Town of Ludlow

Stormwater Infrastructure Mapping Project

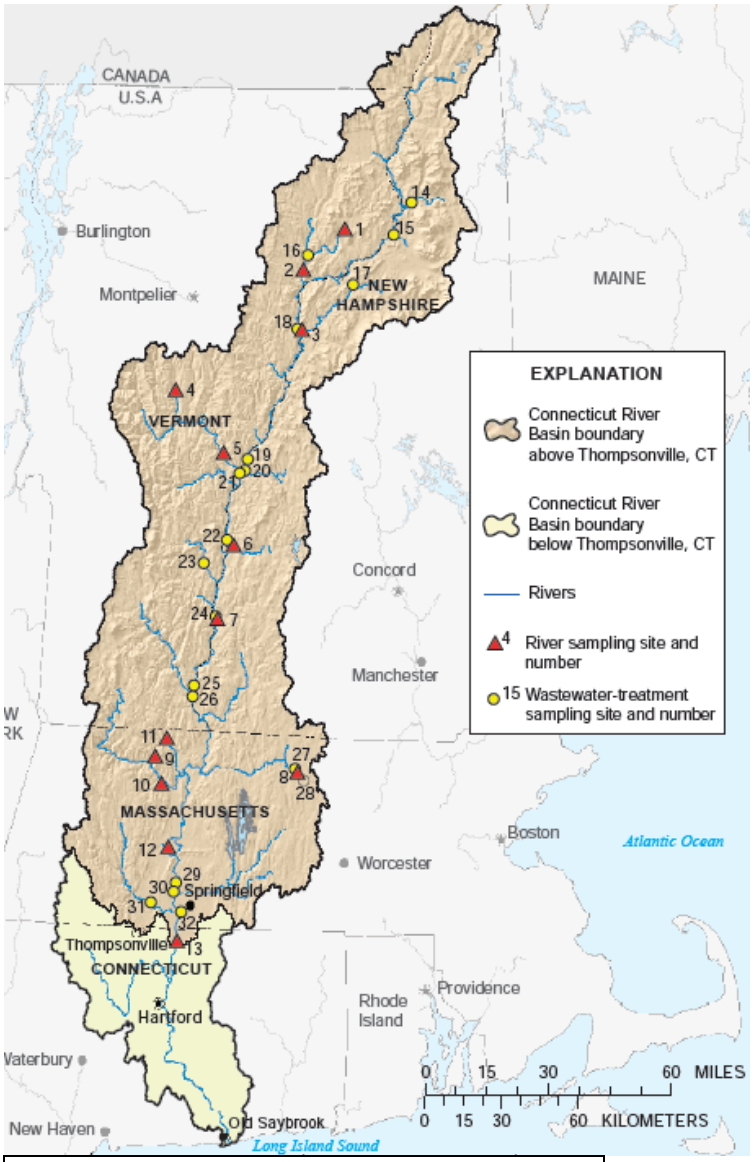
April 2016

VTDEC – CLEAN WATER INITIATIVE PROGRAM, WATERSHED MANAGEMENT DIVISION

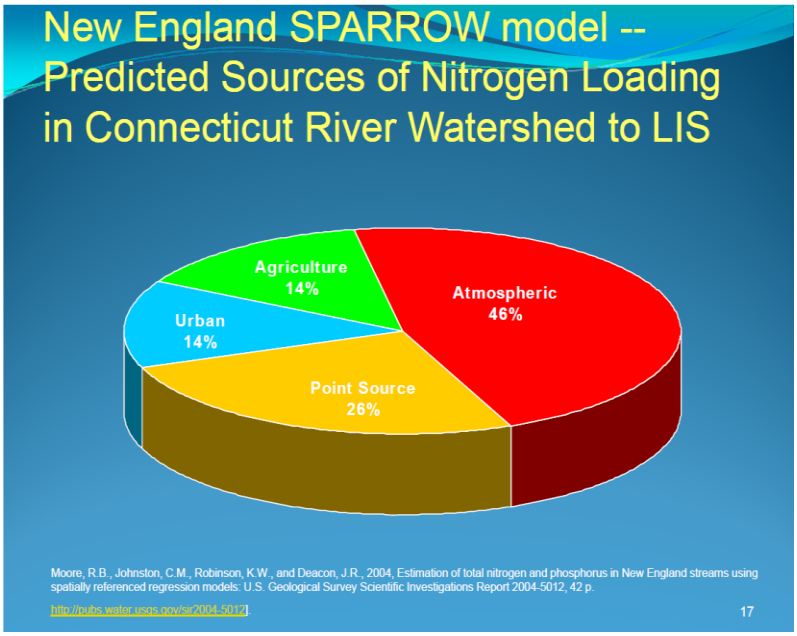
dec.vermont.gov/watershed/cwi/manage/idde

David Ainley, David.Ainley@vermont.gov
Jim Pease, Jim.Pease@vermont.gov

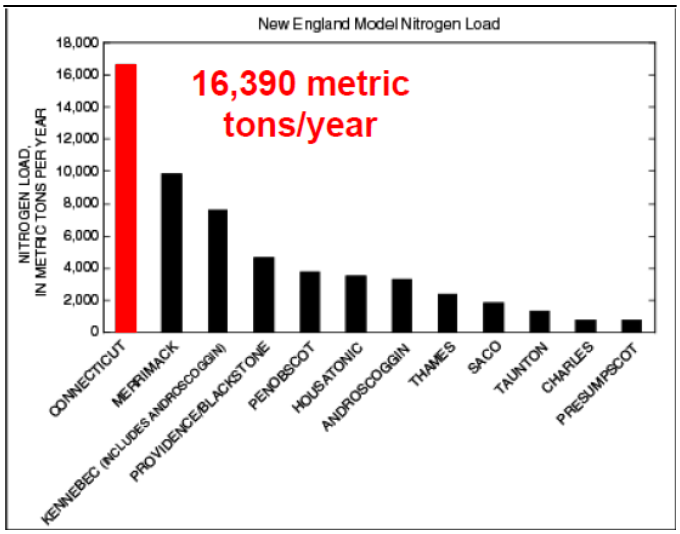
Long Island Sound – Connecticut River Watershed Nitrogen Overview



- This map shows an overview of the extent of the Connecticut River watershed including areas of Vermont, New Hampshire, Massachusetts, and Connecticut.



- This figure shows the modeled nitrogen loading contribution per year from the Connecticut River basin to the Long Island Sound.



- This graph shows the breakdown of the modeled nitrogen load from the Connecticut River watershed to the Long Island Sound from various sources.

- Above figure taken from USGS – *Assessment of Total Nitrogen in the Upper Connecticut River Basin in New Hampshire, Vermont, and Massachusetts, Dec 2002 – Sept 2005*. http://pubs.usgs.gov/sir/2006/5144/pdf/sir2006-5144.pdf

- Above figures taken from EPA/USGS – *Application of NHDPlus for SPARROW nutrient modeling of the Northeastern and Mid-Atlantic Region of the US* http://www.awra.org/orlando2010/presentations/Session22/NHDPlus_SPARROW_AWRA20100330-good.pdf

Overview

This stormwater infrastructure mapping project was completed for the municipality by the Agency of Natural Resources Clean Water Implementation Program.

The GIS maps and geodatabase are meant to provide an overall picture of the connectivity or connectedness of the storm system on both public and private properties in order to raise the public's awareness of the impact of stormwater runoff and the need for regular system maintenance. The generation and transport of nonpoint source pollution increases with increasing connectivity of a drainage system. Knowledge of the geographic extent of the system is also essential for the detection and elimination of illicit wastewater discharges that can be found in the stormwater system. Outfall locations and system connectedness data are used as a basis for locating illicit or illegal discharges of non-stormwater to the municipal storm system and tracing them to the source. Having an understanding of the connectedness of the system is also a valuable tool for hazardous material spill planning and prevention. 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. Documentation 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. Awareness of where storm drains are located can also assist municipalities and residents with emergency preparedness for large rainfall events (i.e. Tropical Storms or Hurricanes) or spring snowmelt runoff events. By keeping storm drains clean and clear a great deal of localized flooding can be prevented. Finally, by providing a more thorough understanding of the system this project could be the basis for a local stormwater ordinance or be used to help create or enhance a municipal 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 2.1inch 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.

Act 64 Municipal Roads General Permit (MRGP)

The 2015 Vermont Legislature adopted Act 64 which will require all municipalities to address stormwater runoff from all existing municipal roads. The time line for adopting this general permit is as follows: December 2016 – Draft general permit available for public review, January-December 2017 public comment and review, January 2018 final general permit issued; municipalities must file notice of intents to comply with the permit, currently proposed for summer-fall 2018. The permit will likely require:

- An evaluation of municipal roads to see if they meet new MRGP standards. Road segments that can impact waterways will be prioritized for remediation.
- Municipal development of a road stormwater management plan which will include a prioritization of road remediation efforts, capital budget, and implementation schedule
- Implementation schedule and the municipality's transportation capital plan

Towns will submit annual reports to DEC documenting progress in road BMP implementation and MRGP compliance. This infrastructure report and the mapping information

contained in it can be used by municipalities to develop the plan for the directly connected paved with catchbasin segments of municipal roadways. A graphical estimate of which roads meet this criterion is shown in the map(s) on the following page. While the general permit requirements for directly connected paved roads with catchbasins is currently under discussion and not final it is very likely these road segments will need to have more frequent cleaning activities and outfall erosion repair. As with other classes of roads covered by this permit the municipality should first check the maps provided. It is suggested (although not currently required) that the following steps be taken to check the maps to determine what road segments will require municipal attention for cleaning or erosion repair:

1. Using the provided maps and/or data as a guide confirm that these sections of roads are paved, have catch basins, and the discharge pipe from those catchbasins is directly discharging to waters of the state (include any outfall within 500 linear feet of surface waters).

2. For those sections of directly connected roads use two calibrated rods and measure the catch basin depth to the outlet pipe invert and the depth to the floor of the sump, subtract the difference and record which catch basins have at least a 12" sump between the sump floor and the invert. These basins and the main storm line(s) between them will likely be required to be cleaned in the future under the general permit.

3. If you do not already do so, you must prepare a street sweeping log book, and include in the log book at a minimum, the street names for the directly connected paved with catchbasin sections and record the month and year each these road sections are swept and the type of sweeper used (brush, vacuum, regenerative air, or high efficiency).

4. Using the maps locate the outfall and note any level of erosion present in the outfall and/or the 500 foot or less long swale between the pipe outlet and waters of the state.

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.

Abbreviation Key	
Code	**Structure Type**
BB	Baffle Box
BFCB	Baffled Catchbasin
BRA	Bioretention Area (aka Bioretention Filter)
BS	Buffer Strip (25' Min.)
CB	Catch Basin
CBI	Catch Basin Insert
CD	Check Dam
DI	Drop Inlet
DP	Dry Pond
DS	Dry Swale
DW	Drywell
EDP	Extended Detention Pond with Micropool (aka Micropool Extended Detention Basin)
GR	Green Roof
GS	Grass Swale (aka Open Channel)
IB	Infiltration Basin
IG	Infiltration Gallery
IP	Infiltration Pipe
OF	Overland Flow
OGF	Organic Filter
PA/PC	Pervious Asphalt or Pervious Concrete
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/VS	Swirl Separator
ST	Septic Tank
SWPPP	Stormwater Pollution Prevention Plan
TT	Treatment Tank
WL	Wetland (Constructed)
WP	Wet Pond (Retention)
WS	Wet Swale

Ludlow - Subwatershed Prioritization and Recommendations

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.)	Nitrogen Load with Current Reductions (lbs.)	Nitrogen Load with Priority Action (lbs.)
2 Ludlow	1	Bioretention in front of 53 Main St	CB/OF/BRA		6.35	47.7	2,916	2,333	24.3	19.4
13 Ludlow	1	Establish filter strips or sedimentation areas adjacent to stream corridor in parking areas	CB/GS/FS	3169-9010/4470-9003	13.68	56.7	10,167	7,117	84.7	72.0
27 Ludlow	1	Infiltration basin to treat cemetery runoff behind 1 Orchard St	CB/IB		7.90	18.7	1,288	644	10.7	5.4
48 Ludlow	1	Check dams at outfall	CB/GS/CD	4812-9003	17.99	28.5	5,972	3,583	49.8	39.8
51 Ludlow	1	Infiltration basin or bioretention area in front of town garage	CB/GS/IB		54.30	15.4	7,528	5,270	62.7	43.9
56 Ludlow	1	Infiltration basin in parking lot	GS/CB/IB	3643-9010/ 3125-9010	512.19	6.7	40,144	24,086	334.5	200.7
62 Ludlow	1	Bioretention around White Loop Lane	CB/GS/SB/BRA	3384-9010/ 3718-9010	521.70	5.0	41,522	37,370	346.0	311.4
66 Ludlow	1	Modify outlet to allow for detention and infiltration	CB/GS/SB/IB		8.00	30.4	1,796	898	15.0	7.5
50 Ludlow	2	Infiltration basin in parking lot	OF/GS/IB		14.50	44.2	6,038	1,208	50.3	30.2
58 Ludlow	2	Infiltration basin and bioretention area below base lodge and access road	CB/GS/IB/BRA	3125-9010	26.46	28.9	5,588	2,794	46.6	23.3
44 Ludlow	3	Underground Treatment tank at rear of building	CB/GS/TT		2.90	60.0	2,075	415	17.3	10.4

Ludlow - Subwatershed Prioritization and Recommendations

Watershed Number	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Nitrogen Removal Per Pound (based on annual nitrogen load)	Assistance Program	# LID-Roof Raingardens to Treat Water Quality Volume	Raingarden Cost
2 Ludlow	0.16	FALSE		$10,000	$17	$2,057	CWIP,SRF	82	$37,948
13 Ludlow	0.58	FALSE		$10,000	$3	$787	CWIP,SRF	288	$132,306
27 Ludlow	0.07	FALSE	$66,671		$104	$12,421	CWIP,SRF	36	$16,763
48 Ludlow	0.34	FALSE		$5,000	$2	$502	CWIP,SRF	169	$77,711
51 Ludlow	0.43	0.92		$20,000	$9	$1,063	CWIP,SRF	213	$97,965
56 Ludlow	2.27	3.77		$75,000	$5	$560	CWIP,SRF	1136	$522,391
62 Ludlow	2.35	2.87		$10,000	$2	$289	CWIP,SRF	1175	$540,322
66 Ludlow	0.10	FALSE		$10,000	$11	$1,336	CWIP,SRF	51	$23,375
50 Ludlow	0.34	0.70	$312,509		$65	$15,527	CWIP,SRF	171	$78,574
58 Ludlow	0.32	0.84	$289,228		$104	$12,421	CWIP,SRF	158	$72,720
44 Ludlow	0.12	FALSE	$35,802		$22	$5,176	CWIP,SRF	59	$27,005

Ludlow - Subwatershed Prioritization and Recommendations

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.)	Nitrogen Load with Current Reductions (lbs.)	Nitrogen Load with Priority Action (lbs.)
45 Ludlow	3	Underground Treatment tank at rear of building	CB/GS/TT		3.75	64.2	2,885	577	24.0	14.4
46 Ludlow	3	Underground Treatment tank at rear of building	CB/GS/TT		13.56	39.4	6,211	1,242	51.8	31.1
1 Ludlow			CB/GS/EDP	5698-9015	112.48	6.0	8,579	8,579	71.5	71.5
3 Ludlow			CB		0.55	94.0	649	649	5.4	5.4
4 Ludlow			OF		13.58	32.7	3,931	3,931	32.8	32.8
5 Ludlow			GS/EDP	5698-9015	7.29	6.3	103	103	4.3	2.6
6 Ludlow			GS	5698-9015	86.52	8.5	8,280	8,280	69.0	69.0
7 Ludlow			OF/GS		155.63	7.7	14,264	14,264	118.9	118.9
8 Ludlow			OF/CB/GS		47.25	4.6	3,680	3,680	30.7	30.7
9 Ludlow			OF/GS		73.57	6.1	6,209	6,209	51.7	51.7
10 Ludlow			OF/GS/IB/WP	4429-9010	43.90	16.0	2,547	2,547	28.3	28.3
11 Ludlow			CB/GS		161.23	7.5	14,631	14,631	121.9	121.9
12 Ludlow			GS/CB/WP		410.17	7.6	33,385	33,385	278.2	278.2
14 Ludlow			OF/GS		40.12	3.9	3,021	3,021	25.2	25.2
15 Ludlow			OF/GS		42.25	8.9	4,141	4,141	34.5	34.5
16 Ludlow			GS/OF/IG/SWPPP	4849-9010/ 5067-9003	32.16	32.2	9,156	9,156	76.3	76.3
17 Ludlow			CB/GS		67.65	14.7	9,033	9,033	75.3	75.3
18 Ludlow			OF/GS		82.85	5.3	6,704	6,704	55.9	55.9
19 Ludlow			CB		82.09	5.2	8,256	8,256	68.8	68.8
20 Ludlow			CB		1.13	59.0	792	792	6.6	6.6
21 Ludlow			CB		3.58	41.4	1,728	1,728	14.4	14.4
22 Ludlow			CB/OF		18.04	25.8	4,018	4,018	33.5	33.5
23 Ludlow			CB/GS		28.07	31.3	10,216	10,216	85.1	85.1
24 Ludlow			GS/OF		137.67	6.8	12,028	12,028	100.2	100.2
25 Ludlow			OF/GS/WP		132.10	6.9	9,498	9,498	79.2	79.2
26 Ludlow			CB/GS/DW		78.03	14.8	10,464	10,464	87.2	87.2
28 Ludlow			CB/GS		35.29	25.9	7,884	7,884	65.7	65.7
29 Ludlow			CB/OF		3.66	27.9	887	887	7.4	7.4
30 Ludlow			CB/GS		2.97	28.1	724	724	6.0	6.0
31 Ludlow			CB		5.37	83.5	5,707	5,707	47.6	47.6
32 Ludlow			CB/OF		8.50	40.6	3,183	3,183	26.5	26.5
33 Ludlow			CB		1.16	84.0	1,235	1,235	10.3	10.3

Ludlow - Subwatershed Prioritization and Recommendations

Watershed Number	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Nitrogen Removal Per Pound (based on annual nitrogen load)	Assistance Program	# LID-Roof Raingardens to Treat Water Quality Volume	Raingarden Cost
45 Ludlow	0.16	FALSE	$49,772		$22	$5,176	CWIP,SRF	82	$37,542
46 Ludlow	0.35	0.59	$107,144		$22	$5,176	CWIP,SRF	176	$80,818
1 Ludlow	0.49	0.74					CWIP,SRF	243	$111,642
3 Ludlow	0.04	0.06					CWIP,SRF	18	$8,440
4 Ludlow	0.22	FALSE					CWIP,SRF	111	$51,156
5 Ludlow	0.03	FALSE					CWIP,SRF	15	$6,733
6 Ludlow	0.47	FALSE					CWIP,SRF	234	$107,742
7 Ludlow	0.81	FALSE					CWIP,SRF	404	$185,612
8 Ludlow	0.21	0.24					CWIP,SRF	104	$47,890
9 Ludlow	0.35	0.50					CWIP,SRF	176	$80,801
10 Ludlow	0.24	0.77					CWIP,SRF	120	$55,246
11 Ludlow	0.83	FALSE					CWIP,SRF	414	$190,390
12 Ludlow	1.89	3.44					CWIP,SRF	944	$434,434
14 Ludlow	0.17	FALSE					CWIP,SRF	85	$39,318
15 Ludlow	0.23	FALSE					CWIP,SRF	117	$53,891
16 Ludlow	0.52	FALSE					CWIP,SRF	259	$119,147
17 Ludlow	0.51	FALSE					CWIP,SRF	256	$117,547
18 Ludlow	0.38	FALSE					CWIP,SRF	190	$87,239
19 Ludlow	0.47	FALSE					CWIP,SRF	234	$107,431
20 Ludlow	0.04	FALSE					CWIP,SRF	22	$10,306
21 Ludlow	0.10	FALSE					CWIP,SRF	49	$22,486
22 Ludlow	0.23	FALSE					CWIP,SRF	114	$52,281
23 Ludlow	0.58	FALSE					CWIP,SRF	289	$132,938
24 Ludlow	0.68	FALSE					CWIP,SRF	340	$156,517
25 Ludlow	0.54	FALSE					CWIP,SRF	269	$123,597
26 Ludlow	0.59	FALSE					CWIP,SRF	296	$136,173
28 Ludlow	0.45	FALSE					CWIP,SRF	223	$102,593
29 Ludlow	0.05	FALSE					CWIP,SRF	25	$11,542
30 Ludlow	0.04	FALSE					CWIP,SRF	20	$9,425
31 Ludlow	0.32	FALSE					CWIP,SRF	161	$74,258
32 Ludlow	0.18	FALSE					CWIP,SRF	90	$41,423
33 Ludlow	0.07	FALSE					CWIP,SRF	35	$16,067

Ludlow - Subwatershed Prioritization and Recommendations

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.)	Nitrogen Load with Current Reductions (lbs.)	Nitrogen Load with Priority Action (lbs.)
34 Ludlow			CB		2.85	77.1	2,806	2,806	23.4	23.4
35 Ludlow			CB		3.11	80.1	3,065	3,065	25.5	25.5
36 Ludlow			CB		0.69	24.6	201	201	1.7	1.7
37 Ludlow			CB/WP/GS	4241-9015	204.54	11.6	23,187	23,187	193.2	193.2
38 Ludlow			CB		21.14	17.0	4,432	4,432	36.9	36.9
39 Ludlow			OF/GS		30.35	10.4	3,225	3,225	26.9	26.9
40 Ludlow			GS/OF/CB		39.01	4.1	2,976	2,976	24.8	24.8
41 Ludlow			CB		4.85	24.6	1,030	1,030	8.6	8.6
42 Ludlow			GS/OF		32.33	8.4	3,074	3,074	25.6	25.6
43 Ludlow			GS/OF/CB		62.65	7.7	5,741	5,741	47.8	47.8
47 Ludlow			CB/GS/EDP	7349-9015	11.73	33.1	1,170	1,170	17.1	17.1
49 Ludlow			CB	3392-9010	5.11	49.4	2,962	2,962	24.7	24.7
52 Ludlow			OF/GS/WP		46.65	9.0	3,540	3,540	29.5	29.5
53 Ludlow			OF/SB	3125-9010	21.01	28.0	3,356	3,356	28.0	28.0
54 Ludlow			GS/EDP/WP/CB/PP	3924-9010/ 3924-9015/ 3214-9010/ 3378-9010	840.66	4.0	57,312	57,312	477.6	477.6
55 Ludlow			CB/GS		26.92	9.6	3,734	3,734	31.1	31.1
57 Ludlow			OF/GS		17.28	19.3	2,897	2,897	24.1	24.1
59 Ludlow			GS/OF		15.25	14.7	2,039	2,039	17.0	17.0
60 Ludlow			CB/GS/OF/SB		134.62	10.4	14,284	14,284	119.0	119.0
61 Ludlow			GS/OF		93.84	4.3	7,230	7,230	60.2	60.2
63 Ludlow			CB/GS/WP	3970-9010	307.85	10.1	24,125	24,125	201.0	201.0
64 Ludlow			CB/GS/EDP(2)	3491-9010/ 3491-9015	752.64	5.1	10,437	10,437	260.9	260.9
65 Ludlow			CB/GS/SF/EDP	3924-9015	74.89	0.3	993	993	24.8	24.8
67 Ludlow			OF		56.07	12.2	6,571	6,571	54.8	54.8
69 Ludlow			OF/SWPPP	4668-9003	64.13	7.2	5,728	5,728	47.7	47.7
70 Ludlow			OF/SWPPP	4668-9003	6.63	8.3	630	630	5.3	5.3
71 Ludlow			OF/GS		219.60	4.2	16,831	16,831	140.3	140.3
72 Ludlow			OF/GS/CB		1209.22	1.8	83,624	83,624	696.9	696.9
73 Ludlow			DW/GS/OF		187.55	4.3	14,394	14,394	119.9	119.9
74 Ludlow			OF/GS	3778-9010	493.73	3.5	34,678	34,678	289.0	289.0
75 Ludlow			OF/GS/IB	5325-9015	192.56	1.7	2,566	2,566	21.4	21.4
76 Ludlow			OF/GS/SWPPP	4852-9003	527.37	1.0	35,582	35,582	296.5	296.5
77 Ludlow			OF/GS/CB		229.01	2.4	16,170	16,170	134.7	134.7
78 Ludlow			CB		1.49	51.4	752	752	6.3	6.3
79 Ludlow			CB		3.47	40.9	1,310	1,310	10.9	10.9

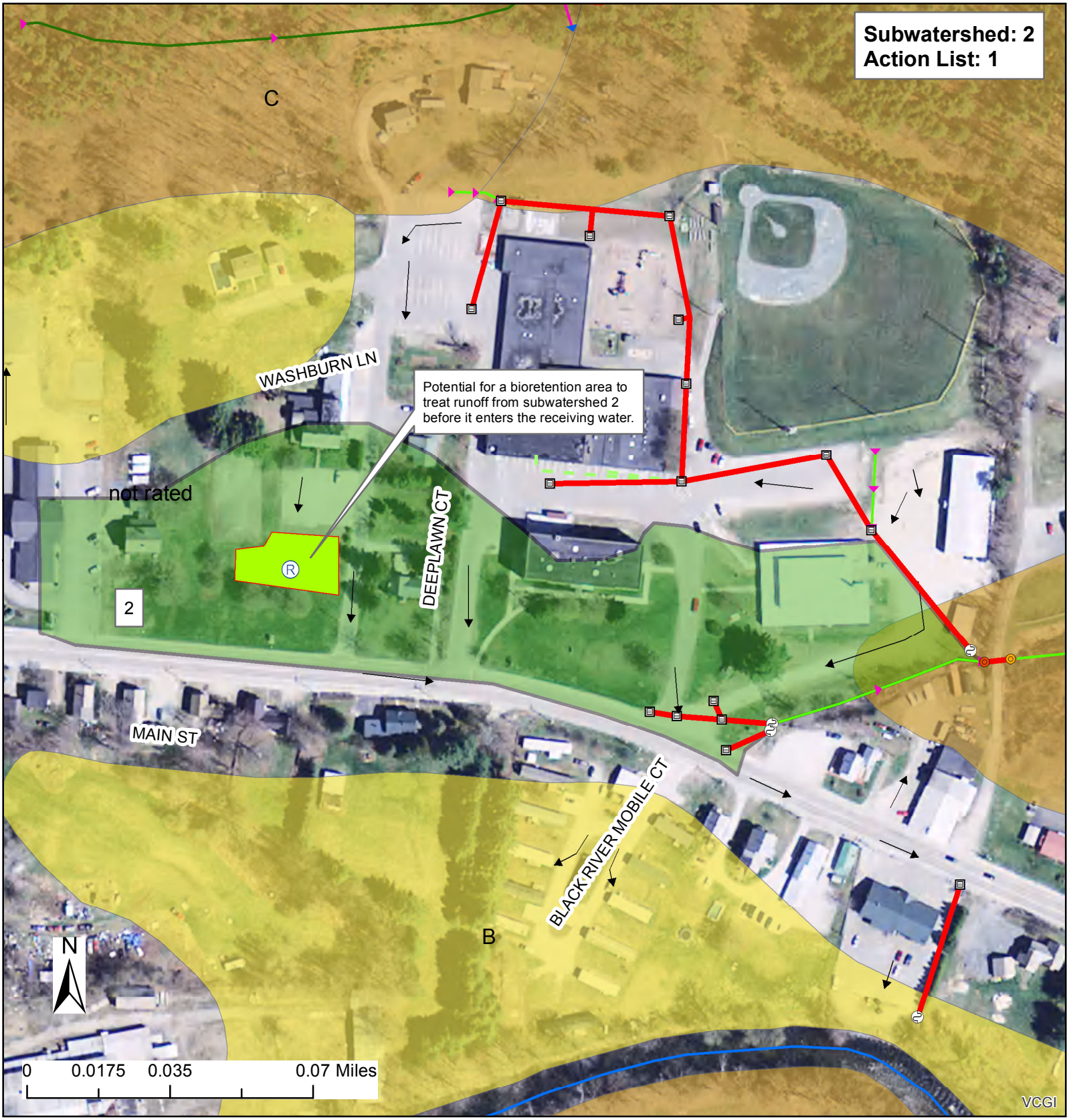
Ludlow - Subwatershed Prioritization and Recommendations

Watershed Number	Water Quality Volume (Acre-Feet)	Channel Protection (Acre-Feet)	Estimated Basin Construction Cost	Estimated Other BMP Construction Cost	Cost of Sediment Removal Per Pound (based on annual sediment load)	Cost of Nitrogen Removal Per Pound (based on annual nitrogen load)	Assistance Program	# LID-Roof Raingardens to Treat Water Quality Volume	Raingarden Cost
34 Ludlow	0.16	FALSE					CWIP,SRF	79	$36,514
35 Ludlow	0.17	FALSE					CWIP,SRF	87	$39,888
36 Ludlow	0.01	FALSE					CWIP,SRF	6	$2,610
37 Ludlow	1.31	FALSE					CWIP,SRF	656	$301,726
38 Ludlow	0.25	FALSE					CWIP,SRF	125	$57,677
39 Ludlow	0.18	FALSE					CWIP,SRF	91	$41,972
40 Ludlow	0.17	FALSE					CWIP,SRF	84	$38,721
41 Ludlow	0.06	0.13					CWIP,SRF	29	$13,402
42 Ludlow	0.17	FALSE					CWIP,SRF	87	$40,006
43 Ludlow	0.32	0.53					CWIP,SRF	162	$74,707
47 Ludlow	0.17	0.43					CWIP,SRF	83	$38,070
49 Ludlow	0.17	FALSE					CWIP,SRF	84	$38,544
52 Ludlow	0.20	0.46					CWIP,SRF	100	$46,063
53 Ludlow	0.19	0.65					CWIP,SRF	95	$43,667
54 Ludlow	3.24	3.69					CWIP,SRF	1621	$745,791
55 Ludlow	0.21	0.29					CWIP,SRF	106	$48,586
57 Ludlow	0.16	FALSE					CWIP,SRF	82	$37,692
59 Ludlow	0.12	FALSE					CWIP,SRF	58	$26,531
60 Ludlow	0.81	1.54					CWIP,SRF	404	$185,881
61 Ludlow	0.41	0.45					CWIP,SRF	205	$94,082
63 Ludlow	1.36	FALSE					CWIP,SRF	682	$313,932
64 Ludlow	2.95	4.19					CWIP,SRF	1476	$679,099
65 Ludlow	0.28	FALSE					CWIP,SRF	140	$64,601
67 Ludlow	0.37	FALSE					CWIP,SRF	186	$85,505
69 Ludlow	0.32	FALSE					CWIP,SRF	162	$74,537
70 Ludlow	0.04	FALSE					CWIP,SRF	18	$8,202
71 Ludlow	0.95	FALSE					CWIP,SRF	476	$219,017
72 Ludlow	4.73	2.39					CWIP,SRF	2366	$1,088,193
73 Ludlow	0.81	FALSE					CWIP,SRF	407	$187,302
74 Ludlow	1.96	1.89					CWIP,SRF	981	$451,267
75 Ludlow	0.73	FALSE					CWIP,SRF	363	$166,939
76 Ludlow	2.01	FALSE					CWIP,SRF	1007	$463,023
77 Ludlow	0.91	FALSE					CWIP,SRF	457	$210,416
78 Ludlow	0.04	FALSE					CWIP,SRF	21	$9,784
79 Ludlow	0.07	FALSE					CWIP,SRF	37	$17,043

Target Maps

Showing Priority Action List Drainage Areas

And Potential Retrofit Locations



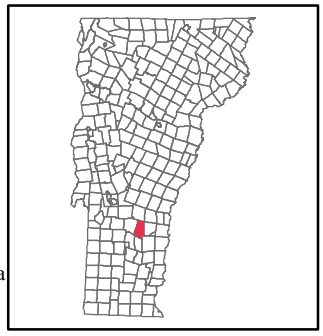
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

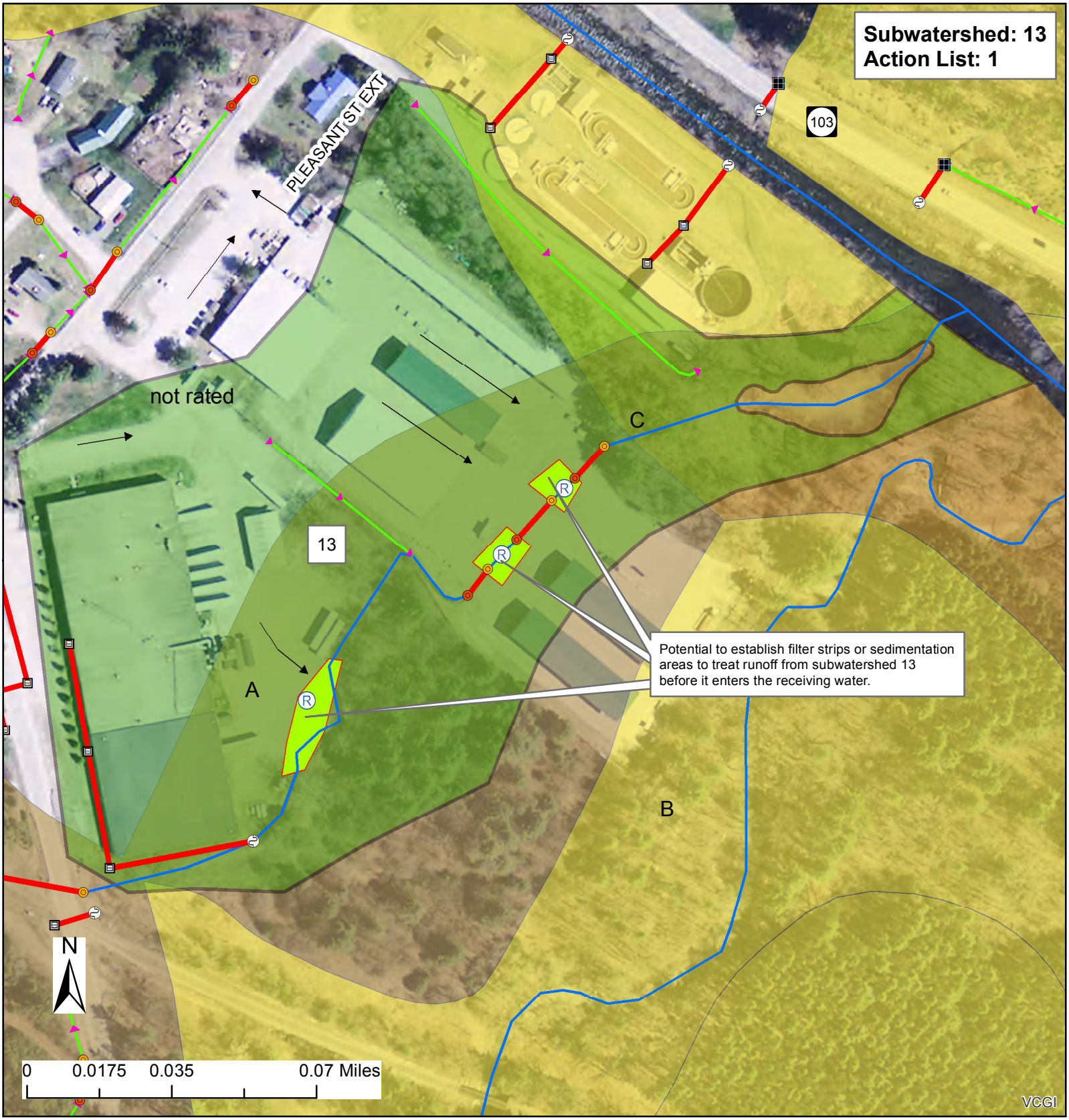
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



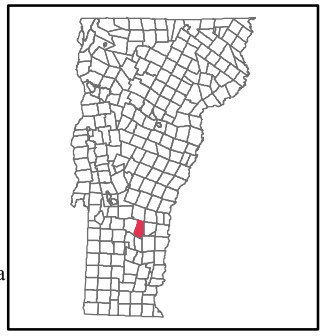
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

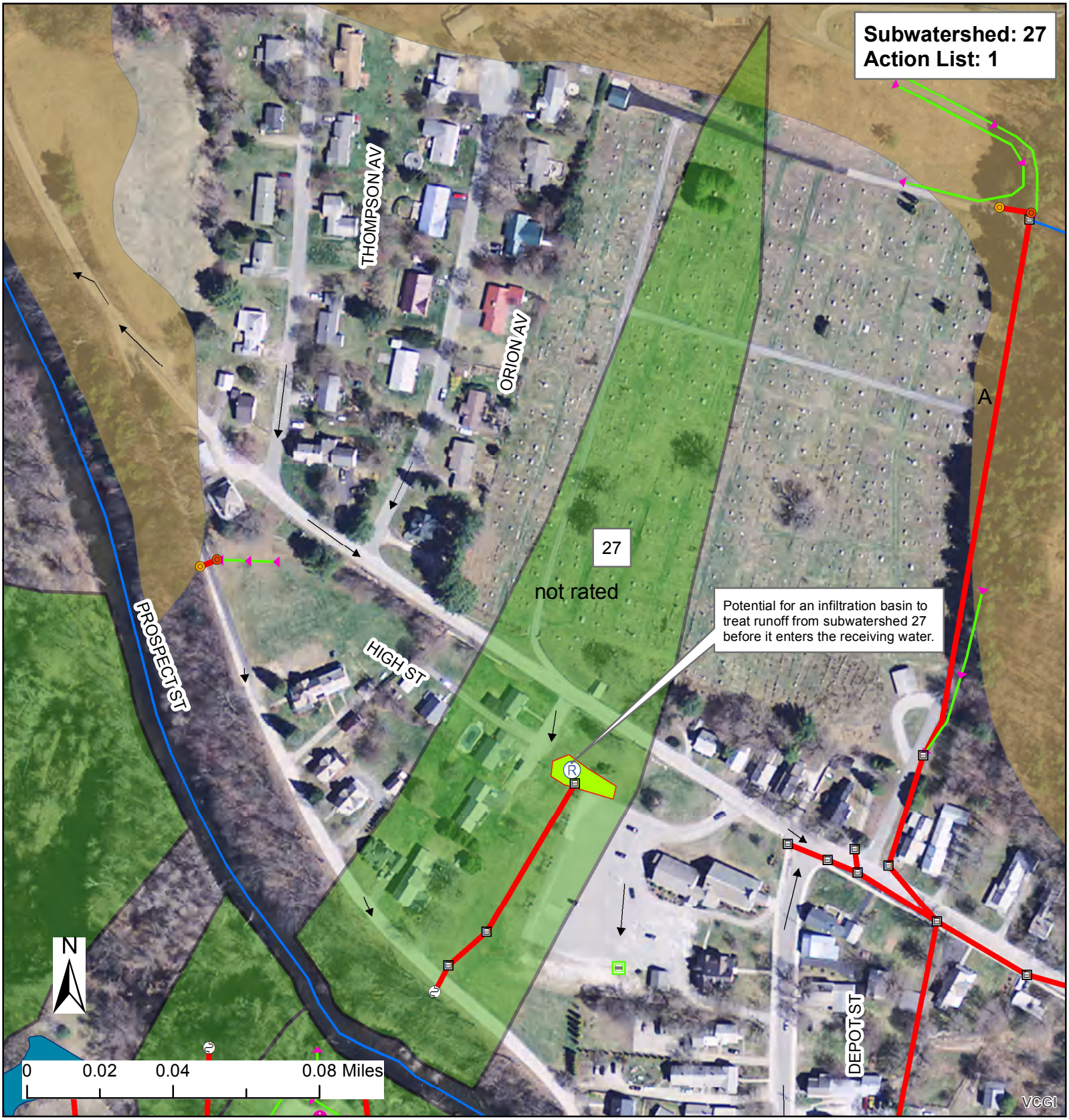
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



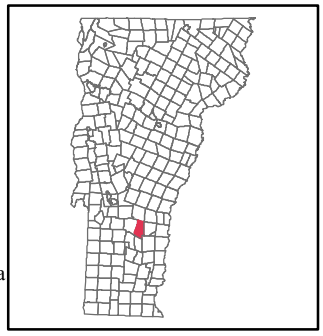
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

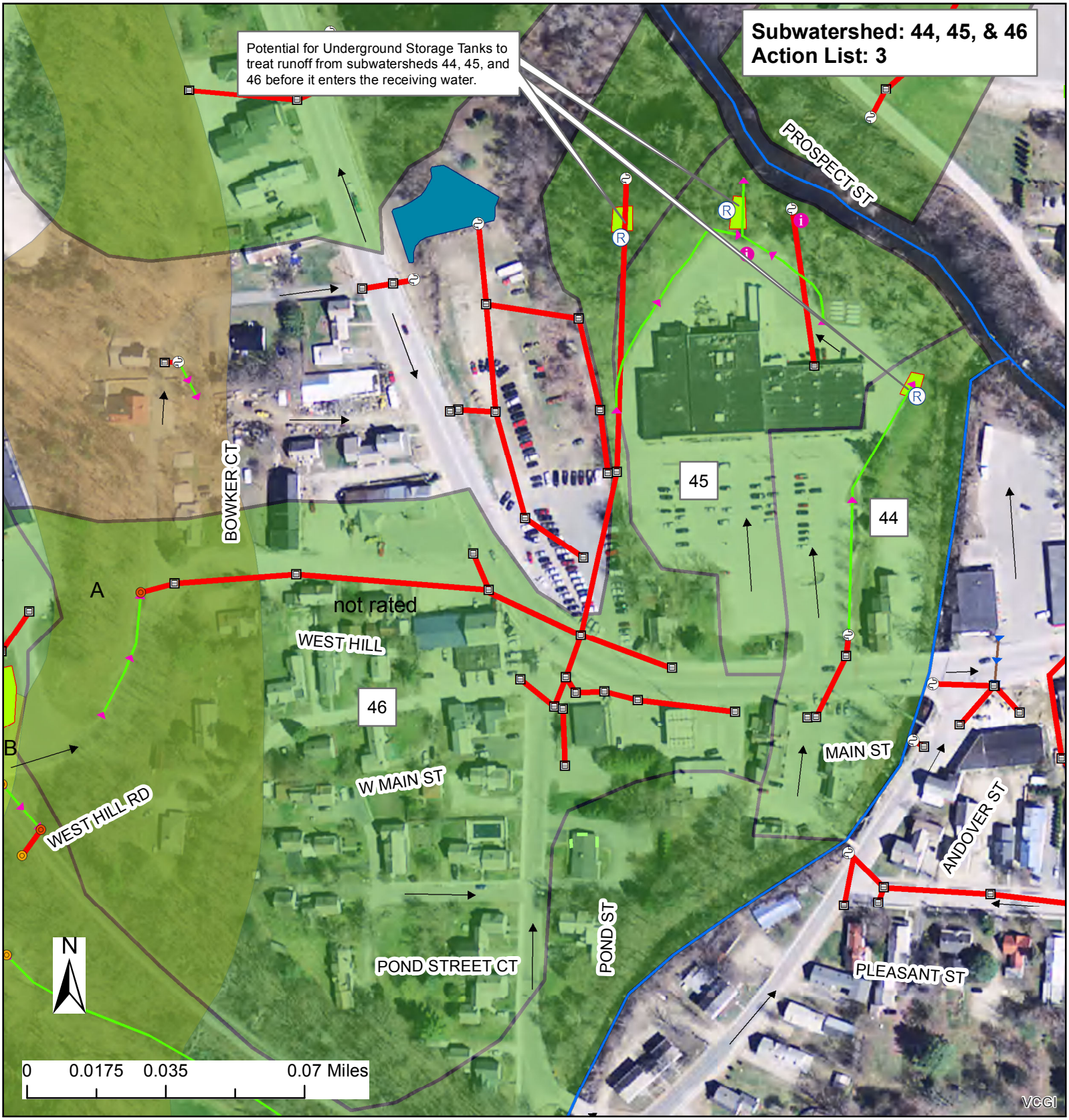
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



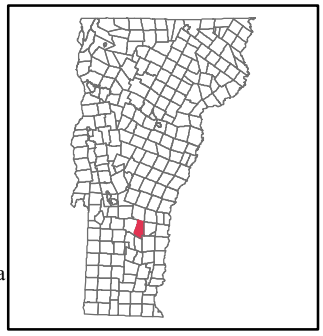
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m

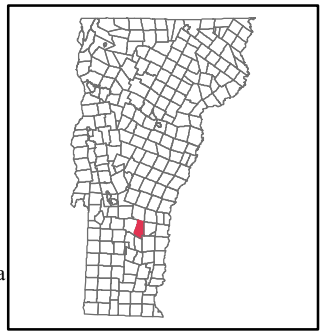
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

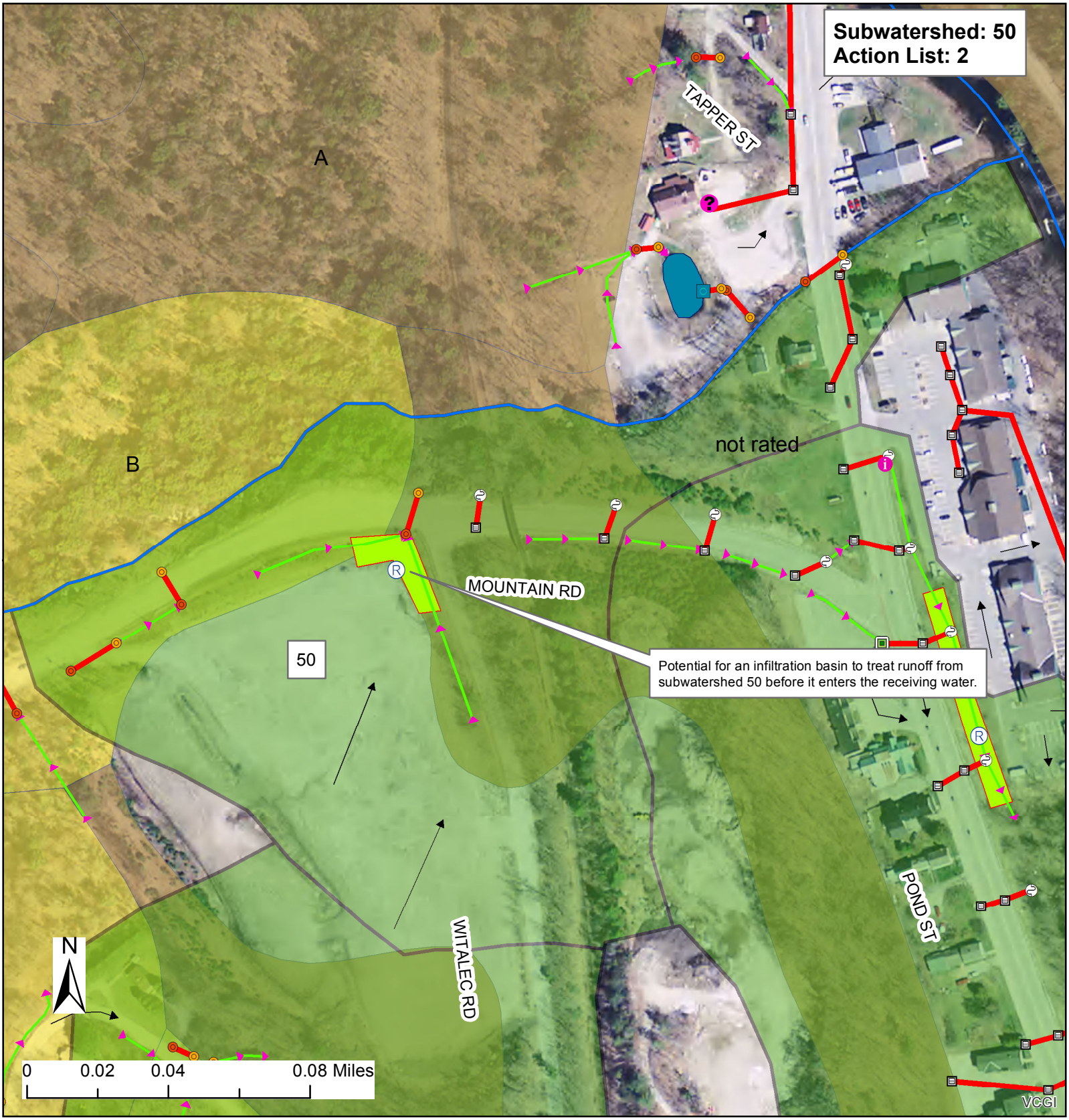
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



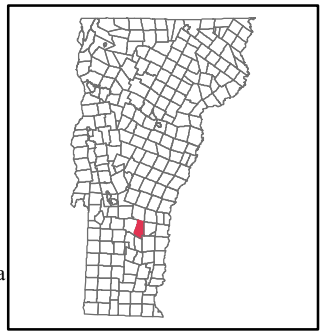
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

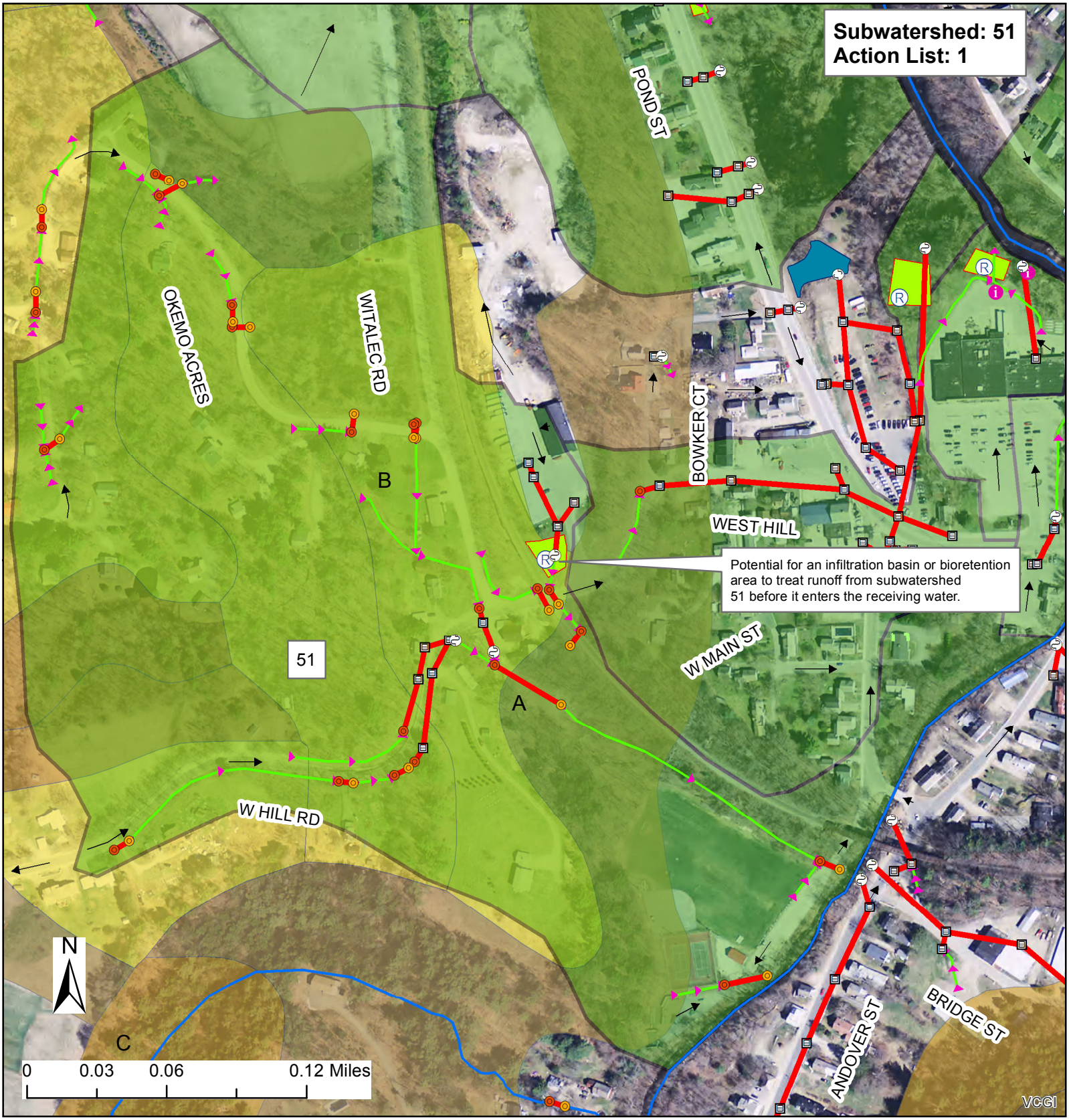
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



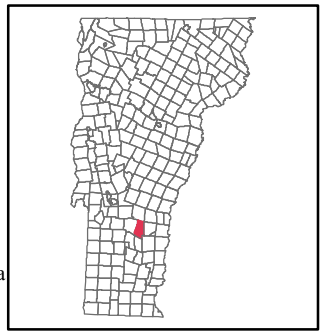
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

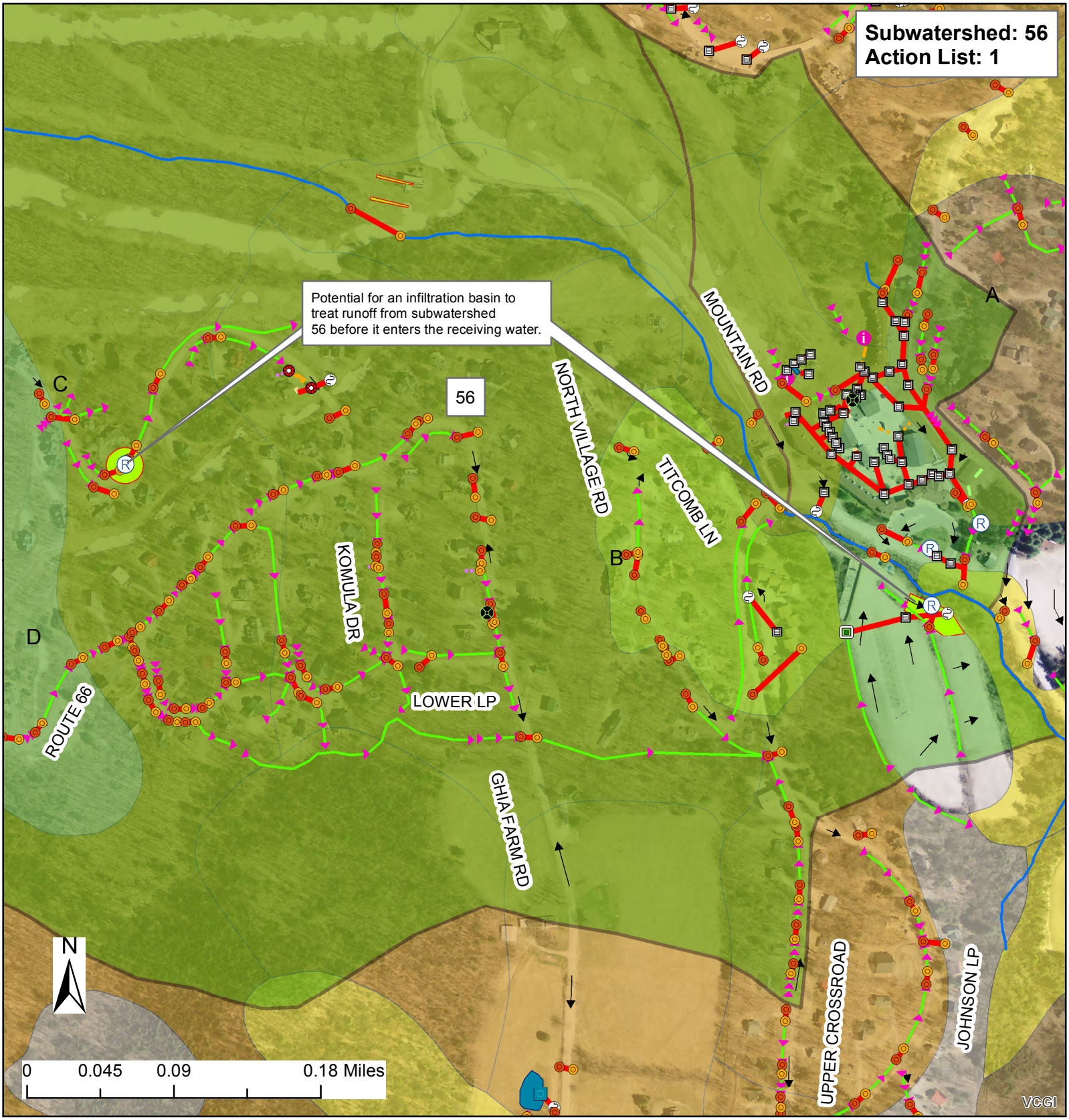
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



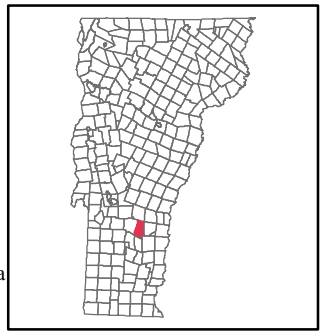
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

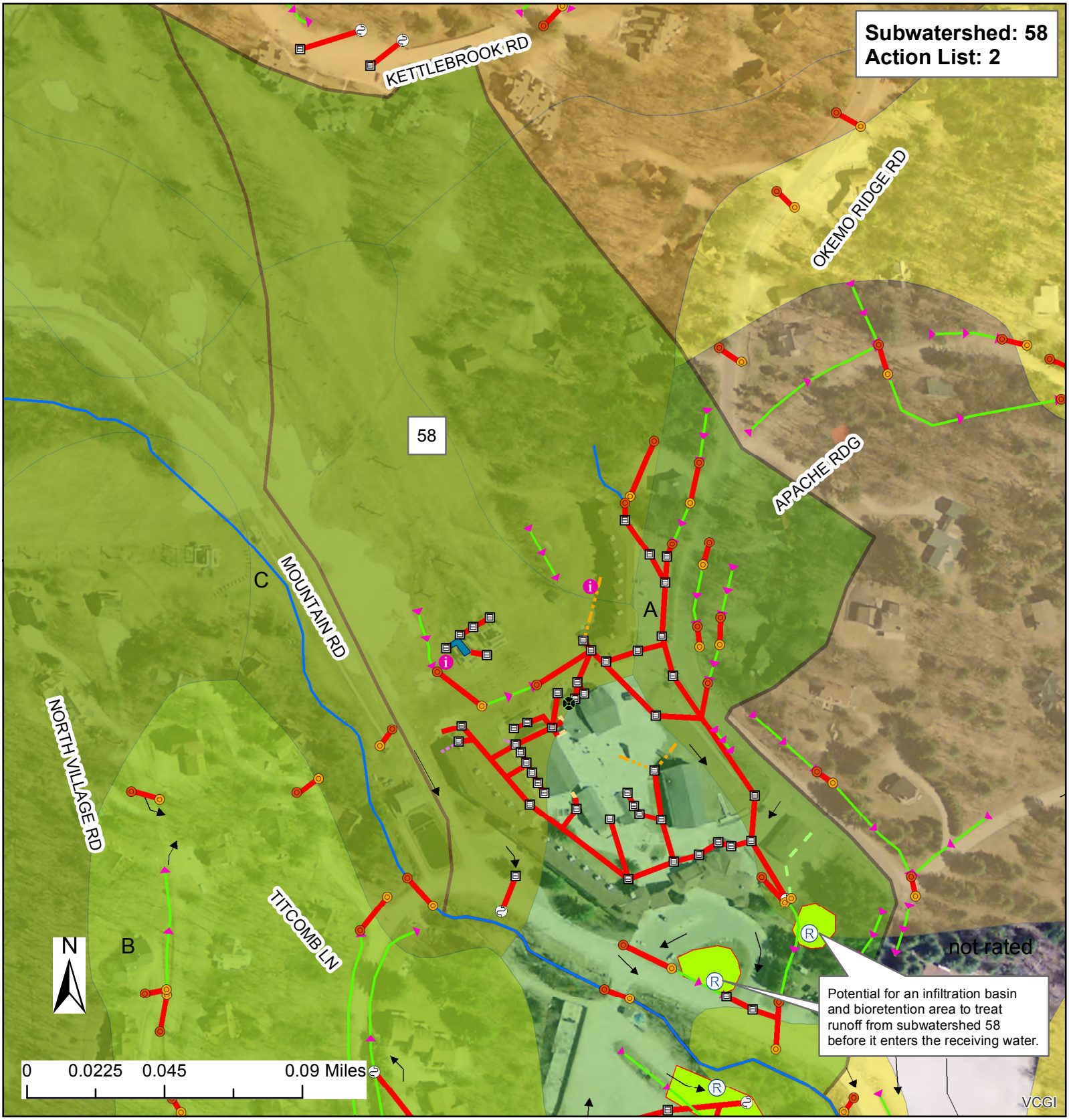
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



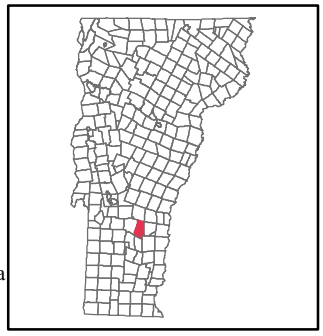
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

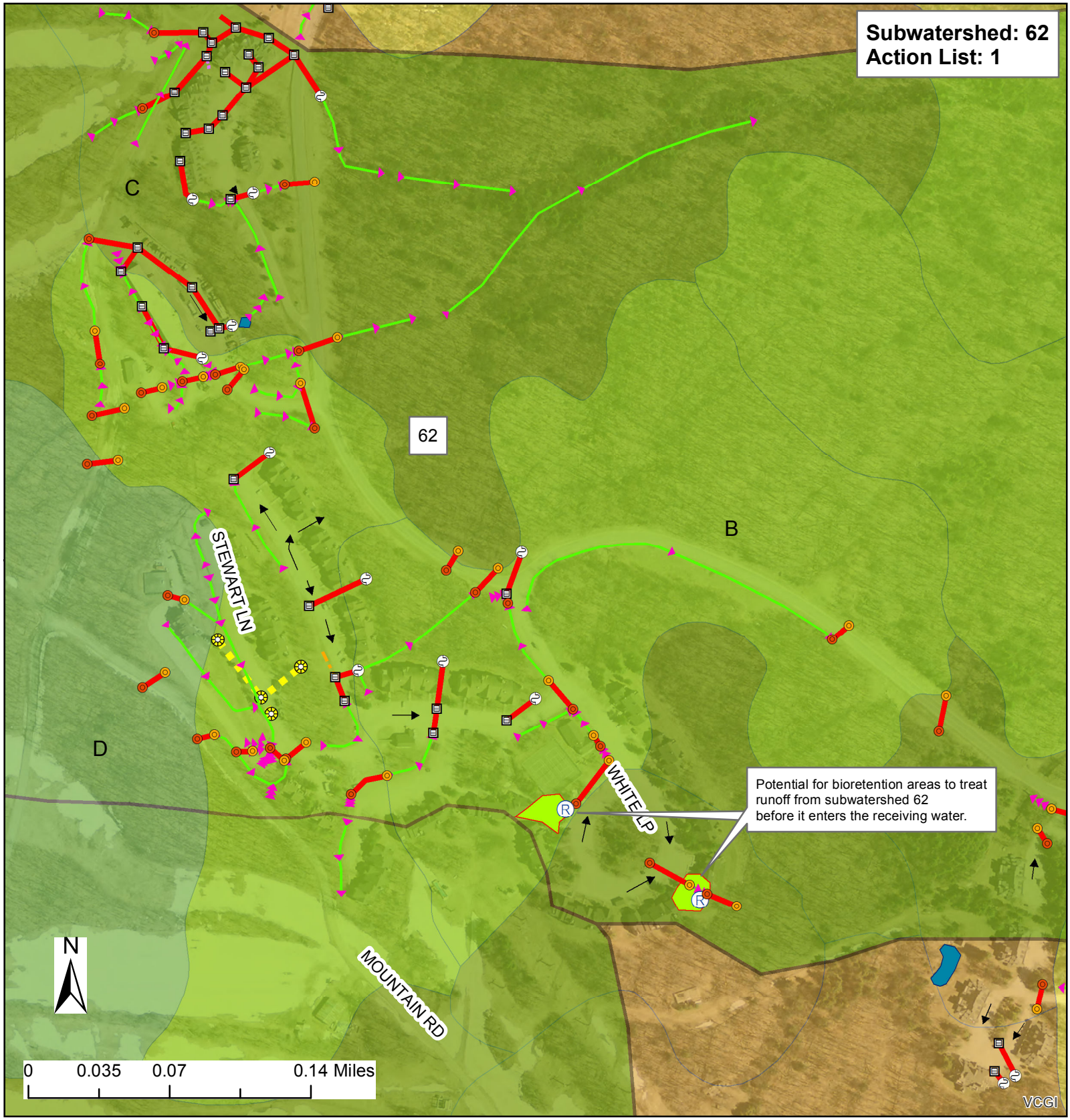
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



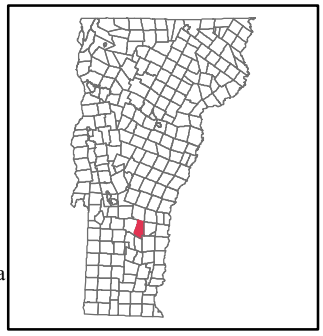
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

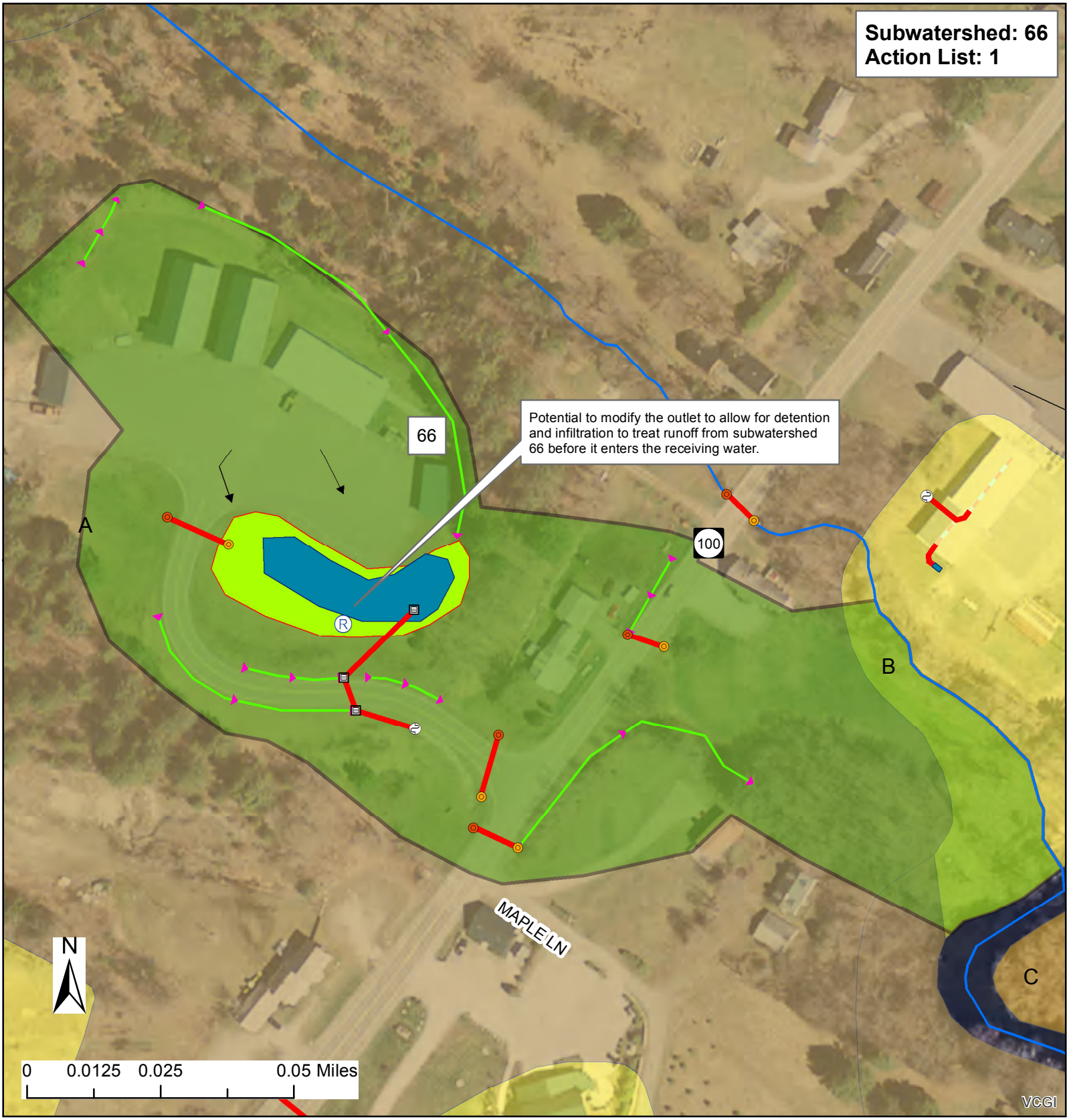
NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m



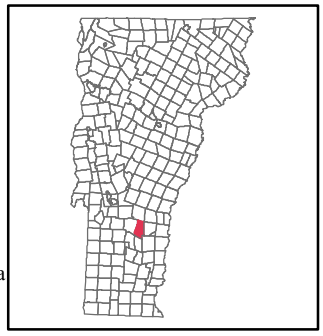
Ludlow, VT

DEC Stormwater Infrastructure Mapping Project

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.

VERMONT



Stormwater points

- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

NRCS - Soils

- A
- B
- C
- D

SubwatershedID

- Priority Subwatershed
- Stormwater Treatment Area
- Potential Stormwater Treatment Area

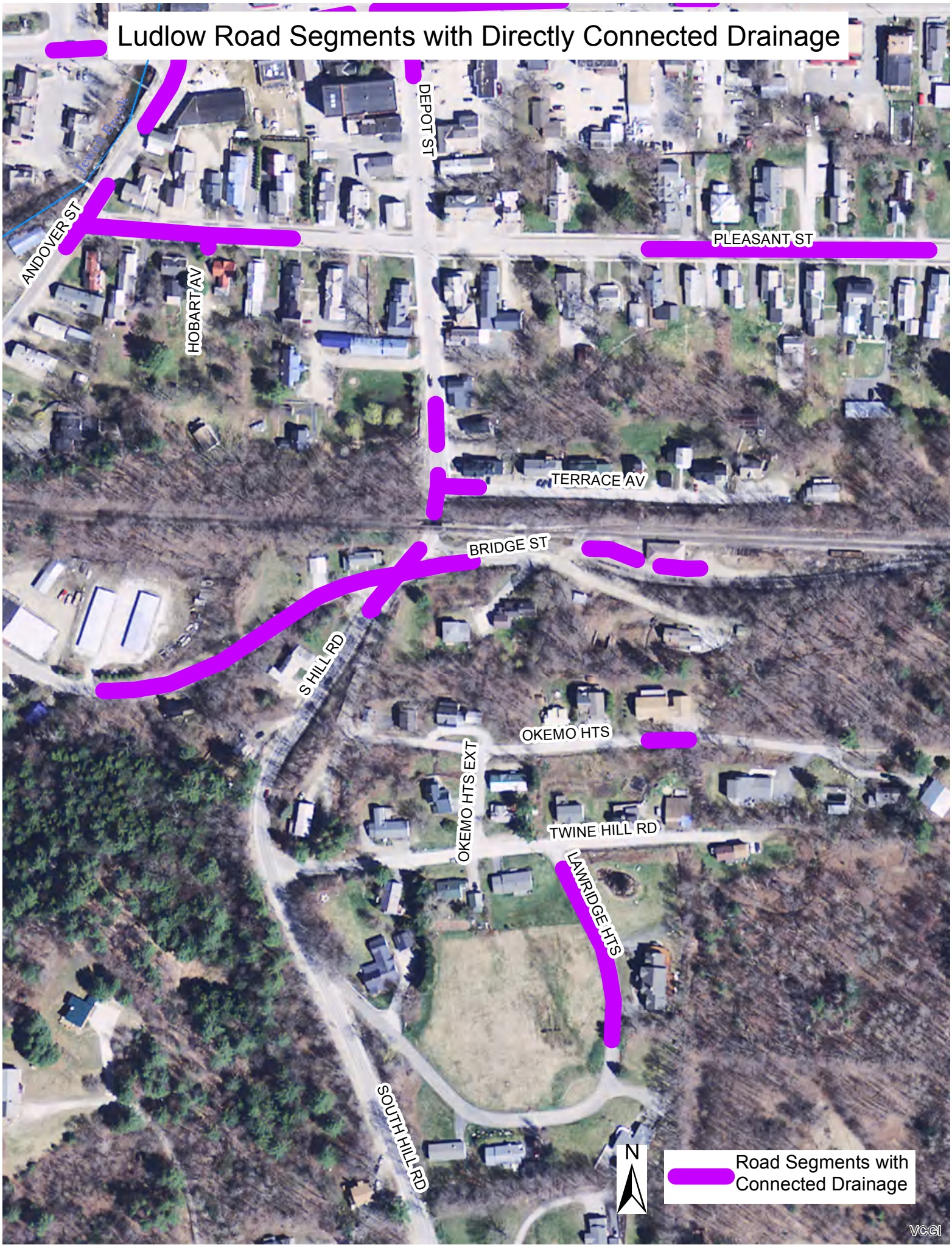
Creator: Jim Pease, David Ainley
DEC - WSMD - Ecosystem Restoration Program
Plotted Date: 3/9/2016
Data Sources: VTRANS Roads data, VT Hydrography data set, DEC Stormwater database, NRCS soils survery
Imagery Source: VCGI 2012, .5m

Connected Roads

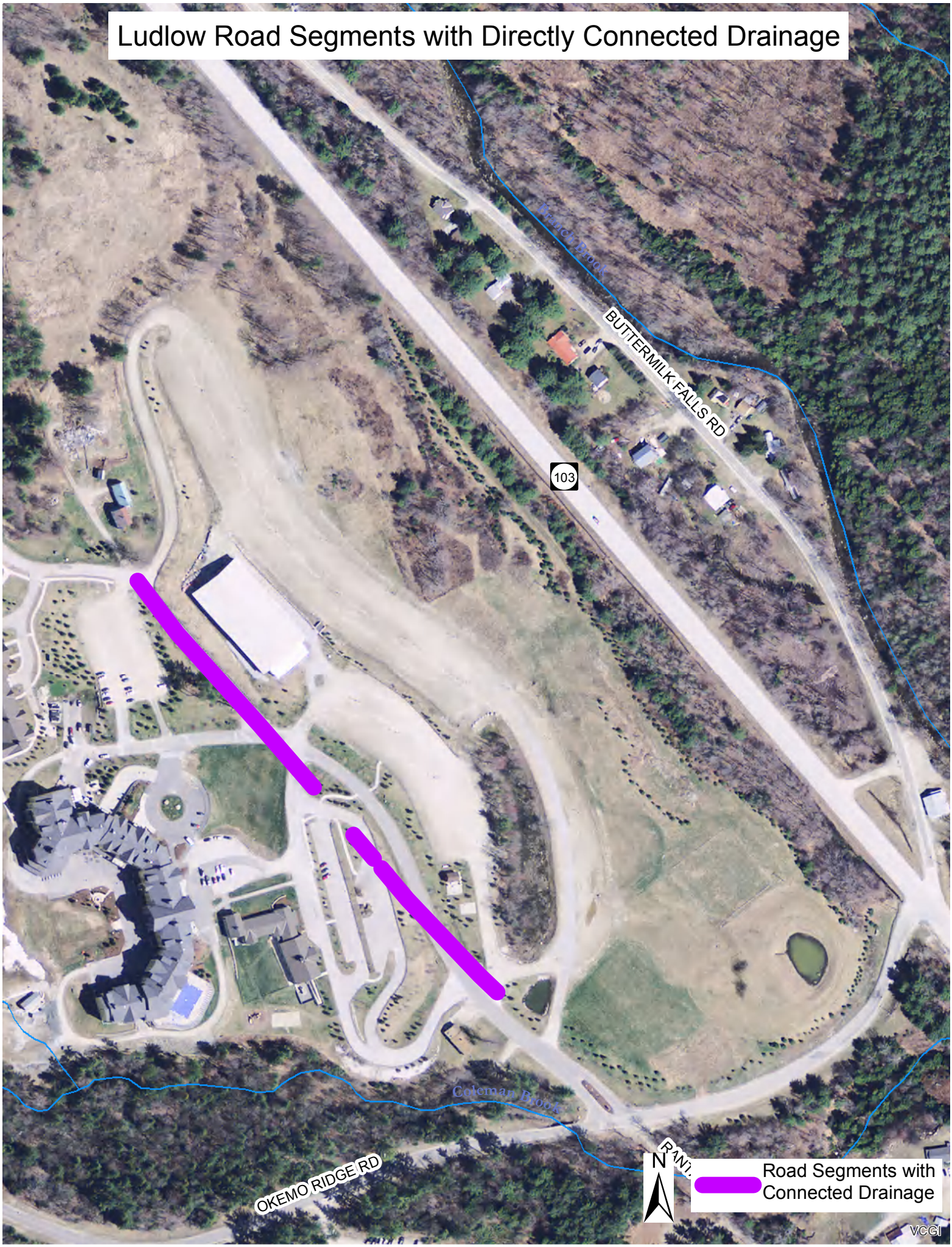
Roads potentially connected to waters of the state

Ludlow Road Segments with Directly Connected Drainage

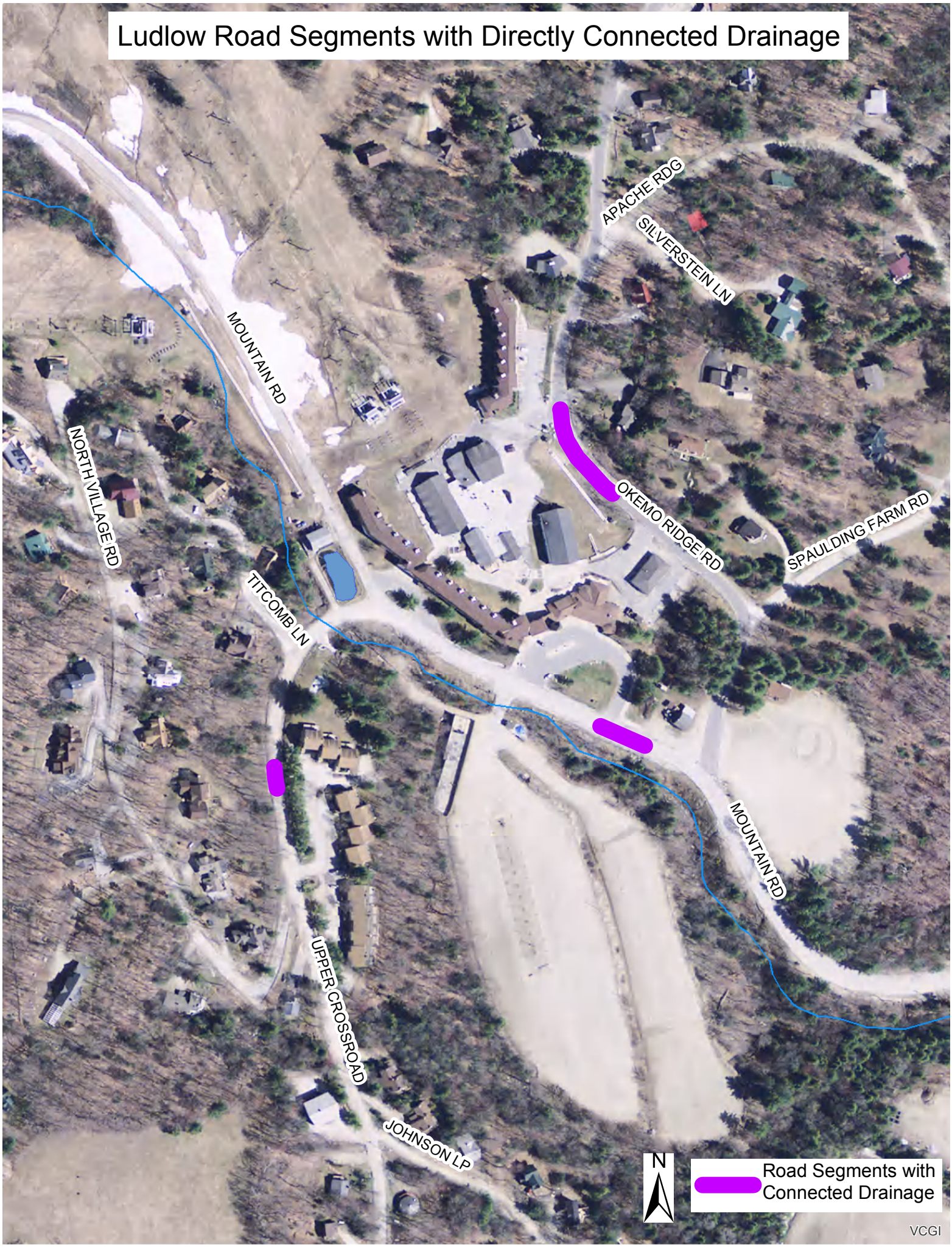
Ludlow Road Segments with Directly Connected Drainage



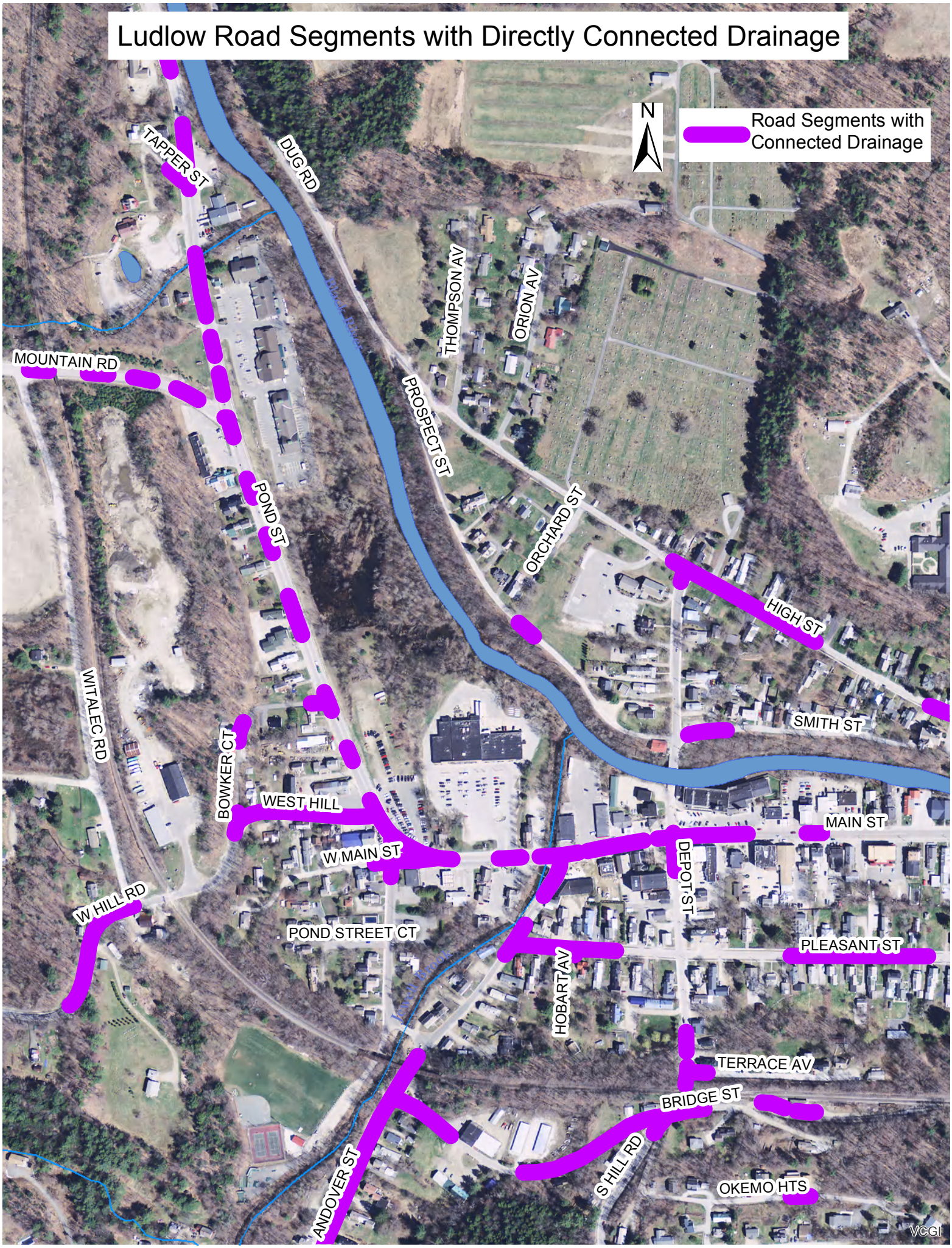
Ludlow Road Segments with Directly Connected Drainage



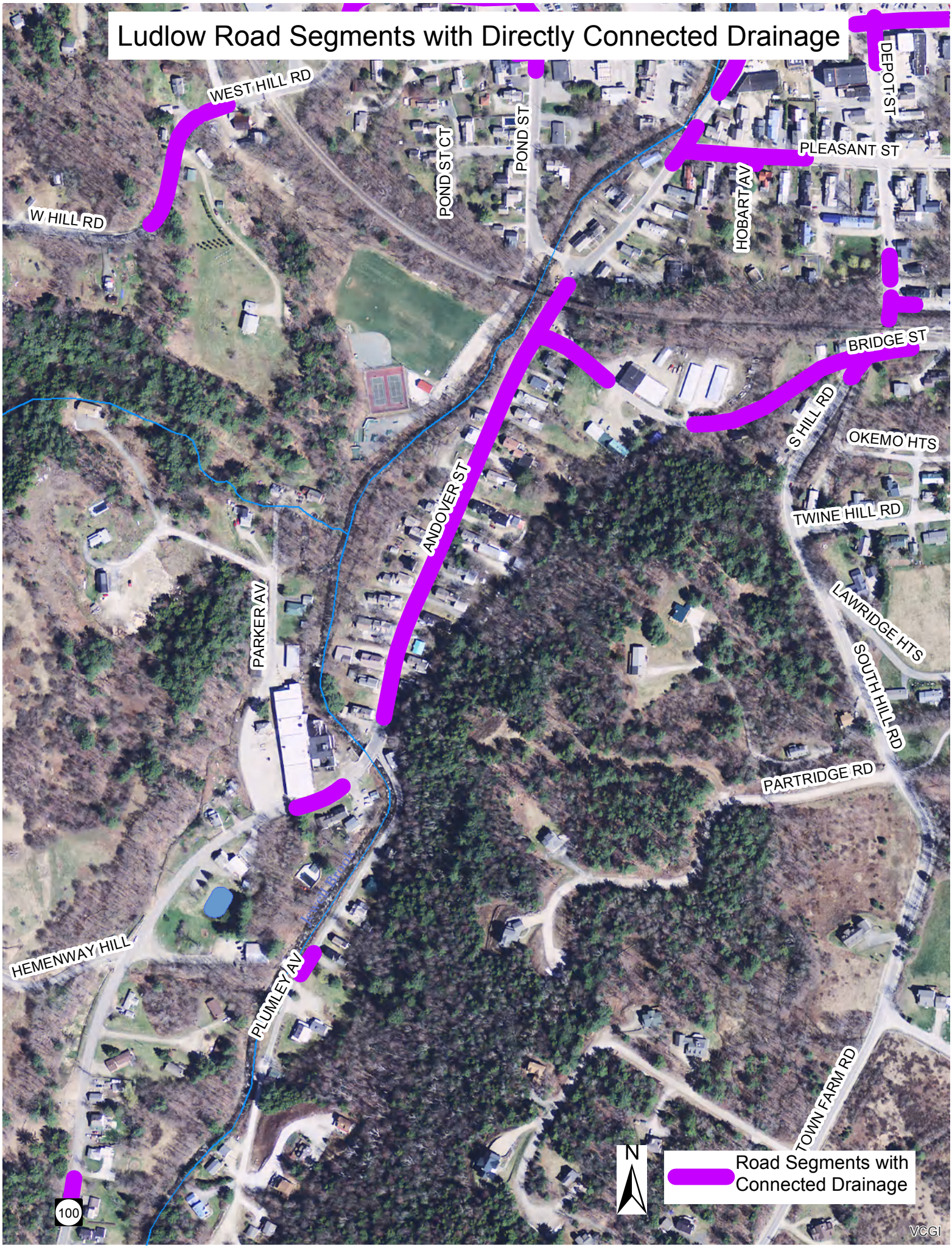
Ludlow Road Segments with Directly Connected Drainage



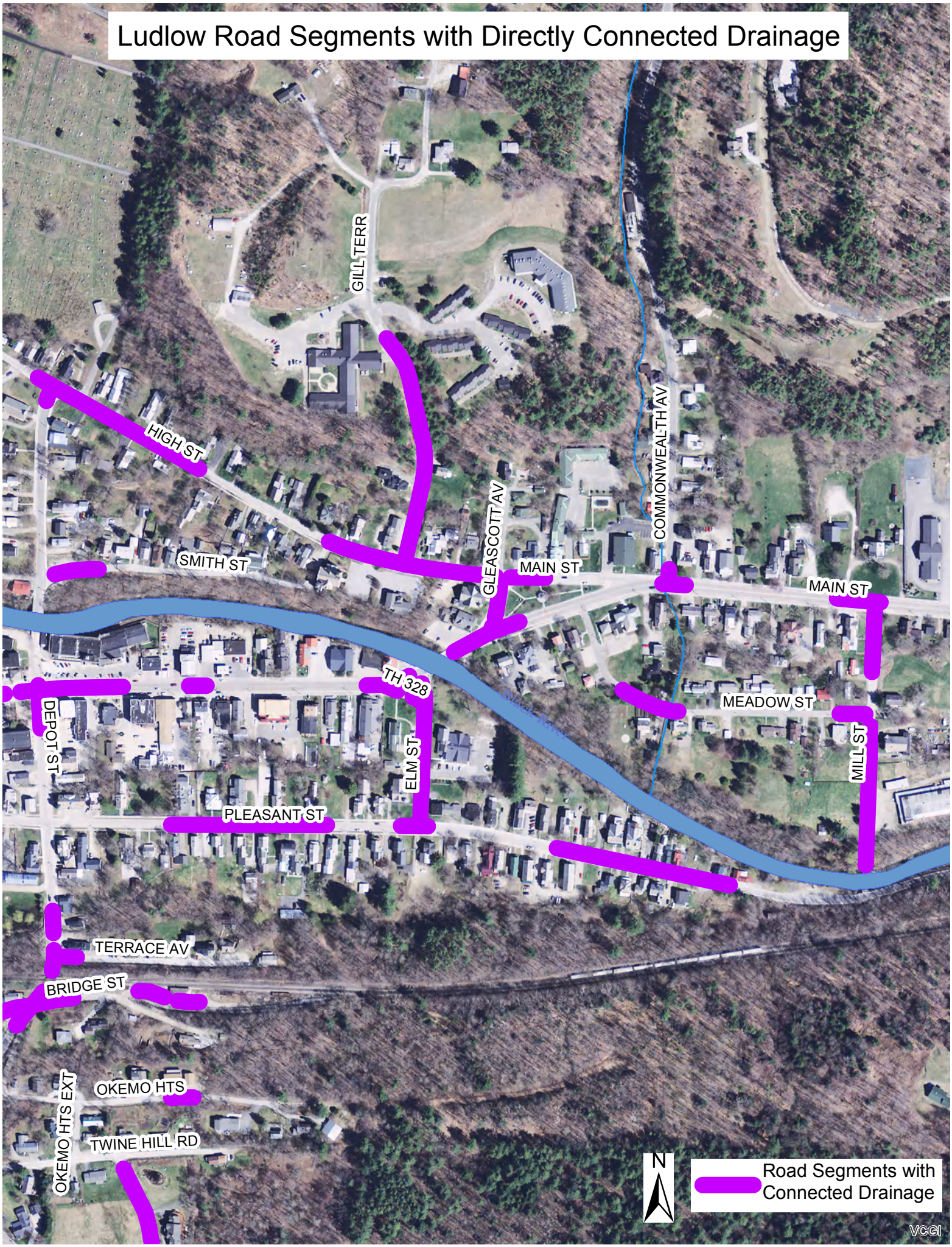
Ludlow Road Segments with Directly Connected Drainage



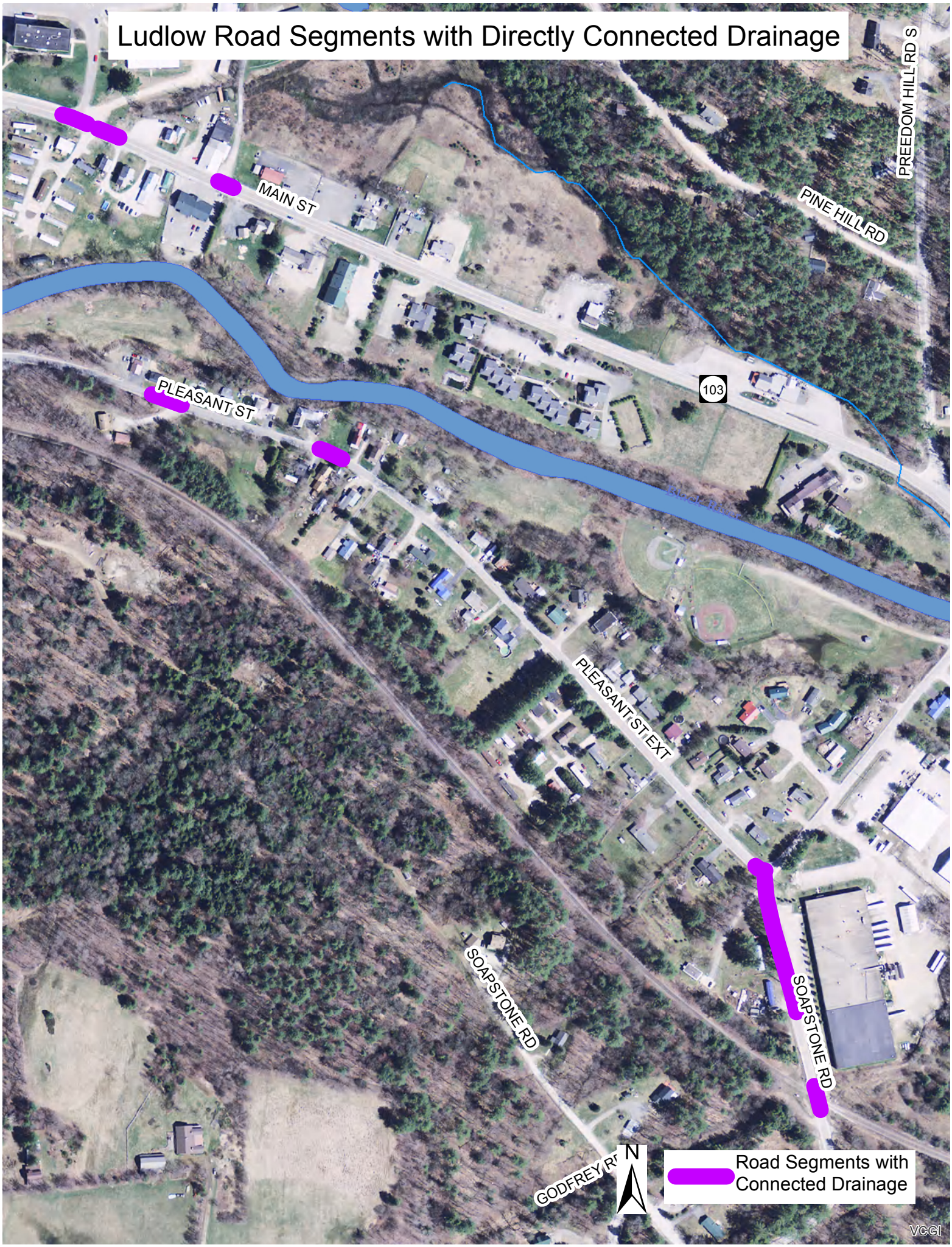
Ludlow Road Segments with Directly Connected Drainage



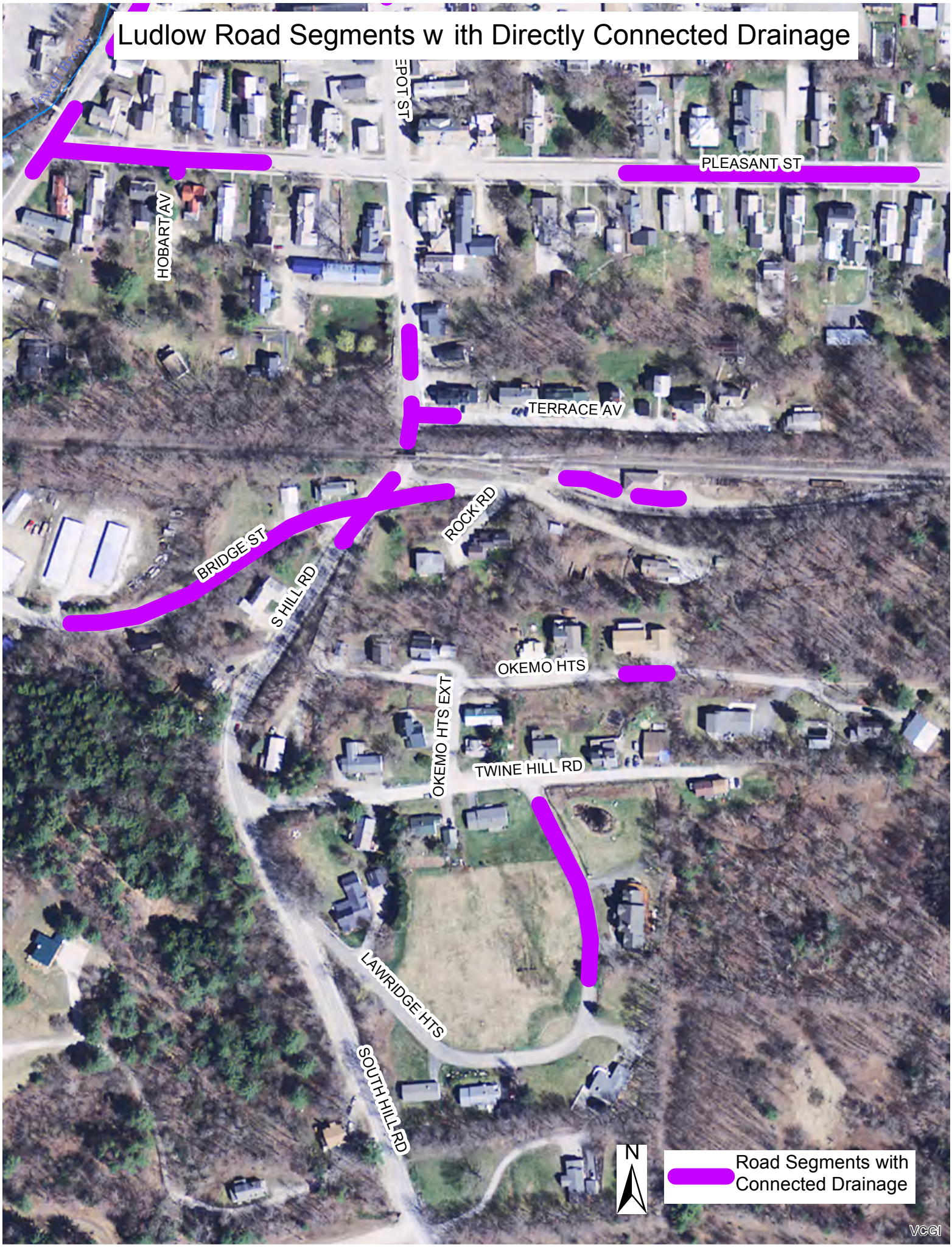
Ludlow Road Segments with Directly Connected Drainage



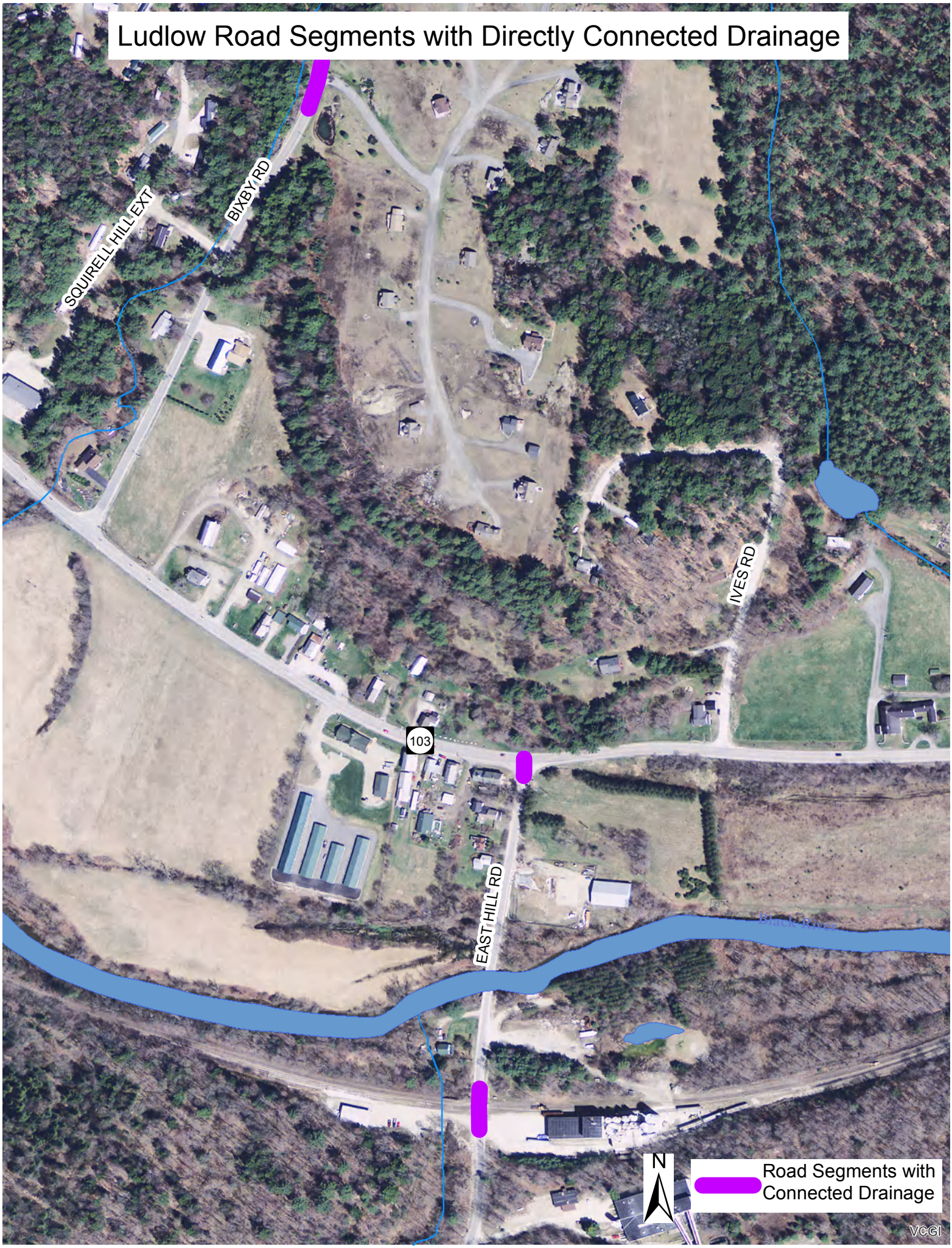
Ludlow Road Segments with Directly Connected Drainage



Ludlow Road Segments w ith Directly Connected Drainage



Ludlow Road Segments with Directly Connected Drainage



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:

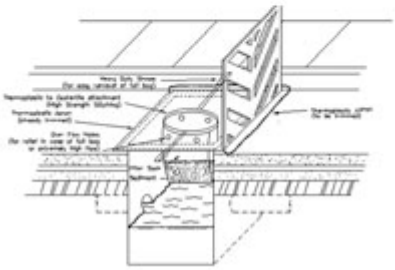
— Proper notification when a spill occurs;
— Site responsibility with respect to addressing the cleanup of a spill;
— Stopping the source of a spill;
— Cleaning up a spill;
— Proper disposal of materials contaminated by the spill;
— Location of spill response equipment programs; and
— Training for designated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

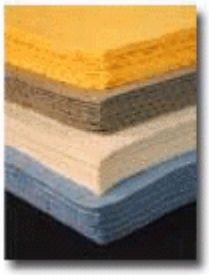
Absorbent socks are flexible tubes used to contain and clean-up spilled fluids. Socks are widely used in industrial applications and are ideal for Spill Kits. Fast spreading spills are quickly stopped with a sock.

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 land, easily absorbing 20 to 25 times their own weight in recovered liquid. Rolls can easily be cut to the exact size required.

water or

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.

§ **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.

(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.

(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

(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.

(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**.

(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. § 80**05 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.

(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.