



Stormwater Management Program

City of South Burlington, Vermont

April 26, 2019 (Approved by VTDEC on _____)



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Introduction

This Stormwater Management Program (SWMP) documents the City of South Burlington's strategy to address and reduce the impacts of stormwater runoff. Preparation of this plan is required by the Vermont Municipal Separate Storm Sewer System (MS4) permit number 3-9014 issued by the Vermont Department of Environmental Conservation (DEC) last issued on July 27, 2018. This plan contains all the required elements described in the 2018 Vermont MS4 permit and is intended to minimize the adverse impact that unmanaged stormwater runoff from the City of South Burlington can have on water quality.

Municipal Background

The City of South Burlington is located in the northwest corner of Vermont along the shores of Lake Champlain (Figure 1). The City covers 29.6 square miles and includes numerous commercial enterprises that are critical to Vermont and the region, including the Burlington International Airport. During the 1960's South Burlington was the fastest growing municipality in the State of Vermont. The City has continued to grow since that time, to a population of 18,017 (2010 census data) and is one of Vermont's largest municipalities.

Impacts of Stormwater

The impervious surfaces created by the buildings and pavement that make up South Burlington's developed areas cause rainwater and snowmelt to flow quickly over the landscape rather than soak naturally into the soil. This can lead to: changes in stream flow, increased flooding, damage to private and public property, eroded stream banks, and destruction of aquatic habitat. As runoff flows over impervious surfaces it can collect pollutants such as sediment, petroleum products from automobiles, nutrients from lawn fertilizer, trash, bacteria from pet waste, soaps, detergents, and other chemicals. These pollutants are then carried by runoff to lakes and streams. The combined impacts of hydrologic change in streams and water pollution can have serious negative impacts for water bodies.

Stormwater Utility Description

The City of South Burlington was the first municipality in Vermont to create a Stormwater Utility. The Utility was created in order to address increasing environmental problems and regulatory requirements associated with stormwater runoff. The South Burlington Stormwater Utility (SBSU) is a division of the Department of Public Works (DPW) and its operation is overseen by the Deputy Director of Public Works, who is also designated as the Stormwater Superintendent. The SBSU collects fees from all developed property in the City. This funding is used to manage the City's stormwater program. Additional information on the SBSU can be found on line at www.sburlstormwater.com or by calling (802) 658-7961.



Figure 1 – City of South Burlington Vermont Location Map

Watershed Descriptions

All of South Burlington drains to Lake Champlain (Figure 2). Runoff from the City reaches the lake via the Winooski River and its tributaries, or small streams that drain directly to the Lake (Figure 3).

Watershed	Total Watershed Drainage Area (Acres)	Drainage Area in South Burlington (Acres)	Watershed Impervious Area in South Burlington (Acres)	Total Number of Stormwater Outfalls in the Watershed	Number of South Burlington owned Stormwater Outfalls in the Watershed	303(d) Part D Listed Pollutants	303(d) Part A Listed Pollutants
Bartlett Brook	704	667	147	55	19	Stormwater	
Centennial Brook	884	587	150	36	19	Stormwater	
Englesby Brook	609	91	28	0	0	Stormwater, E. Coli	
Lake Champlain	5,269,760	10,640	75	13	5		
Shelburne Bay						Phosphorous	PCBs
Burlington Bay						Phosphorous	PCBs
Main Lake						Phosphorous	
Muddy Brook	13,594	2,384	269	35	22		
Munroe Brook	3,540	327	26	4	4	Stormwater	
North Brook	218	218	91	0	0		
Potash Brook	4,673	4,511	918	326	113	Stormwater, E. Coli	
Winooski River	691,200	4,436	314	36	26		

Figure 2 - South Burlington Watershed Summary Information

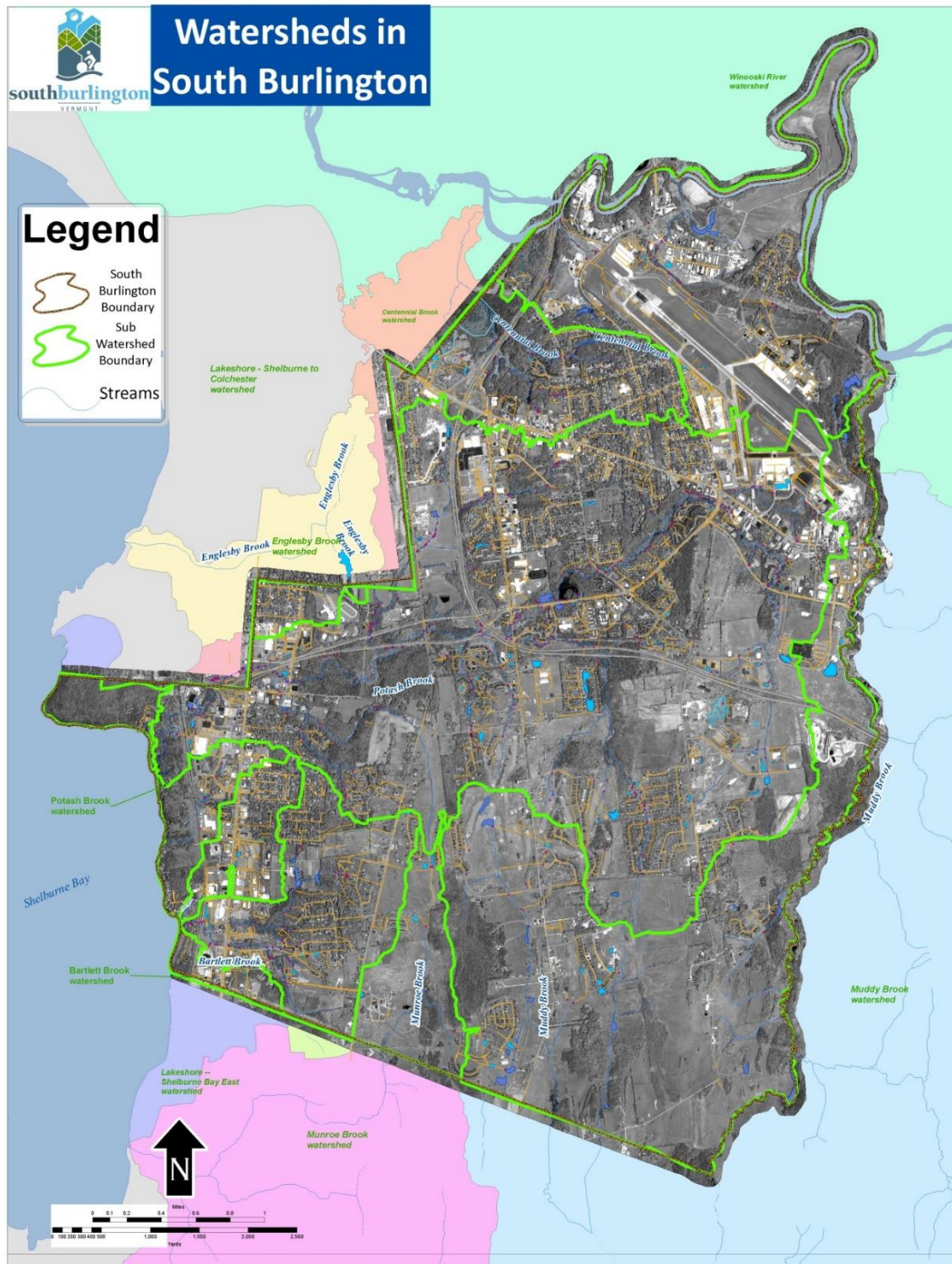


Figure 3 - Map of South Burlington Watersheds

Stormwater Management Program

The MS4 permit is a federally mandated stormwater permit under the National Pollutant Discharge Elimination Systems (NPDES) program. In Vermont, the MS4 permit program is administered by the DEC, which is a division of the Agency of Natural Resources (ANR). The MS4 permit is issued by DEC for a five-year period. The primary mechanism by which the City of South Burlington meets requirements of the MS4 permit is through the activities of the South Burlington Stormwater Utility.

Stormwater Eligible Discharges

The MS4 permit authorizes discharges of stormwater to enter waters of the State and waters of the United States. The following non-stormwater discharges are allowed to co-mingle with discharges of stormwater provided they are not substantial contributors of pollution to the MS4:

- Water line flushing
- Landscape irrigation and lawn watering, provided all pesticides, herbicides and fertilizers have been applied in accordance with the approved label
- Diverted stream flows
- Rising ground waters
- Uncontaminated ground water
- Uncontaminated pumped ground water
- Discharges from potable water sources
- Foundation drains or footing drains where flows are not contaminated with process materials, and to which there are no floor drain, septic wastewater, or grey water connections
- Uncontaminated condensate from air conditioners, coolers/ chillers, and other compressors and from the outside storage of refrigerated gases or liquids
- Irrigation water
- Spring water
- Uncontaminated water from crawl spaces
- Flows from riparian habitats and wetlands
- Discharges from emergency/ unplanned fire-fighting activities
- Fire hydrant flushing
- Incidental windblown mist
- De-chlorinated swimming pool discharges

Any discharge to the City's MS4 that is not contained in the above list, or covered under a separate NPDES permit, will be treated as illicit discharges and dealt with according to requirements of the MS4 permit and regulations established in City ordinance.

Six Minimum Control Measures

Much of the SBSU's time is spent complying with the MS4 permit requirements called the "Six Minimum Control Measures". These measures include:

1. Public Education and Outreach
2. Public Participation/Involvement
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention/Good Housekeeping.

The MS4 permit requires that the City identify Best Management Practices (BMPs) by which it will achieve the goals of each Minimum Control Measure (MCM). The City must also provide a rationale regarding why each BMP was selected and a measurable goal for each BMP.

MCM 1: Public Education and Outreach on Stormwater Impacts

In order to comply with MCM 1, Public Education and Outreach, the City must implement a public education program that distributes educational materials to the community. In order to meet this requirement, the City will take the following steps:

- A. Maintain a website dedicated to stormwater management – The City previously created a website (www.sburlstormwater.com) dedicated to stormwater management in South Burlington. Use of the web site will be continued.
 1. Responsible Parties: SBSU
 2. Rationale: Public education is a key component to any effective stormwater management program. The site has proven to be an excellent way for the City to communicate directly with the public on topics related to stormwater, including updates on stormwater improvement projects. The website provides links to valuable resources for residents, staff, and consultants.
 3. Measurable Goals:
 - a. The City's annual report will contain information on the annual number of website visitors and other web statistics.
 - b. The website provides stormwater project information and updates
- B. Participate in Rethink Runoff – In order to provide education and outreach to the public on stormwater impacts, the City of South Burlington will continue to partner with other area MS4 communities in Rethink Runoff, managed by the Chittenden County Regional Planning Commission (CCRPC). Rethink Runoff is responsible for advertising focused on regional residential stormwater impacts and solutions to mitigate those impacts on water quality. The partnered MS4 communities additionally formed the Chittenden County Stream Team (CCST) in 2011 to act as the outreach and hands-on event arm of the regional education program. CCST educates the

public and gets them involved in hands-on activities through hands-on events within the community. For more information: <http://rethinkrunoff.org/get-involved/get-involved-stream-team>. For further information on the partnership, see the Chittenden County MS4 Stormwater Program Agreement (Appendix A).

1. Responsible Parties: SBSU, CCRPC
 2. Rationale: The intent of Rethink Runoff is to combine the resources of multiple MS4 communities to create and distribute educational materials related to stormwater and reach a more diverse audience than any municipality could reasonably achieve on its own. Support of the campaign will educate the general public in the MS4 area about key storm water quality issues by using TV, radio, online media placements/advertising to drive viewers to the www.rethinkrunoff.org website. Working together also provides a consistent message to the public.
 3. Measurable Goals:
 - a. The City will participate in and provide financial support for operation of the regional Rethink Runoff campaign consisting generally of periodic advertising throughout each year supplemented by a survey of residents every 5 years to track reported behavior with regards to residential stormwater BMPs.
 - b. The City will provide a summary of steering committee activities, website statistics (<http://rethinkrunoff.org/>), and a total of the City's cash contributions to the CCRPC MS4 program on an annual basis.
- C. Provide Technical Assistance for Low Impact BMPs – The City developed a program to identify opportunities for and provide technical assistance related to low impact BMPs to landowners in South Burlington. In May 2009, the City created a Low Impact Development Guidance Manual to support requirements in the Land Development Regulations (LDRs). South Burlington's LDRs require the use of infiltration or LID practices on a City-wide basis. The revised language includes reference to LID and the existing Guidance Manual (available for download at: <http://www.sburstormwater.com/download-material/>). In addition, Rethink Runoff provides on-going education and technical support related to LID practices. The City participates in these programs and makes financial contributions to support this work. Additional information on these programs can be found at <http://rethinkrunoff.org/>.
1. Responsible Parties: SBSU, CCRPC
 2. Rationale: By identifying opportunities for Low Impact BMPs the SBSU can help to maximize infiltration of stormwater runoff, prevent and eliminate soil erosion and minimize the delivery of pollutants to surface waters. There are several organizations and agencies operating in the Chittenden County MS4 region. By providing such links, the visitor can figure out which entity is best suited to provide technical assistance.
 3. Measurable Goals:

- a. Enforce requirements in the City LDRs that require development to use infiltration practices and LID strategies.
- b. Participate in the CCST and RSEP programs.

MCM 2: Public Involvement and Participation

In order to comply with MCM 2, Public Involvement and Participation, the City must implement a public involvement/participation program designed to engage the public in stormwater issues. In order to meet this requirement, the City will take the following steps:

- A. Participate in the Rethink Runoff program - The Rethink Runoff program leverages the resources of multiple communities to create a more engaging public participation program than any single municipality could reasonably achieve on its own. The City will continue to participate on the MS4 steering committee and make payments in accordance with the terms of the Chittenden County MS4 Stormwater Program Agreement (Appendix A). For more information: <http://rethinkrunoff.org/the-stream-team/>.
 1. Responsible Parties: SBSU, CCRPC
 2. Rationale: The Rethink Runoff program offers volunteer opportunities, educational workshops and events in cities, and provides community engagement. These learning opportunities increase public awareness of issues related to stormwater management and build a community of stakeholders. This approach to public involvement is capable of reaching a greater percentage of the public than alternatives such as coordination of public meetings that may be difficult for individuals to attend.
 3. Measurable Goal: The City will report annually on Rethink Runoff activities including the number of volunteers that participated in stormwater related events and a total of the City's cash contributions to the Rethink Runoff program.
- B. Storm drain stenciling program - The City previously established a storm drain stenciling program. As part of this program, metal markers that contain a "No Dumping" or similar water quality message are affixed to the storm drain grates. In some cases, the asphalt adjacent to the storm drain is painted with a similar message. These "stencils" will be installed/painted by SBSU staff and public volunteers whenever possible.
 1. Responsible Parties: SBSU
 2. Rationale: Storm drain stenciling sends a clear message to keep trash and debris, leaf litter, and pollutants out of the storm drain system, and may deter illegal dumping and discharges. Stenciling will increase watershed awareness and stewardship and can be used in any neighborhood with enclosed closed drainage system.
 3. Measurable Goal: The City will continue its storm drain stenciling program and report the number of new "no dumping" labels put in place on an annual basis.

MCM 3: Illicit Discharge Detection and Elimination

In order to comply with MCM 3, Illicit Discharge Detection and Elimination (IDDE), the City must develop, implement, and enforce a program to detect and eliminate non-stormwater discharges that may be entering the MS4. Effective IDDE programs are dynamic and flexible to respond to an ever-changing set of discharge problems, program obstacles, and emerging technologies. At a minimum, the City will maintain and evaluate the IDDE tracking system annually, and modify program components as needed. The results of the efforts will be compiled in the MS4 Annual report. In order to meet this requirement, the City will take the following steps:

- A. Maintain a storm sewer systems map – Knowing the location and type of structures that make up the City’s storm sewer system is critical to its maintenance. The City has developed a Geographic Information System (GIS) based map of stormwater infrastructure located in South Burlington. Included in the database is information pertaining to: storm drains, stormwater piping, stormwater outfalls, and stormwater treatment practices (STPs). The SBSU will continue to maintain and improve this information and make it available upon request.
 1. Responsible Parties: SBSU
 2. Rationale: Knowing the location and type of structures that make up the City’s stormwater system is critical to system maintenance. Having these systems mapped enhances the City’s ability to locate and eliminate illicit connections and discharges.
 3. Measurable Goal: The City’s annual report will contain information on the number of stormwater drainage structures, miles of stormwater conveyance, and stormwater outfalls that are located in South Burlington. Digital versions of the map will be made available upon request.
- B. Enforce existing ordinances regulating non-stormwater discharges to the MS4 – The City’s “Ordinance Regulating the Use of Public and Private Sanitary Sewerage and Stormwater Systems” was last amended on October 18, 2016. The ordinance makes it clear that illicit discharges are not allowed to enter the stormwater system (see Article V Section 5).
 1. Responsible Parties: SBSU
 2. Rationale: The Ordinance provides a framework for inspection and enforcement of illicit discharges to the stormwater system. The Ordinance describes the power and authority of inspectors and enforcement regarding violations, judicial enforcement, and fines that may be recovered by the City (see Appendix J: Stormwater Management Ordinance).
 3. Measurable Goals:
 - a. The City will track the number of illicit discharges encountered and eliminated each year. The information will be made available upon request.
 - b. The City will continue to enforce its existing stormwater ordinance.
 - c. The City will review its existing ordinance and make any updates required by the new permit within 3 years of authorization under the 2018 MS4 permit.

- C. Conduct video inspections of the storm sewer system – The DPW owns equipment that enables us to conduct video inspections of our underground pipe systems. The use of video inspection will assist the City in locating areas likely to have illicit discharges (e.g. areas with older sewer lines) and prioritizing the necessary repairs to alleviate the situation.
 - 1. Responsible Parties: SBSU
 - 2. Rationale: While above ground inspections are still a valuable tool, a proactive underground pipe inspection program will allow the City to find maintenance issues or illicit connections that may otherwise have gone unnoticed until they resulted in a serious problem.
 - 3. Measurable Goal: The City will continue its video inspection program and report the linear feet of stormwater pipe inspected each year.

- D. Conduct stormwater outfall inspections – Evaluating the water at stormwater outfalls allows the City to identify potential locations where illicit discharges may be entering the MS4. The City has developed a program to inspect City owned stormwater outfalls and will continue this program. These inspections are conducted in accordance with procedures outlined in the EPA’s Illicit Discharge Detection and Elimination Guidance Manual (October 2004). An Outfall Inspection summary is completed for each outfall and this information is kept in a GIS database. Should the City determine that there are significant water quality concerns at an outfall it will take proactive steps to identify the source of the problem. This may include video inspection of the upstream system or water sample collection and analysis.
 - 1. Responsible Parties: SBSU
 - 2. Rationale: Regular inspection of stormwater outfalls allows the City to monitor areas of concern. These inspections can target dry weather flows and note potential cold climate indicators of an illicit discharge. Additionally, the City will be able to coordinate management activities to remove illicit connections and track storm drain system maintenance.
 - 3. Measurable Goals:
 - a. The City will inspect no less than 50% of City-owned stormwater outfalls each year and report the number of inspections completed annually.
 - b. Measurable Goals: The City will report the number of outfall samples collected annually. Sample results will be made available upon request.

- E. Inform public employees, businesses and the general public of hazards associated with illegal discharges and improper disposal of waste – The City’s stormwater web site has a section dedicated to detection and elimination of illicit discharges. Information on the site indicates how illicit discharges were successfully eliminated and describes the resulting benefits to water quality.
 - 1. Responsible Parties: SBSU
 - 2. Rationale: Learning about illicit discharges and its effects on our rivers, streams and lakes is an important step in minimizing the pollutants in stormwater. Educating the public on

the impacts of illicit discharges will foster a sense of responsibility and ultimately result in a collaborative approach in the detection and elimination of occurrences.

3. Measurable Goal: The City will dedicate a section on its stormwater website (<http://www.sburlstormwater.com/stormwater-projects/>) to illicit discharge detection and elimination success stories.
- F. Coordination with drinking water suppliers – The Champlain Water District (CWD) operates the potable water system within the City of South Burlington MS4 area. As part of their normal preventative maintenance procedures, the district must annually flush the lines and fire hydrants in the water system. Regular flushing helps ensure the reliability of water system components and that customers receive high quality, sanitary, potable water at their tap. The CWD has BMPs in place to ensure that their maintenance activities will not result in discharges to the MS4 that could contribute to water quality issues. Example BMPs include the use of a hydrant diffuser, dechlorinator and positioning diffusers to prevent erosion when flushing hydrants.
1. Responsible Parties: SBSU
 2. Rationale: Flushing the water lines is necessary to keep the pipes clean and prevent accumulation of silt and tuberculation in the pipes that would be stirred up during a hard use (e.g. firefighting) of the system. This activity ensures reliability of the water system and helps to deliver a quality product. The CWD has BMPs in place to ensure that their maintenance activities will not result in discharges to the MS4 that could contribute to water quality issues.
 3. Measurable Goal: The CWD will continue to use BMPs to prevent pollutants from entering the MS4. Before the end of the permit cycle the City will meet with CWD to review their BMPs relating to discharges of drinking water to the MS4. If necessary, improvements will be made to CWD BMPs.

MCM 4: Construction Site Stormwater Runoff Control

In order to comply with MCM 4, Construction Site Stormwater Runoff Control, the City must develop and enforce a program to reduce pollutants originating at construction sites from entering the MS4. The City recognizes construction site runoff control as a key means of protecting and improving surface water quality in South Burlington. Therefore, the City will assist the ANR in implementing requirements of the Construction General Permit (3-9020) and maintain its own standards related to construction site erosion control. In order to meet this requirement, the City will take the following steps:

- A. Implement local regulations related to erosion control – The City has established standards that address erosion from all construction sites. These requirements are codified in Article 16 (Construction and Erosion Control Standards) of the LDRs. Through this provision in the LDRs, the

City has the authority to issue zoning violations and to pursue enforcement of construction and erosion control non-compliance on sites of all sizes in Vermont Environmental Court.

1. Responsible Parties: SBSU
 2. Rationale: Small construction sites have been shown to contribute as much sediment as large sites on a per acre basis. Determining erosion and sediment control practices in advance of construction is an important step in preventing sediment from entering the MS4. Ensuring that construction contractors working in the City implement and maintain these BMPs is critical to establishing construction practices that include understanding and implementation of erosion prevention and sediment control practices.
 3. Measurable Goal: Enforce the existing LDRs pertaining to Construction and Erosion Control Standards.
- B. Conduct construction site inspections – SBSU staff will be trained in the appropriate use of construction site BMPs and conduct inspections to ensure that construction contractors working in the City are implementing BMPs in compliance with local regulations and any State permits that their project may be subject to.
- a. Responsible Parties: SBSU
 - b. Rationale: Educating contractors and staff about the proper selection, installation, inspection, and maintenance of BMPs will help to ensure compliance with Erosion Prevention and Sediment Control (EPSC) requirements.
 - c. Measurable Goal: The City will report the number of construction site inspections it conducts each year.
- C. Distribute construction BMP handout – The City developed a simple brochure that summarizes local regulations regarding stormwater runoff from construction sites. The brochure also provides information on BMPs for construction sites and identify sources of additional information. See Erosion and Sediment Control South Burlington (Appendix B).
1. Responsible Parties: SBSU
 2. Rationale: Educating contractors about the proper selection, installation, inspection, and maintenance of BMPs will help to ensure compliance with EPSC requirements.
 3. Measurable Goals:
 - a. Measurable Goal: The City will report the number of construction site BMP brochures it distributes each year.
- D. Employee Training – City public works staff shall receive annual training associated with the proper installation and uses of EPSC measures. Employees will additionally receive training pertaining to proper disposal of wastes and invasive species.
- a. Responsible Parties: SBSU
 - b. Rationale: Trainings will help to educate employees in the use and inspection of EPSC requirements.

- c. Measurable Goal: Trainings will be provided on an annual basis. A list of attendees and the number of hours will be documented at the training.
- E. Assist the ANR with implementation of its Construction General Permit (CGP) 3-9020 – The Vermont ANR has issued General Permit 3-9020 for stormwater runoff from construction activities which result in land disturbance of greater than 1 acre. The City will assist ANR with its implementation of this program.
 - 1. Responsible Parties: SBSU
 - 2. Rationale: Through plan review and site inspection, SBSU staff will be aware of the intended outcome of a project and can support the ANR with achieving the goals of the CGP 3-9020.
 - 3. Measurable Goal: When a project will disturb greater than 1 acre of land the City will include in its findings of fact a note that we believe the project requires a State of Vermont Construction General Permit (3-9020). A summary of the projects in South Burlington that will exceed 1 acre of disturbance will be reported each year.

MCM 5: Post Construction Stormwater Management for New Development and Redevelopment

In order to comply with MCM 5, Post Construction Stormwater Management, the City must develop and enforce a program to control stormwater runoff from new and re-development projects. This goal is primarily achieved through the actions of the SBSU and its staff. One of the SBSU's primary functions is to maintain STPs that were installed to manage post-construction stormwater runoff. In order to meet this requirement, the City will take the following steps:

- A. Maintain an updated list of the STPs covered by the City's MS4 permit authorization - The SBSU maintains numerous STPs located throughout the City. All STPs that receive permit coverage under the City's MS4 permit authorization are included in Figure 4. The list included in Figure 4 will be updated as the City assumes responsibility for additional stormwater systems.
 - 1. Responsible Parties: SBSU
 - 2. Rationale: Regular inspection of STPs allows the municipality to better maintain the systems by quickly identifying any concerns such as damage to fences, evidence of burrowing animals, woody growth detrimental to function, erosion, plugged outlet structures, and vegetative maintenance needs.
 - 3. Measurable Goals: The City will report on an annual basis all new STPs for which it has assumed responsibility.

Stormwater Management Program

April 26, 2019 (revision approved by VT DEC on _____)

Stormwater Treatment Practice Name	Street	State Stormwater Permit	SBStrmID	Year SWU Began Maintenance
Butler Farms Pond	Marcy Street	2-0312	Pd0134	2012
Cider Mill Pond 2	Winesap Lane	3144-9010.2	Pd0090	2018
Cider Mill Pond 3	Royal Drive	3144-9010.2	Pd0064	2018
Cider Mill Pond 4	Crispin Drive	3144-9010.2	Pd0062	2018
Cider Mill Pond 5	Braeburn Street	3144-9010.2	Pd0066	2018
Cider Mill Pond 6	Crispin Drive	3144-9010.2	Pd0061	2018
City Hall Bio-Retention Area	Dorset St	2-0909	BR0002	2014
City Hall Underground Infiltration	Dorset St	2-0909	ST0026	2014
Dorset Farms Basin A	Midland Ave	3049-9010.RT	Pd0058	2018
Dorset Farms Basin B	Floral Dr	3049-9010.RT	Pd0057	2018
Dorset Farms Basin C	Catkin Dr	3049-9010.RT	Pd0056	2018
Dorset Park Pond	Swift St	1-1033	Pd0032	2007
Farrel Street Swirl Separator	Farrell St	5080-INDO.R	Sw0001	2008
Farrell Street Bio-Retention	Farrell St	5080-INDO.R	Pd0030	2007
Farrell Street Pond	Farrell St	5080-INDO.R	Pd0029	2007
Gregory Drive Swirl Separator	Gregory Dr	3351-9010	SW0002	2007
Harbor Heights Swirl Separator	Harbor View Road	6294-9030	SW0005	2010
Harbor Heights Underground Storage	Harbor Heights	6294-9030	ST0021	2010
Hayes Avenue Stormwater Detention Basin	Kinsington Street	6553-INDO	Pd0072	2013
Heatherfield Pond 1	Songbird Rd	3658-INDS.A1RT	Pd0065	2018
Heatherfield Pond 2	Songbird Rd	3658-INDS.A1RT	Pd0011	2018
Heatherfield Pond 3	Mockingbird Lane	3658-INDS.A1RT	Pd0098	2018
Heatherfield Offset Pond	Songbird Rd	3864-INDO.R1T	Pd0009	2018
Kennedy Drive Pond 1	Kennedy Dr	1-1582	Pd0042	2007
Kennedy Drive Pond 2	Kennedy Dr	1-1582	Pd0043	2007
Kennedy Drive Pond 3	Kennedy Dr	1-1582	Pd0044	2007
Kennedy Drive Pond 4	Kennedy Dr	1-1582	Pd0045	2007
Kennedy Drive Pond 5	Kennedy Dr	1-1582	Pd0046	2007
Kennedy Drive Pond 6	Kennedy Dr	1-1582	Pd0047	2007
Kennedy Drive Pond 7	Kennedy Dr	1-1582	Pd0048	2007
Mayfair Park Swirl Separator	Mayfair Street	7226-INDO	SW0008	2014
National Guard Avenue	National Guard Avenue	6627-9015	Pd0143	2013
Oak Creek Village Micropool (Pond 1)	Hinesburg Rd	1-0464	Pd0111	2009
Oak Creek Detention Pond 2	Mill Pond Lane	1-0464	Pd0054	2012
Oak Creek Detention Pond 3	Moss Glen Lane	1-0464	Pd0055	2012
Quarry Ridge Pond	Juniper Drive	1-1257	Pd0025	2009
Route 2 Widening STP5200(18)	Williston Road	6676-INDS	IA0025	2015
South Pointe Pond 1	Parkside Road	3443-INDS.R1A	Pd0063	2018
South Pointe Pond 2	Upswept Lane	3443-INDS.R1A	Pd0026	2018
Valley Ridge	Valley Ridge Dr	3301-9010	Swal001	2009
Village at Dorset Park Pond 1	Brand Farm Road	1-0647	PD0172	2018
Village at Dorset Park Pond 2	Brand Farm Road	1-0647	PD0173	2018
Village at Dorset Park Pond 3	Brand Farm Road	1-0647	PD0174	2018
White Rocks Pond	Country Club Drive	4124-9010.R	Pd0050	2012
Winding Brook Pond	Winding Brook Dr	6391-INDS	Pd0041	2010

Figure 4 – Stormwater Treatment Practices Maintained by the City of South Burlington and Covered Under the MS4 Permit

- B. Inspect and ensure the proper maintenance of all STPs covered under the City's MS4 permit authorization –The SBSU will inspect and ensure proper maintenance of all STPs included in Figure 4.
 - 1. Responsible Parties: SBSU
 - 2. Rationale: Regular inspection of STPs allows the municipality to better maintain the systems by quickly identifying any concerns such as damage to fences, evidence of burrowing animals, woody growth detrimental to function, erosion, plugged outlet structures, and vegetative maintenance needs.
 - 3. Measurable Goals:
 - a. The City will ensure proper maintenance of all STPs included in Figure 4. These STPs will be inspected at least twice per year. The City will report the number of inspections conducted on an annual basis. The results of these inspections will be made available upon request.
 - b. The City will track the number of new STPs constructed by the City and the existing STPs that were transferred to the City and report this information annually.
- C. Implement local regulations related to post-construction stormwater management - The City's Land Development Regulations (LDRs) include requirements for stormwater controls to minimize water quality impacts from runoff on projects of any impervious acreage, irrespective of the area disturbed. The City addresses these needs through the following requirements in the LDRs: Article 12 (surface water protection, including stream buffers), Article 14 (site plan review; includes trash management, snow storage areas, and landscaping standards), and Article 16 (construction and erosion control standards). These regulations apply City-wide to all new development, redevelopment and are enforceable in Vermont Environmental Court.
 - 1. Responsible Parties: SBSU
 - 2. Rationale: Through regular plan review, the SBSU will better serve the needs of the community by noting any concerns prior to construction.
 - 3. Measurable Goals:
 - a. Continue to enforce the stormwater management regulations contained in the LDRs.
 - b. The City will evaluate the existing stormwater management requirements included in the LDRs and determine if any changes could be made to improve these regulations. Progress towards this goal will be reported annually.
 - c. City staff will ensure that stormwater management related regulations found in the City's LDRs are properly interpreted and implemented during the City's project approval process.
- D. Assist the ANR with implementation of its stormwater permitting program (3-9015) – The Vermont ANR has issued General Permit 3-9015 that regulates post-construction stormwater

runoff. All projects that create greater than 1 acre of impervious area must obtain permit coverage from the ANR. The City will assist ANR with its implementation of this program.

1. Responsible Parties: SBSU
2. Rationale: Through plan review and site inspection, the SBSU will become more aware of the intended outcome of a project and can support the ANR with achieving the goals of the 3-9015 permit.
3. Measurable Goal: When a project will create greater than 1 acre of impervious area the City will include in its findings of fact a note that we believe the project requires a State of Vermont General Stormwater Permit (3-9015). A summary of projects in South Burlington that will create 1 acre or more of impervious area will be reported each year.

MCM 6: Pollution Prevention / Good Housekeeping for Municipal Operations

In order to comply with MCM6, Pollution Prevention / Good Housekeeping for Municipal Operations, the City must evaluate the systems it has in place to prevent and reduce polluted runoff occurring as a result of municipal operations. The City must also develop and enforce a program to control stormwater runoff from new and re-development projects. In order to meet this requirement, the City will take the following steps:

- A. Proper disposal of animal waste - The City is responsible for cleaning up animal wastes left on City property, when they are not appropriately taken care of by residents. In order to facilitate residential assistance, the City hands out pet waste bags when dog licenses are purchased from City Hall. In addition, City parks and other recreation areas have permanent pet waste bag dispensers and signage reminding residents to pick up after their pets.
 1. Responsible Parties: SBSU
 2. Rationale: Pet waste is one of the many contributors of stormwater pollution that can degrade water quality. During rainfall, pet waste left on lawns, beaches, trails, and sidewalks washes into storm drains or into water bodies. The waste and the pathogens it contains (nutrients, bacteria, parasites, and viruses) can flow directly into streams, lakes and ponds where they can be harmful to human health and the environment. By providing pet waste bags, the City allows pet owners easy access to the materials needed to clean up after their pet. This increases the likelihood of the waste removal before a storm event.
 3. Measurable Goal: The City will report the number of pet waste bags distributed on an annual basis.
- B. Participate in the Municipal Compliance Assistance Program (MCAP) – Municipal facilities are subject to many different state and federal environmental regulations. In order to ensure continued compliance with these regulations the City works with ANR staff in the Environmental Assistance Office to identify shortfalls in current practices and design solutions to address any issues that could result in non-compliance with environmental regulations.

1. Responsible Parties: SBSU
 2. Rationale: By identify shortfalls in existing operations, the overall accomplishments and goals will be strengthened.
 3. Measurable Goal: The City will work with ANR staff and complete an MCAP inspection before the end of the 5-year permit cycle.
- C. Inspection of City Maintained STPs – The SBSU maintains numerous STPs located throughout the City. As part of normal maintenance activities, the City conducts inspections of these STPs to ensure that they are functioning properly. Some of these STPs are subject to State permits that also require inspections. In order to minimize efforts related to duplicative inspection and reporting requirements, inspection information for all City maintained STPs will be relayed to DEC as part of the MS4 annual report.
1. Responsible Parties: SBSU
 2. Rationale: Regular inspection of STPs allows the municipality to better maintain these systems by quickly identifying any concerns such as damage to fences, evidence of burrowing animals or trash, woody growth detrimental to function, erosion, plugged outlet structures, and vegetative maintenance needs.
 3. Measurable Goal: The City will inspect all STPs for which it has maintenance responsibility at least twice a year. The City will report the number of inspections conducted on an annual basis. The results of these inspections will be available upon request
- D. Street sweeping - The Department of Public Works and SBSU are responsible for the maintenance of streets, bike paths, and municipal parking lots within the City. Maintenance of these facilities includes sweeping on a regular basis. The City's current practice is to sweep all curbed roads, curbed paths, and parking lots with curb twice per year. The first sweeping occurs as soon as practicable following snowmelt in the spring. The second occurs as late in the fall as possible to allow for the collection of leaves. Main roads are swept more frequently, as staff time allows or as needed.
1. Responsible Parties: SBSU
 2. Rationale: The debris collected by street sweepers includes many materials that can be hazardous to the environment or our health, such as petroleum products, rubbish, sediment, and green waste. Sweeping the streets on a regular basis reduces the likelihood that these pollutants will enter the City's stormwater systems. Keeping the drains and gutters clear will also reduce the chance of flooding during heavy rain.
 3. Measurable Goal: Sweep all curbed streets, curbed bike paths, and parking lots with curb that the City owns at least twice per year. The total volume of material collected will be reported annually.
- E. Storm drain cleaning – The SBSU is responsible for maintenance of the publicly owned stormwater drainage system in South Burlington. The municipality owns over 3,164 storm drains and 94 miles

of pipe, ditch, or other stormwater conveyance. If the system is not properly maintained it can result in increased pollution and flooding issues.

1. Responsible Parties: SBSU
 2. Rationale: A clean storm drain will more effectively collect stormwater and remove sediment. This minimizes the amount of pollution reaching water bodies and the instances of flooding.
 3. Measurable Goal: The SBSU will clean a minimum of 250 storm drains and the associated piping each year. The total volume of material removed will be reported annually.
- F. Storm drain inspections - The SBSU is responsible for maintenance of the publicly owned stormwater drainage system in South Burlington. Part of the SBSU's established maintenance program includes regular inspection of drainage structures to ensure their proper operation and condition.
1. Responsible Parties: SBSU
 2. Rationale: Properly maintained storm drains can prevent pollution from reaching the waterways by collecting the sediment and debris that washes off the road. When the storm drains sump fills with sediment, any new pollutants entering the drain will continue through the stormwater system and into waterways. Debris may also clog storm drain grates and prevent water from entering the drainage system. Regular inspection allows SBSU to determine which portions of the system require maintenance prior to a storm event.
 3. Measurable Goal: Inspect a minimum of 350 storm drains each year. The total number of storm drains inspected will be reported annually.
- G. Properly dispose of materials collected from street sweeping, pond maintenance, and the stormwater drainage system – The City has developed and implemented procedures for disposing of materials collected from street sweeping, maintenance of STPs, and cleaning of the stormwater drainage system (Appendix C).
1. Responsible Parties: SBSU
 2. Rationale: The sediment collected from storm drains is tested for pollution and hazardous materials before being used as construction fill or treated as hazardous waste. The effort allows the clean material to be reused as opposed to being sent to the landfill.
 3. Measurable Goal: Continue to implement the City's approved procedure for handling of materials collected during street sweeping, maintenance of STPs, and cleaning of the stormwater drainage system.
- H. Employee Training – Municipal operations in the department of public works typically utilize materials that can be harmful to the environment if not properly managed. Public works staff shall receive annual training associated with the correct procedures to prevent the discharge of

sediment, nutrients (e.g. phosphorus) and other harmful contaminants that may be caused through municipal operations.

1. Responsible Parties: SBSU
 2. Rationale: Regular trainings will help to educate public works employees and make them aware of how their various job activities can affect stormwater quality.
 3. Measurable Goal: Trainings will be provided on an annual basis. A list of attendees and the number of hours will be documented at the training.
- I. Minimize winter sand and salt usage – The DPW’s current practice is to manage winter snow and ice with the application of salt products and normal plowing practices. All of the City’s salt trucks have calibrated systems on board to regulate the flow of salt from the trucks. In the winter of 2008, the City began purchasing equipment that allows the use of a liquid chloride salt product. The use of the liquid chloride has been expanded to the entire fleet.
1. Responsible Parties: DPW
 2. Rationale: Treating road salt with liquid chloride mixture prior to spreading on the road reduces the amount of salt lost to scatter (i.e. salt that bounces off the road). In addition, application of liquid chloride reduces the operating temperature of the salt allowing it to work more effectively at lower temperatures. These practices will reduce the total amount of salt needed to achieve similar results. Proper calibration of the equipment is necessary to know how much material is being applied to a roadway, benefiting both the environment and the budget. Calibration of the trucks will subsequently reduce the amount of salt reaching surface waters.
 3. Measurable Goal: The salt delivery systems on plow trucks will be calibrated at the beginning of each winter to ensure proper application rate of salt products.
- J. Phosphorus Fertilizer Use: The city will prohibit the use of any phosphorus containing fertilizer on municipally controlled parks and recreational fields unless warranted by a current (within previous 18 months prior to application) soil test. If P-fertilizer is used to supplement turf that is shown to be deficient in phosphorous, a copy of the soil test will be submitted with the annual reports. If the City is establishing grass or turf via seed or sod procedures, a phosphorous fertilizer that is labeled as starter fertilizer and is intended for application to turf may be utilized. This application will be limited to the first growing season.
1. Responsible Parties: DPW
 2. Rationale: Simple management practices will help to reduce the amount of phosphorous runoff from municipal properties and reduce the discharge of phosphorous to our waterways.
 3. Measurable Goal: Soil tests will be submitted with the annual report as applicable.

Municipally Operated Industrial Facilities

Multi-Sector General Permit (MSGP) is a federally mandated National Pollutant Discharge Elimination System (NPDES) permit that covers new and existing discharges of stormwater from industrial facilities. Industrial facilities conduct activities and use materials that have the potential to impact the quality of Vermont's waters. The permit requires facilities to examine potential sources of pollution, implement measures to reduce the risk of stormwater contamination, and test stormwater discharges for sources of pollution. The City owns two facilities that are subject to the MSGP:

- Bartlett Bay Wastewater Treatment Plant (4889-9003.R)
- Airport Parkway Wastewater Treatment Plant (4888-9003.R)

These facilities have obtained coverage under the MSGP. Management of these facilities is the responsibility of the City's Wastewater Superintendent. Stormwater Utility staff provides assistance as appropriate.

Discharges to Impaired Waters

Lake Champlain- Burlington Bay and Shelburne Bay

Both of the above-mentioned Bays have documentation and data indicating impairment and do not meet VT Water Quality Standards according to the methodology described in the VT Surface Water Assessment and Listing Methodology. Burlington and Shelburne Bay are recognized as having elevated levels of polychlorinated biphenyl (PCB), impacting allowable fish consumption. Establishing a TMDL is listed as "low" on the state's schedule. The Response Plan to this impairment includes implementing the Phosphorous Control Plan for Lake Champlain and implementing the municipal road standard.

TMDL Implementation

Impaired waters are those waters that the Secretary of ANR has identified as not meeting Vermont Water Quality Standards. Once a waterbody is designated as impaired, the State of Vermont lists it on the Vermont “303(d) Part A list” and submits this information to the U.S. Environmental Protection Agency (EPA). In some cases, ANR will prepare a Total Maximum Daily Load (TMDL) for an impaired waterbody. A TMDL is a calculation of the maximum amount of a particular pollutant that a waterbody can receive and still meet water quality standards. These waterbodies are then moved to the “303(d) Part D list”.

Flow Restoration Plan (FRP)

The City of South Burlington has developed FRPs for the following stormwater impaired watersheds: Bartlett Brook, Centennial Brook, Englesby Brook, Munroe Brook, and Potash Brook. FRPs are included in this Stormwater Management Plan as follows:

- Bartlett Brook Flow Restoration Plan – Appendix D
- Centennial Brook Flow Restoration Plan – Appendix E
- Englesby Brook Flow Restoration Plan – Appendix F
- Munroe Brook Flow Restoration Plan – Appendix G
- Potash Brook Flow Restoration Plan – Appendix H

Schedule of Compliance

Part 8.1.C of the 2018 MS4 permit requires that the City shall implement all measures necessary to achieve the flow restoration targets in the TMDLs no later than December 5, 2032. Each FRP contains an implementation schedule that ends before this date.

Annual Reporting

The City will submit an annual report to the Vermont ANR on or before April 1 of each year. The report will detail the City’s efforts over the previous calendar year and include the following information:

- The status of the City’s compliance with MS4 permit conditions
- An assessment of the appropriateness of the BMPs identified in the SWMP
- A report on progress towards implementation of the BMPs identified in the SWMP
- A report on the progress of FRP development and implementation
- A summary of stream flow monitoring data in the stormwater impaired watersheds
- A summary of stormwater activities that the City plans to undertake during the next reporting cycle (i.e. calendar year)
- Proposed changes to the City’s approved SWMP
- Notice that the City is relying on another entity to satisfy permit obligations.

Flow Monitoring

Part 8.1.D of the 2018 MS4 permit requires that the City prepare a plan for flow monitoring in stormwater impaired streams. The City currently is under contract with Vermont DEC to monitor 9 stormwater impaired watersheds in Chittenden County and St. Albans. There are 16 individual sites

monitoring precipitation, stream flows or both, three of which are within South Burlington's borders. In the 2018 MS4 permit cycle, the City will:

- Continue working with the consultant selected by DEC to conduct stream flow monitoring.
- Sign an MOU with Vermont DEC related to paying for stream flow monitoring services.
- Continue to make payments to Vermont DEC as outlined in the signed MOU.
- The City, in collaboration with DEC stormwater section staff, will continue to evaluate the data collected as part of the stream flow monitoring MOU.

Stream Corridor Protection

South Burlington protects stream buffers through regulations included in the City's LDRs. Section 12.01 of the South Burlington Land Use Regulations lists buffer requirements for surface waters. These requirements vary depending upon the surface water affected and are enforced by the Department of Planning & Zoning. Individuals must keep a certain distance away from streams and are not allowed to remove trees, or disturb the buffer area during development of their property. The following is a summary of the conditions:

Surface Water	Distance (feet) from centerline
Muddy Brook	100
Potash Brook (except Queen City Park zone)	100
Winooski River	100
Minor streams	50
Drainage way	10
Lake Champlain	150
Queen City Park	See Article 12.01 (D) in LDRs

In addition to regulations limiting the activities allowed in stream buffers, the SBSU offers credits for individuals who maintain a buffer around streams. All properties in the City pay a monthly fee to the Stormwater Utility. This fee is based on the amount of impervious surface area found on the property. The Stormwater Utility offers a 10% fee reduction if a property meets the Stream Buffer Credit requirements.

Lake Champlain Phosphorus Control Plan

All of South Burlington drains to Lake Champlain. Vermont's 303(d) Part D list of impaired waters indicates that Lake Champlain is impaired due to excessive Phosphorus (P). On June 17, 2016, the state of Vermont established a P TMDL for Lake Champlain. This TMDL requires a 20.2% reduction in P discharged to Shelburne Bay and the Main Lake. It requires a reduction of 24.2% for discharges to the Burlington Bay Lake segment.

During this MS4 permit cycle, South Burlington will develop a Phosphorous Control Plan (PCP) for City owned properties. At a minimum, the PCP will be designed to achieve a level of phosphorus reduction equivalent to the percent reduction target for developed land in the associated TMDL lake segment.

The PCP will adhere to the following schedule:

April 1, 2019	- Submit the first Annual PCP Report
April 1, 2020	- Submit the Annual PCP Report and the Implementation Table with results of the Road Erosion Inventory (REI)
April 1, 2021	- Complete the Phosphorus Control Plan (PCP) and submit it to the Secretary - Submit the Annual PCP Report
April 1, 2022 and every year thereafter	- Submit Annual PCP Report
No later than June 17, 2036	- Complete full implementation of the approved PCP

Figure 5 – PCP Implementation Table

An annual PCP report will be submitted to DEC on April 1 of each year. The reports shall address actions taken by the City to implement all PCP components, including:

- Extent of implementation of the Municipal Roads Standards and any necessary updates to the PCP Implementation Table,
- Extent of street sweeping and catch basin cleaning,
- Extent of stormwater BMP implementation,
- An estimate of the extent of remaining items requiring completion,
- An assessment of the ability to meet outstanding schedule items, and
- A written statement, signed by a designer acceptable to the Secretary, that any structural BMP built or implemented within the preceding six-month period was constructed in compliance with the approved plans.

Municipal Road Requirement

The Municipal Roads General Permit is intended to achieve significant reductions in stormwater-related erosion from municipal roads, both paved and unpaved. The City of South Burlington will implement a customized, multi-year plan to stabilize the road drainage system. The plan will include bringing road drainage systems up to basic maintenance standards, and additional corrective measures to reduce erosion as necessary to meet a TMDL or other water quality restoration effort.

Road Erosion Inventory (REI)

The City of South Burlington has initiated a Road Erosion Inventory (REI) of all hydrologically-connected road segments within the municipality. The REI is intended to verify which municipal road segments are hydrologically connected, and identify which of those segments meet the operational standards

required under this permit. The municipal road segments are broken down into the following categories: Gravel and Paved Roads with Ditches, Paved Roads with Catch Basins, and Class 4 Roads. Beginning in 2019, an Annual MRGP compliance update will be submitted by April 1st. The Initial Road Erosion Inventory and Implementation Table will be submitted by April 1, 2019. A minimum of 15% of non-compliant segments will be upgraded to meet the standards by 2021 and 2022.

Implementation Table

The City will record the REI scoring information in the Implementation Table and prioritize road segments for upgrades to meet the standards of the 2018 MS4 Permit Subpart 8.3.C. The municipality shall submit the MRGP Implementation Table on April 1, 2020. The Table shall include:

- The planned road upgrades for the first permit term.
- Updates pertaining to the segments brought up to standards.
- Itemization of the segments to be brought up to standard within the next year.

Road Stormwater Management Standards

The City will utilize the minimum required BMPs applicable to all hydrologically-connected municipal roads. The City will be responsible to maintain all practices after installation. If the feasibility affects the implementation of the standards, the City will document the instance in the MRGP Implementation.

Monitoring, Record Keeping, and Reporting

Monitoring

When the SBSU conducts monitoring of illicit discharges pursuant to subpart 6.2.3 of the 2018 MS4 permit, all records of monitoring information shall include:

- The date, exact place, and time of sampling or measurements;
- The names(s) of the individual(s) who performed the sampling or measurements;
- The date(s) analyses were performed;
- The names of the individuals who performed the analyses;
- The analytical techniques or methods used; and
- The results of such analyses.

Record Keeping

The SBSU shall retain all records required by this permit, including records of all monitoring information, copies of all reports required by this permit, a copy of its authorization and amended authorizations under this permit, and records of all data used to complete the application (Notice of Intent) for this permit, for a period of at least three years from the date of the sample, measurement, report, or application. The City will submit its records to the Secretary when specifically asked to do so. The City will retain a copy of the SWMP required by this permit, and a copy of the permit language, at a location

accessible to the Secretary. All records, including the Notice of Intent and SWMP, will be available to the public on the City website, or in writing if requested.

Annual Report

The permittee shall submit an annual report that evaluates the permittee's compliance with the minimum control measures. The permittee shall submit its annual reports to the DEC, Watershed Management Division, Stormwater Management Program by April 1st each year, and upon receipt, the DEC shall post each annual report on its website. FRP and PCP reports shall be included with the annual report. In addition to any FRP and PCP reporting requirements, the annual report shall include all annual reporting requirements under Parts 4, 5, and 6 of this permit as well as:

- The status of the progress, compliance and assessment towards achieving TMDL requirements;
- Results of information collected and analyzed, if any, during the reporting period,
- A summary of the stormwater activities to be undertaken during the next reporting cycle,
- A change in any identified BMPs or measurable goals for any of the minimum measures, and
- Notice that the City is relying on another entity to satisfy some of its permit obligations, if applicable.

Amendments

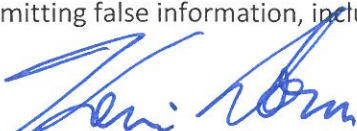
Amendments or changes to the City's SWMP will be made in writing to ANR and contain the signatures of appropriate SBSU staff. These changes may occur at any time, but efforts will be made to coordinate these requests with scheduled reporting activities. Appendix I contains a summary of amendments made to the City's 2019 SWMP.

Individual Responsible for Implementation

The South Burlington City Manager is ultimately responsible for implementation of the City's SWMP. The Stormwater Superintendent, Deputy Director of Public Works, Director of Public Works, City Health Officer, Director of Planning and Zoning, and Wastewater Superintendent are responsible for various subcomponents of the plan, but through the City Manager's overall authority.

Signatures

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."



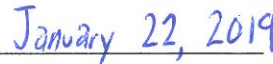
Kevin Dorn
City Manager



Date



Thomas J. DiPietro Jr.
Deputy Director of Public Works / Stormwater Superintendent



Date

Appendix A – Chittenden County MS4 Stormwater Program Agreement

**CHITTENDEN COUNTY MS4
STORMWATER PROGRAM AGREEMENT
EFFECTIVE July 1, 2017
Amended effective July 1, 2018**

Preamble

This Stormwater Program Agreement ("Agreement") is entered into by and between a group of Municipal Separate Storm Sewer System ("MS4") permittees ("MS4 Permittees") and the Chittenden County Regional Planning Commission ("CCRPC") to operate an MS4 Stormwater Program ("Program") that conforms with and satisfies the relevant requirements of both Minimum Control Measure One (Public Outreach and Education) and Minimum Control Measure Two (Public Involvement and Participation) of the Phase II NPDES Permit issued by the Vermont Department of Environmental Conservation ("DEC") on December 2012 through General Permit 3-9014 ("MS4 Permit"), as these requirements may be continued, renewed, amended, or otherwise modified during the term of this Agreement.

1. **Prior Agreements** – Effective July 1, 2017, this Agreement
 - a. supersedes an MOU signed by the CCRPC and twelve MS4 permittees, effective March 10, 2013 through March 9, 2018, governing the operation of a Regional Stormwater Education Program to satisfy the relevant requirements of Minimum Control Measure One (Public Outreach and Education), and
 - b. supersedes an MOU signed by the CCRPC and eleven MS4 permittees, effective July 1, 2011 through June 30, 2016, and an amendment to this MOU extending its effective date through June 30, 2017, governing the operation of a Regional Stormwater Public Involvement and Participation Program to satisfy the relevant requirements of Minimum Control Measure Two (Public Involvement and Participation).
2. **Service Agreement** – This Agreement constitutes a service agreement pursuant to 24 V.S.A. § 4345b (Intermunicipal Service Agreements).
3. **Definitions**—For purposes of this Agreement, the term "MS4 Permittees" includes the Vermont Agency of Transportation, which on December 28, 2016 became eligible for coverage under General Permit 3-9007 for Stormwater Discharges from the State Transportation Separate Storm Sewer System (TS4).
4. **Parties** – The following are the parties to this Agreement:
 - a. **MS4 Permittees** – the undersigned MS4 Permittees, and
 - b. **CCRPC** – the undersigned regional planning commission.
5. **MS4 Steering Committee**
 - a. **Composition** – The Members of the Steering Committee shall consist of one representative from each of the signatory MS4 Permittees to this Agreement. Another MS4 permittee may request

to join this Agreement if approved by a two-thirds vote of the Members. The Members shall be appointed either by the governing bodies of their municipalities at publicly warned meetings or, if a Member representing an MS4 Permittee is non-municipal agency, via a process consistent with that agency's policies. At its first meeting, the Steering Committee shall elect a Chair by a majority vote. The Chair shall serve until such time as the Chair resigns or the Steering Committee elects a new Chair.

- b. **Duties** – The Steering Committee shall direct the CCRPC on the development and performance of Program Services in particular and on all other matters bearing on the administration of this Agreement. All actions of the Steering Committee shall be by majority vote unless otherwise specified in this Agreement.
- c. **Organization of Meetings** – The Steering Committee shall meet on a quarterly basis at a minimum. The CCRPC shall provide Steering Committee Members with reasonable notice of meetings. Notice shall include a meeting agenda and draft meeting minutes. In addition, the CCRPC shall post notice of Steering Committee meetings on its website and on the Program website.

6. **CCRPC**

- a. **Duties** – The CCRPC shall:
 - 1) Administer this Agreement and agreements with contractors (including executing contracts approved by the Steering Committee, receiving and disbursing funds, and monitoring the provision of services) for the benefit of the MS4 Permittees.
 - 2) Provide other services contributing to the operation of the Program (including, but not limited to, social media management, public relations, grant writing, creating and managing a Program website, organizing meetings as set forth in Section 4.c, above, etc.) as directed by the Steering Committee; and at a level consistent with each year's Program Budget as described in Section 8.b, below.
 - 3) Provide a quarterly budget report to the Steering Committee detailing expenses the CCRPC incurred and the payments it has received.
 - 4) Pay contractors and vendors for charges consistent with the relevant contract, using funds from the Program Budget, as defined in Section 8, below.
 - 5) Upon approval of the Steering Committee or its designee, reimburse itself for personnel and other expenses for charges consistent with its duties, using funds from the Program Budget.
 - 6) Consult with the Steering Committee prior to authorizing any contractor activities or charges outside the scope of work of a contract.
 - 7) Notify the Steering Committee when 75% of the annual budget (as defined in Section 8, below) for an individual category of expenses (e.g., contractors, CCRPC fees, advertising, etc.) is reached. When these levels are reached, subsequent expenditures by the CCRPC in that category shall be reviewed and approved by the Steering Committee Chair in advance.

- 8) At the request of the Steering Committee, assign any or all contracts that the CCRPC has entered into pursuant to this Agreement to the MS4 Permittees who are signatories to this Agreement at the time or to another contractor of the Steering Committee's choosing.
- 9) Comply with all applicable federal, state, and local laws, including Burlington's Livable Wage Ordinance as applicable.
- b. **Compensation** – Through the Program Budget, the MS4 Permittees shall compensate the CCRPC for the actual costs of performing its duties defined in Section 5.a, above; provided, however, that the CCRPC shall not be entitled to compensation that would exceed ten percent (10%) of the Program Budget as specified in Section 8.b, below, without the prior approval of a majority of the Steering Committee.
- c. **Invoices** – The CCRPC shall invoice the Program to cover personnel charges, mileage reimbursement, and other direct expenses necessary to perform its duties. Personnel charges for CCRPC staff shall be calculated at a rate of salary plus fringe plus CCRPC's applicable indirect rate as required by 24 V.S.A. § 4345b. As set forth in Section 5.b, above, upon approval of the Steering Committee or its designee, the CCRPC may reimburse itself for charges consistent with its duties, using funds from the Program Budget.

7. Selection of Contractors

- a. The CCRPC, in consultation with the Steering Committee, shall competitively bid for contract(s) for Program services that collectively satisfy the requirements for Minimum Control Measure One (Public Outreach and Education) and Minimum Control Measure Two (Public Involvement and Participation) of the Phase II NPDES Permit then in effect. The parties to the contracts shall be the contractors and the CCRPC. All contracts shall require the contractor to indemnify and hold harmless the MS4 Permittees from any claims related to the contract and to procure and maintain liability insurance for all services performed under the contract.
- b. All contracts shall be awarded based on qualifications, price, and the ability of the entity to provide services that meet the relevant MS4 Permit requirements. The selection of contractors shall comply with the procurement policy of the CCRPC and with applicable state and federal procurement laws and procedures.
- c. Contracts shall generally be 1 to 5 years in length and shall include, but not be limited to, a Maximum Limiting Amount and the right of the CCRPC to 1) cancel a contract if services are not being adequately provided, 2) specify that payments to contractors shall be made only for services rendered, 3) specify the annual scope of work and budget as approved by the Steering Committee, 4) allow a contract extension if desired, and 5) assign the contract to the MS4 Permittees that are signatories to this Agreement at the time of the assignment or to a contractor of the Steering Committee's choosing.
- d. Contracting for services under this Agreement shall comply with the Fair Employment Act and Americans with Disabilities Act: the CCRPC shall comply with the requirement of Title 21 V.S.A Chapter 5, Subchapter 6, relating to fair employment practices, to the full extent applicable. The CCRPC shall also ensure, to the full extent required by the Americans with Disabilities Act of

1990, that qualified individuals with disabilities receive equitable access to the services, programs, and activities provided by the Steering Committee under this Agreement. This provision shall also be included in all contracts and subcontracts executed under this Agreement.

- e. The CCRPC and the Steering Committee recognize the important contribution and vital impact which small businesses have on the State's economy. In this regard, the CCRPC shall ensure a free and open bidding process that affords all businesses equal access and opportunity to compete, except under circumstances where competitive bidding may not be practicable and is not required by applicable procurement policies. The CCRPC and the Steering Committee also recognize the existence of businesses owned by minorities and women, and the CCRPC shall make a good faith effort to encourage these firms to compete for contracts involving state or federal funds and comply with applicable law relating to civil rights and disadvantaged business enterprises.
8. **Program Services** – The Steering Committee, assisted by the CCRPC and its contractors, shall implement a unified Program that satisfies the relevant requirements of Minimum Control Measure One (Public Education and Outreach) and Minimum Control Measure Two (Public Involvement and Participation) of the MS4 Permit.

The Program Content for each Program Year shall be as defined in writing by a majority of the Steering Committee. The Program Year shall be the State of Vermont's fiscal year. The Program Content shall implement the following deliverables:

- a. **Public Education and Outreach** – Elements shall include, at a minimum:
 - 1) operating the Program's website, www.smartwaterways.org, or its equivalent; and
 - 2) advertising in various media.
 - b. **Public Involvement and Participation** – Elements shall include, at a minimum:
 - 1) operating the Program's website, www.ccstreamteam.org, or its equivalent;
 - 2) hosting and/or organizing workshops, projects, and other events to engage the public; and
 - 3) recruiting volunteers to support projects, promote events, and/or engage the public.
 - c. **End of MS4 permit year annual reporting** – Elements shall include preparation of a narrative report 25 business days prior to the MS4 Permittees' reporting deadline to DEC.
9. **Program Dues, Budget, Costs, and Payments**
- a. **Dues**
 - 1) For State Fiscal Year, FY18, July 2017-June 2018, the annual dues for each of the undersigned MS4 Permittees shall be \$5,500.

- 2) For the following fiscal years, the annual dues shall be set by a two-thirds majority by October 15th of the preceding calendar year. In the absence of agreement, the dues shall remain at \$5,500.
- 3) The CCRPC shall invoice each MS4 Permittee on or about July 1st of each year with payment to the CCRPC due 30 days later.
- 4) All Members shall pay equal dues.

b. Program Budget

- 1) The annual Program Budget shall consist of the sum of the annual payments for each Program Year made by MS4 Permittees, plus any funds from other sources made available to the Program by majority vote of the Steering Committee.
- 2) Prior to the start of each Program Year, the Steering Committee shall adopt a Program Budget governing expenditures for the subsequent Program Year. Budget categories shall include, but not be limited to: CCRPC Duties, Contractual Services, and Expenses.
- 3) Once the Program Year starts, a majority of the Steering Committee may amend the Program Budget as needed, for example to reflect any surplus or deficits from the prior Program Year, receipt of new sources of funds, or a desired change in the Program Budget, subject to Section 8.a, above.
- 4) In the event that costs are less than anticipated or that grants or other funding sources become available, a majority of the voting Members of the Steering Committee may decide to reduce each Member's payment by an equal amount or to credit all or part of the following Program Year assessment to each MS4 Permittee.

- c. **Maximum Annual Costs and Payments** – Except as otherwise provided by this section, each MS4 Permittee shall within 30 days of receipt of an invoice make a single annual dues payment, as provided by Section 8.a, above.
- d. **Other Funds** – Any funds made available to the Program shall be dedicated to reducing the annual costs of each MS4 Permittee participating in the Program, except as a majority of the voting Members of the Steering Committee may decide.
- e. **Excess Funds** – Any funds remaining at the end of a Program Year shall be carried over to the next Program Year, unless a majority of the voting Members of the Steering Committee decides otherwise.
- f. **Non-appropriation** – The obligations of each MS4 Permittee to make payments under this Agreement shall constitute a current expense of the MS4 Permittee and shall not in any way be construed to be a debt of the MS4 Permittee in contravention of any applicable constitutional or statutory limitation or requirement, or the MS4 Permittee's charter or articles of incorporation; nor shall anything contained in this Agreement constitute a pledge of the credit or tax revenues, funds, or monies of the MS4 Permittee. The decision whether or not to budget and appropriate funds during each fiscal year of the MS4 Permittee is within the discretion of the governing body

of the MS4 Permittee. The obligations of a MS4 Permittee under the Agreement are subject to annual appropriations by the governing body of the MS4 Permittee, except as provided by Section 12 of this Agreement. An MS4 Permittee cannot choose to not appropriate funds and then withdraw in a manner that shifts prior contractual obligations on to the others. Non-appropriation will be considered withdrawal and must be prospective in fairness to all signatories as per Section 13.

10. **Contract Approval** – All CCRPC contracts shall be conditioned upon approval by a majority of the voting Members of the Steering Committee and shall be consistent with Section 6, above.
11. **Termination of CCRPC** – The CCRPC on its own or the Steering Committee by a majority vote of its full Membership may elect to terminate the CCRPC's future participation in this Agreement by providing 90 days' written notice to the other. In the event of termination under this section, the CCRPC shall continue to administer and comply with each existing contract, and the MS4 Permittees shall continue to reimburse the CCRPC from the Program Budget for the actual costs of administering and complying with each contract, as provided by this Agreement, unless and until the CCRPC assigns the contract pursuant to Sections 5.a.8 and 6.c of this Agreement.
12. **Termination of Agreement**
 - a. This Agreement shall become null and void with no further obligation of the parties if:
 - 1) Two-thirds of the Members of the Steering Committee vote to end participation, or
 - 2) DEC determines that the Program outlined in this Agreement does not meet the relevant requirements for Minimum Control Measure One (Public Education and Outreach) or Minimum Control Measure Two (Public Involvement and Participation), and the parties to this Agreement are unable to craft a Program to satisfy DEC.
 - b. In the event of termination, any funds remaining in the Program Budget (after payment of obligations to vendors or to satisfy debts) shall be reimbursed to the MS4 Permittees with each MS4 Permittee receiving a share proportional to the number of MS4 Permittees at the time of termination. For example, if there are twelve MS4 Permittees at the time of termination, each MS4 Permittee shall receive a 1/12th share.
13. **Withdrawal of Member** – An MS4 Permittee may withdrawal from participation in this Agreement only at the end of a state fiscal year. If an MS4 Permittee wishes to withdrawal from participation, it shall provide at least 90 days' notice to the other MS4 Permittees and the CCRPC. After withdrawal, a MS4 Permittee shall remain responsible for its share of the costs of contracts that the Steering Committee approved prior to the effective date of the withdrawal.

14. **Effective Date and Duration of Agreement** – The effective date of this Agreement shall be July 1, 2017, and this Agreement shall terminate June 30, 2022.
15. **Amendment** – This Agreement may be amended only upon unanimous action of all the Members.
16. **Counterparts** – This Agreement may be executed in multiple counterparts, each of which is deemed an original and all of which constitute one and the same document. Each such counterpart may be a facsimile or PDF copy, and such facsimile or PDF copy shall be deemed an original.
17. **Public Records** – Any and all records submitted to the CCRPC or MS4 Permittees - including Bids, Proposals, Qualifications, Contracts, etc.-- whether electronic, paper, or otherwise recorded, are subject to the Vermont Public Records Act.

Signature of CCRPC

 5/24/18
 Christopher D. Roy, Board Chair, Chittenden County Regional Planning Commission Date

Signatures of Members

_____ Name	_____ Title	The Burlington International Airport	_____ Date
_____ Name	_____ Title	The City of Burlington	_____ Date
_____ Name	_____ Title	The Town of Colchester	_____ Date
_____ Name	_____ Title	The Town of Essex	_____ Date
_____ Name	_____ Title	The Village of Essex Junction	_____ Date
_____ Name	_____ Title	The Town of Milton	_____ Date

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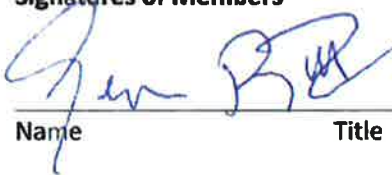
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Signature of CCRPC

Christopher D. Roy, Board Chair, Chittenden County Regional Planning Commission Date

Signatures of Members

 Director of Aviation 3-28-18

Name Title The Burlington International Airport Date

Name Title The City of Burlington Date

Name Title The Town of Colchester Date

Name Title The Town of Essex Date

Name Title The Village of Essex Junction Date

Name Title The Town of Milton Date

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Signature of CCRPC

Christopher D. Roy, Board Chair, Chittenden County Regional Planning Commission Date

Signatures of Members

Name Title The Burlington International Airport Date

S. Chapin Spencer - Director
Name Title The City of Burlington Date 4/9/18

Name Title The Town of Colchester Date

Name Title The Town of Essex Date

Name Title The Village of Essex Junction Date

Name Title The Town of Milton Date

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Signature of CCRPC

Christopher D. Roy, Board Chair, Chittenden County Regional Planning Commission Date _____

Signatures of Members

Name	Title	Date
	The Burlington International Airport	

Name	Title	The City of Burlington	Date
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Sarah H. Francis Town Manager Town of Colchester 3/27/18
Name Title The Town of Colchester Date

Name	Title	The Town of Essex	Date
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Name	Title	The Village of Essex Junction	Date
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Name	Title	The Town of Milton	Date
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Signature of CCRPC


Christopher D. Roy, Board Chair, Chittenden County Regional Planning Commission Date _____

Signatures of Members

Name Title The Burlington International Airport Date _____

Name Title The City of Burlington Date _____

Name Title The Town of Colchester Date _____

 *Public Works Director*
Name Title The Town of Essex Date 4-11-18

Name Title The Village of Essex Junction Date _____

Name Title The Town of Milton Date _____

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Signature of CCRPC

Christopher D. Roy, Board Chair, Chittenden County Regional Planning Commission Date _____

Signatures of Members

Name Title The Burlington International Airport Date _____

Name Title The City of Burlington Date _____

Name Title The Town of Colchester Date _____

Name Title The Town of Essex Date _____

 _____
Name Title The Village of Essex Junction Date 4/13/2018

Name Title The Town of Milton Date _____

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Signature of CCRPC

Christopher D. Roy, Board Chair, Chittenden County Regional Planning Commission Date _____

Signatures of Members

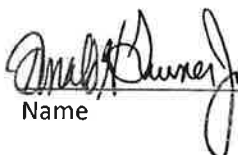
Name Title The Burlington International Airport Date _____

Name Title The City of Burlington Date _____

Name Title The Town of Colchester Date _____

Name Title The Town of Essex Date _____

Name Title The Village of Essex Junction Date _____

 _____
Name Title Town Manager Date 5/8/18
The Town of Milton

Joe Colangelo Town Manager The Town of Shelburne

6-March-2018

Date

Name Title The City of South Burlington _____
Date

Name Title Vermont Agency of Transportation _____
Date

Name Title The University of Vermont _____
Date

Name Title The Town of Williston _____
Date

Name Title The City of Winooski _____
Date

Name Title The Town of Shelburne

Date

Helen Rieker Chair

Name Title The City of South Burlington

4/2/18
Date

Name Title Vermont Agency of Transportation

Date

Name Title The University of Vermont

Date

Name Title The Town of Williston

Date

Name Title The City of Winooski

Date

Name	Title	The Town of Shelburne	Date
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Name	Title	The City of South Burlington	Date
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Joe Flynn	e-Signed by Joe Flynn on 2018-04-02 12:47:56 GMT		April 02, 2018
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Name	Title	Vermont Agency of Transportation	Date
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Name	Title	The University of Vermont	Date
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Name	Title	The Town of Williston	Date
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Name	Title	The City of Winooski	Date
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Name	Title	The Town of Shelburne	Date
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Name	Title	The City of South Burlington	Date
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Name	Title	Vermont Agency of Transportation	Date
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Linda Seavey
Linda Seavey, Director, Campus Planning Services

The University of Vermont

3/28/2018
Date

Name	Title	The Town of Williston	Date
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Name	Title	The City of Winooski	Date
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Name	Title	The Town of Shelburne	Date
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Name	Title	The City of South Burlington	Date
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Name	Title	Vermont Agency of Transportation	Date
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Name	Title	The University of Vermont	Date
------	-------	---------------------------	------

Richard McGuire	Town Manager	The Town of Williston	3/21/18
Name	Title		Date


Name	Title	The City of Winooski	Date
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Name	Title	The Town of Shelburne	Date
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Name	Title	The City of South Burlington	Date
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Name	Title	Vermont Agency of Transportation	Date
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Name	Title	The University of Vermont	Date
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Name	Title	The Town of Williston	Date
 Jessie Baker - City Manager	City Manager	The City of Winooski	3/23/18 Date

Appendix B – Erosion and Sediment Control South Burlington

Don't Dump Paint Down the Drain!



The South Burlington Sewer and Stormwater Ordinance prohibits the discharge of any non-stormwater liquids into storm drains. Paint can be recycled for free at the Chittenden Solid Waste District (CSWD). Other waste liquids (stain, automobile fluids, urethanes, etc) should be sealed, labeled, and properly disposed to prevent spilling and contamination.

Contact CSWD at (802) 872-8111 for information regarding the proper disposal of waste liquids.

Winter Requirements

Plant grass before September 15th in order to ensure that it has enough time to grow and stabilize the soil on your construction site.

If construction will continue after October 15th, disturbed areas must be covered in mulch at the end of each work day when precipitation is forecast within 24 hours.

CONSTRUCTION SITE CLEAN UP

Keep your site clean! At the end of each day, sweep or vacuum all dirt and debris that is deposited on pavement and sidewalks. Try to avoid using water to wash down the site. If water is required, the water must be collected or directed to a grassed area for infiltration. Don't discharge dirty water to storm drains or water bodies!



Dumpsters should not be left uncovered.

Keep dumpster lids closed to prevent rain from filtering through the trash and leaching pollutants out of the dumpster. Storing material next to a dumpster can allow for trash and sediment to be carried away by rainwater.



www.sburlstormwater.com

Email: SWstaff@sburl.com

Phone: (802) 658 - 7961



Erosion & Sediment Control South Burlington

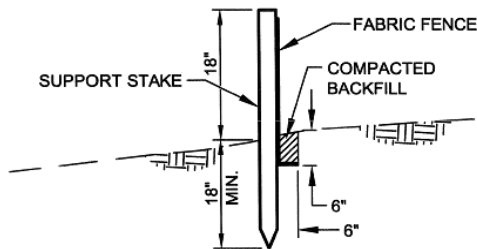
How to manage stormwater runoff during your construction project.

Install Erosion Control Measures

All construction projects are required to comply with City Regulations that prohibit the discharge of sediment laden runoff (dirty water) from leaving the site or reaching waterbodies (the lake, streams, wetlands, etc). Below are some techniques that can be used to meet this requirement.

INSTALL SILT FENCE

Install silt fence downhill of your construction site, around stockpiles, and before waterways to contain sediment.



Once installed silt fence must be maintained until grass is growing and the site is stabilized.



This silt fencing was not properly maintained, resulting in failure and discharge of polluted stormwater to the City's waterways.

More information on erosion control can be found online:
www.sburlstormwater.com/stormwater-resources/

INSTALL CHECK DAMS

Install stone check dams in drainage ditches or channels on steep slopes to slow water down and prevent erosion.



The dams should span the width of the channel and be spaced so that the bottom (toe) of the upstream dam is at the same elevation of the top (crest) of the next downstream dam.

PREVENT VEHICLES FROM TRACKING DIRT OFFSITE

Clean dirt and mud from construction equipment before it leaves the site and install stabilized construction entrances at the site using filter fabric topped with 8 inches of stone.



Tracking of dirt and mud onto City streets is subject to penalty.

COVER STOCKPILED MATERIALS

Make sure that stockpiled material (e.g. top soil) is covered with a tarp or straw matting. This will prevent the material from washing offsite during heavy rain.



ESTABLISH GRASS

Bare soil erodes up to 100x faster than forested land. Stabilize exposed soil by establishing grass growth as soon as possible! If the disturbed area will be exposed for more than two weeks, cover it with mulch.



Phosphorous (P) is a nutrient found in many fertilizers. Phosphorous is a major contributor to algae blooms in Lake Champlain. If you are seeding a new lawn, or want to learn more about your lawn's nutrient content, take a soil test. Research by UVM has shown that Chittenden County lawns had enough phosphorous (P) and only needed a nitrogen (N) fertilizer. Only apply fertilizer once/year and look for a "zero" phosphorous fertilizer on the bag!

Appendix C – Procedure for Handling Material Collected During Street Sweeping, Catch Basin and Stormwater Pipe Cleaning, and Stormwater Pond Maintenance

Procedure for Handling Material Collected During Street Sweeping, Catch Basin and Stormwater Pipe Cleaning, and Stormwater Pond Maintenance

City of South Burlington Department of Public Works

Prepared on June 7, 2016

Introduction

The City of South Burlington Department of Public Works (DPW) regularly uses a vacuum assisted street sweeper to remove sediment and debris from all curbed streets in the City. The DPW also uses a vacuum truck to clean stormwater drainage pipes and remove accumulated sediment from catch basin (a.k.a. storm drain) sumps. In addition, DPW staff is responsible for maintaining stormwater detention ponds on City property. Pond maintenance includes the removal of accumulated sediment from these ponds and their associated forebays.

Regular completion of these activities is a requirement of the City's Municipal Separate Storm Sewer System (MS4) permit, which is administered by the State of Vermont Agency of Natural Resources (ANR) Department of Environmental Conservation (DEC). Once collected, materials removed from streets and catch basin sumps are regulated under the Solid Waste Management Rules promulgated by the Vermont ANR DEC. Materials removed from stormwater treatment ponds are not regulated by the Vermont ANR DEC. This procedure provides South Burlington DPW employees with guidelines for the storage, handling, testing, and disposal of these materials.

Storage

All materials collected during street sweeping, stormwater pipe cleaning, catch basin cleaning, and pond maintenance activities will be stored at the DPW facility at 104 Landfill Road. Materials collected during street sweeping will be stored in a separate pile from materials collected during stormwater pipe and catch basin cleaning activities. Materials collected during pond maintenance will be combined with the materials collected during catch basin cleaning. Any collected material that shows obvious signs of pollution will be stored in a separate pile so that it does not contaminate the presumably "clean" piles collected during normal maintenance activities. These materials will also be tested separately from the presumably "clean" materials.

The material storage area will be maintained to ensure that collected materials do not become a source of pollution. Piles will be confined using concrete barriers, silt fence, and hay bails to ensure that sediment laden runoff does not leave the storage area.

Testing

Materials collected as part of street sweeping activities do not require testing before they can be used as indicated below. Prior to use, these materials must be screened to remove any trash collected as part of street sweeping. The screen used must be 2" or smaller. After screening, these materials will be moved to a fill pile maintained by the DPW at a separate location. During transport, DPW staff will measure the amount of material collected for reporting in the City's MS4 annual report submitted to Vermont ANR DEC.

Materials collected as part of stormwater drainage pipe and catch basin cleaning must be tested for Volatile Organic Compounds (VOCs) using either EPA method 8021B or 8260B prior to being used as indicated below. A composite sample will be collected from the pile of collected

materials and sent to a lab for analysis. Results will be compared to the Primary Groundwater Quality Standards (enforcement standards) located in Appendix A of the Vermont ANR DEC Groundwater Protection Rule and Strategy. Using the EPA methods described above, the lower detection limits for some of these compounds in soil samples does not reach the levels specified in the Groundwater Rule (e.g. the lower detection limit for benzene in a soil sample is 13 ug/Kg and the Groundwater Standard is 5 ppb). A sample whose result is at the lower detection limit of the methods specified will be considered a “non-detect” (e.g. if the results of lab analysis indicate that the amount of benzene in the soil sample is <13ug/Kg, which is below the analysis’ lower detection limit in soil, then it will be assumed that the sample meets the standard of 5 ppb)

Materials removed from stormwater ponds as part of normal maintenance activities are not regulated by the Vermont ANR DEC. Between 2011 and 2016 the City tested these materials separately and found no reason to believe that this material contained higher levels of pollution than the materials that accumulate in catch basin sumps. However, since these materials will be mixed with the materials collected from catch basins they will be tested as part of that process.

Materials that are below the thresholds identified in the Groundwater Projection Rule will then be screened to remove trash using a 2” or smaller screen. After screening, these materials will be moved to a fill pile maintained by the DPW at a separate location. During transport, DPW staff will estimate the amount of material collected for reporting in the City’s MS4 annual report submitted to Vermont ANR DEC.

Materials will be screened, tested, and moved to a separate fill pile as necessary to ensure that the material storage area has enough space for new materials. The storage area is currently able to store about one year’s worth of collected materials.

Procedure for Material Containing VOCs

Materials tested using EPA method 8021B or 8260B that show VOC levels exceeding the Groundwater Quality Standards in the Vermont Groundwater Protection Rule will be moved to a separate location for storage. Compost, manure or another material high in organic matter will be blended into collected materials and they will sit for a minimum of 6 months before being re-tested. These piles will be “turned” regularly during this time. If these materials fail a second test they will be turned and blended again. A third test will take place at least a year from the second failed test. If the third fails, these materials will be landfilled.

Use of Collected Material

Once screened and tested, all materials can be used as common fill by the DPW or others who receive permission from the DPW. Alternatively, these materials can be blended with other materials (e.g. compost, manure) to create top soil or tree planting material for use by the DPW or others who receive permission from the DPW.

Policy Review and Schedule for Update

This plan will be updated as necessary to comply with State regulation, or to fit changing circumstances at the DPW facility. At a minimum, this policy will be reviewed once every 5 years when the City’s Stormwater Management Plan is revised as part of the MS4 permit application.

Appendix D – Bartlett Brook Flow Restoration Plan



BARTLETT BROOK FLOW RESTORATION PLAN

City of South Burlington, Vermont

October 1, 2016
Updated January 2019

Updated by:
City of South Burlington
104 Landfill Road, South Burlington, VT 05403



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- Appendix 1: BMP Summary Sheets
- Appendix 2: Table A-3-1: BMPDSS Modeling Run Summary

Appendix 3: Map of BMPs Included in the Bartlett Brook Flow Restoration Plan
Appendix 4: Table A-5-1: BMP Ranking Criteria Key, Table A-5-2: Scoring Key
Appendix 5: Bartlett Brook Watershed BMP Design and Construction Schedule
Appendix 6: Bartlett Brook Expired Permit List

I. Disclaimer

The Bartlett Brook FRP was prepared to meet the compliance requirement under the National Pollutant Discharge Elimination System (NPDES) General Permit 3-9014 (VTDEC 2012) for stormwater discharges to impaired waters for the Bartlett Brook impervious surface owners (the City of South Burlington, the Vermont Agency of Transportation (VTRANS) and the Town of Shelburne).

1. Executive Summary

This Flow Restoration Plan (FRP) for the Bartlett Brook watershed was developed in accordance with requirements in the Municipal Separate Storm Sewer System (MS4) General Permit #3-9014 (2018). On July 27, 2018 the Vermont Department of Environmental Conservation (VTDEC) approved an update to the MS4 General Permit (3-9014), at which time the Bartlett Brook FRP became part of the Stormwater Management Plans (SWMP) prepared by the MS4 permittees in the Bartlett Brook watershed. This includes the City of South Burlington, the Town of Shelburne, and the Vermont Agency of Transportation (VTrans). The Bartlett Brook FRP acts as a guidance document for the MS4 entities as they implement stormwater Best Management Practices (BMP's) over a twenty (20) year timeframe from 2012 to 2032, in the effort to return Bartlett Brook to its attainment condition.

Development of the Bartlett Brook FRP was an iterative process that utilized the Vermont Best Management Practice Decision Support System (BMPDSS) model maintained by VTDEC. This model was created by VTDEC and its partners as part of the initial Total Maximum Daily Load (TMDL) development. The BMPDSS model allows the user to add, remove, or modify information related to the existing and proposed stormwater BMPs in the watershed. The BMPDSS then predicts the impacts that these changes will have on stream flow. In 2002, the Vermont Department of Environmental Conservation (VTDEC) provided a "Baseline Condition" BMPDSS model for Bartlett Brook. This version of the BMPDSS model, also referred to as the Pre-2002 model, included all stormwater Best Management Practices (BMPs) that existed in the watershed prior to 2002 and provided an estimated stream flow during the 1-year storm event. The goal of the FRP, as established in the Bartlett Brook TMDL¹, is to reduce stream flow by 33.0% during this target storm event.

In February 2014, at the request of the City of South Burlington, the Chittenden County Regional Planning Commission (CCRPC)² completed a study to estimate the expected non-jurisdictional impervious area growth³ in the Bartlett Brook watershed over the next 20 years. The original TMDL assumed a non-jurisdictional impervious growth of 50 acres, whereas the CCRPC study estimated 5.7 acres based on the actual non-jurisdictional growth rate from 2003 to 2010. The revised future growth reduced the high-flow target (Q0.3%) from 33.0% to 11.6%.

The BMPDSS Baseline Condition model was provided to the City and updated to include all BMPs that were constructed in the watershed after 2002. This version of the model became known as the "Existing Condition", or Post-2002, model run. Finally, existing BMPs were evaluated to determine if they could be retrofit to provide improved treatment and detention

¹ Vermont Department of Environmental Conservation (VT DEC). 2007. Total Maximum Daily Load to Address Biological Impairment in Bartlett Brook (VT05-11).

² Chittenden County Regional Planning Commission (CCRPC). 2014. Non Jurisdictional Impervious Surface Analysis for the Bartlett Brook Watershed.

³ "Non-jurisdictional" refers to new imperious surfaces where the parcel's total impervious area is less than one acre and not required to obtain a State stormwater permit.

of stormwater runoff and new BMPs were added to the BMPDSS model until the required stream flow reduction target was achieved. This version of the model became known as the “Proposed Condition” model, or Credit Model run⁴.

The current Proposed Condition BMPDSS model run that exceeds the required reduction in stream flow during the 1-year storm event currently includes a total of 12 proposed sites, along with 13 Baseline Condition BMPs and 19 Existing Condition BMPs. The Proposed Condition model was assessed with the BMPDSS software, and determined to address 126% of the modified TMDL high-flow target (Q0.3%). The total cost for implementation of the proposed plan is estimated at \$2,426,000.

The final list of proposed BMPs were ranked based on best value and feasibility. The MS4 permit requires that the BMPs identified in the FRP be constructed within 20 years of the effective date of the 2012 MS4 permit, which results in a December 5, 2032 deadline. The MS4s involved in the Bartlett Brook FRP worked together to develop an implementation schedule for Bartlett Brook. BMPs that are currently covered by expired State of Vermont stormwater permits were included at the front of the schedule, so that the associated properties could complete the required stormwater improvements and achieve permit compliance. Other BMPs located on land owned or controlled by the MS4 entities were given priority over those that were located on private property. The remaining projects were scheduled based on their ability to contribute to stream flow reductions, cost effectiveness, and constructability.

A financial plan was also developed in conjunction with the implementation schedule. The City of South Burlington has been financing the required stormwater BMPs by utilizing funds raised by stormwater utility fees, State and Federal grants, as well as low interest loan programs.

2. Background

Bartlett Brook is currently on the State of Vermont’s impaired waters list (EPA 303(d)) with the primary pollutant determined to be stormwater runoff. In the effort to restore Bartlett Brook and lift its impaired designation, a flow-based Total Maximum Daily Load (TMDL) was developed for Bartlett Brook. This TMDL requires reductions in stormwater flows during high flow conditions. Increases in stream baseflow were also recommended, but are not required under the TMDL. The flow targets are the basis for the FRP, developed in accordance with the Municipal Separate Storm Sewer System (MS4) General Permit Subpart IV.C.1 as a required part of the MS4s Stormwater Management Program (SWMP).

The purpose of this Flow Restoration Plan (FRP) is to outline a plan for the retrofit of existing impervious surfaces with stormwater management Best Management Practices (BMPs) (e.g. gravel wetlands, infiltration basins, etc.) to meet the TMDL flow targets. The TMDL required that watershed hydrology must be controlled in the Bartlett Brook Watershed to reduce high

⁴ Refer to original Bartlett Brook Flow Restoration Plan dated October 1, 2016 for additional detail on the iterative process to identify proposed projects.

flow discharges, in order to restore degraded water quality and achieve compliance with the Vermont Water Quality Standards (VWQS).

Three (3) MS4's including the City South Burlington, Town of Shelburne, and the Vermont Agency of Transportation (VTRANS) own impervious cover within the Bartlett Brook impaired watershed.

2.1 TMDL Flow Targets

In response to Bartlett Brook not meeting the Vermont water quality standards, it was placed on the list of impaired waters in accordance with Section 303(d) of the Federal Clean Water Act. The VTDEC developed TMDLs for impaired watersheds using flow as a surrogate for pollutant loading.⁵ The basis for the TMDL development was the comparison of modeled Flow Duration Curves (FDCs) between impaired and attainment watersheds. The Program for Predicting Polluting Particles Passage through Pits, Puddles, and Ponds, Urban Catchment Model (P8) was used to develop FDCs from which a normalized high flow and low flow per drainage area in square miles (cfs/sq.mi.) were extracted. FDCs were developed for both impaired and attainment streams and the relative difference between the two was used to establish the flows needed to restore the stream's hydrology.⁶

The high flow point on the FDC for Bartlett Brook was initially modeled at 11.35 cfs/mi² and the mean value of the high flow point on the FDCs for the selected attainment streams was established at 10.27 cfs/mi². In order to meet the attainment target of 10.27 cfs/mi², a 9.5% high-flow reduction was calculated for Bartlett Brook. This 9.5% reduction in high flow was allocated between Urban/Developed lands and Agriculture/Open lands, with an 8.8% high flow reduction assigned to Urban/Developed lands.

The TMDL also assumed a non-jurisdictional growth of 50 acres of impervious surfaces. After rerunning the P8 model, the high flow point on the Bartlett Brook FDC increased from 11.35 to 14.11 cfs/mi². The resulting 2.76 cfs/mi² increase projected from the 50 acres of non-jurisdictional growth resulted in a secondary 24.4% reduction from the 11.35 high point on the Bartlett Brook FDC. The entire 24.4% reduction was allocated to Urban/Developed lands, resulting in a 33.2% total high flow reduction target for Urban/Developed lands in the Bartlett Brook TMDL.

As part of the FRP development, the Chittenden County Regional Planning Commission (CCPRC) completed a study that revised the non-jurisdictional growth estimate from 50 acres to 5.7 acres of non-jurisdictional growth, based on the actual non-jurisdictional

⁵ Vermont Department of Environmental Conservation (VT DEC). 2007. Total Maximum Daily Load to Address Biological Impairment in Bartlett Brook (VT05-11).

⁶ "Stormwater Modeling for Flow Duration Curve Development in Vermont" (Tetra Tech, 2005).

growth rate from 2003 to 2010. The resulting revised future growth analysis reduced the high flow target from 33.20% to 11.6%.

Table 1: TMDL flow targets and modified target with revised future growth

Flow Target	Target High Flow Q 0.3 (± %) Reduction
TMDL Target (Stormwater allocation only)	-8.80
TMDL Target with 50 acres of Non-Jurisdictional Future Growth	-33.20
TMDL Modified Target with 5.7 acres of Non-Jurisdictional Future Growth*	-11.60
* Modified target was calculated as: $-(8.8\%) + (-24.4\%)(5.7 \text{ ac}/50 \text{ ac}) = -11.60\%$	

2.2 MS4 Permit Background and Requirements

On December 5, 2012, Vermont's revised MS4 Permit was issued. Included in the 2012 MS4 permit issuance were requirements for municipalities to develop FRPs to implement the stormwater TMDLs. The FRPs were required to be developed for each impaired watershed by October 1, 2016, and include the following elements:

- 1) An identification of the required controls
- 2) A design and construction schedule
- 3) A financial plan
- 4) A regulatory analysis
- 5) The identification of regulatory assistance, and
- 6) Identification of any third party implementation.

The schedule required implementation of the BMPs as soon as possible, but no later than 20 years from the effective date of the 2012 permit; before December 5, 2032. In 2018 the State revised the MS4 Permit to include additional requirements to address the Lake Champlain Phosphorous TMDL. As part of the permit renewal, each MS4 was required to submit an updated Notice of Intent (NOI) and Stormwater Management Program (SWMP), including updated Flow Restoration Plans.

3. BMPDSS Model

In an effort to implement the Vermont Stormwater TMDLs, the VTDEC worked with an external consultant (TetraTech) to develop the computer-based VT Best Management Practice Decision Support System (BMPDSS), a VT-specific hydrologic BMP assessment model. This modeling tool was developed by TetraTech, Inc., with considerable investment from EPA Region 3 and Prince

George's County, Maryland, and was adapted for use in Vermont using funding from the Vermont Agency of Natural Resources (ANR). The purpose of the modeling tool was to predict progress toward the TMDL flow targets based on proposed BMP implementation scenarios to help MS4 communities identify different BMP options and associated costs.

The information for each BMP entered into the BMPDSS model includes: drainage area, storage volume, outlet control structures and geographic location. The remaining data needed to calculate flow simulations is built into the model and includes: topography, soil types, impervious cover, and rainfall data.

3.1 Baseline Condition Model (Pre-2002)

The Baseline Condition Model includes all stormwater treatment practices in the Bartlett Brook watershed that existed prior to 2002. The purpose of this model was to quantify the flows in the stream prior to beginning the Flow Restoration Planning process and establish a baseline from which to measure.

The Baseline Condition Model includes 16 BMPs. A summary table of the existing BMPs is included in (Table 2). The BMPDSS modeling run results show an unadjusted high flow of 18.46 cfs. The high flow reduction target is an 11.6% reduction in high flow from the Baseline Condition Model of 18.46 cfs.

Table 2: BMPs Included in the Baseline Condition Model for the Bartlett Brook Watershed

BMP ID	BMP Name	BMP Type	Permit #
BBZ056	Irish Farm Pond A	Pond	1-1404a
BBZ012	Irish Farm Pond B	Pond	1-1404b
BBZ057	Irish Farm Pond C	Pond	1-1404c
BBZ014	Pinnacle at Spear Pond A	Pond	1-1155a
BBZ015	Pinnacle at Spear Pond B	Pond	1-1155b
BBZ021	Champ Carwash	Pond	1-0523/ 6280-9030
BBZ019	Willie Racine Jeep West Pond	Pond	3121-9010
BBZ020	Willie Racine Jeep East Pond	Pond	3121-9010

BBZ022	Smart Suites Pond	Pond	1-1372/ 6296-9030
BBZ023	Smart Suites East	Infiltration Trench	1-1372/ 6296-9030
BBZ024	Smart Suites West	Infiltration Trench	1-1372/ 6296-9030
BBZ025	Oil n' Go	Swale	n/a
BBZ026	Overlook at Spear Pond 1	Pond	2-0261
BBZ027	Overlook at Spear Pond 2	Pond	2-0261
BBZ028	Overlook at Spear Pond 3	Pond	2-0261
BBZ029	Overlook at Spear Pond 4	Pond	2-0261

3.2 Existing Condition Model (Post-2002)

The Existing Condition Model includes all existing BMPs in the Baseline Condition Model, as well as the addition of any BMPs that have been constructed since 2002 in the Bartlett Brook watershed. The purpose of the model is to show current flows in Bartlett Brook. This allows the State and MS4 communities to track progress toward the high flow attainment target.

On a routine basis, the Existing Condition BMPDSS model is revised to include any recently constructed BMPs, including BMPs designed and constructed by the MS4s, as well as BMPs constructed as part of commercial development and redevelopment. Additionally, the Existing Conditions Model is updated to reflect any changes to existing BMPs, such as revised drainage areas, modification of outlet control structures, or changes in storage volumes. The results of the Existing Condition Model are compared to the Baseline Condition Model to determine if the 11.6% reduction in high flow has been achieved.

The current Existing Condition Model (model run date 1/7/2019) contains 36 BMPs, including 16 from the Baseline Model, along with an additional 20 BMPs that have been constructed since 2002. A summary table of the existing BMPs is included in (Table 3). The BMPDSS modeling run results show an Unadjusted High Flow of 16.97 cfs, which is an 8.07% reduction in high flow from the Baseline Condition Model of 18.46 cfs.

Table 3: BMPs Included in the 1/7/2019 Existing Condition Model For the Bartlett Brook Watershed

BMP ID	BMP Name	BMP Type	Permit #
Baseline BMPs (16)	Varies	Varies	Varies
BB003	Bartlett Brook Central	Gravel Wetland	1-0202 & 2-0120
BBZ030	Shearer Chevrolet	Pond	3003-INDS
BBZ031	Farm Stand Condominiums	Pond	4827-INDS
BBZ032	South Village Phase 1 Pond 1	Pond	4096-INDS
BBZ033	South Village Phase 1 Pond 2	Pond	4096-INDS
BBZ03	South Village Phase 1 Pond 3	Pond	4096-INDS
BBZ004	BBSTS	Pond	n/a
BBZ036	Harbor Heights Condominiums	Underground Storage	6294-9030
BBZ037	Bay Court Condominiums	Pond	6294-9030.1
BBZ038	South Pointe	Pond	3443-INDS
BBZ039	68 Nesti Drive	Swale/Pond	6281-9030
BBZ042	Bartlett Brook Apartments Dry Swale 1	Dry Swale	7365-INDS
BBZ043	Bartlett Brook Apartments Dry Swale 2	Dry Swale	7365-INDS

BBZ044	Bartlett Brook Apartments Dry Swale 3	Dry Swale	7365-INDS
BBZ045	Bartlett Brook Apartments Bioretention	Bioretention	7365-INDS
BBZ046	Bartlett Brook Apartments Infiltration Trench	Infiltration Trench	7365-INDS
BBZ047	Bartlett Brook Apartments Infiltration Basin	Infiltration Basin	7365-INDS
BBZ048	25 & 27 Green Mountain Drive Infiltration Basin 1	Infiltration Basin	3017-INDS.T
BBZ049	25 & 27 Green Mountain Drive Infiltration Basin 2	Infiltration Basin	3017-INDS.T
BBZ035	South Village Phase 2	Dry Detention Basin	4096-INDS.1A

3.3 Proposed Condition Model (Credit)

The Proposed Condition Model (model run date 1/7/2019) includes all BMPs in the Existing Condition Model, which in turn includes all BMPs from the Baseline Condition Model, as well as a collection of proposed BMPs that can achieve the high flow reduction target in the Bartlett Brook watershed. The iterative process of developing the list of proposed BMPs is detailed further in the original Bartlett Brook FRP, dated October 1, 2016.

The Proposed Condition Model includes 12 new BMPs including four (4) retrofits to existing BMPs with expired permits, eight (8) new stormwater treatment practices. Credit toward the flow target is also provided by all BMPs from the Existing Condition Model that were constructed after 2002.

The BMPDSS Proposed Condition Model results show an unadjusted high flow of 15.77 cfs, which is a 14.58% reduction in high flow from the Baseline Condition Model of 18.46 cfs. This exceeds the target reduction of 11.6% that was established in the Bartlett Brook TMDL. The Proposed Condition Model is estimated to manage 126% of the high flow target. A summary table of the proposed BMPs is included in (Table 4). A map of the proposed BMP locations is included in Appendix 3.

Table 4: BMPs Included in the Proposed Condition Model for the Bartlett Brook Watershed

BMP ID	BMP Name	Owner-ship where BMP is located	BMP Type	Permit #	Runoff Area (ac)	Impervious Cover Managed (ac)
Baseline BMPs (13)	Varies	Varies	Varies	Varies	--	--
Existing BMPs (19)	Varies	Varies	Varies	Varies	--	--
BB0010	Horticulture Farm Bioretention	UVM	Bioretention	N/A	20.08	2.72
BB0016	Underwood Stormwater Pond	City of. S. Burlington	Detention Basin	Drains to Expired #2- 2061	38.15	4.33
BB0004	Bartlett Bay Stormwater Treatment System (BBSTS) Expansion	Private Owner	Retrofit BBSTS Wetland	5625-9010, 2-0180, 2- 0153, 1- 0734	16.06	9.34
BBZ050	Harbor Freight	Private Development	Infiltration/ Detention Basin	7819-INDS	1.97	1.22
BBZ041	Bouyea Lane Dry Detention Channel	Private Redevelopment	Dry Detention Channel	6342-INDS	2.74	1.21
BBZ040	Bouyea Lane Wet Pond	Private Redevelopment	Wet Pond	6342-INDS	4.23	2.68
BB0009	Holiday Inn Parking Lot	Developer - Pizzagalli	Detention Basin	6297-9030	5.01	3.34
BB0001	1690 Shelburne Road	VTrans	Detention Chamber	N/A	0.81	.55
BB0012	Irish Farm Condos Pond B	HOA	Retrofit to Gravel Wetland	Expired # 1-1404	18.35	3.55
BB0015	Pinnacle at Spear Pond B	Private Owner	Retrofit to Sand Filter	Expired #1-1155	3.45	0.97
BB0011	Horticulture Farm Detention Pond	UVM	Detention	N/A	7.66	1.24
BB0014	Pinnacle at Spear Pond A	Private Owner	Retrofit to Gravel Wetland	Expired #1-1155	12.66	4.50

3.4 Watershed-Wide Project Ranking

All proposed stormwater BMPs in the Bartlett Brook watershed were subjected to a ranking process. The City of South Burlington contains a portion of five different stormwater impaired watersheds and is subject to five stormwater TMDLs (Potash, Bartlett, Englesby, Centennial, and Munroe Brook). As a result, the City has developed an FRP for each watershed and these FRPs contain a number of proposed stormwater BMPs. Proposed stormwater BMPs for all watersheds were ranked together and a City-wide project prioritization was created. Only proposed stormwater BMPs located in the Bartlett Brook watershed will be presented in the Bartlett Brook FRP.

Considerations that factored into the ranking of proposed BMP projects include the estimated benefit of a BMP towards the FRP's flow restoration targets, and the amount of impervious area treated. The project ranking matrix ranked the proposed stormwater BMPs based on the following criteria, which were grouped into four general categories as shown in Table 5.

Table 5: Factors Included in the Proposed Stormwater BMP Project Ranking Matrix

Category	ID	Criteria
Cost/Operations	A	Project Cost per Impervious Acre
Project Design Metrics	B	Impervious Acres Managed (ac)
	C	Channel Protection Volume (CPv) Mitigated, (ie. 1-year Storm)
	D	Volume Infiltrated (ac-ft)
Project Implementation	E	Permits
	F	Land Availability
Other Project Benefits/Constraints	G	Flood Mitigation (Is existing flooding issue mitigated by project?)
	H	TMDL Flow Target Addressed (Q03, Q95)
	I	Lake Champlain Phosphorus TMDL
	J	Other Project Benefits/Constraints

Values for each criteria were identified and assigned a relative score, so that proposed BMP projects could be ranked based on a total score. The final ranking of proposed projects is included in Table 6 below. The scoring key and full descriptions of the criteria are included in Appendix 4. It should be noted that three projects from the Proposed Condition BMPs list (Table 4) are not included in the project ranking list below, as they are redevelopment projects on private property that were not anticipated during FRP development. Since these projects are being constructed as a result of private development, they do not need to be ranked for the purpose of implementation by the MS4s.

Table 6: Ranking Summary of Proposed Stormwater BMPs in the Bartlett Brook Watershed

ID #	Site ID	BMP Type	Retrofit Description	Total Score
BB0010	Horticulture Farm Bioretention	Bioretention	Bioretention basin along walking path.	19.75
BB0016	Underwood Stormwater Pond	Detention Basin	Detention BMP in ROW and/or on City property. Would alleviate flooding downstream.	19.5
BB0009	Holiday Inn Parking Lot	Detention Basin	Detention BMP on private open land. Planned for design as part of 1690 Shelburne Rd. Project. Infiltration potential	18
BB0004	BBSTS Expansion	Wetland	Route CPv storm to BBSTS Wetland, and add forebay.	16.75
BB0014	Pinnacle at Spear Pond A	Gravel Wetland	Retrofit of existing dry detention basin into gravel wetland.	16.75
BB00012	Irish Farm Condos Pond B	Gravel Wetland	Upgrade existing pond to gravel wetland STP, with more storage. Route additional 5.47 acres to Pond B.	16
BB0015	Pinnacle at Spear Pond B	Sand Filter	Retrofit of existing dry detention basin into sand filter.	13.75
BB0011	Horticulture Farm Detention Pond	Detention	Provide irrigation pond for UVM farm	12
BB0001	1690 Shelburne Rd.	Detention Basin	Detain unmanaged portion of Route 7 in underground detention chamber.	12

4. Design and Construction Schedule

A Design and Construction (D&C) schedule is a required element of the final FRP. This schedule must show how the proposed BMPs included in the FRP can be implemented over a timeframe of less than 20 years from the date of MS4 permit issuance. This means that all BMPs associated with FRPs must be implemented prior to December 5, 2032. The City of South Burlington owns impervious surface in five stormwater impaired watersheds; Bartlett, Englesby, Centennial, Munroe, and Potash Brook. Therefore, proposed stormwater BMPs in all five watersheds were considered when developing a realistic D&C schedule for the City. However, only the projects located within the Bartlett Brook watershed are presented in the implementation schedule in Table 7.

Table 7: Bartlett Brook Watershed BMP Project Implementation Schedule

Project ID	Project Name	MS4	BMP Type	BMP Description	Implementation Year	Project Cost w/ Inflation
BB0003	Bartlett Brook Central	South Burlington	GW	Gravel Wetland constructed to treat runoff from a 70 acre drainage area. Previous outfalls had significant erosion issues.	2017	\$ 767,000
BBZ050	Harbor Freight	Private	IG/DB	Private redevelopment including an infiltration gallery and detention pond. Project constructed in 2018.	2018	N/A
BB0015	Pinnacle at Spear Pond B	South Burlington	SF	Retrofit of existing dry detention basin into sand filter and expansion of drainage area. Project constructed in 2018.	2018	\$ 85,000
BB0014	Pinnacle at Spear Pond A	South Burlington	GW	Retrofit of existing dry detention basin into gravel wetland. Project currently under contract for construction in 2019.	2019	\$ 141,000
BB0004	BBSTS Expansion	South Burlington	DP	Expansion of an existing system to treat an additional 9.34 acres of impervious from Route 7 and Harborview Dr. The project would involve pretreatment, as well as expanding the pond.	2020	\$ 498,000
BB0010	Horticulture Farm Bioretention	UVM	Bio	The proposed project would involve the retrofit of a swale into a bioretention basin. A berm in the center of the basin would provide an extended flow path.	2020	\$ 320,000

BB0011	Horticulture Farm Detention Pond	UVM	DP	The proposed pond on the UVM Horticulture Farm property to control flow from 7.6 acre drainage area. Pond would provide store of usable water on-site.	2020	\$ 221,000
BBZ042	Bouyea Lane Development Wet Pond	Private	DP	Private redevelopment in the Bartlett Brook watershed that will result in the construction of a detention pond.	2021	N/A
BBZ043	Bouyea Lane Development Dry Detention Channel	Private	DT	Private redevelopment in the Bartlett Brook watershed that will result in the construction of a dry detention channel.	2021	N/A
BB0012	Irish Farm Condos Pond B	South Burlington	GW	Upgrade existing pond to gravel wetland STP, with more storage. Route additional 5.47 acres to Pond B.	2021	\$ 304,000
BB0009	Holiday Inn Parking Lot	South Burlington	UD	Opportunity for an underground infiltration gallery in the open space to mitigate runoff from the Holiday Inn Parking lot and hotel.	2023	\$ 247,000
BB0016	Underwood Stormwater Pond	South Burlington	DP	The proposed project would retrofit the existing roadside swale along Spear St, just South of Nowland Farm Rd, into a detention basin with a 44.3 acre area.	2025	\$ 308,000
BB0001	1690 Shelburne Road	VTrans	UD	Detain unmanaged portion of Route 7 in underground detention chamber.	2028	\$ 302,000

In addition to a project's score within the BMP ranking matrix, development of a BMP implementation schedule required the consideration of additional factors, such as expired State of Vermont stormwater permits, properties containing more than 3 acres of impervious area, and land owned or controlled by the MS4 entities. Additionally, private property redevelopment and development of the City's Phosphorus Control Plan (PCP) may cause certain projects to gain or lose priority within the implementation schedule in the future.

5. Financial Plan

Subject to the requirements of the MS4 permit, a financial plan is required as part of the FRP. This plan must provide initial BMP cost estimates and demonstrate the means by which BMP implementation will be financed. The financial plan must also include the steps that each MS4 will take to implement the finance plan. Initial BMP cost estimates were calculated in 2014 using cost values that were current at that time. Once projects were scheduled over the 20 year implementation schedule, an annual 3% inflation rate (based on historic trends in the construction cost index⁷) was applied. Table 7 presents inflation adjusted project costs for each BMP project. Applying this inflation rate provides a more accurate annual cost for BMP construction in the later years of the schedule.

5.1 City of South Burlington Financial Plan

In 2005, the City of South Burlington created Vermont's first stormwater utility. Under the stormwater utility system, all developed properties in the City pay an impervious area-based stormwater fee using an Equivalent Residential Unit (ERU) system. These stormwater fees provide the City with a stable funding source that is used to comply with State and Federal stormwater regulations and maintain stormwater infrastructure throughout the City. The stormwater utility was created with the understanding that there would be future stormwater costs related to the five stormwater impaired watersheds located in South Burlington, as well as costs related to future implementation of projects required by the Lake Champlain Phosphorous TMDL. The City is currently utilizing funds generated from stormwater utility fees to fund FRP related costs.

Once the BMP cost and implementation schedule was developed, the City of South Burlington Stormwater Utility was able to incorporate this information into its existing stormwater rate model. The City evaluated two different scenarios for funding the BMPs included in the FRP. The first scenario assumed that there would be no grant funding available to assist with implementation. The second scenario assumed that grant funding of approximately \$250,000 per year would be available in 2018 through 2029, and that this amount would increase to \$500,000 in 2030, 2031, and 2032. The resulting annual cost to a single family residential property and commercial property owner containing 1 acre of impervious area is summarized in Table 8. Calculations for "Commercial Property Containing 1 Acre Impervious Area" in Table 8 assume an Equivalent Residential Unit (ERU) rate of 17 and do not take into account the City's relative tier factors based on percent impervious cover.

⁷ RSMean. "Historical Cost Indexes." <https://www.rsmeansonline.com/references/unit/refpdf/hci.pdf>

Table 8: Annual Stormwater Fee Paid by Property Owners Under Different FRP Funding Scenarios

Fiscal Year	Funding Scenario 1 - Receive No Grants		Funding Scenario 2 - Receive \$250,000 in Grants Annually	
	Single Family Residential Property	Commercial Property Containing 1 Acre Impervious Area	Single Family Residential Property	Commercial Property Containing 1 Acre Impervious Area
2018	\$80.28	\$1,364.76	\$80.28	\$1,364.76
2019	\$82.44	\$1,401.48	\$82.08	\$1,395.36
2020	\$84.60	\$1,438.20	\$83.88	\$1,425.96
2021	\$87.12	\$1,481.04	\$85.68	\$1,456.56
2022	\$90.00	\$1,530.00	\$87.48	\$1,487.16
2023	\$93.24	\$1,585.08	\$89.28	\$1,517.76
2024	\$96.84	\$1,646.28	\$91.08	\$1,548.36
2025	\$100.80	\$1,713.60	\$92.88	\$1,578.96
2026	\$105.12	\$1,787.04	\$94.68	\$1,609.56
2027	\$109.80	\$1,866.60	\$96.48	\$1,640.16
2028	\$114.84	\$1,952.28	\$98.28	\$1,670.76
2029	\$119.88	\$2,037.96	\$100.08	\$1,701.36
2030	\$124.92	\$2,123.64	\$101.88	\$1,731.96
2031	\$129.96	\$2,209.32	\$103.68	\$1,762.56
2032	\$135.00	\$2,295.00	\$105.48	\$1,793.16

It is the City's expectation that grant funding from the State of Vermont and other Federal sources will be available to help with the cost of stormwater TMDL implementation. In 2015 the Vermont legislature created the Clean Water Fund (CWF). The CWF was provided with \$2,005,000 in 2016, \$7,688,000 in 2017, \$5,325,477 in 2018, and \$4,000,000 in 2019 (along with \$25M allocated from the Capital Bill Budget). State investment in the CWF alone is not at the level necessary to provide significant funding to the MS4 communities subject to stormwater TMDLs. The City of South Burlington intends to work closely with our legislative representatives to ensure that the required long term, dedicated funding is made available for the stormwater improvements included in the FRPs. The City of South Burlington will also continue to pursue funding from existing and new grant sources from other organizations including, but not limited to, VTDEC, the Vermont Agency of Transportation, and the Lake Champlain Basin Program.

5.2 Vermont Agency of Transportation Financial Plan

Planning level costs were independently estimated for VTrans projects. As such, some cost estimates may differ slightly from those presented in other FRP documents. VTrans will request state and federal funding for the appropriate amount to implement the BMPs as outlined in their design and construction schedule. If a project requires joint funding with a municipality, VTrans will request funding sufficient to cover their portion of the

project cost. In watersheds where VTrans is either not meeting or exceeding their allocated target there may be cost sharing between MS4s.

5.3 BMP Cost Estimates:

Cost estimates were developed based on a simple spreadsheet method that calculated base construction cost as a product of the design control volume, the unit cost, and the site adjustment factor, as outlined in Table 9 below⁸. Additionally, permitting, engineering, land acquisition, and O&M costs were factored into the total cost estimate.

Table 9: Retrofit unit costs and adjustment factors

BMP	Base Cost (\$/ft3)
Detention Basin	\$2
Infiltration Basin	\$4
Underground Chamber (infiltration or detention)	\$12
Bioretention	\$10
Green Infrastructure/ Underground Chamber Combo	\$22
Site Type	Cost Multiplier
Existing BMP retrofit	0.25
New BMP in undeveloped area	1
New BMP in partially developed area	1.5
New BMP in developed area	2
Adjustment factor for large aboveground basin projects	0.5

6. Regulatory Analysis

In accordance with the MS4 permit, an FRP requires a regulatory analysis that identifies and describes what, if any additional regulatory authorities that the permittees will need in order to effectively implement the FRP.

Currently, stormwater runoff within the Bartlett Brook watershed is regulated primarily by the VTDEC, City of South Burlington, Town of Shelburne, and VTrans. VTDEC regulates new developments through issuance of Stormwater Discharge Permits with technical requirements as outlined in the 2017 Vermont Stormwater Management Manual. The City of South Burlington and Town of Shelburne require improved stormwater practices and low impact development for new developments through their stormwater ordinances and Land Development Regulations (LDRs). VTrans regulates stormwater discharges to the state Right of Way through 19 V.S.A. §1111 “Permitted use of the right-of-way”.

⁸ Methodology based on Horsley Witten Group Memorandum (Page 11). Included in Appendix 8.

The City of South Burlington updated the stormwater requirements in its LDRs in June 2016.⁹ The revised LDRs require that any project resulting in ½ acre or more of impervious area implement stormwater controls that prioritize infiltration. The revised LDRs also contain new requirements for properties that are being redeveloped. It is the City's expectation that these changes will result in gradual improvements in stormwater management over the course of the 20 year BMP implementation schedule.

The City of South Burlington also revised its "Ordinance Regulating the Use of Public and Private Sanitary Sewerage and Stormwater Systems" in October 2015.¹⁰ The ordinance provides a policy regarding the handling of expired VTDEC stormwater permits located in South Burlington. The City will continue to take over responsibility for exclusively residential stormwater systems that complete upgrades. In addition, the revised ordinance allows commercial properties with expired permits to obtain coverage under the City's MS4 permit if upgrades to the stormwater system are completed. These properties will still be responsible for maintaining their systems, but the permit coverage required by the State of Vermont can now be provided through the City's MS4 permit instead of obtaining coverage under one of VTDEC's other permit programs.

A full list of the expired State of Vermont permits with discharges to Bartlett Brook indicating the retrofits proposed under this FRP is included in Appendix 6 (Table A-9).

7. Third Party Implementation

As required by the approved MS4 general permit, all expired stormwater permits in the watershed were reviewed for inclusion within the BMPDSS model. The process of BMP identification involved an initial assessment of the existing BMPs with expired permits that did not already meet the Channel Protections standards in the 2002 Vermont Stormwater Management Manual (VSMM) to determine if they could be retrofit to meet the VSMM design standards (Table 10).

⁹ Section 12.03 – Stormwater Management Standards, "South Burlington Land Development Regulations," dated 8/6/18, can be viewed at the following link:
<http://www.southburlingtonvt.gov/Planning/LDR%20Amendments/2018-5/LDRs%20Complete%20Effective%208-6-2018%20reduced.pdf>

¹⁰ South Burlington's "Ordinance Regulating the Use of Public and Private Sanitary Sewerage and Stormwater Systems," dated 10/5/15, can be viewed at the following link:
http://www.southburlingtonvt.gov/document_center/planning/Sewerage_Stormwater_Systems.pdf

Table 10: Stormwater BMPs Required by Expired State of Vermont Stormwater Permits That Are Included in the Bartlett Brook BMPDSS Model

Permit #	Project Name	BMP Type in Model	Permit Status	RDA	Permit Issued
1-1404.9912	Irish Farms Residential Subdivision	Ponds (3)	Issued	n/a	5/31/2000
1-0523.XXXX	Champ Carwash	Pond, Swale system	Issued	6280-9030	11/3/1987
1-1155.9806	Pinnacle at Spear	Ponds (2)	Issued	n/a	4/21/1999
3121-9010	Willie Racine Jeep Isuzu	Ponds (2)	Issued	n/a	11/24/2003
1-1372.9905	Staybridge Suites & Harbor Sunset Hotel	Infiltration Trenches (2)	Issued	6296-9030	9/1/1999
	Oil n' Go	Swale	n/a		4/1/1999
2-0261.XXXX	Overlook at Spear/Summit at Spear	Ponds in series (4)	Issued	n/a	4/17/1985

*Table Prepared by Emily Schelley (VT DEC 2014). Revised by WCA (2014)

7.1 Expired Permit Proposed Retrofits

All expired permit holders in the Bartlett Brook watershed will be required to obtain valid State stormwater permit coverage. This can be accomplished through a process that the State has identified in their current draft Stormwater Permitting Rule, or through the City's Stormwater Upgrade Feasibility Analysis (SUFA) process. Refer to sburlstormwater.com/download-material/ for the latest available version of the City's Stormwater Upgrade Feasibility Analysis (SUFA) document.

As noted in the SUFA, "FRPs for the stormwater impaired watersheds located in the City contain a preliminary assessment of the stormwater treatment potential of some sites. If an FRP identifies an STP on a site, then the site must install either the specified STP or an STP that provides equivalent or greater treatment. In addition, final FRPs will contain a schedule indicating when various retrofits must occur. Properties that choose to construct STPs must do so before November 15, 2023, or the date specified in the FRP, whichever is sooner." The City may revise the date included in the ordinance depending upon the dates included in the final version of State of Vermont Stormwater Permitting Rule. The City expects that VTDEC will finalize the rule in 2019. This will provide the City with sufficient time to update its ordinance.

The City has identified a specific retrofit project for the Irish Farm Condominiums neighborhood (expired Permit #1-1404), which is currently included in the Proposed Condition Model run. All other expired permits in the Bartlett Brook Watershed will be required to complete upgrades as determined by the technical standards included in the City's SUFA.

8. Appendices

Appendix 1: BMP Summary Sheets

Appendix 2: Table A-3-1: BMPDSS Modeling Run Summary

Appendix 3: Map of BMPs Included in the Bartlett Brook Flow Restoration Plan

Appendix 4: Table A-5-1: BMP Ranking Criteria Key, Table A-5-2: Scoring Key

Appendix 5: Bartlett Brook Watershed BMP Design and Construction Schedule

Appendix 6: Bartlett Brook Expired Permit List

APPENDIX 1

BMP SUMMARY SHEETS

APPENDIX 2

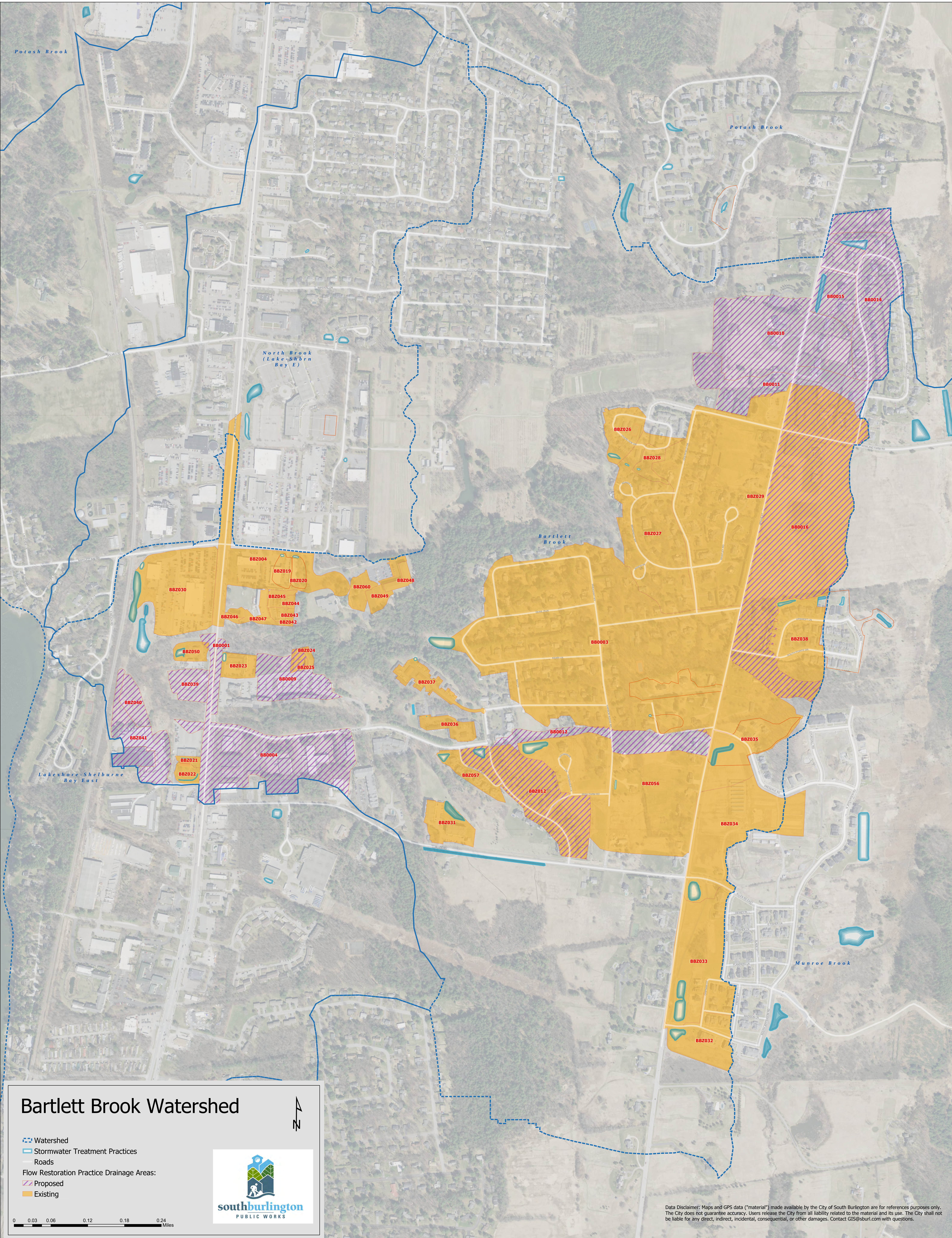
TABLE A-3-1: BMPDSS MODELING RUN SUMMARY

Table A-3-1: BMPDSS Modeling Run Summary

Input file	Description	Area	Normalized flow (cfs/ sq mi)		Unadjusted flow (cfs)	
			Q0.3	Q95	Q0.3	Q95
Bartlett_base_03-27-2018.inp	updated draiange area of 1-1404 to take in drainage from offsite swale	1.1888	15.528	0.1935	18.460	0.230
Bartlett_Post2002_03262018.inp	update of the post run with built BMPs: Keari Lane, Laurel Hill, 3017-INDS, 7365-INDS, and 4096-INDS.1A. Updated 1-1404 drainage area, same as base.	1.1762	14.360	0.1955	16.890	0.230
	% Change vs Base				-8.50%	0.00%
Bartlett_Post_12-21-2018_1.inp	Removed Laurel Hill	1.1762	14.428	0.1870	16.970	0.220
	% Change vs Base				8.07%	-4.38%
Bartlett_proposed_4-20-2018.inp	Added BBTS and Pinnacle at Spear upgrades, as well as Harbor Frieght, Bouyea Lane Development new projects	1.1766	13.828	0.1870	16.270	0.220
	% Change vs Base				11.86%	-4.35%
Bartlett_proposed_12-21-2018.inp	Took out Laurel Hill.	1.1766	13.922	0.1870	16.380	0.220
	% Change vs Base				11.27%	-4.35%
Bartlett_proposed_1_4_2019.inp	same as Bartlett_proposed_12-21-2018.inp but added Hort Farm Bioretention (BB0010), Hort Farm Detention Pond (BB0011), Irish Farm Condos Pond B (BB0012), Holiday Inn Parking Lot (BB0009), Underwood (BB0016), & 1690 Shelburne Road (BB0001)	1.1766	13.402	0.1870	15.768	0.220
					14.58%	-4.35%

APPENDIX 3

MAP OF BEST MANAGEMENT PRACTICES INCLUDED IN THE BARTLETT BROOK FLOW RESTORATION PLAN



Bartlett Brook Watershed

- Watershed
- Stormwater Treatment Practices
- Roads
- Flow Restoration Practice Drainage Areas:
 - Proposed
 - Existing



0 0.03 0.06 0.12 0.18 0.24 Miles

Data Disclaimer: Maps and GPS data ("material") made available by the City of South Burlington are for reference purposes only. The City does not guarantee accuracy. Users release the City from all liability related to the material and its use. The City shall not be liable for any direct, indirect, incidental, consequential, or other damages. Contact GIS@sburl.com with questions.

APPENDIX 4

TABLE A-5-1: BMP RANKING CRITERIA KEY

TABLE A-5-2: SCORING KEY

Table A-5-1: BMP Ranking Criteria Key

Category	ID	Criteria	Technical Description	Description
Cost/Operations	A	Project Cost	The project costs were grouped into categories from >\$50,000 to \$1,000,000 based on the range of projects proposed. Cost estimates were developed using the latest unit costs from VTrans as well as local experience. More expensive	Project Costs include additional engineering, permitting, and construction. Transportation and utility conflicts, as well as overall constructability is also reflected in the cost.
Project Design Metrics	B	Impervious Acres Managed (ac)	Natural groupings within the range of impervious managed for the proposed projects were identified. More impervious managed receives a higher score.	The more impervious managed by a project, the higher the potential pollutant reduction. Additionally, the goal of the FRP is to manage existing impervious surfaces.
	C	Channel Protection Volume (CPv) Mitigated, (i.e.. 1-year Storm)	Groupings within the range of CPv volume storage were identified. The largest grouping receives the highest score. The CPv was estimated in HydroCAD, using local rainfall data.	The Channel Protection Volume (CPv) is the volume of stormwater runoff generated from the 1-year design storm (1.98" in Burlington). A BMP which provides CPv storage was determined to reduce the High-flow (Q0.3%), which is the flow rate exceeded 0.3% of the time (output from the State's BMPDSS model). Mitigating the CPv reduces channel erosion and excessive
	D	Volume Infiltrated (ac-ft)	Natural groupings within the range of volumes infiltrated for the BMPs were identified to which relative points were be assigned. The largest volume infiltrated was assigned the highest score. Volumes were calculated in HydroCAD.	The Volume Infiltrated indicates the amount of stormwater runoff that is infiltrated into the groundwater, and provides baseflow for the stream. The TMDL flow targets include a low-flow target, which is addressed by an infiltration-based BMP.
Project Implementation	E	Permitability	Permitability is simplified into two categories to reflect the common scenarios in permitting, as 1) minimal permitting, versus 2) Complex permitting issues. An itemized list of permits was included to inform the ranking, but was not used in the scoring.	Permitability is a measure of the expected level of effort to permit the project, based on knowledge that each type of permit takes varying amounts of time. Some common permits include Stormwater Construction, Local Zoning, Act 250 amendments, VTRANS ROW, etc.
	F	Land Availability	Public land is preferred, followed by regulated private land, and private land where the owners are known to be open to participate. Private land, in which participation of the owner is unknown is lower priority.	Land availability is critical for BMPs requiring open space for detention and access for the City. Properties owned by the City are ranked the highest, followed by privately owned land that has an expired permit, which provides leverage for owner participation.
Other Project Benefits	G	Flood Mitigation	Flood mitigation is categorized by the scale of the impact.	Flood mitigation is categorized by the scale of the impact. A neighborhood flooding issue is weighed more heavily than a localized drainage issue.
	H	TMDL Flow Target Addressed (Q03, Q95)	More weight is on BMPs that address both TMDL targets- the high-flow (Q0.3%) and low-flow targets (Q95%). The high-flow target is addressed by detention BMPs which storage the CP volume.	The goal of the FRP is to implement projects which address the TMDL flow targets. The high-flow target is measured as a reduction in the stream flow rate exceeded 0.3% of the time, while the low-flow target is an increase in the stream flow rate exceeded 95% of the time (baseflow). Projects which address both targets through storage or infiltration of the 1-year design storm are weighted the highest, followed by projects which address just the high-flow. Projects which do not address the full 1-year storm volume are weighted the lowest.
	I	Lake Champlain Phosphorus TMDL	Yes or no whether the proposed practice will provide benefit toward the Lake Champlain Phosphorus TMDL. This will be determined once the TMDL compliance metrics are released.	The Lake Champlain Phosphorus TMDL has been developed in the effort to reduce nutrient loading and consequential toxic algal blooms in Lake Champlain. The TMDL will require stormwater BMPs to meet a certain level of Total Phosphorus reduction. Each BMP will be evaluated against the TMDL compliance metrics, and scored yes or no if the project meets the TMDL standards.
	J	Other Project Benefits/Constraints	This criteria is to account for indirect project benefits like infrastructure improvements (e.g. aging culvert replacement, wetlands enhancement, and if it addresses an expired permit), or potential constraints (e.g. utility issues encountered during construction).	This criteria is to account for indirect project benefits like infrastructure improvements, community benefits, habitat creation, etc., as well as things that might constrain the project such as the potential of encountering utilities during construction.

Table A-5-2: Scoring Key

Category	ID	Criteria	Quality	Score
Cost/Operations	A	Relative Project Cost	\$1.00 - \$24,999	4
			\$25,000 - \$49,999	3
			\$49,999 - \$99,999	2
			\$100,000 - \$199,999	1
			\$200,000 - \$499,999	0
			\$500,000 +	-1
Project Design Metrics	B	Impervious Acres Managed (ac)	>10 acres	6
			>5-10 acres	5
			>4-5 acres	4
			>2-4 acres	3
			>1-2 acres	2
			< 1 acre	1
			0 acres	0
	C	Channel Protection Volume (CPv) Mitigated, (ie. 1-year Storm)	0.6-1.0 ac-ft	5
			0.4-0.6 ac-ft	4
			0.2-0.4 ac-ft	3
			0.05-0.2 ac-ft	2
			>0-0.05 ac-ft	1
			0 ac-ft	0
	D	Volume Infiltrated (ac-ft)	>2 ac-ft	5
			1 - 2 ac-ft	4
			0.5-1 ac-ft	3
			0.1- 0.5 ac-ft	2
			>0.01 - 0.1 ac-ft	1
			no infiltration	0
Project Implementation	E	Permitability	Minimal Issues/Concerns or no permits	2
			Complex issues/Potential permit denial	0
	F	Land Availability	MS4 owned	4
			Non MS4 owned regulated (expire permit)	3
			Non MS4 owned/Participatory Owner	2
			Unknown	0
Other Project Benefits	G	Flood Mitigation (Is existing flooding issue mitigated by project?)	Neighborhood Wide Flooding Issue	3
			Infrastructure damage (e.g. Wet Basement)	2
			Nuisance Issue (ie. ponding, puddles, etc).	1
			None	0
	H	TMDL Flow Target Addressed (Q03, Q95)	High and Low Flow Targets	3
			High Flow Target	2
			No target addressed in BMPDSS (just WQ treatment)	1
	I	Lake Champlain Phosphorus TMDL	Addressed TMDL	1
			Does not address TMDL	0
	J	Other Project Benefits	Infrastructure Improvement (e.g. Culvert Replacement)	1
			Educational/Functional Benefit	1
			Recreational Benefit	1
			Natural Habitat Creation/Protection	1
			Outfall Erosion Control	1
			Utility Issues/Uncertainty	-1

APPENDIX 5

BARTLETT BROOK WATERSHED BMP DESIGN AND CONSTRUCTION SCHEDULE

Bartlett Brook Flow Restoration Plan
Bartlett Brook Watershed BMP Project Implementation Schedule

Project ID	Project Name	Expired Permit	MS4	BMP Type	BMP Description	Implementation Year	Project Cost (Rounded to Nearest \$1,000)	Project Cost with Inflation (Rounded to Nearest \$1,000)
BB0003	Bartlett Brook Central	1-0202; 2-0120	South Burlington	GW	Gravel Wetland and collection system constructed to treat runoff from four outfalls, a 70 acre drainage area. Outfalls had significant erosion issues. Land acquisition was not required for the project.	2017	\$ 767,000	\$ 767,000
BBZ050	Harbor Freight	7819-INDS	Private Development	IG/DB	Private redevelopment that includes an infiltration gallery and detention pond. Project was constructed in 2018.	2018	-	-
BB0015	Pinnacle at Spear Pond B	1-1155	South Burlington	SF	Retrofit of existing dry detention basin into sand filter and expansion of drainage area. Project was constructed in the Fall of 2018.	2018	\$ 85,000	\$ 85,000
BB0014	Pinnacle at Spear Pond A	1-1155	South Burlington	GW	Retrofit of existing dry detention basin into gravel wetland. Project is currently under contract for construction in Spring/Summer of 2019.	2019	\$ 141,000	\$ 141,000
BB0004	BBSTS Expansion	2-0180; 2-0153; 1-0734	South Burlington	DP	The proposed expansion would route additional area to system via a new stormline connection from a portion of Route 7 and Harborview Dr. The project would involve pretreatment, as well as expanding the pond.	2020	\$ 470,000	\$ 498,000
BB0010	Horticulture Farm Bioretention	No Permit	UVM	Bio	The proposed project would involve a retrofit of the swale into a 0.81 ac-ft bioretention basin. A berm in the center of the basin would provide an extended flow path to improve water quality treatment.	2020	\$ 268,000	\$ 320,000
BB0011	Horticulture Farm Detention Pond	1-1155	UVM	DP	BMP is located on the UVM Horticulture Farm property. The 10-year storm (Qp10) overflow from the Horticulture Farm basin would be routed to the dug pond, providing a store of usable water on-site and Qp10 control for the basin.	2020	\$ 185,000	\$ 221,000
BBZ042	Bouyea Lane Development Wet Pond	6342-INDS	Private Development	DP	Private redevelopment in the Bartlett Brook watershed that will result in the construction of a detention pond.	2021	-	-
BBZ043	Bouyea Lane Development Dry Detention Channel	6342-INDS	Private Development	DT	Private redevelopment in the Bartlett Brook watershed that will result in the construction of a dry detention channel.	2021	-	-
BB0012	Irish Farm Condos Pond B	1-1404	South Burlington	GW	Upgrade existing pond to gravel wetland STP, with more storage. Route additional 5.47 acres to Pond B.	2021	\$ 247,000	\$ 304,000
BB0009	Holiday Inn Parking Lot	6297-9030	South Burlington	UD	Opportunity for an underground infiltration gallery in the open space to mitigate runoff from the Holiday Inn Parking lot and hotel.	2023	\$ 189,000	\$ 247,000
BB0016	Underwood Stormwater Pond	No Permit	South Burlington	DP	The confluence of the existing stormline along Spear St, just South of Nowland Farm Rd. has been the source of flooding during large storm events. The proposed project would involve a retrofit of the existing roadside swale into a detention basin, designed to provide CPv (1-year) for a 44.3 acre area.	2025	\$ 222,000	\$ 308,000
BB0001	1690 Shelburne Road	No Permit	VTrans	UD	Detain unmanaged portion of Route 7 in underground detention chamber.	2028	\$ 199,000	\$ 302,000

APPENDIX 6

BARTLETT BROOK EXPIRED PERMITS LIST

Table A-9: Bartlett Brook Expired Permit Discharges and Proposed Retrofits

BMP in BMPDSS Model	Permit Number	Project Name	RDA/Other ¹	Permit Issued	Existing Manner of Discharge ²	Proposed System Upgrades under FRP ³
No Channel Protection Volume (CPv) BMP covered under Permit	1-0202.XXXX	Meadowwood at Spear	n/a	6/1/1976	CB	Drains to proposed Keri Lane BMP (Infiltration Gallery)
	1-0665.XXXX	Pillsbury Manor	n/a	9/30/1988	GS, RS, ST	Proposed Underground detention chamber assessed. Determined not necessary to meet FRP targets.
	1-0705.XXXX	Freedom Nissan	6342-9030	5/23/1988	CB, GS	No retrofit proposed. System currently covered under RDA permit.
	1-0734	Champ Car Care	n/a	11/29/1988	CB, GS	Drains to proposed BBTS Expansion Project (Wetland Pond)
	1-1134.XXXX	Freedom Nissan	6342-9030	5/10/1993	OF	No retrofit proposed. System currently covered under RDA permit.
	1-1220.9908	Allen Rd Community Care	n/a	5/12/1996	CB, (2)ST	Proposed Infiltration Basin assessed. Determined not necessary to meet FRP
	1-1291.0112	US Route 7 Expansion	5625-9010	12/20/2002	CB, OF	Covered under 5625-9010. Portion of coverage area drains to proposed BBTS Expansion Project (Wetland Pond), and a portion drains to proposed Shelburne Rd. Project (Detention Chamber)
	2-0153.XXXX	WESCO Distributors	n/a	4/26/1983	CB	Drains to proposed BBTS Expansion Project (Wetland Pond)
	2-0180.XXXX	Shelburne Plastics	n/a	9/26/1983	GS	Drains to proposed BBTS Expansion Project (Wetland Pond)
Channel Protection Volume (CPv) BMP covered under Permit	3121-9010	Willie Racine Jeep Isuzu	n/a	11/24/2003	GS, (2)DP, CB	Drains to proposed BBTS Expansion Project (Wetland Pond). Limited space to manage on-site.
	3017-9010	IDX Headquarters - 25 GMD	n/a	6/2/2003	IB	No retrofit proposed. Current system meeting VT 2002 SWMM standard for CPv.
	1-1404.9912	Irish Farms Residential Subdivision	n/a	5/31/2000	CB, (3)DP, GS	Irish Farms Pond Retrofit: Upgrade Pond B to gravel wetland, and new outlet control for Pond C.
	1-1372.9905	Staybridge Suites & Harbor Sunset Hotel	6296-9030	9/1/1999	CB, ST, DP, (2) IG	Proposed alternative option to route upper portion of Staybridge runoff to the Holiday Inn BMP rather than upgrade existing detention pond.
	1-1155.9806	Pinnacle at Spear	n/a	4/21/1999	CB, (2)DP, OF	Upgrade Pond A and B with new outlet control and increase storage.
	1-0949.XXXX	Bouyea-Fassetts Building	6281-9030	6/6/1990	OF, IB	No retrofit proposed. System currently covered under RDA permit.
	1-0523.XXXX	Champ Carwash	6280-9030	11/3/1987	GS, OF, DP	No retrofit proposed. System currently covered under RDA permit.
	2-1073.XXXX	Howard Johnson's	6297-9030	12/20/1985	DW, CB, OF, ST	Portion of coverage area drains to proposed Holiday Inn Project (Infiltration Gallery)
	2-0261.XXXX	Overlook at Spear/Summit at Spear	n/a	4/17/1985	CB, GS, (4)DP	Neighborhood GSI Retrofit: Propose 6 collections of biofilters or infiltration basins in the ROW, within the drainage area for the 4 on-stream ponds covered under #2-0261. Retrofit of on-stream ponds determined less feasible than distributed GSI retrofit.
	2-0120.XXXX	Bay Court/Harbor Heights/Keri Rd	6294-9030 & 6294-9030.1	8/11/1982	CB, (4)SF	Drains to proposed Keri Lane BMP (Infiltration Gallery)

* Table Originally Prepared by Emily Schelley (VT DEC, last revised 1-31-14), Revised by WCA (2014).

¹ RDA: Residual Designation Authority- Private Permittees requests to have their expired stormwater system covered under an RDA permit, which overwrites their expired permit

² Manner of Discharge: CB: Catch Basin, GS: Grass Swale, RS: Retention Swale, ST: Settling Tank, OF: Control orifice, IB: Infiltration Basin, DP: Detention Pond, DW: Dry Well, IG: Infiltration Gallery, SF: Sand Filter

³ Expired permit retrofits were determined based on direct benefit to the Flow Restoration Targets. Expired permits with a CPv(extended detention of the 1-year design storm) BMP were assessed for retrofit opportunity, and if the flow reduction benefit was determined negligible, a retrofit was not proposed. It was determined beneficial to route several expired permit systems to a larger retrofit project, rather than retrofit the existing system on-site.

Appendix E – Centennial Brook Flow Restoration Plan



CENTENNIAL BROOK FLOW RESTORATION PLAN

City of South Burlington, Vermont

October 1, 2016
Updated January 2019

Updated by:
City of South Burlington
104 Landfill Road, South Burlington, VT 05403



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Appendix A – Centennial Brook Flow Restoration Plan Proposed Best Management Practices

Table C-1: Final Proposed BMPs for Centennial Brook FRP
Centennial Brook FRP BMP Summary Sheets

Appendix B – Project Ranking

Table D-1: BMP Ranking Criteria Key
Table D-2: BMP Ranking Scoring Key

Appendix C – Proposed Cost Estimates, Prioritization Ranking, and Implementation Schedule

Table E-1: Project Cost Estimates
Table E-2: Centennial Brook Watershed BMP Project Scoring
Table E-3: Centennial Brook Watershed BMP Project Implementation Schedule

1. Executive Summary

This Flow Restoration Plan (FRP) for the Centennial Brook watershed was developed in accordance with requirements in the Municipal Separate Storm Sewer System (MS4) General Permit #3-9014 (2012). Once approved by the Vermont Department of Environmental Conservation (VTDEC) this FRP will become part of the Stormwater Management Plans (SWMP) prepared by the MS4 permittees in the Centennial Brook watershed. This includes the City of South Burlington, the Vermont Agency of Transportation (VTrans), the City of Burlington, Burlington International Airport (BTV), and the University of Vermont (UVM). The Centennial Brook FRP will act as a guidance document for the MS4 entities as they implement the stormwater Best Management Practices (BMPs) necessary to attain the flow restoration targets established by the Centennial Brook Total Maximum Daily Load (TMDL). The Centennial Brook TMDL was approved by the U.S. Environmental Protection Agency (EPA) on September 28, 2007. The TMDL suggests a 23.2% increase in stream flow during low flow conditions, and requires a 63.4% reduction in stream flow during high flow conditions (established as the 1-year storm event).

Development of the Centennial Brook FRP was an iterative process that utilized the Vermont Best Management Practice Decision Support System (BMPDSS) model maintained by VTDEC. This model was created by VTDEC and its partners as part of the initial TMDL development. The BMPDSS model allows the user to add, remove, or modify information related to the existing and proposed stormwater BMPs in the watershed. The BMPDSS then predicts the impacts that these changes will have on stream flow. In 2002, VTDEC provided a “Baseline Condition” BMPDSS model for Centennial Brook. This version of the BMPDSS model included all stormwater BMPs that existed in the watershed prior to 2002 and provided an estimated stream flow during the 1-year storm event. The goal of the FRP is to reduce stream flow by 63.4% during this target storm event.

In July 2013, at the request of the City of South Burlington, the Chittenden County Regional Planning Commission (CCRPC)¹ completed a study to estimate the expected non-jurisdictional impervious area growth² in the Centennial Brook watershed over the next 20 years. The original TMDL assigned a non-jurisdictional impervious growth of 40 acres, whereas the CCRPC study estimated 5 acres based on the actual non-jurisdictional growth rate from 2003 to 2010. With the revised future growth, the high-flow target (Q0.3%) would be reduced from 63.4% to 51.6%³.

The BMPDSS Baseline Condition model was provided to the City and updated to include all BMPs that were constructed in the watershed after 2002. This version of the model became known as the “Existing Condition”, or Post-2002, model run. Finally, existing BMPs were evaluated to determine if they could be retrofit to provide improved treatment and detention of stormwater runoff and new BMPs were added to the BMPDSS model until the required stream flow reduction target was achieved. This version of the model became known as the “Proposed Condition” model, or Credit Model run⁴.

¹ Chittenden County Regional Planning Commission (CCRPC). 2013. Non Jurisdictional Impervious Surface Analysis for the Centennial Brook Watershed.

² “Non-jurisdictional” refers to new impervious surfaces where the parcel’s total impervious area is less than 1 acre and not required to obtain a State stormwater permit.

³ See Table 1: The Modified target was calculated as: $-(49.9\%) + (63.4 - 49.9\%)(5 \text{ ac}/40 \text{ ac}) = -51.6\%$

⁴ Refer to original Centennial Brook Flow Restoration Plan dated October 1, 2016 for additional detail on the iterative process to identify proposed projects.

The current Proposed Condition BMPDSS model run that meets the required 51.9% reduction in stream flow during the 1-year storm event includes a total of 23 sites; seven (7) retrofits to existing BMPs, one (1) new detention system, thirteen (13) new infiltration systems, one (1) gravel wetland, and one (1) new bioretention system. The total cost for implementation of these BMPs is estimated at approximately \$7,370,000.

The final list of proposed BMPs were ranked based on best value and feasibility. The MS4 permit requires that the BMPs identified in the FRP be constructed within 20 years of the effective date of the 2012 MS4 permit, which results in a December 5, 2032 deadline. The MS4s involved in the Centennial Brook FRP worked together to develop an implementation schedule for Centennial Brook. BMPs that are currently covered by expired State of Vermont stormwater permits were included at the front of the schedule, so that the associated properties could complete the required stormwater improvements and achieve permit compliance. Other BMPs located on land owned or controlled by the MS4 entities were given priority over those that were located on private property. The remaining projects were scheduled based on their ability to contribute to stream flow reductions, cost effectiveness, and constructability.

A financial plan was also developed in conjunction with the implementation schedule. The City of South Burlington has been financing the required stormwater BMPs by utilizing funds raised by stormwater utility fees, State and Federal grants, as well as low interest loan programs.

2. Background

Centennial Brook and its watershed are located in Chittenden County, principally in the City of South Burlington, and encompass an area of approximately 1.4 square miles. Centennial Brook is a small second order tributary to the Winooski River, with its confluence located about one half mile above the Winooski Dam. At river mile (RM) 0.8 it divides into two branches. The southern branch is 0.8 miles in length and includes within it drainage from the I-89 interchange and Route 2 east of the interchange in South Burlington. The east branch is 1.3 miles in length and drains dense residential areas from the upper portion of the watershed. The entire stream and its tributaries are Class B waters designated as cold water fish habitat pursuant to the Vermont Water Quality Standards.

Centennial Brook has been identified as not attaining water quality standards and has been placed on the list of impaired waters in accordance with Section 303(d) of the Federal Clean Water Act. In 2007, the EPA approved the Centennial Brook Stormwater TMDL⁵. This TMDL requires reductions in stormwater flows during high flow conditions. Increases in stream base flow were also recommended, but are not required under the TMDL. The flow targets are the basis for the FRP, developed in accordance with the Municipal Separate Storm Sewer System (MS4) General Permit Subpart IV.C.1 as a required part of the MS4s Stormwater Management Program (SWMP).

The purpose of this Flow Restoration Plan (FRP) is to outline a plan for the retrofit of existing impervious surfaces with stormwater management Best Management Practices (BMPs) (e.g. gravel wetlands, infiltration basins, etc.) to meet the TMDL flow targets. The TMDL required that watershed hydrology must be controlled in the Centennial Brook Watershed to reduce high flow discharges, in order to restore degraded water quality and achieve compliance with the Vermont Water Quality Standards (VWQS).

⁵ The EPA approval of the Centennial Brook TMDL can be viewed at the following links:

https://ofmpub.epa.gov/waters10/attains_impaired_waters.show_tmdl_document?p_tmdl_doc_blobs_id=72381

Four (4) MS4s including the City of South Burlington, the City of Burlington, the University of Vermont (UVM), and the Vermont Agency of Transportation (VTRANS) own impervious cover within the Centennial Brook Watershed.

2.1. Centennial Brook Total Maximum Daily Load (TMDL)

In response to Centennial Brook not meeting the Vermont water quality standards, it was placed on the list of impaired waters in accordance with Section 303(d) of the Federal Clean Water Act. Most watershed reaches are rated as poor for sediment content. The VTDEC developed TMDLs for impaired watersheds using flow as a surrogate for pollutant loading⁶. The basis for the TMDL development was the comparison of modeled Flow Duration Curves (FDCs) between impaired and attainment watersheds. The Program for Predicting Polluting Particles Passage through Pits, Puddles, and Ponds, Urban Catchment Model (P8) was used to model gauged and ungauged watersheds in Vermont and develop Flow Duration Curves (FDCs) from which a normalized high flow and low flow per drainage area in square miles (cfs/sq.mi.) were extracted.

For the purposes of the Centennial Brook Stormwater TMDL, VTDEC determined that the low flow target would be represented by the 95th percentile (Q95%) of the curve and the high flow target would be represented by the 5th percentile (Q0.3%). The high and low flow values from the FDCs were then compared between impaired watersheds and comparable attainment watersheds to determine a percent change. The high flow target required a total 63.4% reduction in watershed flow allocation during the 1-year storm event. UVM and DEC have discussed the exclusion of flows derived from agricultural/open space lands, which would reduce the 63.4% TMDL reduction target to 63.0%.

As part of the FRP development, the Chittenden County Regional Planning Commission (CCRPC) completed a study to estimate the expected non-jurisdictional impervious area growth in the Centennial Brook watershed over the next 20 years. Non-jurisdictional growth by definition the impervious area that does not require a stormwater permit, and is therefore important to account for within the 20 year management plan. The original TMDL assigned a non-jurisdictional impervious growth of 40 acres, whereas the CCRPC study estimated 5 acres based on the actual non-jurisdictional growth rate from 2003 to 2010. With the revised future growth, the high-flow target (Q0.3%) would be reduced from 63.4% to 51.6%⁷ as summarized in Table 1 below. The modified flow target was considered, but ultimately the original (unmodified) flow target of 16.5%, was incorporated into the FRP planning process and proposed BMP implementation scenario.

Table 1. TMDL Flow Target and modified target with revised future growth

Flow Target	Target High Flow Q 0.3(± %) Reduction
TMDL Target from current Urban/Developed areas	-49.9%
TMDL Targets with 40 acres of Non-Jurisdictional Future Growth	-63.4%
TMDL <i>Modified</i> Targets with 5 acres of Non-Jurisdictional Future Growth ¹	-51.6%
1 Modified target was calculated as: $-[(49.9\%) + (63.4\% - 49.9\%)(5 \text{ ac}/40 \text{ ac})] = -15.6\%$	

⁷ VTDEC. 2007. Centennial Brook TMDL

2.2 MS4 Permit Background and Requirements

On December 5, 2012, Vermont's revised MS4 Permit was issued. Included in the 2012 MS4 permit issuance were new requirements for municipalities to develop FRPs to implement the stormwater TMDLs. The FRPs were required to be developed for each impaired watershed by October 1, 2016, and include the following elements:

- 1) An identification of the required controls
- 2) A design and construction schedule
- 3) A financial plan
- 4) A regulatory analysis
- 5) The identification of regulatory assistance, and
- 6) Identification of any third party implementation.

The schedule required implementation of the required BMPs as soon as possible, but no later than 20 years from the effective date of the permit, before December 5, 2032. In 2018 the State revised the MS4 Permit to include additional requirements to address the Lake Champlain Phosphorous TMDL. As part of the permit renewal, each MS4 was required to submit an updated Notice of Intent (NOI) and Stormwater Management Program (SWMP), including updated Flow Restoration Plans.

3. BMPDSS Model

In an effort to implement the Vermont Stormwater TMDLs, the VTDEC worked with an external consultant (TetraTech) to develop the computer-based VT BMPDSS, a VT-specific hydrologic BMP assessment model. This modeling tool was developed by TetraTech, Inc., with considerable investment from EPA Region 3 and Prince George's County, Maryland, and was adapted for use in Vermont using funding from the Vermont Agency of Natural Resources (ANR). The purpose of the modeling tool was to predict progress toward the TMDL flow targets based on proposed BMP implementation scenarios to help MS4 communities identify different BMP options and associated costs.

The information for each BMP entered into the BMPDSS model includes: drainage area, storage volume, outlet control structures and geographic location. The remaining data needed to calculate flow simulations is built into the model and includes: topography, soil types, impervious cover, and rainfall data.

In order to complete a flow target assessment, VTDEC developed three model scenarios for each impaired watershed, including a Baseline Condition Model (Pre-2002), an Existing Condition Model (Post-2002), and a Proposed Condition Model (Credit).

3.1 Baseline Condition Model (Pre-2002)

The Baseline Scenario Model includes all stormwater BMPs installed prior to issuance of the VT Stormwater Design Standards in 2002. The purpose of this model was to quantify the flows in the stream prior to beginning the Flow Restoration Planning process and establish a baseline from which to measure.

3.2 Existing Condition Model (Post-2002)

The Existing Condition Model includes all existing BMPs in the Baseline Condition Model, as well as the addition of any BMPs that have been constructed since 2002 in the Centennial Brook watershed. The purpose of the model is to show current flows in Centennial Brook. This allows the State and MS4 communities to track progress toward the high flow attainment target. On a routine basis, the Existing Condition BMPDSS model is revised to include any recently constructed BMPs, including BMPs designed and constructed by the MS4s, as well as BMPs constructed as part of commercial development and redevelopment. Additionally, the Existing Conditions Model is updated to reflect any changes to existing BMPs, such as revised drainage areas, modification of outlet control structures, or changes in storage volumes. The results of the Existing Condition Model are compared to the Baseline Condition Model to determine if the 51.6% reduction in high flow has been achieved.

The Proposed Condition Model includes all BMPs in the Existing Condition Model, which in turn includes all BMPs from the Baseline Condition Model, as well as a collection of proposed BMPs that can achieve the high flow reduction target in the Centennial Brook watershed. The iterative process of developing the list of proposed BMPs is detailed further in the original Centennial Brook FRP, dated October 1, 2016.

3.3 Proposed Condition Model (Credit)

The Proposed Condition Model includes a total of 24 sites; seven (7) retrofits to existing BMPs, two (2) new detention systems, fourteen (14) new infiltration systems, and one (1) new bioretention system. Credit toward the flow target is also provided by stormwater BMPs from the Existing Condition Model. A summary table of the proposed BMPs is included in Appendix A, along with individual summary sheets describing each proposed BMP the Centennial Brook FRP.

A summary table of the BMPDSS Model Results is shown below in Table 2.

Table 2: Summary of BMPDSS Model Results

Description	Q03 High Flow	
	(cfs)	% Reduction
Baseline Condition	33.28	-
Existing Condition	23.2	14.8%
Proposed Condition	15.98	51.9%

The BMPDSS model did not predict a significant increase in the stream base flow despite the preferential selection of infiltration-based BMPs when possible given site constraints such as soil type. It has been noted by the VTDEC and other BMPDSS model users that the model tends to under represent infiltration-based BMPs and is not sensitive enough to accurately predict base flow increases as a result of smaller infiltration-based BMPs. It is expected that actual base flow increases will be higher than predicted by the BMPDSS.

3.4 Project Ranking

All proposed BMPs identified as part of FRP development in the five stormwater impaired watersheds of Potash, Bartlett, Englesby, Centennial, and Munroe Brook were ranked and a project prioritization was created. Considerations that factored into the ranking of BMP projects include the estimated benefit of a BMP towards the FRP's flow restoration targets, and the amount of impervious area treated. The comprehensive ranking matrix ranked the proposed BMP projects based on the following criteria, which were grouped into four general categories as shown in Table 3.

Table 3: Project Ranking Matrix

Category	ID	Criteria
Cost/Operations	A	Project Cost per Impervious Acre
Project Design Metrics	B	Impervious Acres Managed (ac)
	C	Channel Protection Volume (CPv) Mitigated, (ie. 1-year Storm)
	D	Volume Infiltrated (ac-ft)
Project Implementation	E	Permits
	F	Land Availability
Other Project Benefits/Constraints	G	Flood Mitigation (Is existing flooding issue mitigated by project?)
	H	TMDL Flow Target Addressed (Q03, Q95)
	I	Lake Champlain Phosphorus TMDL
	J	Other Project Benefits/Constraints

Values for each criteria were identified and assigned a relative score, so that proposed BMP projects could be ranked based on a total score. A full description of the ranking criteria is presented in Table D-1 in Appendix B, and a scoring key is presented in Table D-2 in Appendix B. The final scoring of proposed BMP projects in the Centennial Brook Watershed is presented Table E-2 in Appendix C.

4. Design and Construction Schedule

A Design and Construction (D&C) schedule is a required element of the final FRP. This schedule must show how the proposed BMPs included in the FRP can be implemented over a timeframe of less than 20 years from the date of MS4 permit issuance. This means that all BMPs associated with FRPs must be implemented prior to December 5, 2032. The City of South Burlington owns impervious surface in five stormwater impaired watersheds; Bartlett, Englesby, Centennial, Munroe, and Potash Brook. Therefore, proposed stormwater BMPs in all five watersheds were considered when developing a realistic D&C schedule for the City. However, only the projects located within the Centennial Brook watershed are presented in the implementation schedule in Appendix C.

In addition to a project's score within the BMP ranking matrix, development of a BMP implementation schedule required the consideration of additional factors, such as expired State of Vermont stormwater permits, properties containing more than 3 acres of impervious area, and land owned or controlled by the MS4 entities. Additionally, private property redevelopment and development of the City's Phosphorus

Control Plan (PCP) may cause certain projects to gain or lose priority within the implementation schedule in the future.

5. Financial Plan

Subject to the requirements of the MS4 permit, a financial plan is required as part of the FRP. This plan must provide initial BMP cost estimates and demonstrate the means by which BMP implementation will be financed. The financial plan must also include the steps that each MS4 will take to implement the finance plan. Initial BMP cost estimates were calculated in 2014 using cost values that were current at that time. Once projects were scheduled over the 20 year implementation schedule, an annual 3% inflation rate (based on historic trends in the construction cost index¹) was applied. Table E-3 in Appendix C presents inflation adjusted project costs for each BMP project. Applying this inflation rate provides a more accurate annual cost for BMP construction in the later years of the schedule.

5.1. City of South Burlington Financial Plan

In 2005, the City of South Burlington created Vermont's first stormwater utility. Under the stormwater utility system, all developed properties in the City pay an impervious area-based stormwater fee using an Equivalent Residential Unit (ERU) system. These stormwater fees provide the City with a stable funding source that is used to comply with State and Federal stormwater regulations and maintain stormwater infrastructure throughout the City. The stormwater utility was created with the understanding that there would be future stormwater costs related to the five stormwater impaired watersheds located in South Burlington, as well as costs related to future implementation of projects required by the Lake Champlain Phosphorous TMDL. The City is currently utilizing funds generated from stormwater utility fees to fund FRP related costs.

Once the BMP cost and implementation schedule was developed, the City of South Burlington Stormwater Utility was able to incorporate this information into its existing stormwater rate model. The City evaluated two different scenarios for funding the BMPs included in the FRP. The first scenario assumed that there would be no grant funding available to assist with implementation. The second scenario assumed that grant funding of approximately \$250,000 per year would be available in 2018 through 2029, and that this amount would increase to \$500,000 in 2030, 2031, and 2032. The resulting annual cost to a single family residential property and commercial property owner containing 1 acre of impervious area is summarized in Table 5. Calculations for "Commercial Property Containing 1 Acre Impervious Area" in Table 4 assume an Equivalent Residential Unit (ERU) rate of 17 and do not take into account the City's relative tier factors based on percent impervious cover.

¹ RSMeans. "Historical Cost Indexes." <https://www.rsmeansonline.com/references/unit/refpdf/hci.pdf>

Table 4: Annual Stormwater Fee Paid by Property Owners Under Different FRP Funding Scenarios

Fiscal Year	Funding Scenario 1 - Receive No Grants		Funding Scenario 2 - Receive \$250,000 in Grants Annually	
	Single Family Residential Property	Commercial Property Containing 1 Acre Impervious Area	Single Family Residential Property	Commercial Property Containing 1 Acre Impervious Area
2018	\$80.28	\$1,364.76	\$80.28	\$1,364.76
2019	\$82.44	\$1,401.48	\$82.08	\$1,395.36
2020	\$84.60	\$1,438.20	\$83.88	\$1,425.96
2021	\$87.12	\$1,481.04	\$85.68	\$1,456.56
2022	\$90.00	\$1,530.00	\$87.48	\$1,487.16
2023	\$93.24	\$1,585.08	\$89.28	\$1,517.76
2024	\$96.84	\$1,646.28	\$91.08	\$1,548.36
2025	\$100.80	\$1,713.60	\$92.88	\$1,578.96
2026	\$105.12	\$1,787.04	\$94.68	\$1,609.56
2027	\$109.80	\$1,866.60	\$96.48	\$1,640.16
2028	\$114.84	\$1,952.28	\$98.28	\$1,670.76
2029	\$119.88	\$2,037.96	\$100.08	\$1,701.36
2030	\$124.92	\$2,123.64	\$101.88	\$1,731.96
2031	\$129.96	\$2,209.32	\$103.68	\$1,762.56
2032	\$135.00	\$2,295.00	\$105.48	\$1,793.16

It is the City's expectation that significant funding from the State of Vermont and other Federal sources will be available to help with the cost of stormwater TMDL implementation. The State of Vermont has already taken initial steps towards providing this funding. In 2015, the Vermont legislature created the Clean Water Fund (CWF). The CWF was provided with \$2,005,000 in 2016 and \$7,688,000 in 2016. While these initial investments are not at the level necessary to provide significant funding to the MS4 communities subject to stormwater TMDLs, it is our understanding that the State is working to provide additional funding to the CWF in the future. The City of South Burlington intends to work closely with our legislative representatives to ensure that funding is made available for the stormwater improvements included in the FRPs. The City of South Burlington will also pursue funding from existing and new grant sources from other organizations including, but not limited to, VTDEC, the Vermont Agency of Transportation, and the Lake Champlain Basin Program.

5.2 City of Burlington Financial Plan

In 2009, the City of Burlington followed the example of the City of South Burlington in implementing an impervious area based stormwater fee to provide the City of Burlington with a stable funding source to maintain stormwater infrastructure throughout the City and to comply with numerous State and Federal stormwater regulations including the Stormwater TMDLs, Lake Champlain TMDL and Combined Sewer requirements. Implementation of retrofits for which the City is responsible will ultimately be the responsibility of the stormwater ratepayers. In order to limit the impact to the ratepayers, the City intends to leverage existing and new grant and loan sources, as they are available. Later analyses will determine exactly which retrofit financial obligations (i.e. paying into project completed elsewhere in the watershed) will be necessary for the City to meet its obligations in

Centennial Brook as the City continues to work in partnership with the other Centennial Brook MS4s. Additionally, as part of the Integrated Planning effort, the City will be completing a financial capability assessment (FCA) to evaluate the long-term ability of ratepayers to fund these and other Clean Water Act obligations. An FCA doesn't mean that Clean Water Act obligations won't be met – but may point to an adjustment of the overall schedule of implementation of all of the City of Burlington's obligations, including implementation of this and other Flow Restoration Plan projects, in order to mitigate the impact of stormwater and wastewater rates increasing at an unsustainable rate for the Burlington community. This FRP and SWMP will be amended with an updated financial plan, including stormwater rate projections for this and other Clean Water Act obligations once the FCA under the Integrated Plan is completed. The City is aware that due to the nature of the several joint/regional projects that are part of the Centennial Brook watershed plan and the fact that other MS4s may not be pursuing the possible scheduling flexibilities associated with integrated permitting, it is likely that significant adjustments of implementation schedules and associated financial planning will not be plausible for this watershed. This reality will be evaluated within the context of the FCA and the Integrated Planning effort.

5.3 University of Vermont Financial Plan

Under the current budgeting process, the University would establish project funds to fulfill the University of Vermont's obligation. We would endeavor to pursue federal and state stormwater grant opportunities.

5.4 Vermont Agency of Transportation Financial Plan

Planning level costs were independently estimated for each VTrans project using a consistent spreadsheet-based method for all projects. As such, some cost estimates may differ slightly from those presented in other FRP documents. VTrans will request state and federal funding for the appropriate amount to implement the BMPs as outlined in their design and construction schedule. For those projects that will require a joint effort with another municipality, VTrans will request funding for their portion of the cost share. In watersheds where VTrans is either not meeting or exceeding their allocated target there may be cost sharing between MS4s.

5.5 Burlington International Airport Financial Plan

A financial plan that estimates the costs for implementing the BMPs and describes a strategy for financing is a required element of the FRP. The financing plan includes the steps each permittee will take to implement the financing plan. The City of South Burlington Potash Brook and Centennial Brook FRPs include cost estimates for each of the BMPs, using 2014 cost estimates with an annual 3% inflation rate as noted above. The VTDEC and the contributing MS4 permittees within these watersheds have signed a Memorandum of Agreement (MOA) to perform monitoring and other data collection required under the MS4 permitting program. Each MS4 permittee, including BTV, has been assigned a percentage of the total cost of the contracted work over a five-year timeframe. This type of collaborative arrangement will also apply to implementation and financing of the BMPs.

As described in the FRPs, it is BTV's expectation that significant funding from the State of Vermont and other Federal sources will be available to help with the cost of stormwater TMDL implementation. In 2015, the Vermont legislature created the Clean Water Fund (CWF). This fund was provided with

\$2,005,000 in 2015 and \$7,688,000 in 2016, and will likely receive additional funding in the years to come. The City of South Burlington and Burlington Airport intend to work closely with legislative representatives to ensure that this funding is made available for the stormwater improvements included in the FRPs.

The Burlington Airport also intends to seek funding for implementing its commensurate share of the BMPs within the watersheds, including requests from the CWF and other sources. BTV is committed to participating in a cost share with the City of South Burlington to implement its FRP in a manner that is fair and reasonable for the airport. It is also noted that BTV reserves the right to achieve its FRP commitments through implementing projects of its own choosing that may not be identified on South Burlington's present list of proposed watershed improvement projects.

5.6 Proposed BMP Cost Estimates

The Proposed Condition Model that achieved the required 51.6% reduction in stream flow during the 1-year storm event included 23 BMPs costing approximately \$7,370,000. Cost estimates were developed based on a simple spreadsheet method that calculated base construction cost as a product of the design control volume, the unit cost, and the site adjustment factor, as outlined in Table 5 below¹. Additionally, permitting, engineering, land acquisition, and O&M costs were factored into the total cost estimate.

Table 5: Proposed BMP Unit Costs and Adjustment Factors

BMP	Base Cost (\$/ft ³)
Detention Basin	\$2
Infiltration Basin	\$4
Underground Chamber (infiltration or detention)	\$12
Bioretention	\$10
Green Infrastructure/ Underground Chamber Combo	\$22
Site Type	Cost Multiplier
Existing BMP retrofit	0.25
New BMP in undeveloped area	1
New BMP in partially developed area	1.5
New BMP in developed area	2
Adjustment factor for large aboveground basin projects	0.5

A summary of all project costs for each proposed BMP in the Centennial Brook Watershed are included in Table E-1 in Appendix C.

¹ Methodology based on Horsley Witten Group Memorandum (Page 11).

6. Regulatory Analysis

In accordance with the MS4 permit, an FRP requires a regulatory analysis that identifies and describes what, if any additional regulatory authorities that the permittees will need in order to effectively implement the FRP.

Currently, stormwater runoff within the Centennial Brook watershed is regulated primarily by the VTDEC, City of South Burlington, City of Burlington, and VTrans. VTDEC regulates new developments through issuance of Stormwater Discharge Permits with technical requirements as outlined in the 2017 Vermont Stormwater Management Manual. The City of South Burlington and City of Burlington require improved stormwater practices and low impact development for new developments through their stormwater ordinances and Land Development Regulations (LDRs). VTrans regulates stormwater discharges to the state Right of Way through 19 V.S.A. §1111 “Permitted use of the right-of-way”.

The City of South Burlington updated the stormwater requirements in its LDRs in June 2016.¹ The revised LDRs require that any project resulting in ½ acre or more of impervious area implement stormwater controls that prioritize infiltration. The revised LDRs also contain new requirements for properties that are being redeveloped. It is the City’s expectation that these changes will result in gradual improvements in stormwater management over the course of the 20 year BMP implementation schedule.

The City of South Burlington also revised its “Ordinance Regulating the Use of Public and Private Sanitary Sewerage and Stormwater Systems” in October 2015.² The ordinance provides a policy regarding the handling of expired VTDEC stormwater permits located in South Burlington. The City will continue to take over responsibility for exclusively residential stormwater systems that complete upgrades. In addition, the revised ordinance allows commercial properties with expired permits to obtain coverage under the City’s MS4 permit if upgrades to the stormwater system are completed. These properties will still be responsible for maintaining their systems, but the permit coverage required by the State of Vermont can now be provided through the City’s MS4 permit instead of obtaining coverage under one of VTDEC’s other permit programs.

A full list of the expired State of Vermont permits with discharges to Centennial Brook is presented in Table 6 in Section 7.

¹ Section 12.03 – Stormwater Management Standards, “South Burlington Land Development Regulations,” dated 8/6/18, can be viewed at the following link:
<http://www.southburlingtonvt.gov/Planning/LDR%20Amendments/2018-5/LDRs%20Complete%20Effective%208-6-2018%20reduced.pdf>

² South Burlington’s “Ordinance Regulating the Use of Public and Private Sanitary Sewerage and Stormwater Systems,” dated 10/5/15, can be viewed at the following link:
http://www.southburlingtonvt.gov/document_center/planning/Sewerage_Stormwater_Systems.pdf

7. Third Party Implementation

In accordance with the MS4 permit, a FRP requires identification of the name of any party, other than the permittee, that is responsible for implementing any portion of the FRP. A full list of VTDEC permits discharging to the Centennial Brook and the type of system covered under the permit is included in Table 6. Several of the expired permits may have obtained new permit coverage under a Residual Designation Authority (RDA) permit from VTDEC.

Table 6. Expired Permits Within The Centennial Brook Watershed

PERMIT NUMBER	Project Name	PERMIT BUSINESS	EXPDATE
2-0126		Larkin Realty	7/1/1985
1-0871	Summer Woods	CGPM Inc.	6/30/1994
1-0946	Queensbury Rd and Bluff Court	O'Brien Brothers Agency, Inc.	6/30/1995
1-1257	Quarry Ridge (Centennial Heights)	Quarry Ridge Homeowners Association (So Burlington Realty)	6/30/2001
4330-INDS		South Burlington School District	9/19/2011
4524-INDS	Benson Development	Benson Development LP	3/26/2012
5932-INDS	Precourt Properties	Precourt Investment Co., LLC	12/30/2013

7.1 Expired Permit Proposed Retrofits

All expired permit holders in the Centennial Brook watershed will be required to obtain valid State stormwater permit coverage. This can be accomplished through a process that the State has identified in their current draft Stormwater Permitting Rule, or through the City's Stormwater Upgrade Feasibility Analysis (SUFA) process. Refer to sburlstormwater.com/download-material/ for the latest available version of the City's Stormwater Upgrade Feasibility Analysis (SUFA) document.

As noted in the SUFA, "FRPs for the stormwater impaired watersheds located in the City contain a preliminary assessment of the stormwater treatment potential of some sites. If an FRP identifies an STP on a site, then the site must install either the specified STP or an STP that provides equivalent or greater treatment. In addition, final FRPs will contain a schedule indicating when various retrofits must occur. Properties that choose to construct STPs must do so before November 15, 2023, or the date specified in the FRP, whichever is sooner." The City may revise the date included in the ordinance depending upon the dates included in the final version of State of Vermont Stormwater Permitting Rule. The City expects that VTDEC will finalize the rule in 2019. This will provide the City with sufficient time to update its ordinance.

The City has identified specific retrofit projects for BMPs with expired State of Vermont permits. These projects are included in Table C-1: Final Proposed BMPs for Centennial Brook FRP in Appendix A. All other expired permits in the Centennial Brook Watershed will be required to complete upgrades as determined by the technical standards included in the City's SUFA.

8. Appendices

Appendix A - Stormwater BMP Site Inspection Field Sheets

Appendix B – Future Growth Memorandum

Appendix C – Centennial Brook Flow Restoration Plan Proposed Best Management Practices

Table C-1: Final Proposed BMPs for Centennial Brook FRP

Centennial Brook FRP BMP Summary Sheets

Appendix D – Project Ranking

Table D-1: BMP Ranking Criteria Key

Table D-2: BMP Ranking Scoring Key

Appendix E – Proposed Cost Estimates, Prioritization Ranking, and Implementation Schedule

Table E-1: Project Cost Estimates

Table E-2: Centennial Brook Watershed BMP Project Scoring

Table E-3: Centennial Brook Watershed BMP Project Implementation Schedule

APPENDIX A

CENTENNIAL BROOK FRP PROPOSED BMPs

Centennial Brook Flow Restoration Plan

Table C-1: Final Proposed BMPs for the Centennial Brook FRP

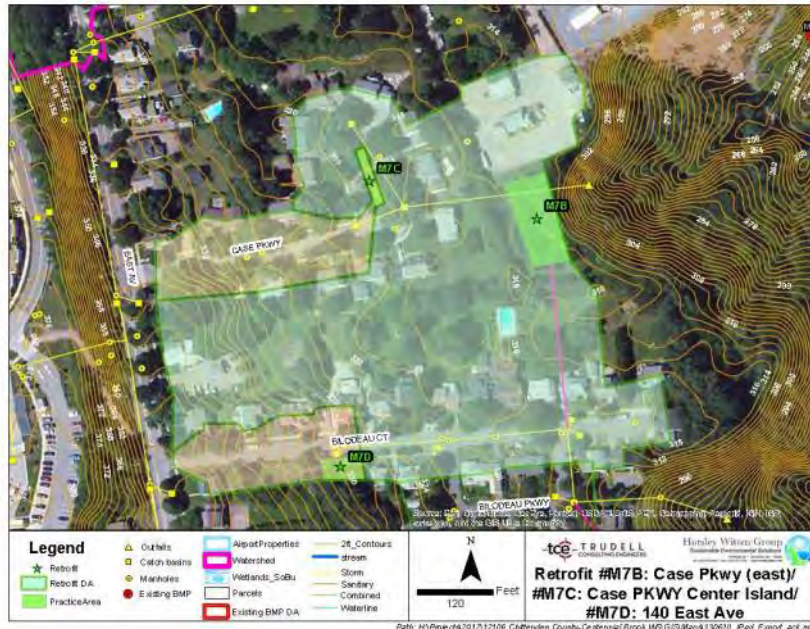
Project ID	Project Name	BMP Address	BMP Landowner	MS4s with Impervious Area	New or Existing	BMP Type	Expired Permit	Drainage Area (acres)	Impervious Area Managed	Impervious %	CPv Managed (ac-ft)	Volume Infiltrated (ac-ft)	BMP Description
CB0001	140 East Ave Residence	Bilodeau Ct, Burlington	MS4 Owned	Burlington	New	Bio		0.63	0.18	28%	0.046	0.046	Construct a bioretention area in underutilized private green space. Divert drainage from existing drainage structure in Bilodeau Court. Alternative practice may include permeable pavement shoulders/parking lanes in the road ROW.
CB0002	Best Western Windjammer Infiltration Basin A	North of Williston Rd and east of Dorset St, South Burlington	Private	South Burlington	New	IB	6323-9030	29.42	21.82	74%	2.023	2.023	Site drainage area currently includes only Best Western property. Outfall is severely eroded and is headcutting to the east and may soon reach paved access road. Concept includes stabilizing outfall and constructing a detention basin within existing gully. Expand current drainage area to intercept runoff from Williston Road drainage network and redirect drainage from abutting commercial properties.
CB0003	Best Western Windjammer Infiltration Basin B	North of Williston Rd and east of Dorset St, South Burlington	Private	South Burlington	New	IB	6323-9030	4.09	1.33	33%	0.053	0.053	Outfall is located west of Best Western. Site drainage area currently includes only Best Western property. Moderate erosion occurring. Concept includes stabilizing outfalls and constructing a detention basin within existing gully. Expand current drainage area to intercept runoff from the Williston Road drainage network. A portion of this drainage area could be directed to Retrofit 22 if necessary.
CB0004	Case Parkway Center Island	Case Pkwy, South Burlington	MS4 Owned	Burlington	Existing	Bio	No Permit	0.86	0.23	27%	0.042	0.042	Proposed bioretention area in center island on Case Parkway. Direct road drainage to bioretention using a speed bump across Case Parkway. The bioretention could underdrain/overflow to existing drainage system and outfall.
CB0006	Chamberlin School	South of Hanover St and west of Airport Pkwy, South Burlington	MS4 Owned	South Burlington	New	IG	No Permit	31.49	9.69	31%	1.955	1.955	Underground detention in open space of school property. It seems possible to collect drainage off of White Street (and upgradient residential neighborhood) and connect to existing system via school entrance. Underground chambers could be designed as infiltration pending results of soils test pitting. (note HSG – D on east side of school property; HSG – B on west side of school property).
CB0007	Clover St GSI	Clover St and Berkley St, South Burlington	MS4 Owned/Private	South Burlington	New	IG	No Permit	3.82	1.40	37%	0.073	0.073	30-ft wide residential streets with direct outfalls to streams, flat terrain, and good soils offer green street and neighborhood-scale disconnection opportunities (e.g., dry wells, rain gardens, pervious driveways, bump outs).
CB0008	Dumont Ave Infiltration Chambers	Dumont Ave, South Burlington	MS4 Owned	South Burlington, BTV	New	IG	No Permit	3.93	0.86	22%	0.047	0.047	Divert flows from existing catchbasins and convey down Dumont Ave via pipe or swale to underground recharge chambers on empty lot. Options exist for practice type, siting and conveyance mechanism depending on depth to GW, existing inverts, and future use by Airport. Discharge to existing pipe outlet at Airport basin.
CB0009	Duval St GSI	Duval St, South Burlington	MS4 Owned/Private	South Burlington	New	IG	No Permit	3.57	0.99	28%	0.048	0.048	30-ft wide residential streets with direct outfalls to streams, flat terrain, and good soils offer green street and neighborhood-scale disconnection opportunities (e.g., dry wells, rain gardens, pervious driveways, bump outs).
CB0010	Fielding Lane Condos Infiltration Gallery	Richard Terr and Clover St, South Burlington	Private	South Burlington	New	IG	No Permit	18.74	5.14	27%	0.148	0.148	Detention-retention facility. Open parcel adjacent to Fielding Lane Condos – seems to be owned by Fielding Lane Condos, existing surface storage available below outfall pipe. Would require access from Fielding Lane.

CB0011	Fletcher Allen Green Space	Carrigan Dr, Burlington	MS4 Owned	Burlington, UVM	Existing	Bio		0.89	0.53	59%	0.131	0.131	Proposed bioretention area in green space near hospital entrance. Redirect existing roadway trench drains into practice. Site currently drains to the UVM East Campus Pond.
CB0012	Fletcher Allen Parking Lot	Carrigan Dr, Burlington	MS4 Owned	Burlington	Existing	Bio		0.83	0.61	74%	0.097	0.097	Proposed bioretention area in existing drainage feature. Site is currently managed by existing swales, curb cuts, and a drainage depression. Swales and depression are currently eroding. Raise existing catchbasin frame/grate to provide ponding for bioretention.
CB0013	Grove Street Parking Lot	Grove St, Burlington	MS4 Owned	Burlington	New	IG	1-0811	8.82	2.33	26%	0.205	0.205	Divert existing drainage network and capture runoff from parking lot and direct to proposed underground recharge system. Low point in road drainage area is immediately south of the City parking lot. Consider replacing parking lot with permeable pavement.
CB0014	I-89 Cloverleaf Underground Detention	I-89 Exit 14 interchange, South Burlington	MS4 Owned	South Burlington, VTrans	Existing	UD	2-0126; 6323-9030; 2-0619	39.17	17.18	44%	2.35	0	Detention structure bounded by northbound lanes and off-ramp (directing traffic to westbound Williston Rd). Existing culvert drains all upgradient area from interchange and Williston Rd. Modify outlet to install new control structure for Cpv storage.
CB0015	I-89 Exit 14 Detention Pond	I-89 Exit 14 interchange, South Burlington	Public or MS4 Owned (depending on option)	South Burlington, VTrans	New	GW	No Permit	13.07	3.58	27%	2.87	0	Location flexible depending on evaluation. Most downstream location would be across from drainage outlet, below water main (best location for embankment – maximizes storage), but impact to water main R/W likely and partially on private property. Alternative is to move embankment upgradient to limit of I-89 R/W – would reduce available storage, but keep all work w/in VTrans jurisdiction.
CB0016	Jaycee Park	Patchen Rd north of White St, South Burlington	MS4 Owned	South Burlington	New	IG	No Permit	15.73	6.42	41%	0.898	0.898	Pretreatment tank to underground infiltration chambers. Pretreatment could be proprietary device (e.g. StormCeptor or equal) before underground chambers. Access would need to be coordinated with playing fields. Flow diversion structure would be in Patchen Road, with depth to drain pipe at approx 6.5 feet.
CB0018	N Henry Court	N Henry Ct, South Burlington	MS4 Owned	South Burlington, BTv	New	IG	No Permit	1.03	0.33	32%	0.024	0.024	Dead-end road with excess impervious cover. Currently, drainage comes down the road and flows directly down a steep slope to the stream/wetland area below. Install a rain garden/bio with an overflow to a leaching catch basin at end of road. Dumping of yard waste and debris was also observed down the slope. An old corrugated discharge pipe was found down in stream.
CB0019	North Campus Pond Retrofit	University Rd, Burlington	MS4 Owned	Burlington, UVM	Existing	DP		76.94	45.99	60%	4.719995	0	Proposed expansion of existing North Campus Pond to over control existing and future development. Raise existing embankment (10' +/-) to provide additional capacity. May consider horizontal expansion to the north and/or south.
CB0021	Patchen Rd & Pine St Infiltration Gallery	Pine St and Patchen Rd, South Burlington	Private	South Burlington	New	IG	No Permit	20.41	5.40	26%	0.913	0.913	Underground detention or infiltration (depending on soils). Diversion of flows from Patchen Road feasible, incoming pipe from open space/low point behind lots too deep to capture. Single lot also contains SF house (see photo). Would require diversion structure and pretreatment tank/structure.
CB0022	Patchen Road Kettle Hole	Patchen Rd south of I-89, South Burlington	MS4 Owned/Private	South Burlington, VTrans	New	IG	6292-9030	14.06	5.45	39%	0.268	0.268	Detention Pond (or infiltration basin if soils are acceptable). Directly convey runoff from contributing area off Patchen Road down slope to sediment forebay. Modify existing 30" culvert headwall (under I-89) to achieve required flow control. Could pick up Kirby Rd.

CB0023	Picard Circle Infiltration	Picard Cir, South Burlington	MS4 Owned	South Burlington, BTV	New	IG	No Permit	69.80	21.06	30%	0.682	0.682	Subsurface infiltration system. All houses within Picard Circle have been purchased by Airport and are now abandoned. Significant site area exists within yards and the road for major underground infiltration/ detention system. Constraints include depth of existing drainage pipe and depth above groundwater (adjacent brook approx 14 feet below existing ground).
CB0024	Queensbury Pond Retrofit	Queensbury Rd, South Burlington	Private	South Burlington	Existing	IB	1-0946	7.60	2.88	38%	0.16	0.16	Existing dry detention pond. Modify outlet to create an infiltration basin. Existing pond might predate subdivision (newer PVC outlet connects to older CMP barrel). Facility appears to have additional storage capacity to expand drainage area (level run confirmed this is feasible).
CB0025	Retrofit of Main Street UVM Pond	North of Williston Rd and East Terr, South Burlington	MS4 Owned	South Burlington, Burlington, UVM	Existing	DP		39.64	17.51	44%	3.89	0	Repair outlet structure. Retrofit options include expanding the pond southward toward Williston Road or eastward as part of Retrofit #24 for additional storage, extended detention, and improved water quality. Site has the ability to capture drainage from Williston Road, adjacent commercial properties, and unmanaged UVM land.
CB0027	Staples Plaza Underground Detention A	West of I-89 Exit 14 interchange, South Burlington	Private	South Burlington	New	UD	No Permit	2.50	2.50	100%	0.26	0	Convert landscaped island to bioswale w/ UG storage to manage parking and small roof. Overflow to existing drain. Add trees for cover, shading, interception. Reduce width of one-way aisle for bioswale. Flat roof drains internally, discharges to drain inlet east of building. Modify internal roof drains, install trays, or use other blue roof design to provide temporary detention.

Centennial Brook FRP BMP Summary Sheet

Site name:		140 East Ave Residence		South Burlington ID:		CB0001	
Approximate address:	Bilodeau Ct, Burlington		MS4 where BMP is located:	Burlington	New or existing BMP?	New	
Proposed BMP type:	Bioretention						



Estimated project cost	\$44,000	MS4s contributing drainage to BMP	Burlington
Drainage area (acres)	0.63	Primary land use in drainage	Residential
Impervious acres managed	0.18	2 or more landowners?	Yes
% Impervious	28%	CPv managed (ac-ft)	0.05
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.05
BMP Footprint Size (acres)		Primary or secondary BMP?	Secondary
BMP Depth (feet)		Expired permit(s)?	
Hydrologic soil group	A/B		

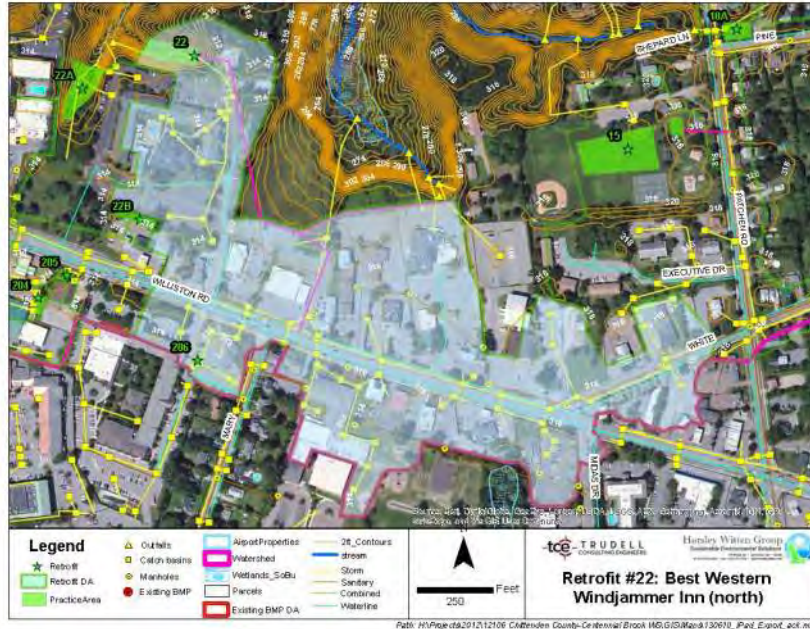
Proposed BMP description:	Feasibility concerns:
Construct a bioretention area in underutilized private green space. Divert drainage from existing drainage structure in Bilodeau Court. Alternative practice may include permeable pavement shoulders/parking lanes in the road ROW.	Proposed site location is on private property. Utilities may present conflicts for retrofit opportunities.

Centennial Brook FRP BMP Summary Sheet

Site name:	Best Western Windjammer Infiltration Basin A	South Burlington ID:	CB0002
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Approximate address:	North of Williston Rd and east of Dorset St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Infiltration Basin
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Estimated project cost	\$557,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	29.42	Primary land use in drainage	Commercial/Industrial
Impervious acres managed	21.82	2 or more landowners?	Yes
% Impervious	74%	CPv managed (ac-ft)	2.02
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	2.02
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	6323-9030
Hydrologic soil group	A		

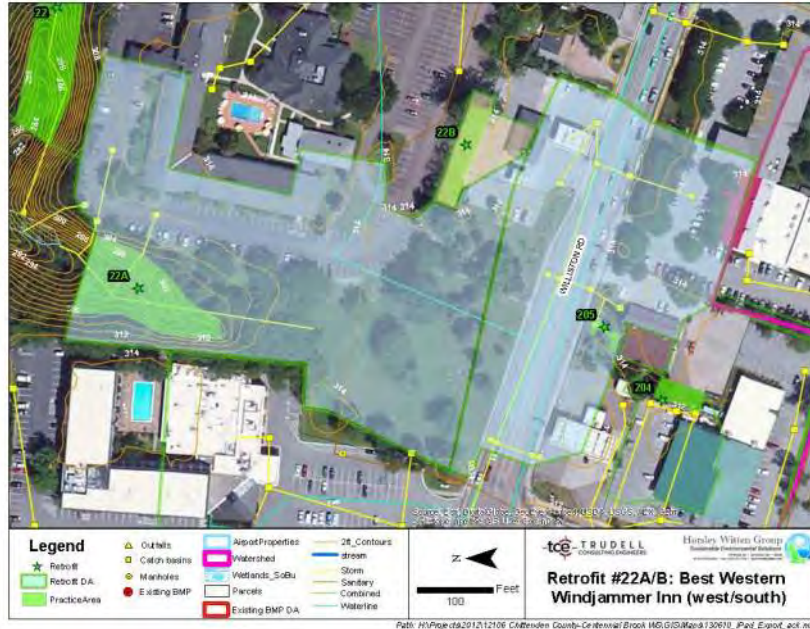
Proposed BMP description:	Feasibility concerns:
Site drainage area currently includes only Best Western property. Outfall is severely eroded and is headcutting to the east and may soon reach paved access road. Concept includes stabilizing outfall and constructing a detention basin within existing gully. Expand current drainage area to intercept runoff from Williston Road drainage network and redirect drainage from abutting commercial properties.	Priority project. The proposed site could manage a large drainage area that is unmanaged and unstable. Since the outfall is in need of immediate repair, feasibility is high. Planning considerations include the redirection of flow from abutting commercial properties.

Centennial Brook FRP BMP Summary Sheet

Site name:	Best Western Windjammer Infiltration Basin B	South Burlington ID:	CB0003
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Approximate address:	North of Williston Rd and east of Dorset St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Infiltration Basin
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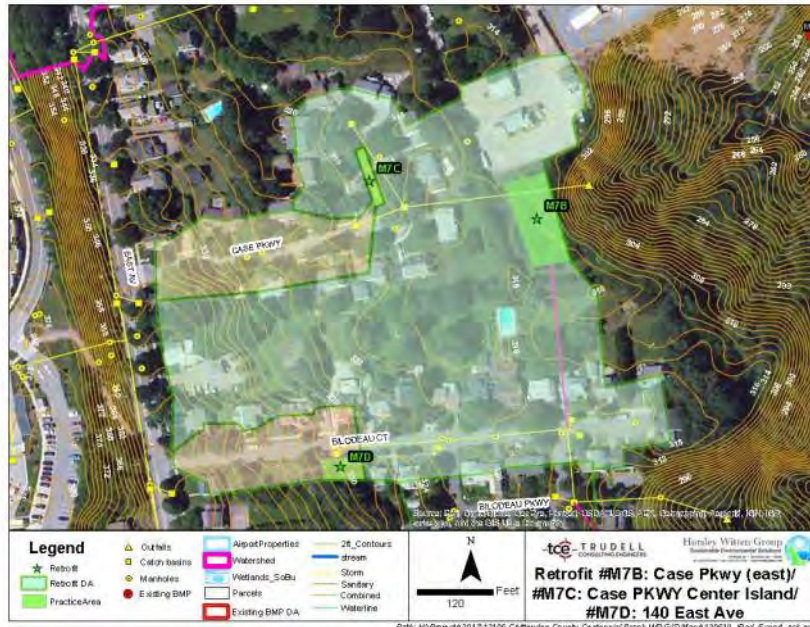


Estimated project cost	\$81,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	4.09	Primary land use in drainage	Commercial/Industrial
Impervious acres managed	1.33	2 or more landowners?	No
% Impervious	33%	CPv managed (ac-ft)	0.05
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.05
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	6323-9030
Hydrologic soil group	A/B		

Proposed BMP description:	Feasibility concerns:
Outfall is located west of Best Western. Site drainage area currently includes only Best Western property. Moderate erosion occurring. Concept includes stabilizing outfalls and constructing a detention basin within existing gully. Expand current drainage area to intercept runoff from the Williston Road drainage network. A portion of this drainage area could be directed to Retrofit 22 if necessary.	Good. May make economic sense to divert some or all of this area to Retrofit site #22.

Centennial Brook FRP BMP Summary Sheet

Site name:		Case Parkway Center Island	South Burlington ID:		CB0004	
Approximate address:	Case Pkwy, South Burlington		MS4 where BMP is located:	Burlington	New or existing BMP?	Existing
Proposed BMP type:	Bioretention					



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	Burlington
Drainage area (acres)	0.86	Primary land use in drainage	Residential
Impervious acres managed	0.23	2 or more landowners?	Yes
% Impervious	27%	CPv managed (ac-ft)	0.04
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.04
BMP Footprint Size (acres)		Primary or secondary BMP?	Secondary
BMP Depth (feet)		Expired permit(s)?	
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Proposed bioretention area in center island on Case Parkway. Direct road drainage to bioretention using a speed bump across Case Parkway. The bioretention could underdrain/overflow to existing drainage system and outfall.	Site currently is within the drainage area for the UVM North Campus Pond.

Centennial Brook FRP BMP Summary Sheet

Site name:	Chamberlain School		South Burlington ID:	CB0006	
Approximate address:	South of Hanover St and west of Airport Pkwy, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Infiltration Gallery				

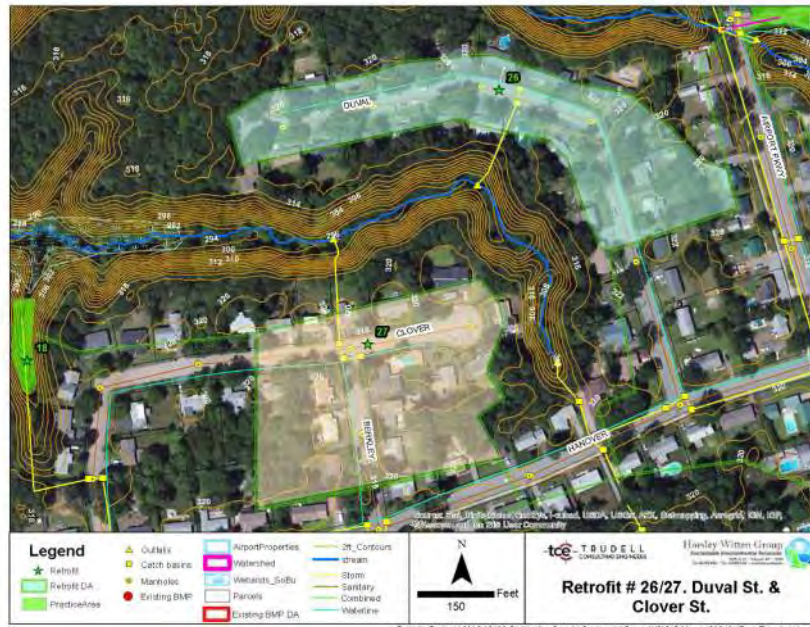


Estimated project cost	\$1,216,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	31.49	Primary land use in drainage	Institutional
Impervious acres managed	9.69	2 or more landowners?	Yes
% Impervious	31%	CPv managed (ac-ft)	1.96
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	1.96
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	B/Not Rated		

Proposed BMP description:	Feasibility concerns:
Underground detention in open space of school property. It seems possible to collect drainage off of White Street (and upgradient residential neighborhood) and connect to existing system via school entrance. Underground chambers could be designed as infiltration pending results of soils test pitting. (note HSG – D on east side of school property; HSG – B on west side of school property).	Existing drainage system (12" cmp) drains building and parking lot. Would need to verify capacity to add addition upgradient lands – only need to be sized for 1- YR. Cpv.

Centennial Brook FRP BMP Summary Sheet

Site name:	Clover St GSI		South Burlington ID:	CB0007	
Approximate address:	Clover St and Berkley St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Infiltration Gallery				



Estimated project cost	\$72,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	3.82	Primary land use in drainage	Residential
Impervious acres managed	1.40	2 or more landowners?	Yes
% Impervious	37%	CPv managed (ac-ft)	0.07
Land owner of BMP location	MS4 Owned/ Private	Volume infiltrated (ac-ft)	0.07
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	A		

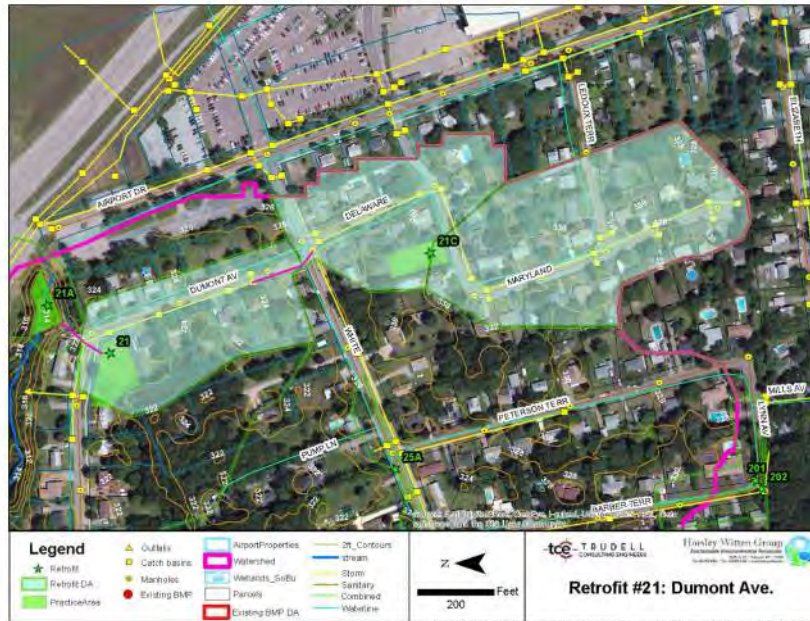
Proposed BMP description:	Feasibility concerns:
30-ft wide residential streets with direct outfalls to streams, flat terrain, and good soils offer green street and neighborhood-scale disconnection opportunities (e.g., dry wells, rain gardens, pervious driveways, bump outs).	Small drainage area; requires participation by homeowners.

Centennial Brook FRP BMP Summary Sheet

Site name:	Dumont Ave Infiltration Chambers	South Burlington ID:	CB0008
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Approximate address:	Dumont Ave, South Burlington	MS4 where BMP is located:	BTV	New or existing BMP?	New
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Proposed BMP type:	Infiltration Gallery
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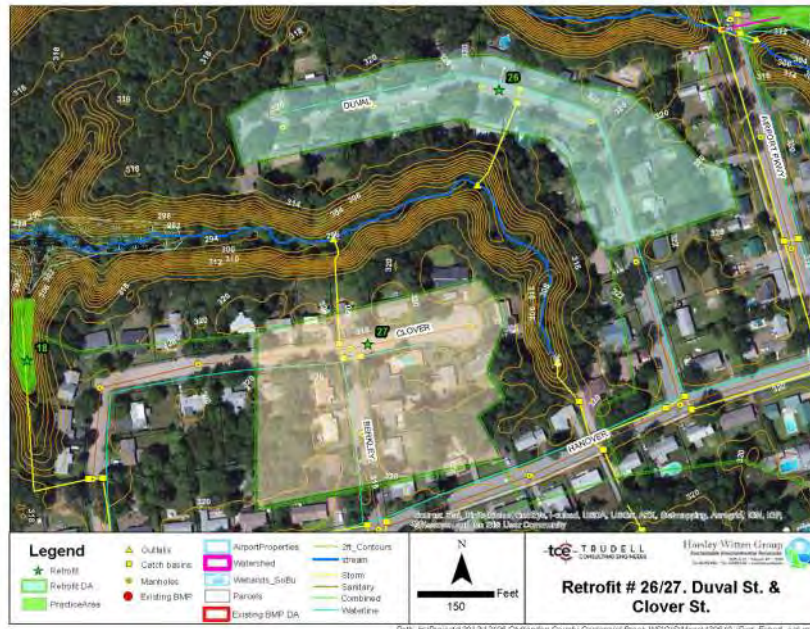


Estimated project cost	\$27,000	MS4s contributing drainage to BMP	South Burlington, BTV
Drainage area (acres)	3.93	Primary land use in drainage	Residential
Impervious acres managed	0.86	2 or more landowners?	Yes
% Impervious	22%	CPv managed (ac-ft)	0.05
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.05
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Divert flows from existing catchbasins and convey down Dumont Ave via pipe or swale to underground recharge chambers on empty lot. Options exist for practice type, siting and conveyance mechanism depending on depth to GW, existing inverts, and future use by Airport. Discharge to existing pipe outlet at Airport basin.	Invert at White St. 321.40. Distance to vacant lot on corner – approx. 580' @ .005 slope; pipe outlets at 318.5'. Storage would be below grade. Depth to GW could be an issue and eliminate infiltration option. For above grade system inverts at White/Delaware would need to be raised. May be possible by resetting pipe inverts. Possible to create sand filter on top of UG chambers or shallow infiltration basin.

Centennial Brook FRP BMP Summary Sheet

Site name:	Duval St GSI		South Burlington ID:	CB0009	
Approximate address:	Duval St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Infiltration Gallery				



Estimated project cost	\$79,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	3.57	Primary land use in drainage	Residential
Impervious acres managed	0.99	2 or more landowners?	Yes
% Impervious	28%	CPv managed (ac-ft)	0.05
Land owner of BMP location	MS4 Owned/ Private	Volume infiltrated (ac-ft)	0.05
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	A		

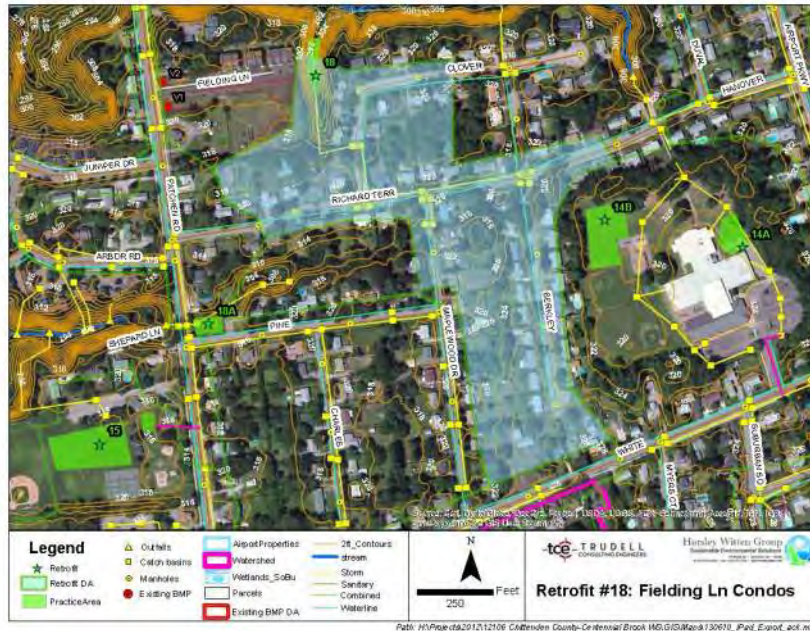
Proposed BMP description:	Feasibility concerns:
30-ft wide residential streets with direct outfalls to streams, flat terrain, and good soils offer green street and neighborhood-scale disconnection opportunities (e.g., dry wells, rain gardens, pervious driveways, bump outs).	Small drainage area; requires participation by homeowners.

Centennial Brook FRP BMP Summary Sheet

Site name:	Fielding Lane Condos Infiltration Gallery	South Burlington ID:	CB0010
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Approximate address:	Richard Terr and Clover St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Infiltration Gallery
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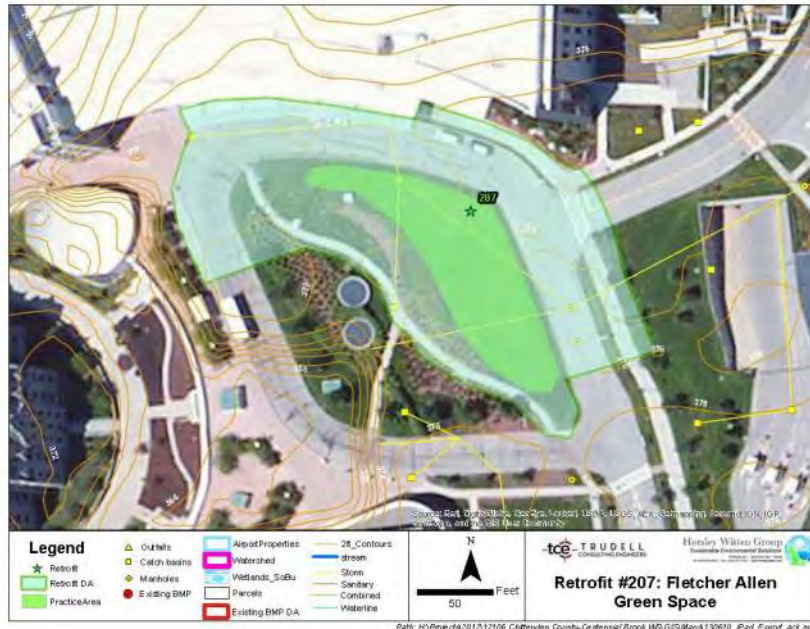


Estimated project cost	\$208,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	18.74	Primary land use in drainage	Residential
Impervious acres managed	5.14	2 or more landowners?	Yes
% Impervious	27%	CPv managed (ac-ft)	0.15
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.15
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Detention-retention facility. Open parcel adjacent to Fielding Lane Condos – seems to be owned by Fielding Lane Condos, existing surface storage available below outfall pipe. Would require access from Fielding Lane.	Likely private land - Major constraint is construction and maintenance access. Homeowners on Clover Street most impacted. Downgradient wetlands/stream below outfall pipe.

Centennial Brook FRP BMP Summary Sheet

Site name:		Fletcher Allen Green Space		South Burlington ID:		CB0011					
Approximate address:		Carrigan Dr, Burlington		MS4 where BMP is located:		Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Bioretention									



Estimated project cost	\$50,000	MS4s contributing drainage to BMP	Burlington, UVM
Drainage area (acres)	0.89	Primary land use in drainage	Institutional
Impervious acres managed	0.53	2 or more landowners?	No
% Impervious	59%	CPv managed (ac-ft)	0.13
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.13
BMP Footprint Size (acres)		Primary or secondary BMP?	Secondary
BMP Depth (feet)		Expired permit(s)?	
Hydrologic soil group	Not Rated		

Proposed BMP description:	Feasibility concerns:
Proposed bioretention area in green space near hospital entrance. Redirect existing roadway trench drains into practice. Site currently drains to the UVM East Campus Pond.	Moderate feasibility. Trench drain outlets are shallow so daylighting is possible. Plenty of green space for practice area. High profile location.

Centennial Brook FRP BMP Summary Sheet

Site name:	Fletcher Allen Parking Lot		South Burlington ID:	CB0012	
Approximate address:	Carrigan Dr, Burlington	MS4 where BMP is located:	Burlington	New or existing BMP?	Existing
Proposed BMP type:	Bioretention				



Estimated project cost	\$37,000	MS4s contributing drainage to BMP	Burlington
Drainage area (acres)	0.83	Primary land use in drainage	Institutional
Impervious acres managed	0.61	2 or more landowners?	No
% Impervious	74%	CPv managed (ac-ft)	0.10
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.10
BMP Footprint Size (acres)		Primary or secondary BMP?	Secondary
BMP Depth (feet)		Expired permit(s)?	
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Proposed bioretention area in existing drainage feature. Site is currently managed by existing swales, curb cuts, and a drainage depression. Swales and depression are currently eroding. Raise existing catchbasin frame/grate to provide ponding for bioretention.	Easy retrofit and aesthetic improvement. Parking lot already has features necessary directing drainage to the retrofit practice location.

Centennial Brook FRP BMP Summary Sheet

Site name: Grove Street Parking Lot **South Burlington ID:** CB0013

Approximate address:

Grove St, Burlington

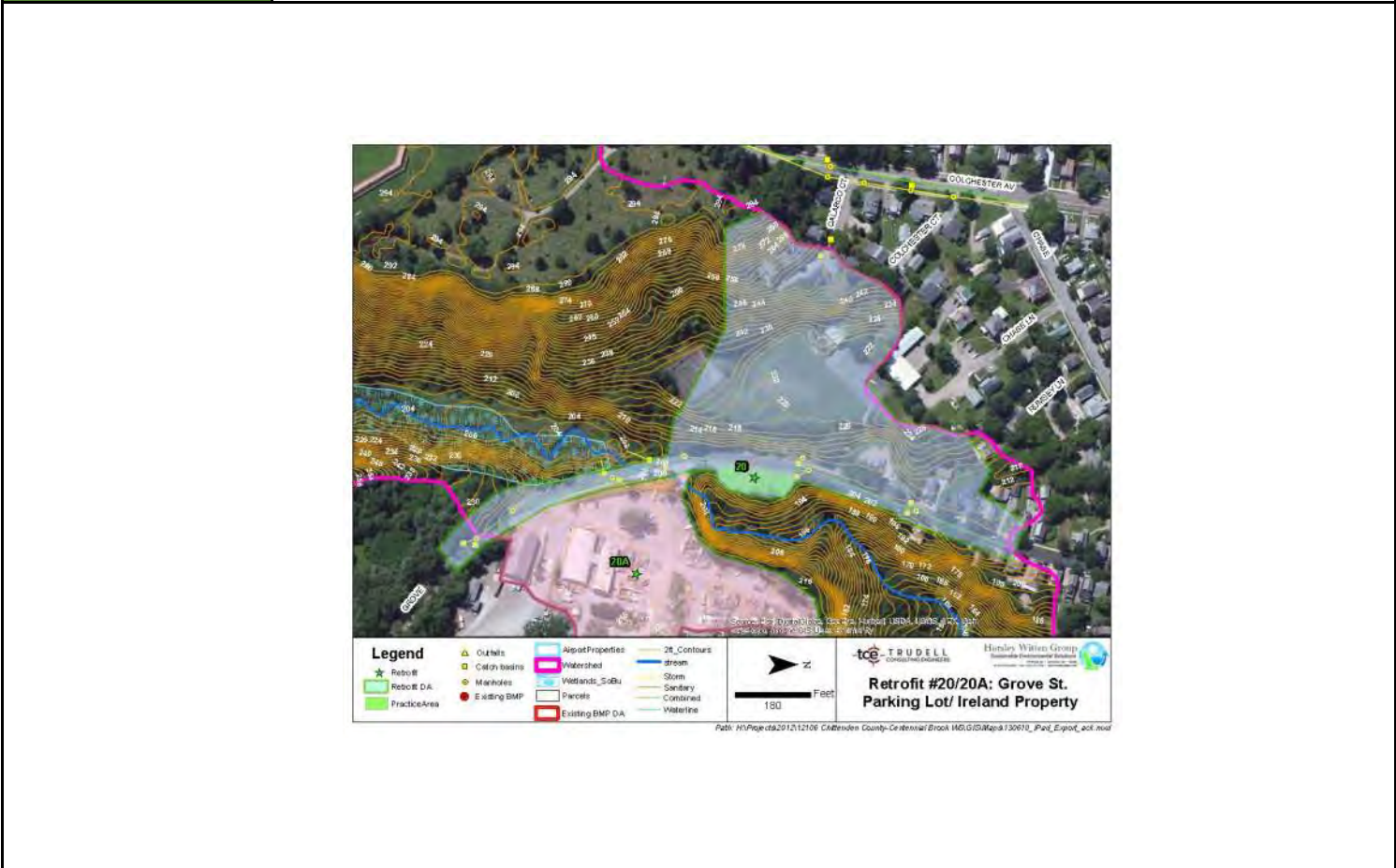
MS4 where BMP is located:

Burlington

New or existing BMP?

New

Proposed BMP type:	Infiltration Gallery
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Estimated project cost	\$156,000	MS4s contributing drainage to BMP	Burlington	
Drainage area (acres)	8.82			
Impervious acres managed	2.33		Primary land use in drainage	Road
% Impervious	26%		2 or more landowners?	Yes
Land owner of BMP location	MS4 Owned		CPv managed (ac-ft)	0.20
BMP Footprint Size (acres)			Volume infiltrated (ac-ft)	0.20
BMP Depth (feet)			Primary or secondary BMP?	Primary
Hydrologic soil group	B		Expired permit(s)?	1-0811

<p>Proposed BMP description:</p>

Divert existing drainage network and capture runoff from parking lot and direct to proposed underground recharge system. Low point in road drainage area is immediately south of the City parking lot. Consider replacing parking lot with permeable pavement.

Feasibility concerns:

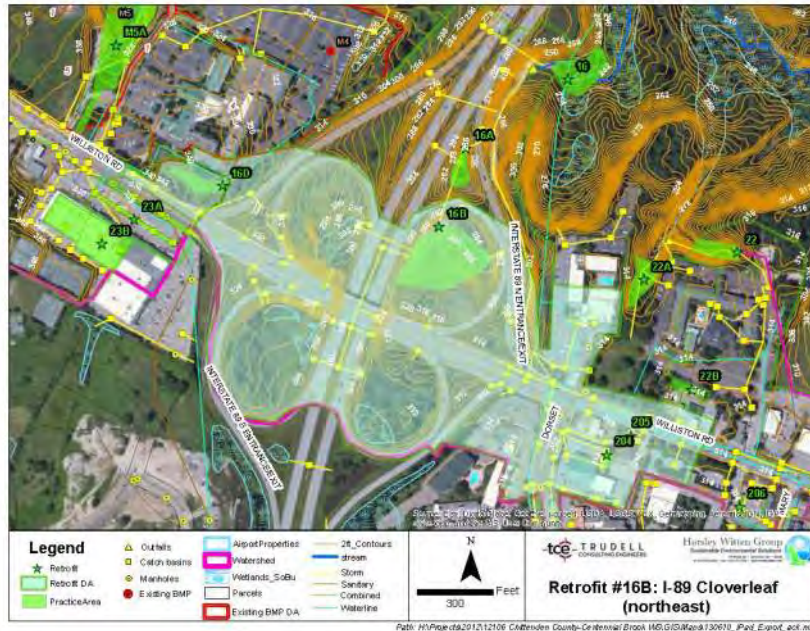
High feasibility since parking lot is currently in poor condition. Adequate head to capture roadway drainage. Test pits or borings needed to confirm soils and depth to groundwater.

Centennial Brook FRP BMP Summary Sheet

Site name:	I-89 Cloverleaf Underground Detention	South Burlington ID:	CB0014
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Approximate address:	I-89 Exit 14 interchange, South Burlington	MS4 where BMP is located:	VTrans	New or existing BMP?	Existing
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Proposed BMP type:	Underground Detention
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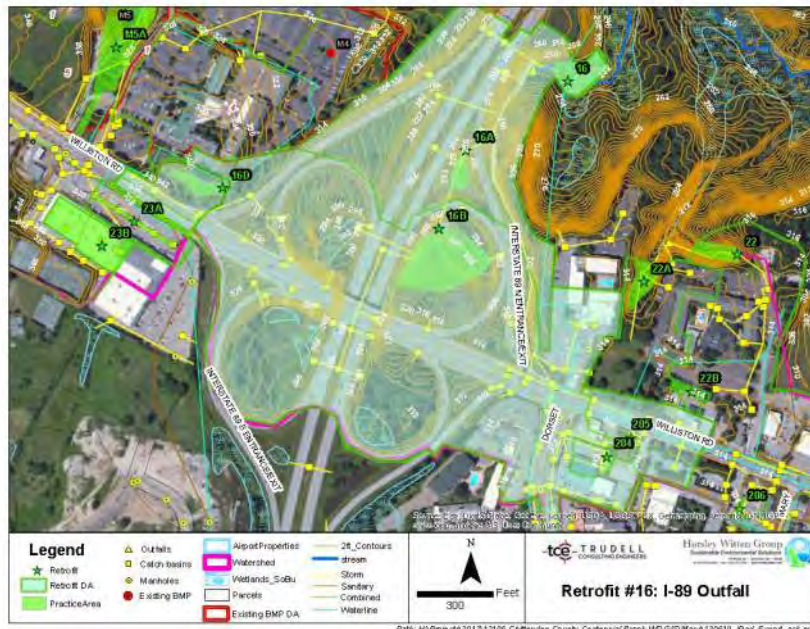


Estimated project cost	\$215,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	39.17	Primary land use in drainage	Transportation
Impervious acres managed	17.18	2 or more landowners?	Yes
% Impervious	44%	CPv managed (ac-ft)	2.35
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)		Primary or secondary BMP?	Secondary
BMP Depth (feet)		Expired permit(s)?	2-0126; 6323-9030; 2-0610
Hydrologic soil group	Not Rated		

Proposed BMP description:	Feasibility concerns:
Detention structure bounded by northbound lanes and off-ramp (directing traffic to westbound Williston Rd). Existing culvert drains all upgradient area from interchange and Williston Rd. Modify outlet to install new control structure for Cpv storage.	Good location for retrofit. Existing outlet pipe (48" CMP) is easily accessible. Constraints: safety considerations from highway and existing wetlands (though mapped- all areas appear to be phrag dominated and isolated). Approx 14 of grade from invert to low point on off-ramp.

Centennial Brook FRP BMP Summary Sheet

Site name:		I-89 Exit 14 Detention Pond		South Burlington ID:		CB0015	
Approximate address:		I-89 Exit 14 interchange, South Burlington		MS4 where BMP is located:	VTrans	New or existing BMP?	New
Proposed BMP type:		Gravel Wetland					

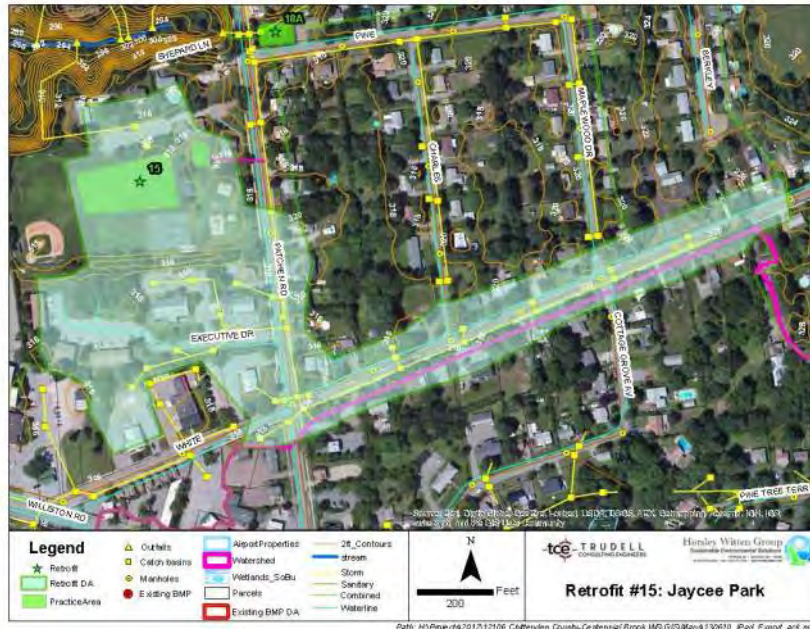


Estimated project cost	\$1,787,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	13.07	Primary land use in drainage	Highway R/W
Impervious acres managed	3.58	2 or more landowners?	No
% Impervious	27%	CPv managed (ac-ft)	2.87
Land owner of BMP location	Public or MS4 Owned (depending on location)	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	Not Rated		

Proposed BMP description:	Feasibility concerns:
Location flexible depending on evaluation. Most downstream location would be across from drainage outlet, below water main (best location for embankment – maximizes storage), but impact to water main R/W likely and partially on private property. Alternative is to move embankment upgradient to limit of I-89 R/W – would reduce available storage, but keep all work w/in VTrans jurisdiction.	Feasible, but constraints need to be quantified, including property ownership, wetlands impacts (see Phrag in photo), water main. Construction and maintenance access good, via water mail R/W. VTrans noted that prior rip rap work was NOT a permitting issues with COE or DEC.

Centennial Brook FRP BMP Summary Sheet

Site name:		Jaycee Park		South Burlington ID:		CB0016					
Approximate address:		Patchen Rd north of White St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Gallery									

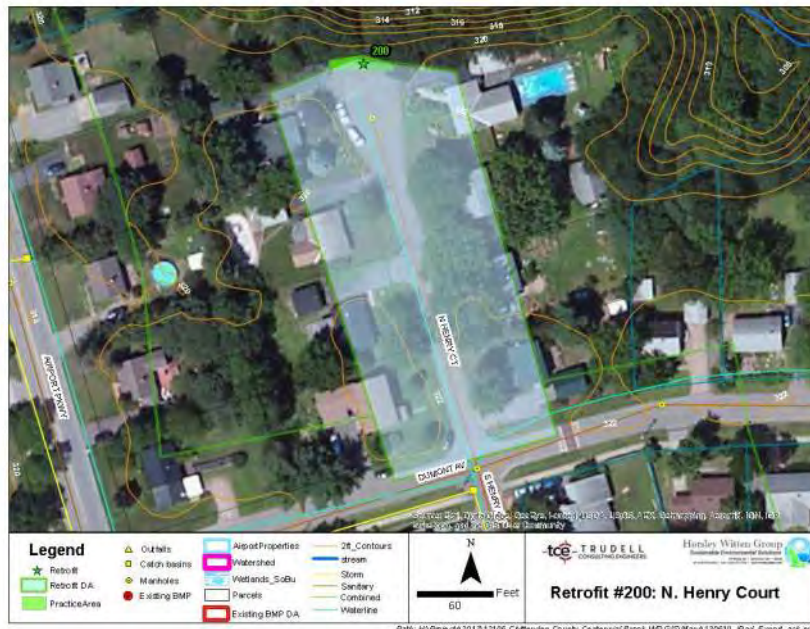


Estimated project cost	\$418,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	15.73	Primary land use in drainage	Park
Impervious acres managed	6.42	2 or more landowners?	Yes
% Impervious	41%	CPv managed (ac-ft)	0.90
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.90
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
<p>Pretreatment tank to underground infiltration chambers.</p> <p>Pretreatment could be proprietary device (e.g, StormCeptor or equal) before underground chambers.</p> <p>Access would need to be coordinated with playing fields.</p> <p>Flow diversion structure would be in Patchen Road, with depth to drain pipe at approx 6.5 feet.</p>	<p>Flow diversion from Patchen Road drives depth of inflow approx 10.5 feet below grade (bottom of chambers 12-13 feet). Existing trees in park, reconstruction of fields Soils at design depth, unknown.</p>

Centennial Brook FRP BMP Summary Sheet

Site name:		N Henry Court		South Burlington ID:		CB0018					
Approximate address:		N Henry Ct, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Gallery									



Estimated project cost	\$27,000	MS4s contributing drainage to BMP	South Burlington, BTW
Drainage area (acres)	1.03	Primary land use in drainage	Residential
Impervious acres managed	0.33	2 or more landowners?	Yes
% Impervious	32%	CPv managed (ac-ft)	0.02
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.02
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Dead-end road with excess impervious cover. Currently, drainage comes down the road and flows directly down a steep slope to the stream/wetland area below. Install a rain garden/bio with an overflow to a leaching catch basin at end of road. Dumping of yard waste and debris was also observed down the slope. An old corrugated discharge pipe was found down in stream.	Small project, but could be a good GI demonstration.

Centennial Brook FRP BMP Summary Sheet

Site name:	North Campus Pond Retrofit	South Burlington ID:	CB0019
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Approximate address:	University Rd, Burlington	MS4 where BMP is located:	UVM	New or existing BMP?	Existing
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$324,000	MS4s contributing drainage to BMP	Burlington, UVM
Drainage area (acres)	76.94	Primary land use in drainage	Institutional
Impervious acres managed	45.99	2 or more landowners?	Yes
% Impervious	60%	CPv managed (ac-ft)	4.72
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Proposed expansion of existing North Campus Pond to over control existing and future development. Raise existing embankment (10' +/-) to provide additional capacity. May consider horizontal expansion to the north and/or south.	Prior to advancing design, UVM will provide a build-out analysis of the contributing drainage area. Drainage area to be updated to reflect the additional portion of UVM that will be redirected to the North Campus Pond.

Centennial Brook FRP BMP Summary Sheet

Site name:	Patchen Rd & Pine St Infiltration Gallery	South Burlington ID:	CB0021
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Approximate address:	Pine St and Patchen Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Infiltration Gallery
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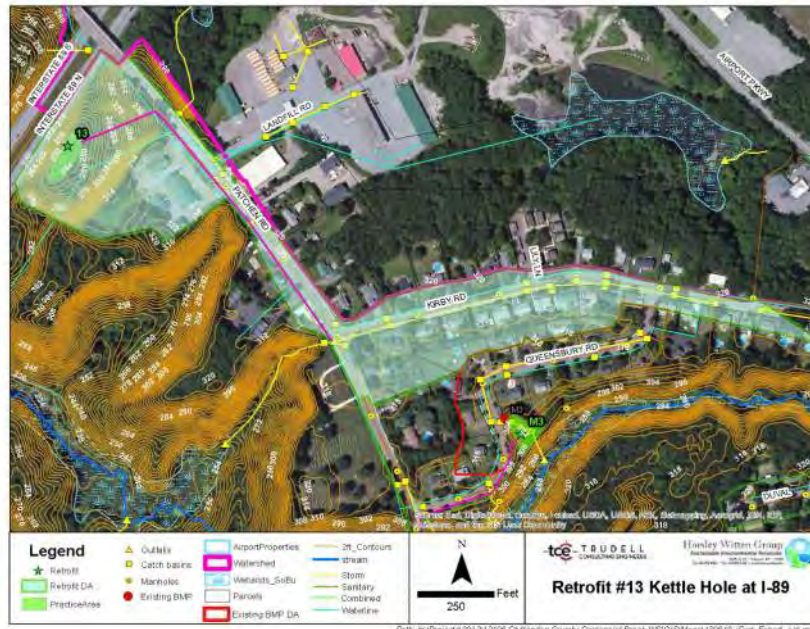


Estimated project cost	\$427,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	20.41	Primary land use in drainage	Residential
Impervious acres managed	5.40	2 or more landowners?	Yes
% Impervious	26%	CPv managed (ac-ft)	0.91
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.91
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Underground detention or infiltration (depending on soils). Diversion of flows from Patchen Road feasible, incoming pipe from open space/low point behind lots too deep to capture. Single lot also contains SF house (see photo). Would require diversion structure and pretreatment tank/structure.	Pipe inverts in Patchen Rd. feasible to divert to underground storage, except west side of road would require crossing water and sewer. Depth of construction ~8 to 10 ft. Private ownership of parcel biggest constraint.

Centennial Brook FRP BMP Summary Sheet

Site name:		Patchen Road Kettle Hole		South Burlington ID:		CB0022					
Approximate address:		Patchen Rd south of I-89, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Gallery									



Estimated project cost	\$220,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	14.06	Primary land use in drainage	Forest
Impervious acres managed	5.45	2 or more landowners?	Yes
% Impervious	39%	CPv managed (ac-ft)	0.27
Land owner of BMP location	MS4 Owned/ Private	Volume infiltrated (ac-ft)	0.27
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	6292-9030
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Detention Pond (or infiltration basin if soils are acceptable). Directly convey runoff from contributing area off Patchen Road down slope to sediment forebay. Modify existing 30" culvert headwall (under I-89) to achieve required flow control. Could pick up Kirby Rd.	Good site; final feasibility will require verification of wetland limits (soils generally upland), assessment of impacts to existing water main (runs through parcel, see blow-off valve in photo), and coordination with VTrans for ponding against I-89 R/W.

Centennial Brook FRP BMP Summary Sheet

Site name:	Picard Circle Infiltration	South Burlington ID:	CB0023
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**Approximate
address:**

Picard Cir, South Burlington

MS4 where BMP is located:

South
Burlington

New or existing BMP?

New

Proposed BMP type:	Infiltration Gallery
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Estimated project cost	\$591,000
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Drainage area (acres)	69.80
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Impervious acres managed	21.06
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% Impervious	30%
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Land owner of BMP location	MS4 Owned
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BMP Footprint Size (acres)	

BMP Depth (feet)	

Hydrologic soil group	A
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MS4s contributing drainage to BMP	MS4s contributing drainage to BMP	MS4s contributing drainage to BMP
MS4s contributing drainage to BMP	MS4s contributing drainage to BMP	MS4s contributing drainage to BMP

South Burlington, BTV

Primary land use in drainage

Residential

2 or more landowners?

Yes

CPv managed (ac-ft)

0.68

Volume infiltrated (ac-ft)

0.68

Primary or secondary BMP?

Primary

Expired permit(s)?

No Permit

Proposed BMP description:

Subsurface infiltration system. All houses within Picard Circle have been purchased by Airport and are now abandoned. Significant site area exists within yards and the road for major underground infiltration/ detention system. Constraints include depth of existing drainage pipe and depth above groundwater (adjacent brook approx 14 feet below existing ground).

Feasibility concerns:

Depth of existing drainage line in Airport Pkwy may preclude piping from existing infrastructure to new system. One option would be to install diversion structure and partially submerge existing piping system.

Centennial Brook FRP BMP Summary Sheet

Site name:	Queensbury Pond Retrofit	South Burlington ID:	CB0024		
Approximate address:	Queensbury Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Infiltration Basin				



Estimated project cost	\$110,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	7.60	Primary land use in drainage	Residential
Impervious acres managed	2.88	2 or more landowners?	Yes
% Impervious	38%	CPv managed (ac-ft)	0.16
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.16
BMP Footprint Size (acres)		Primary or secondary BMP?	Primary
BMP Depth (feet)		Expired permit(s)?	1-0946
Hydrologic soil group	A		

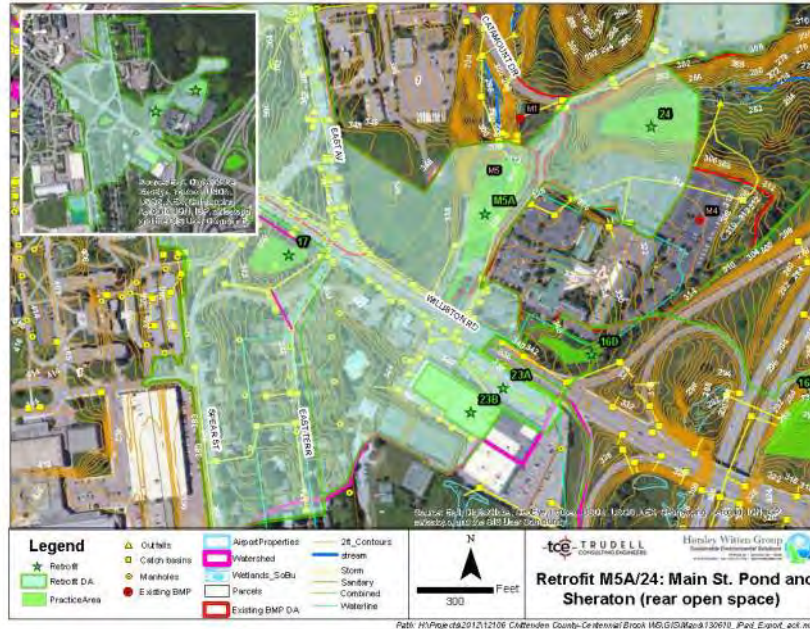
Proposed BMP description:	Feasibility concerns:
Existing dry detention pond. Modify outlet to create an infiltration basin. Existing pond might predate subdivision (newer PVC outlet connects to older CMP barrel). Facility appears to have additional storage capacity to expand drainage area (level run confirmed this is feasible).	Old CMP barrel, new 15" PVC outlet, sink hole evidence – top of existing embankment, scour hole at barrel outlet, Incoming 15" HDPE, eroded inflow channel

Centennial Brook FRP BMP Summary Sheet

Site name:	Retrofit of Main Street UVM Pond		South Burlington ID:	CB0025	
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Approximate address:	North of Williston Rd and East Terr, South Burlington	MS4 where BMP is located:	UVM	New or existing BMP?	Existing
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$365,000		MS4s contributing drainage to BMP	South Burlington, Burlington, UVM
Drainage area (acres)	39.64			
Impervious acres managed	17.51		Primary land use in drainage	Institutional
% Impervious	44%		2 or more landowners?	Yes
Land owner of BMP location	MS4 Owned		CPv managed (ac-ft)	3.89
BMP Footprint Size (acres)			Volume infiltrated (ac-ft)	0.00
BMP Depth (feet)			Primary or secondary BMP?	Primary
Hydrologic soil group	C		Expired permit(s)?	

Proposed BMP description:	Feasibility concerns:
Repair outlet structure. Retrofit options include expanding the pond southward toward Williston Road or eastward as part of Retrofit #24 for additional storage, extended detention, and improved water quality. Site has the ability to capture drainage from Williston Road, adjacent commercial properties, and unmanaged UVM land.	Priority location with high feasibility. Additional storage volume can be added by excavating southward toward the adjacent dirt parking lot and Williston Road.

Centennial Brook FRP BMP Summary Sheet

Site name:	Staples Plaza Underground Detention A	South Burlington ID:	CB0027
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Approximate address:	West of I-89 Exit 14 interchange, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Underground Detention
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Estimated project cost	\$334,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	2.50	Primary land use in drainage	Commercial/Industrial
Impervious acres managed	2.50	2 or more landowners?	No
% Impervious	100%	CPv managed (ac-ft)	0.26
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)		Primary or secondary BMP?	Secondary
BMP Depth (feet)		Expired permit(s)?	No Permit
Hydrologic soil group	Not Rated		

Proposed BMP description:	Feasibility concerns:
Convert landscaped island to bioswale w/ UG storage to manage parking and small roof. Overflow to existing drain. Add trees for cover, shading, interception. Reduce width of one-way aisle for bioswale. Flat roof drains internally, discharges to drain inlet east of building. Modify internal roof drains, install trays, or use other blue roof design to provide temporary detention.	This area could be managed in a larger retrofit downstream (Site # 24_M5). Primary outlet in catchbasin at lot entrance/exit. Rim to invert = 5.05'. Stalls are 18'x8', with a 27' drive aisle (60' and 57' curb to curb on the north and south side of island, respectively).

APPENDIX B

PROJECT RANKING

Centennial Brook Flow Restoration Plan
Table D-1: BMP Ranking Criteria Key

Category	ID	Criteria	Technical Description	Description
Cost/Operations	A	Project Cost	The project costs were grouped into categories from >\$50,000 to \$1,000,000 based on the range of projects proposed. Cost estimates were developed using the latest unit costs from VTrans as well as local experience. More expensive projects are ranked lower.	Project Costs include additional engineering, permitting, and construction. Transportation and utility conflicts, as well as overall constructability is also reflected in the cost.
Project Design Metrics	B	Impervious Acres Managed (ac)	Natural groupings within the range of impervious managed for the proposed projects were identified. More impervious managed receives a higher score.	The more impervious managed by a project, the higher the potential pollutant reduction. Additionally, the goal of the FRP is to manage existing impervious surfaces.
	C	Channel Protection Volume (CPv) Mitigated, (i.e.. 1-year Storm)	Groupings within the range of CPv volume storage were identified. The largest grouping receives the highest score. The CPv was estimated in HydroCAD, using local rainfall data.	The Channel Protection Volume (CPv) is the volume of stormwater runoff generated from the 1-year design storm (1.98" in Burlington). A BMP which provides CPv storage was determined to reduce the High-flow (Q0.3%), which is the flow rate exceeded 0.3% of the time (output from the State's BMPDSS model). Mitigating the CPv reduces channel erosion and excessive
	D	Volume Infiltrated (ac-ft)	Natural groupings within the range of volumes infiltrated for the BMPs were identified to which relative points were be assigned. The largest volume infiltrated was assigned the highest score. Volumes were calculated in HydroCAD.	The Volume Infiltrated indicates the amount of stormwater runoff that is infiltrated into the groundwater, and provides baseflow for the stream. The TMDL flow targets include a low-flow target, which is addressed by an infiltration-based BMP.
Project Implementation	E	Permitability	Permitability is simplified into two categories to reflect the common scenarios in permitting, as 1) minimal permitting, versus 2) Complex permitting issues. An itemized list of permits was included to inform the ranking, but was not used in the scoring.	Permitability is a measure of the expected level of effort to permit the project, based on knowledge that each type of permit takes varying amounts of time. Some common permits include Stormwater Construction, Local Zoning, Act 250 amendments, VTRANS ROW, etc.
	F	Land Availability	Public land is preferred, followed by regulated private land, and private land where the owners are known to be open to participate. Private land, in which participation of the owner is unknown is lower priority.	Land availability is critical for BMPs requiring open space for detention and access for the City. Properties owned by the City are ranked the highest, followed by privately owned land that has an expired permit, which provides leverage for owner participation.
Other Project Benefits	G	Flood Mitigation	Flood mitigation is categorized by the scale of the impact.	Flood mitigation is categorized by the scale of the impact. A neighborhood flooding issue is weighed more heavily than a localized drainage issue.
	H	TMDL Flow Target Addressed (Q03, Q95)	More weight is on BMPs that address both TMDL targets- the high-flow (Q0.3%) and low-flow targets (Q95%). The high-flow target is addressed by detention BMPs which storage the CP volume.	The goal of the FRP is to implement projects which address the TMDL flow targets. The high-flow target is measured as a reduction in the stream flow rate exceeded 0.3% of the time, while the low-flow target is an increase in the stream flow rate exceeded 95% of the time (baseflow). Projects which address both targets through storage or infiltration of the 1-year design storm are weighted the highest, followed by projects which address just the high-flow. Projects which do not address the full 1-year storm volume are weighted the lowest.
	I	Lake Champlain Phosphorus TMDL	Yes or no whether the proposed practice will provide benefit toward the Lake Champlain Phosphorus TMDL. This will be determined once the TMDL compliance metrics are released.	The Lake Champlain Phosphorus TMDL has been developed in the effort to reduce nutrient loading and consequential toxic algal blooms in Lake Champlain. The TMDL will require stormwater BMPs to meet a certain level of Total Phosphorus reduction. Each BMP will be evaluated against the TMDL compliance metrics, and scored yes or no if the project meets the TMDL standards.
	J	Other Project Benefits/Constraints	This criteria is to account for indirect project benefits like infrastructure improvements (e.g. aging culvert replacement, wetlands enhancement, and if it addresses an expired permit), or potential constraints (e.g. utility issues encountered during construction).	This criteria is to account for indirect project benefits like infrastructure improvements, community benefits, habitat creation, etc., as well as things that might constrain the project such as the potential of encountering utilities during construction.

Centennial Brook Flow Restoration Plan

Table D-2: BMP Ranking Scoring Key

Category	ID	Criteria	Quality	Score
Cost/Operations	A	Relative Project Cost	\$1.00 - \$24,999	4
			\$25,000 - \$49,999	3
			\$49,999 - \$99,999	2
			\$100,000 - \$199,999	1
			\$200,000 - \$499,999	0
			\$500,000 +	-1
Project Design Metrics	B	Impervious Acres Managed (ac)	>10 acres	6
			>5-10 acres	5
			>4-5 acres	4
			>2-4 acres	3
			>1-2 acres	2
			< 1 acre	1
			0 acres	0
	C	Channel Protection Volume (CPv) Mitigated, (ie. 1-year Storm)	0.6-1.0 ac-ft	5
			0.4-0.6 ac-ft	4
			0.2-0.4 ac-ft	3
			0.05-0.2 ac-ft	2
			>0-0.05 ac-ft	1
	D	Volume Infiltrated (ac-ft)	0 ac-ft	0
			>2 ac-ft	5
			1 - 2 ac-ft	4
			0.5-1 ac-ft	3
			0.1- 0.5 ac-ft	2
Project Implementation	E	Permitability	>0.01 - 0.1 ac-ft	1
			no infiltration	0
	F	Land Availability	Minimal Issues/Concerns or no permits	2
			Complex issues/Potential permit denial	0
			MS4 owned	4
			Non MS4 owned regulated (expire permit)	3
Other Project Benefits	G	Flood Mitigation (Is existing flooding issue mitigated by project?)	Non MS4 owned/Participatory Owner	2
			Unknown	0
			Not MS4 owned/Non participatory owner	-2
			Neighborhood Wide Flooding Issue	3
	H	TMDL Flow Target Addressed (Q03, Q95)	Infrastructure damage (e.g. Wet Basement)	2
			Nuisance Issue (ie. ponding, puddles, etc).	1
			None	0
	I	Lake Champlain Phosphorus TMDL	High and Low Flow Targets	3
			High Flow Target	2
	J	Other Project Benefits	No target addressed in BMPDSS (just WQ treatment)	1
			Addressed TMDL	1
			Does not address TMDL	0
			Infrastructure Improvement (e.g. Culvert Replacement)	1
			Educational/Functional Benefit	1
			Recreational Benefit	1
			Natural Habitat Creation/Protection	1
			Outfall Erosion Control	1
			Utility Issues/Uncertainty	-1

APPENDIX C

PROPOSED BMP COST ESTIMATES, PRIORITIZATION RANKING, AND IMPLEMENTATION SCHEDULE

Centennial Brook Flow Restoration Plan
Table E-1: Project Cost Estimates

BMP ID	Project Name	Retrofit Description	Impervious Area Mangaged (acres)	Design Control Volume (ft3)	Base Unit Cost (\$/cu.ft.)	Site Adjust Factor	Site Specific Cost	Base Constr. Cost	Permits & Eng.	Land Cost	Summed Project Cost	Minimum Project Cost	Final Project Cost	Cost/ Imp. Acre	O&M
CB0001	140 East Ave Residence	Bio	0.18	1,800	\$10	1.5	\$0	\$27,000	\$10,000	\$7,200	\$44,200	\$25,000	\$44,200	\$249,000	\$1,300
CB0002	Best Western Windjammer Infiltration Basin A	IB	21.82	181,000	\$4	0.5	\$50,000	\$412,000	\$145,000	\$0	\$557,000	\$25,000	\$557,000	\$26,000	\$10,000
CB0003	Best Western Windjammer Infiltration Basin B	IB	1.33	30,000	\$4	0.5	\$0	\$60,000	\$21,000	\$0	\$81,000	\$25,000	\$81,000	\$61,000	\$2,400
CB0004	Case Parkway Center Island	Bio	0.23	1,000	\$10	1.5	\$0	\$15,000	\$6,000	\$0	\$21,000	\$25,000	\$25,000	\$110,000	\$800
CB0006	Chamberlin School	IG	9.69	60,473	\$12	1.5	\$0	\$1,088,514	\$127,000	\$0	\$1,215,514	\$25,000	\$1,215,514	\$125,000	\$10,000
CB0007	Clover St GSI	IG	1.40	1,700	\$12	1.5	\$0	\$30,600	\$11,000	\$30,000	\$71,600	\$25,000	\$71,600	\$51,000	\$2,100
CB0008	Dumont Ave Infiltration Chambers	IG	0.86	1,100	\$12	1.5	\$0	\$19,800	\$7,000	\$0	\$26,800	\$25,000	\$26,800	\$31,000	\$800
CB0009	Duval St GSI	IG	0.99	1,100	\$22	1.5	\$0	\$36,300	\$13,000	\$30,000	\$79,300	\$25,000	\$79,300	\$80,000	\$2,400
CB0010	Fielding Lane Condos Infiltration Gallery	IG	5.14	21,700	\$4	1	\$0	\$86,800	\$31,000	\$90,000	\$207,800	\$25,000	\$207,800	\$40,000	\$6,200
CB0011	Fletcher Allen Green Space	Bio	0.53	3,700	\$10	1	\$0	\$37,000	\$13,000	\$0	\$50,000	\$25,000	\$50,000	\$94,000	\$1,500
CB0012	Fletcher Allen Parking Lot	Bio	0.61	2,700	\$10	1	\$0	\$27,000	\$10,000	\$0	\$37,000	\$25,000	\$37,000	\$60,000	\$1,100
CB0013	Grove Street Parking Lot	IG	2.33	4,800	\$12	2	\$0	\$115,200	\$41,000	\$0	\$156,200	\$25,000	\$156,200	\$67,000	\$4,700
CB0014	I-89 Cloverleaf Underground Detention	UD	17.18	102,577	\$2	0.5	\$0	\$102,577	\$112,000	\$0	\$214,577	\$25,000	\$214,577	\$12,000	\$10,000
CB0015	I-89 Exit 14 Detention Pond	GW	3.58	125,016	\$12	1	\$0	\$1,500,189	\$227,000	\$60,000	\$1,787,189	\$25,000	\$1,787,189	\$500,000	\$10,000
CB0016	Jaycee Park	IG	6.42	19,211	\$12	1.5	\$0	\$345,798	\$72,000	\$0	\$417,798	\$25,000	\$417,798	\$65,000	\$10,000
CB0018	N Henry Court	IG	0.33	600	\$22	1.5	\$0	\$19,800	\$7,000	\$0	\$26,800	\$25,000	\$26,800	\$82,000	\$800
CB0019	North Campus Pond Retrofit	DP	45.99	205,603	\$2	0.25	\$100,000	\$202,801	\$121,000	\$0	\$323,801	\$25,000	\$323,801	\$7,000	\$10,000
CB0021	Patchen Rd & Pine St Infiltration Gallery	IG	5.40	8,600	\$12	1.5	\$0	\$353,970	\$55,000	\$18,000	\$426,970	\$25,000	\$426,970	\$79,000	\$10,000
CB0022	Patchen Road Kettle Hole	IG	5.45	11,674	\$4	0.25	\$25,000	\$36,674	\$33,000	\$150,000	\$219,674	\$25,000	\$219,674	\$40,000	\$6,600
CB0023	Picard Circle Infiltration	IG	21.06	14,700	\$12	1.5	\$273,400	\$538,000	\$53,000	\$0	\$591,000	\$25,000	\$591,000	\$28,000	\$17,700
CB0024	Queensbury Pond Retrofit	IB	2.88	26,700	\$4	0.25	\$25,000	\$51,700	\$19,000	\$39,600	\$110,300	\$25,000	\$110,300	\$38,000	\$3,300
CB0025	Main Street UVM Pond	DP	17.51	169,663	\$2	0.5	\$100,000	\$269,663	\$95,000	\$0	\$364,663	\$25,000	\$364,663	\$21,000	\$10,000
CB0027	Staples Plaza Underground Detention A	UD	2.50	11,600	\$12	2	\$0	\$278,400	\$56,000	\$0	\$334,400	\$25,000	\$334,400	\$134,000	\$10,000

Centennial Brook Flow Restoration Plan

Table E-2: Centennial Brook Watershed BMP Project Scoring

Project ID	Project Name	Expired Permit	MS4	BMP Type	Project Cost Estimate	BMP Description	Total Score
CB0023	Picard Circle Infiltration	No Permit	South Burlington	IG	\$591,000	Subsurface infiltration system. All houses within Picard Circle have been purchased by Airport and are now abandoned. Significant site area exists within yards and the road for major underground infiltration/ detention system. Constraints include depth of existing drainage pipe and depth above groundwater (adjacent brook approx 14 feet below existing ground).	27
CB0002	Best Western Windjammer Infiltration Basin A	6323-9030	South Burlington	IB	\$557,000	Site drainage area currently includes only Best Western property. Outfall is severely eroded and is headcutting to the east and may soon reach paved access road. Concept includes stabilizing outfall and constructing a detention basin within existing gully. Expand current drainage area to intercept runoff from Williston Road drainage network and redirect drainage from abutting commercial properties.	27
CB0025	Retrofit of Main Street UVM Pond		UVM	DP	\$365,000	Repair outlet structure. Retrofit options include expanding the pond southward toward Williston Road or eastward as part of Retrofit #24 for additional storage, extended detention, and improved water quality. Site has the ability to capture drainage from Williston Road, adjacent commercial properties, and unmanaged UVM land.	24
CB0016	Jaycee Park	No Permit	South Burlington	IG	\$418,000	Pretreatment tank to underground infiltration chambers. Pretreatment could be proprietary device (e.g. Stormceptor or equal) before underground chambers. Access would need to be coordinated with playing fields. Flow diversion structure would be in Patchen Road, with depth to drain pipe at approx 6.5 feet.	24
CB0019	North Campus Pond Retrofit		UVM	DP	\$324,000	Proposed expansion of existing North Campus Pond to over control existing and future development. Raise existing embankment (10' +/-) to provide additional capacity. May consider horizontal expansion to the north and/or south.	23
CB0006	Chamberlin School	No Permit	South Burlington	IG	\$1,215,000	Underground detention in open space of school property. It seems possible to collect drainage off of White Street (and upgradient residential neighborhood) and connect to existing system via school entrance. Underground chambers could be designed as infiltration pending results of soils test pitting. (note HSG – D on east side of school property; HSG – B on west side of school property).	22
CB0014	I-89 Cloverleaf Underground Detention	2-0126; 6323-9030; 2-0619	VTrans	UD	\$215,000	Detention structure bounded by northbound lanes and off-ramp (directing traffic to westbound Williston Rd). Existing culvert drains all upgradient area from interchange and Williston Rd. Modify outlet to install new control structure for Cpv storage.	21
CB0024	Queensbury Pond Retrofit	1-0946	South Burlington	IB	\$110,000	Existing dry detention pond. Modify outlet to create an infiltration basin. Existing pond might predate subdivision (newer PVC outlet connects to older CMP barrel). Facility appears to have additional storage capacity to expand drainage area (level run confirmed this is feasible).	20
CB0013	Grove Street Parking Lot	1-0811	Burlington	IG	\$156,000	Divert existing drainage network and capture runoff from parking lot and direct to proposed underground recharge system. Low point in road drainage area is immediately south of the City parking lot. Consider replacing parking lot with permeable pavement.	19
CB0021	Patchen Rd & Pine St Infiltration Gallery	No Permit	South Burlington	IG	\$427,000	Underground detention or infiltration (depending on soils). Diversion of flows from Patchen Road feasible, incoming pipe from open space/low point behind lots too deep to capture. Single lot also contains SF house (see photo). Would require diversion structure and pretreatment tank/structure.	18
CB0022	Patchen Road Kettle Hole	6292-9030	South Burlington	IG	\$220,000	Detention Pond (or infiltration basin if soils are acceptable). Directly convey runoff from contributing area off Patchen Road down slope to sediment forebay. Modify existing 30" culvert headwall (under I-89) to achieve required flow control. Could pick up Kirby Rd.	18
CB0010	Fielding Lane Condos Infiltration Gallery	No Permit	South Burlington	IG	\$208,000	Detention-retention facility. Open parcel adjacent to Fielding Lane Condos – seems to be owned by Fielding Lane Condos, existing surface storage available below outfall pipe. Would require access from Fielding Lane.	18

CB0011	Fletcher Allen Green Space		Burlington	Bio	\$50,000	Proposed bioretention area in green space near hospital entrance. Redirect existing roadway trench drains into practice. Site currently drains to the UVM East Campus Pond.	16
CB0012	Fletcher Allen Parking Lot		Burlington	Bio	\$37,000	Proposed bioretention area in existing drainage feature. Site is currently managed by existing swales, curb cuts, and a drainage depression. Swales and depression are currently eroding. Raise existing catchbasin frame/grate to provide ponding for bioretention.	16
CB0015	I-89 Exit 14 Detention Pond	No Permit	VTrans	GW	\$1,787,000	Location flexible depending on evaluation. Most downstream location would be across from drainage outlet, below water main (best location for embankment – maximizes storage), but impact to water main R/W likely and partially on private property. Alternative is to move embankment upgradient to limit of I-89 R/W – would reduce available storage, but keep all work w/in VTrans jurisdiction.	16
CB0007	Clover St GSI	No Permit	South Burlington	IG	\$72,000	30-ft wide residential streets with direct outfalls to streams, flat terrain, and good soils offer green street and neighborhood-scale disconnection opportunities (e.g., dry wells, rain gardens, pervious driveways, bump outs).	16
CB0008	Dumont Ave Infiltration Chambers	No Permit	BTV	IG	\$27,000	Divert flows from existing catchbasins and convey down Dumont Ave via pipe or swale to underground recharge chambers on empty lot. Options exist for practice type, siting and conveyance mechanism depending on depth to GW, existing inverts, and future use by Airport. Discharge to existing pipe outlet at Airport basin.	15
CB0003	Best Western Windjammer Infiltration Basin B	6323-9030	South Burlington	IB	\$81,000	Outfall is located west of Best Western. Site drainage area currently includes only Best Western property. Moderate erosion occurring. Concept includes stabilizing outfalls and constructing a detention basin within existing gully. Expand current drainage area to intercept runoff from the Williston Road drainage network. A portion of this drainage area could be directed to Retrofit 22 if necessary.	15
CB0018	N Henry Court	No Permit	South Burlington	IG	\$27,000	Dead-end road with excess impervious cover. Currently, drainage comes down the road and flows directly down a steep slope to the stream/wetland area below. Install a rain garden/bio with an overflow to a leaching catch basin at end of road. Dumping of yard waste and debris was also observed down the slope. An old corrugated discharge pipe was found down in stream.	15
CB0009	Duval St GSI	No Permit	South Burlington	IG	\$79,000	30-ft wide residential streets with direct outfalls to streams, flat terrain, and good soils offer green street and neighborhood-scale disconnection opportunities (e.g., dry wells, rain gardens, pervious driveways, bump outs).	14
CB0027	Staples Plaza Underground Detention A	No Permit	South Burlington	UD	\$334,000	Convert landscaped island to bioswale w/ UG storage to manage parking and small roof. Overflow to existing drain. Add trees for cover, shading, interception. Reduce width of one-way aisle for bioswale. Flat roof drains internally, discharges to drain inlet east of building. Modify internal roof drains, install trays, or use other blue roof design to provide temporary detention.	13
CB0001	140 East Ave Residence		Burlington	Bio	\$44,200	Construct a bioretention area in underutilized private green space. Divert drainage from existing drainage structure in Bilodeau Court. Alternative practice may include permeable pavement shoulders/parking lanes in the road ROW.	13
CB0004	Case Parkway Center Island		Burlington	Bio	\$25,000	Proposed bioretention area in center island on Case Parkway. Direct road drainage to bioretention using a speed bump across Case Parkway. The bioretention could underdrain/overflow to existing drainage system and outfall.	12

Centennial Brook Flow Restoration Plan

Table E-3: Centennial Brook Watershed BMP Project Implementation Schedule

Project ID	Project Name	Expired Permit	MS4	BMP Type	BMP Description	Implementation Year	Project Cost Estimate	Project Cost Estimate w/ Inflation
CB0023	Picard Circle Infiltration	No Permit	South Burlington	IG	Subsurface infiltration system. All houses within Picard Circle have been purchased by Airport and are now abandoned. Significant site area exists within yards and the road for major underground infiltration/ detention system. Constraints include depth of existing drainage pipe and depth above groundwater (adjacent brook approx 14 feet below existing ground).	2019	\$591,000	\$591,000
CB0008	Dumont Ave Infiltration Chambers	No Permit	BTV	IG	Divert flows from existing catchbasins and convey down Dumont Ave via pipe or swale to underground recharge chambers on empty lot. Options exist for practice type, siting and conveyance mechanism depending on depth to GW, existing inverts, and future use by Airport. Discharge to existing pipe outlet at Airport basin.	2020	\$27,000	\$32,000
CB0027	Staples Plaza Underground Detention A	No Permit	South Burlington	UD	Convert landscaped island to bioswale w/ UG storage to manage parking and small roof. Overflow to existing drain. Add trees for cover, shading, interception. Reduce width of one-way aisle for bioswale. Flat roof drains internally, discharges to drain inlet east of building. Modify internal roof drains, install trays, or use other blue roof design to provide temporary detention.	2021	\$334,000	\$411,000
CB0006	Chamberlin School	No Permit	South Burlington	IG	Underground detention in open space of school property. It seems possible to collect drainage off of White Street (and upgradient residential neighborhood) and connect to existing system via school entrance. Underground chambers could be designed as infiltration pending results of soils test pitting. (note HSG – D on east side of school property; HSG – B on west side of school property).	2023	\$1,215,500	\$1,586,000
CB0015	I-89 Exit 14 Detention Pond	No Permit	VTrans	DP	Location flexible depending on evaluation. Most downstream location would be across from drainage outlet, below water main (best location for embankment – maximizes storage), but impact to water main R/W likely and partially on private property. Alternative is to move embankment upgradient to limit of I-89 R/W – would reduce available storage, but keep all work w/in VTrans jurisdiction.	2023	\$1,787,000	\$2,332,000
CB0019	North Campus Pond Retrofit		UVM	DP	Proposed expansion of existing North Campus Pond to over control existing and future development. Raise existing embankment (10' +/-) to provide additional capacity. May consider horizontal expansion to the north and/or south.	2023	\$323,800	\$422,000
CB0024	Queensbury Pond Retrofit	1-0946	South Burlington	IB	Existing dry detention pond. Modify outlet to create an infiltration basin. Existing pond might predate subdivision (newer PVC outlet connects to older CMP barrel). Facility appears to have additional storage capacity to expand drainage area (level run confirmed this is feasible).	2024	\$110,000	\$148,000
CB0002	Best Western Windjammer Infiltration Basin A	6323-9030	South Burlington	IB	Site drainage area currently includes only Best Western property. Outfall is severely eroded and is headcutting to the east and may soon reach paved access road. Concept includes stabilizing outfall and constructing a detention basin within existing gully. Expand current drainage area to intercept runoff from Williston Road drainage network and redirect drainage from abutting commercial properties.	2025	\$557,000	\$771,000
CB0003	Best Western Windjammer Infiltration Basin B	6323-9030	South Burlington	IB	Outfall is located west of Best Western. Site drainage area currently includes only Best Western property. Moderate erosion occurring. Concept includes stabilizing outfalls and constructing a detention basin within existing gully. Expand current drainage area to intercept runoff from the Williston Road drainage network. A portion of this drainage area could be directed to Retrofit 22 if necessary.	2025	\$81,000	\$112,000

CB0025	Retrofit of Main Street UVM Pond		UVM	DP	Repair outlet structure. Retrofit options include expanding the pond southward toward Williston Road or eastward as part of Retrofit #24 for additional storage, extended detention, and improved water quality. Site has the ability to capture drainage from Williston Road, adjacent commercial properties, and unmanaged UVM land.	2025	\$364,600	\$505,000
CB0011	Fletcher Allen Green Space		Burlington	Bio	Proposed bioretention area in green space near hospital entrance. Redirect existing roadway trench drains into practice. Site currently drains to the UVM East Campus Pond.	2026	\$50,000	\$71,000
CB0012	Fletcher Allen Parking Lot		Burlington	Bio	Proposed bioretention area in existing drainage feature. Site is currently managed by existing swales, curb cuts, and a drainage depression. Swales and depression are currently eroding. Raise existing catchbasin frame/grate to provide ponding for bioretention.	2026	\$37,000	\$53,000
CB0013	Grove Street Parking Lot	1-0811	Burlington	IG	Divert existing drainage network and capture runoff from parking lot and direct to proposed underground recharge system. Low point in road drainage area is immediately south of the City parking lot. Consider replacing parking lot with permeable pavement.	2026	\$156,000	\$222,000
CB0021	Patchen Rd & Pine St Infiltration Gallery	No Permit	South Burlington	IG	Underground detention or infiltration (depending on soils). Diversion of flows from Patchen Road feasible, incoming pipe from open space/low point behind lots too deep to capture. Single lot also contains SF house (see photo). Would require diversion structure and pretreatment tank/structure.	2026	\$427,000	\$609,000
CB0022	Patchen Road Kettle Hole	6292-9030	South Burlington	IG	Detention Pond (or infiltration basin if soils are acceptable). Directly convey runoff from contributing area off Patchen Road down slope to sediment forebay. Modify existing 30" culvert headwall (under I-89) to achieve required flow control. Could pick up Kirby Rd.	2026	\$220,000	\$313,000
CB0007	Clover St GSI	No Permit	South Burlington	IG	30-ft wide residential streets with direct outfalls to streams, flat terrain, and good soils offer green street and neighborhood-scale disconnection opportunities (e.g., dry wells, rain gardens, pervious driveways, bump outs).	2028	\$72,000	\$109,000
CB0009	Duval St GSI	No Permit	South Burlington	IG	30-ft wide residential streets with direct outfalls to streams, flat terrain, and good soils offer green street and neighborhood-scale disconnection opportunities (e.g., dry wells, rain gardens, pervious driveways, bump outs).	2028	\$79,000	\$119,000
CB0010	Fielding Lane Condos Infiltration Gallery	No Permit	South Burlington	IG	Detention-retention facility. Open parcel adjacent to Fielding Lane Condos – seems to be owned by Fielding Lane Condos, existing surface storage available below outfall pipe. Would require access from Fielding Lane.	2028	\$208,000	\$315,000
CB0016	Jaycee Park	No Permit	South Burlington	IG	Pretreatment tank to underground infiltration chambers. Pretreatment could be proprietary device (e.g. StormCeptor or equal) before underground chambers. Access would need to be coordinated with playing fields. Flow diversion structure would be in Patchen Road, with depth to drain pipe at approx 6.5 feet.	2028	\$418,000	\$632,000
CB0001	140 East Ave Residence		Burlington	Bio	Construct a bioretention area in underutilized private green space. Divert drainage from existing drainage structure in Bilodeau Court. Alternative practice may include permeable pavement shoulders/parking lanes in the road ROW.	2029	\$44,200	\$69,000
CB0004	Case Parkway Center Island		Burlington	Bio	Proposed bioretention area in center island on Case Parkway. Direct road drainage to bioretention using a speed bump across Case Parkway. The bioretention could underdrain/overflow to existing drainage system and outfall.	2029	\$25,000	\$39,000
CB0014	I-89 Cloverleaf Underground Detention	2-0126; 6323-9030; 2-0619	VTrans	UD	Detention structure bounded by northbound lanes and off-ramp (directing traffic to westbound Williston Rd). Existing culvert drains all upgradient area from interchange and Williston Rd. Modify outlet to install new control structure for Cpv storage.	2032	\$215,000	\$365,000

CB0018	N Henry Court	No Permit	South Burlington	IG	Dead-end road with excess impervious cover. Currently, drainage comes down the road and flows directly down a steep slope to the stream/wetland area below. Install a rain garden/bio with an overflow to a leaching catch basin at end of road. Dumping of yard waste and debris was also observed down the slope. An old corrugated discharge pipe was found down in stream.	2032	\$27,000	\$46,000
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Appendix F - Englesby Brook Flow Restoration Plan

ENGLESBY BROOK FLOW RESTORATION PLAN

FINAL REPORT

BURLINGTON, VT

Stone Project ID: 14-171

December 5, 2017

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ACKNOWLEDGEMENTS

This project was completed by Stone Environmental, Inc., Horsley Witten Group, and Stantec.

DISCLAIMER

The intent of this document is to present the data, evaluations, alternatives, preliminary designs, and opinions of probable costs needed to support the development of a flow restoration plan for Englesby Brook, as required by the National Pollutant Discharge Elimination System (NPDES) General Permit 3-9014 (VTDEC 2012) for stormwater discharges to impaired waters from municipal separate storm sewer systems (MS4). The presented plan is in draft form and, at this time, the MS4s are not bound in any way to the proposed BMP list.

EXECUTIVE SUMMARY

Stone Environmental, Inc., and its partners Horsley Witten Group and Stantec, were retained by the City of Burlington to develop a Flow Restoration Plan (FRP) for Englesby Brook. The FRP was developed in accordance with the MS4 General Permit (3-9014), subpart IV.C.1. The purpose of the FRP is to serve as a planning tool for the MS4 entities in the Englesby Brook watershed (the cities of Burlington and South Burlington, the Vermont Agency of Transportation (VTrans) and the University of Vermont (UVM)) to implement stormwater Best Management Practices (BMPs) in an effort to return Englesby Brook to its attainment condition.

In developing the FRP, an assessment was completed to determine to what extent current stormwater controls have reduced high flows (e.g., flows occurring less than 0.3% of the time) from the pre-2002 conditions as required by the *Total Maximum Daily Load [TMDL] to Address Biological Impairment in Englesby Brook* (VTDEC 2007). The Vermont Best Management Practice Decision Support System (VTBMPDSS), a GIS-based hydrologic model used to assess the impacts of various BMP scenarios while developing the TMDL, was used to evaluate the impact of current stormwater controls on flows in Englesby Brook.

As part of this effort, a comprehensive evaluation of the future growth allocation contained in the TMDL was completed. This is important because the TMDL requires reductions from currently developed areas that are equal to the anticipated future impacts of new impervious surfaces that will not be subject to State of Vermont stormwater permitting requirements (“non-jurisdictional”). Our analysis shows that the TMDL significantly overstates the amount of non-jurisdictional impervious surface that is likely to be constructed over the next fifteen years in the Englesby Brook watershed, and thus the needed reduction in peak flows to achieve the desired flow regime.

A suite of potential BMPs and retrofit projects were identified as part of FRP development which fall into the following categories:

- Retrofits to existing stormwater management practices in the watershed to improve control of high flows;
- Retrofits to sites with expired state-issued stormwater permits;
- New stormwater management practices for sites currently without stormwater controls; and,
- Neighborhood-scale disconnection/green stormwater infrastructure (GSI) retrofit practices to reduce the effective impervious area in specific subwatersheds.

Field forms were prepared for each of the potential BMPs and retrofit projects and presented to the City of Burlington. Retrofits to existing stormwater management practices in the watershed were generally found to be cost-efficient and therefore were prioritized for implementation. These projects, combined with retrofits to sites with expired state-issued permits and a single new, centralized treatment practice on Flynn Avenue adjacent to the planned Champlain Parkway, were assessed with VTBMPDSS and determined to be sufficient to meet the high-flow target. A conceptual engineering design and planning level cost estimate has been prepared for each of these practices. Although the flow reduction possible via additional, new stormwater management practices and neighborhood-scale disconnection were evaluated, planning level cost estimates were not developed. It is anticipated that, as part of the City’s on-going integrated permitting project, neighborhood-scale initiatives may receive further consideration and may ultimately be reprioritized.

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1. BACKGROUND

The Englesby Brook watershed is located in Chittenden County, primarily in the City of Burlington with a small portion in the City of South Burlington. Englesby Brook drains an area of approximately 605 acres in the Burlington Bay watershed, flowing from east to west into Lake Champlain. (Figure 1). The entire stream and its tributaries are Class B waters designated as cold water fish habitat pursuant to the Vermont Water Quality Standards (WQS). Land use in the Englesby Brook watershed is 96% developed land and 4% forested.

Englesby Brook was designated as a stormwater-impaired watershed on the 2006 Vermont 303(d) list due to multiple impacts associated with excess stormwater runoff throughout the watershed. The Vermont Department of Environmental Conservation (VT DEC) developed a total maximum daily load (TMDL) for Englesby Brook that was approved by the U.S. Environmental Protection Agency in 2007. The TMDL identifies changes in watershed hydrology – a reduction in stormwater high flows and an increase in baseflow – that are needed to restore water quality.

The TMDL establishes a high flow reduction target (Q0.3) of 34.4% and a low flow augmentation target (Q95) of 11.2% measured at the mouth during the one-year storm event. There is an underlying assumption that a sufficient number of BMPs (and associated storage volumes) can be identified and sited in the watershed to achieve the required flow restoration targets and subsequent aquatic life benefits. VT DEC relies on the VTBMPDSS model to quantify flows and to evaluate if flow restoration targets are achieved. The flow targets are the basis for development of the flow restoration plan (FRP).

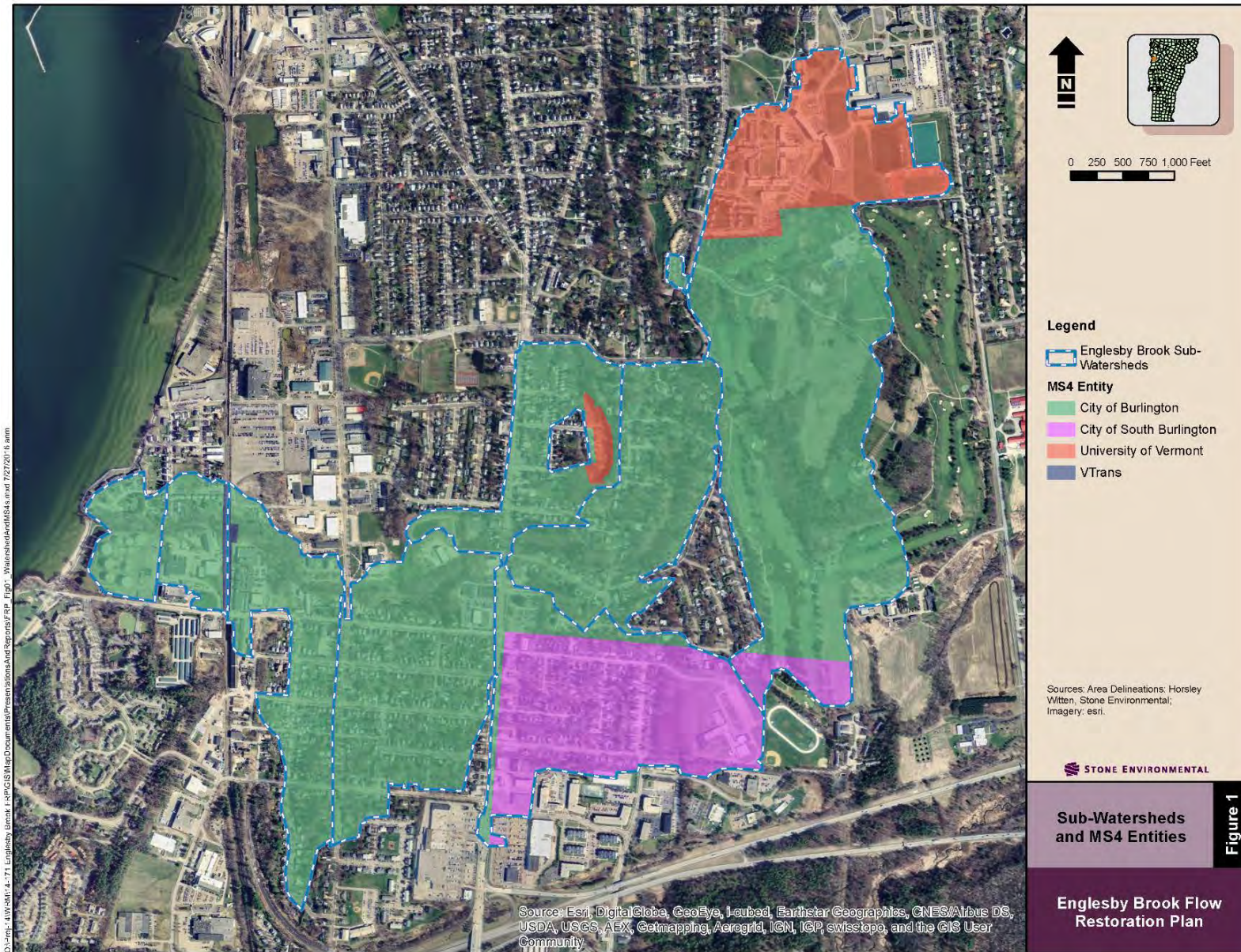
The FRP identifies the scope and scale of the best management practice (BMP) retrofits of existing impervious surface that, when implemented, are projected to meet the flow targets established in the TMDL and ultimately, to attain compliance with the Class B WQS. In addition, the Municipal Separate Storm Sewer System (MS4) general permit (issued December 5, 2012) outlines the following components of an FRP: identification of required controls, a construction and design schedule, a financial plan, regulatory analysis of any additional authorities needed to implement the FRP including support from the Vermont Department of Environmental Conservation (VT DEC), and any third party(ies) that have responsibility for implementing the FRP.

There are four MS4s with impervious cover contributing to stormwater high flows in Englesby Brook – the City of Burlington, the City of South Burlington, the University of Vermont (UVM), and the Vermont Agency of Transportation (VTrans). The relative share of impervious cover in each MS4's portion of the watershed, based on 2003 QuickBird high-resolution satellite imagery, is presented in Table 1, below.

Table 1: Summary of Impervious Cover in the Englesby Brook Watershed.

Jurisdiction	Total Area (ac)	Impervious Area (ac)	Fraction of Watershed Impervious Area (%)
City of Burlington	431.2	101.6	67.5%
City of South Burlington	83.5	24.8	16.5%
University of Vermont	56.6	22.9	15.2%
VTrans	2.6	1.3	0.8%
TOTAL	573.9	150.6	100.0%

Figure 1. Englesby Brook Watershed Boundaries and MS4 Landholdings



1.1. TMDL Flow Targets

In developing the TMDLs for waters that were determined to be impaired by stormwater runoff, VT DEC chose to use flow as a surrogate. Flow was used as a surrogate because the impacts on streams of increased stormwater flows resulting from urbanization are cumulative and include multiple stressors. Using flow was thought to integrate the effects of multiple stressors, which are all related to stormwater runoff. In general, the basis for the TMDL flow targets was a comparison of modeled flow duration curves (FDCs) between the impaired watershed and attainment watersheds with similar hydrologic characteristics where the WQS are currently met. In the case of Englesby Brook, there are seven attainment streams with similar hydrologic characteristics.

A FDC displays the percentage of time that a flow equals or exceeds a certain value, with low or baseflow represented by the 95th percentile ($Q_{95\%}$) of the curve and stormwater high flows at the 0.3% exceedance interval ($Q_{0.3\%}$). The FDC for Englesby Brook and its attainment watersheds were compared to determine the percent change (e.g., reduction in high flows and increase in base flows) required from current conditions. The percent change was codified in the TMDL document, and is presented in Table 2 below.

Table 2: TMDL Flow Restoration Targets, with and without Future Growth Allocations.

Flow Target	High Flow ($Q_{0.3\%}$) Reduction Target (%) ¹	Low Flow ($Q_{95\%}$) Increase Target (%) ²
TMDL Targets	-25.5%	11.2%
TMDL Targets with 20 acres of non-jurisdictional future growth	-34.4%	11.2%

¹ The high flow reduction target is negative (-), indicating there needs to be a reduction in high flow from the baseline condition.

² The low flow target is positive (+), indicating there needs to be an increase in low flow from the baseline condition. The low flow target is not actionable under the TMDL, but is included because improving base flow in the watershed is also a water quality goal

The high flow target ($Q_{0.3\%}$) was determined to be relatively equivalent to the 1-year design storm flow, and therefore BMPs sized to manage the channel protection volume (CP_v) as described in the 2002 Vermont Stormwater Management Manual were optimal for sizing BMPs to achieve the required high-flow reductions.

1.2. Future Growth

VT DEC added a future growth allocation to the TMDL flow targets to account for non-jurisdictional (e.g., not subject to state regulation and therefore unlikely to be managed by a BMP) impervious area that could reasonably be estimated to be constructed in the Englesby Brook watershed during the next 10-15 years while the TMDL is implemented. New, non-jurisdictional impervious surfaces are typically created as a part of smaller projects – such as the construction of a single family home – that are not part of a common plan of development and therefore do not rise to the state regulatory threshold of one acre of post-construction impervious cover. The future growth allocation in the TMDL assumes that no local zoning or land use regulations would be in place that require stormwater management for smaller projects. The Englesby Brook TMDL assumes that 20 acres of non-jurisdictional impervious surface will be created.

In order to incorporate the future growth estimate into the flow restoration target, 20 acres was added to the watershed's existing impervious cover to simulate projected watershed conditions when the TMDL is fully implemented. With the projected non-jurisdictional growth of 20 acres of impervious surface, the high flow target reduction was changed by -8.9% and the low flow target was unchanged (Table 2).

As a result, the reduction in peak flows required to account for future growth amounted to more than 25% of the total high flow reduction required. Given this outcome, and existing land use and development patterns in the Englesby Brook watershed, a careful re-examination of the allocation was completed. Each parcel in the watershed was categorized in one of four categories based on the most recent impervious surface data developed by each jurisdiction¹ and stormwater permit information available through the State of Vermont's Environmental Research Tool²:

- Parcels less than one acre in area;
- Parcels that are greater than one acre but currently contain less than one acre of impervious surface;
- Parcels that are greater than one acre, currently contain more than one acre of impervious surface, and currently have a state stormwater permit; and
- Parcels that are greater than one acre, currently have more than one acre of impervious surface, but do not have a state stormwater permit.

Roads were not included in this analysis, consistent with the impervious cover analysis conducted by CCRPC during the development of the TMDL. Parcels covered by an existing state-issued Stormwater Permit were excluded from this analysis, as it was assumed there could be no additional subjurisdictional development on these parcels. A summary of impervious cover by parcel type and by municipality in the Englesby Brook watershed is presented in Table 3, below.

The maximum amount of additional, subjurisdictional impervious area that can be created in the Englesby watershed, given current state regulatory thresholds and current lot coverage maximums contained in local land development regulations, is slightly more than 30 acres. It is highly unlikely that this amount of impervious surface will ever be developed, as it would require every landowner within the watershed to maximize their lot coverage to the limits allowed by zoning. Both the ultimate increase in subjurisdictional impervious cover and the increase predicted during the next 10-15 years would ideally be extrapolated based on the change in the amount of impervious cover in the watershed between 2003 – which served as the base condition when the TMDL was developed – and the 2010/2012 data.

Unfortunately, the impervious cover dataset from 2003 (often referred to as the QuickBird high-resolution satellite imagery), is of such poor quality that it is virtually impossible to make an accurate comparison between the datasets. Therefore, we selected a reasonable annual growth rate using a recent paper from the U.S. Forest Service, which assessed changes in impervious cover over time in 20 cities. In this work, Nowak et al.³ found that the overall average rate of increase in impervious cover was 0.31% per year. We applied this impervious area growth rate to impervious areas within the Englesby Brook watershed to determine the acreage of non-jurisdictional impervious growth potential using the following equation:

$$\begin{aligned} \text{Non-jurisdictional impervious acres} &= 2010/2012 \text{ impervious acres} * ((1 + \% \text{ change per year})^{\# \text{ years}}) \\ &= 102.79 \text{ acres} * (1 + 0.31)^{15} = 107.67 \text{ acres or } \underline{4.88 \text{ acres increase between 2012 and 2027}} \end{aligned}$$

¹ Burlington impervious cover dataset produced in 2012; So. Burlington impervious cover dataset produced in 2010

² <https://anrweb.vt.gov/DEC/ERT/StormWater.aspx>

³ Nowak, D.J., and E.J. Greenfield. 2012. Tree and impervious cover change in U.S. cities. Urban For. Urban Green. 11:21-30.

Table 3: Summary of Impervious Cover by Parcel Type in the Englesby Brook Watershed

	Parcel Type	Parcel Count	Current IA (ac)	Maximum Subjurisdictional IA (ac)
Burlington	Less than 1ac	662	50.80	15.54
	>1ac with <1ac IA	23	8.01	5.48
	>1ac with >1ac IA and no SW permit	17	25.58	0.72
	SUBTOTAL	702	84.39	21.74
South Burlington	Less than 1ac	172	8.30	5.57
	>1ac with <1ac IA	8	2.71	2.45
	>1ac with >1ac IA and no SW permit	7	7.40	0.38
	SUBTOTAL	187	18.41	8.40
Watershed-wide TOTAL		889	102.79	30.36

This estimate is conservative because it does not consider whether each parcel could actually add more impervious area given site and/or setback constraints (e.g., only lot coverage was considered). Even with these conservative assumptions, it was estimated that a net increase of 4.88 acres of non-jurisdictional impervious cover could reasonably be expected to be constructed between 2012 and 2027. Reducing the estimated future growth in non-jurisdictional impervious surface to 4.88 acres has a significant impact on the high flow target reduction (see Section 2.3).

In the unlikely event that the 20-acre future growth allocation assigned by VT DEC in the TMDL to account for non-jurisdictional impervious area estimated to be constructed in the Englesby Brook watershed during the next 10-15 years is actually constructed, an estimated additional 28 acres of impervious surface would need to be treated to meet the full high flow target. At five-year intervals during the implementation of this FRP (beginning in 2020 and depending upon the availability of high-quality aerial imagery and/or impervious cover datasets), VT DEC and the MS4s will assess changes in actual non-jurisdictional impervious cover within the Englesby Brook watershed, to determine whether the 4.88-acre projection remains appropriate. If more non-jurisdictional growth is found to be occurring than was projected, additional BMPs may be required to be developed and implemented to meet the high flow target in future years of the design and construction schedule (see Section 3 and Section 4).

The City of Burlington's stormwater ordinance enacted in December 2008 (Chapter 26) provides for comprehensive review of projects in the City at much lower jurisdictional thresholds than required under Vermont's state stormwater regulations. All projects disturbing more than 400 ft² of earth require review from the Stormwater Program. Single Family or duplex projects that are disturbing more than 400 ft² and where the total amount of impervious is greater than 2500 ft² (the average amount of impervious) must manage increased stormwater runoff from any increase in impervious surface to the maximum extent practicable by applying a series of primarily disconnection-based practices and principles. Projects on commercial properties (including triplexes) disturbing more than 400 ft² are required to submit both an Erosion Prevention and Sediment Control Plan and Stormwater Management Plan, depending on the size of the project. Commercial projects where impervious cover is being added or redeveloped are required to meet stormwater management requirements for runoff reduction, water quality treatment, and/or water quantity management; with management principles

determined by the watershed the project is located in. Since the City currently regulates site disturbance and impervious cover change at thresholds well below those required by the state, whether through the MS4 permit or through operational stormwater management permitting, the actual increase in non-jurisdictional impervious cover in the Englesby Brook watershed is expected to remain well below even the 4.88-acre revised projection.

2. VTBMPDSS MODEL ASSESSMENT

The VTBMPDSS model is a continuous hydrological simulation model that estimates the effect of land use changes and stormwater BMPs on streamflow. This model was applied to the Englesby Brook watershed to predict progress toward the TMDL flow targets based on proposed BMP implementation scenarios. The most important inputs to the model for this study are the GIS layers of land use, impervious cover, and soil, as well as the locations, configuration, and connections of the BMPs themselves. The VTBMPDSS model is used to predict stormwater high flows and baseflows at the watershed outlet for a base condition (pre-2002) and then a future BMP implementation condition; VT DEC requires the use of the model to document compliance with the TMDL flow restoration targets. VT DEC established both a base and a credit (existing conditions) model scenario to determine the remaining high flow reduction needed under the flow restoration plan. As described below, the Base and Credit Model Scenarios were updated to correct errors, utilize updated impervious cover datasets, add BMPs constructed since the VTBMPDSS was last updated, and make subwatershed boundary adjustments.

2.1. Baseline Conditions

The Base Scenario establishes watershed conditions and flows against which the 2007 Englesby Brook TMDL flow restoration targets are applied. The original Base Scenario includes five existing stormwater BMPs (all stormwater ponds) designed prior to the 2002 Vermont Stormwater Management Manual, when only large storms (i.e. 10-year storm events) required flow reduction. In coordination with VT DEC, a revised Base Scenario was created to address the following:

- Minor errors in the VTBMPDSS setup;
- Updated impervious cover datasets. The updated impervious cover layer for the Credit model (see below) was used as a starting point, and then the 2003 QuickBird high-resolution satellite imagery was used to subtract new areas of impervious cover; and
- Slight changes in subwatershed boundaries resulting from new development and refinement of CSO boundaries.

2.2. Current (Credit) Conditions

The Credit Scenario represents current conditions and includes changes in the watershed that have occurred since the time of the base scenario's creation. For the original Credit Scenario, VT DEC added one new BMP, the O8 Pond, which was a large storage retrofit that was a priority project identified in the *Englesby Brook Watershed Restoration Project Final Report* (CWP, 2001). In addition, several of the existing ponds in the north east corner of the watershed – owned and operated by the University of Vermont and the Burlington Country Club – had been retrofitted since baseline conditions were established. VT DEC also increased impervious cover in the watershed by 4.2 acres and changed subwatershed boundaries from the Base Scenario.

In coordination with VT DEC, a revised Credit Scenario was created to account for the following:

- Minor errors in the VTBMPDSS setup;

- Updated impervious cover datasets. The latest impervious cover layer from Burlington and South Burlington was used as a starting point, and then the 2013 (circa) imagery was used to add missing areas of impervious cover;
- Removal of the O8 Pond regulator #1;
- Corrected subwatershed boundaries (described above);
- Addition of three BMPs (M7/M8/M9) to represent the forebay and two west ponds for the SM06 retrofit from the Watershed Plan, which provided water quality treatment but little flow reduction capacity; and
- Addition of three newly constructed BMPs, brought on-line as part of new development or redevelopment projects.

Under the Credit Scenario there are ten BMPs used to manage stormwater within the Englesby Brook watershed; these BMPs are discussed in more detail in Section 3 of this report. Not all of these BMPs, however, are able to meet current (2002) stormwater standards for controlling high flows and thus provide the same level of support in terms of achieving the goals of the FRP. Assuming responsibility for the high flow allocation should be apportioned based on impervious area, it is possible to estimate the current amount of high flow treatment credit toward to the TMDL that should be assigned to each MS4 based on the amount of impervious area in each MS4 being treated by BMPs which provide high flow treatment. The high flow treatment credit is the MS4's high flow allocation multiplied by the proportion of the MS4's impervious area currently receiving high flow treatment (impervious acres within the MS4 treated by the BMP / MS4 impervious acres), and is summarized in Table 4 below.

Table 4: Remaining Untreated High Flow Allocation, by MS4

MS4 Entity	Allocation (%)	High Flow Treatment Credit (%)	High Flow Allocation Remaining Untreated (%)
Burlington	18.7	-4.5	14.2
South Burlington	4.6	-4.1	0.5
UVM	4.2	-7.5	-
VTrans	0.3	-	0.3
TOTAL	27.7	-15.7	14.7

It should be noted that UVM's facilities currently generate more high flow treatment credit (-7.5%) than their allocation (-4.2%) requires. This excess treatment credit has NOT been assigned to another MS4 for the purpose of this summary.

2.3. Future (Restoration) Condition

The Flow Restoration Scenario represents the retrofits needed to sufficiently manage high flows in order to achieve the flow restoration target in the TMDL. In addition, as discussed in Section 1.2, the future growth allocation was revisited and a more reasonable assumption about potential growth in non-jurisdictional impervious surfaces was established. In preparing this FRP, a number of restoration scenarios were modeled to evaluate the efficacy of 28 stormwater retrofit opportunities that were identified in the field, as well as a number of neighborhood-scale impervious disconnection options. These retrofit opportunities are discussed

Identification of Required Controls / 3

further in Section 3, and field forms for each opportunity are included as Appendix A of this report. After an initial evaluation of BMP performance and discussions with the City of Burlington on BMP implementation feasibility, a preferred flow restoration scenario was selected that meets the revised TMDL high flow reduction target. The restoration scenario includes an upgrade to the existing O8 Pond, a retrofit in the vicinity of the proposed Champlain Parkway, and three retrofits at sites where the current stormwater permits have expired.

Taken together these adjustments to the VTBMPSDSS base scenario resulted in updated flow restoration targets and the flow restoration scenario results presented in Table 5, below. VTBMPSDSS model files for the Flow Restoration Scenario were provided to VT DEC for review and comment; the summary presented below incorporates feedback from VT DEC on the modeling of the BMPs.

Table 5: Summary of Modeling Scenarios.

Model Scenario		Purpose	High Flow ($Q_{0.3\%}$) Target		Conclusion
			(cfs)	% reduction	
Original Base Scenario	Five pre-2002 BMPs	These flows are the baseline from which restoration/treatment is measured	20.9	-	Successfully replicated VT DEC's model.
Revised Base Scenario	Original Base with corrections and updated IA	Allow for more accurate comparison with restoration scenarios.	25.6	-	New baseline to measure achieved flow reductions.
Original Credit Scenario	Original Base + new O8-Pond; updated IA and subwatersheds	What is the change in baseline flow given current conditions?	19.2	8.0	Successfully replicated VT DEC's model.
Revised Credit Scenario	Original Credit with corrections + SM6 retrofit + new BMPs; revised IA and subwatersheds	Update to today's existing conditions.	21.6	15.7	Corrections result in higher flow reductions than VT DEC's original prediction.
Flow Restoration Scenario	Revised Credit + retrofit of O8-Pond + Champlain Pkwy retrofit + retrofit of 4 BMPs in need of permit renewal	What is the max. flow reduction achievable with implementation of most feasible retrofits?	18.5	27.7	Meets the revised TMDL target, assuming 4.88 acres of future growth. Some BMPs have greater than 12-hr detention times.

3. IDENTIFICATION OF REQUIRED CONTROLS

In 2015, field studies were performed throughout the Englesby Brook watershed to identify and assess existing BMPs that were candidates for retrofits, view newly constructed BMPs that needed to be included in the Credit Scenario, and evaluate potential locations for new BMPs. A comprehensive list of all of the BMPs considered in developing the Englesby Brook FRP is presented in Table 6 and Figure 2. The table lists the candidate BMP sites, provides general information about each BMP, and highlights practices that were ultimately included as part of the Flow Restoration Scenario. Because the ultimate goal of the Englesby Brook FRP is flow control, all new BMPs were modeled as dry basins in order to maximize the amount of storage that could be achieved within a given footprint. More detailed information for each BMP site is provided in Appendix A.

Identification of Required Controls / 3

Table 6: Summary of BMPs Considered in Developing Englesby Brook FRP.

Model ID	Permit ID	Model Run	Location / Description	Address	Practice
M1		Base	BCC Lower Pond		Wet basin
M2		Base	BCC Upper Pond 2		Wet basin
M3		Base	BCC Upper Pond 1		Wet basin
M4	3753-INDS	Base	Catamount Lower Pond	UVM	Wet basin
M5	3753-INDS	Base	Catamount Upper Pond	UVM	Wet basin
M6		Credit	O8 Pond	Champlain School	Wet basin
M7, M8, M9		Credit	SM6		Treatment wetland
M10		FRP	O8 Pond retrofit		Retrofit existing wet basin
M11			SM6 retrofit		Retrofit existing wetland w/ underground storage
M12	6298-9030		Harbor Watch retrofit		Dry basin
M13	3-1239 (w/w)	Base	Tank Farm	38 Flynn Ave	Dry basin
M14	6308-9030		Switchback et al	160 Flynn Ave	Underground storage
M15	6290-9030 & 6315-9030		208 Flynn Ave, west edge of parcel	208 Flynn Ave	Swale
M16	6290-9030 & 6315-9030		208 Flynn Ave, north end of parking lot	208 Flynn Ave	Underground storage
M17		FRP	Green space between CP alignment and parking lot	288 Flynn Ave	Dry basin
M18	1-1087	FRP	Flynn Ave Co-Op retrofit	288 Flynn Ave	Dry basin
M19	1-0337	FRP	Pine Street Counseling Center retrofit	300 Flynn Ave	Dry basin
M20			Pine Street Deli	316 Flynn Ave	Wet basin
M21			Burlington Subaru		Underground storage
M22			Rice High School		Dry basin
M23			Harrison Ave	Harrison Ave, near Central Ave	Detention basin + swale
M24			Sears Lane	Sears Lane	unsuitable
M25	2-0789	FRP	Overlake Condos retrofit		Dry basin
M26			Champlain Parkway – Englesby Brook	208 Flynn Ave	Gravel wetland
M27	6145-INDS	Credit	Hickok & Boardman (H&B)	346 Shelburne Rd	Swale/wet pond /infiltration chamber
M28			Walgreens	514 Farrell St	Underground storage
M29		FRP	Champlain Co-op	810 Pine St	Underground storage
M30		Credit	Pizzigalli Properties	462 Shelburne Rd	Permeable pavement
M31		Credit	847 Pine St. redevelopment	847 Pine St.	Bioretention

Identification of Required Controls / 3

Model ID	Permit ID	Model Run	Location / Description	Address	Practice
M32	6756-INDS		Route 7 roundabout	Rte 7-S. Willard St.	Underground storage
M33	2-0999		Champlain Apartments	817 Pine St	Underground storage, combined with M29
M34	2-1052		Crescent Terrace		unsuitable

Each site was reviewed to determine its ability to site a BMP capable of meeting the CP_v criteria of the 2002 Vermont Stormwater Management Manual. The CP_v criteria was utilized as part of the FRP evaluation, since the 1-year, 24-hour storm event is a close approximation to the storm event associated with the $Q_{0.3\%}$ flow. The CP_v criteria requires 12 hours of detention for cold water fish habitats, such as Englesby Brook. Several sites were constrained such that they were found to be unsuitable for meeting this criterion, and were therefore not considered further.

The suite of BMPs ultimately included in the Flow Restoration Scenario is summarized in Table 7, including an estimated drainage area and impervious area managed through each practice, as well as the modeled impact the practice has on attainment of the high flow target. A visual summary of the areas in the watershed receiving treatment is offered in Figure 3, with grey indicating the portion of the watershed draining to a flow BMP. While some field work was performed as part of identifying these candidate sites, no detailed hydrologic analysis, property research, engineering, or other studies were performed, and thus unidentified constraints may exist that prevent certain sites from being utilized in the FRP.

In addition to the site-specific controls identified in developing the FRP, neighborhood-scale disconnection efforts were also considered. In general, it was assumed that 50% of the currently directly connected impervious areas could be disconnected. The disconnection efforts were found to have varying degrees of impact on high flow conditions at the watershed outlet and will likely be considered further at part of the City of Burlington's on-going integrated planning project.

Figure 2. Locations and Drainage Areas of BMPs Considered in Developing Englesby Brook FRP

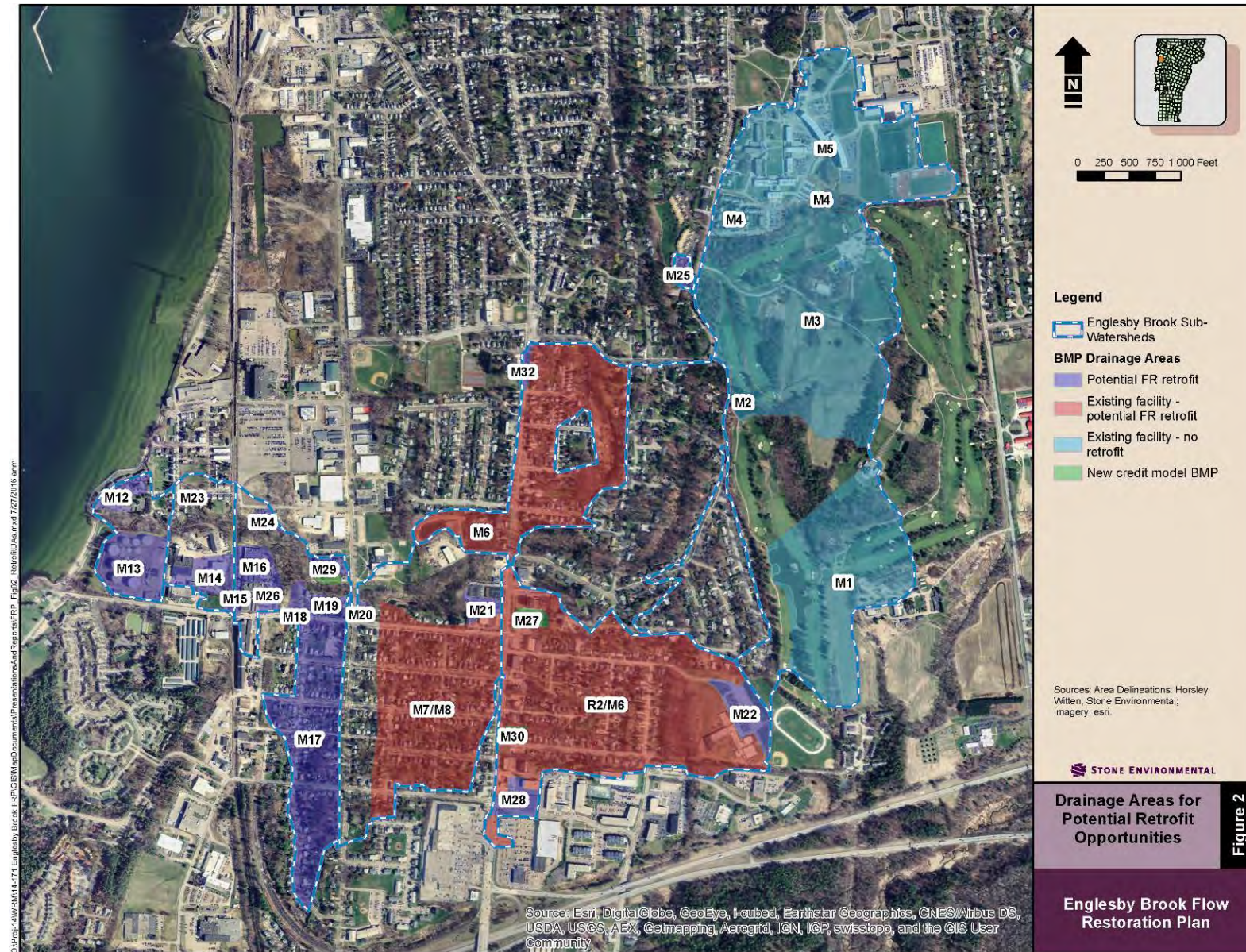


Table 7: Summary of BMPs Included in Englesby Brook Flow Restoration Scenario.

Site ID	Site Name	BMP Type	Model Scenario	DA (ac)	IA (ac)	% Difference in Q03 ¹		Detention Time ⁴ (min)
						BMP ²	Water-shed ³	
M1	BCC Lower Pond	Wet Basin	Base/ Credit	43.40	1.28	-6.7	-3.0	997
M2	BCC Upper Pond 2	Wet Basin	Base/ Credit	9.34	0.54	-0.2	0.7	33
M3	BCC Upper Pond 1	Wet Basin	Base/ Credit	67.94	5.60	-0.1	0.0	17
M4	Catamount Lower Pond	Wet Basin	Base/ Credit	7.46	3.36	-37.5	-1.6	517
M5	Catamount Upper Pond	Wet Basin	Base/ Credit	45.23	20.61	-46.3	-8.5	843
M6B (M10)	Englesby 08 Pond Retrofit	Wet Basin	Credit/FRP	129.76	48.55	-63.4	-36.9	721
M7/M8/M9	Englesby SM6 Ponds	Forebay/ 2 Wet Basins	Credit	44.09	19.52	3.5	0.05	47
M17	288 Flynn Ave/ Champlain Pkwy	Dry Basin	FRP	30.77	13.07	-49.4	-5.1	763
M18	208 Flynn Ave Coop	Dry Basin	FRP	0.42	0.30	-66.7	0.0	758
M19	Pine St. Counseling Ctr.	Dry Basin	FRP	0.80	0.48	-50.0	-0.1	704
M25	Overlake Condos	Dry Basin	FRP	1.19	0.73	-62.5	-0.8	647
V27/M27A/ M27B	Hickok & Boardman	Swale/Wet Pond/Infil. Chamber	Credit	1.29	0.92	-100.0	-0.9	55
M29	Champlain Co-op	Dry Basin	FRP	1.59	1.09	-57.1	-0.6	847
M30	Pizzagalli Properties	Permeable Pavement	Credit	0.64	0.58	-100.0	-0.3	360
M31	847 Pine St.	Dry Basin	Credit	0.45	0.23	-100.0	-0.1	101

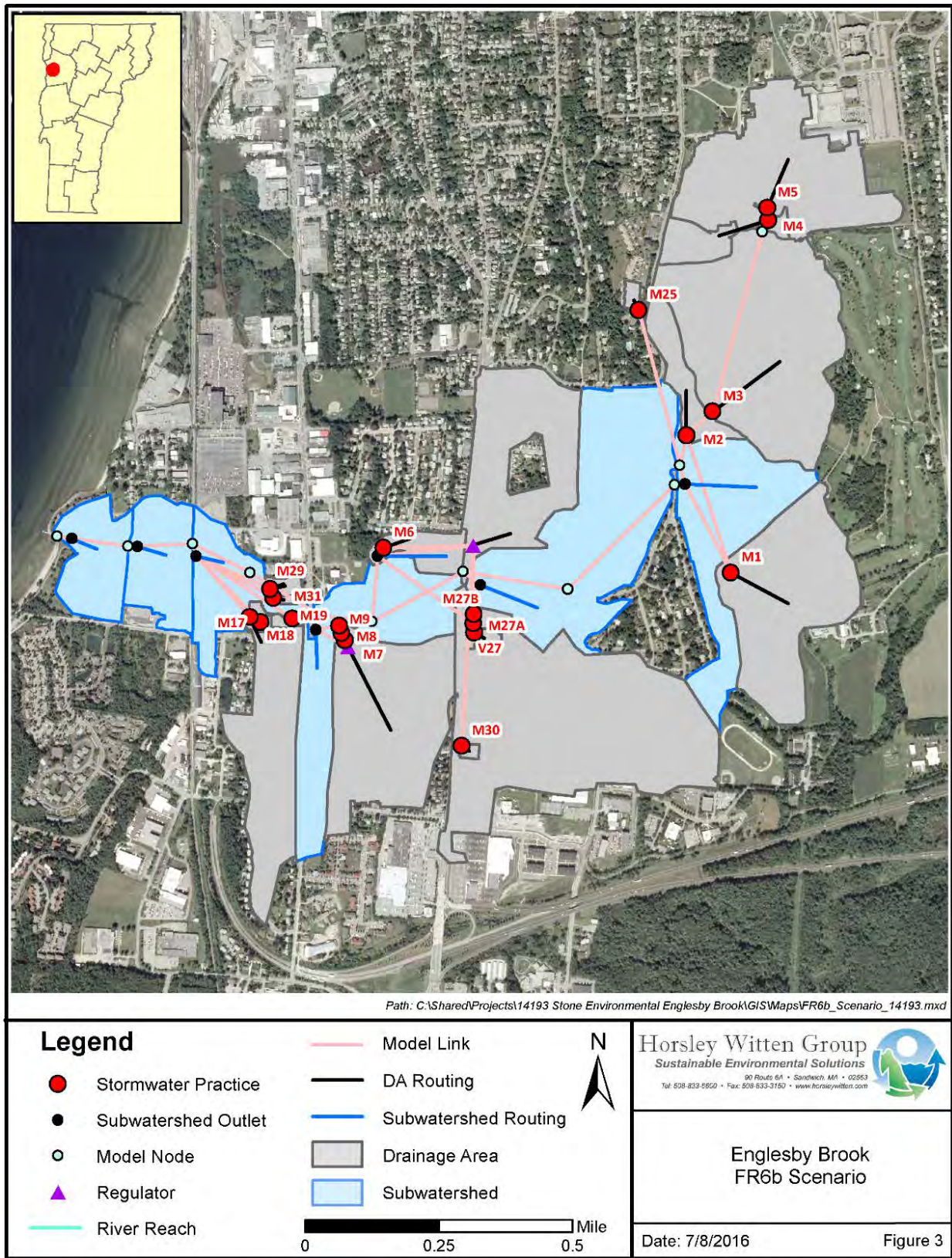
¹ Percent difference in high flows is negative when showing a reduction. The model was run with all BMPs turned on and then with individual BMPs turned off, one at a time, to quantify differences in flow and relative performance.

² Differences at each BMP were determined by comparing the inflows and outflows in the BMP. 100% represents no surface discharge; BMPs with less than 50% at the BMP outlet could be opportunities to enhance performance.

³ Differences in flow at the watershed outlet are intended as a relative comparison of BMP effectiveness, but are not absolute or additive. Individual BMP values do not add up to corresponding total watershed reductions due to other losses in the system.

⁴ Detention times are restricted to ~12 hrs (720 mins) per cold water fisheries requirements.

Figure 3: Englesby Brook Watershed Areas Receiving Treatment in the Flow Restoration Scenario



4. DESIGN AND CONSTRUCTION SCHEDULE

The 2012 MS4 permit requires that this FRP include a design and construction schedule for the stormwater BMPs that have “been identified by the permittee[s] as necessary to achieve the flow restoration targets.” The schedule must provide for implementation of the BMPs as soon as possible, but no later than 20 years from the effective date of MS4 permit, which is December 5, 2012—meaning that the BMPs must be implemented by the end of 2032 (Appendix E). The BMPs included in this FRP will, at a minimum, require permitting and design work prior to construction, and will have varying costs. In addition, and as discussed in more detail in Section 6, an undetermined level of effort will be required to support expired permit holders in implementing necessary upgrades to their systems and obtaining current permit coverage.

Implementation of the BMPs included in the Flow Restoration Scenario will fall largely to the City of Burlington. Flow restoration efforts are one of several Clean Water Act obligations, including the Lake Champlain Phosphorus TMDL, similar Flow Restoration efforts in Centennial and Potash Brooks, the Englesby Brook Bacteria TMDL, and improvements to the City’s combined sewer system.

The City is actively engaged in developing an integrated plan, and anticipates this plan will have broad implications for the prioritization and timing of flow restoration projects in the context of the full suite of the City’s Clean Water Act obligations. As such, it is anticipated that implementation of the Flow Restoration Scenario BMPs will be initiated within three years from receipt of approval of this FRP from VT DEC. Development of the full design and construction will, by necessity, follow completion of the integrated plan in 2018.

5. FINANCIAL PLAN

The 2012 MS4 permit also requires that this FRP include a financing plan that estimates the costs for implementing the FRP and describes a strategy for financing the FRP. A conceptual design, showing the location and layout for each BMP included in the Flow Restoration Scenario is included in Appendix C. Itemized cost estimates were developed for the top two priority projects, as discussed in Section 5.1 below. For the other BMPs included in the Flow Restoration Scenario – retrofits for sites with expired permits – a modified spreadsheet method was used to develop cost estimates, as detailed in Section 5.2.

5.1. Itemized Cost Estimates

An engineer’s opinion of probable cost estimate was developed for the two highest priority projects – the retrofit of the O8 Pond (M10) and the centralized treatment area bordered by Flynn Ave, 288 Flynn Ave, and the future location of the Champlain Parkway (M17). The cost estimate includes an itemized list of materials as well as final design and construction engineering costs in 2016 dollars. The cost estimates are summarized in Table 8, below, and presented in full in Appendix D.

Table 8: Proposed Priority BMP Cost Estimates.

BMP ID	Site Name	Storage Volume (cf)	Total Cost (\$)	Impervious Area (ac)	Cost per Impervious Acre
M10	O8 Pond retrofit ¹	136,061	\$360,850	48.55	\$7,433
M17	288 Flynn Ave/ Champlain Pkwy	74,201	\$385,500	13.07	\$29,495
TOTAL			\$746,350	61.62	

¹ This is an expansion of an existing practice which increases available storage and optimizes detention; costs reflect only the incremental cost of the retrofit.

5.2. Spreadsheet Cost Estimates

Estimating costs for implementing BMP retrofits for sites with expired permits utilized a somewhat less robust approach. Cost estimates were calculated as a base construction cost plus a 30% contingency factor for final design and permitting. The base cost was estimated on a unit cost basis, using a specified design volume (cu. ft.) multiplied by a unit cost (\$/cu. ft.). Unit costs were calculated based on the memorandum from Tetra Tech, Inc. dated October 30, 2007. These rates use a 2000 base year and have been updated to account for inflation to the year 2016, using a 2.5% inflation rate. The costs are calculated based on the following equation:

$$\text{total cost} = \text{installation cost (I)} + \text{land cost (L)} + \text{fixed cost (F)}$$

Where:

I = \$6/cf of infiltration, inflated at 2.5% to year 2016 = \$8.70/cf

L = \$0 as it is not anticipated that property will be required to be purchased

F = design/permitting costs (30% of I)

The anticipated costs associated with implementing the expired permit BMP retrofits, as identified in Table 7 as part of the Flow Restoration Scenario, are presented below in Table 9. Although all of these projects would be located on private land, no cost has been assigned for land acquisition.

Table 9: Proposed Expired Permit BMP Retrofit Cost Estimates.

BMP ID	Site Name	Treatment Volume (cf)	I (\$)	F (\$)	Total Cost (\$)	Impervious Area (ac)	Cost per Impervious Acre
M18	208 Flynn Ave Coop	1,370	\$11,919	\$3,576	\$15,495	0.30	\$51,649
M19	Pine St Counseling Ctr	2,349	\$20,436	\$6,131	\$26,567	0.48	\$55,348
M25	Overlake Condos	3,537	\$30,772	\$9,232	\$40,004	0.73	\$54,799
M29	Champlain Co-op ¹	5,089	\$55,343	\$16,603	\$71,946	1.09	\$66,005
TOTAL					\$154,011	2.60	

¹ Any BMP at this location will likely need to be subsurface, and therefore the assumed unit cost per cf treated was increased by 25%.


6. REGULATORY ANALYSIS

As part of this plan, retrofits are being proposed on sites tied to expired State operational stormwater permits. A field assessment of each of the five systems in the Englesby Brook watershed with expired stormwater permits has been completed, and is included as Appendix B; all five systems are located within the City of Burlington. The expired permits were written broadly with few enforceable items and typically focus on curb-and-gutter system elements, including catch basins. Ultimately, the permit holders will either have to have their permit adopted under the MS4 permit, or to request coverage under a Residual Designation Authority (RDA) permit from the State. The decision as to how the responsibility for the proposed retrofit projects on private land are covered in the future will be subject to discussion and agreement with the private landowners and the City of Burlington.

Table 5 indicates that only BMPs on properties with expired permits and two other retrofits (the retrofit of O8 and the retrofit related to the Champlain Parkway) are required to meet the flow targets (with the revised future growth analysis). The M29 (Champlain Co-op) BMP listed in Table 6 as being part of the FR model run appears to be in conflict with this statement. This retrofit was originally conceived as a dry basin in combination with underground storage at M33 (Champlain Apartments), which does have an expired operational permit. Responsibility for implementation for M29/M33 will be shared between the private landowner and the City of Burlington—or, if only M29 is ultimately implemented, that responsibility will fall to the City.


APPENDICES

APPENDIX A: CONSIDERED FLOW REDUCTION BMPS

ID#: M10		
Name: O8 Pond retrofit		
Concept Description: Expand the existing pond to the east toward the forebay and raise permanent pool to create additional storage volume and extend detention.		
Notes/Feasibility: Existing pond is lined, so it will be slightly more complicated than simply digging		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 1 st tier
Ownership:		Retrofit of new or existing BMP: retrofit
Land Use Type:		Proposed Retrofit Practice 1: expand existing facility
Land Use Detail:		Proposed Retrofit Practice 2:
Existing BMP on Site? Y		Non-Structural Controls:
Is site a hotspot? N		Non-Structural Other:
Sources/pollutants:		Maintenance Burden: moderate, but existing
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: N Demonstration: N Repair: Y Reuse: N
Use in Retrofit DA: Y		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac): 131.50		
Impervious Area (ac): 49.97		
Practice Area Available (ft²):		
Existing Head Available? Y		


Date: 04/10/15

Assessed by: JSM

ID#: M11			
Name: SM6 retrofit			
Concept Description: Modify existing treatment wetland system to provide detention storage in addition to water quality functions.			
Notes/Feasibility: Limited available space for additional storage without relocating stream channel; concept would result in some loss of WQ function.			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info:		Project Candidate: N	
Ownership:		Retrofit of new or existing BMP:	
Land Use Type:		Proposed Retrofit Practice 1:	
Land Use Detail:		Proposed Retrofit Practice 2:	
Existing BMP on Site?		Non-Structural Controls:	
Is site a hotspot?		Non-Structural Other:	
Sources/pollutants:		Maintenance Burden:	
Soils:		Benefits: Storage: Water Quality: Recharge: Demonstration: Repair: Reuse: Other:	Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
Use in Retrofit DA:			
SIZING INFORMATION			
Drainage Area (ac):			
Impervious Area (ac):			
Practice Area Available (ft²):			
Existing Head Available?			

Date:

Assessed by:

ID#: M12		
Name: Harbor Watch		
Concept Description: Following EFA, runoff from a portion of the parking lot is diverted using speed bump to existing green space where it flows overland to the storm sewer system. Detention area could be constructed in green space to control peak flows; additional impervious areas (roofs and parking) could be redirected to improved stormwater practice.		
Notes/Feasibility: Existing practice has limited effectiveness.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 2 nd tier
Ownership:		Retrofit of new or existing BMP: Retrofit
Land Use Type:		Proposed Retrofit Practice 1: Bioretention
Land Use Detail:		Proposed Retrofit Practice 2: Dry basin
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden: Moderate
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: Y Demonstration: N Repair: N Reuse: N
Use in Retrofit DA: N		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac): 2.30		
Impervious Area (ac): 1.70		
Practice Area Available (ft²): 6,970		
Existing Head Available? Y		

Date: 04/10/15

Assessed by: JSM

ID#: M13

Name: Tank Farm

Concept Description:

None.

Notes/Feasibility:

Existing w/w permit (3-1239) requires that storm flows are controlled such that "it does not exceed 100 gallons per minute". VTBMPSDSS was modified to reflect this level of control.



GENERAL SITE INFORMATION

RETROFIT DETAILS

Site Contact Info:

Project Candidate: N

Ownership:

Retrofit of new or existing BMP:

Land Use Type:

Proposed Retrofit Practice 1:

Land Use Detail:

Proposed Retrofit Practice 2:

Existing BMP on Site?

Non-Structural Controls:

Is site a hotspot?

Non-Structural Other:

Sources/pollutants:

Maintenance Burden:

Soils:

Benefits:

Storage: Y

Water Quality: N

Recharge: N

Demonstration: N

Repair: N

Reuse: N

Other:

Conflicts:

Soils:

Access:

Land Use:

Utilities:

Polluted:

High WT:

Wetlands:

Other:

Use in Retrofit DA: Added to base model

SIZING INFORMATION

Drainage Area (ac): 8.76


Impervious Area (ac): 8.67

Practice Area Available (ft²): 10,890

Existing Head Available? Y

Date: 04/10/15


Assessed by: JSM

ID#: M14		
Name: 160 Flynn Ave		
Concept Description: Infrastructure maps shows two outfalls at the northwest corner of the property draining. The one slightly to the east receives stormwater from the back parking lot (shown in photo) and roof drains from the building currently occupied by Booska Movers, approximately 6.1 acres of impervious. Outfall was NOT located during initial field work. Concept includes constructing underground storage in the parking lot. It may be possible to also capture stormwater being carried in 12" VCP line immediately to the west.		
Notes/Feasibility: Feasible, but constraints including actual use of area by existing owner/tenant need to be more fully understood		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: Y
Ownership: private		Retrofit of new or existing BMP: New BMP
Land Use Type: Commercial/industrial		Proposed Retrofit Practice 1: Underground storage
Land Use Detail:		Proposed Retrofit Practice 2: Dry pond
Existing BMP on Site? no		Non-Structural Controls: none
Is site a hotspot? no		Non-Structural Other: none
Sources/pollutants:		Maintenance Burden:
Soils: Silt loam, poorly drained		Benefits: Storage: Yes Water Quality: Yes Recharge: ? Demonstration: No Repair: Yes Reuse: No Other:
Use in Retrofit DA:		Conflicts: Soils: No Access: Maybe Land Use: Maybe Utilities: No Polluted: Maybe High WT: No Wetlands: No Other:
SIZING INFORMATION		
Drainage Area (ac): 6.1		
Impervious Area (ac): 4.21		
Practice Area Available (ft²): 13,000		
Existing Head Available? Y		

Date: 04/10/15


Assessed by: JSM

ID#: M15		
Name: 208 Flynn Ave, west edge of parcel (along railroad)		
Concept Description: Runoff from paved areas and canopy roofs on the west side of 208 Flynn drain west and north toward green space between the lot and railroad. A bioswale (or other linear treatment practice) could potentially be installed in the green space; there is also a limited amount of room at the northwest corner of the parking lot that could potentially be used for detention storage.		
Notes/Feasibility: Daycare facility has outdoor play yard at the north end of the parcel; it would be important to ensure any practice did not interfere with their use of this area. It may be challenging to work within the railroad ROW.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 2 nd tier
Ownership:		Retrofit of new or existing BMP: new
Land Use Type:		Proposed Retrofit Practice 1: Bioswale
Land Use Detail:		Proposed Retrofit Practice 2: Dry basin
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: Y Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac): 2.60		
Impervious Area (ac): 2.50		
Practice Area Available (ft²): 3,000		
Existing Head Available? Y		

ID#: M16			
Name: 208 Flynn Ave, north end of parking lot			
Concept Description: Currently stormwater runoff from parking is being diverted to rock-lined swale and conveyed to Englesby Brook. Evidence of erosion in stone-lined channel. Underground storage could be constructed at the northeast corner of the lot. Some runoff from parking lot will be captured and treated in stormwater facility planned for Champlain Parkway.			
Notes/Feasibility: Field inspection found that it would be extremely challenging to convey sufficient runoff volume to the proposed facility.			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info:		Project Candidate: N	
Ownership:		Retrofit of new or existing BMP:	
Land Use Type:		Proposed Retrofit Practice 1:	
Land Use Detail:		Proposed Retrofit Practice 2:	
Existing BMP on Site?		Non-Structural Controls:	
Is site a hotspot?		Non-Structural Other:	
Sources/pollutants:		Maintenance Burden:	
Soils:		Benefits: Storage: Water Quality: Recharge: Demonstration: Repair: Reuse: Other:	Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
Use in Retrofit DA:			
SIZING INFORMATION			
Drainage Area (ac):			
Impervious Area (ac):			
Practice Area Available (ft²):			
Existing Head Available?			


Date: 04/10/15

Assessed by: JSM

ID#: M17		
Name: 288 Flynn Ave/Champlain Pkwy		
Concept Description: Planned Champlain Parkway alignment leaves a modest amount of green space between the roadway and the parking lot for 288 Flynn Ave. Stormwater flows from Pine St can be diverted down Flynn Ave and to this facility, allowing for treatment of a significant volume at this site		
Notes/Feasibility: Concept design maximizes use of available space; unlikely the residents of 288 Flynn Ave would support this level of exposure to the planned Champlain Parkway		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 1 st tier
Ownership:		Retrofit of new or existing BMP: new
Land Use Type:		Proposed Retrofit Practice 1: Dry basin
Land Use Detail:		Proposed Retrofit Practice 2: Bioretention
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: Y Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac):	31.70	
Impervious Area (ac):	13.63	
Practice Area Available (ft²):	30,500	
Existing Head Available?	Y	


Date: 04/10/15

Assessed by: JSM

ID#: M18		
Name: Flynn Ave Co-op Parking Lot		
Concept Description: An underground storage facility could be constructed in the parking lot to attenuate flows from the parking lot and building roofs draining to the west side of the site.		
Notes/Feasibility: Expired permit 1-1087. Area could also potentially be made to flow to M17.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 1 st tier
Ownership:		Retrofit of new or existing BMP: new
Land Use Type:		Proposed Retrofit Practice 1: Underground storage
Land Use Detail:		Proposed Retrofit Practice 2:
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden: High
Soils:		Benefits: Storage: Y Water Quality: N Recharge: N Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands:
SIZING INFORMATION		Other:
Drainage Area (ac): 0.42		
Impervious Area (ac): 0.30		
Practice Area Available (ft²): 3,000		
Existing Head Available? Y		


Date: 04/10/15

Assessed by: JSM

ID#: M19		
Name: Pine Street Counseling Center		
Concept Description: Install dry basin or possibly bioretention area in north central area of lot to capture flows from roof and parking areas.		
Notes/Feasibility: Expired permit 1-0337		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 1 st tier
Ownership:		Retrofit of new or existing BMP: New
Land Use Type:		Proposed Retrofit Practice 1: Dry basin
Land Use Detail:		Proposed Retrofit Practice 2: Bioretention
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden: moderate
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: M Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac):	0.80	
Impervious Area (ac):	0.48	
Practice Area Available (ft²):	1750	
Existing Head Available?	Y	


Date: 04/10/15

Assessed by: JSM

ID#: M20			
Name: Pine Street Deli			
Concept Description: As part of planned renovation of Pine Street Deli, City is requiring improved stormwater management. CAD files were provided by owner's engineer.			
Notes/Feasibility: Although modeled, proposed BMP resulted in 0% change in high flows at watershed outlet and therefore was not included in the Flow Restoration Scenario			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info:		Project Candidate: Proposed	
Ownership:		Retrofit of new or existing BMP:	
Land Use Type:		Proposed Retrofit Practice 1:	
Land Use Detail:		Proposed Retrofit Practice 2:	
Existing BMP on Site?		Non-Structural Controls:	
Is site a hotspot?		Non-Structural Other:	
Sources/pollutants:		Maintenance Burden:	
Soils:		Benefits: Storage: Water Quality: Recharge: Demonstration: Repair: Reuse: Other:	Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
Use in Retrofit DA:			
SIZING INFORMATION			
Drainage Area (ac):			
Impervious Area (ac):			
Practice Area Available (ft²):			
Existing Head Available?			


Date: 04/10/15

Assessed by: JSM

ID#: M21			
Name: Burlington Subaru			
Concept Description: Underground storage could be installed along back edge of Burlington Subaru dealership to manage parking lot runoff.			
Notes/Feasibility: As shown in photo, area is currently used for vehicle parking/storage, therefore any practice would need to be underground, increasing the cost			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info:		Project Candidate: 2 nd tier	
Ownership:		Retrofit of new or existing BMP: New	
Land Use Type:		Proposed Retrofit Practice 1: Underground storage	
Land Use Detail:		Proposed Retrofit Practice 2:	
Existing BMP on Site?		Non-Structural Controls:	
Is site a hotspot?		Non-Structural Other:	
Sources/pollutants:		Maintenance Burden:	
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: N Demonstration: N Repair: Y Reuse: N	Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
Use in Retrofit DA:			
SIZING INFORMATION			
Drainage Area (ac):	1.58		
Impervious Area (ac):	1.56		
Practice Area Available (ft²):	3,920		
Existing Head Available?	Y		


Date: 04/10/15

Assessed by: JSM

ID#: M22		
Name: Rice High School		
Concept Description: Runoff from Rice High School currently flows to O8 Pond, but a nested treatment practice could be built on-site at the school to create additional storage capacity in the O8 Pond.		
Notes/Feasibility: Green space available both immediately adjacent to parking lot, as well as along access road.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 2 nd tier
Ownership:		Retrofit of new or existing BMP: New
Land Use Type:		Proposed Retrofit Practice 1: Dry basin
Land Use Detail:		Proposed Retrofit Practice 2:
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: Y Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac): 4.85		
Impervious Area (ac): 2.12		
Practice Area Available (ft²): 4,350		
Existing Head Available? Y		


Date: 04/10/15

Assessed by: JSM

ID#: M23		
Name: Harrison Ave., near Central Ave.		
Concept Description: Install "green street" style practice in green space between road and sidewalk along Harrison Ave.		
Notes/Feasibility: Also considered opportunity to shunt flow to existing green space to north of Harrison Ave, but would not have head to allow gravity flow.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 3 rd tier
Ownership:		Retrofit of new or existing BMP:
Land Use Type:		Proposed Retrofit Practice 1: Swale
Land Use Detail:		Proposed Retrofit Practice 2: Dry basin
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: Y Demonstration: Y Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac):	0.38	
Impervious Area (ac):	0.31	
Practice Area Available (ft²):	875	
Existing Head Available?	Y	

Date: 04/10/15

Assessed by: JSM

ID#: M24			
Name: Sears Ln			
Concept Description: Looked for opportunities to capture runoff from Sears Ln and several adjacent structures; much of the runoff from this area flows north to the Pine St Barge Canal. Area was determined to be inefficient/unsuitable for retrofit based on field inspection.			
Notes/Feasibility: Estimated drainage area may be generous.			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info:		Project Candidate: N	
Ownership:		Retrofit of new or existing BMP:	
Land Use Type:		Proposed Retrofit Practice 1:	
Land Use Detail:		Proposed Retrofit Practice 2:	
Existing BMP on Site?		Non-Structural Controls:	
Is site a hotspot?		Non-Structural Other:	
Sources/pollutants:		Maintenance Burden:	
Soils:		Benefits: Storage: Water Quality: Recharge: Demonstration: Repair: Reuse: Other:	Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
Use in Retrofit DA:			
SIZING INFORMATION			
Drainage Area (ac):	0.77		
Impervious Area (ac):	0.34		
Practice Area Available (ft²): 1,300			
Existing Head Available?			

Date: 04/10/15

Assessed by: JSM

ID#: M25

Name: Overlake Condos**Concept Description:**

Opportunity to capture the front (eastern half of the roofs of most residential building, as well as garages and parking area in a centralized facility at the southern end of the complex. May require elimination of 2 parking spot to have sufficient area for the treatment practice.

Notes/Feasibility:

Expired permit 2-0789. Northern portion of complex appears to drain overland to Prospect St where it likely enters the combined sewer system

**GENERAL SITE INFORMATION****RETROFIT DETAILS****Site Contact Info:****Project Candidate:** 1st tier**Ownership:****Retrofit of new or existing BMP:** New**Land Use Type:****Proposed Retrofit Practice 1:** Dry basin**Land Use Detail:****Proposed Retrofit Practice 2:** Bioretention**Existing BMP on Site?****Non-Structural Controls:****Is site a hotspot?****Non-Structural Other:****Sources/pollutants:****Maintenance Burden:****Soils:****Benefits:**

Storage: Y
 Water Quality: Y
 Recharge: M
 Demonstration: N
 Repair: N
 Reuse: N


Conflicts:

Soils:
 Access:
 Land Use:
 Utilities:
 Polluted:
 High WT:
 Wetlands:
Other:

Use in Retrofit DA:**SIZING INFORMATION****Drainage Area (ac):** 1.19**Impervious Area (ac):** 0.73**Practice Area Available (ft²):** 2,200**Existing Head Available?**

Date: 04/10/15


Assessed by: JSM


ID#: M26		
Name: Champlain Parkway		
Concept Description: Stormwater management will be provided as part of the Champlain Parkway. Based on current plans for the roadway, a gravel wetland will be constructed to the west of the alignment in this area and will also provide treatment for a portion of the parking lot at 208 Flynn Ave. The timeline for the Champlain Pkwy is outside the purview of this project and therefore it has not been included as part of the FRP.		
Notes/Feasibility: Were the Champlain Pkwy project to be abandoned there is an opportunity for a large, centralized facility on this site that could be expanded to include M17.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: Proposed
Ownership:		Retrofit of new or existing BMP: New
Land Use Type:		Proposed Retrofit Practice 1: Gravel wetland
Land Use Detail:		Proposed Retrofit Practice 2:
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: N Demonstration: Y Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac):	1.67	Other:
Impervious Area (ac):	1.23	
Practice Area Available (ft²):	3,500	
Existing Head Available?	Y	

ID#: M27		
Name: Hickock & Boardman		
Concept Description: Retrofit of this property was completed as part of redevelopment and includes a suite of green stormwater infrastructure practices: grass swales, disconnection, infiltration/Stormtech.		
Notes/Feasibility: Permit 6145-INDS. No changes considered.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: Constructed
Ownership:		Retrofit of new or existing BMP: Existing
Land Use Type:		Proposed Retrofit Practice 1:
Land Use Detail:		Proposed Retrofit Practice 2:
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: Y Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac):	1.29	
Impervious Area (ac):	0.92	
Practice Area Available (ft²): 1,300		
Existing Head Available?	Y	

Date: 11/16/15

Assessed by: JSM


ID#: M28			
Name: Walgreens			
Concept Description: Stormwater runoff from existing parking lot at Walgreens and travel lane that connects through to Bacon St is unmanaged. The concept design for this site would involve underground storage to manage parking lot runoff.			
Notes/Feasibility: Travel lane is unpaved and there was evidence of significant sediment transport to Bacon St. Runoff from this area ultimately ends up in the O8 Pond			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info:		Project Candidate: 3 rd tier	
Ownership:		Retrofit of new or existing BMP: New	
Land Use Type:		Proposed Retrofit Practice 1: Underground storage	
Land Use Detail:		Proposed Retrofit Practice 2:	
Existing BMP on Site?		Non-Structural Controls:	
Is site a hotspot?		Non-Structural Other:	
Sources/pollutants:		Maintenance Burden:	
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: N Demonstration: N Repair: N Reuse: N	Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
Use in Retrofit DA:			
SIZING INFORMATION			
Drainage Area (ac): 2.94			
Impervious Area (ac): 2.61			
Practice Area Available (ft²): 3,900			
Existing Head Available? Yes			

ID#: M29		
Name: Champlain Co-op, 810 Pine St.		
Concept Description: Concept would include underground storage due to surface site constraints; practice would be used to manage runoff from roofs and parking areas.		
Notes/Feasibility: City infrastructure mapping suggests significant underground utility constraints are also likely present on this site.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: 3 rd tier
Ownership:		Retrofit of new or existing BMP: New
Land Use Type:		Proposed Retrofit Practice 1: Underground storage
Land Use Detail:		Proposed Retrofit Practice 2:
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: N Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac):	1.59	
Impervious Area (ac):	1.09	
Practice Area Available (ft²): 3,900		
Existing Head Available?	Y	

ID#: M30		
Name: Pizzigalli Properties, 462 Shelburne Rd.		
Concept Description: As part of redevelopment effort, permeable pavement was installed in parking bays in this lot.		
Notes/Feasibility: Permeable paver walk at E. end of S. lot was considered too small to effectively include in VTBMPDSS.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: Constructed
Ownership:		Retrofit of new or existing BMP: Existing
Land Use Type:		Proposed Retrofit Practice 1: Permeable pavement
Land Use Detail:		Proposed Retrofit Practice 2:
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: Y Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac):	0.64	
Impervious Area (ac):	0.58	
Practice Area Available (ft²):	11,800	
Existing Head Available?	Y	

Date: 11/16/15

Assessed by: JSM

ID#: M31		
Name: 847 Pine St redevelopment		
Concept Description: A rain garden/bioretention facility was constructed at this site as part of a redevelopment effort.		
Notes/Feasibility:		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info:		Project Candidate: Constructed
Ownership:		Retrofit of new or existing BMP: Existing
Land Use Type:		Proposed Retrofit Practice 1: Bioretention
Land Use Detail:		Proposed Retrofit Practice 2:
Existing BMP on Site?		Non-Structural Controls:
Is site a hotspot?		Non-Structural Other:
Sources/pollutants:		Maintenance Burden:
Soils:		Benefits: Storage: Y Water Quality: Y Recharge: Y Demonstration: N Repair: N Reuse: N
Use in Retrofit DA:		Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
SIZING INFORMATION		
Drainage Area (ac):	0.45	
Impervious Area (ac):	0.23	
Practice Area Available (ft²): 2,100		
Existing Head Available?		

ID#: M32

Name: Route 7/South Willard St roundabout**Concept Description:**

A roundabout is planned for the intersection of Route 7 and So Willard St. As part of the project, underground storage with a sand filter has been proposed. The timeline for this project is outside the purview of the City and therefore is has not been included as part of the FRP.

Notes/Feasibility:

Permit 6756-INDS. Stormwater runoff from this area ultimately flows to the O8 Pond.

**GENERAL SITE INFORMATION****RETROFIT DETAILS****Site Contact Info:****Project Candidate:** Proposed**Ownership:****Retrofit of new or existing BMP:****Land Use Type:****Proposed Retrofit Practice 1:****Land Use Detail:****Proposed Retrofit Practice 2:****Existing BMP on Site?****Non-Structural Controls:****Is site a hotspot?****Non-Structural Other:****Sources/pollutants:****Maintenance Burden:****Soils:****Benefits:****Conflicts:**

Storage: Y

Soils:

Water Quality: Y

Access:

Recharge: N

Land Use:

Demonstration: N

Utilities:

Repair: N

Polluted:

Reuse: N

High WT:

Wetlands:

Other:**Other:****SIZING INFORMATION**

Drainage Area (ac): 0.73

Impervious Area (ac): 0.60

Practice Area Available (ft²): 1,300

Existing Head Available? Y

Date: 11/16/15

Assessed by: JSM

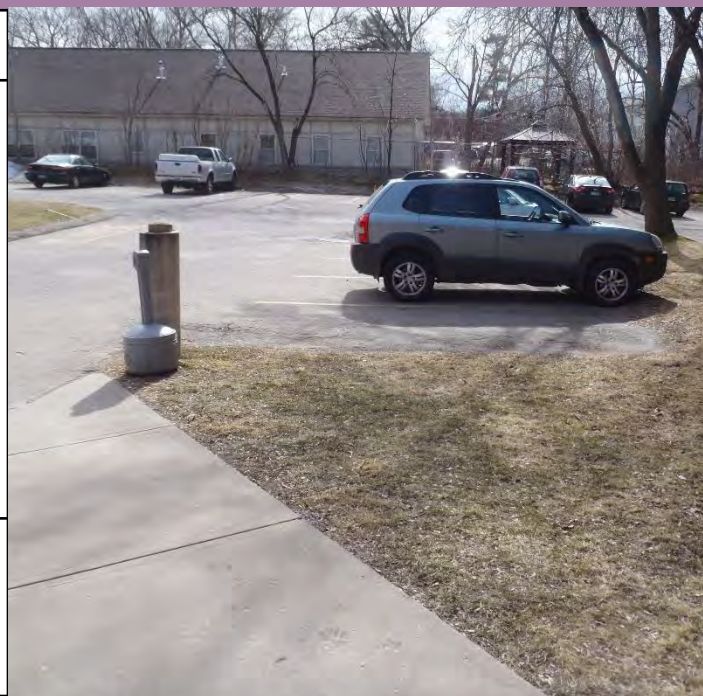
ID#: M33

Name: Champlain Apartments, 817 Pine St.**Concept Description:**

Concept for this location is a combined underground storage facility that would also serve M29. See that summary sheet for additional detail.

Notes/Feasibility:


Expired permit 2-0999.



GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info:		Project Candidate:	N
Ownership:		Retrofit of new or existing BMP:	
Land Use Type:		Proposed Retrofit Practice 1:	
Land Use Detail:		Proposed Retrofit Practice 2:	
Existing BMP on Site?		Non-Structural Controls:	
Is site a hotspot?		Non-Structural Other:	
Sources/pollutants:		Maintenance Burden:	
Soils:		Benefits:	Conflicts:
Use in Retrofit DA:		Storage:	Soils:
		Water Quality:	Access:
		Recharge:	Land Use:
		Demonstration:	Utilities:
		Repair:	Polluted:
		Reuse:	High WT:
		Other:	Wetlands:
			Other:
SIZING INFORMATION			
Drainage Area (ac):			
Impervious Area (ac):			
Practice Area Available (ft²):			
Existing Head Available?			

Date: 03/29/16

Assessed by: JSM/HA

ID#: M34			
Name: Crescent Terrace			
Concept Description: Given the neighborhood constraints, no location for a single centralized facility was identified. There are opportunities into this area for lot-scale disconnection and small bioretention/rain garden practices.			
Notes/Feasibility: Expired permit 2-1052			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info:		Project Candidate: N	
Ownership:		Retrofit of new or existing BMP:	
Land Use Type:		Proposed Retrofit Practice 1:	
Land Use Detail:		Proposed Retrofit Practice 2:	
Existing BMP on Site?		Non-Structural Controls:	
Is site a hotspot?		Non-Structural Other:	
Sources/pollutants:		Maintenance Burden:	
Soils:		Benefits: Storage: Water Quality: Recharge: Demonstration: Repair: Reuse: Other:	Conflicts: Soils: Access: Land Use: Utilities: Polluted: High WT: Wetlands: Other:
Use in Retrofit DA:			
SIZING INFORMATION			
Drainage Area (ac):			
Impervious Area (ac):			
Practice Area Available (ft²):			
Existing Head Available?			

APPENDIX B: REVIEW OF EXPIRED STORMWATER PERMITS IN THE ENGLESBY BROOK WATERSHED

March 29, 2016

To: Megan Moir, CPESC, CPSWQ

From: Julie Moore, PE

Stone Project No. 16-030

MEMO

Subject: Englesby Watershed Expired Stormwater Permit Review

Stone completed a field assessment of each of the five systems in the Englesby Brook watershed with expired stormwater permits. These systems are identified in Table 1, below.

Table 1: Expired Stormwater Permits in the Englesby Brook Watershed

Permit Number	Project Name	Permit Issued
1-0337	Howard Mental Health Services	3/4/1982
1-1087	Flynn Ave Coop Housing	9/15/1992
2-0789	Overlake Condominiums	11/24/1988
2-0999	Champlain Apartments	4/20/1982
2-1052	Crescent Terrace	12/20/1985

In general, the permits are written rather broadly with few enforceable items and typically focus on curb-and-gutter system elements, including catch basins. Further, the site plans available in the permit files tend to lack the specificity and level of detail provided for systems constructed post-2002. A brief summary of our observations is provided below, including recommendations for completing any actions that would be required to bring the facilities into compliance.

1-0337, Howard Mental Health Services, 300 Flynn Ave.

Permit covers the discharge of roof drainage via “stone lined ditch in natural drainage swale” to Englesby Brook; parking lot runoff does not appear to be regulated under the permit. During the site visit we found that the stone lined ditch is not well defined. The majority of flow leaving the site and discharging to Englesby Brook appears to occur via subsurface drain pipes not included in the permit; four outfalls were identified during the site visit that are not included in the City’s stormwater GIS layer, including one of which appears to divert water directly from Pine Street. In order to bring this facility into compliance with its existing permit, the stone lined ditch would need to be improved. In addition, the source of the water draining to each of the subsurface drains should be confirmed. As part of the Englesby Brook Flow

Restoration Plan (FRP), a potential retrofit was identified for managing runoff from parking lots draining to the existing green space behind 300 Flynn Ave.

Photo 1: Presumed Location of Natural Drainage Swale and Unknown Subsurface Drainage Outlet



1-1087, Flynn Ave Coop Housing, 288 Flynn Ave

Permit covers the discharge of stormwater runoff from roofs and paved parking lots following treatment “via grass-lined swales, through rip-rapped areas at the top of bank of Englesby Ravine, and via overland flow across vegetated terrain...” During the site visit we found that there are grass-lined to the north of the apartment complex which appear to convey stormwater runoff to rip-rapped areas that lead down to the ravine. We also noted during our site visit that the parking lot catch basin indicated in the City’s stormwater GIS layer does not exist. This site was generally found to be in compliance with its permit. As part of the Englesby Brook FRP, a significant potential retrofit was identified for in the green space immediately to the west of 288 Flynn Ave. and to the east of the proposed Champlain Parkway alignment.

Photo 2: Rip-rapped Slope Behind 288 Flynn Ave



2-0789, Overlake Properties, 545 Prospect St

Permit covers the discharge of stormwater runoff from paved road and parking lots after treatment by “passage through trap catch basins” to a stone bed and “approximately 1000 feet overland flow through wooded area and grassed drainage swale to the stream.” During the site visit we observed that sediment levels in the catch basin were below the invert of the outlet pipe, but that the outlet lacked a trap or hood. In addition, we observed a PVC pipe passing through the basin (not draining into). The stone bed noted in the permit could not be located. A 15” concrete pipe and 6” PVC pipe were both located approximately 100 feet southeast of Prospect St, which discharged into a small wetland area (see Photo 3). We followed the outflow from the wetland area for a considerable distance but could not see where it connected to the stream; a portion of the flow appeared to cross Prospect Pkwy. In order to bring this facility into compliance with its existing permit, a trap or hood would need to be fitted onto the catch basin outlet and a stone bed or other

energy dissipation measures added at the outlet. In addition, it would also be prudent to determine the source of the water passing through the catch basin in the PVC pipe in order to guard against a potential illicit discharge were it to carry something other than stormwater. As part of the Englesby Brook FRP, a potential retrofit was identified for managing runoff in the green space at the southern end of the parcel.

Photo 3: Looking Downstream from the 15" Concrete Pipe Outfall



2-0999, Champlain Apartments, 817 Pine St

Permit covers the discharge of stormwater runoff from paved parking areas after “passage through trap catch basins and a 1500 gallon septic tank in series” before being piped directly to the city stormwater system.

During our site visit we observed that sediment in all three parking lot catch basins has accumulated above the invert of the outlet pipe. No access manholes (or similar) for the septic tank were observed; the septic tank may be located under the dumpster cage in the south west corner of the parking lot (see Photo 4). The catch basin indicated in the City’s stormwater GIS layer in the green space/courtyard area near the building could not be located. In order to bring this facility into compliance with its existing permit, the catch basins would need to be serviced and a trap or hood would fitted onto each of the outlets. In addition, the septic tank should be formally located and likely serviced. As part of the Englesby Brook FRP, a potential retrofit was identified along/underneath the western edge of the parking lot.

Photo 4: Looking East toward Dumpster Cage and Probable Septic Tank Location



2-1052, Crescent Terrace

Permit covers the discharge of stormwater runoff from the paved roads and driveways, roofs and natural terrain, via overland flow across “grassed and/or vegetated terrain to a catch basin and rip-rapped outfall, prior to discharge to an unnamed tributary...” During our site visit we observed that sediment levels in the three catch basins indicated in the City’s stormwater GIS layer were below the invert of the outlet pipes. The vegetated terrain and rip-rapped outfall were observed as described in the permit. This site was generally found to be in compliance with its permit. No specific retrofit for this site is currently contemplated as part of the Englesby Brook FRP, however this is a part of a neighborhood generally being evaluated for targeted disconnection.

Photo 5: Large Stone Rip-Rap at Outfall



APPENDIX C: FLOW RESTORATION BMP CONCEPT DESIGNS

[illegible]

VERMONT

BURLINGTON

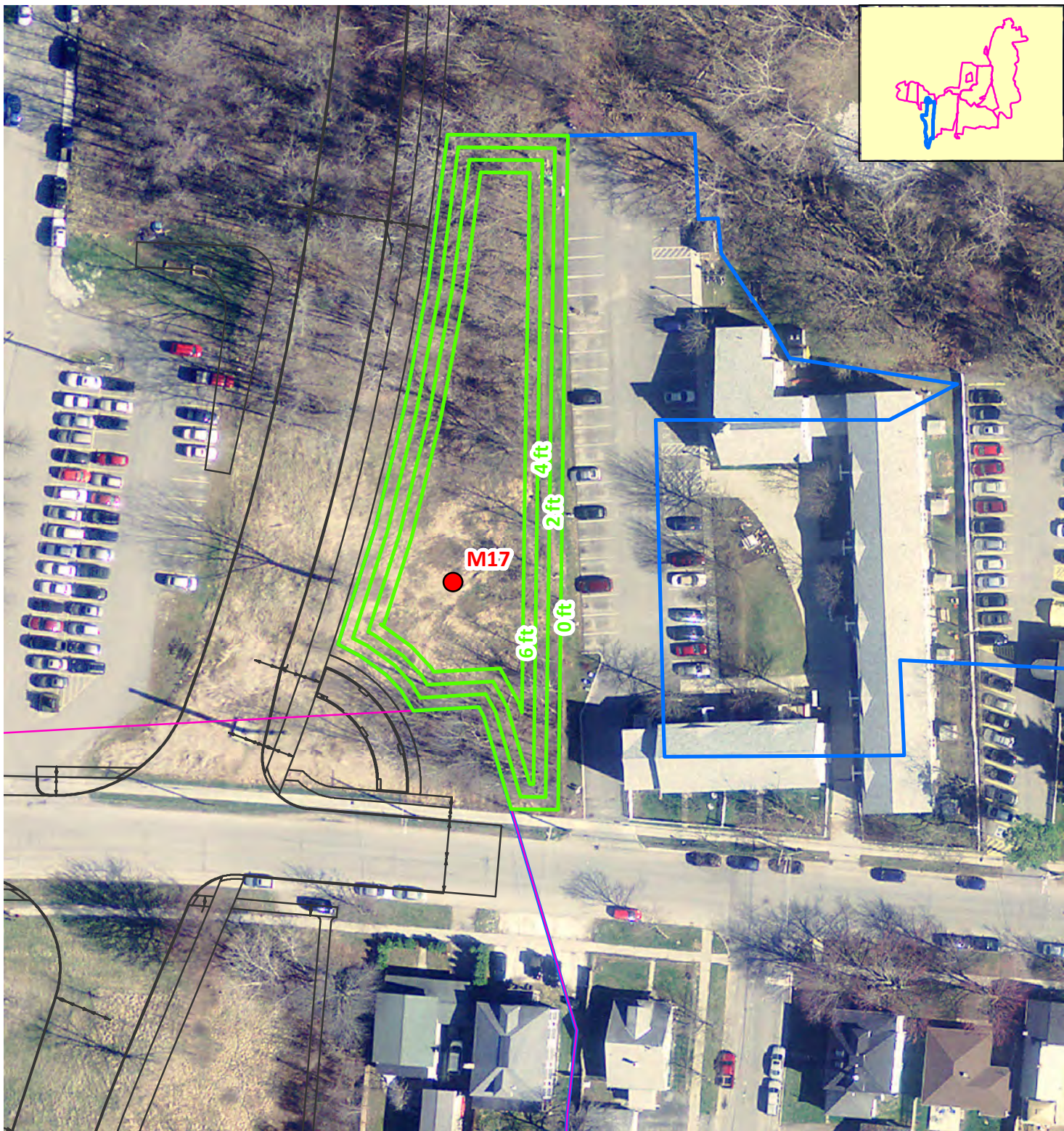
POND 08 SITE PLAN

ENGLESBY WATERSHED IMPROVEMENTS

Project No.	6523004
Proj. Manager	JTM
Proj. Designer	JTM
Drawn By	JSK
Checked By	
Scale	1"=20'
Approved	
Date	APRIL, 2005

C2

Sheet	3	of	18
D	6523004		



Path: C:\Shared\Projects\14193 Stone Environmental Englesby Brook\GIS\Maps\M17_Concept_14193.mxd

Legend

- Proposed M17 BMP
- Proposed M17 Depth Contours
- Proposed M17 Drainage Area
- Proposed Champlain Parkway
- Sub-watersheds



0 25 50 Feet

Horsley Witten Group
Sustainable Environmental Solutions

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M17 Concept Design

Date: 7/22/2016

Figure C.1



Path: \\CIFS1\netdrv-o\Proj-14\WRM\14-171 Englesby Brook FRP\GIS\MapDocuments\PpresentationsAndReports\FR_concepts\Englesby_Concept_14193_M19.mxd

Legend

- Proposed M19 BMP
- Proposed M19 Depth Contours
- Proposed M19 Drainage Area
- Sub-watersheds



0 25 50 Feet

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M19 Concept Design

Date: 7/29/2016

Figure C.3



Path: O:\Proj-14\WRM\14-171 Englesby Brook FRP\GISMapDocuments\PpresentationsAndReports\VR_concepts\Englesby_Concept_14193_M18.mxd

Legend

- Proposed M18 BMP
- Proposed M18 Depth Contours
- Proposed M18 Drainage Area
- Sub-watersheds



0 25 50 Feet

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Sustainable Environmental Solutions

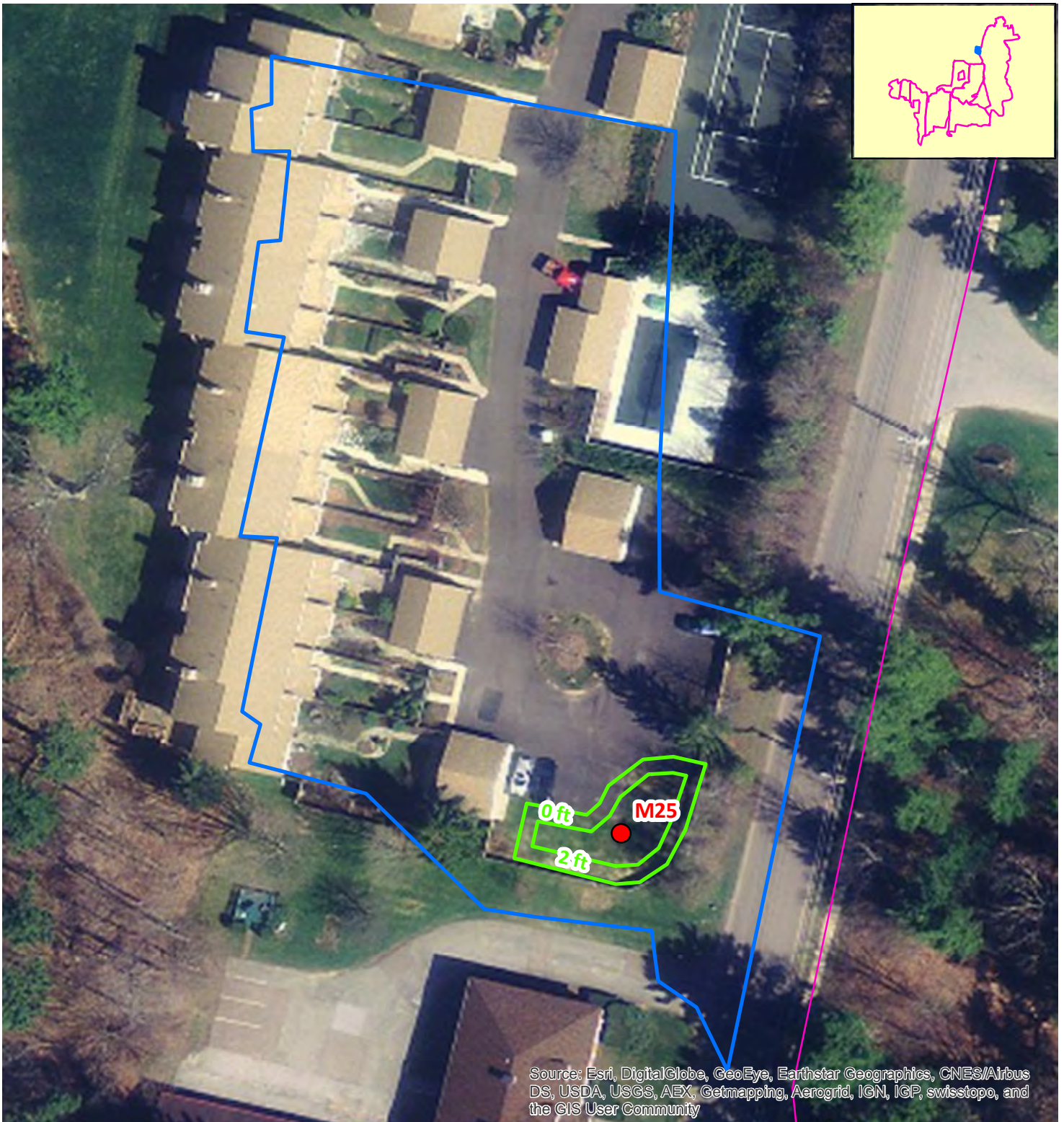
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M18 Concept Design

Date: 8/2/2016

Figure C.4



Path: O:\Proj-14WRM\14-171 Englesby Brook FRP\GISMapDocuments\PpresentationsAndReports\VR_concepts\Englesby_Concept_14193_M25.mxd

Legend

- Proposed M25 BMP
- Proposed M25 Depth Contours
- Proposed M25 Drainage Area
- Sub-watersheds



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M25 Concept Design

Date: 8/2/2016

Figure C.6



Path: O:\Proj-14\WRM\14-171 Englesby Brook FRP\GIS\MapDocuments\PpresentationsAndReports\FR_concepts\Englesby_Concept_14193_M31.mxd

Legend

- Proposed M31 BMP
- Proposed M31 Depth Contours
- Proposed M31 Drainage Area
- Sub-watersheds



0 25 50 Feet

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M31 Concept Design

Date: 8/2/2016

Figure C.7

APPENDIX D: M10 AND M17 OPINIONS OF PROBABLE COST

Table D.1: M10, O8-Pond Retrofit, Cost Estimate

Item #	Item Description	Unit	Unit Price	Amount	Total Price
1	36" RCP Pipe	LF	\$ 75	30	\$ 2,250
2	6. Dia Manhole	each	\$ 7,500	1	\$ 7,500
3	New Headwall	each	\$ 5,000	1	\$ 5,000
4	Excavation and Material Disposal	CY	\$ 40	3600	\$ 144,000
5	Extend PVC Liner.	SF	\$ 3	18200	\$ 54,600
6	Rip Rap	CY	\$ 70	50	\$ 3,500
7	Access Drive	LS	\$ 5,000		\$ -
8	Sidewalk Replacement	SF	\$ 10		\$ -
9	Concrete Curb Replacement	LF	\$ 30		\$ -
10	Rock and Boulder Excavation	CY	\$ 200	0	\$ -
11	Erosion Control	LS	\$ 10,800	1	\$ 10,800
12	Landscaping	LS	\$ 10,000	1	\$ 10,000
13	Mobilization and Miscellaneous Work (10%)	LS	\$ 23,800	1	\$ 23,800
SUB-TOTAL:					\$ 261,450
	Design and Construction Engineering (20%)	LS	\$52,300	1	\$ 52,300
	Contingency (15%)	LS	\$47,100	1	\$ 47,100
TOTAL:					\$ 360,850

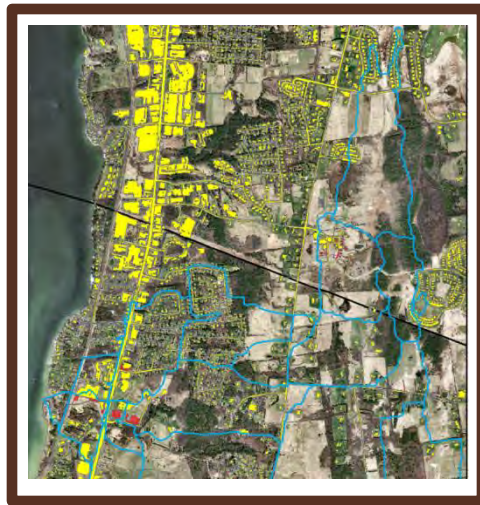
Table D.2: M17, 288 Flynn Ave/Champlain Parkway, Cost Estimate

Item #	Item Description	Unit	Unit Price	Amount	Total Price
1	24" RCP Pipe	LF	\$ 65	300	\$ 19,500
2	4' Dia Catch Basin	each	\$ 3,000	2	\$ 6,000
3	New Drainage Manhole	each	\$ 5,000	1	\$ 5,000
4	6' x 6' Detention Pond Outlet Structure	each	\$ 15,000	1	\$ 15,000
5	Excavation and Material Disposal	CY	\$ 1,100	150	\$ 165,000
6	Rip Rap	CY	\$ 70	50	\$ 3,500
7	Access Drive	LS	\$ 5,000	1	\$ 5,000
8	Sidewalk Replacement	SF	\$ 10	100	\$ 1,000
9	Concrete Curb Replacement	LF	\$ 30	20	\$ 600
10	Rock and Boulder Excavation	CY	\$ 200	0	\$ -
11	Erosion Control	LS	\$ 11,000	1	\$ 11,000
12	Landscaping	LS	\$ 10,000	1	\$ 10,000
13	Mobilization and Miscellaneous Work (10%)	LS	\$ 24,200	1	\$ 24,200
SUB-TOTAL:					\$ 265,800
	Design and Construction Engineering (20%)	LS	\$53,200	1	\$ 53,200
	Contingency (25%)	LS	\$66,500	1	\$ 66,500
TOTAL:					\$ 385,500

APPENDIX E: DESIGN AND CONSTRUCTION SCHEDULE



Appendix G – Munroe Brook Flow Restoration Plan



MUNROE BROOK FLOW RESTORATION PLAN

TCE# 14-042
Shelburne, Vermont

Date:
December 7, 2016
Revised: January 22, 2019

Prepared For:
Town of Shelburne

Prepared By:
Trudell Consulting Engineers
The Horsley Witten Group

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Sustainable Environmental Solutions

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4)	IDENTIFICATION OF REQUIRED CONTROLS.....	6
5)	DESIGN AND CONSTRUCTION SCHEDULE	8
6)	FINANCIAL PLAN.....	10
7)	REGULATORY ANALYSIS	13
8)	REGULATORY ASSISTANCE.....	13
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Appendices

- Appendix A: Overall BMP Maps and Individual BMP Information
- Appendix B: HydroCAD Model Outputs
- Appendix C: Tetra Tech Memorandum dated October 30, 2007

1) EXECUTIVE SUMMARY

The State of Vermont (VT) Agency of Natural Resources (ANR) Department of Environmental Conservation (DEC) has issued a National Pollutant Discharge Elimination System (NPDES) General Permit 3-9014 (2012) for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4). The VT MS4 permit requires communities that drain to waters impaired by stormwater runoff to develop Flow Restoration Plans (FRPs) capable of meeting the targets established in approved stormwater Total Maximum Daily Load (TMDLs). The purpose of this FRP is to identify stormwater Best Management Practices (BMPs), including retrofits to existing BMPs, that will be implemented in order to meet the established TMDL targets for Munroe Brook.

This FRP meets the attainment goals defined in the Munroe Brook TMDL approved by the United States Environmental Protection Agency (EPA) on August 21, 2008. The attainment goals set forth in the TMDL are defined in terms of flow modification in the stream. The TMDL requires a 6.6% stream flow reduction in Munroe Brook during high flow events (Q0.3%) and recommends a 9.5% increase in stream flow during low flow (Q95%) conditions (Table 1).

Table 1: Summary of Stormwater TMDL Flow Targets for Munroe Brook

Scenario	High Flow Target Reduction (%)	Low Flow Target Increase (%)
2013 Conditions	6.2	9.5
2013 Conditions with future growth (20 impervious acres)	6.6 ^a	9.5 ^b
2013 Conditions + no Agriculture	4.8	7.4
Current + no Agriculture + future growth ^c	5.2	7.4

^a TMDL flow reduction target of 6.6% (allocation of 4.8% from current urban/developed areas, 0.4% future development, and 1.6% agricultural areas)

^b TMDL flow increase target of 9.5% (allocation of 7.4% from current urban/developed areas, 0 % future development, and 2.1% agricultural areas)

^c Recommended TMDL targets for urban stormwater management only, 2003 conditions & no agriculture

In order to assess the impacts associated with construction of stormwater BMPs in the Munroe Brook watershed, VT DEC provided MS4 permittees with the Vermont Best Management Practice Decision Support System (VT BMP DSS) model. The BMP DSS model was created during the stormwater TMDL development process and is capable of estimating stream flow in Munroe Brook under current conditions. The model can also be modified to show the impact that new or retrofit stormwater BMPs will have on stream flow. Table 2 provides a summary of BMP DSS modeled stream flow in Munroe Brook for a number of model iterations.

Table 2: Summary of Munroe Brook Stream Flow Modeled at the Confluence of Lake Champlain

VT BMPDSS runs	Scenario Description	Area (acres)	Stream Flow (cfs)		% Flow Change from Base	
			High Q0.3	Low Q95	High Q0.3	Low Q95
ANR Original models	Attainment flow *		73.4	1.2		
	ANR Base (2002)	3,454	78.3	1.1	-	-
	ANR Credit (2013)	3,462	78.5	1.1	-0.3	-
Updated Models (1/8/15)	Attainment flow**		74.2	1.2		
	Revised Base	3,454	78.5	1.10	-	-
	Revised Credit	3,484	80.5	1.10	+2.6	-
	Flow Restoration Scenario 7	3,484	74.1	1.10	-5.6	-

* Reflects 6.2% reduction of ANR Base Q0.3 flow and 9.5% increase of ANR Base Q95 Flow

** Reflects 5.2% reduction (Current + No Agriculture + Future Growth Scenario) reduction of Revised Base Q0.3 flow and 9.5% increase of Revised Base Q95 Flow

In order to determine the BMPs necessary to meet TMDL flow targets, the MS4 permittees worked with an engineering consultant to find opportunities in the watershed where existing BMPs could be improved or new BMPs could be installed. This was an iterative process. New BMPs were identified and added to the model until the BMP DSS model output indicated that the required high flow reduction target was achieved. This occurred in iteration 7 of the BMP DSS model run, also known as Flow Restoration Scenario 7 (FRS7).

The low flow target, which was included in the TMDL as a recommendation, was not met. Conditions within the watershed, in particular soil types, are not able to accommodate the infiltration based BMPs that would help meet the low flow target. Given that the TMDL requires the high flow target be met, but only recommends that the low flow target be achieved, this FRP has prioritized BMPs which help to meet the high flow target. This resulted in inclusion of detention based BMPs, which do not increase stream flow during low flow conditions.

The final BMP plan included in the Munroe Brook FRP includes 10 BMPs that are already in place and 20 new or retrofit BMPs. Construction of these BMPs has been scheduled so that work is completed before December 5, 2032, as required by the VT MS4 permit. It is estimated that construction of these BMPs will cost approximately \$7.2M.

2) INTRODUCTION

Vermont DEC issued a revised NPDES General Permit 3-9014 for Stormwater Discharges from Small MS4's in 2012. The revised MS4 permit required communities that drain to waters impaired by stormwater runoff to develop FRPs capable of meeting the targets established in approved stormwater TMDLs.

The purpose of this FRP is to identify stormwater BMPs, including retrofits to existing BMPs, that will be implemented in order to meet the established TMDL targets for Munroe Brook. The ultimate goal of this FRP is to restore Munroe Brook so that it is removed from **the State's list** of impaired waters.

Munroe Brook is currently included on the Vermont 303(d) list of impaired waters. The source of impairment is identified as unmanaged stormwater runoff. MS4 permittees discharging to Munroe Brook are required to create a FRP for all stormwater impaired waters within their jurisdiction. The Munroe Brook impaired watershed is located almost entirely within the Town of Shelburne, with the exception of a small portion along the northern boundary that is located in the City of South Burlington. VTrans, which has been designated a Non-Traditional MS4, also has jurisdiction over portions of the drainage area along the U.S. Route 7 corridor.

VT DEC prepared, and the United States EPA approved, a stormwater TMDL for the Munroe Brook watershed in 2008. The *Total Maximum Daily Load to Address Biological Impairment in Munroe Brook* (September 2008) document includes an aggregate Waste Load Allocation (WLA), which applies to various watershed sources. No specific WLA was specified for MS4 sources. The attainment goals set forth in the Munroe Brook TMDL are defined as stream flow targets. The TMDL requires a reduction in stream flow during high flow events (Q0.3%) and recommends an increase in stream flow during low flow (Q95%) conditions.

3) WATERSHED MODELING

In order to assess the impacts associated with construction of stormwater BMPs in the watershed, Vermont DEC provided MS4 permittees with the VT BMP DSS model. The VT BMP DSS model was created during the TMDL development process and is capable of estimating stream flow under current conditions as well after stormwater BMPs are installed in the watershed.

BMPs were identified and incorporated into the VT BMP DSS watershed model in an iterative fashion. Identified BMPs were added to the VT BMP DSS model, which then

assessed the impact on stream flow. Potential BMPs were identified and included in the model over 7 iterations. The results of these BMP iterations are summarized in Table 3.

Additionally, drainage area information for existing BMPs was updated in the BMP DSS model. Review of the GIS mapping and field verification showed an increase in the overall watershed area of approximately 30 acres. This change resulted in a 2.6% increase in peak flow, as indicated in Table 3.

Table 3: Summary of BMP DSS Model Runs

VT BMPDSS runs	Scenario Description	Area (ac)	Flow (cfs)		% Flow Change from Base	
			High Q0.3	Low Q95	High Q0.3	Low Q95
ANR Original Model Runs	Attainment flow *		73.4	1.2		
	ANR Base (2002)	3,454	78.3	1.1	-	-
	ANR Credit (2013)	3,462	78.5	1.1	-0.3	-
Updated VT BMP DSS Model Runs	Attainment flow**		74.2	1.2		
	Revised Base	3,454	78.5	1.08	-	-
	Revised Credit	3,484	80.5	1.08	+2.6	0
	FRS1	3,484	77.3	1.08	-1.5	0
	FRS2	3,484	77.5	1.08	-2.1	0
	FRS3	3,484	75.9	1.08	-3.4	0
	FRS4	3,484	74.7	1.08	-4.9	0
	FRS5	3,484	74.1	1.08	-5.7	0
	FRS6	3,484	74.2	1.08	-5.4	0
	FRS7	3,484	74.1	1.08	-5.6	0

* Reflects 6.2% reduction of ANR Base Q0.3 flow and 9.5% increase of ANR Base Q95 Flow

** Reflects 5.2% reduction (Current + No Agriculture + Future Growth Scenario) of Revised Base Q0.3 flow and 9.5% increase of Revised Base Q95 Flow

The BMPs included in the final BMP DSS model run will meet the high flow reduction target of the TMDL of 5.2%. This addresses peak flow requirements for developed land along with a projected non-jurisdictional growth of 20 acres of impervious surface in the Munroe Brook Watershed. This FRP does not address flow reduction requirements for agricultural areas within the watershed.

The TMDL's recommended low flow target is not met. This is the result of detention based BMPs being utilized to meet the high flow target. Detention based BMPs do not provide a significant improvement in stream flow during low flow conditions. Infiltration based BMPs would serve to meet both the high and low targets simultaneously. Based on information provided by web soil survey data and site observations, there was little opportunity for inclusion of infiltration based BMPs in the Munroe Brook watershed. However, soil borings were not carried out at BMP site locations, as projects included in the VT BMP DSS model were only developed to a concept level. It is recommend that as project design and engineering moves forward that each project be evaluated for additional opportunities to provide infiltration based on actual soil boring data. This

could increase recharge to groundwater, which would in turn increase stream flow during the low flow condition.

4) IDENTIFICATION OF REQUIRED CONTROLS

In 2014 site visits were performed throughout the Munroe Brook watershed to identify and evaluate existing stormwater BMPs that were candidates for retrofits as well as find locations for new BMPs. The BMPs included in this FRP are based on the results of this field work, potential construction costs, and the BMPs performance in the VT BMP DSS model. In general, priority was given to retrofit BMPs as they typically provide a better cost/benefit ratio than construction of new BMPs.

Each potential BMP site was reviewed to determine its ability to meet the channel protection criteria (CPv) from the 2002 Vermont Stormwater Management Manual. The CPv criteria requires 12 hour detention of stormwater runoff during the 1-year, 24-hour storm event in cold water fish habitats and 24 hour detention in warm water fish habitats. Munroe Brook is classified as a warm water fish habitat; therefore BMPs were designed to meet the 24-hour detention standard. Since the 1-year, 24-hour storm event is a close approximation to the storm event associated with the Q0.3 flow defined in the TMDL this criterion was utilized as part of the FRP evaluation. Hydrologic modeling for BMPs is provided in Appendix B.

As previously noted, BMPs included in the final FRP were only developed to a concept level. Significant field work was performed to identify and screen candidate sites, but this work did not include a detailed hydrologic analysis, property research, site engineering, wetlands delineation, and other necessary studies which will be required to move these projects towards a final engineering design and ultimately construction. There may be constraints that prevent certain BMPs from being utilized, either wholly or in part, in the FRP. All BMP sites included in this FRP will require additional permitting, engineering and design work to determine the feasibility of installing a BMP in the specified location.

Table 4 lists the BMPs included in this FRP and provides general information about each BMP. Detailed information for each BMP, including maps, can be found in Appendix A. All of the BMPs included in Table 4 have been incorporated into the BMP DSS model. If the BMP includes a note that indicates **“No change”** then this BMP will not require additional work. It either already meets the current design standards (2002) or retrofits of this BMP did not provide any additional benefit in the BMP DSS model.

Table 4: Summary of Best Management Practices Included in Munroe Brook Flow Restoration Plan

BMP ID #	Model ID	State Permit Number	Site Name	BMP Type	Notes
M01	134	1-0607 A	Westview Estates	Wet Pond	Retrofit outlet structure, lower permanent pool
M02	135	1-0607 B	Westview Estates	Wet Pond	Retrofit outlet structure, lower permanent pool
M03	138	1-0732 B	Deer Run	Wet Pond	Retrofit outlet structure
M04	140	1-0732 C	Farmstead Drive	Detention Pond	No change, BMP to be verified installed as assumed
M05	142	1-1155 P2	Pinnacle at Spear	Wet Pond	Retrofit outlet structure, converted to wet pond
M06	143	1-1155 P5	Pinnacle at Spear	Detention Pond	Retrofit outlet structure
M07	148	1-1155 P3	Pinnacle at Spear	Detention Pond	Retrofit outlet structure
M08	150	1-1291	Route 7	Wet Pond	Storage expanded with underground storage
M09	152	1-1390	Automaster Mini	Detention Pond	Retrofit outlet structure
M10	154	1-1400 A	Shelburne Meadows Business Park	Detention Pond	Retrofit outlet structure, expanded storage
M11	156	1-1400 B	Shelburne Meadows Business Park	Detention Pond	Retrofit outlet structure
M12	158	1-1534	Boulder Hill	Detention Pond	Retrofit outlet structure, expanded storage
M13	160	6959-INDO	Roberts Mini Storage	Detention Pond	No change
M14	161	6959-INDO	Roberts Mini Storage	Detention Pond	No change
M15	171	4444-INDS	Sutton Farms	Wet Pond	No change
M16	176	3443-INDS 2	South Pointe	Detention Pond	Retrofit outlet structure
M17	178	4096-INDS P3	South Village	Wet Pond	No change
M18	180	4096-INDS P1	South Village	Wet Pond	No change
M19	182	4096-INDS P2	South Village	Wet Pond	No change
M20	185	3928-INDO	Hullcrest Park	Detention Pond	No change
M21	193	6938-INDS P1	Automaster Parking Expansion	Detention Pond	No change

M22	194	6938- INDS P2	Automaster Parking Expansion	Detention Pond	No change
M23	195	6909- INDS	Lilly Creek	Detention Pond	No change
M27	199	1-0732 A	Deer Run	Wet Pond	New BMP (located where BMP was never built)
M28A	205	N/A	Shelburne Camping	Wet Pond	New BMP
M28B	206	N/A	Shelburne Camping	Wet Pond	New BMP
M29	207	N/A	Shelburne Commons- Rice Lumber	Wet Pond	New BMP
M32	201	N/A	Drew Lane	Wet Pond	New BMP
M34	208	N/A	Hullcrest South	Wet Pond	New BMP
M35	203	N/A	Morse Drive Neighborhood	Wet Pond	New BMP

5) DESIGN AND CONSTRUCTION SCHEDULE

A design and construction schedule is a required element of the final FRP. This schedule must show how the proposed BMPs included in the FRP can be implemented over a timeframe of less than 20 years from the date of MS4 permit issuance. This means that all BMPs associated with FRPs must be implemented prior to December 5, 2032.

The BMPs included in this FRP were scheduled with consideration given to expired permit sites, performance in the watershed, and estimated construction costs. As retrofit BMPs typically provide a better cost/benefit ratio than construction of new BMPs, retrofit projects were placed toward the front end of the construction schedule. A final BMP implementation schedule is included in Table 5.

The BMP schedule presented in this FRP is expected to receive updates on an annual basis. Projects will be added, modified, or removed as necessary to meet FRP flow targets and respond to real world conditions. This is necessary primarily due to the fact that the BMPs presented in this FRP have only been developed to concept level planning. It is reasonable to anticipate that changes will occur when these concepts are further developed. Depending on actual circumstances, the level of treatment achieved may be more or less than the level of treatment anticipated (e.g. variations in soil conditions allow for either more or less infiltration of stormwater runoff than originally anticipated). These type of modifications are common when advancing BMP plans from concept to final design. Therefore, flexibility in the schedule is necessary to accommodate these changes.

Additionally, in order for project implementation to move forward in a cost effective manner, the MS4s will need to take advantage of opportunities for stormwater improvements as they present themselves. For example, a private property owner may decide to redevelop their property on a schedule that was not anticipated in the current BMP implementation schedule. If this occurs, the MS4s may need to shift

available resources from a scheduled project in order to take advantage of a cost savings opportunity.

Finally, projects may need to be shifted in the BMP schedule based on Vermont's changing regulatory system. VTDEC is currently developing an implementation plan for the Lake Champlain Phosphorous TMDL. When this document is finalized, the MS4 permit will require regulated entities to develop Phosphorus Control Plans (PCPs), similar in size and scope to the FRPs being developed as part of stormwater TMDLs. When this occurs, the FRPs will likely need to be revised based on PCP requirements, which are yet to be defined by VTDEC.

Table 5: BMP Implementation Schedule

Project ID	Project Name	Project Rank	BMP Description	Construction Fiscal Year
M2	Westview Estates	1	Wet Pond	2021
M1	Westview Estates	2	Wet Pond	2021
M3	Deer Run	4	Wet Pond	2025
M10	Shelburne Meadows Business Park	3	Detention Pond	2024
M11	Shelburne Meadows Business Park	6	Detention Pond	2024
M4	Farmstead Drive	5	Detention Pond	2022
M5	Pinnacle @ Spear		Wet Pond	2030
M6	Pinnacle @ Spear		Detention Pond	2019
M7	Pinnacle @ Spear		Detention Pond	2019
M9	Automaster (CEA 99 design)	7	Detention Pond	2023
M32	Drew Lane	11	Wet Pond	2024
M16	South Pointe		Detention Pond	2023
M29	Shelburne Commons-Rice Lumber	10	Wet Pond	2024
M27	Deer Run	8	Wet Pond	2025
M12	Boulder Hill	9	Detention Pond	2026
M35	Morse Drive Neighborhood	12	#N/A	2027
M28B	Shelburne Camping	15	Wet Pond	2028
M28A	Shelburne Camping	16	Wet Pond	2028
M34	Hullcrest South	14	#N/A	2029
M8	Route 7	13	Wet Pond	2030
M13	Roberts Mini Storage		Detention Pond	NA
M14	Roberts Mini Storage		Detention Pond	NA

M15	Sutton Farms		Wet Pond	NA
M17	South Village		Wet Pond	NA
M18	South Village		Wet Pond	NA
M19	South Village		Wet Pond	NA
M20	Hulcrest Park		Detention Pond	NA
M21	Automaster Parking Expansion		Detention Pond	NA
M22	Automaster Parking Expansion		Detention Pond	NA
M23	Lilly Creek		Detention Pond	NA

6) FINANCIAL PLAN

Subject to the requirements of the MS4 permit, a financial plan is required as part of the final FRP. This plan must provide initial BMP cost estimates and demonstrate the means by which BMP implementation will be financed. The financial plan must also include the steps that each MS4 will take to implement the finance plan.

Costs for implementing each BMP were estimated based on a Tetra Tech, Inc. memorandum dated October 30, 2007 (Appendix C). This memorandum provided a methodology for estimating BMP construction costs based on simple BMP attributes. The methodology utilized a construction cost base year of 2000. In order to more accurately estimate these costs over the FRP's 20 year implementation schedule a 2.5% annual inflation rate was applied. Therefore, the estimated costs presented in this FRP reflect anticipated construction costs in the year 2032. While it is likely that many, if not all, of the BMPs will be constructed prior to the year 2032 utilizing these costs provide a margin of safety that will be useful for financial planning. Total project costs were calculated based on the following equation:

$$\text{Total Cost} = \text{Installation Cost (I)} + \text{Land Cost (L)} + \text{Fixed Cost (F)}$$

Where:

I = \$5/cf of CPv detention, inflated at 2.5% to year 2032 = \$11/cf (\$479,160/acre-foot)

L = \$0 as it is not anticipated that it will be necessary to purchase property

F = Design/permitting costs. Varies depending on whether a large project or simple retrofit BMP

For new BMPs and retrofits requiring storage expansion, the Installation Cost (I) value was calculated using the volume of the BMP. For retrofits requiring only a modification to the outlet structure, the I value was estimated based on conservative engineering judgement. In these cases, a minimum I value of \$20,000 was utilized. The Fixed Cost (F) value for BMPs varies based on percentage of Installation Costs, with 5% of the estimated Installation Cost used for large projects and 20% of the estimated Installation

Cost used for small retrofit projects. This reflects a minimum Fixed Cost regardless of project scope. Estimated construction costs for each BMP are shown in Table 6. BMPs with no associated costs have been included in the BMPDSS model as they currently exist. Therefore, no additional implementation costs are anticipated for these BMPs.

The costs included in Table 6 are planning level estimates only. Unforeseen constraints or other factors have the potential to increase or lower the implementation cost of BMPs. These values should be reevaluated during the engineering design process.

Each MS4 that drains to Munroe Brook must determine how it will fund its portion of the FRP. The Town of Shelburne currently pays for stormwater related costs utilizing the General Fund derived by tax revenue. The implementation costs associated with this FRP will require a significant increase in expenditures. Shelburne is currently evaluating options for raising additional funds to pay for FRP related work. One option under evaluation is the implementation of a stormwater utility or a similar stormwater fee based on impervious area.

In addition to local funding sources, it is the Town's expectation that significant funding from the State of Vermont and other Federal sources will be available to help with the cost of stormwater TMDL implementation. The State of Vermont has already taken initial steps towards providing this funding. In 2015 the Vermont legislature created the Clean Water Fund (CWF). The CWF was provided with \$2,005,000 in 2015, and \$7,688,000 in 2016. While these initial investments are not at the level necessary to provide significant funding to the MS4 communities subject to stormwater TMDLs, it is the Town's understanding that the State is working to provide additional funding to the CWF in the future. In December 2016, the State Treasurer and State agencies will be delivering a report to the Vermont legislature that provides options for raising significant money to fund the CWF. The Town will also pursue funding from existing and new grant sources from other organizations including, but not limited to VTDEC, the Vermont Agency of Transportation, and the Lake Champlain Basin Program.

Table 6: BMP Cost Estimates

BMP ID #	Site Name	Storage Volume (Acre-Feet)	I	F	Total
M1	Westview Estates	N/A	\$20,000	\$4,000	\$24,000
M2	Westview Estates	N/A	\$20,000	\$4,000	\$24,000
M3	Deer Run	N/A	\$20,000	\$4,000	\$24,000
M4	Farmstead Drive	N/A	\$20,000	\$4,000	\$24,000
M5	Pinnacle @ Spear	N/A	\$20,000	\$4,000	\$24,000
M6	Pinnacle @ Spear	N/A	\$20,000	\$4,000	\$24,000
M7	Pinnacle @ Spear	N/A	\$20,000	\$4,000	\$24,000
M8	Route 7	2.31	\$1,104,464	\$55,223	\$1,159,687
M9	Automaster (CEA 99 design)	N/A	\$20,000	\$4,000	\$24,000
M10	Shelburne Meadows Business Park	0.60	\$287,496	\$14,375	\$301,871
M11	Shelburne Meadows Business Park	N/A	\$20,000	\$4,000	\$24,000
M12	Boulder Hill	2.51	\$1,204,608	\$60,230	\$1,264,838
M13	Roberts Mini Storage	N/A	N/A	\$0	\$0
M14	Roberts Mini Storage	N/A	N/A	\$0	\$0
M15	Sutton Farms	N/A	N/A	\$0	\$0
M16	South Pointe	N/A	\$20,000	\$4,000	\$24,000
M17	South Village	N/A	N/A	\$0	\$0
M18	South Village	N/A	N/A	\$0	\$0
M19	South Village	N/A	N/A	\$0	\$0
M20	Hullcrest Park	N/A	N/A	\$0	\$0
M21	Automaster Parking Expansion	N/A	N/A	\$0	\$0
M22	Automaster Parking Expansion	N/A	N/A	\$0	\$0
M23	Lilly Creek	N/A	N/A	\$0	\$0
M27	Deer Run	0.51	\$242,934	\$12,147	\$255,081
M28A	Shelburne Camping	0.34	\$164,831	\$8,242	\$173,073
M28B	Shelburne Camping	0.60	\$286,059	\$14,303	\$300,362
M29	Shelburne Comms-Rice	3.57	\$1,709,643	\$85,482	\$1,795,125
M32	Drew Lane	0.87	\$416,869	\$20,843	\$437,712
M34	Hullcrest South	1.53	\$731,677	\$36,584	\$768,261
M35	Morse Drive Neighborhood	1.12	\$534,743	\$26,737	\$561,480

Total \$7,257,490

7) REGULATORY ANALYSIS

The VT MS4 permit requires that final FRPs include a regulatory analysis that identifies and describes what, if any, additional regulatory authorities the permittees will need to implement the FRP. Stormwater runoff in the Munroe Brook watershed is currently regulated by the VT DEC stormwater program which regulates new, expanded, or redeveloped sites as dictated by the Stormwater Management Rule for Impaired Waters (Environmental Protection Rules, Chapter 22), by the Town of Shelburne and City of South Burlington through zoning regulations and ordinances, and by VTTrans through 19 V.S.A.1111 which covers discharges in State Right of Ways.

At this time, and based on the above existing regulatory authorities, the MS4s do not anticipate the need for additional regulatory authorities in order to implement the Munroe Brook FRP.

8) REGULATORY ASSISTANCE

The MS4 permit requires this FRP to identify any regulatory assistance the permittees will need from the Secretary in order to implement the FRP, such as use of Residual Designation Authority (RDA) pursuant to 40 C.F.R. §122.26. Based on the above regulatory analysis, and the fact that the BMPs identified in this FRP are capable of meeting the requirements of the TMDL, it is not anticipated that additional regulatory assistance will be necessary to implement the FRP at this time.

9) THIRD-PARTY IMPLEMENTATION

The MS4 permit requires the identification of any party, other than the MS4 permittees, that is responsible for implementing any portion of the FRP. There are several properties in the Munroe Brook watershed that are covered by expired State of Vermont stormwater permits. Some of these sites are located on private property. Properties covered by expired permits may be required to retrofit and/or construct BMPs to meet the level of treatment described in this FRP. The controlling interest of these permits will have the ability to obtain valid permit coverage under an existing Vermont DEC permit programs (e.g. the RDA permit or an individual stormwater permit). The Town of Shelburne is also considering allowing expired permit holders to transfer these permits under the Town's MS4 permit coverage. The details of this transfer are still being evaluated.

10) SUMMARY & IMPLEMENTATION

This FRP was developed for the MS4 permittees located within the Munroe Brook watershed. The proposed BMPs were identified via preliminary field work and discussions with the MS4 permittees. While the BMPs included in this FRP are capable of meeting the requirements of the TMDL, there are likely other combinations of BMPs that are also capable of meeting these same requirements. The permittees are not strictly bound to the BMPs included in this document and plan to make adjustments to this FRP, as necessary over the implementation schedule, in order to achieve the required TMDL stream flow target.

As this FRP is implemented the VT BMP DSS model will be updated to show the impacts of the BMPs as they are actually constructed. The BMP DSS model will also be updated to account for any other changes that occur in the watershed.

Appendix A: Overall BMP Maps and Individual BMP Information



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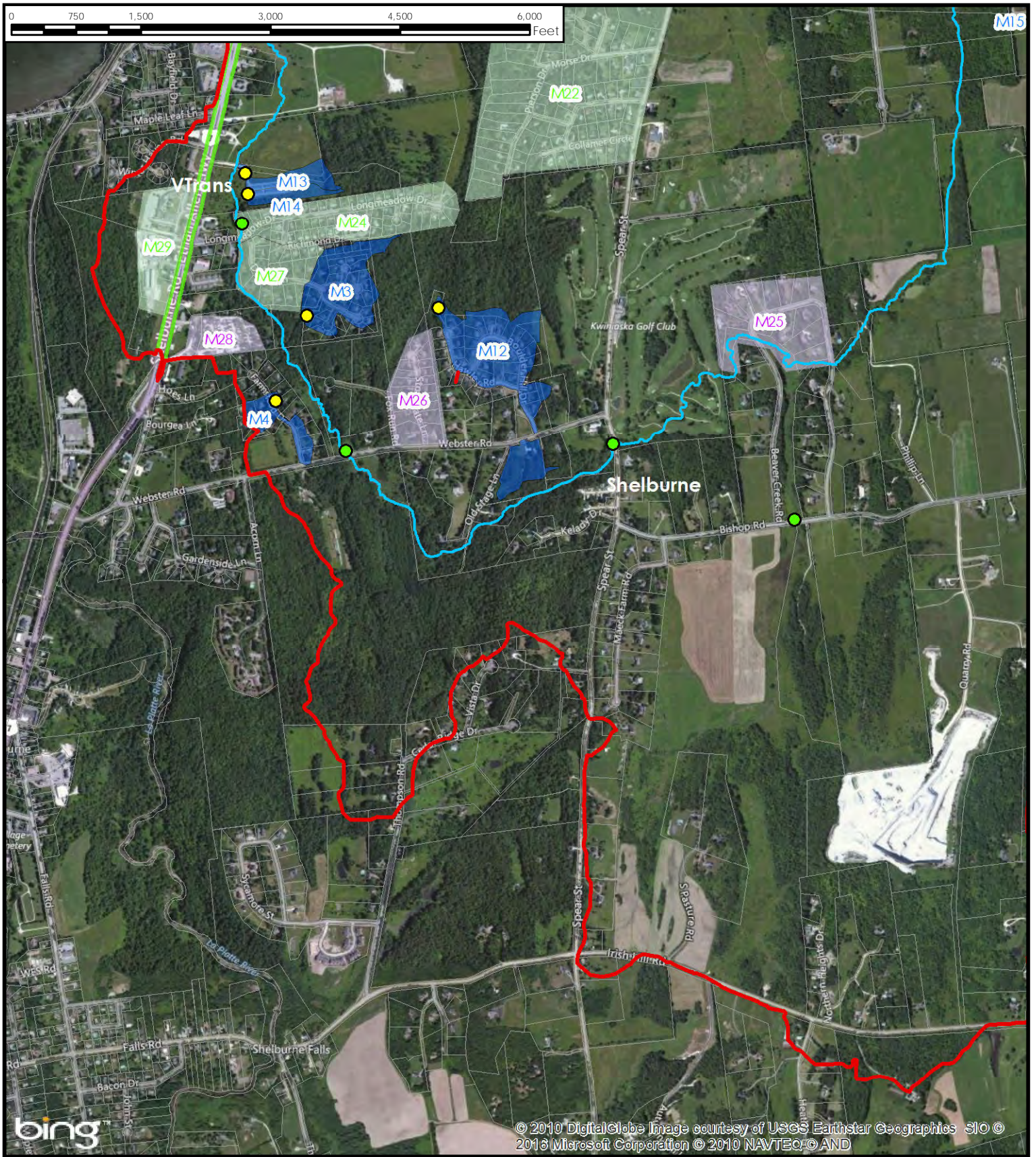


Munroe Brook Watershed Northern Section - FRP BMPs Shelburne & South Burlington, VT

Project: 14-042
Prepared By: ALD
09/14/2016
1 inch = 1500 feet

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); M54 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).
Disclaimer: The accuracy of information presented is determined by its sources. TCE is not responsible for any errors or omissions that may exist. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not a replacement for surveyed information or engineering studies.

- Munroe Brook Watershed
- BMP
- Munroe Brook
- No Change to BMP
- Potential Retrofit BMP
- Potential New BMP
- Town Boundary
- Tax Parcel Boundary



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Munroe Brook Watershed Southern Section - FRP BMPs Shelburne & South Burlington, VT

Project: 14-042
Prepared By: ALD
09/14/2016
1 inch = 1500 feet

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); M54 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).
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- Munroe Brook Watershed
- BMP
- Munroe Brook
- No Change to BMP
- Retrofit BMP
- New BMP
- Shelburne
- South Burlington
- VTrans
- Town Boundary
- Tax Parcel Boundary

ID#: M01		
Name: Westview Estates		
Permit #: 1-0607 A		
Concept Description: Conversion of existing BMP to 2002 standard		
Notes/Feasibility: 12 in horizontal stand pipe. Head available dependent on lowering water surface level, existing pond has +/-1' of freeboard.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne	Project Candidate: Tier II	
Ownership:	New or Retrofit BMP: Retrofit	
Land Use 1: Residential	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: No	
Existing BMP on site? Yes	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: No Land Use: No Utilities: No High WT: Unknown Wetlands: Yes Demo: No Other: N/A
Soils: C		
SIZING INFORMATION		
Drainage Area (ac): 29.90		
Impervious Area (ac): 4.01		
Practice Area Available(ft²): 20700		
Existing Head Available? 4-5' Est.		

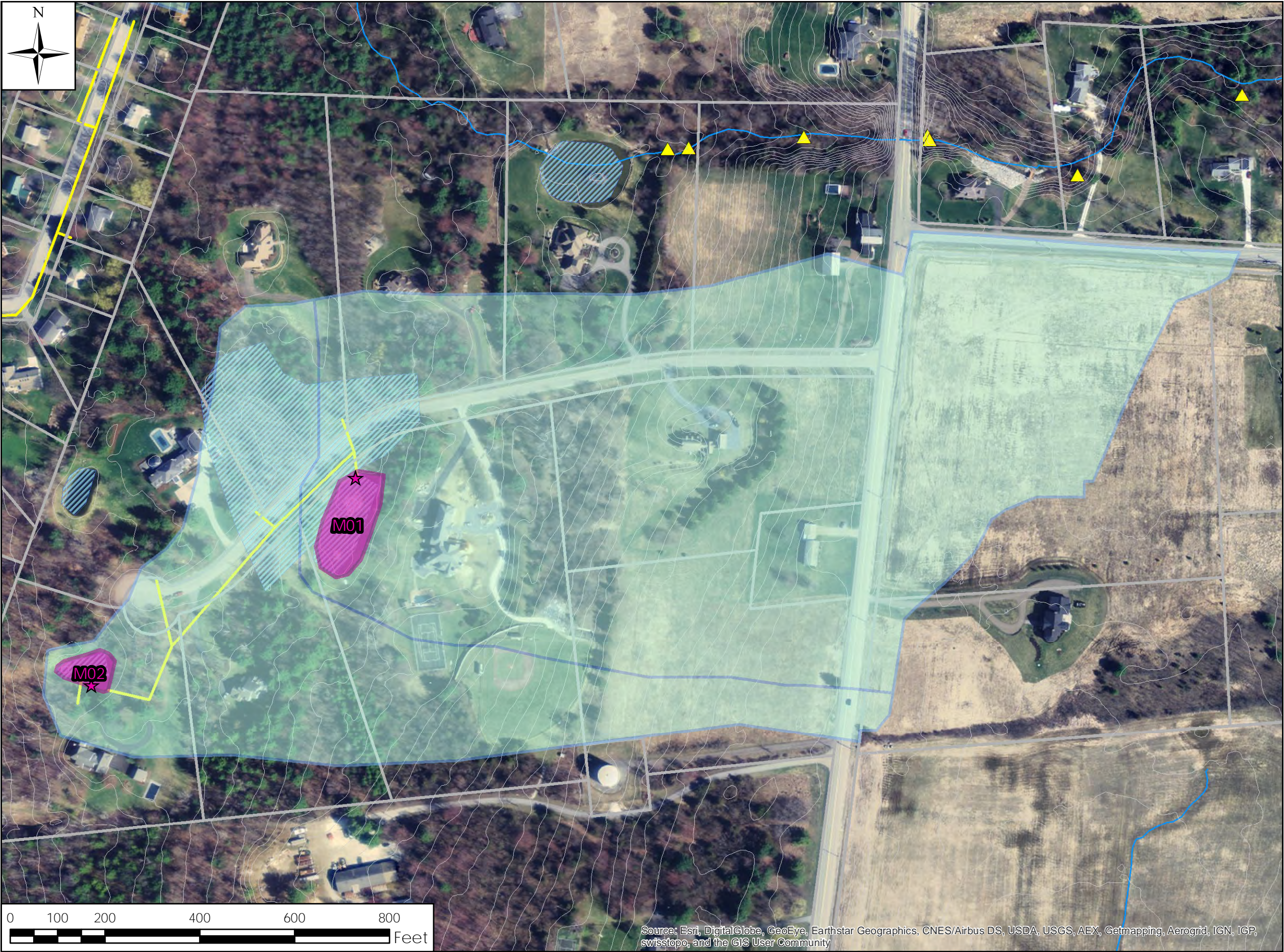
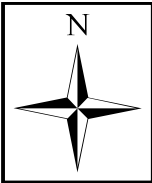
Date Assessed: 10/30/2014

Assessed by: AGM/LMJ

ID#: M02			
Name: Westview Estates	No Image Available		
Permit #: 1-0607 B			
Concept Description: Retrofit of existing BMP to 2002 standards			
Notes/Feasibility:			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info: Shelburne	Project Candidate: Tier II		
Ownership:	New or Retrofit BMP: Retrofit		
Land Use 1: Residential	Proposed Retrofit Practice: Pond		
Land Use 2:	Non-Structural Controls: no		
Existing BMP on site? Yes	Maintenance Burden: Moderate		
Is site a hotspot? No	Benefits: Storage: yes Water Quality: yes Recharge: No Repair: no Other: N/A	Conflicts: Soils: No Access: no Land Use: no Utilities: no High WT: unknown Wetlands: No Demo: no Other: N/A	
Soils: C			
SIZING INFORMATION			
Drainage Area (ac): 12.43			
Impervious Area (ac): 0.92			
Practice Area Available(ft²): 6900			
Existing Head Available? N/A			

Date Assessed: 10/30/2014

Assessed by: AGM/LMJ



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Project Location

Legend


- Munroe Brook Watershed
- Proposed BMP
- Practice Area
- BMP Drainage Area
- Contours (2')
- Tax Parcel Boundary
- Munroe Brook
- Outfalls
- Catch Basins
- Manholes
- Stormline
- VT Significant Wetland
- Stream

Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

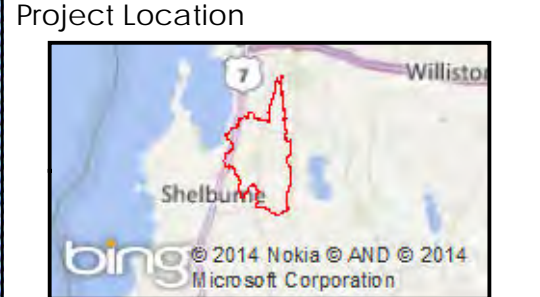
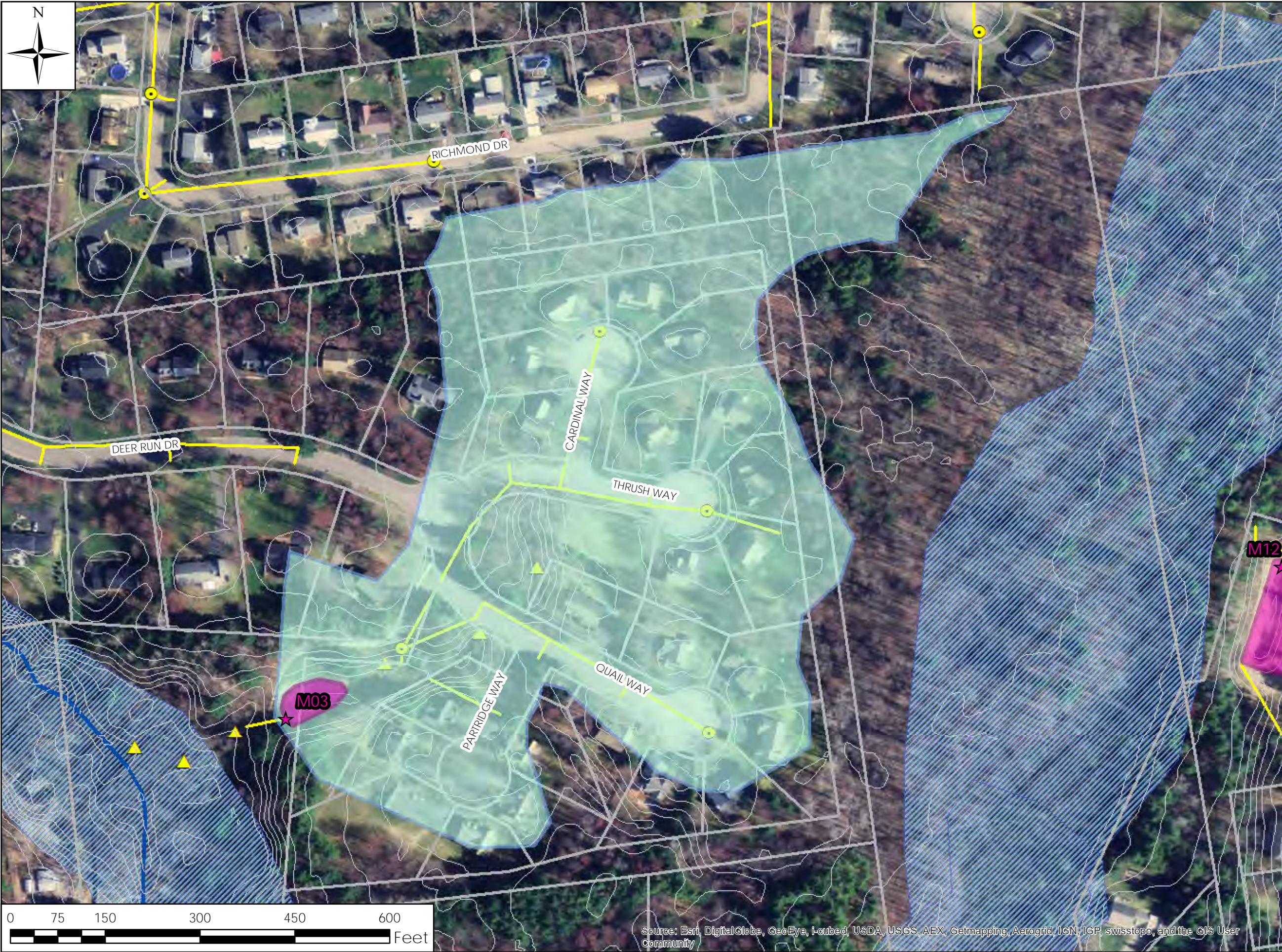
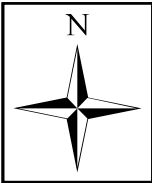
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M1 & M2 - Westview Est
Shelburne, VT
Project: 14-042
Prepared By: ALD
09/14/2016
1 inch = 200 feet

ID#: M03		
Name: Deer Run		
Permit #: 1-0732 B		
Concept Description: Expand existing BMP		
Notes/Feasibility: Outlet clogged - unable to verify low flow orifices.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne	Project Candidate: Tier I	
Ownership:	New or Retrofit BMP: Retrofit	
Land Use 1: Residential	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: No	
Existing BMP on site? Yes	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: Yes Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Unknown Wetlands: No Demo: No Other: N/A
Soils: C		
SIZING INFORMATION		
Drainage Area (ac): 15.40		
Impervious Area (ac): 3.23		
Practice Area Available(ft²): 4600		
Existing Head Available? 2-3' Est.		

Date Assessed: 10/30/2014

Assessed by: AGM/LMJ




- Legend
- Munroe Brook Watershed
 - Proposed BMP
 - Practice Area
 - BMP Drainage Area
 - Contours (2')
 - Tax Parcel Boundary
 - Munroe Brook
 - Outfalls
 - Catch Basins
 - Manholes
 - Stormline
 - VT Significant Wetland
 - Stream

Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

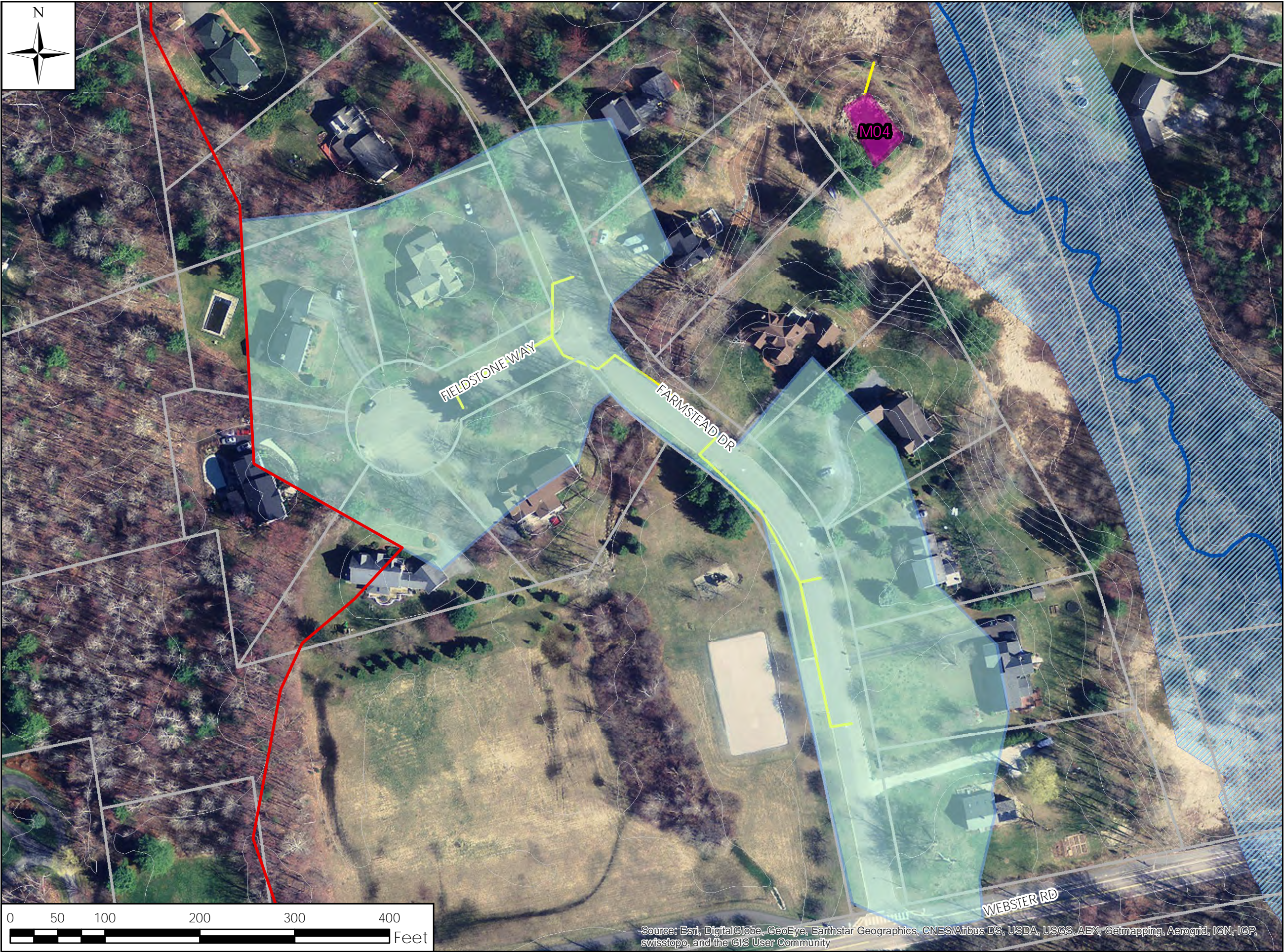
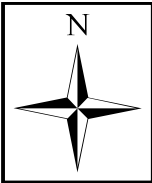
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M03 - Deer Run
Shelburne, VT
Project: 14-042
Prepared By: LMJ
12/03/2014
1 inch = 150 feet


ID#: M04		
Name: Farmstead Drive		
Permit #: 1-0732 C		
Concept Description: Verify installed as designed		
Notes/Feasibility: No retrofit required provided that system is installed per assumed design. To be verified.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne	Project Candidate: Tier II	
Ownership:	New or Retrofit BMP: Retrofit	
Land Use 1: Residential	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: no	
Existing BMP on site? Yes	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: yes Water Quality: yes Recharge: No Repair: no Other: N/A	Conflicts: Soils: No Access: no Land Use: no Utilities: no High WT: unknown Wetlands: No Demo: no Other: N/A
Soils: C		
SIZING INFORMATION		
Drainage Area (ac): 5.60		
Impervious Area (ac): 1.83		
Practice Area Available(ft²): 2200		
Existing Head Available? 3' Est.		


Date Assessed: 10/29/2014

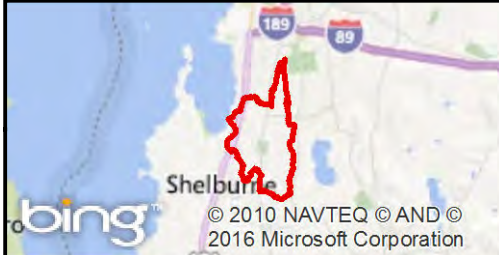
Assessed by: AGM/LMJ















Horsley Witten Group
Sustainable Environmental Solutions
96 Route 6A • Shelburne, MA • 02583
Tel: 508-833-6800 • Fax: 508-533-3150 • www.horsleywitten.com



**TRUDELL**
Consulting Engineers
802.879.6331 www.tcevt.com

Project Location

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Legend

-  Munroe Brook Watershed
-  Practice Area
-  BMP Drainage Area
-  Contours (2')
-  Tax Parcel Boundary
-  Munroe Brook
-  Outfalls
-  Catch Basins
-  Manholes
-  Stormline
-  VT Significant Wetland
-  Stream


Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

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M04 - Farmstead Drive
Shelburne, VT
Project: 14-042
Prepared By: ALD
09/14/2016
1 inch = 100 feet

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ID#: M05		
Name: Pinnacle at Spear		
Permit #: 1-1155 P2		
Concept Description: Retrofit of existing BMP to 2002 standards		
Notes/Feasibility:		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: South Burlington		Project Candidate: Tier I
Ownership:		New or Retrofit BMP: Retrofit
Land Use 1: Residential		Proposed Retrofit Practice: Pond
Land Use 2:		Non-Structural Controls: No
Existing BMP on site? Yes		Maintenance Burden: Minimal change
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Yes Wetlands: No Demo: No Other: N/A
Soils: D		
SIZING INFORMATION		
Drainage Area (ac): 10.20		
Impervious Area (ac): 3.86		
Practice Area Available(ft²): 17400		
Existing Head Available? N/A		


Date Assessed: 10/30/2014

Assessed by: AGM/LMJ

ID#: M06			
Name: Pinnacle at Spear			
Permit #: 1-1155 P5			
Concept Description: Retrofit of existing BMP to 2002 standards			
Notes/Feasibility:			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info: South Burlington		Project Candidate: Tier I	
Ownership:		New or Retrofit BMP: Retrofit	
Land Use 1: Residential		Proposed Retrofit Practice: Pond	
Land Use 2:		Non-Structural Controls: No	
Existing BMP on site? Yes		Maintenance Burden: Minimal change	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Yes Wetlands: No Demo: No Other: N/A	
Soils: D			
SIZING INFORMATION			
Drainage Area (ac): 1.76			
Impervious Area (ac): 0.06			
Practice Area Available(ft²): 11700			
Existing Head Available? N/A			

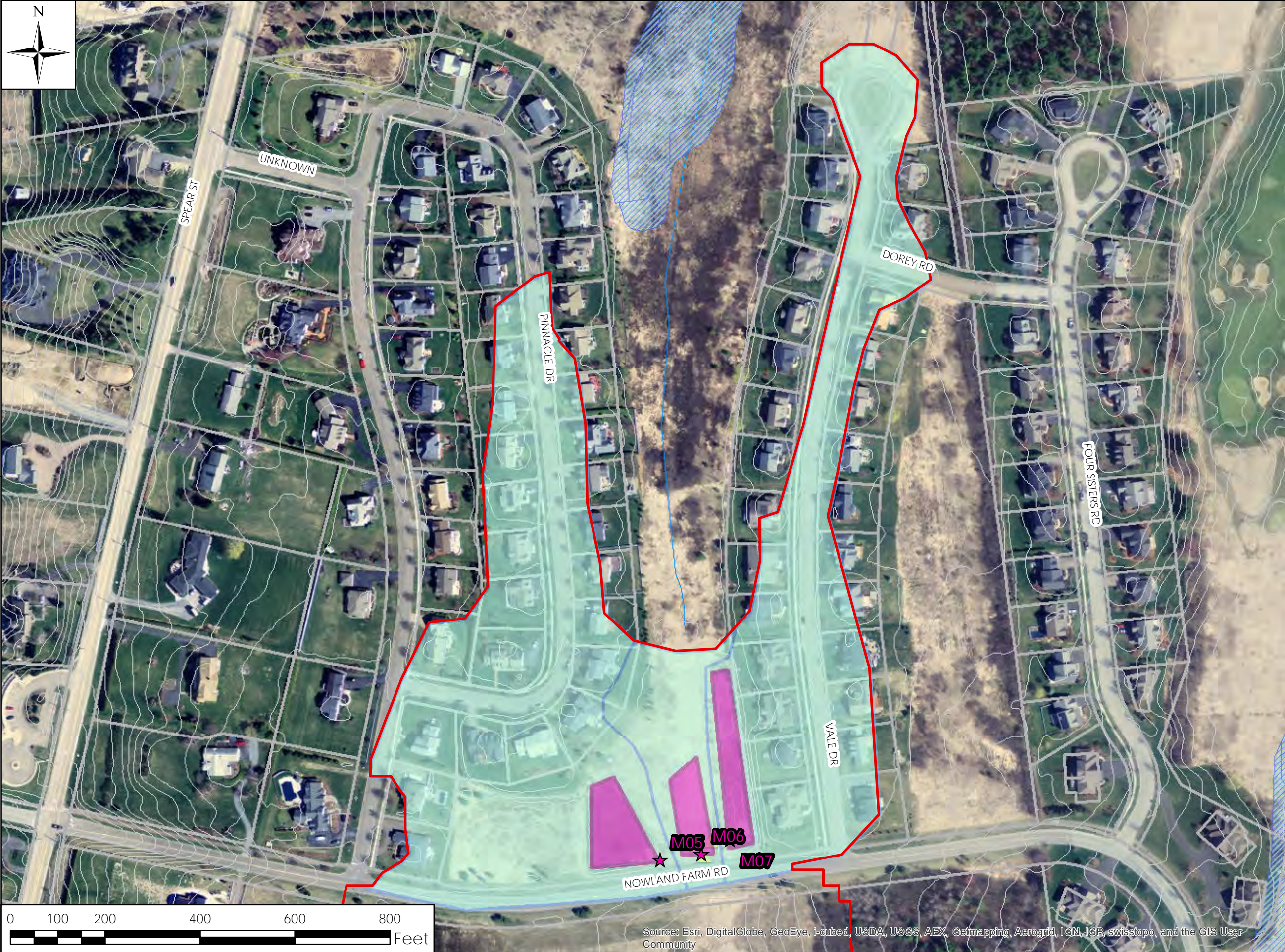
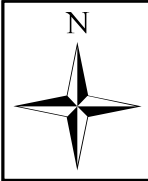
Date Assessed: 10/30/2014

Assessed by: AGM/LMJ

ID#: M07		
Name: Pinnacle at Spear		
Permit #: 1-1155 P3		
Concept Description: Retrofit of existing BMP to 2002 standards		
Notes/Feasibility:		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: South Burlington		Project Candidate: Tier I
Ownership:		New or Retrofit BMP: Retrofit
Land Use 1: Residential		Proposed Retrofit Practice: Pond
Land Use 2:		Non-Structural Controls: No
Existing BMP on site? Yes		Maintenance Burden: Minimal change
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Yes Wetlands: No Demo: No Other: N/A
Soils: D		
SIZING INFORMATION		
Drainage Area (ac): 7.60		
Impervious Area (ac): 3.84		
Practice Area Available(ft²): 16200		
Existing Head Available? N/A		

Date Assessed: 10/30/2014

Assessed by: AGM/LMJ




- Legend**
- Munroe Brook Watershed
 - Proposed BMP
 - Practice Area
 - BMP Drainage Area
 - Contours (2')
 - Tax Parcel Boundary
 - Munroe Brook
 - Outfalls
 - Catch Basins
 - Manholes
 - Stormline
 - VT Significant Wetland
 - Stream

Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

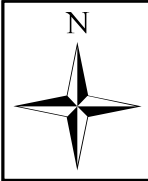
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M05, M06, M07
Pinnacle at Spear
South Burlington, VT
Project: 14-042
Prepared By: LMJ
12/03/2014
1 inch = 200 feet

ID#: M08		
Name: Route 7		
Permit #: 1-1291		
Concept Description: Retrofit of existing BMP to provide additional control as feasible.		
Notes/Feasibility: The drainage area for this practice is significantly larger than original models indicated, may limit feasibility for retrofit.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne/VTrans	Project Candidate: Tier I	
Ownership:	New or Retrofit BMP: Retrofit	
Land Use 1: Transportation	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: no	
Existing BMP on site? Yes	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: No Land Use: No Utilities: No High WT: Unknown Wetlands: No Demo: No Other: N/A
Soils: D		
SIZING INFORMATION		
Drainage Area (ac): 115.20		
Impervious Area (ac): 33.00		
Practice Area Available(ft²): 7900		
Existing Head Available? N/A		

Date Assessed: 10/29/2014

Assessed by: AGM/LMJ



Project Location



Legend

- Munroe Brook Watershed
- Proposed BMP
- Practice Area
- BMP Drainage Area
- Contours (2')
- Tax Parcel Boundary
- Munroe Brook
- Outfalls
- Catch Basins
- Manholes
- Stormline
- VT Significant Wetland
- Stream

Notes


Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).
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M08 - Route 7
Shelburne, VT

Project: 14-042
Prepared By: LMJ
12/03/2014
1 inch = 500 feet

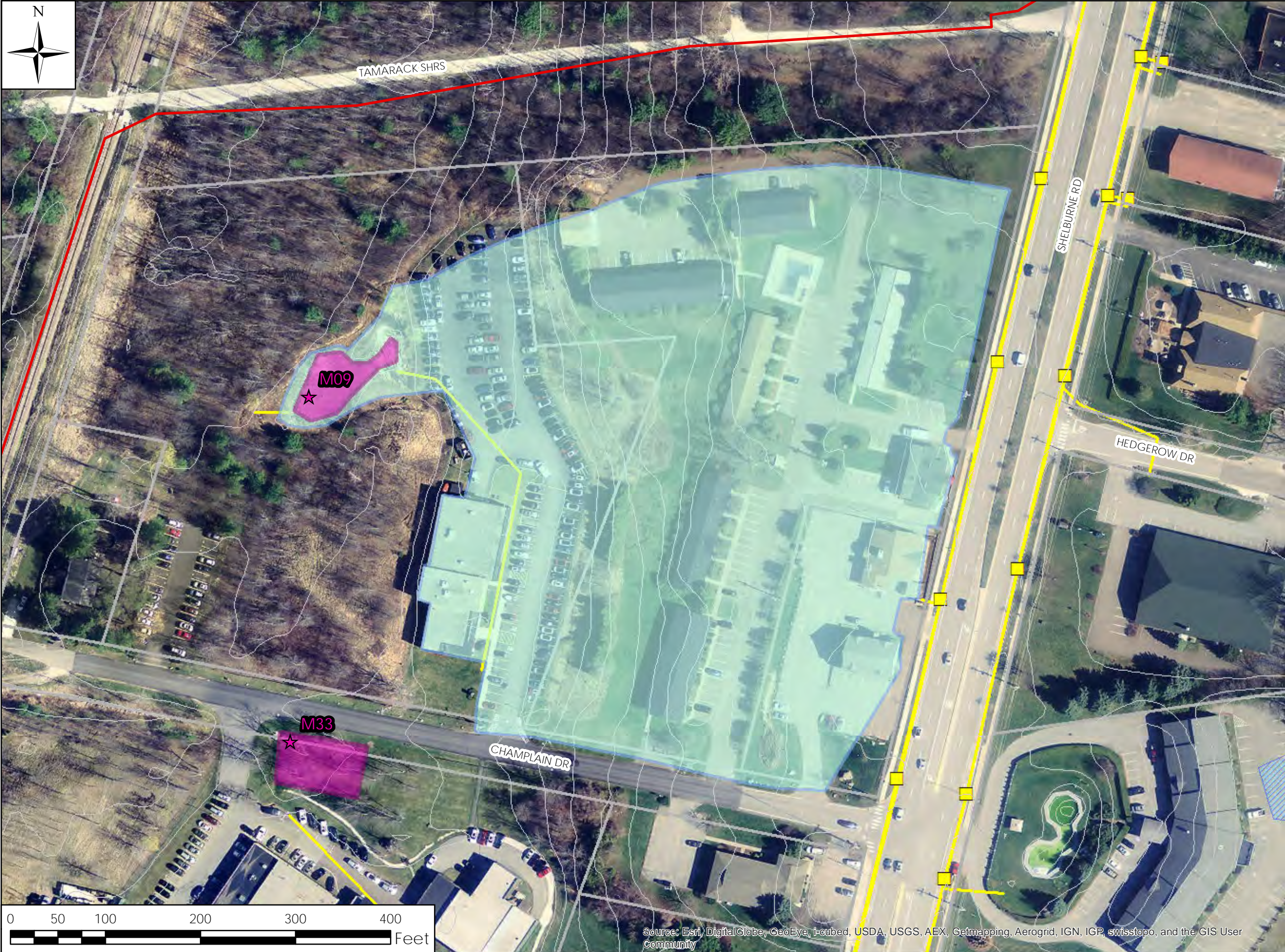
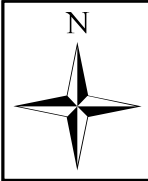


Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ID#: M09			
Name: Automaster - MINI Dealership			
Permit #: 1-1390			
Concept Description: Expansion of existing BMP			
Notes/Feasibility: There is potential to redirect significant portions of Rt. 7 runoff to this practice if space allows.			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info: Shelburne/VTrans		Project Candidate: Tier I	
Ownership:		New or Retrofit BMP: Retrofit	
Land Use 1: Commercial		Proposed Retrofit Practice: Pond	
Land Use 2: Transportation		Non-Structural Controls: No	
Existing BMP on site? Yes		Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: Yes Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: No Wetlands: No Demo: No Other: N/A	
Soils: D			
SIZING INFORMATION			
Drainage Area (ac): 7.44			
Impervious Area (ac): 4.04			
Practice Area Available(ft²): 4000			
Existing Head Available? >10'			

Date Assessed: 10/30/2014

Assessed by: AGM/LMJ



- Legend**
- Munroe Brook Watershed
 - Proposed BMP
 - Practice Area
 - BMP Drainage Area
 - Contours (2')
 - Tax Parcel Boundary
 - Munroe Brook
 - Outfalls
 - Catch Basins
 - Manholes
 - Stormline
 - VT Significant Wetland
 - Stream


Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

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M09 - MINI Dealership
Shelburne, VT

Project: 14-042
Prepared By: LMJ
12/03/2014
1 inch = 100 feet

ID#: M10		
Name: Shelburne Meadows Business Park		
Permit #: 1-1400 A		
Concept Description: Retrofit of existing BMP to 2002 standards		
Notes/Feasibility: 2 3" orifices at 2 ft 24 by 24 in horizontal grate at 4 ft		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne	Project Candidate: Tier II	
Ownership:	New or Retrofit BMP: Retrofit	
Land Use 1: Commercial	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: No	
Existing BMP on site? Yes	Maintenance Burden: Minimal change	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: No Land Use: No Utilities: no High WT: Yes Wetlands: Yes Demo: Other: N/A
Soils: C		
SIZING INFORMATION		
Drainage Area (ac): 1.80		
Impervious Area (ac): 0.74		
Practice Area Available(ft²): 2100		
Existing Head Available? 2' Est.		

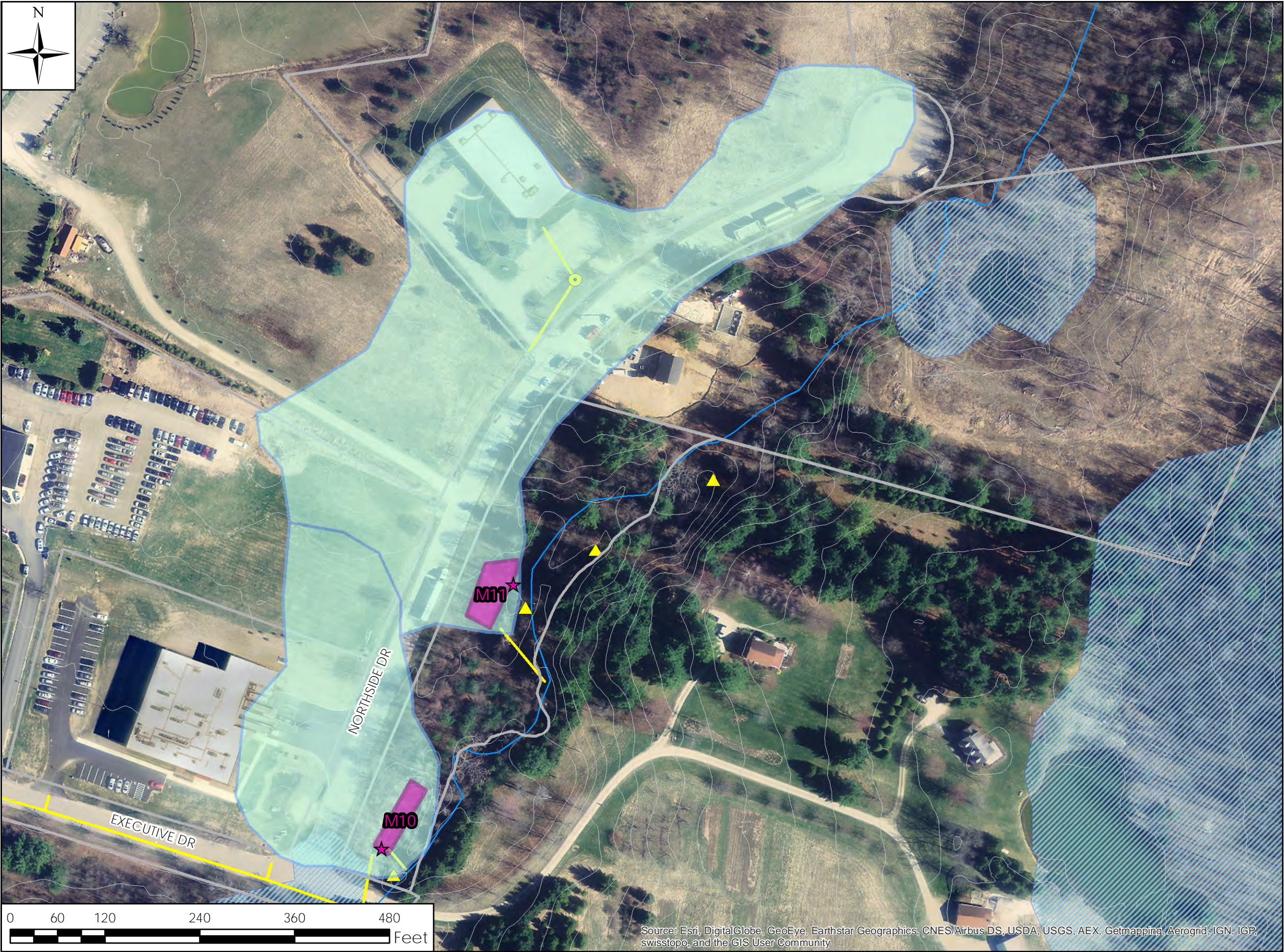
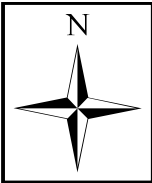
Date Assessed: 10/30/2014

Assessed by: AGM/LMJ

ID#: M11			
Name: Shelburne Meadows Business Park	No Image Available		
Permit #: 1-1400 B			
Concept Description: Retrofit of existing BMP to 2002 standards			
Notes/Feasibility: 24 in pipe with 15 in end cap			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info: Shelburne		Project Candidate: Tier II	
Ownership:		New or Retrofit BMP: Retrofit	
Land Use 1: Commercial		Proposed Retrofit Practice: Pond	
Land Use 2:		Non-Structural Controls: No	
Existing BMP on site? Yes		Maintenance Burden: Minimal change	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: Yes Repair: No Other: N/A	Conflicts: Soils: No Access: No Land Use: Utilities: no High WT: yes Wetlands: No Demo: No Other: N/A	
Soils: B			
SIZING INFORMATION			
Drainage Area (ac): 5.30			
Impervious Area (ac): 1.74			
Practice Area Available(ft²): 3000			
Existing Head Available? 2' Est.			

Date Assessed: 10/30/2014

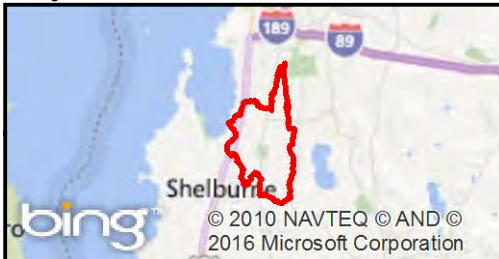
Assessed by: AGM/LMJ



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Project Location



Legend

- Munroe Brook Watershed
- Proposed BMP
- Practice Area
- BMP Drainage Area
- Contours (2')
- Tax Parcel Boundary
- Munroe Brook
- Outfalls
- Catch Basins
- Manholes
- Stormline
- VT Significant Wetland
- Stream

Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).
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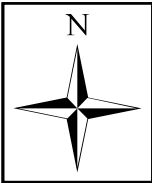
M10 & M11 Shelburne Meadows Shelburne, VT

Project: 14-042
Prepared By: ALD
09/14/2016
1 inch = 120 feet

ID#: M12			
Name: Boulder Hill Drive	No Image Available		
Permit #: 1-1534			
Concept Description: Retrofit of existing BMP to 2002 standards			
Notes/Feasibility: Existing practice has significant room for expansion.			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info: Shelburne	Project Candidate: Tier I		
Ownership:	New or Retrofit BMP: Retrofit		
Land Use 1: Residential	Proposed Retrofit Practice: Pond		
Land Use 2:	Non-Structural Controls: No		
Existing BMP on site? Yes	Maintenance Burden: Moderate		
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: Yes Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Unknown Wetlands: No Demo: No Other: N/A	
Soils: B			
SIZING INFORMATION			
Drainage Area (ac): 22.30			
Impervious Area (ac): 5.36			
Practice Area Available(ft²): 11700			
Existing Head Available? N/A			

Date Assessed: 10/30/2014

Assessed by: AGM/LMJ



Project Location



Legend

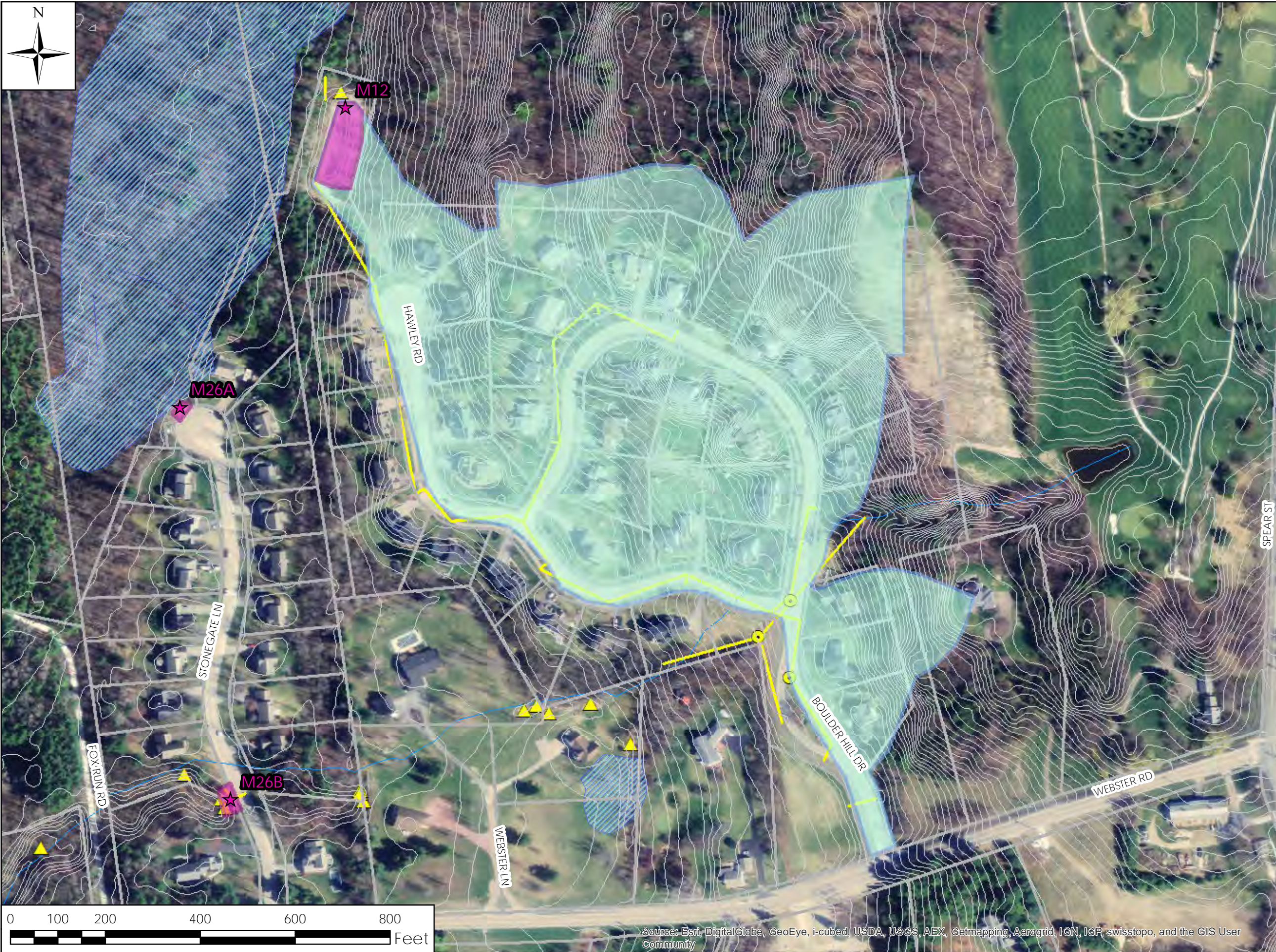
- Munroe Brook Watershed
- Proposed BMP
- Practice Area
- BMP Drainage Area
- Contours (2')
- Tax Parcel Boundary
- Munroe Brook
- Outfalls
- Catch Basins
- Manholes
- Stormline
- VT Significant Wetland
- Stream


Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).
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**M12 - Boulder Hill Drive
Shelburne, VT**

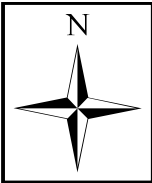
Project: 14-042
Prepared By: LMJ
12/03/2014
1 inch = 200 feet



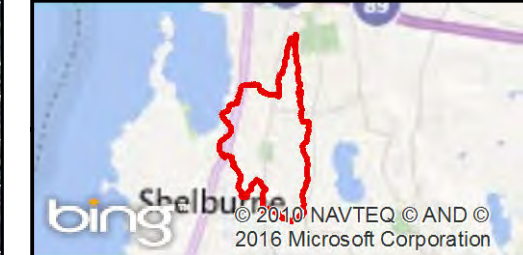
ID#: M16			
Name: South Pointe			
Permit #: 3443-INDS M1			
Concept Description: Retrofit Outlet Structure			
Notes/Feasibility: While designed to 2002 standards, there was benefit to retrofitting the outlet structure			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info: South Burlington		Project Candidate: Tier III	
Ownership:		New or Retrofit BMP: Retrofit	
Land Use 1: Residential		Proposed Retrofit Practice:	
Land Use 2:		Non-Structural Controls: No	
Existing BMP on site? Yes		Maintenance Burden:	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: No Land Use: No Utilities: No High WT: Yes Wetlands: Yes Demo: No Other: N/A	
Soils: D			
SIZING INFORMATION			
Drainage Area (ac): 4.98			
Impervious Area (ac): 2.10			
Practice Area Available(ft²): 3900			
Existing Head Available? N/A			

Date Assessed: 10/30/2014

Assessed by: AGM/LMJ



Project Location



Legend

- Munroe Brook Watershed
- Proposed BMP
- Practice Area
- BMP Drainage Area
- Contours (2')
- Tax Parcel Boundary
- Munroe Brook
- Outfalls
- Catch Basins
- Manholes
- Stormline
- VT Significant Wetland
- Stream


Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).
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M16 - South Pointe
Shelburne, VT

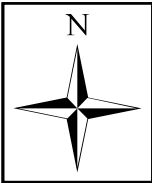
Project: 14-042
Prepared By: ALD
09/23/2016
1 inch = 100 feet



ID#: M27		
Name: Deer Run		
Permit #: 1-0732		
Concept Description: Build pond in location where originally specified		
Notes/Feasibility: Proposed BMP at location indicated in permit. Existing recreation area must be demolished.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne	Project Candidate: Tier I	
Ownership:	New or Retrofit BMP: New	
Land Use 1: Residential	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: N/A	
Existing BMP on site? No	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Yes Wetlands: Yes Demo: No Other: N/A
Soils: C		
SIZING INFORMATION		
Drainage Area (ac): 8.70		
Impervious Area (ac): 1.65		
Practice Area Available(ft²): 1500		
Existing Head Available? 2-3' Est.		

Date Assessed: 10/29/2014

Assessed by: AGM/LMJ



- Legend
- Munroe Brook Watershed
 - Proposed BMP
 - Practice Area
 - BMP Drainage Area
 - Contours (2')
 - Tax Parcel Boundary
 - Munroe Brook
 - Outfalls
 - Catch Basins
 - Manholes
 - Stormline
 - VT Significant Wetland
 - Stream

Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

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M27 - Deer Run
Shelburne, VT

Project: 14-042
Prepared By: LMJ
12/03/2014
1 inch = 100 feet

ID#: M28A		
Name: Shelburne Camping Area	No Image Available	
Permit #: N/A		
Concept Description: Two BMPs located at local low points to capture existing unpermitted impervious surface		
Notes/Feasibility: Site is relatively flat, proposed BMP located at local low point, offers little ability for treatment of Rt. 7 runoff.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne	Project Candidate: Tier I	
Ownership:	New or Retrofit BMP: New	
Land Use 1: Commercial	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: N/A	
Existing BMP on site? No	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Yes Wetlands: Yes Demo: No Other: N/A
Soils: C		
SIZING INFORMATION		
Drainage Area (ac): 4.50		
Impervious Area (ac): 1.32		
Practice Area Available(ft²): 1300		
Existing Head Available? N/A		

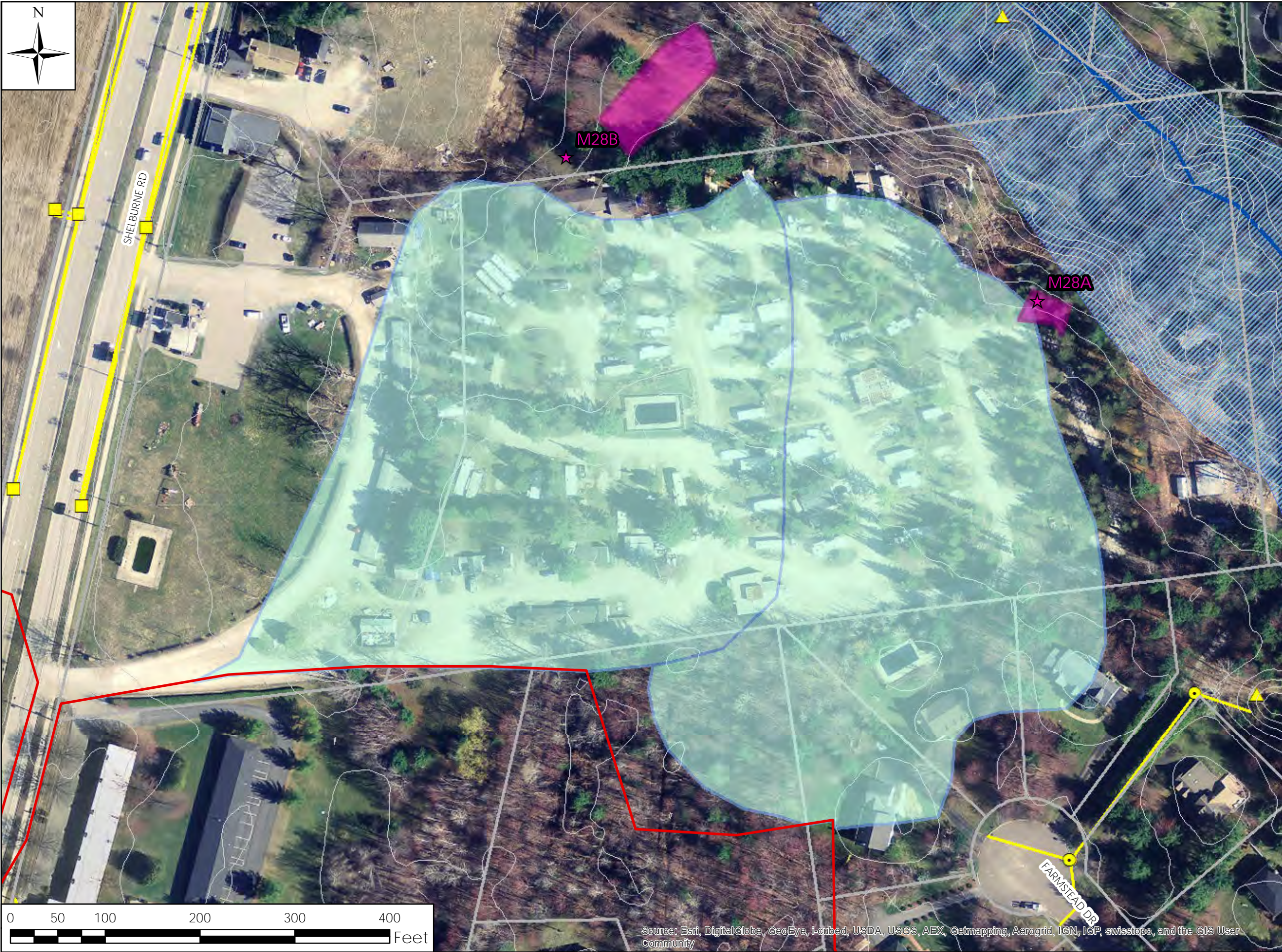
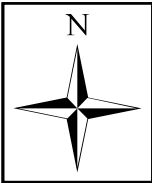
Date Assessed: 10/29/2014

Assessed by: AGM/LMJ

ID#: M28B			
Name: Shelburne Camping Area	No Image Available		
Permit #: N/A			
Concept Description: Two BMPs located at local low points to capture existing unpermitted impervious surface			
Notes/Feasibility: Site is relatively flat, proposed BMP located at local low point, offers little ability for treatment of Rt. 7 runoff.			
GENERAL SITE INFORMATION		RETROFIT DETAILS	
Site Contact Info: Shelburne	Project Candidate: Tier I		
Ownership:	New or Retrofit BMP: New		
Land Use 1: Commercial	Proposed Retrofit Practice: Pond		
Land Use 2:	Non-Structural Controls: N/A		
Existing BMP on site? No	Maintenance Burden: Moderate		
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: Yes Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Unknown Wetlands: No Demo: No Other: N/A	
Soils: B			
SIZING INFORMATION			
Drainage Area (ac): 5.30			
Impervious Area (ac): 2.27			
Practice Area Available(ft²): 7500			
Existing Head Available? N/A			

Date Assessed: 10/29/2014

Assessed by: AGM/LMJ



- Legend
- Munroe Brook Watershed
 - Proposed BMP
 - Practice Area
 - BMP Drainage Area
 - Contours (2')
 - Tax Parcel Boundary
 - Munroe Brook
 - Outfalls
 - Catch Basins
 - Manholes
 - Stormline
 - VT Significant Wetland
 - Stream

Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

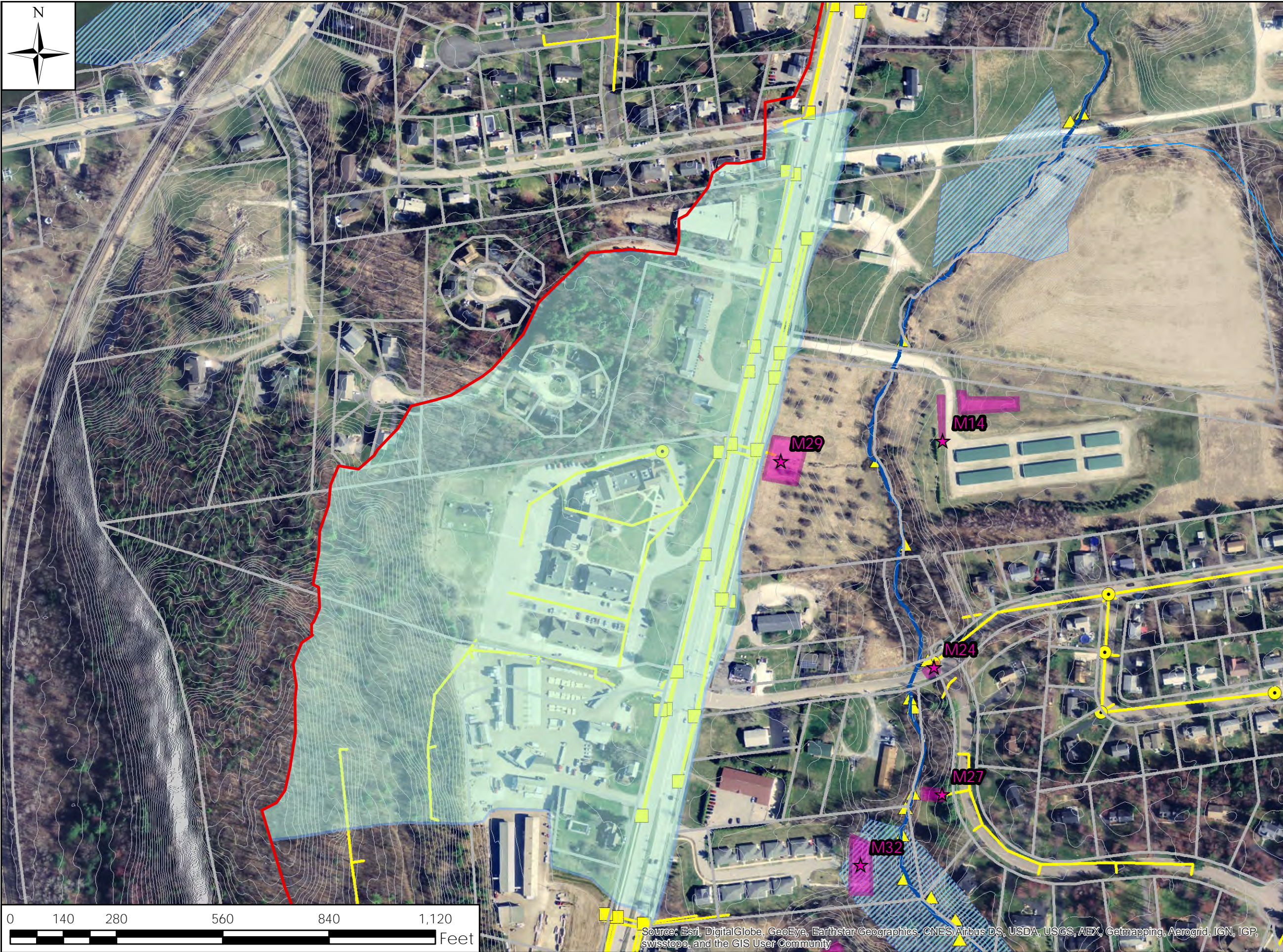
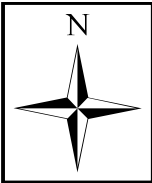
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M28 A & M28 B
Shelburne Camping Area
Shelburne, VT
Project: 14-042
Prepared By: LMJ
12/03/2014
1 inch = 100 feet

ID#: M29 Option 1		
Name: Shelburne Commons/Rice Lumber		
Permit #: N/A		
Concept Description: Construct new wet pond to capture existing impervious from unpermitted site as well as Route 7		
Notes/Feasibility: Good candidate for collecting Rt. 7 runoff, significant head available.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne/VTrans		Project Candidate: Tier I
Ownership:		New or Retrofit BMP: New
Land Use 1: Commercial		Proposed Retrofit Practice: Pond
Land Use 2: Transportation		Non-Structural Controls: N/A
Existing BMP on site? No		Maintenance Burden: Moderate
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: Utilities: Yes High WT: Yes Wetlands: Yes Demo: Yes Other: N/A
Soils: D		
SIZING INFORMATION		
Drainage Area (ac): 41.10		
Impervious Area (ac): 16.40		
Practice Area Available(ft²): 10400		
Existing Head Available? N/A		

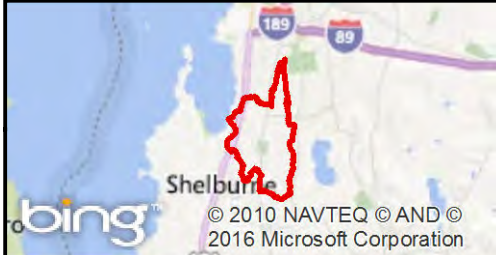
Date Assessed: 10/29/2014

Assessed by: AGM/LMJ



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Project Location



Legend

- Munroe Brook Watershed
- Proposed BMP
- Practice Area
- BMP Drainage Area
- Contours (2')
- Tax Parcel Boundary
- Munroe Brook
- Outfalls
- Catch Basins
- Manholes
- Stormline
- VT Significant Wetland
- Stream

Notes

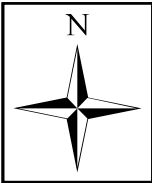
Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).
Disclaimer: The accuracy of information presented is determined by its sources. TCE is not responsible for any errors or omissions that may exist. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not a replacement for surveyed information or engineering studies.

M29 - Shleburne Commons
Shelburne, VT
Project: 14-042
Prepared By: ALD
09/23/2016
1 inch = 250 feet

ID#: M32		
Name: Drew Lane		
Permit #: N/A		
Concept Description: Retrofit of existing pond to 2002 standards		
Notes/Feasibility: A pond exists in this development that does not appear to have a permit associated with it. Portion of Rt. 7 runoff runs past practice, with relatively easy ability to redirect to the practice.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne/VTrans	Project Candidate: Tier I	
Ownership:	New or Retrofit BMP: Retrofit	
Land Use 1: Residential	Proposed Retrofit Practice: Pond	
Land Use 2: Transportation	Non-Structural Controls: N/A	
Existing BMP on site? Yes	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: Yes Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Unknown Wetlands: No Demo: No Other: N/A
Soils: B		
SIZING INFORMATION		
Drainage Area (ac): 19.70		
Impervious Area (ac): 4.40		
Practice Area Available(ft²): 7700		
Existing Head Available? >5'		

Date Assessed: 10/29/2014

Assessed by: AGM/LMJ



- Legend**
- Munroe Brook Watershed
 - Proposed BMP
 - Practice Area
 - BMP Drainage Area
 - Contours (2')
 - Tax Parcel Boundary
 - Munroe Brook
 - Outfalls
 - Catch Basins
 - Manholes
 - Stormline
 - VT Significant Wetland
 - Stream

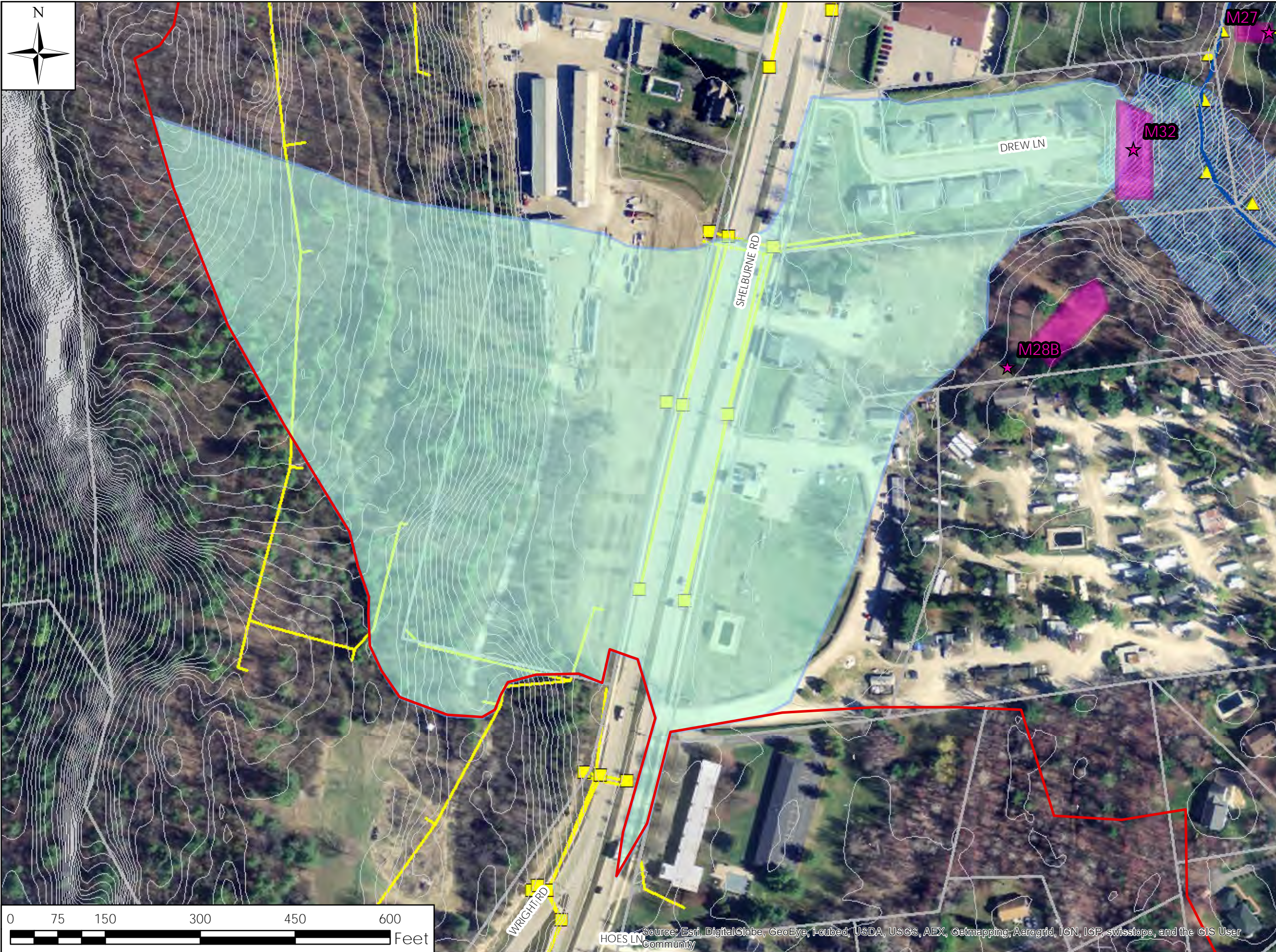
Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

Disclaimer: The accuracy of information presented is determined by its sources. TCE is not responsible for any errors or omissions that may exist. Questions of on-the-ground location can be resolved by site inspections and/or surveys by a registered surveyor. This map is not a replacement for surveyed information or engineering studies.

M32 - Drew Lane Shelburne, VT

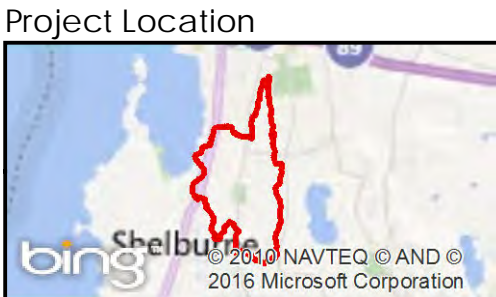
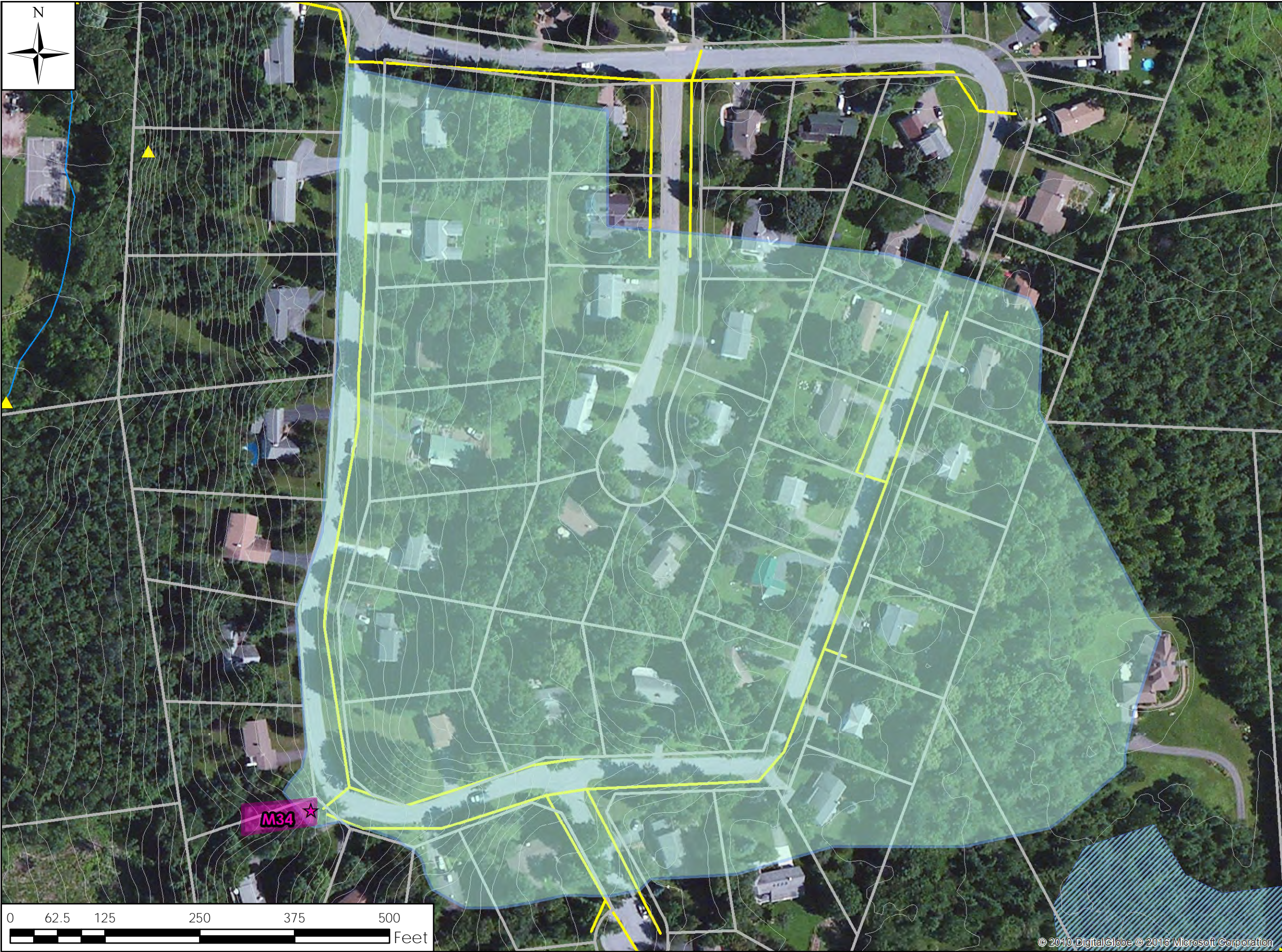
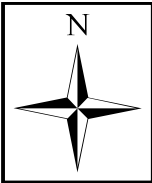
Project: 14-042
Prepared By: LMJ
12/03/2014
1 inch = 150 feet



ID#: M34		
Name: Hullcrest South		
Permit #: N/A		
Concept Description: Construction of new BMP to capture existing unpermitted impervious		
Notes/Feasibility: Area can not feasibly be drained to an existing nearby practice. Proposed practice located in wooded area along a property line.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne	Project Candidate: Tier II	
Ownership:	New or Retrofit BMP: New	
Land Use 1: Residential	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: N/A	
Existing BMP on site? No	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: Yes Land Use: No Utilities: No High WT: Unknown Wetlands: No Demo: No Other: N/A
Soils: D		
SIZING INFORMATION		
Drainage Area (ac): 20.60		
Impervious Area (ac): 4.30		
Practice Area Available(ft²): 3400		
Existing Head Available? 3-5' Est.		

Date Assessed: 10/29/2014

Assessed by: AGM/LMJ




- Legend**
- Munroe Brook Watershed
 - Proposed BMP
 - Practice Area
 - BMP Drainage Area
 - Contours (2')
 - Tax Parcel Boundary
 - Munroe Brook
 - Outfalls
 - Catch Basins
 - Manholes
 - Stormline
 - VT Significant Wetland
 - Stream

Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); M34 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

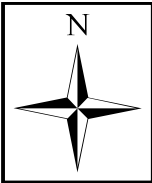
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M34 - Hullcrest South
Shelburne, VT
Project: 14-042
Prepared By: ALD
09/23/2016
1 inch = 125 feet


ID#: M35		
Name: Morse Drive Neighborhood		
Permit #: N/A		
Concept Description: The existing drainage system for the proposed practice DA daylight to a single discharge adjacent to a recently constructed home. There appears to be ample area for a pond BMP at this location with good vertical relief for discharge from the practice.		
Notes/Feasibility: Strong candidate site due to presence of existing network of ditches, culverts, and drain piping directing the majority of runoff to single point.		
GENERAL SITE INFORMATION		RETROFIT DETAILS
Site Contact Info: Shelburne	Project Candidate: Tier I	
Ownership:	New or Retrofit BMP: New	
Land Use 1: Residential	Proposed Retrofit Practice: Pond	
Land Use 2:	Non-Structural Controls: No	
Existing BMP on site? No	Maintenance Burden: Moderate	
Is site a hotspot? No	Benefits: Storage: Yes Water Quality: Yes Recharge: No Repair: No Other: N/A	Conflicts: Soils: No Access: No Land Use: Utilities: No High WT: Unknown Wetlands: No Demo: No Other: N/A
Soils: C		
SIZING INFORMATION		
Drainage Area (ac): 23.20		
Impervious Area (ac): 3.89		
Practice Area Available(ft²): 4500		
Existing Head Available? >10'		

Date Assessed: 10/30/2014

Assessed by: AGM/LMJ

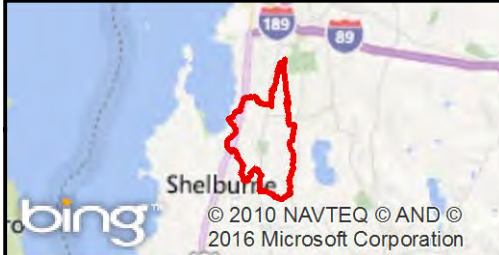


Horsley Witten Group
Sustainable Environmental Solutions
90 Route 6A • Shelburne, VT • 05483
Tel: 508-833-6800 • Fax: 508-533-3150 • www.horsleywitten.com



tce

TRUDELL
Consulting Engineers
802.879.6331 www.tcevt.com

Project Location

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Legend

- Munroe Brook Watershed
- Proposed BMP
- Practice Area
- BMP Drainage Area
- Contours (2')
- Tax Parcel Boundary
- Munroe Brook
- Outfalls
- Catch Basins
- Manholes
- Stormline
- VT Significant Wetland
- Stream

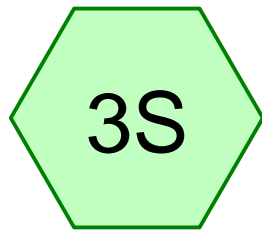
Notes

Sources: Bing Aerial Photography (2012); Streams by ANR (2012); Munroe Brook Subwatersheds by ANR (Updated by TCE 2014); Drainage Areas by ANR (Updated by TCE 2014); MS4 Boundaries by ANR; BMPs by Horsley Witten Group & TCE (2014).

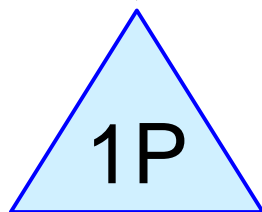
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M35 - Morse Drive
Shelburne, VT
Project: 14-042
Prepared By: ALD
09/14/2016
1 inch = 200 feet

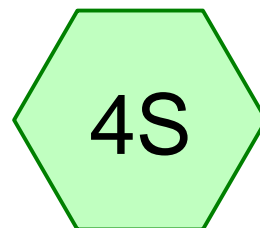
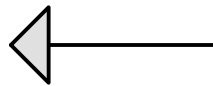
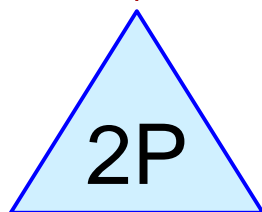
Appendix B: HydroCAD Model Outputs



DA 1 (from GIS)

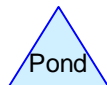
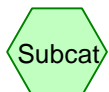


Pond 1



Pond 2

DA 2 (from GIS)



Summary for Subcatchment 3S: DA 1 (from GIS)

Runoff = 2.64 cfs @ 12.22 hrs, Volume= 0.458 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
8.902	39	>75% Grass cover, Good, HSG A
3.208	61	>75% Grass cover, Good, HSG B
8.290	74	>75% Grass cover, Good, HSG C
6.382	80	>75% Grass cover, Good, HSG D
* 3.102	98	
29.884	66	Weighted Average
26.782		89.62% Pervious Area
3.102		10.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0					Direct Entry,

Summary for Subcatchment 4S: DA 2 (from GIS)

Runoff = 3.22 cfs @ 12.05 hrs, Volume= 0.263 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
1.104	39	>75% Grass cover, Good, HSG A
3.296	61	>75% Grass cover, Good, HSG B
7.207	74	>75% Grass cover, Good, HSG C
* 0.833	98	
12.440	69	Weighted Average
11.607		93.30% Pervious Area
0.833		6.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

Summary for Pond 1P: Pond 1

Inflow Area = 29.884 ac, 10.38% Impervious, Inflow Depth = 0.18" for 1 year event
 Inflow = 2.64 cfs @ 12.22 hrs, Volume= 0.458 af
 Outflow = 0.28 cfs @ 19.18 hrs, Volume= 0.297 af, Atten= 89%, Lag= 418.1 min
 Primary = 0.28 cfs @ 19.18 hrs, Volume= 0.297 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

M01-02 - Westview Estates Rev 2016 0401

Type II 24-hr 1 year Rainfall=2.10"

Prepared by TCE

Printed 9/12/2016

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Page 3

Starting Elev= 272.50' Surf.Area= 0.494 ac Storage= 1.127 af

Peak Elev= 273.09' @ 19.18 hrs Surf.Area= 0.515 ac Storage= 1.422 af (0.295 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 1,095.7 min (2,056.3 - 960.6)

Volume	Invert	Avail.Storage	Storage Description
#1	270.00'	2.478 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
270.00	0.409	0.000	0.000
271.00	0.442	0.425	0.425
272.00	0.476	0.459	0.884
273.00	0.512	0.494	1.378
274.00	0.549	0.531	1.909
275.00	0.588	0.568	2.478

Device	Routing	Invert	Outlet Devices
#1	Primary	270.00'	12.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 270.00' / 269.70' S= 0.0150 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	272.50'	1.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	273.00'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Secondary	274.50'	25.0' long x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.28 cfs @ 19.18 hrs HW=273.09' (Free Discharge)

↑ **1=Culvert** (Passes 0.28 cfs of 6.08 cfs potential flow)
 ↑ **2=Orifice/Grate** (Orifice Controls 0.02 cfs @ 3.55 fps)
 ↑ **3=Orifice/Grate** (Weir Controls 0.26 cfs @ 0.96 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=272.50' (Free Discharge)

↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Pond 2

lowered orifice elevation, increased pond footprint, raised spillway

Inflow Area =	42.324 ac,	9.30% Impervious, Inflow Depth > 0.16" for 1 year event
Inflow =	3.22 cfs @ 12.05 hrs,	Volume= 0.560 af
Outflow =	0.10 cfs @ 25.80 hrs,	Volume= 0.532 af, Atten= 97%, Lag= 824.5 min
Primary =	0.10 cfs @ 25.80 hrs,	Volume= 0.532 af
Secondary =	0.00 cfs @ 0.00 hrs,	Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Starting Elev= 257.00' Surf.Area= 3,500 sf Storage= 3,929 cf

Peak Elev= 260.07' @ 25.80 hrs Surf.Area= 6,568 sf Storage= 19,370 cf (15,441 cf above start)

Flood Elev= 260.50' Surf.Area= 7,000 sf Storage= 22,304 cf (18,375 cf above start)

M01-02 - Westview Estates Rev 2016 0401

Type II 24-hr 1 year Rainfall=2.10"

Prepared by TCE

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Page 4

Plug-Flow detention time= 2,330.0 min calculated for 0.442 af (79% of inflow)

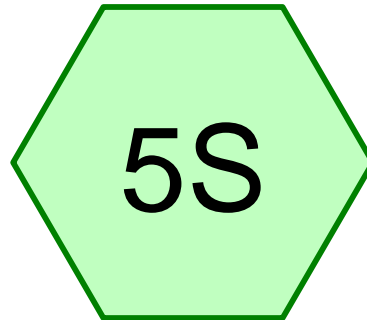
Center-of-Mass det. time= 1,474.1 min (3,000.7 - 1,526.6)

Volume	Invert	Avail.Storage	Storage Description
#1	255.00'	22,304 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

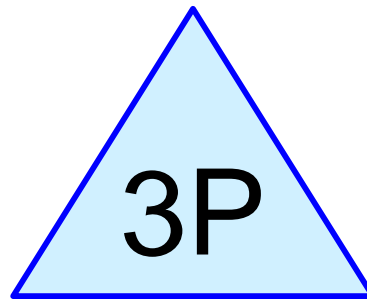
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
255.00	1,307	0	0
256.00	1,525	1,416	1,416
257.00	3,500	2,513	3,929
257.50	4,000	1,875	5,804
258.00	4,500	2,125	7,929
258.50	5,000	2,375	10,304
259.00	5,500	2,625	12,929
259.50	6,000	2,875	15,804
260.00	6,500	3,125	18,929
260.50	7,000	3,375	22,304

Device	Routing	Invert	Outlet Devices
#1	Primary	257.00'	1.5" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Secondary	260.25'	20.0' long x 10.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

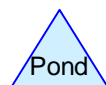
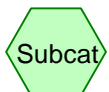
Primary OutFlow Max=0.10 cfs @ 25.80 hrs HW=260.07' (Free Discharge)↑ **1=Orifice/Grate** (Orifice Controls 0.10 cfs @ 8.43 fps)**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=257.00' (Free Discharge)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Area B (GIS)



Pond 2 (from map)



Summary for Subcatchment 5S: Area B (GIS)

Runoff = 6.26 cfs @ 12.01 hrs, Volume= 0.392 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-99.99 hrs, dt= 0.03 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
3.890	98	Paved parking & roofs
12.046	61	>75% Grass cover, Good, HSG B
0.900	74	>75% Grass cover, Good, HSG C
16.836	70	Weighted Average
12.946		76.89% Pervious Area
3.890		23.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6					Direct Entry,

Summary for Pond 3P: Pond 2 (from map)

lowered & reduced size of control orifice, raised elevation of overflow grate

Inflow Area = 16.836 ac, 23.11% Impervious, Inflow Depth = 0.28" for 1 year event
 Inflow = 6.26 cfs @ 12.01 hrs, Volume= 0.392 af
 Outflow = 0.17 cfs @ 20.83 hrs, Volume= 0.343 af, Atten= 97%, Lag= 529.4 min
 Primary = 0.17 cfs @ 20.83 hrs, Volume= 0.343 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-99.99 hrs, dt= 0.03 hrs
 Starting Elev= 167.00' Surf.Area= 0.046 ac Storage= 0.040 af
 Peak Elev= 171.03' @ 20.83 hrs Surf.Area= 0.105 ac Storage= 0.342 af (0.302 af above start)
 Flood Elev= 174.00' Surf.Area= 0.155 ac Storage= 0.725 af (0.686 af above start)

Plug-Flow detention time= 2,284.1 min calculated for 0.303 af (77% of inflow)
 Center-of-Mass det. time= 1,945.1 min (2,861.9 - 916.8)

Volume	Invert	Avail.Storage	Storage Description		
#1	166.00'	0.725 af	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
166.00	0.034	153.6	0.000	0.000	0.034
168.00	0.059	203.8	0.092	0.092	0.068
170.00	0.091	243.2	0.149	0.241	0.102
172.00	0.120	270.8	0.210	0.451	0.130
174.00	0.155	301.4	0.274	0.725	0.165

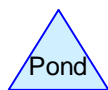
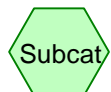
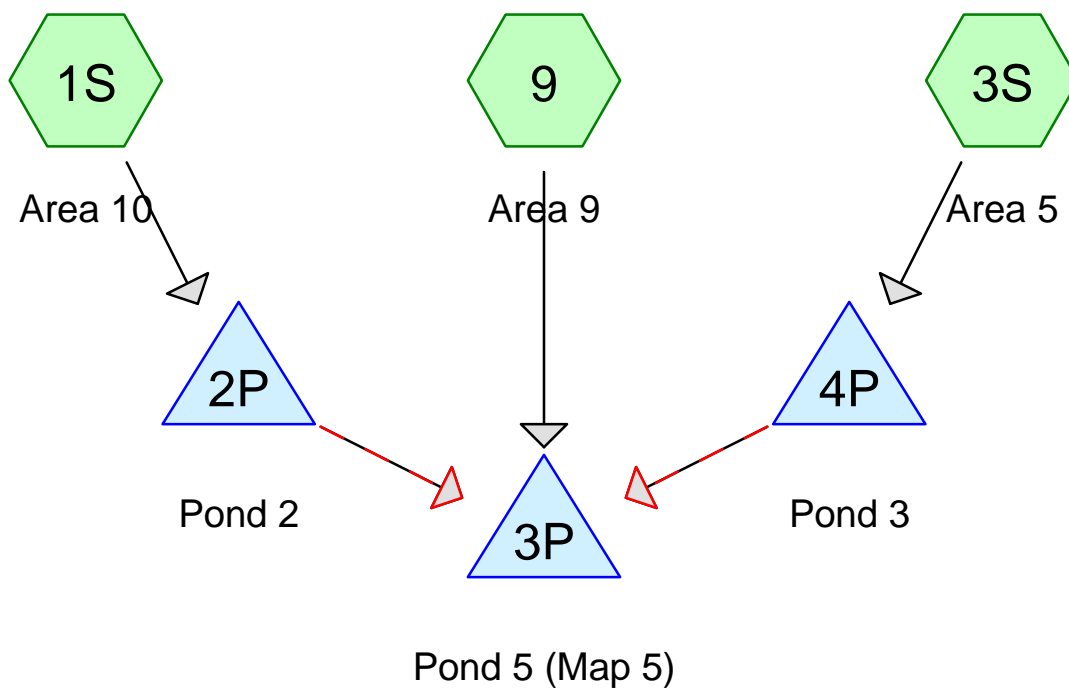
Device	Routing	Invert	Outlet Devices
#1	Primary	167.00'	24.0" Round Culvert L= 35.0' Ke= 0.500 Inlet / Outlet Invert= 167.00' / 166.50' S= 0.0143 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf
#2	Device 1	167.00'	1.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	171.00'	24.0" Horiz. overflow grate C= 0.600 Limited to weir flow at low heads
#4	Secondary	172.00'	60.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.15 cfs @ 20.83 hrs HW=171.03' (Free Discharge)

↑ **1=Culvert** (Passes 0.15 cfs of 22.72 cfs potential flow)
 ↑ **2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 9.61 fps)
 ↑ **3=overflow grate** (Weir Controls 0.10 cfs @ 0.56 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=167.00' (Free Discharge)

↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Summary for Subcatchment 1S: Area 10

Runoff = 7.19 cfs @ 12.08 hrs, Volume= 0.491 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 10.130	79	
10.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4					Direct Entry,

Summary for Subcatchment 3S: Area 5

Runoff = 7.16 cfs @ 12.11 hrs, Volume= 0.523 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 10.060	80	
10.060		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9					Direct Entry,

Summary for Subcatchment 9: Area 9

Runoff = 1.70 cfs @ 12.23 hrs, Volume= 0.194 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 6.360	73	
6.360		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5					Direct Entry,

Summary for Pond 2P: Pond 2

Inflow Area = 10.130 ac, 0.00% Impervious, Inflow Depth = 0.58" for 1 year event
 Inflow = 7.19 cfs @ 12.08 hrs, Volume= 0.491 af
 Outflow = 0.10 cfs @ 12.82 hrs, Volume= 0.225 af, Atten= 99%, Lag= 44.3 min
 Primary = 0.10 cfs @ 12.82 hrs, Volume= 0.225 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs

Starting Elev= 384.00' Surf.Area= 0.000 ac Storage= 0.110 af

Peak Elev= 384.98' @ 24.85 hrs Surf.Area= 0.000 ac Storage= 0.573 af (0.463 af above start)

Plug-Flow detention time= 4,609.8 min calculated for 0.115 af (23% of inflow)

Center-of-Mass det. time= 3,306.8 min (4,183.0 - 876.2)

Volume	Invert	Avail.Storage	Storage Description
#1	383.00'	2.970 af	Custom Stage Data Listed below

Elevation (feet)	Cum.Store (acre-feet)
383.00	0.000
384.00	0.110
385.00	0.580
386.00	1.090
387.00	1.660
388.00	2.280
389.00	2.970

Device	Routing	Invert	Outlet Devices
#1	Primary	383.00'	24.0" Round Culvert L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 383.00' / 382.25' S= 0.0125 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf
#2	Device 1	384.00'	2.5" Vert. Orifice/Grate C= 0.600
#3	Secondary	388.00'	12.6' long (Profile 1) Broad-Crested Rectangular Weir Head (feet) 0.49 0.98 1.48 Coef. (English) 2.92 3.37 3.59
#4	Secondary	388.50'	20.0' long (Profile 1) Broad-Crested Rectangular Weir Head (feet) 0.49 0.98 1.48 Coef. (English) 2.92 3.37 3.59

Primary OutFlow Max=0.10 cfs @ 12.82 hrs HW=384.50' TW=384.12' (Dynamic Tailwater)

↑ **1=Culvert** (Passes 0.10 cfs of 4.53 cfs potential flow)

↑ **2=Orifice/Grate** (Orifice Controls 0.10 cfs @ 2.99 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=384.00' TW=383.00' (Dynamic Tailwater)

↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Pond 5 (Map 5)

added control orifice

[80] Warning: Exceeded Pond 2P by 0.08' @ 21.75 hrs (0.05 cfs 0.075 af)

Inflow Area = 26.550 ac, 0.00% Impervious, Inflow Depth > 0.42" for 1 year event
 Inflow = 1.88 cfs @ 12.23 hrs, Volume= 0.937 af
 Outflow = 0.12 cfs @ 25.33 hrs, Volume= 0.811 af, Atten= 94%, Lag= 786.1 min
 Primary = 0.12 cfs @ 25.33 hrs, Volume= 0.811 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
 Peak Elev= 385.05' @ 25.33 hrs Surf.Area= 0.250 ac Storage= 0.241 af
 Flood Elev= 388.00' Surf.Area= 1.420 ac Storage= 2.357 af

Plug-Flow detention time= 1,164.5 min calculated for 0.811 af (86% of inflow)
 Center-of-Mass det. time= 730.0 min (3,314.9 - 2,584.9)

Volume	Invert	Avail.Storage	Storage Description
#1	383.00'	5.197 af	Custom Stage Data (Pyramidal) Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
383.00	0.035	0.000	0.000	0.035
384.00	0.095	0.063	0.063	0.095
385.00	0.240	0.162	0.225	0.240
386.00	0.460	0.344	0.569	0.461
387.00	0.870	0.654	1.223	0.871
388.00	1.420	1.134	2.357	1.421
389.00	1.420	1.420	3.777	1.444
390.00	1.420	1.420	5.197	1.467

Device	Routing	Invert	Outlet Devices
#1	Primary	383.00'	18.0" Round Culvert L= 80.0' Ke= 0.900 Inlet / Outlet Invert= 383.00' / 382.00' S= 0.0125 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf
#2	Device 1	383.00'	1.8" Vert. Orifice/Grate C= 0.600
#3	Device 1	387.00'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	389.50'	35.0' long x 1.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.62 2.64 2.64 2.68 2.75 2.86 2.92 3.07 3.07 3.03 3.28 3.32

Primary OutFlow Max=0.12 cfs @ 25.33 hrs HW=385.05' (Free Discharge)

1=Culvert (Passes 0.12 cfs of 6.52 cfs potential flow)
 2=Orifice/Grate (Orifice Controls 0.12 cfs @ 6.76 fps)
 3=Orifice/Grate (Controls 0.00 cfs)
 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 4P: Pond 3

Inflow Area = 10.060 ac, 0.00% Impervious, Inflow Depth = 0.62" for 1 year event
 Inflow = 7.16 cfs @ 12.11 hrs, Volume= 0.523 af
 Outflow = 0.13 cfs @ 15.48 hrs, Volume= 0.518 af, Atten= 98%, Lag= 202.1 min
 Primary = 0.13 cfs @ 15.48 hrs, Volume= 0.518 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
 Peak Elev= 386.37' @ 24.15 hrs Surf.Area= 0.000 ac Storage= 0.396 af

Plug-Flow detention time= 1,645.3 min calculated for 0.518 af (99% of inflow)
 Center-of-Mass det. time= 1,641.3 min (2,515.4 - 874.2)

Volume	Invert	Avail.Storage	Storage Description
#1	384.50'	1.810 af	Custom Stage Data Listed below

Elevation (feet)	Cum.Store (acre-feet)
384.50	0.000
385.00	0.050
386.00	0.280
387.00	0.590
388.00	0.930
389.00	1.330
390.00	1.810

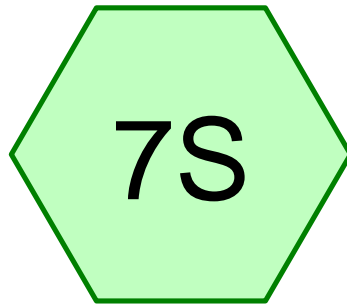
Device	Routing	Invert	Outlet Devices
#1	Primary	384.50'	18.0" Round Culvert L= 40.0' Ke= 0.500 Inlet / Outlet Invert= 384.50' / 383.00' S= 0.0375 ' /' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf
#2	Device 1	384.50'	2.0" Vert. Orifice/Grate C= 0.600
#3	Secondary	387.50'	12.6' long x 1.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.62 2.64 2.64 2.68 2.75 2.86 2.92 3.07 3.07 3.03 3.28 3.32
#4	Secondary	389.00'	20.0' long x 1.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.62 2.64 2.64 2.68 2.75 2.86 2.92 3.07 3.07 3.03 3.28 3.32

Primary OutFlow Max=0.13 cfs @ 15.48 hrs HW=386.19' TW=384.59' (Dynamic Tailwater)

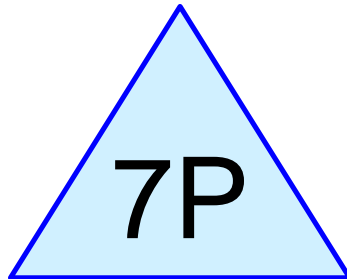
↑ **1=Culvert** (Passes 0.13 cfs of 8.26 cfs potential flow)
 ↑ **2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 6.10 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=384.50' TW=383.00' (Dynamic Tailwater)

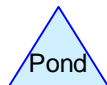
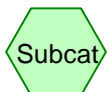
↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
 ↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Updated DA



Modified Pond



Routing Diagram for M8 - Route 7 - Updated

Prepared by TCE, Printed 9/12/2016

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M8 - Route 7 - Updated

Prepared by TCE

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Type II 24-hr 1 year Rainfall=2.10"

Printed 9/12/2016

Page 2

Summary for Subcatchment 7S: Updated DA

Runoff = 24.33 cfs @ 12.75 hrs, Volume= 4.830 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 12.129	98	Impervious, HSG B
10.499	61	>75% Grass cover, Good, HSG B
26.260	60	Woods, Fair, HSG B
* 17.317	98	Impervious, HSG C
8.496	74	>75% Grass cover, Good, HSG C
19.802	73	Woods, Fair, HSG C
* 3.349	98	Impervious, HSG D
5.493	80	>75% Grass cover, Good, HSG D
11.910	79	Woods, Fair, HSG D
115.255	77	Weighted Average
82.460		71.55% Pervious Area
32.795		28.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
64.8	5,331	0.0420	1.37		Lag/CN Method,

Summary for Pond 7P: Modified Pond

Inflow Area = 115.255 ac, 28.45% Impervious, Inflow Depth = 0.50" for 1 year event
 Inflow = 24.33 cfs @ 12.75 hrs, Volume= 4.830 af
 Outflow = 12.80 cfs @ 13.49 hrs, Volume= 4.794 af, Atten= 47%, Lag= 44.3 min
 Primary = 12.80 cfs @ 13.49 hrs, Volume= 4.794 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
 Starting Elev= 146.24' Surf.Area= 0.386 ac Storage= 0.389 af
 Peak Elev= 150.68' @ 13.49 hrs Surf.Area= 0.553 ac Storage= 2.168 af (1.779 af above start)

Plug-Flow detention time= 837.4 min calculated for 4.405 af (91% of inflow)
 Center-of-Mass det. time= 717.5 min (1,649.4 - 931.9)

Volume	Invert	Avail.Storage	Storage Description
#1	144.50'	2.305 af	Custom Stage Data (Irregular) Listed below (Recalc) 100.00'W x 130.00'L x 5.00'H Prismaoid 1.492 af Overall x 90.0% Voids
#2	145.10'	1.343 af	
		3.648 af	
			Total Available Storage

M8 - Route 7 - Updated

Type II 24-hr 1 year Rainfall=2.10"

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Printed 9/12/2016

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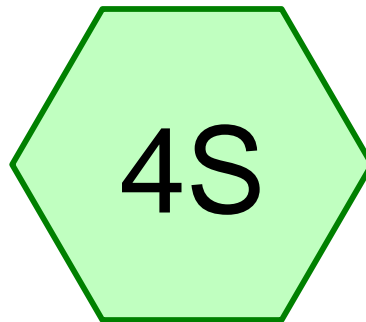
Page 3

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
144.50	0.012	360.0	0.000	0.000	0.012
146.00	0.081	470.0	0.062	0.062	0.179
150.00	0.231	564.0	0.598	0.660	0.363
154.00	0.383	543.0	1.215	1.876	0.429
155.00	0.478	606.0	0.430	2.305	0.562

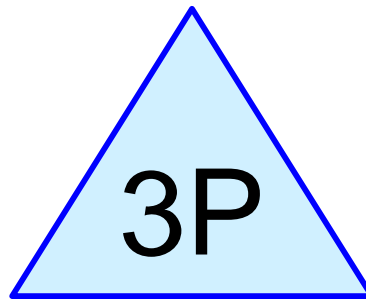
Device	Routing	Invert	Outlet Devices
#1	Primary	145.10'	30.0" Round Culvert L= 128.0' Ke= 0.500 Inlet / Outlet Invert= 145.10' / 143.82' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	146.24'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	148.40'	3.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	150.24'	48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=12.76 cfs @ 13.49 hrs HW=150.68' (Free Discharge)

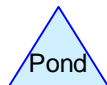
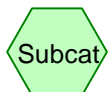
- ↑ **1=Culvert** (Passes 12.76 cfs of 49.17 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.49 cfs @ 10.00 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 0.35 cfs @ 7.07 fps)
- ↑ **4=Orifice/Grate** (Weir Controls 11.92 cfs @ 2.16 fps)



Auto Spa



Pond Contours from
map



Routing Diagram for M09 - 1-1390 rev 2016 0224

Prepared by TCE, Printed 9/12/2016

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Summary for Subcatchment 4S: Auto Spa

Runoff = 1.93 cfs @ 12.31 hrs, Volume= 0.234 af, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 6.020	76	
6.020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5					Direct Entry,

Summary for Pond 3P: Pond Contours from map

replaced 4 x 1.5" control orifices

Inflow Area = 6.020 ac, 0.00% Impervious, Inflow Depth = 0.47" for 1 year event
 Inflow = 1.93 cfs @ 12.31 hrs, Volume= 0.234 af
 Outflow = 0.06 cfs @ 24.31 hrs, Volume= 0.234 af, Atten= 97%, Lag= 720.1 min
 Primary = 0.06 cfs @ 24.31 hrs, Volume= 0.234 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
 Peak Elev= 142.95' @ 24.31 hrs Surf.Area= 0.167 ac Storage= 0.176 af
 Flood Elev= 143.50' Surf.Area= 0.189 ac Storage= 0.274 af

Plug-Flow detention time= 1,402.1 min calculated for 0.234 af (100% of inflow)
 Center-of-Mass det. time= 1,402.9 min (2,308.7 - 905.8)

Volume	Invert	Avail.Storage	Storage Description
#1	140.50'	0.274 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
140.50	0.000	0.000	0.000
141.00	0.027	0.007	0.007
142.00	0.078	0.052	0.059
143.00	0.172	0.125	0.184
143.50	0.189	0.090	0.274

Device	Routing	Invert	Outlet Devices
#1	Primary	140.50'	12.0" Round Culvert L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 140.50' / 140.40' S= 0.0050 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	140.50'	1.2" Vert. Orifice/Grate C= 0.600
#3	Device 1	143.00'	8.0" Vert. Orifice/Grate X 2.00 C= 0.600
#4	Secondary	143.00'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir

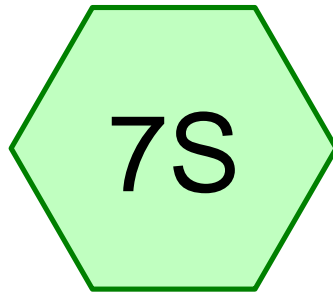
Head (feet)	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00
	2.50	3.00	3.50	4.00	4.50	5.00	5.50			
Coef. (English)	2.38	2.54	2.69	2.68	2.67	2.67	2.65	2.66	2.66	2.68
	2.72	2.73	2.76	2.79	2.88	3.07	3.32			

Primary OutFlow Max=0.06 cfs @ 24.31 hrs HW=142.95' (Free Discharge)

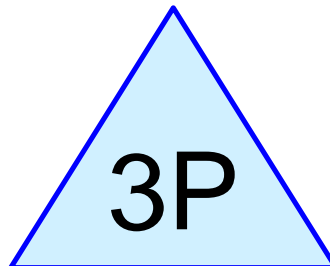
- ↑ **1=Culvert** (Passes 0.06 cfs of 5.28 cfs potential flow)
 - ↑ **2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 7.46 fps)
 - ↑ **3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.50' (Free Discharge)

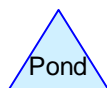
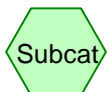
- ↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



DA (TCE GIS)



South Pond



Routing Diagram for M10 - Shelb Mead So Pond (A) Rev 2016 0224

Prepared by TCE, Printed 9/12/2016

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M10 - Shelb Mead So Pond (A) Rev 2016 0224

Type II 24-hr 1 year Rainfall=2.10"

Prepared by TCE

Printed 9/12/2016

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Page 2

Summary for Subcatchment 7S: DA (TCE GIS)

Runoff = 6.75 cfs @ 12.30 hrs, Volume= 0.718 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 1.484	98	Impervious, HSG B
0.113	61	>75% Grass cover, Good, HSG B
1.762	60	Woods, Fair, HSG B
* 0.539	98	Impervious, HSG C
0.551	74	>75% Grass cover, Good, HSG C
0.112	73	Woods, Fair, HSG C
* 3.281	98	Impervious, HSG D
0.164	80	>75% Grass cover, Good, HSG D
1.904	79	Woods, Fair, HSG D
9.910	85	Weighted Average
4.606		46.48% Pervious Area
5.304		53.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.4	1,082	0.0074	0.54		Lag/CN Method,

Summary for Pond 3P: South Pond

Inflow Area = 9.910 ac, 53.52% Impervious, Inflow Depth = 0.87" for 1 year event
 Inflow = 6.75 cfs @ 12.30 hrs, Volume= 0.718 af
 Outflow = 0.18 cfs @ 23.33 hrs, Volume= 0.714 af, Atten= 97%, Lag= 661.8 min
 Primary = 0.18 cfs @ 23.33 hrs, Volume= 0.714 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 153.72' @ 23.33 hrs Surf.Area= 8,117 sf Storage= 23,468 cf

Plug-Flow detention time= 1,545.0 min calculated for 0.714 af (99% of inflow)
 Center-of-Mass det. time= 1,543.5 min (2,412.2 - 868.7)

Volume	Invert	Avail.Storage	Storage Description
#1	150.00'	25,812 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
150.00	4,500	0	0
151.00	5,766	5,133	5,133
153.00	7,104	12,870	18,003
154.00	8,514	7,809	25,812

M10 - Shelb Mead So Pond (A) Rev 2016 0224*Type II 24-hr 1 year Rainfall=2.10"*

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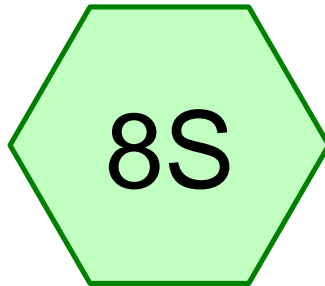
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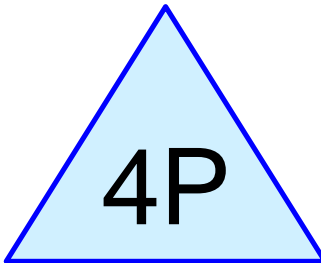
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Device	Routing	Invert	Outlet Devices
#1	Primary	149.82'	24.0" Round Culvert L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 149.82' / 149.50' S= 0.0128 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf
#2	Device 1	150.00'	1.9" Vert. Orifice C= 0.600
#3	Device 1	153.78'	24.0" x 24.0" Horiz. Grate C= 0.600 Limited to weir flow at low heads

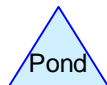
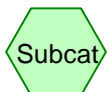
Primary OutFlow Max=0.18 cfs @ 23.33 hrs HW=153.72' (Free Discharge)↑ **1=Culvert** (Passes 0.18 cfs of 23.06 cfs potential flow)↑ **2=Orifice** (Orifice Controls 0.18 cfs @ 9.19 fps)↑ **3=Grate** (Controls 0.00 cfs)



North Pond (TCE GIS)



North Pond



Routing Diagram for M11 - Shelb Mead No Pond Rev 2016 0224

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M11 - Shelb Mead No Pond Rev 2016 0224

Type II 24-hr 1 year Rainfall=2.10"

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Summary for Subcatchment 8S: North Pond (TCE GIS)

Runoff = 1.96 cfs @ 12.10 hrs, Volume= 0.161 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
1.738	98	Paved roads w/curbs & sewers
2.627	61	>75% Grass cover, Good, HSG B
0.905	60	Woods, Fair, HSG B
5.270	73	Weighted Average
3.532		67.02% Pervious Area
1.738		32.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					Direct Entry,

Summary for Pond 4P: North Pond

Inflow Area = 5.270 ac, 32.98% Impervious, Inflow Depth = 0.37" for 1 year event
 Inflow = 1.96 cfs @ 12.10 hrs, Volume= 0.161 af
 Outflow = 0.04 cfs @ 24.18 hrs, Volume= 0.160 af, Atten= 98%, Lag= 724.4 min
 Primary = 0.04 cfs @ 24.18 hrs, Volume= 0.160 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 158.85' @ 24.18 hrs Surf.Area= 3,846 sf Storage= 5,446 cf

Plug-Flow detention time= 1,610.8 min calculated for 0.160 af (99% of inflow)
 Center-of-Mass det. time= 1,607.8 min (2,514.0 - 906.2)

Volume	Invert	Avail.Storage	Storage Description
#1	156.75'	10,332 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
156.75	0	0	0
158.00	3,600	2,250	2,250
159.00	3,888	3,744	5,994
160.00	4,788	4,338	10,332

Device	Routing	Invert	Outlet Devices
#1	Primary	156.75'	24.0" Round Culvert L= 30.0' Ke= 0.200 Inlet / Outlet Invert= 150.00' / 156.75' S= -0.2250 '/' Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 3.14 sf
#2	Device 1	156.75'	1.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	159.00'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

M11 - Shelb Mead No Pond Rev 2016 0224

Type II 24-hr 1 year Rainfall=2.10"

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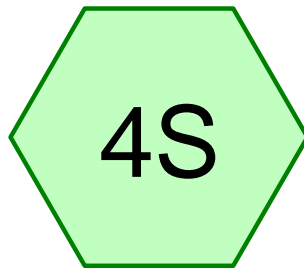
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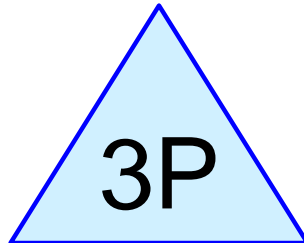
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Primary OutFlow Max=0.04 cfs @ 24.18 hrs HW=158.85' (Free Discharge)

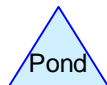
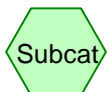
- ↑ **1=Culvert** (Passes 0.04 cfs of 19.86 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 6.91 fps)
- ↑ **3=Orifice/Grate** (Controls 0.00 cfs)



Boulder Hill



Pond



Routing Diagram for 1-1534 rev 2014 0829

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Summary for Subcatchment 4S: Boulder Hill

Runoff = 17.15 cfs @ 12.13 hrs, Volume= 1.348 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 25.900	80	
25.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.0					Direct Entry,

Summary for Pond 3P: Pond

simplified orifices to single 2" for 1-year control

Inflow Area = 25.900 ac, 0.00% Impervious, Inflow Depth = 0.62" for 1 year event
 Inflow = 17.15 cfs @ 12.13 hrs, Volume= 1.348 af
 Outflow = 0.05 cfs @ 24.44 hrs, Volume= 0.153 af, Atten= 100%, Lag= 738.4 min
 Primary = 0.05 cfs @ 24.44 hrs, Volume= 0.153 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 197.20' @ 24.44 hrs Surf.Area= 16,793 sf Storage= 56,500 cf
 Flood Elev= 200.00' Surf.Area= 21,000 sf Storage= 109,500 cf

Plug-Flow detention time= 1,106.1 min calculated for 0.153 af (11% of inflow)
 Center-of-Mass det. time= 946.9 min (1,823.0 - 876.1)

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	109,500 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
193.00	9,000	0	0
194.00	12,000	10,500	10,500
196.00	15,000	27,000	37,500
198.00	18,000	33,000	70,500
200.00	21,000	39,000	109,500

Device	Routing	Invert	Outlet Devices
#1	Primary	192.50'	24.0" Round Culvert L= 35.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0143 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	193.00'	1.0" Vert. Orifice C= 0.600
#3	Device 1	199.50'	36.0" Horiz. Grate C= 0.600 Limited to weir flow at low heads
#4	Secondary	200.00'	8.0' long x 4.0' breadth Broad-Crested Rectangular Weir

Head (feet)	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00
	2.50	3.00	3.50	4.00	4.50	5.00	5.50			
Coef. (English)	2.38	2.54	2.69	2.68	2.67	2.67	2.65	2.66	2.66	2.68
	2.72	2.73	2.76	2.79	2.88	3.07	3.32			

Primary OutFlow Max=0.05 cfs @ 24.44 hrs HW=197.20' (Free Discharge)

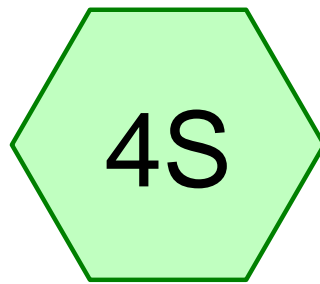
↑ **1=Culvert** (Passes 0.05 cfs of 29.08 cfs potential flow)

↑ **2=Orifice** (Orifice Controls 0.05 cfs @ 9.81 fps)

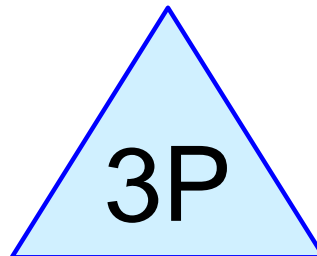
↑ **3=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=193.00' (Free Discharge)

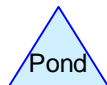
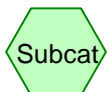
↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



002



Pond 2 (from site plans)



Summary for Subcatchment 4S: 002

Runoff = 4.58 cfs @ 12.05 hrs, Volume= 0.278 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 5.340	80	
5.340		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

Summary for Pond 3P: Pond 2 (from site plans)

Inflow Area = 5.340 ac, 0.00% Impervious, Inflow Depth = 0.62" for 1 year event
 Inflow = 4.58 cfs @ 12.05 hrs, Volume= 0.278 af
 Outflow = 0.04 cfs @ 24.17 hrs, Volume= 0.145 af, Atten= 99%, Lag= 727.1 min
 Primary = 0.04 cfs @ 24.17 hrs, Volume= 0.145 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.01 hrs
 Peak Elev= 371.89' @ 24.17 hrs Surf.Area= 0.134 ac Storage= 0.240 af

Plug-Flow detention time= 1,391.4 min calculated for 0.145 af (52% of inflow)
 Center-of-Mass det. time= 1,251.4 min (2,121.0 - 869.6)

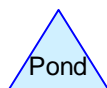
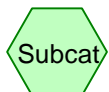
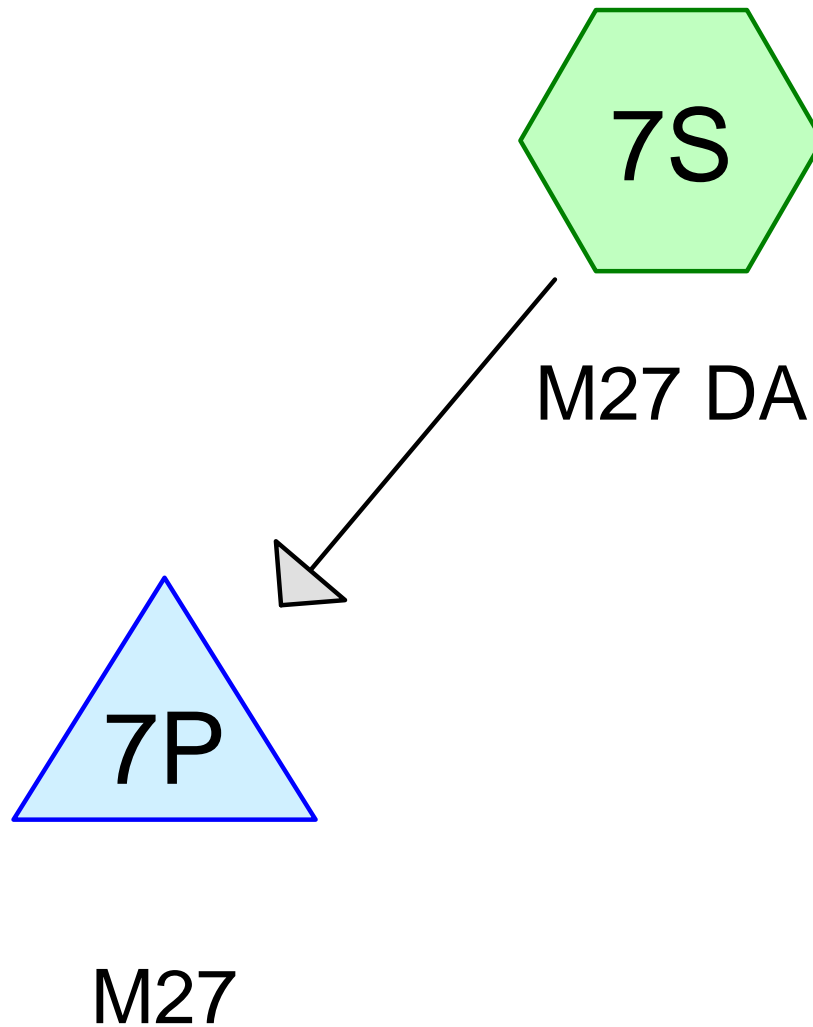
Volume	Invert	Avail.Storage	Storage Description
#1	369.50'	0.585 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
369.50	0.034	0.000	0.000
370.00	0.087	0.030	0.030
372.00	0.137	0.224	0.254
374.00	0.194	0.331	0.585

Device	Routing	Invert	Outlet Devices
#1	Primary	369.50'	15.0" Round Culvert L= 39.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 369.50' / 366.50' S= 0.0769 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Device 1	369.50'	1.0" Vert. Orifice/Grate C= 0.600
#3	Primary	371.90'	8.0" Vert. Orifice/Grate X 2.00 C= 0.600
#4	Primary	372.30'	6.0" Vert. Orifice/Grate X 6.00 C= 0.600
#5	Device 1	373.25'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 24.17 hrs HW=371.89' (Free Discharge)

- 1=Culvert (Passes 0.04 cfs of 7.85 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.04 cfs @ 7.38 fps)
- 5=Orifice/Grate (Controls 0.00 cfs)
- 3=Orifice/Grate (Controls 0.00 cfs)
- 4=Orifice/Grate (Controls 0.00 cfs)



Summary for Subcatchment 7S: M27 DA

Runoff = 2.61 cfs @ 12.13 hrs, Volume= 0.243 af, Depth= 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 0.893	98	Impervious, HSG B
0.878	61	>75% Grass cover, Good, HSG B
3.342	60	Woods, Fair, HSG B
* 0.765	98	Impervious, HSG C
0.604	74	>75% Grass cover, Good, HSG C
2.207	73	Woods, Fair, HSG C
8.689	72	Weighted Average
7.031		80.92% Pervious Area
1.658		19.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	825	0.0400	0.80		Lag/CN Method,

Summary for Pond 7P: M27

Inflow Area = 8.689 ac, 19.08% Impervious, Inflow Depth = 0.34" for 1 year event
 Inflow = 2.61 cfs @ 12.13 hrs, Volume= 0.243 af
 Outflow = 0.06 cfs @ 24.19 hrs, Volume= 0.242 af, Atten= 98%, Lag= 723.2 min
 Primary = 0.06 cfs @ 24.19 hrs, Volume= 0.242 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
 Starting Elev= 157.50' Surf.Area= 2,856 sf Storage= 1,344 cf
 Peak Elev= 159.68' @ 24.19 hrs Surf.Area= 4,495 sf Storage= 9,307 cf (7,963 cf above start)

Plug-Flow detention time= 1,723.9 min calculated for 0.211 af (87% of inflow)
 Center-of-Mass det. time= 1,451.7 min (2,365.7 - 914.0)

Volume	Invert	Avail.Storage	Storage Description
#1	157.00'	22,080 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
157.00	2,520	0	0
158.00	3,192	2,856	2,856
159.00	3,936	3,564	6,420
160.00	4,752	4,344	10,764
161.00	5,640	5,196	15,960
162.00	6,600	6,120	22,080

M27- Deer Run Rev 2016 0225*Type II 24-hr 1 year Rainfall=2.10"*

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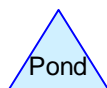
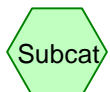
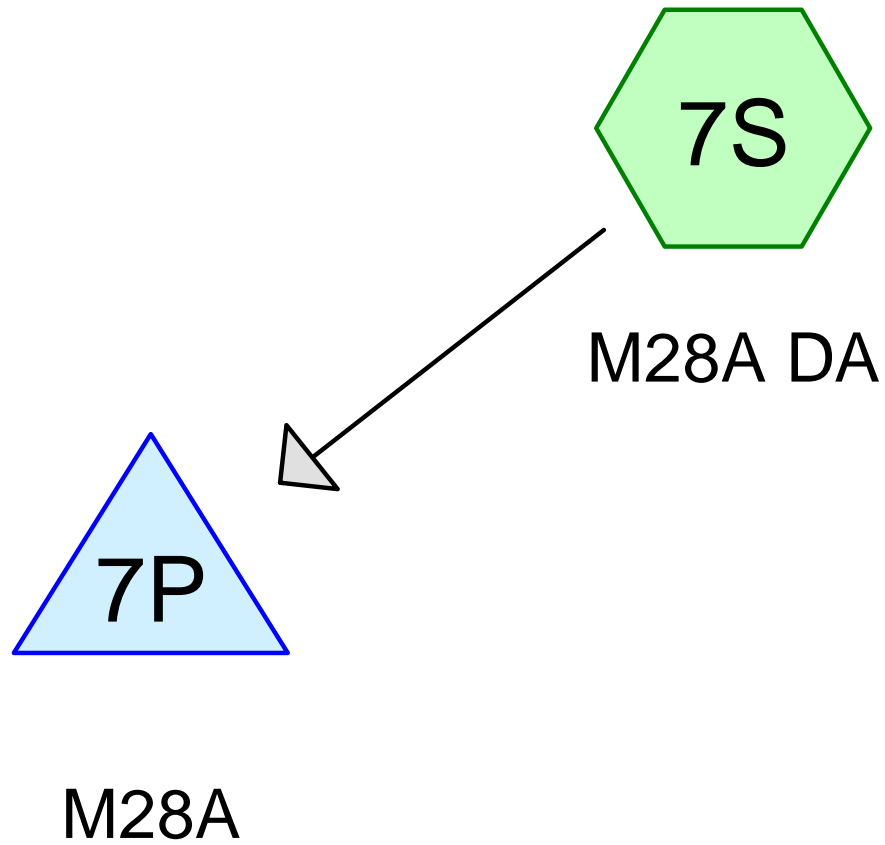
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Device	Routing	Invert	Outlet Devices
#1	Primary	154.00'	24.0" Round Culvert L= 173.0' Ke= 0.500 Inlet / Outlet Invert= 154.00' / 52.00' S= 0.5896 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	157.50'	1.3" Vert. Orifice/Grate C= 0.600
#3	Device 1	161.00'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.06 cfs @ 24.19 hrs HW=159.68' (Free Discharge)

- ↑ **1=Culvert** (Passes 0.06 cfs of 32.74 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 7.03 fps)
- ↑ **3=Orifice/Grate** (Controls 0.00 cfs)



M28A - Shelb Camping Rev 2016 0225

Type II 24-hr 1 year Rainfall=2.10"

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Summary for Subcatchment 7S: M28A DA

Runoff = 2.41 cfs @ 12.22 hrs, Volume= 0.232 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 1.317	98	Impervious, HSG C
0.273	74	>75% Grass cover, Good, HSG C
2.876	73	Woods, Fair, HSG C
4.466	80	Weighted Average
3.149		70.51% Pervious Area
1.317		29.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.3	610	0.0066	0.39		Lag/CN Method,

Summary for Pond 7P: M28A

Inflow Area = 4.466 ac, 29.49% Impervious, Inflow Depth = 0.62" for 1 year event
 Inflow = 2.41 cfs @ 12.22 hrs, Volume= 0.232 af
 Outflow = 0.14 cfs @ 16.02 hrs, Volume= 0.230 af, Atten= 94%, Lag= 228.2 min
 Primary = 0.14 cfs @ 16.02 hrs, Volume= 0.230 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
 Starting Elev= 172.00' Surf.Area= 2,548 sf Storage= 3,776 cf
 Peak Elev= 174.02' @ 16.02 hrs Surf.Area= 4,138 sf Storage= 10,493 cf (6,717 cf above start)

Plug-Flow detention time= 2,355.6 min calculated for 0.143 af (62% of inflow)
 Center-of-Mass det. time= 1,486.4 min (2,369.3 - 882.9)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	14,975 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
170.00	1,264	0	0
171.00	1,870	1,567	1,567
172.00	2,548	2,209	3,776
173.00	3,298	2,923	6,699
174.00	4,120	3,709	10,408
175.00	5,014	4,567	14,975

Device	Routing	Invert	Outlet Devices
#1	Primary	168.00'	24.0" Round Culvert L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 168.00' / 166.00' S= 0.0667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	172.00'	1.1" Vert. Orifice/Grate C= 0.600
#3	Device 1	174.00'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

M28A - Shelb Camping Rev 2016 0225

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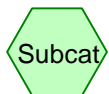
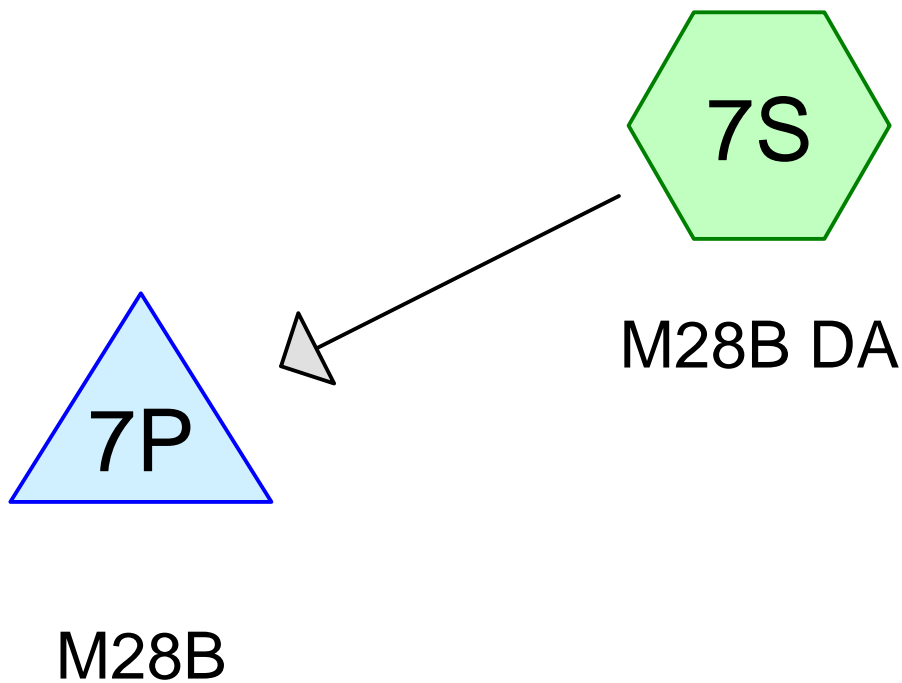
Type II 24-hr 1 year Rainfall=2.10"

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Primary OutFlow Max=0.11 cfs @ 16.02 hrs HW=174.02' (Free Discharge)

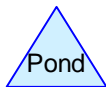
- ↑ 1=Culvert (Passes 0.11 cfs of 33.89 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.04 cfs @ 6.77 fps)
- ↑ 3=Orifice/Grate (Weir Controls 0.06 cfs @ 0.47 fps)



Subcat



Reach



Pond



Link

Routing Diagram for M28B - Shelb Camping Rev 2016 0225

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M28B - Shelb Camping Rev 2016 0225

Type II 24-hr 1 year Rainfall=2.10"

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Summary for Subcatchment 7S: M28B DA

Runoff = 4.38 cfs @ 12.09 hrs, Volume= 0.297 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 0.523	98	Impervious, HSG B
0.171	61	>75% Grass cover, Good, HSG B
0.754	60	Woods, Fair, HSG B
* 1.741	98	Impervious, HSG C
0.362	74	>75% Grass cover, Good, HSG C
1.770	73	Woods, Fair, HSG C
5.321	81	Weighted Average
3.057		57.45% Pervious Area
2.264		42.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.3	535	0.0149	0.58		Lag/CN Method,

Summary for Pond 7P: M28B

Inflow Area = 5.321 ac, 42.55% Impervious, Inflow Depth = 0.67" for 1 year event
 Inflow = 4.38 cfs @ 12.09 hrs, Volume= 0.297 af
 Outflow = 0.08 cfs @ 24.10 hrs, Volume= 0.293 af, Atten= 98%, Lag= 720.6 min
 Primary = 0.08 cfs @ 24.10 hrs, Volume= 0.293 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
 Starting Elev= 171.00' Surf.Area= 4,625 sf Storage= 7,414 cf
 Peak Elev= 172.75' @ 24.10 hrs Surf.Area= 6,448 sf Storage= 17,101 cf (9,687 cf above start)

Plug-Flow detention time= 2,772.9 min calculated for 0.123 af (42% of inflow)
 Center-of-Mass det. time= 1,514.3 min (2,382.8 - 868.5)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	26,005 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
169.00	2,825	0	0
170.00	3,689	3,257	3,257
171.00	4,625	4,157	7,414
172.00	5,633	5,129	12,543
173.00	6,713	6,173	18,716
174.00	7,865	7,289	26,005

M28B - Shelb Camping Rev 2016 0225*Type II 24-hr 1 year Rainfall=2.10"*

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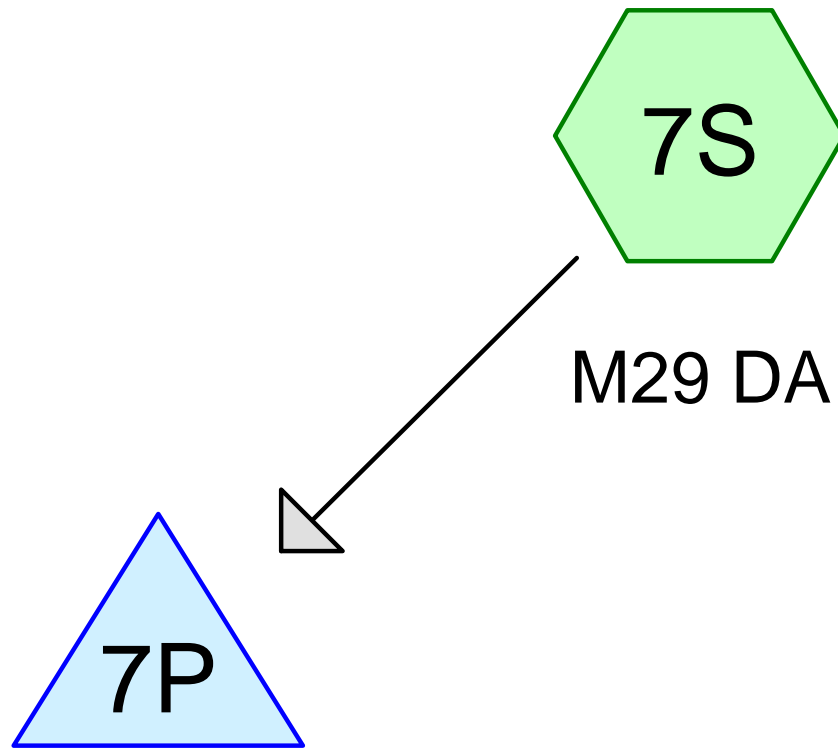
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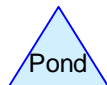
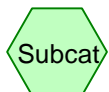
Device	Routing	Invert	Outlet Devices
#1	Primary	167.00'	24.0" Round Culvert L= 116.0' Ke= 0.500 Inlet / Outlet Invert= 167.00' / 166.00' S= 0.0086 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	171.00'	1.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	173.00'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.08 cfs @ 24.10 hrs HW=172.75' (Free Discharge)

- ↑ **1=Culvert** (Passes 0.08 cfs of 32.03 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.08 cfs @ 6.26 fps)
- ↑ **3=Orifice/Grate** (Controls 0.00 cfs)



M29 Option 2



Routing Diagram for M29 Option 1 - Shelb Comms-Rice Rev 2016 0225

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Summary for Subcatchment 7S: M29 DA

Runoff = 32.86 cfs @ 12.15 hrs, Volume= 2.584 af, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
 Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 6.998	98	Impervious, HSG B
1.871	61	>75% Grass cover, Good, HSG B
0.799	60	Woods, Fair, HSG B
* 5.008	98	Impervious, HSG C
4.200	74	>75% Grass cover, Good, HSG C
6.328	73	Woods, Fair, HSG C
* 3.411	98	Impervious, HSG D
0.989	80	>75% Grass cover, Good, HSG D
8.415	79	Woods, Fair, HSG D
38.019	84	Weighted Average
22.602		59.45% Pervious Area
15.417		40.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.9	1,942	0.0515	1.55		Lag/CN Method,

Summary for Pond 7P: M29 Option 2

Inflow Area = 38.019 ac, 40.55% Impervious, Inflow Depth = 0.82" for 1 year event
 Inflow = 32.86 cfs @ 12.15 hrs, Volume= 2.584 af
 Outflow = 1.82 cfs @ 14.73 hrs, Volume= 2.394 af, Atten= 94%, Lag= 155.1 min
 Primary = 1.82 cfs @ 14.73 hrs, Volume= 2.394 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
 Starting Elev= 163.00' Surf.Area= 29,861 sf Storage= 55,213 cf
 Peak Elev= 165.17' @ 14.73 hrs Surf.Area= 34,988 sf Storage= 125,611 cf (70,399 cf above start)

Plug-Flow detention time= 2,865.7 min calculated for 1.126 af (44% of inflow)
 Center-of-Mass det. time= 1,446.4 min (2,307.7 - 861.2)

Volume	Invert	Avail.Storage	Storage Description
#1	161.00'	155,400 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
161.00	25,380	0	0
162.00	27,592	26,486	26,486
163.00	29,861	28,727	55,213
164.00	32,186	31,024	86,236
165.00	34,568	33,377	119,613
166.00	37,006	35,787	155,400

M29 Option 1 - Shelb Comms-Rice Rev 2016 0225*Type II 24-hr 1 year Rainfall=2.10"*

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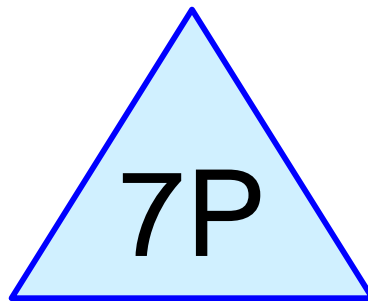
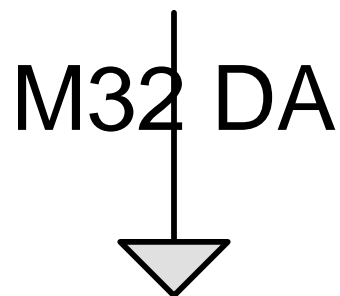
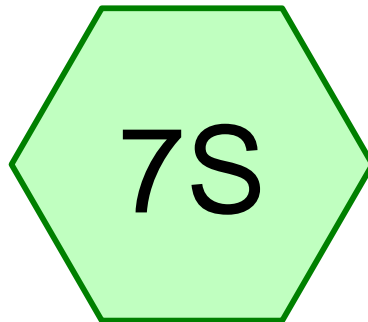
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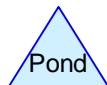
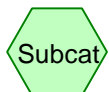
Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	24.0" Round Culvert L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 159.00' / 154.00' S= 0.0500 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	163.00'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	165.00'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.81 cfs @ 14.73 hrs HW=165.17' (Free Discharge)

- ↑ **1=Culvert** (Passes 1.81 cfs of 34.40 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.34 cfs @ 6.89 fps)
- ↑ **3=Orifice/Grate** (Weir Controls 1.47 cfs @ 1.36 fps)



M32



Summary for Subcatchment 7S: M32 DA

Runoff = 15.04 cfs @ 12.11 hrs, Volume= 1.097 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 0.053	98	Impervious, HSG B
0.484	61	>75% Grass cover, Good, HSG B
0.381	60	Woods, Fair, HSG B
* 3.069	98	Impervious, HSG C
3.930	74	>75% Grass cover, Good, HSG C
1.538	73	Woods, Fair, HSG C
* 1.303	98	Impervious, HSG D
1.372	80	>75% Grass cover, Good, HSG D
7.552	79	Woods, Fair, HSG D
19.682	81	Weighted Average
15.257		77.52% Pervious Area
4.425		22.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	1,504	0.0602	1.44		Lag/CN Method,

Summary for Pond 7P: M32

Inflow Area = 19.682 ac, 22.48% Impervious, Inflow Depth = 0.67" for 1 year event
Inflow = 15.04 cfs @ 12.11 hrs, Volume= 1.097 af
Outflow = 0.91 cfs @ 14.24 hrs, Volume= 1.051 af, Atten= 94%, Lag= 127.9 min
Primary = 0.91 cfs @ 14.24 hrs, Volume= 1.051 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 161.00' Surf.Area= 5,781 sf Storage= 5,253 cf
Peak Elev= 164.61' @ 14.24 hrs Surf.Area= 10,202 sf Storage= 33,832 cf (28,579 cf above start)

Plug-Flow detention time= 1,722.5 min calculated for 0.931 af (85% of inflow)
Center-of-Mass det. time= 1,459.5 min (2,329.9 - 870.4)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	37,905 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
160.00	4,725	0	0
161.00	5,781	5,253	5,253
162.00	6,909	6,345	11,598
163.00	8,109	7,509	19,107
164.00	9,381	8,745	27,852
165.00	10,725	10,053	37,905

M32- Drew Lane Rev 2016 0225*Type II 24-hr 1 year Rainfall=2.10"*

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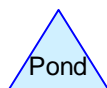
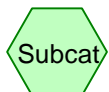
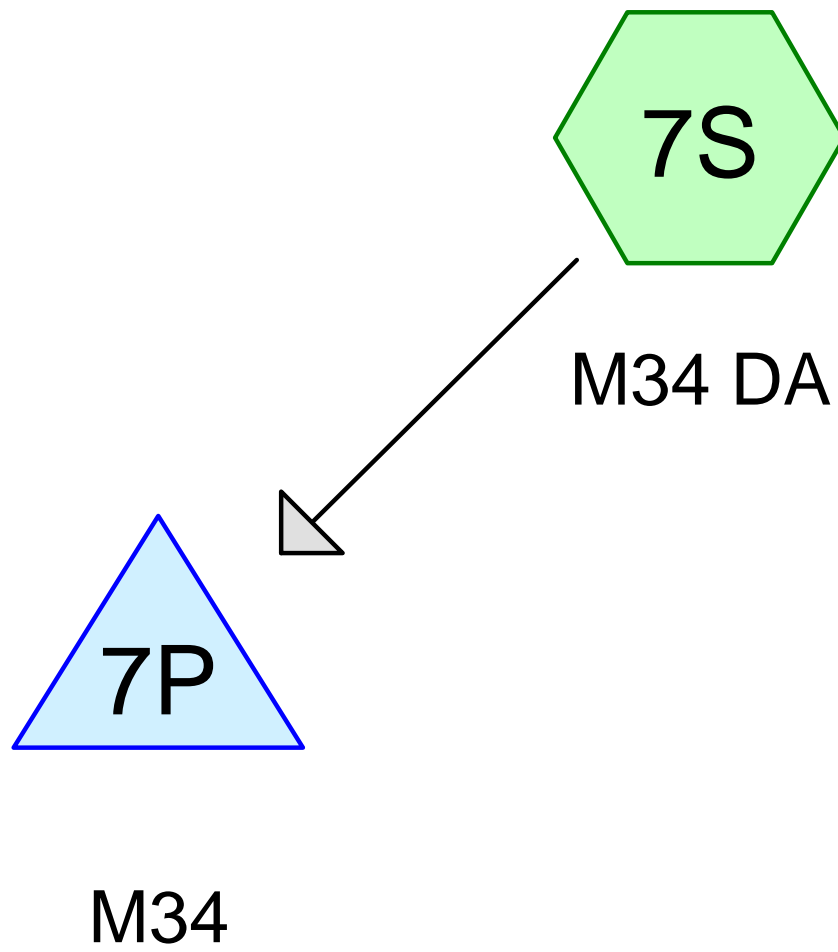
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Device	Routing	Invert	Outlet Devices
#1	Primary	157.00'	24.0" Round Culvert L= 173.0' Ke= 0.500 Inlet / Outlet Invert= 157.00' / 55.00' S= 0.5896 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	161.00'	1.7" Vert. Orifice/Grate C= 0.600
#3	Device 1	164.50'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.90 cfs @ 14.24 hrs HW=164.61' (Free Discharge)

- ↑ **1=Culvert** (Passes 0.90 cfs of 38.89 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 9.06 fps)
- ↑ **3=Orifice/Grate** (Weir Controls 0.76 cfs @ 1.09 fps)



M34 - Hullcrest South - Rev 2016 0225

Type II 24-hr 1 year Rainfall=2.10"

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Summary for Subcatchment 7S: M34 DA

Runoff = 12.03 cfs @ 12.15 hrs, Volume= 0.998 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 3.576	98	Impervious, HSG C
1.915	74	>75% Grass cover, Good, HSG C
12.495	73	Woods, Fair, HSG C
* 0.791	98	Impervious, HSG D
0.510	80	>75% Grass cover, Good, HSG D
1.297	79	Woods, Fair, HSG D
20.584	79	Weighted Average
16.217		78.78% Pervious Area
4.367		21.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.4	1,290	0.0388	1.05		Lag/CN Method,

Summary for Pond 7P: M34

Inflow Area = 20.584 ac, 21.22% Impervious, Inflow Depth = 0.58" for 1 year event
 Inflow = 12.03 cfs @ 12.15 hrs, Volume= 0.998 af
 Outflow = 0.27 cfs @ 24.14 hrs, Volume= 0.984 af, Atten= 98%, Lag= 719.6 min
 Primary = 0.27 cfs @ 24.14 hrs, Volume= 0.984 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
 Starting Elev= 194.50' Surf.Area= 11,881 sf Storage= 16,397 cf
 Peak Elev= 196.89' @ 24.14 hrs Surf.Area= 15,216 sf Storage= 48,706 cf (32,309 cf above start)

Plug-Flow detention time= 2,249.2 min calculated for 0.607 af (61% of inflow)
 Center-of-Mass det. time= 1,456.4 min (2,338.2 - 881.7)

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	66,526 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
193.00	10,000	0	0
194.00	11,236	10,618	10,618
194.50	11,881	5,779	16,397
195.00	12,544	6,106	22,504
196.00	13,924	13,234	35,738
197.00	15,376	14,650	50,388
198.00	16,900	16,138	66,526

M34 - Hullcrest South - Rev 2016 0225*Type II 24-hr 1 year Rainfall=2.10"*

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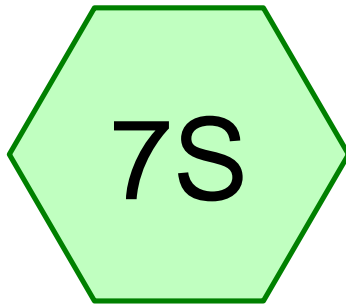
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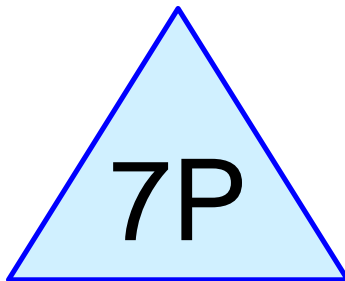
Device	Routing	Invert	Outlet Devices
#1	Primary	191.00'	24.0" Round Culvert L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 191.00' / 186.00' S= 0.1667 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	194.50'	2.6" Vert. Orifice/Grate C= 0.600
#3	Device 1	197.00'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.27 cfs @ 24.14 hrs HW=196.89' (Free Discharge)

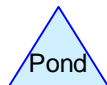
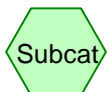
- ↑ **1=Culvert** (Passes 0.27 cfs of 33.45 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 7.27 fps)
- ↑ **3=Orifice/Grate** (Controls 0.00 cfs)



M35 DA



M35



M35- Morse Drive Rev 2016 0225

Type II 24-hr 1 year Rainfall=2.10"

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Summary for Subcatchment 7S: M35 DA

Runoff = 13.55 cfs @ 12.12 hrs, Volume= 1.049 af, Depth= 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.10"

Area (ac)	CN	Description
* 0.885	98	Impervious, HSG A
0.800	39	>75% Grass cover, Good, HSG A
1.334	36	Woods, Fair, HSG A
* 0.011	98	Impervious, HSG C
0.141	73	Woods, Fair, HSG C
* 3.000	98	Impervious, HSG D
3.282	80	>75% Grass cover, Good, HSG D
13.804	79	Woods, Fair, HSG D
23.257	78	Weighted Average
19.361		83.25% Pervious Area
3.896		16.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	1,780	0.0915	1.67		Lag/CN Method,

Summary for Pond 7P: M35

Inflow Area = 23.257 ac, 16.75% Impervious, Inflow Depth = 0.54" for 1 year event
 Inflow = 13.55 cfs @ 12.12 hrs, Volume= 1.049 af
 Outflow = 0.62 cfs @ 16.16 hrs, Volume= 1.036 af, Atten= 95%, Lag= 242.1 min
 Primary = 0.62 cfs @ 16.16 hrs, Volume= 1.036 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
 Starting Elev= 248.00' Surf.Area= 7,920 sf Storage= 7,392 cf
 Peak Elev= 251.07' @ 16.16 hrs Surf.Area= 11,617 sf Storage= 37,246 cf (29,854 cf above start)

Plug-Flow detention time= 1,786.6 min calculated for 0.866 af (83% of inflow)
 Center-of-Mass det. time= 1,437.3 min (2,321.0 - 883.7)

Volume	Invert	Avail.Storage	Storage Description
#1	247.00'	48,600 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
247.00	6,864	0	0
248.00	7,920	7,392	7,392
249.00	9,048	8,484	15,876
250.00	10,248	9,648	25,524
251.00	11,520	10,884	36,408
252.00	12,864	12,192	48,600

Appendix C: Tetra Tech Memorandum dated October 30, 2007



Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007
Water Resources Group

MEMORANDUM

Date: October 30, 2007
From: Tham Saravanapavan
To: Jennifer Callahan, Vermont Department of Environmental Conservation
Re: BMP Cost Function in Vermont's BMPDSS

Defining Cost Function and Variables

When refer to the cost of stormwater best management practices (BMP), generally it includes construction cost, maintenance and inspection cost, and land opportunity cost (Wossink and Hunt, 2003). In BMPDSS (Cheng et al., 2006), a generic cost function is employed as described below.

$$\text{Total Cost} = \text{Installation Cost [I]} + \text{Land Cost [L]} + \text{Fixed Cost [F]}$$

Installation Cost [I] represents the material and labor expenses related to the construction of the BMP. Land Cost [L] represents the land value. It is important to note that L is negligible if the BMP were installed in small areas, such as bioretention or infiltration, and underground storages. Fixed Cost [F] represents the cost associated with design and permitting activities. Due to the unavailability of the cost information on maintenance and inspection, these costs were not included in the equation.

In Vermont BMPDSS, a detention BMP (assumed a wet pond) represents to control the flood flow and a bio-infiltration BMP represents to control the low flow. The following equations represent the selected BMPs.

Detention BMP:

$$\text{Cost} = \text{I} * \text{Detention Volume (ft}^3\text{)} + \text{Detention Surface Area (acre)} * \text{L} + \text{F}$$

I = \$5 per ft³ and L = \$ 217,800 per acre, were based on USEPA (1999a) similar to the Prince George's County model.

F = [\$ 2,000 x number of eligible parcels within a sub-watershed] (Assuming each parcel will install a separate BMP and it will cost \$ 2,000 for permitting and design of these BMPs)

Infiltration BMP:

$$\text{Cost} = \text{I} * \text{BMP volume (ft}^3\text{)} + \text{F}$$

I = \$6 per ft³, was based on USEPA (1999b) similar to the Prince George's County model.

F = [\$ 2,000 x number of eligible parcels within a sub-watershed] (Assuming each parcel will install a separate BMP and it will cost \$ 2,000 for permitting and design of these BMPs)

Discussion on Selection of Cost Function and Variables

One of the challenges to apply BMPDSS in Vermont is to identify appropriate cost variables to be input into BMPDSS that represent Vermont's site specific environment. Tetra Tech, along with Vermont Department of Environmental Conservation, has conducted a limited research on BMP cost information available for Vermont environment, including data and reports from University of Vermont (UVM) and the City of South Burlington.

The cost information available at the City of South Burlington excludes the resources that were directly provided by the City (For example, the staff time of City employees, the use of City owned equipments, etc.). Therefore, the data is not complete enough to be represented in BMPDSS. A review further revealed that the cost information available at UVM Redesigning American Neighborhood (RAN) program are based on USEPA (1999 a & b) that is the same information of the Prince George's County BMPDSS.

Due to the unavailability of the site-specific cost data for Vermont and USEPA (1999 a & b) data are presently used in UVM RAN program, Tetra Tech has employed the cost information of existing BMPDSS model. As and when more site specific information available, the variables can be easily updated in BMPDSS. Although the changes in these variables will result in changes in the total cost for implementing BMP, the optimization and other BMPDSS results, such as sizing and locations, have no impact due the changes.

Reference:

Cheng, M.S., C.A. Akinbobola, J. Zhen, J. Riverson, K. Alvi, and L. Shoemaker. 2006. BMP decision support system for evaluating watershed-based stormwater management alternatives. In *Proc. 2006 World Environmental and Water Resources Congress*, May 21-25, 2006, Omaha, Nebraska.

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University of Vermont, Redesigning the American Neighborhood (RAN) Toolbox.
<http://www.uvm.edu/~ran/ran/toolbox/bmp/index.php>, (accessed May 2007).

Wossink, A. and B. Hunt, 2003. An evaluation of cost and benefits of structural stormwater BMPs in North Carolina, NC State Corporative Extension.

M35- Morse Drive Rev 2016 0225*Type II 24-hr 1 year Rainfall=2.10"*

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Device	Routing	Invert	Outlet Devices
#1	Primary	244.00'	24.0" Round Culvert L= 173.0' Ke= 0.500 Inlet / Outlet Invert= 244.00' / 142.00' S= 0.5896 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	248.00'	2.1" Vert. Orifice/Grate C= 0.600
#3	Device 1	251.00'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.60 cfs @ 16.16 hrs HW=251.07' (Free Discharge)

- ↑ **1=Culvert** (Passes 0.60 cfs of 37.28 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.20 cfs @ 8.32 fps)
- ↑ **3=Orifice/Grate** (Weir Controls 0.40 cfs @ 0.88 fps)

Appendix H – Potash Brook Flow Restoration Plan



POTASH BROOK FLOW RESTORATION PLAN

City of South Burlington, Vermont

October 1, 2016
Updated January 2019

Updated by:
City of South Burlington
104 Landfill Road, South Burlington, VT 05403



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1. Executive Summary

This Flow Restoration Plan (FRP) for the Potash Brook watershed was developed in accordance with requirements in the Municipal Separate Storm Sewer System (MS4) General Permit #3-9014 (2018). On July 27, 2018 the Vermont Department of Environmental Conservation (VTDEC) approved an update to the MS4 General Permit (3-9014), at which time the Potash Brook FRP became part of the Stormwater Management Plans (SWMP) prepared by the MS4 permittees in the Potash Brook watershed. This includes the City of South Burlington, the Vermont Agency of Transportation (VTrans), the City of Burlington, Burlington International Airport (BTV) and the University of Vermont (UVM). The Potash Brook FRP will act as a guidance document for the MS4 entities as they implement the stormwater Best Management Practices (BMPs) necessary to attain the flow restoration targets established by the Potash Brook Total Maximum Daily Load (TMDL). The Potash Brook TMDL was approved by the U.S. Environmental Protection Agency (EPA) on December 19, 2006. The TMDL requires a 16.5% reduction in stream flow during high flow conditions (established as the 1-year storm event).

Development of the Potash Brook FRP was an iterative process that utilized the Vermont Best Management Practice Decision Support System (BMPDSS) model maintained by VTDEC. This model was created by VTDEC and its partners as part of the initial TMDL development. The BMPDSS model allows the user to add, remove, or modify information related to the existing and proposed stormwater BMPs in the watershed. The BMPDSS then predicts the impacts that these changes will have on stream flow. In 2002, VTDEC provided a “Baseline Condition” BMPDSS model for Potash Brook. This version of the BMPDSS model, also referred to as the Pre-2002 model, included all stormwater BMPs that existed in the watershed prior to 2002 and provided an estimated stream flow during the 1-year storm event. The goal of the FRP, as established by the Potash Brook TMDL¹, is to reduce stream flow by 16.5% during this target storm event.

In May 2015, at the request of the City of South Burlington, the Chittenden County Regional Planning Commission (CCRPC)² completed a study to estimate the expected non-jurisdictional impervious area growth³ in the Potash Brook watershed over the next 20 years. The original TMDL assigned a non-jurisdictional impervious growth of 30 acres, whereas the CCRPC study estimated 22 acres based on the actual non-jurisdictional growth rate from 2003 to 2010. With the revised future growth, the high-flow target (Q0.3%) would be reduced from 16.5% to 16.0%.

The BMPDSS Baseline Condition model was provided to the City and updated to include all BMPs that were constructed in the watershed after 2002. This version of the model became known as the “Existing Condition”, or Post-2002, model run. Finally, existing BMPs were evaluated to determine if they could be retrofit to provide improved treatment and detention of stormwater runoff and new BMPs were added to the BMPDSS model until the required stream flow reduction target was achieved. This version of the model became known as the “Proposed Condition” model, or Credit Model run⁴.

The current Proposed Condition BMPDSS model run that meets the required 16.5% reduction in stream flow during the 1-year storm event includes a total of 107 sites; forty-two (42) retrofits to existing BMPs, twenty-five (25) new detention systems, seventeen (17) new infiltration systems, twenty-two (22) new

¹ VT DEC. 2006. Total Maximum Daily Load to Address Biological Impairment in Potash Brook (VT05-11).

² Chittenden County Regional Planning Commission (CCRPC). 2015. Non Jurisdictional Impervious Surface Analysis for the Potash Brook Watershed.

³ “Non-jurisdictional” refers to new impervious surfaces where the parcel’s total impervious area is less than 1 acre and not required to obtain a State stormwater permit.

⁴ Refer to original Potash Brook Flow Restoration Plan dated October 1, 2016 for additional detail on the iterative process to identify proposed projects.

gravel wetlands, and one (1) new median filter system. The total cost for implementation of these BMPs is estimated at approximately \$21,362,000.

The final list of proposed BMPs were ranked based on best value and feasibility. The MS4 permit requires that the BMPs identified in the FRP be constructed within 20 years of the effective date of the 2012 MS4 permit, which results in a December 5, 2032 deadline. The MS4s involved in the Potash Brook FRP worked together to develop an implementation schedule for Potash Brook. BMPs that are currently covered by expired State of Vermont stormwater permits were included at the front of the schedule, so that the associated properties could complete the required stormwater improvements and achieve permit compliance. Other BMPs located on land owned or controlled by the MS4 entities were given priority over those that were located on private property. The remaining projects were scheduled based on their ability to contribute to stream flow reductions, cost effectiveness, and constructability.

A financial plan was also developed in conjunction with the implementation schedule. The City of South Burlington has been financing the required stormwater BMPs by utilizing funds raised by stormwater utility fees, State and Federal grants, as well as low interest loan programs.

2. Background

Potash Brook and its watershed are located in Chittenden County, principally in the City of South Burlington, and encompass an area of approximately 7.13 square miles. The main stem of Potash Brook flows to its mouth at Shelburne Bay in Lake Champlain. Several major tributaries flow to the main stem and drain significant portions of the watershed north and south. The entire stream and its tributaries are Class B waters designated as cold water fish habitat pursuant to the Vermont Water Quality Standards.

Potash Brook has been identified as not attaining water quality standards and has been placed on the list of impaired waters in accordance with Section 303(d) of the Federal Clean Water Act. In 2006, the EPA approved the Potash Brook Stormwater TMDL¹. This TMDL requires reductions in stormwater flows during high flow conditions. Increases in stream base flow were also recommended, but are not required under the TMDL. The flow targets are the basis for the FRP, developed in accordance with the Municipal Separate Storm Sewer System (MS4) General Permit Subpart IV.C.1 as a required part of the MS4s Stormwater Management Program (SWMP).

The purpose of this Flow Restoration Plan (FRP) is to outline a plan for the retrofit of existing impervious surfaces with stormwater management Best Management Practices (BMPs) (e.g. gravel wetlands, infiltration basins, etc.) to meet the TMDL flow targets. The TMDL required that watershed hydrology must be controlled in the Potash Brook Watershed to reduce high flow discharges, in order to restore degraded water quality and achieve compliance with the Vermont Water Quality Standards (VWQS).

Five (5) MS4s including the City South Burlington, the City of Burlington, Burlington International Airport (BTV), the University of Vermont (UVM), and the Vermont Agency of Transportation (VTRANS) own impervious cover within the Potash Brook impaired watershed.

¹ The EPA approval of the Potash Brook TMDL can be viewed at the following links:

http://dec.vermont.gov/sites/dec/files/wsm/stormwater/docs/SWImpaired/sw_pot_tmdl_finalapproved.pdf
http://dec.vermont.gov/sites/dec/files/wsm/stormwater/docs/SWImpaired/sw_potashTMDLapprovaldoc.pdf

2.1. Potash Brook Total Maximum Daily Load (TMDL)

In response to Potash Brook not meeting the Vermont water quality standards, it was placed on the list of impaired waters in accordance with Section 303(d) of the Federal Clean Water Act. The VTDEC developed TMDLs for impaired watersheds using flow as a surrogate for pollutant loading¹. The basis for the TMDL development was the comparison of modeled Flow Duration Curves (FDCs) between impaired and attainment watersheds. The Program for Predicting Polluting Particles Passage through Pits, Puddles, and Ponds, Urban Catchment Model (P8) was used to model gauged and ungauged watersheds in Vermont and develop Flow Duration Curves (FDCs) from which a normalized high flow and low flow per drainage area in square miles (cfs/sq.mi.) were extracted. FDCs were developed for both impaired and attainment streams and the relative difference between the two was used to establish the flows needed to restore the stream's hydrology.²

The Potash Brook was designated as impaired on the 2004 Vermont 303(d) List from its mouth at Lake Champlain to a point upstream 5.2 miles due to non-support of aquatic life designated uses. The TMDL concluded that since all tributaries and the main stem drain to the impaired lower portion of the stream, the entire Potash Brook watershed was considered to contribute to its impairment. The source of the impairment was considered to be multiple impacts associated with unmanaged stormwater runoff including runoff from both urban and developed areas, as well as from agricultural and open areas. The high flow target required a total 17.9% reduction in watershed flow allocation during the 1-year storm event (16.5% wasteload allocation for urban/developed areas).

As part of the FRP development, the Chittenden County Regional Planning Commission (CCRPC) completed a study to estimate the expected non-jurisdictional impervious area growth in the Potash Brook watershed over the next 20 years. Non-jurisdictional growth by definition the impervious area that does not require a stormwater permit, and is therefore important to account for within the 20 year management plan. The original TMDL assigned a non-jurisdictional impervious growth of 30 acres, whereas the CCRPC study estimated 22 acres based on the actual non-jurisdictional growth rate from 2003 to 2010. With the revised future growth, the high-flow target (Q0.3%) would be reduced from 16.5% to 16.0%¹ as summarized in Table 1 below. The modified flow target was considered, but ultimately the original (unmodified) flow target of 16.5%, was incorporated into the FRP planning process and proposed BMP implementation scenario.

Table 1: TMDL Flow Target and modified target with revised future growth

Flow Target	Target High Flow Q 0.3(± %) Reduction
TMDL Target from current Urban/Developed areas	-14.6%
TMDL Targets with 30 acres of Non-Jurisdictional Future Growth	-16.5%
TMDL <i>Modified</i> Targets with 22 acres of Non-Jurisdictional Future Growth ¹	-16.0%
1 Modified target was calculated as: $-[(14.6\%) + (16.5\% - 14.6\%)(22 \text{ ac}/30 \text{ ac})] = -16.0\%$	

¹ VTDEC. 2006. Potash Brook TMDL.

² "Stormwater Modeling for Flow Duration Curve Development in Vermont" (Tetra Tech, 2005).

2.2 MS4 Permit Background and Requirements

On December 5, 2012, Vermont's revised MS4 Permit was issued. Included in the 2012 MS4 permit issuance were new requirements for municipalities to develop FRPs to implement the stormwater TMDLs. The FRPs were required to be developed for each impaired watershed by October 1, 2016, and include the following elements:

- 1) An identification of the required controls
- 2) A design and construction schedule
- 3) A financial plan
- 4) A regulatory analysis
- 5) The identification of regulatory assistance, and
- 6) Identification of any third party implementation.

The schedule required implementation of the required BMPs as soon as possible, but no later than 20 years from the effective date of the permit, before December 5, 2032. In 2018 the State revised the MS4 Permit to include additional requirements to address the Lake Champlain Phosphorous TMDL. As part of the permit renewal, each MS4 was required to submit an updated Notice of Intent (NOI) and Stormwater Management Program (SWMP), including updated Flow Restoration Plans.

3. BMPDSS Model

In an effort to implement the Vermont Stormwater TMDLs, the VTDEC worked with an external consultant (TetraTech) to develop the computer-based VT BMPDSS, a VT-specific hydrologic BMP assessment model. This modeling tool was developed by TetraTech, Inc., with considerable investment from EPA Region 3 and Prince George's County, Maryland, and was adapted for use in Vermont using funding from the Vermont Agency of Natural Resources (ANR). The purpose of the modeling tool was to predict progress toward the TMDL flow targets based on proposed BMP implementation scenarios to help MS4 communities identify different BMP options and associated costs.

The information for each BMP entered into the BMPDSS model includes: drainage area, storage volume, outlet control structures and geographic location. The remaining data needed to calculate flow simulations is built into the model and includes: topography, soil types, impervious cover, and rainfall data.

In order to complete a flow target assessment, VTDEC developed three model scenarios for each impaired watershed, including a Baseline Condition Model (Pre-2002), an Existing Condition Model (Post-2002), and a Proposed Condition Model (Credit).

3.1. Baseline Condition Model (Pre-2002)

The Baseline Scenario Model includes all stormwater BMPs installed prior to issuance of the VT Stormwater Design Standards in 2002. The purpose of this model was to quantify the flows in the stream prior to beginning the Flow Restoration Planning process and establish a baseline from which to measure.

3.2. Existing Condition Model (Post-2002)

The Existing Condition Model includes all existing BMPs in the Baseline Condition Model, as well as the addition of any BMPs that have been constructed since 2002 in the Potash Brook watershed. The purpose of the model is to show current flows in Potash Brook. This allows the State and MS4 communities to track progress toward the high flow attainment target. On a routine basis, the Existing Condition BMPDSS model is revised to include any recently constructed BMPs, including BMPs designed and constructed by the MS4s, as well as BMPs constructed as part of commercial development and redevelopment. Additionally, the Existing Conditions Model is updated to reflect any changes to existing BMPs, such as revised drainage areas, modification of outlet control structures, or changes in storage volumes. The results of the Existing Condition Model are compared to the Baseline Condition Model to determine if the 16.5% reduction in high flow has been achieved.

The Proposed Condition Model includes all BMPs in the Existing Condition Model, which in turn includes all BMPs from the Baseline Condition Model, as well as a collection of proposed BMPs that can achieve the high flow reduction target in the Potash Brook watershed. The iterative process of developing the list of proposed BMPs is detailed further in the original Potash Brook FRP, dated October 1, 2016.

3.3. Proposed Condition Model (Credit)

The Proposed Condition Model includes a total of 107 sites; forty (40) retrofits to existing BMPs, forty (40) new detention systems, eighteen (18) new infiltration systems, six (6) new gravel wetlands, two (2) new bioretention systems, and one (1) new median filter system. Credit toward the flow target is also provided by stormwater BMPs from the Existing Condition Model. A summary table of the proposed BMPs is included in Appendix B, along with a map of the proposed BMP locations and individual summary sheets describing each proposed BMP the Potash Brook FRP.

A summary table of the BMPDSS Model Results is shown below in Table 2. The final number of proposed BMPs differs from the number of BMPs added to the model runs shown on Table 3 because some BMPs were initially included in the model as two separate sites and then later combined into one project in a subsequent model run.

Table 2: Summary of BMPDSS Model Results

Description	Q0.3		# of BMPs Added for Model Runs	Impervious Area Managed (acres)*
	Area adjusted (cfs/sq.mi.)	Unadjusted flow (cfs)		
Baseline Condition	18.570	131.020		
Existing Condition	17.697	124.677	93	254.3
% Change vs Base		-4.8%		
Proposed Condition	15.558	109.280	116	601.6
% Change vs Base		-16.6%		

3.4. Project Ranking

All proposed BMPs identified as part of FRP development in the five stormwater impaired watersheds of Potash, Bartlett, Englesby, Centennial, and Munroe Brook were ranked and a project prioritization was created. Considerations that factored into the ranking of BMP projects include the estimated benefit of a BMP towards the FRP's flow restoration targets, and the amount of impervious area treated. The comprehensive ranking matrix ranked the proposed BMP projects based on the following criteria, which were grouped into four general categories as shown in Table 3.

Table 3: Project Ranking Matrix

Category	ID	Criteria
Cost/Operations	A	Project Cost per Impervious Acre
Project Design Metrics	B	Impervious Acres Managed (ac)
	C	Channel Protection Volume (CPv) Mitigated, (ie. 1-year Storm)
	D	Volume Infiltrated (ac-ft)
Project Implementation	E	Permits
	F	Land Availability
Other Project Benefits/Constraints	G	Flood Mitigation (Is existing flooding issue mitigated by project?)
	H	TMDL Flow Target Addressed (Q03, Q95)
	I	Lake Champlain Phosphorus TMDL
	J	Other Project Benefits/Constraints

Values for each criteria were identified and assigned a relative score, so that proposed BMP projects could be ranked based on a total score. A full description of the ranking criteria is presented in Table D-1 in Appendix C, and a scoring key is presented in Table D-2 in Appendix C. The final scoring of proposed BMP projects in the Potash Brook Watershed is presented Table E-2 in Appendix D.

4. Design and Construction Schedule

A Design and Construction (D&C) schedule is a required element of the final FRP. This schedule must show how the proposed BMPs included in the FRP can be implemented over a timeframe of less than 20 years from the date of MS4 permit issuance. This means that all BMPs associated with FRPs must be implemented prior to December 5, 2032. The City of South Burlington owns impervious surface in five stormwater impaired watersheds; Bartlett, Englesby, Centennial, Munroe, and Potash Brook. Therefore, proposed stormwater BMPs in all five watersheds were considered when developing a realistic D&C schedule for the City. However, only the projects located within the Potash Brook watershed are presented in the implementation schedule in Appendix D.

In addition to a project's score within the BMP ranking matrix, development of a BMP implementation schedule required the consideration of additional factors, such as expired State of Vermont stormwater permits, properties containing more than 3 acres of impervious area, and land owned or controlled by the MS4 entities. Additionally, private property redevelopment and development of the City's Phosphorus

Control Plan (PCP) may cause certain projects to gain or lose priority within the implementation schedule in the future.

5. Financial Plan

Subject to the requirements of the MS4 permit, a financial plan is required as part of the FRP. This plan must provide initial BMP cost estimates and demonstrate the means by which BMP implementation will be financed. The financial plan must also include the steps that each MS4 will take to implement the finance plan. Initial BMP cost estimates were calculated in 2014 using cost values that were current at that time. Once projects were scheduled over the 20 year implementation schedule, an annual 3% inflation rate (based on historic trends in the construction cost index¹) was applied. Table E-1 in Appendix D presents inflation adjusted project costs for each BMP project. Applying this inflation rate provides a more accurate annual cost for BMP construction in the later years of the schedule.

5.1. City of South Burlington Financial Plan

In 2005, the City of South Burlington created Vermont's first stormwater utility. Under the stormwater utility system, all developed properties in the City pay an impervious area-based stormwater fee using an Equivalent Residential Unit (ERU) system. These stormwater fees provide the City with a stable funding source that is used to comply with State and Federal stormwater regulations and maintain stormwater infrastructure throughout the City. The stormwater utility was created with the understanding that there would be future stormwater costs related to the five stormwater impaired watersheds located in South Burlington, as well as costs related to future implementation of projects required by the Lake Champlain Phosphorous TMDL. The City is currently utilizing funds generated from stormwater utility fees to fund FRP related costs.

Once the BMP cost and implementation schedule was developed, the City of South Burlington Stormwater Utility was able to incorporate this information into its existing stormwater rate model. The City evaluated two different scenarios for funding the BMPs included in the FRP. The first scenario assumed that there would be no grant funding available to assist with implementation. The second scenario assumed that grant funding of approximately \$250,000 per year would be available in 2018 through 2029, and that this amount would increase to \$500,000 in 2030, 2031, and 2032. The resulting annual cost to a single family residential property and commercial property owner containing 1 acre of impervious area is summarized in Table 5. Calculations for "Commercial Property Containing 1 Acre Impervious Area" in Table 4 assume an Equivalent Residential Unit (ERU) rate of 17 and do not take into account the City's relative tier factors based on percent impervious cover.

¹ RSMeans. "Historical Cost Indexes." <https://www.rsmeansonline.com/references/unit/refpdf/hci.pdf>

Table 4: Annual Stormwater Fee Paid by Property Owners Under Different FRP Funding Scenarios

Fiscal Year	Funding Scenario 1 - Receive No Grants		Funding Scenario 2 - Receive \$250,000 in Grants Annually	
	Single Family Residential Property	Commercial Property Containing 1 Acre Impervious Area	Single Family Residential Property	Commercial Property Containing 1 Acre Impervious Area
2018	\$80.28	\$1,364.76	\$80.28	\$1,364.76
2019	\$82.44	\$1,401.48	\$82.08	\$1,395.36
2020	\$84.60	\$1,438.20	\$83.88	\$1,425.96
2021	\$87.12	\$1,481.04	\$85.68	\$1,456.56
2022	\$90.00	\$1,530.00	\$87.48	\$1,487.16
2023	\$93.24	\$1,585.08	\$89.28	\$1,517.76
2024	\$96.84	\$1,646.28	\$91.08	\$1,548.36
2025	\$100.80	\$1,713.60	\$92.88	\$1,578.96
2026	\$105.12	\$1,787.04	\$94.68	\$1,609.56
2027	\$109.80	\$1,866.60	\$96.48	\$1,640.16
2028	\$114.84	\$1,952.28	\$98.28	\$1,670.76
2029	\$119.88	\$2,037.96	\$100.08	\$1,701.36
2030	\$124.92	\$2,123.64	\$101.88	\$1,731.96
2031	\$129.96	\$2,209.32	\$103.68	\$1,762.56
2032	\$135.00	\$2,295.00	\$105.48	\$1,793.16

It is the City's expectation that significant funding from the State of Vermont and other Federal sources will be available to help with the cost of stormwater TMDL implementation. The State of Vermont has already taken initial steps towards providing this funding. In 2015, the Vermont legislature created the Clean Water Fund (CWF). The CWF was provided with \$2,005,000 in 2016 and \$7,688,000 in 2016. While these initial investments are not at the level necessary to provide significant funding to the MS4 communities subject to stormwater TMDLs, it is our understanding that the State is working to provide additional funding to the CWF in the future. The City of South Burlington intends to work closely with our legislative representatives to ensure that funding is made available for the stormwater improvements included in the FRPs. The City of South Burlington will also pursue funding from existing and new grant sources from other organizations including, but not limited to, VTDEC, the Vermont Agency of Transportation, and the Lake Champlain Basin Program.

5.2 City of Burlington Financial Plan

In 2009, the City of Burlington followed the example of the City of South Burlington in implementing an impervious area based stormwater fee to provide the City of Burlington with a stable funding source to maintain stormwater infrastructure throughout the City and to comply with numerous State and Federal stormwater regulations including the Stormwater TMDLs, Lake Champlain TMDL and Combined Sewer requirements. Implementation of retrofits for which the City is responsible will ultimately be the responsibility of the stormwater ratepayers. In order to limit the impact to the ratepayers, the City intends to leverage existing and new grant and loan sources, as they are available. In the case of Potash Brook, the two retrofits identified within Burlington City limits are on private property. Later analyses will determine whether additional retrofit financial obligations (i.e. paying

into project completed elsewhere in the watershed) will be necessary for the City to meet its obligations in Potash Brook. As part of its Integrated Planning effort, the City of Burlington will also be evaluating possible mechanisms for incentivizing the construction of retrofits identified on private property, particularly if the City can get improvements that go above the Flow Restoration Plan requirements and make gains in phosphorus control. Additionally, as part of the Integrated Planning effort, the City will be completing a financial capability assessment (FCA) to evaluate the long-term ability of ratepayers to fund these and other Clean Water Act obligations. An FCA won't mean that Clean Water Act obligations won't be met – but may point to an adjustment of the overall schedule of implementation of all of the City of Burlington's obligations, including implementation of this and other Flow Restoration Plan projects, in order to mitigate the impact of stormwater and wastewater rates increasing at an unsustainable rate for the Burlington community. This FRP and SWMP will be amended with an updated financial plan, including stormwater rate projections for this and other Clean Water Act obligations once the FCA under the Integrated Plan is completed.

5.3 University of Vermont Financial Plan

Under the current budgeting process, the University would establish project funds to fulfill the University of Vermont's obligation. We would endeavor to pursue federal and state stormwater grant opportunities.

5.4 Vermont Agency of Transportation Financial Plan

Planning level costs were independently estimated for each VTTrans project using a consistent spreadsheet-based method for all projects. As such, some cost estimates may differ slightly from those presented in other FRP documents. VTTrans will request state and federal funding for the appropriate amount to implement the BMPs as outlined in their design and construction schedule. For those projects that will require a joint effort with another municipality, VTTrans will request funding for their portion of the cost share. In watersheds where VTTrans is either not meeting or exceeding their allocated target there may be cost sharing between MS4s.

5.5 Burlington International Airport Financial Plan

A financial plan that estimates the costs for implementing the BMPs and describes a strategy for financing is a required element of the FRP. The financing plan includes the steps each permittee will take to implement the financing plan. The City of South Burlington Potash Brook and Centennial Brook FRPs include cost estimates for each of the BMPs, using 2014 cost estimates with an annual 3% inflation rate as noted above. The VTDEC and the contributing MS4 permittees within these watersheds have signed a Memorandum of Agreement (MOA) to perform monitoring and other data collection required under the MS4 permitting program. Each MS4 permittee, including BTV, has been assigned a percentage of the total cost of the contracted work over a five-year timeframe. This type of collaborative arrangement will also apply to implementation and financing of the BMPs.

As described in the FRPs, it is BTV's expectation that significant funding from the State of Vermont and other Federal sources will be available to help with the cost of stormwater TMDL implementation. In 2015, the Vermont legislature created the Clean Water Fund (CWF). This fund was provided with \$2,005,000 in 2015 and \$7,688,000 in 2016, and will likely receive additional funding in the years to come. The City of South Burlington and Burlington Airport intend to work closely with legislative

representatives to ensure that this funding is made available for the stormwater improvements included in the FRPs.

The Burlington Airport also intends to seek funding for implementing its commensurate share of the BMPs within the watersheds, including requests from the CWF and other sources. BTV is committed to participating in a cost share with the City of South Burlington to implement its FRP in a manner that is fair and reasonable for the airport. It is also noted that BTV reserves the right to achieve its FRP commitments through implementing projects of its own choosing that may not be identified on South Burlington's present list of proposed watershed improvement projects.

5.6 Proposed BMP Cost Estimates

The Proposed Condition Model that achieved the required 16.5% reduction in stream flow during the 1-year storm event included 107 BMPs costing approximately \$16,700,000. Cost estimates were developed based on a simple spreadsheet method that calculated base construction cost as a product of the design control volume, the unit cost, and the site adjustment factor, as outlined in Table 5 below¹. Additionally, permitting, engineering, land acquisition, and O&M costs were factored into the total cost estimate.

Table 5: Proposed BMP Unit Costs and Adjustment Factors

BMP	Base Cost (\$/ft ³)
Detention Basin	\$2
Infiltration Basin	\$4
Underground Chamber (infiltration or detention)	\$12
Bioretention	\$10
Green Infrastructure/ Underground Chamber Combo	\$22
Site Type	Cost Multiplier
Existing BMP retrofit	0.25
New BMP in undeveloped area	1
New BMP in partially developed area	1.5
New BMP in developed area	2
Adjustment factor for large aboveground basin projects	0.5

A summary of all project costs for each proposed BMP in the Potash Brook Watershed are included in Table E-1 in Appendix D.

¹ Methodology based on Horsley Witten Group Memorandum (Page 11). Included in Appendix D.

6. Regulatory Analysis

In accordance with the MS4 permit, an FRP requires a regulatory analysis that identifies and describes what, if any additional regulatory authorities that the permittees will need in order to effectively implement the FRP.

Currently, stormwater runoff within the Potash Brook watershed is regulated primarily by the VTDEC, City of South Burlington, City of Burlington, and VTrans. VTDEC regulates new developments through issuance of Stormwater Discharge Permits with technical requirements as outlined in the 2017 Vermont Stormwater Management Manual. The City of South Burlington and City of Burlington require improved stormwater practices and low impact development for new developments through their stormwater ordinances and Land Development Regulations (LDRs). VTrans regulates stormwater discharges to the state Right of Way through 19 V.S.A. §1111 “Permitted use of the right-of-way”.

The City of South Burlington updated the stormwater requirements in its LDRs in June 2016.¹ The revised LDRs require that any project resulting in ½ acre or more of impervious area implement stormwater controls that prioritize infiltration. The revised LDRs also contain new requirements for properties that are being redeveloped. It is the City’s expectation that these changes will result in gradual improvements in stormwater management over the course of the 20 year BMP implementation schedule.

The City of South Burlington also revised its “Ordinance Regulating the Use of Public and Private Sanitary Sewerage and Stormwater Systems” in October 2015.² The ordinance provides a policy regarding the handling of expired VTDEC stormwater permits located in South Burlington. The City will continue to take over responsibility for exclusively residential stormwater systems that complete upgrades. In addition, the revised ordinance allows commercial properties with expired permits to obtain coverage under the City’s MS4 permit if upgrades to the stormwater system are completed. These properties will still be responsible for maintaining their systems, but the permit coverage required by the State of Vermont can now be provided through the City’s MS4 permit instead of obtaining coverage under one of VTDEC’s other permit programs.

A full list of the expired State of Vermont permits with discharges to Potash Brook is presented in Table 6 in Section 7.

¹ Section 12.03 – Stormwater Management Standards, “South Burlington Land Development Regulations,” dated 8/6/18, can be viewed at the following link:
<http://www.southburlingtonvt.gov/Planning/LDR%20Amendments/2018-5/LDRs%20Complete%20Effective%208-6-2018%20reduced.pdf>

² South Burlington’s “Ordinance Regulating the Use of Public and Private Sanitary Sewerage and Stormwater Systems,” dated 10/5/15, can be viewed at the following link:
http://www.southburlingtonvt.gov/document_center/planning/Sewerage_Stormwater_Systems.pdf

7. Third Party Implementation

In accordance with the MS4 permit, a FRP requires identification of the name of any party, other than the permittee, that is responsible for implementing any portion of the FRP. A full list of VTDEC permits discharging to the Potash Brook and the type of system covered under the permit is included in Table 6. Several of the expired permits obtained new permit coverage under a Residual Designation Authority (RDA) permit from VTDEC.

Table 6: Existing VTDEC Permits

Permit Number	RDA/Other ¹	Project Name Where Permit is Located	Permittee	Permit Expiration Date	Existing Manner of Discharge ²
1-0239	6285-9030	Ridgewood Estates	Ridgewood Estates Homeowners Association	11/19/2014; 8/26/2013	CB, 2 DP (new), 1 DP upgrade
1-0464		Oak Creek Village	Butler Farms Inc.	12/31/1991	OF, GS, CB, (2) DP
1-0526	6279-9030	Woodlands Industrial Park	Woodland Commons Condominium Association	11/19/2014	DP
1-0538	7294-INDS; 7294-INDO	Price Chopper Pond	Pomerleau Real Estate Corp	3/31/1992	DP, GS
1-0647		Village at Dorset Park	Village at Dorset Park Community Assoc.	6/30/1993	(3) DP, CB
1-1020		Park Place	David Dubrul	3/31/1996	GS, OF
1-1033		Dorset Park Pond	City of South Burlington	3/31/1998	DP, GS
1-1155		Pinnacle at Spear	John Larkin; L&M Partnership	12/31/2003	CB, OF
1-1337	4442-9003	The Lane Press	The Lane Press	6/30/2003; 8/18/2011	IB
1-1380		South Burlington Community Housing	South Burlington Community Housing	9/30/2004	PP, IG
1-1391/ 1-1270/ 1-0839		Burlington International Airport	Heather Kendrew; Burlington International Airport	9/30/2004	IG, CB
1-1520		O'Brien Home Farm	Daniel and Leo O'Brien Jr.; dba Forest Park Realty Corp	10/9/2007	(3) DP, CB, GS
2-0100	7220-9020	Stonehedge	BAM Property Management	7/1/1985; 7/7/2016	DP, BR
2-0140		1 Kennedy Drive	Merv Brown	7/1/1987	PP, SF for 1st 1/2" only
2-0195		Healthy Living Wetland Pond	Mings Inc.	11/17/1983	OF, GS
2-0825		Twin Oaks Pond	Property Management Associates	6/30/1980	SF and RP for 1st 1/2" runoff
2-0909		South Burlington City Hall	City of South Burlington	7/1/1985	SF for 1st 1/2" runoff - NOT BUILT
2-0988	6391-INDS	Winding Brook	Winding Brook Homeowner's Association	7/1/1985; 12/7/2015	DP

Permit Number	RDA/Other ¹	Project Name Where Permit is Located	Permittee	Permit Expiration Date	Existing Manner of Discharge ²
6170-9020		Summerfield	John O'Brien; Buckthorn Group	8/12/2013	DP
6174-INDS.A		South Burlington High School	South Burlington School District	10/18/2015	(2) IB
1-1214		Shopping Center - Hannaford - Lowe's	Southland Plaza	9/30/2005	(2) DP, RS, GS
6204-9020		Fay Dr Pond	Allen Road Land Company, Inc	4/23/2014	DP
1-1254	4113-INDS	Technology Park Lot 8A	Technology Park Associates	9/30/2001	DP
1-0233		Key Bank	ICV Construction Inc.	5/1/1982	CB
1-0234	6322-9030	Quarry Hill South	Horizon Heights Condominiums Association	11/19/2014	CB
1-0237; 1-1013; 1-1290		Kennedy Dr. P4 Expansion	CPA Partnership	7/1/1982; 3/31/1996; 3/30/2002	CB, OF, OGS, GS
1-0242		Dorset Commons	Veve Associates	8/1/1982	CB
1-0503	6282-9030	UMall	University Mall Realty Trust	9/30/2003; 11/19/2014	(2) DP, (2) IG
1-0618	6853-9003; 6853-INDS	Dynapower	Burlington Properties LTD	12/31/1992	OF, GS, CB, (2) DP
1-0661		South Meadows Pond	c/o Richard Feeley; South Meadow Housing Associates	6/30/1993	CB, DP
1-0969	6295-9030	INS Building	INS	9/30/1995	(2) DP
1-0998		Retina Center	Daniel and Eugene Morrissey	12/31/1995	OF, GS, CB
1-1000	6291-9030	Adelphia Cable Communications	Comcast Cable	12/31/1995; 11/19/2014	DP, CB, GS
1-1015		Pillsbury Manor	John P Larkin	3/31/1996	DP
1-1117		The Pines	Pines Housing LP	12/31/1997	DP, CB
1-1269	4290-INDS	Meadowland	Attn: Mark R. Neagley; Summer Ice Joint Ventures	9/30/2001; 1/16/2013; 9/30/2015	(8) DP
1-1438		Farrell/ Eastwood Commons	D Farrell; S McConaughy & New Enterprises Inc.	9/30/2005	DP, CB
1-1452		Olympiad Apartments	Dan Morrissey; Sixty Farrell Street Associates	12/31/2005	DP
1-1458		Technology Park	Technology Park Partners	3/31/2006	DP, PW
1-1504		110 Kimball Ave	James Foster; 110-120 Kimball LLC	9/18/2006	(2) IB
1-1526	6269-9030	30 Kimball Ave	Kimball Partners, LLC	11/19/2014	DP
1-1582		Kennedy Dr	City of South Burlington	5/29/2008	(7) DP
2-0101		Ashbrook Dr	Ashbrook Park H.O. Assoc	7/1/1985	CB, GS
2-0144		Outback	Merv Brown	7/1/1985	IT for 1st 1/2", ST, GS
2-0167		Easy Self Storage	Easy Self Storage	7/1/1985	CB
2-0212		Fairpoint Communications	Gregory Myka; Verizon	7/1/1985	CB, OF, GS

Permit Number	RDA/Other ¹	Project Name Where Permit is Located	Permittee	Permit Expiration Date	Existing Manner of Discharge ²
2-0220		Dubois Dr	City of South Burlington	7/1/1985	CB, GS
2-0238; 2-0737		Grandview Dr	Carol Gamsby; CGPM Inc.	7/1/1985; 9/1/1983	CB, SF for 1st 1/2"
2-0312		Adirondack St	Butler Farms Inc	7/1/1986; 6/23/2013	CB
2-0619		Dorset Street Expansion	City of South Burlington	12/31/1992	CB, OF
2-0767	6553-INDO	Chelsea Cir	Art Dudek, President; Foxcroft Condominium Assoc.	6/30/1980; 4/22/2015	CB
2-0794		Brookwood Dr	Brookwood LTD	7/1/1980	CB
2-0811		Ace Hardware	LNP, Inc.	7/1/1980	ST
2-0824		Windridge Ct	Dan and Leo O'Brien; O'Brien Family Partnership	7/1/1980	CB
2-0878		Sugartree Ln	Dan Zang; SugarTree Condominium Association	6/30/1985	SF for 1st 1/2" runoff
2-0939	6275-9030; 6269-9030	Business Park North	Alan Palmer	7/1/1986; 11/19/2014	CB, OF, GS
2-1023; 2-0219		Wellesley Grove	Wellesley Grove Condominium Assoc.	7/1/1986; 7/1/1985	PP
2-1069		One Twin Oaks Assoc.	c/o Stephen Pitman; One Twin Oaks Assoc.	7/1/1987	IT for 1st 1/2" of runoff.
2-1171		Merchants Bank	Merchants Bank	7/1/1988	CB
2-0228	6293-9030	Vermont Gas Systems	James Mallowney; Vermont Gas Systems, Inc	7/1/1988; 11/19/2014	CB, OF, GS
2-0179	6318-9030	Church of Jesus Christ of Latter-Day Saints	The Church of Jesus Christ of Latter-Day Saints	7/1/1985; 11/19/2014	GS
1-1241	4049-9030; 4049-9030.1	Vt National Country Club	Vermont National Country Club	3/31/2001	(3) DP, CB, GS
1 - RDA: Residual Designation Authority- Private Permittees requests to have their expired stormwater system covered under an RDA permit, which overwrites their expired permit.					
2 - Manner of Discharge: CB: Catch Basin, GS: Grass Swale, RS: Retention Swale, ST: Settling Tank, OF: Control orifice, IB: Infiltration Basin, DP: Detention Pond, DW: Dry Well, IG: Infiltration Gallery, SF: Sand Filter, BR: Bioretention.					

7.1 Expired Permit Proposed Retrofits

All expired permit holders in the Potash Brook watershed will be required to obtain valid State stormwater permit coverage. This can be accomplished through a process that the State has identified in their current draft Stormwater Permitting Rule, or through the City's Stormwater Upgrade Feasibility Analysis (SUFA) process. Refer to sburlstormwater.com/download-material/ for the latest available version of the City's Stormwater Upgrade Feasibility Analysis (SUFA) document.

As noted in the SUFA, "FRPs for the stormwater impaired watersheds located in the City contain a preliminary assessment of the stormwater treatment potential of some sites. If an FRP identifies an STP on a site, then the site must install either the specified STP or an STP that provides equivalent or greater

treatment. In addition, final FRPs will contain a schedule indicating when various retrofits must occur. Properties that choose to construct STPs must do so before November 15, 2023, or the date specified in the FRP, whichever is sooner.” The City may revise the date included in the ordinance depending upon the dates included in the final version of State of Vermont Stormwater Permitting Rule. The City expects that VTDEC will finalize the rule in 2019. This will provide the City with sufficient time to update its ordinance.

The City has identified specific retrofit projects for BMPs with expired State of Vermont permits. These projects are included in Table C-1: Final Proposed BMPs for Potash Brook FRP in Appendix B. All other expired permits in the Potash Brook Watershed will be required to complete upgrades as determined by the technical standards included in the City’s SUFA.

8. Appendices

Appendix A - Existing Potash Brook Watershed BMPs

Table A-2: Post BMPDSS Model Existing Stormwater BMP List

Map A-1: Existing Stormwater BMP

Appendix B – Potash Brook FRP Proposed BMPs

Table C-1: Final Proposed BMPs for Potash Brook FRP

Map C-1: Existing and Proposed Potash Brook FRP BMPs

Potash Brook FRP BMP Summary Sheets

Appendix C – Project Ranking

Table D-1: BMP Ranking Criteria Key

Table D-2: BMP Ranking Scoring Key

Appendix D – Proposed BMP Cost Estimates, Prioritization Ranking, and Implementation Schedule

Table E-1: Potash Brook Watershed BMP Project Cost Estimates

Table E-2: Potash Brook Watershed BMP Project Scoring

Table E-3: Potash Brook Watershed BMP Project Implementation Schedule

APPENDIX A

EXISTING POTASH BROOK WATERSHED BMPs

Potash Brook FRP Phase I

Table A-2: Post2002 BMPDSS Model Existing SW BMP List
as of 7-11-16

Table A-2: Post2002 BMPDSS Model Existing Stormwater BMP List

#	Model	MS4	Pond Name	BMP Type	Current Permit Number	RDA/ Renewed/ Related Permit	Location (Cross Streets)	BMP Drainage Area (acres)
Burlington Airport								
1	Base	BTV	I3_South	Infiltration Gallery	1-0839	n/a	1200 Airport Dr.	6.02
2	Base	BTV	1-1391 Infiltration System	Infiltration Gallery	1-1391	n/a	1200 Airport Dr.	3.11
3	Base	BTV	I3_North	Infiltration Gallery	No Permit	n/a	1200 Airport Dr.	19.88
4	Base-new	BTV	BTV I4 North Infiltration	Infiltration Field	3028-INDS.A	n/a	1200 Airport Dr.	2.08
5	Base-new	BTV	BTV I4 South Infiltration	Infiltration Field	3028-INDS.A	n/a	1200 Airport Dr.	13.42
City of Burlington								
6	Base	Burlington	South Meadows Pond	Detention Pond	1-0661	n/a	Baird St/ S. Meadow Dr.	10.10
7	Post 2002	Burlington	Howard Center	Wet Pond	7372-9020	n/a	Bard St. / Pine St.	5.29
City of South Burlington								
8	Base	South Burlington	110 Kimball Ave - South IB	Infiltration Basin	1-1504	n/a	Kimball Ave/Comcast Wy	1.42
9	Base	South Burlington	110 Kimball Ave - North IB	Infiltration Basin	1-1504	n/a	Kimball Ave/Comcast Wy	1.43
10	Base	South Burlington	30 Kimball Ave Detention	Detention Swale	6269-9030	1-1526	30 Kimball Avenue	1.27
11	Base	South Burlington	Adelphia Cable Communications	Detention Pond	6291-9030	1-1000	Comcast Wy/Kimball Ave.	1.91
12	Base	South Burlington	Dynapower	Detention Pond	6853-INDS	1-0618	85 Meadowland Dr.	5.81
13	Base	South Burlington	Economou Farm Pond	Detention Pond	4049-9030	1-1241	Swift St. / Economou Farm Rd.	6.37
14	Base	South Burlington	Farrell/Eastwood Commons	Detention Pond	1-1438	n/a	Farrell St.	20.95
15	Base	South Burlington	INS Building Pond a	Detention Pond	1-0969	6295-9030 (abandoned)	70 Kimball Ave	2.11
16	Base	South Burlington	INS Building Pond b	Detention Pond	1-0969	6295-9030 (abandoned)	70 Kimball Ave	1.44
17	Base	South Burlington	Lane Press Printing Facility IB	Infiltration Basin	1-1337	n/a	Meadowland Dr.	4.17
18	Base	South Burlington	Meadowland Lot 4 Pond	Detention Pond	1-1269	1-1269	Meadowland Dr. /Bowdoin St.	2.76
19	Base	South Burlington	Olympiad Apartments	Detention Pond	1-1452	n/a	Farrell St./ Eastwood Dr.	9.65
20	Base	South Burlington	Pillsbury Manor	Detention Pond	1-1015	n/a	Williston Rd/ Pillsbury Manor N.	1.06
21	Base	South Burlington	S. Burlington Community Housing	Infiltration Gallery	1-1380	n/a	Anderson Pwky/ Williston Rd.	6.92
22	Base	South Burlington	Swift Estates Pond	Pond	Swift Estates	n/a	Meadowood Dr.	18.52
23	Base	South Burlington	Technology Park Culvert Detention P4	Detention Area	1-1458 P4	n/a	Kimball Ave/Community Drive	8.05
24	Base	South Burlington	Technology Park Field Detention P3	Detention Area	1-1458 P3	n/a	Kimball Ave/Community Drive	15.12
25	Base	South Burlington	The Pines	Detention Pond	1-1117	n/a	Aspen Dr./Dorset Dr.	12.67
26	Base	South Burlington	UMall SN 001 Underground Infiltration	Infiltration Gallery	1-0503	6282-9030	Dorset St	17.15
27	Base	South Burlington	UMall SN 002 Undergrond Infiltration	Infiltration Gallery	1-0503	6282-9030	Dorset St	5.61
28	Base	South Burlington	UMall SN 003 Detention Pond	Detention Pond	1-0503	6282-9030	Dorset St	16.90
29	Base	South Burlington	UMall SN 005 Sears Automotive Pond	Detention Pond	1-0503	6282-9030	Dorset St	1.15
30	Base	South Burlington	Vermont National Country Club Pond b	Detention Pond	4049-9030	1-1241	Golf Course Rd. (Near 13th Tee)	36.03
31	Base	South Burlington	Vermont National Country Club Pond c	Detention Pond	4049-9030	1-1241	Swift St. / Economou Farm Rd.	9.94
32	Base	South Burlington	Woodlands Industrial Park	Detention Pond	6279-9030	6279-9030	102 Kimball Ave. (Woodland Commons)	2.39
33	Base-new	South Burlington	Shunpike Infiltration Basin	Infiltration Basin	No Permit	n/a	Shunpike Rd/ Kimball Ave	0.78
34	Base-new	South Burlington	UVM Forestry Research Center	Dry Well	No Permit	n/a	Spear St	1.02
35	Base-new	South Burlington	Panurgy Infiltration Basin	Infiltration Basin	No Permit	n/a	Shunpike Rd/ Kimball Ave	1.33
36	Existing BMP Retrofit	South Burlington	Mountain View Business Park - Lot A	Detention Pond	5395-INDS	1-1536	62 Tilley Drive	6.05
37	Existing BMP Retrofit	South Burlington	Winding Brook Pond	Detention Pond	6391-INDS	2-0988	Winding Brook Drive	9.11
38	Existing BMP Retrofit-new	South Burlington	Dorset Park Pond	Detention Pond	1-1033	n/a	Swift St./Dorset St.	26.07
39	Existing BMP Retrofit-new	South Burlington	Foxcroft Pond	Detention Pond	6553-INDO upgrades	2-0848	Kinsington St./ Hayes Ave.	5.38
40	Existing BMP Retrofit-new	South Burlington	Hayes Avenue Pond	Detention Pond	6553-INDO upgrades	2-0848	Kinsington St./ Hayes Ave.	12.66
41	Existing BMP Retrofit-new	South Burlington	Meadowland P1	Detention Pond	4290-9020.1 Lot 1b	1-1269 lot 1b	Meadowland Dr.	30.58
42	Existing BMP Retrofit-new	South Burlington	Oak Creek Village Flow Splitter to Pond 2	Flow Splitter	1-0464	n/a	Moss Glen Lane/Hinesburg Rd.	5.28
43	Existing BMP Retrofit-new	South Burlington	Oak Creek Village Pond 2	Detention Pond	1-0464	n/a	Moss Glen Lane/Hinesburg Rd.	16.75
44	Existing BMP Retrofit-new	South Burlington	Oak Creek Village Pond 3	Detention Pond	1-0464	n/a	Moss Glen Lane/Hinesburg Rd.	7.78

#	Model	MS4	Pond Name	BMP Type	Current Permit Number	RDA/ Renewed/ Related Permit	Location (Cross Streets)	BMP Drainage Area (acres)
45	Existing BMP Retrofit-new	South Burlington	Price Chopper Pond	Detention Pond	7294-9020	1-0538	End of Midas Dr./Williston Rd.	99.49
46	Existing BMP Retrofit-new	South Burlington	Ridgewood Pond	In stream pond.	1-0239/6285-9030	n/a	Corner of Dorset St & Swift Street	38.40
47	Existing BMP Retrofit-new	South Burlington	Technology Park Pond 1	Detention Pond	4113-INDS	1-1254	Community Dr.	8.96
48	Existing BMP Retrofit-new	South Burlington	Village at Dorset Park Pond a	Detention Pond	1-0647	n/a	Swift St/Brand Farm Dr.	16.31
49	Existing BMP Retrofit-new	South Burlington	Village at Dorset Park Pond b	Detention Pond	1-0647	n/a	Swift St/Brand Farm Dr.	8.27
50	Existing BMP Retrofit-new	South Burlington	Village at Dorset Park Pond c	Detention Pond	1-0647	n/a	Swift St/Brand Farm Dr.	20.48
51	post 2002	South Burlington	Double Tree Pond	Detention Pond	No Permit	n/a	Williston Rd.	5.78
52	post 2002	South Burlington	East Mountain View Pond	Detention Pond	5042-INDS	n/a	1100 Hinesburg Road	2.44
53	post 2002	South Burlington	Farrell Street Bioretention	Bioretention	5080-INDS	n/a	19 Farrell Street	0.35
54	post 2002	South Burlington	Farrell Street Pond	Detention Pond	5080-INDS	n/a	19 Farrell Street	32.96
55	post 2002	South Burlington	Fay Dr. Pond	Detention Pond	6204-9020	n/a	725 Hinesburg Road	2.81
56	post 2002	South Burlington	Hannafords Pond	Detention Pond	1-1214	n/a	Hannaford Dr	14.71
57	post 2002	South Burlington	Healthy Living Wet Pond #1	Detention Pond	4461-INDS.A	n/a	222, 200, 196 & 192 Dorset Street	3.36
58	post 2002	South Burlington	Healthy Living Wetland Pond	Wetland Pond Area	4461-INDS.A	n/a	222, 200, 196, &192 Dorset St.	15.35
59	post 2002	South Burlington	Heatherfield P1	Detention Pond	3658-INDS	n/a	885 Dorset St.	1.40
60	post 2002	South Burlington	Heatherfield P2	Detention Pond	3658-INDS	n/a	885 Dorset St.	10.76
61	post 2002	South Burlington	Heatherfield P3	Detention Pond	3658-INDS	n/a	885 Dorset St.	4.30
62	post 2002	South Burlington	Heatherfield Offset Pond	Detention Pond	3864-NDO	n/a	Dorset and Spear St.	23.93
63	post 2002	South Burlington	Kennedy Dr. P1	Detention Pond	1-1582	n/a	Kennedy Drive	1.47
64	post 2002	South Burlington	Kennedy Dr. P2	Detention Pond	1-1582	n/a	Kennedy Drive	2.16
65	post 2002	South Burlington	Kennedy Dr. P3	Detention Pond	1-1582	n/a	Kennedy Drive	2.11
66	post 2002	South Burlington	Kennedy Dr. P4	Detention Pond	1-1582	n/a	Kennedy Drive	1.41
67	post 2002	South Burlington	Kennedy Dr. P5	Detention Pond	1-1582	n/a	Kennedy Drive	0.70
68	post 2002	South Burlington	Kennedy Dr. P6	Detention Pond	1-1582	n/a	Kennedy Drive	0.66
69	post 2002	South Burlington	Kennedy Dr. P7	Detention Pond	1-1582	n/a	Kennedy Drive	1.82
70	post 2002	South Burlington	K-Mart Retrofit IB	Infiltration Gallery	5406-9020	n/a	Hannaford Drive	1.70
71	post 2002	South Burlington	Lot 1 Mountainview Pond	Detention Pond	3805-INDS.2	n/a	Tilley Drive, off of Rt. 116 (Hinesburg Rd)	3.92
72	post 2002	South Burlington	Lot 3 Mountainview Pond	Detention Pond	3805-INDS.3	n/a	Tilley Drive, off of Rt. 116 (Hinesburg Rd)	2.11
73	post 2002	South Burlington	Lot 4 Mountainview P1	Detention Pond	3805-INDS.1	n/a	Tilley Drive, off of Rt. 116 (Hinesburg Rd)	2.27
74	post 2002	South Burlington	Lot 4 Mountainview P2	Detention Pond	3805-INDS.1	n/a	Tilley Drive, off of Rt. 116 (Hinesburg Rd)	1.81
75	post 2002	South Burlington	Lowes Pond	Detention Pond	1-1214	n/a	Hannaford Dr.	12.73
76	post 2002	South Burlington	Meadowland Lot 2 Pond	Detention Pond	4290-INDC lot 2	1-1269	472 Meadowland Drive, 66 Bowdoin St.	5.85
77	post 2002	South Burlington	Meadowland Lot 8&9 Filter	Filter	5913-9020.1	1-1269	65 and 103 Bowdoin Street	0.22
78	post 2002	South Burlington	Meadowland Lot 8&9 North Pond	Detention Pond	5913-9020.1	1-1269	65 and 103 Bowdoin Street	1.29
79	post 2002	South Burlington	Meadowland Lot 8&9 South Pond	Detention Pond	5913-9020.1	1-1269	65 and 103 Bowdoin Street	1.73
80	post 2002	South Burlington	Meadowland Bus. Park Pond #2	Detention Pond	4290-9020.3 Lot 10	1-1269	472 Meadowland Dr	13.46
81	post 2002	South Burlington	Mountain View Business Park, Lot B	Detention Pond	3622-INDS	n/a	116 Hinesburg Rd.	2.33
82	post 2002	South Burlington	Mountain View Office Park Pond b	Detention Pond	3805-INDS	n/a	Tilley Drive, off of Rt. 116 (Hinesburg Rd)	0.90
83	post 2002	South Burlington	Oak Creek Village Micropool	Detention Pond	6009-9020	n/a	Hinesburg Road, Butler Drive, Fox Run Lane	5.80
84	post 2002	South Burlington	Obrien Pond a	Detention Pond	1-1520	n/a	Stonington Circle & Eldredge Street	31.76
85	post 2002	South Burlington	Obrien Pond b	Detention Pond	1-1520	n/a	Stonington Circle & Eldredge Street	3.08
86	post 2002	South Burlington	Obrien Pond c	Detention Pond	1-1520	n/a	Stonington Circle & Eldredge Street	4.06
87	post 2002	South Burlington	Quarry Hill Pond	Detention Pond	3602-INDS	n/a	Quarry Hill Road	21.75
88	post 2002	South Burlington	SBHS IB North	Infiltration Basin	6174-INDS.A	n/a	Dorset St.	0.21
89	post 2002	South Burlington	SBHS IB South	Infiltration Basin	6174-INDS.A	n/a	Dorset St.	0.46
90	post 2002	South Burlington	St. John Vianney Church IB	Infiltration Basin	3745-INDS	n/a	160 Hinesburg Road	4.17
91	post 2002	South Burlington	Technology Park Lot 2 PW	Pocket Wetland	1-1458	n/a	Kimball Ave/Community Drive	2.66
92	post 2002	South Burlington	Technology Park Lot 3 PW	Pocket Wetland	1-1458	n/a	Kimball Ave/Community Drive	3.85
93	post 2002	South Burlington	The Rock Pond A	detention pond	4207-INDC	1-1269	Meadowland Business Park	1.12
94	post 2002	South Burlington	The Rock Pond B	Detention Pond	4207-INDC	1-1269	Meadowland Business Park	1.85
95	post 2002	South Burlington	Trader Joes Median Swale	Infiltration Swale	4461-INDS.A	n/a	222, 200, 196, &192 Dorset St.	0.56
96	post 2002	South Burlington	Trader Joes Wet Pond #2	Wet Pond	4461-INDS.A	n/a	222, 200, 196, &192 Dorset St.	1.72
97	post 2002	South Burlington	Twin Oaks Pond	Detention Pond	5358-9020	2-0825	Twin Oaks Terrace, Kennedy Drive	19.81
98	post 2002	South Burlington	Vt Assoc. for the Blind- IG 1	Infiltration Gallery	5717-INDS	n/a	Kimball Avenue	1.19
99	post 2002	South Burlington	Vt Assoc. for the Blind- IG 2	Infiltration Gallery	5717-INDS	n/a	Kimball Avenue	0.56
100	post 2002 new	South Burlington	1060 Hinesburg Rd Parking lot	Detention Pond	6499-9020	n/a	1060, 1070 and 1080 Route 116	2.87

#	Model	MS4	Pond Name	BMP Type	Current Permit Number	RDA/ Renewed/ Related Permit	Location (Cross Streets)	BMP Drainage Area (acres)
101	post 2002 new	South Burlington	Butler Farms Pond	Detention Pond	6660-9020	n/a	Route 116, Butler Drive, Marcy Street	33.56
102	post 2002 new	South Burlington	City Hall Bioretention	Bioretention Basin	2-0909	n/a	575 Dorset St.	0.82
103	post 2002 new	South Burlington	City Hall Underground Storage	Underground Storage	2-0909	n/a	575 Dorset St.	2.43
104	post 2002 new	South Burlington	Dorset St Hotel Pond #1	Wet Pond	6970-9020	n/a	5 Dorset St.	2.97
105	post 2002 new	South Burlington	Dorset St Hotel Pond #2	Wet Pond	6970-9020	n/a	5 Dorset St.	1.01
106	post 2002 new	South Burlington	Elsom Pkwy System	Perforated Pipe	Mayfair Park Improvement	n/a	Elsom Pkwy	6.98
107	post 2002 new	South Burlington	Farrell Park Constructed Wetland	Constructed Wetland	No Permit	n/a	Swift St. / Farrell St.	1.37
108	post 2002 new	South Burlington	Hayes Apartments Stormwater Pond	Detention Pond	1-0839	n/a	635 Hinesburg Rd	1.98
109	post 2002 new	South Burlington	Indian Creek Dry Detention Basin 1	Detention Pond	1-0239/6285-9030	n/a	Corner of Dorset St & Swift Street	6.13
110	post 2002 new	South Burlington	Indian Creek Dry Detention Basin 2	cul-de-sac pond	1-0239/6285-9030	n/a	Corner of Dorset St & Swift Street	8.98
111	post 2002 new	South Burlington	Mayfair St System	Perforated Pipe	Mayfair Park Improvement	n/a	Elsom Pkwy	8.42
112	post 2002 new	South Burlington	Meadowland Bus. Park Lot 5 Pond	Detention Pond	4290-9020.2 Lot 5	1-1269	472 Meadowland Dr	2.71
113	post 2002 new	South Burlington	Meadowland Bus. Park Lot 6 Pond	Detention Pond	4319-INDC lot 6	1-1269	104 Bowdoin St	2.40
114	post 2002 new	South Burlington	Meadowlands Business Complex Lot 1C	Future Detention Pond	4290-9020.4 Lot 1C	n/a	472 Meadowland Drive, 66 Bowdoin St	2.70
115	post 2002 new	South Burlington	North West Bioretention	Bioretention Basin	7220-9020	n/a	Stonehedge Drive	5.74
116	post 2002 new	South Burlington	Ryes Associates - Dry Pond	Dry Pond	7017-INDS	n/a	Hinesburg Rd/Fox Run Lane	3.12
117	post 2002 new	South Burlington	Ryes Associates - Pond #1	Wet Pond	7017-INDS	n/a	Hinesburg Rd/Fox Run Lane	9.99
118	post 2002 new	South Burlington	Ryes Associates - Pond #2	Wet Pond	7017-INDS	n/a	Hinesburg Rd/Fox Run Lane	2.67
119	post 2002 new	South Burlington	South East Bioretention	Bioretention Basin	7220-9020	n/a	Stonehedge Drive	0.82
120	post 2002 new	South Burlington	South West Bioretention	Bioretention Basin	7220-9020	n/a	Stonehedge Drive	3.92
121	post 2002 new	South Burlington	Stonehedge Detention Pond	Detention Pond-Future	7220-9020	n/a	Stonehedge Drive	40.18
122	post 2002 new	South Burlington	Summerfield Pond	Detention Pond	6170-9020	n/a	1404 Hinesburg Rd.	4.26
123	post 2002 new	South Burlington	UVM Dialysis Center Bioretention	Bioretention	7317-INDS	n/a	35 Joy Dr.	0.45
124	post 2002 new	South Burlington	UVM Dialysis Center Infiltration	Infiltration Basin	7317-INDS	n/a	35 Joy Dr.	0.19
125	post 2002 new	South Burlington	Happy Tails	Grassed Channel	No Permit	n/a	1045 Hinesburg Road	1.06
126	post 2002 new	South Burlington	Blackbay Ventures Inf Chamber 1	Underground Storage	No Permit	n/a	135 Hinesburg Road	0.33
127	post 2002 new	South Burlington	Blackbay Ventures Inf Chamber 2	Underground Storage	No Permit	n/a	135 Hinesburg Road	0.22
127	post 2002 new	South Burlington	Market Street East Pond	Detention Pond	7483-INDS	n/a	Market Street	1.05
128	post 2002 new	South Burlington	Market Street West Pond	Detention Pond	7483-INDS	n/a	Market Street	3.24

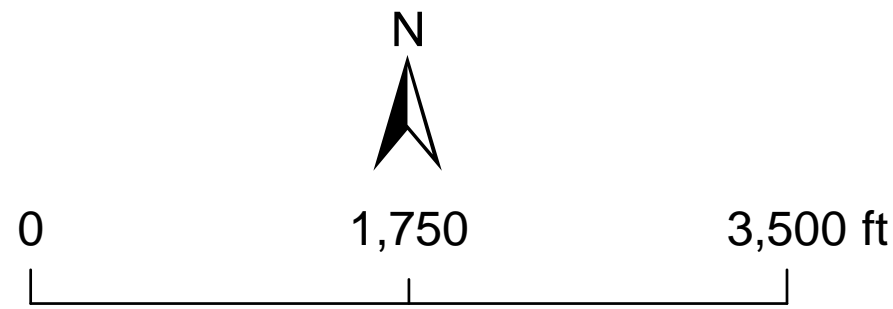
Legend

- Stream Centerlines
- Stormwater BMPs
- Subwatershed Boundaries
- Watershed Boundary
- MS4 Boundaries
- Town Boundaries
- BMP Drainage Areas**
- Base
- Base - new
- Existing BMP Retrofit
- Existing BMP Retrofit - new
- Post 2002
- Post 2002 - new

Stormwater Permits

- Construction
- Expired
- INDO
- INDS
- MSGP-9003
- RDA

Table 1: Drainage Area Scenario Groupings		
Grouping ID	BMPDSS Model Scenario	Description
Base	Pre-2002	BMP added to model by VT DEC as of April 2015. Includes BMPs implemented prior to 2002. BMPs were not designed to meet VT SWMM design standards.
Base - new	Pre-2002	BMP added to model by the HTA-WCA Team as a part of Potash Brook FRP Project after April 2015. Includes BMPs implemented prior to 2002.
Existing BMP Retrofit	Post-2002	BMP added to model by VT DEC as of April 2015. Includes retrofits to existing BMPs implemented after 2002, designed to meet VT 2002 SWMM Standards.
Existing BMP Retrofit - new	Post-2002	BMP added to model by the HTA-WCA Team as a part of Potash Brook FRP Project after April 2015. Includes retrofits to existing BMPs implemented after 2002, designed to meet VT 2002 SWMM Standards.
Post 2002	Post-2002	BMP added to model by VT DEC as of April 2015. Includes BMPs implemented after 2002, designed to meet VT 2002 SWMM Standards.
Post 2002 - new	Post-2002	BMP added to Post 2002 BMPDSS model by the HTA-WCA Team as a part of Potash Brook FRP Project after April 2015. Includes BMPs implemented after 2002, designed to meet VT 2002 SWMM Standards.



Map A-1 - Existing Stormwater BMPs
Potash Brook Watershed
South Burlington, VT

APPENDIX B

POTASH BROOK FRP PROPOSED BMPs

Potash Brook FRP
Table C-1: Final Proposed BMPs for the Potash Brook FRP

Proposed BMP ID #	Project Name	BMP Address	BMP Landowner	MS4s with Impervious Area	New or Existing	BMP Type	BMP Description	Expired Permit #	Drainage Area (acres)	Impervious Area Managed (acres)	Impervious %	CPv Managed (ac-ft)	Volume Infiltrated (ac-ft)	WQ Volume controlled (%)
PB0001	1050 Hinesburg Road	1050 Hinesburg Rd, South Burlington	Private	South Burlington, VTrans	New	GW	There is an existing wet depression here where stormwater is already routed. Propose gravel wetland and meet CPv standards.	No Permit	1.43	0.74	52%	0.111	0	100%
PB0002	110 Kimball Ave - North Infiltration Basin	110 Kimball Ave, South Burlington	Private	South Burlington	Existing	IB	Runoff is bypassing infiltration basin with direct discharge to the brook. Add trench along west edge of parking lot to direct runoff to infiltration basin. Expand basin to accommodate increased volume.	1-1504a	1.51	0.58	38%	0.024	0.04	100%
PB0003	110 Kimball Ave - South Infiltration Basin	110 Kimball Ave, South Burlington	Private	South Burlington	Existing	IB	Retrofit outlet structure and add proposed outlet control riser that was not constructed.	1-1504b	1.42	0.94	66%	0.053	0.06	100%
PB0004	189 Cloverleaf Detention Pond	Shelburne Rd and Queen City Pkwy, South Burlington	MS4 Owned	South Burlington, VTrans, Burlington	New	DP	Add outlet structure to area that is already depressed to detain stormwater. Reroute stormline from Shelburne Rd to this area.	No Permit	21.25	12.14	57%	1.129	0	100%
PB0005	189 Ramp Detention Pond	Dorset St and 189 Ramps, South Burlington	MS4 Owned	South Burlington, VTrans	New	GW	Detain stormwater from a large section of Dorset St. Intercept stormline near Kennedy Dr and reroute to the area between 189 ramps. Treat with gravel wetland.	2-0619	9.36	5.78	62%	0.348	0	100%
PB0006	30 Kimball Ave Swale Retrofit	30 Kimball Ave, South Burlington	Private	South Burlington	Existing	DS	Retrofit existing swale detention to meet CPv. Expand swale to accommodate modified outlet structure.	1-1526; 6269-9030	1.27	1.05	82%	0.025	0	100%
PB0007	Adelphia Cable Pond Retrofit	Kimball Ave and Adelphia Dr, South Burlington	Private	South Burlington	Existing	GW	Reroute drainage from Kimball Ave to this detention pond behind Adelphia Cable. Retrofit and expand existing pond into a gravel wetland to detain CPv.	1-1000; 6291-9030	4.15	2.66	64%	0.086	0	100%
PB0008	Adirondack Street	Adirondack St and Butler Dr, South Burlington	Private	South Burlington	New	UD	Construct underground detention chambers under ROW and grassed shoulder.	2-0312	11.95	3.52	29%	0.580	0	100%
PB0009	Airport Drive	Airport Dr and Airport Rd, South Burlington	MS4 Owned	South Burlington, BTV	New	IG	Construct subsurface infiltration chambers in southernmost lot where houses will be removed. Intercept stormline running south down Airport Dr.	No Permit	9.65	2.70	28%	0.455	0.46	100%
PB0010	Ashbrook Drive	Ashbrook Dr and Dorset St, South Burlington	Private	South Burlington	New	GW	Reroute stormwater to gravel wetland southwest of Dorset St behind apartment buildings.	2-0101	2.49	0.88	35%	0.178	0	100%
PB0011	Blue Mall Infiltration	Dorset St south of Market St, South Burlington	Private	South Burlington	New	IG	Construct underground infiltration chambers in the southwest edge of parking lot. Overflow to existing stormline that flows to Dorset St.	2-0144	2.49	2.40	97%	0.367	0.37	100%
PB0012	Brookwood Drive Pond	Brookwood Dr off of Dorset St, South Burlington	Private	South Burlington	New	DP	Construct new detention pond to detain this large outfall. Forebay to be located in empty lot near Brookwood Dr.	2-0794; 2-0619	41.24	24.49	59%	1.998	0	100%
PB0013	Burlington Price Chopper	Shelburne Rd, Burlington	Private	Burlington	New	GW	Construct new gravel wetland in area between parking lot and stream to the south of parking lot.	No Permit	12.69	11.48	90%	1.229	0	100%
PB0014	Chelsea Circle	Chelsea Cir and Hayes Ave, South Burlington	Private	South Burlington	New	IB	Construct new infiltration basin constructed to south of existing swale, which receives flow from Chelsea Cir condos and Timberlane Dental parking lot. Neighborhood icing and flooding issues can be mitigated with this project.	2-0767	3.28	1.82	56%	0.292	0.29	100%
PB0015	Church of Jesus Christ of Latterday Saints	Swift St and Dorset St, South Burlington	Private	South Burlington	New	DS	Add detention to swale to the west of parking area with outlet control to detain CPv	2-0179; 6318-9030	3.12	1.58	51%	0.099	0	100%
PB0016	Community Bible Church Infiltration	Williston Rd and Millham Ct, South Burlington	Private	South Burlington	New	IT	Construct linear infiltration trench (perforated pipe) along back of several businesses.	No Permit	10.34	6.17	60%	0.912	0.91	100%
PB0017	Domino's	Swift St and Farrell St, South Burlington	Private	South Burlington	New	GW	Construct a gravel wetland pond behind parking area. Add catchbasin along Swift St to also capture half of the road drainage.	No Permit	2.30	1.34	58%	0.231	0	100%
PB0018	Dorset Commons Pond	Dorset St and Town Square Dr, South Burlington	Private	South Burlington	New	DP	Construct new detention pond in wooded area behind Dorset Commons.	1-0242	17.54	5.01	29%	0.602	0	100%
PB0019	Dumont Park Stormwater Project	Barrett St and Obrien Dr, South Burlington	Private	South Burlington, VTrans	New	DP	Construct new detention pond to the north of Barrett St where two stormlines converge.	No Permit	9.56	4.16	43%	0.269	0	100%
PB0020	Dynapower	Hinesburg Rd and Meadowland Dr, South Burlington	Private	South Burlington	Existing	GW	Reroute roof drainage to existing detention pond. Retrofit to gravel wetland and detain CPv.	1-0618	12.20	6.50	53%	0.952	0	100%

Proposed BMP ID #	Project Name	BMP Address	BMP Landowner	MS4s with Impervious Area	New or Existing	BMP Type	BMP Description	Expired Permit #	Drainage Area (acres)	Impervious Area Managed (acres)	Impervious %	CPv Managed (ac-ft)	Volume Infiltrated (ac-ft)	WQ Volume controlled (%)
PB0021	East Terrace Detention Pond	East Terrace, South Burlington	Private	South Burlington	New	GW	Construct new gravel wetland near the outfall to the east side of East Terrace.	No Permit	6.36	2.28	36%	0.344	0	100%
PB0022	Eastwood Commons Pond Expansion	Farrell St, South Burlington	Private	South Burlington	Existing	DP	Reroute area to the west of existing pond (eastern side of Shaw's plaza) to this pond. Add a new connection between these stormwater systems to the east of the Shaw's property. Expand pond and modify outlet structure to accommodate additional drainage.	1-1438	28.39	20.78	73%	0.728	0	100%
PB0023	Easy Self Storage	Swift St and Shelburne Rd, South Burlington	Private	South Burlington	New	GW	Create new gravel wetland to the north of the storage area.	2-0167	1.87	1.21	65%	0.203	0	100%
PB0024	Economou Farm Pond	Economou Farm Rd, South Burlington	Private	South Burlington	Existing	GW	Retrofit existing dry pond to gravel wetland to detain CPv. Expand and add forebay.	1-1241d	6.37	1.46	23%	0.669	0	100%
PB0025	Exit 13 Gravel Wetland	I-89 Exit 13, South Burlington	MS4 Owned	VTrans	New	GW	Propose new gravel wetland in depressed triangle greenspace between ramps. Reroute several culverts to this area.	No Permit	16.72	5.57	33%	0.567	0	100%
PB0026	Exit 14 Gravel Wetland	I-89 Exit 14, South Burlington	MS4 Owned	VTrans	New	GW	Propose new gravel wetland in depressed triangle greenspace between ramps. Reroute several culverts to this area.	No Permit	4.91	1.93	39%	0.294	0	100%
PB0027	Fairpoint Communications	Hinesburg Rd south of I-89, South Burlington	Private	South Burlington	New	GW	Construct new gravel wetland to the east of property in grassed area. Two outfalls on site drain to wetland swales that need to be rerouted to the east.	2-0212	8.75	4.76	54%	0.591	0	100%
PB0028	Faith United Methodist Church	Dorset St south of Songbird Ln, South Burlington	Private	South Burlington	New	UD	Construct new underground detention behind church (northwest) in grassy area. Current outfall is eroded.	No Permit	1.68	1.03	61%	0.149	0	100%
PB0029	Golf Course Road South	Golf Course Rd and Old Cross Rd, South Burlington	Private	South Burlington	New	GW	Construct new gravel wetland at the end of pipe before it enters the golf course. Existing infrastructure already drains to swale.	1-1241	5.19	1.67	32%	0.232	0	100%
PB0030	Gonzo's Underground	Williston Rd east of Kennedy Dr, South Burlington	Private	South Burlington, VTrans	New	UD	Propose to intercept stormline that flows west along Williston Rd to underground detention chambers under grassed area in front of Budget Car Rental / Gonzo's plaza.	2-0811	13.62	8.72	64%	0.451	0	100%
PB0031	Grandview Drive North Detention Pond	Grandview Dr and W Twin Oaks Terr, South Burlington	Private	South Burlington	New	DP	Construct new surface detention BMP following outfall, which is currently broken and experiencing significant erosion.	2-0238; 2-0737	3.02	1.38	46%	0.142	0	100%
PB0032	Grandview Drive West Detention Pond	Grandview Dr and Dorset St, South Burlington	Private	South Burlington	New	DP	Construct new surface detention basin to the west of Dorset St. Reroute stormline away from brook to new BMP.	2-0238; 2-0737	3.14	1.89	60%	0.179	0	100%
PB0033	Hawthorne Circle Detention Pond	Hawthorne Cir and Kennedy Dr, South Burlington	Private	South Burlington	New	GW	Construct new gravel wetland in greenspace formed in the triangle between three garages.	No Permit	4.95	2.55	51%	0.150	0	100%
PB0034	Helen Ave Cul De Sac	Helen Ave, South Burlington	Private	South Burlington	New	IB	Construct new infiltration basin in the cul de sac at the end of Helen Ave, which would provide significant water quality benefit.	No Permit	5.70	2.15	38%	0.354	0.35	100%
PB0035	Hinesburg Road	Hinesburg Rd and Deane St, South Burlington	Private	South Burlington, VTrans	New	DP	Reroute stormwater to existing catchbasin on Deane St and detain to the west of Hinesburg Rd to the south of existing houses.	No Permit	3.53	1.27	36%	0.138	0	100%
PB0036	I-89 Swale	Between I-89 N and S lanes west of Hinesburg Rd, South Burlington	MS4 Owned	VTrans	New	MF	Construct median filter in depressed area between north and south I-89 lanes. Reroute several culverts.	No Permit	6.28	1.91	30%	0.531	0	100%
PB0037	Iby Gravel Wetland	Iby St off of Hinesburg Rd, South Burlington	Private	South Burlington	New	GW	Construct new gravel wetland at the end of Iby St to capture stormwater for the street.	No Permit	2.82	1.14	40%	0.067	0	100%
PB0038	INS Building Pond A Retrofit	Kimball Ave west of Community Dr, South Burlington	Private	South Burlington	Existing	GW	Retrofit existing detention pond into gravel wetland. Add forebay and construct outlet structure with low flow orifice to meet CPv standards.	1-0969	2.11	0.98	47%	0.040	0	100%
PB0039	INS Building Pond B Retrofit	Kimball Ave west of Community Dr, South Burlington	Private	South Burlington	Existing	GW	Retrofit existing detention pond into gravel wetland. Add forebay and construct outlet structure with low flow orifice to meet CPv standards.	1-0969b	1.44	0.61	42%	0.040	0	100%
PB0040	Joy Dr Detention Pond	Joy Dr, South Burlington	Private	South Burlington	New	GW	Construct new gravel wetland area in adjacent flat area near the Green Mountain Power transmission corridor.	No Permit	3.07	1.34	44%	0.210	0	100%
PB0041	Kennedy Dr Pond 2 Expansion	Kennedy Dr and W Twin Oaks Terr, South Burlington	MS4 Owned	South Burlington	Existing	GW	Retrofit existing detention pond to accommodate additional drainage from The Edge and 1 Twin Oaks.	1-1582b; 2-1069	3.89	2.36	61%	0.159	0	100%

Proposed BMP ID #	Project Name	BMP Address	BMP Landowner	MS4s with Impervious Area	New or Existing	BMP Type	BMP Description	Expired Permit #	Drainage Area (acres)	Impervious Area Managed (acres)	Impervious %	CPv Managed (ac-ft)	Volume Infiltrated (ac-ft)	WQ Volume controlled (%)
PB0042	Kennedy Dr Pond 3 Expansion	Kennedy Dr west of Timber Ln, South Burlington	MS4 Owned	South Burlington	Existing	GW	Reroute culvert that crosses under access ramp to pond, expand footprint and retrofit to gravel wetland	1-1582c	6.39	4.82	75%	0.175	0	100%
PB0043	Kennedy Dr Pond 4 Expansion	Kennedy Dr and Hinesburg Rd, South Burlington	MS4 Owned	South Burlington, VTrans	Existing	DP	Reroute stormline from Chatham Green and swale along Hinesburg Rd to existing detention pond. Expand pond to accommodate additional drainage area and detain CPv.	1-1582d; 1-0237; 1-1023; 1-1290	10.07	4.78	47%	0.252	0	100%
PB0044	Kennedy Dr Pond 7 Expansion	Kennedy Dr north of Kimball Ave, South Burlington	MS4 Owned	South Burlington	Existing	DP	Reroute stormline that currently outfalls behind Key Bank to existing detention pond. Add CMAC valve to detain CPv.	1-1582g; 1-0233	11.24	8.67	77%	0.583	0	100%
PB0045	K-Mart Plaza Infiltration	Shelburne Rd north of Hannaford Dr, South Burlington	Private	South Burlington	New	IG	Construct new underground infiltration chambers in K-Mart parking lot.	No Permit	8.86	7.68	87%	0.863	0.10	100%
PB0046	Knoll Circle	Knoll Cir north of Dubois Dr, South Burlington	Private	South Burlington	New	GW	Construct new gravel wetland with swale inlet. Current stormline draining subdivision already enters swale, which also drains area to the west.	2-0220	12.16	2.16	18%	0.802	0	100%
PB0047	Lane Press Roof	Meadowland Dr, South Burlington	Private	South Burlington	New	IB	Capture roof drainage in a new infiltration basin. Roof drains already flows to grassed area where treatment is proposed.	1-1337	5.57	4.17	75%	0.691	0.69	100%
PB0048	Laurel Hill Drive	Laurel Hill Dr off of Shelburne Rd, South Burlington	Private	South Burlington	New	IB	Construct new infiltration basin to the north of houses before stormline pipe enters riparian buffer.	No Permit	6.50	1.84	28%	0.405	0.41	100%
PB0049	Lilac Ln Infiltration Basin	Lilac Ln off of Hinesburg Rd, South Burlington	Private	South Burlington	New	IB	Formalize infiltration basin in depressed area at the end of Lilac Ln.	No Permit	1.46	0.85	58%	0.131	0.13	100%
PB0050	Lindenwood Drive Detention Pond	Lindenwood Dr off of Shelburne Rd, South Burlington	Private	South Burlington	New	DP	Add catchbasins and infrastructure to reroute stormwater to the east of Lindenwood Dr. Part of Brewer Pkwy drains to this area as well. Propose to create one detention basin to detain drainage from both streets. Lindenwood Dr has existing puddling and icing issues. This BMP would also mitigate those issues.	No Permit	10.57	2.19	21%	0.205	0	100%
PB0051	Logwood Neighborhood Detention Pond	Williston Rd south of intersection with Airport Rd, South Burlington	Private	South Burlington	New	DP	Construct new end of pipe surface impoundment BMP behind Lean Dental Group. Outfall is currently eroded.	No Permit	44.81	18.44	41%	0.606	0	100%
PB0052	Marcotte Central School	Market St near Dorset St intersection, South Burlington	MS4 Owned	South Burlington	New	GW	Construct new gravel wetland in wooded area directly south of school parking lot. Route outfall to existing stormline. Potential educational benefit.	No Permit	2.11	1.83	87%	0.186	0	100%
PB0053	Marine Connection	Williston Rd and Shunpike Rd, South Burlington	Private	South Burlington	New	DS	Add detention to existing swale near the back of the large Marine Connection building. Expand swale to accommodate additional volume.	No Permit	10.79	4.73	44%	0.214	0	100%
PB0054	Meadowland Business Park Pond 2	Meadowland Dr, South Burlington	Private	South Burlington, VTrans	Existing	DP	Retrofit existing detention pond. Add forebay and CMAC valve to detain CPv.	1-1269_4290-9020.3 Lot 10	13.46	5.13	38%	1.704	0	100%
PB0055	Merchant's Bank Detention Pond	Kimball Ave and Kennedy Dr, South Burlington	Private	South Burlington	New	DP	Route stormwater from Allstate Insurance west to Merchant's Bank and provide detention in grassed area	2-1171; 6275-9030; 6269-9030; 2-0939	4.36	3.17	73%	0.228	0	100%
PB0056	Spear St	Spear St north of I-89, South Burlington	MS4 Owned	South Burlington, Burlington, UVM	New	GW	Install gravel wetland at the end of the drainage system along Spear Street.	No Permit	79.01	4.90	6%	2.140	0	100%
PB0057	Nicklaus Circle	Nicklaus Cir off of Dorset St, South Burlington	Private	South Burlington	New	GW	Construct new gravel wetland feature to the north of Nicklaus Cir where the stormline and swale converge.	1-1241, 4049-9030	9.25	2.23	24%	0.537	0	100%
PB0058	North Country Credit North West Infiltration	Swift St west of Shelburne Rd, South Burlington	Private	South Burlington	New	IT	Install perforated pipe to the north of parking lot in grassed area to infiltrate stormwater.	No Permit	0.25	0.21	84%	0.026	0.03	100%
PB0059	North Country Credit South Infiltration	Swift St west of Shelburne Rd, South Burlington	Private	South Burlington	New	IG	Construct underground infiltration chambers in the southeast corner of parking lot. Overflow to existing stormline.	No Permit	0.76	0.62	81%	0.119	0.12	100%
PB0060	O'Brien Drive Underground Detention	Obrien Dr, South Burlington	Private	South Burlington	New	UD	Construct underground storage chambers in open lot between existing houses.	No Permit	8.47	2.87	34%	0.536	0.54	100%

Proposed BMP ID #	Project Name	BMP Address	BMP Landowner	MS4s with Impervious Area	New or Existing	BMP Type	BMP Description	Expired Permit #	Drainage Area (acres)	Impervious Area Managed (acres)	Impervious %	CPv Managed (ac-ft)	Volume Infiltrated (ac-ft)	WQ Volume controlled (%)
PB0061	Olympiad Apartments & Office Building Pond Retrofit	Farrell St south of Eastwood Dr, South Burlington	Private	South Burlington	Existing	GW	Retrofit detention basin to gravel wetland. Add forebay and ensure pond detains CPv.	1-1452	9.65	3.68	38%	0.055	0	100%
PB0062	Panurgy Infiltration Basin	Kimball Ave and Shunpike Rd, South Burlington	Private	South Burlington	Existing	IB	Retrofit and expand existing infiltration basin to infiltrate the CPv.	3409-9010	1.33	0.8	60%	0.081	0.14	100%
PB0063	Park Road Detention Pond	Park Rd off of Dorset St, South Burlington	Private	South Burlington	New	DP	Propose to reroute swale on southern side of Park Rd to the north and detain in wooded area.	1-1241	6.96	1.27	18%	0.421	0	100%
PB0064	Pillsbury Manor Infiltration Basin Retrofit	Pillsbury Manor N and Williston Rd, South Burlington	Private	South Burlington	Existing	IB	Retrofit existing pond to infiltration basin. Overflow to existing culvert.	1-1015	1.06	0.40	38%	0.068	0.07	100%
PB0065	Quarry Hill South	Quarry Hill Rd off of Spear St, South Burlington	Private	South Burlington	New	DS	Add detention to existing swale running northeast behind garages.	6322-9030	5.62	2.52	45%	0.478	0	100%
PB0066	Queen City Park Road Detention Pond	Queen City Park Rd off of Shelburne Rd, South Burlington	MS4 Owned	South Burlington, VT	New	DP	Add detention to existing depressed area where stormlines already outfall. Drainage from Shelburne Rd is assumed to be already rerouted to larger depression to the north (see project entitled 189 Cloverleaf).	No Permit	6.51	2.98	46%	0.452	0	100%
PB0067	Shaws West	Shelburne Rd north of 189, South Burlington	Private	South Burlington	New	UD	Construct underground detention in vegetated island along west side of parking lot. Reroute last catchbasin in southwest corner of parking to this area.	No Permit	1.85	1.71	93%	0.157	0	100%
PB0068	South Burlington High School Infiltration	Dorset St north of Kennedy Dr, South Burlington	MS4 Owned	South Burlington	New	IB	Construct new infiltration basin to the southeast of sports field in currently wooded area.	No Permit	3.57	3.10	87%	0.443	0.443	100%
PB0069	South Burlington High School North	Dorset St north of Kennedy Dr, South Burlington	MS4 Owned	South Burlington	New	IG	Construct dry wells to infiltrate stormwater from the high school parking lot and middle school roof. Potential educational benefit.	6174-INDS.A	5.77	4.26	74%	0.689	0.69	100%
PB0070	South Meadows Pond	Farrell St, South Burlington	Private	Burlington	Existing	DP	Retrofit existing detention pond to meet CPv standards. Add forebay and expand pond. Upgrade outlet structure.	1-0661	10.10	4.73	47%	0.370	0	100%
PB0071	Southview Drive	Southview Dr off of Prouty Pkwy, South Burlington	Private	South Burlington	New	UD	Construct underground detention chambers in ROW and grassed area. Road is 30ft wide and could be narrowed for storage.	No Permit	12.26	4.81	39%	0.711	0.04	100%
PB0072	Staples Plaza Underground Detention	Williston Rd west of I-89, South Burlington	Private	South Burlington, VT	New	UD	Construct underground detention chambers in southeast corner of parking lot.	No Permit	1.70	1.64	97%	0.198	0.03	100%
PB0073	Stonehedge Circle	Stonehedge Dr off of Spear St, South Burlington	Private	South Burlington	New	DP	Construct bioretention along road in grassed area with discharge to existing catchbasin.	2-0100	2.48	1.26	51%	0.203	0	100%
PB0074	Sugartree Lane	Sugartree Ln off of Kennedy Dr, South Burlington	Private	South Burlington	New	GW	Expand existing depressed area at the end of Sugartree Ln , which appears to be an abandoned detention area, into a gravel wetland. Reroute catchbasins to pond. Upgrade outlet.	2-0878	1.54	1.05	69%	0.115	0	100%
PB0075	Swift Estates Pond	Meadowood Dr and Swift St, South Burlington	Private	South Burlington	Existing	DP	Retrofit existing detention pond to meet CPv standards. Add forebay and upgrade outlet structure.	No Permit	18.52	3.57	19%	0.326	0	100%
PB0076	Technology Park Pond Retrofit	Community Dr off of Kimball Ave, South Burlington	Private	South Burlington	Existing	GW	Retrofit existing detention pond to gravel wetland and meet CPv standards. Upgrade outlet structure and expand accommodate additional storage.	1-1458 P4	8.05	0.03	0%	0.271	0	100%
PB0077	Temple Detention Pond	Swift St and Dorset St, South Burlington	Private	South Burlington	New	GW	Propose new gravel wetland in depressed area in front of Temple by intersection of Dorset St and Swift St. Stormwater already collects in this area.	No Permit	1.81	0.92	51%	0.192	0	100%
PB0078	The Pines	Oakwood Dr, South Burlington	Private	South Burlington	Existing	GW	Retrofit existing detention pond to gravel wetland. Add forebay and CMAC valve to detain CPv.	1-1117	12.67	5.85	46%	0.215	0	100%
PB0079	UMall Detention Pond	Dorset St (University Mall), South Burlington	Private	South Burlington	Existing	DP	Retrofit existing detention pond to detain CPv. Upgrade outlet structure and expand pond.	1-0503c; 6282-9030	16.90	14.96	89%	0.909	0	100%
PB0080	UMall Infiltration 1	Dorset St (University Mall), South Burlington	Private	South Burlington	Existing	IG	Retrofit existing infiltration gallery to infiltrate the CPv.	1-0503b; 6282-9030	17.15	15.30	89%	0.032	0.18	100%
PB0081	UMall Infiltration 2	Dorset St (University Mall), South Burlington	Private	South Burlington	Existing	IG	Retrofit existing infiltration gallery to infiltrate the CPv.	1-0503a; 6282-9030	5.61	5.55	99%	0.311	2.17	100%

Proposed BMP ID #	Project Name	BMP Address	BMP Landowner	MS4s with Impervious Area	New or Existing	BMP Type	BMP Description	Expired Permit #	Drainage Area (acres)	Impervious Area Managed (acres)	Impervious %	CPv Managed (ac-ft)	Volume Infiltrated (ac-ft)	WQ Volume controlled (%)
PB0082	UMall Sears Auto Pond	Dorset St (University Mall), South Burlington	Private	South Burlington	Existing	GW	Construct gravel wetland in unused section of parking lot in Umall (to the east of the party store). Reroute Dorset St stormline here.	1-0503d; 6282-9030; 2-0619	11.62	9.29	80%	0.612	0	100%
PB0083	UVM Bio Research Complex	Spear St north of I-89, South Burlington	MS4 Owned	UVM	New	DP	Construct bioretention to treat stormwater in grassed area near the center of complex. Potential educational benefit.	5269-9003.R	1.85	0.92	50%	0.199	0	100%
PB0084	UVM Forestry Research Center - East Roof	Spear St north of I-89, South Burlington	MS4 Owned	UVM	New	IG	Construct dry well to capture and infiltrate roof drain. Potential educational benefit.	No Permit	0.42	0.41	98%	0.055	0.01	100%
PB0085	UVM Forestry Research Center - West Roof	Spear St north of I-89, South Burlington	MS4 Owned	UVM	New	IG	Construct dry well to capture and infiltrate roof drain. Potential educational benefit.	No Permit	0.12	0.12	100%	0.016	0.01	100%
PB0086	Vermont National Country Club Pond B	Golf Course Rd and Park Rd, South Burlington	Private	South Burlington	Existing	DP	Retrofit existing detention pond. Add forebay and expand pond.	1-1241b	35.72	8.63	24%	0.427	0	100%
PB0087	Vermont National Country Club Pond C	Golf Course Rd and Park Rd, South Burlington	Private	South Burlington	Existing	DP	Retrofit existing detention pond. Add forebay and expand pond.	1-1241c	9.94	0.47	5%	0.848	0	100%
PB0088	VT Gas Detention Pond	Swift St and Farrell St, South Burlington	Private	South Burlington	New	GW	Reroute stormline from Swift St to grassed area to the north of VT Gas property and construct new gravel wetland.	2-0228; 6293-9030	7.57	3.09	41%	0.172	0	100%
PB0089	Wellesley Grove	Georgetown off of Kennedy Dr, South Burlington	Private	South Burlington	New	GW	Add outlet control to existing depression to detain stormwater, construct new gravel wetland. Repair outfall erosion.	2-1023	8.85	2.15	24%	0.269	0	100%
PB0090	Windridge Court	Windridge Ct and Kennedy Dr, South Burlington	Private	South Burlington	New	IB	Construct new infiltration basin to infiltrate stormwater to the west of this small development.	2-0824	1.04	0.58	55%	0.099	0.10	100%
PB0091	Woodcrest Drive	Woodcrest Dr and Deane St, South Burlington	MS4 Owned	South Burlington, VTrans	New	IB	Infiltrate stormwater to the southwest of drainage area. Reroute stormline south to new BMP. Construct new swale to drain the end of Woodcrest Dr, which is currently eroding slope following road.	No Permit	7.46	2.38	32%	0.496	0.50	100%
PB0092	Woodlands Industrial Park	Kimball Ave west of Community Dr, South Burlington	Private	South Burlington	Existing	GW	Reroute roof drainage to existing detention pond. Retrofit pond to gravel wetland and expand to accommodate additional volume and detain CPv.	1-0526/ 6279-9030	4.40	3.89	88%	0.371	0	100%
PB0093	Worcester Street	Adirondack St and Butler Dr, South Burlington	Private	South Burlington	New	UD	Construct underground detention chambers under ROW and grassed shoulder.	2-0312	10.84	3.82	35%	0.560	0	100%
PB0094	Dorset Park Pond	Dorset St and Swift St, South Burlington	MS4 Owned	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	1-1033	26.07	5.95	23%	0.30	0	100%
PB0095	Hannaford's Pond	Hannaford Dr, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	1-1214	14.71	7.75	53%	0.34	0	100%
PB0096	Lowes Pond	Hannaford Dr, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	1-1214	12.73	10.05	79%	0.196	0	100%
PB0097	Vermont National Country Club Pond B	Golf Course Rd, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	1-1241b	35.72	8.63	24%	0.92	0	100%
PB0098	Technology Park Pond 1	Community Dr, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	1-1254	8.96	3.78	42%	0.37	0	100%
PB0099	Lot A Mountain View Pond	Tilley Dr, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	1-1536	6.05	2.55	42%	0.02	0	100%
PB0100	Kennedy Dr Pond 1	Kennedy Dr, South Burlington	MS4 Owned	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	1-1582a	1.47	1.33	91%	0.05	0	100%
PB0101	Quarry Hill Pond	Quarry Hill Rd off of Spear St, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	3602-INDS	21.75	6.19	28%	0.00	0	100%
PB0102	Heatherfield P1	Off of Spear St, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	3658a	1.40	0.90	64%	0.00	0	100%
PB0103	Heatherfield P2	Off of Spear St, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	3658b	10.76	7.08	66%	0.03	0	100%
PB0104	Heatherfield P3	Off of Spear St, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	3658c	4.30	2.71	63%	0.05	0	100%
PB0105	Winding Brook	Winding Brook Dr, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	3691-INDS	9.11	3.32	36%	0.11	0	100%
PB0106	Mountainview Pond b	Tilley Dr, South Burlington	Private	South Burlington	Existing	DP	Retrofit pond with CMAC valve.	3805-INDS	0.90	0.61	68%	0.08	0	100%
PB0107	Farrell St Pond	Farrell St, South Burlington	MS4 Owned	South Burlington, VTrans	Existing	DP	Retrofit pond with CMAC valve.	5080-INDO	32.96	11.03	33%	0.05	0	100%

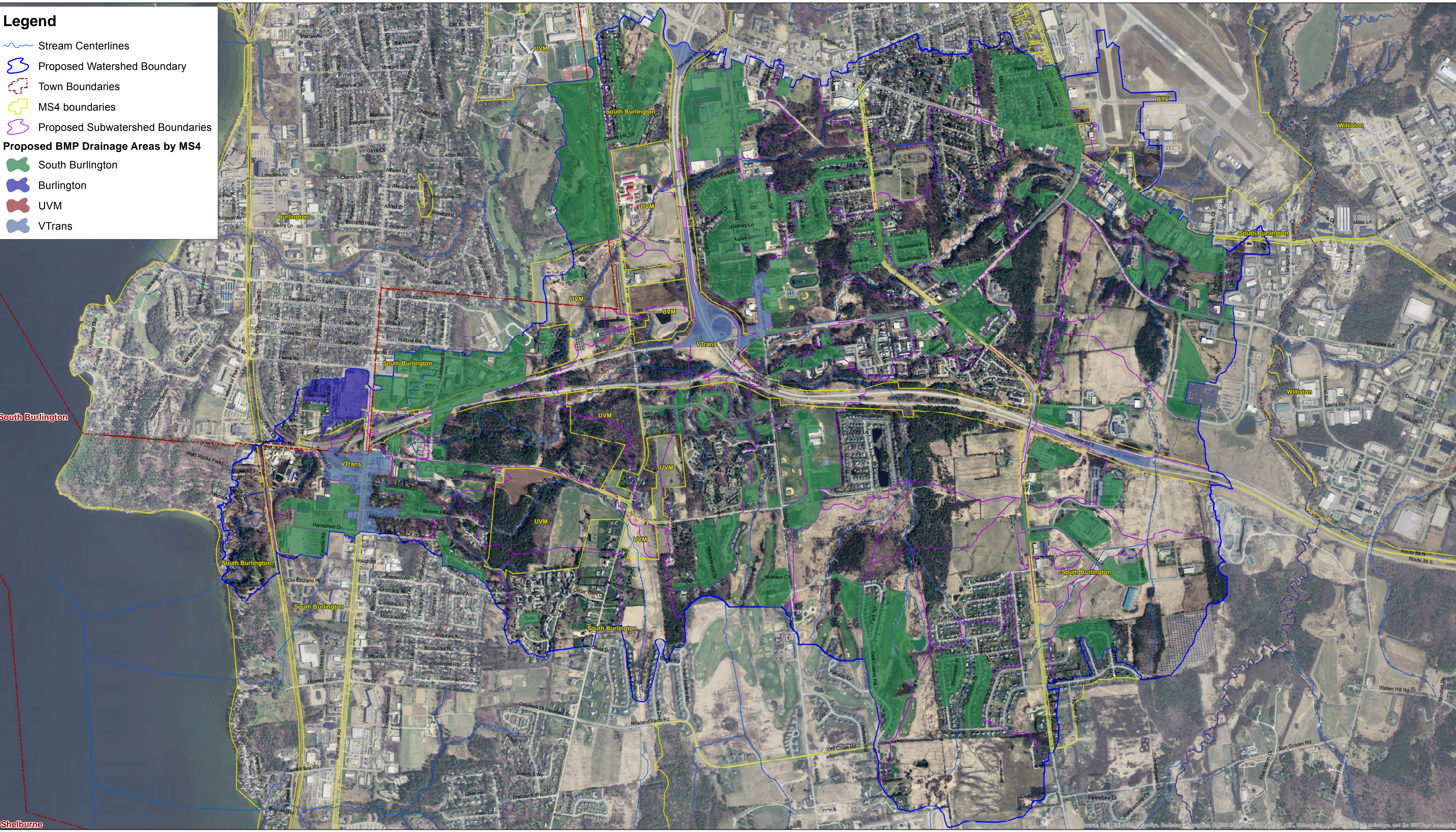
Notes:
1. BMP Type Abbreviations: GW: Gravel Wetland, GS: Grass Swale, RS: Retention Swale, ST: Settling Tank, OF: Control orifice, IB: Infiltration Basin, IT: Infiltration Trench, DP: Detention Pond, UD: Underground Detention, RP: Retention Pond, DS: Detention Swale, DW: Dry Well, IG: Infiltration Gallery, SF: Sand Filter, BR: Bioretention, MF: Median Filter.

Legend

- Stream Centerlines
- Proposed Watershed Boundary
- Town Boundaries
- MS4 boundaries
- Proposed Subwatershed Boundaries

Proposed BMP Drainage Areas by MS4

- South Burlington
- Burlington
- UVM
- VTrans



Map C-1 – Proposed Stormwater BMPs
Potash Brook Watershed
South Burlington, VT

Potash Brook FRP BMP Summary Sheet

Site name:		1050 Hinesburg Road		South Burlington ID:		PB0001					
Approximate address:		1050 Hinesburg Rd, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$106,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	1.43	Primary land use in drainage	Commercial
Impervious acres managed	0.74	2 or more landowners?	No
% Impervious	52%	CPv managed (ac-ft)	0.11
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.07	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	No Permit
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
There is an existing wet depression here where stormwater is already routed. Propose gravel wetland and meet CPv standards.	

Potash Brook FRP BMP Summary Sheet

Site name: 110 Kimball Ave - North Infiltration Basin
South Burlington ID: PB0002

Approximate address:

110 Kimball Ave, South Burlington

MS4 where BMP is located:

South Burlington

New or existing BMP?

Existing

Proposed BMP type:

Retrofit Existing Infiltration Basin



Estimated project cost
\$25,000

Drainage area (acres)
1.51

Impervious acres managed
0.58

% Impervious
38%

Land owner of BMP location
Private

BMP Footprint Size (acres)
0.15

BMP Depth (feet)
1.50

Hydrologic soil group
B

MS4s contributing drainage to BMP

South Burlington

Primary land use in drainage

Commercial

2 or more landowners?

No

CPv managed (ac-ft)

0.02

Volume infiltrated (ac-ft)

0.04

Primary or secondary BMP?

Primary

Expired permit(s)?

1-1504a

Proposed BMP description:

Runoff is bypassing infiltration basin and sheet flowing to a swale with direct discharge to the brook. Add trench along west edge of parking lot to direct runoff to infiltration basin. Expand basin to accommodate increased volume.

Feasibility concerns:

Potash Brook FRP BMP Summary Sheet

Site name: 110 Kimball Ave - South Infiltration Basin
 South Burlington ID: PB0003

Approximate address:

110 Kimball Ave, South Burlington

MS4 where BMP is located:

South Burlington

New or existing BMP?

Existing

Proposed BMP type:

Retrofit Existing Infiltration Basin



Estimated project cost \$10,000

Drainage area (acres) 1.42

Impervious acres managed 0.94

% Impervious 66%

Land owner of BMP location Private

BMP Footprint Size (acres) 0.14

BMP Depth (feet) 3.50

Hydrologic soil group A

MS4s contributing drainage to BMP

South Burlington

Primary land use in drainage

Commercial

2 or more landowners?

No

CPv managed (ac-ft)

0.05

Volume infiltrated (ac-ft)

0.06

Primary or secondary BMP?

Primary

Expired permit(s)?

1-1504b

Proposed BMP description:

Feasibility concerns:

Retrofit outlet structure and add proposed outlet control riser that was not constructed.

Potash Brook FRP BMP Summary Sheet

Site name:	189 Cloverleaf Detention Pond	South Burlington ID:	PB0004
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Approximate address:	Shelburne Rd and Queen City Pkwy, South Burlington	MS4 where BMP is located:	VTrans	New or existing BMP?	New
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$59,000	MS4s contributing drainage to BMP	South Burlington, VTrans, Burlington
Drainage area (acres)	21.25	Primary land use in drainage	Commercial
Impervious acres managed	12.14	2 or more landowners?	Yes
% Impervious	57%	CPv managed (ac-ft)	1.13
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	1.19	Primary or secondary BMP?	Primary
BMP Depth (feet)	16.00	Expired permit(s)?	No Permit
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Add outlet structure to area that is already depressed to detain stormwater. Reroute stormline from Shelburne Rd to this area.	Wetlands concerns.

Potash Brook FRP BMP Summary Sheet

Site name:		189 Ramp Detention Pond	South Burlington ID:		PB0005
Approximate address:	Dorset St and 189 Ramps, South Burlington	MS4 where BMP is located:	VTrans	New or existing BMP?	New
Proposed BMP type:	Gravel Wetland				



Estimated project cost	\$347,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	9.36		
Impervious acres managed	5.78		Primary land use in drainage
% Impervious	62%		Commercial
Land owner of BMP location	MS4 Owned		2 or more landowners?
BMP Footprint Size (acres)	0.33		Yes
BMP Depth (feet)	8.00		CPv managed (ac-ft)
Hydrologic soil group	C		0.35
			Volume infiltrated (ac-ft)
			0.00
			Primary or secondary BMP?
			Primary
			Expired permit(s)?
			2-0619

Proposed BMP description:	Feasibility concerns:
Detain stormwater from a large section of Dorset St. Intercept stormline near Kennedy Dr and reroute to the area between 189 ramps. Treat with gravel wetland.	BMP location will need significant earthwork as area is elevated.

Potash Brook FRP BMP Summary Sheet

Site name:	30 Kimball Ave Swale Retrofit	South Burlington ID:	PB0006
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Approximate address:	30 Kimball Ave, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Retrofit Existing Swale
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Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.27	Primary land use in drainage	Commercial
Impervious acres managed	1.05	2 or more landowners?	No
% Impervious	82%	CPv managed (ac-ft)	0.02
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.06	Primary or secondary BMP?	Primary
BMP Depth (feet)	3.50	Expired permit(s)?	1-1526; 6269-9030
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Retrofit existing swale detention to meet CPv. Expand swale to accommodate modified outlet structure.	Space is limited.

Potash Brook FRP BMP Summary Sheet

Site name:	Adelphia Cable Pond Retrofit	South Burlington ID:	PB0007
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Approximate address:	Kimball Ave and Adelphia Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Gravel Wetland
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Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	4.15	Primary land use in drainage	Commercial
Impervious acres managed	2.66	2 or more landowners?	Yes
% Impervious	64%	CPv managed (ac-ft)	0.09
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.21	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	1-1000; 6291-9030
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Reroute drainage from Kimball Ave to this detention pond behind Adelphia Cable. Retrofit and expand existing pond into a gravel wetland to detain CPv.	Utilities limited pond expansion to the east.

Potash Brook FRP BMP Summary Sheet

Site name:		Adirondack Street		South Burlington ID:		PB0008					
Approximate address:		Adirondack St and Butler Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Underground detention									



Estimated project cost	\$845,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	11.95	Primary land use in drainage	Residential
Impervious acres managed	3.52	2 or more landowners?	Yes
% Impervious	29%	CPv managed (ac-ft)	0.58
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.22	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.67	Expired permit(s)?	2-0312
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Construct underground detention chambers under ROW and grassed shoulder.	Space is very limited. Utilities concerns. Unsure how high groundwater table is here.

Potash Brook FRP BMP Summary Sheet

Site name:	Airport Drive		South Burlington ID:	PB0009	
Approximate address:	Airport Dr and Airport Rd, South Burlington	MS4 where BMP is located:	BTV	New or existing BMP?	New
Proposed BMP type:	Infiltration Gallery				



Estimated project cost	\$439,000	MS4s contributing drainage to BMP	South Burlington, BTV
Drainage area (acres)	9.65		
Impervious acres managed	2.71		Primary land use in drainage
% Impervious	28%		Residential
Land owner of BMP location	MS4 Owned		2 or more landowners?
BMP Footprint Size (acres)	0.09		Yes
BMP Depth (feet)	3.50		CPv managed (ac-ft)
Hydrologic soil group	A		0.46
			Volume infiltrated (ac-ft)
			0.46
			Primary or secondary BMP?
			Primary
			Expired permit(s)?
			No Permit

Proposed BMP description:	Feasibility concerns:
Construct subsurface infiltration chambers in southernmost lot where houses will be removed. Intercept stormline running south down Airport Dr.	

Potash Brook FRP BMP Summary Sheet

Site name:	Ashbrook Drive	South Burlington ID:	PB0010		
Approximate address:	Ashbrook Dr and Dorset St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Gravel Wetland				



Estimated project cost	\$168,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	2.49	Primary land use in drainage	Residential
Impervious acres managed	0.88	2 or more landowners?	Yes
% Impervious	35%	CPv managed (ac-ft)	0.18
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.09	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	2-0101
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Reroute stormwater to gravel wetland southwest of Dorset St behind apartment buildings.	Space is limited. Potential wetlands concerns.

Potash Brook FRP BMP Summary Sheet

Site name:		Blue Mall Infiltration		South Burlington ID:		PB0011					
Approximate address:		Dorset St south of Market St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Gallery									



Estimated project cost	\$531,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	2.49	Primary land use in drainage	Commercial
Impervious acres managed	2.40	2 or more landowners?	No
% Impervious	97%	CPv managed (ac-ft)	0.37
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.37
BMP Footprint Size (acres)	0.11	Primary or secondary BMP?	Primary
BMP Depth (feet)	3.50	Expired permit(s)?	2-0144
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Construct underground infiltration chambers in the southwest edge of parking lot. Overflow to existing stormline that flows to Dorset St.	Potential underground utilities.

Potash Brook FRP BMP Summary Sheet

Site name:		Brookwood Drive Pond		South Burlington ID:		PB0012					
Approximate address:		Brookwood Dr off of Dorset St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Detention Pond									



Estimated project cost	\$394,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	41.24	Primary land use in drainage	Commercial
Impervious acres managed	24.49	2 or more landowners?	Yes
% Impervious	59%	CPv managed (ac-ft)	2.00
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.34	Primary or secondary BMP?	Primary
BMP Depth (feet)	14.00	Expired permit(s)?	2-0794; 2-0619
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Construct new detention pond to detain this large outfall. Forebay to be located in empty lot near Brookwood Dr.	Space is limited. Potential wetlands concerns and utility issues.

Potash Brook FRP BMP Summary Sheet

Site name:		Burlington Price Chopper		South Burlington ID:		PB0013					
Approximate address:		Shelburne Rd, Burlington		MS4 where BMP is located:		Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel wetland									



Estimated project cost	\$1,459,000	MS4s contributing drainage to BMP	Burlington
Drainage area (acres)	12.69	Primary land use in drainage	Commercial
Impervious acres managed	11.48	2 or more landowners?	No
% Impervious	90%	CPv managed (ac-ft)	1.23
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.11	Primary or secondary BMP?	Primary
BMP Depth (feet)	8.00	Expired permit(s)?	No Permit
Hydrologic soil group	Not Rated		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland in area between parking lot and stream to the south of parking lot.	Space is limited.

Potash Brook FRP BMP Summary Sheet

Site name:		Chelsea Circle		South Burlington ID:		PB0014					
Approximate address:		Chelsea Cir and Hayes Ave, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Basin									



Estimated project cost	\$115,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	3.28		
Impervious acres managed	1.82	Primary land use in drainage	Residential
% Impervious	56%	2 or more landowners?	Yes
Land owner of BMP location	Private	CPv managed (ac-ft)	0.29
BMP Footprint Size (acres)	0.20	Volume infiltrated (ac-ft)	0.29
BMP Depth (feet)	4.50	Primary or secondary BMP?	Primary
Hydrologic soil group	B	Expired permit(s)?	2-0767

Proposed BMP description:	Feasibility concerns:
Construct new infiltration basin constructed to south of existing swale, which receives flow from Chelsea Cir condos and Timberlane Dental parking lot. Neighborhood icing and flooding issues can be mitigated with this project.	

Potash Brook FRP BMP Summary Sheet

Site name: Church of Jesus Christ of Latterday Saints
 South Burlington ID: PB0015

Approximate address:

Swift St and Dorset St, South Burlington

MS4 where BMP is located:

South Burlington

New or existing BMP?

New

Proposed BMP type:

Detention Swale



Estimated project cost \$29,000

Drainage area (acres) 3.12

Impervious acres managed 1.58

% Impervious 51%

Land owner of BMP location Private

BMP Footprint Size (acres) 0.09

BMP Depth (feet) 4.00

Hydrologic soil group D

MS4s contributing drainage to BMP

South Burlington

Primary land use in drainage

Institutional

2 or more landowners?

No

CPv managed (ac-ft)

0.10

Volume infiltrated (ac-ft)

0.00

Primary or secondary BMP?

Primary

Expired permit(s)?

2-0179; 6318-9030

Proposed BMP description:

Feasibility concerns:

Add detention to swale to the west of parking area with outlet control to detain CPv

Potash Brook FRP BMP Summary Sheet

Site name:	Community Bible Church Infiltration	South Burlington ID:	PB0016
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Approximate address:	Williston Rd and Millham Ct, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Infiltration Trench
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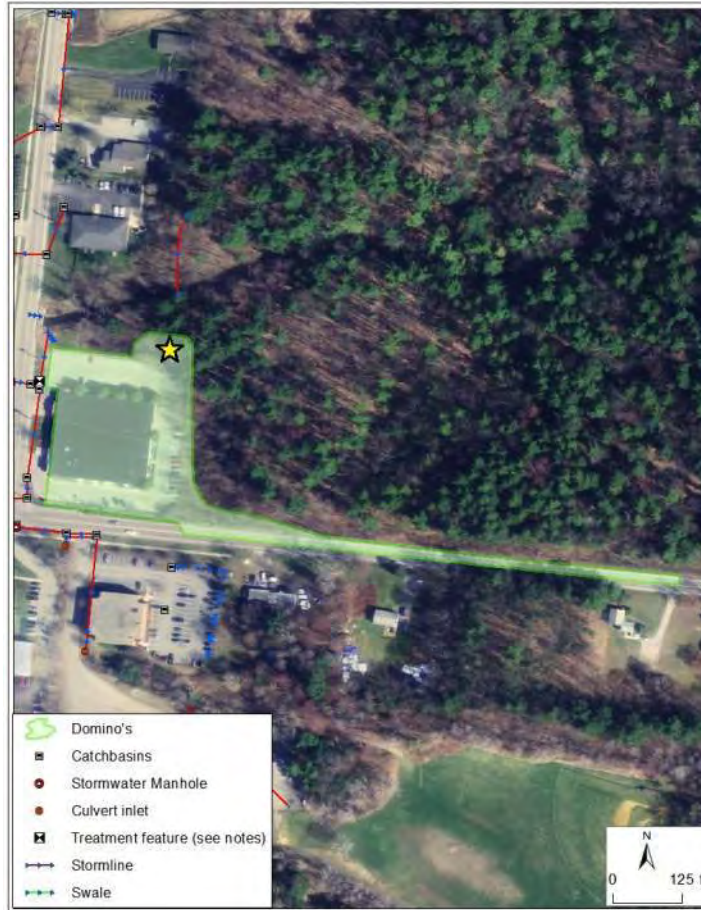


Estimated project cost	\$975,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	2.52	Primary land use in drainage	Institutional
Impervious acres managed	1.68	2 or more landowners?	Yes
% Impervious	67%	CPv managed (ac-ft)	0.91
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.91
BMP Footprint Size (acres)	0.08	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.00	Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Construct linear infiltration trench (perforated pipe) along back of several businesses.	

Potash Brook FRP BMP Summary Sheet

Site name:		Domino's		South Burlington ID:		PB0017					
Approximate address:		Swift St and Farrell St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$199,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	2.30	Primary land use in drainage	Commercial
Impervious acres managed	1.34	2 or more landowners?	No
% Impervious	58%	CPv managed (ac-ft)	0.23
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.14	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.60	Expired permit(s)?	No Permit
Hydrologic soil group	C/D		

Proposed BMP description:	Feasibility concerns:
Construct a gravel wetland pond behind parking area. Add catchbasin along Swift St to also capture half of the road drainage.	Space is limited. Site is in close proximity to Potash Brook.

Potash Brook FRP BMP Summary Sheet

Site name:		Dorset Commons Pond		South Burlington ID:		PB0018	
Approximate address:		Dorset St and Town Square Dr, South Burlington		MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:		Detention Pond					



Estimated project cost	\$168,000		MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	17.54			
Impervious acres managed	5.01		Primary land use in drainage	Residential
% Impervious	29%		2 or more landowners?	Yes
Land owner of BMP location	Private		CPv managed (ac-ft)	0.60
BMP Footprint Size (acres)	0.51		Volume infiltrated (ac-ft)	0.00
BMP Depth (feet)	6.00		Primary or secondary BMP?	Primary
Hydrologic soil group	D		Expired permit(s)?	1-0242

Proposed BMP description:	Feasibility concerns:
Construct new detention pond in wooded area behind Dorset Commons.	Potential wetlands issues. There is a water transmission main that runs through this area.

Potash Brook FRP BMP Summary Sheet

Site name:	Dumont Park Stormwater Project	South Burlington ID:	PB0019
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Approximate address:	Barrett St and Obrien Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$69,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	9.56	Primary land use in drainage	Residential
Impervious acres managed	4.16	2 or more landowners?	Yes
% Impervious	43%	CPv managed (ac-ft)	0.27
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.22	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	No Permit
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Construct new detention pond to the north of Barrett St where two stormlines converge.	Wetlands concerns. This site is near the future Dumont Park development.

Potash Brook FRP BMP Summary Sheet

Site name:		Dynapower		South Burlington ID:		PB0020					
Approximate address:		Hinesburg Rd and Meadowland Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$124,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	12.20	Primary land use in drainage	Industrial
Impervious acres managed	6.50	2 or more landowners?	No
% Impervious	53%	CPv managed (ac-ft)	0.95
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.27	Primary or secondary BMP?	Primary
BMP Depth (feet)	9.50	Expired permit(s)?	1-0618
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Reroute roof drainage to existing detention pond. Retrofit to gravel wetland and detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:	East Terrace Detention Pond	South Burlington ID:	PB0021
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Approximate address:	East Terrace, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Gravel Wetland
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Estimated project cost	\$318,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	6.36	Primary land use in drainage	Residential
Impervious acres managed	2.28	2 or more landowners?	Yes
% Impervious	36%	CPv managed (ac-ft)	0.34
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.40	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.00	Expired permit(s)?	No Permit
Hydrologic soil group	D		

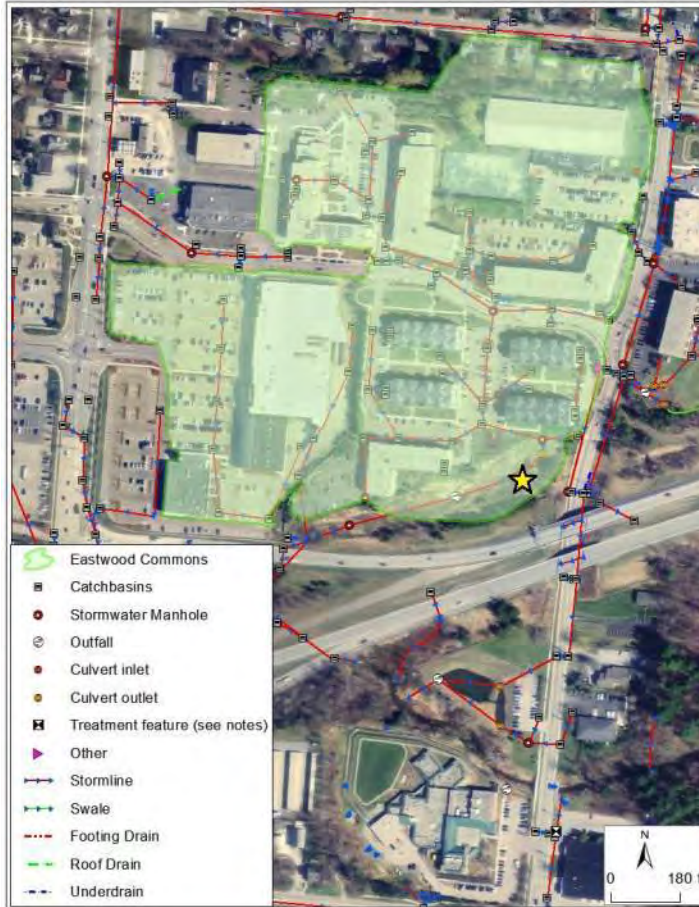
Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland near the outfall to the east side of East Terrace.	Must ensure that BMP is >50 ft from delineated wetlands that exist north of the treatment area.

Potash Brook FRP BMP Summary Sheet

Site name:	Eastwood Commons Pond Expansion	South Burlington ID:	PB0022
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Approximate address:	Farrell St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Retrofit Existing Detention Pond
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Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	28.39	Primary land use in drainage	Commercial
Impervious acres managed	20.78	2 or more landowners?	Yes
% Impervious	73%	CPv managed (ac-ft)	0.73
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	1.05	Primary or secondary BMP?	Primary
BMP Depth (feet)	13.00	Expired permit(s)?	1-1438
Hydrologic soil group	A/C/D		

Proposed BMP description:	Feasibility concerns:
Reroute area to the west of existing pond (eastern side of Shaw's plaza) to this pond. Add a new connection between these stormwater systems to the east of the Shaw's property. Expand pond and modify outlet structure to accommodate additional drainage.	

Potash Brook FRP BMP Summary Sheet

Site name:		Easy Self Storage		South Burlington ID:		PB0023	
Approximate address:	Swift St and Shelburne Rd, South Burlington			MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Gravel Wetland						



Estimated project cost	\$196,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.87	Primary land use in drainage	Commercial
Impervious acres managed	1.21	2 or more landowners?	No
% Impervious	65%	CPv managed (ac-ft)	0.20
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.14	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	2-0167
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Create new gravel wetland to the north of the storage area.	

Potash Brook FRP BMP Summary Sheet

Site name:		Economou Farm Pond		South Burlington ID:		PB0024	
Approximate address:		Economou Farm Rd, South Burlington		MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:		Gravel Wetland					



Estimated project cost	\$87,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	6.37	Primary land use in drainage	Residential
Impervious acres managed	1.46	2 or more landowners?	Yes
% Impervious	23%	CPv managed (ac-ft)	0.67
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.87	Primary or secondary BMP?	Primary
BMP Depth (feet)	7.00	Expired permit(s)?	1-1241d
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Retrofit existing dry pond to gravel wetland to detain CPv. Expand and add forebay.	

Potash Brook FRP BMP Summary Sheet

Site name:		Exit 13 Gravel Wetland		South Burlington ID:		PB0025					
Approximate address:		I-89 Exit 13, South Burlington		MS4 where BMP is located:		VTrans		New or existing BMP?		New	
Proposed BMP type:		Gravel wetland									



Estimated project cost	\$219,000	MS4s contributing drainage to BMP	VTrans
Drainage area (acres)	16.72	Primary land use in drainage	Transportation
Impervious acres managed	5.57	2 or more landowners?	No
% Impervious	33%	CPv managed (ac-ft)	0.57
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.43	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.50	Expired permit(s)?	No Permit
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Propose new gravel wetland in depressed triangle greenspace between ramps. Reroute several culverts to this area.	

Potash Brook FRP BMP Summary Sheet

Site name:	Exit 14 Gravel Wetland	South Burlington ID:	PB0026		
Approximate address:	I-89 Exit 14, South Burlington	MS4 where BMP is located:	VTrans	New or existing BMP?	New
Proposed BMP type:	Gravel wetland				



Estimated project cost	\$131,000	MS4s contributing drainage to BMP	VTrans
Drainage area (acres)	4.91	Primary land use in drainage	Transportation
Impervious acres managed	1.93	2 or more landowners?	No
% Impervious	39%	CPv managed (ac-ft)	0.29
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.37	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	No Permit
Hydrologic soil group	Not Rated/B		

Proposed BMP description:	Feasibility concerns:
Propose new gravel wetland in depressed triangle greenspace between ramps. Reroute several culverts to this area.	Soils are unmapped.

Potash Brook FRP BMP Summary Sheet

Site name:		Fairpoint Communications		South Burlington ID:		PB0027					
Approximate address:		Hinesburg Rd south of I-89, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$495,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	8.75	Primary land use in drainage	Commercial
Impervious acres managed	4.76	2 or more landowners?	No
% Impervious	54%	CPv managed (ac-ft)	0.59
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.26	Primary or secondary BMP?	Primary
BMP Depth (feet)	7.00	Expired permit(s)?	2-0212
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland to the east of property in grassed area. Two outfalls on site drain to wetland swales that need to be rerouted to the east.	There is bedrock nearby. Ensure that BMP is outside of wetlands buffer.

Potash Brook FRP BMP Summary Sheet

Site name: Faith United Methodist Church **South Burlington ID:** PB0028

Approximate address:

Dorset St south of Songbird Ln, South Burlington

MS4 where BMP is located:

South Burlington

New or existing BMP?

New

Proposed BMP type:

Underground Detention



Estimated project cost \$49,000

Drainage area (acres) 1.68

Impervious acres managed 1.03

% Impervious 61%

Land owner of BMP location Private

BMP Footprint Size (acres) 0.12

BMP Depth (feet) 6.00

Hydrologic soil group D

MS4s contributing drainage to BMP

South Burlington

Primary land use in drainage

Institutional

2 or more landowners?

No

CPv managed (ac-ft)

0.15

Volume infiltrated (ac-ft)

0.00

Primary or secondary BMP?

Primary

Expired permit(s)?

No Permit

Proposed BMP description:

Feasibility concerns:

Construct new underground detention behind church (northwest) in grassy area. Current outfall is eroded.

Space is limited.

Potash Brook FRP BMP Summary Sheet

Site name:		Golf Course Road South		South Burlington ID:		PB0029					
Approximate address:		Golf Course Rd and Old Cross Rd, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$135,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	5.19	Primary land use in drainage	Residential
Impervious acres managed	1.67	2 or more landowners?	Yes
% Impervious	32%	CPv managed (ac-ft)	0.23
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.12	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	1-1241
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland at the end of pipe before it enters the golf course. Existing infrastructure already drains to swale.	Space is somewhat limited.

Potash Brook FRP BMP Summary Sheet

Site name:		Gonzo's Underground		South Burlington ID:		PB0030					
Approximate address:		Williston Rd east of Kennedy Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Underground detention									



Estimated project cost	\$662,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	13.62	Primary land use in drainage	Commercial
Impervious acres managed	8.72	2 or more landowners?	Yes
% Impervious	64%	CPv managed (ac-ft)	0.45
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.21	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.33	Expired permit(s)?	2-0811
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Propose to intercept stormline that flows west along Williston Rd to underground detention chambers under grassed area in front of Budget Car Rental / Gonzo's plaza.	Space is limited. Buried utilities may be a concern.

Potash Brook FRP BMP Summary Sheet

Site name:	Grandview Drive North Detention Pond	South Burlington ID:	PB0031
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Approximate address:	Grandview Dr and W Twin Oaks Terr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$33,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	3.02	Primary land use in drainage	Residential
Impervious acres managed	1.38	2 or more landowners?	No
% Impervious	46%	CPv managed (ac-ft)	0.14
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.07	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.50	Expired permit(s)?	2-0238; 2-0737
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Construct new surface detention BMP following outfall, which is currently broken and experiencing significant erosion.	Wetlands concerns. There are delineated Class II wetlands downstream of outlet.

Potash Brook FRP BMP Summary Sheet

Site name:	Grandview Drive West Detention Pond	South Burlington ID:	PB0032
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Approximate address:	Grandview Dr and Dorset St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$36,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	3.14	Primary land use in drainage	Residential
Impervious acres managed	1.89	2 or more landowners?	No
% Impervious	60%	CPv managed (ac-ft)	0.18
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.03	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.20	Expired permit(s)?	2-0238; 2-0737
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Construct new surface detention basin to the west of Dorset St. Reroute stormline away from brook to new BMP.	Wetlands concerns.

Potash Brook FRP BMP Summary Sheet

Site name:	Hawthorne Circle Detention Pond	South Burlington ID:	PB0033
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Approximate address:	Hawthorne Cir and Kennedy Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Gravel Wetland
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Estimated project cost	\$143,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	4.95	Primary land use in drainage	Residential
Impervious acres managed	2.55	2 or more landowners?	No
% Impervious	51%	CPv managed (ac-ft)	0.15
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.09	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	No Permit
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland in greenspace formed in the triangle between three garages.	Potential underground utilities.

Potash Brook FRP BMP Summary Sheet

Site name:		Helen Ave Cul De Sac		South Burlington ID:		PB0034					
Approximate address:		Helen Ave, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Basin									

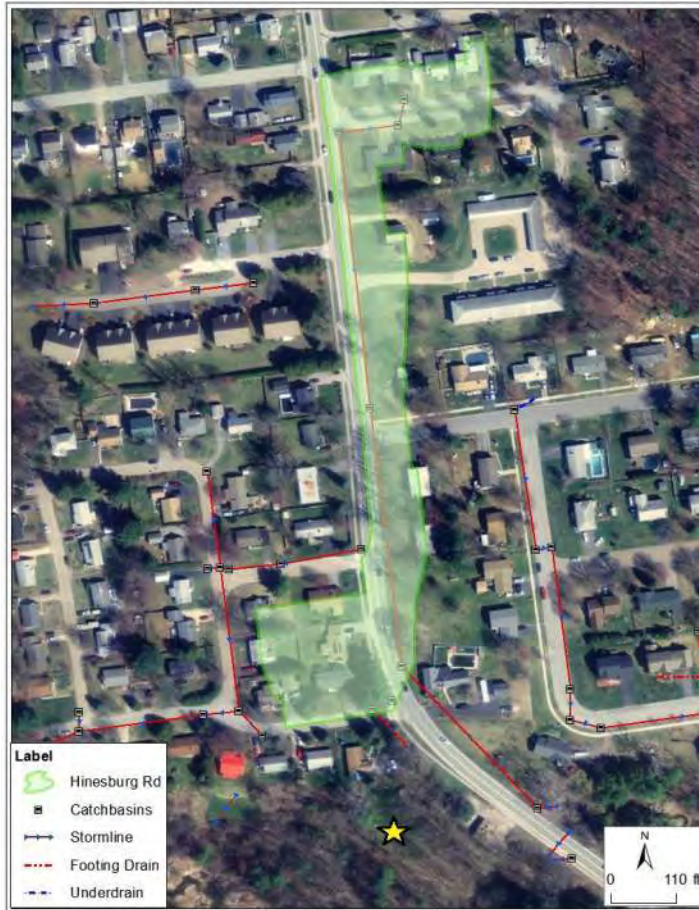


Estimated project cost	\$136,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	5.70	Primary land use in drainage	Residential
Impervious acres managed	2.15	2 or more landowners?	Yes
% Impervious	38%	CPv managed (ac-ft)	0.35
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.35
BMP Footprint Size (acres)	0.09	Primary or secondary BMP?	Secondary
BMP Depth (feet)	6.00	Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Construct new infiltration basin in the cul de sac at the end of Helen Ave, which would provide significant water quality benefit.	Water line and mature tree present in cul-de-sac.

Potash Brook FRP BMP Summary Sheet

Site name:	Hinesburg Road		South Burlington ID:	PB0035	
Approximate address:	Hinesburg Rd and Deane St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Detention pond				



Estimated project cost	\$33,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	3.53	Primary land use in drainage	Residential
Impervious acres managed	1.27	2 or more landowners?	Yes
% Impervious	36%	CPv managed (ac-ft)	0.14
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.07	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	No Permit
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Reroute stormwater to existing catchbasin on Deane St and detain to the west of Hinesburg Rd to the south of existing houses.	Must ensure BMP is located outside of river corridor.

Potash Brook FRP BMP Summary Sheet

Site name:		I-89 Swale		South Burlington ID:		PB0036					
Approximate address:		Between I-89 N and S lanes west of Hinesburg Rd, South Burlington		MS4 where BMP is located:		VTrans		New or existing BMP?		New	
Proposed BMP type:		Median Filter									



Estimated project cost	\$208,000	MS4s contributing drainage to BMP	VTrans
Drainage area (acres)	6.28	Primary land use in drainage	Transportation
Impervious acres managed	1.91	2 or more landowners?	No
% Impervious	30%	CPv managed (ac-ft)	0.53
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.38	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.50	Expired permit(s)?	No Permit
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Construct median filter in depressed area between north and south I-89 lanes. Reroute several culverts.	

Potash Brook FRP BMP Summary Sheet

Site name:		Iby Gravel Wetland		South Burlington ID:		PB0037					
Approximate address:		Iby St off of Hinesburg Rd, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel wetland									



Estimated project cost	\$167,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	3.31	Primary land use in drainage	Residential
Impervious acres managed	1.65	2 or more landowners?	Yes
% Impervious	50%	CPv managed (ac-ft)	0.07
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.06	Primary or secondary BMP?	Primary
BMP Depth (feet)	3.00	Expired permit(s)?	No Permit
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland at the end of Iby St to capture stormwater for the street.	Wetlands concerns. This site is near the future Dumont Park development.

Potash Brook FRP BMP Summary Sheet

Site name:		INS Building Pond A Retrofit	South Burlington ID:		PB0038
Approximate address:	Kimball Ave west of Community Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Gravel Wetland				



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	2.11	Primary land use in drainage	Governmental
Impervious acres managed	0.98	2 or more landowners?	No
% Impervious	47%	CPv managed (ac-ft)	0.04
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.33	Primary or secondary BMP?	Primary
BMP Depth (feet)	2.25	Expired permit(s)?	1-0969
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond into gravel wetland. Add forebay and construct outlet structure with low flow orifice to meet CPv standards.	

Potash Brook FRP BMP Summary Sheet

Site name:		INS Building Pond B Retrofit		South Burlington ID:		PB0039	
Approximate address:	Kimball Ave west of Community Dr, South Burlington		MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing	
Proposed BMP type:	Gravel Wetland						



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.44	Primary land use in drainage	Governmental
Impervious acres managed	0.61	2 or more landowners?	No
% Impervious	42%	CPv managed (ac-ft)	0.04
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.15	Primary or secondary BMP?	Primary
BMP Depth (feet)	3.00	Expired permit(s)?	1-0969b
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond into gravel wetland. Add forebay and construct outlet structure with low flow orifice to meet CPv standards.	

Potash Brook FRP BMP Summary Sheet

Site name:		Joy Dr Detention Pond		South Burlington ID:		PB0040	
Approximate address:	Joy Dr, South Burlington		MS4 where BMP is located:	South Burlington	New or existing BMP?	New	
Proposed BMP type:	Gravel Wetland						



Estimated project cost	\$179,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	3.07	Primary land use in drainage	Residential
Impervious acres managed	1.34	2 or more landowners?	No
% Impervious	44%	CPv managed (ac-ft)	0.21
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.12	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	No Permit
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland area in adjacent flat area near the Green Mountain Power transmission corridor.	Power line corridor is close to proposed BMP.

Potash Brook FRP BMP Summary Sheet

Site name:	Kennedy Dr Pond 2 Expansion	South Burlington ID:	PB0041
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Approximate address:	Kennedy Dr and W Twin Oaks Terr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Gravel Wetland
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Estimated project cost	\$380,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	3.53	Primary land use in drainage	Commercial
Impervious acres managed	2.23	2 or more landowners?	Yes
% Impervious	63%	CPv managed (ac-ft)	0.16
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.90	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.57	Expired permit(s)?	1-1582b; 2-1069
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond to accommodate additional drainage from The Edge and 1 Twin Oaks.	Space to expand pond is limited.

Potash Brook FRP BMP Summary Sheet

Site name:	Kennedy Dr Pond 3 Expansion	South Burlington ID:	PB0042
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Approximate address:	Kennedy Dr west of Timber Ln, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Gravel Wetland
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Estimated project cost	\$321,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	8.58	Primary land use in drainage	Commercial
Impervious acres managed	6.12	2 or more landowners?	Yes
% Impervious	71%	CPv managed (ac-ft)	0.18
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.11	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.56	Expired permit(s)?	1-1582c
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Reroute culvert that crosses under access ramp to pond, expand footprint and retrofit to gravel wetland	Limited area to expand pond.

Potash Brook FRP BMP Summary Sheet

Site name:	Kennedy Dr Pond 4 Expansion	South Burlington ID:	PB0043
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Approximate address:	Kennedy Dr and Hinesburg Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Retrofit Existing Detention Pond
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Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	10.07	Primary land use in drainage	Residential
Impervious acres managed	4.78	2 or more landowners?	Yes
% Impervious	47%	CPv managed (ac-ft)	0.25
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.11	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.62	Expired permit(s)?	1-1582d; 1-0237; 1-1023; 1-1200
Hydrologic soil group	A/C		

Proposed BMP description:	Feasibility concerns:
Reroute stormline from Chatham Green and swale along Hinesburg Rd to existing detention pond. Expand pond to accommodate additional drainage area and detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:	Kennedy Dr Pond 7 Expansion	South Burlington ID:	PB0044
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Approximate address:	Kennedy Dr north of Kimball Ave, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Gravel Wetland
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Estimated project cost	\$407,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	11.24	Primary land use in drainage	Commercial
Impervious acres managed	8.67	2 or more landowners?	Yes
% Impervious	77%	CPv managed (ac-ft)	0.58
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.30	Primary or secondary BMP?	Primary
BMP Depth (feet)	7.95	Expired permit(s)?	1-1582g; 1-0233
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Reroute stormline that currently outfalls behind Key Bank to existing detention pond. Add CMAC valve to detain CPv.	Elevations of pipes near Key Bank are quite low.

Potash Brook FRP BMP Summary Sheet

Site name:		K-Mart Plaza Infiltration		South Burlington ID:		PB0045					
Approximate address:		Shelburne Rd north of Hannaford Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Sand Filter/Detention Gallery									



Estimated project cost	\$1,121,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	5.60	Primary land use in drainage	Commercial
Impervious acres managed	5.00	2 or more landowners?	Yes
% Impervious	89%	CPv managed (ac-ft)	0.86
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.10
BMP Footprint Size (acres)	0.32	Primary or secondary BMP?	Primary
BMP Depth (feet)	3.50	Expired permit(s)?	No Permit
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Construct new underground infiltration chambers in K-Mart parking lot.	Unsure what the plans are for this plaza in the future.

Potash Brook FRP BMP Summary Sheet

Site name:		Knoll Circle		South Burlington ID:		PB0046					
Approximate address:		Knoll Cir north of Dubois Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$750,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	12.16	Primary land use in drainage	Residential
Impervious acres managed	2.16	2 or more landowners?	Yes
% Impervious	18%	CPv managed (ac-ft)	0.80
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.35	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	2-0220
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland with swale inlet. Current stormline draining subdivision already enters swale, which also drains area to the west.	Proposed BMP is located outside of Knoll Cir residential property.

Potash Brook FRP BMP Summary Sheet

Site name:		Lane Press Roof		South Burlington ID:		PB0047					
Approximate address:		Meadowland Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Basin									



Estimated project cost	\$310,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	5.57	Primary land use in drainage	Industrial
Impervious acres managed	4.17	2 or more landowners?	No
% Impervious	75%	CPv managed (ac-ft)	0.69
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.69
BMP Footprint Size (acres)	0.55	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.00	Expired permit(s)?	1-1337
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Capture roof drainage in a new infiltration basin. Roof drains already flows to grassed area where treatment is proposed.	Soils are mapped as D, but infiltration basin directly to the west seems to be performing well and soils in this area appear similar. Would need to test infiltration rates to confirm that infiltration is possible here. If not, gravel wetland STP could be used.

Potash Brook FRP BMP Summary Sheet

Site name:		Laurel Hill Drive		South Burlington ID:		PB0048					
Approximate address:		Laurel Hill Dr off of Shelburne Rd, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Basin									



Estimated project cost	\$162,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	6.50	Primary land use in drainage	Residential
Impervious acres managed	1.84	2 or more landowners?	Yes
% Impervious	28%	CPv managed (ac-ft)	0.41
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.41
BMP Footprint Size (acres)	0.16	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.50	Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Construct new infiltration basin to the north of houses before stormline pipe enters riparian buffer.	Proposed BMP is on private property.

Potash Brook FRP BMP Summary Sheet

Site name:		Lilac Ln Infiltration Basin		South Burlington ID:		PB0049					
Approximate address:		Lilac Ln off of Hinesburg Rd, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Basin									



Estimated project cost	\$44,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.46	Primary land use in drainage	Residential
Impervious acres managed	0.85	2 or more landowners?	Yes
% Impervious	58%	CPv managed (ac-ft)	0.13
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.13
BMP Footprint Size (acres)	0.03	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Formalize infiltration basin in depressed area at the end of Lilac Ln.	

Potash Brook FRP BMP Summary Sheet

Site name:	Lindenwood Drive Detention Pond	South Burlington ID:	PB0050
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Approximate address:	Lindenwood Dr off of Shelburne Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Detention pond
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Estimated project cost	\$379,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	10.57	Primary land use in drainage	Residential
Impervious acres managed	2.19	2 or more landowners?	Yes
% Impervious	21%	CPv managed (ac-ft)	0.20
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.44	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	No Permit
Hydrologic soil group	A/B		

Proposed BMP description:	Feasibility concerns:
Add catchbasins and infrastructure to reroute stormwater to the east of Lindenwood Dr. Part of Brewer Pkwy drains to this area as well. Propose to create one detention basin to detain drainage from both streets. Lindenwood Dr has existing puddling and icing issues. This BMP would also mitigate those issues.	BMP will require installing catchbasins and associated infrastructure on Lindenwood Dr. There is a water line running nearby.

Potash Brook FRP BMP Summary Sheet

Site name:	Logwood Neighborhood Detention Pond	South Burlington ID:	PB0051
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Approximate address:	Williston Rd south of intersection with Airport Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$151,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	44.81	Primary land use in drainage	Residential
Impervious acres managed	18.44	2 or more landowners?	Yes
% Impervious	41%	CPv managed (ac-ft)	0.61
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.47	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.50	Expired permit(s)?	No Permit
Hydrologic soil group	Not Rated		

Proposed BMP description:	Feasibility concerns:
Construct new end of pipe surface impoundment BMP behind Lean Dental Group. Outfall is currently eroded.	Proposed BMP is on private property. Soils are unmapped. There are Class II wetlands south of proposed BMP, but BMP area should be well outside of wetlands buffer.

Potash Brook FRP BMP Summary Sheet

Site name:		Marcotte Central School		South Burlington ID:		PB0052					
Approximate address:		Market St near Dorset St intersection, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$189,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	2.11	Primary land use in drainage	Institutional
Impervious acres managed	1.83	2 or more landowners?	No
% Impervious	87%	CPv managed (ac-ft)	0.19
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.20	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.25	Expired permit(s)?	No Permit
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland in wooded area directly south of school parking lot. Route outfall to existing stormline. Potential educational benefit.	Potential wetlands concerns. Future Market St development.

Potash Brook FRP BMP Summary Sheet

Site name:		Marine Connection		South Burlington ID:		PB0053					
Approximate address:		Williston Rd and Shunpike Rd, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Detention Swale									



Estimated project cost	\$58,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	10.79	Primary land use in drainage	Commercial
Impervious acres managed	4.73	2 or more landowners?	Yes
% Impervious	44%	CPv managed (ac-ft)	0.21
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.20	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	No Permit
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Add detention to existing swale near the back of the large Marine Connection building. Expand swale to accommodate additional volume.	Potential for future development in greenspace.

Potash Brook FRP BMP Summary Sheet

Site name: Meadowland Business Park Pond 2
South Burlington ID: PB0054

Approximate address:

Meadowland Dr, South Burlington

MS4 where BMP is located:

South Burlington

New or existing BMP?

Existing

Proposed BMP type:

Retrofit Existing Detention Pond and add CMAC Valve



Estimated project cost
\$45,000

Drainage area (acres)
13.46

Impervious acres managed
5.13

% Impervious
38%

Land owner of BMP location
Private

BMP Footprint Size (acres)
0.89

BMP Depth (feet)
4.00

Hydrologic soil group
D

MS4s contributing drainage to BMP

South Burlington, VTrans

Primary land use in drainage

Industrial

2 or more landowners?

Yes

CPv managed (ac-ft)

1.70

Volume infiltrated (ac-ft)

0.00

Primary or secondary BMP?

Primary

Expired permit(s)?

1-1269_4290-9020.3 Lot 10

Proposed BMP description:

Retrofit existing detention pond. Add forebay and investigate opportunity to include CMAC valve to detain CPv.

Feasibility concerns:

Space is somewhat limited.

Potash Brook FRP BMP Summary Sheet

Site name:	Merchant's Bank Detention Pond	South Burlington ID:	PB0055
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Approximate address:	Kimball Ave and Kennedy Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$66,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	4.36	Primary land use in drainage	Commercial
Impervious acres managed	3.17	2 or more landowners?	Yes
% Impervious	73%	CPv managed (ac-ft)	0.23
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.10	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.50	Expired permit(s)?	2-1171; 6275-9030; 6260-0030-2-0030
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Route stormwater from Allstate Insurance west to Merchant's Bank and provide detention in grassed area	Space is limited.

Potash Brook FRP BMP Summary Sheet

Site name:		Spear Street		South Burlington ID:		PB0056					
Approximate address:		Spear St north of I-89, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$653,000	MS4s contributing drainage to BMP	South Burlington, Burlington, VTrans
Drainage area (acres)	71.00	Primary land use in drainage	Golf Course
Impervious acres managed	4.94	2 or more landowners?	Yes
% Impervious	7%	CPv managed (ac-ft)	2.14
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.77	Primary or secondary BMP?	Primary
BMP Depth (feet)	9.00	Expired permit(s)?	No Permit
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Reroute drainage from swale that runs south down Spear St to the west and create a new gravel wetland to detain flow on Country Club property.	

Potash Brook FRP BMP Summary Sheet

Site name:		Nicklaus Circle		South Burlington ID:		PB0057					
Approximate address:		Nicklaus Cir off of Dorset St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$667,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	9.25	Primary land use in drainage	Residential
Impervious acres managed	2.23	2 or more landowners?	Yes
% Impervious	24%	CPv managed (ac-ft)	0.54
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.29	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	1-1241, 4049-9030
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Construct new gravel wetland feature to the north of Nicklaus Cir where the stormline and swale converge.	Golf course is adjacent to proposed practice area and may object to large BMP.

Potash Brook FRP BMP Summary Sheet

Site name:	North Country Credit North West Infiltration	South Burlington ID:	PB0058
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Approximate address:	Swift St west of Shelburne Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Infiltration Trench
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Estimated project cost	\$37,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	0.25	Primary land use in drainage	Commercial
Impervious acres managed	0.21	2 or more landowners?	No
% Impervious	84%	CPv managed (ac-ft)	0.03
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.03
BMP Footprint Size (acres)	0.01	Primary or secondary BMP?	Primary
BMP Depth (feet)	3.00	Expired permit(s)?	No Permit
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Install perforated pipe to the north of parking lot in grassed area to infiltrate stormwater.	BMP only treats a small impervious area.

Potash Brook FRP BMP Summary Sheet

Site name:	North Country Credit South Infiltration	South Burlington ID:	PB0059
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Approximate address:	Swift St west of Shelburne Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Infiltration Gallery
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Estimated project cost	\$129,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	0.76	Primary land use in drainage	Commercial
Impervious acres managed	0.62	2 or more landowners?	No
% Impervious	81%	CPv managed (ac-ft)	0.12
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.12
BMP Footprint Size (acres)	0.03	Primary or secondary BMP?	Primary
BMP Depth (feet)	3.50	Expired permit(s)?	No Permit
Hydrologic soil group	A/B		

Proposed BMP description:	Feasibility concerns:
Construct underground infiltration chambers in the southeast corner of parking lot. Overflow to existing stormline.	BMP only treats a small impervious area.

Potash Brook FRP BMP Summary Sheet

Site name: O'Brien Drive Underground Detention
 South Burlington ID: PB0060

Approximate address:

Obrien Dr, South Burlington

MS4 where BMP is located:

South Burlington

New or existing BMP?

New

Proposed BMP type:

Underground Detention



Estimated project cost
 \$580,000

Drainage area (acres)
 8.47

Impervious acres managed
 2.87

% Impervious
 34%

Land owner of BMP location
 Private

BMP Footprint Size (acres)
 0.11

BMP Depth (feet)
 3.50

Hydrologic soil group
 A

MS4s contributing drainage to BMP

South Burlington

Primary land use in drainage

Residential

2 or more landowners?

Yes

CPv managed (ac-ft)

0.54

Volume infiltrated (ac-ft)

0.54

Primary or secondary BMP?

Primary

Expired permit(s)?

No Permit

Proposed BMP description:

Construct underground storage chambers in open lot between existing houses.

Feasibility concerns:

Space is limited.

Potash Brook FRP BMP Summary Sheet

Site name: Olympiad Apartments & Office Building Pond Retrofit
South Burlington ID: PB0061

Approximate address:

Farrell St south of Eastwood Dr, South Burlington

MS4 where BMP is located:

South Burlington

New or existing BMP?

Existing

Proposed BMP type:

Gravel Wetland



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	9.65	Primary land use in drainage	Commercial
Impervious acres managed	3.68	2 or more landowners?	Yes
% Impervious	38%	CPv managed (ac-ft)	0.06
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.21	Primary or secondary BMP?	Primary
BMP Depth (feet)	8.00	Expired permit(s)?	1-1452
Hydrologic soil group	C		

Proposed BMP description:

Feasibility concerns:

Retrofit detention basin to gravel wetland. Add forebay and ensure pond detains CPv.

Potash Brook FRP BMP Summary Sheet

Site name:		Panurgy Infiltration Basin		South Burlington ID:		PB0062					
Approximate address:		Kimball Ave and Shunpike Rd, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Retrofit Existing Infiltration Basin									



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.33	Primary land use in drainage	Commercial
Impervious acres managed	0.80	2 or more landowners?	No
% Impervious	60%	CPv managed (ac-ft)	0.08
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.14
BMP Footprint Size (acres)	0.06	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	3409-9010
Hydrologic soil group	A/C		

Proposed BMP description:	Feasibility concerns:
Retrofit and expand existing infiltration basin to infiltrate the CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		Park Road Detention Pond	South Burlington ID:		PB0063
Approximate address:	Park Rd off of Dorset St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Detention Pond				



Estimated project cost	\$94,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	6.96		
Impervious acres managed	1.27	Primary land use in drainage	Residential
% Impervious	18%	2 or more landowners?	Yes
Land owner of BMP location	Private	CPv managed (ac-ft)	0.42
BMP Footprint Size (acres)	0.23	Volume infiltrated (ac-ft)	0.00
BMP Depth (feet)	6.00	Primary or secondary BMP?	Primary
Hydrologic soil group	D	Expired permit(s)?	1-1241

Proposed BMP description:	Feasibility concerns:
Propose to reroute swale on southern side of Park Rd to the north and detain in wooded area.	Ledge outcroppings were noted nearby.

Potash Brook FRP BMP Summary Sheet

Site name:	Pillsbury Manor Infiltration Basin Retrofit	South Burlington ID:	PB0064
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Approximate address:	Pillsbury Manor N and Williston Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Retrofit to Infiltration Basin
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Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.06	Primary land use in drainage	Commercial
Impervious acres managed	0.40	2 or more landowners?	No
% Impervious	38%	CPv managed (ac-ft)	0.07
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.07
BMP Footprint Size (acres)	0.05	Primary or secondary BMP?	Secondary
BMP Depth (feet)	5.00	Expired permit(s)?	1-1015
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Retrofit existing pond to infiltration basin. Overflow to existing culvert.	

Potash Brook FRP BMP Summary Sheet

Site name:		Quarry Hill South		South Burlington ID:		PB0065	
Approximate address:	Quarry Hill Rd off of Spear St, South Burlington			MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Detention Swale						



Estimated project cost	\$132,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	5.62		
Impervious acres managed	2.52	Primary land use in drainage	Residential
% Impervious	45%	2 or more landowners?	Yes
Land owner of BMP location	Private	CPv managed (ac-ft)	0.48
BMP Footprint Size (acres)	0.40	Volume infiltrated (ac-ft)	0.00
BMP Depth (feet)	5.00	Primary or secondary BMP?	Primary
Hydrologic soil group	B/D	Expired permit(s)?	6322-9030

Proposed BMP description:	Feasibility concerns:
Add detention to existing swale running northeast behind garages.	The wall slope to the west of the swale is quite steep.

Potash Brook FRP BMP Summary Sheet

Site name:	Queen City Park Road Detention Pond	South Burlington ID:	PB0066
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Approximate address:	Queen City Park Rd off of Shelburne Rd, South Burlington	MS4 where BMP is located:	VTrans	New or existing BMP?	New
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$99,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	6.51	Primary land use in drainage	Commercial
Impervious acres managed	2.99	2 or more landowners?	Yes
% Impervious	46%	CPv managed (ac-ft)	0.45
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.63	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.00	Expired permit(s)?	No Permit
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Add detention to existing depressed area where stormlines already outfall. Drainage from Shelburne Rd is assumed to be already rerouted to larger depression to the north (see project entitled 189 Cloverleaf).	Space is somewhat limited.

Potash Brook FRP BMP Summary Sheet

Site name:		Shaws West		South Burlington ID:		PB0067					
Approximate address:		Shelburne Rd north of 189, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Underground Detention									



Estimated project cost	\$230,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.85	Primary land use in drainage	Commercial
Impervious acres managed	1.71	2 or more landowners?	Yes
% Impervious	93%	CPv managed (ac-ft)	0.16
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.07	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.83	Expired permit(s)?	No Permit
Hydrologic soil group	B/D		

Proposed BMP description:	Feasibility concerns:
Construct underground detention in vegetated island along west side of parking lot. Reroute last catchbasin in southwest corner of parking to this area.	Space is limited.

Potash Brook FRP BMP Summary Sheet

Site name: South Burlington High School Infiltration
South Burlington ID: PB0068

Approximate address:

Dorset St north of Kennedy Dr, South Burlington

MS4 where BMP is located:

South Burlington

New or existing BMP?

New

Proposed BMP type:

Infiltration Basin



Estimated project cost

\$165,000

Drainage area (acres)

3.57

Impervious acres managed

3.10

% Impervious

87%

Land owner of BMP location

MS4 Owned

BMP Footprint Size (acres)

0.22

BMP Depth (feet)

6.00

Hydrologic soil group

A

MS4s contributing drainage to BMP

South Burlington

Primary land use in drainage

Institutional

2 or more landowners?

No

CPv managed (ac-ft)

0.44

Volume infiltrated (ac-ft)

0.44

Primary or secondary BMP?

Primary

Expired permit(s)?

No Permit

Proposed BMP description:

Feasibility concerns:

Construct new infiltration basin to the southeast of sports field in currently wooded area.

Potash Brook FRP BMP Summary Sheet

Site name:	South Burlington High School North	South Burlington ID:	PB0069
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Approximate address:	Dorset St north of Kennedy Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Underground Infiltration
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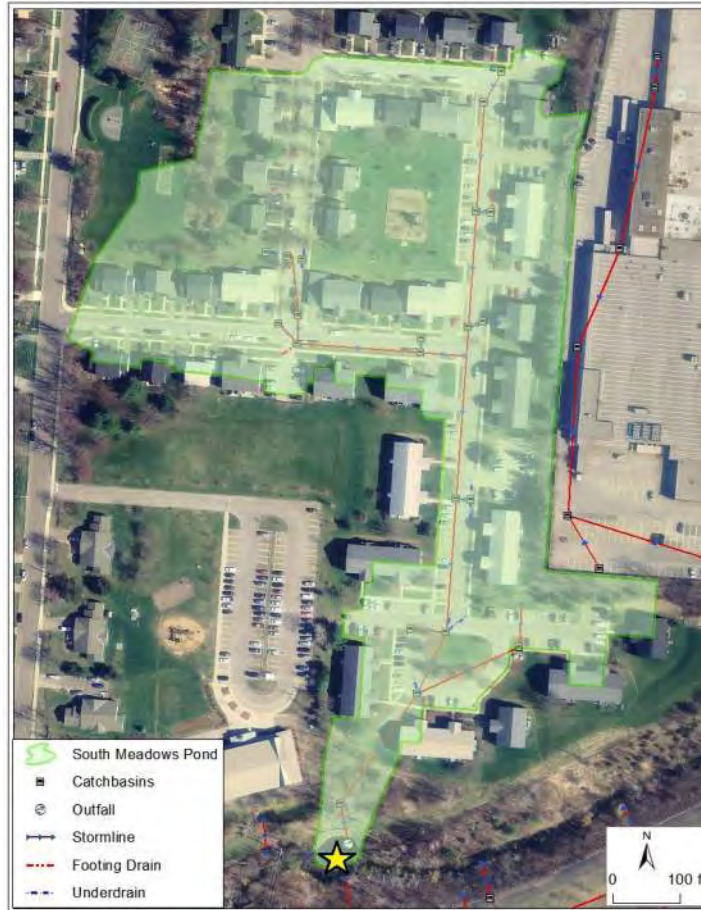


Estimated project cost	\$992,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	5.77	Primary land use in drainage	Institutional
Impervious acres managed	4.26	2 or more landowners?	No
% Impervious	74%	CPv managed (ac-ft)	0.69
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.69
BMP Footprint Size (acres)	0.16	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.17	Expired permit(s)?	6174-INDS.A
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Construct dry wells to infiltrate stormwater from the high school parking lot and middle school roof. Potential educational benefit.	

Potash Brook FRP BMP Summary Sheet

Site name:		South Meadows Pond		South Burlington ID:		PB0070					
Approximate address:		South Meadow Drive, Burlington		MS4 where BMP is located:		Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Retrofit Existing Detention Pond									



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	Burlington
Drainage area (acres)	10.10	Primary land use in drainage	Residential
Impervious acres managed	4.73	2 or more landowners?	No
% Impervious	47%	CPv managed (ac-ft)	0.37
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.19	Primary or secondary BMP?	Primary
BMP Depth (feet)	10.00	Expired permit(s)?	1-0661
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond to meet CPv standards. Add forebay and expand pond. Upgrade outlet structure.	Space is limited. Water line runs nearby. Pond is very close to brook.

Potash Brook FRP BMP Summary Sheet

Site name:		Southview Drive		South Burlington ID:		PB0071					
Approximate address:		Southview Dr off of Prouty Pkwy, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Underground Detention									



Estimated project cost	\$1,048,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	12.26	Primary land use in drainage	Residential
Impervious acres managed	4.81	2 or more landowners?	Yes
% Impervious	39%	CPv managed (ac-ft)	0.71
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.04
BMP Footprint Size (acres)	0.37	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	No Permit
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Construct underground detention chambers in ROW and grassed area. Road is 30ft wide and could be narrowed for storage.	Space is limited.

Potash Brook FRP BMP Summary Sheet

Site name:	Staples Plaza Underground Detention	South Burlington ID:	PB0072
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Approximate address:	Williston Rd west of I-89, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
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Proposed BMP type:	Underground Detention
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Estimated project cost	\$288,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	1.70	Primary land use in drainage	Commercial
Impervious acres managed	1.64	2 or more landowners?	No
% Impervious	97%	CPv managed (ac-ft)	0.20
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.03
BMP Footprint Size (acres)	0.07	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.17	Expired permit(s)?	No Permit
Hydrologic soil group	Not Rated		

Proposed BMP description:	Feasibility concerns:
Construct underground detention chambers in southeast corner of parking lot.	

Potash Brook FRP BMP Summary Sheet

Site name:	Stonehedge Circle		South Burlington ID:	PB0073	
Approximate address:	Stonehedge Dr off of Spear St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	New
Proposed BMP type:	Bioretention				



Estimated project cost	\$55,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	2.48	Primary land use in drainage	Residential
Impervious acres managed	1.26	2 or more landowners?	Yes
% Impervious	51%	CPv managed (ac-ft)	0.20
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.16	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.00	Expired permit(s)?	2-0100
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Construct bioretention along road in grassed area with discharge to existing catchbasin.	

Potash Brook FRP BMP Summary Sheet

Site name:		Sugartree Lane		South Burlington ID:		PB0074					
Approximate address:		Sugartree Ln off of Kennedy Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$96,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.54	Primary land use in drainage	Residential
Impervious acres managed	1.05	2 or more landowners?	No
% Impervious	69%	CPv managed (ac-ft)	0.12
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.05	Primary or secondary BMP?	Primary
BMP Depth (feet)	8.00	Expired permit(s)?	2-0878
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Expand existing depressed area at the end of Sugartree Ln , which appears to be an abandoned detention area, into a gravel wetland. Reroute catchbasins to pond. Upgrade outlet.	Space to expand depressed area is limited.

Potash Brook FRP BMP Summary Sheet

Site name:		Swift Estates Pond		South Burlington ID:		PB0075					
Approximate address:		Meadowood Dr and Swift St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Retrofit Existing Detention Pond									



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	18.52	Primary land use in drainage	Residential
Impervious acres managed	3.57	2 or more landowners?	Yes
% Impervious	19%	CPv managed (ac-ft)	0.33
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.41	Primary or secondary BMP?	Primary
BMP Depth (feet)	7.00	Expired permit(s)?	No Permit
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond to meet CPv standards. Add forebay and upgrade outlet structure.	Space is limited to expand pond.

Potash Brook FRP BMP Summary Sheet

Site name:	Technology Park Pond Retrofit	South Burlington ID:	PB0076
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Approximate address:	Community Dr off of Kimball Ave, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Gravel Wetland
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Estimated project cost	\$35,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	8.05	Primary land use in drainage	Industrial
Impervious acres managed	0.03	2 or more landowners?	No
% Impervious	0%	CPv managed (ac-ft)	0.27
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	1.08	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.50	Expired permit(s)?	1-1458 P4
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond to gravel wetland and meet CPv standards. Upgrade outlet structure and expand accommodate additional storage.	

Potash Brook FRP BMP Summary Sheet

Site name:		Temple Detention Pond		South Burlington ID:		PB0077					
Approximate address:		Swift St and Dorset St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$47,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.81	Primary land use in drainage	Institutional
Impervious acres managed	0.92	2 or more landowners?	No
% Impervious	51%	CPv managed (ac-ft)	0.19
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.14	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	No Permit
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Propose new gravel wetland in depressed area in front of Temple by intersection of Dorset St and Swift St. Stormwater already collects in this area.	Wetlands concerns.

Potash Brook FRP BMP Summary Sheet

Site name:		The Pines		South Burlington ID:		PB0078					
Approximate address:		Oakwood Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	12.67	Primary land use in drainage	Commercial
Impervious acres managed	5.85	2 or more landowners?	Yes
% Impervious	46%	CPv managed (ac-ft)	0.21
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	1.14	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	1-1117
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond to gravel wetland. Add forebay and CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		UMall Detention Pond		South Burlington ID:		PB0079					
Approximate address:		Dorset St (University Mall), South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Retrofit Existing Detention Pond									



Estimated project cost	\$27,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	16.90	Primary land use in drainage	Commercial
Impervious acres managed	14.96	2 or more landowners?	No
% Impervious	89%	CPv managed (ac-ft)	0.91
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.34	Primary or secondary BMP?	Primary
BMP Depth (feet)	9.00	Expired permit(s)?	1-0503c; 6282-9030
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond to detain CPv. Upgrade outlet structure and expand pond.	Space is limited.

Potash Brook FRP BMP Summary Sheet

Site name:		UMall Infiltration 1		South Burlington ID:		PB0080					
Approximate address:		Dorset St (University Mall), South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Retrofit Infiltration Gallery									



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	17.15	Primary land use in drainage	Commercial
Impervious acres managed	15.30	2 or more landowners?	No
% Impervious	89%	CPv managed (ac-ft)	0.03
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.18
BMP Footprint Size (acres)	0.09	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.40	Expired permit(s)?	1-0503b; 6282-9030
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Retrofit existing infiltration gallery to infiltrate the CPv.	Need to assess capacity for expanding infiltration gallery.

Potash Brook FRP BMP Summary Sheet

Site name:		UMall Infiltration 2		South Burlington ID:		PB0081					
Approximate address:		Dorset St (University Mall), South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Retrofit Infiltration Gallery									



Estimated project cost	\$55,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	5.61	Primary land use in drainage	Commercial
Impervious acres managed	5.55	2 or more landowners?	No
% Impervious	99%	CPv managed (ac-ft)	0.31
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	2.17
BMP Footprint Size (acres)	0.48	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.72	Expired permit(s)?	1-0503a; 6282-9030
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Retrofit existing infiltration gallery to infiltrate the CPv.	Need to assess capacity for expanding infiltration gallery.

Potash Brook FRP BMP Summary Sheet

Site name:		UMall Sears Auto Pond		South Burlington ID:		PB0082					
Approximate address:		Dorset St (University Mall), South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Retrofit Pond to Gravel Wetland									



Estimated project cost	\$90,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	11.62	Primary land use in drainage	Commercial
Impervious acres managed	9.29	2 or more landowners?	Yes
% Impervious	80%	CPv managed (ac-ft)	0.61
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.86	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	1-0503d; 6282-9030; 2-0610
Hydrologic soil group	A/B/D		

Proposed BMP description:	Feasibility concerns:
Construct large gravel wetland in unused section of parking lot in Umail (to the east of the party store). Reroute Dorset St stormline here.	Proposed BMP will require reducing parking. Potential buried utilities.

Potash Brook FRP BMP Summary Sheet

Site name:		UVM Bio Research Complex		South Burlington ID:		PB0083					
Approximate address:		Spear St north of I-89, South Burlington		MS4 where BMP is located:		UVM		New or existing BMP?		New	
Proposed BMP type:		Bioretention									



Estimated project cost	\$176,000	MS4s contributing drainage to BMP	UVM
Drainage area (acres)	1.85	Primary land use in drainage	Institutional
Impervious acres managed	0.92	2 or more landowners?	No
% Impervious	50%	CPv managed (ac-ft)	0.20
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.10	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	5269-9003.R
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Construct bioretention to treat stormwater in grassed area near the center of complex. Potential educational benefit.	Potential buried utilities.

Potash Brook FRP BMP Summary Sheet

Site name: UVM Forestry Research Center - East Roof
 South Burlington ID: PB0084

Approximate address:

Spear St north of I-89, South Burlington

MS4 where BMP is located:

UVM

New or existing BMP?

New

Proposed BMP type:

Infiltration Gallery



Estimated project cost \$39,000

Drainage area (acres) 0.42

Impervious acres managed 0.41

% Impervious 98%

Land owner of BMP location MS4 Owned

BMP Footprint Size (acres) 0.01

BMP Depth (feet) 3.33

Hydrologic soil group B

MS4s contributing drainage to BMP

UVM

Primary land use in drainage

Institutional

2 or more landowners?

No

CPv managed (ac-ft)

0.06

Volume infiltrated (ac-ft)

0.01

Primary or secondary BMP?

Primary

Expired permit(s)?

No Permit

Proposed BMP description:

Feasibility concerns:

Construct dry well to capture and infiltrate roof drain.
 Potential educational benefit.

Potash Brook FRP BMP Summary Sheet

Site name:	UVM Forestry Research Center - West Roof	South Burlington ID:	PB0085
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Approximate address:	Spear St north of I-89, South Burlington	MS4 where BMP is located:	UVM	New or existing BMP?	New
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Proposed BMP type:	Infiltration Gallery
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Estimated project cost	\$25,000	MS4s contributing drainage to BMP	UVM
Drainage area (acres)	0.12	Primary land use in drainage	Institutional
Impervious acres managed	0.11	2 or more landowners?	No
% Impervious	91%	CPv managed (ac-ft)	0.02
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.01
BMP Footprint Size (acres)	0.03	Primary or secondary BMP?	Primary
BMP Depth (feet)	3.33	Expired permit(s)?	No Permit
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Construct dry well to capture and infiltrate roof drain. Potential educational benefit.	

Potash Brook FRP BMP Summary Sheet

Site name:	Vermont National Country Club Pond B	South Burlington ID:	PB0086
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Approximate address:	Golf Course Rd and Park Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Retrofit Existing Detention Pond
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Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	35.72	Primary land use in drainage	Residential
Impervious acres managed	8.63	2 or more landowners?	Yes
% Impervious	24%	CPv managed (ac-ft)	0.43
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.47	Primary or secondary BMP?	Primary
BMP Depth (feet)	10.50	Expired permit(s)?	1-1241b
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond. Add forebay and expand pond.	

Potash Brook FRP BMP Summary Sheet

Site name:	Vermont National Country Club Pond C	South Burlington ID:	PB0087
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Approximate address:	Golf Course Rd and Park Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Retrofit Existing Detention Pond
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Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	9.94	Primary land use in drainage	Golf Course
Impervious acres managed	0.47	2 or more landowners?	No
% Impervious	5%	CPv managed (ac-ft)	0.85
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	1.78	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.00	Expired permit(s)?	1-1241c
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Retrofit existing detention pond. Add forebay and expand pond.	

Potash Brook FRP BMP Summary Sheet

Site name:		VT Gas Detention Pond		South Burlington ID:		PB0088					
Approximate address:		Swift St and Farrell St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$52,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	7.57	Primary land use in drainage	Commercial
Impervious acres managed	3.09	2 or more landowners?	No
% Impervious	41%	CPv managed (ac-ft)	0.17
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.10	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	2-0228; 6293-9030
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Reroute stormline from Swift St to grassed area to the north of VT Gas property and construct new gravel wetland.	Space is limited. Proposed BMP is in close proximity to brook.

Potash Brook FRP BMP Summary Sheet

Site name:		Wellesley Grove		South Burlington ID:		PB0089					
Approximate address:		Georgetown off of Kennedy Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$77,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	8.85	Primary land use in drainage	Residential
Impervious acres managed	2.15	2 or more landowners?	Yes
% Impervious	24%	CPv managed (ac-ft)	0.27
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.29	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	2-1023
Hydrologic soil group	A/C		

Proposed BMP description:	Feasibility concerns:
Add outlet control to existing depression to detain stormwater, construct new gravel wetland. Repair outfall erosion.	Wetlands concerns.

Potash Brook FRP BMP Summary Sheet

Site name:		Windridge Court		South Burlington ID:		PB0090					
Approximate address:		Windridge Ct and Kennedy Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Basin									



Estimated project cost	\$45,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.04	Primary land use in drainage	Residential
Impervious acres managed	0.58	2 or more landowners?	No
% Impervious	55%	CPv managed (ac-ft)	0.10
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.10
BMP Footprint Size (acres)	0.09	Primary or secondary BMP?	Primary
BMP Depth (feet)	4.50	Expired permit(s)?	2-0824
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Construct new infiltration basin to infiltrate stormwater to the west of this small development.	

Potash Brook FRP BMP Summary Sheet

Site name:		Woodcrest Drive		South Burlington ID:		PB0091					
Approximate address:		Woodcrest Dr and Deane St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Infiltration Basin									



Estimated project cost	\$303,000	MS4s contributing drainage to BMP	South Burlington, VTrans
Drainage area (acres)	7.46	Primary land use in drainage	Residential
Impervious acres managed	2.38	2 or more landowners?	Yes
% Impervious	32%	CPv managed (ac-ft)	0.50
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.50
BMP Footprint Size (acres)	0.22	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.00	Expired permit(s)?	No Permit
Hydrologic soil group	A/C		

Proposed BMP description:	Feasibility concerns:
Infiltrate stormwater to the southwest of drainage area. Reroute stormline south to new BMP. Construct new swale to drain the end of Woodcrest Dr, which is currently eroding slope following road.	Wetlands exist to the west and south of proposed BMP.

Potash Brook FRP BMP Summary Sheet

Site name:		Woodlands Industrial Park		South Burlington ID:		PB0092					
Approximate address:		Kimball Ave west of Community Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Gravel Wetland									



Estimated project cost	\$25,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	4.40	Primary land use in drainage	Industrial
Impervious acres managed	3.89	2 or more landowners?	No
% Impervious	88%	CPv managed (ac-ft)	0.37
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.20	Primary or secondary BMP?	Primary
BMP Depth (feet)	8.00	Expired permit(s)?	1-0526/ 6279-9030
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Reroute roof drainage to existing detention pond. Retrofit pond to gravel wetland and expand to accommodate additional volume and detain CPv.	Space to expand pond is limited.

Potash Brook FRP BMP Summary Sheet

Site name:		Worcester Street		South Burlington ID:		PB0093					
Approximate address:		Adirondack St and Butler Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		New	
Proposed BMP type:		Underground Detention									



Estimated project cost	\$821,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	10.84		
Impervious acres managed	3.82	Primary land use in drainage	Residential
% Impervious	35%	2 or more landowners?	Yes
Land owner of BMP location	Private	CPv managed (ac-ft)	0.56
BMP Footprint Size (acres)	0.26	Volume infiltrated (ac-ft)	0.00
BMP Depth (feet)	5.17	Primary or secondary BMP?	Primary
Hydrologic soil group	D	Expired permit(s)?	2-0312

Proposed BMP description:	Feasibility concerns:
Construct underground detention chambers under ROW and grassed shoulder.	Space is very limited. Utilities concerns. Unsure how high groundwater table is here.

Potash Brook FRP BMP Summary Sheet

Site name:	Dorset Park Pond		South Burlington ID:	PB0094	
Approximate address:	Dorset St and Swift St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Detention Pond				



Estimated project cost	\$20,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	26.07	Primary land use in drainage	Recreational
Impervious acres managed	5.95	2 or more landowners?	Yes
% Impervious	23%	CPv managed (ac-ft)	0.30
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	1.18	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.60	Expired permit(s)?	1-1033
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with under drain and include CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:	Hannaford's Pond	South Burlington ID:	PB0095		
Approximate address:	Hannaford Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Detention Pond				



Estimated project cost	\$21,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	14.71	Primary land use in drainage	Commercial
Impervious acres managed	7.75	2 or more landowners?	No
% Impervious	53%	CPv managed (ac-ft)	0.34
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.59	Primary or secondary BMP?	Primary
BMP Depth (feet)	10.50	Expired permit(s)?	1-1214
Hydrologic soil group	B		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:	Lowes Pond		South Burlington ID:	PB0096	
Approximate address:	Hannaford Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Detention Pond				



Estimated project cost	\$17,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	12.73	Primary land use in drainage	Commercial
Impervious acres managed	10.05	2 or more landowners?	No
% Impervious	79%	CPv managed (ac-ft)	0.20
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.34	Primary or secondary BMP?	Primary
BMP Depth (feet)	6.00	Expired permit(s)?	1-1214
Hydrologic soil group	A/D		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:	Vermont National Country Club Pond B	South Burlington ID:	PB0097
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Approximate address:	Golf Course Rd, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
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Proposed BMP type:	Detention Pond
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Estimated project cost	\$36,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	35.72	Primary land use in drainage	Residential
Impervious acres managed	8.63	2 or more landowners?	Yes
% Impervious	24%	CPv managed (ac-ft)	0.92
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.63	Primary or secondary BMP?	Primary
BMP Depth (feet)	12.00	Expired permit(s)?	1-1241b
Hydrologic soil group	C/D		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:	Technology Park Pond 1		South Burlington ID:	PB0098	
Approximate address:	Community Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Detention Pond				



Estimated project cost	\$22,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	8.96	Primary land use in drainage	Industrial
Impervious acres managed	3.78	2 or more landowners?	No
% Impervious	42%	CPv managed (ac-ft)	0.37
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.74	Primary or secondary BMP?	Primary
BMP Depth (feet)	8.00	Expired permit(s)?	1-1254
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		Lot A Mountain View Pond		South Burlington ID:		PB0099	
Approximate address:		Tilley Dr, South Burlington		MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:		Detention Pond					



Estimated project cost	\$12,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	6.05	Primary land use in drainage	Commercial
Impervious acres managed	2.55	2 or more landowners?	No
% Impervious	42%	CPv managed (ac-ft)	0.02
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.16	Primary or secondary BMP?	Primary
BMP Depth (feet)	14.00	Expired permit(s)?	1-1536
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		Kennedy Dr Pond 1		South Burlington ID:		PB0100					
Approximate address:		Kennedy Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Detention Pond									



Estimated project cost	\$13,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.47	Primary land use in drainage	Road
Impervious acres managed	1.33	2 or more landowners?	No
% Impervious	91%	CPv managed (ac-ft)	0.05
Land owner of BMP location	MS4 Owned	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.08	Primary or secondary BMP?	Primary
BMP Depth (feet)	5.91	Expired permit(s)?	1-1582a
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		Quarry Hill Pond		South Burlington ID:		PB0101					
Approximate address:		Quarry Hill Rd off of Spear St, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Detention Pond									



Estimated project cost	\$12,000		MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	21.75			
Impervious acres managed	6.19		Primary land use in drainage	Residential
% Impervious	28%		2 or more landowners?	Yes
Land owner of BMP location	Private		CPv managed (ac-ft)	0.00
BMP Footprint Size (acres)	0.41		Volume infiltrated (ac-ft)	0.00
BMP Depth (feet)	5.40		Primary or secondary BMP?	Primary
Hydrologic soil group	B/D		Expired permit(s)?	3602-INDS

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		Heatherfield P1		South Burlington ID:		PB0102	
Approximate address:		Off of Spear St, South Burlington		MS4 where BMP is located:		South Burlington	<div>New or existing BMP?</div> <div>Existing</div>
Proposed BMP type:		Detention Pond					



Estimated project cost	\$12,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	1.40	Primary land use in drainage	Residential
Impervious acres managed	0.90	2 or more landowners?	No
% Impervious	64%	CPv managed (ac-ft)	0.00
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.05	Primary or secondary BMP?	Primary
BMP Depth (feet)	8.00	Expired permit(s)?	3658a
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		Heatherfield P2		South Burlington ID:		PB0103	
Approximate address:	Off of Spear St, South Burlington			MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Detention Pond						



Estimated project cost	\$13,000		MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	10.76			
Impervious acres managed	7.08		Primary land use in drainage	Residential
% Impervious	66%		2 or more landowners?	No
Land owner of BMP location	Private		CPv managed (ac-ft)	0.03
BMP Footprint Size (acres)	0.26		Volume infiltrated (ac-ft)	0.00
BMP Depth (feet)	11.00		Primary or secondary BMP?	Primary
Hydrologic soil group	B/C		Expired permit(s)?	3658b

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		Heatherfield P3		South Burlington ID:		PB0104	
Approximate address:		Off of Spear St, South Burlington		MS4 where BMP is located:		South Burlington	<div>New or existing BMP?</div> <div>Existing</div>
Proposed BMP type:		Detention Pond					



Estimated project cost	\$13,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	4.30	Primary land use in drainage	Residential
Impervious acres managed	2.71	2 or more landowners?	No
% Impervious	63%	CPv managed (ac-ft)	0.05
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.10	Primary or secondary BMP?	Primary
BMP Depth (feet)	11.50	Expired permit(s)?	3658c
Hydrologic soil group	A		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:	Winding Brook		South Burlington ID:	PB0105	
Approximate address:	Winding Brook Dr, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Detention Pond				



Estimated project cost	\$15,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	9.11	Primary land use in drainage	Residential
Impervious acres managed	3.32	2 or more landowners?	Yes
% Impervious	36%	CPv managed (ac-ft)	0.11
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.19	Primary or secondary BMP?	Primary
BMP Depth (feet)	9.50	Expired permit(s)?	3691-INDS
Hydrologic soil group	C		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:		Mountainview Pond b		South Burlington ID:		PB0106					
Approximate address:		Tilley Dr, South Burlington		MS4 where BMP is located:		South Burlington		New or existing BMP?		Existing	
Proposed BMP type:		Detention Pond									



Estimated project cost	\$14,000	MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	0.90	Primary land use in drainage	Road
Impervious acres managed	0.61	2 or more landowners?	No
% Impervious	68%	CPv managed (ac-ft)	0.08
Land owner of BMP location	Private	Volume infiltrated (ac-ft)	0.00
BMP Footprint Size (acres)	0.13	Primary or secondary BMP?	Primary
BMP Depth (feet)	9.50	Expired permit(s)?	3805-INDS
Hydrologic soil group	D		

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

Potash Brook FRP BMP Summary Sheet

Site name:	Farrell St Pond		South Burlington ID:	PB0107	
Approximate address:	Farrell St, South Burlington	MS4 where BMP is located:	South Burlington	New or existing BMP?	Existing
Proposed BMP type:	Detention Pond				



Estimated project cost	\$13,000		MS4s contributing drainage to BMP	South Burlington
Drainage area (acres)	32.96			
Impervious acres managed	11.03		Primary land use in drainage	Commercial
% Impervious	33%		2 or more landowners?	Yes
Land owner of BMP location	MS4 Owned		CPv managed (ac-ft)	0.05
BMP Footprint Size (acres)	0.41		Volume infiltrated (ac-ft)	0.00
BMP Depth (feet)	9.00		Primary or secondary BMP?	Primary
Hydrologic soil group	A/C/D		Expired permit(s)?	5080-INDO

Proposed BMP description:	Feasibility concerns:
Investigate option to retrofit pond with CMAC valve to detain CPv.	

APPENDIX C
PROJECT RANKING

Potash Brook Flow Restoration Plan

Table D-1: BMP Ranking Criteria Key

Category	ID	Criteria	Technical Description	Description
Cost/Operations	A	Project Cost per Impervious Acre	The project costs per impervious acre were grouped into categories from \$2/acre to \$500,000/acre based on the range of projects proposed. Cost estimates were developed using the latest unit costs from VTrans as well as local experience. More expensive projects are ranked lower.	Project Costs include additional engineering, permitting, and construction. Transportation and utility conflicts, as well as overall constructability is also reflected in the cost.
Project Design Metrics	B	Impervious Acres Managed (ac)	Natural groupings within the range of impervious managed for the proposed projects were identified. More impervious managed receives a higher score.	The more impervious managed by a project, the higher the potential pollutant reduction. Additionally, the goal of the FRP is to manage existing impervious surfaces.
	C	Channel Protection Volume (CPV) Mitigated, (i.e.. 1-year Storm)	Groupings within the range of CPv volume storage were identified. The largest grouping receives the highest score. The CPv was estimated in HydroCAD, using local rainfall data.	The Channel Protection Volume (CPv) is the volume of stormwater runoff generated from the 1-year design storm (1.98" in Burlington). A BMP which provides CPv storage was determined to reduce the High-flow (Q0.3%), which is the flow rate exceeded 0.3% of the time (output from the State's BMPDSS model). Mitigating the CPv reduces channel erosion and excessive pollutant loading from streams.
	D	Volume Infiltrated (ac-ft)	Natural groupings within the range of volumes infiltrated for the BMPs were identified to which relative points were be assigned. The largest volume infiltrated was assigned the highest score. Volumes were calculated in HydroCAD.	The Volume Infiltrated indicates the amount of stormwater runoff that is infiltrated into the groundwater, and provides baseflow for the stream. The TMDL flow targets include a low-flow target, which is addressed by an infiltration-based BMP.
Project Implementation	E	Permitability	Permitability is simplified into two categories to reflect the common scenarios in permitting, as 1) minimal permitting, versus 2) Complex permitting issues. An itemized list of permits was included to inform the ranking, but was not used in the scoring.	Permitability is a measure of the expected level of effort to permit the project, based on knowledge that each type of permit takes varying amounts of time. Some common permits include Stormwater Construction, Local Zoning, Act 250 amendments, VTRANS ROW, etc.
	F	Land Availability	Public land is preferred, followed by regulated private land, and private land where the owners are known to be open to participate. Private land, in which participation of the owner is unknown is lower priority.	Land availability is critical for BMPs requiring open space for detention and access for the City. Properties owned by the City are ranked the highest, followed by privately owned land that has an expired permit, which provides leverage for owner participation.
	G	Flood Mitigation	Flood mitigation is categorized by the scale of the impact.	Flood mitigation is categorized by the scale of the impact. A neighborhood flooding issue is weighed more heavily than a localized drainage issue.
	H	TMDL Flow Target Addressed (Q03, Q95)	More weight is on BMPs that address both TMDL targets- the high-flow (Q0.3%) and low-flow targets (Q95%). The high-flow target is addressed by detention BMPs which storage the CP volume.	The goal of the FRP is to implement projects which address the TMDL flow targets. The high-flow target is measured as a reduction in the stream flow rate exceeded 0.3% of the time, while the low-flow target is an increase in the stream flow rate exceeded 95% of the time (baseflow). Projects which address both targets through storage or infiltration of the 1-year design storm are weighted the highest, followed by projects which address just the high-flow. Projects which do not address the full 1-year storm volume are weighted the lowest.
	I	Lake Champlain Phosphorus TMDL	Yes or no whether the proposed practice will provide benefit toward the Lake Champlain Phosphorus TMDL. This will be determined once the TMDL compliance metrics are released.	The Lake Champlain Phosphorus TMDL has been developed in the effort to reduce nutrient loading and consequential toxic algal blooms in Lake Champlain. The TMDL will require stormwater BMPs to meet a certain level of Total Phosphorus reduction. Each BMP will be evaluated against the TMDL compliance metrics, and scored yes or no if the project meets the TMDL standards.
	J	Other Project Benefits/Constraints	This criteria is to account for indirect project benefits like infrastructure improvements (e.g. aging culvert replacement, wetlands enhancement, and if it addresses an expired permit), or potential constraints (e.g. utility issues encountered during construction).	This criteria is to account for indirect project benefits like infrastructure improvements, community benefits, habitat creation, etc, as well as things that might constrain the project such as the potential of encountering utilities during construction.

Potash Brook Flow Restoration Plan
Table D-2: BMP Ranking Scoring Key

Category	ID	Criteria	Quality	Score
Cost/Operations	A	Project Cost per Impervious Acre	\$1.00 - \$24,999	4
			\$25,000 - \$49,999	3
			\$50,000 - \$99,999	2
			\$100,000 - \$199,999	1
			\$200,000 - \$499,999	0
			\$500,000 +	-1
Project Design Metrics	B	Impervious Acres Managed (ac)	>10 acres	6
			>5-10 acres	5
			>4-5 acres	4
			>2-4 acres	3
			>1-2 acres	2
			≤ 1 acre	1
			0 acres	0
	C	Channel Protection Volume (CPv) Mitigated, (ie. 1-year Storm)	>0.6 ac-ft	5
			>0.4-0.6 ac-ft	4
			>0.2-0.4 ac-ft	3
			>0.05-0.2 ac-ft	2
			>0-0.05 ac-ft	1
			0 ac-ft	0
	D	Volume Infiltrated (ac-ft)	>2 ac-ft	5
			1 - 2 ac-ft	4
			0.5 - 1 ac-ft	3
			0.1 - 0.5 sc-ft	2
			>0.01 - 0.1 ac-ft	1
			no infiltration	0
Project Implementation	E	Permitability	Minimal Issues/Concerns or no permits	2
			Complex issues/Potential permit denial	0
	F	Land Availability	City owned	4
			Non City owned regulated (expire permit)	3
			Non City owned/Participatory Owner	2
			Unknown	0
	G	Flood Mitigation (Is existing flooding issue mitigated by project?)	Neighborhood Wide Flooding Issue	3
			Infrastructure damage (e.g. Wet Basement)/Single Property	2
			Nuisance Issue (ie. ponding, puddles, etc).	1
			None	0
	H	TMDL Flow Target Addressed (Q03, Q95)	High and Low Flow Targets	3
			High Flow Target	2
			No target addressed in BMPDSS (just WQ treatment)	1
	I	Lake Champlain Phosphorus TMDL	Addressed TMDL	1
			Does not address TMDL	0
	J	Other Project Benefits/Constraints	Infrastructure Improvement (e.g. Culvert Replacement)	1
			Educational/Functional Benefit	1
			Recreational Benefit	1
			Natural Habitat Creation/Protection	1
			Outfall Erosion Control	1
			Utility Issues/Uncertainty	-1

APPENDIX D

PROPOSED BMP COST ESTIMATES, PRIORITIZATION RANKING, AND IMPLEMENTATION SCHEDULE

Potash Flow Restoration Plan
Table E-1: Project Cost Estimates

BMP ID	Project Name	Retrofit Description	Imp acres	Design Control Volume (ac-ft)	Design Control Volume (cft)	Base Unit Cost (\$/cft)	Site Adjustment Factor	Base Construction Cost ¹	Permits & Engineering Contingency	BMP Footprint Area (Acres)	Land Cost	Summed Project Cost	Minimum Project Cost (\$10k for simple retrofits; \$25k otherwise)	Final Project Cost	Cost/Imp Acre	O&M
PB0001	1050 Hinesburg Road	Gravel Wetland	0.7	0.11	4835	\$10	1.5	\$72,527	\$ 25,385	0.065	\$7,800	\$ 105,712	\$ 25,000	\$ 105,712	\$ 132,392	\$ 2,176
PB0002	110 Kimball Ave - North Infiltration Basin	Retrofit Existing Infiltration Basin	0.58	0.02	1045	\$4	0.25	\$1,045	\$ 366	NA	\$0	\$ 1,411	\$ 25,000	\$ 25,000	\$ 2,449	\$ 31
PB0003	110 Kimball Ave - South Infiltration Basin	Retrofit Existing Infiltration Basin	0.9	0.05	2309	\$4	0.25	\$2,309	\$ 808	NA	\$0	\$ 3,117	\$ 10,000	\$ 10,000	\$ 3,308	\$ 69
PB0004	189 Cloverleaf Detention Pond	Detention Pond	12.1	1.13	49179	\$2	0.5	\$49,179	\$ 9,836	1.19	\$0	\$ 59,015	\$ 25,000	\$ 59,015	\$ 4,861	\$ 1,475
PB0005	189 Ramp Detention Pond	Gravel Wetland	5.8	0.35	15159	\$10	1.5	\$227,383	\$ 79,584	0.33	\$39,600	\$ 346,567	\$ 25,000	\$ 346,567	\$ 53,134	\$ 6,821
PB0006	30 Kimball Ave Swale Retrofit	Retrofit Existing Swale	1.0	0.03	1089	\$2	0.25	\$545	\$ 191	NA	\$0	\$ 735	\$ 25,000	\$ 25,000	\$ 703	\$ 16
PB0007	Adelphia Cable Pond Retrofit	Gravel Wetland	2.7	0.09	3746	\$10	0.25	\$9,365	\$ 3,278	NA	\$0	\$ 12,643	\$ 25,000	\$ 25,000	\$ 4,753	\$ 281
PB0008	Adirondack Street	Underground detention	3.5	0.58	25265	\$12	2	\$606,355	\$ 212,224	0.217	\$26,040	\$ 844,620	\$ 25,000	\$ 844,620	\$ 232,439	\$ 10,000
PB0009	Airport Drive	Infiltration Gallery	3.6	0.46	19820	\$12	1.5	\$356,756	\$ 71,351	0.091	\$10,920	\$ 439,028	\$ 25,000	\$ 439,028	\$ 118,182	\$ 10,000
PB0010	Ashbrook Drive	Gravel Wetland	0.9	0.18	7754	\$10	1.5	\$116,305	\$ 40,707	0.089	\$10,680	\$ 167,692	\$ 25,000	\$ 167,692	\$ 177,895	\$ 3,489
PB0011	Blue Mall Infiltration	Infiltration Gallery	2.4	0.37	15987	\$12	2	\$383,676	\$ 134,287	0.11	\$13,015	\$ 530,978	\$ 25,000	\$ 530,978	\$ 215,397	\$ 10,000
PB0012	Brookwood Drive Pond	Detention Pond	24.5	2.00	87033	\$2	1.5	\$261,099	\$ 91,385	0.344	\$41,280	\$ 393,763	\$ 25,000	\$ 393,763	\$ 14,392	\$ 7,833
PB0013	Burlington Price Chopper	Gravel wetland	11.5	1.23	53550	\$10	2	\$1,071,002	\$ 374,851	0.11	\$13,223	\$ 1,459,075	\$ 25,000	\$ 1,459,075	\$ 125,945	\$ 10,000
PB0014	Chelsea Circle	Infiltration Basin	1.8	0.29	12720	\$4	1.5	\$76,317	\$ 15,263	0.196	\$23,520	\$ 115,101	\$ 25,000	\$ 115,101	\$ 50,350	\$ 2,290
PB0015	Church of Jesus Christ of Latterday Saints	Detention Swale	1.6	0.10	4312	\$2	1.5	\$12,937	\$ 4,528	0.093	\$11,160	\$ 28,625	\$ 25,000	\$ 28,625	\$ 11,032	\$ 388
PB0016	Community Bible Church Infiltration	Infiltration Trench	6.2	0.91	39727	\$12	1.5	\$715,081	\$ 250,278	0.083	\$9,960	\$ 975,319	\$ 25,000	\$ 975,319	\$ 156,497	\$ 10,000
PB0017	Domino's	Gravel Wetland	1.3	0.23	10062	\$10	1.5	\$150,935	\$ 30,187	0.145	\$17,400	\$ 198,522	\$ 25,000	\$ 198,522	\$ 134,769	\$ 4,528
PB0018	Dorset Commons Pond	Detention Pond	5.0	0.60	26223	\$2	1.5	\$78,669	\$ 27,534	0.513	\$61,560	\$ 167,764	\$ 25,000	\$ 167,764	\$ 21,210	\$ 2,360
PB0019	Dumont Park Stormwater Project	Detention Pond	4.2	0.27	17118	\$2	1.5	\$35,153	\$ 7,031	0.223	\$26,760	\$ 68,944	\$ 25,000	\$ 68,944	\$ 10,143	\$ 1,055
PB0020	Dynapower	Gravel Wetland	6.5	0.95	41469	\$10	0.25	\$103,673	\$ 20,735	NA	\$0	\$ 124,407	\$ 25,000	\$ 124,407	\$ 19,140	\$ 3,110
PB0021	East Terrace Detention Pond	Gravel Wetland	2.3	0.34	14985	\$10	1.5	\$224,770	\$ 44,954	0.401	\$48,120	\$ 317,844	\$ 25,000	\$ 317,844	\$ 118,316	\$ 6,743
PB0022	Eastwood Commons Pond Expansion	Retrofit Existing Detention Pond	20.8	0.73	33712	\$2	0.25	\$15,856	\$ 3,171	NA	\$0	\$ 19,027	\$ 25,000	\$ 25,000	\$ 916	\$ 476
PB0023	Easy Self Storage	Gravel Wetland	1.2	0.20	8843	\$10	1.5	\$132,640	\$ 46,424	0.140	\$16,800	\$ 195,864	\$ 25,000	\$ 195,864	\$ 147,987	\$ 3,979
PB0024	Economou Farm Pond	Gravel Wetland	1.5	0.67	29142	\$10	0.25	\$72,854	\$ 14,571	NA	\$0	\$ 87,425	\$ 25,000	\$ 87,425	\$ 59,762	\$ 2,186
PB0025	Exit 13 Gravel Wetland	Gravel wetland	5.6	0.57	24699	\$10	0.5	\$123,493	\$ 43,222	0.434	\$52,080	\$ 218,795	\$ 25,000	\$ 218,795	\$ 29,931	\$ 3,705
PB0026	Exit 14 Gravel Wetland	Gravel wetland	1.9	0.29	12807	\$10	0.5	\$64,033	\$ 22,412	0.372	\$44,640	\$ 131,085	\$ 25,000	\$ 131,085	\$ 44,790	\$ 1,921
PB0027	Fairpoint Communications	Gravel Wetland	4.8	0.59	25744	\$10	1.5	\$386,159	\$ 77,232	0.260	\$31,200	\$ 494,591	\$ 25,000	\$ 494,591	\$ 97,387	\$ 10,000
PB0028	Faith United Methodist Church	Underground Detention	1.0	0.15	6490	\$2	2	\$25,962	\$ 9,087	0.116	\$13,920	\$ 48,968	\$ 25,000	\$ 48,968	\$ 33,983	\$ 779
PB0029	Golf Course Road South	Gravel Wetland	1.7	0.23	10106	\$10	1	\$101,059	\$ 20,212	0.117	\$14,040	\$ 135,311	\$ 25,000	\$ 135,311	\$ 72,780	\$ 3,032
PB0030	Gonzo's Underground	Underground detention	8.7	0.45	19646	\$12	2	\$471,493	\$ 165,023	0.21	\$25,026	\$ 661,542	\$ 25,000	\$ 661,542	\$ 72,986	\$ 10,000
PB0031	Grandview Drive North Detention Pond	Detention Pond	1.4	0.14	6186	\$2	1.5	\$18,557	\$ 6,495	0.066	\$7,920	\$ 32,971	\$ 25,000	\$ 32,971	\$ 18,141	\$ 557
PB0032	Grandview Drive West Detention Pond	Detention Pond	1.9	0.18	7786	\$2	1.5	\$23,358	\$ 8,175	0.034	\$4,132	\$ 35,666	\$ 25,000	\$ 35,666	\$ 16,704	\$ 701
PB0033	Hawthorne Circle Detention Pond	Gravel Wetland	2.5	0.15	6534	\$10	1.5	\$98,010	\$ 34,304	0.093	\$11,160	\$ 143,474	\$ 25,000	\$ 143,474	\$ 51,891	\$ 2,940
PB0034	Helen Ave Cul De Sac	Infiltration Basin	2.2	0.35	15420	\$4	1.5	\$92,521	\$ 32,383	0.093	\$11,160	\$ 136,064	\$ 25,000	\$ 136,064	\$ 58,071	\$ 2,776
PB0035	Hinesburg Road	Detention pond	1.3	0.14	6011	\$2	1.5	\$18,034	\$ 6,312	0.070	\$8,400	\$ 32,746	\$ 25,000	\$ 32,746	\$ 19,147	\$ 541
PB0036	I-89 Swale	Median Filter	1.9	0.53	23130	\$5	1.5	\$173,478	\$ 34,696	NA	\$0	\$ 208,173	\$ 25,000	\$ 208,173	\$ 108,991	\$ 5,204
PB0037	Iby Gravel Wetland	Gravel wetland	1.1	0.07	2919	\$10	1.5	\$43,778	\$ 15,322	0.062	\$7,440	\$ 66,540	\$ 25,000	\$ 167,000	\$ 51,829	\$ 1,313
PB0038	INS Building Pond A Retrofit	Gravel Wetland	1.0	0.04	1742	\$10	0.25	\$4,356	\$ 1,525	NA	\$0	\$ 5,881	\$ 25,000	\$ 25,000	\$ 5,981	\$ 131
PB0039	INS Building Pond B Retrofit	Gravel Wetland	0.6	0.04	1742	\$10	0.25	\$4,356	\$ 1,525	NA	\$0	\$ 5,881	\$ 25,000	\$ 25,000	\$ 9,632	\$ 131
PB0040	Joy Dr Detention Pond	Gravel Wetland	1.3	0.21	9148	\$10	1.5	\$137,214	\$ 27,443	0.119	\$14,280	\$ 178,937	\$ 25,000	\$ 178,937	\$ 122,928	\$ 4,116
PB0041	Kennedy Dr Pond 2 Expansion	Gravel Wetland	2.4	0.16	6926	\$10	0.25	\$17,315	\$ 6,060	NA	\$0	\$ 23,375	\$ 25,000	\$ 380,041	\$ 9,905	\$ 519
PB0042	Kennedy Dr Pond 3 Expansion	Gravel Wetland	4.8	0.18	7623	\$10	0.25	\$29,058	\$ 5,812	NA	\$0	\$ 34,869	\$ 10,000	\$ 320,920	\$ 7,234	\$ 872
PB0043	Kennedy Dr Pond 4 Expansion	Retrofit Existing Detention Pond	4.8	0.25	10977	\$2	0.25	\$5,489	\$ 1,921	NA	\$0	\$ 7,410	\$ 25,000	\$ 25,000	\$ 1,550	\$ 165
PB0044	Kennedy Dr Pond 7 Expansion	Gravel Wetland	8.7	0.58	25395	\$10	0.25	\$73,489	\$ 25,721	NA	\$0	\$ 99,210	\$ 10,000	\$ 407,000	\$ 11,449	\$ 2,205
PB0045	K-Mart Plaza Infiltration	Sand Filter/Detention Gallery	7.7	0.86	37592	\$12	2	\$902,215	\$ 180,443	0.32	\$38,400	\$ 1,121,058	\$ 25,000	\$ 1,121,058	\$ 140,894	\$ 10,000
PB0046	Knoll Circle	Gravel Wetland	2.2	0.80	34935	\$10	1.5	\$524,027	\$ 183,409	0.352	\$42,240	\$ 749,676	\$ 25,000	\$ 749,676	\$ 327,517	\$ 10,000
PB0047	Lane Press Roof	Infiltration Basin	4.2	0.69	30100	\$4	1.5	\$180,600	\$ 63,210	0.55	\$66,000	\$ 309,810	\$ 25,000	\$ 309,810	\$ 58,468	\$ 5,418
PB0048	Laurel Hill Drive	Infiltration Basin	1.8	0.41	17642	\$4	1.5	\$105,851	\$ 37,048	0.16	\$19,200	\$ 162,099	\$ 25,000	\$ 162,099	\$ 77,662	\$ 3,176
PB0049	Lilac Ln Infiltration Basin	Infiltration Basin	0.8	0.13	5706	\$4	1.5	\$34,238	\$ 6,848	0.027	\$3,240	\$ 44,326	\$ 25,000	\$ 44,326	\$ 48,344	\$ 1,027
PB0050	Lindenwood Drive Detention Pond	Detention pond	2.2	0.21	8930	\$2	1.5	\$26,789	\$ 9,376	0.440	\$52,800	\$ 88,966	\$ 25,000	\$ 379,468	\$ 16,500	\$ 804
PB0051	Logwood Neighborhood Detention Pond	Detention Pond	18.4	0.61	26397	\$2	1.5	\$79,192	\$ 15,838	0.47	\$56,280	\$ 151,310	\$ 25,000	\$ 151,310	\$ 5,154	\$ 2,376
PB0052	Marcotte Central School	Gravel Wetland	1.8	0.19	8102	\$10	1.5	\$121,532	\$ 42,536	0.204	\$24,480	\$ 188,549	\$ 25,000	\$ 188,549	\$ 89,832	\$ 3,646
PB0053	Marine Connection	Detention Swale	0.7	0.21	9322	\$2	1.5	\$27,966	\$ 5,593	0.2	\$24,000	\$ 57,559	\$ 25,000	\$ 57,559	\$ 7,088	\$ 839
PB0054	Meadowland Business Park Pond 2	Retrofit Existing Detention Pond and add CMA	2.9	1.70	74226	\$2	0.25	\$37,113	\$ 7,423	NA	\$0	\$ 44,536	\$ 25,000	\$ 44,536	\$ 15,142	\$ 1,113
PB0055	Merchant's Bank Detention Pond	Detention Pond	3.2	0.23	9932	\$2	2	\$39,727	\$ 13,904	0.101	\$12,120	\$ 65,751	\$ 25,000	\$ 65,751	\$ 16,916	\$ 1,192
PB0056	Spear St	Gravel Wetland	4.9	2.14	93393	\$10	0.5	\$466,963	\$ 93,393	0.773	\$92,760	\$ 653,116	\$ 25,000	\$ 653,116	\$ 113,389	\$ 10,000
PB0057	Nicklaus Circle	Gravel Wetland	2.2	0.54	23392	\$10	2	\$467,834	\$ 163,742	0.292	\$35,040	\$ 666,616	\$ 25,000	\$ 666,616	\$ 283,218	\$ 10,000
PB0058	North Country Credit North West Infiltration	Infiltration Trench	0.2	0.03	1133	\$12	2	\$27,181	\$ 9,514	0.006	\$720	\$ 37,415	\$ 25,000	\$ 37,415	\$ 174,094	\$ 815
PB0059	North Country Credit South Infiltration	Infiltration Gallery	0.6	0.12	5184	\$12	1.5	\$93,306	\$ 32,657	0.03	\$3,125	\$ 129,087	\$ 25,000	\$ 129,087	\$ 203,749	\$ 2,799
PB0060	O'Brien Drive Underground Detention	Underground Detention	2.9	0.54	23348	\$12	1.5	\$420,267	\$ 147,093	0.11	\$13,015	\$ 580,375	\$ 25,000	\$ 580,375	\$ 197,409	\$ 10,000
PB0061	Olympiad Apartments & Office Building Pond Retrofit	Gravel Wetland	3.7	0.06	2396	\$10	0.25	\$5,990	\$ 1,198	NA	\$0	\$ 7,187	\$ 25,000	\$ 25,000	\$ 1,951	\$ 180
PB0062	Panurgy Infiltration Basin	Retrofit Existing Infiltration Basin	0.8	0.08	3528	\$4	0.25	\$3,528	\$ 706	NA	\$0	\$ 4,234	\$ 25,000	\$ 25,000	\$ 5,293	\$ 106
PB0063	Park Road Detention Pond	Detention Pond	1.3	0.42	18339	\$2	1.5	\$55,016	\$ 11,003	0.23	\$27,600	\$ 93,620	\$ 25,000	\$ 93,620	\$ 51,984	\$ 1,650
PB0064	Pillsbury Manor Infiltration Basin Retrofit	Retrofit to Infiltration Basin	0.4	0.07	2962	\$4	0.25	\$2,962	\$ 1,037	NA	\$0	\$ 3,999	\$ 25,000	\$ 25,000	\$ 10,019	\$ 89
PB0065	Quarry Hill South	Detention Swale	2.5	0.48	20822	\$2	1.5	\$62,465	\$ 21,863	0.399	\$47,880	\$ 132,208	\$ 25,000	\$ 132,208	\$ 33,505	\$ 1,874
PB0066	Queen City Park Road Detention Pond	Detention Pond	3.0	0.45	19689	\$2	0.5	\$19,689	\$ 3,938	0.63	\$75,600	\$ 99,227	\$ 25,000	\$ 99,227	\$ 7,929	\$ 591
PB0067	Shaws West	Underground Detention	1.7	0.16	6839	\$12	2	\$164,134	\$ 57,447	0.07	\$8,447	\$ 230,028	\$ 25,000	\$ 230,028	\$ 129,256	\$ 4,924
PB0068	South Burlington High School Infiltration	Infiltration Basin	3.1	0.44	19297	\$4	1.5	\$115,782	\$ 23,156	0.22	\$26,400	\$ 165,339	\$ 25,000	\$ 165,339	\$ 44,851	\$ 3,473
PB0069	South Burlington High School North	Underground Infiltration	4.3	0.69	30013	\$12	2	\$720,308	\$ 252,108	0.16</						

BMP ID	Project Name	Retrofit Description	Imp acres	Design Control Volume (ac-ft)	Design Control Volume (cft)	Base Unit Cost (\$/cft)	Site Adjustment Factor	Base Construction Cost ¹	Permits & Engineering Contingency	BMP Footprint Area (Acres)	Land Cost	Summed Project Cost	Minimum Project Cost (\$10k for simple retrofits; \$25k otherwise)	Final Project Cost	Cost/Imp Acre	O&M
PB0073	Stonehedge Circle	Bioretention	1.3	0.20	8843	\$2	1.5	\$26,528	\$ 9,285	0.16	\$18,720	\$ 54,533	\$ 25,000	\$ 54,533	\$ 28,423	\$ 796
PB0074	Sugartree Lane	Gravel Wetland	1.1	0.12	5009	\$10	1.5	\$75,141	\$ 15,028	0.05	\$6,000	\$ 96,169	\$ 25,000	\$ 96,169	\$ 85,538	\$ 2,254
PB0075	Swift Estates Pond	Retrofit Existing Detention Pond	3.6	0.33	14201	\$2	0.25	\$7,100	\$ 1,420	NA	\$0	\$ 8,520	\$ 25,000	\$ 25,000	\$ 2,388	\$ 213
PB0076	Technology Park Pond Retrofit	Gravel Wetland	0.03	0.27	11805	\$10	0.25	\$29,512	\$ 5,902	NA	\$0	\$ 35,414	\$ 25,000	\$ 35,414	\$ 1,193,163	\$ 885
PB0077	Temple Detention Pond	Detention Pond	0.9	0.19	8364	\$2	1.5	\$25,091	\$ 5,018	0.14	\$16,800	\$ 46,909	\$ 25,000	\$ 46,909	\$ 32,727	\$ 753
PB0078	The Pines	Retrofit Existing Detention Pond	5.8	0.22	9365	\$2	0.25	\$4,683	\$ 937	NA	\$0	\$ 5,619	\$ 25,000	\$ 25,000	\$ 961	\$ 140
PB0079	UMall Detention Pond	Retrofit Existing Detention Pond	15.0	0.91	39596	\$2	0.25	\$19,798	\$ 6,929	NA	\$0	\$ 26,727	\$ 25,000	\$ 26,727	\$ 1,786	\$ 594
PB0080	UMall Infiltration 1	Retrofit Infiltration Gallery	5.5	0.31	13547	\$12	0.25	\$40,641	\$ 14,225	NA	\$0	\$ 54,866	\$ 25,000	\$ 25,000	\$ 9,890	\$ 1,219
PB0081	UMall Infiltration 2	Retrofit Infiltration Gallery	15.3	0.03	1394	\$12	0.25	\$4,182	\$ 1,464	NA	\$0	\$ 5,645	\$ 25,000	\$ 54,866	\$ 369	\$ 125
PB0082	UMall Sears Auto Pond	Gravel Wetland	9.3	0.61	26670	\$10	0.25	\$66,674	\$ 23,336	NA	\$0	\$ 90,010	\$ 25,000	\$ 90,010	\$ 9,684	\$ 2,000
PB0083	UVM Bio Research Complex	Bioretention	0.9	0.20	8668	\$10	1.5	\$130,027	\$ 45,509	0.104	\$0	\$ 175,536	\$ 25,000	\$ 175,536	\$ 191,667	\$ 3,901
PB0084	UVM Forestry Research Center - East Roof	Infiltration Gallery	0.4	0.06	2396	\$12	1	\$28,750	\$ 10,062	0.011	\$0	\$ 38,812	\$ 25,000	\$ 38,812	\$ 95,055	\$ 862
PB0085	UVM Forestry Research Center - West Roof	Infiltration Gallery	0.1	0.02	697	\$12	1	\$8,364	\$ 2,927	0.034	\$0	\$ 11,291	\$ 25,000	\$ 25,000	\$ 104,974	\$ 251
PB0086	Vermont National Country Club Pond B	Retrofit Existing Detention Pond	8.6	0.43	18600	\$2	0.25	\$9,300	\$ 1,860	NA	\$0	\$ 11,160	\$ 25,000	\$ 25,000	\$ 1,293	\$ 279
PB0087	Vermont National Country Club Pond C	Retrofit Existing Detention Pond	0.5	0.85	36939	\$2	0.25	\$18,469	\$ 3,694	NA	\$0	\$ 22,163	\$ 25,000	\$ 25,000	\$ 46,732	\$ 554
PB0088	VT Gas Detention Pond	Detention pond	3.1	0.17	7492	\$2	2	\$29,969	\$ 10,489	0.099	\$11,880	\$ 52,339	\$ 25,000	\$ 52,339	\$ 13,093	\$ 899
PB0089	Wellesley Grove	Detention pond	2.1	0.27	11718	\$2	1.5	\$35,153	\$ 7,031	0.294	\$35,280	\$ 77,464	\$ 25,000	\$ 77,464	\$ 19,659	\$ 1,055
PB0090	Windridge Court	Infiltration Basin	0.6	0.10	4312	\$4	1.5	\$25,875	\$ 9,056	0.085	\$10,200	\$ 45,131	\$ 25,000	\$ 45,131	\$ 60,479	\$ 776
PB0091	Woodcrest Drive	Infiltration Basin	2.4	0.50	21606	\$4	1.5	\$129,635	\$ 25,927	0.224	\$26,880	\$ 182,441	\$ 25,000	\$ 302,500	\$ 65,362	\$ 3,889
PB0092	Woodlands Industrial Park	Retrofit Existing Detention Pond	3.9	0.37	16161	\$2	0.25	\$8,080	\$ 2,828	NA	\$0	\$ 10,909	\$ 25,000	\$ 25,000	\$ 2,804	\$ 242
PB0093	Worcester Street	Underground Detention	3.8	0.56	24394	\$12	2	\$585,446	\$ 204,906	0.258	\$30,905	\$ 821,258	\$ 25,000	\$ 821,258	\$ 206,899	\$ 10,000
PB0094	Dorset Park Pond	Retrofit pond with CMAC valve.	5.9	0.30	13024	\$2	0.25	\$16,512	\$ 3,302	NA	\$0	\$ 19,815	\$ 10,000	\$ 19,815	\$ 3,331	\$ 495
PB0095	Hannaford's Pond	Retrofit pond with CMAC valve.	7.8	0.34	14723	\$2	0.25	\$17,362	\$ 3,472	NA	\$0	\$ 20,834	\$ 10,000	\$ 20,834	\$ 2,687	\$ 521
PB0096	Lowes Pond	Retrofit pond with CMAC valve.	10.1	0.20	8538	\$2	0.25	\$14,269	\$ 2,854	NA	\$0	\$ 17,123	\$ 10,000	\$ 17,123	\$ 1,703	\$ 428
PB0097	Vermont National Country Club Pond B	Retrofit pond with CMAC valve.	8.6	0.92	40119	\$2	0.25	\$30,059	\$ 6,012	NA	\$0	\$ 36,071	\$ 10,000	\$ 36,071	\$ 4,181	\$ 902
PB0098	Technology Park Pond 1	Retrofit pond with CMAC valve.	3.8	0.37	15987	\$2	0.25	\$17,993	\$ 3,599	NA	\$0	\$ 21,592	\$ 10,000	\$ 21,592	\$ 5,720	\$ 540
PB0099	Lot A Mountain View Pond	Retrofit pond with CMAC valve.	2.6	0.02	784	\$2	0.25	\$10,392	\$ 2,078	NA	\$0	\$ 12,470	\$ 10,000	\$ 12,470	\$ 4,888	\$ 312
PB0100	Kennedy Dr Pond 1	Retrofit pond with CMAC valve.	1.3	0.05	2047	\$2	0.25	\$11,024	\$ 2,205	NA	\$0	\$ 13,228	\$ 10,000	\$ 13,228	\$ 9,912	\$ 331
PB0101	Quarry Hill Pond	Retrofit pond with CMAC valve.	6.2	0.00	0	\$2	0.25	\$10,000	\$ 2,000	NA	\$0	\$ 12,000	\$ 10,000	\$ 12,000	\$ 1,940	\$ 300
PB0102	Heatherfield P1	Retrofit pond with CMAC valve.	0.9	0.00	0	\$2	0.25	\$10,000	\$ 2,000	NA	\$0	\$ 12,000	\$ 10,000	\$ 12,000	\$ 13,356	\$ 300
PB0103	Heatherfield P2	Retrofit pond with CMAC valve.	7.1	0.03	1220	\$2	0.25	\$10,610	\$ 2,122	NA	\$0	\$ 12,732	\$ 10,000	\$ 12,732	\$ 1,799	\$ 318
PB0104	Heatherfield P3	Retrofit pond with CMAC valve.	2.7	0.05	2222	\$2	0.25	\$11,111	\$ 2,222	NA	\$0	\$ 13,333	\$ 10,000	\$ 13,333	\$ 4,924	\$ 333
PB0105	Winding Brook	Retrofit pond with CMAC valve.	3.3	0.11	4661	\$2	0.25	\$12,330	\$ 2,466	NA	\$0	\$ 14,797	\$ 10,000	\$ 14,797	\$ 4,457	\$ 370
PB0106	Mountainview Pond b	Retrofit pond with CMAC valve.	0.6	0.08	3398	\$2	0.25	\$11,699	\$ 2,340	NA	\$0	\$ 14,039	\$ 10,000	\$ 14,039	\$ 23,024	\$ 351
PB0107	Farrell St Pond	Retrofit pond with CMAC valve.	11.0	0.05	2004	\$2	0.25	\$11,002	\$ 2,200	NA	\$0	\$ 13,202	\$ 10,000	\$ 13,202	\$ 1,197	\$ 330

Notes:

1. Project costs are based on the Horsley-Witten Spreadsheet Method
2. \$10,000 is added to the base construction cost for a CMAC valve installation.
3. Minimum project costs are \$10,000 for simple retrofits and \$25,000 otherwise. The "Final Project Cost" is the greater of the "Summed Project Costs" or the "Minimum Project Costs".

Table E-2: Potash Brook Watershed BMP Project Scoring

ID #	Project Name	Expired Permit	MS4	BMP Type ¹	Project Cost Estimate ²	Retrofit Description	Total Score ³
PB0001	1050 Hinesburg Road	No Permit	South Burlington	GW	\$106,000	There is an existing wet depression here where stormwater is already routed. Propose gravel wetland and meet CPv standards.	16
PB0002	110 Kimball Ave - North Infiltration Basin	1-1504a	South Burlington	IB	\$25,000	Runoff is bypassing infiltration basin to a swale with direct discharge to the brook. Add trench along west edge of parking lot to direct runoff to infiltration basin. Expand basin.	15
PB0003	110 Kimball Ave - South Infiltration Basin	1-1504b	South Burlington	IB	\$10,000	Retrofit outlet structure and add proposed outlet control riser that was not constructed.	17
PB0004	189 Cloverleaf Detention Pond	No Permit	VTrans	DP	\$59,000	Add outlet structure to area that is already depressed to detain stormwater. Reroute stormline from Shelburne Rd to this area.	21
PB0005	189 Ramp Detention Pond	2-0619	VTrans	GW	\$347,000	Detain stormwater from a large section of Dorset St. Intercept stormline near Kennedy Dr and reroute to the area between 189 ramps. Treat with gravel wetland.	21
PB0006	30 Kimball Ave Swale Retrofit	1-1526; 6269-9030	South Burlington	DS	\$25,000	Retrofit existing swale detention to meet CPv. Expand swale to accommodate modified outlet structure.	15
PB0007	Adelphia Cable Pond Retrofit	1-1000; 6291-9030	South Burlington	GW	\$25,000	Reroute drainage from Kimball Ave to this detention pond behind Adelphia Cable. Retrofit and expand existing pond into a gravel wetland to detain CPv.	17
PB0008	Adirondack Street	2-0312	South Burlington	UD	\$845,000	Construct underground detention chambers under ROW and grassed shoulder.	15
PB0009	Airport Drive	No Permit	BTV	IG	\$439,000	Construct subsurface infiltration chambers in southernmost lot where houses will be removed. Intercept stormline running south down Airport Dr.	20
PB0010	Ashbrook Drive	2-0101	South Burlington	GW	\$168,000	Reroute stormwater to gravel wetland southwest of Dorset St behind apartment buildings.	14
PB0011	Blue Mall Infiltration	2-0144	South Burlington	IG	\$531,000	Construct underground infiltration chambers in the southwest edge of parking lot. Overflow to existing stormline that flows to Dorset St.	16
PB0012	Brookwood Drive Pond	2-0794; 2-0619	South Burlington	DP	\$394,000	Construct new detention pond to detain this large outfall. Forebay to be located in empty lot near Brookwood Dr.	22
PB0013	Burlington Price Chopper	No Permit	Burlington	GW	\$1,459,000	Construct new gravel wetland in area between parking lot and stream to the south of parking lot.	14
PB0014	Chelsea Circle	2-0767	South Burlington	IB	\$115,000	Construct new infiltration basin constructed to south of existing swale, which receives flow from Chelsea Cir condos and Timberlane Dental parking lot. Neighborhood icing and flooding issues can be mitigated with this project.	21
PB0015	Church of Jesus Christ of Latterday Saints	2-0179; 6318-9030	South Burlington	DS	\$29,000	Add detention to swale to the west of parking area with outlet control to detain CPv	16
PB0016	Community Bible Church Infiltration	No Permit	South Burlington	IT	\$975,000	Construct linear infiltration trench (perforated pipe) along back of several businesses.	20
PB0017	Domino's	No Permit	South Burlington	GW	\$199,000	Construct a gravel wetland pond behind parking area. Add catchbasin along Swift St to also capture half of the road drainage.	10
PB0018	Dorset Commons Pond	1-0242	South Burlington	DP	\$168,000	Construct new detention pond in wooded area behind Dorset Commons.	21
PB0019	Dumont Park Stormwater Project	No Permit	South Burlington	DP	\$69,000	Construct new detention pond to the north of Barrett St where two stormlines converge.	20
PB0020	Dynapower	1-0618	South Burlington	GW	\$124,000	Reroute roof drainage to existing detention pond. Retrofit to gravel wetland and detain CPv.	22
PB0021	East Terrace Detention Pond	No Permit	South Burlington	GW	\$318,000	Construct new gravel wetland near the outfall to the east side of East Terrace.	14
PB0022	Eastwood Commons Pond Expansion	1-1438	South Burlington	DP	\$25,000	Reroute eastern side of Shaw's plaza to this pond. Expand pond and modify outlet structure to accommodate additional drainage.	23
PB0023	Easy Self Storage	2-0167	South Burlington	GW	\$196,000	Create new gravel wetland to the north of the storage area.	16
PB0024	Economou Farm Pond	1-1241d	South Burlington	GW	\$87,000	Retrofit existing dry pond to gravel wetland to detain CPv. Expand and add forebay.	19

ID #	Project Name	Expired Permit	MS4	BMP Type ¹	Project Cost Estimate ²	Retrofit Description	Total Score ³
PB0025	Exit 13 Gravel Wetland	No Permit	VTrans	GW	\$219,000	Propose new gravel wetland in depressed triangle greenspace between ramps. Reroute several culverts to this area.	25
PB0026	Exit 14 Gravel Wetland	No Permit	VTrans	GW	\$131,000	Propose new gravel wetland in depressed triangle greenspace between ramps. Reroute several culverts to this area.	20
PB0027	Fairpoint Communications	2-0212	South Burlington	GW	\$495,000	Construct new gravel wetland to the east of property in grassed area. Two outfalls on site drain to wetland swales that need to be rerouted to the east.	19
PB0028	Faith United Methodist Church	No Permit	South Burlington	UD	\$49,000	Construct new underground detention behind church (northwest) in grassy area. Current outfall is eroded.	13
PB0029	Golf Course Road South	1-1241	South Burlington	GW	\$135,000	Construct new gravel wetland at the end of pipe before it enters the golf course. Existing infrastructure already drains to swale.	17
PB0030	Gonzo's Underground	2-0811	South Burlington	UD	\$662,000	Propose to intercept stormline that flows west along Williston Rd to underground detention chambers under grassed area in front of Budget Car Rental / Gonzo's plaza.	16
PB0031	Grandview Drive North Detention Pond	2-0238; 2-0737	South Burlington	DP	\$33,000	Construct new surface detention BMP following outfall, which is currently broken and experiencing significant erosion.	14
PB0032	Grandview Drive West Detention Pond	2-0238; 2-0737	South Burlington	DP	\$36,000	Construct new surface detention basin to the west of Dorset St. Reroute stormline away from brook to new BMP.	13
PB0033	Hawthorne Circle Detention Pond	No Permit	South Burlington	GW	\$143,000	Construct new gravel wetland in greenspace formed in the triangle between three garages.	13
PB0034	Helen Ave Cul De Sac	No Permit	South Burlington	IB	\$136,000	Construct new infiltration basin in the cul de sac at the end of Helen Ave, which would provide significant water quality benefit.	16
PB0035	Hinesburg Road	No Permit	South Burlington	DP	\$33,000	Reroute stormwater to existing catchbasin on Deane St and detain to the west of Hinesburg Rd to the south of existing houses.	16
PB0036	I-89 Swale	No Permit	VTrans	MF	\$208,000	Construct median filter in depressed area between north and south I-89 lanes. Reroute several culverts.	21
PB0037	Iby Gravel Wetland	No Permit	South Burlington	GW	\$167,000	Construct new gravel wetland at the end of Iby St to capture stormwater for the street.	15
PB0038	INS Building Pond A Retrofit	1-0969	South Burlington	GW	\$25,000	Retrofit existing detention pond into gravel wetland. Add forebay and construct outlet structure with low flow orifice to meet CPv standards.	13
PB0039	INS Building Pond B Retrofit	1-0969b	South Burlington	GW	\$25,000	Retrofit existing detention pond into gravel wetland. Add forebay and construct outlet structure with low flow orifice to meet CPv standards.	13
PB0040	Joy Dr Detention Pond	No Permit	South Burlington	GW	\$179,000	Construct new gravel wetland area in adjacent flat area near the Green Mountain Power transmission corridor.	12
PB0041	Kennedy Dr Pond 2 Expansion	1-1582b; 2-1069	South Burlington	GW	\$380,000	Retrofit existing detention pond to accommodate additional drainage from The Edge and 1 Twin Oaks.	18
PB0042	Kennedy Dr Pond 3 Expansion	1-1582c	South Burlington	GW	\$321,000	Reroute culvert that crosses under access ramp to pond, expand footprint and retrofit to gravel wetland	19
PB0043	Kennedy Dr Pond 4 Expansion	1-1582d; 1-0237; 1-102	South Burlington	DP	\$25,000	Reroute stormline from Chatham Green and swale along Hinesburg Rd to existing detention pond. Expand pond to accommodate additional drainage area and detain CPv.	20
PB0044	Kennedy Dr Pond 7 Expansion	1-1582g; 1-0233	South Burlington	DP	\$407,000	Reroute stormline that currently outfalls behind Key Bank to existing detention pond. Add CMAC valve to detain CPv.	22
PB0045	K-Mart Plaza Infiltration	No Permit	South Burlington	IG	\$1,121,000	Construct new underground infiltration chambers in K-Mart parking lot.	17
PB0046	Knoll Circle	2-0220	South Burlington	GW	\$750,000	Construct new gravel wetland with swale inlet. Current stormline draining subdivision already enters swale, which also drains area to the west.	18
PB0047	Lane Press Roof	1-1337	South Burlington	IB	\$310,000	Capture roof drainage in a new infiltration basin. Roof drains already flows to grassed area where treatment is proposed.	23

ID #	Project Name	Expired Permit	MS4	BMP Type ¹	Project Cost Estimate ²	Retrofit Description	Total Score ³
PB0048	Laurel Hill Drive	No Permit	South Burlington	IB	\$162,000	Construct new infiltration basin to the north of houses before stormline pipe enters riparian buffer.	16
PB0049	Lilac Ln Infiltration Basin	No Permit	South Burlington	IB	\$44,000	Formalize infiltration basin in depressed area at the end of Lilac Ln.	13
PB0050	Lindenwood Drive Detention Pond	No Permit	South Burlington	DP	\$379,000	Add catchbasins to reroute stormwater to the east of Lindenwood Dr. Part of Brewer Pkwy drains to this area as well. Propose to create one detention basin to detain drainage from both streets.	17
PB0051	Logwood Neighborhood Detention Pond	No Permit	South Burlington	DP	\$151,000	Construct new end of pipe surface impoundment BMP behind Lean Dental Group. Outfall is currently eroded.	21
PB0052	Marcotte Central School	No Permit	South Burlington	GW	\$189,000	Construct new gravel wetland in wooded area directly south of school parking lot. Route outfall to existing stormline. Potential educational benefit.	16
PB0053	Marine Connection	No Permit	South Burlington	DS	\$58,000	Add detention to existing swale near the back of the large Marine Connection building. Expand swale to accommodate additional volume.	16
PB0054	Meadowland Business Park Pond 2	1-1269_4290-9020.3 L	South Burlington	DP	\$45,000	Retrofit existing detention pond. Add forebay and investigate opportunity to include CMAC valve to detain CPv.	22
PB0055	Merchant's Bank Detention Pond	2-1171; 6275-9030; 62	South Burlington	DP	\$66,000	Route stormwater from Allstate Insurance west to Merchant's Bank and provide detention in grassed area	18
PB0056	Spear St	No Permit	South Burlington	GW	\$653,000	Reroute drainage from swale that runs south down Spear St to the west and create a new gravel wetland to detain flow on Country Club property.	24
PB0057	Nicklaus Circle	1-1241, 4049-9030	South Burlington	GW	\$667,000	Construct new gravel wetland feature to the north of Nicklaus Cir where the stormline and swale converge.	17
PB0058	North Country Credit North West Infiltration	No Permit	South Burlington	IT	\$37,000	Install perforated pipe to the north of parking lot in grassed area to infiltrate stormwater.	10
PB0059	North Country Credit South Infiltration	No Permit	South Burlington	IG	\$129,000	Construct underground infiltration chambers in the southeast corner of parking lot. Overflow to existing stormline.	11
PB0060	O'Brien Drive Underground Detention	No Permit	South Burlington	UD	\$580,000	Construct underground storage chambers in open lot between existing houses.	16
PB0061	Olympiad Apartments & Office Building Pond Retrofit	1-1452	South Burlington	GW	\$25,000	Retrofit detention basin to gravel wetland. Add forebay and ensure pond detains CPv.	17
PB0062	Panurgy Infiltration Basin	3409-9010	South Burlington	IB	\$25,000	Retrofit and expand existing infiltration basin to infiltrate the CPv.	14
PB0063	Park Road Detention Pond	1-1241	South Burlington	DP	\$94,000	Propose to reroute swale on southern side of Park Rd to the north and detain in wooded area.	16
PB0064	Pillsbury Manor Infiltration Basin Retrofit	1-1015	South Burlington	IB	\$25,000	Retrofit existing pond to infiltration basin. Overflow to existing culvert.	15
PB0065	Quarry Hill South	6322-9030	South Burlington	DS	\$132,000	Add detention to existing swale running northeast behind garages.	17
PB0066	Queen City Park Road Detention Pond	No Permit	VTrans	DP	\$99,000	Add detention to existing depressed area where stormlines already outfall. Drainage from Shelburne Rd is assumed to be already rerouted to larger depression to the north (see project entitled 189 Cloverleaf).	19
PB0067	Shaws West	No Permit	South Burlington	UD	\$230,000	Construct underground detention in vegetated island along west side of parking lot. Reroute last catchbasin in southwest corner of parking to this area.	10
PB0068	South Burlington High School Infiltration	No Permit	South Burlington	IB	\$165,000	Construct new infiltration basin to the southeast of sports field in currently wooded area.	21
PB0069	South Burlington High School North	6174-INDS.A	South Burlington	IG	\$992,000	Construct dry wells to infiltrate stormwater from the high school parking lot and middle school roof. Potential educational benefit.	23
PB0070	South Meadows Pond	1-0661	Burlington	DP	\$25,000	Retrofit existing detention pond to meet CPv standards. Add forebay and expand pond, upgrade outlet structure.	19
PB0071	Southview Drive	No Permit	South Burlington	UD	\$1,048,000	Construct underground detention chambers in ROW and grassed area. Road is 30ft wide and could be narrowed for storage.	19
PB0072	Staples Plaza Underground Detention	No Permit	South Burlington	UD	\$288,000	Construct underground detention chambers in southeast corner of parking lot.	11

ID #	Project Name	Expired Permit	MS4	BMP Type ¹	Project Cost Estimate ²	Retrofit Description	Total Score ³
PB0073	Stonehedge Circle	2-0100	South Burlington	DP	\$55,000	Construct bioretention along road in grassed area with discharge to existing catchbasin.	13
PB0074	Sugartree Lane	2-0878	South Burlington	GW	\$96,000	Expand existing abandoned detention area, into a gravel wetland. Reroute catchbasins to pond. Upgrade outlet.	16
PB0075	Swift Estates Pond	No Permit	South Burlington	DP	\$25,000	Retrofit existing detention pond to meet CPv standards. Add forebay and upgrade outlet structure.	15
PB0076	Technology Park Pond Retrofit	1-1458 P4	South Burlington	GW	\$35,000	Retrofit existing detention pond to gravel wetland and meet CPv standards. Upgrade outlet structure and expand accommodate additional storage.	11
PB0077	Temple Detention Pond	No Permit	South Burlington	GW	\$47,000	Propose new gravel wetland in depressed area in front of Temple by intersection of Dorset St and Swift St. Stormwater already collects in this area.	9
PB0078	The Pines	1-1117	South Burlington	GW	\$25,000	Retrofit existing detention pond to gravel wetland. Add forebay & CMAC valve for CPv.	20
PB0079	UMall Detention Pond	1-0503c; 6282-9030	South Burlington	DP	\$27,000	Retrofit existing detention pond to detain CPv. Upgrade outlet structure and expand pond.	23
PB0080	UMall Infiltration 1	1-0503b; 6282-9030	South Burlington	IG	\$25,000	Retrofit infiltration gallery to infiltrate the CPv.	22
PB0081	UMall Infiltration 2	1-0503a; 6282-9030	South Burlington	IG	\$55,000	Retrofit infiltration gallery to infiltrate the CPv.	25
PB0082	UMall Sears Auto Pond	1-0503d; 6282-9030; 2	South Burlington	GW	\$90,000	Construct large gravel wetland in unused section of parking lot in Umall (to the east of the party store). Reroute Dorset St stormline here.	22
PB0083	UVM Bio Research Complex	5269-9003.R	UVM	DP	\$176,000	Construct bioretention to treat stormwater in grassed area near the center of complex. Potential educational benefit.	13
PB0084	UVM Forestry Research Center - East Roof	No Permit	UVM	IG	\$39,000	Construct dry well to capture and infiltrate roof drain. Potential educational benefit.	15
PB0085	UVM Forestry Research Center - West Roof	No Permit	UVM	IG	\$25,000	Construct dry well to capture and infiltrate roof drain. Potential educational benefit.	12
PB0086	Vermont National Country Club Pond B	1-1241b	South Burlington	DP	\$25,000	Retrofit existing detention pond. Add forebay and expand pond.	21
PB0087	Vermont National Country Club Pond C	1-1241c	South Burlington	DP	\$25,000	Retrofit existing detention pond. Add forebay and expand pond.	17
PB0088	VT Gas Detention Pond	2-0228; 6293-9030	South Burlington	GW	\$52,000	Reroute stormline from Swift St to grassed area to the north of VT Gas property and construct new gravel wetland.	17
PB0089	Wellesley Grove	2-1023	South Burlington	GW	\$77,000	Add outlet control to existing depression to detain stormwater, construct new gravel wetland. Repair outfall erosion.	15
PB0090	Windridge Court	2-0824	South Burlington	IB	\$45,000	Construct new infiltration basin to infiltrate stormwater to the west of this small development.	15
PB0091	Woodcrest Drive	No Permit	South Burlington	IB	\$303,000	Infiltrate stormwater to the southwest of drainage area. Reroute stormline south to new BMP. Construct new swale to drain the end of Woodcrest Dr, which is currently eroding slope following road.	18
PB0092	Woodlands Industrial Park	1-0526/ 6279-9030	South Burlington	GW	\$25,000	Reroute roof drainage to existing detention pond. Retrofit pond to gravel wetland and expand to accommodate additional volume and detain CPv.	18
PB0093	Worcester Street	2-0312	South Burlington	UD	\$821,000	Construct underground detention chambers under ROW and grassed shoulder.	15
PB0094	Dorset Park Pond	1-1033	South Burlington	DP	\$20,000	Investigate option to retrofit pond with under drain and include CMAC valve to detain CPv.	21
PB0095	Hannaford's Pond	1-1214	South Burlington	DP	\$21,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	17
PB0096	Lowes Pond	1-1214	South Burlington	DP	\$17,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	17
PB0097	Vermont National Country Club Pond B	1-1241b	South Burlington	DP	\$36,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	19
PB0098	Technology Park Pond 1	1-1254	South Burlington	DP	\$22,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	15
PB0099	Lot A Mountain View Pond	1-1536	South Burlington	DP	\$12,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	13
PB0100	Kennedy Dr Pond 1	1-1582a	South Burlington	DP	\$13,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	17
PB0101	Quarry Hill Pond	3602-INDS	South Burlington	DP	\$12,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	14

ID #	Project Name	Expired Permit	MS4	BMP Type ¹	Project Cost Estimate ²	Retrofit Description	Total Score ³
PB0102	Heatherfield P1	3658a	South Burlington	DP	\$12,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	12
PB0103	Heatherfield P2	3658b	South Burlington	DP	\$13,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	17
PB0104	Heatherfield P3	3658c	South Burlington	DP	\$13,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	16
PB0105	Winding Brook	3691-INDS	South Burlington	DP	\$15,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	18
PB0106	Mountainview Pond b	3805-INDS	South Burlington	DP	\$14,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	12
PB0107	Farrell St Pond	5080-INDO	South Burlington	DP	\$13,000	Investigate option to retrofit pond with CMAC valve to detain CPv.	21

Notes:

1. BMP Type Abbreviations: GW: Gravel Wetland, GS: Grass Swale, RS: Retention Swale, ST: Settling Tank, OF: Control orifice, IB: Infiltration Basin, IT: Infiltration Trench, DP: Detention Pond, UD: Underground Detention, RP: Retention Pond, DS: Detention Swale, DW: Dry Well, IG: Infiltration Gallery, SF: Sand Filter, BR: Bioretention, MF: Median Filter.

2. Project costs estimates are rounded.

3. Total score is based on scoring criteria and scoring key presented in Tables D-1 and D-2 in Appendix D.

Potash Brook Flow Restoration Plan

Table E-3: Potash Brook Watershed BMP Project Implementation Schedule

ID #	Project Name	Expired Permit	BMP Type ¹	Retrofit Description	Implementation Year	Project Cost Estimate ²	Project Cost Estimate w/ Inflation ³
PB0002	110 Kimball Ave - North Infiltration Basin	1-1504a	IB	Runoff is bypassing infiltration basin and sheet flowing to a swale with direct discharge to the brook. Add trench along west edge of parking lot to direct runoff to infiltration basin. Expand basin to accommodate increased volume.	2018	\$25,000	\$28,000
PB0003	110 Kimball Ave - South Infiltration Basin	1-1504b	IB	Retrofit outlet structure and add proposed outlet control riser that was not constructed.	2018	\$10,000	\$11,000
PB0016	Community Bible Church Infiltration	No Permit	IT	Construct linear infiltration trench (perforated pipe) along back of several businesses.	2018	\$975,000	\$1,098,000
PB0037	Iby Gravel Wetland	No Permit	GW	Construct new gravel wetland at the end of Iby St to capture stormwater for the street.	2018	\$167,000	\$172,000
PB0042	Kennedy Dr Pond 3 Expansion	1-1582c	GW	Reroute culvert that crosses under access ramp to pond, expand footprint and retrofit to gravel wetland	2019	\$321,000	\$331,000
PB0091	Woodcrest Drive	No Permit	IB	Infiltrate stormwater to the southwest of drainage area. Reroute stormline south to new BMP. Construct new swale to drain the end of Woodcrest Dr, which is currently eroding slope following road.	2019	\$303,000	\$312,000
PB0041	Kennedy Dr Pond 2 Expansion	1-1582b; 2-1069	GW	Retrofit existing detention pond to accommodate additional drainage from The Edge and 1 Twin Oaks.	2020	\$380,000	\$403,000
PB0022	Eastwood Commons Pond Expansion	1-1438	DP	Reroute area to the west of existing pond (eastern side of Shaw's plaza) to this pond. Add a new connection between these stormwater systems to the east of the Shaw's property. Expand pond and modify outlet structure to accommodate additional drainage.	2021	\$25,000	\$31,000
PB0024	Economou Farm Pond	1-1241d	GW	Retrofit existing dry pond to gravel wetland to detain CPv. Expand and add forebay.	2021	\$87,000	\$108,000
PB0029	Golf Course Road South	1-1241	GW	Construct new gravel wetland at the end of pipe before it enters the golf course. Existing infrastructure already drains to swale.	2021	\$135,000	\$166,000
PB0044	Kennedy Dr Pond 7 Expansion	1-1582g; 1-0233	DP	Reroute stormline that currently outfalls behind Key Bank to existing detention pond. Add CMAC valve to detain CPv.	2021	\$407,000	\$445,000
PB0050	Lindenwood Drive Detention Pond	No Permit	DP	Add catchbasins and infrastructure to reroute stormwater to the east of Lindenwood Dr. Part of Brewer Pkwy drains to this area as well. Propose to create one detention basin to detain drainage from both streets. Lindenwood Dr has existing puddling and icing issues. This BMP would also mitigate those issues.	2021	\$379,000	\$415,000
PB0063	Park Road Detention Pond	1-1241	DP	Propose to reroute swale on southern side of Park Rd to the north and detain in wooded area.	2021	\$94,000	\$115,000
PB0067	Shaws West	No Permit	UD	Construct underground detention in vegetated island along west side of parking lot. Reroute last catchbasin in southwest corner of parking to this area.	2021	\$230,000	\$283,000
PB0072	Staples Plaza Underground Detention	No Permit	UD	Construct underground detention chambers in southeast corner of parking lot.	2021	\$288,000	\$355,000
PB0086	Vermont National Country Club Pond B	1-1241b	DP	Retrofit existing detention pond. Add forebay and expand pond.	2021	\$25,000	\$31,000
PB0087	Vermont National Country Club Pond C	1-1241c	DP	Retrofit existing detention pond. Add forebay and expand pond.	2021	\$25,000	\$31,000
PB0007	Adelphia Cable Pond Retrofit	1-1000; 6291-9030	GW	Reroute drainage from Kimball Ave to this detention pond behind Adelphia Cable. Retrofit and expand existing pond into a gravel wetland to detain CPv.	2022	\$25,000	\$32,000
PB0013	Burlington Price Chopper	No Permit	GW	Construct new gravel wetland in area between parking lot and stream to the south of parking lot.	2022	\$1,459,000	\$1,848,000
PB0019	Dumont Park Stormwater Project	No Permit	DP	Construct new detention pond to the north of Barrett St where two stormlines converge.	2022	\$69,000	\$87,000
PB0031	Grandview Drive North Detention Pond	2-0238; 2-0737	DP	Construct new surface detention BMP following outfall, which is currently broken and experiencing significant erosion.	2022	\$33,000	\$42,000

Potash Brook Flow Restoration Plan

Table E-3: Potash Brook Watershed BMP Project Implementation Schedule

ID #	Project Name	Expired Permit	BMP Type ¹	Retrofit Description	Implementation Year	Project Cost Estimate ²	Project Cost Estimate w/ Inflation ³
PB0032	Grandview Drive West Detention Pond	2-0238; 2-0737	DP	Construct new surface detention basin to the west of Dorset St. Reroute stormline away from brook to new BMP.	2022	\$36,000	\$45,000
PB0034	Helen Ave Cul De Sac	No Permit	IB	Construct new infiltration basin in the cul de sac at the end of Helen Ave, which would provide significant water quality benefit.	2022	\$136,000	\$172,000
PB0056	Spear Street	No Permit	GW	Reroute drainage from swale that runs south down Spear St to the west and create a new gravel wetland to detain flow on Country Club property.	2022	\$653,000	\$827,000
PB0083	UVM Bio Research Complex	5269-9003.R	DP	Construct bioretention to treat stormwater in grassed area near the center of complex. Potential educational benefit.	2022	\$176,000	\$222,000
PB0004	189 Cloverleaf Detention Pond	No Permit	DP	Add outlet structure to area that is already depressed to detain stormwater. Reroute stormline from Shelburne Rd to this area.	2023	\$59,000	\$77,000
PB0006	30 Kimball Ave Swale Retrofit	1-1526; 6269-9030	DS	Retrofit existing swale detention to meet CPv. Expand swale to accommodate modified outlet structure.	2023	\$25,000	\$33,000
PB0011	Blue Mall Infiltration	2-0144	IG	Construct underground infiltration chambers in the southwest edge of parking lot. Overflow to existing stormline that flows to Dorset St.	2023	\$531,000	\$693,000
PB0015	Church of Jesus Christ of Latterday Saints	2-0179; 6318-9030	DS	Add detention to swale to the west of parking area with outlet control to detain CPv	2023	\$29,000	\$37,000
PB0018	Dorset Commons Pond	1-0242	DP	Construct new detention pond in wooded area behind Dorset Commons.	2023	\$168,000	\$219,000
PB0020	Dynapower	1-0618	GW	Reroute roof drainage to existing detention pond. Retrofit to gravel wetland and detain CPv.	2023	\$124,000	\$162,000
PB0023	Easy Self Storage	2-0167	GW	Create new gravel wetland to the north of the storage area.	2023	\$196,000	\$256,000
PB0025	Exit 13 Gravel Wetland	No Permit	GW	Propose new gravel wetland in depressed triangle greenspace between ramps. Reroute several culverts to this area.	2023	\$219,000	\$285,000
PB0026	Exit 14 Gravel Wetland	No Permit	GW	Propose new gravel wetland in depressed triangle greenspace between ramps. Reroute several culverts to this area.	2023	\$131,000	\$171,000
PB0027	Fairpoint Communications	2-0212	GW	Construct new gravel wetland to the east of property in grassed area. Two outfalls on site drain to wetland swales that need to be rerouted to the east.	2023	\$495,000	\$645,000
PB0036	I-89 Swale	No Permit	MF	Construct median filter in depressed area between north and south I-89 lanes. Reroute several culverts.	2023	\$208,000	\$272,000
PB0038	INS Building Pond A Retrofit	1-0969	GW	Retrofit existing detention pond into gravel wetland. Add forebay and construct outlet structure with low flow orifice to meet CPv standards.	2023	\$25,000	\$33,000
PB0039	INS Building Pond B Retrofit	1-0969b	GW	Retrofit existing detention pond into gravel wetland. Add forebay and construct outlet structure with low flow orifice to meet CPv standards.	2023	\$25,000	\$33,000
PB0045	K-Mart Plaza Infiltration	5855-INDS	IG	Construct new underground infiltration chambers in K-Mart parking lot.	2023	\$1,121,000	\$1,463,000
PB0047	Lane Press Roof	1-1337	IB	Capture roof drainage in a new infiltration basin. Roof drains already flows to grassed area where treatment is proposed.	2023	\$310,000	\$404,000
PB0055	Merchant's Bank Detention Pond	2-1171; 6275-9030; 6269-9030; 2-0939	DP	Route stormwater from Allstate Insurance west to Merchant's Bank and provide detention in grassed area	2023	\$66,000	\$86,000
PB0057	Nicklaus Circle	1-1241, 4049-9030	GW	Construct new gravel wetland feature to the north of Nicklaus Cir where the stormline and swale converge.	2023	\$667,000	\$870,000
PB0061	Olympiad Apartments & Office Building Pond Retrofit	1-1452	GW	Retrofit detention basin to gravel wetland. Add forebay and ensure pond detains CPv.	2023	\$25,000	\$33,000
PB0062	Panurgy Infiltration Basin	3409-9010	IB	Retrofit and expand existing infiltration basin to infiltrate the CPv.	2023	\$25,000	\$33,000
PB0064	Pillsbury Manor Infiltration Basin Retrofit	1-1015	IB	Retrofit existing pond to infiltration basin. Overflow to existing culvert.	2023	\$25,000	\$33,000

Potash Brook Flow Restoration Plan

Table E-3: Potash Brook Watershed BMP Project Implementation Schedule

ID #	Project Name	Expired Permit	BMP Type ¹	Retrofit Description	Implementation Year	Project Cost Estimate ²	Project Cost Estimate w/ Inflation ³
PB0070	South Meadows Pond	1-0661	DP	Retrofit existing detention pond to meet CPv standards. Add forebay and expand pond. Upgrade outlet structure.	2023	\$25,000	\$33,000
PB0074	Sugartree Lane	2-0878	GW	Expand existing depressed area at the end of Sugartree Ln , which appears to be an abandoned detention area, into a gravel wetland. Reroute catchbasins to pond. Upgrade outlet.	2023	\$96,000	\$125,000
PB0076	Technology Park Pond Retrofit	1-1458 P4	GW	Retrofit existing detention pond to gravel wetland and meet CPv standards. Upgrade outlet structure and expand accommodate additional storage.	2023	\$35,000	\$46,000
PB0078	The Pines	1-1117	GW	Retrofit existing detention pond to gravel wetland. Add forebay and CMAC valve to detain CPv.	2023	\$25,000	\$33,000
PB0079	UMall Detention Pond	1-0503c; 6282-9030	DP	Retrofit existing detention pond to detain CPv. Upgrade outlet structure and expand pond.	2023	\$27,000	\$35,000
PB0080	UMall Infiltration 1	1-0503b; 6282-9030	IG	Retrofit existing infiltration gallery to infiltrate the CPv.	2023	\$25,000	\$33,000
PB0081	UMall Infiltration 2	1-0503a; 6282-9030	IG	Retrofit existing infiltration gallery to infiltrate the CPv.	2023	\$55,000	\$72,000
PB0089	Wellesley Grove	2-1023	GW	Add outlet control to existing depression to detain stormwater, construct new gravel wetland. Repair outfall erosion.	2023	\$77,000	\$101,000
PB0090	Windridge Court	2-0824	IB	Construct new infiltration basin to infiltrate stormwater to the west of this small development.	2023	\$45,000	\$59,000
PB0092	Woodlands Industrial Park	1-0526/ 6279-9030	GW	Reroute roof drainage to existing detention pond. Retrofit pond to gravel wetland and expand to accommodate additional volume and detain CPv.	2023	\$25,000	\$33,000
PB0010	Ashbrook Drive	2-0101	GW	Reroute stormwater to gravel wetland southwest of Dorset St behind apartment buildings.	2024	\$168,000	\$225,000
PB0046	Knoll Circle	2-0220	GW	Construct new gravel wetland with swale inlet. Current stormline draining subdivision already enters swale, which also drains area to the west.	2024	\$750,000	\$1,008,000
PB0082	UMall Sears Auto Pond	1-0503d; 6282-9030; 2-0619	GW	Construct large gravel wetland in unused section of parking lot in Umall (to the east of the party store). Reroute Dorset St stormline here.	2024	\$90,000	\$121,000
PB0094	Dorset Park Pond	1-1033	DP	Investigate option to retrofit pond with under drain and include CMAC valve to detain CPv.	2024	\$20,000	\$27,000
PB0105	Winding Brook	3691-INDS	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2024	\$15,000	\$20,000
PB0107	Farrell St Pond	5080-INDO	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2024	\$13,000	\$18,000
PB0009	Airport Drive	No Permit	IG	Construct subsurface infiltration chambers in southernmost lot where houses will be removed. Intercept stormline running south down Airport Dr.	2025	\$439,000	\$608,000
PB0043	Kennedy Dr Pond 4 Expansion	1-1582d; 1-0237; 1-1023; 1-1290	DP	Reroute stormline from Chatham Green and swale along Hinesburg Rd to existing detention pond. Expand pond to accommodate additional drainage area and detain CPv.	2025	\$25,000	\$35,000
PB0100	Kennedy Dr Pond 1	1-1582a	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2025	\$13,000	\$18,000
PB0102	Heatherfield P1	3658a	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2025	\$12,000	\$17,000
PB0103	Heatherfield P2	3658b	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2025	\$13,000	\$18,000
PB0104	Heatherfield P3	3658c	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2025	\$13,000	\$18,000
PB0014	Chelsea Circle	2-0767	IB	Construct new infiltration basin constructed to south of existing swale, which receives flow from Chelsea Cir condos and Timberlane Dental parking lot. Neighborhood icing and flooding issues can be mitigated with this project.	2026	\$115,000	\$164,000

Potash Brook Flow Restoration Plan

Table E-3: Potash Brook Watershed BMP Project Implementation Schedule

ID #	Project Name	Expired Permit	BMP Type ¹	Retrofit Description	Implementation Year	Project Cost Estimate ²	Project Cost Estimate w/ Inflation ³
PB0049	Lilac Ln Infiltration Basin	No Permit	IB	Formalize infiltration basin in depressed area at the end of Lilac Ln.	2026	\$44,000	\$63,000
PB0054	Meadowland Business Park Pond 2	1-1269_4290-9020.3 Lot 10	DP	Retrofit existing detention pond. Add forebay and investigate opportunity to include CMAC valve to detain CPv.	2026	\$45,000	\$63,000
PB0065	Quarry Hill South	6322-9030	DS	Add detention to existing swale running northeast behind garages.	2026	\$132,000	\$188,000
PB0001	1050 Hinesburg Road	No Permit	GW	There is an existing wet depression here where stormwater is already routed. Propose gravel wetland and meet CPv standards.	2027	\$106,000	\$155,000
PB0017	Domino's	No Permit	GW	Construct a gravel wetland pond behind parking area. Add catchbasin along Swift St to also capture half of the road drainage.	2027	\$199,000	\$292,000
PB0030	Gonzo's Underground	2-0811	UD	Propose to intercept stormline that flows west along Williston Rd to underground detention chambers under grassed area in front of Budget Car Rental /	2027	\$662,000	\$971,000
PB0068	South Burlington High School Infiltration	No Permit	IB	Construct new infiltration basin to the southeast of sports field in currently wooded area.	2027	\$165,000	\$243,000
PB0069	South Burlington High School North	6174-INDS.A	IG	Construct dry wells to infiltrate stormwater from the high school parking lot and middle school roof. Potential educational benefit.	2027	\$992,000	\$1,457,000
PB0084	UVM Forestry Research Center - East Roof	No Permit	IG	Construct dry well to capture and infiltrate roof drain. Potential educational benefit.	2027	\$39,000	\$57,000
PB0085	UVM Forestry Research Center - West Roof	No Permit	IG	Construct dry well to capture and infiltrate roof drain. Potential educational benefit.	2027	\$25,000	\$37,000
PB0005	189 Ramp Detention Pond	2-0619	GW	Detain stormwater from a large section of Dorset St. Intercept stormline near Kennedy Dr and reroute to the area between 189 ramps. Treat with gravel wetland.	2028	\$347,000	\$524,000
PB0033	Hawthorne Circle Detention Pond	No Permit	GW	Construct new gravel wetland in greenspace formed in the triangle between three garages.	2028	\$143,000	\$217,000
PB0035	Hinesburg Road	No Permit	DP	Reroute stormwater to existing catchbasin on Deane St and detain to the west of Hinesburg Rd to the south of existing houses.	2028	\$33,000	\$50,000
PB0066	Queen City Park Road Detention Pond	No Permit	DP	Add detention to existing depressed area where stormlines already outfall. Drainage from Shelburne Rd is assumed to be already rerouted to larger depression to the north (see project entitled 189 Cloverleaf).	2028	\$99,000	\$150,000
PB0095	Hannaford's Pond	1-1214	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2028	\$21,000	\$32,000
PB0096	Lowes Pond	1-1214	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2028	\$17,000	\$26,000
PB0097	Vermont National Country Club Pond B	1-1241b	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2028	\$36,000	\$55,000
PB0098	Technology Park Pond 1	1-1254	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2028	\$22,000	\$33,000
PB0099	Lot A Mountain View Pond	1-1536	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2028	\$12,000	\$19,000
PB0101	Quarry Hill Pond	3602-INDS	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2028	\$12,000	\$18,000
PB0106	Mountainview Pond b	3805-INDS	DP	Investigate option to retrofit pond with CMAC valve to detain CPv.	2028	\$14,000	\$21,000
PB0008	Adirondack Street	2-0312	UD	Construct underground detention chambers under ROW and grassed shoulder.	2029	\$845,000	\$1,316,000
PB0051	Logwood Neighborhood Detention Pond	No Permit	DP	Construct new end of pipe surface impoundment BMP behind Lean Dental Group. Outfall is currently eroded.	2029	\$151,000	\$236,000
PB0093	Worcester Street	2-0312	UD	Construct underground detention chambers under ROW and grassed shoulder.	2029	\$821,000	\$1,279,000
PB0012	Brookwood Drive Pond	2-0794; 2-0619	DP	Construct new detention pond to detain this large outfall. Forebay to be located in empty lot near Brookwood Dr.	2030	\$394,000	\$632,000
PB0021	East Terrace Detention Pond	No Permit	GW	Construct new gravel wetland near the outfall to the east side of East Terrace.	2030	\$318,000	\$510,000
PB0040	Joy Dr Detention Pond	No Permit	GW	Construct new gravel wetland area in adjacent flat area near the Green Mountain Power transmission corridor.	2030	\$179,000	\$287,000

Potash Brook Flow Restoration Plan

Table E-3: Potash Brook Watershed BMP Project Implementation Schedule

ID #	Project Name	Expired Permit	BMP Type ¹	Retrofit Description	Implementation Year	Project Cost Estimate ²	Project Cost Estimate w/ Inflation ³
PB0052	Marcotte Central School	No Permit	GW	Construct new gravel wetland in wooded area directly south of school parking lot. Route outfall to existing stormline. Potential educational benefit.	2030	\$189,000	\$303,000
PB0053	Marine Connection	No Permit	DS	Add detention to existing swale near the back of the large Marine Connection building. Expand swale to accommodate additional volume.	2030	\$58,000	\$92,000
PB0058	North Country Credit North West Infiltration	No Permit	IT	Install perforated pipe to the north of parking lot in grassed area to infiltrate stormwater.	2030	\$37,000	\$60,000
PB0059	North Country Credit South Infiltration	No Permit	IG	Construct underground infiltration chambers in the southeast corner of parking lot. Overflow to existing stormline.	2030	\$129,000	\$207,000
PB0060	O'Brien Drive Underground Detention	No Permit	UD	Construct underground storage chambers in open lot between existing houses.	2030	\$580,000	\$931,000
PB0075	Swift Estates Pond	No Permit	DP	Retrofit existing detention pond to meet CPv standards. Add forebay and upgrade outlet structure.	2030	\$25,000	\$40,000
PB0088	VT Gas Detention Pond	2-0228; 6293-9030	GW	Reroute stormline from Swift St to grassed area to the north of VT Gas property and construct new gravel wetland.	2030	\$52,000	\$84,000
PB0071	Southview Drive	No Permit	UD	Construct underground detention chambers in ROW and grassed area. Road is 30ft wide and could be narrowed for storage.	2031	\$1,048,000	\$1,732,000
PB0028	Faith United Methodist Church	No Permit	UD	Construct new underground detention behind church (northwest) in grassy area. Current outfall is eroded.	2032	\$49,000	\$83,000
PB0048	Laurel Hill Drive	No Permit	IB	Construct new infiltration basin to the north of houses before stormline pipe enters riparian buffer.	2032	\$162,000	\$276,000
PB0073	Stonehedge Circle	2-0100	DP	Construct bioretention along road in grassed area with discharge to existing catchbasin.	2032	\$55,000	\$93,000
PB0077	Temple Detention Pond	No Permit	GW	Propose new gravel wetland in depressed area in front of Temple by intersection of Dorset St and Swift St. Stormwater already collects in this area.	2032	\$47,000	\$80,000

Notes:

1. **BMP Type Abbreviations:** GW: Gravel Wetland, GS: Grass Swale, RS: Retention Swale, ST: Settling Tank, OF: Control orifice, IB: Infiltration Basin, IT: Infiltration Trench, DP: Detention Pond, UD: Underground Detention, RP: Retention Pond, DS: Detention Swale, DW: Dry Well, IG: Infiltration Gallery, SF: Sand Filter, BR: Bioretention, MF: Median Filter.

2. Project costs estimates are based on 2014 dollars and are rounded.

3. Project costs have been inflated based on the year of implementation and an annual 3% inflation rate.

Appendix I– Summary of Amendments to the SWMP

**Summary of amendments to the SWMP prepared on _____ and approved by
VTDEC on _____.**

No amendments at this time.

Appendix J– Ordinance Regulating the Use of Public and Private Sanitary Sewerage and Stormwater Systems