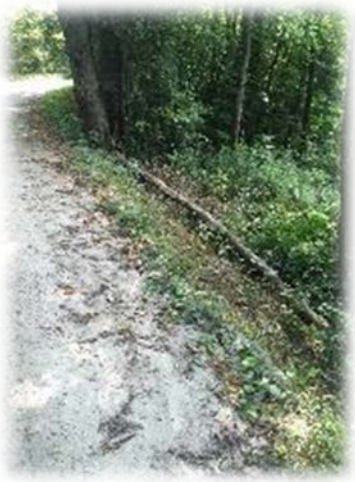

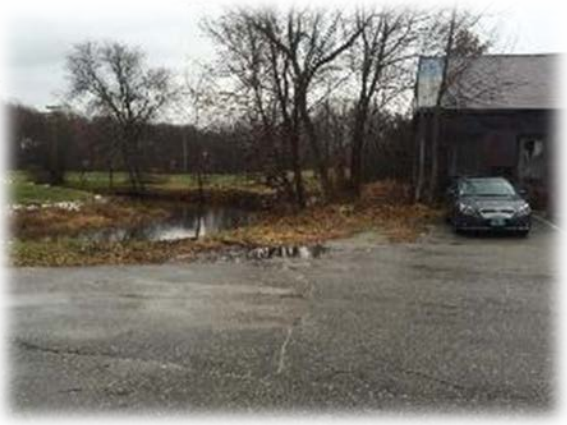

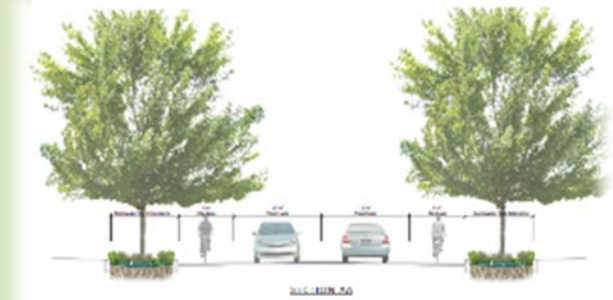

TOWN OF BRANDON –

STORMWATER MASTER PLAN

BRANDON,

VERMONT

FINAL REPORT

October 31, 2017

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I. Disclaimer

The intent of this report is to present the data collected, evaluations, analysis, designs, and cost estimates for the Town of Brandon Stormwater Master Plan under a contract between the Town of Brandon and Watershed Consulting Associates, LLC. Funding for the project was provided from the Vermont Ecosystem Restoration Program (ERP). The plan presented is intended to provide the watershed's stakeholders a means by which to identify and prioritize future stormwater management efforts. This planning study presents a recommended potential collection of Best Management Practices (BMPs) that would address specific concerns relating to stormwater in the Town of Brandon. There are certainly other BMP strategies that could be implemented in the watershed – these are the sites and practices that project stakeholders felt would have the greatest impact and the greatest probability of implementation. **This report does not represent a regulatory obligation of any sort.**

1 Project Overview

In May 2013, the State of Vermont Department of Environmental Conservation (VTDEC) issued a document titled Vermont Stormwater Master Planning Guidelines. This document is designed to provide communities in Vermont with a standardized guideline and series of templates to assist them in planning for future stormwater management practices and programs. Vermont has had stormwater regulations in place since 1978, with updates concerning unified sizing criteria in 2002. In 2017 the VT DEC issued a new stormwater management manual and regulations to reflect the current state of Best Management Practices. The State recognizes that managing stormwater can be a costly endeavor – the guidelines are written to help identify the appropriate practices for each watershed, community, and site in order to maximize the use of funds.

The guidelines encourage each stormwater master plan (SWMP) to follow the same procedures. They are:

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

This stormwater master plan follows those guidelines to maximize the cost-benefit ratio associated with developing meaningful stormwater management solutions in Brandon, VT.

2 Background

2.1 Problem Definition

The Town of Brandon is a small, mostly rural municipality with a moderately developed downtown area. Much of the town is rural and split geographically between the toe of the Green Mountains to the East and flatter areas adjacent to the Otter Creek to the West. Brandon is 25,628 acres total. Of this, 617.94 acres is impervious cover (as delineated by the 2011 Lake Champlain Impervious Coverage remotely-sensed GIS layer) – paved roads and parking lots, roof tops, gravel road and parking lots, and other impervious coverage areas. These areas make up 2.4% of the total town area. Of these ~618 acres of impervious coverage, ~218 acres or 35% are public roads. The remainder is split between public and private parcels of development.

The project team identified all parcels within the Town of Brandon with 3 acres or more of impervious coverage as of 2011 (this is the most current dataset for the Lake Champlain Basin). There are six parcels with more than 3 acres of impervious surfaces. Road surfaces are not counted in this tally as those will be dealt with under the Municipal Roads General Permit guidelines. The six parcels of interest are listed below.

Parcel Number	Owner	Stormwater Permit?	Impervious Acres (ac)	Notes
06-01-87.000	Lawes Agricultural Services	No	~3.28	
10-02-48.000	Otter Valley Union High School	Yes	~6.61	Permit #6041-9010
06-01-58.100	N/A	No	~3.88	Parcel has been subdivided to multiple owners. May not be subject to '3-acre rule'.
06-01-45.200	Vermont Tubbs	Yes	~6.50	Permit #3007-9010
06-01-08.000	Tilton Realty OR Thomas/Holden	No	~3.94	Parcel mapping is not clear - parcel is listed as 06-01-08.000 but parcel with impervious coverage is actually 07-01-01.01-02.
15-20-52.000	New England Woodcraft	Yes	~5.92	Permit #4855-9003.R. Property may fall under '3-acre rule' as permit is Multi-Sector General Permit - not Operational Stormwater Permit.

Of these parcels, three of them currently possess valid stormwater permits, though these may require upgrades under the new stormwater regulations. Three of them are unpermitted. Maps for each of these parcels can be seen in Appendix 6 – 3-acre Impervious Coverage Parcel Maps.

The Town is split in to four different watersheds, all ultimately draining to the Otter Creek. The majority of the downtown area drains to the Neshobe River, which is currently listed on the VT DEC's Stressed Streams list for flow impairments causing excessive streambank erosion from the Forestdale area to the segment of the river below the Brandon Wastewater Treatment Facility. This can be a precursor to a stream or other water body being listed on the 303(d) list as 'surface waters in need of a Total Maximum Daily Load (TMDL) listing,' otherwise known as impairment. One of the causes for this type of stress is unmanaged stormwater from developed surfaces.

This study has found potential projects that rely on a mixture of Green Stormwater Infrastructural development whenever possible, and more traditional end-of-pipe stormwater Best Management Practices where applicable in order to use the most effective tools. These practices are designed to

eliminate sediment in stormwater runoff to the greatest degree and to help mitigate the effects of channel-changing storms.

2.2 *Data Library*

The master planning project team completed a comprehensive review of existing data related to the Town of Brandon and the Neshobe River watershed, and have summarized our review in the Appendix DL.1. A GIS geodatabase of relevant data was also complied and organized as Appendix DL.2 (note – this is in ESRI geodatabase format). Any relevant paper documents and reports have been provided in the folder Appendix DL.3. This work is summarized in the document titled Summary Memo – Data Library.

2.2.1 *Data Review*

The purpose of the data review was to assess the availability and quality of data related to stormwater management within the Town of Brandon and the Neshobe River watershed, to identify any data gaps and/or needs prior to the start of the retrofit assessment. The data library will also serve as a complete compiled source of data that can be easily accessed throughout the project.

2.2.1.1 *Permit Files:*

The State of Vermont's Open Geodata Portal provided by the Vermont Center for Geographic Information (VCGI) and other publishers like the Agency of Natural Resources (ANR) and Vermont Agency of Transportation (VTrans) was used to identify all stormwater issued permits within the town boundary of Brandon. Issued stormwater permits were assessed for ownership, from which the publicly owned permits were identified. Since the Neshobe River is not designated as stormwater-impaired, publicly owned sites are more likely to be retrofitted, in the absence of an MS4 permit requirement.

2.2.1.2 *GIS Data Files:*

GIS data files related to the project were drawn from a variety of public resources including the VCGI Open Data Portal, United States Geological Survey (USGS), and United States Department of Agriculture (USDA). WCA performed select processing of the data (noted in Appendix DL.1: Data Library Table) to ensure that it was relevant and responsive to the needs of this particular SWMP. Individual ArcGIS shapefiles were then combined into a geodatabase file structure for ease of use and data migration from platform to platform. These files represent the most current available data, however GIS data within the State of

Vermont is very dynamic – these files should not be regarded as the 'final' version. Download or access dates were noted for all data to indicate vintage.

2.2.1.3 Past Watershed Studies:

The Related Documents (Appendix DL.3) contain all available reports pertaining to the Neshobe River watershed and the Town of Brandon that the master planning project team was able to find after speaking with various contacts, Town officials, and searching scholarly reports on the Internet. These reports include the Neshobe River in Rutland County Corridor Plan written in 2011 to provide restoration and protection to rivers and wetlands in the community of Brandon, a table of building and site improvements, channel and floodplain management, infrastructure improvements, and public safety improvements recommended in Brandon written by the Vermont Economic Resiliency Initiative (VERI), a report written by the Downtown Brandon Alliance/Design Committee that discusses important issues and opportunities presented by the Segment 6 project, and more. These report resources give background information and past research preformed in the study area as well as future planning and goals set forth; all factors that are important to keep in mind while completing Brandon's SWMP.

2.2.1.4 Data Needs:

Our review of the currently available data and reports does highlight a few needs within the Town of Brandon.

The GIS data for stormwater watersheds (Watershed_Boundaries_HUC12 and Watershed_Boundaries_HUC8) and stormwater utilities (Utility_STORMSEWER_line_12_22_16, Utility_STORMSEWER_point_12_22_16, and Utility_STORMSEWER_poly_12_22_16) should always be field verified prior to use in sensitive modeling environments. As we move forward with our own modeling we will be taking this need into account before accepting the data at face value. These data sets represent a good first step at determining where boundaries and infrastructure lay, but should not be completely relied on as infrastructure changes and many of the boundaries for the subwatersheds were developed using relatively coarse contour information.

The stormwater utilities layer including point, line, and polygon features has data coverage in downtown Brandon along Route 7 and in the areas that are highly developed around the Town's center. Through field investigation it was noted that there is a lack of stormwater infrastructure data coverage in the village

of Forestdale within Brandon. This lack of infrastructure data was brought up with the Town and is planned to be mapped in the summer of 2017 by the Town.

The presence or absence of land use regulations and zoning bylaws concerning stormwater management are also of interest in this project. The Town of Brandon does not currently have a specific stormwater ordinance. It is important to note that the Vermont League of Cities and Towns has a model draft stormwater ordinance which is available here (http://vlct.org/assets/MAC/2015-LID-GSI-model-bylaw.docx). This may be an ordinance which the Town could adopt for future stormwater management efforts.

3 Proposed Best Management Practices

The two main foci of this stormwater master plan were the investigation and development of structural stormwater management solutions to the 30% design level for five different sites and the inventory, prioritization, and development of solutions for unpaved road erosion issues for three to five different hydrologically connected road segments. During development of the plan, a third focus area emerged; development of potential green infrastructure practices to implement during the so-called 'Segment 6' road redevelopment project which is seeking to substantially re-develop a portion of VT Route 7 through the center of Brandon village. This section of the report will detail the methods used and solutions developed for those areas of focus.

3.1 Road Erosion Proposed Solutions

The town of Brandon has numerous miles of unpaved rural roads, many of which are in close proximity to various water bodies. Erosion and runoff from these roads can have an adverse impact on the health of these water bodies. In the initial proposal, our stated methodology was to use the VT DEC developed Road Erosion Risk Ranking GIS layer, along with the then newly-developed Hydrologically Connected Road Segments GIS layer, in concert with conversations with the Town of Brandon's road crew, to identify 20 high-priority sites to visit and assess. Using this information, three to five sites would then have specific solutions developed for them for the crew or a contractor to implement.

Shortly after being awarded the contract, the Rutland County Regional Planning Commission was awarded a grant to conduct a thorough road inventory in numerous Rutland County towns, including Brandon, to assess all hydrologically connected road segments as part of the planning effort for the Municipal Roads General Permit (MRGP) program. In conversation with ERP grant manager Ethan Swift and Rutland County RPC staff member Kitt Shaw, who was to be in charge of collecting the road data, it was decided that the master planning project would rely on data collected by Rutland County RPC for assessment and prioritization of the top 20 sites for further evaluation and solution development. These data were to be available in the spring or early summer of 2017. However, issues with deployment of the field data collection application and other scheduling issues delayed collection until later summer and early fall of 2017.

Prior to obtaining the data, the master planning project team researched the current prioritization method under development by the MRGP program and spoke extensively with staff from the Chittenden

County Regional Planning Commission on how to use the prioritization method. The intent was to use this method to prioritize the Brandon data to select the top 20 road segments. However, once the data were obtained from Rutland County RPC, it was found that numerous key attributes were either not collected in the field or did not upload to the final dataset from the handheld devices used to collect the information. Due to the timing of data receipt from Rutland County RPC and the infeasibility of applying the prioritization method as developed by the MRGP program with the dataset missing attributes, the method was not used to prioritize the top twenty segments. Instead, master planning project team members consulted with Rutland County RPC staff member Kitt Shaw on which road segments were the most important to assess from a water quality standpoint. Mr. Shaw provided a list, which the project team conducted field visits for and used best professional judgement to prioritize and rank. From this list the final 5 road erosion solution sites were selected.

3.1.1 Results

The results of the prioritization process yielded the table seen in Appendix 3b.1 – Prioritization Table. Locations for each of these can be seen in Appendix 3b.2 – Road Erosion Priority Sites Maps. In-field assessment data and photos can be seen in Appendix 3b.3 – Road Erosion Assessment Field Sheets. Additional sites assessed and prioritized, but for which solutions were not developed, can be seen in 3b.4 – Road Erosion Assessments – All Sites Maps. Finally, all solutions specified for the five solutions sites can be seen in 3b.5 – Road Erosion Solutions – Quick Reference Manual which is a document that Watershed Consulting Associates developed based on solutions specified in the Vermont Better Backroads Manual, and supplemented by practices developed over the years through other road erosion projects.

Based on our results, we chose to develop solutions for five sites. These sites are

- Birch Hill Road
- North Birch Hill Road
- Old Brandon Road
- Stone Mill Dam Road
- Hollow Road

Please note that the solutions developed are only for sections of those roads. Not all sections are hydrologically connected and therefore don't need any particular solutions from a water quality point of view.

We estimated labor and materials for each solution using VTrans cost estimates for materials as-placed (includes labor to truck materials to a site and place them using machine or hand labor). Please note that

VTrans costs are usually quite conservative for smaller projects such as these. Costs for labor (hand or machine) were not estimated as part of this scoping.

Costs used for these estimates are as follows:

Material	Unit	Cost per Unit
Type I Stone	CY	$42.93
Type II Stone	CY	$41.39
Type IV Stone	CY	$43.02
18” CPEP Culvert	LF	$34.05
24” CPEP Culvert	LF	$57.17
Crushed Stone Bedding	TON	$35.93

3.1.1.1 *Birch Hill Road:*

The potential risk at this site is related to this ditch and its possible connection to the downhill wetland to the west of McConnell Road. While material transport evidence is not apparent, conducting maintenance on this road prior to the establishment of a hydrologic connection is prudent. Materials and labor necessary to accomplish this work are listed on the Road Erosion Priority Sites map.

Materials listed in the solution map should cost approximately $31,630.00.

North Birch Hill Road:

This road exhibits a relatively long downhill run towards a small wetland area and tributary. Ditching needs to be installed and armored and turnouts need to be maintained. There are areas of the road that can be narrowed. We list the installation of stone check dams as optional, but we do recommend them in this case as the road is relatively steep in certain locations.

Materials listed in the solution map should cost approximately $23,096.00 (exclusive of costs associated with installing stone check dams which require approximate 0.3 CY of Type I stone for a cost of ~$12.87 per dam and any smaller material to repair ditch scour (3/4” to 1 ½” stone which VTrans estimates to cost $35.93 per ton).

3.1.1.2 *Old Brandon Road:*

There is a small tributary on the east side of Old Brandon Road in this section which is at risk from material transported by road erosion, as well as evidence of considerable material transport near the bottom of the section in to an eroding swale that outlets in a wetland. Eliminating the risk to the tributary on the east side of the road and stone armoring the swale at the bottom of the section are the primary concerns for this area.

Materials listed in the solution map should cost approximately $9,385.00.

3.1.1.3 Stone Mill Dam Road:

The main concern in this area is the steep slope from the intersection of Stone Mill Dam road with Forestdale Road. Runoff primarily flows down the east side of the road to a large gravel turnout. Road material is being actively transported to the tributary via a car parking turnout. This turnout is posted with no parking signs, so could be eliminated in favor of installing a stone armored ditch and stone chute and spreader to eliminate material transport to the tributary.

Materials listed in the solution map should cost approximately $2,721.00.

3.1.1.4 Hollow Road:

This section of road displays extensive material transport via a culvert at the intersection with a Class IV road to a wetland complex. By installing ditching, re-grading the road, installing check dams, and installing a plunge pool at the culvert outlet, this material transport could be eliminated.

Materials listed in the solution map should cost approximately $5,663.00. Note that this cost does not include the cost for installation of stone check dams which require approximately 0.3 CY of Type I stone and cost ~$12.87 per dam.

3.1.2 Next Steps

We would recommend that these priority sites be visited by the road foreman for inspection and fine-tuning of material estimates, as well as estimation of labor costs. These fine-tuned material costs and labor cost estimates could then be put together in a Better Roads Grant for FY2018 to fund implementation of these solutions.

As a possible next step, the additional assessed sites (as seen in Appendix 3b.4) could follow the same process as for the initial five priority sites for FY2019 Better Roads grants. Following this, the results of the inventory and prioritization process currently in development by the Rutland County RPC for all roads in Brandon should be used to guide future road erosion practice implementation.

3.2 Engineered BMP Design – 30% Design Sites

To achieve selection of the top five 30% design sites, a series of intermediate steps were taken to determine which sites would be most suitable.

3.2.1 *Desktop Assessment and Preliminary Site Selection*

3.2.1.1 *Methods*

Initially the master planning project team conducted a desktop assessment of the study area, involving a thorough review of existing GIS resources and associated attribute data including storm sewer infrastructure, subwatershed delineations, soils classifications, parcel data, wetlands, and river corridors. These data was used to identify any stormwater subwatersheds with particularly high impervious cover, or that are more directly connected to water bodies (direct pipes to streams, etc.). The goal of this task was to identify approximately 20 sites for additional investigation and prioritization.

A 'green streets' assessment was also conducted to identify any road segments throughout the drainage area appropriate for green stormwater infrastructure (GSI) retrofit opportunities. Streets were evaluated and scored according to width, slope, and soil permeability utilizing a methodology adapted from the "Promoting Green Streets" report published by the River Network (July 2016; included as Appendix 2.7 – Promoting Green Streets Methodology). Preference was given to those highest-scoring road segments in more urban areas.

The methodology was modified to better fit specific conditions found in the study area. The analysis utilized two prerequisites and one secondary consideration.

Prerequisites:

1. Road Slope
    - 1-5% Slope = Ideal (Score: 2 points)
    - 5-7.5% Slope = Potential (Score: 1 point)
    - >7.5% Slope = Unsuitable (Score: 0 points; discarded from further analysis)
2. Road Right-of-Way Width
    - ≥ 50 ft = Ideal (Score: 2 points)
    - 46-50 ft = Potential (Score: 1 point)
    - < 46 ft = Unsuitable (Score: 0 points; discarded from further analysis)

Secondary Consideration:

1. Hydrologic Soil Group (indication of infiltration potential)
    - A/B (highest infiltration potential) = Ideal (Score: 2 points)
    - B/C (moderate infiltration potential) = Potential (Score: 1 point)
    - C/D (lowest infiltration potential) = Unsuitable (Score: 0 points; **not** discarded from further analysis)

The scores from each of the three criteria were added, and a score was assigned for each road segment with higher scores indicating a greater potential for GSI suitability. Those sites with greater potential were noted for assessment in the field.

These data were used to prepare field maps with layers such as parcels, stormwater infrastructure, and soil types, for preforming initial field investigations of potential stormwater management sites. An app was developed for hand-held device use as a platform in which field information was collected and organized. The app also facilitated the mapping and photo-documentation of potential retrofit sites. In two field visits on the 11/29/16 and 12/20/16, WCA identified 63 sites where best management practices (BMPs) could be implemented within and outside of Brandon's town center.

Once all of the initial field work was completed, the data collected for the 63 sites were imported into GIS for further desktop investigation. Segment 6 plans were also obtained and georeferenced into our maps to prevent any overlap of practices already being implemented in future construction along a portion of Route 7. The master planning project team created an overall map of initial retrofit sites showing the potential approximate location of a stormwater management practice (Appendix 2.1 – All Sites Investigated Location Map). For each site, a field data sheet was also created with a photo of the retrofit site, mapped location of the potential practice, a management practice type and description, along with potential constraints (presence of utilities, access for construction, operation and maintenance issues, etc.) This can be seen in Appendix 2.2 – All Sites Investigated Summary Sheets.

This map and these field data sheets were used in a follow-up meeting with the Steering Committee to obtain the Committee's input and thoughts on each site regarding feasibility and desire to see them implemented. From this initial list of 63, 26 sites were chosen for further retrofit investigation.

3.2.1.2 *Results*

Task 2 generated a list of 26 potential retrofit sites, some of which overlap on the same property in a different location. Below is a summary table of the 11 unique properties followed by how many retrofits were scoped on each property.

1. Café Provence (2)
2. Carver Street (1)
3. Hannaford's (2)
4. Mobil Station (1)

5. Neshobe School (8)
6. Park Street (1)
7. Pearl Street (4)
8. Rite Aid (4)
9. Rossiter and Church Street (1)
10. St. Mary's Church (1)
11. West Seminary Street (1)

For further information on these top 26 sites see Appendix 2.3 - Top 26 Sites Location Map and Appendix 2.4 - Top 26 Sites Field Data Sheets.

3.2.1.3 Segment 6 BMP Opportunities

During the meeting with the Steering Committee held on 1-24-2017, a number of possible stormwater BMP retrofits within the Segment 6 project area were discussed. These potential sites can be seen in Appendix 2.5 - Segment 6 Initial BMP Opportunities. Dave Munro from CLD Consulting Engineers, the company in charge of engineering and oversight for the Segment 6 project, was present (via phone) as well to provide input regarding the feasibility of implementing additional retrofits in the project area, given the relative maturity of the engineering designs as this phase. It was decided that the master planning project team would conduct a more thorough review of the drainage and grading plans to determine the most feasibly, high-value potential stormwater retrofits for Segment 6. Additionally, as there are concerns in certain locations of the Segment 6 project for soil contamination from underground storage tanks, or other sources, the project team conducted a preliminary hazardous sites analysis that might affect infiltration practices. This information is presented in Appendix 2.6 - Segment 6 BMP Opportunities and Hazardous Waste Sites and UST Scoping Map. These sites will be decided on at the discretion of the Town, CLD, and the contractor chosen to execute the work. None of these potential sites will be further analyzed by the master planning project team under the scope of this study, unless specifically requested by the Steering Committee.

3.3 Top 10 Sites Selection Process

3.3.1 Preliminary Top 10 Sites

Following the selection of the top 26 sites during Task 2, the master planning project team came up with a list of 10 preliminary selected sites for further investigation. These sites were presented to the Steering Committee on 2-15-2017. These sites were:

1. Pearl Street Location (BRD_049, BRD_049a, BRD_049b, BRD_049c, BRD_049d)
2. Park Street Location (BRD_Park_1, BRD_Park_2, BRD_Park_3)
3. Public parking area behind gas station (BRD_001)
4. Rite Aid (BRD_035)
5. Hannaford's (BRD_037, BRD_040)
6. West Seminary Street public park (BRD_051)
7. Neshobe School front parking area (BRD_059)
8. Neshobe School back parking area (BRD_057)
9. Café Provence area (BRD_019a, BRD_019b, BRD_019c)
10. Church Street Outfalls (BRD_Church_1, BRD_Church_2) a. Back-up Option: St. Mary's Church south of parking area (BRD_045)

The locations for these sites can be seen in Appendix 3.1 - Preliminary Top 10 Sites Map.

The Steering Committee reviewed these sites and agreed that they all had merit to proceed to further investigation.

The master planning project team conducted a more detailed analysis for each chosen site. This involved a review of drainage area delineations for each of the selected sites with respect to topography (using Lidar-generated 2' contours, as well as field observations) and stormwater infrastructure (field-observed, mapped by the VT DEC, and any input given by Town staff). The locations for each of these selected sites can be seen in Appendix 3.2 – Selected Sites Overview Map. Field observations, along with a summary of benefits, constraints, costs, along with a site-specific map and associated drainage area delineations, can be seen in Appendix 3.4 – Selected Sites Field Sheets and Site Maps.

For each site's drainage area, the team generated detailed landuse GIS data layers to be used for pollutant loading and hydrologic and hydraulic modeling using WinSLAMM and HydroCAD programs. These model outputs, that were input into a project ranking matrix, predicted approximate pollutant loading and flow reduction potential for each site's retrofit practice, as well as aided in sizing and retrofit feasibility given site constraints (footprint available, soil conditions, infrastructure limitations, etc.,).

3.3.2 *Proposed Selected Top 10 Sites*

Below are the results of the ranking process for the chosen sites.

Site ID	BMP Type	Retrofit Description	Total Score	Rank
BRD_Church_Outfalls	Gravel Wetland	Tie two existing outfalls together and treat with one large gravel wetland.	132	1
Pearl Street Area - aggregated sites	Streetscape Bioretention	Series of streetscape bioretention features along the entire length of Pearl Street.	103	2
BRD_049d (individual)	*Streetscape Bioretention*	*Create bump-out into street to capture runoff.*	*33*	
BRD_049a (individual)	*Streetscape Bioretention*	*Create bump-out into street to capture runoff.*	*25*	
BRD_049c (individual)	*Streetscape Bioretention*	*Create bump-out into street to capture runoff.*	*24*	
BRD_049b (individual)	*Streetscape Bioretention*	*Create bump-out into street to capture runoff.*	*21*	
Park Street Area - aggregated sites	Streetscape Bioretention	Series of streetscape bioretention features along the entire length of Park Street.	91	3
BRD_Park_3 (indvidual)	*Streetscape Bioretention*	*Create bump-out into street to capture runoff.*	*36*	
BRD_Park_2 (individual)	*Streetscape Bioretention*	*Create bump-out into street to capture runoff.*	*34*	
BRD_Park_1 (individual)	*Streetscape Bioretention*	*Create bump-out into street to capture runoff.*	*21*	
BRD_045	Gravel Wetland	Treat runoff from part of downtown and Route 7 South (part of this drainage already treated with sand filter)	80	4
BRD_019 - aggregated sites	Various BMPs	Several different BMPs to address runoff issues behind the Café Provence building.	70	5
BRD_019c (individual)	*Bioretention*	*Surround the existing catch basin behind Café Provence with a small rain garden to filter runoff before it enters the catch basin.*	*25*	
BRD_019a (individual)	*Biofilter*	*Planted timber-framed box at the edge of the downtown commercial area parking lot with an underdrain.*	*23*	
BRD_019b (individual)	*Permeable Hardscape*	*Replace traditional concrete pavers with permeable hardscape on Café's patio.*	*22*	
BRD_051	Infiltration Chambers	Install sub-surface chambers underneath public park and playing fields.	48	6
BRD_001	Infiltration Swale	Narrow, shallow infiltration swale around perimeter of public parking lot next to stream.	37	7
BRD_035	Infiltration Chambers	Install new catch basin(s) and sub-surface chambers behind Rite-Aid to eliminate runoff causing significant erosion to Neshobe River.	29	8
BRD_033	Streetscape Bioretention	Use existing green space to capture runoff - raise existing catch basin rims to allow infiltration to occur.	28	9
BRD_057	Infiltration Swale	Create infiltration swale below back parking lot at Neshobe School	26	10
BRD_059	Infiltration Swale or Bioretention	Use existing green space to capture runoff - raise existing catch basin rims to allow infiltration to occur.	24	11
BRD_040	Infiltration Chambers	Install sub-surface chambers underneath Hannaford's front lot.	22	12
BRD_037	Infiltration Basin	Create infiltration basin in area behind Hannaford's to infiltrate runoff from roof and catch basin system.	21	13

For a detailed breakdown of these scores, please see Appendix 3.3 – Full Ranking Matrix.

Scoring in this matrix is based on the following factors:

Field	Explanation	Scoring Criteria	Score
Impervious Acres Managed Score	Natural groupings within the range of impervious managed for the proposed projects were identified. More impervious area managed received a higher score.	0 - 0.7	1
		0.71 - 1.0	2
		1.1 - 5.0	4
		5.1 - 10.0	8
		>10.0	16
Project Cost Score	Based on project costs, projects were scored on a scale of 1-4 with more expensive projects ranked lower.	<$10K	16
		$10.1K - $16K	8
		$16.1K - $50K	4
		$50.1K - $100K	2
		>$100K	1
Ease of O/M Score	Based on ease of maintenance, projects were scored on a scale of 0-3 with more maintenance intensive projects ranked lower.	Underground Storage/ Swirl Separator - Hard	3
		Bioretention/Tree Box Filters/Infiltration Basin - Medium	1
		Ponds/Constructed Wetlands - Easy	0
Volume Score	Groupings within the range of Volume Managed were scored.	<0.1	1
		0.101 - 1.00	2
		1.01 - 2.00	4
		>2.00	8
Volume Infiltrated Score	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.	N/A	0
		<0.1	1
		.101 - 1.00	2
		>1.00	4
Permitting Restrictions Score	For each potential permit, a score of -1 is assigned to the project.	Potential Permit Necessary	-1
		No Permit Necessary	0
Land Availability where BMP is Located Score	Public land is preferred, followed by 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.	Public	4
		Private - Willing	1
		Private - Unknown	0
TSS Removal Score	The amount of total suspended solids (pounds) removed by the practice was scored with higher reductions receiving higher scores.	<1000	1
		1001 - 2000	2
		2001 - 5000	4
		5001 - 10000	8
		10001 - 25,000	16
		25001 - 100000	32
		>100000	74
TP Removal Score	The amount of total phosphorus removed by the practice was scored with higher reductions receiving higher scores.	<0.5	1
		0.51 - 1.00	2
		1.01 - 5.00	4
		5.01 - 10.00	8
		10.01 - 50.00	16
		50.01 - 100.00	32
Other Project Benefits/ Constraints Score	This criteria is to account for indirect project benefits or potential constraint like infrastructure improvements, community benefits, habitat creation, utility conflicts, possible (but unknown or uncertain) jurisdiction issues like wetlands or stream corridors.	Possible Benefit	1
		Possible Constraint	-1

Costs for these projects were derived using the modeled BMP volume (from HydroCAD) with typical pricing for each BMP type as follows:

BMP	Base Cost ($/ft^3)
Porous Asphalt	$5.32
Infiltration Basin	$6.24
Underground Chamber (infiltration or detention)	$6.25
Detention Basin / Dry Pond	$6.80
Gravel Wetland	$8.78
Infiltration Trench	$12.49
Bioretention	$15.46
Sand Filter	$17.94
Permeable Hardscape	$18.07

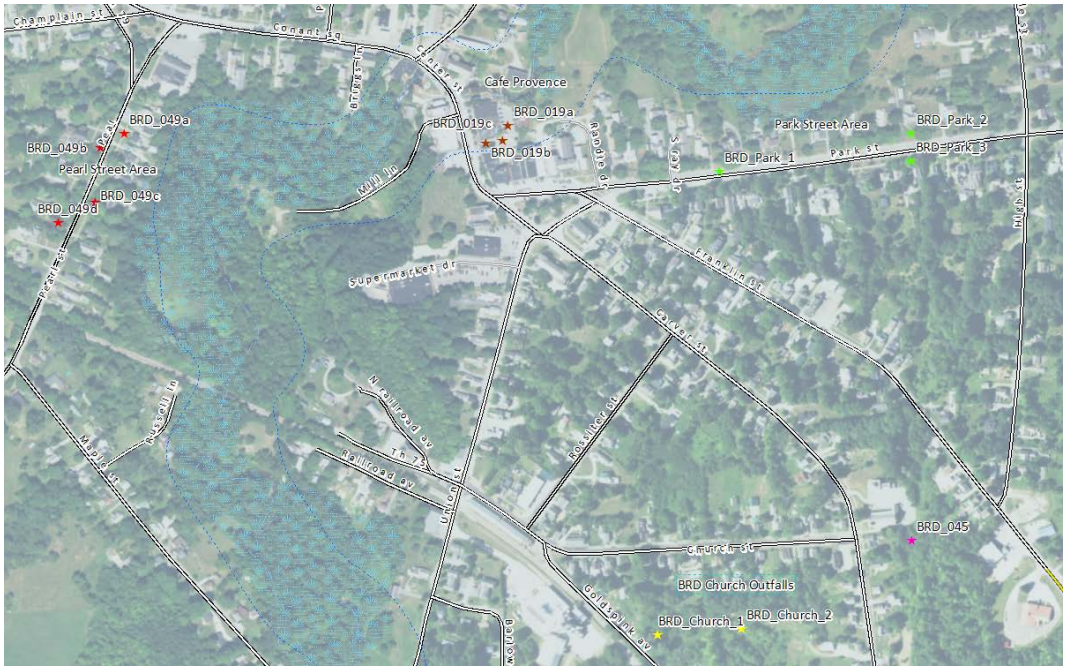
The base costs were derived from research conducted by the Charles River Watershed Association and the Center for Watershed Protection (as well as from experience with similar projects in Vermont). For underground chamber systems, the unit costs were obtained from ADS StormTech based on their cost projections in New England. These costs represent a 'first-cut' projection and may not be entirely indicative of potential final costs depending on final design, site constraints, or other factors not yet explored at this level of design.

Based on the modeling and ranking described above, we would recommend that the Town pursue the following five sites as these will potentially create the largest reductions in phosphorus and other stormwater pollution for the least cost, in addition to being the most feasible. The Park Street site, in particular, conforms with desires voiced by the Town to develop an alternative for stormwater management in that area.

3.3.3 *Initially Recommended Top Five 30% Design Sites*

Based on the outcome of the prioritization and ranking process, the following sites were recommended to the Steering Committee in the Task 3 Summary Memo.

3.3.3.1 *BRD Church Outfalls*



Initially selected Top 5 sites for the Brandon Stormwater Master Plan.

Two outfalls located south of Church Street represent a majority of the untreated drainage from Brandon's downtown area. The areas where these outfalls are located are on private property, and may have a high groundwater table during certain times of year. However, there may be an opportunity to work with the property owners to establish some sort of easement or other agreement to provide some treatment for stormwater. It is recommended that the Town, in collaboration with WCA, pursue the property owners to gauge willingness to conduct a site survey and geotechnical assessment to determine concept feasibility. This does not necessarily obligate the property owner to build anything on the property, but would help determine if a proposed BMP could work.

3.3.3.2 *Pearl Street Area*

This area of Brandon has particularly wide rights-of-way and good soils, as mapped by the NRCS. WCA has spoken with the Town regarding this area, as well as the initial concept (shallow grass swales with raised catch basin rims to encourage sedimentation and infiltration). The Town expressed willingness to proceed with design and potentially implementation in this area, especially in light of upcoming water main work along this street. As the BMPs are potentially relatively simple to implement in this area (and could be worked into upcoming municipal maintenance work) and have a net positive benefit given their relatively low cost, we would recommend that these practices receive additional design.

3.3.3.3 Park Street Area

The Town of Brandon has repeatedly expressed the desire to re-do certain aspects of Park Street. Currently, the street is substantially raised due to frequent re-paving over the years. The Town would like to remedy this issue and concurrently improve stormwater management. This area has the potential to have a demonstrable impact on water quality, as well as achieving additional co-benefits and can be accomplished on public land. Given this, we would recommend that this area be included in further design efforts.

3.3.3.4 BRD_045

The outfall described in BRD_045 is below St. Mary's Church. There are numerous stormwater systems that ultimately drain to this location, including part of the drainage affected by the Segment 6 re-paving project. While some of this drainage will be treated as part of Segment 6, other areas will see no treatment. Though this retrofit will be located on private property, this area seems to be of little use and is not likely an area that will be developed. Creating a treatment feature like a constructed gravel wetland would greatly improve the informal treatment that stormwater currently experiences as it makes its way to the Neshobe River via channels and swales. We recommend that the Town, in collaboration with WCA, pursue an agreement with the potentially affected property owners to at least consent to participate in the 30% design process which will require a survey and geotechnical assessment.

3.3.3.5 BRD_019 (Café Provence parking area)

The parking area behind Café Provence, which serves numerous buildings and businesses, currently runs off directly into the Neshobe River. Creating a number of different practices at this location, some or all of the stormwater runoff could be managed before entering waters of the State. However, this will require participation by private property owners. We recommend that the Town conduct preliminary outreach to these owners, based on the BMPs proposed in this memorandum. If there is a favorable response to this outreach, WCA could proceed with additional 30% design at this site. However, given that this site is the 5th-ranked site of five, there may be other sites from the initial list that would be easier and more effective to pursue. See the section below for recommendations regarding those sites.

3.3.4 Recommendations Regarding Other Sites

3.3.4.1 BRD_051 – West Seminary Street Public Park:

A system of sub-surface infiltration chambers at this site could be a very effective stormwater BMP. It would require a significant disturbance of the park, but once built would be a long-lasting BMP

that would still allow for normal usage of the park. As the project is located on public land, this may be a good alternative to pursue if any of the initially recommended five sites do not work out with respect to landowner buy-in.

3.3.4.2 BRD_001 – Public Parking:

This particular BMP, while effective, is relatively simple and does not necessarily require much additional design. We do not recommend that this site receive any additional design as part of the scope of this project. If, in the future, the Town decides to improve this parking lot, it may be necessary to revisit the BMP initially conceptualized for this area and determine its appropriateness and feasibility.

BRD_035 – Rite-Aid Infiltration Chambers:

This BMP would have a solid impact both in treating pollutants associated with runoff from this parking lot as well as potentially addressing the erosion occurring down the steep bank behind Rite-Aid. We recommend that, at minimum, the Town explore the idea with the owners of the property to determine if they would be amenable to installing this BMP on the property. We do not necessarily recommend that this site receive further design under this scope of work as landowner willingness is currently unknown.

3.3.4.3 BRD_033 – Streetscape Bioretention:

This project, while beneficial, is relatively small. It could be built along the same general design guidelines as the projects on Pearl and Park Streets. For this reason, we don't recommend that the Town proceed with additional design at this time. However, after implementing similar projects on other streets, we recommend that the Town re-visit this project site for implementation.

3.3.4.4 BRD_057 and BRD_059 – Neshobe School:

While neither of these BMP sites concern areas that are directly connected to waters of the State, they are located on one of the only properties that is both publicly-owned and has over 3 acres of impervious surfaces. As such, this site may be regulated in the future under the Lake Champlain TMDL. If, for some reason, one or more projects are deemed infeasible for additional 30% design, these two projects are excellent candidates.

3.3.4.5 BRD_040 and BRD_037 – Hannaford's BMPs:

BRD_040, a system of infiltration chambers under the front of Hannaford's parking lot, and BRD_037, an infiltration basin to treat runoff at the back of Hannaford's site, would both be good retrofits. The Hannaford's site is one of the largest contiguous areas of impervious surface in Brandon, though it is not over 3 acres. These two practices, for the purposes of additional design, should be grouped together.

If other options don't work out, this site represents a good alternative to pursue. In the immediate term, we recommend that the Town pursue a discussion with the property owners to gauge their willingness to participate in additional design. This would not obligate them to implement any stormwater retrofits on the site, but would determine the possibility for future actions.

3.3.5 Final Top 5 Sites – Selection Meeting

These materials were presented to the Town of Brandon and Ethan Swift of the VT DEC digitally. A meeting was then held on 4-6-2017 with these same stakeholders to discuss these ranked options and their suitability for further developed a 30% engineering design sites. This review was conducted to ensure that the sites chosen would be feasible in terms of the Town's and VT DEC's goals, along with landowner buy-in (or potential landowner buy-in).

During this meeting, the options that were selected for further development to 30% engineering design were as follows:

1. Park Street
2. Pearl Street
3. Café Provence parking lot area
4. West Seminary Street Public Park
5. Church Street outfalls area
    a. Rite Aid / Hannaford's as backup option

Based on the outcome of that meeting, these sites were pursued for additional design to the 30% level, with the exception of the site at the Church Street outfalls area. After consultation with the regional Wetland Coordinator, it was determined that this area is unsuitable for development as a gravel treatment wetland as the area is likely a natural Class II wetland, which precludes development. Therefore, the Rite Aid parking lot site was substituted.

3.4 Top 5 30% Concept Designs

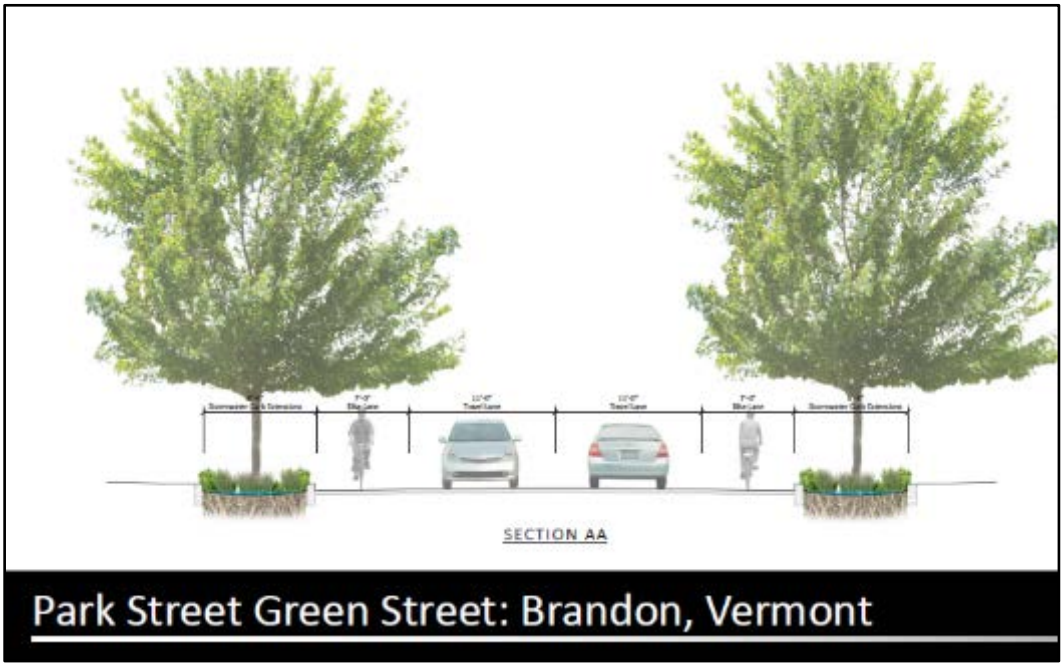
During 30% Concept Design the project team conducted existing conditions surveys for each location to verify topography and infrastructure where necessary. Geotechnical assessments were conducted for each site, with the exception of the infiltration chamber system at the Rite Aid parking lot. The NRCS mapped soil unit is generally suitable for infiltration at this location. We would recommend that an infiltration be conducted prior to further design. The project team also created cost estimates for each

design, along with updated pollutant removal model estimates, impervious coverage treated, and various cost breakdowns as required by Ecosystem Restoration Program guidelines. We are also created a summary of necessary permits for each site (if applicable). We used the Project Readiness Screening document (Basin Planner version) provided by the VT DEC to detail potential permit concerns for each project. The plan and associated details (where applicable) can be seen in Appendix 4.1 – 30% Concept Design Plans. Permit screening information can be seen in Appendix 4.2 – Project Readiness Screening Documents. Results of the geotechnical assessment can be seen in Appendix 4.3 – Geotechnical Assessment.

3.4.1 *Park Street:*

3.4.1.1 *Description:*

The concept envisioned for the Park Street area is a series of streetscape bioretention practices called bio-swales. These practices will make use of the wider than average street width to create long, narrow bioretention practices within the right-of-way that will reduce pollutant by infiltrating runoff to ground water. Practices will follow either one of two Type templates. Type I will be installed where there is no existing or anticipated stormwater infrastructure (catch basins). Runoff will flow in to a concrete notch inlet. Any overflow will exit the practice via a downstream concrete notch inlet where it will continue down the street to eventually collect in a catch basin. Type II practices will make use of the same concrete notch inlet, but will overflow using existing catch basins. These practices are only sized to treat the water quality volume.



Rendering of the initial Green Streets Concept for Park Street.

As an additional scope of work for this task, a concept rendering of the 30% concept design was created by Urban Rain | Design to illustrate what each potential practice will look like in a less technical fashion. This was done to facilitate the public outreach process if and when the street is redeveloped. This rendering can be seen in Appendix 3a.1 – Park Street Concept Rendering. Please note – the first page of this document shows the final rendering based on the finalized 30% concept designs. The second page shows a few additional notes relevant to the final rendering (trees to be preserved, bike lane features,

etc.,) as well as some additional design ideas that may be worth considering when pursuing future redevelopment work along Park Street.

The design standard used was treatment of the Water Quality volume (WQv). This standard is met by fully infiltrating all storms up to 1.0" of rain in a 24-hour period. The Water Quality volume infiltrated (for all practices) is 10,846 cubic feet of runoff.

3.4.1.2 *Pollutant Removal and Other Water Quality Benefits:*

TSS Removed	12,993 lbs
TP Removed	14.68 lbs
Impervious Acres Treated	2.72 acres
Total Drainage Area Acres	5.85 acres

3.4.1.3 *Costs:*

The cost per pound of phosphorus treated is $1,839.00.

The cost per impervious acre treated is $9,926.00.

The cost per cubic foot of runoff treated is $2.48.

The initial construction cost projection is as follows:

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 500.00	$ 500.00
652.10	EPSC Plan	LS	1	$ 3,857.79	$ 3,857.79
652.20	Monitoring EPSC Plan	HR	10	$ 40.21	$ 402.10
				Subtotal:	$ 4,759.89
Type I and Type II Bio Swales					
203.15	Common Excavation	CY	265	$9.50	$ 2,517.50
629.54	3/4" to 1 1/2" Crushed Stone (Crushed Stone Bedding)	TON	20	$35.93	$ 718.60
656.41	Plants* (Perennials)	EACH	1000	$8.77	$ 8,770.00
541.31	Concrete, Class D (Inlet/Outlet Protection)	CY	14	$275.45	$ 3,856.30
				Subtotal:	$ 15,862.40
Subtotal:					$ 20,622.29
	Construction Oversight	HR	20	$ 100.00	$ 2,000.00
	Construction Contingency - 10%				$ 2,062.23
	Incidentals to Construction - 5%				$ 1,031.11
	Minor Additional Design Items - 5%				$ 1,031.11
Total (Rounded)					**$ 27,000.00**

* Use of perennial flower seeds can substantially reduce costs. For plugs, use 1 plug per 2 square feet (approximate)

Additional Costs:

As part of the implementation, some construction oversight may be necessary including pre-construction meeting with bidding contractors, pre-construction stakeout, construction consultation with chosen contractor, and post-construction inspection to ensure that all features were installed as designed. The projected budget for that is as follows (costs are based on Watershed Consulting Associate's LLC's rates and do not necessarily reflect the costs that may be incurred if another consultant is chosen to provide construction oversight services).

Additionally, an operation and maintenance plan and agreement should be developed for the system. The costs for doing so are included in the table below.

Task	***Hours***	***Rate***	***Amount***
Pre-Construction Meeting	2.5	$100.00	$250.00
Pre-Construction Stakeout	2.5	$100.00	$250.00
Construction Oversight	8	$100.00	$800.00
Post-Construction Inspection	3	$100.00	$300.00
Operation and Maintenance Plan Development	4	$100.00	$400.00
TOTAL	**20**		**$2,000.00**

3.4.1.4 *Permit Needs:*

Stormwater Permit

This site may need a stormwater permit. As the entirety of the street is to be substantially re-developed (grading and pavement), a stormwater permit may be necessary if the total re-development is greater than 1 acre. The acreage is currently not known as the project is still in the very preliminary stages of scoping and investigation.

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

- Less than 2 acres of disturbance at any one time (maximum disturbance calculated for this project is 0.9 acres)
- All soils must be stabilized (temporary or final) within 7 days
- Runoff from the site must pass through a 50' vegetated buffer prior to entering any water of the State

Local Permitting

No local permits are anticipated.

Other Permits

No Act 250 or Wetlands permitting is anticipated for this project. Because the outfall (existing) for the street is in a River Corridor, there may need to be review by a River Scientist. However, no development or re-development is anticipated in the River Corridor at all.

3.4.2 *Pearl Street:*

3.4.2.1 *Description:*

The concept envisioned for the Pearl Street area is very similar to the concept for Park Street - a series of streetscape bioretention practices called bio-swales. These practices will make use of the wider than average street width to create long, narrow bioretention practices within the right-of-way that will reduce pollutant by infiltrating runoff to ground water. Unlike Park Street, practices will only be installed in existing green spaces. Runoff will flow in to a concrete notch inlet and will overflow using existing catch basins. These practices are only sized to treat the water quality volume.

Streetscape bioretention installed in Montpelier. This is the type of practice envisioned for Pearl Street.

The design standard used was treatment of the Water Quality volume (WQv) and the Channel Protection volume (CPv). This standard is met by fully infiltrating all storms up to 1.0” of rain in a 24-hour period for the WQv and storms up to 2.10” of rain per 24-hour period for CPv. The Water Quality volume infiltrated (for all practices) is 3,920 cubic feet of runoff. The CPv infiltrated (for all practices) is 6,795 cubic feet of runoff.

3.4.2.2 *Pollutant Removal and Other Water Quality Benefits:*

TSS Removed	5,509 lbs
TP Removed	6.49 lbs
Impervious Acres Treated	0.99 acres

Total Drainage Area Acres	2.44 acres

3.4.2.3 Costs:

The cost per pound of phosphorus treated is $3,325.00.

The cost per impervious acre treated is $21,212.00.

The cost per cubic foot of runoff treated is $5.35 for WQv and $3.09 for CPv.

The initial construction cost projection is as follows:

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 500.00	$ 500.00
652.10	EPSC Plan	LS	1	$ 3,857.79	$ 3,857.79
652.20	Monitoring EPSC Plan	HR	10	$ 40.21	$ 402.10
				Subtotal:	$ 4,759.89
Type I and Type II Bio Swales					
203.15	Common Excavation	CY	150	$9.50	$ 1,425.00
629.54	3/4" to 1 1/2" Crushed Stone (Crushed Stone Bedding)	TON	15	$35.93	$ 538.95
656.41	Plants* (Perennials)	EACH	750	$8.77	$ 6,577.50
541.31	Concrete, Class D (Inlet/Outlet Protection)	CY	8.5	$275.45	$ 2,341.33
				Subtotal:	$ 10,882.78
Subtotal:					$ 15,642.67
	Construction Oversight	HR	20	$ 100.00	$ 2,000.00
	Construction Contingency - 10%				$ 1,564.27
	Incidentals to Construction - 5%				$ 782.13
	Minor Additional Design Items - 5%				$ 782.13
Total (Rounded)					**$ 21,000.00**

* Use of perennial flower seeds can substantially reduce costs. For plugs, use 1 plug per 2 square feet (approximate)

Additional Costs:

As part of the implementation, some construction oversight may be necessary including pre-construction meeting with bidding contractors, pre-construction stakeout, construction consultation with chosen contractor, and post-construction inspection to ensure that all features were installed as designed. The projected budget for that is as follows (costs are based on Watershed Consulting Associate's LLC's rates and do not necessarily reflect the costs that may be incurred if another consultant is chosen to provide construction oversight services).

Additionally, an operation and maintenance plan and agreement should be developed for the system. The costs for doing so are included in the table below.

Task	*Hours*	*Rate*	*Amount*
Pre-Construction Meeting	2.5	$100.00	$250.00
Pre-Construction Stakeout	2.5	$100.00	$250.00
Construction Oversight	8	$100.00	$800.00
Post-Construction Inspection	3	$100.00	$300.00
Operation and Maintenance Plan Development	4	$100.00	$400.00
TOTAL	**20**		**$2,000.00**

3.4.2.4 *Permit Needs:*

Stormwater Permit

Unlike the Park Street projects, installation of the Pearl Street bio swales will not involve substantial re-grading of the street and pavement. Therefore, this site will not likely need a stormwater permit unless the project is paid for using funds granted by the VT DEC's Ecosystem Restoration Program. There has been discussion of requiring stormwater projects funded under this program to obtain a stormwater permit, but there has been no definitive decision on this as yet. Additionally, this site will not trigger the so-called 3-acre rule as there is no substantial re-development or development which would trigger that requirement.

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

- Less than 2 acres of disturbance at any one time (maximum disturbance calculated for this project is 0.9 acres)
- All soils must be stabilized (temporary or final) within 7 days
- Runoff from the site must pass through a 50' vegetated buffer prior to entering any water of the State

Following those guidelines at this site should be very simple.

Local Permitting

No local permits are anticipated.

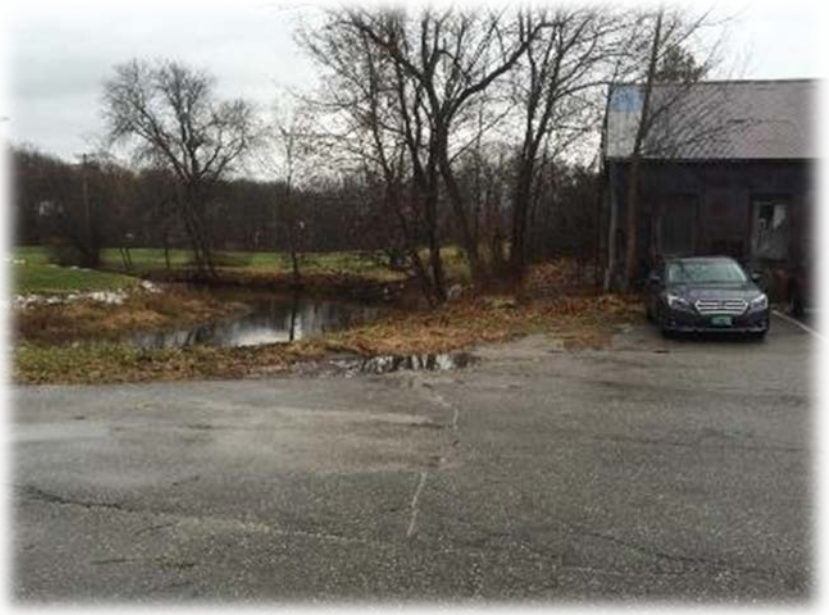
Other Permits

No Act 250, Wetlands, or River Corridor permitting is anticipated for this project.

3.4.3 *Café Provence – Parking Area:*

3.4.3.1 *Description:*

The parking behind Café Provence is governed by the Town of Brandon as a public parking area. This site is highly constrained by buildings, traffic patterns, and the river's riparian area and corridor. However, there are two very promising and relatively simple stormwater retrofits that can be realized on this site. They consist of an 8' concrete dry well to replace the existing catch basin in the upper portion of the parking lot and a lined bioretention practice along the edge of the parking lot to capture and filter sheet flow runoff from the majority of the parking lot's surface, as well as some of the surrounding rooftops.



The parking area behind Café Provence sheet flows directly to the Neshobe River. By removing a small amount of parking, this flow could be managed.

For the dry well, the existing piping in to and out of the catch basin will be maintained to allow for proper drainage of the Café Provence patio area (currently there is an underdrain from the patio to the catch basin), as well as for overflow drainage from the surrounding parking lot surface. Replacing this structure with a dry well to allow the WQv to infiltrate in to the sandy soils in this area will reduce pollutant loading to the Neshobe River.

In order to capture sheet flow runoff from the parking lot surface downhill of the catch basin, a lined bioretention will be installed along the edge of the parking lot. Installing this practice will require removing pavement from the existing parking lot surface and excavating down to achieve the required volume. Soil investigation reveals that there is sufficient depth to groundwater to accomplish this. An 8" perforated underdrain will be used to drain filtered runoff from the sump of the practice back to the river. Amended

bioretention mix soil will be placed above the pipe to accomplish filtration. Overflow from the practice will be routed to a stone armored overflow weir directly to the Neshobe River.

The design standard used was treatment of the Water Quality volume (WQv) for both practices and full infiltration of CPv for the dry well. This standard is met by fully filtering all storms up to 1.0" of rain in a 24-hour period for the WQv in the lined bioretention and fully infiltrating the WQv and CPv (2.10" of rain in 24 hours) in the drywell. The Water Quality volume filtered for the bioretention practice is 827 cubic feet of runoff. The WQv infiltrated for the dry well is 175 cubic feet and 348 cubic feet for the CPv.

3.4.3.2 *Pollutant Removal and Other Water Quality Benefits:*

TSS Removed	978 lbs
TP Removed	0.105 lbs
Impervious Acres Treated	0.282 acres
Total Drainage Area Acres	0.316 acres

The lined bioretention removes 800 lbs. TSS and 0.06 lbs. TP. The dry well removes 178 lbs. TSS and 0.045 lbs. TP.

3.4.3.3 *Costs:*

The cost per pound of phosphorus treated is $133,333.00.

The cost per impervious acre treated is $49,645.00.

The cost per cubic foot of runoff treated is $14.00 for WQv and $40.00 for CPv (dry well only).

The initial construction cost projection is as follows:

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 500.00	$ 500.00
652.10	EPSC Plan	LS	1	$ 3,857.79	$ 3,857.79
652.20	Monitoring EPSC Plan	HR	10	$ 40.21	$ 402.10
				Subtotal:	$ 4,759.89
Lined Bioretention					
203.15	Common Excavation	CY	45	$9.50	$ 427.50
651.35	Topsoil	CY	15	$31.48	$ 472.20
620.26	Woven Wire Fencing with Wood Posts (Split Rail Fencing)	LF	80	$12.20	$ 976.00
613.11	Stone, Type II	CY	2.5	$41.39	$ 103.48
605.11	8 Inch Underdrain Pipe	LF	50	$26.64	$ 1,332.00
651.15	Seed	LBS	4	$7.79	$ 31.16
629.54	3/4" to 1 1/2" Crushed Stone (Crushed Stone Bedding)	TON	2.5	$35.93	$ 89.83
649.31	Geotextile Under Stone Fill	SY	55	$2.52	$ 138.60
656.41	Plants* (Perennials)	EACH	200	$8.77	$ 1,754.00
646.81	Painted Curb	LF	22	$1.59	$ 34.98
				Subtotal:	$ 5,359.74
Dry Well					
203.15	Common Excavation	CY	23	$9.50	$ 218.50
N/A	Dry Well Structure	EACH	1	$2,300.00	$ 2,300.00
				Subtotal:	$ 2,518.50
Subtotal:					$ 10,119.63
	Construction Oversight	HR	16	$ 100.00	$ 1,600.00
	Construction Contingency - 10%				$ 1,011.96
	Incidentals to Construction - 5%				$ 505.98
	Minor Additional Design Items - 5%				$ 505.98
Total (Rounded)					**$ 14,000.00**

* Use of perennial flower seeds can substantially reduce costs. For plugs, use 1 plug per 2 square feet (approximate)

Additional Costs:

As part of the implementation, some construction oversight may be necessary including pre-construction meeting with bidding contractors, pre-construction stakeout, construction consultation with chosen contractor, and post-construction inspection to ensure that all features were installed as designed. The projected budget for that is as follows (costs are based on Watershed Consulting Associate's LLC's rates and do not necessarily reflect the costs that may be incurred if another consultant is chosen to provide construction oversight services).

Additionally, an operation and maintenance plan and agreement should be developed for the system. The costs for doing so are included in the table below.

Task	***Hours***	***Rate***	***Amount***
Pre-Construction Meeting	2.5	$100.00	$250.00
Pre-Construction Stakeout	2.5	$100.00	$250.00
Construction Oversight	6	$100.00	$600.00
Post-Construction Inspection	3	$100.00	$300.00
Operation and Maintenance Plan Development	2	$100.00	$200.00
TOTAL	**16**		**$1,600.00**

3.4.3.4 *Permit Needs:*

Stormwater Permit

This site will not likely need a stormwater permit unless the project is paid for using funds granted by the VT DEC's Ecosystem Restoration Program. There has been discussion of requiring stormwater projects funded under this program to obtain a stormwater permit, but there has been no definitive decision on this as yet. This site will not trigger the 3-acre rule.

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

- Less than 2 acres of disturbance at any one time (maximum disturbance calculated for this project is 0.9 acres)
- All soils must be stabilized (temporary or final) within 7 days
- Runoff from the site must pass through a 50' vegetated buffer prior to entering any water of the State

Following those guidelines at this site should be very simple.

Local Permitting

No local permits are anticipated.

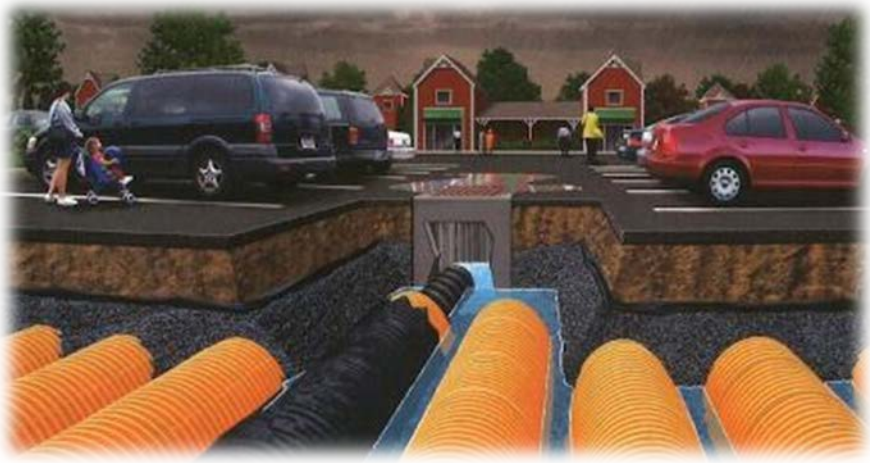
Other Permits

No Act 250 or Wetlands permitting is anticipated for this project. Approval from the River Corridor program may be necessary for this project as the lined bioretention will fall within the river corridor. However, the lined bioretention will be installed in an area of existing pavement which, according to guidance given for similar projects in different river corridor areas, should be acceptable as long as the bioretention does not extend off existing pavement.

3.4.4 *West Seminary Street Park – Sub-surface Chambers:*

3.4.4.1 *Description:*

The Town of Brandon owns a large public park between East and West Seminary Streets. There is a large closed drainage system that outlets to a small tributary of the Neshobe River near the park. By installing some additional stormwater piping, the drainage system can be brought to a system of sub-surface chambers (StormTech SC-740 chambers). Initially, it was thought that runoff routed to these chambers could infiltrate in to groundwater. However, site-specific soil investigation revealed the presence of a restrictive clay layer that would prevent infiltration. The current concept makes use of the chambers with a 2' layer of sand to filter runoff before entering 8" underdrain pipes that would convey runoff to an outlet pipe to the same tributary of the Neshobe River that runoff currently flows to.



Stormwater infiltration chambers, like these shown in this concept rendering, can provide stormwater treatment while maintaining current use of a parking lot space.

The design standard used for this practice is the full filtration of the WQv (1.0" of rain in a 24 hour period). The WQv for this drainage are is 13,025 cubic feet.

Pollutant Removal and Other Water Quality Benefits:

TSS Removed	29,648 lbs
TP Removed	14.68 lbs
Impervious Acres Treated	3.20 acres
Total Drainage Area Acres	10.00 acres

3.4.4.2 Costs:

The cost per pound of phosphorus treated is $8,855.00.

The cost per impervious acre treated is $40,625.00.

The cost per cubic foot of runoff treated is $9.98.

The initial construction cost projection is as follows:

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 1,000.00	$ 1,000.00
652.10	EPSC Plan	LS	1	$ 3,857.79	$ 3,857.79
652.20	Monitoring EPSC Plan	HR	10	$ 40.21	$ 402.10
				Subtotal:	$ 5,259.89
Sub-Surface Chambers - StormTech SC-740					
	SC740	EACH	64	$ 255.00	$ 16,320.00
	SC740 Plain End Cap	EACH	9	$ 52.50	$ 472.50
	SC740 24" Bottom End Cap	EACH	1	$ 366.94	$ 366.94
	12" 90 - 1298AN74	EACH	1	$ 88.19	$ 88.19
	12" Triple Manifold - 1253AN7412	EACH	6	$ 304.56	$ 1,827.38
	12" Coupler - 1265AA	LF	26	$ 8.60	$ 223.60
	24" N12 for Isolater Row (AASHTO)	LF	20	$ 23.88	$ 477.50
	601TG to wrap system (SY)	SY	6500	$ 0.73	$ 4,712.50
	315WTK for scour protection (SY)	SY	1000	$ 0.73	$ 725.00
203.15	Common Excavation	CY	1200	$9.50	$ 11,400.00
204.20	Trench Excavation of Earth	CY	14.07	$353.00	$ 4,966.71
301.26	Subbase of Crushed Gravel, Fine Graded (Sand)	CY	165	$ 40.01	$ 6,601.65
629.54	Crushed Stone Bedding	TON	275	$ 35.93	$ 9,880.75
605.10	6 Inch Underdrain Pipe	LF	530	$20.86	$ 11,055.80
601.0915	18" CPEP	LF	200	$62.94	$ 12,588.00
604.20	Precast Reinforced Concrete Catch Basin with Cast Iron Grate (Manifold Structure and New CBs in Street)	EACH	3	$3,478.51	$ 10,435.53
605.95	Underdrain Flushing Basin (Cleanout)	EACH	5	$331.59	$ 1,657.95
613.11	Type II Stone (Outlet Splash Pad)	CY	165	$41.39	$ 6,829.35
651.25	Hay Mulch	TON	0.25	$596.75	$ 149.19
651.35	Topsoil	CY	4.5	$31.48	$ 141.66
651.15	Seed	LBS	10	$7.79	$ 77.90
				Subtotal:	$ 100,998.09
Subtotal:					$ 106,257.98
	Construction Oversight	HR	23	$ 100.00	$ 2,300.00
	Construction Contingency - 10%				$ 10,625.80
	Incidentals to Construction - 5%				$ 5,312.90
	Minor Additional Design Items - 5%				$ 5,312.90
Total (Rounded)					**$ 130,000.00**

Additional Costs:

As part of the implementation, some construction oversight may be necessary including pre-construction meeting with bidding contractors, pre-construction stakeout, construction consultation with chosen contractor, and post-construction inspection to ensure that all features were installed as designed. The projected budget for that is as follows (costs are based on Watershed Consulting Associates LLC's rates and do not necessarily reflect the costs that may be incurred if another consultant is chosen to provide construction oversight services).

Additionally, an operation and maintenance plan and agreement should be developed for the system. The costs for doing so are included in the table below.

Task	***Hours***	***Rate***	***Amount***
Pre-Construction Meeting	2.5	$100.00	$250.00
Pre-Construction Stakeout	2.5	$100.00	$250.00
Construction Oversight	10	$100.00	$600.00
Post-Construction Inspection	4	$100.00	$300.00
Operation and Maintenance Plan Development	4	$100.00	$200.00
TOTAL	**23**		**$2,300.00**

3.4.4.3 *Permit Needs:*

Stormwater Permit

This site will not likely need a stormwater permit unless the project is paid for using funds granted by the VT DEC's Ecosystem Restoration Program. There has been discussion of requiring stormwater projects

funded under this program to obtain a stormwater permit, but there has not yet been a definitive decision on this.

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

- Less than 2 acres of disturbance at any one time (maximum disturbance calculated for this project is 0.9 acres)
- All soils must be stabilized (temporary or final) within 7 days
- Runoff from the site must pass through a 50' vegetated buffer prior to entering any water of the State

Following those guidelines at this site should be very simple.

Local Permitting

No local permits are anticipated.

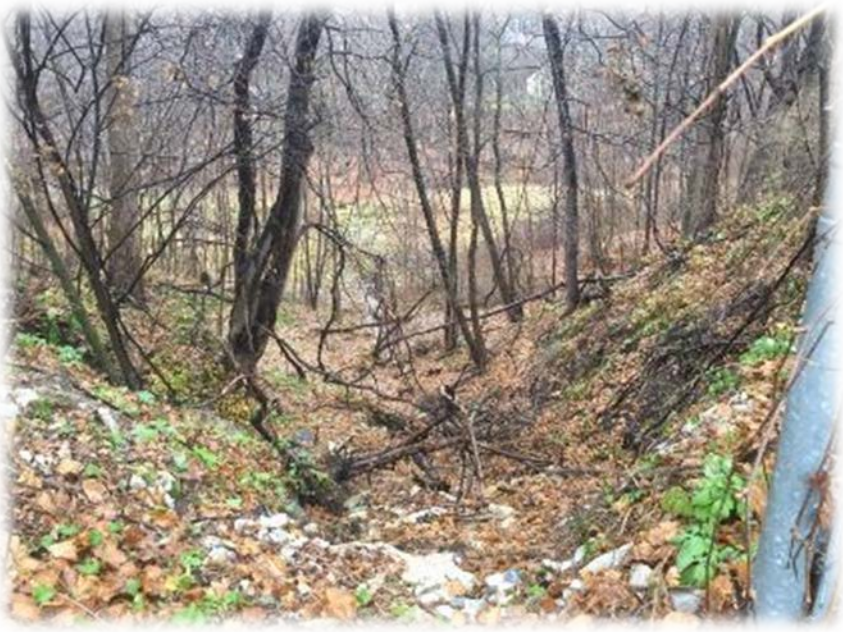
Other Permits

This site will not require a River Corridor, Wetlands, or Act 250 permit.

3.4.5 *Rite Aid Property – Sub-Surface Chambers*

3.4.5.1 *Description:*

One of the largest contiguous areas of impervious surface in Brandon is the Rite Aid and Hannaford's supermarket shopping area. Neither one of these sites has a current stormwater permit and will not likely be required to obtain one in the future as neither parcel exceeds 3 acres of impervious coverage by parcel. However, there is a large eroded swale behind the Rite Aid that leads directly down to the Neshobe River. There is evidence of sediment transport to the floodplain. This material is likely transported during high water.



Sub-surface stormwater chambers at the Rite Aid property would help to alleviate this channelized erosion and prevent sediment from being transported to the Neshobe River.

Using sub-surface chambers at this site, the majority of the drainage from the Rite Aid site could be captured and infiltrated into groundwater. The use of chambers would preserve the current use of this area of the parking lot. Additionally, by creating a new pipe connection from an existing catch basin on the Hannaford's site, additional impervious drainage could be routed to the chambers, increasing the potential water quality benefits.

The design standard used for this practice is the full infiltration of the WQv (1.0" of rain in a 24 hour period) and CPv (2.10" rain in a 24 hour period). The CPv for this drainage are is 2,395 cubic feet.

Pollutant Removal and Other Water Quality Benefits:

TSS Removed	3,066 lbs
TP Removed	3.5 lbs
Impervious Acres Treated	0.828 acres
Total Drainage Area Acres	1.025 acres

3.4.5.2 Costs:

The cost per pound of phosphorus treated is $17,142.00

The cost per impervious acre treated is $72,463.00

The cost per cubic foot of runoff treated is $25.05

The initial construction cost projection is as follows:

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 1,000.00	$ 1,000.00
652.10	EPSC Plan	LS	1	$ 3,857.79	$ 3,857.79
652.20	Monitoring EPSC Plan	HR	10	$ 40.21	$ 402.10
				Subtotal:	$ 5,259.89
Sub-Surface Chambers - StormTech SC-740					
203.15	Common Excavation	CY	210	$9.50	$ 1,995.00
204.20	Trench Excavation of Earth	CY	47	$353.00	$ 16,591.00
629.54	Crushed Stone Bedding	TON	135	$ 35.93	$ 4,850.55
604.20	Precast Reinforced Concrete Catch Basin with Cast Iron Grate (Manifold Structure and New CB in Street)	EACH	2	$3,478.51	$ 6,957.02
613.11	Type II Stone (Outlet Splash Pad)	CY	37	$41.39	$ 1,531.43
	MC4500	EACH	12	$ 525.00	$ 6,300.00
	MC4500 PLAIN END CAP	EACH	2	$ 537.50	$ 1,075.00
	MC4500 24B END CAP	EACH	1	$ 742.19	$ 742.19
	MC4500 12T END CAP	EACH	1	$ 706.25	$ 706.25
	12" 90 BEND	EACH	1	$ 80.70	$ 80.70
	12" N12 FOR MANIFOLD (AASHTO)	LF	20	$ 8.61	$ 172.25
	24" N12 for Isolater Row (AASHTO)	LF	20	$ 25.06	$ 501.25
	601TG to wrap system (SY)	SY	1000	$ 0.75	$ 750.00
	315WTK for scour protection (SY)	SY	1000	$ 0.73	$ 725.00
				Subtotal:	$ 42,977.64
Subtotal:					$ 48,237.53
	Construction Oversight	HR	20	$ 100.00	$ 2,000.00
	Construction Contingency - 10%				$ 4,823.75
	Incidentals to Construction - 5%				$ 2,411.88
	Minor Additional Design Items - 5%				$ 2,411.88
Total (Rounded)					**$ 60,000.00**

Additional Costs:

As part of the implementation, some construction oversight may be necessary including pre-construction meeting with bidding contractors, pre-construction stakeout, construction consultation with chosen contractor, and post-construction inspection to ensure that all features were installed as designed. The projected budget for that is as follows (costs are based on Watershed Consulting Associates LLC's rates and do not necessarily reflect the costs that may be incurred if another consultant is chosen to provide construction oversight services).

Additionally, an operation and maintenance plan and agreement should be developed for the system. The costs for doing so are included in the table below.

Task	***Hours***	***Rate***	***Amount***
Pre-Construction Meeting	2.5	$100.00	$250.00
Pre-Construction Stakeout	2.5	$100.00	$250.00
Construction Oversight	8	$100.00	$600.00
Post-Construction Inspection	4	$100.00	$300.00
Operation and Maintenance Plan Development	4	$100.00	$200.00
TOTAL	**20**		**$2,000.00**

3.4.5.3 *Permit Needs:*

Stormwater Permit

This site will not likely need a stormwater permit unless the project is paid for using funds granted by the VT DEC's Ecosystem Restoration Program. There has been discussion of requiring stormwater projects

funded under this program to obtain a stormwater permit, but there has not yet been a definitive decision on this. This site will not trigger the 3-acre rule.

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

- Less than 2 acres of disturbance at any one time (maximum disturbance calculated for this project is 0.9 acres)
- All soils must be stabilized (temporary or final) within 7 days
- Runoff from the site must pass through a 50' vegetated buffer prior to entering any water of the State

Following those guidelines at this site should be very simple.

Local Permitting

No local permits are anticipated.

Other Permits

This site should not require a River Corridor or Wetlands permit. Execution of this project may require an amendment to an Act 250 permit on the part of the Hannaford's site as this property, formerly the Grand Union Company, has an existing Act 250 permit. However, a change such as the one proposed for this project should only require a minor administrative amendment.

4 Summary and Recommendations:

The results of the Town of Brandon Stormwater Master Planning process have identified and refined designs for a number of potential sites that could have an impact on water quality on water bodies throughout the Town of Brandon. The following is a summary of the steps necessary to bring each of these projects to full implementation.

4.1 Implementation – Next Steps

Under Projects to Implement there are two sub-categories – 1. Road Erosion-related projects and 2. 30% Concept Design sites.

4.1.1 Road Erosion Projects

Each of the top five priority sites should be initially visited by the Town of Brandon Road Foreman to fine-tune solution selection and cost-estimation for materials and labor as all costs given here are taken from VTrans estimation documents. The preliminary cost estimates are as follows:

Site	Priority	Cost
Birch Hill Road	1 of 5	$31,630.00
North Birch Hill Road	2 of 5	$23,096.00 (not including check dam costs)
Old Brandon Road	3 of 5	$9,385.00
Stone Mill Dam Road	4 of 5	$2,721.00
Hollow Road	5 of 5	$5,663.00 (not including check dam costs)
TOTAL		**~$72,495.00**

These projects would all potentially be eligible for a Better Roads Category A grant. However, a town-wide erosion inventory may be required prior the program accepting the grant application as an erosion inventory and implementation plan in accordance with the pending Municipal Roads General Permit is required. This work is currently being performed by the Rutland County RPC.

4.1.2 30% Concept Design Sites

The 30% design sites should now proceed to full 100% design and implementation, once final stakeholder buy-in has been accomplished if and where necessary. In accordance with VT DEC Design Terminology and Guidance, this scope of work will entail updating the designs to 60% concept by further involving

stakeholders (where necessary), refining permitting requirements and updating applications, updating cost estimates for all aspects of construction, and updating of plans to show additional specifications or details beyond the 30% level. Once accomplished, design can proceed to the 90% and then 100% level which comprises plan sets of sufficient quality for regulatory agency review and contractor construction, bidding documents (general conditions, supplementary conditions, specifications, and schedule, with bid form, definitions, and proposed agreement at the 100% level), and final cost projections with reduced contingency to reflect the level of design.

4.1.2.1 Park Street

This project area is currently the subject of a VTrans Municipal Highway and Stormwater mitigation Program grant which envisions replacing water and sewer utilities, implementing stormwater treatment and conveyance systems, and re-developing the road surface (including substantial re-crowning) and re-curbing the length of the street from the limit of the Segment 6 work to the intersection with Marble Street. Members of the project team that developed this stormwater master plan were selected to aid in the design and construction assistance for the VTrans grant. As such, the 30% concept designs envisioned in this master plan will likely be taken to full implementation under the scope of the VTrans grant.

4.1.2.2 Pearl Street

The project team strongly recommends that these practices be implemented during the same time period as the re-development on Park Street. The reason for this is that the contractor implementing the work and practices on Park Street will be familiar with the design. As the practices along Pearl Street are fundamentally the same, it is logical to use an already-mobilized and experienced contractor to construct them. These practices will require some additional design (which will largely be accomplished by refining the designs for the practices along Park Street). It is recommended that, once final designs have been accomplished for Park Street, that these refinements are incorporated in to the Pearl Street designs and full implementation is pursued concurrent with work on Park Street. Because of the cost savings likely realized through the synergy with the Park Street project, the costs for this implementation may be very low.

4.1.2.3 *Café Provence*

It is recommended that additional grant assistance from the Ecosystem Restoration Program be sought to pay for final design of this practice. Final design costs should be between $5-8,000, inclusive of construction oversight. As a preliminary step, however, the regional River Scientist should be contacted to determine concept feasibility prior to pursuing additional grant funding. If the Scientist determines that the project is feasible, this practice may be eligible for what the Ecosystem Restoration Program calls an Intermediate Complexity Round 2 grant which will pay for design and construction. This grant typically only applies to projects that are simpler to engineer and don't have excessive feasibility concerns.

4.1.2.4 *West Seminary Street Park*

This site will require more complex engineering design prior to construction. We recommend that this practice apply for an Ecosystem Restoration Program grant under the Complex level for a Round 2 (30% to 100% construction level design). Landowner and permitting feasibility concerns are low for this site, and the treatment potential is high. As far as large-scale projects go under the scope of this master plan, this is the best one to actively pursue.

4.1.2.5 *Rite Aid*

This project would require a similar grant type to the one described for the West Seminary Street Park project. However, landowner outreach and buy-in questions should be fully resolved prior to proceeding with additional design. Additionally, once landowner buy-in has been achieved, geotechnical assessment should be conducted under the future scope of work.

4.2 *Additional Projects to Pursue*

4.2.1 *Other Best Management Practices (Structural):*

There are a number of other sites in the Town of Brandon that could be pursued for additional assessment, design, and potential implementation.

4.2.1.1 *Segment 6 Projects*

If the recommended projects are not implemented during construction of the Segment 6 roadway area, we recommend re-visiting the projects investigated during the course of this master plan to determine which, if any, would be feasible.

4.2.1.2 *Parcels with 3 acres of impervious coverage or more:*

The maps and ownership information collected in this master plan should be used to conduct outreach to the owners of these parcels where the parcel does not have a valid stormwater permit currently. The owners should be informed that their parcel will require a stormwater permit in the future and that runoff must be managed. There may be funding opportunities currently to help the owners of these properties manage their runoff prior to the so-called '3-acre rule' implementation.

Please note that all the sites listed in below here can be seen on the map included as Appendix 2.2 – All Sites Investigated Location Map and information for each site can be seen in Appendix 2.3 – All Sites Investigated Summary Sheets.

4.2.1.3 *BRD_001 (public parking lot in downtown Brandon):*

This is a relatively simple grass filter strip that would require little additional design and should be simple to implement. It is recommended that the Town of Brandon pursue implementation of this practice using resources from the Town's road crew.

4.2.1.4 *BRD_033 (road right-of-way along Carver Street):*

This project, while beneficial, is relatively small. It could also be built along the same general design guidelines as the projects on Pearl and Park Streets. For this reason, we don't recommend that the Town proceed with additional design at this time. However, after implementing similar projects on other streets, we recommend that the Town potentially re-visit this project site for implementation.

4.2.1.5 *BRD_040 and BRD_037 (Hannaford's parking lot area):*

BRD_040, a system of infiltration chambers under the front of Hannaford's parking lot, and BRD_037, an infiltration basin to treat runoff at the back of Hannaford's site, would both be good potential retrofits. The Hannaford's site is one of the largest contiguous areas of impervious surface in Brandon, though it is not over 3 acres. These two practices, for the purposes of additional design, should probably be grouped together. Part of this area will be treated by the retrofit by the proposed Rite Aid practices. However, if the proposed Rite Aid practice doesn't proceed, this site could be a good alternative.

4.2.1.6 *BRD_045 (outfall below St. Mary's Church):*

It may be possible to investigate this site for a gravel wetland treatment practice. However, this site should be investigated by a Wetlands Coordinator as there is a significant amount of drainage that has rendered this area very wet. It may be considered a classified wetland as such.

BRD_039 (Rossiter Street ROW projects):

The area along Rossiter street has wide rights-of-way. As such, a similar design to the practice specified for Park and Pearl Streets may be feasible in this location.

4.2.1.7 BRD_041 / BRD_042 / BRD_044 (Church Street ROW):

Similar to the practice described above, the rights-of-way along Church street are wide and could accommodate streetscape bioretention practices.

4.2.1.8 BRD_050 (Outfall off Walnut Street):

Runoff from the residential area above Walnut Street is collected via swales and culverts to one final outfall location on public property. This area may be suitable for the development of a gravel treatment wetland or a similar filter-type practice. Soils in the area appear wet and may not be suitable for infiltration.

4.2.1.9 BRD_052 through BRD_059 (Neshobe School):

Though not directly hydrologically connected, the stormwater infrastructure in this area is poorly understood and may, ultimately, get connected to waters of the State or begin to cause nuisance drainage issues at some downhill location. A series of relatively simple practices would begin to manage runoff on-site, as well as provide aesthetic and educational enhancements at the school. This site is a good candidate for a site-specific stormwater master plan.

4.2.2 Other Best Management Practices (non-structural):

4.2.2.1 Adopt Town-specific Stormwater Bylaws

Many towns in Vermont are working to adopt Town-specific stormwater bylaws, whether as part of an MS4 permit or as an initiative to preserve water quality and protect infrastructure within their jurisdiction. These bylaws are meant to complement the VT DEC stormwater regulations for 'sub-jurisdictional' development (essentially any development that would not be covered under a State stormwater permit).

In order to encourage the adoption of such practices, the Vermont League of Cities and Towns (VLCT) has created a set of model bylaws addressing site development during all phases of construction: pre-, during, and post-construction stormwater management practices designed to minimize soil disturbance, reduce or eliminate sediment-laden runoff, and manage site-specific stormwater after construction has finished. These bylaws are intended to be modified by each municipality to fit their desired goals.

To support adoption of these bylaws, the VLCT has also prepared a manual and sizing tool titled the Vermont Green Stormwater Infrastructure Simplified Sizing Tool for Small Projects. Debuted in October, 2015, this manual and tool are specifically aimed at small, sub-jurisdictional sites in Vermont.

Adopting bylaws and encouraging the use of the simplified small sites sizing tool in Middlebury could have a net benefit for the Town in terms of reduction of load on existing stormwater infrastructure and pollutant removal enhancement - ensuring compliance with the Lake Champlain TMDL. Jurisdictional stormwater regulations may not guarantee that cleanup goals are met – and not meeting those goals could lead to stricter regulations across a broader array of sites. Enacting a Town-specific program now could prevent further regulations in the future. A model for this program and tools for implementation can be found in the folder Appendix 5 – Town Specific Stormwater Program Model, which contains the aforementioned model bylaws and small-sites sizing guide and tool.

4.2.2.2 *Adopt and Promote Usage of the VT DEC's Guide to Stormwater Management for Homeowners and Small Businesses*

This guide is specifically aimed at sub-jurisdictional stormwater management practices that are easy for residents and small businesses to adopt. It contains helpful explanations of each practice, along with illustrations for each, and other resources to use when considering implementing stormwater management on small properties. Encouraging the adoption of the guidelines laid out in this manual could have an appreciable cumulative impact on water quality in the Town of Brandon. That document can be found here: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwi_mMiuyZjXAhVIrFQKHeaxCpoQFggoMAA&url=http%3A%2F%2Fdec.vermont.gov%2Fsites%2Fdec%2Ffiles%2Fwsm%2Ferp%2Fdocs%2FVT_Guide_to_Stormwater_for_Homeowners_DRAFT.pdf&usg=AOvVaw3wtDxBzIR4F4u4BK02Z6GB

4.2.2.3 *Enact Town-wide Illicit Discharge Detection and Elimination (IDDE) Program*

The Town of Brandon was the beneficiary of a grant through the VT DEC that investigated the presence of illicit discharges in and around the Town. Several potential illicit discharges were found.

There were several recommended follow-up actions made in the IDDE report. It is recommended that the Town review this report and determine which outfalls have been definitively eliminated as illicit

discharge possibilities. It is important to note that several of the outfalls identified during that study were along Route 7 which is being substantially re-developed as part of the Segment 6 project. It would be prudent to return to these suspect outfalls along Route 7 following completion of the Segment 6 project to ensure that drainage work fixed any potential issues.

Currently, the Town does not have its own IDDE program. As many illicit discharges are the result of broken sanitary or stormwater infrastructure (sagging or broken pipes, leaks in old clay-tile pipe joints, etc.), it is recommended that that Town adopt a town-specific IDDE program that conducts an annual dry weather outfall survey to look for water flowing during periods of no precipitation. This could lead to the regular detection of illicit discharges, dumping, or other issues. Now that the Town possesses updated stormwater system mapping information, as well as sanitary sewer mapping information, this process could be economical.