Hyde Park Stormwater Master Plan

Final Report

SUBMITTED TO:

Lamoille County
Conservation District
109 Professional Drive, Suite 2
Morrisville, VT 05661
(802) 888-9218

SUBMITTED BY:

Kateri Gomez
Watershed Consulting Associates, LLC
208 Flynn Ave Suite 2H | PO Box 4413
Burlington, VT 05406
(802) 497-2367 |
www.watershedca.com

WATERSHED CONSULTING

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I. Disclaimer

The intent of this report is to present the data collected, evaluations, analyses, designs, and cost estimates for the Hyde Park Stormwater Master Plan under a contract between the Lamoille County Conservation District and Watershed Consulting Associates, LLC. Funding for the project was provided by the Vermont Department of Environmental Conservation's Clean Water Fund Grant. The plan presented is intended to provide the Town'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 this area. There is great need to reduce stormwater impacts including phosphorus and sediment loading from stormwater runoff to receiving waters. Especially within municipalities and the greater Lake Champlain Basin considering current and future regulation under the Lake Champlain Total Maximum Daily Load requirements. Although there are other BMP strategies that could be implemented in the study area, those presented in this document 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 at this time, nor is any property owner within the Town obligated to implement them. However, it should be noted that for properties with three or more acres of impervious cover without a current State stormwater permit, regulations will require stormwater management for existing impervious areas. This stormwater master plan, and therefore its resultant strategies, is one of the actions in the Lamoille Tactical Basin Plan. The BMP strategies identified in this stormwater master plan will be put in queue for state funding for implementation.

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 gravel wetlands, infiltration basins, 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 or stone.

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 BMP 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 the permeability of 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- Water 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.

Watershed- The area contributing runoff to a specific point. For watersheds like Centerville Brook, this includes the entire 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 associated with a runoff event.

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 infiltrated 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 use and enjoyment of our water resources. Traditionally, stormwater management techniques have relied heavily upon gray infrastructure, where stormwater is collected and conveyed in a network of catchbasins and pipes, prior to discharging to surface waters (i.e. streams, rivers, ponds, lakes, and coastal waters). Although this approach is effective in removing stormwater from developed areas, it does not eliminate the problem and has proved to worsen negative stormwater effects such as erosion, flooding, and nutrient pollution. It is clear that something must change. This is where stormwater master planning comes into play. Funding is limited to implement projects that will improve water quality and reduce the negative impacts of uncontrolled stormwater runoff. As such, creating a plan of where and how to best use these funds to provide the greatest benefit to our water resources is key.

1.2 What is Stormwater Master Planning?

In the wake of rapid urban development and increasing rainfall intensity, stormwater management that seeks to mimic the undeveloped environment and treat stormwater runoff as close to the source as possible has become the focus of efforts to mitigate flooding and maintain the health of our waterways. 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. This process was developed because many of the developed areas within the State of Vermont predate regulatory requirements for stormwater management, but these distributed and unmanaged areas are contributing to the impairments of our surface waters, including Lake Champlain. These unmanaged stormwater discharges can be identified and addressed through this Stormwater Master Planning process. The process allows for assessment and prioritization of 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 Guidelines

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. This 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 limited funds.

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

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

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

3 Background

3.1 Existing Conditions

The Town of Hyde Park spans approximately 24,959 acres in Lamoille County, VT and is primarily forested (67%), though 6.3% of the Town is classified as urban. Of that area, there are 503 acres (2%) of impervious cover. Hyde Park is located between the more rural towns of Johnson, Eden, Craftsbury, and Wolcott, and the fairly urbanized Morristown (Figure 1). Hyde Park's development is concentrated in the south-western region adjacent to Morristown, as well as the north-western area paralleling the Gihon River (Figure 3).

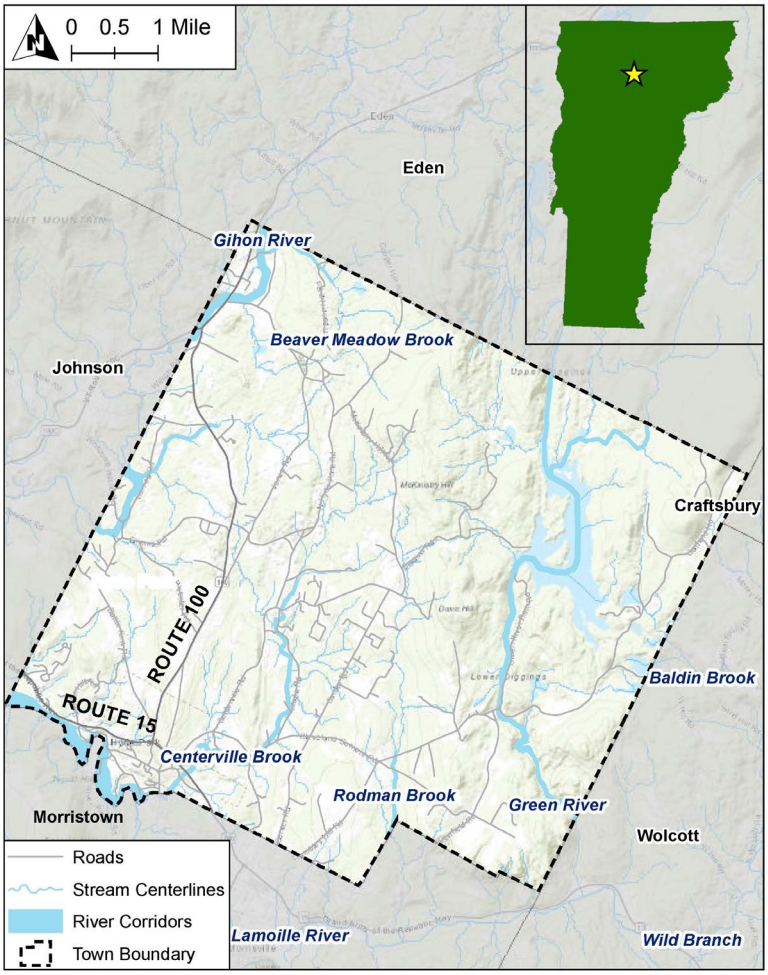

Figure 1. The Town of Hyde Park is located in Lamoille County, VT.

Soils analyses indicate that of the 24,959 total acres in the Town, 74% are classified as either potentially highly-erodible, or highly-erodible by the latest Natural Resources Conservation Service (NRCS) soil mapping data. Additionally, almost half of the mapped soils in the watershed have very low infiltration potential as indicated by NRCS Hydrologic Soil Group classifications where soils are classified from group A (highest infiltration potential) to group D (lowest infiltration potential). In the Town, the majority of areas belong to either Hydrologic Soil Group B (23%) or C (28%), while 16% are in group A and 18% are in group D (18%). The remainder is not classified or comprised of water. This combination of steep slopes with limited infiltration capacity and a highly erodible surface make the area susceptible to erosion.

The majority of developments within these areas were constructed with minimal stormwater management features, which has resulted in significant amounts of untreated stormwater draining large portions of developed lands discharging directly to surface waters, particularly to the Lamoille River south of Route 15. Surrounding the developed lands, rural roads are generally unpaved, with open roadside ditches, and cross culverts. Many 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 overall drainage system.

3.2 Problem Definition

The Town of Hyde Park is located in Lamoille County primarily within the Gihon River (whose tributaries within the Town include Beaver Meadow), the Kenfield Brook-Lamoille River (tributaries include Centerville Brook), the Green River (tributaries include Wiley Brook), and the Ryder Brook-Lamoille River (tributaries include Rodman Brook) watersheds. These watersheds are tributaries of the Lamoille River, located south of the Town. A small area, along the border with the Town of Wolcott, falls within the Wild Branch and Elmore Branch-Lamoille River watersheds, both tributaries of the Lamoille River (Figure 2).

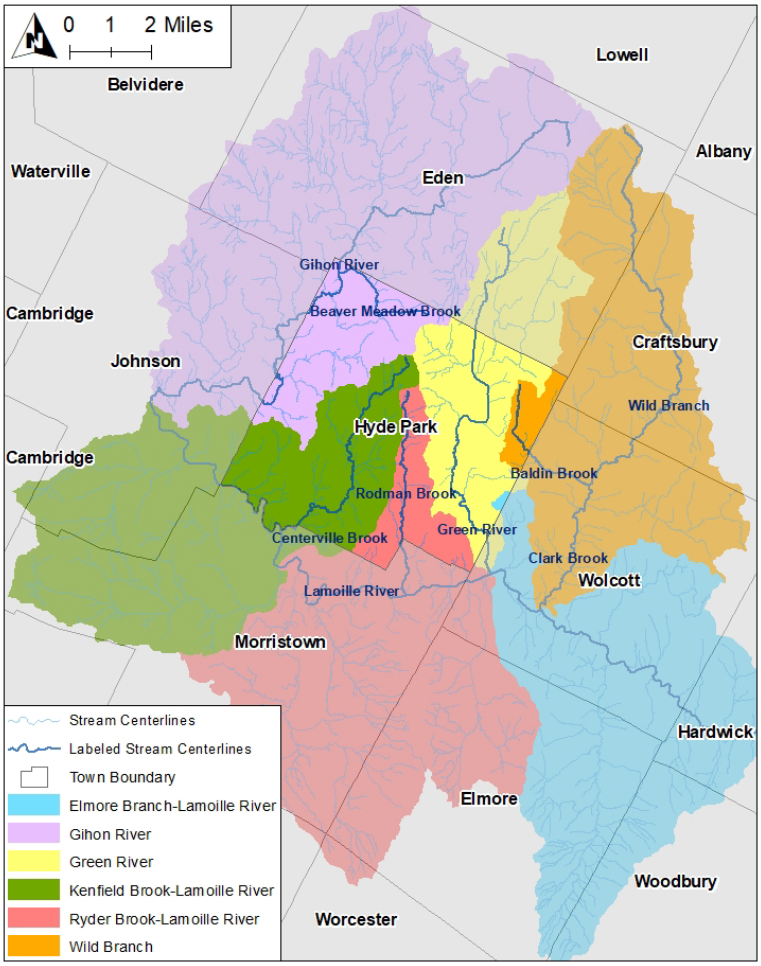

Figure 2. The Town of Hyde Park is located primarily within the Gihon River (purple), Kenfield Brook-Lamoille River (green), Green River (yellow), and Ryder Brook-Lamoille River (pink) watersheds, tributaries of the Lamoille river.

Many of Hyde Park's surface waters have been negatively affected by human activities. Ryder Brook 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 physical alterations, sediment, and loss of riparian vegetation. Furthermore, a section of the Elmore Branch is on the 2016 stressed waters list due to physical alterations such as channelization, sediment and turbidity, road encroachment on the floodplain, and road runoff. The Wild Branch also has reaches that are adversely impacted by stormwater runoff and development, and a section of the river is on the 2016 stressed waters list for re-location of the channel, flood damage and repair, loss of floodplain, encroachments, and sediment from bank erosion. These three stressed waterbodies are tributaries of the Lamoille, which has reaches that are adversely impacted by stormwater runoff and development. A section of the river is on the 2016 stressed waters list due to elevated mercury levels.

There are two main areas in the Town of Hyde Park where development is concentrated. The remainder of the Town is more sparsely developed with scattered rural residential development throughout. The Village of Hyde Park is located south of the intersection of Route 15 and Route 100, and North Hyde Park encompasses the intersection of Route 100 and Route 100C (Figure 3). Both areas have experienced increased development, with expanding areas of impervious surfaces. The main road through the Village parallels the Lamoille River and the main road through North Hyde Park parallels the Gihon River, both with agricultural lands and some development falling in or close to the river corridor. In addition to expanding development along these corridors, Hyde Park has many steep gravel roads that further contribute sediment and nutrients to surface waters. These roads and associated infrastructure can also constrain smaller tributaries, especially during storm events.

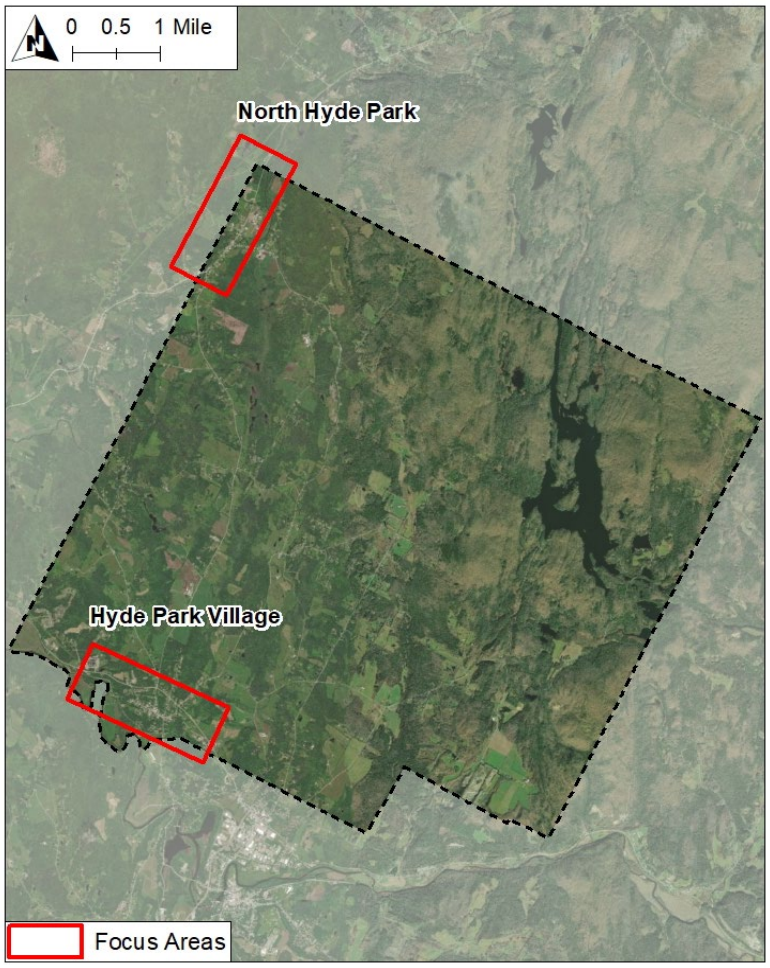

Figure 3. The focus area for this SWMP includes the Village of Hyde Park and North Hyde Park.

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 seek to protect local river resources as well as the larger Lake Champlain Basin, which currently has a Total Maximum Daily Load (TMDL) in place that requires reductions in phosphorus loading to Lake Champlain.

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 River Tactical Basin Plan, the VT DEC's Stormwater Mapping Projects for the Town of Hyde Park and the Village of North Hyde Park, the 2017 Town of Hyde Park Road Erosion Inventory (REI) Report, the 2010 Centerville Brook Corridor Plan, the 2009 Gihon River Corridor Plan, and the 2010 Lamoille River Corridor Plan.

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.

The project team met with Town of Hyde Park stakeholders and the Lamoille County Conservation District (LCCD) on December 11th, 2017 to discuss the SWMP and solicit information on problem areas from the Town. During this meeting, a list of potentially important sites was discussed with the project team. 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.

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.

Two such resources include the Town of Hyde Park Stormwater Mapping Project completed by the VT DEC in 2012, and the Village of North Hyde Park Stormwater Infrastructure Mapping Project completed by the VT DEC in 2015. These stormwater infrastructure mapping projects provided current drainage maps and potential locations of stormwater retrofit sites for the municipality. Designated priority areas, as part of the Town of Hyde Park's Stormwater Mapping Project, were located on Johnson St Ext, Church St, Depot St, and at the intersection of Ten Bends Dr and Woodlands Ln. The Church St, Ten Bends Dr and Woodlands Ln sites were assessed as part of this SWMP. Note that the Johnson St Ext site is being retrofitted and that the Depot St site has already been retrofitted. As such, these sites were not assessed as part of this plan. See Appendix A for Summit Engineering's plan for the Johnson St Ext Sinkhole, and Watershed's plan for Depot St, Depot St Ext, and Morey Rd. Designated priority areas, as part of the Village of North Hyde Park's Stormwater Infrastructure Mapping Project, were located along VT-100 and recommended for catchbasin cleaning. Note that this area was assessed as part of the 2016 North Hyde Park Streetscape Scoping Report (see Appendix A). As such, these sites were not assessed during this plan.

Another resource utilized during the desktop assessment was the Hyde Park road erosion inventory (REI). This assessment was conducted in the summers of 2016 and 2017 by the Lamoille County Planning Commission. The inventory was completed to help the Town prepare for compliance with the, then pending, Municipal Roads General Permit (MRGP), later issued in early 2018. See Appendix A. The assessment looked at how well hydrologically-connected, 100-meter road segments were complying with MRGP standards such as road crown, berm issues, ditches, cross culverts, driveway culverts, outfalls, and presence of rill or gully erosion.

GIS data was then reviewed. Data included, but was not limited to, storm sewer infrastructure, soils classifications, parcel data, wetlands, and river corridors. This data was 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. 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 13 locations were identified for field investigation.

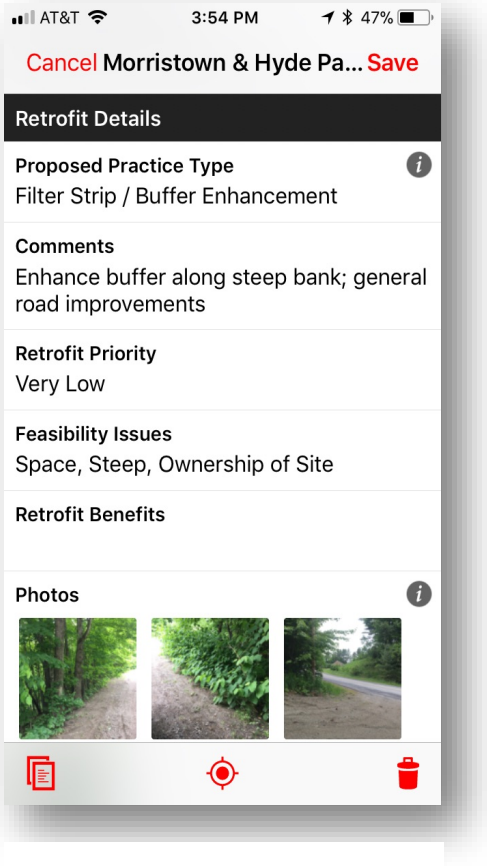

Figure 4. Example screen from data collection app.

4.1.2.2 Digital Map and App Preparation

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, public parcels, 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[1]. The app was also pre-loaded with the 13 point locations for the potential BMP sites. These points allowed for easy site location and data collection in the field (Figure 4).

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.

4.1.2.3 Field Data collection

Each of the 13 previously identified potential BMP locations were evaluated in the field during the Summer of 2018. Data was 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.

[1] www.fulcrumapp.com

4.2 Preliminary BMP Ranking

After the initial field visits were completed, a preliminary ranking system was utilized to prioritize these 13 projects. The goal of this ranking was to identify the 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.

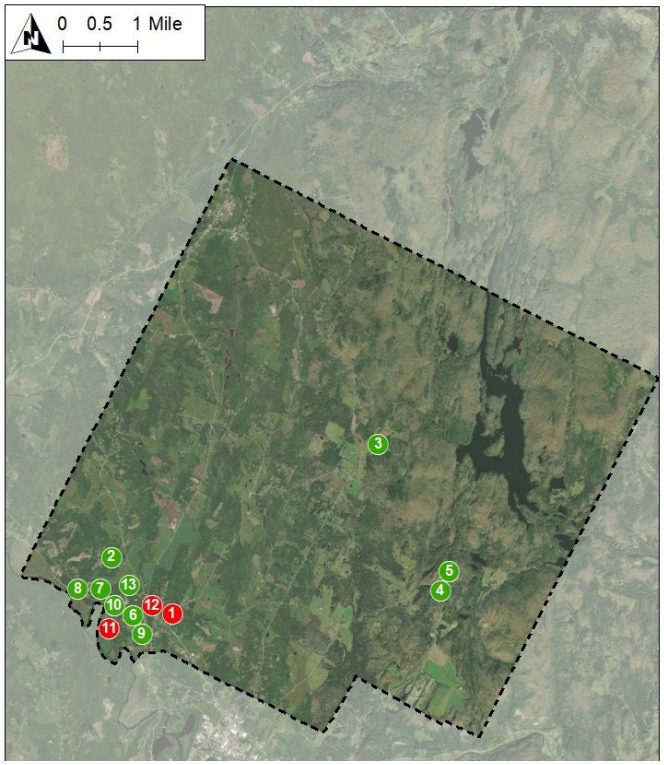

Figure 5. 13 potential sites for BMP implementation were investigated in the field. The Top 10 are shown in green.

The list of sites was distributed to the Town of Hyde Park and the LCCD. As part of this process, the project team met with the stakeholders on June 19th, 2018 to discuss the proposed project sites. During this meeting, the stakeholders nominated the Top 10 projects to be included in the plan, and the Top 3 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. The Top 10 sites, listed in Table 1, reflects the results of the preliminary ranking as well as stakeholder priorities and any feasibility issues previously unknown to the project team. The Top 10 point locations are shown in green in Figure 5; the lower ranked projects are shown in red.

Table 1. The Top 10 BMPs selected for the Hyde Park SWMP.

Project Name	Proposed BMP Practice Type	BMP ID #	BMP Rank
Lamoille Union Schools - West	Underground Storage / Infiltration	8	1
Town Office Building	Infiltration Basin	13	2
Sylvan Hill Rd / Johnson St Ext	Underground Storage / Infiltration	10	3
Main St GSI	Bioretention, Curb Bump out, Dry Well	9	4
Lamoille Union Schools - East	Infiltration Trench, Bioretention	7	5
Hyde Park Highway Dept.	Infiltration Basin	6	6
Diggins Rd	Check Dams, Ditch Improvements, Turnouts	3	7
Cricket Hill Rd	Check Dams, Ditch Improvements, Buffer Enhancement, Turnouts	2	8
Garfield Rd	Check Dams, Ditch Improvements, Buffer Enhancement, Turnouts	4	9
Green River Dam Rd	Check Dams, Ditch Improvements, Infrastructure Addition, Turnouts	5	10

4.3 Top 10 Sites - Concept Refinement

The contributing drainage area of each of the Top 10 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 10 Sites for drainage area delineations).

A matrix was utilized in order to quantitatively and qualitatively describe each of the Top 10 projects. Considerations that factored into the descriptions of BMP projects included:

- Impervious area managed
- Ease of operation and maintenance
- Permitting restrictions
- Land availability
- Flood mitigation
- Other project benefits

Each of these criteria are listed and explained in Appendix D - Top 10 Sites.

4.4 Top 3 Sites - Potential BMPs

Selection of the Town's Top 3 sites considered the results from Watershed's initial site investigations, preliminary modeling and ranking, and input from municipal officials concerning project priorities. The sites selected within the Town of Hyde Park are listed in Table 2.

Table 2. The Top 3 BMP sites for the Town of Hyde Park.

Project Name	Address	Proposed Practice Type	BMP ID #	BMP Rank
Lamoille Union Schools - West	736 VT Route 15 W	Underground Storage/Infiltration	8	1
Town Office Building	344 VT Route 15 W	Infiltration Basin, Underground Storage/Infiltration	13	2
Sylvan Hill Rd and Johnson St Ext	160 Johnson St Ext	Underground Storage/Infiltration, Ditch Improvements	10	3

A map of each project showing the drainage areas and BMP locations can be found in Appendix E - Top 3 Sites.

4.5 Top 3 Sites - Modeling

Modeling was completed for each of the Top 3 sites. 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 using the best available topographic data and land use/land cover was digitized using the best available aerial imagery. Drainage areas were then refined as needed based on field observations. Each of the sites was modeled in HydroCAD to determine the appropriate BMP size and resultant stormwater volume benefits.

The Top 3 sites were also modeled to understand the existing condition pollutant loading and pollutant loading reductions associated with the proposed BMPs. This was completed using two methods. The first method utilized the VT Department of Environmental Conservation's Stormwater Treatment Practice (STP) Calculator[2]. This model is used within the Lake Champlain Basin for estimation and tracking of BMP pollutant load reductions. The STP Calculator is currently only programmed to provide total phosphorus (TP) loading and reductions and cannot at this time be used to estimate total suspended solids (TSS). Pollutant loading estimates were also calculated using the Source Loading and Management Model for Windows (WinSLAMM) to determine the annual TSS and TP loading from the drainage area of each site. The modeling yielded expected pollutant removal loads (lbs) and rates (%).

The modeled volume and pollutant loading reductions are shown in Table 3. Complete modeling results are provided in Appendix E - Top 3 Sites.

Table 3. Modeling results for the Top 3 projects are shown below.

Project Name	Volume Managed (ac-ft)	Volume Infiltrated (ac-ft)	TSS Removal (lbs)	TSS Removal (%)	STP Calculator TP Removal (lbs)	STP Calculator TP Removal (%)
Lamoille Union Schools - West	0.272	0.272	588.20	99.99%	5.071	100.00%
Town Office Building	0.134	0.134	1,228.20	98.77%	8.818	95.51%
Sylvan Hill Rd and Johnson St Ext	0.105	0.105	2,162.20	96.03%	7.011	79.29%

4.6 Top 3 Sites - Concept Advancement

A prioritization matrix was utilized to quantitatively describe each of the Top 3 projects. Considerations that factored into the description of the BMP projects included factors such as:

- Impervious area managed
- Ease of operation and maintenance
- Volume managed
- Volume infiltrated
- Permitting restrictions
- Land availability
- Flood mitigation
- TSS removed
- TP removed
- Other project benefits
- Project cost

Each of these factors are listed and explained in Appendix E - Top 3 Sites.

[2] https://anrweb.vt.gov/DEC/CleanWaterDashboard/STPCalculator.aspx

4.6.1 Project Cost Estimation

Project cost, listed as one of the criteria considered, was calculated for the Top 3 sites using a spreadsheet-based method. The methodology for determining these planning level costs involved using the 2018, 5-year average price list. Pricing was also developed directly from ADS-Stormtech.

5 Priority BMPs

The selected Top 3 BMP implementation sites are briefly described below and shown in Figure 6. These opportunities are located on Town and School property. Individual drainage area maps and an overview map of these Top 3 sites are provided in Appendix E - Top 3 Sites.

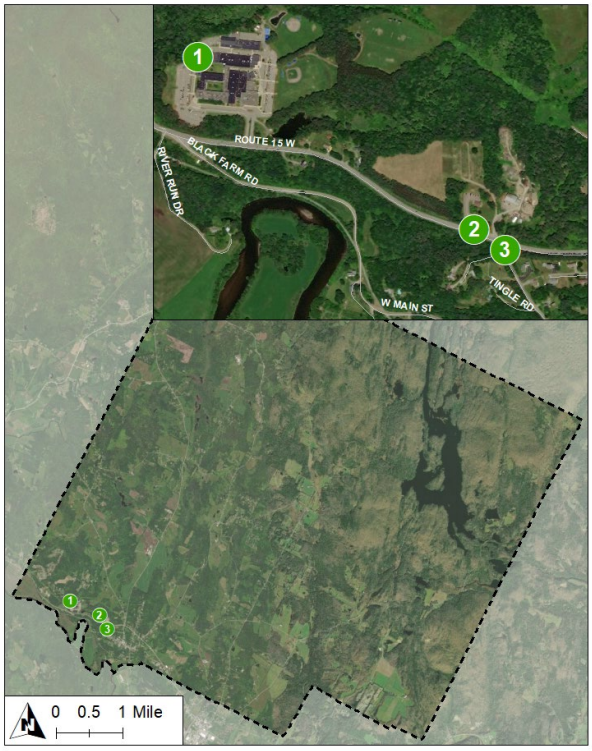

Figure 6. Top 3 BMP sites.

Site: 1
Project Name: Lamoille Union Schools - West
Description: The site includes a stormline connected to three catchbasins, a small portion of a paved access drive, two courtyards, and three roofs. Stormwater is currently collected in catchbasins via surface flow as well as by roof drains that are tied into the catchbasins. The stormline is discharged over the bank beyond the guardrail in Figure 7, and the drainage flows to an adjacent unnamed tributary of the Lamoille River. The concept for this site includes rerouting the stormline to a subsurface infiltration chamber system under the existing access drive. Soils are mapped as being very good at this site for infiltration (Hydrologic Group A).

Figure 7. Subsurface infiltration chambers are proposed under a paved access drive at Lamoille Union High School.

Outreach: Contact was made with Dylan Laflam (Facilities Manager) prior to advancing concept designs at this site. The school allowed further design to be completed at the site.

Site: 2
Project Name: Town Office Building
Description: The site includes a cross-culvert under the paved access drive, the Town Office building and front parking lot, and the land between the parking lot and Route 15. Stormwater currently sheet flows through this area and is collected in the depressed grassy area prior to the culvert inlet. The concept for this site includes implementing an infiltration basin in the lawn between Route 15, the access drive, and the front parking lot (Figure 8). Soils are mapped as being very good and good at this site (Hydrologic Group A).

Figure 8. An infiltration basin is proposed at the Town Office Building site.

Outreach: This site is owned by the Town but involves VTrans right-of-way drainage. As such, contact was made with Jim Cota (VTrans Operations, District 8 Project Manager) prior to advancing concept designs at this site. VTrans initially allowed further design to be completed at the site.

Site: 3
Project Name: Sylvan Hill Rd and Johnson St Ext
Description: The site includes Sylvan Rd, Johnson St Ext, and Route 15. Stormwater currently sheet flows through this area, some of which is collected in a cross culvert and piped under Johnson St Ext. The concept for this site encompasses two areas: Sylvan Hill Rd and the depressed green space at the intersection of Johnson St Ext and Route 15. The concept for Sylvan Hill Rd includes elevating the north side of the road and constructing a stone lined swale along the south side of the road. A single catchbasin would be added at the bottom of the road (south side of Sylvan Hill Rd) to direct road runoff to the subsurface infiltration chamber system located in the green space across the street (Figure 9). Drainage from the swale running along Route 15 to the east would also be routed into this system. Soils are mapped as being good for infiltration at this site (Hydrologic Group B).

Figure 9. Sylvan Hill Rd and Johnson St Ext is the proposed location for ditch improvements and a subsurface storage and infiltration system.

Outreach: This site is owned by the Town but involves VTrans right-of-way drainage. As such, contact was made with Jim Cota (VTrans Operations, District 8 Project Manager) prior to advancing concept designs at this site. VTrans initially allowed further design to be completed at the site.

When implemented, these three BMPs would treat approximately 14 acres, 7 acres (48%) of which is impervious. Modeled pollutant reductions for each of the projects, shown in Table 3, indicate that these BMPs will prevent approximately 3,979 lbs of TSS and 21 lbs of TP from reaching receiving waters annually.

Site surveys were completed for each of the Top 3 sites, from which existing conditions plans were developed. These plans served as the basis for the 30% proposed condition plans that were developed for each site. These plans are located in Appendix F - Existing Conditions Plans.

6 30% Designs

30% designs were developed for each of the Top 3 sites. Site-specific concepts are discussed in the following sections. 30% designs can be found in Appendix G - 30% Designs.

6.1 Site 1 - Lamoille Union Schools - West

6.1.1 30% Concept Design Description

The Lamoille Union Schools - West site is located on Route 15 by Cricket Hill in Hyde Park. Currently, drainage from this portion of the School is collected via roof drains and surface flow in a series of catchbasins and discharged over the bank to an unnamed tributary of the Lamoille River northwest of the paved access drive without any water quality management. This drainage includes runoff from multiple roofs, courtyards, and a section of pavement. Note that the current mapped location of the stream is incorrect and that the pipe discharges directly to the tributary.

With greater than 3 acres of impervious surfaces and an expired stormwater permit, this site will be subject to the 3-Acre General Permit which will require management of the site's stormwater runoff via stormwater retrofits. The proposed retrofit for this site will help the School reach this target.

Soils are mapped as having very good infiltration potential, Hydrologic Soil Group A. As such, the proposed practice for this site is infiltration based. A soils assessment was attempted for this location but was not completed due to scheduling conflicts with stakeholders. See Appendix E - Top 3 Sites for the corresponding NRCS Soil Fact Sheet for soils in this location.

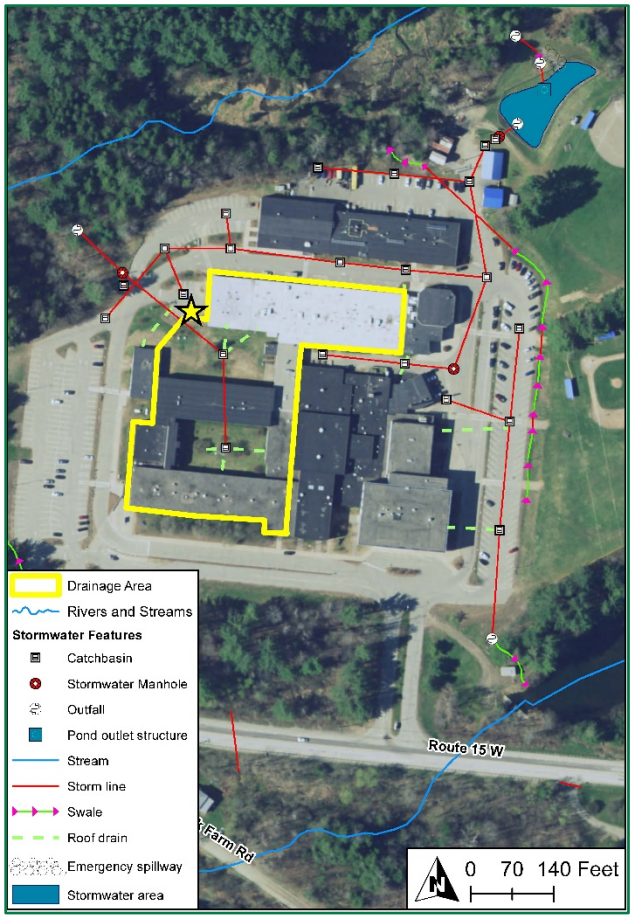

Figure 10. The BMP drainage area is shown in yellow for the Lamoille Union Schools – West site. The proposed BMP location is shown with a star.

The proposed retrofit for this site involves rerouting the existing stormline to a subsurface storage and infiltration system under the small parking lot located west of the School (see starred location in Figure 10). It is recommended that an educational sign be installed in conjunction with the retrofit.

Upon Watershed's field investigation of this site, it was observed that unmanaged discharge from the stormwater outfall was reducing stream bank stability directly downstream of the outfall, increasing in-stream erosion and degradation of water quality. These negative impacts are a direct result of the large volume of stormwater runoff being piped directly to the stream from a largely impervious area. Note that the phosphorus reduction estimate for this project does not account for the mitigation of the in-stream erosion caused by this stormwater input to the stream, but it is expected that significant erosion will be prevented after construction of this infiltration-based project and as such the actual phosphorus reduction would be much higher than that estimated in this report.

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

6.1.2 Pollutant Removal and Other Water Quality Benefits

This practice has the potential to prevent 588.20 lbs of total suspended solids (TSS) and 5.071 lbs of total phosphorus (TP) from entering receiving waters annually. The design standard used for this retrofit was full infiltration of the channel protection volume (CPv, or 2.02" of rain in a 24-hour period), equal to 11,848 ft^3 of runoff. As the project is located at a school, it is recommended that an educational sign be installed in conjunction with the retrofit. See Table 4 for the benefit summary table.

Table 4. Lamoille Union School - West benefit summary table.

TSS Removed	588.20 lbs
TP Removed	5.071 lbs
Impervious Treated	1.87 acres
Total Drainage Area	2.62 acres

6.1.3 Cost Estimates

The total estimate cost for this project is $85,000. Note that these costs are preliminary. Cost projections can be found in Table 5.

- The cost per pound of phosphorus treated is $16,761.98*.
- The cost per impervious acre treated is $45,454.55.
- The cost per cubic foot of runoff treated is $7.17.

*Note that this cost per pound of phosphorus treated estimate does not account for mitigation of the in-stream erosion caused by this stormwater input to the stream, but it is expected that significant erosion will be prevented after construction of this infiltration-based project and as such the actual phosphorus reduction would be higher than that estimated in this report.

Table 5. The initial construction cost projection for Lamoille Union School - West is included below.

VTRANS CODE	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	Site Preparation				
N/A	MOBILIZATION	LS	1	$1,000.00	$1,000.00
653.55	PROJECT DEMARCATION FENCE	LF	225	1.17	$263.25
649.51	GEOTEXTILE FOR SILT FENCE	SY	40	4.13	$165.20
N/A	CONSTRUCTION STAKING	HR	4	125.00	$500.00
				Subtotal:	$1,928.45
	Chambers - Excavation and Materials				
	EXCAVATION				
203.15	COMMON EXCAVATION	CY	488	$9.86	$4,811.68
	MATERIALS				
N/A	MC4500	EACH	31	$483.00	$14,973.00
N/A	MC4500 PLAIN END CAP	EACH	6	$494.50	$2,967.00
N/A	MC4500 24B END CAP	EACH	2	$682.81	$1,365.63
N/A	12” Tee	EACH	1	$80.93	$80.93
N/A	12” 90 Bend	EACH	2	$64.51	$129.02
N/A	12” Couplers	EACH	9	$8.30	$74.73
N/A	12” N12 AASHTO for Manifold	LF	40	$7.75	$310.00
N/A	24” N12 for Isolator Row (AASHTO)	LF	20	$22.54	$450.80
N/A	601TG to wrap system (SY)	SY	1500	$0.84	$1,260.00
N/A	315WTK for scour protection (SY)	SY	500	$0.72	$360.00
N/A	6” Inserta Tee	EACH	2	$95.00	$190.00
N/A	6” Red Hole Saw	EACH	1	$140.00	$140.00
N/A	12” Inline Drain	EACH	2	$333.50	$667.00
629.54	CRUSHED STONE BEDDING (3/4” - 1 ½” STONE)	TON	410	$34.04	$13,956.40
N/A	6” N12 AASHTO to bring inspection ports to grade	LF	20	$2.82	$56.40
	PLANTING (ABOVE CHAMBERS IN GREENSPACE)				
651.15	SEED	LB	10	$7.66	$76.60
653.20	TEMPORARY EROSION MATTING	SY	140	$2.20	$308.00
651.25	HAY MULCH	TON	0.25	$597.15	$149.29
				Subtotal:	$42,326.47
	New Infrastructure for Conveyance of Runoff to Practice				
	STRUCTURES AND PIPES				
604.18	PRECAST REINFORCED CONCRETE DROP INLET WITH CAST IRON GRATE (SPLITTER/MANIFOLD OR OTHER)	EACH	5	$4,099.29	$20,046.45
601.0910	15” CPEP	LF	55	$34.05	$1,872.75
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	6.25	$40.30	$251.88
				Subtotal:	$22,171.08
	Roadway Improvements				
203.28	EXCAVATION OF SURFACES AND PAVEMENTS (PAVED ROADS ONLY)	CY	8	$21.94	$175.52

VTRANS CODE	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
406.25	BITUMINOUS CONRETE PAVEMENT	TON	24	$127.86	$3,068.64
				Subtotal:	$3,244.16
	Subtotal:				$66,425.99
	Construction Oversight**	HR	4	$125.00	$500.00
	Construction Contingency - 10%**				$6,642.60
	Incidentals to Construction - 5%**				$3,321.30
	Minor Additional Design Items - 5%**				$3,321.30
	Final Design	HR	40	$125.00	$5,000.00
TOTAL (Rounded to nearest $1,000)					**$85,000.00**

6.1.4 Next Steps

Preliminary outreach has been conducted with the Lamoille North Supervisory Union. They have indicated their willingness to proceed with further design of this retrofit. Further design will involve refinement of the 30% retrofit concept with respect to size, outlet design, and routing to ensure that the target volume can be completely infiltrated, and larger storms bypass the system safely.

6.1.5 Permit Needs

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

Stormwater Permit

The Lamoille Union Schools – West site already has an existing permit (4315-9015, expired on 09-05-2016) for the detention pond on their property. It is not anticipated that the proposed retrofits would require an additional stormwater permit but the existing permit may need to be amended. The School should renew their expired stormwater permit.

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 a river scientist prior to final design as the project will contribute point source water runoff into the stream. Note that the existing outfall discharges directly to the tributary and that no additional runoff will be routed to the system as part of this project. This site should also be reviewed by a wetland ecologist prior to final design as the project is located within 100' of mapped wetlands and hydric soils. Permits are not anticipated to meet Act 250 requirements for this project.

6.2 Site 2 - Town Office Building

6.2.1 30% Concept Design Description

The Town Office Building site is located on Route 15 next to the Highway Department in Hyde Park. Stormwater from the Town Office Building site is currently unmanaged. This includes drainage from the office building's roof and surrounding grounds, the eastern half of the office's paved access drive, the front paved parking lot, and a small portion of Route 15 as well as the Highway Department's driveway. Stormwater is currently collected in a depressed green space between the front parking lot and Route 15, conveyed west of the access drive via a cross culvert, and under Route 15 to an unnamed tributary of the Lamoille River without any water quality management.

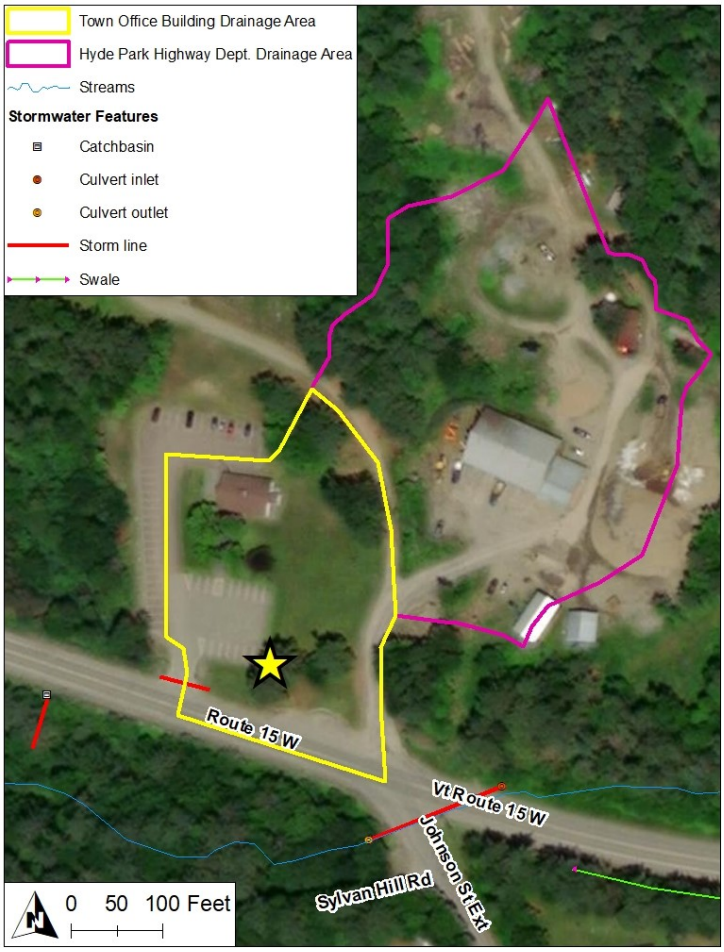

Figure 11. The drainage area for the proposed BMP is shown in yellow for the Town Office Building site. The proposed BMP location is shown with a star. Note that this BMP would also treat drainage from the adjacent Highway Dept. drainage area (pink).

Soils are mapped as having very good infiltration potential, Hydrologic Soil Group A. As such, the proposed practice for this site is infiltration based. A soils assessment was conducted at this location on December 27th, 2018. See Appendix E - Top 3 Sites for the soils report.

The proposed retrofit for this location involves rerouting drainage from the site to an infiltration basin in the green space between the front parking lot and Route 15 (see starred location in Figure 11). Note that this basin includes a single row of infiltration chambers at the bottom. The feature will overflow west of the driveway in the location of the existing cross culvert outlet. It is recommended that the proposed Town's Highway Department project be implemented in conjuncture with the Town Office Building project.

The drainage area for this proposed BMP is 5.20 acres (this includes drainage from the Town's Highway Department), approximately 60% of which is classified as impervious. This practice will provide a significant water quality benefit (Table 6) but 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.

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

6.2.2 Pollutant Removal and Other Water Quality Benefits

This practice has the potential to prevent more than 1,228.20 lbs of total suspended solids (TSS) and 8.818 lbs of total phosphorus (TP) from entering receiving waters annually. The design standard used for this retrofit was full infiltration of the ½ water quality volume (1/2WQv, or 0.5" of rain in a 24-hour period), equal to 5,837.03 ft^3 of runoff. See Table 6 for the benefit summary table.

Table 6. Town Office Building benefit summary table.

TSS Removed	1,228.20 lbs
TP Removed	8.818 lbs
Impervious Treated	3.09 acres
Total Drainage Area	5.20 acres

6.2.3 Cost Estimates

The total estimate cost for this project is $63,000. Note that these costs are preliminary. Cost projections can be found in Table 7.

- The cost per pound of phosphorus treated is $7,144.48.
- The cost per impervious acre treated is $20,388.35.
- The cost per cubic foot of runoff treated is $10.79.

Table 7. The initial construction cost projection for the Town Office Building site is included below.

VTRANS CODE	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
		Site Preparation			
N/A	MOBILIZATION	LS	1	$1,000.00	$1,000.00
653.55	PROJECT DEMARCATION FENCE	LF	235	$1.17	$274.95
649.51	GEOTEXTILE FOR SILT FENCE	SY	10	$4.13	$41.30
N/A	CONSTRUCTION STAKING	HR	4	$125.00	$500.00
				Subtotal:	$1,816.25
		Chamber and Basin - Excavation and Materials			
		EXCAVATION			
203.15	COMMON EXCAVATION	CY	415	$9.86	$4,091.90
		MATERIALS			
N/A	MC3500	EACH	6	$400.20	$2,401.20
N/A	MC3500 PLAIN END CAP	EACH	1	$300.15	$300.15
N/A	MC3500 24B END CAP	EACH	1	$404.23	$404.23
N/A	24” N12 for Isolator Row (AASHTO)	LF	20	$80.93	$1,618.51
N/A	601TG to wrap system (SY)	SY	500	$8.30	$4,151.50
N/A	315WTK for scour protection (SY)	SY	500	$7.75	$3,875.00
N/A	Catchbasins to be provided by others	EACH	1	$22.54	$22.54
629.54	CRUSHED STONE BEDDING (3/4” - 1 ½” STONE)	TON	58	$34.04	$1,974.32
		PLANTING (ABOVE CHAMBERS IN GREENSPACE)			
651.15	SEED	LB	10	$7.66	$76.60
653.21	PERMANENT EROSION MATTING	SY	211	$5.40	$1,139.40
651.25	HAY MULCH	TON	0.5	$597.15	$298.58
				Subtotal:	$20,353.92
		New Infrastructure for Conveyance of Runoff to Practice			
		CONVEYANCE DITCH			
203.25	CHANNEL EXCAVATION OF EARTH	CY	24	$13.59	$326.16
613.10	STONE FILL, TYPE I (Energy Dissipator)	CY	2	$43.91	$87.82
		STRUCTURES AND PIPES			
604.18	PRECAST REINFORCED CONCRETE DROP INLET WITH CAST IRON GRATE (SPLITTER/MANIFOLD OR OTHER)	EACH	2	$4,009.29	$8,018.58
601.0915	18” CPEP	LF	75	$64.04	$4,803.00
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	1	$40.30	$40.30
				Subtotal:	$13,275.86
		Roadway Improvements			
203.28	EXCAVATION OF SURFACES AND PAVEMENTS (PAVED ROADS ONLY)	CY	10	$21.94	$219.40
406.25	BITUMINOUR CONRETE PAVEMENT	TON	65	$127.86	$8,310.90

VTRANS CODE	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
616.26	PRECAST REINFORCED CONRETE CURB, TYPE B	LF	40	$36.50	$1,460.00
621.20	STEEL BEAM GUARDRAIL, GALVANIZED	LF	175	$15.93	$2,787.75
				Subtotal:	$12,778.05
	Subtotal:				$48,224.08
	Construction Oversight**	HR	4	$125.00	$500.00
	Construction Contingency - 10%**				$4,822.41
	Incidentals to Construction - 5%**				$2,411.20
	Minor Additional Design Items - 5%**				$2,411.20
	Final Design	HR	40	$125.00	$5,000.00
Total (Rounded to nearest $1,000)					**$63,000.00**

6.2.4 Next Steps

As this site is owned and operated by the Town of Hyde Park, it is recommended that the Town proceed with further design of this retrofit. Further design will involve refinement of the 30% retrofit concept with respect to size, outlet design, and routing to ensure that the target volume can be completely infiltrated and that larger storms bypass the system safely.

6.2.5 Permit Needs

A project readiness screening worksheet has been completed for this project and is included in Appendix H - 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

Permits are not anticipated to meet Act 250, wetlands, river corridor, or lakeshore requirements for this project. Note that a VTrans 1111 permit will be required for final design and implementation.

6.3 Site 3 - Sylvan Hill Rd and Johnson St Ext

6.3.1 30% Concept Design Description

The Sylvan Hill Rd and Johnson St Ext site is located at the intersection of Johnson St Ext and Route 15 in Hyde Park. Presently in the drainage area to the proposed BMP, runoff is generated from Johnson St Ext, Sylvan Hill Rd, Pine Meadow Dr, and Route 15. To the west, stormwater currently sheet flows down Sylvan Hill Rd to the intersection with Johnson St Ext. At the intersection, runoff from both roads flows over the pavement, off the bank north of Sylvan Hill Rd, and into an unnamed tributary of the Lamoille River without any water quality management. There is existing erosion where this drainage runs down the bank. To the east, stormwater runoff from Pine Meadow Dr flows down to a swale along Route 15 and to the culvert inlet located in the depressed green space at the intersection of Johnson St Ext and Route 15.

Soils are mapped as having high infiltration potential, Hydrologic Soil Group B. As such, the proposed practice for this site is infiltration based. A soils assessment was conducted at this location on December 27th, 2018. See Appendix E - Top 3 Sites for the soils report.

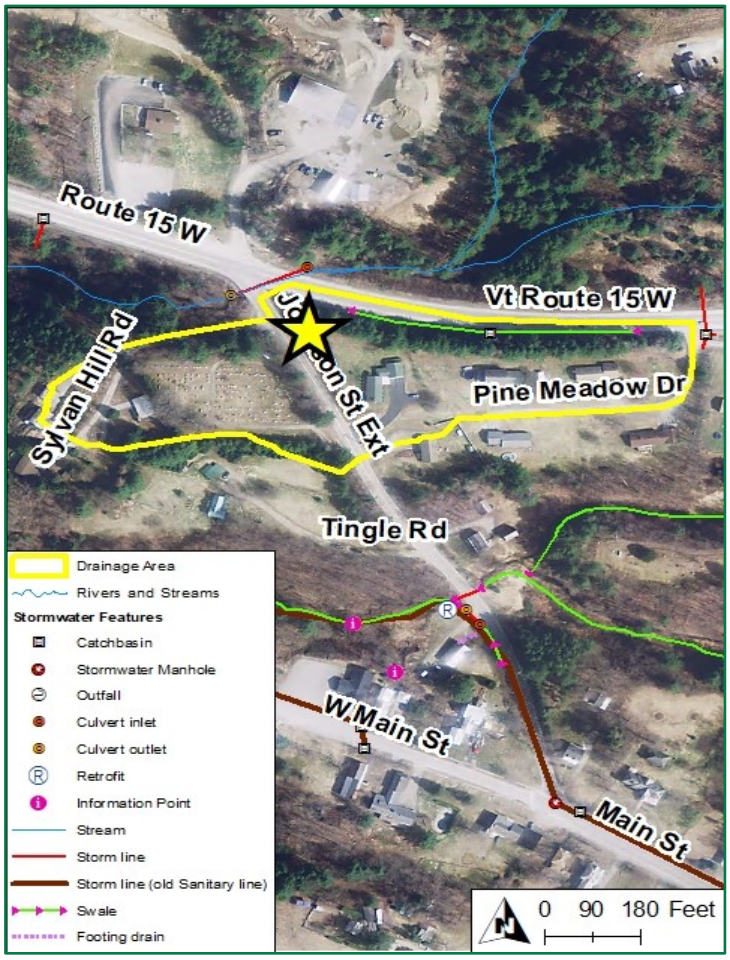

Figure 12. The drainage area for the Sylvan Hill Rd and Johnson St Ext project is shown in yellow. The location of the proposed BMP is shown with a star.

The proposed BMP includes elevating the northern side of Sylvan Hill Rd and adding a stone lined ditch along the southern side. A catchbasin would be installed at the bottom of the road where it intersects with Johnson St Ext. Drainage from both roads would be directed via a single catchbasin to a subsurface storage and infiltration chamber system in the green space across the street at the intersection of Johnson St Ext and Route 15 (see the starred location in Figure 12). A chamber system was determined to be the most appropriate BMP for this location given the site's grading as well as the size of the available green space and the volume of runoff to be treated. This feature would overflow to the west of Johnson St Ext in the location of the existing cross culvert outlet. Note that this system would also treat runoff, collected from Pine Meadow Dr and Route 15, conveyed in the swale along the southern side of Route 15. It is recommended that the eroded bank at the bottom of Sylvan Hill Rd should also be stabilized and revegetated.

The 30% design plan will be provided in Appendix G - 30% Designs.

6.3.2 Pollutant Removal and Other Water Quality Benefits

This practice has the potential to prevent more than 2,162 lbs of total suspended solids (TSS) and 7.011 lbs of total phosphorus (TP) from entering receiving waters annually. The design standard used for this retrofit was full infiltration of the ½ water quality volume (1/2WQv, or 0.5" of rain in a 24-hour period), equal to 4,573.79 ft^3 of runoff. See Table 8 for the benefit summary table.

Table 8. Sylvan Hill Rd and Johnson St Ext benefit summary table.

TSS Removed	2,162 lbs
TP Removed	7.011 lbs
Impervious Treated	1.89 acres
Total Drainage Area	6.40 acres

6.3.3 Cost Estimates

The total estimate cost for this project is $65,000. Note that these costs are preliminary. Cost projections can be found in Table 9.

- The cost per pound of phosphorus treated is $9,271.15.
- The cost per impervious acre treated is $34,391.53.
- The cost per cubic foot of runoff treated is $14.21.

Table 9. The initial construction cost projection for the Sylvan Hill Rd and Johnson St Ext site is included below.

VTRANS CODE	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
		Site Preparation			
N/A	MOBILIZATION	LS	1	$1,000.00	$1,000.00
653.55	PROJECT DEMARCATION FENCE	LF	200	$1.17	$234.00
649.51	GEOTEXTILE FOR SILT FENCE	SY	45	$4.13	$185.85
N/A	CONTRUCTION STAKING	HR	4	$125.00	$500.00
				Subtotal:	$1,919.85
		Chambers - Excavation and Materials			
		EXCAVATION			
203.15	COMMON EXCAVATION	CY	50	$9.86	$493.00
		MATERIALS			
N/A	MC3500	EACH	12	$400.20	$4,802.40
N/A	MC3500 PLAIN END CAP	EACH	4	$300.15	$1,200.60
N/A	MC3500 24B END CAP	EACH	2	$404.23	$808.45
N/A	12” Tee	EACH	1	$80.93	$80.93
N/A	12” Couplers	EACH	3	$8.30	$24.91
N/A	12” N12AASHTO for Manifold	LF	20	$7.75	$155.00
N/A	24” N12 for Isolator Row (AASHTO)	LF	20	$22.54	$450.80
N/A	601TG to wrap system (SY)	SY	1000	$0.84	$840.00
N/A	315WTK for scour protection (SY)	SY	500	$0.72	$360.00
N/A	6” Inserta Tee	EACH	1	$95.00	$95.00
N/A	6” Red Hole Saw	EACH	1	$140.00	$140.00
N/A	12” Inline Drain	EACH	1	$333.50	$333.50
629.54	CRUSHED STONE BEDDING (3/4” - 1 ½” STONE)	TON	145	$34.04	$4,935.80
N/A	6” N12 AASHTO to bring inspection ports to grade	EACH	20	$2.82	$56.40
		PLANTING (ABOVE CHAMBERS IN GREENSPACE)			
651.15	SEED	LB	10	$7.66	$76.60
653.20	TEMPORARY EROSION MATTING	SY	85	$2.20	$187.00
651.25	HAY MULCH	TON	0.25	$597.15	$149.29
				Subtotal:	$15,189.67
		New Infrastructure for Conveyance of Runoff to Practice			
		CONVEYANCE DITCH			
203.25	CHANNEL EXCAVATION OF EARTH	CY	45	$13.59	$611.55
613.10	STONE FILL, TYPE I	CY	28	$43.91	$1,229.48
		STRUCTURES AND PIPES			
604.18	PRECAST REINFORCED CONCRETE DROP INLET WITH CAST IRON GRATE (SPLITTER/MAINFOLD OR OTHER)	EACH	4	$4,009.29	$16,037.16
601.0915	18” CPEP	LF	185	$64.04	$11,847.40
613.11	STONE FILL, TYPE II (Outlet Splash Pad)	CY	8	$42.49	$339.92
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	5	$40.30	$201.50
				Subtotal:	$30,267.01
		Sylvan Rd Guard Rail			

VTRANS CODE	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
621.20	STEEL BEAM GUARDRAIL, GALVANIZED	LF	120	$15.93	$1,911.60
				Subtotal:	$1,911.60
Subtotal:					$49,288.13
	Construction Oversight**	HR	4	$125.00	$500.00
	Construction Contingency - 10%**				$4,928.81
	Incidentals to Construction - 5%**				$2,464.41
	Minor Additional Design Items - 5%**				$2,464.41
	Final Design	HR	40	$125.00	$5,000.00
TOTAL					$65,000.00

6.3.4 Next Steps

As this site is owned and operated by the Town of Hyde Park, it is recommended that the Town proceed with further design of this retrofit. Further design will involve refinement of the 30% retrofit concept with respect to size, outlet design, and routing to ensure that the target volume can be completely infiltrated and that larger storms bypass the system safely.

6.3.5 Permit Needs

A project readiness screening worksheet has been completed for this project and is included in Appendix H - 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

This site should be reviewed by a river scientist prior to final design due to its contribution of point source runoff to a tributary. The project will involve work on the stream bank in order to replace the old existing culvert. This site should also be reviewed by a wetland ecologist prior to final design as the project is located within 100' of mapped hydric soils. Permits are not anticipated to meet Act 250 or lakeshore requirements for this project. Note that a VTrans 1111 permit will be required for final design and implementation.

7 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 Hyde Park and receiving waters. Although designs will only be advanced for the Top 3 projects, this plan also serves to highlight these other opportunities throughout the Town. The momentum developed during this study should be strengthened and continued.

The practices proposed in this study all stand to have a substantial impact on abating water pollution and setting a precedent for integrating GSI in Hyde Park's landscape. It is our recommendation that the Town, in partnership with the LCCD, move to implement the Top 3 practices, but also to move forward with additional design and implementation of other projects presented in this plan (see Appendix I - Projects for Watershed Projects Database for projects identified to the DEC to be inputted into the 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 an implementation grant from this same source. We recommend the following steps in proceeding with this:

- For priority projects being developed to 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.

It is further recommended that a stormwater-specific ordinance be developed for the Town of Hyde Park. Although there is an existing municipal document noting stormwater mitigation efforts in regard to land use and development, a freestanding policy would more clearly define best practices for stormwater management throughout the Town. Additionally, it would make the standards more accessible to Town residents and would be easier to update in response to new research and legislation.

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.

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 (CRW). 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 Appendix A for the web document link.

Regulatory requirements under Act 64 will require management of sites with ≥3 acres of unmanaged and unpermitted (current State stormwater permit) impervious cover. Sites listed on the VT DEC's draft list of 3-acre sites, produced on June 25th, 2019, is provided below in Table 10. Both sites, not including the school, were not assessed as part of this plan due to their location outside of the focus areas and have large concentrations of impervious surfaces. It is recommended that these parcels be assessed for water quality improvements in the future.

Table 10. Unpermitted 3-acre sites

Owner/Permit Name	Location	Permits	Mapped Impervious (acres)
GMTCC-Lamoille UHS	736 Vermont 15 West	4315-9015	11.44
Heath Dennis	360 Ferry Street		3.91
Sterling View Senior Mobile Home Park	Sterling View Road, Oakwood Drive, Pinewood Drive, Redwood Drive	3413-9010.R	12.44