



Kootenay Lake Sustainable Boating Sewage Pump-Out Project



Prepared for:
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1 INTRODUCTION

This report has been prepared for the Kootenay Lake Sustainable Boating Society (KLSB) as part of the application for funding of “Kootenay Lake Sustainable Boating Sewage Pump-Out Project” through the Columbia Basin Trust Environmental Initiatives Program. The Kootenay Lake Boating Society is a non-profit citizens’ group focused on protecting the marine environment in and around Kootenay Lake. KLSB’s end goal is to install 6-8 pump-out stations at preferable locations along Kootenay Lake which will be well used by the public and will minimize the potential of untreated wastewater being discharged into the Lake.

The report details the need for sewage pump out stations, applicable legislation and regulations, the permitting process, types of pumps, investment, proposed site locations, limitations and recommendations.

2 BACKGROUND

Kootenay Lake is a large inland waterbody located in the West Kootenays of British Columbia. Water activities on Kootenay Lake include pleasure boating, fishing, and BC Ferries. Currently no pump-out stations exist on Kootenay Lake with boaters currently discharging their wastewater either directly into the lake or to a sewer system on land.

2.1 Environmental Impacts

Raw sewage and gray water are considered pollutants if discharged into a water body or onto ground causing potential negative impacts to the environment and a risk to human health. This waste contains phosphates, nitrates, pathogenic organisms (fecal and total coliforms) and pharmaceutically-active compounds. The nitrates, phosphates and organic matter found in human waste acts as a food source for algae and bacteria. Increases in these substances in water cause the algae and bacteria to overpopulate, and dissipate the dissolved oxygen concentrations required for the survival by other aquatic organisms such as fish. In addition pathogenic organisms such as fecal and *Escherichia coli* coliforms associated with untreated sewage can be a risk to human health when concentrations exceed the Ministry of Environments Water Quality Criteria for Microbiological Indicators for drinking water and recreation (Appendix A). Many homes and resorts along Kootenay Lake pump water from the lake for drinking water and can be impacted by any type of potential water contamination (Wakelin, 2012).

Pharmaceutically-active-compounds (PhACs) are also known to be existent in raw sewage. PhACs such as birth control pills are endocrine disrupting substances that have the potential to adversely affect the sensitive hormone pathways that regulate reproductive functions. In

aquatic organisms, the adverse effects may be expressed in terms of reduced fertility and egg production in female fish or reduced gonad size and feminization of male fish (Nagpal and Meays, 2009). The level of toxicity is a function of the concentration, the type of aquatic organism, its life stage, length of exposure to the contaminant and the end point used (MOE, 2009).

2.2 Legislation and Regulations

There are a number of acts and regulations that regulate the discharge of raw sewage into the environment as well as regulate the construction of facilities near or within water bodies such as lakes.

The discharge of raw sewage into the environment is not permitted under the Environmental Management Act, without government authorization. The *Environmental Management Act*, Section 13 states:

'A person must not discharge domestic sewage or waste from a trailer, camper, transportable housing unit, boat or house boat onto land, into any reservoir or into any lake, pond, stream or other natural body of water, except

- (a) in compliance with a permit, an approval, an order, a waste management plan or a regulation, or
- (b) if disposal facilities are provided, in accordance with proper and accepted methods of disposal using those facilities, and in accordance with the *Public Health Act* and regulations.'

(Ministry of Environment, 2012)

A person who contravenes section 13 by committing an offence is liable on conviction to a fine not exceeding \$2000 or imprisonment for not more than 6 months, or both.

Under the Ministry of Environment's Water Act Section 9, all proposed works in or about a stream which includes a river, creek, lake, wetland, require a notification or approval. The Department of Fisheries (DFO) will also require a notification or project review application under Section 35 of the Fisheries Act. Standards and best practices developed by MOE and DFO for instream works for a wharf, pier, dock, boathouse and mooring can be found in Appendix B.

Construction and maintenance of a sewage disposal system with flows <22,700 L/day, must meet the requirements of the Sewerage System Regulation, under Public Health Act. Discharge flows of larger sewer disposal systems must meet the requirements of the Municipal Sewage Regulation under the Environmental Protection Act.

3 PERMITTING PROCESS

The permitting processes required for the installation of a sewage pump out station and an extension to a dock to accommodate the pump-out system is discussed below.

3.1 Sewage Pump-out Stations

Permitting for the installation of a sewage pump out station on Kootenay Lake is regulated both by the Ministry of Environment (MOE) and Interior Health. In the case where discharge flows are < 22,700L/day and there is no discharge to surface water, registration of the system would only be required with the Interior Health Agency(IHA) under the Sewerage System Regulation (Ministry of Health, 2004). Under the Municipal Sewage Regulation, wastewater volumes of >22, 700 L/ day which requires treatment/disposal on site (eg. septic field) or discharge into surface water would trigger a registration with MOE under the Municipal Sewage Regulation (MOE, 1999). It is expected that a typical small/mid size marina pump-out station would discharge <22,700L/day; therefore, would only require registration with Interior Health. No notifications or applications are required to be submitted to MOE or DFO for this type of project since Regional Operations Statements are met and proposed works does not impact fish or fish habitat.

3.2 Dock and Boathouse Construction in Freshwater Systems

Both the DFO and MOE regulate the construction of docks and boathouses in freshwater systems. DFO regulates all proposed works which have the potential to impact fish and fish habitat. A DFO Project Review is required if at least one of these conditions pertains to the proposed project:

- The total combined footprint of the dock is >24m².
- The proposed dock is sited over or adjacent to known fish spawning habitat.
- The proposed works requires dredging, blasting, infilling in the waterbody.
- The proposed project does not incorporate the Measures to Protect Fish and Fish Habitat when building your dock as stated in the Dock and Boathouse Construction In Freshwater Systems Operational Statement (See Appendix B).

If none of these conditions pertain to the proposed project, the works can be completed under the Fisheries and Oceans Operational Statement and a notification must be submitted at least 10 working days prior to construction.

Section 9 of the Provincial Water Act requires the submission of an application for proposed dock installations or modification works to a marina setting. Both DFO and MOE require the

completion of an environmental assessment by a Qualified Environmental Professional (QEP) as part of the application process.

4 PROPOSED SEWAGE PUMP-OUT SITE LOCATIONS

The KLSB has conducted a number of surveys and interviews with Kootenay Lake marina owners and boaters to determine optimal locations for pump-out stations. The potential sites were selected on the basis of site location on the lake, boater usage and the interest of the marina owners in purchasing a pump-out station.

In addition, a study of the number of potential boaters that would use the facilities on Kootenay Lake was completed by KLSB. Due to time constraints related to the lack of readily available data, the number of boaters was extrapolated from data gathered on the physical numbers of docks and boat launch facilities using interview answers, and visually counting dock space on Google Earth and Google Maps. Table 1 below provides the approximate boat docking capacity on each arm of the lake.

Table 1: Docking Capacity on Kootenay Lake

Location	# of Marinas	Total Interviewed	Marina Docking Capacity (# Slips)	Private Docking Capacity	Total Capacity	% of Boats at Marinas
West Arm	9	6	374	390	764	49%
North Arm	4	2	232	150	382	60%
South Arm	8	5	402	168	570	70%
Total	21	13	1008	708	1716	59%

Optimally, KLSB would like to install two sewage pump-out stations within each arm of the lake. The feedback received from the Boat Docking Facility survey showed multiple marinas were interested in installing a pump-out station at their location. Surveys were conducted with 19 marina operators in regards to their facilities, number of slips, fees, and their opinion on pump-out stations. The survey and its results can be found in Appendix C. In addition, a boater survey is available for online completion at the KLSB's website and at various local outlets in brochure format. Few surveys have been completed to date; however, KLSB is hoping to increase these numbers by having an on the ground representative conducting surveys with boaters at marinas and boat launch locations this summer. A copy of the boater survey can also be found in Appendix C.

All marinas are considered to have less than 5% vacancy during the year. According to survey results conducted with 14 marina operators, eight marinas are in support of sewage pump-out stations and are interested in installing the systems at their location. Table 2 provides a summary of the services provided at each marina and whether the marina is interested in installing a pump-out station.

Table 2: Kootenay Lake Marinas

Marina	Location	# of Slips	Fuel Services	Washrooms	Boat Launch	Potential Pump-out Station Locations
Nelson Prestige	West	80	X	--	--	X
Lakeside Park, Public	West	--	--	X	X	Unknown
Balfour Beach Inn	West	20	X	X	X	X
Langs	West	30	X	X	--	X
Kuskanook	South	96	--	X	X	X
Lakeview	South	18	X	X	X	X
Fishhawke	South	80	Private	--	--	X
Riondel	South	75	--	--	X	X
Woodbury	North	50	X	X	X	X
Kaslo Beachcomber	North	80	X	--	X	Unknown

Most of the public launches do not have washroom facilities, with most boaters and marina operators indicating that boaters either have porta-potties on the boat, discharge directly into the lake or are not on the lake long enough to require a facility. Port-a-potties are typically discharged into a private/city sewer system or at an unknown location.

5 TYPES OF PUMP-OUT SYSTEMS

There are three types of marine pumps available for a pump-out station installation: diaphragm pump, peristaltic pump and vacuum pump. The three types of pumps are discussed below.

The type of pump for each marina shall be selected based on marina size, required amount of suction lift, suction distance and discharge head required. Most pump manufacturers provide a selection of models for each pump type. Technical Specification Sheets for pumps can be found in Appendix D. A wand attachment with a quick adaptor can be added to the end of a hose to

allow for portable toilets to be emptied easily. Wand attachments are relatively inexpensive, but price can vary, depending on the type and size of hose you are connecting too. Research shows prices ranging from \$14-\$25 per wand.

5.1 Diaphragm Pump

The diaphragm pump is notably used for the transfer and collection of sewage, sludge, waste oil and high viscosity fluids with suspended solids with minimal risk of clogging (Henderson Marine, 2007). The portable diaphragm pump out system has a tank capacity between 25 – 60 gallons depending on the model and manufacturer, and has the potential to pump up to 50% of its load in solids. The diaphragm pump has the following advantages:

- Simple, rugged with self-serviceable components.
- Pumps can handle low to high viscosity liquids and are designed to pump a considerable amount of solids.
- Low purchase cost.
- Low maintenance.
- Available as a station or portable units.

The disadvantages of the diaphragm pump are:

- Moves fluids through pipes in pulses, and cannot be run at high speeds.
- Can be noisy.
- Limited on suction lift and discharge head.

This product is best suited for pump-out systems in boats, carts and trailers. However, it is recommended to be used at small marinas that are supervised.

5.2 Peristaltic Pump

The peristaltic pump is ideally used at marinas that require long horizontal and/or vertical pumping distances. This model is greatly used in self service areas where boaters can pump out their wastes at designated sites.

Advantages of the peristaltic pump include:

- Simple yet durable design.
- Extreme power for high suction and discharge.
- Seal-less design.
- Dry running and self-priming.
- Reversible.
- Low maintenance costs (Edson 2012).

Disadvantages of this type of pump include:

- Non uniform liquid movement.
- Requires the peristaltic valves to be cleaned every three to six months.
- Loses its feed rate as it ages.

5.3 Vacuum Pump

The vacuum pump is known for its high suction lifts and large openings for continuous flow (Henderson Marine 2007). This system is ideal for marinas with long suction runs and multiple pump out points. The stationary vacuum pumps have a tank capacity of 35 gallons, while the portable pumps can hold anywhere from 30 to 235 gallons of waste (Henderson Marine 2007). These types of pumps are commonly used for high demand sites, where multiple stations transport waste to a central location (Edson 2012).

Advantages of the vacuum pump include:

- Transports waste for long distances as it has the largest solid waste holding capacity of all the models (Edson 2012).
- Some systems can accommodate 2 tanks, which helps to maintain an even amount of suction.
- Two tank systems allow for more pumping locations and expansions to the marina.
- Well suited for a self-service site.

The only disadvantage of the vacuum pump found was that they require a larger capital investment compared to the other two pump systems.

5.4 Portable Toilet Dump-Out Station

An alternate option instead of installing a pump station is to install a portable toilet dump-out station. KECO distributes a dump station called a Kleen-a-pottee. The 300D Kleen-a-pottee model has an ejector pump installed within the system and is sized according to specific site conditions such as horizontal discharge, vertical discharge and pipe diameter. This ejector pump is equipped with a level sensory system that automatically activates the ejector tank once it is full. It then drains the sewage through a transport duct that must connect to the septic / holding tank. If you prefer to bury the waste, it can also be set to gravity drain. Alternatively, the dump-out station can also be emptied by connecting it to one of the three pump-out systems and pumping it to the septic tank.

The advantages of a portable toilet dump station include:

- More affordable than most pump-out systems.

- User friendly.
- A solar powered fan is mounted at the top of the cover to prevent unwanted smells.

The disadvantages of a portable toilet dump station include:

- Limited to portable toilet waste disposal only.
- May be limited in ejector pump capacity.
- With this type of system boaters are required to remove their porta-potti's and manually dump its contents into the dump station.

6 PORTABLE TOILETS AND MARINE SANITATION DEVICES

Portable toilets (porta-potties) are commonly used on smaller boats as a bathroom facility. There are many different types of porta-potties, which vary in design and price (typically \$80-\$200). The average porta potty holds up to 2.6 gallons of waste. The province of Ontario's Regulation 343 Discharge of Sewage from Pleasure Boats prohibits portable toilets on pleasure boats if they are not secured to the boat and have a deck fitting and piping necessary for the removal of toilet waste by shore based pumping equipment. If a pleasure boater is found to contravene Regulation 343, fines can be issued (Ministry of Environment Ontario, 2007). Fines are typically \$150 for improper storage equipment or handling of sewage and \$300 for discharge of sewage into a waterbody. At this time, British Columbia and the Regional District of Central Kootenays do not have any regulations or restrictions on portable toilets on pleasure boats. This type of regulation may help to better manage proper sewage waste disposal by boaters, but may be difficult to implement if manpower is limited for spot inspections on boats to see whether people have the correct equipment installed.

Marine sanitation devices (MSDs) consist of an installed head (toilet), a waste treating device, and or a holding tank. In order for an MSD to be legal on BC Lakes, the MSD must have a holding tank so that wastewater can be pumped out at a pump-out station and not discharged directly into the lake. There are three types of MSDs: Type I, Type II and Type III. A Type III MSD would be the most viable MSD option for pleasure boats on a BC Lake, because it holds wastewater, relies on having adequate onshore pump-out facilities and is the more affordable option compared to Type I and Type II MSDs which can treat sewage onboard. Type I and Type II MSD's are only a good option in places where it is legal to discharge waste overboard or if a holding tank is connected to the system for onshore pump-out.

7 INVESTMENT

The investment required for each of these pumps varies depending on the manufacturer, the model and the additional features required. Diaphragm pumps range in price from ~\$3000-\$6000; peristaltic pumps range in price from ~\$6000- \$11,000; vacuum pumps range in price from ~\$7000-\$13,000 and the portable dump stations with ejector pumps start at \$3100. Table 3 below provides cost estimates for specific models.

Table 3: Pump Costs

Pump	Description	Supplier	Cost (not including taxes or shipping)
Stationary Series 175 Diaphragm Pump	0.75HP 115/230 Volt. Includes 30' of hose. Capable of pumping 20-25 gallons /min with up to 20' suction. Can add a wand adaptor for portable toilets	KECO	\$5800
Portable Diaphragm 510 Series Pump	55 gallon and 35 gallon tanks available. Includes a 30' suction hose.	KECO	\$5800
Edson Model 120 Diaphragm Pump	40 GPM. Capable of pumping 15'. No hoses included. Hoses are ~ \$500-\$1000 depending on length.	Edson	\$3000 (no hoses) \$3500-\$4000 (including hoses)
Peristaltic 3HP M40 Pump	20-45 GPM. 208-480 volt. Includes 30' of suction hose.	KECO	\$10,800
Edson 1 HP Vacuum Pump	30 GPM. Suction lift of 25'. No hoses included. Hoses \$500-\$1000.	Edson	\$9000
Portable Toilet Dump-out Station	Basic molded fiberglass construction with UV inhibitors and ejector pump.	KECO	Starts at \$3100

In addition to the pump out station, if a septic field or city sewer is not available to connect to, a septic holding tank will need to be purchased. Septic tanks vary in price depending on the size required. For example a 640 gallon tank costs \$970 and a 750 gallon tank costs \$1200.

Additional costs to consider for the installation of a pump out station are:

- Additional hosing and piping if required.
- Pump out station registration with Interior Health (\$200).

- Excavation costs for the installation of a septic holding tank (~\$500).
- Holding tank permit (\$400).
- Wastewater disposal costs if a septic field or sewer connection is not possible (0.185/gallon plus a pick up fee of ~\$200 for 600 gallon tank).
- Maintenance costs. Typically on a diaphragm pump, the rubber parts (~\$120) should be replaced every 1-2 years and the bowl assembly (~\$525) and the rod assembly (\$160) are to be replaced every 5 years.
- Environmental consulting fees associated with any dock extension works which would include an environmental impact assessment and application preparation (~\$1000).
- Section 9 Application fee (\$130) if conducting dock expansion works.
- Professional engineer or registered onsite waste practitioner (RWOP) fees to design and oversee the construction of the disposal system if required (price variable depending on system).
- Material and labour costs for onsite disposal system (price variable depending on system).
- City sewer connection costs if required (variable depending on location).

These costs can be partially or fully reimbursed over a time period by charging user fees for the sewage pump-out system. A user fee of \$10.00/use is typical around BC for marina pump out stations on the ocean. For lake use where pump outs are typically smaller discharge volumes, a user fee \$6.00 may be more justifiable. A remote pedestal center (RPC) with a credit card acceptor and an integrated wireless model can be installed as part of the pump-out station, so that it does not need to be staffed. The cost for a RPC is ~ \$2300. The RPC's may also be operated as a timed usage; therefore fees for dumpage will vary depending on the volume pumped.

A feasibility analyses was completed for the installation of a pump-out /dump station on the West Arm of Kootenay Lake at a small to mid-size marina (See Table 4). The feasibility analyses demonstrate the projected payback periods to cover the costs associated with the installation of a pump out/ dump station. Three different pump-out/dump station options were calculated with the following assumptions made:

- 17.5% of boaters in the West Arm would use this pump out service. (The 17.5% usage was estimated assuming that 35% of 764 boaters would use the service with two pump-out stations being available on the west arm.
- Boaters would use the service twice a year
- 2.0 gallons of sewage water would be pumped out each use.
- User Fee of \$10/use and \$6/use.

- Labour costs were estimated to be \$500/year. This amount may become nil if someone on staff is able to fix, maintain and clean the systems as part of their regular duties.

Table 4: Pump Out Station Feasibility Analysis For West Arm of Kootenay Lake

Pump Out Station Options	Option 1		Option 2		Option 3	
	Portable Diaphragm Pump		Peristaltic 3HP M40 Pump		Portable Toilet Dump Station	
<i>User fee</i>	<i>\$10/use</i>	<i>\$6/use</i>	<i>\$10/use</i>	<i>\$6/use</i>	<i>\$10/use</i>	<i>\$6/use</i>
Installation Costs						
Pump System	\$5,825	\$5,825	\$10,800	\$10,800	\$3,100	\$3,100
Remote Pedestal Center for credit card/token payment	\$2,300	\$2,300	\$2,300	\$2,300	-	-
Septic Storage Tank- 640 gallons	\$970	\$970	\$970	\$970	\$970	\$970
Excavation costs	\$500	\$500	\$500	\$500	\$500	\$500
Pump-out Station registration	\$200	\$200	\$200	\$200	\$200	\$200
Holding Tank Permit	\$400	\$400	\$400	\$400	\$400	\$400
Total	\$10,195	\$10,195	\$15,170	\$15,170	\$5,170	\$5,170
Operating Costs						
Yearly Maintenance Equipment Costs	\$200	\$200	\$200	\$200	\$200	\$200
Yearly Maintenance Labour Costs	\$500	\$500	\$500	\$500	\$500	\$500
Yearly Wastewater disposal costs (600 gallons)	\$200	\$200	\$200	\$200	\$200	\$200
Yearly Dumpage fees (600 gal @ 0.185/G)	\$111	\$111	\$111	\$111	\$111	\$111
Total	\$1,011	\$1,011	\$1,011	\$1,011	\$1,011	\$1,011
Projected Revenue						
User fees (if 17.5% of the boaters on the West Arm use the pump out station twice per year assuming <2 gallons of disposal each use.)	\$2,674	\$1,604	\$2,674	\$1,604	\$2,674	\$1,604
Total	\$2,674	\$1,604	\$2,674	\$1,604	\$2,674	\$1,604
Projected Net Income and Payback Period						
Yearly net income	\$1,663	\$593	\$1,663	\$593	\$1,663	\$593
Projected Payback Period (yrs)	6.1	17.2	9.1	25.6	3.1	8.7

The projected payback period is variable and could decrease with the increase of boater usage, as well as the potential opportunity of grants, funding and rebates. For example, if the boater usage increased to 50 % of boaters using pump-out systems, the payback period more than halves for the peristaltic pump option. On the downside, if the projected use of the dump-out station is on the optimistic side; the payback period could increase, if boater usage is minimal. It is also important to note that the feasibility analysis was calculated based on the Kootenay Lake West Arm which has the greatest number of boaters. Payback periods for the north and south arm of the lake would be longer upwards of 50 years for the north arm with minimal to

no projected annual revenue. If the capital costs of the systems were subsidized, the systems would become more profitable in a much shorter period of time.

8 LIMITATIONS

The installation of proposed sewage pump-out stations are an environmentally sustainable solution to managing wastewater on Kootenay Lake, although limitations do exist. Limitations to installing these systems may include the location of the septic discharge area whether it is on site or via a city sewer. A second limitation is available funding to purchase the pump out station which can be a significant capital cost for a small marina. The third limitation is the public awareness aspect in regards to encouraging boaters to use the pump-out facilities and pay a fee.

9 RECOMMENDATIONS

The following recommendations are proposed during the planning and implementation stages of the Kootenay Lake Sustainable Sewage Pump-Out Project:

- Develop designs and select locations to minimize potential impacts to fish and fish habitat.
- Ensure that locations are strategically located to maximize use by boaters, easy access, and affordability.
- Select a pump or dump-out station which is suitable for the marina in terms of marina size, lift and discharge head required and whether it is supervised or unsupervised.
- Select an electrical powered pump if possible over a gas powered pump. This will eliminate the possibility of potential spills during re-fueling.
- All pump-out stations to have wand attachments in order to pump out porta-potty units.
- Ensure that best management practices for new dock installations are met or exceeded.
- Retain a qualified environmental professional (QEP) to complete an environmental impact assessment for MOE and DFO notifications/applications.
- Retain a professional engineer or RWOP to design the septic disposal system.
- Develop and implement a public awareness program to ensure that boaters know about these new facilities and understand the advantages and benefits to the environment.
- Communicate with the Kootenay Region Environmental Stewardship Division and the BC Lake Stewardship Society to encourage and implement collaborative education efforts on the project.
- Develop a rebate program for the purchase of a portable toilet or Type III MSD toilet. Rebates may also be applicable to Type I and Type II MSDs if they are equipped with a holding tank that precludes dumping overboard.

- Propose a regulation to the Regional District of Central Kootenays that all toilets on board pleasure boats are to be pumped out at a private or public onshore sewage pump-out facility.

10 CLOSURE

The proposed sewage pump out station installation project on Kootenay Lake will provide boaters with an easy and environmentally friendly solution to discharge sewage. The proposed 6-8 station locations along Kootenay Lake will provide services to most boaters using Kootenay Lake. The initial capital investment will be expensive for some of the marinas, due to the site limitations and upgrades that are required, but with the potential for grants/subsidies, the installation of these pump-out stations will become more feasible. To ensure the success of the project, public awareness should be a priority, which will directly lead to the reduction of boaters discharging directly into the lake.

Sincerely,



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