FAIRFAX, VERMONT
Stormwater Master Plan
2018

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I. Disclaimer

The intent of this report is to present the data collected, evaluations, analyses, designs, and cost estimates for subwatersheds in Fairfax under a contract between the Northwest Regional Planning Commission and Watershed Consulting Associates, LLC. Funding for the project was provided by a Vermont Department of Environmental Conservation, Clean Water Fund grant. The plan presented is intended to provide the watershed's stakeholders a means by which to identify and prioritize future stormwater management efforts. This planning study presents a recommended collection of Best Management Practices (BMPs) that would address specific concerns that have been raised for these areas. In particular, there is great need to reduce stormwater impacts including phosphorus and sediment from stormwater runoff to receiving waters within the Town and the greater Lake Champlain Basin in light of future regulation under the Lake Champlain Total Maximum Daily Load requirements. Although there are other BMP strategies that could be implemented in the watershed, these are the sites and practices that project stakeholders believe will have the greatest impact and probability of implementation. These practices do not represent a regulatory obligation, nor is any property owner within the watershed obligated to implement them. This stormwater master plan, and therefore its resultant strategies, will be included in a list of recommended actions in the Lamoille Tactical Basin Plan, as submitted for consideration by the Northwest Regional Planning Commission (NRPC). This will put the BMP strategies in queue for state final design and implementation funding.

II. Glossary of Terms

Best Management Practice (BMP)- BMPs are practices that manage stormwater runoff to improve water quality and reduce stormwater volume and velocity. Examples of BMPs include detention ponds, gravel wetlands, infiltration trenches, and bioretention practices.

Buffers- Protective vegetated areas (variable width) along stream banks that stabilize stream banks, filter sediment, slow stormwater runoff velocity, and shade streams to keep waters cool in the summer months.

Channel Protection Volume (CPv)- The stormwater volume generated from the one-year, 24-hour rainfall event. Management of this event targets preventing stream channel erosion.

Check Dam- A small dam, often constructed in a swale, that decreases the velocity of stormwater and encourages the settling and deposition of sediment. They are often constructed from wood, stone, or earth.

Detention BMP- A BMP that stores stormwater for a defined length of time before it eventually drains to the receiving water body. Stormwater is not retained in the practice. The objective of a detention BMP is to reduce the peak discharge from the basin to reduce channel erosion and settle out pollutants from the stormwater. Some of these practices also include additional water quality benefits. Examples include gravel wetlands, detention ponds, and non-infiltration-dependent bioretention practices.

Drainage Area- The area contributing runoff to a specific point. Generally, this term is used for the area that drains to a BMP or other feature like a stormwater pipe.

Hydrologic Soil Group- A Natural Resource Conservation Service classification system for soils. They are categorized into four groups (A, B, C, and D) with "A" having the highest permeability and D having the lowest.

Infiltration/Infiltration Rate- Stormwater percolating into the ground surface. The rate at which this occurs (infiltration rate) is generally presented as inches per hour.

Infiltration BMP- A BMP that allows for the infiltration of stormwater into the subsurface soil as groundwater, which returns to the stream as baseflow. Mapped soils of Hydrologic Group A or B (sandy well drained soils) are an indicator of infiltration potential. Infiltration reduces the amount of surface storage required. Typical Infiltration BMP practices include infiltration trenches, bioretention practices, subsurface infiltration chambers, infiltration basins, and others.

Outfall- The point where stormwater discharges from a system like a pipe.

Sheet Flow- Stormwater runoff flowing over the ground surface in a thin layer.

Stabilization- Vegetated or structural practices that prevent erosion from occurring.

Stormwater/Stormwater Runoff- Precipitation and snowmelt that runs off the ground surface.

Stormwater Master Plan (SWMP)- A comprehensive plan to identify and prioritize stormwater management opportunities to address current and prevent future stormwater related problems.

Stormwater Permit- A permit issued by the State for the regulated discharge of stormwater.

Swale- An open vegetated channel used to convey runoff and to provide pre-treatment by filtering out pollutants and sediments.

Total Maximum Daily Load (TMDL)- A TMDL is a calculation of the maximum pollutant loading that a water body can accommodate and still meet Vermont Water Quality Standards. The term TMDL also refers to the regulated management plan, which defines how the water body will be regulated and returned to its acceptable condition. This includes the maximum loading, sources of pollution, and criteria for determining if the TMDL is met.

Total Phosphorus (TP)- The total phosphorus present in stormwater. This value is the sum of particulate and dissolved phosphorus. It includes both organic and inorganic forms.

Total Suspended Solids (TSS)- The total particulate matter suspended in the water column that is larger than 2 microns.

Watershed- The area contributing runoff to a specific point. For watersheds like the Mill Brook, this includes all of the area draining to the point where the river discharges to the Lamoille River.

Water Quality Volume (WQv)- The stormwater volume generated from the first inch of runoff. This runoff is known as the 90th percentile rainfall event and contains the majority of pollutants.

1 Introduction

1.1 The Problem with Stormwater

Stormwater runoff is any precipitation including melting snow and ice that runs off the land. In undeveloped areas, much of the precipitation is soaked into the ground, taken up by plants, or evaporated back into the atmosphere. However, when human development limits or completely prevents this natural sponge-like effect of the land, generally through the introduction of impervious areas such as roads, parking lots, or buildings, the volume of stormwater runoff increases, sometimes dramatically. In addition to the increased volume of stormwater runoff, the runoff is also frequently laden with pollutants such as sediment, nutrients, oils, and pathogens. These stormwater runoff related issues decrease aquatic habitat health, increase flooding and erosion, threaten infrastructure, and prevent human use and enjoyment of water resources. Historically, stormwater management techniques have relied heavily on direct conveyance to surface waters (i.e. streams, rivers, ponds, lakes, and coastal waters). Although this approach is effective at reducing flooding risk in developed areas, it does not address water quality concerns and has been shown to increase other deleterious effects such as in stream erosion. As stormwater management has matured, it has expanded to address both volume and quality as well as integration with other ecosystem services such as wildlife habitat and heat island mitigation in urban areas. Much of the development in Vermont predates this improved approach to stormwater management, leaving many areas without adequate surface runoff treatment and the subsequent impacts to surface waters. The specific development causing damage to surface waters remains unidentified and lacks regulatory controls to instigate improvement.

1.2 Stormwater Master Planning

Stormwater Master Planning is a standard methodology to assess a watershed, Town, or property for stormwater impacts, rank those areas based on relative influence on water quality, and move toward design solutions that address the most pressing stormwater challenges in an area. The resulting list of projects and associated modeling information allows prioritization of state funds based on potential water quality impact, cost, and feasibility.

Given the complexity of current stormwater issues, the development of the Stormwater Master Planning process provides communities with a range of possibilities for stormwater mitigation from small-scale (i.e. individual parcels), to large-scale (i.e. community-wide). Stormwater rarely follows political or parcel boundaries and tackling this problem from a strategic perspective is key to preventing future problems and addressing current sources of water quality degradation. Because much of the urban area within the state of Vermont predates regulatory requirements for stormwater management, unmanaged development across the state are contributing to the impairments of surface waters with no regulatory framework for improvement. These unmanaged stormwater discharges can be identified and addressed through this stormwater master planning process. The process allows for assessment and prioritization of the areas most in need of mitigation while acknowledging that, for many areas, these types of stormwater retrofits are voluntary. Public awareness of both stormwater problems and stormwater management practices are critical to the stormwater master planning process. As such, working with municipal officials, project stakeholders, and community members is key to implementation of and support for these plans. Stormwater master planning involves analysis of current and anticipated future conditions, and seeks to

prioritize stormwater solutions, maximizing the potential for water quality improvement, flood mitigation, erosion reduction, and pollution prevention using a variety of best management practices (BMPs) and allocating limited funds in a planned and methodical way.

2 Project Overview

In May 2013, the State of Vermont Department of Environmental Conservation (VT DEC) issued a document titled *Vermont Stormwater Master Planning Guidelines*, designed to provide VT communities with a standardized guideline and series of templates. The document assists communities in planning for future stormwater management practices and programs. Our Plan is a combination of Templates 2A: Hybrid site & community retrofit approach with green stormwater infrastructure (GSI) stormwater management, and 3A: Large watershed or regional approach with planned build out analysis and traditional (end of pipe or centralized) stormwater management.

Vermont has had stormwater regulations in place since 1978, with updates concerning unified sizing criteria made in 2002, and again in 2017. Recognizing that stormwater management can be a costly endeavor, the new guidelines are written to help identify the appropriate practices for each watershed, community, and site in order to maximize the use of funds.

The guidelines encourage each stormwater master plan (SWMP) to follow the same procedures, and include:

- Problem Definition
- Collection of Existing Data
- Development of New Data
- Existing and Proposed Program, Procedure, or Practice Evaluation
- Summary and Recommendations

In keeping with these guidelines, we have prepared the following report.

3 Background

3.1 Problem Definition

The Town of Fairfax is located in the central uplands of Franklin County. The majority of the Town lies in the Lower Lamoille River subwatershed. The Lamoille River runs east to west along the southern part of the town and ultimately drains into Lake Champlain at Mallett's Bay. Several tributaries to the Lamoille collect runoff throughout the central and northern sections of the Town, including Mill Brook, Swift Brook, Tracy Brook, Beaver Meadow Brook, and Stones Brook. A small percentage of the northwest corner of Fairfax flows to Lake Champlain's St. Albans Bay via the Mill River while the northeast corner of the Town is within the Missisquoi River Basin. Over 7% of the area of the town is surface water – making the aquatic resources of significant value and of importance to protect.

Stressors in the lower Lamoille watershed include toxics leaching from landfills and atmospheric deposition of mercury, encroachment and channel erosion resulting from concentrated development and agricultural land management that denudes riparian vegetation, and thermal impact as a result of riparian vegetation removal for agricultural and residential development. Fairfax's sewage treatment plant discharges treated wastewater into the Lamoille River downstream of its confluence with the Browns River. A large hydroelectric dam operated by Central Vermont Public Service Corporation (CVPSC) is located at Fairfax Falls along the Lamoille's mainstem. Agriculture is concentrated along this reach, mainly in the form of hay and pasture.

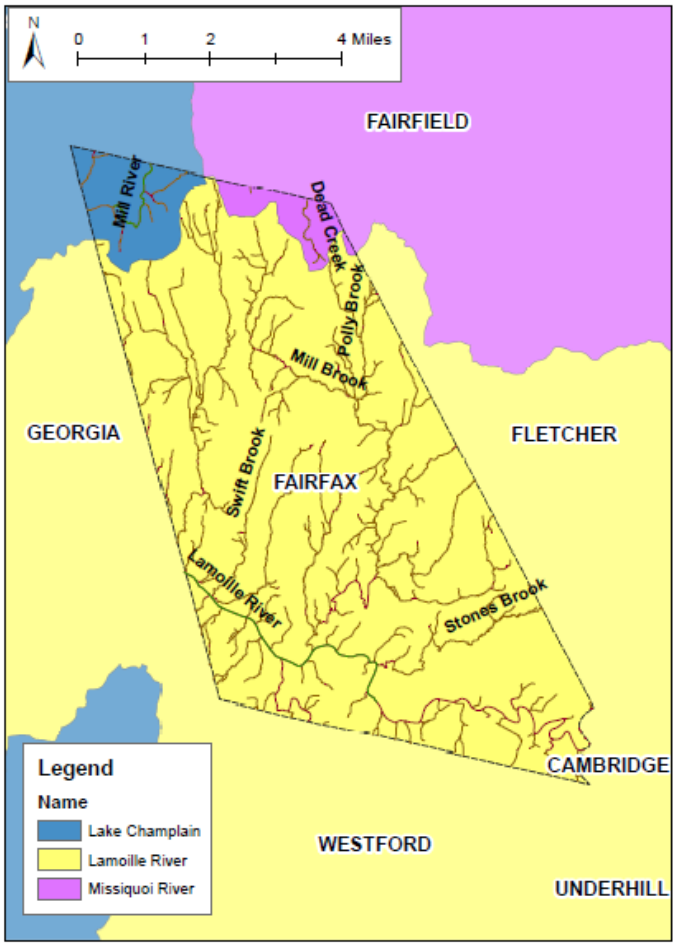

Figure 1. The Town of Fairfax is located primarily in the Lamoille River watershed (yellow) with a portion in the northwest that drains to Lake Champlain (blue) via St. Albans Bay and a northeast portion that drains to the Missisquoi River (pink).

The Browns River has reaches that are adversely impacted by stormwater runoff and development, and a section of the river is on the 2016 stressed waters list due to former large-scale gravel mining and streambank destabilization. The lower Lamoille River provides habitat for a wide range of fish species, including some that are rare and state-listed. The mainstem of the river along this stretch indicates very good biological measurements with taxa that are water quality sensitive. Chloride in the water body is low (<10 mg/L) indicating no significant impact from road salting at this time. This is an important feature that should be preserved in the river going forward, in particular to protect the rare mussel species that live in the river. Nutrients

were also measured to be at low concentrations in the Lamoille's mainstem (TP at 13.8 µg/L and TN at 430 µg/L).

The human-influenced stressors in the watershed include commercial development and associated parking areas, construction of roads, residential development, and clearing of previously forested areas. Unmanaged stormwater runoff, particularly from impervious surfaces and landscaped pervious surfaces exacerbate the occurrence of nuisance flooding as well as more extreme flood events. The Lamoille River watershed and its tributaries have experienced extreme flooding in the past, and these flood events are expected to occur more frequently due to the predicted increased frequency and intensity of extreme weather events associated with climate change. The stormwater management practices investigated here seek to protect local river resources and the larger Lake Champlain Basin in which it is nested.

3.2 *Existing Conditions*

Fairfax is the southernmost town in Franklin County, sharing a boundary to the south with Westford in Chittenden County, Georgia to the west, Fairfield to the north, and Fletcher and Cambridge to the east (Figure 2. The Town of Fairfax is located in Franklin County, VT.). The Town spans approximately 26,688 acres (41 square miles) including wetlands and waterways (7%), agricultural land (39%), forest (43%), and increasing areas of urban/ suburban residential and commercial development (10%). Fairfax's population has grown to record levels in recent years, due in part to its desirable location in proximity to urban employment centers in both Franklin and Chittenden Counties coupled with its rural character and open space. Building permit applications in the Town indicate a spike in single family and multi-unit residential development (particularly in 2006). Dispersed development can quickly shift a watershed impervious cover ratio to undesirable levels without the necessary stormwater controls to mitigate impact. This is a concern for Fairfax as it continues to grow and manage existing development.

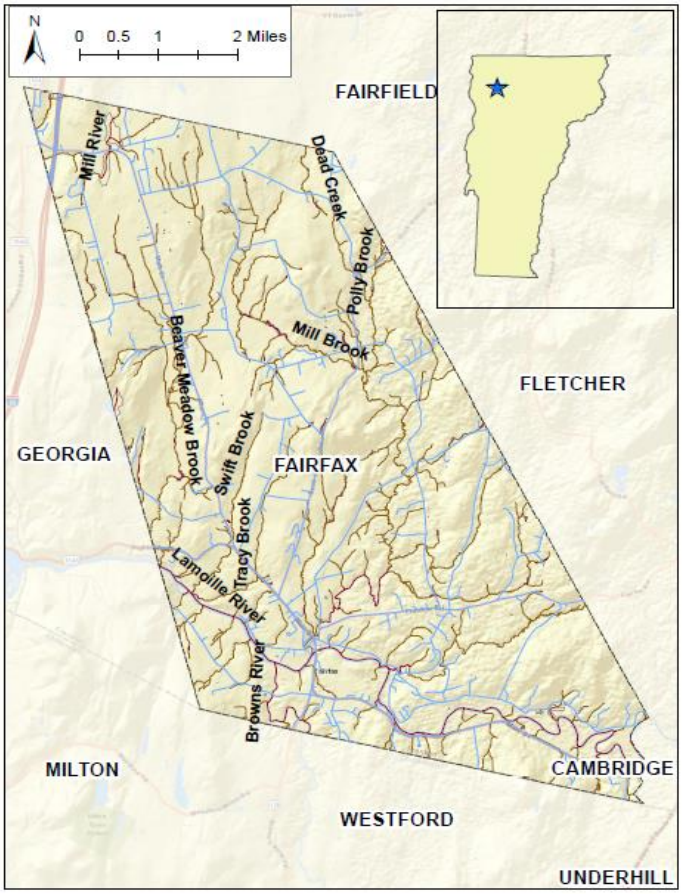

Figure 2. The Town of Fairfax is located in Franklin County, VT.

Fairfax's development is concentrated in the Village Center – the southern part of Town along Main Street (Route 104) from Buck Hollow Road to River Road and along Maple and Hunt Streets near Bellows Free Academy. In recent years, residential development in the Town has been more broadly scattered. Dispersed development patterns can lead to greater disturbance of natural resources in the creation of more road miles and associated transportation and utility services burden.

The majority of developments within these areas were constructed with minimal stormwater management features. There are only eighteen (18) operational stormwater permits in the Town despite dozens of new building permits being issues each year, which has resulted in significant amounts of untreated stormwater draining large portions of developed lands discharging directly to surface waters, particularly to the Mill Brook along School Street and Maple Street and the Lamoille River along Hunt Street and Main Street. Surrounding the developed lands, rural roads are generally unpaved, with open roadside ditches, and cross culverts. Some of these roads have steep slopes, and traverse large areas. Furthermore, the rural roads access residential driveways which often convey drainage into, and through the Town road drainage system. This is a problem because runoff from private lands is negatively impacting the Town's drainage system by causing erosion, sedimentation in ditches as well as damage to roadways from excess overland flow.

Soils analyses indicate that while most (>80%) of the total acres in the Town are classified as hydrologic soil groups C and D (lowest infiltration potential), type A soils (highest infiltration potential) are concentrated in the Town's southern section along the Lamoille River, where much of the newer development is focused. The location of soils with high infiltration capacity where development is focused provides opportunity for excellent stormwater infiltration and treatment rather than direct discharge to river. This opportunity for increased treatment could be capitalized on by the Town via regulation to promote infiltration practices on parcels that do not meet the State stormwater manual thresholds to require treatment.

4 Methodology

4.1 Identification of All Opportunities

4.1.1 Kickoff Meeting and Initial Data Review:

Relevant prior watershed studies and work previously completed in the Town was reviewed in the context of this SWMP study. This includes the 2016 Lamoille Tactical Basin Plan, the 2009 Browns River Corridor Plan, the Browns Phase I and II Geomorphic Assessments, a 2016 Lamoille River water quality assessment report, a 2016 Pedestrian study and design plan set for the Town of Fairfax, VT DEC 2012 Stormwater Mapping Project of the Town, the 2013 Fairfax Town Plan, VT DEC River Corridor maps, Floodplain maps prepared by the Federal Emergency Management Agency, and data on permitted stormwater discharges within the Town.

Relevant Geographic Information System (GIS) data was drawn from a variety of public resources including the Agency of Natural Resources' Atlas, Vermont Center for Geographic Information Open Geodata Portal, and data created by the University of Vermont's Spatial Analysis Lab. A file geodatabase was created to ensure organization and for ease of use. These data represent the "best available" data at the time of data collection (2018). See Appendix A – Data Review.

The project team met with Town of Fairfax stakeholders and the Northwest Regional Planning Commission (NRPC) on February 15, 2018 to discuss the SWMP and solicit information on problem areas from the Town. During this meeting, a list of potentially important sites was discussed. This list included particular parcels as well as general areas of importance. These areas were noted and added to the list of sites identified during the desktop assessment (see section 4.1.2).

4.1.2 Desktop Assessment and Digital Map Preparation

4.1.2.1 Desktop Assessment

A desktop assessment was completed to identify additional potential sites for stormwater BMP implementation. This process involved a thorough review of existing GIS resources and associated attribute data, as well as other resources.

One such resource was the Fairfax Stormwater Mapping Report and accompanying maps completed by the VT DEC in 2012. These stormwater infrastructure mapping projects provided current drainage maps and potential locations of BMP stormwater retrofit sites.

A road erosion inventory (REI) of Fairfax was being completed and approved at the same time as the project team was working on the SWMP. As a result, the final REI was not available for reference by the project team, but sites identified in the REI were discussed during the project kickoff meeting and areas noted as particular concerns were noted for follow up during the SWMP field portion. The REI assessment was conducted by the Northwest Regional Planning Commission to help the Town prepare for compliance with the Municipal Roads General Permit (MRGP). The assessment looks at how well hydrologically-connected, 100-meter road segments comply with MRGP standards such as road crown, berm issues, ditches, cross culverts, driveway culverts, outfalls, and presence of rill or gully erosion. The extent of the SWMP assessment extends beyond the roadway itself and aims to identify the source of erosional forces that may originate outside the road right of way.

Relevant GIS data in the Town was reviewed and included in analysis. These datasets include (but are not limited to): storm sewer infrastructure, soils classifications, parcel data, impervious cover data, wetlands, and river corridors. These data were used to identify and map stormwater subwatersheds with high impervious cover, stormwater subwatersheds that are more directly connected to water bodies (direct pipes to streams or via overland flow), and areas that may have worsening stormwater impacts in the future as a result of uncontrolled stormwater from impervious cover, erodible soils and steep slopes and/ or proximity to surface waters. A point location was created for each identified site or area for assessment in the field.

During this initial BMP identification and after incorporating problem areas noted by the Town, a total of 23 locations were identified for field investigation.

4.1.2.2 Basemap and Mobile App Creation

In order to maximize efficiency in the field and better understand site-specific conditions, digital base maps were created for the Town. The maps show parcel boundaries, stormwater infrastructure, hydrologic soils groups, river corridors, hydric soils, and wetlands. This information was used in the field to assess potential feasibility issues for proposed practices and to better identify preliminary BMP locations.

The base layers were pre-loaded into a project-specific mobile app that was customized for this project using the Fulcrum platform. The app was also pre-loaded with the 23-point locations for the potential BMP sites. These points allowed for easy site location and data collection in the field (Figure 3).

The app was used to collect information including site suitability, photographic documentation, follow-up notes, and other pertinent data. All collected data was securely uploaded to the Cloud for later use.

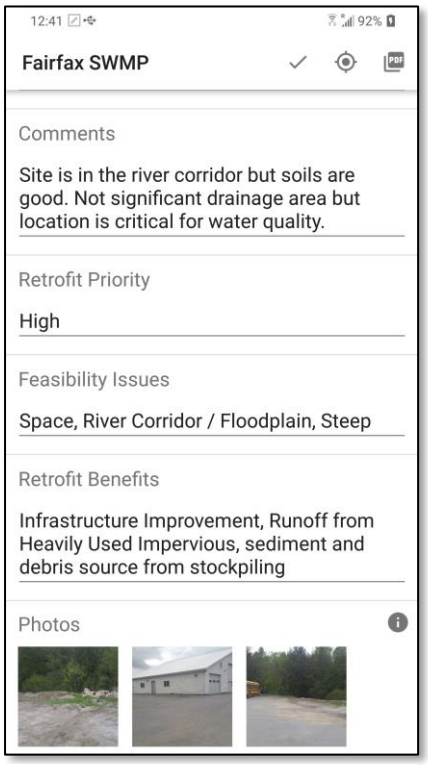

Figure 3. Digital application for field data collection used for Fairfax SWMP

4.1.3 Field Data Collection:

Each of the 23 previously identified potential BMP locations were evaluated in the field during the Summer of 2018 (Figure 4). Data were collected about each site in the mobile app. A large map of these sites with associated site names and a list of these sites including potential BMP options and site notes can be found in Appendix B - Initial Site Identification.

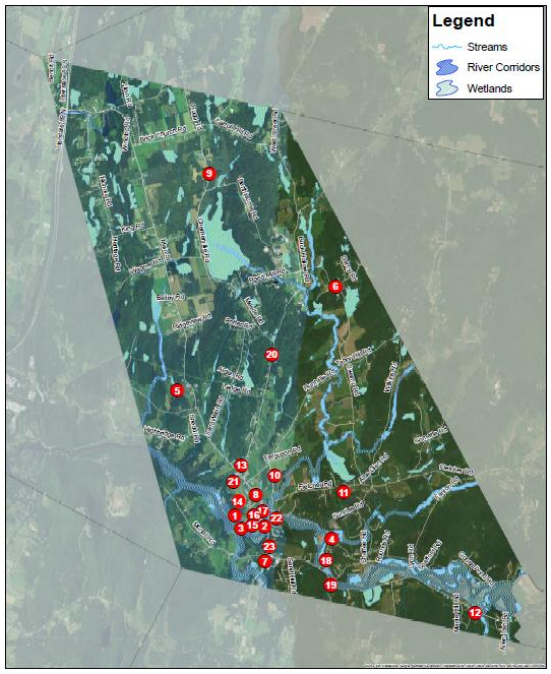

Figure 4. Location of 23 sites identified for field investigation.

Through the course of these field visits, some site locations were excluded from further analysis due to lack of confirmed stormwater issues on site or specific site conditions that would restrict further design. As a result, a total of 6 sites were removed from this plan. Effort was prioritized for management at sites that had potential for significant water quality improvement with retrofit.

The final list of 17 potential BMP sites in Fairfax were included in the ranking exercise.

4.2 Preliminary BMP Ranking

After the initial field visits were completed and the project list was updated, a preliminary ranking system was utilized to prioritize the 17 project sites (See Appendix C – Preliminary Site Ranking). The goal of this ranking was to identify the ten (10) sites that would provide the greatest water quality benefit and have a high likelihood of implementation. This prioritization was accomplished by completing an assessment of project feasibility and benefits including drainage area size, pollutant load reduction potential, proximity to water, ownership, and feasibility issues. See Appendix C - Preliminary Site Ranking for the complete list of factors utilized in the preliminary ranking. Also included in Appendix C is the completed ranking for each potential site, and one-page field data summary sheets with initial ranking information.

The ranked list of BMP sites was distributed to the Town of Fairfax, the NRPC, and the VT DEC grant administrator. Feedback on the ranked list was received via email and incorporated into the final ranking. As part of this process, the project team met with the stakeholders on July 5, 2018 to discuss the proposed project sites. During this meeting, the stakeholders nominated the Top Five projects to be included in the plan and the Top Three priority projects for which 30% concept designs and cost estimates would be created. Following feedback from the Town, the list was refined to reflect the Town's priorities. Bellows Free Academy (BFA) was also contacted at this time to assess their interest in collaborating on two proposed projects involving drainage from the school's parking lots and rooftops. The Top Five sites are listed in Table 1. Point locations are shown in Figure 5. (Note that the proposed practice types indicated in Table 1 evolved in the next phase of the project based on further field evaluation and preferences of the property owners. As a result, the ultimate BMP type for BMP IDs 14 and 13 are different than this table indicates.)

Table 1. Top Five BMPs selected for the Fairfax SWMP

BMP ID	Project Name	Proposed Practice Type
14	Treatment Plant Basin Area (Updated to "BFA West")	Gravel wetland, stormwater pond
16	Corner of Hunt and Maple at School (Updated to "BFA East")	Underground chambers
23	Fairfax Commons	Bioretention/ infiltration
13	Town Offices	Gravel wetland/ Expanded pond design
18	Road Erosion near Hydro Plant	Drop catch basin & improved swale

4.3 Feasibility Investigation – Arriving at the Top Three BMPs

The Top Five ranked BMP locations were investigated for feasibility from a state permitting and property owner perspective in order to arrive at the final three sites for 30% design (Figure 5Figure 5). The treatment plant basin area presented an opportunity to capture a large drainage area of unmanaged impervious cover before discharge to the Lamoille River and is a publicly owned site. However, after further discussions with the Town and the state wastewater program, two concerns eliminated this location for further consideration: 1. The integrity of the earthen berm adjacent to the clarifiers could be compromised by a stormwater practice and the necessary lining and geotechnical considerations may increase the cost of the project and 2. The growing Town of Fairfax may require additional area for sewage treatment in the future. Installation of a stormwater treatment practice at this location would constrain the Town's ability to use that land for wastewater treatment purposes in the when necessary. Because the watershed that drains to this site is critical for treatment, Watershed investigated management of that volume higher in the drainage area. The land adjacent to Hunt Street next to the BFA playing fields was identified as a potential location for underground chambers to intercept some of the volume currently conveyed in pipes along this section. Upon field survey at the site, the parking area at the Bus Depot was identified as having a favorable elevation and would allow maximum capture and treatment of the entire drainage area. The Town and School were in favor of this alternative management location. For clarity,

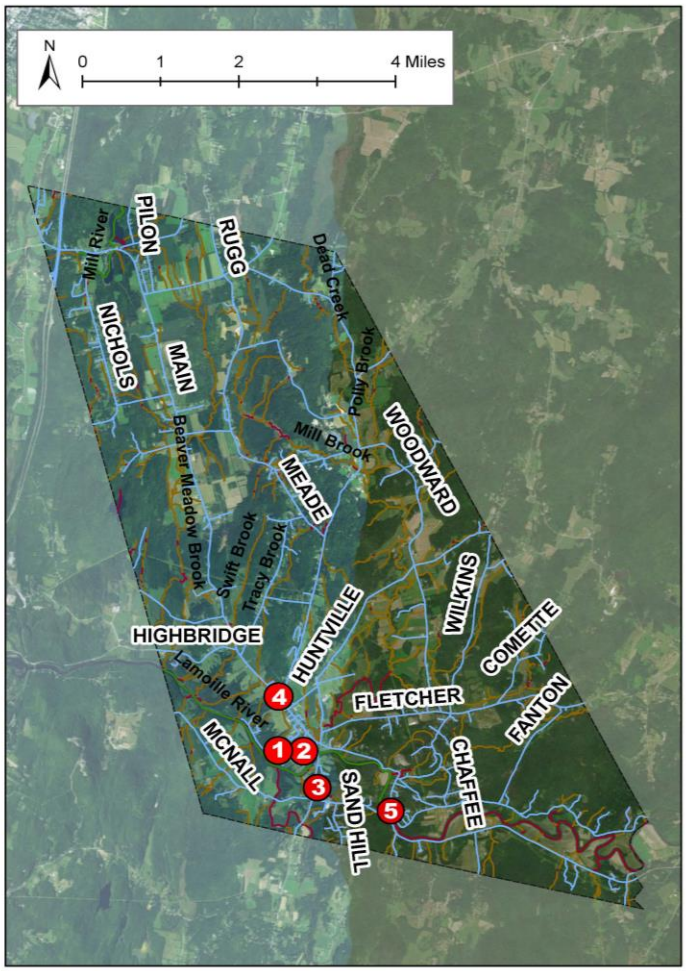

Figure 5. Top 5 projects are shown with numbers indicating rank.

the project ID # was preserved but the name was subsequently changed to "BFA West" in reference to the drainage area and treatment site.

The project site at the corner of Hunt and Maple Street was discussed with BFA administrators who indicated that the grassy area in on the corner was being considered for redevelopment for improved access and therefore a treatment practice there could be constructed as part of that work. Further, removal of the existing building at that site is currently planned. BFA expressed concern with a surface practice due to the reduction in surface area for school use where there is currently limited grassy areas for student activity. The sizing and design of an underground practice at that site was confirmed. Again, for clarity regarding the change in treatment practice location, the BMP ID number was retained but the project name was changed to "BFA East."

Because Fairfax Commons is privately owned which could complicate the implementation and funding of a practice at that site, the Town requested that design work for this SWMP be prioritized on public parcels. As a result, the Town Office site was investigated further. The small stormwater detention pond on the Town Office parcel is not a state-permitted practice and no design drawings are available for it in Town records. Its location and configuration could be improved for greater volume capture and enhanced treatment including the filtration and retention of drainage coming from Buck Hollow Road. The Town indicated that they are in favor of a design for that site that would treat stormwater and improve the current aesthetics of the site which is dominated by cattails. The Town preferred a BMP that would be dry and accessible with a mower for maintenance during non-storm periods.

Modeling was completed for each of the Top Three sites (Table 2). This modeling allowed for accurate sizing of the proposed practices as well as an understanding of the water quality and quantity benefits. The contributing drainage area of each of the BMPs was defined and land use/land cover was digitized using the best available topographic data and aerial imagery. Drainage areas were refined based on field observations (see Appendix D – Top Three Sites for drainage area delineations). Each of the sites was modeled in HydroCAD to determine the appropriate BMP size and resultant stormwater volume reductions. Each of these sites was also modeled using the Source Loading and Management Model for Windows (WinSLAMM) to determine the annual total suspended solids (TSS) and total phosphorus (TP) loading from the drainage area of each site (Table 2).

Table 2. Modeled drainage area runoff characteristics for the Top Three BMP areas.

Project Name	Drainage Area (acres)	Runoff Volume (ft^3/ year)	Total Suspended Solids (lbs/ year)	Total Phosphorus (lbs/ year)
BFA-West	12.6	465,700	37,396	26.62
BFA-East	4.5	141,700	37,239	17.7
Town Office	14.9	140,274	6,248	7.4

Pollutant load reductions from each of the BMPs were then calculated using WinSLAMM. For sites that currently have extensive erosion in channels from uncontrolled runoff (BFA-West and BFA-East), a STEPL

model was also run to estimate the current and post-BMP pollutant loading from the site. This yielded expected pollutant removal loads (lbs). The modeled volume and pollutant loading reductions are shown in Table 3. Complete modeling results are provided in Appendix E - Top Three Sites Modeling.

Table 3. Modeled volume and pollutant load reductions/ year for the Top three BMPs.

Project Name	Volume Managed (ac-ft)	Total Suspended Solids Removal (lbs)	Total Suspended Solids Removal (%)	Total Phosphorus Removal (lbs)	Total Phosphorus Removal (%)
BFA-West	0.762	30,658	82	11.7	44
BFA-East	0.237	29,674	80	12	68
Town Office	0.489	959	15	2.3	31

To put these numbers in perspective, these practices would treat about 25% of the annual TP loading from developed lands in one of the highest loading catchments in the Lamoille Basin (ranking seventh out of 307 catchments).

4.4 Project Cost Estimation

Project cost was calculated for each BMP using a spreadsheet-based method. The methodology for determining these planning level costs was first developed for the City of South Burlington by the Horsley Witten (HW) Group as part of the Centennial Brook Flow Restoration Plan development. The HW Memorandum describing this methodology is provided in Appendix F – Cost Estimation Basis. Note that a variation of this method was used for this plan. This methodology provides consistent budgetary cost estimates across BMPs.

Cost estimates are based on average costs for conceptual level projects and deviation from these estimates are expected as projects move forward with engineering design. Note that costs are not adjusted for inflation. There are differences between project cost estimates presented in the plan and actual project bid costs. The BMP cost estimates presented in the plan are based on limited site investigation. This methodology, while providing consistency in budget cost estimating, may fail to accurately reflect project cost impacts associated with actual site conditions and constraints. Therefore, the BMP cost estimates presented are suitable for planning purposes only, and not detailed program budgeting. The BMP cost estimates were developed based on the following assumptions:

Design Control Volumes: Design control volumes were based on the estimated runoff volume associated with the CPv or WQv storm events for underground, or GSI-type practices. Underground systems and GSI-type practices were conceptually designed as offline practices that only accept runoff from the target storm event. Runoff volumes for all storm events were determined based on HydroCAD model results that rely on the Soil Conservation Service (SCS) TR-55 and TR-20 hydrologic methods.

Unit Costs and Site Adjustment Factors: Unit cost for each BMP and site adjustment factors were derived from research by the Charles River Watershed Association and Center for Watershed Protection, as well

as from experience with actual construction[1] and modified for this project to reflect the newest cost estimates available. Underground filtration chamber systems were typically designed using Stormtech MC-3500™ chamber systems. Cost adjustment factors were used to account for site-specific differences typically related to project size, location, and complexity. The values used to estimate BMP costs are summarized in Table 4.

Table 4. BMP unit costs and adjustment factors modified to reflect newer information.

BMP Type	Base Cost ($/ft^3)	Site Type	Cost Multiplier
Porous Asphalt	$5.32	Existing BMP retrofit or simple BMP	0.25
Infiltration Basin	$6.24	Large above ground basin projects	0.5
Underground Chamber (infiltration or detention)	$6.25	New BMP in undeveloped area	1
Detention Basin / Dry Pond	$6.80	New BMP in partially developed area	1.5
Gravel Wetland	$8.78	New BMP in developed area	2
Infiltration Trench	$12.49	Difficult installation in highly urban settings	3
Bioretention	$15.46		
Sand Filter	$17.94		
Porous Concrete	$18.07		

Site-Specific Costs: Cost of significant utility or other work related to the construction of the BMP itself. Site-specific costs are variable based on past experience.

Base Construction Cost: Calculated as the product of the design control volume, the unit cost, and the site adjustment factor.

Permits and Engineering Costs: Used either 20% for large above-ground projects or 35% for smaller or complex projects.

Land Acquisition Costs *(Modified)*: A variation from the HW method was applied. Based on prior studies completed by Watershed, the land acquisition cost was calculated as $120,000 per acre required for the BMP when located on private land. It should be noted that this value is based on a limited estimate and not necessarily an expected cost per acre. At this time, no land acquisition costs were built into the costs provided for the Fairfax SWMP. It is assumed at this time that sites not owned by the Town will retain ownership of the stormwater management sites – as with the two sites on property owned by BFA.

Total Project Cost: Calculated as the sum of the base construction cost, permitting and engineering costs, and land acquisition costs.

[1] Horsley Witten Group, Inc. 2014. Centennial Brook Watershed: Flow Restoration VTBMPDSS Modeling Analysis and BMP Supporting Information. Memorandum dated January 9th, 2014.

Cost per Impervious Acre: Calculated as the construction costs plus the permitting and engineering costs, divided by the impervious acres managed by the BMP.

Operation and Maintenance: The annual operation and maintenance (O&M) was calculated as 3% of the base construction costs, with a maximum of $10,000.

4.5 Top Three BMPs

Selection of the Town's Top Three sites considered the results from WCA's initial site investigations, preliminary modeling and ranking, input from municipal officials concerning project priorities, and the willingness of landowners to voluntarily participate in this plan. The Top Three sites are listed in Table 5.

Table 5. Top Three BMP sites for the Town of Fairfax

Rank	Site ID	Address	Proposed Practice Type
1	BFA West	117 Hunt Street	Underground Storage/ Chambers
2	BFA East	51 Hunt Street	Underground Storage/ Chambers
3	Town Office	12 Buck Hollow Road	Surface Sand Filter

5 Priority BMPs

The selected Top Three BMP implementation sites are briefly described below. These opportunities are located on property owned by the Town and by the Bellows Free Academy School. Individual drainage area maps are provided in Appendix D.

BMP Rank: 1
Project Name: BFA West (formerly "Treatment Plant Basin Area")
Description: The drainage area to this site includes the School buildings, large parking lots, a portion of the roadway (Hunt Street), and the bus depot roof and parking lot. Stormwater currently drains via surface flow to a network of catch basins dispersed across the Bellow's Free Academy parcel. Captured runoff moves through an underground pipe system to run along the north side of Hunt Street to the west where it ultimately daylights into a ditch to the west of the school's bus depot where signs of erosion are evident before discharging to a tributary to the Lamoille River. The original concept to manage runoff from this site was to retain and treat it across the street from the bus depot in a depressed grassy area adjacent to the wastewater treatment plant. However, concerns about the future use of the site and integrity of the wastewater clarifiers on site initiated a design adjustment that includes moving treatment up the drainage area and storing volume in underground chambers beneath the bus depot parking lot. Using the existing stormwater infrastructure and taking advantage of favorable elevations, storage and infiltration in underground storage and sand filtration will not disturb current use of the site and provides capture and treatment of the water quality volume (WQv) and Channel Protection volume (CPv) (Figure 6. Top image: BFA parking lot looking west. Bottom image: Figure 6). Soils are mapped as being hydrologic groups C and D – poor infiltration capacity.

Figure 6. Top image: BFA parking lot looking west. Bottom image: Bus depot parking lot and structure. Underground chambers are planned for beneath the parking area to provide treatment of the Water Quality volume (WQv) and Channel Protection volume (CPv).

Outreach: Contact was made with Tom Walsh (BFA Elementary and Middle School Principal), Geri Witalec-Krupa (BFA Vice Principal), John Tague (BFA High School Principal), and Tod Granger (BFA Facilities Manager) as well Amy Sears (Fairfax Utility Department Manager) and Randy Devine (Fairfax Chief Water Operator). The school advised on current use of the site. BFA and the Town were in favor of the siting and practice type proposed for this BMP and were pleased with this proposal as an alternative to the originally identified site adjacent to the wastewater treatment plant clarifiers. This location will allow treatment of the largest extent of the drainage area.

BMP Rank: 2
Project Name: BFA East (formerly "Corner of Hunt and Maple at School")
Description: The BFA campus sits at the corner of Hunt and Maple Streets. Most of the campus impervious drains to the west, towards the school bus depot. A portion of the runoff flows to the east and is captured in catch basins in the roadway before discharging to an eroding ditch on Maple Street and eventually to Mill Brook Creek at a geomorphically active section of the river upstream of the covered bridge. The combination of road runoff, drainage from private residences, and the stormwater generated on the sizable school roof and parking areas results in stormwater volume in excess of what can be effectively managed with the existing infrastructure.

The concept for this site includes routing storm lines on Hunt Street to a chamber system under the green at the corner of Hunt and Maple Streets next to the site of a School-owned historic building that is planned to be removed within 24 months. Overflow from this system would be discharged to a newly-stabilized

ditch on Maple Street (Figure 6). Soils are mapped as having limited infiltration capacity at this site (Hydrologic Group D).

Figure 7. Stormwater infrastructure at the corner of Hunt and Maple Street is subject to excessive flow. Underground chambers placed beneath the grassy area will treat the WQv for improved management.

Outreach: Contact was made with Tom Walsh (BFA Elementary and Middle School Principal), Geri Witalec-Krupa (BFA Vice Principal), John Tague (BFA High School Principal), and Tod Graner (BFA Facilities Manager) as well Amy Sears (Fairfax Utility Department Manager) and Randy Devine (Fairfax Chief Water Operator). They were in favor of further design and noted that both current use and future plans at the school would limit the applicability of a surface feature but that an underground system was appropriate.

BMP Rank: 3
Project Name: Town Office
Description: The Town Offices are the current site of a constructed pond that retains stormwater runoff from the building's roof and associated parking lot. The pond is not permitted, nor does it meet Vermont stormwater management standards for a detention basin. Town staff admitted to concerns regarding the aesthetics of the current basin area and confirmed potential interest in an expansion of the parking area associated with the Town office to provide access during community events. There is potential for the current site to manage more runoff including flow from the ditches on adjacent Buck Hollow Road, improve water quality, and address aesthetic concerns. The concept for this site includes an expansion of the BMP footprint and replacement with a surface sand filter to treat and control runoff before conveyance to ditches along Route 104 (Figure 8). Soils at this site are mapped as having limited infiltrative capacity (Hydrologic Group C and D). As a result, infiltration capacity into native soils is limited.

Figure 8: The current wet basin at the Town Office is proposed to be expanded and redesigned as a surface sand filter, allowing improved treatment for more runoff including from the ditches on Buck Hollow Road. The Water Quality volume (WQv) and Channel Protection volume (CPv) would be managed.

Outreach: This site is owned by the Town. During the stakeholder meeting on July 5, Town representatives indicated interest in moving design forward at this site. They further noted a desire to improve what they see as poor appearance of the site

5.1 Priority BMP Summary

When implemented, these three BMPs would treat approximately 32 acres, 10 acres (3%) of which is impervious. Modeled pollutant reductions for each of the projects, indicate that these BMPs will prevent approximately 2,891 lbs of TSS and 4.5 lbs of TP from reaching receiving waters annually.

Site surveys were completed for each of the Top Three sites, and existing conditions plans were developed. These plans were used as the basis for the 30% proposed condition plans that were developed for each site. See Appendix H - Existing Conditions Plans.

6 30% Designs

30% engineering designs were completed for each of the Top Three sites. Site-specific concepts are discussed in the following sections. All 30% designs can be found in Appendix I - 30% Designs.

6.1 BFA West

6.1.1 30% Concept Design Description

Currently, all drainage from the Bellows Free Academy campus is unmanaged. The majority of the drainage from the roofs and large paved parking lot flows to storm sewer infrastructure that runs west down Hunt Street before daylighting to an open ditch and then discharging to a tributary to the Lamoille River.

The Hunt Street ditch shows signs of erosion and sediment loading at the outfall and is significantly impacted where the ditch slope increases west of the bus depot where the paved road transitions to gravel. Mounds of gravel from road grading were found adjacent to the roadway within the boundary of a State Class 2 wetland. It is recommended that road management practices include the removal of material from the site after regrading to avoid source loading to adjacent ditches and impacts to surface waters. The parking lot at BFA shows evidence of winter sand application. To avoid movement of particulate towards sensitive surface water sources in summer storms, effort should be made to sweep or vacuum the parking lot after winter to remove sand particles.

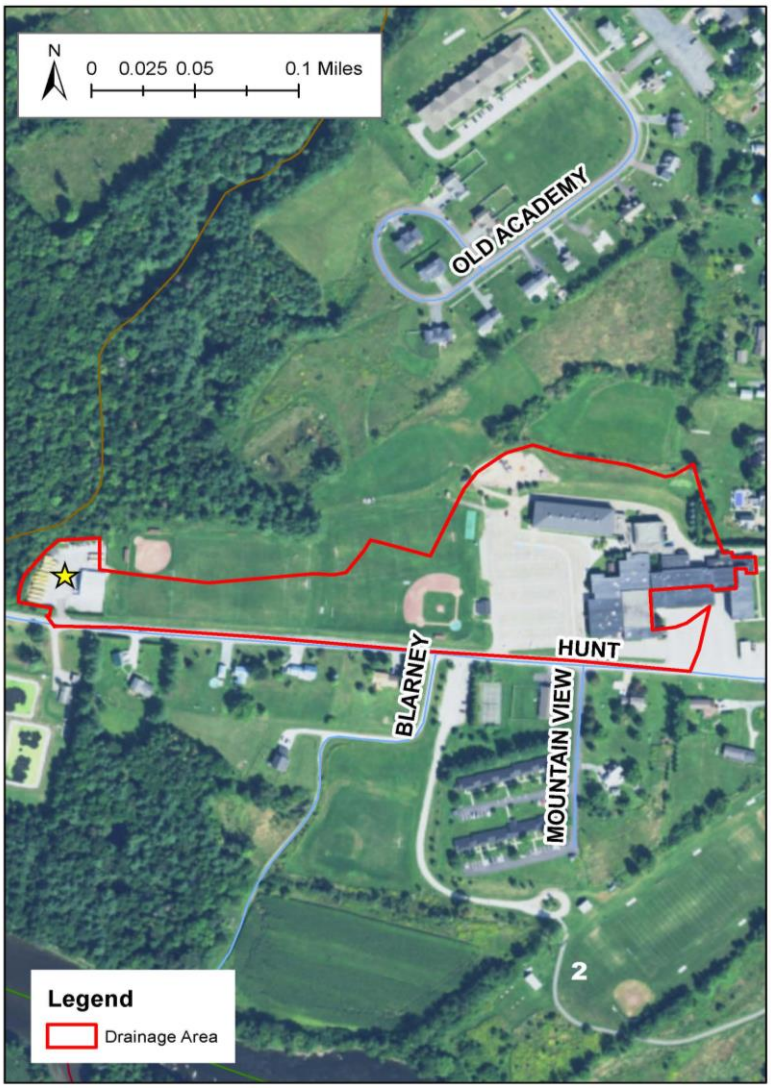

Figure 9. BFA West Drainage area. BMP location is indicated with a yellow star at the site of the bus depot parking lot.

The proposed retrofit for this site is a subsurface storage and filtration system beneath the bus depot paved parking lot (see starred location in Figure 9).

The design standard used for this retrofit is treatment and control of the Channel Protection volume (CPv), equal to 33,193 ft^3.

A 30% design plan is provided in Appendix I - 30% Designs.

6.1.2 Pollutant Removal and Other Water Quality Benefits

This practice has the potential to prevent 1,458 lbs of TSS and 1.4 lbs of TP from entering receiving waters yearly directly due to the chambers themselves and an additional 29,200 lbs TSS and 10.3 lbs of TP yearly as a result of reduced erosion in the ditches and channels currently conveying the runoff (Table 6).

Table 6. BFA West benefit summary table

Total Suspended Solids Removed / yr	30,658 lbs
Total Phosphorus Removed / yr	11.7 lbs
Impervious Area Treated	6.8 acres
Total Drainage Area	12.6 acres

6.1.3 Cost Estimates

The provided costs are very preliminary. Initial cost projections can be found in Table 7. The estimated cost for implementation of this project is $742,000.

- The cost per pound of phosphorus treated is $63,419.
- The cost per impervious acre treated is $109,118.
- The cost per cubic foot of runoff treated is $22.35

Table 7. BFA West project initial construction cost projection.

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 10,000.00	$ 10,000.00
653.55	Project Demarcation Fencing	LF	500	$ 1.17	$ 585.00
652.10	EPSC Plan	LS	1	$ 5,000.00	$ 5,000.00
649.51	Geotextile for silt fence	SY	275	$ 4.13	$ 1,135.75
652.20	Monitoring EPSC Plan	HR	40	$ 37.22	$ 1,488.80
	Construction Staking	HR	8	$ 90.00	$ 720.00
				Subtotal:	$ 18,929.55
Chambers - Costs					
	MC4500	EACH	207	$ 483.00	$ 99,981.00
	MC4500 PLAIN END CAP	EACH	8	$ 494.50	$ 3,956.00
	MC4500 24B END CAP	EACH	3	$ 682.81	$ 2,048.43
	MC4500 18T END CAP	EACH	7	$ 649.75	$ 4,548.25
	18" TEE	EACH	6	$ 230.01	$ 1,380.07
	18" 90 BEND	EACH	1	$ 144.80	$ 144.80
	18" COUPLERS	EACH	20	$ 23.54	$ 470.81
	18" N12 FOR MANIFOLD (AASHTO)	LF	200	$ 14.35	$ 2,870.00
	24" N12 for Isolator Row (AASHTO)	LF	20	$ 21.67	$ 433.40
	601TG to wrap system (SY)	SY	3500	$ 0.87	$ 3,045.00
	315WTM for scour protection (SY)	SY	1500	$ 0.77	$ 1,155.00
	6" INSERTA TEE	EACH	1	$ 86.32	$ 86.32
	6" RED HOLE SAW	EACH	1	$ 132.43	$ 132.43
	12" INLINE DRAIN	EACH	1	$ 310.50	$ 310.50
	6" N12 (AASHTO)	EACH	20	$ 2.70	$ 54.00
				Subtotal:	$ 120,616.01
Materials and Excavation Costs					
604.20	Concrete Catch Basin	EACH	3	$ 3,387.59	$ 10,162.77
203.15	Common Excavation	CY	7500	$ 35.00	$ 262,500.00
	Sand	CY	507	$ 40.00	$ 20,288.89
629.54	Crushed Stone Bedding	CY	761	$ 50.00	$ 38,041.67
601.0920	18" CPEP	LF	230	$ 70.00	$ 16,100.00
651.35	Topsoil	CY	19	$30.96	$ 573.33
653.20	Temporary Erosion Matting	SY	200	$ 2.20	$ 440.00
651.15	Seed	LBS	3	$7.66	$ 22.98
	Paving	SY	780	$75.00	$ 58,500.00
				Subtotal:	$ 406,629.64
Subtotal:					$ 546,175.20

	Construction Oversight**	HR	80	$ 150.00	$ 12,000.00
	Construction Contingency - 20%**				$ 109,235.04
	Incidentals to Construction - 5%**				$ 27,308.76
	Minor Additional Design Items - 5%**				$ 27,308.76
	Final Design	HR	120	$ 150.00	$ 18,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	16	$ 150.00	$ 2,400.00
Total (Rounded)					**$ 742,000.00**

6.1.4 Next Steps

Outreach has been conducted with the Bellows Free Academy leadership and the Town of Fairfax. The School Board and Supervisory Union should be included in further discussion as this design moves toward implementation. Further design will involve refinement of the design details with respect to size, outlet, and routing to ensure that WQv can be safely stored and filtered and that larger storms can pass through the system safely. Assessment of the soil material beneath the parking lot and potential impact from saturation should also be considered in relation to system lining needs. Because implementation at this site will require removal and replacement of existing pavement surface at the bus depot, coordination with other site improvements (such as infrastructure or grading upgrades) should be prioritized. As the BFA site has more than 3-acres of impervious, it will be captured under new stormwater requirements to treat runoff from largely impervious sites. Implementation of treatment at this site should therefore be prioritized to take advantage of potential funding opportunities leading up to the State requirements.

6.1.5 Permit Needs

A project readiness screening worksheet has been completed for this project and is included in Appendix J - Permit Review Sheets. In summary:

Stormwater Permit
Because the site exceeds 3-acres of impervious cover, the 3-Acre rule will be triggered, when it goes into effect.

The site should qualify for an Erosion Prevention and Sediment Control permit (3-9020) under the Low Risk categorization if the following guidelines are followed:

- Less than 2 acres of disturbance at any one time.
- All soils must be stabilized (temporary or final) within 7 days.
- Runoff from the site must pass through a 50’ vegetated buffer prior to entering any Water of the State.

Local Permitting
No local permits are anticipated.

Other Permits

This site should be reviewed by the Act 250 Coordinator prior to final design as there is an Act 250 permit (No. 6F0033) associated with the BFA school site. The siting of the practice falls within delineated wetlands and within the River Corridor. Review by the region's river scientist and wetland ecologist is necessary to proceed. Given that there is currently a structure and parking area in that location, addition of a chamber system that does not extend beyond the footprint of the existing development likely does not constitute a violation of wetland or river corridor rules. However, permitting is anticipated for this project.

6.2 BFA East

6.2.1 30% Concept Design Description

Stormwater from Hunt Street, a portion of the BFA roof, and a section of the school's parking lot is currently unmanaged and causing erosion in a ditch along Maple Street at a geomorphically active bend in the river and causing concern for the integrity of the adjacent roadway. Stormwater is captured in several storm catch basins along Maple and Hunt Streets and conveyed to the outfall at the East corner of the roadway convergence via underground storm sewer pipes. The outfall is severely eroded, exposing a significant portion of a fire hydrant within the right-of-way and transporting material to the outfall to the Mill Brook.

Soils in this location are poor and have limited infiltration capacity (Hydrologic Soil Groups C and D). As a result, the proposed practice type for this site relies on underground storage and sand bed filtration rather than infiltration.

The proposed retrofit for this site involves rerouting drainage from storm lines to an underground chamber system with a sand filter bed for infiltration (pictured in Figure 10 with a yellow star at the corner of Maple and School Streets.) The chambers will be located outside of the defined river corridor. It is recommended that stabilization of the ditch where current erosion is evident be integrated into this project.

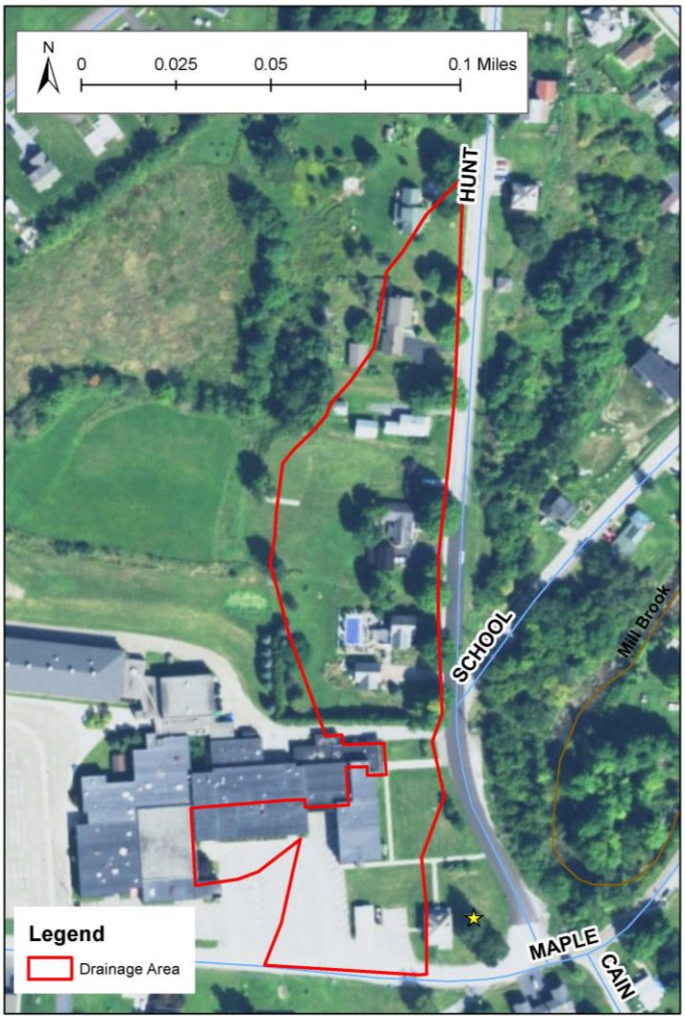

Figure 10. BMP drainage area for BFA East project location. Note that the project site itself (yellow star) is outside of the drainage area due to storm piping that will connect the drainage area to the underground chambers.

The design standards used for this retrofit is treatment and control of the Channel Protection volume (CPv) equal to 10,323 ft^3 of runoff.

A 30% design plan is provided in Appendix I - 30% Designs.

6.2.2 Pollutant Removal and Other Water Quality Benefits

A retrofit of this site has the potential to prevent 474 lbs of TSS and .87 lbs of TP from entering receiving waters annually as a direct influence of the chambers and an additional 32,400 lbs of TSS and 11.5 lbs TP from reduced erosion in channels currently carrying the full unmanaged volume of runoff (Table 8Table 8).

Table 8. BFA East benefit summary table.

Total Suspended Solids Removed / year	32,874 lbs
Total Phosphorus Removed / year	12.37 lbs
Impervious Area Treated	1.4 acres
Total Drainage Area	4.5 acres

6.2.3 Cost Estimates

Note that these costs and benefits are preliminary. Initial cost projections can be found in

Table 9

Table 9. The estimated cost for implementation of this project is $382,000.

- The cost per pound of phosphorus treated is $30,881
- The cost per impervious acre treated is $272,857
- The cost per cubic foot of runoff treated is $37

Table 9. BFA East project initial construction cost projection

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 10,000.00	$ 10,000.00
653.55	Project Demarcation Fencing	LF	500	$ 1.17	$ 585.00
652.10	EPSC Plan	LS	1	$ 5,000.00	$ 5,000.00
649.51	Geotextile for silt fence	SY	275	$ 4.13	$ 1,135.75
652.20	Monitoring EPSC Plan	HR	40	$ 37.22	$ 1,488.80
	Construction Staking	HR	8	$ 90.00	$ 720.00
				Subtotal:	$ 18,929.55
Chambers - Costs					
	MC3500	EACH	55	$ 400.20	$ 22,011.00
	MC3500 PLAIN END CAP	EACH	1	$ 300.15	$ 300.15
	MC3500 24B END CAP	EACH	2	$ 404.23	$ 808.46
	MC3500 18T END CAP	EACH	7	$ 404.23	$ 2,829.61
	18" TEE	EACH	6	$ 230.01	$ 1,380.07
	18" 90 BEND	EACH	1	$ 144.80	$ 144.80
	18" COUPLERS	EACH	20	$ 23.54	$ 470.81
	18" N12 FOR MANIFOLD (AASHTO)	LF	80	$ 14.30	$ 1,144.00
	24" N12 for Isolater Row (AASHTO)	LF	20	$ 21.67	$ 433.40
	601TG to wrap system (SY)	SY	2000	$ 0.87	$ 1,740.00
	315WTM for scour protection (SY)	SY	500	$ 0.77	$ 385.00
	6" INSERTA TEE	EACH	2	$ 86.32	$ 172.64
	6" RED HOLE SAW	EACH	1	$ 132.43	$ 132.43
	12" INLINE DRAIN	EACH	2	$ 310.50	$ 621.00
	6" N12 (AASHTO)	EACH	20	$ 2.70	$ 54.00
				Subtotal:	$ 32,627.37
Materials and Excavation Costs					
604.20	Concrete Catch Basin	EACH	6	$ 3,387.59	$ 20,325.54
203.15	Common Excavation	CY	3981	$ 35.00	$ 139,351.85
	Sand	CY	222	$ 40.00	$ 8,888.89
629.54	Crushed Stone Bedding	CY	333	$ 50.00	$ 16,666.67
601.0920	18" CPEP	LF	380	$ 70.00	$ 26,600.00
651.35	Topsoil	CY	148	$30.96	$ 4,586.67
653.20	Temporary Erosion Matting	SY	444	$ 2.20	$ 976.80
651.15	Seed	LBS	10	$7.66	$ 76.60
				Subtotal:	$ 217,473.01

Subtotal:					$ 269,029.93
	Construction Oversight**	HR	80	$ 150.00	$ 12,000.00
	Construction Contingency - 20%**				$ 53,805.99
	Incidentals to Construction - 5%**				$ 13,451.50
	Minor Additional Design Items - 5%**				$ 13,451.50
	Final Design	HR	120	$ 150.00	$ 18,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	16	$ 150.00	$ 2,400.00
Total (Rounded)					**$ 382,000.00**

6.2.4 Next Steps

This site is located on BFA property. Given the plans to remove the adjacent structure and concurrent intentions to expand parking and/or adjust vehicular access to the site, construction of this BMP should be timed to coincide with those activities to reduce mobilization costs and streamline excavation, stabilization, and surface restoration at the site. It is recommended that BFA include further design for this site in the campus redesign effort. Further design will involve refinement of the concept with respect to size, outlet design, and routing to ensure that CPv can be completely managed and larger storms passed through the system safely.

6.2.5 Permit Needs

A project readiness screening worksheet has been completed for this project and is included in Appendix J - Permit Review Sheets. In summary:

Stormwater Permit
It is not expected that a stormwater permit will be required at this time.

The site should qualify for an Erosion Prevention and Sediment Control permit (3-9020) under the Low Risk categorization if the following guidelines are followed:

- Less than 2 acres of disturbance at any one time.
- All soils must be stabilized (temporary or final) within 7 days.
- Runoff from the site must pass through a 50’ vegetated buffer prior to entering any Water of the State.

Local Permitting
No local permits are anticipated.

Other Permits
The Act 250 coordinator should review this project prior to final design as there is a permit (No. 6F0033) associated with the BFA parcel. This site should be reviewed by a State River Scientist and wetland

ecologist prior to final design as it sits within the river corridor and within 100 feet of a mapped wetland. It should be noted that a roadway sits between the river and the practice site and that attenuation of the existing storm flow will ultimately reduce erosion risk along the river bank.

6.3 Town Office

6.3.1 30% Concept Design Description

The Town Office and Parking Lot site is located on the corner of Main St (Route 104) and Buck Hollow Road in Fairfax. Currently, runoff from the roof and parking area is routed to a surface detention basin in the corner of the lot before discharge to an existing ditch along Route 104. The basin does not meet the standards of the State's stormwater management manual nor is it permitted as a treatment practice. Currently, the pond collects water only from the Town Office site while drainage come from Buck Hollow Road is routed in a roadside ditch along Main Street.

Soils in this location are poor, Hydrologic Soil Groups C and D, with low infiltration potential. As such, the proposed practice for this site relies on storage and surface media filtration.

The proposed BMP for this site is a retrofit of the pond area to expand the footprint and install a surface sand filter to store increased volume and provide treatment to the entire Town Office building envelope as well as the extent of Buck Hollow Road and land to the East that is within the drainage area (see Figure 11).

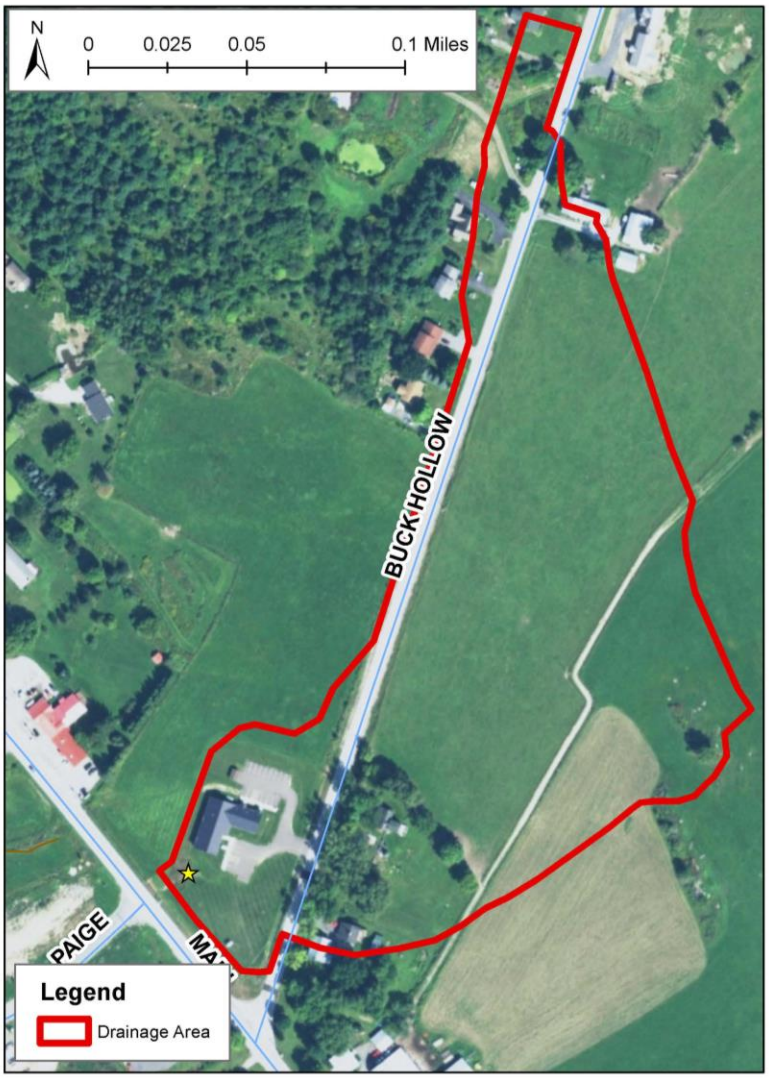

Figure 11. Town Office sand filter drainage area. The current stormwater pond does not intercept flow from Buck Hollow Road or land to the East. This upgrade would expand the BMP capacity.

The drainage area for this proposed BMP is 14.9 acres, approximately 10% (1.45 acres) of which is classified as impervious. This practice will provide a water quality benefit (Table 10). It is also a high visibility site within the Town and this practice could spur additional retrofits and awareness of stormwater issues in the area. It is recommended that an educational sign be installed in conjunction with the retrofit.

The design standard used for this retrofit was treatment and control of the 1-year event (1.91" of rainfall in a 24-hour period) or 21,283 ft^3 of runoff.

A 30% design plan is provided in Appendix I - 30% Designs.

6.3.2 Pollutant Removal and Other Water Quality Benefits

A retrofit of this site has the potential to prevent 959 lbs of TSS and 2.3 lbs of TP from entering receiving waters annually (Table 10).

Table 10. Town Office benefit summary table.

Total Suspended Solids Removed / yr	959 lbs
Total Phosphorus Removed / yr	2.3 lbs
Impervious Area Treated	1.4 acres
Total Drainage Area	14.9 acres

6.3.3 Cost Estimates

Note that these costs and benefits are very preliminary. Initial cost projections can be found in Table 11. The estimated cost for implementation of this project is $145,000

- The cost per pound of phosphorus treated is $63,043.
- The cost per impervious acre treated is $103,571.
- The cost per cubic foot of runoff treated is $6.81.

Table 11. Town Office project initial construction cost projection.

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 10,000.00	$ 10,000.00
653.55	Project Demarcation Fencing	LF	700	$ 1.17	$ 819.00
653.20	Temporary Erosion Matting	SY	2300	$ 2.20	$ 5,060.00
649.51	Geotextile for silt fence	SY	360	$ 4.13	$ 1,486.80
652.10	EPSC Plan	LS	1	$ 5,000.00	$ 5,000.00
652.20	Monitoring EPSC Plan	HR	40	$ 37.22	$ 1,488.80
	Construction Staking	HR	8	$ 90.00	$ 720.00
				Subtotal:	$ 24,574.60
Sand Filter					
203.15	Common Excavation	CY	926	$35.00	$ 32,407.41
651.35	Topsoil	CY	389	$30.96	$ 12,040.00
629.54	Crushed Stone Bedding	CY	108	$50.00	$ 5,398.15
613.11	Type II Stone (overflow)	CY	7	$42.49	$ 314.74
	Sand	CY	324	$40.00	$ 12,955.56
651.15	Seed	LBS	20	$7.66	$ 153.20
605.10	6" Underdrain Piping	LF	300	$21.86	$ 6,558.00
				Subtotal:	$ 69,827.05
New Infrastructure					
604.20	New 5' Catch Basin	EACH	1	$3,387.59	$ 3,387.59
				Subtotal:	$ 3,387.59
Subtotal:					$ 97,789.24
	Construction Oversight**	HR	24	$ 150.00	$ 3,600.00
	Construction Contingency - 20%**				$ 19,557.85
	Incidentals to Construction - 5%**				$ 4,889.46
	Minor Additional Design Items - 5%**				$ 4,889.46
	Final Design	HR	80	$ 150.00	$ 12,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	16	$ 150.00	$ 2,400.00
Total (Rounded)					**$ 145,000.00**

6.3.4 Next Steps

As this site is owned and operated by the Town of Fairfax, it is recommended that the Town proceed with further design and implementation of this retrofit. Further design will require refinement of the retrofit with respect to size, inflow structure to capture additional flow from the ditches, outlet design, and

routing to ensure that CPv can be completely managed and larger storms passed through the system safely.

6.3.5 Permit Needs

A project readiness screening worksheet has been completed for this project and is included in Appendix J - Permit Review Sheets. In summary:

Stormwater Permit
It is not expected that a stormwater permit will be required at this time. However, if the parking area associated with the Town Office site is expanded, review by the stormwater program will be necessary.

The site should qualify for an Erosion Prevention and Sediment Control permit (3-9020) under the Low Risk categorization if the following guidelines are followed:

- Less than 2 acres of disturbance at any one time.
- All soils must be stabilized (temporary or final) within 7 days.
- Runoff from the site must pass through a 50' vegetated buffer prior to entering any Water of the State.

Local Permitting
No local permits are anticipated.

Other Permits
No other permits are anticipated at this site.

Final Recommendations

The results of this SWMP have identified a number of potential BMP concepts and locations that would have a positive impact on water quality in the Town of Fairfax and receiving waters. Although designs were only advanced for the top three projects, this plan serves to highlight other opportunities throughout the Town. The areas identified as priorities should be further investigated for implementation of management practices to reduce threats to water quality.

It is our recommendation that the Town, in partnership with the NRPC move to implement the top three practices, but also to move forward with additional design and implementation of other projects presented in this plan (see Appendix K – Projects for Watershed Projects Database, for projects identified for addition to DEC's Watershed Projects Database). As these practices are the result of a stormwater master planning effort under a VT DEC Clean Water Fund grant, they are well-suited as candidates for implementation grants from this same source. We recommend the following steps in proceeding with to final design and implementation:

- For priority projects already at the 30% concept level, consider grant request for final design and implementation.

- Following implementation of the priority projects, submit grant funding requests for higher scoring projects that may include both preliminary and final design.

Where some of the project sites are road related, funding to implement those practices could include the VTRANS Better Roads grants. Communication with the Basin Planner for the region (Danielle Owczarski) can help to confirm the best source of funding given changing priorities and grant program rules associated with each.

Figure 12. Summit View Street, off of Route 104 in the Village is a recent addition. The roadway is excessively wide and dead-ends which does not support goals of Village connectivity or reduced impervious surface indicated in the Town Plan.

It is further recommended that a stormwater-specific ordinance be developed for the Town of Fairfax. Although existing municipal documents note stormwater mitigation efforts in regard to roads, bridges, driveways, and trails, a freestanding policy would clearly define best practices for stormwater management throughout the Town. The Fairfax Town Plan clearly indicates a desire for more interconnectedness of new developments, increased density in the village growth center, and greater access for bicycle and pedestrian transportation. However, the current growth patterns do not support this goal, as illustrated with multiple dead-end residential roadways off of Route 104 with no connection to adjacent developments or recreational areas. A stormwater-specific bylaw could work in concert with other development guidelines to support multiple goals of the Town including narrower road widths to reduce stormwater generation as well as making room for sidewalk and bicycle lane facilities. Denser development patterns will reduce impervious cover overall if road widths are controlled and the impervious cover threshold for stormwater management is reduced so that even small, single-unit homesites are required to retain and treat runoff prior to discharge to municipal ditches and storm drains that ultimately flow to natural surface waters. The VT League of Cities and Towns has developed a model stormwater bylaw for use by Towns. Further information can be found here: https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/2015-LID-GSI-VLCT%20model-bylaw.11-2015.pdf

The Vermont Agency of Transportation (VTrans), as part of their Transportation Separate Storm Sewer System (TS4) General Permit, will be completing their own retrofit assessment of VTrans-owned impervious surfaces throughout the Town. Projects identified in this plan that involve VTrans drainage should be coordinated with the VTrans TS4 permitting efforts to allow for potential collaboration. Notably, this includes the Route 104 corridor through the village center that was identified as a contributor of sediment to surface waters. Installation of swirl separators (also known as hydrodynamic separators) in catch basins along this stretch would reduce sediment loading to the river. The sidewalk installation effort that is underway currently should include (to the extent possible) some stormwater treatment within the

sidewalk and greenspace width, especially in sections where the slope is gradual which would make treatment more cost effective.

One road erosion site investigated as part of this SWMP remains a concern. BMP ID 18: Road Erosion near Hydro Plant was assessed in the field and identified as a priority location for a drop catch basin to move water off of the roadway without exacerbating erosional force. Because this roadway is constrained by rock ledge to the East and a drop to the river on the west, there is little space for management on site. When discussed at the stakeholder meeting on July 5, 2018, Town staff indicated that improvements had been made to the site to redirect flow. Upon further inspection by Watershed, it was determined that the fix implemented at the site was not sufficient to resolve the erosion concern. Continued undermining of the roadway is likely at this site. A permanent fix to redirect and safely discharge runoff is recommended.

Upcoming regulatory requirements under Act 64 will require management of sites with ≥3 acres of unmanaged and unpermitted (current State stormwater permit) impervious cover. These preexisting areas have been determined to be likely sources of water quality degradation that must be addressed and cannot be "grandfathered" into the current regulatory system. A few sites were identified in the initial GIS-based assessment to identify parcels with greater than 3-acres of impervious. Morse Hardwoods and Millwork was one of the properties identified in that assessment. However, upon field inspection, the site appears to be well-contained - it is flat, has sandy soils, and is surrounded by mature vegetation. As a result, no further action was taken at that site. The BFA site was also identified as an unpermitted site with more than 3-acres of impervious. Because runoff from the BFA site is casing erosion and river impacts to the East and West sides of the campus, it is recommended that immediate attention be focused on management of this site's runoff.

To map and interact with watershed modeling results related to non-point total phosphorus loading sources within the Vermont portion of the Lake Champlain Basin, we recommend using the Clean Water Roadmap (CWR). This web-based tool supports the VT DEC's tactical basin planning and outreach efforts related to Lake Champlain Phosphorus TMDL. For more information, or to use the CWR, see https://anrweb.vt.gov/DEC/CWR/CWR-tool.

6.4 Potential Funding Sources

Moving these projects to final design and implementation will require securing additional funds. Below are some options that may provide the needed resources.

- Department of Environmental Conservation - Ecosystem Restoration Program (ERP) Grants through the Clean Water Initiative Program (CWIP)
    - Requirements for this grant change frequently, so applicants are encouraged to check in with program staff and/or their Basin Planner before developing a detailed proposal. Currently, these grants are being issued quarterly and proposals are received on a rolling basis. Projects must meet a $20,000 minimum funding level. Priority is given for projects on public land. While match is not required for projects outside of MS4 permitted communities, points in proposal ranking are provided where match is offered.
    - For more information: http://dec.vermont.gov/watershed/cwi/grants

- Reginal Planning Commissions (RPCs) – Clean Water Block Grants

  - Block Grant funding is available as pass through Clean Water funding available through an application to the RPC. Funding available for projects needing preliminary design, final design, and/or implementation.
  - Applications are not as complicated as direct ERP funding applications but require 20% match

- Lake Champlain Basin Program (LCBP) – Pollution Prevention, Local Implementation, and others
  - While small ($20,000), the Pollution Prevention grant opportunity from the LCBP is a reliable source of funding for projects to improve water quality in areas that drain to the Lake. Further, these grants will cover elements not allowable in ERP proposals (such as education signage, monitoring, or extra landscape features to enhance use or community enjoyment of an area adjacent to a stormwater practice). In previous cycles, LCBP has issued school stormwater-specific announcements. These are unique opportunities for funding projects that this site could benefit from.
  - Good source of funds for educational signage at the Town Office and BFA East sites.
  - This source can be used as match for ERP-funded projects.
  - For more information on current RFPs: http://www.lcbp.org/about-us/grants-rfps/request-for-proposals-rfps/

- VT Agency of Transportation (VTrans) – Transportation Alternatives Program, Municipal Highway and Stormwater Grant Program, and others
  - The Municipal Highway and Stormwater Grant Program will fund stormwater projects with a highway link. These may include planning studies and the installation of physical infrastructure as well as repair to culverts and stream banks damaged from runoff. Municipalities are the only eligible entity for this grant and must be used for projects that treat highway road runoff. Match is required for these grants and must be from a non-federal source.
  - Insofar as the Town Office project site is collecting some state highway runoff and improving treatment prior to discharge to a state ditch, this could be a good source of funds. While not one of the Top-3 projects, the Route 104 sidewalk project underway in the Town could add a stormwater treatment element, as suggested in this SWMP, using funds from VTrans Municipal Highway and Stormwater Grant Program.
  - For more information: http://vtrans.vermont.gov/highway/local-projects/transport-alt

6.5 Potential Partners

The Town and BFA are obvious partners on the projects that involve a combination of runoff from the Town road and the BFA campus. Further, the Northwest Regional Planning Commission could be helpful in identifying and securing funds as well as grant management for implementation for all projects identified herein.

Local watershed groups such as Friends of Northern Lake Champlain can be valuable partners for education, outreach, and grant management. Where the projects are in public areas (especially the Town Office and BFA East) engagement with teachers for integration with classroom learning as well as public signage has been successful in other publicly accessible project sites. Lastly, the BFA East site is located

across from residential development. Runoff generated from those properties contributes to the erosion problems on site. Including residents in the process and educating them about their options for retaining roof and driveway runoff could have added benefits to the project and increase community support and understanding for the school's effort on stormwater. The Friends of Northern Lake Champlain could provide outreach information to adjacent landowners to increase the educational opportunity during the time of construction.