AHEAD OF THE STORM

Site: Charlotte Central School

Location: Hinesburg Road, Charlotte, Vermont

Primary Problem

The Charlotte Central School is located on Hinesburg Road and all of the stormwater runoff from the school flows to McCabes Brook. Currently runoff from the roof, parking lots, driveways, playgrounds, and fields is collected in a series of swales, catchbasins, underdrains, and pipes that drain to the northwest to a (Vermont Class two) wetland along McCabes Brook. Runoff travels directly from impervious surfaces to the pipe network with no treatment. Students, teachers, and staff at the school have contributed their knowledge of the stormwater drainage patterns and site constraints for the site assessment. *(See existing conditions site summary and plan.)*

Three Optimal Conservation Practices (OCPs) are recommended to treat runoff from the existing impervious cover. The primary goals are to improve water quality protection and flood resiliency by slowing runoff, reducing erosion, and enhancing vegetation. This project will begin to reverse the cumulative impacts from incremental development within the McCabes Brook watershed where past water quality sampling found high turbidity, nitrogen, E.coli, and phosphorus levels in streams.

Final Treatment Recommendations

1. Create a bio-retention area and sediment forebay near the Quonset Hut to capture sediment, slow runoff and increase storage capacity prior to entering the wetland.
2. Create a bio-retention area and sediment trap near the east parking lot to slow runoff and increase storage.
3. Install an infiltration trench and stabilize the surface within the playground area behind the school to improve infiltration, improve function of the playground, and reduce sediment migration.

Site Constraints and Design Basis

The design maximizes treatment while largely maintaining current land use, site features, and maintenance needs. The design avoids wetland impacts. Runoff calculations indicate that the bio-retention area at the east parking area and the infiltration trench in the playground will treat the 1-inch rain storm (i.e., the Water Quality Volume – WQv) (Table 1). The bio-retention area near the Quonset Hut treats a portion of the WQv. The design minimizes long-term maintenance procedures and costs that will be taken on by the school. *(See attached concept design plans, including operation and maintenance notes.)*

Table 1: Summary of Hydrology Calculations

Drainage Location	Total Drainage Area (Acres)	Drainage Area on the Site (Acres)	Impervious Area on the Site (%)	WQv Generated on the Site (Cubic Feet)	CPv Generated on the Site (Cubic Feet)	10-yr Volume (Cubic Feet)	Treatment Volume (Cubic Feet)	Treatment Volume (%)
To Outfall #1	29.6	21.2	22.0	17,177	62,896	141,219	N/A	N/A
To Outfall #2	2.4	0.6	0.0	101	6,242	13,143	N/A	N/A
DA 1a, Quonset Hut	3.3	3.3	67.0	7,040	14,903	26,398	2,600	40% of WQv
DA 1b, East Parking	1.1	1.1	76.0	2,638	5,908	9,901	3,200	120% of WQv
DA 1c, Playground	1.6	1.6	25.0	1,437	5,698	10,874	1,440	100% of WQv
TOTAL DA 1 (a+b+c)	**6.0**	**6.0**		**11,115**	**26,509**	**47,173**	**7,240**	

Cost

Final engineering design and construction for the preferred OCP at the entrance island is estimated to cost $21,000 assuming that labor and materials are purchased at the market rate through a bid process from a construction contractor. Cost savings for this small project may be achieved through donations or sole-source contracting if purchase requirements allow.

MILONE & MACBROOM

LEWIS CREEK ASSOCIATION

Ahead of the Storm
Existing Conditions Site Summary
Charlotte Central School

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The Charlotte Central School is located on Hinesburg Road in Charlotte and almost all runoff from the school goes to the McCabe's Brook which eventually flows to the LaPlatte River and Shelburne Bay (Figure 1). Currently stormwater runoff from the roof, parking lots, driveways, playgrounds, and fields is collected in a series of swales, catchbasins, underdrains, and pipes and drains to the northwest to a wetland leading to McCabe's Brook. In many locations runoff travels directly from an impervious surface to the pipe network with no treatment. This project is to reduce velocity and volume of runoff leaving the site to improve water quality and flood resiliency. Students, teachers, and staff at the schools have contributed their knowledge of the stormwater drainage patterns and constraints at the site to this site assessment.

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Most of the water from the school property drains to the northwest and enters a wetland area prior to crossing the road and flowing to McCabe's brook (Drainage Area 1). This area also collects runoff from Pease Mountain behind the school for a total watershed area of 29.6 acres. All 4.6 acres of impervious surface from the school property

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POND

McCabes Brook

Hinesburg Rd

CHARLOTTE CENTRAL SCHOOL

Mt Philo Rd

Williams Hill Dr

Flinn Ln

OUTFALL
DA # 1 =
29.6 ACRES

OUTFALL
DA # 2 =
2.4 ACRES

N
W E
S

0 250 500
Feet

Drainage Area Boundary
Wetland, Approximate
Stream Order
1 2 3 4 5
School Property

Stormwater Flow
Overland
Swale
Underdrain
Culvert
Pipe

bing™

© 2010 DigitalGlobe Image courtesy of USGS Earthstar Geographics SIO © 2016 Microsoft Corporation © 2010 NAVTEQ © AND

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SOURCE(S):
BING AERIAL
VCGI STREAM MAPPING
MMI / LCA SUBWATERSHEDS

WATERSHED MAP

AHEAD OF THE STORM
ELEMENTARY SCHOOLS IN MCCABE'S BROOK WATERSHED

CHARLOTTE CENTRAL SCHOOL
CHARLOTTE, VERMONT

CONCEPT DESIGN

Map By: JCL
MMI#: 3452-25
MXD:
1st Version: 7/15/2016
Revision:
Scale: SEE SCALE BAR

01

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CATCH BASIN, TYP.

ROOF DRAIN

GRAVEL MIGRATING

COMPOSTING SHED

MINOR EROSION ON PATH

SEPTIC LEACHFIELDS

PONDING AND ICE FORMATION BETWEEN PLAYGROUND AND GARDEN

MINOR EROSION ON SLOPE

GRAVEL MIGRATING AND ACCUMULATING AT PARKING EDGE AND ON PATH

GRAVEL MOVING DOWN PATH

FIELDS (ON FILL)

PATH TO PEASE MOUNTAIN

CHARLOTTE CENTRAL SCHOOL

Hinesburg Rd

Lk, HSG B, not highly erodible

Pas, HSG C, potentially highly erodibl

Cv, HSG D, not highly erodible

Lk, HSG D, not highly erodible

VeB, HSG D, potentially highly erodibl

SuB, HSG C, potentially highly erodibl

0 50 100 Feet

Drainage Area Boundary
Wetland, Approximate
School Property
NRCS Soil Area Boundary
2'-Elevation Contour, 2012 Lidar

Stormwater Flow
Overland
Swale
Underdrain
Culvert
Pipe

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SOURCE(S):
BING AERIAL
VCGI STREAM MAPPING
MMI / LCA SUBWATERSHEDS

EXISTING CONDITIONS

AHEAD OF THE STORM ELEMENTARY SCHOOLS IN MCCABE'S BROOK WATERSHED

CHARLOTTE CENTRAL SCHOOL
CHARLOTTE, VERMONT

CONCEPT DESIGN

Map By: JCL
MMI#: 3452-25
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1st Version: 7/15/2016
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02

CONSIDER REPLACEMENT OF CATCHBASINS WITH DEEPER SUMPS TO CATCH MORE SEDIMENT

CONSIDER ADDING ADDITIONAL CATCHBASINS TO REDUCE PUDDLING

Hinesburg Rd

CHARLOTTE CENTRAL SCHOOL

QUONSET HUT

CONSIDER INSTALLING RAINBARRELS AT ROOF DOWNSPOUTS WHERE WATER CAN BE USED FOR GARDENS

DA 1A =
3.3 ACRES
WQv = 7,040
CUBIC FEET

DA 1B =
1.1 ACRES
WQv = 2,638
CUBIC FEET

DA 1C =
1.6 ACRES
WQv = 1,437
CUBIC FEET

INSTALL STONE FILTER BERMS (SEE DETAILS)

CREATE SEDIMENT FOREBAY AND BIO-RETENTION AREA NEAR QUONSET HUT (SEE DETAIL)
DEPTH ~ 2 FEET
AREA ~ 1,780 SQUARE FEET
VOLUME ~ 2,600 CUBIC FEET

CONSIDER INSTALLATION OF INFILTRATION TRENCH TO IMPROVE DRAINAGE AND STABILIZE SURFACE WITH GEOGRID

CONSIDER CREATING SEDIMENT TRAP AND BIO-RETENTION AREA TO CAPTURE GRAVEL MOVING DOWN PATH
DEPTH ~ 2 FEET
AREA ~ 3,000 SQUARE FEET
VOLUME ~ 3,200 CUBIC FEET

CONSIDER MOVING PATH TO EAST AWAY FROM STEEP SLOPE, INSTALLATION OF INFILTRATION TRENCH, AND STABILIZING WITH GEOGRID

0 50 100 Feet

Drainage Area Boundary
Wetland, Approximate
School Property
2'-Elevation Contour, 2012 Lidar

Stormwater Flow
Overland
Swale
Underdrain
Culvert
Pipe

bing

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SOURCE(S):
BING AERIAL
VCGI STREAM MAPPING
MMI / LCA SUBWATERSHEDS

STORMWATER MANAGEMENT RECOMMENDATIONS

AHEAD OF THE STORM
ELEMENTARY SCHOOLS IN MCCABE'S BROOK WATERSHED
CHARLOTTE CENTRAL SCHOOL
CHARLOTTE, VERMONT

CONCEPT DESIGN

Map By: JCL
MMI#: 3452-25
MXD:
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03

OPERATION AND MAINTENANCE NOTES:

1. PERIODICALLY, INCLUDING AFTER LARGE STORMS AND REGULARLY DURING THE FALL, CHECK SEDIMENT FOREBAY AND BIO-RETENTION AREA.
2. IN SEDIMENT FOREBAY REMOVE ACCUMULATED SEDIMENT AFTER APPROXIMATELY 12 INCHES HAS ACCUMULATED. REMOVE SEDIMENT DOWN TO THE ORIGINAL GRAVEL LAYER. EXPECTED A SEDIMENT REMOVAL PERIOD OF EVERY 1-2 YEARS.
3. IN BIO-RETENTION AREA REMOVE ACCUMULATED SEDIMENT AFTER APPROXIMATELY 12 INCHES HAS ACCUMULATED. WHEN RESHAPING BIO-RETENTION AREAS AND REMOVING SEDIMENT, FOCUS EXCAVATION IN THE AREAS WITH THE MOST SEDIMENT TO ALLOW AS MUCH VEGETATION AS POSSIBLE TO REMAIN. EXPECT A SEDIMENT REMOVAL PERIOD OF EVERY 5-10 YEARS.
4. ANNUALLY INSPECT FILTER BERMS TO MAKE SURE FLOWS ARE NOT CONCENTRATED. IF FLOW PATHS OR EROSION HAVE FORMED, REDISTRIBUTE LARGE ROCKS ACROSS BERM TO REESTABLISH LEVEL OVERFLOW SURFACE AND REMOVE CONCENTRATION POINTS.

NOTES:

1. TOPOGRAPHIC SURVEY AND FINAL ENGINEERING DESIGN IS REQUIRED TO SET FINAL ELEVATION AND EXTEXT OF PROPOSED FEATURES.
2. CONSULT WITH VTANR WETLAND STAFF ON PERMITTING REQUIREMENTS.

QUONSET HUT

DA 1A =
3.3 ACRES
WQv = 7,040
SQUARE FEET

CUT PIPE UPSTREAM TO INCREASE OUTLET ELEVATION

INSTALL STONE LINED SWALE FROM PIPE OUTLET TO SEDIMENT FOREBAY (SEE DETAIL)

CREATE SEDIMENT FOREBAY. EXCAVATE AND INSTALL 4 INCH DEEP LAYER OF 1/2 INCH GRAVEL
DEPTH ~ 2 FEET
AREA ~ 520 SQUARE FEET
VOLUME ~ 200 CUBIC FEET

INSTALL ~33 FOOT LONG STONE FILTER BERM (SEE DETAIL)

CREATE BIO-RETENTION AREA (SEE DETAIL)
DEPTH ~ 2 FEET
AREA ~ 1,260 SQUARE FEET
VOLUME ~ 1,860 CUBIC FEET

INSTALL ~35 FOOT LONG STONE FILTER BERM (SEE DETAIL)

N W E S

0 12.5 25 Feet

Sediment Forebay
Bio-Retention Area
Wetland, Approximate
2'-Elevation Contour, 2012 Lidar

Stormwater Flow
Overland
Swale
Underdrain
Culvert
Pipe

bing™

Y:\3452-25\Maps\LAYOUT\CCS_QUONSET.mxd

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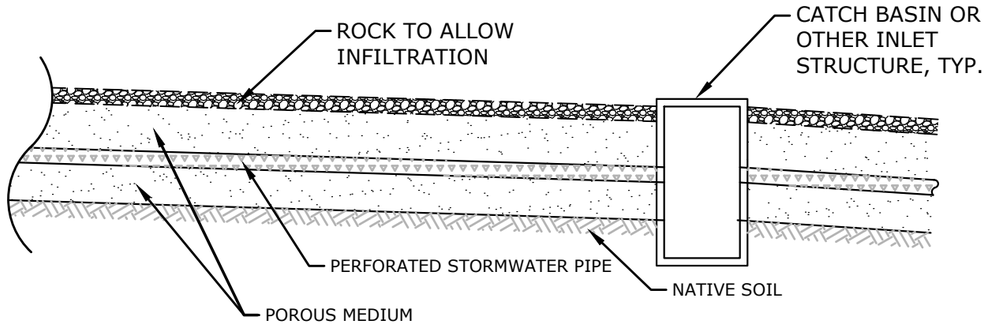
SOURCE(S): BING AERIAL

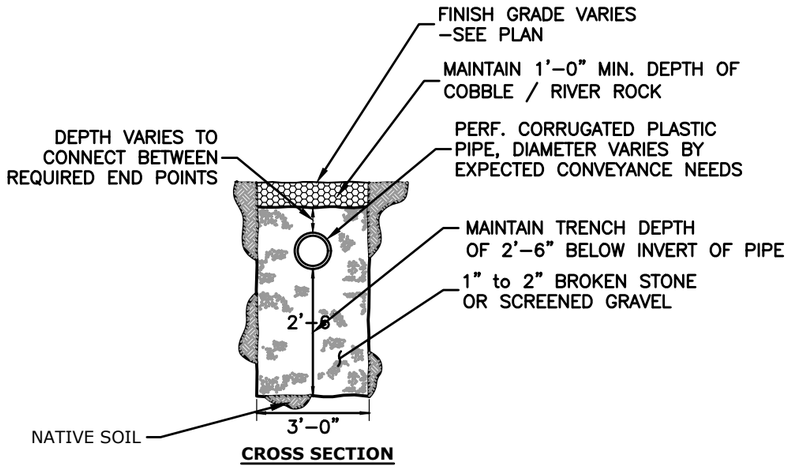
QUONSET HUT TREATMENT AREA
AHEAD OF THE STORM
ELEMENTARY SCHOOLS IN MCCABE'S BROOK WATERSHED
CONCEPT DESIGN
CHARLOTTE CENTRAL SCHOOL
CHARLOTTE, VERMONT

Map By: JCL
MMI#: 3452-25
MXD:
1st Version: 5/18/2016
Revision: 7/15/2016
Scale: SEE SCALE BAR

04



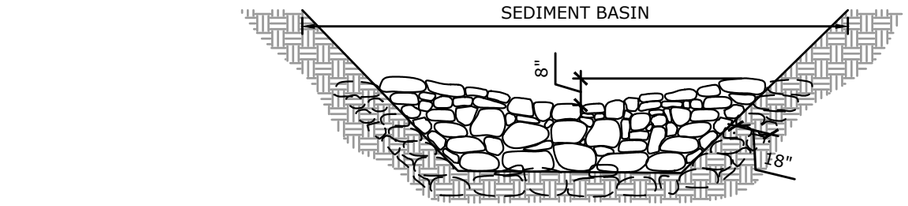
PROFILE



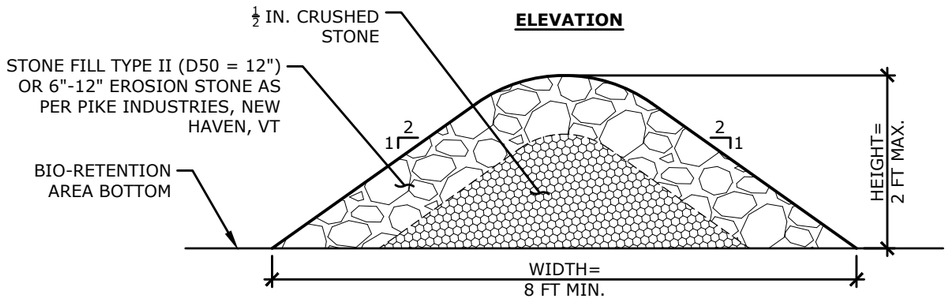
CROSS SECTION

INFILTRATION TRENCH

NOT TO SCALE



ELEVATION

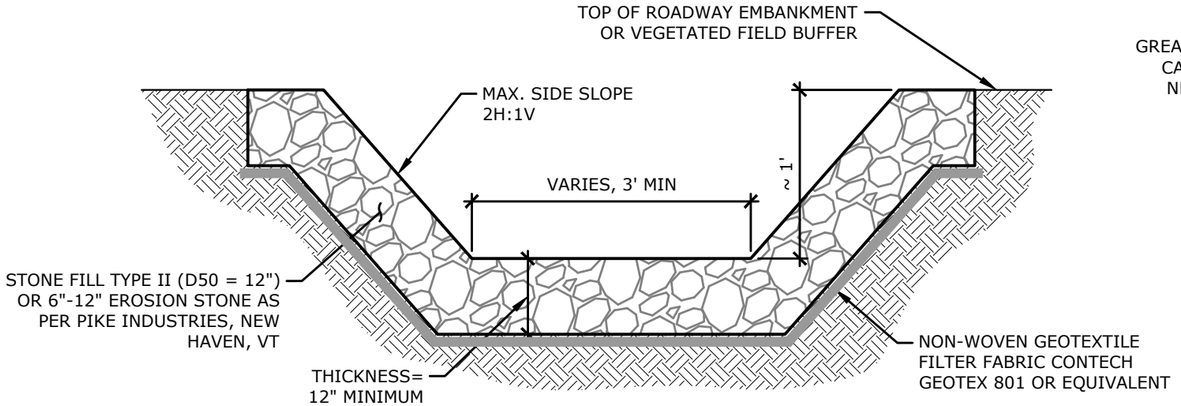


CROSS SECTION

NOTES:
EXTEND THE STONE A MINIMUM OF 18 INCHES INTO BANKS AND BOTTOM TO PREVENT CUTTING AROUND THE ENDS OR UNDER THE FILTER BERM.

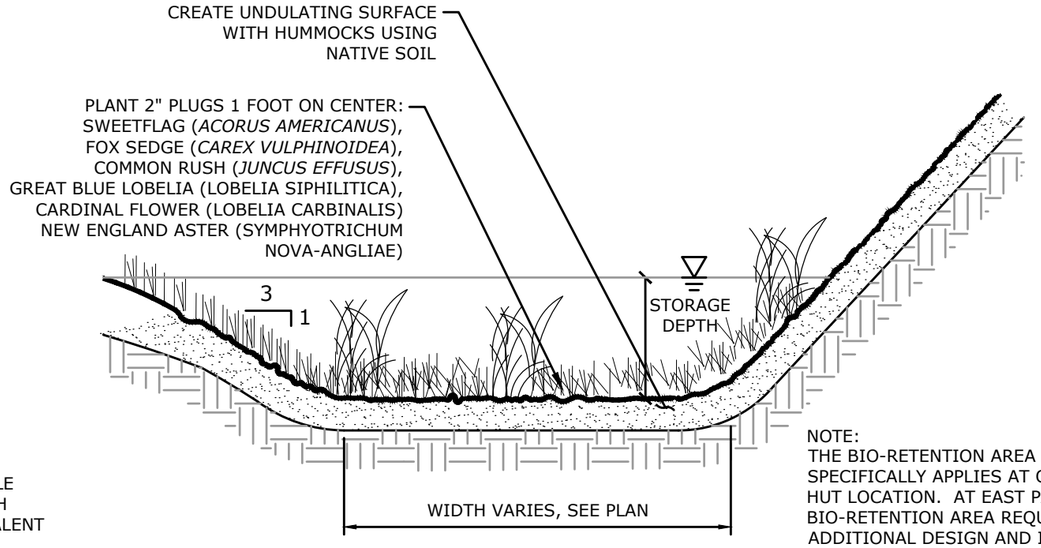
STONE FILTER BERM

NOT TO SCALE



STONE LINED SWALE

NOT TO SCALE



NOTE:
THE BIO-RETENTION AREA DETAIL SPECIFICALLY APPLIES AT QUONSET HUT LOCATION. AT EAST PARKING THE BIO-RETENTION AREA REQUIRES ADDITIONAL DESIGN AND IS EXPECTED TO REQUIRE SOIL AMENDMENTS, AN UNDERDRAIN SYSTEM, AND DIFFERENT PLANT SPECIES.

BIO-RETENTION AREA

NOT TO SCALE

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REVISIONS

DETAILS

AHEAD OF THE STORM
ELEMENTARY SCHOOLS IN MCCABE'S BROOK WATERSHED
CHARLOTTE CENTRAL SCHOOL
CHARLOTTE, VERMONT

CONCEPT DESIGN

JCL	JCL	RS
DESIGNED	DRAWN	CHECKED

SCALE: NOT TO SCALE
DATE: 7/15/2016
PROJECT NO.: 3452-25
SHEET NO.: 05

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Drawing: W:\DESIGN\3452-25-DE\CAD\CGS-DETAILS.DWG Layout: Tab:DETAILS
Plotted by: JESSICAL On this date: Fri, 2016 July 15 - 2:28pm

BALLPARK OPINION OF PROBABLE COST
CHARLOTTE CENTRAL SCHOOL
QUONSET HUT TREATMENT AREA
Charlotte, Vermont
MMI #3452-25
July 29, 2016

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM

Item	ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
	CONSTRUCTION LABOR				
	Labor to Install Plants	HR	8	$35	$280
	Labor to Restore Site	HR	6	$35	$210
	CONSTRUCTION EQUIPTMENT				
	Excavator to Shape Treatment Area	HR	8	$110	$880
	Excavator for Stone Filter Berms	HR	8	$110	$880
	Truck for Stone Filter Berms	HR	8	$80	$640
	Haul Fill Off Site (1 hr round trip)	HR	8	$80	$640
	Haul Materials to Site (Pike Industries, 1.5 hr round trip)	HR	17	$80	$1,360
	CONSTRUCTION MATERIALS				
	Stone for Stone Lined Swale	TN	7	$10	$70
	Stone for Stone Filter Berm	TN	70	$10	$700
	Gravel for Stone Filter Berm	TN	90	$19	$1,710
	Gravel for Sediment Forebay	TN	10	$19	$190
	Seed for Restoring Disturbed Areas	LS	1	$25	$25
	Wetland Plants	EA	1,000	$1	$1,000
	CONSTRUCTION MISCELLANEOUS				
	Mobilization/ Demobilization	LS	1	$500	$500
	ENGINEERING SERVICES				
	Survey and Detailed Site Investigation	HR	16	$113	$1,808
	Wetland Delineation	LS	1	$2,000	$2,000
	Final Engineering Design	HR	24	$113	$2,712
	Permitting, State and Federal Wetland Permits	HR	16	$113	$1,808
	Meeting with Administration and Classroom Visit	HR	6	$113	$678
	Updated Quantities and Cost Opinion	HR	4	$113	$452
	Engineering Construction Layout and Oversight	HR	24	$113	$2,712
	Construction Subtotal				**$9,085**
	Engineering Services Subtotal				**$12,170**
	TOTAL (ROUNDED)				**$21,000**

Memorandum

TO: **Marty Illick, Lewis Creek Association**

FROM: **Jessica Louisos, MS, PE, Milone & MacBroom**

DATE: **7/29/2016**

RE: Implementation Plan
Charlotte Central School
Ahead of the Storm – Elementary Schools in McCabe's Brook Watershed

Three Optimum Conservation Practices (OCPs) have been identified and designed at the Charlotte Central School (CSC) as part of the Ahead of the Storm project to improve water quality and flood resilience. This project is being led by the Lewis Creek Association, funded by the Lake Champlain Basin Program, and designed by Milone & MacBroom. The CSC design project included an education component with staff and students. The project team met to chart a path forward toward implementation of the three OCPs, and the outcome of that meeting is presented here.

Implementation of one OCP per year over the next three years is proposed. The following order of OCP implementation is recommended.

Year 1: East Parking Lot Area
A bio-retention area and sediment trap are recommended for this area. This area directly addresses sedimentation issues and flooding occurring in the nearby playground area, has high visibility to make a nice demonstration project, and has the strong support from the students for implementation. This location has enough space to treat the Water Quality Volume or larger amounts of runoff. No permitting is required for this project.

Year 2: Quonset Hut Area
A bio-retention area and sediment forebay are recommended for this area. The concept design currently includes general layout, dimensions, and details. A preliminary opinion of probable cost for final design and construction has been developed for this site, and a maintenance and operation plan has been drafted. This area is located in the buffer of a (Vermont class two) wetland and will thus require a wetland delineation and a Vermont Wetland Permit. This OCP is recommended for implementation in the second year to allow more time to address wetland permitting requirements.

Year 3: Playground Area
An infiltration trench and surface stabilization are recommended for this area. This OCP will improve water quality and enhance the use of the site by reducing erosion and establishing a smoother playground surface. This OCP is underground and not visible to the school community so it would require signage or ongoing education to allow it to serve as a demonstration project.

The following implementation steps are proposed for each OCP.

1. Seek funding for final design and construction.
2. Hire a wetland ecologist to perform a wetland delineation for the Quonset Hut OCP.
3. Hire an engineer to complete final design.

a. Conduct additional site investigation including survey, location of utilities, and soil test pit.

b. Complete construction plans.

c. Update construction quantities and update opinion of probable construction cost.

d. Apply for required permits. At this time the only anticipated permit for any of the OCPs is a Vermont Wetland Permit for the Quonset Hut area.

4. Continue student education by teachers, school grounds staff, and engineer during design, fundraising, and construction.
5. Perform outreach to raise funds and solicit donations of labor and materials. Identify a leader to organize and run the fundraising effort. Organize students to help with solicitations by letter writing. Consider plant donations as part of the annual plant sale fundraiser.
6. Complete construction with donations, raised money, and supplemental grant funding if necessary.
7. Hire an engineer to perform limited construction oversight to assist with design implementation. Construction oversight will be shared by the engineer and school grounds staff.
8. Create a planting plan to be implemented by students and school personnel.
9. Create a maintenance plan for the bio-retention area to be implemented by students and school personnel.
10. Create educational outreach materials and signage as part of Ahead of the Storm Project.