BARTLETT BROOK FLOW RESTORATION PLAN

City of South Burlington, Vermont

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Prepared for:
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I. Disclaimer

The intent of this plan is to present the data collected, evaluations, analysis, designs, and cost estimates for the Bartlett Brook Flow Restoration Plan (FRP) Project, completed under a contract between the City of South Burlington and the hired consultant team, Watershed Consulting Associates, LLC and Aldrich & Elliott, PC. The Bartlett Brook FRP was prepared to meet the compliance requirement for the Bartlett Brook impervious surface owners (the City of South Burlington, the Vermont Agency of Transportation (VTRANS) and the Town of Shelburne) under the National Pollutant Discharge Elimination System (NPDES) General Permit 3-9014 (VTDEC 2012) for stormwater discharges to impaired waters. The presented plan is in draft form, and will be revised by the City of South Burlington, as needed. A full construction and design schedule will be completed by the City once the City has developed FRP's for all impaired watersheds. **At this time, the MS4s are not bound in any way to the proposed BMP list.**

1 Executive Summary

Watershed Consulting Associates, LLC, and partners Aldrich and Elliott, PC (A+E) were commissioned to develop the following Flow Restoration Plan (FRP) for the Bartlett Brook watershed under contract with the City of South Burlington. The plan was developed in accordance with the MS4 General Permit #3-9014 Subpart IV.C.1 as a part of the City of South Burlington's Stormwater Management Program (SWMP). The FRP provides a planning tool for the MS4 entities to implement stormwater Best Management Practices (BMP's) over a twenty (20) year timeframe, in the effort to return Bartlett Brook to its attainment condition.

Development of the FRP involved field inspection of all existing BMPs with an expired stormwater permit, followed by review and revision of the existing Vermont Best Management Practice Decision Support System (BMPDSS) model based on field inspection of existing stormwater BMPs. The model is used to assess the impact of proposed BMP scenarios. Several revisions to existing BMP drainage areas and BMP design configurations were identified and accounted for in the revised models. After the existing model scenarios were reviewed, new BMPs were identified, inspected, and assessed in the BMPDSS.

In addition to the identification of stormwater controls, the Total Maximum Daily Load (TMDL) flow targets and future growth assumption developed by the Vermont (VT) Department of Environmental Conservation (DEC) was reviewed in the context of the FRP development. Specifically, an independent study, completed by the Chittenden County Regional Planning Commission (CCRPC)[1], was used to estimate the expected non-jurisdictional impervious area growth in the Bartlett Brook watershed over the next 20 years. The original TMDL arbitrarily assumed a non-jurisdictional impervious growth of 50 acres, whereas the CCPRC study estimated 5.7 acres based on the actual non-jurisdictional growth rate from 2003 to 2010. The revised future growth reduced the high-flow target (Q0.3%) from 33.0% to 11.6%[2]. The modified flow target was incorporated into the FRP planning process and proposed BMP implementation scenario.

The final proposed BMP implementation plan includes a total of 18 sites—five(5) retrofits to existing BMPs, four(4) new detention systems, three(3) new infiltration systems, and six(6) green stormwater infrastructure (GSI) systems. The proposed BMPs were assessed with the BMPDSS model, and determined to address 194% of the modified TMDL high-flow target (Q0.3%). The total planning level cost for implementation of the proposed plan is $3,408,728. The projects were ranked using a comprehensive matrix. The top four (4) projects were selected for 30% engineering including 1) an infiltration gallery on Keari Lane, 2) an infiltration basin along the Overlook Dr. walking path on the UVM Horticulture Farm, 3) an expansion of the Bartlett Bay Treatment System (BBTS) and 4) a retrofit to an existing stormwater pond on the Irish Farm Condos property covered under permit #1-1404. Preliminary 30% engineering plans were

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

[2] See Table 1: The Modified target was calculates as: -(8.8%) + (-24.4%)*(5.7 ac/50 ac) = -11.60%

developed for the top four (4) priority projects with itemized planning level cost estimates. Sketch plans were developed for all other proposed BMPs.

The following FRP is complete with the exception of a Construction and Design (C&D) schedule. The City of South Burlington owns impervious surface within Bartlett, Potash, Centennial, Englesby, and Monroe Brook watersheds, which are all impaired and require an FRP under the MS4 permit. The City must plan in the context of all five FRPs over the 20 year implementation schedule, therefore the City plans to develop a final Construction and Design schedule and financial plan for each watershed once the FRPs are complete for the five watersheds.

2 Background

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

The purpose of the FRP is to outline a plan for the retrofit of existing impervious cover with stormwater management BMPs (e.g. detention basins, bioretention filters, etc) to meet the TMDL flow targets. The TMDL set forth that watershed hydrology must be controlled in the Bartlett Brook Watershed to reduce high flow discharges and increase base flow in order to restore degraded water quality and achieve compliance with the Vermont Water Quality Standards (VWQS). Components of the FRP, as outlined in the MS4 general permit include the identification of retrofits to existing BMPs with expired State stormwater permits, new BMP controls, and design plans for selected BMPs, a financial plan, and a regulatory analysis.
Three(3) MS4's including the City South Burlington, Town of Shelburne, and the Vermont Agency of Transportation (VTRANS) own impervious cover within the Bartlett Brook impaired watershed. The contributing MS4s agreed to prepare a joint FRP for the watershed, with consideration of the individual MS4s flow-target allocation based on impervious ownership.

2.1 TMDL Flow Targets

Vermont developed TMDLs for impaired watersheds using flow as a surrogate for pollutant loading. The basis for the TMDL development was the comparison of modeled Flow Duration Curves (FDCs) between impaired and attainment watersheds. The Program for Predicting Polluting Particles Passage through Pits, Puddles, and Ponds, Urban Catchment Model (P8) was used to model gauged and ungauged watersheds in Vermont and develop Flow Duration Curves (FDCs) from which a normalized high flow and low flow per drainage area in square miles (cfs/sqmi) were extracted. An FDC is a curve displaying the percentage of time during a period that flow exceeds a certain value, with the "low" flow represented by the 95th percentile ($Q_{95\%}$)

of the curve and the "high" flow represented by the 5th percentile ($Q_{0.3\%}$). The high and low flow values from the FDCs were then compared between "impaired" watersheds and comparable "attainment" watersheds to determine a percent change (i.e. reduction of high flow, increase of low flow). The percent change was reported in the Environmental Protection Agency (EPA) approved TMDL for each impaired watershed. The high-flow ($Q_{0.3\%}$) was determined to be relatively equivalent to the 1-year Design storm flow. Therefore BMPs designed to meet the State of Vermont Stormwater Management Manual's Channel Protection volume (CP_v) storage standard were used to address the required high-flow reduction target.

2.1.1 Future Growth Modified Target:

With the City of South Burlington, the CCRPC completed a study to estimate the additional non-jurisdictional impervious growth expected in the Bartlett Brook over the next 20 years (Appendix 1)[3]. The purpose of the study was to verify the future growth assumption made by DEC in the original development of the TMDL. Non-jurisdictional growth is by definition impervious area that does not require a stormwater permit, and is therefore important to account for within the 20 year management plan.

The study estimated a future growth of 5.7 acres, accounting for the maximum new impervious surfaces allowed by the zoning lot coverage for each available parcel of land within the City. Modified TMDL flow targets were determined by multiplying the portion of the TMDL target associated with future growth (FG) by a correction factor as follows:

Modified Flow Target= $(Target\ \%\ with\ no\ FG) + (Target\ \%\ from\ FG) * (\frac{Revised\ FG\ acres}{Original\ FG\ acres})$

The approved original TMDL flow targets and modified flow targets with a revised future growth for Bartlett Brook are as follows:

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

Flow Target	Target High Flow Q 0.3 (± %) Reduction	Target Low Flow* Q 95 (± %) Increase
TMDL Targets (Stormwater allocation only)	-8.80	8.80
TMDL Targets with **50 acres** of Non-Jurisdictional Future Growth	-33.20	13.20
TMDL Modified Targets with **5.7 acres** of Non-Jurisdictional Future Growth*	-11.60	9.30
* Modified target was calculates as: -(8.8%) + (-24.4%)*(5.7 ac/50 ac) = -11.60% *The low flow target is not actionable under the TMDL, but is included because improving base flow in the watershed is still a water quality goal.		

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

While the low-flow goal is important to ensure flow during the dry summer months, it is not an actionable requirement in the EPA approved TMDL, and therefore was not the primary focus of the FRP BMP identification for this study.

2.2 MS4 Allocation of Flow Targets

Allocation of the high-flow flow targets between MS4 entities was approximated based on relative impervious ownership and impervious cover currently managed with a BMP which meets the Channel Protection Volume (CPv) design standard. This includes BMPs which detain the 1-year storm for 12-hours in cold-water fish habitat and 24-hours in warm-water fish habitat. However, there are limitations to this method because the BMPDSS model is an aggregate model, in which upstream BMPs affect downstream flow and runoff doesn't necessarily follow political boundaries. A correction factor was applied based on the flow target to account for the relative error in separation of the BMPDSS results by MS4.

Approximately 95% of the impervious cover in the Bartlett Brook watershed is within the City of South Burlington, 1.3% within the Town of Shelburne, and about 3.7% in the VTRANS Right-of-Way (Table 2). The University of Vermont owns land within the Bartlett Brook watershed, used for the operation of the UVM Horticulture Farm. However, EPA has stated land used for agriculture is not considered an MS4, therefore UVM was determined to not be eligible as an MS4 for Bartlett Brook. The TMDL flow targets were then allocated to the three MS4's based on their imperious ownership using both the original 50 acres of non-jurisdictional growth and the revised 5.7 acres non-jurisdictional growth (Table 3). The City of South Burlington has the majority of the flow target responsibility.

Table 2: MS4 Impervious Breakdown

Impervious Owner	Total Area w/in Watershed (acres)	Impervious Cover (acres)	% of Bartlett Impervious Cover
University of Vermont	----	----	----
Town of Shelburne	60.30	1.91	1.3%
South Burlington	685.50	139.52	95.0%
VTrans	9.60	5.51	3.7%
Watershed Total	**755.40**	**146.94**	

Table 3: Bartlett Brook TMDL Flow Target Allocation by MS4

Impervious Owner	With 50 acres Future Growth		With 5.7 acres Future Growth	
	Target High Flow Q 0.3 (± %) Reduction	Target Low Flow Q 95 (± %) Increase	Target High Flow Q 0.3 (± %) Reduction	Target Low Flow Q 95 (± %) Increase
Town of Shelburne	-0.43	0.17	-0.15	0.12
South Burlington	-31.52	12.53	-11.01	8.83
VTrans	-1.24	0.49	-0.43	0.35
Watershed Total	**-33.20**	**13.20**	**-11.60**	**9.30**

3 BMPDSS Model Assessment

The Vermont DEC worked with an external consultant to develop a VT-specific hydrologic model, the Vermont BMPDSS, to predict progress toward the TMDL flow targets based on proposed BMP implementation scenarios. The BMPDSS model is used to predict peak flows at the watershed outlet for a base condition (pre 2002), existing condition (post 2002), and a BMP implementation scenario (Credit), all compared on a percent change basis.

Progress toward the flow targets was assessed using the VT BMPDSS model. In order to complete the assessment, VT DEC developed "Base" condition models for all impaired watersheds. The base scenario includes all stormwater BMPs installed prior to issuance of the VT Stormwater Standards in 2002 that provide Channel-protection Volume (CPv) storage. The land use is based on quickbird satellite imagery from 2002. A "Post2002" model scenario was then developed with all existing BMPs designed to the VT Stormwater standards, providing credit toward the flow target. Results from the BMPDSS model output are provided as unadjusted cubic feet per second (cfs) and normalized flow (flow per drainage area, cfs/sq.mi). The unadjusted flow is used in the determination of progress towards the TMDL targets to eliminate the effect of watershed area in the percent change comparison.

3.1 Existing Condition Review

3.1.1 Permit Review

As per subpart IV.C.1 of the approved MS4 general permit, all expired stormwater permits in the watershed were acquired and reviewed for inclusion within the BMPDSS model assessment. The expired permits were sorted into two groups- Group 1) existing stormwater systems with a CPv BMP which provides extended detention of the 1-year design storm, and Group 2) those without a CPv BMP (e.g. system of catchbasins). The Group 1 list was compared to the current BMP list included in the BMPDSS models to check for omissions (Table 4 below). Only expired permit systems that include a BMP with CPv storage were included in the BMPDSS model, because only BMPs with CPv storage provide credit toward meeting the flow targets. Field assessments were then completed at each site with an existing CPv detention structure, to identify if the facility was operating according to the approved expired permit and if there was opportunity for an upgrade to the 2002 Vermont Stormwater Design Standards. Several of the expired permits are now covered under a Residual Designation Authority (RDA) permit from the state, in which the private permittee applied for a renewal of their permit with the State. A full list of the expired permits discharging to the Bartlett Brook and the type of system covered under the permit is included in Appendix 9 (Table A-9).

Table 4: Expired Permits with Stormwater BMPs in the BMPDSS Model

Permit #	Project Name	BMP Type in Model	Permit Status	RDA	Permit Issued
1-1404.9912	Irish Farms Residential Subdivision	Ponds (3)	Issued	n/a	5/31/2000
1-0523.XXXX	Champ Carwash	Pond, Swale system	Issued	6280-9030	11/3/1987
1-1155.9806	Pinnacle at Spear	Ponds (2)	Issued	n/a	4/21/1999
3121-9010	Willie Racine Jeep Isuzu	Ponds (2)	Issued	n/a	11/24/2003
1-1372.9905	Staybridge Suites & Harbor Sunset Hotel	Infiltration Trenches (2)	Issued	6296-9030	9/1/1999
	Oil n' Go	Swale	n/a		4/1/1999
2-0261.XXXX	Overlook at Spear/Summit at Spear	Ponds in series (4)	Issued	n/a	4/17/1985
1-0818	IDX headquarters	Dry Wells	Issued		6/2/2003

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

3.1.2 VTDEC BMPDSS Existing Model Review

The team field verified the drainage areas and design of the existing BMPs included in the Base (Pre 2002) and Credit (Existing Condition Post 2002) models and compared the field observations to the DEC model inputs for any discrepancies. Updated input files for the Base and Credit models were submitted to VT DEC in order to run the updated models. Input files included revised GIS shapefiles for subwatersheds, BMP locations, BMP drainage areas, as well as HydroCAD (Version 10.0) models used to convey the BMP design parameters. Each BMP design was then converted by State DEC Stormwater Section staff to the equivalent system in the BMPDSS model, which has a slightly different interface for defining the BMP design. Adjustments were made to certain BMP designs, in the case the design of the BMP in HydroCAD was not directly transferrable to the BMPDSS format.

The **Base model** was revised as follows:

Subwatershed Mapping:

- **Deerfield St. Walking Path:** Subwatershed boundaries were adjusted to account for a channel along the walking path, just off Deerfield St.
- **Pheasant Wy:** SW 12 Boundary was corrected to reflect on the ground conditions.
- **Harbor View Road:** Subwatershed boundaries along Harbor View Rd. were adjusted to reflect roof drainage and more accurate topography data.
- **Parking Lot Across from Karen Dr.**: An existing parking lot and building off Karen Dr. had previously been excluded. The roof drain was confirmed to drain to Bartlett Brook.

- **Southern watershed Boundary:** The southern boundary was revised to reflect more accurate topography data and field assessment.

- **Allen Rd:** An adjustment to the subwatershed was made to reflect the 1-1404 pond drainage area.

- **Keari Lane:** The subwatershed boundary was corrected to reflect the roof lines and more refined topography data.

- **Brownell Way:** The subwatershed boundary was revised to better reflect more refined topography data.

- **Yandow Dr.:** The subwatershed boundary from Yandow Dr. to Stonehedge Dr. was corrected to reflect on the ground conditions.

BMP Design Entries:

BMP design entries were revised to reflect field confirmed structures for permitted BMPs including:

- # 1-1404 detention ponds A and B at the Irish Farm Condos along Harbor View Rd.
- #1-1155 detention pond on the Pinnacle at Spear development on Spear St.
- #1-1372 detention pond at the Stay Bridge Suites on Spear St.
- #2-0261 system of 4 on-stream ponds located off Deerfield Dr.
- #1-0818 dry wells and an infiltration tank at the IDX Headquarters along Green Mountain Dr.

The **Post2002 (Credits) model** including all BMPs installed after the 2002 stormwater standards ("Post 2002") was revised as follows:

Subwatershed Mapping:

- **RDA Permits:** RDA permits with proposed changes to the existing stormwater system were added to the model by Emily Schelley (VTDEC) including #6280-9030 Harbor Heights Condominiums, #6281-9030/#6342-9030 Freedom Nissan, and #6294-9030.1 Bay Court Condominiums. Adjustments to the subwatershed boundaries were made to account for the proposed stormwater system changes.

BMP Design Entries:

- 6280-9030: Champ Car Care located on Shelburne Rd. The outlet structure was field confirmed and adjusted.

4 Required Controls Identification

The process of BMP identification involved an initial assessment of the existing CPv BMPs with expired permits for retrofit potential to meet the VT 2002 Stormwater Management Manual design standards (Table 4). Upon review of the existing BMPs it wasdetermined that additional new BMPs would be required to meet the high-flow and low-flow targets. The team then conducted an initial desktop assessment of the watershed to identify open spaces ideal for BMP implementation with priority on City owned land. In addition, the spread of BMPs was considered to provide storage throughout the watershed, and focused on areas with a high-percentage of impervious coverage where flows were expected to be highest and where infiltration may be possible, as indicated by mapped Hydrologic Group A or B soils.

After an initial list of retrofits were identified, a field assessment was completed at each site documenting the preliminary engineering feasibility and mapped drainage areas for the proposed BMPs. The BMPs were then designed using HydroCAD to meet the CPv storage criteria for cold waters (12-hour detention standard), and assessed with the BMPDSS model. The initial model iteration, "Credit 1" scenario, was followed by subsequent iterations of the proposed model in which additional proposed BMPs were added to meet the flow targets.

Once the final list of proposed BMPs was determined to meet the flow targets, the projects were ranked using a comprehensive ranking matrix. In addition 30% preliminary engineering conceptual designs for the top 4 projects were developed. Orthophoto-based sketch plans for all other projects are provided in Appendix 2. The top four projects include:

- Bartlett Bay Treatment System (BBTS) Expansion
- Keari Lane Infiltration Gallery
- Horticulture Farm Basin with Deerfield Dr. Dug Pond
- 1-1404 Irish Farm Condos Pond Retrofit

BMP feasibility was determined based on available space, mapped NRCS soils, existing 1-ft topographic elevation control derived from LIDAR, and mapped stormwater and wastewater infrastructure provided by the City and VTRANS. Supplemental topographical survey data was collected for the top 4 projects as needed. An in-depth engineering assessment will still be required at each site to confirm the presence/absence of utilities, natural resource constraints, and potential transportation impacts as part of the final design process.

4.1 BMPDSS Model Assessment Results

The final recommended BMPs scenario was developed based on an iterative assessment using the BMPDSS modeling tool. The initial model run "Credit1" included five (5) BMPs, addressing **139%** of the modified high-flow target, and **0%** of the low-flow target. The existing condition low-flow was **below** the baseline condition (pre 2002)., Therefore, while the Credit1 run shows 0% of the low-flow managed the proposed BMPs actually increased the existing condition low-flow to meet the baseline (pre 2002) condition. Seven (7) additional BMPs were identified and assessed

followed by a subsequent model run "Credit2". Credit2 was estimated to manage **187%** of the modified high-flow target and **47%** of the low-flow target. Additional GSI collections were added to the final proposed scenario "Credit3_GSI" and found to manage **194%** of the modified high-flow target and **47%** of the low-flow target (Table 5). It should be noted that the groundwater component of the BMPDSS model was found to lack sensitivity based on past experience with the model for other watersheds. The estimated increase in runoff volume infiltrated for the 1-year storm by the proposed BMPs was not reflected in the estimated change in baseflow for the watershed. This general observation has been noted by the State as well as other model users. The model is not sensitive enough to detect the change in baseflow as a result of the addition of from the smaller GSI projects, and hence no percent (%) change between the Credit2 and Credit3_GSI runs was observed. A final model run was completed, "Credit3", to include several additional lower-priority projects, to represent the maximum build-out of retrofit projects. A full modeling summary including all model runs completed under this contract as compared to the original TMDL and modified targets (high and low-flow targets) is included in Appendix 3 (Table 3-1-1). A summary table of the proposed BMPs added to each model scenarios is also included in Appendix 3 (Table 3-1-2). The table shows the model run to which the BMP was first added. The BMPs were maintained in the model for subsequent "Credit" runs.

Table 5: BMPDSS Model Runs Summary for Proposed FRP Scenario

Model Run	Description	High Flow **Reduction** (%)	BMPDSS Model Run Date
TMDL Modified Targets with 5.7 acres of Non-Jurisdictional Future Growth		-11.60	----
DEC Existing Condition Model	DEC's existing model, includes all Post2002 BMPs	-1.71	1/31/2014
WCA Revised Existing Condition Model	Model revisions to existing BMPs.	-2.54	12/9/2014
Percent of Modified Target Managed (w/ Existing 12/9/14 model)		**22%**	----
Credit3 Model with GSI ***(Proposed FRP Scenario)***	Add GSI Practices to Credit2 model scenario	-22.56	12/9/2014
Percent of Modified Target Managed (with Credit3_GSI run)		**194%**	----

4.1.1 Proposed FRP Scenario BMPDSS Model Results

The final recommended BMP list is represented in the model run "Credit3_GSI" which includes 18 proposed BMPs (Table 6). The final FRP scenario is estimated to provide a -22.56% **reduction** in the high flow ($Q_{0.3\%}$) which is a percent change between the unadjusted flow in the baseline condition and credit scenario (Table 5). This surpasses the required high-flow target of -11.60% from baseline conditions, addressing ***194%*** of the target with a significant Factor of Safety (FOS). The additional FOS is included in the recommended BMP list to provide the MS4's additional options, in the event the list has to be modified or as conditions in the watershed change from what is present today.

The individual and cumulative percent of the high-flow target mitigated is also included in Table 6, calculated based on the CPv volume storage and the BMPDSS model run results. The BMPDSS model develops a FDC from which it was determined the High-flow ($Q_{0.3\%}$ cfs) is approximately equivalent to the 1-year storm peak flowrate. The 2002 Vermont Stormwater Management Manual design standard for Channel Protection (CPv) requires mitigation of the 1-year storm event. Therefore, CPv volume storage is used as an indicator of the BMPs contribution toward the estimated high-flow reduction for detention BMPs and increase in baseflow for infiltration BMPs in the BMPDSS model. Essentially, the high-flow is directly reduced in the model by mitigating the CPv volume. The individual and cumulative percent mitigated allows for a quick understanding of the relative benefit of each BMP toward meeting the high-flow target.

Based on the "Cumulative Percent of Target" addressed, the MS4's are required to implement the top two projects. The table is set up so that in the event one of the top projects is determined infeasible, the projects can be rearranged to determine which projects will then need to be implemented to meet 100% of the high-flow target. The ultimate determination for implementation of projects that provide benefit beyond the high-flow target (> 100%) will be made by the State based on monitoring data or other relevant information (MS4 General Permit Sec. IV.J.3). Progress toward the TMDL flow targets with the proposed FRP scenario was allocated by MS4 to determine the extent to which the proposed BMPs addressed each MS4's allocated responsibility of the flow targets, summarized in Table A-4 (Appendix 4). The recommended FRP scenario is meeting the full flow restoration target, with a revised future growth of 5.7 acres, through implementation of the recommended stormwater BMPs (Table 6). For additional future growth above 5.7 acres, the City plans to manage this growth with a Low-Impact Development (LID) zoning ordinance, which will require management of new impervious that is not covered under a state stormwater permit.

5 Proposed Implementation Plan

The final BMP scenario includes the implementation of 18 stormwater BMPs including five(5) retrofits to existing BMPs with expired permits, four(4) new detention systems, three(3) new infiltration systems, and six(6) green stormwater infrastructure (GSI) collections. Credit toward the flow target is also provided by nine (9) existing stormwater structures. The proposed BMPs are summarized in Table 6, including the impervious cover treated, drainage area, and CPv volume storage estimated by the HydroCAD design model. A map of the proposed BMP locations is included in Appendix 5.

Table 6: Final Proposed BMPs for the Bartlett Brook FRP

Proposed BMP ID	Owner-ship where BMP is located	BMP Type	Permit #	Runoff Area (ac)	Impervious Cover Managed (ac)	Channel Protection Volume (CPv) Storage		Percent of High-Flow Target Managed	*Cumulative* Percent of High-Flow Target Managed[2]
						CF	Ac-ft	%	%
Existing Post2002 BMPs[1]	Varies	Varies	Varies	--	--	91040	2.09	22%	22%
Keari Lane	City of S. Burlington	Infiltration Gallery	Expired #1-0202 and 2-0120	84.22	16.11	73616	1.69	46%	68%
Horticulture Farm Basin	UVM	Bioretention	Expired #1-1155	33.79	6.35	66124	1.52	42%	**110%**
Spear St.	City of. S. Burlington	Detention Basin	Drains to Expired #2-2061	44.29	5.99	36590	0.84	23%	133%
Bartlett Bay Treatment System (BBTS) Expansion	Private Owner	BBTS Wetland	5625-9010, 2-0180, 2-0153, 1-0734	15.86	9.51	39291	0.55	15%	148%
Laurel Hill Development	UVM	Culvert Retrofit	NP	109.47	21.13	15899	0.37	10%	158%
Holiday Inn Parking Lot	Developer-Pizzagalli	Detention Basin	6297-9030	5.03	3.20	13286	0.31	8.4%	166%
1-1404b Irish Farm Condos	HOA	Pond Upgrade	Expired # 1-1404	16.30	3.38	6578	0.15	4.1%	171%
Brownell Way 1-2	City ROW	ROW Infiltration	Expired #2-0261	2.58	0.83	5445	0.13	3.4%	174%
Whatley Rd 1-5	City ROW	ROW Planter	Expired #2-0261	3.32	0.87	5227	0.12	3.3%	177%
Deerfield Dr. 1-3	City ROW	ROW Infiltration	Expired #2-0261	2.31	0.80	5227	0.12	3.3%	181%
1-1155b Pinnacle at spear	Private Owner	Pond Upgrade	Expired #1-1155	3.45	0.22	4704	0.11	3.0%	184%
Deerfield Dr.-4-6	City ROW	ROW Planter	Expired #2-0261	1.61	0.48	4312	0.10	2.7%	186%
Deerfield Dr. Dug Pond	UVM	Detention	Expired #1-1155	7.66	1.13	3920	0.09	2.5%	189%
Allen Rd.	City ROW	Detention Basin	NP	6.38	1.44	3136	0.07	2.0%	191%
Windsor Ct-1	City ROW	ROW Infiltration	Expired #2-0261	1.05	0.31	2483	0.06	1.6%	192%
Shelburne Rd./ Route 7	VTRANS/ Developer - Pizzagalli	Detention Basin	5625-9010	0.80	0.63	1873	0.04	1.2%	193%

1-1155a Pinnacle at spear	Private Owner	Pond Upgrade	Expired #1-1155	10.25	3.30	1263	0.029	0.8%	194%
Brownell Way-3	City ROW	ROW Planter	Expired #2-0261	0.96	0.08	610	0.01	0.4%	194%
				TOTAL:	**75.75**		**6.30**		

Notes:
1- Existing Post 2002 BMPs provide credit toward the TMDL flow target. Here the existing Post 2002 BMPs are lumped to show the total benefit of existing BMPs.
2- Cumulative percent of the high-flow target managed is calculated based on the CPv storage and the BMPDSS Model results from the "Credit3_GSI" and Existing Condition (12/9/14) runs. As each BMP is added the total % managed increases.

5.1 Proposed BMPs

Bartlett Bay Treatment System (BBTS) Expansion

The existing Bartlett Bay Treatment System was designed in 2002 to provide WQ treatment for runoff from a portion of Route 7 as well as several buildings along Green Mountain Dr. A 15" pipe was installed with the original system to plan for future connections from Route 7. The proposed expansion of the BBTS system would be to route approximately 15.86 acres of additional area to the BBTS system via a new stormline connection on Route 7 (Figure 1) from a portion of Route 7 and Harborview Dr. The expansion would involve implementing a new forebay for the additional connection in front of the Oil N Go property, as well as expanding the southeast portion of the wetland. The existing access road would also be repositioned.

Figure 1: Proposed location for new connection to BBTS from Route 7.

Keari Lane Infiltration Gallery

The proposed Keari Lane infiltration gallery would manage runoff from 84 acres at the confluence of two existing outfalls, both of which have significant erosion issues (Figure 2). There is a larger open area, with soils mapped as Hydrologic Group "B", providing an opportunity for infiltration. The infiltration gallery would require 330 StormTech SC-740 recharge chambers, with a Downstream Defender at the confluence of the two outfall connections. The system was designed as an offline practice to mitigate just the 1-year storm volume (CPv), estimated to be 0.59 ac-ft, through the use of several flow-splitters.

Figure 2: North outfall shows evidence of significantly erosion.

A majority benefit of this project is the fact that it is on City of South Burlington property and makes use of a previously unused space, without changing the overall appearance of the area for

residents. Land acquisition is not required for the project which significantly reduces the cost as well.

Horticulture Farm Basin (Option 1) and Deerfield Dug Pond (Option 2)

The Overlook Dr. walking path currently has two culverts which are directed to a swale along the path carrying significant flows downstream (Figure 3). Additionally, the mapped soil in this area is hydrologic group "B" providing opportunity for infiltration. The proposed site was identified as an excellent candidate to improve the overall aesthetics of the walking path, while also providing significant stormwater management. The project would involve a retrofit of the swale into a 0.81 ac-ft bioretention basin. A berm in the center of the basin would provide an extended flow path to improve water quality treatment.

Figure 3: Overlook Dr. Walking Path

The BMP is located on the UVM Horticulture Farm property, for which irrigation is an ever-present need. An existing pond just downstream of the proposed basin was identified as a candidate site "Deerfield Dug Pond". The 10-year storm (Qp10) overflow from the Horticulture Farm basin would be routed to the dug pond, providing a store of usable water on-site and Qp10 control for the basin.

Spear St Detention Basin

The confluence of the existing stormline along Spear St., just South of Nowland Farm Rd. has been the source of flooding during large storm-events. The proposed project would involve a retrofit of the existing roadside swale into a detention basin (Figure 4), designed to provide CPv (1-year) for a 44.3 acre area in the upper Bartlett Brook watershed. This project is currently in the preliminary design phase under a contract between Stantec and the City of Burlington. The proposed retrofit included in the FRP analysis is a conceptual-level design for a detention basin.

Figure 4: Spear St. roadside swale.

Laurel Hill Development Culvert Retrofit

An existing 32" culvert, located on the UVM horticulture farm property, just South of the Laurel Hill Neighborhood was identified as an opportunity for retrofit to provide more storage. The

proposed retrofit would involve installing a headwall at the culvert and outlet control structure to increase the CPv storage capacity, while still safely passing the larger storm events.

There may be issues with alternation of an on-stream structure, as DEC has limitations on new on-stream structures. Additionally, UVM has expressed that they want to ensure capacity for further development in the contributing drainage area is maintained.

Holiday Inn Parking Lot BMP

Figure 5: Site proposed for Holiday Inn BMP

The Holiday Inn, located off Shelburne Rd, parking lot is currently covered under an RDA permit (6297-9030). However, the system does not provide any flow-control, only water quality in a sedimentation tank. Just north of the parking lot, there is an open lot slated for development by Pizzigali Development for a new housing complex on 1690 Shelburne Rd, with use of the existing open parcel for a community garden and/or tennis court (Figure 5). The development project provides a potential opportunity to implement an underground infiltration gallery in the open space to mitigate runoff from the Holiday Inn Parking lot. There is also potential to route drainage from the Staybridge Hotel, which is currently routed to a detention pond that does not meet the VT CPv standard. The benefit of this project is the option to provide an offset project for the new development. The project has been presented to the State, who are open to this option.

A conceptual off-line underground infiltration basin, sized to mitigate the 1-year storm was included in the FRP analysis. Further verification of the new connections for the system will need to be completed to prove out the project feasibility. An alternative option would involve a retrofit of several green strips within the parking lot with dry wells and infiltration swales. The green belts provide an opportunity for a distributed green stormwater management collection system for the parking lot runoff.

Allen Rd Detention Basin

The Allen Rd. Detention Basin was designed as a retrofit of an existing swale in the ROW. The basin would mitigate runoff from a 6.38 acres drainage area, providing 0.07 ac-ft of volume storage. The site would require a new culvert under the roadway in order to route additional runoff to the swale.

Shelburne Rd/Route 7

An existing outfall from Shelburne Rd, parallel to the Oil N Go property, was identified as a candidate site for a retrofit. An underground detention chamber is proposed to detain just the 1-year storm volume (CPv) from the existing Route 7 stormline, via a flow splitter. The existing

outfall pipe would need to be reset to make room for the chamber. The detention chamber may encroach on the flood plain for the Bartlett Brook culvert, and could also have other utility conflicts limiting the space available for the proposed system.

5.2 Expired Permit Proposed Retrofits

#2-0261 Overlook Dr. Neighborhood GSI Collection System

Currently, the neighborhood South of Deerfield Dr./Spear St is covered under an expired permit #2-0261. The site was built with four on-stream detention ponds all of which do not function according to the permit, and would be challenging to retrofit given the States limitations for on-stream alterations. Due to lack of available open space at the end of the catch basin system, a more distributed management system is ideal. The 2-0261 neighborhood was selected as a GSI build-out candidate area, in which opportunities for ROW planters were identified. The area has a range of soil types, some of which are Hydrologic Group "A" and "B", providing opportunity for infiltration. Candidate sites were identified in which a filter practice could be installed in the ROW and tied into the existing storm water collection system (Figure 6). Tree and utility conflicts were not verified.

Figure 6: Candidate Site for detention filter in ROW along Brownell Way.

#1-1404b Irish Farm Condos Pond B and C Retrofit

The existing Irish Farm Condos stormwater system is currently under expired permit #1-1404. The system consists of two interconnected detention ponds. The proposed retrofit would involve converting the existing upper pond (Pond C on the attached plan) to an expanded gravel wetland system, while maintaining some of the native tree growth. Pond C would be designed to mitigate the 10 year storm from an additional 5.4 acres, tied to the proposed gravel wetland system via a new 18" culvert and catch basin "flow splitter". The lowest pond would also be retrofit to provide CPv. The system is on private property, owned by the condos HOA. This project could provide the HOA an opportunity to relinquish their responsibly for O&M while improving the value of their lot.

#1-1155a and b Pinnacle at Spear Pond Retrofits

The existing ponds covered under permit #1-1155 for the Pinnacle at Spear development were assessed for retrofit. The outlet structure on Pond a (North lot) is proposed for retrofit, including the removal of the existing 12" culvert, replaced with a 3" low-flow orifice. The outlet structure on Pond b (along Spear St) is also proposed for retrofit including the addition of two low-flow orifices, 1" at 371' and a 2" at 373.5'. The retrofits will provide 0.139 ac-ft of CPv storage.

Figure 7: #1-1155 Pond a

Figure 8: #1-1155 Pond b

5.3 Watershed-Wide Project Ranking

A comprehensive ranking matrix was developed in order to rank the proposed projects based on a multitude of criteria grouped into four general categories including:

Category	ID	Criteria
Cost/Operations	A	Relative Project Cost
	B	Ease of O/M
Project Design Metrics	C	Impervious Acres Managed (ac)
	D	Channel Protection Volume (CPv) Mitigated, (ie. 1-year Storm)
	E	Volume Infiltrated (ac-ft)
	F	Water Quality (WQ) Volume Control
	G	Primary or Secondary BMP
Project Implementation	H	Ability to Obtain Permits
	I	Land Availability
Other Project Benefits	J	Flood Mitigation (Is existing flooding issue mitigated by project?)
	K	TMDL Flow Target Addressed (Q03, Q95)
	L	Lake Champlain Phosphorus TMDL*
	M	Other Project Benefits (Educational, Infrastructure Improvement)

Values for each criteria were identified and assigned a relative score, so the projects could be ranked based on a total score. The final ranking of proposed projects is included in Table 7 below. The scoring key and full descriptions of the criteria are included in Appendix 6.

Table 7: Ranked Proposed FRP BMPs based on comprehensive ranking matrix

ID #	Site ID	BMP Type	Retrofit Description	Total Score
2	Keari Lane	Infiltration Gallery	Underground infiltration gallery at confluence of two large outfalls.	31
3	Horticulture Farm Basin	Bioretention	Bioretention basin along walking path.	28
5	Spear St.	Detention Basin	Detention BMP in ROW and/or on City property. Would alleviate flooding downstream.	24
7	Holiday Inn Parking Lot	Detention Basin	Detention BMP on private open land. Planned for design as part of 1690 Shelburne Rd. Project. Infiltration potential	23
1	BBTS Expansion	Wetland	Route CPv storm to BBTS Wetland, and add forebay.	22
16	1-1404b Irish Farm Condos Pond B	Pond Upgrade	Upgrade existing pond to gravel wetland STP, with more storage. Route additional 5.47 acres to Pond B.	22
13	Deerfield Dr. 1-3	ROW Infiltration Trench	System of Infiltration Trenches in ROW.	21
10	Windsor Ct-1	ROW Infiltration Trench	System of Infiltration Trenches in ROW.	20
8	Allen Rd.	Detention Basin	Detention Basin in ROW. Requires new culvert under roadway.	20
12	Brownell Way 1-2	ROW Infiltration Trench	System of Infiltration Trenches in ROW.	19
4	Deerfield Dr. Dug Pond	Detention	Provide irrigation pond for UVM farm	17
11	Brownell Way-3	ROW Planter	System of Filter strips with storage in ROW.	17
14	Deerfield Dr.-4-6	ROW Planter	System of Filter strips with storage in ROW.	17
15	Whatley Rd 1-5	ROW Planter	System of Filter strips with storage in ROW.	17
17	1-1155a Pinnacle at spear	Pond Upgrade	Drains to proposed Hort Farm Basin. Retrofit riser and deepen.	17
18	1-1155b Pinnacle at spear	Pond Upgrade	Drains to proposed Hort Farm Basin. Retrofit riser and deepen.	17
6	Laurel Hill Development	Culvert Retrofit	Block existing culvert and add storage.	14

9	1690 Shelburne Rd.	Detention Basin	Detain unmanaged portion of Route 7 in underground detention chamber.	11

6 Design and Construction Schedule

A Design and Construction (D&C) schedule is a required element of the final approved FRP, outlined for implementation of the proposed FRP over a timeframe of less than 20 years. The City of South Burlington has impervious ownership in five impaired watersheds; Bartlett, Englesby, Centennial, Monroe, and Potash Brook. Therefore, all five FRPs need to be considered when developing a realistic D&C schedule for the City. The time schedule will need to account for acquisition of necessary permits and/or regulatory approvals, as well as limitations of City Resources on an annual basis. The City of South Burlington plans to develop the D&C schedule once BMPS and construction costs for all five FRPs have been established.

The flow restoration targets are subject to adjustment by the Secretary, as specified in section IV.J.3 of the MS4 permit, based on biological monitoring data and/or other confounding information concerning flow reduction progress. Adjustments to the flow targets may impact the schedule and full implementation of the proposed projects, particularly if the monitoring data shows compliance with the biological markers before full implementation of the proposed FRP.

7 Financial Plan

Subject to the requirements of the MS4 permit, a financial plan is required as a part of the FRP which demonstrates the means by which the plan will be financed as well as initial BMP cost estimates. The TMDL is a watershed-wide reduction in the high-flow, and therefore the proposed BMP's are located throughout the watershed. MS4 permittee ownership was considered and the plan preparersattempted to identify BMPs with a sole MS4 owner. However optimal BMP locations did not always follow property boundaries. As a result, the MS4 permittees—the City of South Burlington, Town of Shelburne, and VTRANS may need to engage in a cost-sharing plan. The challenges with cost-sharing will be considered in the final FRP proposed financial plan, and may dictate the recommended strategy.

The City of South Burlington will develop a full Financial Plan once the FRPs are complete for all five of their impaired watersheds. As of now, the main sources for financing the implementation plan will be from stormwater utility fees collected by the City. Other funding sources that may be available for funding projects include the Clean Water State Revolving Fund (CWSRF) program, Municipal Bond bank funds, or a Statewide Water Quality Fund.

7.1 BMP Cost Estimates:

Itemized cost estimates were developed for the top 4 priority projects based on 30% preliminary engineering plans. For all other projects, a modified spreadsheet method was used.

7.1.1 Itemized Cost Estimates:

The itemized cost estimates for the top 4 projects are included in Appendix 7. The cost estimates are based on the following criteria:

- **Construction Cost**: The construction costs were developed based on using both VTRANS 5 year average costs, VTRANS Estimator Program, and RS Means (where applicable) and vendor estimates as necessary for each of the itemized units.
- **Construction Contingency**: The construction contingency is calculated as 15% of the construction cost.
- **Final Design Engineering**: The final design engineering cost is estimated based on the State Fee Curve Allowance as developed by VT DEC. The equations used are as follows:
    - for construction costs less than 780,000, construction cost = $1,950+(Construction cost *0.069)
    - for construction costs greater than 780,000, construction cost = (Construction cost^0.9206)*0.6788*0.30.
- **Construction Engineering**: The construction engineering cost is based on the State Fee Curve Allowance as developed by VT DEC. The equations used are as follows:
    - for construction costs less than 780,000, construction cost = $3,575+(Construction cost *0.1265)
    - for construction costs greater than 780,000, construction cost = (Construction cost^0.9206)*0.6788*0.55.
- **Other costs:** These costs are established based on simple percentages of the construction cost for the project as follows:
    - Administrative = 0.5%
    - Easement Assistance = 1.5%
    - Land Acquisition =$120,000 per acre for projects on private land (*Value estimated by City Assessor)
    - Legal = 5%
    - Bond Vote Assistance = 0.5%
    - Short Term Interest = 2.5%.

7.1.2 Cost Estimates Using Spreadsheet Method:

A modified spreadsheet method was used to develop planning level costs for the remaining BMP projects. Ultimately, the City will rank all proposed BMPs identified as part of FRP development in the City's five stormwater impaired watersheds and create a city-wide project prioritization. Horsley Witten (HW) previously completed the Centennial Brook FRP and developed cost

estimates using a spreadsheet method[4] (Memorandum Provided in Appendix 8). Use of the HW spreadsheet method was originally planned. However after comparing the spreadsheet results for the top four projects with the itemized cost estimates, it appeared that modifications would improve the confidence in the spreadsheet estimates. Therefore, in order to be consistent with our modifications revisions to the HW estimates were necessary. These modifications were simple and accomplished using the available data. The following criteria and modifications were applied in the cost estimates as follows:

Design Control Volume (*Modified*): HW based the design control volume on the runoff volume from the managed site from the 1-year storm for offline CPv BMPs, and the 100-year storm + 2 ft freeboard for large aboveground basins. We found the runoff volume overestimated the cost significantly and found the storage-volume to be a preferred metric for the control volume. The storage-volume associated with the 1-year storm was used for off-line CPv BMPs only designed to mitigate the 1-year storm, and the 100-year storm + 2 ft of freeboard for large basins.

Unit Costs and Site Adjustment Factors: We used the values developed by HW as summarized in Table 8 below:

Table 8: Retrofit unit costs and adjustment factors

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

*Excerpt from Horsley Witten Memorandum Dated January 9th 2014 (Page 11)

Site Specific Costs: No Site specific costs were included in the cost estimates at this time.

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

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

Permits and Engineering Costs: Either a 20% (for largest storage volume projects) and 35% for smaller or complex projects.

Land Acquisition Costs *(Modified*): A variation from the HW method was applied. Based on an estimate from the City Assessor, the land acquisition cost was calculated as $120,000 per acre required for the BMP, applied to projects on private land.

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.

A summary of the cost estimates is included in Table 9 below.

Table 9: Proposed BMPs Cost Estimates

BMP ID	Control	Imp acres	Design Control Volume		Base Unit Cost ($/cft)	Site Adjustment Factor	Base Construction Cost	Permits & Engineering Contingency	Land Cost	Total Project Cost	Cost/Imp Acre	Annual O&M
			(cft)	(ac-ft)								
BBTS Combined	CPv only	9.33	0.55	30% Itemized Cost Estimate						$ 378,260	$ 40,534	$ 8,100
Keari Lane	CPv only	16.11	1.69	30% Itemized Cost Estimate						$ 853,730	$ 52,990	$ 10,000
Horticulture Farm Basin (Option 1)	100-yr	6.35	3.96	30% Itemized Cost Estimate						$ 267,820	$ 42,182	$ 5,700
Deerfield Dr. Dug Pond (Option 2)	100-yr	1.13	0.39	30% Itemized Cost Estimate						$ 184,990	$ 163,287	$ 3,900
1-1404b Irish Farm Condos	100-yr	3.38	1.06	30% Itemized Cost Estimate						$ 247,380	$ 73,198	$ 3,300
Spear St.	CPv only	5.99	0.84	36721	$2	1.5	$110,163	$ 22,033	$90,000	$ 222,196	$ 22,060	$ 3,305
Laurel Hill Development	100-yr	21.13	3.20	139566	$2	0.5	$139,566	$ 27,913		$ 167,479	$ 7,927	$ 4,187
Holiday Inn Parking Lot	CPv only	3.20	0.12	5314	$12	2	$127,544	$ 25,509	$36,000	$ 189,052	$ 47,856	$ 3,826
Allen Rd.	100-yr	1.44	0.44	19166	$2	1.5	$57,499	$ 11,500		$ 68,999	$ 48,075	$ 1,725
Shelburne Rd./ Route 7	CPv only	0.63	0.12	5227	$12	2	$125,453	$ 43,908	$30,000	$ 199,361	$ 268,401	$ 3,764
Windsor Ct-1	CPv only	0.31	0.02	1002	$10	2	$20,038	$ 7,013		$ 27,051	$ 86,748	$ 601
Brownell Way-3	CPv only	0.08	0.02	915	$10	2	$18,295	$ 6,403		$ 24,699	$ 325,063	$ 549

Brownell Way 1-2	CPv only	0.83	0.08	3354	$10	2	$67,082	$ 23,479		$ 90,561	$ 109,256	$ 2,012
Deerfield Dr. 1-3	CPv only	0.80	0.12	5227	$10	2	$104,544	$ 36,590		$ 141,134	$ 177,069	$ 3,136
Deerfield Dr.-4-6	CPv only	0.48	0.10	4312	$10	2	$86,249	$ 30,187		$ 116,436	$ 241,057	$ 2,587
Whatley Rd 1-5	CPv only	0.87	0.16	6752	$10	2	$135,036	$ 47,263		$ 182,299	$ 210,490	$ 4,051
1-1155a Pinnacle at spear	100-yr	3.30	0.686	29882	$2	0.25	$14,941	$ 5,229		$ 20,170	$ 6,116	$ 448
1-1155b Pinnacle at spear	100-yr	0.22	0.461	20081	$2	0.5	$20,081	$ 7,028		$ 27,110	$ 122,554	$ 602
		75.6							**Total Cost:**	**$3,408,728**		

8 Regulatory Analysis

The City is currently developing a policy regarding the handling of expired State stormwater permits. This final policy be included in the final FRP. As part of this plan, retrofits are being proposed on sites tied to an expired State operational stormwater permit. The decision as to how these retrofit projects are covered in the future will be subject to discussion and agreement with the private landowners, the MS4, and the State. A full list of the expired permits with discharges to Bartlett Brook indicating the retrofits proposed under this FRP is included in Appendix 9 (Table A-9).

One site that relates to the permitting discussion is the Holiday Inn BMP. The Holiday Inn currently has a RDA permit approved by the State. However, the approved stormwater system doesn't provide CPv control, and therefore no benefit in the FRP assessment. The proposed BMP is on land owned by a private property owner who is proposing to develop their lot onShelburne Rd. The State has been approached, and may be open to the option to use the Holiday Inn BMP as an offset for the new development if the overall condition of the watershed is improved with the proposed development and Holiday Inn BMP. The State is considering this as an option now that the TMDL has been approved and the interim permitting measures under Chapter 22 of the Vermont DEC Environmental Protection Rules for Stormwater Management in impaired waters no longer applies.

9 FRP Implementation

The Bartlett Brook FRP was completed to meet the requirements under Part III of the MS4 general permit for the contributing MS4's—City of South Burlington, VTRANS and the Town of Shelburne. According to Subpart IV.C.1. of the General Permit, the MS4 is required to submit a final FRP within 3 years of the permit issuance. The FRP will become a part of the permittees SWMP upon approval. A final D&C schedule will need to be submitted with the FRP. Once a final FRP is approved, implementation of the FRP is required according to the proposed schedule.

10 Appendices