

# Town of Middlebury

## Stormwater Infrastructure Mapping Project

August 2012



***VTDEC – CLEAN WATER INITIATIVE PROGRAM,  
WATERSHED MANAGEMENT DIVISION***

<https://dec.vermont.gov/water-investment/cwi/solutions/developed-lands/idde>

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## **Overview**

This stormwater infrastructure mapping project was completed for the municipality by the Agency of Natural Resources Ecosystems Restoration program to supplement the existing drainage data collected by the town and with the intention of providing a tool for planning, maintenance, and inspection of the stormwater infrastructure.

The GIS maps and geodatabase are meant to provide an overall picture and understanding of the connectivity or connectedness of the storm system on both public and private properties in order to raise the awareness of the need for regular maintenance. The generation and transport of nonpoint source pollution increases with increasing connectivity of a drainage system. Having an understanding of the connectedness of the system is also a valuable tool for hazardous material spill planning and prevention. Knowledge of the extent of the system is also essential for the detection and elimination of illicit discharges. Outfall locations and system connectedness data are used as a base for locating illicit or illegal discharges of non-stormwater to the municipal storm system and tracing them up to the source. Knowledge of which areas of the sewer service area have combined stormwater and sewer systems can better assist the municipality in planning and implementing combined sewer separation projects. Knowledge of the layout and extent of the stormwater system can inform options for cleaning up existing polluted stormwater discharges. This project provides information and guidance for potential retrofit treatment locations and opportunities. Finally, by providing a more thorough understanding of the system it is the hope that this project could be the basis for a local stormwater ordinance or be used to help enhance an existing stormwater management program.

## **Project Summary**

The principal goal of this project was to develop up to date municipal drainage maps. These drainage maps were created showing the paths that stormwater runoff travels from where it falls on impervious surfaces such as parking lots, roads, and rooftops, to the outfall points in various receiving waters. These maps show the stormwater infrastructure including features like pipes, manholes, catchbasins, and swales within a municipality. Data sources included data collected from field work, a mapping grade Trimble GPS unit, available state permit plans, record drawings, town plans, WWMD plans, existing GIS data from contractors, and the input and guidance of knowledgeable members from the municipalities.

A second goal of this project was to establish potential locations for Best Management Practice (BMP) stormwater retrofit sites. These are sites where stormwater treatment structures could be added and where they would be most cost effective and efficient for sediment and phosphorus or nitrogen removal. In order to develop a retrofit site list, drainage area subwatersheds were delineated around the drainage networks. Determining how the stormwater infrastructure was connected was necessary in determining the subwatershed drainage areas within the town.

Delineating the drainage areas was done using the stormwater infrastructure maps, along with satellite imagery, a Digital Elevation Model (DEM), and USGS topographic maps. These data sources were used to approximate where the land area within each municipality was draining to; as well as where the high points were that divided the sub-drainage areas. The completed maps show the drainage coverage for essentially the entire municipality, but with a focus on areas with greater concentrations of impervious cover.

Impervious cover layers were created by either hand digitization or by using a method of raster pixel calculation (with ArcGIS spatial analyst extension) to create a vegetation index from the National Agricultural Imagery Program (NAIP) 08 orthophotos. The area which contrasted with the vegetation represents impervious surfaces and was then modified with buffered water and roads layers to make it more accurate. A more detailed explanation of this process is available in a separate document. The impervious layer was used to calculate the percent of each delineated drainage area that would generate stormwater runoff. The percentage of impervious surface number for each subwatershed was then adjusted with a connectivity rating. A rating was assigned to each drainage area polygon describing how directly connected the impervious surfaces within that subwatershed are to the receiving water. By adjusting the percent impervious area numbers with this connectivity rating the effective impervious area (EIA) was established for each subwatershed (Sutherland, 1995). This effective impervious number is a more accurate description of the amount of runoff produced by each of the subwatersheds because it helps to take factors such as infiltration into account.

After the effective impervious numbers were calculated for the subwatersheds the Simple Method was used to estimate the annual sediment (TSS) and phosphorus (TP) or Nitrogen (TN) loads generated by each subwatershed. The Simple method uses information which includes the adjusted impervious value, average annual rainfall for the location, total subwatershed area, and a given pollutant concentration value to calculate an annual load for various pollutants (Schueler, 1987). Pollutant loads estimated by the Simple Method in this project are planning level estimates and are meant to give a general idea of the amounts of sediment or nutrient wash-off produced by each subwatershed for prioritization purposes. Subwatersheds were then prioritized, using the loading calculations as well as other criteria, and given Action List numbers ranging from 1 to 3 (one being the highest priority). The Action List number depends both upon loading values and feasibility of potential retrofit treatment options. Potential retrofit options listed in the TARGET maps are based on field observations and not on actual availability of land or willingness of landowner.

Water Quality Volume (WQv – the amount of storage needed to treat stormwater from a 0.9 inch storm) and Channel Protection Volume (CPv – the volume of storage that is needed to hold and slowly release stormwater for a 2.1 inch rain event) were also calculated for delineated subwatershed areas. CPv calculations are only applicable if the receiving water is not a large body of water and is therefore susceptible to channel erosion. These numbers were used in the retrofit recommendation process because the volume of water to be treated was a key factor in determining the type of retrofit.

### ***Project References***

Schueler, T. 1987. *Technical Documentation of a Simple Method for Estimating Urban Storm Pollutant Export. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Appendix A.*

Schueler, T. et al., 2007. *Urban Stormwater Retrofit Practices, Version 1.0. Manual 3, Center for Watershed Protection, August 2007.*

Sutherland, R. 1995. *Methodology for Estimating the Effective Impervious Area of Urban Watersheds. Technical Note 58 – Pervious Area Management. Watershed Protection Techniques. Vol. 2, No. 1*

**\*All data was created in an ArcGIS 10 Geodatabase format and is available from VTDEC.**

# *Subwatershed Data*

*Tables showing calculations and  
Priority drainage area retrofit possibilities*

This is a key showing the abbreviations of the different stormwater treatment structures or practices listed in the calculation sheets.

<b>Abbreviation Key</b>	
<b>Code</b>	<b>Structure Type</b>
BB	Baffle Box
BFCB	Baffled Catchbasin
BR	Bioretention Area (aka Bioretention Filter)
BS	Buffer Strip (25' Min.)
CB	Catch Basin
CBI	Catch Basin Insert
CD	Check Dam
DG	Detention Gallery
DI	Drop Inlet
DP	Dry Pond
DS	Dry Swale
DW	Drywell
EDPMP	Extended Detention Pond with Micropool (aka Micropool Extended Detention Basin)
GS	Grass Swale (aka Open Channel)
IB	Infiltration Basin
IG	Infiltration Gallery
IP	Infiltration Pipe
OF	Overland Flow
OGF	Organic Filter
POP	Pocket Pond
PP	Perforated Pipe
RDD	Roof Drain Disconnect
RR	Rock Riprap
RS	Riprap Swale
SB	Sediment Basin
SF	Sand Filter (aka Surface Sand Filter)
SS-SF	Swirl Separator – Sand Filter
ST	Septic Tank
SWPPP	Stormwater Pollution Prevention Plan
TT	Treatment Tank
WL	Wetland (Constructed)
WP	Wet Pond (Retention)
WS	Wet Swale

## Middlebury - Subwatershed Prioritization and Recommendations (p1)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
68	1	Bioretention at Elementary School	BR/CB/GS		25.1	54	13,537	2,707	37.6	15.0	0.77	
74	1	Upgrade Pond to 2002 standards/ Combine with 103,104,106	WP/CB/GS/EDP	4946-9010	20.3	44	3,570	2,142	12.4	9.3	0.34	0.97
233	1	Bioretention in front of 1197 Exchange St	BR/CB/GS/EDP	3188-9010	48.1	13	2,475	1,485	8.6	6.0	0.23	
103	1	Combine with 74	WP/CB/EDP		0.7	69	263	158	0.9	0.7	0.02	0.05
3000	1	Further investigation of the St Stephens Church Green area is needed			4.0	74	266	266	0.7	0.7	0.02	
106	1	Combine with 74	WP/OF/EDP		3.2	11	159	95	0.6	0.4	0.01	0.04
104	1	Combine with 74	WP/CB/EDP		0.3	87	146	88	0.5	0.4	0.01	0.02
199	1/2	Fix erosion near 187 Shannon St/ Wet Pond	RR/WP/CB/GS		47.3	33	18,333	3,667	50.9	25.5	1.04	
203	2	Wet Pond off Weybridge St/ Bioretention on Campus	BR/WP/CB/DW/GS	4944-9010	54.6	25	11,640	3,492	32.3	19.4	0.66	
117	2	Add sediment forebay or pocket pond	SB/CB/GS/WP		5.5	31	392	313	1.6	1.4	0.06	0.19
44			CB/GS/OF		128.4	37	54,758	54,758	152.1	152.1	3.10	
194			CB/BR/PP/GS		49.8	40	22,964	22,964	63.8	63.8	1.30	
183			GS/EDP/OF	3020-9010/ 3470-9015	113.9	22	18,239	18,239	50.7	50.7	1.03	2.80
198			CB/GS/WP		103.9	28	16,799	16,799	46.7	46.7	0.95	3.23
214			GS/OF	5586-9010	125.8	11	13,993	13,993	38.9	38.9	0.79	
38			GS/CB/SWPPP/PP/	4789-9003/ 5316-9003/ 5751-9015/ 5786-9010	50.4	35	13,534	13,534	37.6	37.6	0.77	1.95
163			OF		109.5	12	12,460	12,460	34.6	34.6	0.70	1.40
184			GS		103.6	12	12,170	12,170	33.8	33.8	0.69	1.40
107			OF		65.4	19	10,869	10,869	30.2	30.2	0.61	1.38
197			CB/GS/WP		26.6	51	10,131	10,131	28.1	28.1	0.57	1.50
148			CB/TT	3548-9010	9.3	88	9,596	9,596	26.7	26.7	0.54	0.90
153			OF/GS		81.6	11	9,168	9,168	25.5	25.5	0.52	1.03
218			CB/GS/OF		67.8	14	8,764	8,764	24.3	24.3	0.50	1.05
169			CB/GS	6153-9010/ 3713-9010	37.3	32	8,758	8,758	24.3	24.3	0.50	1.29
134			OF		14.4	47	6,485	6,485	18.0	18.0	0.37	
186			GS/CB		17.8	36	5,800	5,800	16.1	16.1	0.33	0.71
196			CB/GS	6673-9015	23.1	29	5,752	5,752	16.0	16.0	0.33	

**Middlebury - Subwatershed Prioritization and Recommendations (p1 cont.)**

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof raingardens to treat WQv (Residential)	Raingarden Cost	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
68	1	BR/CB/GS	\$132,117		\$12	\$5,856	ERP, Section 319, LCBP				
74	1	WP/CB/GS/EDP	\$188,034		\$114	\$52,349	ERP, Section 319, LCBP				
233	1	BR/CB/GS/EDP	\$40,254		\$41	\$15,615	ERP, Section 319, LCBP				
103	1	WP/CB/EDP	Combined w/ 74				ERP, Section 319, LCBP	12	\$5,708	26	\$12,040
3000	1						ERP, Section 319, LCBP				
106	1	WP/OF/EDP	Combined w/ 74				ERP, Section 319, LCBP	7	\$3,444	20	\$9,340
104	1	WP/CB/EDP	Combined w/ 74				ERP, Section 319, LCBP				
199	1/2	RR/WP/CB/GS	\$225,916		\$15	\$8,872	ERP, Section 319, LCBP			0	\$0
203	2	BR/WP/CB/DW/GS	\$113,606		\$14	\$8,784	ERP, Section 319, LCBP	329	\$151,475	0	\$0
117	2	SB/CB/GS/WP	\$31,944		\$408	\$156,536	ERP, Section 319, LCBP	28	\$12,746	93	\$42,592
44								1,549	\$712,562		
194											
183											
198										1,616	\$743,358
214								396	\$182,085		
38											
163											
184											
107								307	\$141,436	689	\$316,709
197										751	\$345,629
148											
153											
218											
169									\$113,968		
134											
186											
196								163	\$74,845		

## Middlebury - Subwatershed Prioritization and Recommendations (p2)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
23			CB/GS/EDP	3188-9010	70.2	9	5,362	5,362	14.9	14.9	0.30	
33			CB/GS/SWPPP	3418-9010/ 4861-9003/ 3513-9010	32.1	23	5,343	5,343	14.8	14.8	0.30	0.82
168			CB/GS	6153-9010	8.9	61	5,216	5,216	14.5	14.5	0.30	0.60
43			GS/SWPPP	5853-9003	10.5	53	5,044	5,044	14.0	14.0	0.29	
217			CB		9.3	52	4,838	4,838	13.4	13.4	0.27	0.54
182			GS		16.8	31	4,637	4,637	12.9	12.9	0.26	0.58
119			OF/GS		19.7	27	4,594	4,594	12.8	12.8	0.26	0.58
210			OF		40.6	11	4,570	4,570	12.7	12.7	0.26	
160			GS/CB	4287-9015	5.8	77	4,486	4,486	12.5	12.5	0.25	0.49
122			CB		6.8	56	4,460	4,460	12.4	12.4	0.25	0.41
109			CB/DW/OF/WP		64.7	3	4,367	4,367	12.1	12.1	0.25	0.23
156			PP/GS/CB	4287-9015	5.2	79	4,269	4,269	11.9	11.9	0.24	0.46
64			CB		5.0	64	4,128	4,128	11.5	11.5	0.23	
88			GS/CB/WP	3776-9010	30.5	23	3,984	3,984	11.1	11.1	0.23	0.78
219			OF		43.4	8	3,951	3,951	11.0	11.0	0.22	0.36
177			GS		31.7	13	3,835	3,835	10.7	10.7	0.22	0.45
167			GS/OF		17.0	26	3,822	3,822	10.6	10.6	0.22	0.49
37			GS/EDPMP/CB	3116-9015	4.1	85	3,805	3,805	10.6	10.6	0.22	0.38
96			GS/CB/WP	3494-9010	21.1	31	3,776	3,776	10.5	10.5	0.21	0.71
234			OF		30.8	13	3,748	3,748	10.4	10.4	0.21	
66			OF		25.9	16	3,668	3,668	10.2	10.2	0.21	
78			GS/CB		20.3	20	3,515	3,515	9.8	9.8	0.20	0.45
57			OF		25.8	14	3,375	3,375	9.4	9.4	0.19	
230			OF		30.1	11	3,305	3,305	9.2	9.2	0.19	
36			GS/SB	5658-9010	22.0	25	3,103	3,103	8.6	8.6	0.18	0.61
165			GS/OF		23.3	15	3,086	3,086	8.6	8.6	0.17	
181			GS		8.6	39	3,050	3,050	8.5	8.5	0.17	0.37
112			CB/GS		14.0	25	3,042	3,042	8.5	8.5	0.17	0.39
125			CB		5.5	55	3,036	3,036	8.4	8.4	0.17	
82			GS/CB		10.1	33	2,994	2,994	8.3	8.3	0.17	0.37
211			OF		11.9	29	2,957	2,957	8.2	8.2	0.17	
67			CB	6058-INDS	5.2	47	2,864	2,864	8.0	8.0	0.16	
154			GS/WP/CB	4286-9015	30.7	15	2,850	2,850	7.9	7.9	0.16	0.50
13			CB/EDP/SWPPP	3010-9010/ 4858-9003	24.6	20	2,813	2,813	7.8	7.8	0.16	
27			GS	3985-9015	4.5	67	2,721	2,721	7.6	7.6	0.15	0.33
208			OF		9.3	32	2,614	2,614	7.3	7.3	0.15	
127			CB		3.1	75	2,610	2,610	7.2	7.2	0.15	0.26
1			CB/EDP	3052-9010	13.4	32	2,568	2,568	7.1	7.1	0.15	0.48
200			CB/GS		12.0	25	2,536	2,536	7.0	7.0	0.14	
161			PP/GS/CB	4287-9015	4.9	61	2,507	2,507	7.0	7.0	0.14	0.33
80			GS/CB		15.2	19	2,445	2,445	6.8	6.8	0.14	0.31
76			GS/CB		17.7	15	2,445	2,445	6.8	6.8	0.14	0.30
4			OF/GS/SWPPP	3052-9010/ 4541-9003	35.1	5	2,437	2,437	6.8	6.8	0.14	0.20
48			GS/CB		34.1	2	2,407	2,407	6.7	6.7	0.14	0.09



**Middlebury - Subwatershed Prioritization and Recommendations (p2 cont.)**

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof raingardens to treat WQv (Residential)	Raingarden Cost	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
23											
33											
168									\$67,871		
43								143	\$65,632		
217											
182											
119								130	\$59,787	292	\$134,358
210								129	\$59,467		
160											
122											
109								124	\$56,826	113	\$52,157
156											
64											
88								113	\$51,844	390	\$179,200
219											
177											
167									\$49,736		
37											
96								107	\$49,136	357	\$164,009
234											
66											
78								99	\$45,736	223	\$102,794
57								95	\$43,914		
230											
36											
165								87	\$40,160		
181											
112								86	\$39,590	194	\$89,291
125											
82								85	\$38,958	186	\$85,352
211								84	\$38,480		
67											
154								81	\$37,087	252	\$115,904
13											
27											
208											
127											
1											
200								72	\$32,995	0	\$0
161											
80								69	\$31,822	154	\$71,005
76								69	\$31,814	149	\$68,754
4											
48								68	\$31,322	44	\$20,142

## Middlebury - Subwatershed Prioritization and Recommendations (p3)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
166			OF		23.0	10	2,376	2,376	6.6	6.6	0.13	
162			GS/WP/CB	4286-9015	24.2	16	2,316	2,316	6.4	6.4	0.13	0.42
30			GS		28.1	5	2,232	2,232	6.2	6.2	0.13	0.15
159			PP/GS/CB	4287-9015	4.3	61	2,228	2,228	6.2	6.2	0.13	0.29
19			GS/OF		21.7	9	2,174	2,174	6.0	6.0	0.12	
79			GS/CB		23.4	8	2,173	2,173	6.0	6.0	0.12	0.20
97			OF		22.0	9	2,143	2,143	6.0	6.0	0.12	0.21
70			OF		3.7	48	2,096	2,096	5.8	5.8	0.12	
12			CB/GS/EDP	3010-9010	19.1	19	2,055	2,055	5.7	5.7	0.12	
77			GS/CB		11.5	20	2,012	2,012	5.6	5.6	0.11	0.26
60			CB		4.1	42	2,001	2,001	5.6	5.6	0.11	
215			CB		4.0	50	1,942	1,942	5.4	5.4	0.11	0.22
21			CB/GS	3010-9010	15.0	18	1,922	1,922	5.3	5.3	0.11	
87			GS/CB/WP	3250-9010	8.3	37	1,920	1,920	5.3	5.3	0.11	0.34
190			CB		1.7	87	1,911	1,911	5.3	5.3	0.11	
179			CB/WP		5.7	47	1,891	1,891	5.3	5.3	0.11	0.30
42			CB/GS		15.0	13	1,853	1,853	5.1	5.1	0.10	
149			GS/OF		2.1	73	1,831	1,831	5.1	5.1	0.10	0.17
20			CB/GS/SWPPP	3188-9010/ 3188-9003	2.3	74	1,824	1,824	5.1	5.1	0.10	
228			CB/GS		2.4	70	1,812	1,812	5.0	5.0	0.10	
146			CB/GS		1.8	84	1,811	1,811	5.0	5.0	0.10	0.16
206			OF		16.6	11	1,796	1,796	5.0	5.0	0.10	
31			GS/CB		22.5	5	1,777	1,777	4.9	4.9	0.10	0.12
204			CB/GS		12.6	15	1,734	1,734	4.8	4.8	0.10	
188			OF		21.9	5	1,728	1,728	4.8	4.8	0.10	
236			CB/GS/EDPMP		13.9	22	1,722	1,722	4.8	4.8	0.10	
193			CB/CF	6058-INDS	2.8	63	1,713	1,713	4.8	4.8	0.10	
176			PS/WP		17.5	16	1,705	1,705	4.7	4.7	0.10	0.31
224			CB		1.8	78	1,689	1,689	4.7	4.7	0.10	
147			CB		1.8	77	1,679	1,679	4.7	4.7	0.09	0.15
75			CB/OF		8.5	22	1,648	1,648	4.6	4.6	0.09	0.21
124			CB		3.8	46	1,636	1,636	4.5	4.5	0.09	0.19
6			CB/EDPMP	3955-9015	2.1	77	1,626	1,626	4.5	4.5	0.09	0.18
232			OF		17.2	8	1,620	1,620	4.5	4.5	0.09	
144			GS		5.2	35	1,604	1,604	4.5	4.5	0.09	0.20
126			CB		1.8	77	1,547	1,547	4.3	4.3	0.09	0.15
26			GS		2.4	61	1,541	1,541	4.3	4.3	0.09	0.16
59			CB		2.6	49	1,483	1,483	4.1	4.1	0.08	
180			GS		5.4	30	1,445	1,445	4.0	4.0	0.08	0.18
10			CB/EDP/SWPPP	3010-9010/ 5420-9003	10.5	24	1,412	1,412	3.9	3.9	0.08	
221			GS		2.1	63	1,383	1,383	3.8	3.8	0.08	
143			CB/WP	3938-9015	1.7	78	1,363	1,363	3.8	3.8	0.08	0.15
9			CB/EDP/SWPPP	3010-9010/ 4914-9003	1.6	78	1,310	1,310	3.6	3.6	0.07	
138			CB/WP	3938-9015	2.1	68	1,301	1,301	3.6	3.6	0.07	0.16



## Middlebury - Subwatershed Prioritization and Recommendations (p4)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
131			OF/GS		5.7	26	1,293	1,293	3.6	3.6	0.07	
152			GS/CB	3354-9010	2.8	52	1,286	1,286	3.6	3.6	0.07	0.16
14			CB/EDP/SWPPP	3188-9010/ 3188-9003	1.8	72	1,234	1,234	3.4	3.4	0.07	
16			CB/GS/SWPPP	3188-9010/ 3188-9003	2.6	53	1,233	1,233	3.4	3.4	0.07	
187			GS/CB		5.3	27	1,227	1,227	3.4	3.4	0.07	0.16
52			GS/SWPPP	4860-9003	1.2	87	1,223	1,223	3.4	3.4	0.07	
46			CB		2.3	54	1,217	1,217	3.4	3.4	0.07	
81			GS/CB		1.9	62	1,212	1,212	3.4	3.4	0.07	0.13
216			CB		3.1	42	1,210	1,210	3.4	3.4	0.07	0.14
72			CB		1.3	75	1,177	1,177	3.3	3.3	0.07	0.11
130			CB		1.8	62	1,170	1,170	3.2	3.2	0.07	
95			CB/GS		3.7	34	1,141	1,141	3.2	3.2	0.06	0.14
41			CB/GS	3698-9010	2.7	49	1,139	1,139	3.2	3.2	0.06	
150			CB/GS/WP	3938-9015	2.6	56	1,131	1,131	3.1	3.1	0.06	0.16
11			CB/GS/EDP	3010-9010	1.1	91	1,130	1,130	3.1	3.1	0.06	
226			CB/GS		1.6	65	1,082	1,082	3.0	3.0	0.06	
116			CB	5375-9010	1.9	65	1,058	1,058	2.9	2.9	0.06	0.13
225			CB/GS		1.9	56	1,056	1,056	2.9	2.9	0.06	
145			OF		4.1	30	1,048	1,048	2.9	2.9	0.06	0.13
15			CB/EDP/SWPPP	3188-9010/ 3188-9003	1.2	84	1,040	1,040	2.9	2.9	0.06	
53			CB/PP	5751-9015	0.8	99	1,006	1,006	2.8	2.8	0.06	
39			GS/CB/DW/SB	3698-9010	3.2	45	987	987	2.7	2.7	0.06	
185			GS		7.8	13	966	966	2.7	2.7	0.05	0.11
133			CB/GS		1.5	55	954	954	2.6	2.6	0.05	
115			CB/GS/IB	5375-9010	1.3	73	946	946	2.6	2.6	0.05	0.11
171			GS/CB/WP	3251-9010	2.4	52	938	938	2.6	2.6	0.05	0.14
137			CB/WP	3938-9015	1.1	80	917	917	2.5	2.5	0.05	0.10
231			GS		2.1	45	890	890	2.5	2.5	0.05	
62			CB		0.8	82	889	889	2.5	2.5	0.05	
7			GS/EDP	3052-9010	5.8	27	871	871	2.4	2.4	0.05	0.17
92			CB/GS		3.1	32	863	863	2.4	2.4	0.05	0.11
192			CB		1.0	68	861	861	2.4	2.4	0.05	
100			OF		0.9	80	852	852	2.4	2.4	0.05	0.08
135			GS/CB		0.8	81	840	840	2.3	2.3	0.05	0.08
25			GS/OF	3985-9015	1.6	61	837	837	2.3	2.3	0.05	0.11
2			GS/EDP	3052-9010	5.2	28	832	832	2.3	2.3	0.05	0.16
237			GS/OF		6.6	13	830	830	2.3	2.3	0.05	
45			CB/GS/OF		3.7	26	830	830	2.3	2.3	0.05	
89			GS/CB/WP	3450-9010	6.8	21	809	809	2.2	2.2	0.05	0.16
32			GS/CB		9.4	6	782	782	2.2	2.2	0.04	0.06
235			CB/GS/WP		4.0	33	766	766	2.1	2.1	0.04	
8			CB/EDP/SWPPP	3010-9010/ 4914-9003	1.3	65	753	753	2.1	2.1	0.04	
29			GS		8.7	6	736	736	2.0	2.0	0.04	0.06
111			OF/WP		8.3	13	723	723	2.0	2.0	0.04	0.12

**Middlebury - Subwatershed Prioritization and Recommendations (p4 cont.)**

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof raingardens to treat WQv (Residential)	Raingarden Cost	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
131								37	\$16,830		
152											
14											
16											
187								35	\$15,970	78	\$35,896
52											
46											
81											
216											
72											
130											
95								32	\$14,851	70	\$32,352
41								32	\$14,815		
150								32	\$14,716	79	\$36,346
11											
226											
116											
225											
145											
15											
53											
39								28	\$12,839		
185								27	\$12,566	57	\$26,163
133								27	\$12,411		
115											
171								27	\$12,206	69	\$31,620
137											
231											
62											
7											
92								24	\$11,235	54	\$24,756
192											
100											
135											
25											
2											
237											
45								23	\$10,798		
89								23	\$10,527	79	\$36,121
32								22	\$10,182	31	\$14,066
235											
8											
29											
111								20	\$9,406	60	\$27,794

## Middlebury - Subwatershed Prioritization and Recommendations (p5)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
50			GS/CB		2.6	32	719	719	2.0	2.0	0.04	
40			CB/GS	3698-9010	1.9	45	709	709	2.0	2.0	0.04	
84			GS/CB		1.8	42	692	692	1.9	1.9	0.04	0.08
141			CB/WP	3938-9015	0.7	88	689	689	1.9	1.9	0.04	0.07
202			GS/CB/BR		2.3	43	663	663	1.8	1.8	0.04	
5			OF/GS		9.4	2	651	651	1.8	1.8	0.04	0.02
157			WP/GS/CB	4287-9015	4.3	26	648	648	1.8	1.8	0.04	0.13
238			GS/OF		3.2	23	633	633	1.8	1.8	0.04	
136			CB/WP	3938-9015	0.7	82	627	627	1.7	1.7	0.04	0.07
54			CB/GS		0.7	69	621	621	1.7	1.7	0.04	
98			GS		1.7	39	614	614	1.7	1.7	0.03	0.07
158			OF/GS/CB	4287-9015	4.7	17	603	603	1.7	1.7	0.03	0.09
102			CB/OF		0.7	74	602	602	1.7	1.7	0.03	0.06
223			CB		0.7	74	600	600	1.7	1.7	0.03	
209			OF/GS		5.1	10	545	545	1.5	1.5	0.03	0.06
71			CB		0.6	73	530	530	1.5	1.5	0.03	0.05
207			CB		0.6	73	513	513	1.4	1.4	0.03	
17			CB/GS		0.7	68	506	506	1.4	1.4	0.03	
164			CB/WP		0.5	91	497	497	1.4	1.4	0.03	0.05
34			GS/CB		1.2	43	492	492	1.4	1.4	0.03	0.06
120			OF		2.7	21	487	487	1.4	1.4	0.03	0.06
90			GS/CB/WP	3450-9010	5.9	12	486	486	1.4	1.4	0.03	0.08
51			GS		0.8	60	484	484	1.3	1.3	0.03	
170			GS	3251-9010	6.6	5	484	484	1.3	1.3	0.03	0.03
85			GS/CB		1.5	35	478	478	1.3	1.3	0.03	0.06
63			CB		0.4	93	472	472	1.3	1.3	0.03	
201			CB/GR		1.0	59	470	470	1.3	1.3	0.03	
113			CB/GS		2.3	24	463	463	1.3	1.3	0.03	0.06
86			GS/CB/WP		3.7	22	459	459	1.3	1.3	0.03	0.09
140			CB	3938-9015	0.5	83	448	448	1.2	1.2	0.03	0.04
110			CB/WP		2.0	35	428	428	1.2	1.2	0.02	0.08
175			GS/OF		2.1	24	427	427	1.2	1.2	0.02	0.05
73			CB/GS		0.7	59	414	414	1.2	1.2	0.02	0.04
22			CB/EDP/SWPPP	3188-9010/ 3188-9003	1.7	38	413	413	1.1	1.1	0.02	
151			CB/GS/WP	3938-9015	1.9	35	410	410	1.1	1.1	0.02	0.07
178			GS/OF	3497-9010	0.6	68	395	395	1.1	1.1	0.02	0.04
118			CB/GS		0.7	54	393	393	1.1	1.1	0.02	0.04
114			CB/GS/IB	5375-9010	1.3	43	374	374	1.0	1.0	0.02	0.06
3			GS/EDP	3052-9010	4.4	12	367	367	1.0	1.0	0.02	0.06
93			GS/CB/WP	3450-9010	0.8	57	356	356	1.0	1.0	0.02	0.05
83			GS/CB		0.5	62	354	354	1.0	1.0	0.02	0.04
139			CB/WP	3938-9015	0.8	53	342	342	1.0	1.0	0.02	0.05
212			CB/TT	4202-9010	1.8	26	341	341	0.9	0.9	0.02	
101			CB		0.5	60	339	339	0.9	0.9	0.02	0.03
58			OF/GS		1.4	28	336	336	0.9	0.9	0.02	
91			CB/GS		0.6	56	317	317	0.9	0.9	0.02	0.03
213			CB/GS		0.8	41	316	316	0.9	0.9	0.02	

**Middlebury - Subwatershed Prioritization and Recommendations (p5 cont.)**

Watershed Number	Action List #	Proposed or Existing Stormwater Treatment Practice	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Phosphorus Removal Per Pound (based on annual phosphorus load)	Assistance Program	Number of LID - Roof raingardens to treat WQv (Residential)	Raingarden Cost	Number of LID - Roof Raingardens to treat CPv (Residential)	Raingarden Cost
50								20	\$9,353		
40								20	\$9,224		
84								20	\$9,001	41	\$18,792
141											
202										0	\$0
5											
157											
238											
136											
54											
98								17	\$7,986	37	\$16,992
158											
102											
223											
209											
71											
207											
17											
164								14	\$6,470	24	\$10,859
34								14	\$6,398	29	\$13,278
120								14	\$6,336	31	\$14,291
90								14	\$6,329	38	\$17,386
51											
170								14	\$6,299	17	\$8,046
85								14	\$6,221	29	\$13,503
63											
201										0	\$0
113								13	\$6,026	30	\$13,616
86								13	\$5,967	45	\$20,593
140											
110								12	\$5,563	39	\$17,836
175											
73											
22											
151								12	\$5,339	37	\$17,104
178											
118								11	\$5,116	22	\$9,959
114											
3											
93								10	\$4,634	24	\$11,253
83								10	\$4,602	19	\$8,552
139											
212								10	\$4,432		
101											
58								9	\$4,367		
91								9	\$4,120	17	\$7,933
213								9	\$4,116		

## Middlebury - Subwatershed Prioritization and Recommendations (p6)

Watershed Number	Action List #	Proposed Action	Proposed or Existing Stormwater Treatment Practice	Permit Number	Watershed Area (Acres)	Percent Mapped Impervious Area (MIA)	Sediment Load with Current Reductions (lbs)	Sediment Load with Priority Action (lbs)	Phosphorus Load with Current Reductions (lbs)	Phosphorus Load with Priority Action (lbs)	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)
227			CB/GS		0.7	46	307	307	0.9	0.9	0.02	
121			CB		0.3	91	302	302	0.8	0.8	0.02	0.03
55			CB/GS		0.8	41	289	289	0.8	0.8	0.02	
229			CB/GS		0.2	94	275	275	0.8	0.8	0.02	
18			CB/GS		0.6	46	274	274	0.8	0.8	0.02	
47			GS/CB		2.8	9	274	274	0.8	0.8	0.02	0.03
49			CB/GS/WP		0.9	45	273	273	0.8	0.8	0.02	
155			GS/WP/CB	4286-9015	2.4	20	273	273	0.8	0.8	0.02	0.05
94			OF/WP	3450-9010	3.1	13	266	266	0.7	0.7	0.02	0.04
65			CB/CF	4247-9015	0.3	89	257	257	0.7	0.7	0.01	
24			CB/GS/EDP	3188-9010	0.7	51	247	247	0.7	0.7	0.01	
189			CB		0.2	90	239	239	0.7	0.7	0.01	
105			CB	4946-9010	0.5	45	239	239	0.7	0.7	0.01	0.02
28			GS/EDDP	3985-9015	0.4	66	234	234	0.6	0.6	0.01	0.03
35			GS/CB		0.8	33	220	220	0.6	0.6	0.01	0.03
108			CB	3322-9010	0.4	57	215	215	0.6	0.6	0.01	0.03
173			GS	3251-9010	1.8	12	179	179	0.5	0.5	0.01	0.02
61			DW		0.2	95	177	177	0.5	0.5	0.01	
129			CB		2.2	4	166	166	0.5	0.5	0.01	
222			GS		0.7	25	157	157	0.4	0.4	0.01	
205			CB		0.2	62	146	146	0.4	0.4	0.01	
191			CB		0.2	61	145	145	0.4	0.4	0.01	
56			CB/GS		0.3	47	138	138	0.4	0.4	0.01	
174			CB/GS/SBB	3713-9010	1.3	13	137	137	0.4	0.4	0.01	0.02
128			CB		0.1	96	127	127	0.4	0.4	0.01	0.01
195			CB/OF		0.3	43	115	115	0.3	0.3	0.01	
220			CB/BR	6097-9015	1.4	12	113	113	0.3	0.3	0.01	
99			GS		0.5	24	111	111	0.3	0.3	0.01	0.01
132			CB		0.1	96	107	107	0.3	0.3	0.01	
142			CB/WP	3938-9015	0.1	74	98	98	0.3	0.3	0.01	0.01
172			OF/WP	3251-9010	0.4	32	77	77	0.2	0.2	0.00	0.01
123			CB		0.1	61	69	69	0.2	0.2	0.00	0.01





# *Target Maps*

*Showing Priority Action List  
Drainage Areas*

*And Potential Retrofit Locations*

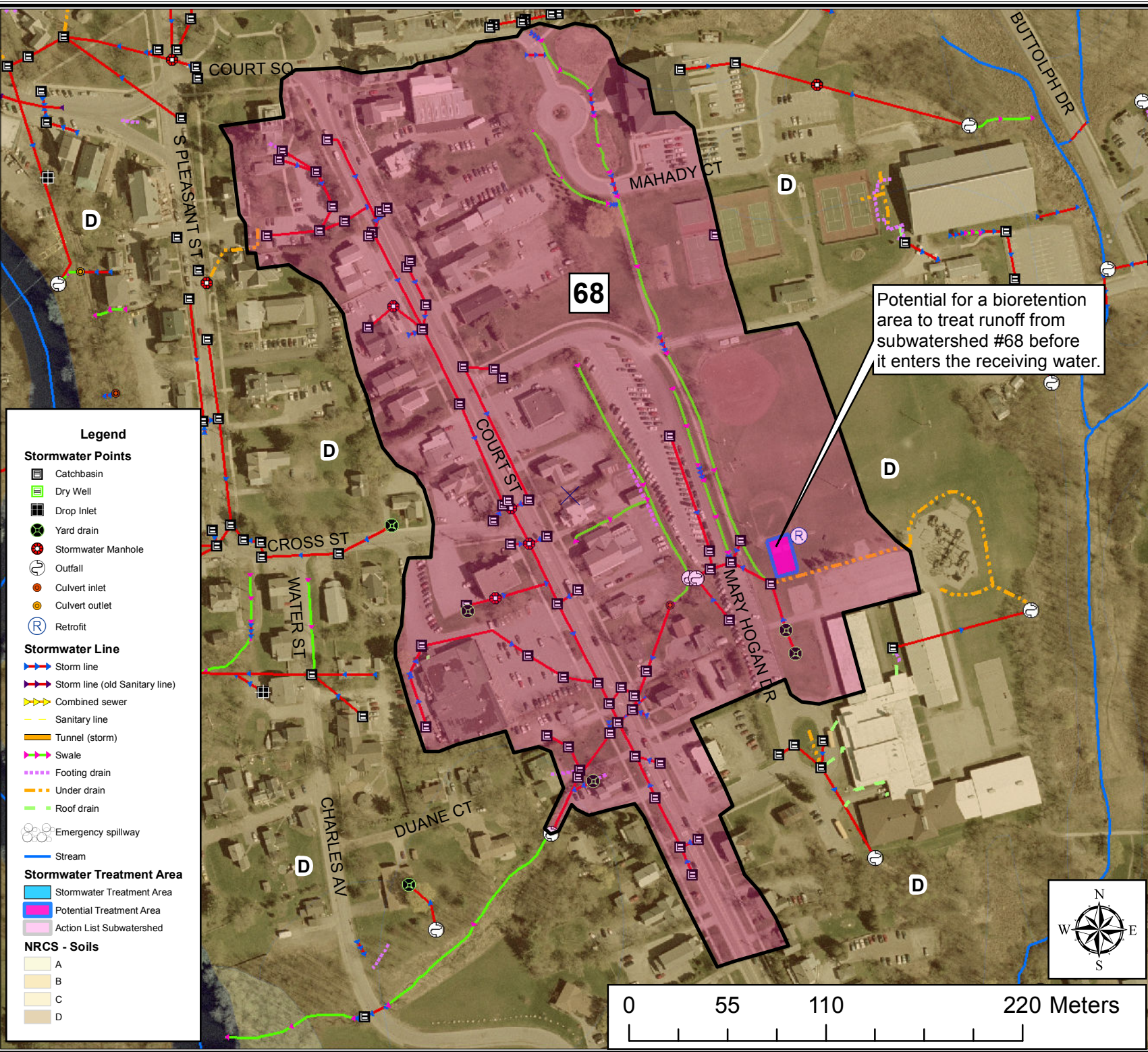
# Middlebury

## Action List 1 Subwatershed: 68

This map shows high priority subwatersheds which are ranked by connectedness, percent of impervious cover, field observations, and potential retrofit measures and locations.

The data shown on this map is only as accurate as the available sources and field observations allowed and should be used as a basic planning level tool only.

Potential for a bioretention area to treat runoff from subwatershed #68 before it enters the receiving water.



**Legend**

**Stormwater Points**

- Catchbasin
- Dry Well
- Drop Inlet
- Yard drain
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Retrofit

**Stormwater Line**

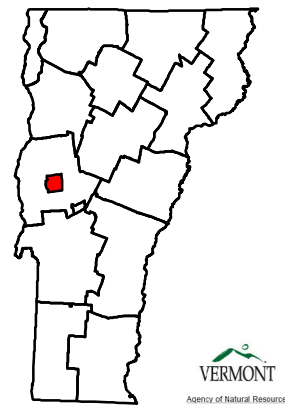
- Storm line
- Storm line (old Sanitary line)
- Combined sewer
- Sanitary line
- Tunnel (storm)
- Swale
- Footing drain
- Under drain
- Roof drain
- Emergency spillway

**Stormwater Treatment Area**

- Stormwater Treatment Area
- Potential Treatment Area
- Action List Subwatershed

**NRCS - Soils**

- A
- B
- C
- D



VTANR - DEC - WSMD  
Creator: Jim Pease, Collin Smythe  
Date: 6/7/2012  
Data Sources: Field data, Town and stormwater permit plans, existing GIS data, GPS data, municipal member knowledge, VTRANS roads data, VT Hydrography dataset, NRCS soils map  
Imagery Source: Route 7 Imagery

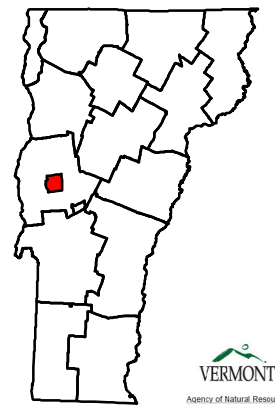
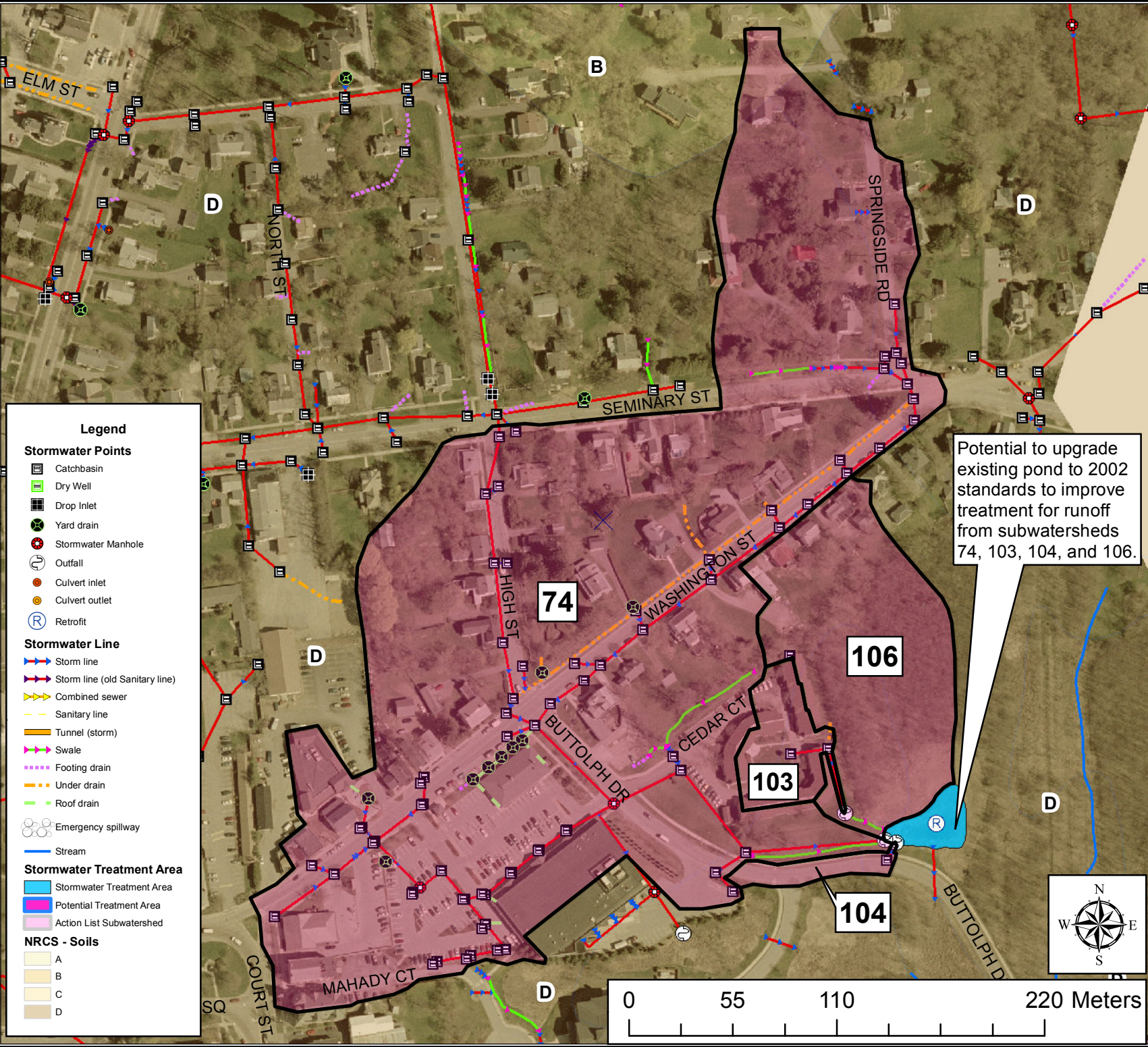
# Middlebury

**Action List 1**  
**Subwatersheds: 74, 103, 104, 106**

This map shows high priority subwatersheds which are ranked by connectedness, percent of impervious cover, field observations, and potential retrofit measures and locations.

The data shown on this map is only as accurate as the available sources and field observations allowed and should be used as a basic planning level tool only.

Potential to upgrade existing pond to 2002 standards to improve treatment for runoff from subwatersheds 74, 103, 104, and 106.



VTANR - DEC - WSMD  
 Creator: Jim Pease, Collin Smythe  
 Date: 6/7/2012  
 Data Sources: Field data, Town and stormwater permit plans, existing GIS data, GPS data, municipal member knowledge, VTRANS roads data, VT Hydrography dataset, NRCS soils map  
 Imagery Source: Route 7 Imagery

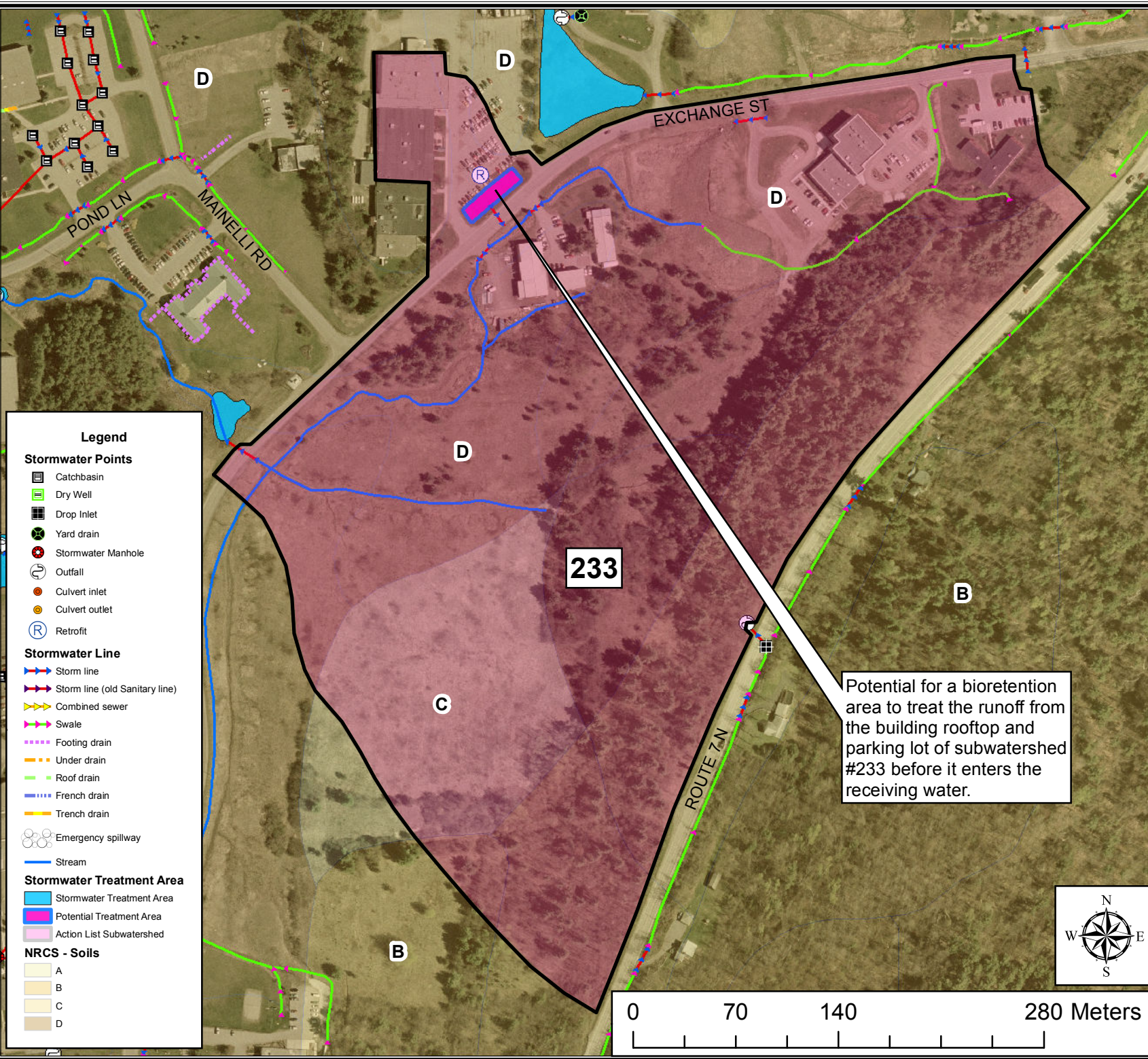
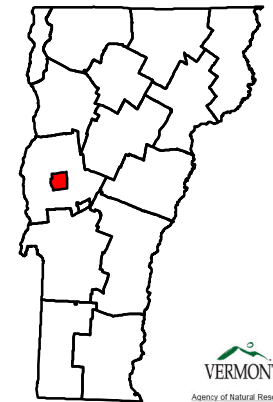
# Middlebury

## Action List 1

Subwatershed: 233

This map shows high priority subwatersheds which are ranked by connectedness, percent of impervious cover, field observations, and potential retrofit measures and locations.

The data shown on this map is only as accurate as the available sources and field observations allowed and should be used as a basic planning level tool only.



**Legend**

**Stormwater Points**

- Catchbasin
- Dry Well
- Drop Inlet
- Yard drain
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Retrofit

**Stormwater Line**

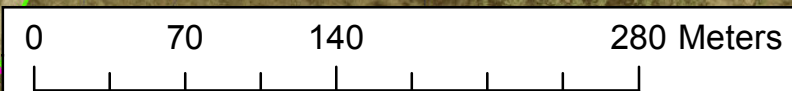
- Storm line
- Storm line (old Sanitary line)
- Combined sewer
- Swale
- Footing drain
- Under drain
- Roof drain
- French drain
- Trench drain
- Emergency spillway

**Stormwater Treatment Area**

- Stormwater Treatment Area
- Potential Treatment Area
- Action List Subwatershed

**NRCS - Soils**

- A
- B
- C
- D



Potential for a bioretention area to treat the runoff from the building rooftop and parking lot of subwatershed #233 before it enters the receiving water.

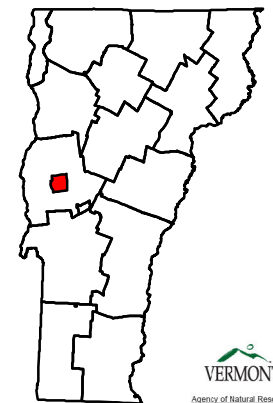
VTANR - DEC - WSMD  
Creator: Jim Pease, Collin Smythe  
Date: 6/8/2012  
Data Sources: Field data, Town and stormwater permit plans, existing GIS data, GPS data, municipal member knowledge, VTRANS roads data, VT Hydrography dataset, NRCS soils map  
Imagery Source: Route 7 Imagery

# Middlebury

## Action List 1 Subwatershed: 3000

This map shows high priority subwatersheds which are ranked by connectedness, percent of impervious cover, field observations, and potential retrofit measures and locations.

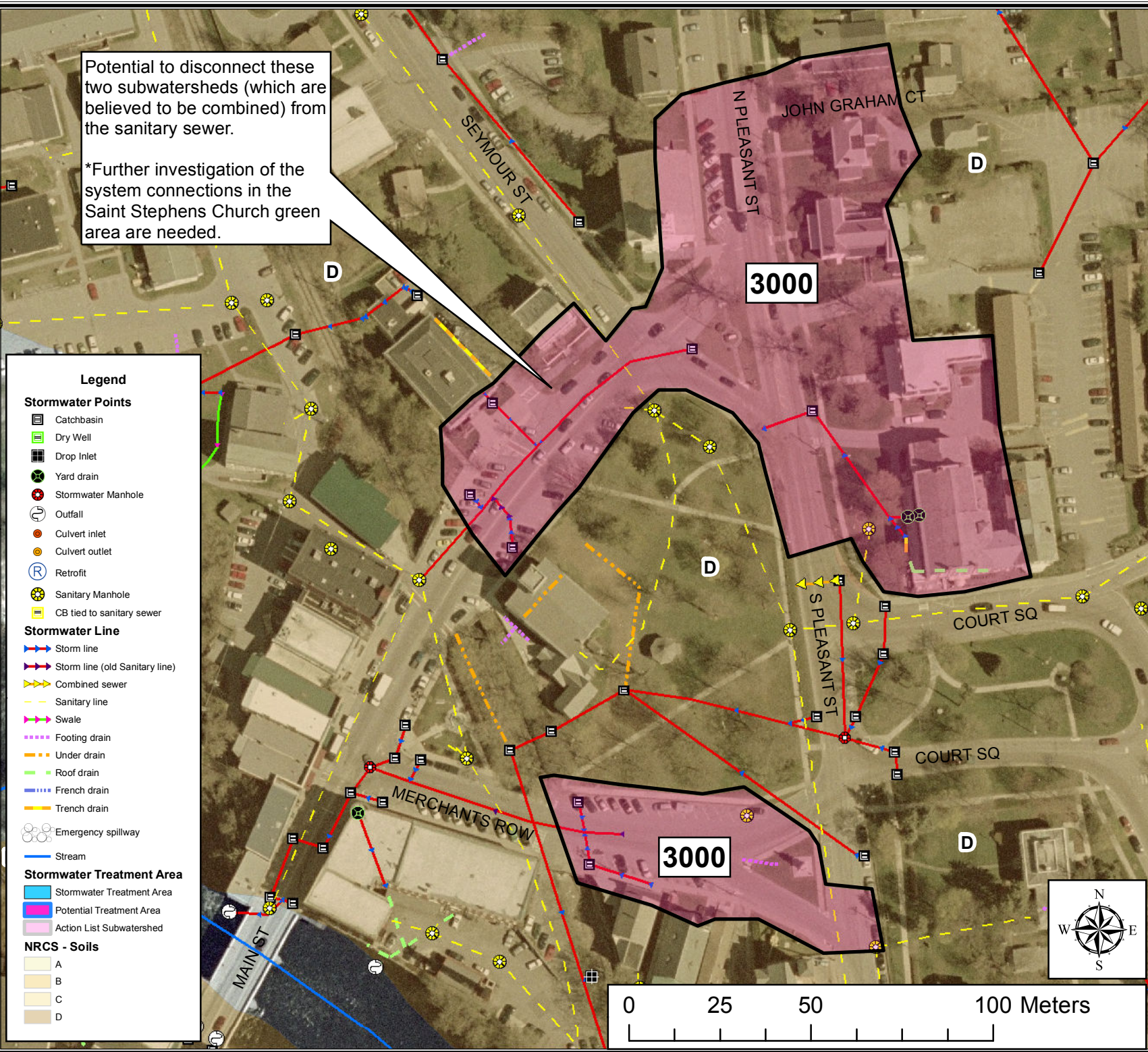
The data shown on this map is only as accurate as the available sources and field observations allowed and should be used as a basic planning level tool only.



VTANR - DEC - WSMD  
Creator: Jim Pease, Collin Smythe  
Date: 6/8/2012  
Data Sources: Field data, Town and stormwater permit plans, existing GIS data, GPS data, municipal member knowledge, VTRANS roads data, VT Hydrography dataset, NRCS soils map  
Imagery Source: Route 7 Imagery

Potential to disconnect these two subwatersheds (which are believed to be combined) from the sanitary sewer.

\*Further investigation of the system connections in the Saint Stephens Church green area are needed.



### Legend

#### Stormwater Points

- Catchbasin
- Dry Well
- Drop Inlet
- Yard drain
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Retrofit
- Sanitary Manhole
- CB tied to sanitary sewer

#### Stormwater Line

- Storm line
- Storm line (old Sanitary line)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- French drain
- Trench drain

#### Emergency spillway

- Stream

#### Stormwater Treatment Area

- Stormwater Treatment Area
- Potential Treatment Area
- Action List Subwatershed

#### NRCS - Soils

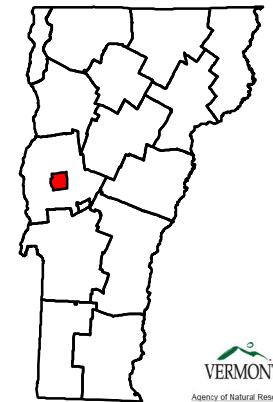
- A
- B
- C
- D

# Middlebury

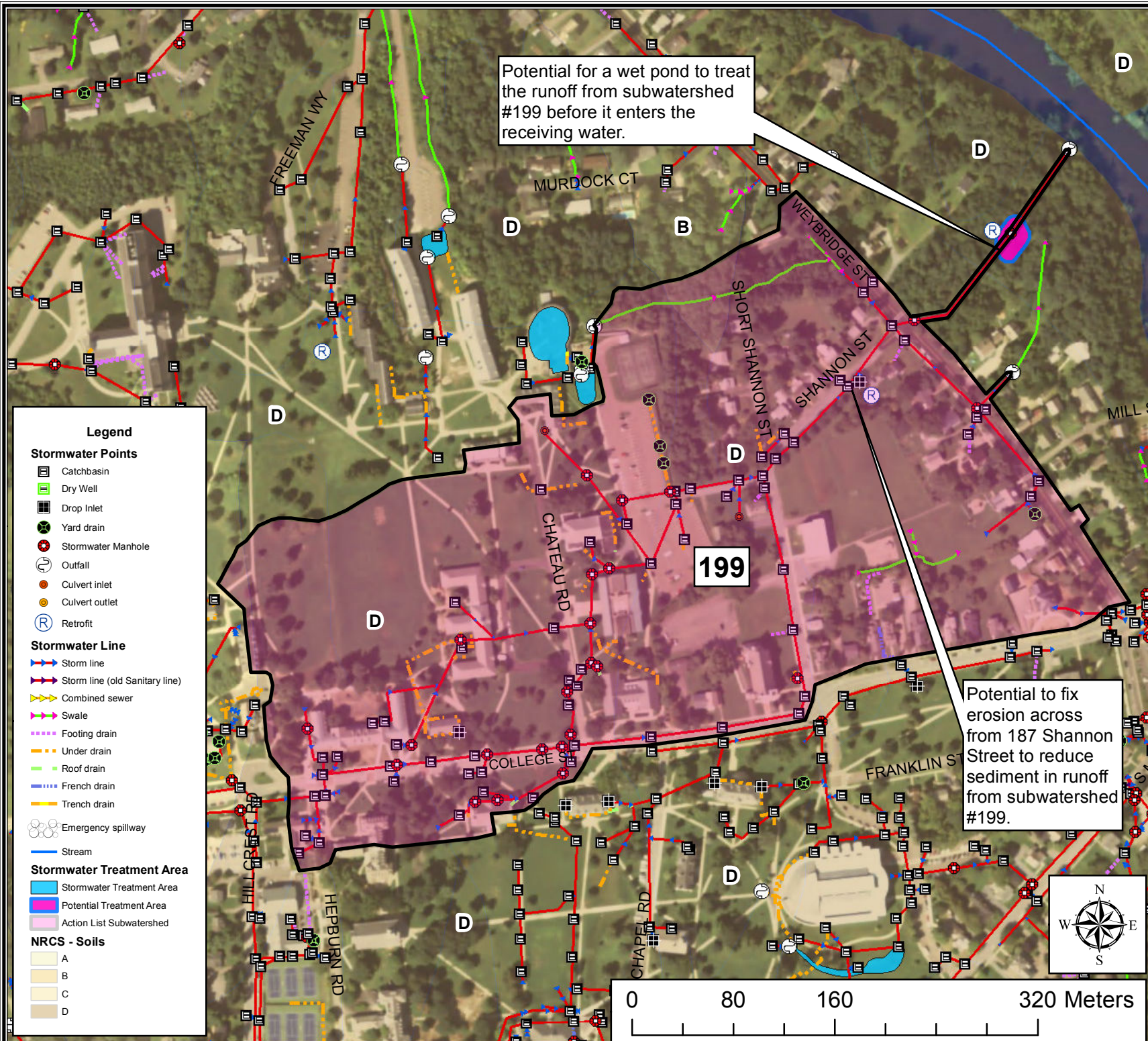
## Action List 1 & 2 Subwatershed: 199

This map shows high priority subwatersheds which are ranked by connectedness, percent of impervious cover, field observations, and potential retrofit measures and locations.

The data shown on this map is only as accurate as the available sources and field observations allowed and should be used as a basic planning level tool only.



VTANR - DEC - WSMD  
 Creator: Jim Pease, Collin Smythe  
 Date: 6/8/2012  
 Data Sources: Field data, Town and stormwater permit plans, existing GIS data, GPS data, municipal member knowledge, VTRANS roads data, VT Hydrography dataset, NRCS soils map  
 Imagery Source: NAIP 2011



Potential for a wet pond to treat the runoff from subwatershed #199 before it enters the receiving water.

Potential to fix erosion across from 187 Shannon Street to reduce sediment in runoff from subwatershed #199.

**Legend**

**Stormwater Points**

- Catchbasin
- Dry Well
- Drop Inlet
- Yard drain
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Retrofit

**Stormwater Line**

- Storm line
- Storm line (old Sanitary line)
- Combined sewer
- Swale
- Footing drain
- Under drain
- Roof drain
- French drain
- Trench drain
- Emergency spillway

**Stormwater Treatment Area**

- Stormwater Treatment Area
- Potential Treatment Area
- Action List Subwatershed

**NRCS - Soils**

- A
- B
- C
- D

*Spill Control*

*and*

*Vermont Hazardous Waste Management  
Regulations*



## **Have a spill control plan for accidental spills at municipal facilities and on municipal streets**

These stormwater infrastructure maps show the connectivity of the stormwater system for the municipality as accurately as it could be determined with the collected and existing data. In the event of a spill this can be a valuable tool for controlling spills and in spill response.

Towns should be equipped with suitable equipment to contain and clean up spills of hazardous materials. Accidental spills of materials can be sources of runoff pollution if not addressed appropriately. If possible Towns should be prepared to address spills on municipal streets while at the same time contacting the state Waste Management Division. DPW managers should be aware of all applicable requirements and should contact regulatory authorities if requirements are not known.

All spills should be cleaned up immediately after they occur. For municipal facilities the creation of a site specific spill control and response plan in combination with spill response training for designated on-site personnel can be effective in dealing with accidental spills and preventing the contamination of soil, water, and runoff. Preparation of a spill containment, control, and countermeasures (SPCC) plan might be required to meet regulatory requirements (e.g., requirements regarding storage of specified chemicals above certain volume thresholds).

Even if a formal plan is not required, preparing one is a good idea. In general, an SPCC plan should include guidance to site personnel on the following:

- Proper notification when a spill occurs;
- Site responsibility with respect to addressing the cleanup of a spill;
- Stopping the source of a spill;
- Cleaning up a spill;
- Proper disposal of materials contaminated by the spill;
- Location of spill response equipment programs; and
- Training for designated on-site personnel.

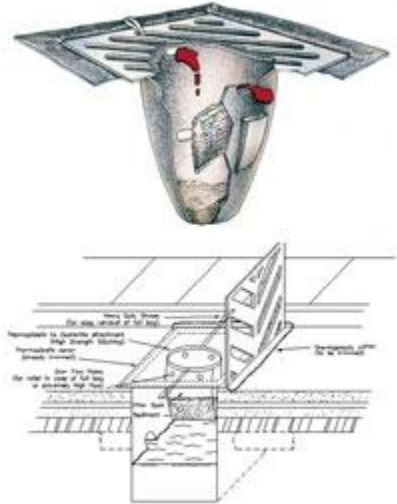
A periodic spill “fire drill” should be conducted to help prepare Town personnel in the event of a spill.

# *Spill Prevention and Response Measures*

## **Catch Basin Inserts**

Catch Basin Inserts (Drain Guards / Sediment Traps) protect our rivers and streams by capturing sediment, debris, oil and grease at storm water catch basins. Catch Basin Inserts are an economical and effective method to protect you from costly clean-up work.

The standard filter material is a non-woven geotextile with built-in overflow ports for cases of abnormally high water flow or over-filled filter bags. Catch Basin Inserts are available with a replaceable 5" x 15" oil absorbent boom that floats to absorb any oil, gas or diesel entering a storm water catch basin.



## **Urethane Drain Protector**

Urethane Drain Protectors are positive sealing drain covers that ensure spills do not enter drains. Drain Protectors are environmentally safe and resistant to chemicals, solvents and hydrocarbons. After use, the Drain Protector can be washed and stored in its tube storage container.



## **Absorbent Socks**

Absorbent socks are flexible tubes used to contain and clean-up spilled fluids. Socks are widely used in industrial applications and are ideal for Spill Kits. Fast spreading spills are quickly stopped with a sock.



## Drums & Intermediate Bulk Containers (IBC's)

New and reconditioned steel drums are ideal for storing solid and liquid waste. Poly drums available for durable outdoor storage or for building your own spill kits. Steel and poly drums are available in both tight-head (TH) and full open-head styles (FOH).



## Pads & Rolls

Absorbent pads and rolls made from polypropylene fibers are the most popular form of absorbents on the market. Various types of absorbent pads and rolls can be used for different liquids and site applications.



The most widely used absorbent pads and rolls are oil-only (white) and universal (grey). Pads and rolls are great for spills on water or land, easily absorbing 20 to 25 times their own weight in recovered liquid. Rolls can easily be cut to the exact size required.



## Booms

### Linkable Absorbent Booms

Absorbent booms are ideal for containing and cleaning up spills on water. Booms repel water and float even when completely saturated.

Absorbent booms are constructed with a strong mesh outer skin encasing non-linting and highly absorbent polypropylene filler. Linkable booms come complete with end rings and clips attached to nylon rope running the length of the boom.



## **Collection basins**

Collection basins are permanent structures in which large spills or contaminated storm water is contained and stored before cleanup or treatment. Collection basins are designed to receive spills, leaks, etc., and to prevent pollutants from being released into the environment. Unlike containment dikes, collection basins can receive and contain materials from many locations across a facility.

## **Containment diking**

Containment dikes are temporary or permanent earth or concrete berms or retaining walls that are designed to hold spills. Diking can be used at any industrial facility, but is most common for controlling large spills or releases from liquid storage and transfer areas. Diking can provide one of the best protective measures against the contamination of storm water because it surrounds the area of concern and keeps spilled materials separated from the storm water outside of the diked area.

## **Curbing**

Similar to containment diking, a curb is a barrier that surrounds an area of concern. Unlike diking, curbing is unable to contain large spills and is usually implemented on a small-scale basis. However, curbing is common at many facilities and in small areas where liquids are handled and transferred.

## **Granular Absorbents**

A variety of granular and powdered absorbents are available for the effective clean-up of spills on streets, construction sites and in repair shops. These products absorb spilled liquids of various kinds to greatly lower the viscosity, aiding in the clean-up of the spill.

## **Sorbents, Gels, and Foams**

Sorbents are compounds that immobilize materials by surface absorption or adsorption in the sorbent bulk. Gelling agents interact with the spilled chemical(s) by concentrating and congealing to form a rigid or viscous material more conducive to a mechanical cleanup. Foams are mixtures of air and aqueous solutions of proteins and surfactant-based foaming agents. The primary purpose of foams is to reduce the vapor concentration above the spill surface, thereby controlling the rate of evaporation.

# VERMONT HAZARDOUS WASTE MANAGEMENT REGULATIONS

## § 7-105 EMERGENCY AND CORRECTIVE ACTIONS

### (a) Emergency actions

(1) In the event of a discharge of hazardous waste or a release of a hazardous material, the person in control of such waste or material shall:

(A) Take all appropriate immediate actions to protect human health and the environment including, but not limited to, emergency containment measures and notification as described below; and

(B) Take any further clean up actions as may be required and approved by federal, state, or local officials, or corrective actions as specified under **subsection (b)** of this section so that the discharged waste or released material and related contaminated materials no longer present a hazard to human health or the environment.

### (2) Reporting

(A) All discharges and/or releases that meet any of the following criteria shall be immediately reported to the Secretary by the person or persons exercising control over such waste by calling the Waste Management Division at **(802) 241-3888**, Monday through Friday, 7:45 a.m. to 4:30 p.m. or the Department of Public Safety, Emergency Management Division at **(800) 641-5005**, 24 hours/day:

(i) A discharge of hazardous waste, or release of hazardous material that exceeds 2 gallons;

(ii) A discharge of hazardous waste, or release of hazardous material that is less than or equal to 2 gallons and poses a potential or actual threat to human health or the environment; or

(iii) A discharge of hazardous waste, or release of hazardous material that equals or exceeds its corresponding reportable quantity under CERCLA as specified under **40 CFR § 302.4**.

Note: Under the Federal Water Pollution Control Act, certain spills of “oil” and/or “hazardous substances” are prohibited and must be reported pursuant to the requirements of **40 CFR Part 110** / Discharge of Oil. Certain spills of hazardous substances must also be reported pursuant to CERCLA. In both cases, the National Response Center must be notified at **(800) 424-8802**. Finally, in addition to federal and state spill reporting, EPCRA requires that spills are also reported to local authorities.

## VERMONT HAZARDOUS WASTE MANAGEMENT REGULATIONS

- (B) A written report shall be submitted to the Secretary within ten (10) days following any discharge or release subject to **subsection (a)(1)** of this section. The report should be sent to: The Vermont Department of Environmental Conservation, Waste Management Division, 103 South Main Street, Waterbury, VT 05671-0404. The person responsible for submitting the written report may request that it not be submitted for small discharges and/or releases that were reported pursuant to subsection (a)(2)(A) of this section, and that have been entirely remediated within the ten (10) day period immediately following the discharge and/or release
- (3) If the discharge or release occurred during transportation, the transporter shall, in addition to notifying the Secretary:
- (A) Notify the National Response Center at (800) 424-8802 or (202) 426-2675, if required by **49 CFR § 171.15**; and
  - (B) Report in writing to the Director, Office of Hazardous Materials Regulations, Materials Transportation Bureau, Department of Transportation, Washington, D.C. 20590, if required by **49 CFR § 171.16**; and
  - (C) A water (bulk shipment) transporter who has discharged hazardous wastes must give the same notice as required by **33 CFR § 153.203** for oil and hazardous substances.
- (4) If a discharge or release occurs and the Secretary determines that immediate removal of the waste is necessary to protect human health or the environment, the Secretary may authorize its removal by unpermitted transporters without the preparation of a manifest. Such hazardous waste may be transported to a site authorized by the Secretary under the provisions of **§ 7-503** to temporarily accept hazardous waste generated during an emergency cleanup of a discharge or release.
- (5) In the case of an explosives or munitions emergency response, if a Federal, State, Tribal or local official acting within the scope of his or her official responsibilities, or an explosives or munitions emergency response specialist, determines that immediate removal of the material or waste is necessary to protect human health or the environment, that official or specialist may authorize the removal of the material or waste by transporters who do not have EPA identification numbers or hold Vermont hazardous waste transportation permits and without the preparation of a manifest. In the case of emergencies involving military munitions, the responding military emergency response specialist's organizational unit must retain records for three years identifying the dates of the response, the responsible persons responding, the type and description of material addressed, and its disposition.

## VERMONT HAZARDOUS WASTE MANAGEMENT REGULATIONS

(6) All clean up debris and residues that are hazardous waste must be transported ultimately to either:

(A) A designated facility;

(B) A person authorized by the Secretary to use such waste if the waste has been delisted pursuant to § 7-218;

(C) Some other location specified and authorized by the Secretary to receive clean up debris and residues if the waste has been delisted pursuant to § 7-218; or

(D) For hazardous waste not defined as hazardous in 40 CFR Part 261 (i.e., waste regulated as hazardous by Vermont), to a facility, that is not a designated facility, located in a state other than Vermont provided the facility can receive such waste under applicable state and local laws, regulations and ordinances.

(b) Corrective actions

(1) If a discharge of hazardous waste, or a release of hazardous material has not been adequately addressed under **subsection (a)(1)(A)** of this section the Secretary may require that the person or persons responsible pursuant to **10 V.S.A. § 6615** complete the following:

(A) Engage the services of an environmental consultant experienced in the investigation and remediation of hazardous waste-contaminated sites; and

(B) Within thirty (30) days from either the date of the discharge/release or the date that the release was discovered if the date of discharge/release is not known, or within a period of time established by an alternative schedule approved by the Secretary, submit for approval by the Secretary a work plan for an investigation of the contaminated site (i.e., site investigation) prepared by the environmental consultant. The site investigation shall define the nature, degree and extent of the contamination; and shall assess potential impacts to human health and the environment (refer to the document titled: "Site Investigation Procedure" which is available from the Secretary upon request); and

(C) Perform the site investigation within either ninety (90) days of receiving written approval of the work plan by the Secretary, or a period of time established by an alternative schedule approved by the Secretary. A report detailing the findings of the site investigation shall be sent to the Secretary for review; and

## VERMONT HAZARDOUS WASTE MANAGEMENT REGULATIONS

(D) Within either thirty (30) days from the date of final acceptance of the site investigation report by the Secretary, or a period of time established by an alternative schedule approved by the Secretary, submit a corrective action plan prepared by the environmental consultant (refer to the document titled: “Corrective Action Guidance” which is available from the Secretary upon request); and

(E) Implement the corrective action plan within either ninety (90) days of receiving written approval of the plan by the Secretary, or a period of time established by an alternative schedule approved by the Secretary. The corrective action activity shall continue until the contamination is remediated to levels approved by the Secretary; and

(F) Submit to the Secretary all investigative, corrective action and monitoring reports, and all analytical results related to subsections (b)(1)(C) through (E) of this section, as they become available.

(2) A used or fired military munition is a waste and is potentially subject to corrective action authorities pursuant to 10 V.S.A. § 6615, and the process described by subsection (b)(1) of this section if the munition lands off-range and is not promptly rendered safe or retrieved. Any imminent and substantial threats associated with any remaining material must be addressed. If remedial action is infeasible, the operator of the range must maintain a record of the event for as long as any threat remains. The record must include the type of munition and its location (to the extent the location is known).

### § 7-106 LAND DISPOSAL RESTRICTIONS

(a) Certain hazardous wastes shall not be disposed of in or on the land. **40 CFR Part 268**, which is hereby incorporated by reference, except for 40 CFR §§ 268.5, 268.6, and 268.42(b), identifies those wastes which shall not be land disposed and describes the limited circumstances under which an otherwise prohibited waste may continue to be land disposed. The authority for implementing the CFR sections not incorporated by reference remains with the EPA.

**Note:** A copy of 40 CFR Part 268 (the Land Disposal Restrictions rule), as incorporated by these regulations, is available from the Secretary upon request.



## VERMONT HAZARDOUS WASTE MANAGEMENT REGULATIONS

(b) In addition to the prohibitions of **40 CFR Part 268**, the Secretary may restrict the land disposal of any hazardous waste in the State of Vermont:

- (1) Which may present an undue risk to human health or the environment, immediately or over a period of time; or
- (2) Which would be incompatible with the **groundwater protection rule and strategy** of chapter 12 of the environmental protection rules.

(c) Dilution of hazardous waste subject to the land disposal restrictions of **40 CFR Part 268** is prohibited pursuant to **40 CFR § 268.3**.

### § 7-107 ENFORCEMENT

(a) Information that the generation, transportation, treatment, storage or disposal of hazardous waste may present an actual or potential threat to human health or the environment, or is a violation of the 10 V.S.A. chapter 159, or these regulations, or any term or condition of certification, order, or assurance, may serve as grounds for an enforcement action by the Secretary, including, but not limited to:

(1) After notice and opportunity for hearing, issuing an order directing any person to take such steps as are necessary to:

- (A) Immediately cease and desist any operation or practice;
- (B) Correct or prevent environmental damage likely to result from any deficiency in operation or practice;
- (C) Suspend or revoke any certification and require temporary or permanent cessation of the operation of such facility;

(2) A request that the Attorney General or appropriate State's Attorney commence an action for injunctive relief, the imposition of penalties and fines provided in **10 V.S.A. § 6612** and other relief as may be appropriate.

(3) An order for reimbursement to any agency of federal, state, or local government from any person whose act caused governmental expenditures under **10 V.S.A § 1283**.

(4) All other powers of enforcement available to the Secretary through **10 V.S.A., chapter 201**.

## VERMONT HAZARDOUS WASTE MANAGEMENT REGULATIONS

(b) The hearing by the Secretary identified under **subsection (a)(1)** of this section shall be conducted as a contested case. Pursuant to **10 V.S.A. § 6610(b)**, the Secretary may issue an emergency order without a prior hearing when an ongoing violation presents an immediate threat of substantial harm to the environment or an immediate threat to public health. An emergency order shall be effective upon actual notice to the person against whom the order is issued. Any person to whom an emergency order is issued shall be given the opportunity for a hearing within five (5) business days of the date the order is issued.

(c) Inspections, investigations, and property access (**10 V.S.A. § 8005**)

(1) Inspections and investigations

(A) An investigator may perform routine inspections to determine compliance.

(B) An investigator may investigate upon receipt or discovery of information that an activity is being or has been conducted that may constitute or cause a violation.

(C) An investigator, upon presentation of credentials, may seek permission to inspect or investigate any portion of the property, fixtures, or other appurtenances belonging to or used by a person whose activity is required to be in compliance. The investigator shall state the purpose of the inspection or investigation. An inspection or investigation may include monitoring, sampling, testing, and copying of any records, reports, or other documents relating to the purposes to be served by compliance.

(D) If permission for an inspection or investigation is refused, the investigator may seek an access order from the district or superior court in whose jurisdiction the property is located enabling the investigator to perform the inspection or investigation.

(2) Access orders

(A) If access has been refused, an access order may be sought pursuant to either **10 V.S.A. § 8005** or **10 V.S.A. § 6609**.

(B) Issuance of an access order shall not negate the Secretary's authority to initiate criminal proceedings in the same matter by referring the matter to the office of the attorney general or a state's attorney.

## VERMONT HAZARDOUS WASTE MANAGEMENT REGULATIONS

(d) In an action to enforce these regulations, anyone raising a claim that a certain material is not a hazardous waste, or is exempt from regulation as hazardous waste, must demonstrate that there is a known market or disposition for the material, and that they meet the terms of the exclusion or exemption. Appropriate documentation (such as contracts showing that a second person uses the material as an ingredient in a production process) to demonstrate that the material is not a waste, or is exempt from regulation, must be provided. Owners and operators of facilities claiming that they are actually recycling materials must show that they have the necessary equipment to do so.