the water (pile driving) and did not impede the use of the ramp but support vehicles would have been counted.

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

7. Conclusion

Results to date suggest changes in daily visitor volume are mixed following boat ramp improvements. Improvements did not result in reduced usage of nearby existing boat ramps, an increase in new users, or a change in the type of user group. Visitor satisfaction was the factor most affected post-construction, suggesting these projects have been effective in providing benefits to recreational

interests in the area. At this time, all ramps have been fully constructed; more robust conclusions may be made in Year 10, after more visitors have been able to use the improved sites.

8. References

BC Hydro (2007). Columbia River Project Water Use Plan. BC Hydro dated January 11, 2007.

BC Hydro (2009). Columbia River Project Water Use Plan Monitoring Program Terms of Reference – CLBMON 14 Boat Ramp Use Study.

BC Hydro (2017). Columbia River Project Water Use Plan. Monitoring Program and Physical Works Annual Report: 2017. BC Hydro dated January 31, 2017.

LEES+Associates (2015). CLBMON-14 Boat Ramp Use Study. Mid-Term Analysis Report (Year 4) Implementation Period – 2010-2013. Vancouver, BC. BC Hydro, Water License Requirements.

APPENDIX A – TRAFx Vehicle Counters

Vehicle counter settings

Vehicle counters were configured and installed at 11 monitoring sites with boat launch facilities: nine sites on the Arrow Lakes Reservoir and two on Kinbasket Reservoir. Vehicle counters were configured and installed using the following settings (Table 9):

Table 9. Vehicle counter settings.

Location	Mode	Period	Delay	Threshold	Rate
Arrow Lakes Reservoir					
Nakusp	VEH_5d	000	96	16	S
McDonald 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
Shelter Bay	VEH_2s	000	120	16	S
Syringa Creek	VEH_4d	000	96	16	S
Kinbasket Reservoir					
Bush Harbour	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 with counter on side of road;
VEH_5d=double lane traffic with counter in middle of road

Period: 000 = timestamps

Delay: 8 = 1 sec; 96 = 12 sec; 120 = 15 sec

Threshold: Range is 3-16; 16 is least sensitive

Rate: S = slow (<50 km/h)

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 will 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 provincial and territorial governments, and numerous countries in Europe and the South Pacific.

For this study, 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 average daily traffic count (ADT) is applied to all days within a missing month. The sum of recorded and calculated counts generates the total estimate for the year.

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 15-17 second delay is applied (15 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. This may provide a slightly more conservative estimate than reality at Anderson Point but it is applicable for much of the year and maintains a common standard application of the methodology across all sites.

- 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).

The ADT procedure has been applied as described above for minor occurrences of missing data. However, as most boat launch locations in this study are snow bound in winter, recorded summer use has been higher and winter use has been lower than the daily average.

APPENDIX B – Site Photos

Kinbasket Reservoir Boat Ramp Construction – Before and After Photos

Figure 13. Bush Harbour at low water before

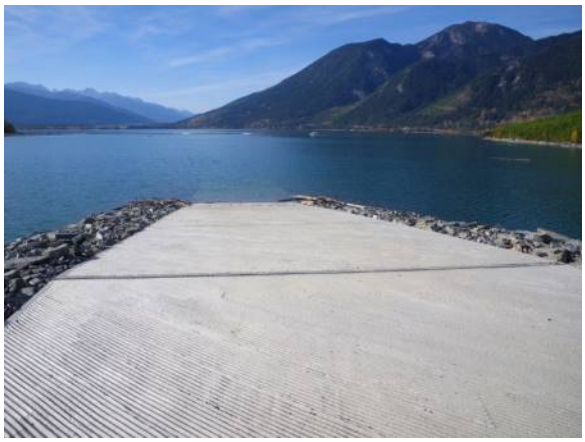


Figure 14. Bush Harbour high water after

Figure 15. Valemount before

Figure 16. Valemount after

Arrow Lakes Reservoir Boat Ramp Construction – Before and After Photos

Figure 17. Anderson Point before

Figure 18. Anderson Point after

Figure 19. Burton South before

Figure 20. Burton South after

Figure 21. Edgewood before

Figure 22. Edgewood after

Figure 23. Fauquier before

Figure 24. Fauquier after

Figure 25. McDonald Creek before

Figure 26. McDonald Creek after

Figure 27. Nakusp before

Figure 28. Nakusp after

Figure 29. Shelter Bay before

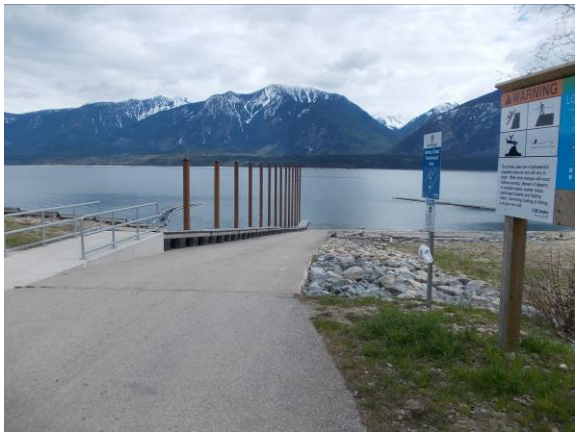


Figure 30. Shelter Bay after

Figure 31. Syringa before

Figure 32. Syringa after