An integrated approach to study the limits of development for the watershed of Little Silver and Rainbow Lakes.

The Issues

This proposal aims to preserve and protect the quality of these two lakes for future generations. It also considers the impact of development of 48 further properties in Maberly Pines, which adds about 50% to the total in the watershed that may be stressed. An integrated approach is proposed which may assist resolution of the issues.

Background

1. What is the watershed of Little Silver and Rainbow Lakes?

The watershed includes all the lakeshore properties plus about 30 of the properties in Maberly Pines (MP). This may be seen on the attached map. Figure 1.

2. The lakes have been determined to be "at capacity" for development. Should the MP properties be included in the estimate of lakeshore capacity?

This was asked of the Ministry of Environment, Conservation and Parks, and the answer was "yes". The watershed map (Figure 2, produced by Ontario Flow Assessment Tool – OFAT) shows that the majority of MP properties that drain into the lakes.

3. What is used to determine "Lakeshore Capacity"?

The phosphate levels in the lake are used to assess this. See paper on "A natural History of Phosphates" attached as Appendix A.

The "Lakeshore Capacity Model" combines the geography, meteorology, and human occupancy of the watershed to obtain predictions for background, current and future Total Phosphate (TP) levels. The levels are compared with the background+50% to determine whether a lake is at capacity. Here are the figures for LSL (Plotted in Figure 3):

LCM Results for Little Silver Lake µg/L	
TP Background	7.34
TP Background +50%	11.01
TP Lake, Estimate from LCM	13.64
TP Measured	11.79
TP Future (if all vacant lots developed)	18.07

The current measured TP level is 7% over the TPbkgn+50 figure. This is considered marginal. The future level would be 64% over capacity.

Phosphates are considered to flow from source to lake unless physically removed. In the lake TP will be taken up by flora and enter the sediment. The remainder will be removed by flow. The principal inputs are soap & detergents and human excreta. The rate of flow of phosphates may be reduced by vegetative buffers but only sophisticated septic systems can remove phosphate. Traditional septic systems do not remove phosphates since most phosphate is water soluble and will eventually leach out.

The amount of phosphate is directly proportional to the number of dwellings and their type. The lakes are already at capacity, hence efforts to encourage development by "assuming" the roads and Special Development Charges may exacerbate an already "fair" situation.

Recommendations.

A. This background suggests that the following four issues are strongly linked together: development around Little Silver and Rainbow Lakes; development at Maberly Pines (MP); proposed changes to unassumed roads; and finally, the suggested Special Development Charges for MP.

Recommendation 1. The issues are considered together, not separately. A combined solution for the entire watershed should be developed, discussed, and decided upon.

B. There are numerous parties in the discussions. This includes property owners, both individual, road committees and property owners Associations; the RVCA and MVCA; Blumetric Consulting; the PURWG and Jp2g consulting; TVT staff; and Council.

Recommendation 2. A workshop/discussion forum is held with all stakeholders to permit cohesive strategy and transparent consultation. This would permit a swifter resolution to all issues.

Recommendation 3. Action should not be taken which unilaterally encourages development of one part of the watershed without considering overall impacts. The entire watershed should be considered as one unit, respecting the right to develop with planning guidelines.

C. Phosphates may be removed at source, removed by sophisticated septic systems, mitigated by vegetation barriers, removed from the lakes by maintenance of flow

Recommendation 4. The suggestions in the draft Official Plan should be followed. TVT and local Associations should encourage mitigation methods, including zero phosphate soaps and detergents; phosphate precipitation septic systems in new developments or replacements; continued monitoring of lake phosphate levels and continued efforts to understand how lake outflow helps.

Recommendation 5. No new severances should be considered. Properties of record may proceed with recommendations from Blumetric/RVCA to be included in the final criteria for planning approval. Modest development may be appropriate. The impact of seasonal versus permanent residences needs to be considered.

D. Properties in MP that lie within the Fall River catchment may not require such stringent controls. Lots 1-8; 41-47, 49, 50, 54 and 55 are wholly or partly within Fall River catchment rather than the watershed of the LSARLs.

Recommendation 6. Properties wholly or partially within the Fall River catchment area of MP may merit separate consideration.

Figures

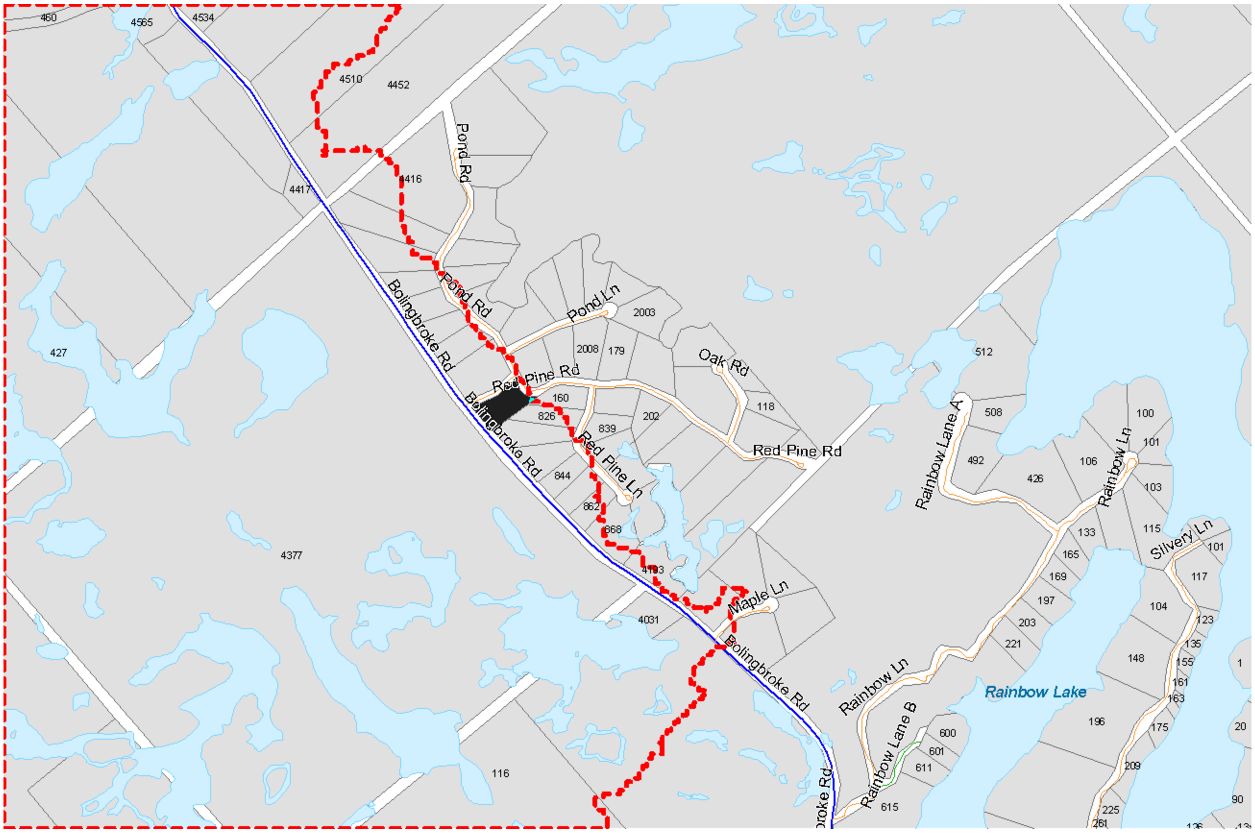

Figure 1. Map of Maberly Pines and Little Silver and Rainbow lakes to show the boundary of the watershed for the lake, with the adjacent Fall River watershed. About 30 undeveloped properties in Maberly Pines are within of the LSARL watershed. [Source Planner@TVT]

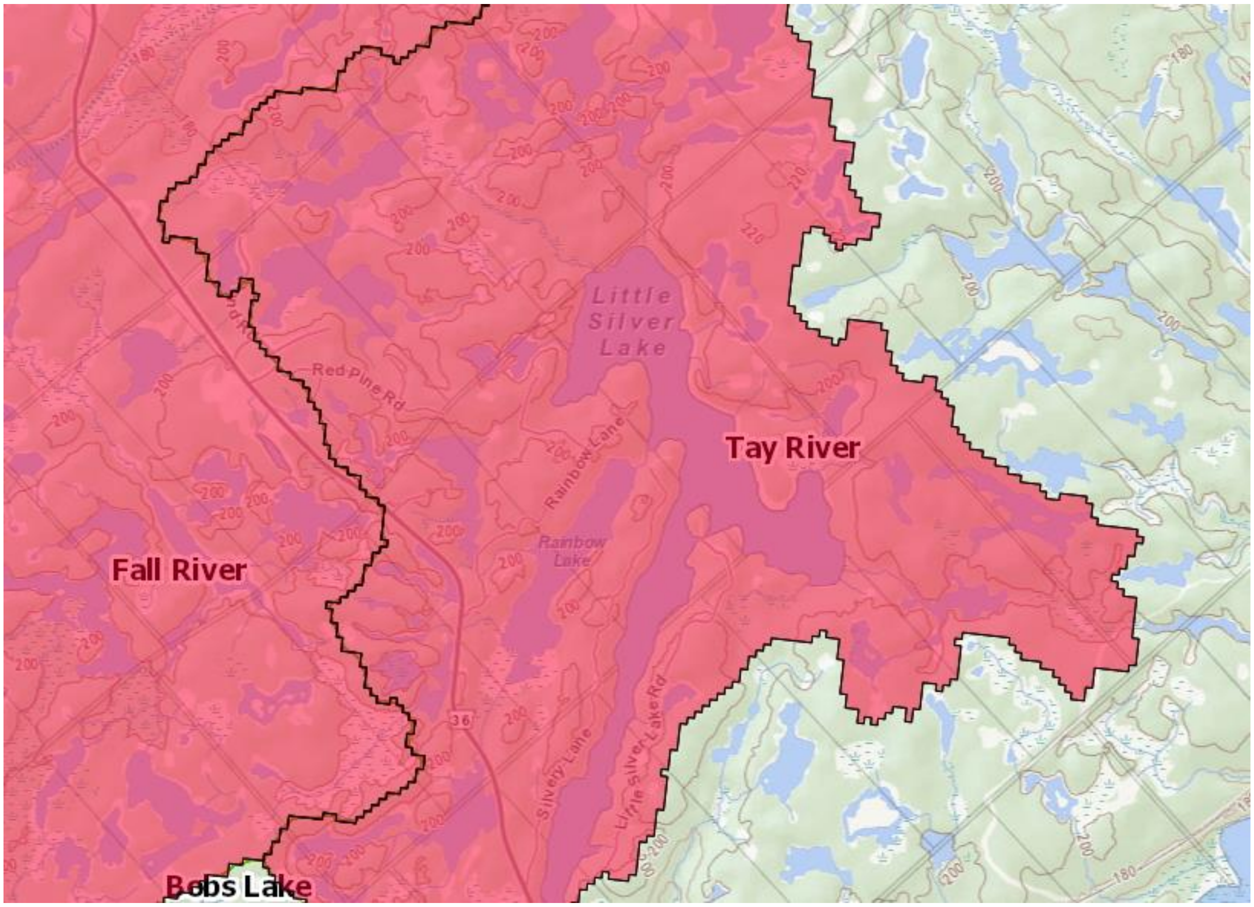

Figure 2. Map of watershed of Fall River and Little Silver and Rainbow Lakes using the Ontario Flow Assessment Tool.

The "Tay River" section is the watershed of Little Silver and Rainbow lakes and is under the jurisdiction of the RVCA. The "Fall River" section includes about 18 properties in MP on Red Pine and Bolingbroke Roads and is under the jurisdiction of the MVCA.

LCM Results for Little Silver Lake	µg/L
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TP Background +50%	11.01
TP Lake, Estimate from LCM	13.64_
TP Lake, Measured RVCA (average)	11.79
TP Future (if all vacant lots developed)	18.07

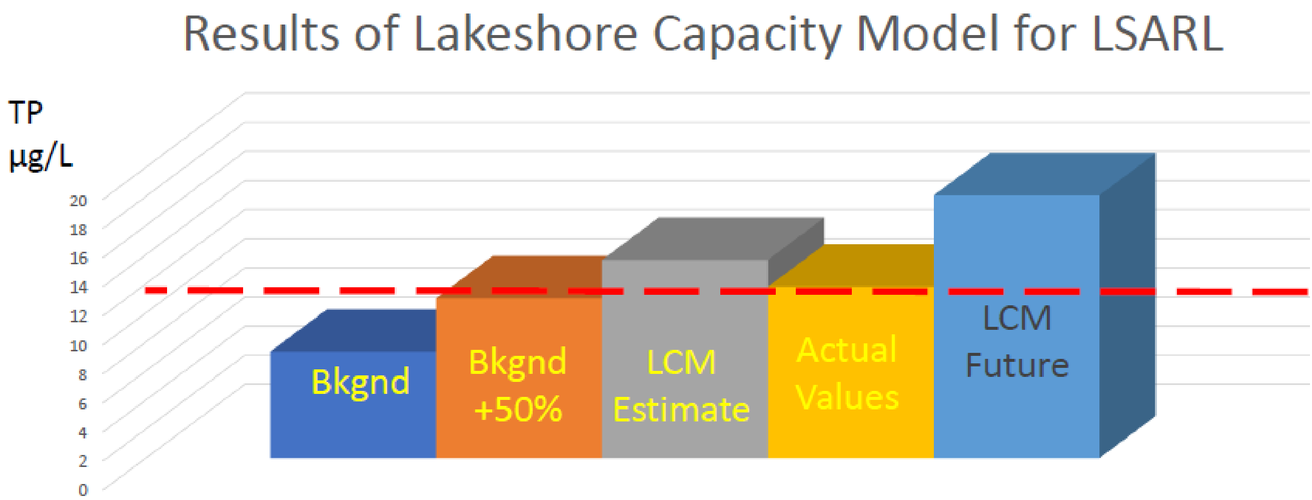


Figure 3. Estimates from the Lakeshore Capacity Model as verified by the Ministry of Environment, Parks and Conservation.

The **Background** +50% is the threshold for concern. 11.01 in this case.

The **Estimate** is the model's estimate of lake TP

The **Measured (Actual) value** is the value from the RVCA samples, averaged over many years.

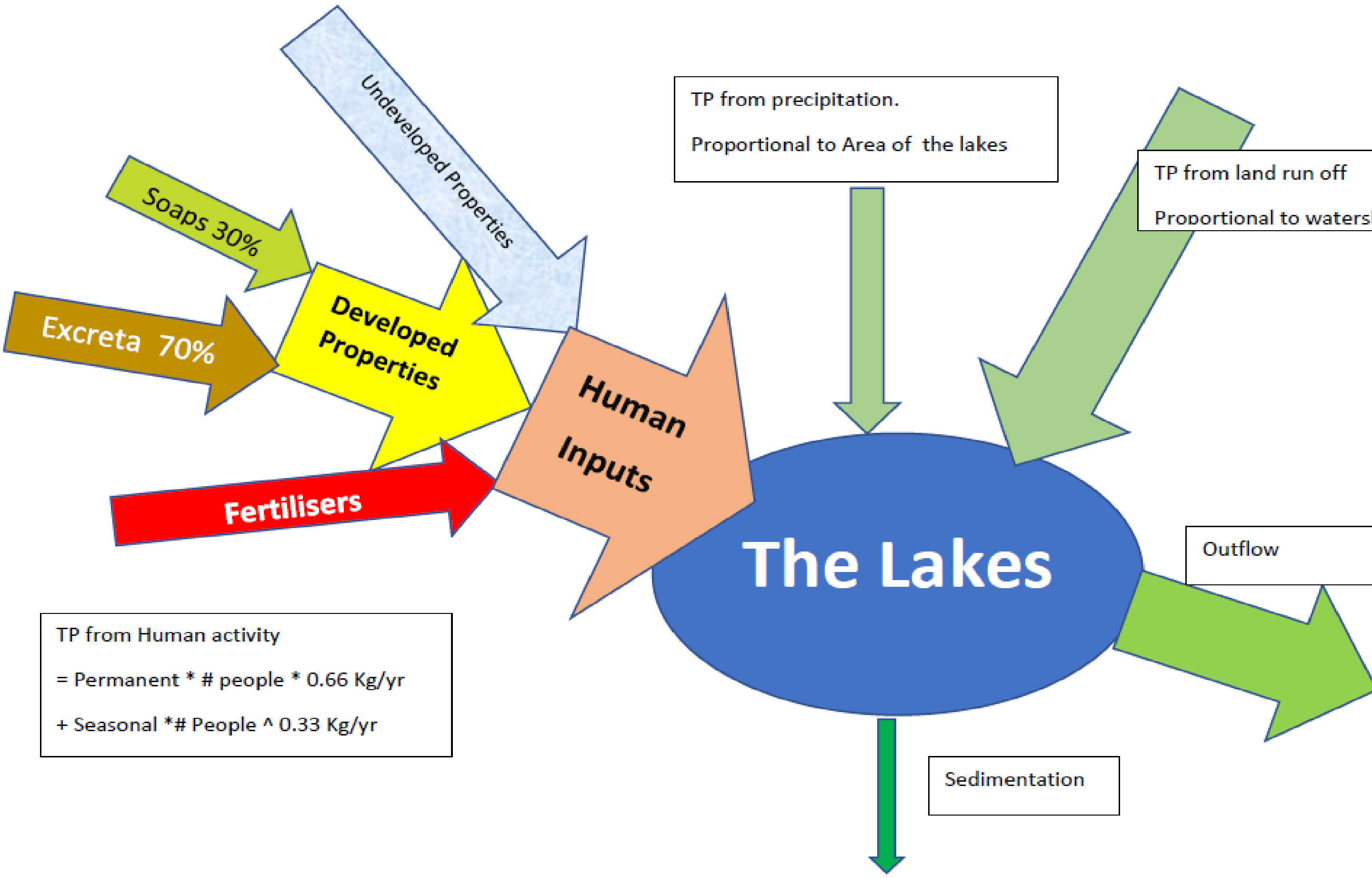
> This suggests that the lake, at the moment, is just 7% above threshold, and efforts to mitigate TP have been working thus far. ±10% is within bounds of acceptance.

The Future value is 64% above threshold. Every new seasonal use property adds about 0.09µg/L TP, permanent properties would add 0.18µg/L, which would take the TP to about 22.56µg/L

It is this future prediction (even assuming only Seasonal properties) that causes concern.

Figure 4. Phosphorous loading – a simplified Lakeshore Capacity Model

Note that “undeveloped properties” are assumed to be “seasonal”. “Permanent” would double the phosphate loading per property.



Summary of Recommendations

An Integrated Approach

Recommendation 1. The issues are considered together, not separately. A combined solution for the entire watershed should be developed, discussed, and decided upon.

An Inclusive Solution

Recommendation 2. A workshop/discussion forum is held with all stakeholders to permit cohesive strategy and transparent consultation. This would permit a swifter resolution to all issues.

Recommendation 3. Action should not be taken which unilaterally encourages development of one part of the watershed without considering overall impacts. The entire watershed should be considered as one unit, respecting the right to develop within planning guidelines.

Action to reduce Phosphate loading

Recommendation 4. The suggestions in the draft Official Plan should be followed. TVT and local Associations should encourage mitigation methods, including zero phosphate soaps and detergents; phosphate precipitation septic systems in new developments or replacements; continued monitoring of lake phosphate levels and continued efforts to understand how lake outflow helps.

Recommendation 5. No new severances should be considered. Properties of record may proceed with recommendations from Blumetric/RVCA to be included in the final criteria for planning approval. Modest development may be appropriate. The impact of seasonal versus permanent residences needs to be considered.

Development outside the LSARL Watershed

Recommendation 6. Properties wholly within the Fall River catchment area of MP may merit separate consideration.

Appendix A

A Natural History of Phosphates. From Sink to the Lake

Phosphorous is a key element of life, an essential component of bones, teeth, shells and cell walls. Typically combined with oxygen as a phosphate ion, the chemistry of phosphates is almost as complex and diverse as life itself. This article gives an engineer's overview of the journey of phosphates from kitchen sink and toilet to the lake, with a glance at the efforts of beavers to help flush it out.

Origins

Mirroring the origins of life, phosphorous in nature is both omnipresent and complex. Rain and snow contain measurable amounts of phosphorous in one form or another. The result of precipitation on the land is to wash out phosphates that lurk in the soil from minerals, rotting vegetation, animal waste and fertiliser. Because of the variety of forms and chemistries, phosphates are lumped together as "Total Phosphates, or TP. In Little Silver Lake about 15% TP comes direct from rain and snow, the rest is runoff from the land.

Man-made contributions from detergents, soaps and excreta.

For about 100 cottages around Little Silver Lake in Tay Valley Township the contribution equals that from the natural sources. All of this TP descends monotonically from soap to septic, from septic to groundwater and then seeps inevitably downhill to the lakes.

Phosphates in the lake.

A little phosphate feeds the algae, which feed the daphnia, which feed the fish. Too much phosphate and there are too many algae, which blooms and dies, sinks to the bottom, decomposes, uses up the oxygen and the fish die. As with all nature there needs to be a balance.

So, what can be done?

There is little we can do about rainfall except change the climate. That is topic for another day.

There are simple ways to reduce the direct runoff caused by rainfall: Drain roofs away from the lake; do not make hard surfaces near the lake; have a good vegetation buffer zone; etc. And do not use lawn fertilisers. insecticides or pesticides since they too will get into the lake and cause havoc.

There are two human activities that we can do something about. About 30% of anthropogenic phosphates come from soaps and detergents. Use phosphate-free products, of which there are many.

The remaining 70%, or 0.5kg/person/year, come from excreta. Phosphates are present in both urine and faeces. A typical "traditional" septic does not do a great job of removing the phosphates from excreta, and so the inevitable result is that the phosphate leaches into the groundwater, and then, eventually, into the lake. It may take a year or more, but it will surely arrive. The official position is "all of the P deposited in septic systems will eventually migrate to lake ecosystems." Not much help there. Even more guidance may be found in the Lakeshore Capacity Assessment Handbook, section 5.2 on shoreline setbacks. Typically, 30m is required, <u>but 300m is suggested</u> if the lake is at capacity.

Most phosphates are water soluble, but it is possible to convince the phosphate ion to combine with elements such as iron which are insoluble and will then precipitate out. There are septic systems that attempt to do this – the "Waterloo" system is one example. Common to all is the need for annual maintenance, removal of the precipitate and replenishing the chemical for precipitation.

And If all else fails

Downstream of the septic where the groundwater finally emerges, we still have one more chance to mitigate the phosphorous load on the lake. Plants at the lakeshore will be delighted by the ready supply of fertiliser. Use as many as you can in rampant abundance. Do not install a lawn that goes to the edge of the lake. The Lake Protection Handbook is an invaluable resource.

Finally we arrive at Phosphates in the Lake.

Just as the terrestrial plants welcome the life-giving phosphates, so do those in the water. Especially the algae at the bottom of the food chain. Too little P and the lake is dead. Too much P and fecundity takes over, overpopulation strikes, the population crashes and dead algae rot consuming the oxygen in the water and the lake dies. Just right and Goldilocks is happy. So are the fish.

What is "Just right"?

This all depends. In the last two decades understanding of lakes on the Pre-Cambrian Shield of eastern and northern Ontario has been refined. What is now considered ideal is a level which is not more than 50% above the background level before development. Where the background value is determined by the area, precipitation, the mix of land use, (wetlands, forest, and agriculture). All these data can be input to the model to predict the natural background Total Phosphate (TPbk) level.

Then add 50% to that and that gives the limit for anthropogenic input of TP.

Phosphates and the Lakeshore Capacity Model

The figure for acceptable development is derived this way. In studies of lakes in our Township it has been found that many are already at the limit of capacity. Little Silver and Rainbow Lakes were recently evaluated by the Ministry of Environment, Conservation and Parks and it was found that the following phosphate levels were predicted by the Lakeshore Capacity Model for Little Silver Lake:

LCM Results for Little Silver Lake	
TP Background	7.34 µg/L
TP Background +50%	11.01 µg/L
TP Measured	11.79 µ/L
TP Future (if all vacant lots developed)	18.07 µg/L

In this table, the TP measured in the lake is already over the TPbk+50% figure, so the lake is considered to be over capacity. The expected future TP level if all the lots in the watershed were developed would be well over the limit. In this case strict mitigation measures are needed possibly with 300m setback of septics

One last hope

The only natural recourse once TP are in the lake is to flush it out. Beaver have been managing water quality for aeons. A beaver dam at the end of the lake can appreciably improve TP levels by maintaining flow year-round, flushing out the lake. But that is broad tail for another day.

Dr Frank Johnson PEng is an engineer with a professional interest in environmental water quality. He was president of RBR Ltd, a world leading manufacturer of water quality monitoring equipment and has worked on projects around the world from the Yangtze River to Lake Baikal. He has an off-grid property on Little Silver Lake and is currently President of the Little Silver and Rainbow Lakes Property Owners' Association.

Lake Dianchi, Hunnan Province, China in the watershed of the Yangtze. 50 years ago wetlands were removed to be replaced with rice paddies. The lake is now in a parlous state. The runoff from fertilisers will take a century to remediate. This is what happens when phosphates get out of control! (web image)

We wish to avoid this degeneration at Little Silver and Rainbow Lakes.

This document was prepared with comments and input from the Executive of Little Silver and Rainbow Lakes Property Owners Association, and several members of the Association on all the roads adjacent to the lakes. It has not been considered by the membership at large, for which a General Meeting would be needed, and does not include input from property owners in Maberly Pines.