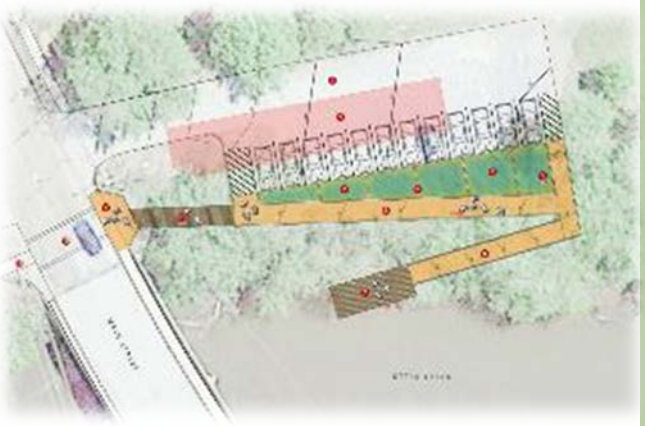

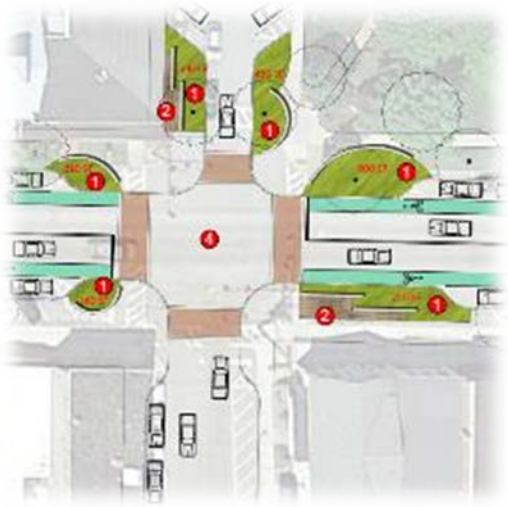

CITY OF VERGENNES –

STORMWATER MASTER PLAN

VERGENNES,

VERMONT

FINAL REPORT

June, 2018

Prepared for:

City of Vergennes

120 Main Street

Vergennes, VT 05491

Prepared by:

Watershed Consulting Associates, LLC

208 Flynn Avenue - P.O. Box 4413

Burlington, VT 05406

P: 802.497.2367

info@watershedca.com

TABLE OF CONTENTS

List of Appendices:

Appendix 2.1 – Sanitary Sewer Plans

Appendix 2.2 – Sanitary Sewer Maps.

Appendix 2.3 – Sanitary Sewer KML Files

Appendix 2.4 – Sanitary Sewer Field Inspection Sheets

Appendix 2.5 – Sanitary Sewer Geodatabase

Appendix 3.1 – Preliminary Sites Overview Map

Appendix 3.2 – Public and 3-acre Parcels

Appendix 3.3 – Existing Stormwater Permit Summary Table

Appendix 3.4 – Field Data Sheets

Appendix 3.5 - Vergennes BMP Opportunities – Presentation

Appendix 3.6 - BMP Examples Photos

Appendix 3.7 - Vergennes Downtown-Basin Master Plan

Appendix 3.8 – Ranking Criteria

Appendix 3.9 – Cost Estimation Basis Memo

Appendix 3.10 – Project Cost Estimation Criteria

Appendix 3.11 – Full Ranking Spreadsheet (MS Excel)

Appendix 3.12 – Preferred Sites Locations and Drainage Area Maps

Appendix 3.13 - Drainage Area Delineations

Appendix 4.1 – 30% Concept Design Plans

Appendix 4.2 – Landscape Renderings

Appendix 5.1 – Town Specific Stormwater Program Model

I. Disclaimer

The intent of this report is to present the data collected, evaluations, analysis, designs, and cost estimates for the City of Vergennes Stormwater Master Plan under a contract between the City of Vergennes and Watershed Consulting Associates, LLC. Funding for the project was provided by the Lake Champlain Basin Program (LCBP). 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 City of Vergennes, as well as recommendations related to sanitary sewer infrastructure replacement that could potentially help alleviate sewage overflows from the City's sewer system. 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 Vergennes, VT.

2 Background

2.1 Problem Definition

The City of Vergennes is a small municipality of 2,500 residents located in a relatively compact city center. Vergennes is 1621 acres total. Of this, 217.59 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 13.4% of the total town area. Of these ~217.59 acres of impervious coverage, ~55.87 acres or 25.6% are public roads. This impervious coverage will be subject to the newly-issued Municipal Roads General Permit (MRGP). The remainder is split between public and private parcels of development. Impervious surfaces can all contribute runoff to the various tributaries as well as directly to the Otter Creek that negatively impact water quality.

The project team identified all parcels within the City of Vergennes with 3 acres or more of impervious coverage as of 2011 (this is the most current dataset for the Lake Champlain Basin). There are 4 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 4 parcels of interest are listed below.

Parcel Number	Owner	Stormwater Permit?	Impervious Acres	Notes
220201000	DR Power Corporate Office (formerly Country Home Building Products	Yes	4.29	DR Power has two valid stormwater permits, 3897-9010 and 3897-9003. The operational (9010) permit is older and may require an upgrade.
250101000	Northwoods Job Center	No	10.31	The parcel is State-owned and does not possess a valid stormwater permit. The site is rented by a private organization.
260514000	Vergennes High School	Yes	6.67	The High School has a valid stormwater permit (4913-9010) but system is a small retention pond that appears undersized and could be upgraded to provide additional phosphorus treatment.
250208000	Goodrich Corporation	Yes	13.16	The site has two valid stormwater permits (3408.9010.R and 3408.9003). Operational permit is older and the site may require an upgrade.

Of these parcels, three of them currently possess valid stormwater permits, though these may require upgrades under the new stormwater regulations. One is unpermitted. Maps of these parcels can be seen in Appendix 3.2 – Public and 3-acre parcels and Permitted Sites. Summaries of the stormwater permits can be seen in Appendix 3.3 – Existing Stormwater Permit Summary Table.

This study has sought to reduce water quality stressors associated with development in Vergennes in two ways. One is by identifying potential stormwater management 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 and phosphorus in stormwater runoff to the greatest

degree. The second is by creating a more comprehensive sanitary sewer map showing accurate manhole and pipe locations, as well as listing pipe type and size in an effort to help the City of Vergennes prioritize sewer pipe replacement in an effort to reduce groundwater intrusion into sanitary sewer pipes throughout the City. During times of saturated groundwater conditions, this can cause sewage overflows to the Otter Creek. By replacing sections of pipe that allow groundwater intrusion, the City will be able to reduce the occurrence of sewage overflows.

2.2 *Data Review*

The master planning project team completed a comprehensive review of existing data related to the City of Vergennes for the purposes of identifying 1) sanitary sewer plans or other data layers that would be relevant to mapping efforts and 2) stormwater permit information and impervious coverage by parcel information that could possibly be of assistance in identifying high value stormwater management sites. The project team also conducted modeling for all publicly controlled street rights-of-way (ROW) to determine suitability for distributed streetscape stormwater management practices. This modeling made use of street centerline and ROW information, as well as soil and slope data.

2.2.1 *Sanitary Sewer Plans:*

Sanitary sewer plans were initially obtained from City Manager Mel Hawley in the form of ~100 sheets of plans dating from 1978. These plans were hand drawn. The project team scanned these plans on a high-quality flatbed scanner, then georeferenced them in ArcMap to being to create point and line features for manholes and pipes. Pipes were assigned a size and type based on the plans. City Manager Hawley later provided an updated map from 1998 that Forcier Aldrich and Associates had created based on the 1978 plans that had been overlooked during the initial data transfer from the City to the project team. The accuracy and readability of this map was much greater than that of the 1978 plans and led to the creation of an initial map of the downtown area of Vergennes. This map only covered the downtown core of Vergennes and some outlying areas. The project team then downloaded all available digital plans from the State of Vermont's Wastewater Regional Office permit database. These plans, which included many subdivision, office and commercial areas, institutions, and some smaller developments as well, were georeferenced in ArcMap. Manhole and pipe features were then created for all permit plans found for later field verification.

2.2.2 *Stormwater 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 issued stormwater permits within the town boundary of Vergennes. Issued stormwater permits were assessed for ownership, from which the publicly owned permits were identified. The outcome of this work can be seen in Appendices 3.2 – Public and 3-acre parcels and 3.3 – Existing Stormwater Permit Summary Table.

2.2.3 *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 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.

2.2.3.1 *Past Studies:*

The project team reached out to City Manager Hawley as well as Addison County Regional Planning Commission's (ACRPC) Land Use Planner Claire Tebbs, to determine if any past studies had been performed that would inform the current project. The Vergennes Downtown-Basin Master Plan was highlighted as a comprehensive master planning document for the downtown area of Vergennes, including the area around the Otter Creek, that could possibly inform further stormwater management efforts as it calls out stormwater management in certain zones as being specifically needed. This document was reviewed by the project team and certain aspects of it incorporated into the stormwater master plan. This document can be seen in Appendix 3.7 – Vergennes Downtown-Basin Master Plan.

2.2.4 *Data Needs:*

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

The first is clearly the need for a comprehensive sanitary sewer map that identifies accurate locations and routing for the system, as well as attributes related to potential need for replacement. This is being performed as part of this project.

The presence or absence of land use regulations and zoning bylaws concerning stormwater management are also of interest in this project. The City of Vergennes 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 City could adopt for future stormwater management efforts.

3 Sanitary Sewer Mapping

In order to assist the City of Vergennes reduce the occurrence of sanitary sewage overflows from the City's separate sanitary sewer (SS) system, the project team undertook to accurately map features locations and routing, as well as to assign pipe type and size to all SS pipes.

In general, the City has four main types of pipe. They are:

- Vitrified clay (VC)
- Asbestos cement (AC)
- Polyvinyl chloride (PVC)
- Acrylonitire-Butadiene-Styrene (ABS)

Over the years, Vergennes has made efforts to replace as much of the older pipe system as possible. These pipes are typically VC in 2' segments. These segments tend to separate from each other in Vergennes dense clay soils, allowing groundwater to intrude into the pipes. Additionally pipes can crack over time, allowing groundwater to intrude. These pipes are of particular concern in Vergennes as they are typically the oldest and most prone to failure. The other class of pipe that is of concern are the AC pipes. These pipes were widely used starting the in 1940s and 1950s and have an approximate design-life of 50 years. These pipes are also a replacement priority.

The remaining two pipes types, PVC and ABS, are both newer, degradation-resistant plastic piping. As both types are relatively new compared to VC and AC pipes, no replacement priority has been assigned them at this time.

Summaries for all pipe lengths and associated costs are presented in the following table. Please note that costs are provided as a range from a minimum cost of approximately $10/linear foot to replace sanitary sewer pipes using pipe lining (slip-lining or other lining methods) to $200/linear foot using full pipe replacement involving excavation of existing pipes and full replacement with new pipes (and structures if existing structures are unsuitable). These costs are based on current estimates provided by local engineering firms based on past projects. Given the data collected and the methods used during

this study, this is the best way to present potential costs as there are too many unknown variables to present more accurate costs.

High Priority Replacements		
Field Verified		
Length (ft)	Cost ($, min)	Cost ($, max)
15,508	$155,080.00	$3,101,600.00
Non-Field Verified		
Length (ft)	Cost ($, min)	Cost ($, max)
641	$6,410.00	$128,200.00

Medium Priority Replacements		
Field Verified		
Length (ft)	Cost ($, min)	Cost ($, max)
1,436	$14,360.00	$287,200.00
Non-Field Verified		
Length (ft)	Cost ($, min)	Cost ($, max)
0	$0.00	$0.00

Table 1: Approximate replacement costs for High and Medium priority pipes in Vergennes (provided as a range from $10/linear foot for lining to $200/linear foot for full replacement.

There are also 70,240 feet of low priority pipes (ABS and PVC) that have been field verified, along with 4,681 feet of low priority pipes that have not been field verified as yet. It is not anticipated that these pipes are in need of replacement, so costs are not provided, though could be calculated using the amounts given above.

3.1 *Desktop Mapping*

As described in section 2.2.1, the project team initially scanned and georeferenced sanitary sewer plans from 1978 to create initial maps of the system. This mapping layer was then updated using plans developed in 1998. These plans were then supplemented by VT DEC Wastewater Regional Permit office permit plans for various private sanitary sewer systems throughout the City. Features were created as points (for manholes) or lines (for pipes) in ArcGIS. All line features were snapped to points and drawn in the direction of flow. Each point was assigned a feature class of existing, abandoned, or proposed, according to information obtained from the plans. Each line was assigned the same feature class, as well as a pipe type from the four main types present in the City (or assigned a value of 'Unknown') as well as a pipe size (if known).

All plans associated with this work can be seen in Appendix 2.1 – Sanitary Sewer Plans (please note this is provided as a binder of PDF files).

3.2 *Field Verification*

Once all features had been digitized to the maximum extent possible using plan information, all point and line features were loaded into a smartphone app for field inspection. The app has fields for data entry for:

- Existence (Existing/Proposed/Abandoned)
- Field Edit (Moved in Field / In Correct Location (from plan))
- Label
- Field Notes
- Photo

Using this app, a field report sheet can be generated for each point inspected. This will assist in future inspections and understanding of mapped data. If necessary, points were moved in the field using the smartphones GPS unit and high-accuracy digital imagery for the City. This was found to be as accurate as using sub-meter GPS units. Each manhole was opened and pipes were inspected for type, size, and routing. Any updates to line features were noted on a paper map and later digitally entered into the ESRI geodatabase used to store features. All points were downloaded from the app and re-imported into the ESRI database. Line features were re-connected to each point where necessary. The final mapped system can be seen in Appendix 2.2 – Sanitary Sewer Maps. We are also providing Google KML files that are

viewable and interactive in Google Earth as Appendix 2.3 – Sanitary Sewer KML Files. These files are split into pipes and manholes. Additionally, we have loaded this data into a shareable Google Map, the link for which is: https://drive.google.com/open?id=1ZyGM5-8h_ijWTXaxEbJ3SMon0iu5T60p&usp=sharing
We are also including an ESRI geodatabase of this information as Appendix 2.5 – Sanitary Sewer Geodatabase.

Field inspection sheets for each catch basin can be seen in Appendix 2.4 – Field Inspection Sheets.

4 Stormwater Proposed Best Management Practices

The main focus of this stormwater master plan was the investigation and development of structural stormwater management solutions to the 30% design level for three different sites, as well as the development of three landscape architectural renderings (either for the chosen 30% engineering design sites or for other sites as chosen by project stakeholders). This section of the report will detail the methods used and solutions developed for this area of focus.

4.1 Engineered BMP Design – 30% Design Sites

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

4.1.1 Desktop Assessment and Preliminary Site Selection

4.1.1.1 Methods

Relevant Geographic Information System (GIS) data was drawn from a variety of public resources including the Agency of Natural Resource's Atlas, Vermont Center for Geographic Information, and data created by the University of Vermont's Spatial Analysis Lab. A file geodatabase was created to ensure organization and for ease of use. These data represent the "best available" data at the time of data collection (2017). These data include, but are not limited to

- Stormwater infrastructure (catch basins, pipes, etc.)
- Topography (Lidar derived from 2012)
- Soils (NRCS mapped soil units)
- Hydrologic data (streams/wetlands/river corridors)

- Parcels (including derivation of any publicly owned parcels)
- Impervious cover data for the Lake Champlain Basin
- Road centerlines

Preliminary Site Selection

Desktop Assessment and Map Preparation

A desktop assessment was completed in order to identify potential sites for stormwater BMP implementation. This process involved a thorough review of existing GIS resources and associated attribute data. Data included, but was not limited to, storm sewer infrastructure, soils classifications, parcel data, wetlands, and river corridors. This data was used to identify stormwater subwatersheds with particularly high impervious cover, stormwater subwatersheds that are more directly connected to water bodies (direct pipes to streams or via overland flow), public parcels with stormwater outfalls on or near them, public parcels with potential stormwater management opportunities, and parcels with ≥3 acres of impervious cover without a current stormwater permit as these areas will be subject to a permit in the future. These areas were noted, and a point location was created for assessment in the field. These point locations can be seen in Appendix 3.1 – Preliminary Sites Overview Map.

Also during this process all existing publicly-owned parcels (City or State) were identified as well as all parcels with 3 acres or more of impervious surfaces. All existing stormwater permits within the City of Vergennes were identified and summarized with respect to their relative need for future upgrade, whether because of permit vintage or because of permit type (e.g. Multi-Sector General Permit (MSGP) 'industrial' stormwater permits for sites with more than three acres of impervious cover are likely to be required to also obtain an 'operational' stormwater permit in the future which carries additional management stipulations beyond MSGP permit requirements). These parcels are identified in Appendix 3.2 – Public and 3-acre Parcels and Appendix 3.3 – Existing Stormwater Permit Summary Table.

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). 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.

Using this data, digital maps for field investigations were developed for 27 potential BMP sites, both general watershed-wide sites and green streets locations. Base layers included parcel boundaries, public parcels, stormwater infrastructure, hydrologic soils groups, river corridors, and wetlands. A watershed-specific mobile app for the drainage area was customized, and the app was pre-loaded with the potential BMP sites for ease of location and data collection in the field.

Field Data Collection

Each of the 27 potential BMP locations were evaluated in the field during the summer of 2017. The customized mobile app was used to collect information at each site including site suitability, potential

practice description, site description, photographic documentation, follow-up notes or questions, and other pertinent data. This information was used to generate field data sheets for each site. These can be seen in Appendix 3.4 – Field Data Sheets.

Preferred Sites Selection

The process for selecting the preferred sites for Vergennes was as follows.

Following the completion of the field work, WCA contacted the Addison County Regional Planning Commission (ACRPC) planner Claire Tebbs. With Ms. Tebbs' assistance, a meeting was setup with members of the Vergennes Planning Commission and City Manager Mel Hawley. Kevin Robert Perry of Urban Rain | Design also attended via phone and screen share. The purpose of this meeting was to discuss the preliminary sites identified, in particular with respect to the Vergennes Downtown-Basin Master Plan (Appendix 3.7). The material presented can be seen in Appendix 3.5 – Vergennes BMP Opportunities – Presentation. This meeting was held on Monday, October 23, 2017. During this meeting various opportunities regarding stormwater management were discussed, in particular opportunities along Main Street, MacDonough Drive, MacDonough Park, Settler's Park, and Falls Park. It was decided during this meeting that opportunities along Main Street should be part of the landscape rendering process.

The remainder of the sites outside of the areas mentioned above were not discussed during the meeting. WCA sent the presentation from Appendix 3.5 to the Planning Commission for them to choose along with the material in Appendix 3.6 – BMP Examples Photos. Three members responded to the request for feedback. This is summarized in the table below. Of the preliminary 27 sites, one site garnered a 'No' vote from Commission members based on past investigation in to a possible stormwater solution at this location. Site 24, or the Bowman Road Detention Pond, was rejected for further consideration under this study as residents of the area had previously rejected a modification of the stormwater pond.

Site	Planning Commission Member 1	Planning Commission Member 2	Planning Commission Member 3
1) Northlands Job Corps Center			
2) High Street Swale			
3) MacDonough Park			
4) Comfort Hill			
5) Battery Hill			
6) MacDonough Drive Swales			
7) Bixby Memorial Library			
8) Vergennes City Park (to include Main Street)			
9) Vergennes Elementary School			
10) Mountain View Lane			
11) Vergennes High School			
12) Vergennes Fire Department			
13) Maple Manor			
14) New Haven Road Swale			
15) West Main Street Parking Lot			
16) Vergennes Falls Park			
17) Fraternal Order of the Eagles			
18) DR Power Corporate Offices			
19) UTC Aerospace Systems			
20) Settlers Park			
21) Sunset Drive Residential Subdivision			
22) UTC Outfalls			
23) WW Treatment Plant Facility			
24) Bowman Road Detention Pond			
25) Monkton Road Gravel Wetland			
26) Armory Lane Gravel Wetland			
27) South Maple Street / St. Peter's			

Table 2: Summary of feedback received from the Vergennes Planning Commission members based on initial sites selected.

In order to arrive at a final list of preferred sites (~20), all sites receiving a 'Yes' from one or more commission members were kept. That resulted in the following list:

1. Northlands Job Corps
2. MacDonough Park
3. Battery Hill
4. MacDonough Drive Swales

5. Bixby Memorial Library
6. Vergennes City Park (to include Main Street)
7. Vergennes Elementary School
8. Mountain View Lane
9. Vergennes High School
10. Vergennes Fire Department
11. New Haven Road Swale
12. West Main Street Parking Lot
13. Vergennes Falls Park
14. Settlers Park
15. Sunset Drive Residential Subdivision
16. Monkton Road Gravel Wetland
17. Armory Lane Gravel Wetland
18. South Maple Street / St. Peter's

The remaining sites are

- High Street Swale
- Comfort Hill
- Maple Manor
- Fellowship of the Eagles
- DR Power Corporate Offices
- UTC Aerospace Systems
- UTC Aerospace Systems Outfalls (outfalls draining lands adjacent to UTC's campus)
- Wastewater Treatment Plant Facility
- Bowman Road

Additionally, during the meeting Planning Commission members requested that the Project Team look at the intersection of Green Street and New Haven Road. This area receives a considerable amount of surface runoff.

From this list, WCA eliminated the following sites for the following reasons:

- High Street Swale – relatively simple outfall stabilization project that may or may not have a high cost/benefit ratio. This project should be looked at more critically under the Municipal Roads General Permit (MRGP) process.
- Comfort Hill – small-scale residential retrofits (rain gardens and rain barrels) with potentially complex landowner outreach for smaller benefits. This project may be best undertaken as a neighborhood initiative under a different project.
- Fraternal Order of the Eagles – Planning Commission members expressed the feeling that this organization is more able to address its own stormwater runoff independent of this study, which they felt should focus on public parcels and communally-generated runoff.
- DR Power Corporate Offices – this site was eliminated as 1) outreach to the facility manager was not successful and B) this site will be required to obtain a new permit under the upcoming 3-acre impervious cover rule.
- UTC Aerospace Systems – this site was eliminated as it will also be required to obtain an upgraded permit under the new Lake Champlain TMDL regulations.

Following the elimination of these sites, there are three sites left:

- Maple Manor
- Wastewater Treatment Plant Facility
- Green Street and New Haven Road Intersection

All three of these sites have the potential to have large impact on water quality in Vergennes and will also potentially solve nuisance runoff issues (particularly in the case of Green Street and New Haven Road intersection). For this reason, we will conduct modeling and prioritization for 21 sites. The results from the modeling and prioritization process will allow us to select three sites for 30% engineering design, along with two additional sites for landscape rendering (the collection of Main Street retrofits was already selected as a site for landscape rendering). Please note – these two selections do not necessarily have to be the same sites.

Modeling and Prioritization Process:

Modeling

Modeling was completed for each of the 21 sites. This modeling allowed for accurate sizing of the proposed practices as well as an understanding of the water quality and quantity benefits. The contributing drainage area of each of the BMPs was defined and landuse/ landcover was digitized using the best available topographic data and aerial imagery. Drainage areas were refined based on field observations (see Appendix 3.13 – Drainage Area Delineations). Then, each of the sites was modeled in HydroCAD to determine the appropriate BMP size and resultant stormwater management benefits.

Each of these sites was also modeled using the Source Loading and Management Model for Windows (WinSLAMM) to determine the annual total suspended solids (TSS) and total phosphorus (TP) loading from the drainage area of each site. Pollutant load reductions from each of the BMPs were then calculated using pollutant removal rates published by the University of New Hampshire Stormwater Center. These rates were applied to the initial pollutant loading modeled with WinSLAMM for the site's current conditions. This yielded expected pollutant removal loads (lbs) and rates (%). The modeled volume and pollutant loading reductions are shown in Table 1.

Vergennes - Drainage Area Characterization							
BMP ID	Drainage Area (acres)	Impervious Area Managed	Volume Managed (cu. Ft.)	TSS Removal (lbs)	TSS Removal (%)	TP Removal (lbs)	TP Removal (%)
Armory Lane	1.27	0.63	5,140	1,754.88	96%	3.92	58%
Battery Hill	0.97	0.53	3,049	2,016.66	87%	0.91	34%
Bixby Memorial Library	0.48	0.33	3,049	309.72	87%	0.30	34%
Falls Park	0.74	0.34	1,307	565.50	87%	0.74	34%
Fire Department	0.11	0.11	653	25.43	50%	0.02	50%
Green Street - New Haven Road Intersection	2.67	2.11	6,098	7,414.14	87%	3.28	34%
High School	9.73	5.77	69,696	13,133.76	96%	19.19	58%
MacDonough Park	1.95	0.33	1,350	5,199.99	87%	2.75	34%
MacDonough Drive Swales	6.94	3.19	9,017	17,446.08	96%	17.10	58%
Maple Manor	6.99	0.82	9,757	18,697.92	96%	15.18	58%
Monkton Road	29.49	1.95	152,460	26,096.64	96%	14.63	58%
Mountain View Lane	5.61	1.97	9,627	7,658.67	51%	6.44	33%
New Haven Road Swale	33.77	6.73	19,558	80,633.28	96%	100.34	58%
Northlands Job Corps	111.72	6.11	162,914	24,858.42	51%	61.78	33%
Settlers Park	3.17	2.38	5,968	440.03	51%	4.35	33%
St Peter's Church	1.24	1.24	5,663	884.79	87%	0.36	34%
Sunset Drive	8.35	2.30	45,999	11,700.42	96%	10.22	33%
West Main Street Parking Lot	20.58	5.62	8,581	29,071.02	51%	25.10	33%
Wastewater Treatment Facility	12.53	3.24	4,269	33,137.28	96%	27.12	58%
Vergennes Elementary School	5.16	1.99	4,661	627.55	96%	0.75	58%
Main Street Practices (Collectively)	3.14	2.22	2,919	5,742.00	87%	1.20	34%

Table 3: Drainage area characterization for the preferred sites showing modeled pollutant reduction amounts.

Prioritization

Final Ranking Methodology

A prioritization matrix was utilized in order to quantitatively rank each of the preferred sites. Considerations that factored into the ranking of BMP projects included:

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

Each of these criteria are listed and explained in Appendix 3.8 – Ranking Criteria. The scores associated with each of the categories are also provided in this table. Project cost, listed as one of the criteria considered, was calculated for each project using a spreadsheet-based method. The methodology for determining these planning level costs was first developed for the City of South Burlington by the Horsley Witten (HW) Group as part of the Centennial Brook Flow Restoration Plan development. The HW Memorandum describing this methodology is provided in Appendix 3.9 – Cost Estimation Basis Memo. Note that a variation of this method was used for this plan. The criteria used in this cost estimation can be found in Appendix 3.10 – Project Cost Estimation Criteria. This methodology provides consistent budgetary cost estimates across BMPs. Please note that land acquisition cost is normally valued at $120,000/acre. These costs were not accounted for in this ranking.

Cost estimates are based on average costs for conceptual level projects and deviation from these estimates are expected as projects move forward with engineering design. There are differences between project cost estimates presented in the plan and actual project bid costs. The BMP cost estimates

presented in the plan are based on limited site investigation. This methodology, while providing consistency in budget cost estimating, may fail to accurately reflect project cost impacts associated with actual site conditions and constraints. Therefore, the BMP cost estimates presented are suitable for planning purposes only, and not detailed program budgeting. The BMP cost estimates were developed based on the following assumptions:

Design Control Volumes: Design control volumes were based on the estimated runoff volume associated with the 1-year storm event for off-line, underground, or GSI-type practices. Off-line stormwater management systems are designed to manage storm events by diverting a percentage of stormwater from a stream or storm drainage system. Control volumes for large, in-line infiltration or detention basins were based on the estimated runoff associated with the 100-year storm event, plus approximately 2 feet of freeboard volume. Underground systems and GSI-type practices were conceptually designed as offline practices that only accept runoff from the 1-year event. Runoff volumes for all storm events were determined based on HydroCAD model results that rely on the Soil Conservation Service (SCS) TR-55 and TR-20 hydrologic methods.

Unit Costs and Site Adjustment Factors: Unit cost for each BMP and site adjustment factors were derived from research by the Charles River Watershed Association and Center for Watershed Protection, as well as from experience with actual construction[1] and modified for this project to reflect the newest cost estimates available. Underground detention and infiltration chamber systems were typically designed using Stormtech SC-740™ chamber systems. Cost adjustment factors were used to account for site-specific differences typically related to project size, location, and complexity. The values used to estimate BMP costs are summarized in Table 2.

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

BMP Type	Base Cost ($/ft³)
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
Porous Concrete	$18.07
Site Type	**Cost Multiplier**
Existing BMP retrofit	0.25
Large aboveground basin projects	0.5
New BMP in undeveloped area	1
New BMP in partially developed area	1.5
New BMP in developed area	2
Difficult installation in highly urban settings	3

Table 4: BMP Unit Costs by volume (cubic feet).

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

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

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

Land Acquisition Costs *(Modified)*: A variation from the HW method was applied. Based on prior studies completed by WCA, the land acquisition cost was calculated as $120,000 per acre required for the BMP when located on private land. It should be noted that this value is based on a limited estimate and not necessarily an expected cost per acre. This cost was not used in this ranking, but is presented here as a reference.

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

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

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

Minimum Cost Adjustment: After total project costs were determined for each proposed BMP based on the HW methodology, costs were reviewed and adjusted so that projects involving an outlet retrofit, such as a new outlet structure, were assigned a minimum cost of $10,000 and more complex projects were assigned a minimum cost of $25,000.

Each of the factors noted in Appendix 3.8 were scored, and scores were totaled for each of the criteria. These scores were totaled, and projects were assigned a rank from 1 to 21 with those projects receiving the highest scores assigned the highest rank. In the case of a tie between two projects, the amount of impervious coverage managed was the tie-breaker (larger impervious coverage managed equals higher score).

Final Ranking Results

A summary of the practices with scores and ranks are shown below in Table 4. The comprehensive ranking matrix used to rank the proposed BMP projects is provided in the Excel Spreadsheet Appendix 3.11 – Full Ranking Spreadsheet. If future funding becomes available for further implementation, this prioritization matrix can be utilized in selecting additional projects for implementation.

BMP Rank	BMP ID	BMP Type	BMP Description	Total Score
1	New Haven Road Swale	Gravel Wetland	12'x300'x3"D gravel wetland with 3:1 side slopes designed to treat WQv only.	76
2	Wastewater Treatment Facility	Gravel Wetland	20'x20'x4'D gravel wetland designed to treat WQv only.	56
3	West Main Street Parking Lot	Sub-Surface Filters	8x10 SC-740 Chambers designed to treat WQv only and bypass larger storms using 18" overflow pipe.	55
4	Monkton Road	Gravel Wetland	160'x160'x5'D gravel wetland with 3:1 side slopes sized for CPv control with 30" overflow to pass larger storms.	48
5	Northlands Job Corps	Dry Pond with Sub-Surface Chamber Filter	System is comprised of 2 BMPs - an initial flow-control dry pond to attenuate upstream flows from agricultural fields with a volume of 2.85 acre-feet of storage with low-flow CPv control orifice, followed by a 10x20 MC-4500 sub-surface chambers designed to filter runoff through 2' of bedding sand for WQv and CPv control.	44
6	High School	Gravel Wetland	120'x120'x4'D gravel wetland @ 3:1 sides with low flow orifice for CPv control and 24" overflow at 3' for bypass.	44
7	MacDonough Drive Swales	Gravel Wetland	35'x35'x4'D gravel wetland with 3:1 sides sized for WQv only with 24" overflow at 3' for bypass of larger storms.	42
8	Maple Manor	Sub-Surface Filters	10x7 SC-740 sub-surface chambers designed to filter runoff through 2' bedding sand with a low-flow orifice for CPv control.	35
9	MacDonough Park	Lined Bioretention	20'x20'xx3'D lined bioretention with 2:1 sides and 2' bioretention media with 8" perf. Pipe underdrain with low-flow orifice and 18" overflow at 2.5'.	33
10	Settlers Park	Sub-Surface Filters	6x9 SC-740 Chambers designed to treat WQv only and bypass larger storms via 24" overflow orifice and pipe. To be located under existing parking.	31
11	Armory Lane	Gravel Wetland	30'x30'x3'D gravel wetland with 3:1 side slopes - low flow orifice for CPv control, overflow at 2' for overflow protection.	25
12	Mountain View Lane	Sub-Surface Sand Filter	10x9 SC-740 sub-surface chambers designed to filter runoff through 2' bedding sand with a low-flow orifice for CPv control.	21

BMP Rank	BMP ID	BMP Type	BMP Description	Total Score
13	Vergennes Elementary School	Gravel Wetland	3'x110'x3'D gravel wetland with 3:1 side slopes designed to treat WQv only.	20
14	Falls Park	Lined Bioretention	15'x15'x3'D lined bioretention with 3:1 sides, 2' bioretention media, low-flow orifice at bottom of soil (underdrained with 8" perf. Pipe), and weir overflow at 2.5' for bypass.	20
15	Main Street Practices (Collectively)	Streetscape Bioretention	Streetscape bioretention features designed to fit within the Main Street right-of-way. Underdrained, with vertical sidewalls and 6" of ponding with new 12" overflows.	19
16	Battery Hill	Lined Bioretention	15'x15'x4'D lined bioretention with 3:1 side slopes, 2' bioretention media, low-flow orifice at bottom of soil (underdrained with 8" perf. Pipe) and 18" overflow @ 3' for bypass of large storms.	19
17	Sunset Drive	Gravel Wetland	95'x95'x4'D Gravel wetland with 2.3" low flow orifice for CPv control and 18" overflow bypass for larger storms.	18
18	Green Street - New Haven Road Intersection	Sub-Surface Filter	10x7 StormTech SC-740 sub-surface chambers designed to filter runoff through 2' of bedding sand to an underdrain with a low-flow orifice for CPv control.	18
19	Fire Department	Cistern	7,500 gallon cisterm to supply fire suppresion usage. Optimized for 2,000 gallon per month use (2 fillings of tanker truck). Supplied 89% of demand.	16
20	Bixby Memorial Library	Lined Bioretention	20'x20'x4'D lined bioretention with 3:1 sides, 2' bioretention media, low-flow orifice at bottom of soil (underdrained with 8" perf. Pipe), and 18" overflow at 3' for large storm bypass.	15
21	St Peter's Church	Lined Bioretention	35'x35'x4'D lined bioretention with 3:1 side slopes with 8" perf. Pipe underdrain and 2' bioretention media for WQv treatment only.	14

Table 5: Scores and ranks for the preferred sites in Vergennes.

Recommended Design Sites

Based on the modeling and ranking described above, we would recommend that the following sites be considered for 30% concept design:

1. Main Street Practices (Collectively) – Streetscape Bioretention
2. Wastewater Treatment Facility – Gravel Wetland
3. Vergennes High School – Gravel Wetland
4. Settler's Park – Sub-Surface Chambers
5. Monkton Road – Gravel Wetland
6. West Main Street Parking Lot – Sub-surface Chambers

Additionally, we would recommend that the following sites be considered for landscape rendering:

1. Main Street Practices (Collectively) – Streetscape Bioretention
2. MacDonough Park – Lined Bioretention
3. Falls Park – Lined Bioretention
4. Settler's Park – Sub-surface Chambers
5. Vergennes High School – Gravel Wetland

The approximate location and size for each BMP, along with the potential BMP's drainage area can be seen in Appendix 3.12 – Preferred Sites Locations and Drainage Areas Maps.

Please note – the highest scoring site, the New Haven Road Swale Gravel Wetland, is not being recommended for additional 30%. The reasoning for this is that, even though the retrofit could potentially reduce phosphorus and sediment substantially, it would have to be located either entirely within the road right-of-way, which would greatly constrain design, or would have to make use of private land adjacent to the road. While we do believe that this site should be pursued at some point, the complexity of design at this site is significant and should possible be the subject of an individual retrofit study.

1) Main Street Practices (Collectively) – Streetscape Bioretention

During the meeting with the Vergennes Planning Commission on October 23rd, a number of potential locations and options were discussed for Vergennes' Main Street. These locations were noted. By installing a series of lined, underdrained streetscape bioretention features on Main Street, runoff from smaller 'water quality volume' (WQv) storms (under 1" of rain per 24 hours) could be collected and filtered. These practices could also serve to beautify Main Street, calm traffic, and provide pedestrian

shelter while crossing the street. Care would have to be taken to ensure that they don't reduce parking to a great degree, infringe on turning radii for larger vehicles, or obstruct pedestrian or bicycle traffic. These practices would be informed, to the greatest degree possible, by the goals outlined in the Vergennes Downtown-Basin Master Plan.

2) Wastewater Treatment Facility – Gravel Wetland

A system of swales and culverts conveys a large volume of runoff to an eroding low-gradient swale near the wastewater treatment facility. By converting this low-gradient swale to a treatment wetland, a substantial amount of sediment, phosphorus, and other pollutants could be reduced. This practice would be sized to treat WQv storms only. Treating larger runoff volumes at this location isn't necessary as the practice would discharge to the Otter Creek where controlling for Channel Protection volume (CPv) storms, which often cause in-stream erosion, is not necessary in a larger body of water. It is important to note that this practice would be located in a river corridor and flood area. However, it would be implemented in an area that is already developed and that is expected to be maintained for the foreseeable future. River Corridor and Wetlands staff would likely have to make a determination on the allowability of this feature, but we believe that it is worthwhile given the developed nature of the location.

3) Vergennes High School

The Vergennes High School has an existing stormwater pond. However, the practice is reportedly undersized and is not designed to current stormwater manual standards. From field assessment, this appears to be the case. Additionally, it is a detention pond, which is currently classified in the 2017 Vermont Stormwater Management Manual as a Tier 3 practice. This group of practices has the lowest grouping of pollutant removal abilities. By creating a gravel treatment wetland in this location, additional phosphorus and sediment could be removed as gravel wetlands are considered Tier 2 practices (a grouping of practices with higher pollutant removal abilities). There is also the potential to use this practice as an educational opportunity for students at the High School.

4) Settler's Park

Settler's Park, at the base of Main Street on the banks of the Otter Creek, could be a prime location for a system of sub-surface chambers to filter stormwater runoff below the surface of the existing parking lot. Currently, Main Street has limited stormwater catch basins. Most of the runoff is conveyed down the

street along the curb edge and the majority of it enters the catch basin adjacent to Settler's Park. If a system of chambers was installed here, it could treat a significant amount of runoff. It is important to note that this system does not necessarily exclude the benefit of installing streetscape bioretention practices along Main Street. The streetscape bioretention practices could provide a level of pre-treatment for the system of chambers under Settler's Park, making them excellent complementary practices.

5) Monkton Road

A large drainage area collects runoff from the commercial and residential areas surrounding Monkton Road and conveys that runoff to an outfall near the High School. By creating a gravel treatment wetland at this outfall, a substantial amount of phosphorus and sediment could be removed from that runoff. This feature would also serve to reduce in-stream erosion in downstream reaches. Though the outfall appears to be on private land, it's possible that this feature could be located on public land (High School property). It is important to note that the channel below this outfall may be considered a jurisdictional stream by the VT DEC's Streams program. This issue would have to be investigate prior to proceeding with 30% design.

6) West Main Street Parking Lot

A vacant lot adjacent to the Otter Creek (west shoreline) has a large stormwater outfall running underneath it that outlets directly to the Otter Creek. The drainage area that is routed here is large. A system of sub-surface chambers designed to filter runoff through a filter bed of sand or other soil media. Though this land is privately owned, the chamber system could be designed to allow for eventual development of this site as a typical application of these chambers is under parking lots. Buildings could not be placed on the system, but a driveway or parking lot would be a compatible use.

7) MacDonough Park

This site, a small publicly owned park off MacDonough Drive, actually has a large drainage area that runs to it via surface sheet flow. Though the site is highly constrained, it may be possible to create a small lined bioretention on this site. However, the site does fall within the River Corridor and Flood area, so that may inhibit development. However, if the practice were to be installed on an area that is currently paved, the Rivers program would be more likely to allow it. We are only recommending this site for development of a landscape rendering plan as it does not have enough benefit to pursue a 30% concept design.

8) Falls Park

Much like MacDonough Park, Falls Park is a small, publicly owned park on the west shore of the Otter Creek that is currently a highly-used public boat launch. Though the drainage area for this site is small, runoff enters the Otter Creek directly. By installing a lined bioretention at this site, this could be eliminated. However, the same River Corridor and Flood restrictions may apply at this site as well, i.e. it may only be allowable to develop the bioretention practice in paved areas. We are only recommending this site for development of a landscape rendering plan as it does not have enough benefit to pursue a 30% concept design.

4.2 Top 3 30% Concept Designs

The information presented in section 3.1 was given to the project stakeholders. A meeting was then held with the City of Vergennes Manager, members of the Planning Commission, and Claire Tebbs of the Addison County Regional Planning Commission to discuss the results of the process outlined in 3.1 and to choose the final two landscape rendering sites (the collection of Main Street practices had already been decided on previously) and the final three 30% concept design sites.

During the meeting the group chose to pursue 30% concept design for

- Vergennes High School (gravel wetland)
- Vergennes Wastewater Treatment Facility (gravel wetland)
- West Main Street Parking Lot (or Settler's Park parking lot if an agreement with the owner of the West Main Street Parking Lot could not be reached) (sub-surface chambers)

City Manager Mel Hawley reached out to the owner of the West Main Street Parking Lot about purchasing the property but a suitable price could not be agreed upon by both parties. It was then decided that 30% concept design would be pursued for Settler's Park.

During 30% Concept Design the project team conducted existing conditions surveys for each location to verify topography and infrastructure where necessary. As none of the final 30% design sites are being considered for infiltration, no soils testing was conducted at these sites, consistent with VT DEC

recommendations. 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.

4.2.1 Vergennes High School – Gravel Wetland:

Description:

The proposed gravel wetland at the Vergennes High School would treat a total of 9.77 acres, 5.77 acres of which is impervious. The gravel wetland would fully filter the 1" water quality volume (WQv) storm and detain the Channel Protection volume (CPv) storm for 24 hours in accordance with regulatory guidelines. The total volume managed (CPv) is approximately 70,000 cubic feet. WinSLAMM modeling, along with pollutant load reduction percentages obtained from the UNH Stormwater Center's 2012 Biennial report, show that up to 13,133.76 pounds of sediment (96%) could be filtered out of runoff annually while up to 19.19 pounds of phosphorus (58%) would be removed every year. This practice would replace a much smaller stormwater pond that is currently permitted for the site (stormwater permit # 4913-9010). This pond appears to be undersized and would do little to treat for phosphorus.

Urban Rain | Design (URD) developed a detailed landscape plan for the gravel wetland that would ensure that the feature integrate with the school's campus. This is important as the gravel wetland will have to be expanded to provide adequate treatment for CPv and is situated between the high-use student parking lot and one of the school's ballfields. In order to integrate with these uses, URD designed features such as raised wooden and concrete boardwalks that span the gravel wetland between the parking lot and the ballfield to facilitate pedestrian traffic from one side to the other. URD also envisions incorporating two seating and viewing platforms that would look out over the wetland with a pedestrian pathway that surrounds the perimeter of the wetland and integrates with an existing informal pathway that connects to Mountain View Lane.

Cost Projection:

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 1,000.00	$ 1,000.00
653.55	Project Demarcation Fencing	LF	1400	$ 1.17	$ 1,638.00
653.20	Temporary Erosion Matting	SY	2500	$ 2.20	$ 5,500.00
649.51	Geotextile for silt fence	SY	225	$ 4.13	$ 929.25
652.10	EPSC Plan	LS	1	$ 1,000.00	$ 1,000.00
652.20	Monitoring EPSC Plan	HR	10	$ 37.22	$ 372.20
	Construction Staking	HR	8	$ 90.00	$ 720.00
				Subtotal:	$ 11,159.45
Gravel Wetland					
203.15	Common Excavation	CY	3000	$9.86	$ 29,580.00
651.35	Muck Soil (Topsoil)	CY	250	$30.96	$ 7,740.00
629.54	3/4" to 1 1/2" Crushed Stone (Crushed Stone Bedding)	TON	700	$34.04	$ 23,828.00
629.54	Pea Stone (Crushed Stone Bedding)	TON	100	$34.04	$ 3,404.00
613.11	Type II Stone (overflow)	CY	10	$42.49	$ 424.90
613.10	Type I Stone (hydraulic inlet, forebays)	CY	100	$43.91	$ 4,391.00
649.31	Geotextile Under Stone Fill	SY	1200	$2.51	$ 3,012.00
N/A	Wetland Plant Seeds	LBS	35	$125.00	$ 4,375.00
651.15	Seed (grass)	LBS	200	$7.66	$ 1,532.00
605.11	8" Underdrain Piping	LF	30	$27.04	$ 811.20
601.0915	18" CPEP Outlet Works	LF	165	$64.04	$ 10,566.60
N/A	18" Beehive Grate with Anti-Vortex Baffle	EACH	1	$615.00	$ 615.00
				Subtotal:	$ 90,279.70
New Infrastructure					
604.20	New Catch Basin (outlet structure)	EACH	1	$3,387.59	$ 3,387.59
601.0920	24" CPEP	LF	140	$61.37	$ 8,591.80
	Wooden Boardwalk (lump sum)	LS	1	$20,000.00	$ 20,000.00
				Subtotal:	$ 31,979.39
Subtotal:					$ 133,418.54
	Construction Oversight**	HR	24	$ 100.00	$ 2,400.00
	Construction Contingency - 10%**				$ 13,341.85
	Incidentals to Construction - 5%**				$ 6,670.93
	Minor Additional Design Items - 5%**				$ 6,670.93
	Final Design	HR	40	$ 100.00	$ 4,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	12	$ 100.00	$ 1,200.00
Total (Rounded)					**$ 168,000.00**

Cost per pound Phosphorus Removed:

The cost per pound of phosphorus removed is expected to be approximately $8,754.00.

4.2.2 Vergennes Wastewater Treatment Facility – Gravel Wetland:

Description:

The proposed gravel wetland at the Vergennes Wastewater Treatment Facility will treat 12.53 acres, 3.24 of which is impervious. As this practice will discharge to the Otter Creek, only the WQv will be treated. This volume is approximately 4,200 cubic feet. However, given the high removal rate of gravel wetlands for sediment, the practice is modeled to remove 33,137 pounds of sediment (96%) and up to 27.12 pounds of phosphorus (58%).

Cost Projection:

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 1,000.00	$ 1,000.00
653.55	Project Demarcation Fencing	LF	350	$ 1.17	$ 409.50
653.20	Temporary Erosion Matting	SY	500	$ 2.20	$ 1,100.00
649.51	Geotextile for silt fence	SY	45	$ 4.13	$ 185.85
652.10	EPSC Plan	LS	1	$ 500.00	$ 500.00
652.20	Monitoring EPSC Plan	HR	4	$ 37.22	$ 148.88
	Construction Staking	HR	8	$ 90.00	$ 720.00
				Subtotal:	$ 4,064.23
Gravel Wetland					
203.15	Common Excavation	CY	1000	$9.86	$ 9,860.00
651.35	Muck Soil (Topsoil)	CY	250	$30.96	$ 7,740.00
629.54	Pea Stone (Crushed Stone Bedding)	TON	65	$34.04	$ 2,212.60
301.26	Gravel (Subbase of Gravel, Fine Graded)	CY	200	$40.03	$ 8,006.00
613.10	Type I Stone (weirs and overflow)	CY	200	$43.91	$ 8,782.00
649.31	Geotextile Under Stone Fill	SY	750	$2.51	$ 1,882.50
N/A	Wetland Plant Seeds	LBS	10	$125.00	$ 1,250.00
651.15	Seed	LBS	45	$7.66	$ 344.70
605.11	8" Underdrain Piping	LF	35	$27.04	$ 946.40
601.0915	18" CPEP Outlet Works	LF	110	$64.04	$ 7,044.40
N/A	18" Anti-Seep Collar	EACH	1	$250.00	$ 250.00
N/A	18" Beehive Grate with Anti-Vortex Baffle	EACH	1	$615.00	$ 615.00
				Subtotal:	$ 48,933.60
Subtotal:					$ 52,997.83
	Construction Oversight**	HR	24	$ 100.00	$ 2,400.00
	Construction Contingency - 10%**				$ 5,299.78
	Incidentals to Construction - 5%**				$ 2,649.89
	Minor Additional Design Items - 5%**				$ 2,649.89
	Final Design	HR	60	$ 100.00	$ 6,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	16	$ 100.00	$ 1,600.00
Total (Rounded)					**$ 74,000.00**

Cost per pound Phosphorus Removed:

The cost per pound of phosphorus removed is expected to be approximately $2,728.00.

4.2.3 Settler's Park Parking Lot – Sub-surface chamber filter:

Description:

The proposed system of sub-surface chambers underneath the Settler's Park parking lot would treat 3.17 acres, 2.38 of which is impervious surfaces. This practice is envisioned in combination with the system of streetscape bioretention practices shown in Attachment 4.2 for Main Street. Those practices would treat the maximum amount of runoff possible for their respective drainage areas given the available space along Main Street for individual bioretention features. The overflow from each would then be conveyed via overflows into a separate storm sewer system (proposed to be installed by the City of Vergennes as part of a comprehensive Main Street renovation project as there is currently no separate storm sewer system along this street) to then be treated by the chamber system under the Settler's Park parking lot. The soils in this area are presumed unsuitable for infiltration, therefore the system will be configured as a sub-surface sand filter to fully treat WQv. CPv and above will not be treat at this location as the discharge is to the Otter Creek. Volume managed is approximately 6,000 cubic feet. Pollutant load modeling indicates that up to 440 pounds of sediment (51%) could be removed annually along with 4.35 pounds of total phosphorus (33%). In reality these amounts may actually be higher given the in-series treatment configuration of this treatment system with the streetscape bioretention features.

URD developed a landscape plan for this site as it was deemed a priority site by the City of Vergennes in light of the City's need for a 'gateway park' to serve as a welcoming entry to the City for boaters coming from the Otter Creek. URD envisions developing the existing park in such a way as to stabilize the parking lot surface using pavement (currently gravel) to limit fine particle transport, surround the lot with a vegetated swale that would pre-treat runoff from the lot before directing it to the chamber system, and install an ADA-compliant ramp to the Creek with boat launch dock, as well as a defined boat portage path separate from parking spaces. A new crossing of Main Street is also envisioned.

Cost Projection:

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 1,000.00	$ 1,000.00
653.55	Project Demarcation Fencing	LF	350	$ 1.17	$ 409.50
652.10	EPSC Plan	LS	1	$ 1,000.00	$ 1,000.00
649.51	Geotextile for silt fence	SY	75	$ 4.13	$ 309.75
652.20	Monitoring EPSC Plan	HR	6	$ 37.22	$ 223.32
	Construction Staking	HR	4	$ 90.00	$ 360.00
				Subtotal:	$ 3,302.57
Chambers - Costs					
	SC740	EACH	55	$ 234.60	$ 12,903.00
	SC740 Plain End Cap	EACH	7	$ 48.30	$ 338.10
	SC740 24B	EACH	1	$ 337.58	$ 337.58
	12" 90 - 1299ST	EACH	1	$ 74.19	$ 74.19
	12" Tee - 1264ST	EACH	2	$ 109.70	$ 219.40
	12" Coupler - 1265AA	EACH	8	$ 8.30	$ 66.42
	24" 22.5 Bend	EACH	1	$ 215.50	$ 215.50
	24" Coupler - 2465AA	EACH	2	$ 33.20	$ 66.40
	12" N12 AASHTO for splicing as needed	LF	20	$ 7.87	$ 157.32
	24" N12 AAHSTO for Isolater Row	LF	20	$ 21.67	$ 433.32
	601TG to wrap system (SY)	SY	2000	$ 0.67	$ 1,334.00
	315WTK for scour protection (SY)	SY	1000	$ 0.69	$ 690.00
	Inline Drain 12x6 for Inspection Port	EACH	2	$ 310.50	$ 621.00
	Inserta Tee for Inspection Port - N12 to Stormte	EACH	2	$ 86.32	$ 172.64
	6" red Hole saw	EACH	1	$ 132.43	$ 132.43
	6" AASHTO N12 for Inspection port	LF	20	$ 2.70	$ 54.05
	8" AASHTO N12 Perf for underdrain	LF	380	$ 4.61	$ 1,752.37
	8" Tee	EACH	13	$ 32.21	$ 418.75
	8" End Cap	EACH	14	$ 7.16	$ 100.30
	8" 90 Bend	EACH	1	$ 27.07	$ 27.07
				Subtotal:	$ 20,113.85
Materials and Excavation Costs					
604.20	Concrete Catch Basin	EACH	2	$ 3,387.59	$ 6,775.18
203.15	Common Excavation	CY	415	$ 9.86	$ 4,091.90
629.54	Crushed Stone Bedding	TON	435	$ 34.04	$ 14,807.40
601.0920	24" CPEP	LF	205	$ 61.37	$ 12,580.85
653.20	Temporary Erosion Matting	SY	150	$ 2.20	$ 330.00
651.15	Seed	LBS	25	$7.66	$ 191.50
				Subtotal:	$ 38,776.83
Subtotal:					$ 62,193.25
	Construction Oversight**	HR	16	$ 100.00	$ 1,600.00
	Construction Contingency - 10%**				$ 6,219.32
	Incidentals to Construction - 5%**				$ 3,109.66
	Minor Additional Design Items - 5%**				$ 3,109.66
	Final Design	HR	30	$ 100.00	$ 3,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	16	$ 100.00	$ 1,600.00
Total (Rounded)					**$ 81,000.00**

Cost per pound Phosphorus Removed:
The cost per pound of phosphorus removed is expected to be approximately $18,620.00.

4.2.1 Main Street – Landscape Rendering - Streetscape Bioretention:

In addition to the rendering developed for Settler's Park, URD also developed a comprehensive vision for the inclusion of stormwater features, as well as pedestrian and bicycle access in Vergennes' core downtown area. This can be seen in Attachment 4.2. It is envisioned that these streetscape bioretention practices would be integrated with the chamber system at Settler's Park by installing new separate storm sewer infrastructure along Main Street. This is critical as the soils in Vergennes do not support infiltration generally, therefore an underdrain must be used with these streetscape bioretention practices. However, as there is no separate storm sewer currently, one would have to be installed. This new pipe system would then serve as the underdrain and overflow receptor for the streetscape bioretention features. This pipe system would then feed into the chamber system at Settler's Park.

5 Summary and Recommendations:

The results of the City of Vergennes 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 City. The following is a summary of the steps necessary to bring each of these projects to full implementation.

5.1 Implementation – Next Steps

Under Projects to Implement there are two sub-categories – 1. Sanitary Sewer Related Projects and 2. 30% Concept Design or Landscape Rendering sites.

5.1.1 Sanitary Sewer Related Projects

These recommendations are a result of the sanitary sewer mapping process and subsequent field verifications. Locations are described by road intersections. Pipe lengths are given as measured using ArcGIS line features for the described pipe and may not reflect the precise actual length of pipe given the idealized routing that the snapped line features provide. However, these lengths should be within +/- 5% of actual lengths.

Pipe Reach	Priority	Potential Cost
Meigs Road to Coventry Lane (approx.)	High	1,927’ ($19,271 – 385,436)
Monkton Rd (near High School)	High	877’ ($8,770 – 175,375)
Main Street (near Town Hall)	High	450’ ($4,500 – 90,000)
Green Street	High	1107’ ($11,007 – 221,400)
Lower Main Street (near Otter Creek Bridge)	High	1,397’ ($13,970 – 279,400)
MacDonough Drive (High St to Comfort Hill)	High	1,403’ ($14,030 – 280,600)
Victory Street	High	573’ ($5,730 – 114,602)
Green Street (Green Meadow Acres towards Victory Street)	High	877’ ($8,770 – 175,400)
Maple Manor	High	1,339’ ($13,390 – 267,800)
From Waltham Town Line along Otter Creek to just past Maple Manor	High	1,841’ ($18,410 – 368,200)
Upper New Haven Road	High/Medium	1,095’ ($10,950 – 219,000)

Panton Road to W Main Street	High	415' ($4,150 – 83,000)
Scoval Lane across W Main Street	High	364' ($3,640 – 72,800)
West Main Street (near Canal Street)	High	434' ($4,340 – 86,800)
UTC Aerospace Campus	High	601' ($6,010 – 120,200)
Northlands Job Corps Campus	High/Medium	1,699' ($16,990 – 339,800)
Pipe along Otter Creek Below S Water Street	Medium	848 ($8,480 – 169,600)

5.1.2 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.

5.1.2.1 Vergennes High School – Gravel Wetland

In order to progress this design from 30% to full 100% construction plans, outreach would need to be conducted with School officials to ensure that the designed feature would integrate with the School's campus master plan, if applicable. Further, some infrastructure verification would need to be performed, specifically with respect to the sanitary sewer infrastructure near the proposed wetland.

As this project potentially addresses a larger area of impervious coverages that is only partially treated for phosphorus and sediment pollution, this retrofit would be a good candidate for an Ecosystem Restoration Program design grant to further design to 100%. Once finalized to that level, it would then be a good candidate, depending on the outcome of the 100% design process, for an implementation grant through

the same program. Another potential source of design and implementation funding for this retrofit would be through the Lake Champlain Basin Program (LCBP), which funded this study. LCBP has grant funding available for both design and implementation projects like this one. The project team would strongly recommend that, if the School stakeholders are willing, that this project continue to implementation.

5.1.2.2 *Vergennes Wastewater Treatment Plant – Gravel Wetland*

Of all the retrofits designed to 30% in Vergennes, this could potentially be one of the simplest to implement as it would be located wholly on municipally owned land. The implementation would not be without its challenges, specifically that installation of this feature would require excavation of a fairly large amount of an existing storage yard adjacent to the wastewater treatment plant. Additionally, the area to develop is in a floodplain and floodway area. Though there is significant development already in that zone, this may prove to be the largest stumbling block for this potential retrofit as ERP will have to closely examine the floodplain issues to determine if this practice is appropriate for further design and implementation funding. That is typically part of the 60% design process and was not undertaken during this scope of work. However, as the area is already significantly developed and the project requires no net fill, it is likely that it could be approved. This project would also have to examined by both the regional River Corridor scientist along with the Wetlands Program specialist for the area for compliance with those regulations. Despite these potential challenges, this project remains of high value. If ERP funding is not possible, there are mechanisms, such as LCBP funding or State-based Clean Water State Revolving Fund loan programs which could help bring this project to fruition.

5.1.2.3 *Settler's Park – Sub-Surface Chambers*

The plan developed for this site is both worthwhile from a water quality standpoint as well as of high value as it corresponds well with the goals of the Vergennes Downtown-Basin Master Plan as it would provide a much more public-facing access to the Otter Creek for boaters, and provide a safer crossing of Main Street for the mandatory portage at that location. This retrofit was also explicitly designed to allow for the development of a stormwater runoff collection system along Main Street (which currently does not exists) that would also integrate streetscape bioretention as part of the pre-treatment. A meaningful amount of treatment could be accomplished for a significant portion of Vergennes' downtown area by pursuing this retrofit.

The most significant issues facing this site is the question of property use and property ownership as the property currently has one owner (Green Mountain Power) but two other additional interested parties (the City of Vergennes has access to nine parking spaces while an additional private owner has access to between 20-25 parking spaces at this location). Formalizing an agreement to allow the sub-surface chambers as well as the proposed access features at this location would be crucial to proceeding.

Funding for the stormwater chambers could come from either ERP or LCBP funds and would need to initially proceed to 100% design (which, for this system could be relatively simple and not overly expensive). However, funding for the improved access features would not necessarily come from the same funding source as those features aren't specifically related to water quality. There may be other funding sources that would need to be leverage to develop those assets.

5.1.2.4 Main Street – Landscape Rendering - Streetscape Bioretention

The proposed streetscape bioretention practices along Main Street serve the dual purpose of creating stormwater treatment along Main Street as well as improving the aesthetics of the downtown area while simultaneously calming traffic and providing safer spaces for pedestrians and cyclists. This is one of the primary goals of the Vergennes Downtown-Basin Master Plan. Coupling these proposed retrofits with a holistic plan for installation of a stormwater collection system of catch basins and pipes that could then be routed to the sub-surface chambers at Settler's Park would be a wise use of planning dollars. Because of the complexity of the project, as well as the multiple systems that would have to designed in this area (stormwater, traffic, etc.), this project would not likely be eligible for ERP or LCBP funding (though those two sources might be leveraged eventually to pay for streetscape bioretention design or implementation alone). Rather, this project is more likely to make use of either a Clean Water State Revolving Fund loan or a VTrans grant. As this project is integral to many different goals stated in the Vergennes Downtown-Basin Master Plan, the project team would urge that this be pursued.

5.2 Additional Projects to Pursue

5.2.1 Other Best Management Practices (Structural):

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

5.2.1.1 West Main Street Parking Lot

Though a satisfactory purchase of this property could not be worked out during this study, this site remains a highly likely candidate for stormwater management retrofit. The owner is currently selling the site a commercial or residential development, which will require parking. If an agreement can be reached where the City obtains a right-of-way for the site of the current stormwater sewer pipe that outlets below this property to the Otter Creek, installation of sub-surface stormwater chambers could occur here. These chambers would not hamper the development of the rest of the site in a significant fashion. The site's parking lot could be constructed over these chambers with minimal impact to site layout. As such, as easement should be pursued with the current owner that would allow this.

5.2.1.2 Monkton Road – Gravel Wetland

This project would treat a substantial portion of drainage that currently flows to the open channel below the High School. It could be integrated with the High School gravel wetland. However, there would be some necessary outreach to private property owners in the area. While the treatment potential is high for phosphorus and sediment, the costs could also be quite significant. Initial outreach to property owners should be conducted, as should an examination by the regional Wetland Program specialist to determine what wetlands-related regulations may be present on this site.

5.2.1.3 3-acre impervious sites

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.

Of the 3-acre sites in Vergennes, only the Northlands Job Corps property lacks a stormwater permit. The project team's master planning process considered some opportunities for this property, however much

of impervious is distributed over a large area. A more specific campus-wide plan should be undertaken for this site.

Additionally, the Goodrich Corporation and DR Power Corporate Office sites both have valid stormwater permits. However, both permits are older and may be required to obtain upgrades to comply with the Lake Champlain Phosphorus TMDL. Outreach to these property owners is recommended.

The Vergennes High School was the subject of a 30% design during this scope of work. The retrofit should be pursued.

Please note that all the sites can be seen on the map included as Appendix 3.2 and Appendix 3.3.

5.2.1.4 *Northlands Job Corps – Dry Pond with Chamber Filter System*

A large dry pond with an associated sub-surface chamber filter system on this site could treat a portion of the campus, as well as a relatively large area of agricultural fields that run on to the campus. Using the chambers to treat smaller flows while using the dry pond to treat larger volumes would the best way to accomplish treatment that would remove pollutants from runoff and reduce erosion associated with larger precipitation events. This retrofit could be part of a larger campus plan for stormwater management.

5.2.1.5 *MacDonough Drive Swales – Gravel Wetland*

The eroded swales below MacDonough Drive present a good opportunity for stormwater treatment. However, the most likely site to install them would be in the River Corridor and Floodplain. This issue should be investigated before proceeding with further design. A relatively simple screening process conducted with the appropriate State agencies would determine whether or not this site should proceed. The project team would recommend that this be pursued.

5.2.1.6 *Maple Manor – Sub-surface Chambers*

Installing a system of sub-surface within the road right-of-way would seem to be one of the only potential options present at this residential neighborhood site. The site is otherwise too constrained or steep for

other options. Using the chambers as a sub-surface filter would likely work best. This work could, potentially, be accomplished along the sides of the road. Alternatively, a UNH Stormwater Center based design for a Media Filter Catch Basin Box (essentially a catch basin inlet with an overflow to a sand filter contained within a large concrete tank) could be installed at the various catch basins in this area to provide filtration of runoff. The project team recommends that this be investigated when the City next upgrades or performs maintenance in this area.

5.2.1.7 *Vergennes Elementary School – Gravel Wetland*

Though not as highly-ranked as some other projects in this plan, the potential gravel wetland at the Elementary School would be relatively easy to implement and could be build on municipally owned land. This would greatly simplify the outreach process. Additionally, there are no other significant permitting concerns at this site. A gravel wetland could also provide a learning opportunity for the school to use as an outdoor classroom. Funding for additional work at this site could be obtained from the ERP program. Funding through 100% design is recommended as the site has already been identified as a relatively high-value site.

5.2.2 ***Other Best Management Practices (non-structural):***

5.2.2.1 *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 Vergennes 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 5.1 – Town Specific Stormwater Program Model, which contains the aforementioned model bylaws and small-sites sizing guide and tool.

5.2.2.2 *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 City of Vergennes. This manual is provided as Appendix 5.2 – VT Guide to Stormwater for Homeowners and Small Businesses.

5.2.2.3 *Adopt and Promote Usage of the VT DEC's Vermont Green Streets Guide*

Published in May, 2018, the new Vermont Green Streets Guide seeks to provide a comprehensive overview of the potential planning and implementation process for installing green stormwater infrastructure within the streetscape right-of-way in Vermont. This guide provides the necessary steps to follow from initial planning to final implementation and operation and maintenance. Adopting parts of this guide for future planning in Vergennes is high encouraged. This guide is provided as Appendix 5.3 – Vermont Green Streets Guide.

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

The City of Vergennes was the beneficiary of a grant through the VT DEC that investigated the presence of illicit discharges in and around the City. Several potential illicit discharges were found. Some of them were repaired. However, the report created by Stone Environmental dated May 31, 2014, states that while investigating a potential illicit discharge on South Water Street in the company of Public Works Director Jim Larrow, an uncooperative resident was encountered and the program was temporarily suspended.

It is recommended that the appropriate follow-up work occur at the outfalls labeled VG450 (South Water Street, suspected laundry discharge), VG470 (South Maple and Victory Streets, dye testing needed at South Maple Street 45, 46, 48, 51, 53, and 54), VG570 (Sunset Drive, suspected laundry discharge, City should follow up with dye testing as recommended), VG640 (Bowman Road, suspected laundry discharge, City should follow up with dye testing as recommended), VG670 (West Main Street, suspected sewer leak, dye test as recommended below Scovel lane), and VG830 (Panton Road industrial building, suspected washwater discharge, no action recommended by report so needs follow-up by City to building owner).

Currently, the City 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 City 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 City possesses updated stormwater system mapping information, as well as sanitary sewer mapping information, this process could be economical.