



MEMORANDUM

To: Dr. Fred Quimby, Cyanobacteria Mitigation Steering Committee (CMSC), and Laura Diemer, FB Environmental Associates (FBE)

From: Ellie Baker, Brian A. Laverriere, Jonas Procton, and Lori Kennedy

Date: September 28, 2020

Re: Mill Pond Outfall Assessment

Horsley Witten Group (HW) performed a site visit on April 30, 2020 of the 7 outfalls and associated drainage areas previously identified by Dr. Fred Quimby on behalf of the Cyanobacteria Mitigation Steering Committee (CMSC). HW observed each outfall into Mill Pond from the Alton, NH stormwater drainage network. The contributing drainage areas to each culvert/outfall were field delineated, building on the preliminary drainage area delineations provided by Dr. Quimby. Each outfall was assessed to determine the type and condition of the pipe, evidence of embankment erosion, and side-slope stability. HW also identified opportunities within each drainage area to potentially install stormwater and erosion best management practices (BMPs) to reduce the loading of total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) into Mill Pond. We provide recommendations for potential BMPs to address the conditions in each drainage area to Mill Pond.

The locations of each outfall or culvert and the associated drainage areas are presented in Figure 1 on the following page. A summary of HW's field observations and recommendations is presented in Table 1. HW's site investigation observations are included as an Attachment to this memorandum. Table 2 presents a summary of the pollutant load reduction estimates calculated for each site using either the Region 5 Method for erosion in gullies or the methods presented in the MS4 General Permit Appendix F. It also presents planning level construction cost estimates for each site, for comparison purposes only.



Figure 1. Subcatchment Areas Draining to Mill Pond.
Subcatchments 8 & 9 are north of subcatchment 7 and do not contribute runoff to Mill Pond.



Table 1: Outfall Assessment Summary Matrix

Drainage Area	Problems	Condition of Pipe Outfall and Embankment	Recommendations
1 – Frank C Gilman Hwy (East of Fire Dept.), Church Street, Pine Street (North), Alton Central School Facilities, & School Street	<ul style="list-style-type: none"> Minor erosion at School St. outfall Sediment accumulation clogging outfall Salting/sanding of road 	<p><u>Pipe Material:</u> Flared end reinforced concrete pipe (RCP)</p> <p><u>Pipe Condition:</u> Medium</p> <p><u>Embankment Condition:</u> Fair</p>	<ul style="list-style-type: none"> Pavement reduction on School Street Flow-in / Flow-out Bioswales on Pine Street, School Street, and Church Street Rain Garden at Alton Community Church Permeable pavement retrofit Pretreatment and maintenance
2 – Downtown Alton	<i>Drainage area does not drain to Mill Pond</i>	-	-
3 – Profile Bank	<i>Drainage area managed by retention pond</i>	-	-
4 – Main St Laundry	<ul style="list-style-type: none"> Bank erosion at rear of property Loose aggregate parking/storage yard at rear of property 	<p><u>Pipe Material:</u> HDPE</p> <p><u>Pipe Condition:</u> Good</p> <p><u>Embankment Condition:</u> Poor</p>	<ul style="list-style-type: none"> Rain garden with level spreader at point of erosion
5 – 189 Main St	<ul style="list-style-type: none"> State road runoff bypasses catch basins Overland flow across loose aggregate on homeowner's driveway is eroding 	<p><u>Pipe Material:</u> Ductile Iron</p> <p><u>Pipe Condition:</u> Good</p> <p><u>Embankment Condition:</u> Poor</p>	<ul style="list-style-type: none"> Bituminous berm at 189 Main Street driveway to direct runoff into existing CB Protect natural drainage conveyance system behind 177 Main Street

Drainage Area	Problems	Condition of Pipe Outfall and Embankment	Recommendations
6 – Alton Home & Garden Center	<ul style="list-style-type: none"> • Minor erosion at outfall • State road runoff is bypassing catch basin • Erosion and sedimentation down driveway • Invasive plants 	<p><u>Pipe Material:</u> HDPE</p> <p><u>Pipe Condition:</u> Good</p> <p><u>Embankment Conditions:</u> Good</p>	<ul style="list-style-type: none"> • Install roadside rain garden to collect and treat road runoff • Promote positive drainage into existing CB • Permeable pavement retrofit
7 – 235 Main St	<i>Drainage area does not drain to Mill Pond</i>	-	-
8 – Main Street (North of Letter S Rd.) See Note 1.	<i>Drainage area does not drain to Mill Pond</i>	-	-
9 – Main Street (North of Letter S Rd.) See Note 1.	<i>Drainage area does not drain to Mill Pond</i>	-	-
10 – Frank C Gilman Hwy (West of Alton Town Fire Dept.)	<ul style="list-style-type: none"> • Untreated road runoff, direct discharge from culvert • Sediment accumulation clogging culverts • Lack of routine maintenance • Salting/sanding of roadway 	Good	<ul style="list-style-type: none"> • Formalize settling basin and sediment trap within landscape island at Letter S Road • Perform routine maintenance
11 – 55 Frank C Gilman Hwy	<ul style="list-style-type: none"> • Untreated road runoff, direct discharge from culvert • Sediment accumulation within culvert • Salting/sanding of roadway 	Good	<ul style="list-style-type: none"> • Formalize roadside swale into settling basin • Pretreatment to prevent pollutant transport through culvert • Perform routine maintenance

Drainage Area	Problems	Condition of Pipe Outfall and Embankment	Recommendations
12 – Western Shoreline: Alton Highway Department Facilities, Letter S Road (East), Gravel Parking Area adjacent to Mill Pond (Across from Alton Fire Dept.)	<ul style="list-style-type: none"> Loose aggregate parking areas Storage of equipment and materials within shoreland buffer Lack of stormwater controls Lack of defined input source to implement stormwater controls 	<p><u>Pipe Material:</u> N/A (Overland Flow)</p> <p><u>Pipe Condition:</u> N/A</p> <p><u>Embankment Conditions:</u> Poor</p>	<ul style="list-style-type: none"> Permeable pavement retrofit Stormwater controls to prevent/minimize undefined input points Restore shoreline along Letter S Road (East) Define parking/ fishing spots to minimize adverse, human impacts Bioretention basin at Alton Highway Facilities with pretreatment and sizing capacity for water quality volume at existing low point Perform routine maintenance
13 – Eastern Shoreline: Behind businesses and residences along Route 11, Mooney St., and Hutchins Circle	<ul style="list-style-type: none"> Mooney Street and Hutchins Circle road runoff flows down loose aggregate driveway of 3 Hutchins Circle Minor bank erosion as described for sites 4 & 5 	<p><u>Pipe Material:</u> N/A (Overland Flow)</p> <p><u>Pipe Condition:</u> N/A</p> <p><u>Embankment Conditions:</u> Fair</p>	<ul style="list-style-type: none"> Control road runoff on Mooney Street and Hutchins Circle to prevent road runoff from eroding driveways/private property
14 – Pine Street (South), Appleyard Lane, and ball fields	<p><i>Drainage area does not drain to Mill Pond</i></p>	<p>-</p>	<p>-</p>

Notes:

- HW determined in the field that drainage areas 2, 7, 8, 9, and 14 do not drain to Mill Pond. Drainage Areas 8 and 9 were not fully delineated and therefore are not included on the Drainage Area Map.

Table 2: Estimated Pollutant Removal and Capital Costs for Recommended Structural Controls

Drainage Area	Recommended Structural Controls	Estimated Potential Pollutant Removal			Estimated Capital Costs	
		TSS (lb/yr)	TP (lb/yr)	TN (lb/yr)	Low Range	High Range
1	Bioswale/ Bioretention	391	0.2	1.4	\$4,000	\$6,000
4	Bioretention, gully stabilization	744	0.3	1.7	\$4,000	\$6,000
5	Regrade/ berm, gully stabilization	1,120	0.5	1.0	\$1,000	\$2,000
6	Bioretention	364	0.1	1.4	\$4,000	\$6,000
12	Permeable pavement	364	0.1	1.4	\$5,000	\$7,000
13	Bioretention	391	0.2	1.4	\$4,000	\$6,000

Notes:
 Pollutant removal estimated using MS4 Permit Appendix F (for treatment systems) and EPA Region 5 Erosion Control Model (for gully stabilization)
 Capital costs estimated using EPA Opti-tool unit costs, as presented in USEPA, 2016

SUMMARY OF SITE INVESTIGATION

Drainage Area 1: Frank C Gilman Hwy (East of Fire Dept.), Church Street, Pine Street (North), Alton Central School Facilities, & School Street

Existing Conditions:

Stormwater is captured by catch basins on School Street, Church Street, Pine Street (north), the school facilities, and a portion of Frank C Gilman Highway (Rt. 140) and is conveyed via a closed pipe drainage system to Outfall 1. The contributing drainage area to this outfall is the largest single drainage area in the Mill Pond watershed. At its discharge point, the invert of Outfall 1 is lower in elevation than the conveyance swale that connects to Mill Pond. This depression allows the settling and accumulation of sediments and debris.

Site Photos:



Photo 1. Outfall 1 is clogged with leaves and is set lower than the swale leading to Mill Pond.



Photo 2. Bus drop off/pick up area at Alton Central School. Road width exceeds 30 horizontal feet and provides an opportunity for pavement reduction and simple flow-in/flow-out bioswale system.

BMP Solution:

HW recommends analyzing the traffic patterns and turning radius needs to determine the extent of pavement removal along School Street and at the Bus drop-off zone. The existing landscape island containing the white split-rail fence may be retrofitted into a simple flow-in-flow-out bioswale system to allow for soil filtration and plant uptake.

Due to existing topography and available space, water quality BMP opportunities should be focused up-gradient of the intersection of School, Pine, and Church streets. The public right-of-way and steep terrain down-gradient of the intersection of School, Pine, and Church streets does not present ideal conditions to implement successful water quality BMPs. To reduce project cost and improve pollutant removal efficiency, BMP solutions should be located where stormwater flow can be naturally collected/embraced. Furthermore, BMP solutions should be located where existing structural infrastructure currently exists (i.e., catch basins).

By embracing the existing stormwater flow path(s), the design and implementation of BMPs will minimize earthwork expenses and utilize existing controls to convey larger (>1") storm events. HW recommends the installation of a flow-in/flow-out bioswale pilot project at the drop-off area in front of the Alton Central School. This solution incorporates both a reduction of impervious cover (pavement) and stormwater treatment up to the water quality volume (WQv). Beyond

stormwater management and treatment, the site selection at Alton Central School offers a high degree of visibility to promote proper maintenance, as well as numerous educational benefits.

Drainage Area 2: Downtown Alton

Existing Conditions:

Downtown Alton contains a closed pipe drainage system which captures stormwater runoff from approximately ¼ mile along Main Street, as well as portions of several abutting streets and private properties. HW reviewed the infrastructure associated with drainage area 2 (DA2) on-site. HW agrees with the previous assessment conducted by Fred Quimby of CSMC and can confirm that stormwater from DA2 does not drain to Mill Pond.

Drainage Area 3: Profile Bank

Existing Conditions:

Runoff from the Profile Bank property and the immediate surrounding area is captured by a closed pipe drainage system. All runoff within DA3 is conveyed to a retention pond in the rear of Profile Bank. The stormwater report related to this work was reviewed by HW for the development project and was modelled with underlying soil conditions as well-draining, hydraulic soil group (HSG) type A. HW did not conduct test pits as part of this project and relies on the findings from previous studies and reports to determine soil permeability.

Site Photos:



Photo 3. Retention pond at Profile Bank manages stormwater for DA3

Drainage Area 4: Main Street Laundry

Existing Conditions:

Two catch basins on Main Street (Rt. 11) capture stormwater runoff, which is piped to Outfall 4, where it is conveyed to a natural depression on private property behind Main Street Laundry. Although the catch basins capture most runoff from the road, during heavy rain events road runoff bypasses the catch basins and flows overland across the laundromat property. Events of this magnitude reportedly occur approximately 1-2 times per year.

Erosion was not observed at Outfall 4. Erosion from surface flow was observed at the top of bank behind the existing parking lot / stockpile area in the rear of the building. A channel gully leading to Mill Pond is forming as a result of channelized flow. The slope down-gradient of the laundromat parking lot / stockpile area is extremely steep (2:1), much like the terrain throughout the eastern edge of Mill Pond.

Site Photos:



Photo 4. Outfall 4 is directed to a natural depression via a pipe.



Photo 5. Channel gully forming at top of bank flowing towards Mill Pond.

BMP Solution:

With the property owner's consent, HW recommends the installation of a sediment forebay and rain garden at the point of erosion. The rain garden should be designed to accommodate the existing use(s) and sized to treat the WQv. HW recommends that the rain garden be designed with side-wall filter fabric to prevent seepage and a level spreader as the primary overflow device to dissipate velocity/channelized flow to reduce bank erosion.

Drainage Area 5: 189 Main Street

Existing Conditions:

Due to the existing topography of Main Street, stormwater runoff bypasses the existing catch basins that direct flow to Outfall 5. Instead, a majority of stormwater flows over the driveway of 189 Main Street, where severe channel erosion is present. Eroded material is washed down-gradient on to 177 Main Street where stormwater eventually flows through a simple swale system. The swale runs along the property boundary through the owner's backyard toward Mill Pond where minimal erosion/sedimentation is observed at the outflow. The swale is sufficient to manage the run-on that reaches the site. Visible erosion does not extend beyond the backyard of 189 Main Street. However, sediment transport is an immediate issue which may impact the swales performance long-term.

Site Photos:



Photo 6. Severe channel erosion down the driveway of 189 Main Street towards Mill Pond.

BMP Solution:

The homeowner has proactively installed the swale system and trench drain to mitigate the adverse impacts of uncontrolled road runoff. HW recommends that the Town of Alton engage NHDOT to install a bituminous berm along the pavement edge of Rt. 11 to promote positive drainage into the existing catch basin.

Short-term, HW also recommends simple check-dams within the swale system, using naturally occurring materials (rocks), to dissipate velocity and prevent sediment from reaching Mill Pond. To avoid sediment wash-out, HW recommends the property owner investigate porous soil retention products (such as Ecoraster E40) and/or implement a shallow rain garden to intercept the road runoff currently causing the erosion. A short-term fix should be considered until NHDOT can install the bituminous berm along Route 11.

Drainage Area 6: Alton Home & Garden Center

Existing Conditions:

Three catch basins on Main Street collect runoff and direct it behind the Alton Home & Garden Center. Stormwater runoff discharging from Outfall 6 settles in a small depression. When the depression exceeds capacity and overtops, stormwater flows toward Mill Pond through forested terrain. Minor erosion and gullies were observed along the flow path leading to Mill Pond. Like Outfalls 4 & 5, Outfall 6 is located at the bottom of a steep, rocky slope. Due to site access and substantial existing vegetation, HW does not recommend disturbing the landscape below Outfall 6.

A portion of road runoff does bypass the existing catch basins on Main Street and flows into the gravel parking lot of the Garden Center. Runoff then flows down a gravel path behind the Garden Center, eroding the slope leading toward Mill Pond and Outfall 6. A patch of invasive Japanese Knotweed grows on the slope north of this runoff path and should be addressed in conjunction with any stormwater improvement work.

Site Photos:



Photo 7. Outfall 6 discharging into shallow depression.



Photo 8. Sedimentation from road runoff draining towards Mill Pond.

BMP Solution:

Because of the steep and rocky terrain, site access to Outfall 6 will likely cause more harm than good. Therefore, HW recommends the placement of a sediment forebay and rain garden at the edge of the Garden Center parking lot to collect sediment, reduce erosion, and treat the WQv. To reduce sediment transport, HW recommends that the installation of permeable grass pavers in the Garden Center parking lot.

Drainage Area 7, 8, & 9: North of 235 Main Street

Existing Conditions:

Outfall 7, 8, and 9 are individual outfalls located north of Mill Pond and are separated from Outfall 6 by a natural saddle in the landscape. HW reviewed the infrastructure associated with DA7 on site. HW agrees with the previous assessment conducted by Fred Quimby of CSMC and can confirm that stormwater from DA7 does not drain to Mill Pond, but rather drains to the Merrymeeting River.

Drainage Area 10: Route 140 (West of Alton Fire Department)

Existing Conditions:

West of Outfall 1, stormwater runoff from Rt. 140, the Alton Town Fire Department, and portions of Liberty Tree Park is collected in a swale at the edge of the Fire Department parking lot.

Stormwater is conveyed through a culvert to a depression at the intersection of Rt. 140 and Letter S Road, which is then conveyed to Outfall 10. The depression at the intersection has significant sediment buildup from neglected maintenance.

Site Photos:



Photo 9. Landscape island at the intersection of Letter S Road and Frank C Gilman Hwy. Shallow depression conveys stormwater from the road and fire station to Outfall 10.

BMP Solution:

HW recommends establishing an operation and maintenance plan to clean the culverts and depression at the intersection of Letter S Road and Frank C Gilman Hwy. HW also recommends formalizing the depression at the intersection of Rt. 140 and Letter S Road 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. Given the spatial constraints and public safety, any stormwater controls within the intersection should be designed with a minimum freeboard of 12”. Wetland plants, such as cattails, should be planted within the expanded treatment area to allow for plant uptake and soil filtration.

Drainage Area 11: 55 Frank C Gilman Hwy

Existing Conditions:

Outfall 11 collects minor amounts of road runoff along the southern edge of Frank C Gilman. Stormwater settles into a shallow depression located at 55 Frank C Gilman Hwy and a culvert connects the depression to Mill Pond. During HW's field visit, Outfall 11 was almost entirely clogged with leaf litter and miscellaneous debris.

Site Photos:



Photo 10. Shallow depression conveys stormwater from Frank C Gilman Hwy to Mill Pond.

BMP Solution:

HW recommends routine maintenance be performed on an annual basis to remove sediments and road debris, such as salt, after the conclusion of winter maintenance practices. A trash rack may be considered at culvert inlet to prevent trash and larger debris from being transported by culverts.

Drainage Area 12: Western Shoreline: Alton Highway Department Facilities, Letter S Road (East), Gravel Parking Area adjacent to Mill Pond (Across from Alton Fire Dept.)

Existing Conditions:

In addition to the three outfalls (#1, #10, #11), runoff along Rt.140 flows overland across a loose aggregate parking lot across the street from the Alton Fire Department. Non-point source stormwater inputs enter Mill Pond throughout DA12. As a result, bank stability is noticeably compromised. Implementing source, stormwater controls is paramount to providing water quality treatment prior to stormwater discharge into Mill Pond. Numerous gullies were observed between the parking lot and Mill Pond. Bank erosion and naturally occurring vegetation along Letter S Road is failing, which is due in large part to undefined parking and recreational uses.

Letter S Road does not contain a curb and gutter system. The country drainage approach with limited space is leading to direct, road runoff discharging directly into Mill Pond which is likely salted and sanded several times each winter and spring.

Site Photos:



Photo 11. Loose aggregate parking area across from the Alton Fire Department.



Photo 12. Bank instability and erosion along Letter S Road.

BMP Solution:

HW recommends a more involved design approach be considered to better balance the recreational demands and environmental protection issues specific to the Letter S Road area.

To reduce erosion across the public parking area, HW recommends installing permeable pavers at the edge of pavement along Frank C Gilman Hwy to prevent overland flow across the parking area. The permeable paver swale should divert stormwater flows toward Outfall 1 or Outfall 10. Minor re-grading of the road shoulder and parking area will be required to promote positive drainage toward an existing point-source input.

Drainage Area 13: Eastern Shoreline: Behind businesses and residences along Route 11, Mooney St., and Hutchins Circle

Existing Conditions:

Stormwater runoff generated by Mooney Street and Hutchins Circle run uncontrolled down the driveway of 3 Hutchins Circle.

Site Photo:

No photo was taken at this site.

BMP Solution:

Install a rain garden and bituminous berm as a driveway apron to divert stormwater flow.