

Supplement to the Watershed Management Plan to include Mill Pond Subwatershed. LLRM and Survey
Lake Loading Response Model Technical Memorandum (Laura Diemer, FBE)

1. The Lakes Loading Response Model (LLRM) predictions were in good agreement with observed median annual values for Phosphorus, Secchi disk transparency and chlorophyll-a. Mill Pond has an annual total phosphorus (TP) value of 31.6, Secchi disk transparency of 1.6 meters and a chlorophyll-a concentration of 13.2ppb placing Mill Pond in the eutrophic category (highly productive).
2. While the sub-watershed was 36% forested and 64% developed, TP by land cover type predicts that 97% of all TP in the pond comes from developed land.
3. While the estimated water loading (WL) in the pond remains about the same as it did before development (320,000 cubic meters per year (M³/Y)), the TP load (TPL) levels have increased from a predevelopment level of 3.0Kg/Y to 24.9 Kg/Y, mainly due to a lack of stormwater infiltration on paved surfaces and developed areas.
4. Sources of the current total phosphorus load (TPL) include: watershed runoff and base flow (55%), septic systems (34%), waterfowl (5%), internal loading (<1%), and atmospheric (5%). Clearly watershed runoff and septic systems are the main culprits. Legacy sources of TP in the sediment of Mill Pond is another consideration.
5. When the watershed is divided into sub-basins it becomes clear that MP-1 (School Street/Church Street /Rt 140) and direct overland shoreland flow are the two largest contributors of TP. This is because MP-1 has a very extensive stormwater conveyance system and the shoreline has extensive land tied up in steep slopes, where flow is rapid and infiltration minimal, or the land has a minimal protective riparian buffer allowing stormwater to flow over land causing erosion of gravel parking lots and pond embankments. It is noteworthy, that shoreline overland flow does not include the culvert system from Rt 11, which is presented separately and contributes much less TP and water to the pond. In total the subwatershed receives an annual WL of 218,925 M³/Y and TPL of 14.0 Kg/Y. Contributions by sub-basin for WL are: MP-1(37%), overland flow (43.9%), MP-4,5,6 (Rt.11) (14%), MP-10,11 (Rt.140)(4.5%) and the managed area in Alton Village around Profile Bank is (0.6%). The same sub-basin contributions to TPL are MP-1(59.2%), overland flow (27.1%), MP-4,5,6 (9.2%), MP-10,11(2.8%) and the managed area (1.4%). From this breakdown it is clear the greatest effort should be focused on the MP-1 system and the shoreline overland flow with Rt.11 and Rt 140 culverts secondary to these.
6. Conclusions and Recommendations:
 - a. Quantify the prevalence of internal loading by :
 - i. Three sample events at deep sites, and
 - ii. Sediment Core sample analysis.
 - b. Inspect the condition of the capped landfill by developing a monitoring strategy using surface and ground water samples to determine the extent of seepage.
 - c. Design and install stormwater improvements to outfalls MP-1,4, 5, and 10.
 - i. Hire stormwater engineers to design and install these improvements.
 - ii. Design and conduct an outfall monitoring strategy to assess and track improvements.

Note: The specific conductivity in Mill Pond runs from 410-450 uS/cm which is very high. However, David Neils measured chloride ion concentration in Mill Pond which was 112-136 mg/L, also very high, and compatible with the high conductivity. See Laura's notes on use of road salt. For comparison Marsh Pond chloride runs 9-12 mg/L. Also, nitrogen concentrations in Mill Pond are 540-710 ug/L which are not excessive. Levels in New Durham MMR are 241-517 ug/L (0.24-0.51 mg/L). Under conditions of failing septic systems we would expect nitrogen to be much higher. Typical inflow into a septic tank is 48.6 mg/L. Agriculture fertilizer runoff into fresh water around Lake Erie is 4 mg/L. Recommendations for dealing with failing septic systems may be found in the original Watershed Management Plan.

Watershed Survey Technical Report and Memo (Ellie Baker et al., HWG)

This report is organized by catchment or drainage area, which closely aligns with the sub-basins in the LLRM but also include area 12 which is the Western shoreline of the overland flow along Letter S Road and the parking area across from Alton Fire Department and area 13 which is the Eastern shoreline overland flow at Moody and Hutchins Circle. There is no recommendation nor description of the managed area at Profile bank. Investigation of drainage areas 2,3 7,8, and 9 were not found to contribute to pollution problems in Mill Pond and were not addressed in this report. Areas 1,4,5,6,10, and 11 (all with culverts) as well as area 12 and 13 (described above) were described, the problem recognized, a recommendation made for a Best Management Practice (BMP) and the approximate cost for the construction of the BMP provided.

This report includes the following: A memorandum from Ellie Baker including a description of each site with photographs, Figure 1 showing the geographic location of each sub-basin/catchment area, table 1- Overall assessment summary matrix, Table 2 Estimated pollutant removal and capital costs. And also included is an Excell spreadsheet with 6 tabs which fully describes each site, pollutant load, remediation, costs and the raw data upon which all these determinations were made. This spread sheet allows for the data to be displayed in different formats. Note that this Data Tab is also presented in a separate printable format as a PDF file.

Drainage area 1 (MP-1): This is a very large catchment area which terminates along Rt 140 beside Mill Pond. The reinforced concrete pipe is in medium(between Excellent and Poor) condition but there is sediment accumulation and clogging of the pipe and the embankment condition is only fair. The invert of outfall 1 is lower in elevation than the conveyance swale that connects to Mill Pond. The depression allows the accumulation of sediments and debris. HWG recommends cleaning out the clogged culvert and installing a simple level spreader to maintain the sediment trap and eliminate scouring and gullyng from concentrated flow. HWG also calls for providing opportunities for infiltration upgradient from the intersection of School, Church, and Pine Streets in order to reduce flow at the terminus . BMPs should be located where stormwater flow can be naturally embraced and where existing structural infrastructure exists (catch basins). BMPs here include check dams, sediment forebays and infiltration swales. Several sites were photographed by Quimby at 28 Pine Street and 28 School Street and HWG thought each would be suitable for an infiltration swale ahead of the catch basin.

HWG recommends the installation of a flow-in flow-out bioswale pilot project at the drop off area of Alton Central School. They recommend removal of unnecessary impermeable pavement (road), install a flow-in, flow-out swale in the center of the roadway where the fence currently exists. This would collect

water running off the pavement and allow infiltration before it reaches a catch basin. Estimated costs \$4000.-\$6000 for this installation.

HWG recommend development of a rain garden at the Alton Community Church to capture water running off the parking lot.

Drainage Area 2 and 3 were not contributing to pollution at Mill Pond.

Drainage Area 4 (old laundromat on Rt.11). Erosion was not observed at outfall MP-4 which discharges into a natural depression on private land and does not enter Mill Pond. However, during heavy rainfall (1-2 times a year) runoff by-passes the Rt.11 catch basins and travels down the Laundromat parking lot forming a channel gully leading to Mill Pond. With the owner's consent, install a sediment forebay and rain garden at the site of erosion(BMP Matrix also recommend placing a level spreader at the point of erosion). Estimated costs are \$4000.-\$5000.

Drainage Area 5 (189 Main Street). Stormwater by-passes the catch basin on Rt.11 that directs flow to outfall MP-5, and water runs down the driveway of 189 Main where severe channel erosion is present. The runoff runs into a simple swale system, created by the owner, which runs down the property line. Visible erosion does not extend beyond the owner's backyard, however, sediment transport is an immediate issue and may affect the long term function of the swale. HWG recommends the Town of Alton engage the NH DOT to install a bituminous berm along the pavement edge of Rt.11 to promote positive drainage to the existing catch basin. HWG also recommends simple check dams in the swale system using naturally occurring materials. The BMP Matrix also recommends protection of the natural conveyance system behind 177 Main Street. Cost \$1000.-2000.

Drainage Area 6 (Alton Home and Garden Center). Catch basins along Rt.11 direct runoff to outfall MP-6 at the bottom of a steep bank where water settles in a small depression. When runoff exceeds the capacity of the depression, it flows toward Mill Pond through forested terrain. Due to access and existing vegetation, HWG does not recommend disturbing the landscape below outfall MP-6. However, a portion of runoff does bypass the catch basins on Rt. 11 and flows into the gravel parking lot behind the Garden Center, eroding the slope leading to Mill Pond. HWG recommends installation of a sediment forebay and rain garden at the edge of the Garden Center Parking Lot and the installation of permeable grass pavers in the parking lot. Estimated costs \$4000.-\$6000.

Drainage Areas 7, 8, and 9 are culverts which do not discharge water into Mill Pond but rather over forested land and depressions or along the road side of Letter S road. Clogging is apparent in the culvert in Drainage Area 8 and 9 and it has been reported that during very heavy storms water from culverts 8 and 9 saturate the soil and travel across Letter S Road into the Merrymeeting River.

Drainage Area 10. Stormwater runoff from Rt.140, the Alton Fire Department, and portions of Liberty Tree Park is collected in a swale at the edge of the Fire department Parking Lot and conveyed, via a culvert, to a depression at the intersection of Rt.140 and Letter S Road. The depression has significant sediment buildup and accumulated debris from neglected maintenance. HWG recommends establishing an operation and maintenance plan to clean the culverts and depression. It also recommends formalizing the depression by establishing a sediment trap between culverts to consolidate the maintenance burden. With the available space a second shelf could be considered to increase treatment capacity. No estimated cost provided.

Drainage Area MP-11 (Rt.140 between culvert 1 and 10 at 55 Frank Gilman Highway). Stormwater settles in a depression at 55 FGH and is transported via culvert across the highway to Mill Pond. The culvert was almost completely clogged with leaf litter and debris. HWG recommends routine maintenance of the culvert and perhaps a trash rack be considered to keep trash out of the culvert. No estimated cost provided.

Drainage Area MP-12 (Western shoreline of Mill Pond including Alton Highway Department Facilities, Letter S Road east, and the gravel parking area across from the Alton Fire Department and adjacent to Mill Pond). Stormwater runoff from Rt.140 travels across the gravel parking lot and into Mill Pond causing erosion, gullies, and bank instability to the pond itself. Letter S Road does not use a curb and gutter system and this country drainage approach, with limited space allows direct discharge including salt and sand, from the road into Mill Pond. The BMP Matrix tab data also describes a low point at the Alton Highway Department along Letter S Road where a BMP may be installed. HWG recommends installing permeable pavers at the edge of Rt.11 into the parking area to prevent overland flow into the pond. A permeable paver swale should divert stormwater to outfalls MP-10 or MP-11. Estimated cost for the pavers is \$5000.-\$7000. In separate correspondence with Fred Quimby HWG recommended placing pavers the entire length of the parking lot / roadway transition they also recommend using a product made by Soil Retention or geogrid(which is embedded a few inches below grade) to avoid adverse impacts from plowing. Also they recommend looking at the entire embankment along the parking lot and along the southern end of Letter S Road for building up the riparian buffer zone with appropriate vegetation to enhance bank stability around the pond, removing pull offs along Letter S Road and discouraging parking along the banks of the pond. Finally, they recommend That , to allow sensitive areas to re-vegetate, you program space using signage to direct car parking to selected areas. Along these lines the once-paved portion of the Parking Lot where boats are introduced into the pond (and in which the asphalt is very degraded) should be replaced with permeable pavers down to the waterline and signs should be erected to inform the public of this public boat landing. Restrict boat introductions to this area alone.

Drainage Area MP-13 (Eastern Shoreline behind Main Street businesses and Mooney Street/Hutchins Circle). Stormwater generated by Mooney Street and Hutchins Circle run uncontrolled down driveway at 3 Hutchins Circle. HWG recommends the installation of a rain garden and a bituminous berm as a driveway apron to divert stormwater flow. Estimated cost \$4000.-\$6000.

The methods for developing costs associated with BMP construction and Maintenance may be found in the BMP Matrix under the tab entitled, Opti-Tool.

I have follow-up correspondence with Laura, Don Kretchmer, and HWG with more detail on the improvements and suggested use of salt on roadways.

One final note: With an average total phosphorus concentration of 30 ppb and acres of water behind it, Mill Pond should be considered a point source of pollution to the Merrymeeting River. The Fish Hatchery outfalls vary from 20-90 ppb TP and discharge 5-6.5 Million Gallons a Day into the River. It may be wise to determine the flow from Mill Pond to the MMR and calculate the total phosphorus load being discharged. In follow up correspondence, HWG mentions working with the Alton Highway Department to determine how to approach these problems around Mill Pond and which entity is in the best position to correct them. Perhaps Alton could contact HWG and get an estimated cost for having such a meeting. There is still a small amount of money left in the WMP budget which may be used for this.