



# STORMWATER MASTER PLAN FOR THE TOWN OF UNDERHILL, VERMONT



## FINAL REPORT

April 30, 2018

### Prepared for:

*Chittenden County*

*Regional Planning Commission*

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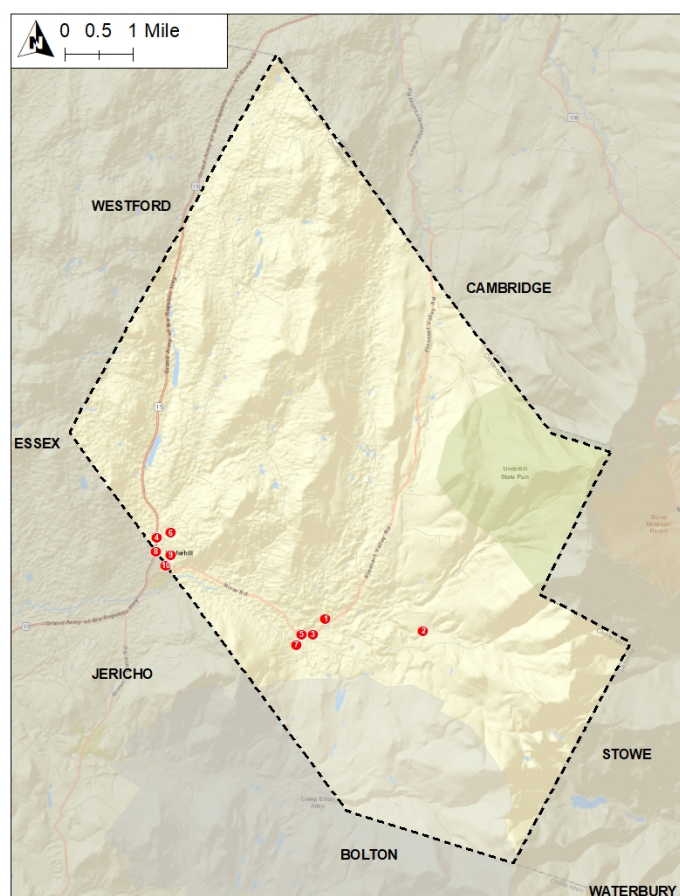
**Table 2. Top 10 BMPs selected for the Underhill SWMP.**

Site ID	Proposed Practice Type
Underhill Central School	Underground Storage / Infiltration
Maple Leaf Rd (1)	Infiltration Basin, Buffer Enhancement and Restoration
Town Clerk's Office and Parking Lot	Bioretention
Fire Department Swale	Underground Storage / Infiltration
St. Thomas Church Parking Lot	Impervious Reduction, Bioretention
Sugar Hill and Meadow Ln	Infiltration Basin, Ditch and Swale Improvements
Krug Rd and Pleasant Valley Rd	Underground Storage / Infiltration
Park St Park	Underground Storage / Infiltration
Harvest Run	Ditch and Swale Improvements, Floodplain Enhancement and Restoration
Underhill Post Office	Vegetated Swale, Infiltration Basin

### 4.3 Modeling and Concept Refinement for Top 10 BMPs

Modeling was completed for each of the Top 10 sites (Figure 8). 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 land use/land cover was digitized using the best available topographic data and aerial imagery. Drainage areas were refined based on field observations (see Appendix D – Top 10 Sites for drainage area delineations). Each of the sites was modeled in HydroCAD to determine the appropriate BMP size and resultant stormwater volume reductions (see Appendix E - Top 10 Sites Modeling for modeling reports).

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 WinSLAMM, pollutant removal rates published by the University of New Hampshire Stormwater Center 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 3. Complete modeling results are provided in Appendix E - Top 10 Sites Modeling.

**Figure 8. The Top 10 project locations are shown.**

**Table 3. Modeled volume and pollutant load reductions for the Top 10 BMPs.**

Site ID	Volume Managed (ac-ft)	Volume Infiltrated (ac-ft)	Total Suspended Solids Removal (lbs)	Total Suspended Solids Removal (%)	Total Phosphorus Removal (lbs)	Total Phosphorus Removal (%)
Underhill Central School	0.308	0.31	3,341	100%	3.74	100%
Maple Leaf Rd (1)	0.19	0.19	8,291	97.1%	5.58	97.4%
Town Clerk's Office and Parking Lot	0.031	0.03	1,458	99.8%	0.46	99.7%
Fire Department Swale	0.130	0.13	1,113	100%	0.32	100%
St. Thomas Church Parking Lot	0.113	0.11	1,185	100%	0.45	100%
Sugar Hill and Meadow Ln	0.211	0.21	6,576	74.6%	4.80	75.1%
Krug Rd and Pleasant Valley Rd	2.072	2.07	11,832	100%	8.49	100%
Park St Park	0.18	0.18	4,092	100%	1.13	100%
Harvest Run	1.70	--	23,030	26%	17.32	26%
Underhill Post Office	0.06	0.06	780	100%	0.41	100%

#### 4.4 Final Ranking Methodology

A prioritization matrix was utilized in order to quantitatively rank each of the Top 10 projects. 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
- Project cost

Each of these criteria are listed and explained in Appendix F - Top 10 Site Final Ranking. The scores associated with each of the categories are also provided in this table.

##### 4.4.1 Project Cost Estimation

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 G. Note that a variation of this method was used for this plan. The criteria used in this cost estimation can be found in Appendix F - Top 10 Site Final Ranking. This methodology provides consistent budgetary cost estimates across BMPs.

## 6.3 Town Clerk's Office and Parking Lot

### 6.3.1 30% Concept Design Description

The Town Clerk's Office and Parking Lot site is located on Pleasant Valley Rd in Underhill Flats. Presently in the drainage area to the proposed BMP, runoff is generated from the roof and parking lot. The runoff is collected in a culvert in front of the building and is conveyed under the road before discharging to the riverbank without any water quality management.

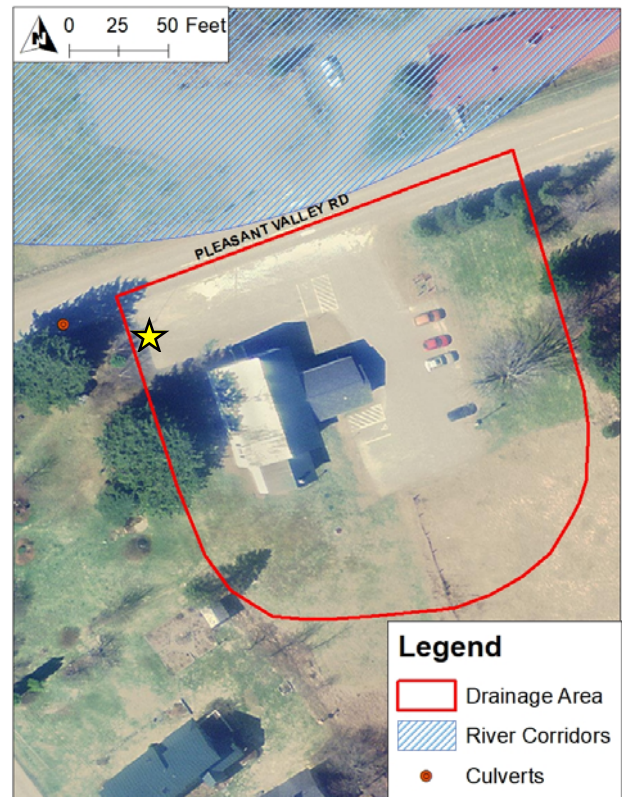
Soils in this location are very good, Hydrologic Soil Group A, with high infiltration potential. As such, the proposed practice for this site is infiltration based.

The proposed BMP includes a bioretention between the side of the front parking lot and the culvert inlet (see Figure 17). The roof should also be guttered with a downspout draining directly to this feature. This practice will provide water quality benefit by treating runoff from the site's impervious surfaces (see Table 12). Note that any needed municipal culvert upgrades could be coordinated with the construction of the bioretention feature.

The drainage area for this proposed BMP is 0.91 acres, approximately 40% of which is classified as impervious. This practice will provide a water quality benefit (Table 14), but is also a high visibility site within the Town, and this practice could spur additional retrofits and awareness of stormwater issues in the area. It is recommended that an educational sign be installed in conjunction with the retrofit.

The design standard used for this retrofit was full infiltration of the water quality volume (WQv, or 1" of rain in a 24-hour period), equal to 1,350 ft<sup>3</sup> of runoff.

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



**Figure 17.** The drainage area for the Town Clerk's Office and Parking Lot project is shown in red. The location of the proposed BMP is shown with a star.

### 6.3.2 Pollutant Removal and Other Water Quality Benefits

A retrofit of this site has the potential to prevent 1,458 lbs of TSS and 0.46 lbs of TP from entering receiving waters annually (Table 12).

**Table 12. Town Clerk's Office and Parking Lot benefit summary table.**

Total Suspended Solids Removed	1,458 lbs
Total Phosphorus Removed	0.46 lbs
Impervious Treated	0.36 acres
Total Drainage Area	0.91 acres

### 6.3.3 Cost Estimates

Note that these costs and benefits are very preliminary. Initial cost projections can be found in Table 13. This amount differs from the amount initially projected for this site as design-specific amounts and costs were used. The estimated cost for implementation of this project is \$16,000.

- The cost per pound of phosphorus treated is \$34,782.61.
- The cost per impervious acre treated is \$44,444.44.
- The cost per cubic foot of runoff treated is \$11.85.

**Table 13. Town Clerk's Office and Parking Lot project initial construction cost projection.**

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
<b>Site Preparation</b>					
	Mobilization	LS	1	\$ 500.00	\$ 500.00
653.55	Project Demarcation Fencing	LF	100	\$ 1.17	\$ 117.00
652.10	EPSC Plan	LS	1	\$ 250.00	\$ 250.00
652.20	Monitoring EPSC Plan	HR	4	\$ 37.22	\$ 148.88
	Construction Staking	HR	4	\$ 90.00	\$ 360.00
<i>Subtotal:</i>					<b>\$ 1,375.88</b>
<b>Bioretention</b>					
203.28	Excavation of Surfaces and Pavements	CY	40	\$ 21.94	\$ 877.60
N/A	Rain Guardian Inlet Device	EACH	1	\$ 1,500.00	\$ 1,500.00
651.35	Bioretention Media (Topsoil)	CY	35	\$ 30.96	\$ 1,083.60
629.54	Crushed Stone Bedding (weed suppression)	TON	12	\$ 34.04	\$ 408.48
656.41	Plants* (Perennials)	EACH	100	\$ 8.77	\$ 877.00
N/A	Plant Seeds	LBS	2	\$ 125.00	\$ 250.00
601.0920	24" CPEP Outlet Works	LF	5	\$ 64.04	\$ 320.20
616.21	Vertical Granite Curb	LF	90	\$ 35.69	\$ 3,212.10
<i>Subtotal:</i>					<b>\$ 8,528.98</b>
<b>New Infrastructure</b>					
601.0915	24" CPEP	LF	15	\$ 64.04	\$ 960.60
<i>Subtotal:</i>					<b>\$ 960.60</b>
<b>Subtotal:</b>					<b>\$ 10,865.46</b>
	Construction Oversight**	HR	8	\$ 100.00	\$ 800.00
	Construction Contingency - 10%**				\$ 1,086.55
	Incidentals to Construction - 5%**				\$ 543.27
	Minor Additional Design Items - 5%**				\$ 543.27
	Final Design	HR	15	\$ 100.00	\$ 1,500.00
	Permit Review and Applications (exclusive of permit fees)	HR	4	\$ 100.00	\$ 400.00
<b>Total (Rounded)</b>					<b>\$ 16,000.00</b>

### 6.3.4 Next Steps

As this site is owned and operated by the Town of Underhill, it is recommended that the Town proceed with further design of this retrofit. Further design will involve refinement of the retrofit design with respect to size, outlet design, and routing to ensure that CPv can be completely managed and larger storms passed through the system safely.



### **6.3.5 Permit Needs**

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

#### *Stormwater Permit*

It is not expected that a stormwater permit will be required at this time.

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

- Less than 2 acres of disturbance at any one time.
- All soils must be stabilized (temporary or final) within 7 days.
- Runoff from the site must pass through a 50' vegetated buffer prior to entering any Water of the State.

#### *Local Permitting*

No local permits are anticipated.

#### *Other Permits*

This site should be reviewed by a State River Scientist prior to final design. However, it should be noted that the proposed BMP is located outside of the river corridor. No Act 250 or Wetlands permitting is anticipated for this project.

## PROJECT SUMMARY SHEET

**DEC Block Grant to Southern Windsor County RPC** (\_\_\_\_\_).

**Sub-Grantee:** Chittenden County RPC

**Project Recipient:** Town of Underhill

**Name of Project:** Town Clerk Office & Parking Lot Bioretention

### Description of Project

*The following project is one of five projects that were identified as priorities in the Underhill SWMP completed in late April 2018. The description is excerpted from the SWMP.*

The Town Clerk's Office and Parking Lot site is located on Pleasant Valley Rd in Underhill Flats. Presently in the drainage area to the proposed BMP, runoff is generated from the roof and parking lot. The runoff is collected in a culvert in front of the building and is conveyed under the road before discharging to the riverbank without any water quality management.

Soils in this location are very good, Hydrologic Soil Group A, with high infiltration potential. As such, the proposed practice for this site is infiltration based. The proposed BMP includes a bioretention between the side of the front parking lot and the culvert inlet (see attached Figures). The roof should also be guttered with a downspout draining directly to this feature. This practice will provide water quality benefit by treating runoff from the site's impervious surfaces (see Table 12). Note that any needed municipal culvert upgrades could be coordinated with the construction of the bioretention feature.

The drainage area for this proposed BMP is 0.91 acres, approximately 40% of which is classified as impervious. A retrofit of this site has the potential to prevent 1,458 lbs of TSS and 0.46 lbs of TP from entering receiving waters as detailed in Table 12 from the SWMP:

**Table 12. Town Clerk's Office and Parking Lot benefit summary table.**

Total Suspended Solids Removed	1,458 lbs
Total Phosphorus Removed	0.46 lbs
Impervious Treated	0.36 acres
Total Drainage Area	0.91 acres

The proposed practice would also have a high visibility site within the Town which would provide an educational benefit through expanded awareness of stormwater issues in the area and hopefully spur the adoption of additional retrofits by local residents and businesses.

The design standard used for this retrofit was full infiltration of the water quality volume (WQv, or 1" of rain in a 24-hour period), equal to 1,350 ft<sup>3</sup> of runoff.

	TOWN OF UNDERHILL	CLEAN WATER BLOCK GRANT WITH CCRPC		
Town of Underhill Town Clerk's office		Bioretention project		
	<b>Category</b>	<b>Requested Funds</b>	<b>Match</b>	<b>Total Project Budget</b>
	Personnel		\$481	\$481
	Fringe		\$257	\$257
	Travel		\$0	\$0
	Equipment			\$0
	Supplies			\$0
	Contractual	\$3,502	\$3,500	\$7,002
	Construction	\$13,000	0	\$13,000
	Other			\$0
	<b>AWARD TOTAL</b>	<b>\$16,502</b>	<b>\$4,238</b>	<b>\$20,740</b>

20% target >>>>

\$4,148

In-kind match from Town of Underhill			
<b>Personnel: Salary @ \$/hr.</b>	<b>Rate</b>	<b>Hours</b>	<b>Total</b>
Town Administrator @ \$/hr.	\$24.03	20	\$481
<b>Fringe: @ \$/hr.</b>			
Town Administrator @ \$/hr.	\$12.83	20	\$257
		<b>sub-total</b>	<b>\$738</b>
Cash match from TOWN OF UNDERHILL		<b>sub-total</b>	<b>\$3,500</b>

## Project Readiness Screening – UNDERHILL TOWN CLERK'S OFFICE, PROPOSED BIORETENTION

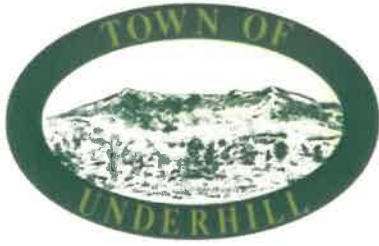
This information will help the Clean Water Initiative Program (CWIP) streamline the environmental review and project readiness process for your water quality improvement project. If you have general questions about the Department of Environmental Conservation (DEC) permit process, please contact a [Permit Specialist](#) who can assist you in identifying all necessary state permits or approvals for any given project.

<b><u>Part A: Natural Resource Conflicts</u></b>	This section of the Project Readiness Screening Form identifies any lakeshore, river, and/or wetland natural resource conflicts that may be present at your project site and provides resources on who to contact if a permit is likely required.	
<b>I. Act 250 Permits</b>		
<b>1. Have any Act 250 (Vermont's Land Use and Development Control Law) Permits been issued in the project site's parcel location?</b> An Act 250 Permit is required for certain categories of development, such as subdivisions of 10 lots or more, commercial projects on more than one acre or ten acres (depending on whether the town has permanent zoning and subdivision regulations), and any development above the elevation of 2,500 feet. Contact the project district's Permit Specialist if you have any questions about Act 250. Visit <a href="http://dec.vermont.gov/environmental-assistance/permits/specialists">http://dec.vermont.gov/environmental-assistance/permits/specialists</a> to find the Permit Specialist for your project's district.		Yes <input type="radio"/> No <input checked="" type="radio"/>
If <b>yes</b> , please provide the permit number and list any water resource issues or natural resource issues found: Permit Number: Resource Issues:		
<b>II. Lakeshore</b>		
<b>1. Is the project site located within 250 feet of a lakeshore water's edge?</b>		Yes <input type="radio"/> No <input checked="" type="radio"/>
If <b>yes</b> , have you spoken with a Lake and Shoreland Regional Permit Analyst? You might need either a Shoreland Protection Act Permit or an Encroachment Permit. Visit <a href="http://dec.vermont.gov/watershed/lakes-ponds/permit/contact">http://dec.vermont.gov/watershed/lakes-ponds/permit/contact</a> to find the Permit Analyst for your project's region.		<b>Yes</b> needs permit. <b>No</b> permit required.
<b>III. River Corridor</b>		
<b>1. Is the project a river corridor easement?</b>		Yes <input type="radio"/> No <input checked="" type="radio"/>
If <b>yes</b> , have you coordinated with a River Scientist? All river corridor easement projects require coordinating with a River Scientist to be eligible for funding. Visit <a href="http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection">http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection</a> to find the River Scientist for your project's region.		<b>Yes</b> , approved by RMP.

	No, not approved.
<b>2. If the project is not a river corridor easement, is there any portion of the project site located within 100' of a river corridor and/or mapped Federal Emergency Management Agency (FEMA) flood hazard area?</b>	Yes <input checked="" type="radio"/> No
If <b>yes</b> , have you spoken with a River Scientist and/or Floodplain Manager? Visit <a href="http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection">http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection</a> to find the River Scientist and/or Floodplain manager for your project's region.	<b>Yes</b> - project cleared by RMP. <b>No</b> , project cancelled.
<b>3. If the project itself is not in the river corridor and/or flood hazard area, is there any portion of the project that may contribute point source water runoff into the stream?</b> Ex. A stormwater pond's pipe draining into a river corridor area	Yes <input checked="" type="radio"/> No
If <b>yes</b> , have you spoken with a River Scientist? They must approve the project. Visit <a href="http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection">http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection</a> to find the River Scientist for your project's region.	<b>Yes</b> - project cleared by RMP. <b>No</b> , project cancelled.
<b>4. Does any portion of the project involve work on the stream bank and/or floodplain?</b>	Yes <input checked="" type="radio"/> No
If <b>yes</b> , have you spoken with a River Scientist? You may need a Stream Alteration Permit. Stream Alteration Permits regulate activities that take place in or along streams. The types of activities that are regulated include streambank stabilization, road improvements that encroach on streams, and bridge construction or repair. Visit <a href="http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection">http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection</a> to find the River Scientist for your project's region.	<b>Yes</b> , permit required.  <b>No</b> permit required.
<b>IV. Wetland</b>	
<b>1. Is there any portion of the project site located in or within 100 feet of a mapped wetland, wetland advisory layer, or hydric soil area?</b>	Yes <input checked="" type="radio"/> No
<b>2. Are there any indications that you may have a wetland area onsite outside of mapping?</b> See <a href="#">Landowners Guide to Wetlands</a> for additional information on identifying wetlands onsite.	Yes <input checked="" type="radio"/> No
If <b>yes to either of the above</b> , have you spoken with a District Ecologist or another wetland professional regarding the potential that the project may trigger a permit requirement? The District Wetlands Ecologist can help determine the approximate locations of wetlands and whether you need to hire a Wetland Consultant to conduct a wetland delineation. Any activity within a Class I or II wetland or wetland buffer zone (100 feet and 50 feet respectively) which is not exempt or considered an "allowed use" under the <a href="#">Vermont Wetland Rules</a> requires a permit. All permits must go through a public notice process, which takes time. Visit	<b>Yes</b> , project has no wetland impacts.  <b>Yes</b> , permit required

<a href="http://dec.vermont.gov/watershed/wetlands/contact">http://dec.vermont.gov/watershed/wetlands/contact</a> to find the District Ecologist for your project's region.	
<b>V. Stormwater</b>	
<b>1. Will the project disturb more than an acre of land during construction?</b>	Yes <input checked="checked" type="radio"/> No
If yes, forward to the appropriate Stormwater specialist to ensure necessary permitting.	
<b>2. Will this project add impervious surface, create new development or otherwise require a Stormwater permit?</b>	





## Town of Underhill

P.O Box 120, Underhill, VT 05489

[www.underhillvt.gov](http://www.underhillvt.gov)

Phone: (802) 899-4434

Fax: (802) 899-2137

October 23, 2018

Thomas Kennedy, Executive Director  
Southern Windsor County Regional Planning Commission  
Ascutney Professional Building, Route 5  
P.O. Box 320  
Ascutney, VT 05030-0320

**Re: Confirmation of commitment as required by the Clean Water Block Grant Program  
for Town of Underhill Town Clerk's Office and Parking Lot Bioretention, ID#7050**

Dear Mr. Kennedy,

This letter is to serve as confirmation of the Town of Underhill's commitment to provide eligible match of 20% of total project cost for the Underhill Town Clerk's Office & Parking Lot Bioretention project, with 80% to be funded by the Clean Water Block Grant through the Chittenden County RPC.

The Town shall provide match, estimated at this time to not exceed \$4,238, via cash and in-kind contributions from the Town.

We understand that the Period of Performance under this program ends on December 31, 2019. All work associated with this project will be complete prior to that date.

The Town of Underhill will work with the Chittenden County RPC to develop an Operations and Maintenance (O&M) Plan for the Underhill Town Clerk's Office & Parking Lot Bioretention project in consultation with the Vermont Department of Environmental Conservation (DEC). The O&M Plan shall be maintained for a minimum of ten (10) years.

Sincerely,

Kurt Johnson, Underhill Selectboard Chair

Cc: Dan Albrecht, CCRPC via email: [dalbrecht@ccrpcvt.org](mailto:dalbrecht@ccrpcvt.org)  
Cindy Ingersoll, SWCRPC via email [cingersoll@swcrpc.org](mailto:cingersoll@swcrpc.org)