

## **Full Reserve Study Questions for Lake Advocates**

Preface: The care and maintenance of our lakes is a very complex issue. Reading your past reports, attending your December zoom meeting with the Lake Dam Committee and attending the field trip to Cranberry Lake earlier this summer has definitely helped to develop a better understanding.

The LLCC BOD is looking at a 30 year Reserve Study attempting to approximate the costs of significant expenditures (not normal operational expenses) that will be needed to maintain all of our assets. Presently we are looking specifically at Lake Limerick, Lake Leprechaun and the Bird Sanctuary. Costs such as annual aquatic plant survey, aquatic herbicide treatment, water quality monitoring, geese mitigation, etc. are considered normal operational expense costs and therefore not in the purview of the Reserve Study.

In the past the significant expenditures regarding our two lakes have been primarily costs associated with dredging. While future alternatives are being discussed and investigated these questions are focused on helping us better understand future costs associated with what we have been doing up to this point, basically dredging. We appreciate your assistance in helping us establish a more informed Reserve Study estimate of long term (30 year) frequencies and significant expense costs for our lakes.

### **BOD QUESTIONS FOR LAKE ADVOCATES**

1. The Reserve Study done for Lake Limerick by Association Reserves in 2021, was done with input from committee members which included members of the Lake Dam Committee. It showed a 5-year useful dredging life for Limerick (#270), Leprechaun (#272) and Sanctuary (#274) at \$780,000 (\$4,680,00 for 30 years). The update recently done by Association Reserves uses extrapolated data from your (Lake Advocates) June 26, 2022 report with figures (using a three quarter mark of your spread) showing a useful life of 10 years with a cost of \$6,250,000 (\$18,750,000 for 30 years). Question - not considering other actions (such as possible sedimentation pond development) does the \$18,750,000 seem to be a reasonable reserve estimate for anticipated dredging needs for Lake Limerick, Lake Leprechaun and the Bird Sanctuary? Is it reasonable to believe that this 10 year frequency and cost of dredging for 30 years will maintain our two lakes?

<p><b>LA Response:</b> Yes, estimated costs for the 10-year dredging interval is correct. Note site-specific dredging of portions of Lake Limerick will be periodically needed to maintain its long-term beneficial uses, aquatic habitat, water quality, recreation, prevention of over production by algae (toxic algal blooms) and aquatic plants, overall aesthetics, and property values.</p>
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Maintenance of the Bird Sanctuary will be required including dredging and aquatic plant aggressive control for the same benefits listed above. The vulnerability of the bird sanctuary to rapid aquatic plant establishment has been documented with the annual aquatic plant surveys from 2017-present. Factors that promote this condition include shallow water depth, build-up of nutrients in sediment, and greater influence of groundwater sources to this portion of the lake.

Lake Leprechaun will need targeted areas dredged on an adaptive schedule based upon external sediment inputs and aquatic plant production of organic sediment. Targeted dredging is determined with an integrated analysis of data collected annually including aquatic plant appearance, effectiveness of herbicide application, and water quality data. Trends using these three lines of information are used to determine hot spots in both lakes that have rapidly deteriorating beneficial uses (aesthetics, boating, fishing).

2. Do we know if generally the creation/maintenance of sedimentation retention ponds have an effect for our type of lakes/reservoirs? We know that it does not completely eliminate the need for dredging . . . correct? Per your November, 2021 email response to Pat Paradise I believe you are saying our situation is very unique and although your firm has had significant experience in this area you outline a number of specific issues that need “. . . to be addressed in the feasibility and pre-design phase before alternative characteristics of this facility can be developed or visualized.” This sounds very costly and time consuming. Can you give us an estimate of how much time and cost gets us to the point where we can make a reasonable cost/benefit evaluation of this alternative to our unique situation? Do you believe this work is worth the time and money it will take to get us to the point where we can make cost/benefit estimate comparisons to determine the best option for this 30 year period . . . comparing having sedimentation pond(s) with less dredging versus no sedimentation pond(s) with more dredging? With our two lake/reservoirs presently in “senior citizen” status and considering the distribution of funds necessary to care for all LLCC assets is it best to just stick with regularly scheduled dredging for the next 30 years. Your thoughts?

**LA Response:** Correct. A sedimentation pond only reduces the volume of sediment that is coming into the lake an adding to sediment, and this will reduce the frequency and intensity of periodic dredging. Hence, it will reduce the total cost of maintaining the lake.

Evaluation of the need for reduction in sedimentation of Cranberry Cove originating from Cranberry Creek needs to progress through several steps before making future a decision about an end-product like a sedimentation pond. The first step is to compare the contours of the lake bottom (bathymetry) using an updated map with the bathymetry collected in 2015. This will provide us a rough estimate for rate of in-filling of sediment into Cranberry Cove and extent into Lake Limerick.

The next step in this evaluation includes estimating costs for periodic management of Cranberry Cove by dredging versus the cost and maintenance of a sedimentation pond.

This is a component of a feasibility study. The information we collect from comparison of bathymetric surveys (2015-present) inform the estimated volume of sediment originating from Cranberry Creek. Cost of construction and maintenance of a sedimentation pond will be influenced by the volume of estimated sediment contributed to Cranberry Cove.

We are planning to conduct a bathymetric survey and the Cranberry Creek sediment survey in 2023. These two projects are necessary components for estimating the most beneficial and cost-effective approach in reducing sedimentation to Cranberry Cove and other portions of Lake Limerick. We are using a stepwise and least costly approach for a need for control of sediment from Cranberry Creek.

3. In the Lake Limerick Integrated Aquatic Plant Management Plan, September, 1996 Maribeth Gibbons reported that Washington State prefers Intergrated Approach Treatment options and listed . . . herbicide applications, mechanical dredging, sterile grass carp introduction, mechanical harvesting, hand removal and diver assisted suction dredging (in smaller areas). Is that still Washington's position?

**LA Response:** Yes, this is still the basic Washington Department of Ecology's position. However, bottom barriers were also included in Maribeth's and my 1996 IAPMP. Also, she and I co-authored the original IAVMP manuals for Washington, Oregon and USEPA in the mid 1990's. All these management plans support and promote an adaptive, integrated approach that would change over time based upon data (such as that we collect annually) and environmental conditions.

4. I have heard that the approximate "life" of a reservoir like ours is 100 years. Is that correct? If not, what is it?

**LA Response:** The "life" of a reservoir is defined as its ecological existence as an open water aquatic habitat with human beneficial uses. This is until it evolves into an open water wetland that then becomes a wetland and in time turns into dry land (with or without a stream running through it. On average, reservoirs exist for a time period of 50 (known) to 500 (estimated) years. To enhance relative understanding of the condition of a reservoir the relative "age" in human life cycle terms is 0 to 100 years, hence, the "life of a reservoir" compared to human cycle time framed. So, the calendar life for Lake Leprechaun is 60 to 120 years and it current human life cycle age is 70 to 80 years. Lake limerick calendar life range is 100 to 200 years but without in-lake and watershed management its human life cycle age is currently 40 to 60 years. Note the Bird Sanctuary is currently 65- to 75-year-old in human terms.

5. You have informed us that our two lakes/reservoirs are senior citizens in human years (10/19 presentation, Limerick 60-70 and Leprechaun 70-80) and it seems

that Mother Nature is fighting us harder each year wanting to revert back. Using the latest Reserve Study projected frequency and costs of dredging Lake Limerick, Lake Leprechaun and Bird Sanctuary, what is your best approximation of how many years of life are left for each lake/reservoir? Again, just based on the frequency and cost figures used in your June, 2022 report and not considering frequencies and costs that would be more often and more expensive.

**LA Response:** If both lakes were managed aggressively as outlined for the next 30 years both lakes would reduce their current “human age” by 5 to 15%. That means they would improve in beneficial use conditions over the next 30 years and not age (e.g., in-filling with sediments and organics contributed from the watershed).

To be clear, action to control sedimentation and organic input to both lakes effectively slows the aging process. Over the 30-year period the lake aging process would be interrupted and continue to resemble lakes instead of wetlands.

6. Would limiting some of our uses, such as use of motorized boats on the lake, lengthen the life and reduce costs and if so by how much?

**LA Response:** Studies have shown that motorized boats that can exceed 10 mph will mix the water column to a depth of 15 to 20 feet. This can accelerate the release of nutrients and organics from the sediment to the water column resulting in an increase in organic production of plants and algae. Hence, speeding up the lake’s eutrophication process...aging faster. Also, motorized boats will directly increase the spread and density of non-native and some native plants by fragmentation of plant stems. Hence, Lake Leprechaun is at greater risk of aging than Lake Limerick, but Lake Limerick is becoming shallower due to high-speed boat activity causing water mixing and weed fragmentation.

The proposed bathymetric survey and comparison with the 2015 survey will help determine areas and rate of in-filling of the bottom in each lake. Re-suspension of sediments results in re-distribution depending on prevailing winds or mild current in each of the lakes.

7. Recently I heard L/D members discussing what the right level of the lake should be. Some have said that the lake is 6 inches higher than historic levels which is a major factor in beach erosion. Is that true? Being a reservoir is there such a thing as a natural level?

**LA Response:** Change in lake level, i.e. increase, will have an impact on the lake shoreline. That impact will depend on several factors that can increase beach erosion. For example, the following factors may lead to beach erosion: the size of the sediment and shoreline matrix, sand versus small to larger stones, larger vegetation root matrix within the shoreline versus grass, wave velocity hitting shoreline versus wave energy reduction by floating barriers, shallow ground water interflow that reduces the soil density of the shoreline.

Stable high water level in a reservoir during the spring, summer and fall plant growth period results in less erosion of the shoreline.

8. Many L/D members when asked if the concentrations of plant/algae growth at certain locations on the lake are related primarily to septic and lawn fertilizers used for homes on the lake say no that those mapped concentrations are located at the multiple creek entrances where there is runoff from the entire community and beyond. Is that true? If so, what is your best guestimate of what the percentage is from LLCC homes away from the lake? Besides Cranberry Creek and Kings Cove, are there flow concerns from other areas such as from the Mason Lake direction?

**LA Response:** Yes and No. External watershed input in the lakes is part of the over-fertilization of the lakes (aging through over production of organic, aquatic plants and algae). However, the input of nitrogen and phosphorus from landscape practices and shallow groundwater (interflow) migration that can be “flushing” septic drainfields into the lake is an on-going and increasing potential issue that has been observed and an increasing factor over the past three decades. To control these inputs, a nutrient loading analysis is the best overall next step to define the most cost-effective approach to addressing this issue. However, at little cost relative to effective impact, community education of landscape practices that increase nutrient retention while also increasing the shoreline physical stability as is an important first step. A second step is to educate and promote basic septic system maintenance including planting septic drain field vegetation.

Homes next to the lakes are greater contributors of nutrients than those further away. The further homes from the lake can reverse, partially, any progress made in reducing nutrient input from homes next to the lake. A concerted effort is necessary to see real and lasting results for nutrient input.

9. Status of Lake Leprechaun. Believe you reported that the weed/plant problem is being well taken care of and that the latest core samples indicate no need for dredging. Is that understanding correct?

**LA Response:** There appears to be no need for massive lake wide dredging but dredging in some areas where external loading of sand and sediment has filled in shallow areas would benefit from dredging. This dredging would return select areas to open water lake versus continued filling in and progressing toward wetland habitat. For example, areas that could use attention include the bay at inlet park and the small inlet around the lake’s island that is slowly filling in with fine sediment.

10. Have we determined whether the lakes are better, worse or the same since the 2016 dredging? If not, how soon will that information be available?

**LA Response:** Cranberry Cove has received a significant amount of sediment from inflow of Cranberry Creek. However, the aquatic plant management has reduced the organic sediment build-up, so this Cove is still in better condition than before dredging. Kings Cove has not been as impacted by external sediment to the same degree as Cranberry Cove, but organic generation from plants is still adding to the sediment buildup. Kings Cove is in better general condition than pre-dredging conditions, however, aggressive plant control is a continued need in Kings Cove.

We will know about rate of sediment in-filling in each of the coves once bathymetric survey maps are compared between 2015 to present. We will determine lake levels between the periods when bathymetric surveys were completed in order to standardize depth measurements.

11. Some feedback recently received from L/D states that the dredging of Lake Leprechaun and the Bird Sanctuary is “critical”. Is that true?

**LA Response:** Yes. The Bird Sanctuary has a diverse aquatic habitat with an island that resembles a wetland. This area is moving rapidly toward being wetland habitat. The loss of open water in this area of Lake Limerick will reduce desirable aquatic habitat and diminish property values for that area. Also, as this area of Lake Limerick continues to age by advancing toward a eutrophic state (high nutrient content) will be a source of nutrient contribution of Lake Limerick’s main basin.