March 2024

BASIN 1
Assessment Report

Batten Kill-Walloomsac-Hoosic

Contents

Basin overview

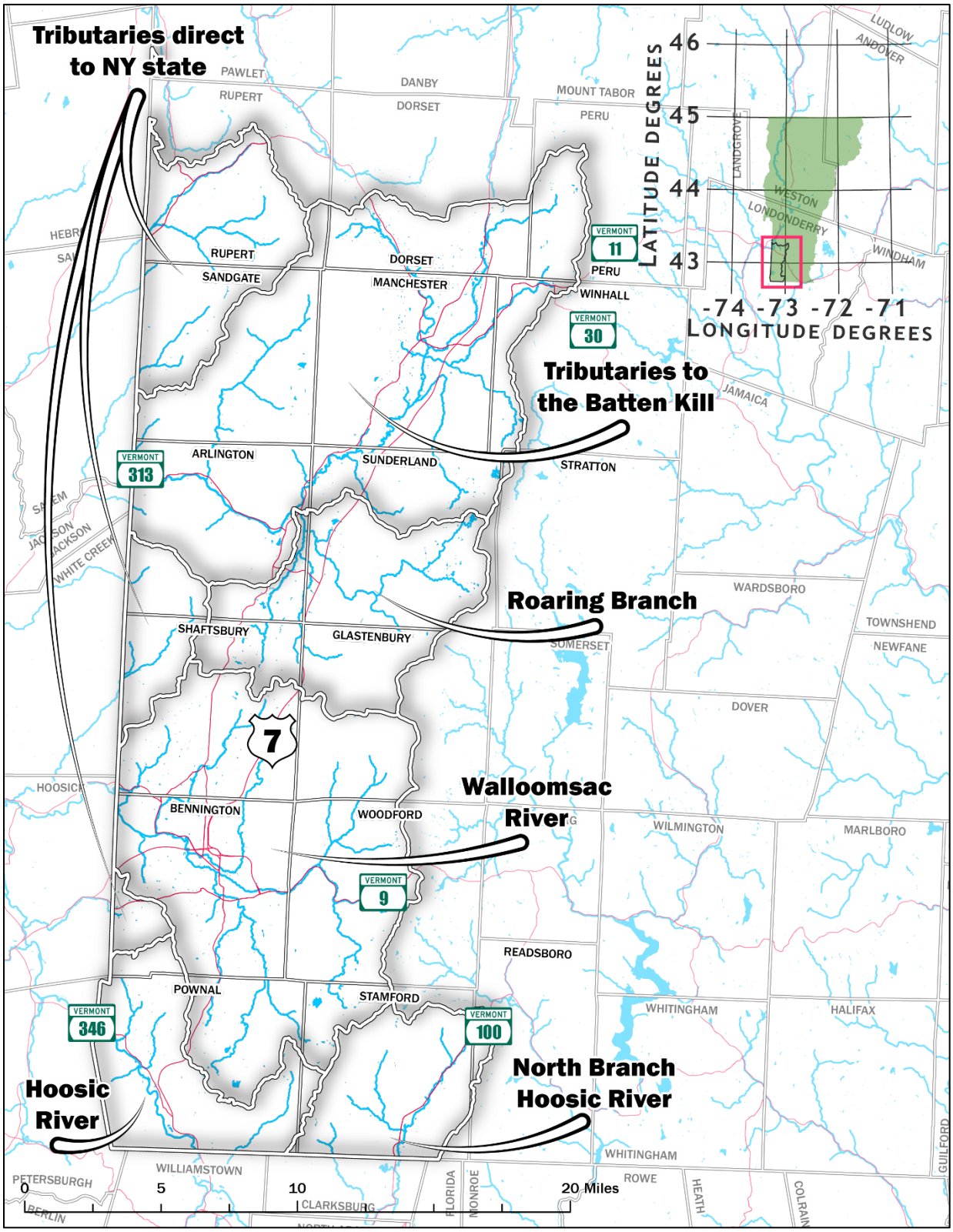

Figure 1 The 454 square mile Batten Kill-Walloomsac-Hoosic basin encompasses waters of Bennington County.

Table 1 Distribution of Strahler stream orders by miles across Basin 1. This data is from the High-Resolution National Hydrography Dataset Plus (NHDPlus).

1	2	3	4	5
605	273	135	85	1

Table 2 Distribution of lake surface area (acres) across Basin 1. Data from the High-Resolution National Hydrography Dataset Plus (NHDPlus).

Lake area (acres)			
<10	*>10<100*	*>100<500*	*>500*
12	12	0	0

Table 3 Distribution of wetland area (acres) across Basin 1. Data from the Vermont State Wetland Inventory (VSWI). Contiguous wetlands were combined to account for wetlands complexes containing multiple classes.

<5	*>5<50*	*>50<500*	*>500*
1317	374	50	1

Table 4 Summation of town level human population over time that intersects with Basin 1.

Basin-wide human population by year				
1980	*1990*	*2000*	*2010*	*2020*
30505	32522	33219	33334	33086

Table 5 . Major waters of Basin 1.

Largest River	Batten Kill (27 miles)
Largest Lake or Reservoir	Lye Brook South (99 acres)
Deepest Lake or Reservoir	Branch Pond (35 feet)
Largest Wetland Complex	Lye Brook wetland complex (Sunderland) (537 acres)

Land cover

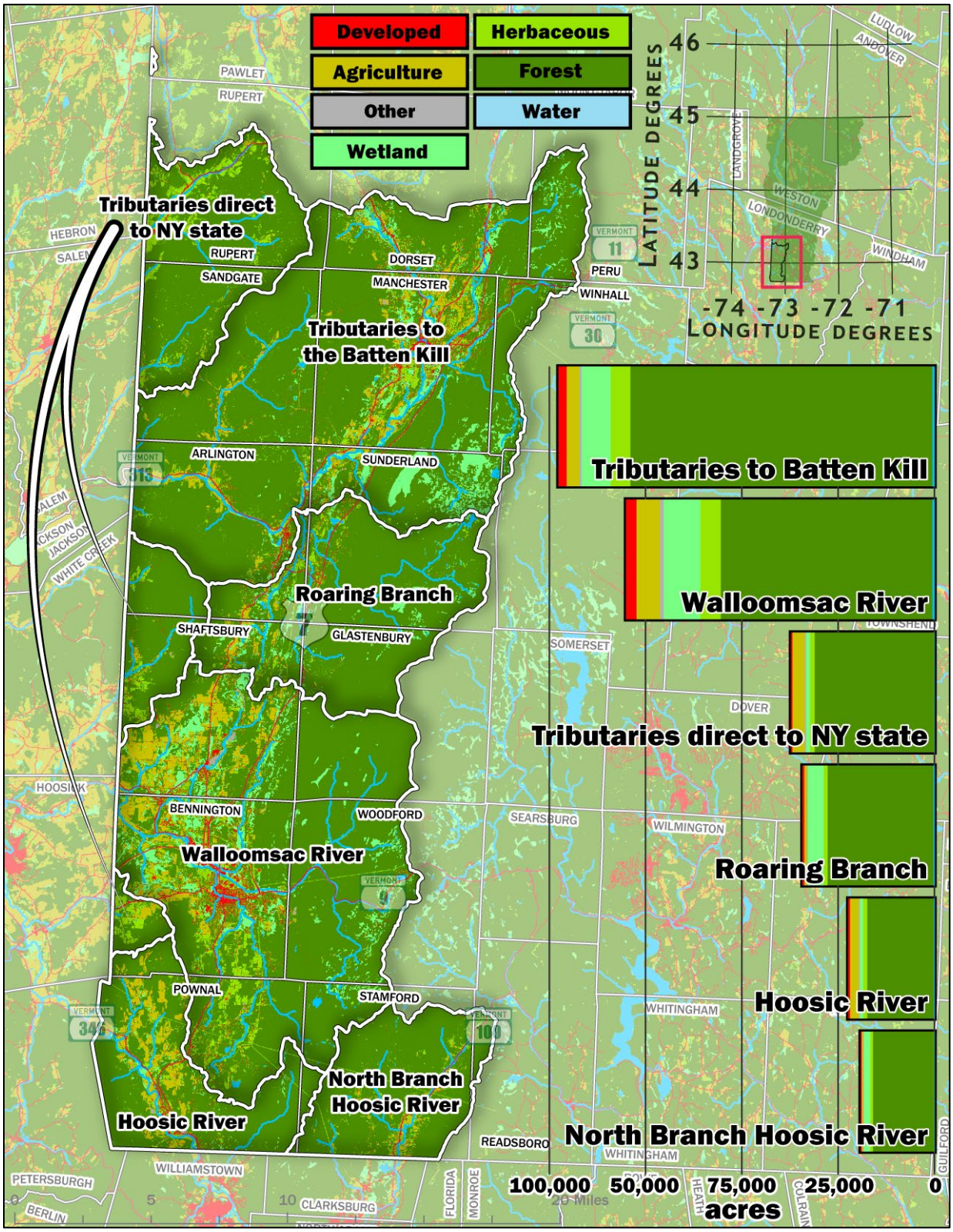

Figure 2. Landcover based on the 1-meter Lake Champlain land cover dataset produced by the University of Vermont spatial analysis laboratory and the Lake Champlain Basin program. The bar graph is a summary based on the Vermont WBID subwatersheds of the tactical basin.

Table 6 The percentage of major land cover types across the Vermont WBID subwatersheds of Basin 1. 0.5-meter Vermont land cover dataset produced by the University of Vermont spatial analysis laboratory and the Lake Champlain Basin program. Common land cover types were combined, for example deciduous and coniferous are categorized as forest. The other category includes shrubs and barren land. Wetlands are found throughout other cover types.

Name	*Acres*	*Developed*	*Agriculture*	*Other*	*Wetlands*	*Herbaceous*	*Forest*	*Water*
Hoosic River	22342.2	1.8	10.6	1.2	3.6	4.7	77.6	0.5
North Branch Hoosic River	19136.8	1.2	2.4	0.9	8.5	3.8	83.2	0.1
Roaring Branch	34222.7	1.2	2.3	0.6	11.9	2.9	80.4	0.7
Tributaries direct to NY state	37205.7	0.9	8.8	0.8	2.6	3.2	83.5	0.1
Tributaries to the Batten Kill	97597.2	2.2	3.4	0.6	7.7	5.2	80.4	0.5
Walloomsac River	80085.4	3.4	7.7	1.2	11.8	6.6	68.7	0.6

Lakes and Ponds

Conditions and trends

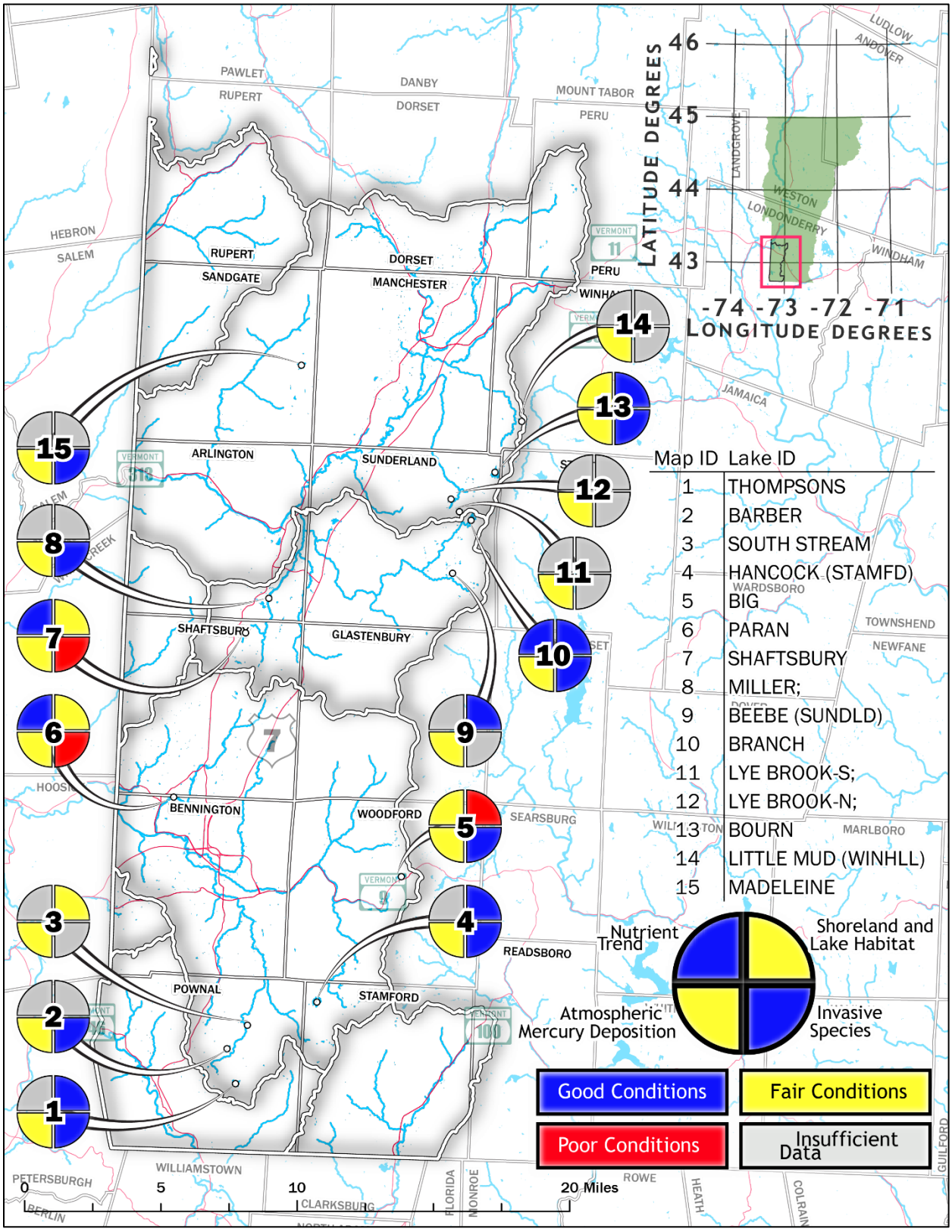

Figure 3. Lake scorecards for Basin 1. Only lakes greater than 10 acres are included. Lake IDs and additional information is provided in the table below.

The Lakes and Ponds Management and Protection Program (VLMPP) reports lake condition with the Vermont Inland Lake Score Card. Lake condition includes these key aspects: nutrients status and trends, aquatic invasive species, shoreland and lake habitat, and mercury pollution. For a more detailed overview, see the *score card webpage*. For more technical information, see *how lakes are scored*, and for lake specific information, navigate to the Score Card tab in this *Lake Score Card* links using the Lake IDs reported below.

VLMPP provides score cards for nine lakes in Basin 1. The colors are a ranked representation of condition: blue is better than yellow, yellow is better than red, and grey is insufficient data. The Map ID numbers correspond with the following table. Use the ID to navigate the *report viewer* to find more information.

The score for a lake's nutrient trend is derived primarily from data obtained through two lake monitoring programs within the Lakes and Ponds Program - the Spring Phosphorus Program and the Lay Monitoring Program; both data sets are used for analysis when available. The final nutrient trend score, which determines the color of the nutrient quadrant on the Score Card, combines the individual scores from the spring TP (total phosphorus), summer TP, summer Chlorophyll-a and summer Secchi depth. See *how lakes are scored* for more information.

Shoreland habitat is assessed using the Lakeshore Disturbance Index (LDI). A value of 0.2 or less is considered in good condition; an LDI value between 0.2 and 0.75 is considered in fair condition and an LDI value of greater than 0.75 is considered in poor condition. The Lake Wise Program offers technical assistance to shoreland property owners who want to protect or restore their shoreland habitat. Take advantage of free technical assistance through the Lake Wise Program and have your shoreland property assessed for controlling runoff and preventing erosion. The Lake Wise Program offers solutions - Best Management Practices - for managing shoreland property and making it lake-friendly for all.

The Aquatic Invasive Species (AIS) score is based on the presence of one or more invasive animal or plant species. A good score indicates there are no known invasive species present while a poor score indicates that there is at least one invasive species present, regardless of its abundance or 'nuisance' level (a fair score is not used for this criteria).

The Mercury Fish Tissue Contamination Score reflects the most recent data that VLMPP has regarding the presence of mercury (Hg) in the food web of Vermont lakes. A good score indicates low probability of Hg accumulation in fish tissue; a fair score indicates that Hg accumulation in fish tissue is likely; a poor score indicates that Hg in fish tissue exceeds EPA guidelines.

Table 7 Vermont Inland Lake Score Card table: lake-specific information with area in acres and depth in feet. Only lakes greater than 10 acres are included. AIS: Aquatic invasive species score. Mercury: mercury fish tissue contamination. Shoreland: shoreland disturbance (USEPA National Lake Assessment). Nutrient Trend: an index of trends in annual means of spring TP, summer TP, Secchi, and chlorophyl-a.

Map ID	Lake ID	Area (ac)	Max Depth (ft)	Nutrient Trend	Shoreland	AIS	Mercury
1	THOMPSONS	32.1	8	Insufficient data	Good	Good	Fair
2	BARBER	20.9	20	Insufficient data	Insufficient data	Good	Fair
3	SOUTH STREAM	25.2	2	Insufficient data	Fair	Insufficient data	Fair
4	HANCOCK (STAMFD)	55.9	12	Insufficient data	Good	Good	Fair
5	BIG	33.7	28	Fair	Poor	Good	Fair
6	PARAN	35.1	23	Good	Fair	Poor	Fair
7	SHAFTSBURY	23.7	7	Good	Fair	Poor	Fair
8	MILLER;	18.5		Insufficient data	Insufficient data	Good	Fair
9	BEEBE (SUNDLD)	10.3	19	Insufficient data	Good	Insufficient data	Fair
10	BRANCH	44.1	35	Good	Good	Good	Fair
11	LYE BROOK-S;	99.3		Insufficient data	Insufficient data	Insufficient data	Fair
12	LYE BROOK-N;	31.4		Insufficient data	Insufficient data	Insufficient data	Fair
13	BOURN	56.7	27	Fair	Good	Good	Fair
14	LITTLE MUD (WINHLL)	19.2	2	Insufficient data	Insufficient data	Insufficient data	Fair
15	MADELEINE	26.7	27	Insufficient data	Insufficient data	Good	Fair

Lake Reclassification

To protect the waters of the State of Vermont, the Watershed Management Division (WSMD) can initiate rulemaking to reclassify surface waters to maintain a higher standard. The public may also petition the Division to request the initiation of rulemaking. The major implication of reclassification is the application of the most recent *Water Quality Standards*.

Most lakes in the state have a classification of B(2) for aesthetics uses, requiring that the lake maintains a total phosphorus criteria of below 18 ug/l. Reclassification to B(1) for aesthetics uses would lower the criteria to 17 ug/l, and a reclassification to A(1) for aesthetics uses would lower the criteria to 12 ug/l.

There are no lake reclassification candidates in Basin 1.

Impaired Lakes

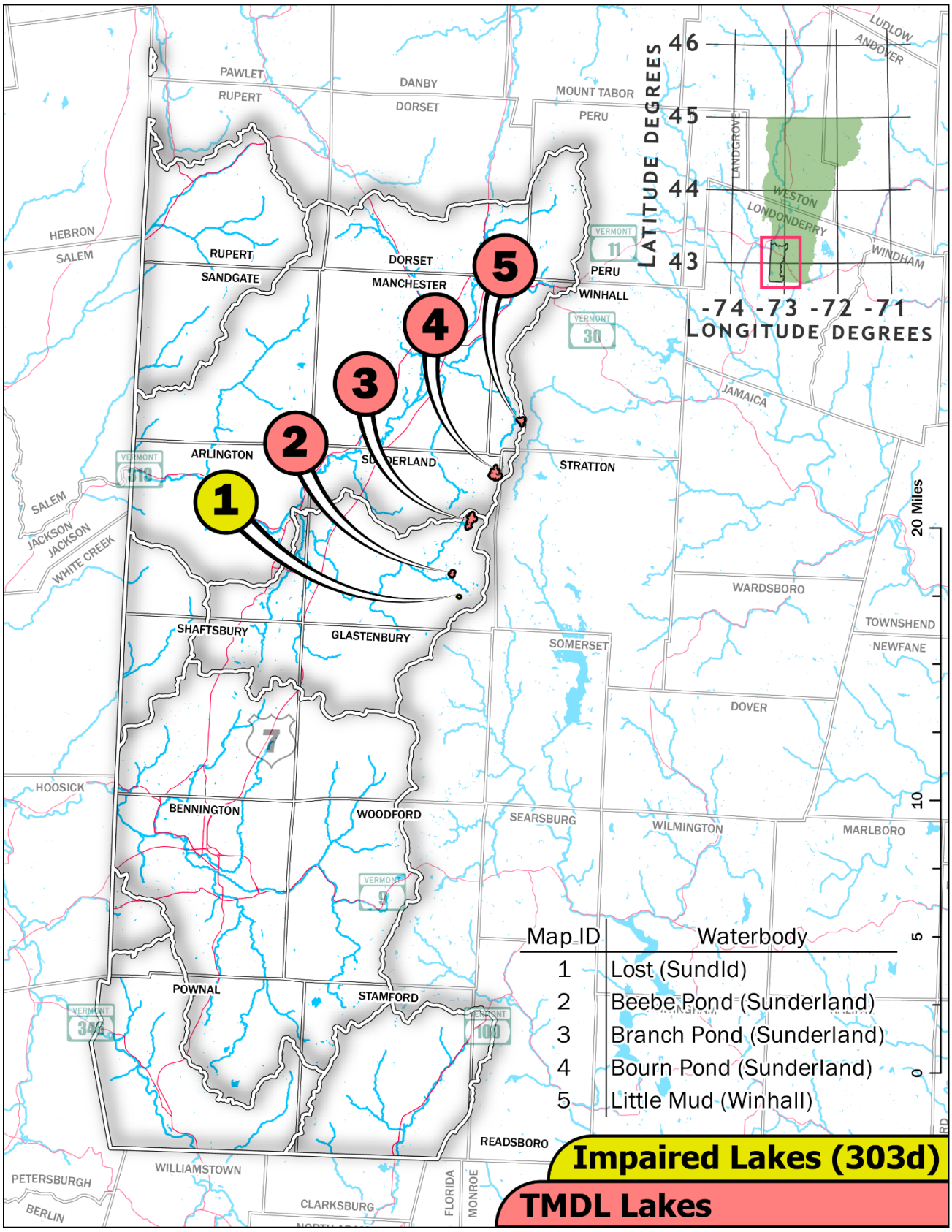

Figure 4 Map of impaired lakes across Basin 1 through 2024. Salmon color represent lakes that are on Part D of the Priority Waters List and have an approved Total Maximum Daily Load (TMDL).

Restoring waters is one of the priorities of the *Watershed Management Division's Strategic Management Plan*. WSMD begins the process of restoring Vermont surface waters by listing waters not in compliance with the water quality standards on a biennial basis. Waters are added and removed based on whether they meet *water quality standards* through a process defined in the Vermont *Surface Water Assessment and Listing Methodology*[1]. Adding waters to these lists prioritizes them for fund allocation, remediation, and monitoring.

Table 8 List of impaired lakes across Basin 1. Map IDs correspond to the map above. Part A= impaired and needs a TMDL, Part B=impaired with alternative restoration plan in place, and Part D=impaired with an EPA approved TMDL.

MAP ID	NAME	PROBLEM	POLLUTANT	PART
1	Lost (SundId)	Atmospheric deposition: critically acidified; chronic acidification	pH	A
2	Beebe Pond (Sunderland)	Atmospheric deposition: extremely sensitive to acidification; episodic acidification	pH	D
3	Branch Pond (Sunderland)	Observed Al always exceeds Acute criteria, Atmospheric deposition: critically acidified; chronic acidification	ALUMINUM, TOTAL, pH	D
4	Bourn Pond (Sunderland)	Observed Al always exceeds Acute criteria, Atmospheric deposition: extremely sensitive to acidification; episodic acidification	ALUMINUM, TOTAL, pH	D
5	Little Mud (Winhall)	Atmospheric deposition: critically acidified; chronic acidification	pH	D

Altered Lakes

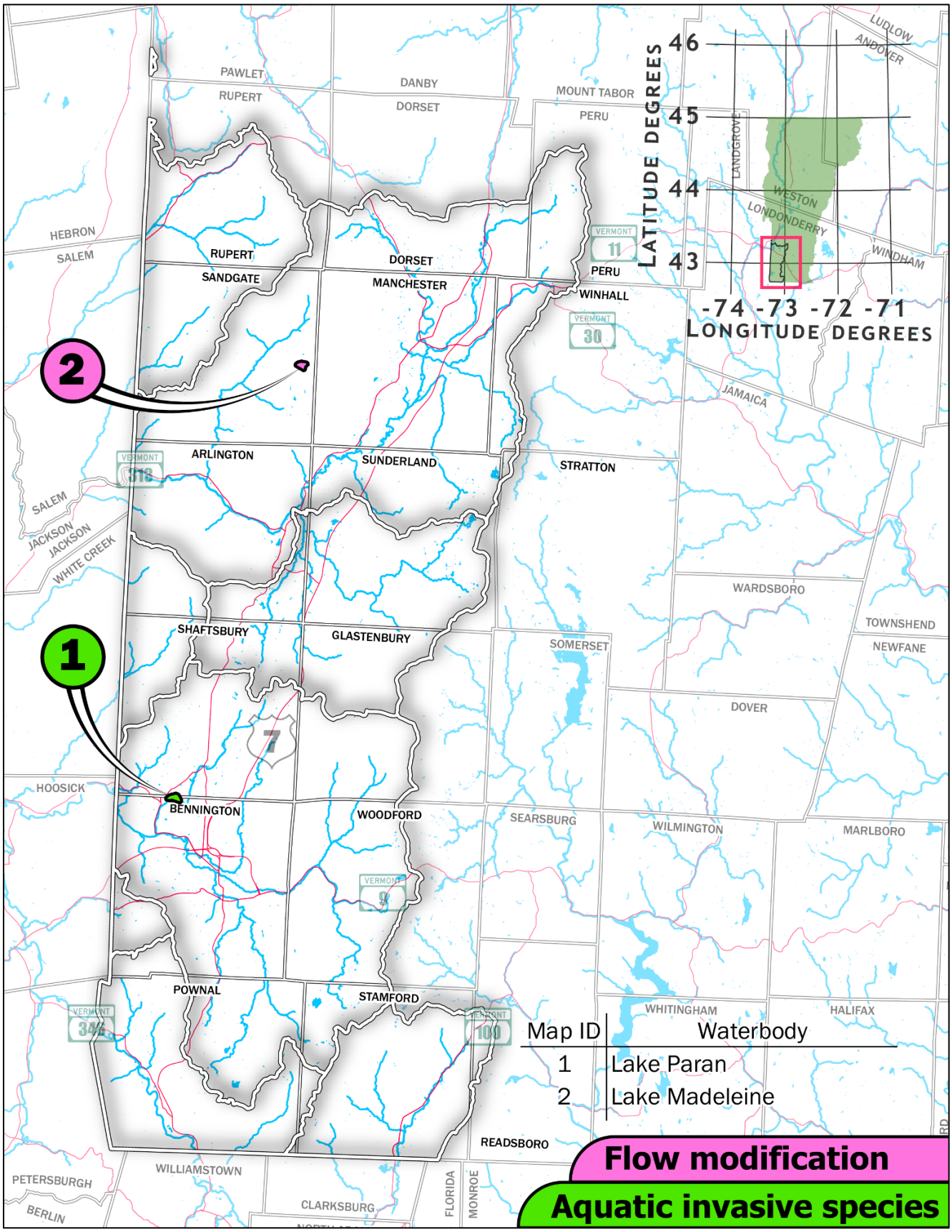

Figure 5 Map of altered lakes for Basin 1. Lakes in green are those altered by aquatic invasive species. Lakes in pink are altered by flow modification.

Lakes are assessed as Altered when aquatic habitat and/or other designated uses are not supported due to the extent of invasive aquatic species, or hydrologic factors such as a lack of flow, water level or flow fluctuations, or some other modified hydrologic condition. These waters are listed on the Priority Waters List in Parts E (invasive species) and F (flow) respectively. For Parts E, Eurasian water milfoil (EWM), zebra mussels (ZM) are indicated in Table 9.

Table 9 Altered lakes in Basin 1.

MAP ID	NAME	PROBLEM	PART
1	Paran	Moderate EWM growth; Planning to implement mechanical harvesting for invasive plants	E
2	Lake Madeleine	Water level fluctuation alters aquatic habitat; Unlicensed hydroelectric project	F

Phosphorus Trends in Lakes

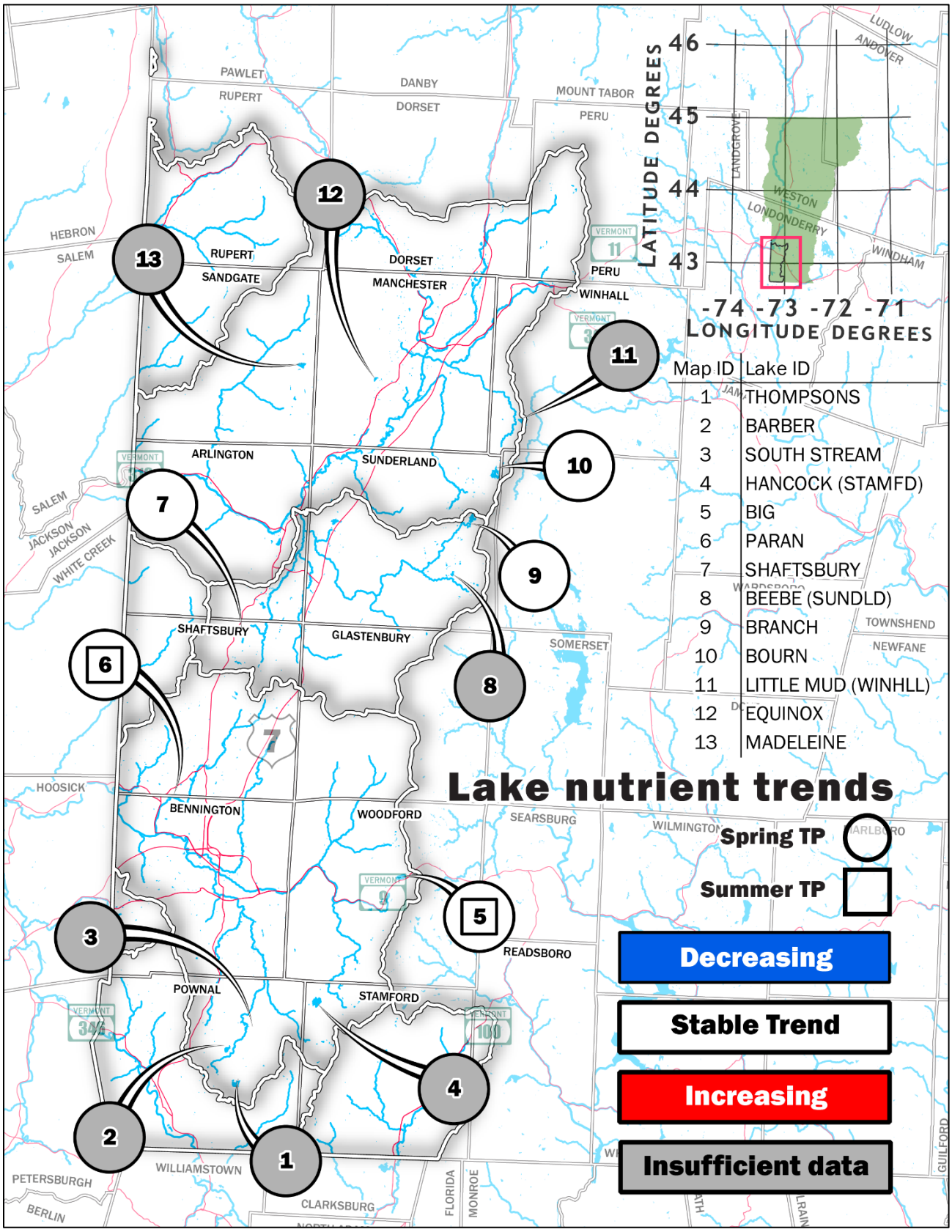

Figure 6 Total phosphorus trends for lakes in Basin 1. Note that trends can be for either spring or summer data or for both.

The WSMD conducts long-term monitoring of surface waters to identify increasing, stable, and decreasing trends of the most relevant water quality parameters in the Vermont Water Quality Standards. Modeling water quality trends before a surface water becomes impaired or altered can lead to more effective and efficient actions to reduce stressors to these waters. For more information on how trends in lakes are identified, see the nutrient trend section of the *Lake Score Card Document*.

While the Lake Score Card identifies trends for multiple parameters of lake health, Lakes with sufficient data to identify a trend in total phosphorus concentrations are shown on the above map. Trends are categorized into three groups: Increasing (models with p-values <0.05 and positive coefficients), stable (models with p-values > 0.05) and decreasing (models with p-values <0.05 and negative coefficients). Use the Lake ID in Table 10 to find more information in the *report viewer*.

Table 10 List of lakes with enough data to model trends in summer or spring total phosphorus. Map IDs correspond with the map above. (+) increasing TP trends, (=) stable TP trends, and (-) negative TP trends. Insufficient data are lakes with data but require more to model a trend.

Map ID	Lake ID	Summer	Spring
1	THOMPSONS	No data	Insufficient data
2	BARBER	No data	Insufficient data
3	SOUTH STREAM	No data	Insufficient data
4	HANCOCK (STAMFD)	No data	Insufficient data
5	BIG	=	=
6	PARAN	=	=
7	SHAFTSBURY	No data	=
8	BEEBE (SUNDLD)	No data	Insufficient data
9	BRANCH	No data	=
10	BOURN	No data	=
11	LITTLE MUD (WINHLL)	No data	Insufficient data
12	EQUINOX	No data	Insufficient data
13	MADELEINE	No data	Insufficient data

Lakes in need of further assessment

In the Lake Score Card section above, there are numerous lakes that have insufficient data. For these lakes, impervious cover and agricultural land uses information is shown below to help watershed evaluation because these land cover / use types tend to export more pollutants than other land cover/use types. Use the Lake ID in the table below to find more information in the report viewer. The Watershed Disturbance Score is derived from a landscape development intensity index (LDI) developed by Brown and Vivas (2005)[1]. The LDI is a measure of human-induced alterations to the biological, chemical, and physical processes of a watershed's lands that impact the receiving water, in this case a lake.

Table 11. Landcover of watersheds of lakes with insufficient data to determine water quality status.

	Lake area	Watershed disturbance	Impervious surface		Agricultural land	
Lake ID			Percent	Acres	Percent	Acres
ALDER;	2.7	Good	0.28	1.76	0.00	0.28
BARBOS	5.7	Good	1.35	4.66	0.00	1.35
BUGBEE;	3.2	Fair	2.55	34.04	0.30	6.92
BULLHEAD (MANCHR)	8.1	Poor	6.51	5.54	0.00	7.63
HOPPER	1.6	Insufficient data	1.09	7.01	0.00	1.35
NORTH BENNINGTON	2.5	Insufficient data	0.00	0.03	0.00	0.00
PICKEREL	8.1	Poor	6.53	15.11	3.04	14.63
SOUTH VILLAGE	6.6	Poor	3.55	22.88	2.86	22.42

[1] Brown, M. T., & Vivas, M. B. (2005). Landscape development intensity index. Environmental monitoring and assessment, 101, 289-309.

Rivers

Conditions and trends

Physical condition

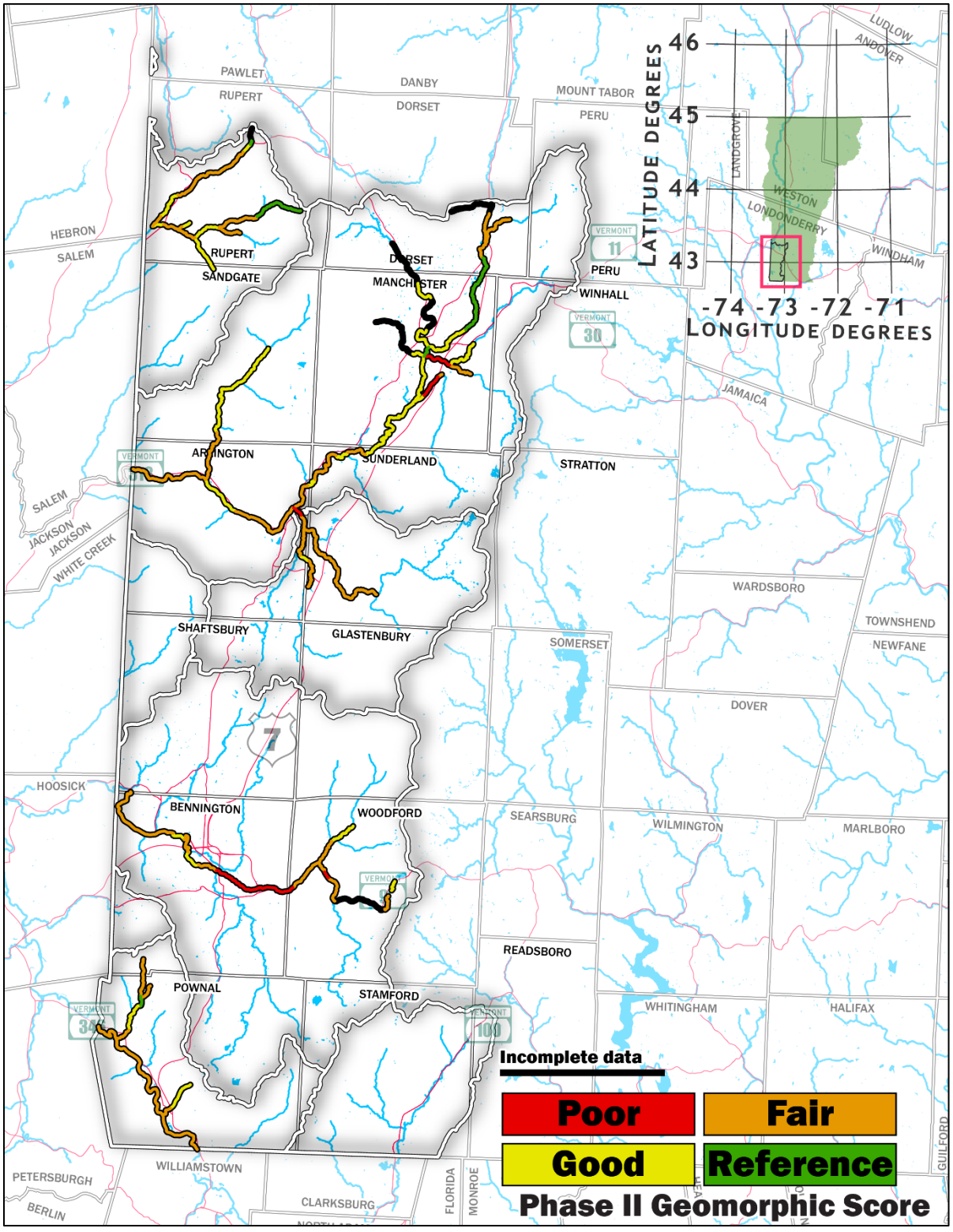

Figure 7 Map of rivers in Basin 1, with Phase II geomorphic condition scores through 2023. Poor rivers have extreme departure from reference condition, fair rivers have major departure, and good rivers have minor departure. Reference rivers have no departure.

Within the WSMD Rivers Program, two sections conduct assessments of Vermont's rivers and streams. The Biomonitoring Section collects data and assesses the biological and chemical condition of rivers, and the Physical River Science Section collects data and assesses the physical condition of rivers.

Fluvial geomorphology is a subdiscipline of geomorphology that investigates how flowing water shapes and modifies Earth's surface through erosional and depositional processes. The Rivers Program conducts a three-phase approach to assess the physical condition of rivers in the State of Vermont. Phase 1 is a watershed assessment. Phase 2 is a rapid field stream assessment, and Phase 3 is a survey assessment. Figures 7- 9 give the overall Phase 2 geomorphic condition score of rivers in Basin 1. Figures displayed here are based on Phase 2 data.

The Stream Geomorphic Assessment (SGA) can be used to problem solve and set priorities for river corridor conservation and restoration strategies at a watershed scale because it allows you to ascertain how one reach may be affecting the condition of another. In Phase 2 SGA direct observations are used to evaluate stream geomorphic condition and different channel adjustment processes in each reach. In the Phase 2 SGA, the geomorphic stream condition is largely a function of the type and degree to which the stream has departed from its reference condition and the type and magnitude of channel adjustments that are happening in response to the channel and floodplain modifications that have been documented at assessed reaches in the watershed.

For more information on these type of assessments see the River's Assessment *webpage*. To learn more about the rivers and streams with Phase 1 and Phase 2 assessments in Basin 1, final reports for each project can be found at: *https://anrweb.vt.gov/DEC/SGA/finalReports.aspx*.

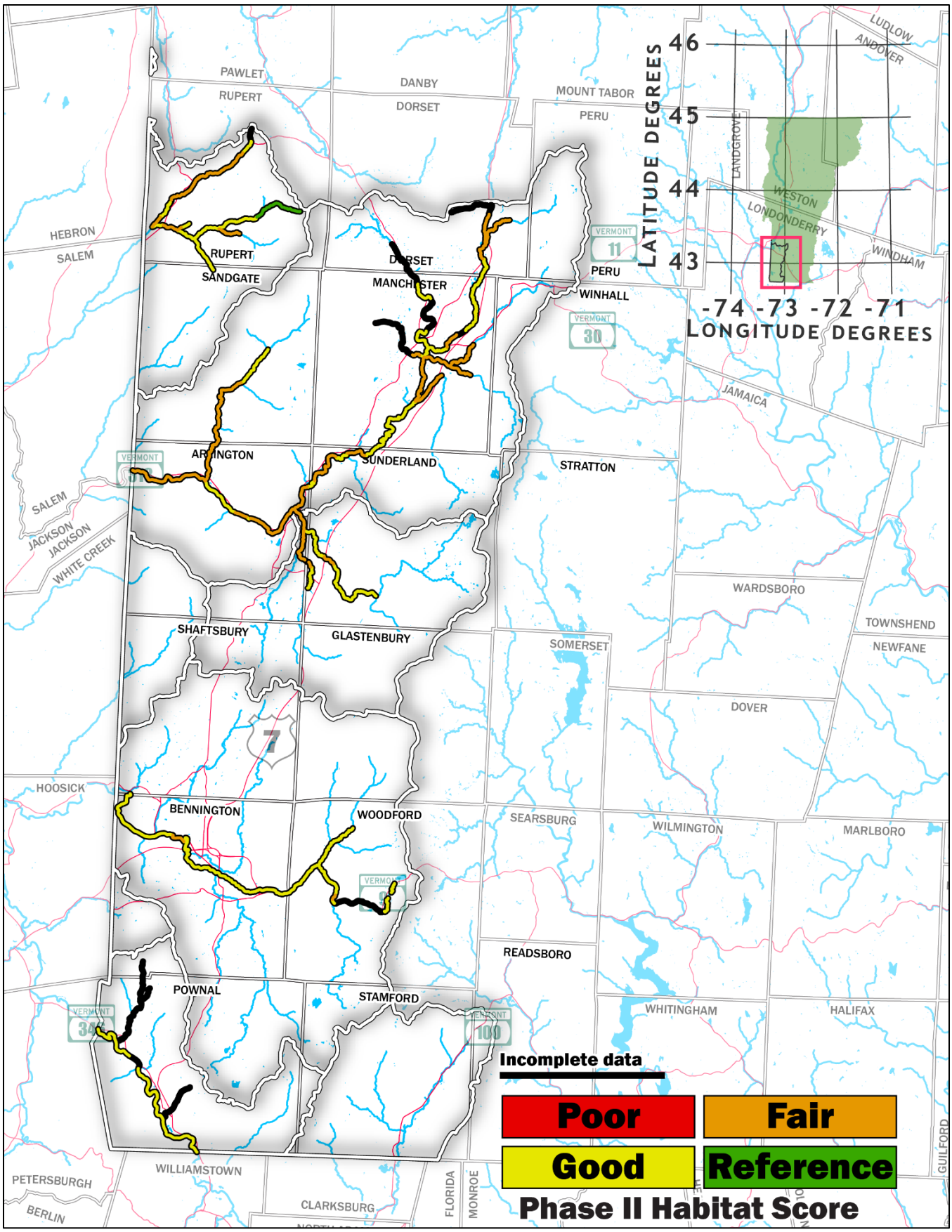

Figure 8 Map of rivers in Basin 1 Phase II habitat condition ratings through 2023. Low number ratings have extreme departure from reference conditions. High number ratings have non-significant departure from reference conditions.

The Rapid Habitat Assessment evaluates the physical components of a channel bed, banks, and riparian vegetation and how they may affect aquatic life. The Habitat condition ratings can be used to identify high quality habitat and to red-flag areas of degraded physical habitat. It is also useful to examine habitat condition ratings at a watershed scale and compare these ratings with Phase 1 and Phase 2 impact rating data to determine potential reasons for habitat degradation, and to understand habitat quality and availability throughout the watershed. Looking closely at the physical processes and the resulting physical conditions that determine aquatic habitat, and thus the biota that inhabit it, and by comparing healthy systems to unhealthy systems, a better understanding of how fluvial processes impact aquatic habitat and biota can be determined. For information on habitat assessments, see the rapid habit assessment section in the SGA handbook: https://dec.vermont.gov/sites/dec/files/wsm/rivers/docs/rv_SGA_Phase2_Protocol.pdf#page=69.

Physical condition - protection

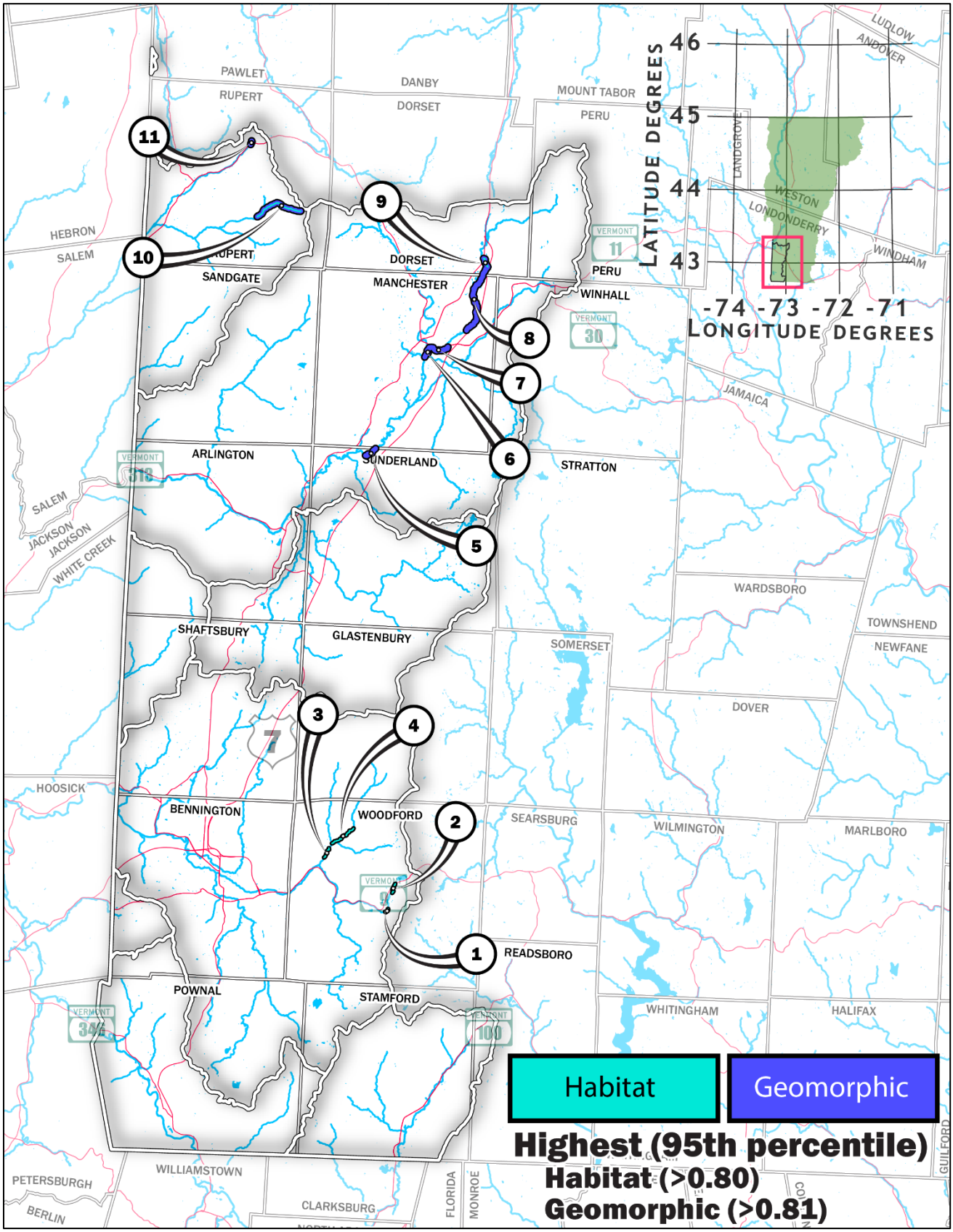

Figure 9. Map of the 95th percentile (highest) habitat and geomorphic condition scores (Basin 1 south section). Map IDs correspond to the table below. Using this percentile approach identifies the reaches with the best geomorphic and habitat condition relative to conditions across the basin. Each is scored separately but overlap does occur.

Table 12 The highest 5th percentile habitat and geomorphic condition scores. Map IDs correspond to the map above and the Assessment link hyperlinks to more information on the reach.

Map ID	SGAT_ID	Name	Geomorphic	Habitat	Assessment	Longitude	Latitude
1	146_M6T3.05S1.04B	City Stream			Link	42.874	-73.079
2	146_M6T3.05S1.06-	City Stream			Link	42.886	-73.075
3	146_M6T3.05B	Roaring Branch Walloomsac Brook			Link	42.904	-73.123
4	146_M6T3.06-	Bolles Brook			Link	42.913	-73.111
5	23_M06-	Batten Kill			Link	43.116	-73.093
6	23_M10-	Batten Kill			Link	43.170	-73.052
7	23_M11A	Batten Kill			Link	43.171	-73.044
8	23_M11D	Batten Kill			Link	43.198	-73.019
9	23_M12A	Batten Kill			Link	43.218	-73.011
10	79_M03T2.02-	Tributary to White Creek			Link	43.247	-73.159
11	79_M01T1.06A	Mill Brook			Link	43.281	-73.181

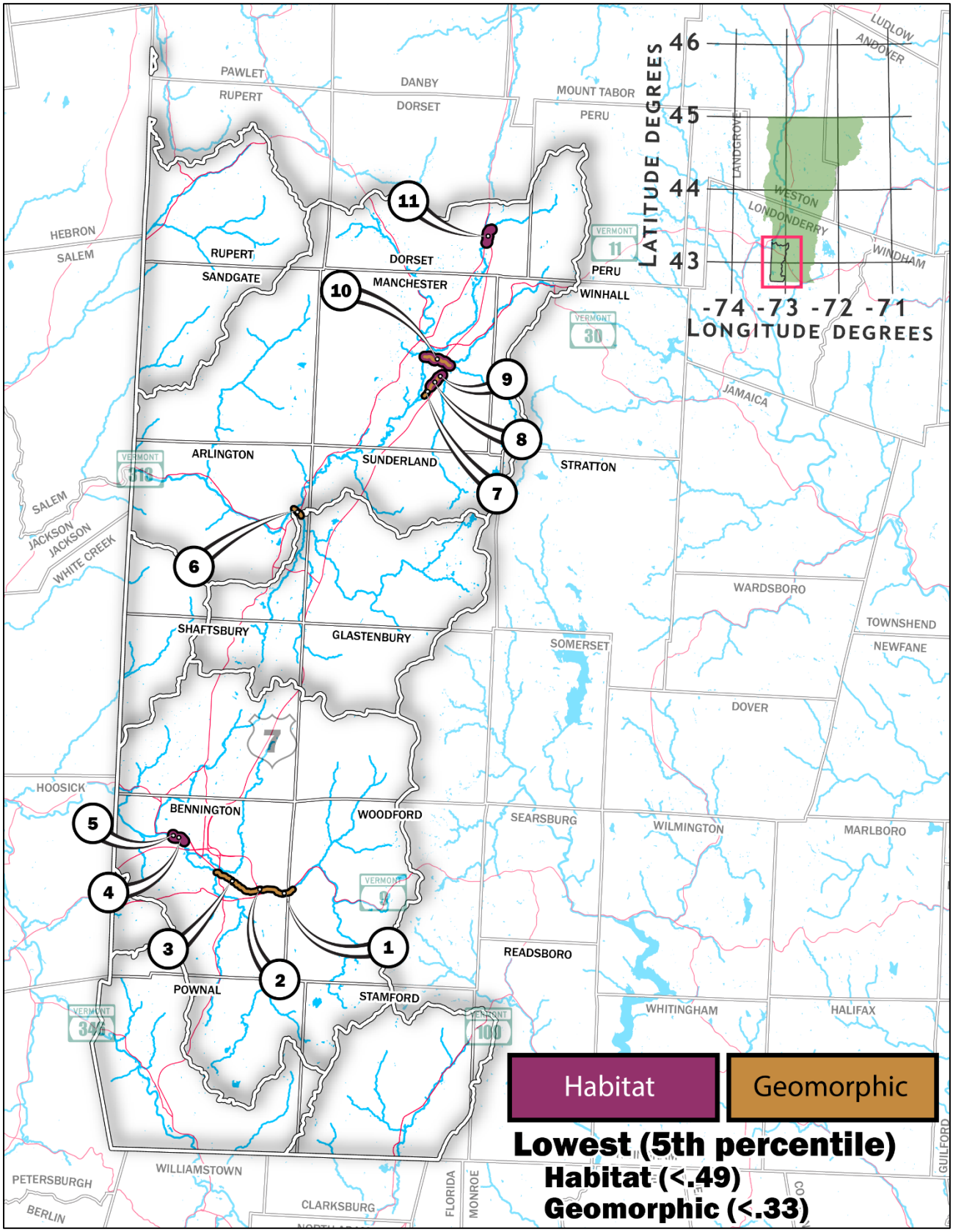

Figure 10 Map of the lowest 5th percentile habitat and geomorphic condition scores (Basin 1 south section). Map IDs correspond to the table below.

Table 13. The lowest 5th percentile habitat and geomorphic condition scores. Map IDs correspond to the map above and the Assessment link hyperlinks to more information on the reach.

Map ID	SGAT_ID	Name	Geomorphic	Habitat	Assessment	Longitude	Latitude
1	24_M06T3.03-	Roaring Branch Walloomsac Brook			Link	-73.153	42.882
2	24_M06T3.02-	Roaring Branch Walloomsac Brook			Link	-73.171	42.884
3	24_M06T3.01-	Roaring Branch Walloomsac Brook			Link	-73.191	42.889
4	24_M04-	Walloomsac River			Link	-73.229	42.911
5	24_M03B	Walloomsac River			Link	-73.233	42.912
6	23_T2.01-	Warm Brook			Link	-73.146	43.085
7	23_T3.01B	Lye Brook			Link	-73.052	43.149
8	23_T3.02A	Lye Brook			Link	-73.047	43.154
9	23_T3.02B	Lye Brook			Link	-73.043	43.157
10	23_T4.01-	Bourn Brook			Link	-73.045	43.166
11	23_T7.01-	Mad Tom Brook			Link	-73.009	43.232

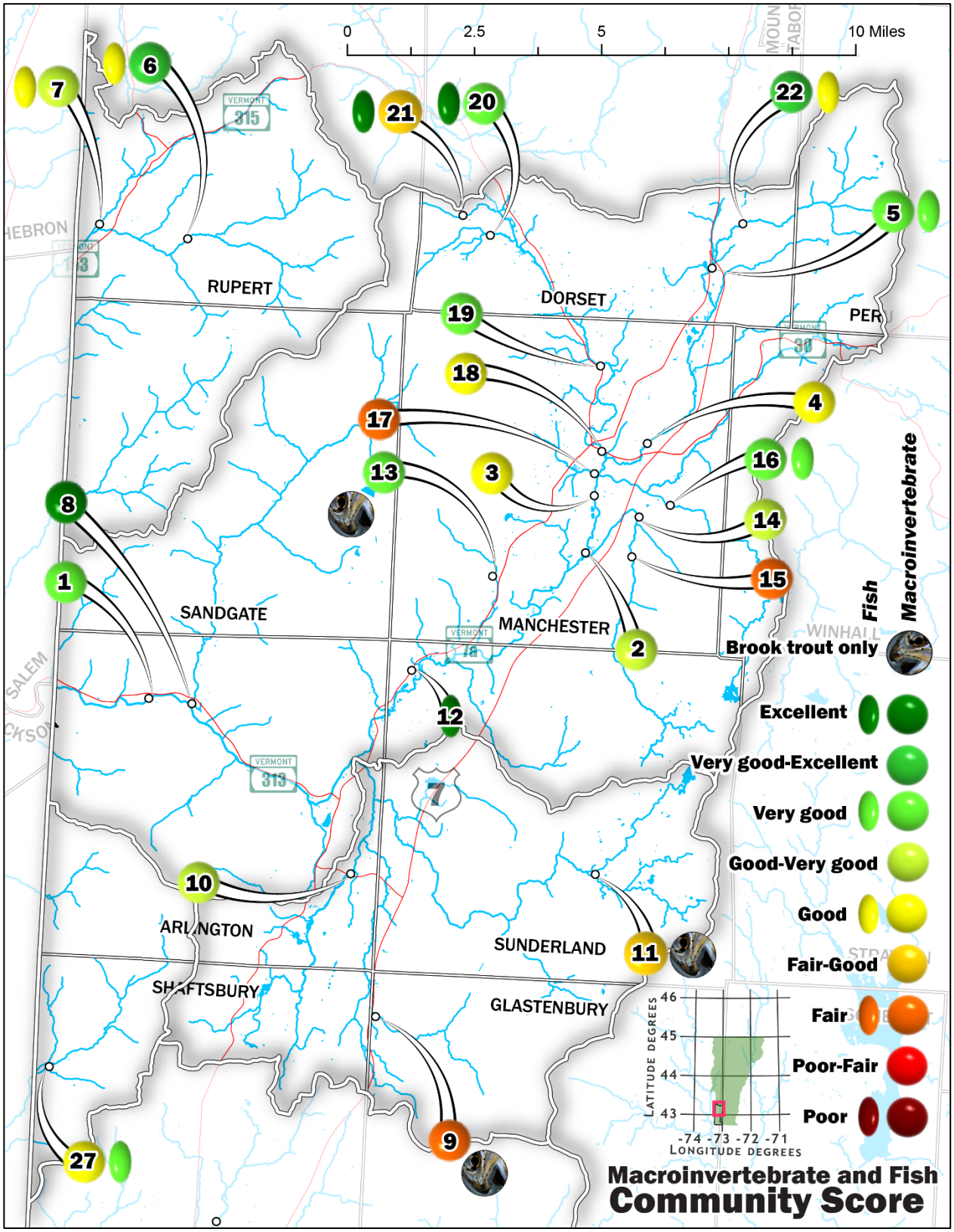

Figure 11. Map of the most recent Macroinvertebrate Community assessments over last 12 years for sites in Basin 1, North section (see below). Poor scores represent the greatest deviation from reference conditions and Excellent scores represent non-significant deviation from reference conditions. We do not have criteria for assessing Brook Trout Only streams (where brook trout are the only observed taxa). Map IDs correspond with the table below.

The Biomonitoring Section conducts biological assessments of wadeable rivers and streams. For more information on these assessments see the WSMD Biomonitoring Section webpage[1]. The assessments include sampling of macroinvertebrate and fish communities to determine Aquatic Biota use support, as well as the collection of water quality and habitat data to better understand the condition of the biological communities. Aquatic biota health in streams is one of the primary areas of study by the WSMD with data used to determine a river's ability to fully support aquatic biota. Brook Trout (BKT) only streams are defined as streams that contain only Brook Trout, which cannot be assessed using the VDEC Fish Index of Biological Integrity (IBI), which requires two or more native species to score.

Table 14 Macroinvertebrate (bug) and fish community assessment matrix for the streams of Basin 1, south section. Blank = no data,

Unable to sample or assess	Poor (P)	Poor-fair (PF)	Fair (F)	Fair-good (Fg)	Good (G)	Good-Very good (GVg)	Very good (Vg)	Very good-excellent (VgE)	Excellent (E)

Name	Map ID		2015	2016	2017	2018	2019	2020	2021	2022	2023
Mill Brook, 0.2	6	Bug				GVg					
Mill Brook, 0.2	6	Fish				G					
Fayville Branch, 3.7	7	Bug				F					
Fayville Branch, 3.7	7	Fish				BKT					
Warm Brook, 3.1	8	Bug				GVg					
Branch Pond Brook, 0.1	9	Bug				FG					
Branch Pond Brook, 0.1	9	Fish				BKT					
Mill Brook, 0.7	10	Fish									E
Lye Brook, 1.6	11	Bug				GVg					
Lye Brook, 2.5	12	Bug						F			
Lye Brook, 2.5	12	Fish									U
Bourn Brook, 1.6	13	Bug				Vg					
Bourn Brook, 1.6	13	Fish				Vg					

Name	Map ID		2015	2016	2017	2018	2019	2020	2021	2022	2023
Munson Brook, 0.2	14	Bug				F	F				
Munson Brook, 0.2	14	Fish					U				
West Branch Batten Kill, 0.2	15	Bug				G					
Mad Tom Brook, 1.2	16	Bug							VgE		
Mad Tom Brook, 1.2	16	Fish							G		
Walloomsac River, 9.2	17	Bug	F					F			
Walloomsac River, 10.1	18	Bug	G					G			
Walloomsac River, 15.1	19	Bug		Vg	FG	FG					
Little White Creek, 8.6	20	Bug				G					
Little White Creek, 8.6	20	Fish				Vg					
Trib to Walloomsac, 0.5	21	Bug				GVg					
Trib to Walloomsac, 0.5	21	Fish				G					
Paran Creek, 0.1	22	Bug				U	FG				
Paran Creek, 0.1	22	Fish					G				
Hewitt Brook, 1.8	27	Bug		Vg	G	F					

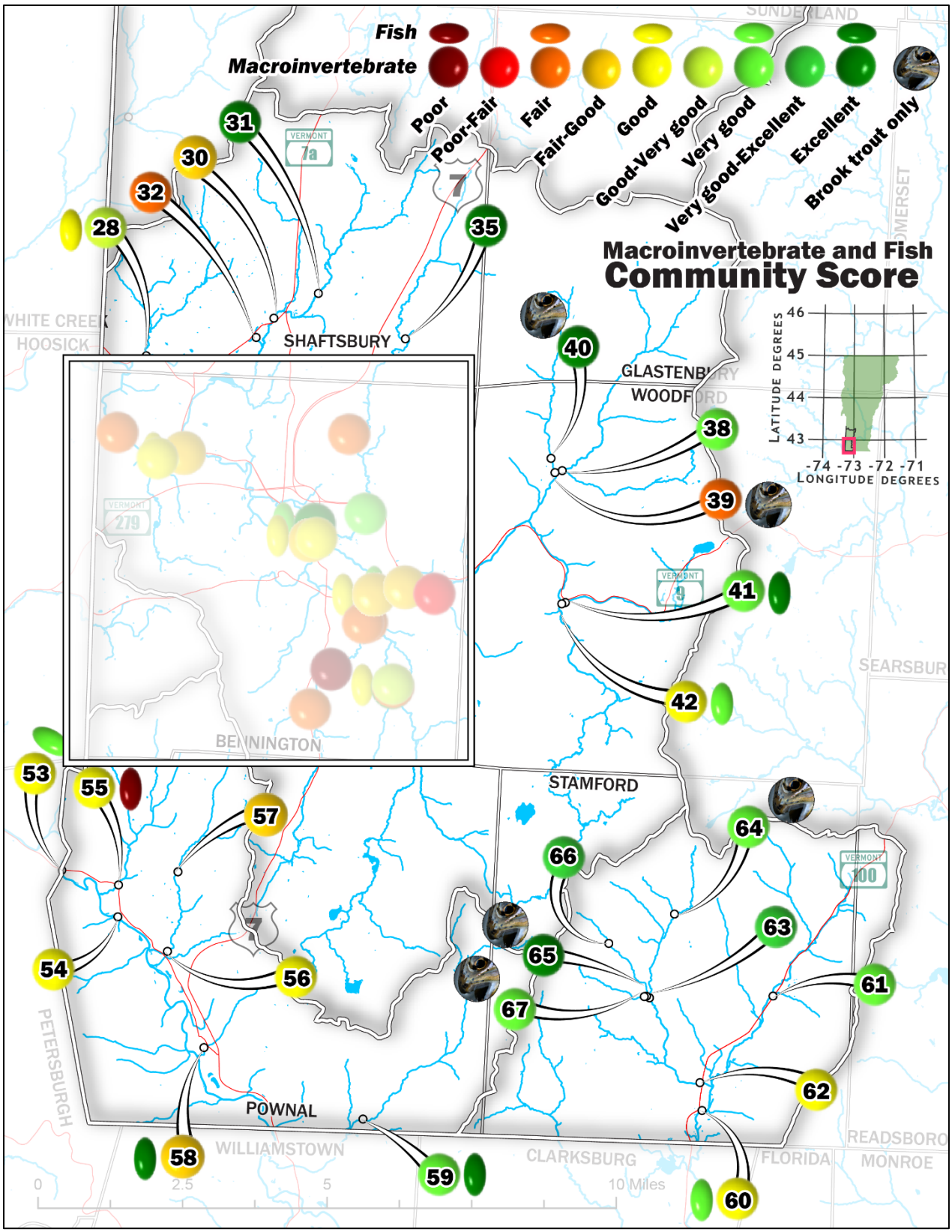

Figure 12 Map of the Macroinvertebrate Community assessment for Basin 1, South section, (see below). Poor scores represent the greatest deviation from reference conditions and Excellent scores represent non-significant deviation from reference conditions. We do not have criteria for assessing Brook Trout Only streams (where brook trout are the only observed taxa). Map IDs correspond with the table below.

Table 15 Macroinvertebrate (bug) and fish community matrix for the watersheds of Basin 1, middle section. Blank = no data, bkt = streams with a robust brook trout community

Unable to sample or assess	Poor (P)	Poor-fair (PF)	Fair (F)	Fair-good (Fg)	Good (G)	Good-Very good (GVg)	Very good (Vg)	Very good-excellent (VgE)	Excellent (E)

Name	Map ID		2015	2016	2017	2018	2019	2020	2021	2022	2023
Trib to Walloomsac, 0.5	28	Bug				GVg					
Trib to Walloomsac, 0.5	28	Fish				G					
Paran Creek, 1.9	30	Bug	FG								
Paran Creek, 3.1	31	Bug	E								
Cold Spring Brook, 0.2	32	Bug				F					
Bolles Brook, 1.6	38	Bug					Vg				
Bickford Hollow Brook, 0.1	39	Bug				F					
Bickford Hollow Brook, 0.1	39	Fish				BKT					
Bickford Hollow Brook, 0.4	40	Bug								E	
Bickford Hollow Brook, 0.4	40	Fish								BKT	
City Stream, 2.0	41	Bug				Vg					
City Stream, 2.0	41	Fish				E					
Stamford Brook, 0.1	42	Bug				G					
Stamford Brook, 0.1	42	Fish				Vg					
Hoosic River, 37.2	53	Bug				G					
Hoosic River, 38.9	54	Bug				G					

Name	Map ID		2015	2016	2017	2018	2019	2020	2021	2022	2023
Tubbs Creek, 0.5	55	Bug	G								
Cedar Hill Brook, 0.4	56	Bug				G					
Cedar Hill Brook, 2.1	57	Bug							FG		
Cedar Hill Brook, 2.1	57	Fish							P		
Ladd Brook, 0.3	58	Bug				FG					
Ladd Brook, 0.3	58	Fish				E					
Broad Brook, 2.4	59	Bug	Vg	Vg		VgE				Vg	
Broad Brook, 2.4	59	Fish				E				E	
North Branch Hoosic River, 5.7	60	Bug				G					
North Branch Hoosic River, 5.7	60	Fish				Vg					
Roaring Brook, 0.2	62	Bug				G					
Roaring Brook, 2.4	63	Bug		VgE							
Roaring Brook, 4.1	64	Bug								Vg	
Roaring Brook, 4.1	64	Fish								BKT	
Cardinal Brook, 0.1	65	Fish					BKT				
Cardinal Brook, 1.1	66	Bug		VgE							
Cardinal Brook Trib 1, 0.1	67	Fish				BKT					

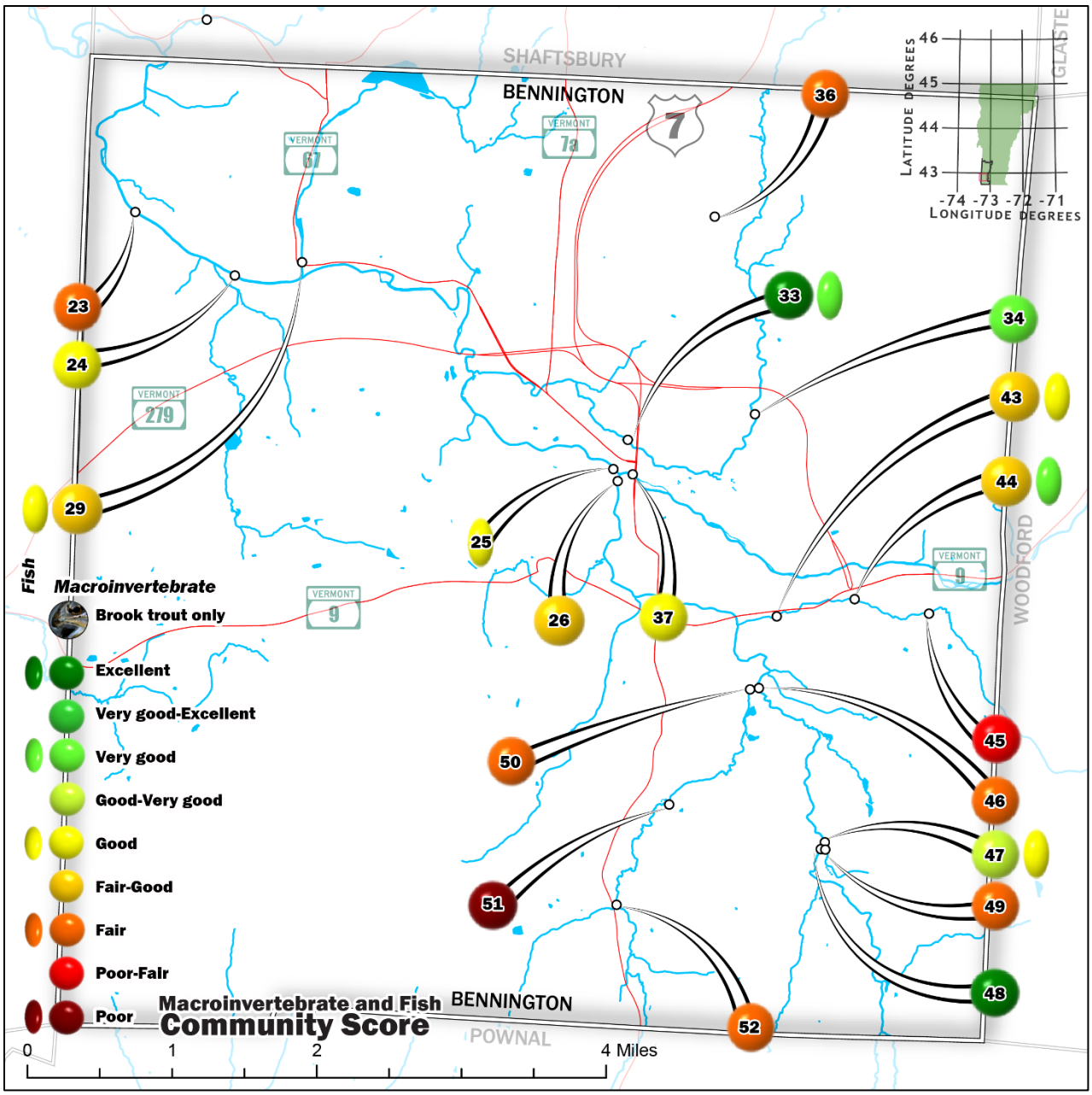

Figure 13 Map of the Macroinvertebrate Community assessment for Basin 1, Bennington section, (see below). Poor scores represent the greatest deviation from reference conditions and Excellent scores represent non-significant deviation from reference conditions. We do not have criteria for assessing Brook Trout Only streams (where brook trout are the only observed taxa). Map IDs correspond with the table below.

Table 16 Macroinvertebrate (bug) and fish community matrix for the watersheds of Basin 1, north section. Blank = no data, bkt = streams with a robust brook trout community

Unable to sample or assess	Poor (P)	Poor-fair (PF)	Fair (F)	Fair-good (Fg)	Good (G)	Good-Very good (GVg)	Very good (Vg)	Very good-excellent (VgE)	Excellent (E)

Name	Map ID		2015	2016	2017	2018	2019	2020	2021	2022	2023
Walloomsac River, 9.2	23	Bug	F					F			
Walloomsac River, 10.1	24	Bug	G					G			
Walloomsac River, 15.1	26	Bug		Vg	FG	FG					
Paran Creek, 0.1	29	Bug				U	FG				
Paran Creek, 0.1	29	Fish					G				
Furnace Brook, 3.1	34	Bug		E	GVg	Vg					
Hewitt Brook, 1.8	36	Bug		Vg	G	F					
Roaring Branch Walloomsac River, 0.1	37	Bug		GVg	G	G					
Barney Brook, 0.3	43	Bug				FG					
Barney Brook, 0.3	43	Fish				G					
Barney Brook, 1.5	45	Bug				PF					
South Stream, 0.1	46	Bug				F					
South Stream, 2.0	47	Bug								GVg	
Jewett Brook, 0.1	50	Bug				F					
Jewett Brook, 1.4	51	Bug							P		
Jewett Brook, 2.3	52	Bug				F					

Chemical water quality monitoring occurs across the state in rivers and streams in a variety of ways: targeted, probability-based, and special studies. Examples of targeted monitoring include the LaRosa Partnership Program (LPP) and water quality samples collected by the Ambient Biomonitoring Network (ABN). All chemical data can be accessed through the Vermont Integrated Watershed Information System (VIWIS) and generally there is too much data that requires special contextual information to effectively display in graphics and tables in the format of this report. LPP monitoring stations are normally sampled eight times during the spring and summer season, and may be monitored from one to several years, depending on the monitoring purpose. LPP data can provide enough information to make assessment determinations (i.e., impaired or full support). Chemical monitoring associated with the ABN is used to help interpret the biological data, which is relied upon more heavily for assessment and regulatory purposes.

Special chemical studies are usually only conducted in response to compelling data and information obtained from fixed-station and probability-based projects. The number and nature of special studies is commonly dictated by the nature of issues that need further monitoring or that arise as interest or funding permits. These types of studies include detailed sampling to assess use support or standards violations, stressor identification, diagnostic-feasibility studies, effectiveness evaluations of pollution control measures, and watershed-based surveys and evaluations. These evaluations are usually resource intensive and are reserved for issues of particular interest. Additionally, data from these investigations are usually organized and presented in a summary report format and would not be used separately for assessments.

River reclassification candidates (Aquatic biota)

To protect aquatic biota in rivers in the State of Vermont, the Watershed Management Division can initiate reclassification for Aquatic Biota use in rivers that meet a high-quality standard. The major implication of reclassification is the application of new *Water Quality Standards*. Most rivers in the State of Vermont are classified B(2) for Aquatic Biota use and must maintain biological assessments of Good or better for both macroinvertebrate and fish communities. Rivers reclassified to B(1) must maintain biological assessments of Very Good or better, and Rivers reclassified to A(1) must maintain biological assessments of Excellent. The rivers shown here have maintained biological condition expected of either A(1) or B(1) waters and therefore, are candidates for reclassification. For more information, visit the *stream reclassification webpage*.

There are no reclassification candidates in Basin 1.

Impaired rivers

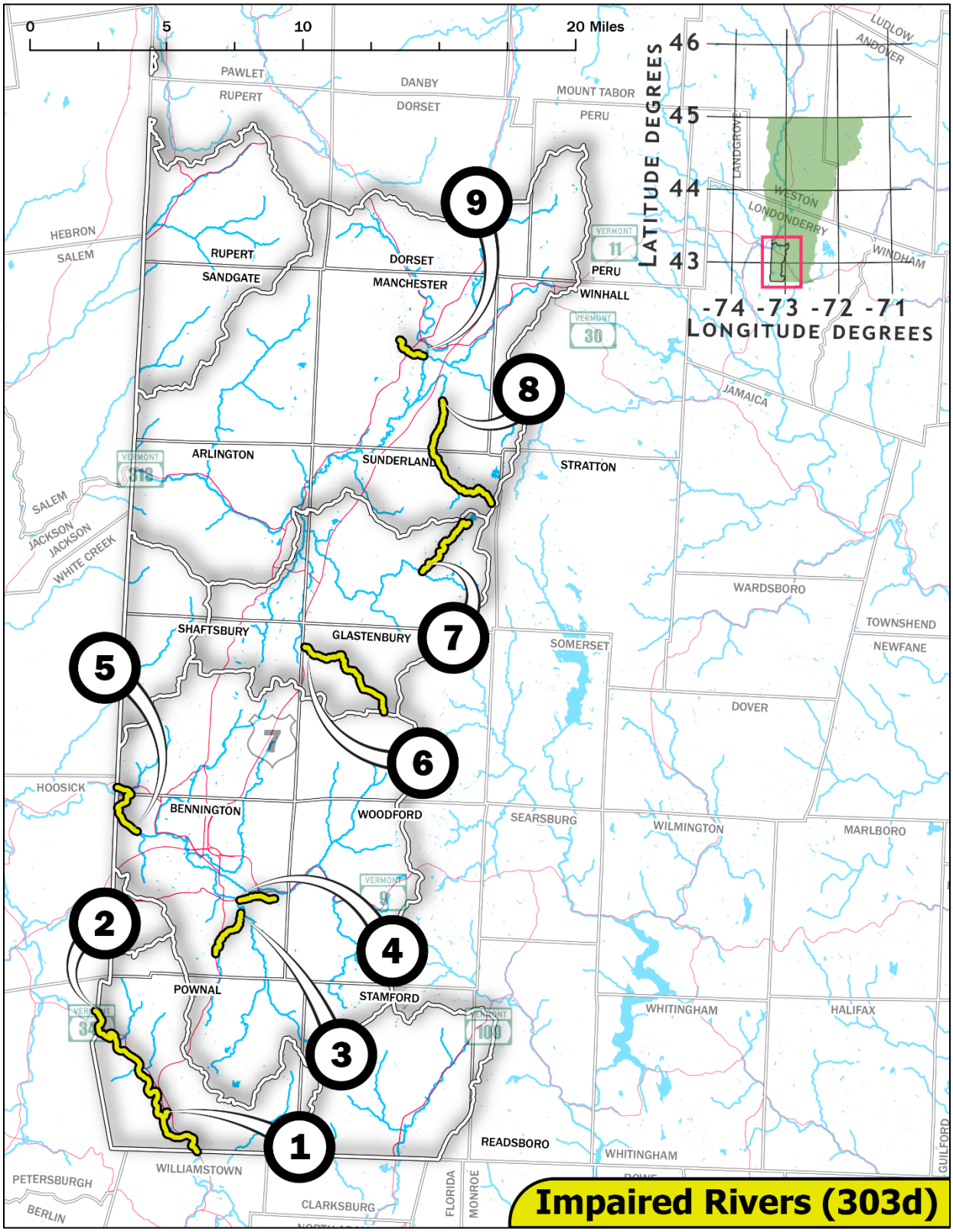

Figure 14. Map of impaired rivers in Basin 1. Yellow represents rivers that are on the 2022 303(d) list (Part A-Priority Waters List). Use the stream name and the first seven characters of the Assessment Unit ID to find monitoring data from the reach in this report viewer.

Table 17 Table of impaired rivers in Basin 1. Map IDs are associated with the map above. (ALS) Aquatic biota and wildlife that may utilize or are present in the waters; (AH) Aquatic habitat to support aquatic biota, wildlife, or plant life; (CR) The use of wate6rs for swimming and other primary contact recreation; (RF) The use of waters for fishing and related recreational uses; (RB) The use of waters for boating and related recreational uses; (AES) The use of waters for the enjoyment of aesthetic conditions.

MAP ID	NAME	ASSESSMENT UNIT ID	POLLUTANT	PROBLEM	IMPAIRED USE	PART
1	Ladd Brook, Mouth to rm 0.4	VT01-02.02	SEDIMENTATION/SILTATION	Indication of sediment stress; potential impacts from eroding gravel roads	AB	A
2	Hoosic River, Entire 7 Mile Length in Vermont	VT01-02.01	PCBS IN FISH TISSUE	Elevated levels of toxic contaminant in Brown Trout	FC	A
3	Jewett Brook from its mouth upstream to Fuller Road	VT01-03.09	NUTRIENTS	Agricultural land uses as source of nutrient	AB	A
4	Barney Brook, Mouth to rm 1.5	VT01-03.01	IRON, SEDIMENTATION/SILTATION	Downstream of landfill, hazardous site, and constructed wetlands; silt and iron precipitate impact fish/invertebrates	AB, AES	A
5	Walloomsac River, New York State border upstream to rm 9.2	VT01-03.08	NUTRIENTS	Bennington WWTF discharge	AB	A
6	Fayville Branch, rm 3.7 to Headwaters	VT01-06.02	PH, LOW	Atmospheric deposition: critically acidified; chronic acidification	AB	A
7	Branch Pond Brook (Pond to Roaring Branch)	VT01-06.01	PH, LOW	Atmospheric deposition: critically acidified; chronic acidification	AB	A
8	Lye Brook, rm 2.5 to Headwaters (4.5 Miles)	VT01-05.01	PH, LOW	Atmospheric deposition: critically acidified; chronic acidification	AB	A
9	Munson Brook	VT01-05.03	SEDIMENTATION/SILTATION	Runoff from developed lands, chloride stress biological community	AB	A

Altered Rivers

Altered waters are waters where a lack of flow, water level or flow fluctuations, modified hydrology, physical channel alterations, documented channel degradation, or stream type change is occurring and arises from some human activity, or where the occurrence of aquatic invasive species has had negative impacts on designated uses. This assessment category includes those waters where there is documentation of water quality standards violations for flow and aquatic habitat, but EPA does not consider the problem(s) caused by a pollutant.

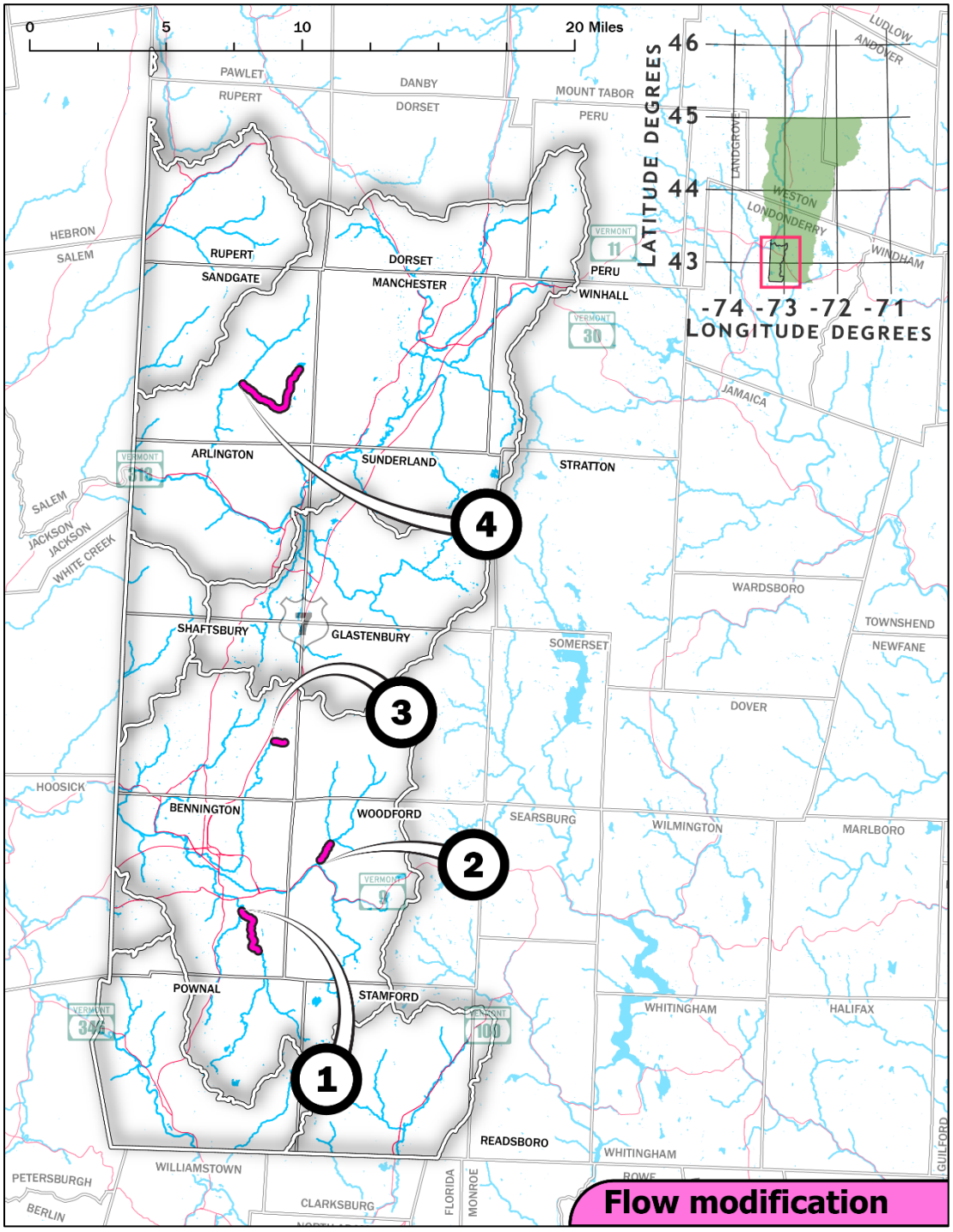

Figure 15 Map of altered lakes for Basin 1. Lakes in pink are those altered by flow modification.

Table 18 Table of altered rivers in Basin 1. Map IDs are associated with the map above. (ALS) Aquatic biota and wildlife that may utilize or are present in the waters; (AH) Aquatic habitat to support aquatic biota, wildlife, or plant life; (CR) The use of wate6rs for swimming and other primary contact recreation; (RF) The use of waters for fishing and related recreational uses; (RB) The use of waters for boating and related recreational uses; (AES) The use of waters for the enjoyment of aesthetic conditions.

MAP ID	NAME	PROBLEM	PART
1	South Stream, mouth upstream to Coleville Road	Insufficient conservation flow downstream of Bennington fish hatchery withdrawal	F
2	Bolles Brook/Roaring Branch, Intake to City Stream Confluence	Possible lack of minimum flow below water supply withdrawal point	F
3	Basin Brook	Possible lack of minimum flow below water supply withdrawal point	F
4	Hopper Brook	Artificial flow regime and condition by hydroelectric operations may alter aquatic habitat	F

Trending rivers

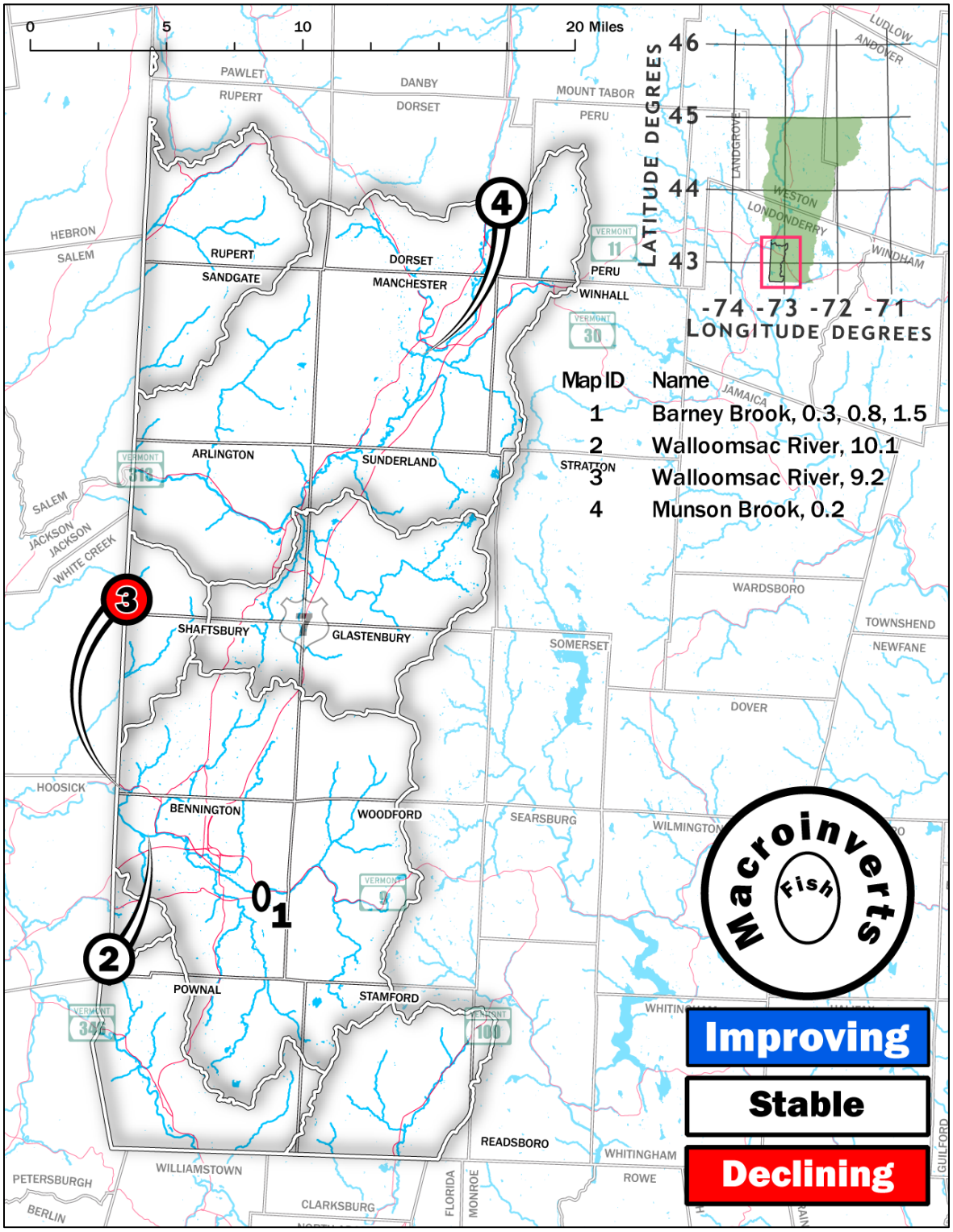

Figure 16 Map of rivers with enough biological data to model a water quality trend.

To maintain waters in their current state, WSMD conducts long term monitoring on surface waters and identifies increasing, stable, and decreasing trends of the most relevant water quality parameters in the Vermont Water Quality Standards. Modeling trends can act as an early warning system for declining water quality, and it may be cost effective to reduce stressors to these waters before they become impaired or altered. Likewise, increasing trends can show areas of effective remediation. For each biological monitoring site, two linear regression models are used with year of sampling as the independent variable. The response variables include the community assessment ratings for macroinvertebrates and/or fish (Poor to Excellent; coded as 1 to 9). Sites with more than three data points were included. Data from sites is pooled by coincident NHD+ reach code (multiple sites on the same reach) unless the sites are bracketing. Trends are categorized into three groups: Improving (models with p-values <0.1 and positive coefficients), stable (models with p-values > 0.1) and declining (models with p-values <0.1 and negative coefficients.

Table 19 Trends in biological condition of macroinvertebrate (bug) and fish communities in Basin 1. + Improving, - declining, = stable/no trend. B = Bug community, F = Fish community. Community: B = macroinvertebrate, F = fish.

Unable to sample or assess	Poor (2)	Poor-fair (3)	Fair (4)	Fair-good (5)	Good (6)	Good-Very good (7)	Very good (8)	Very good-excellent	Excellent (10)

Stream name, river mile	Map ID	Trend	Community	2003	2006	2008	2013	2015	2018	2019	2020
Barney Brook, 0.3	1	=	Fish	0	P	G	0	0	G	0	0
Barney Brook, 0.8	1	=	Fish	0	0	G	Vg	0	0	0	0
Barney Brook, 1.5	1	=	Fish	0	F	P	0	0	0	0	0
Walloomsac River, 10.1	2	=	Bug	0	0	Vg	G	G	0	0	G
Walloomsac River, 9.2	3	-	Bug	G	0	G	F	F	0	0	F
Munson Brook, 0.2	4	=	Bug	0	0	F	0	0	F	F	0

Rivers in need of assessment

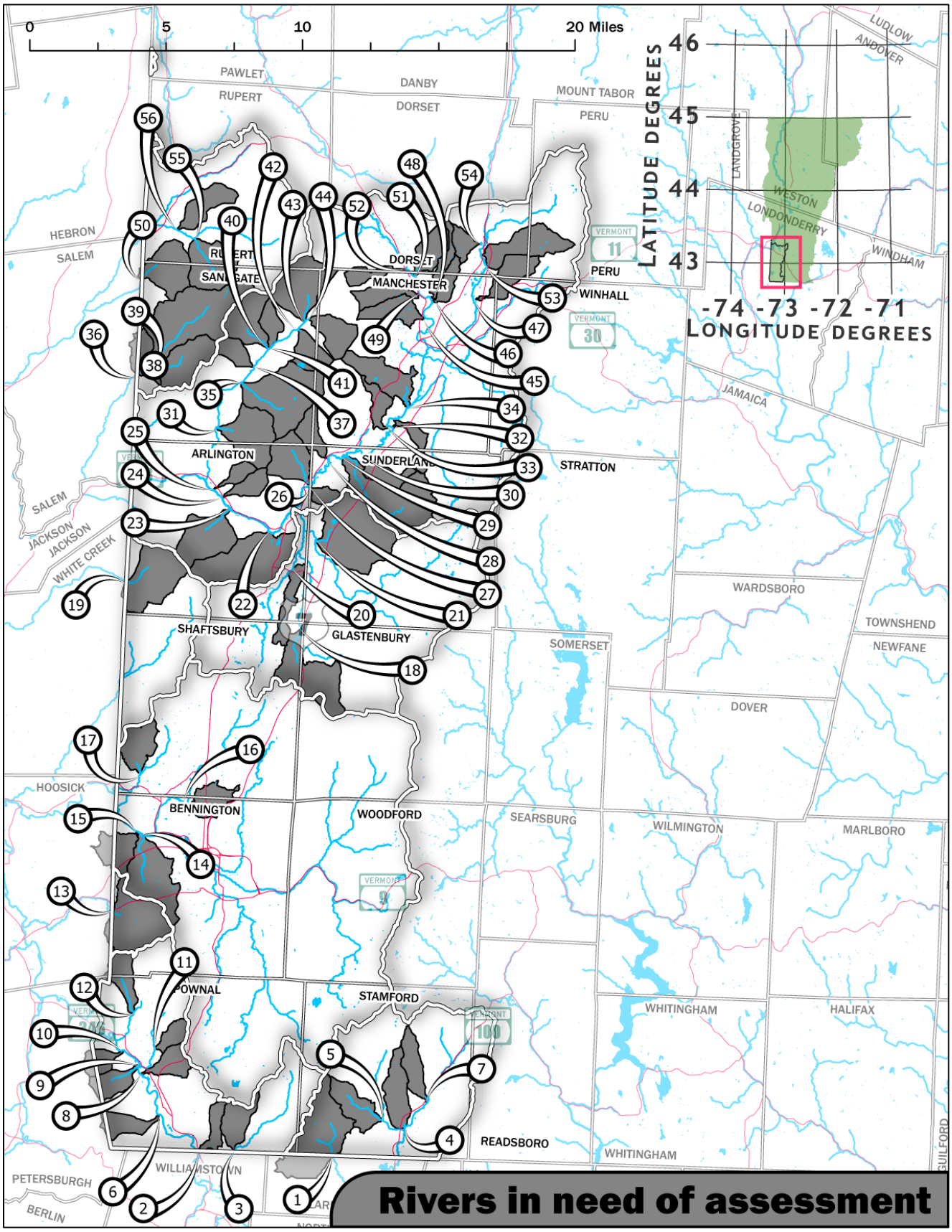

Figure 17 Map of rivers with unassessed aquatic biota use in Basin 1.

Aquatic biota health in streams is one of the primary areas of assessment by the WSMD. In the sections above, areas with sufficient data were used to determine a river's ability to fully support aquatic biota. This section highlights the 56 streams within this basin that lack data needed to determine the support status of aquatic biota. Streams larger than 2 square kilometers and have no biological data between 2000 and 2024 were removed. Because all these streams cannot be monitored at the same time, land use/cover data are provided in the figure below to aid site prioritization. Many of these streams are unnamed, therefore, names were added based on their source location (hill names) or adjacent road names and are identified by an asterisk.

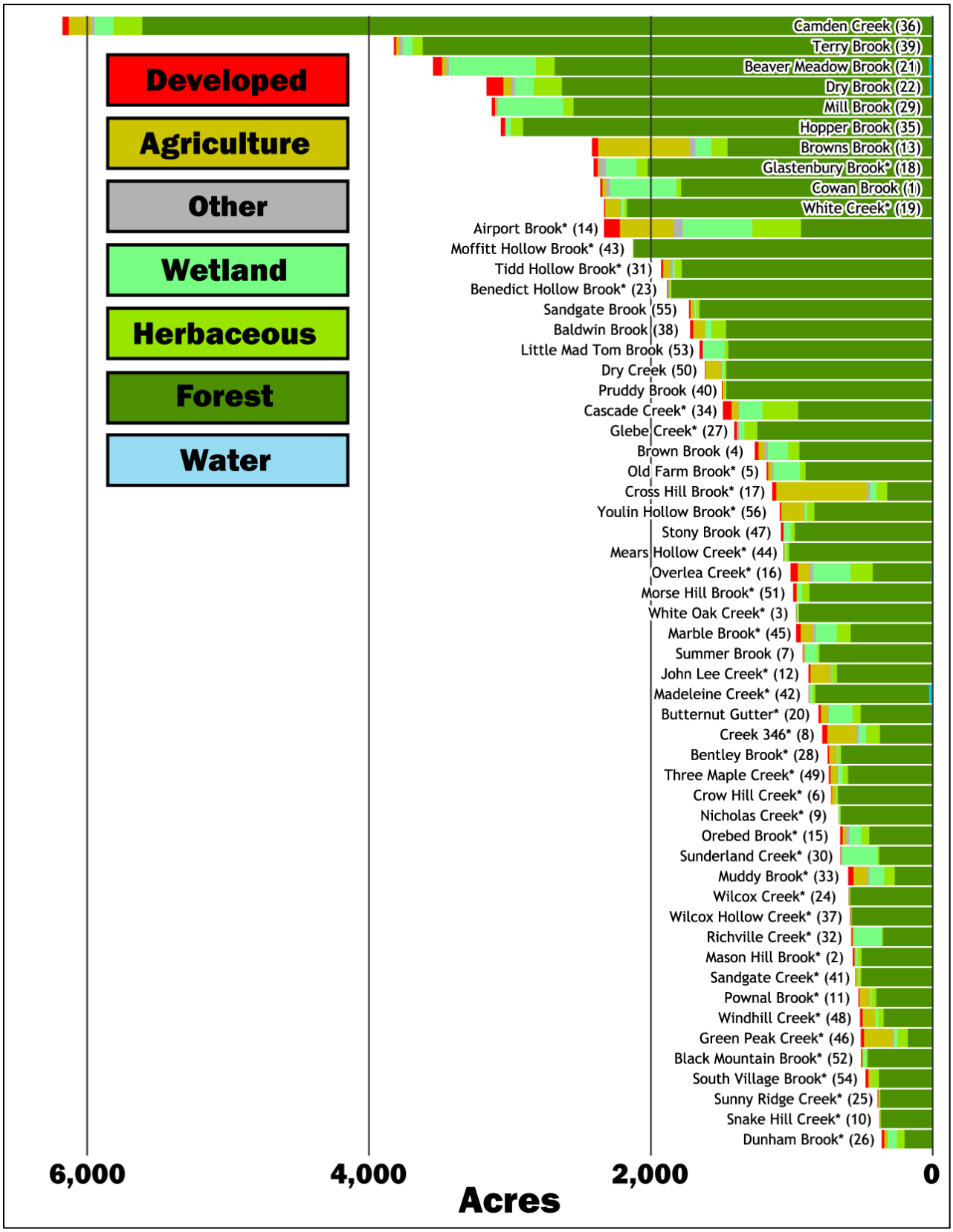

Figure 18 Land cover of unassessed waters ranked by watershed size. (#)'s associated with the stream name correspond to the map above. Asterisks are officially unnamed streams in the National Hydrography Dataset. Landcover is based on the Vermont High Resolution Land Cover dataset produced by the University of Vermont Spatial Analysis Laboratory.

Table 20. Rivers with unassessed aquatic biota use, values are in percent land cover. The Map IDs correspond to the map above. Latitude and longitudes designate the pour point of the watershed. Asterisks are officially unnamed streams.

Name, Map ID	Latitude	Longitude	Acres	Developed	Agriculture	Other	Wetlands	Herbaceous	Forest	Water
Airport Brook* (14)	42.913	-73.258	2332.3	4.8	16.3	2.9	21.1	14.8	39.7	0.4
Baldwin Brook (38)	43.162	-73.25	1721.3	1.3	4.9	0.1	2.5	6	85.1	0.1
Beaver Meadow Brook (21)	43.07	-73.132	3545.4	1.8	0.9	0.5	17.4	3.8	74.9	0.7
Benedict Hollow Brook* (23)	43.086	-73.194	1883.2	0.3	0.1	0.3	0.1	0.8	98.5	0
Bentley Brook* (28)	43.113	-73.124	744.9	1.1	7.3	0.8	0.5	2.9	87.3	0.1
Black Mountain Brook* (52)	43.214	-73.068	506.9	1.2	1.2	0	4.4	2.2	90.8	0.2
Brown Brook (4)	42.758	-73.065	1262.4	2	3.6	1.8	11.2	6.5	75	0
Browns Brook (13)	42.871	-73.277	2417.9	1.8	26.9	1.6	4.7	4.8	59.9	0.3
Butternut Gutter* (20)	43.055	-73.148	809.7	1.9	6.6	0.8	20.3	7.3	62.1	1
Camden Creek (36)	43.157	-73.262	6173.9	0.7	2.6	0.4	2.1	3.3	90.7	0.1
Cascade Creek* (34)	43.141	-73.066	1487.6	4	3.4	0.3	11	17.1	63.3	1
Cowan Brook (1)	42.742	-73.116	2358.4	0.5	1.3	1.1	20	1.4	75.7	0
Creek 346* (8)	42.786	-73.255	783.5	4.6	26.6	2.1	6.3	12.5	47.7	0.1
Cross Hill Brook* (17)	42.945	-73.258	1138.2	2.4	56.8	1.9	3.9	6.6	28.3	0.2
Crow Hill Creek* (6)	42.764	-73.243	720.6	0.6	4.1	0	0.7	1.5	93.2	0
Dry Brook (22)	43.074	-73.166	3164.8	3.7	1.9	0.7	4.1	6.3	82.5	0.6
Dry Creek (50)	43.207	-73.259	1616.1	0.2	6.8	0.6	0.9	0.9	90.6	0
Dunham Brook* (26)	43.098	-73.136	361.5	4.6	7.2	0	17.8	15.1	54.2	1
Glastenbury Brook* (18)	43.023	-73.142	2406.1	1.2	0.4	2	9	3.3	83.9	0.2
Glebe Creek* (27)	43.099	-73.137	1407.5	1.2	0.7	0.5	2.6	6.6	88.4	0
Green Peak Creek* (46)	43.197	-73.049	510.4	4.4	40.2	2.2	4	14.3	34.6	0.3
Hopper Brook (35)	43.153	-73.187	3064.8	1	0	0.3	1	2.8	94.5	0.4
John Lee Creek* (12)	42.818	-73.261	881.4	1.3	16.3	1.2	0.1	4	76.9	0.2
Little Mad Tom Brook (53)	43.216	-73.009	1654.3	1.3	0	0.3	9.1	1.6	87.3	0.4
Madeleine Creek* (42)	43.182	-73.146	879.1	0.2	0	0.1	2.7	2.1	91.9	2.9
Marble Brook* (45)	43.189	-73.054	968.4	3.3	8.9	2.2	15.5	10.1	59.7	0.4
Mason Hill Brook* (2)	42.745	-73.214	567	2	1	1.1	1.7	5	89.1	0.1

Name, Map ID	Latitude	Longitude	Acres	Developed	Agriculture	Other	Wetlands	Herbaceous	Forest	Water
Mears Hollow Creek (44)*	43.188	-73.138	1058.9	0.3	0.5	0	1.1	1.8	96.2	0
Mill Brook (29)	43.114	-73.113	3128.9	0.7	0.3	0.4	14.7	2.3	81.5	0
Moffitt Hollow Brook (43)*	43.186	-73.141	2126.6	0	0	0	0.1	0.1	99.8	0
Morse Hill Brook (51)*	43.211	-73.062	990.2	2.2	0.8	0.1	3.1	5.4	88.1	0.2
Muddy Brook (33)*	43.131	-73.081	599.8	6.1	16.7	2	17.8	12.4	44.7	0.3
Nicholas Creek (9)*	42.79	-73.257	668.7	0	0.1	0	1.3	0.7	97.8	0
Old Farm Brook (5)*	42.762	-73.081	1177.6	0.7	2.4	0.8	16	3.3	76.6	0.1
Orebed Brook (15)*	42.914	-73.26	656.3	2.4	4.2	3.3	13	8.5	68.7	0
Overlea Creek (16)*	42.93	-73.225	1008.1	4.9	8.6	2.4	26.3	15.5	41.5	0.7
Pownal Brook (11)*	42.799	-73.245	526	1.2	14.5	0	1.5	6.6	76.2	0.1
Pruddy Brook (40)	43.171	-73.168	1496.1	0.2	0.6	0.1	0.1	1.2	97.8	0.1
Richville Creek (32)*	43.13	-73.077	577.7	1.2	1.9	0.3	33.7	1.7	61	0.2
Sandgate Brook (55)	43.23	-73.222	1728.7	0.5	1.6	0.1	0.7	1.3	95.6	0.1
Sandgate Creek (41)*	43.171	-73.167	548.5	0.5	3.1	0	0.9	2.7	92.8	0
Snake Hill Creek (10)*	42.798	-73.268	377.6	0.3	1.3	0	0.1	0.8	97.6	0
South Village Brook (54)*	43.228	-73.015	476.3	3.9	3.8	0.3	0.6	11	80	0.3
Stony Brook (47)	43.198	-73.017	1076.8	1.7	0	0	4.7	2.5	91	0
Summer Brook (7)	42.772	-73.048	921.8	0.3	1.1	0.6	9.1	1.7	87.2	0
Sunderland Creek (30)*	43.115	-73.097	654.9	0.6	0	0.7	38.9	1.7	58	0
Sunny Ridge Creek (25)*	43.096	-73.206	390.9	1.2	0.6	0	0	2.8	95.3	0.1
Terry Brook (39)	43.162	-73.25	3823.2	0.4	0.7	0.6	1.8	1.9	94.6	0.1
Three Maple Creek (49)*	43.201	-73.058	735.7	1.3	6.6	0.9	4.4	5.1	81.6	0.1
Tidd Hollow Brook (31)*	43.129	-73.205	1927.6	0.7	2.8	0.9	0.6	2.6	92.4	0
White Creek (19)*	43.047	-73.269	2332.7	0.3	4.9	0.1	1	0.9	92.9	0.1
White Oak Creek (3)*	42.745	-73.187	970.5	0.3	0	0	1.4	0.4	97.9	0
Wilcox Creek (24)*	43.092	-73.2	596.6	0.5	0	0	0.6	0.7	98.1	0
Wilcox Hollow Creek (37)*	43.162	-73.178	586.2	0.5	0.2	0.1	0	1.2	98	0
Windhill Creek (48)*	43.199	-73.05	515.8	3.3	17.9	0.4	3	8	67.1	0.4
Youlin Hollow Brook (56)*	43.234	-73.234	1084.4	0.8	15.5	0.1	1.4	4.7	77.4	0.1

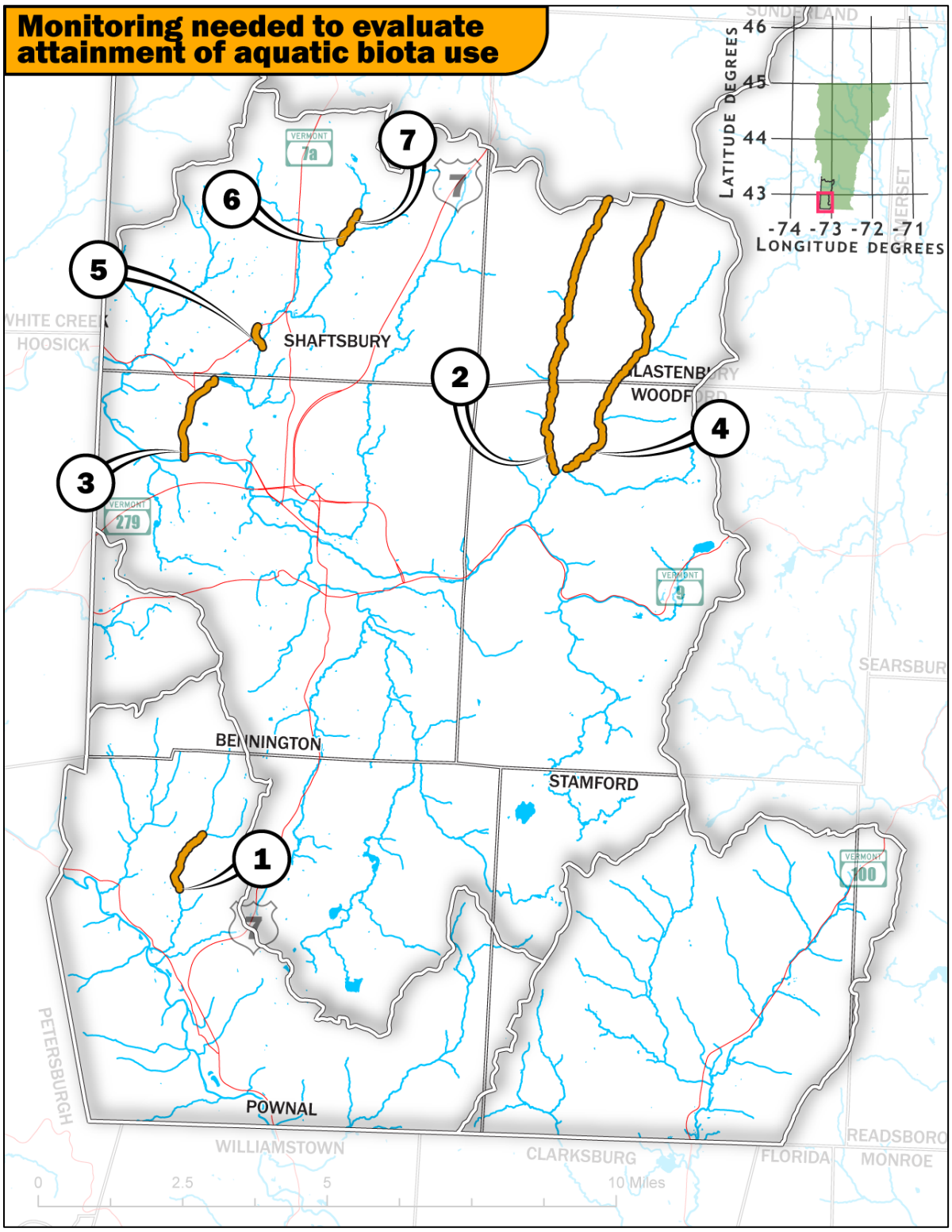

Figure 19 Map of rivers that require more monitoring to evaluate attainment of Aquatic Biota use. Unlike the streams mentioned above with no biological monitoring data, the streams here have limited biomonitoring data that indicates fair or poor condition, however, there is either not enough data to fully evaluate the attainment of Aquatic Biota use or monitoring results show volatile condition year to year.

Table 21 Table of rivers that require more monitoring to evaluate attainment of aquatic biota use. Map IDs correspond to the map above.

Map ID	*Assessment unit name*	*Pollutant*	*Problem*
1	Cedar Hill Brook, North Pownal Road upstream 1 mile	SEDIMENTATION/SILTATION, NUTRIENTS, METALS	Macroinvertebrate and fish communities stressed by nutrients, metals, and sedimentation.
2	Bickford Brook, Headwaters to mouth	pH, LOW	Acid deposition, low buffering capacity, episodic acidification
3	Paran Creek from its confluence with the Walloomsac Upstream to Lake Paran	TEMPERATURE	Elevated temperatures caused by impoundments (Whites Mill, Polygraphic, Cushman, Stark Mill, Lake Paran)
4	Bolles Brook, Headwaters to mouth	pH, LOW	Acid deposition, low buffering capacity, episodic acidification
5	Cold Spring Brook, from its confluence with Paran Creek upstream 0.5 miles	CAUSE UNKNOWN	Failing macroinvertebrate community with potential stressors from upstream road network.
6	Paran Creek, Airport Road upstream 0.3 miles to confluence with Cedar Mill Creek	TEMPERATURE	Elevated temperatures due to upstream impoundments stresses the fish community.
7	Cedar Mill Creek from its confluence with Paran Creek upstream 0.3 miles to the impoundment.	TEMPERATURE	Elevated temperatures due to upstream impoundments stresses the fish community.

River reclassification candidates (Aquatic biota)

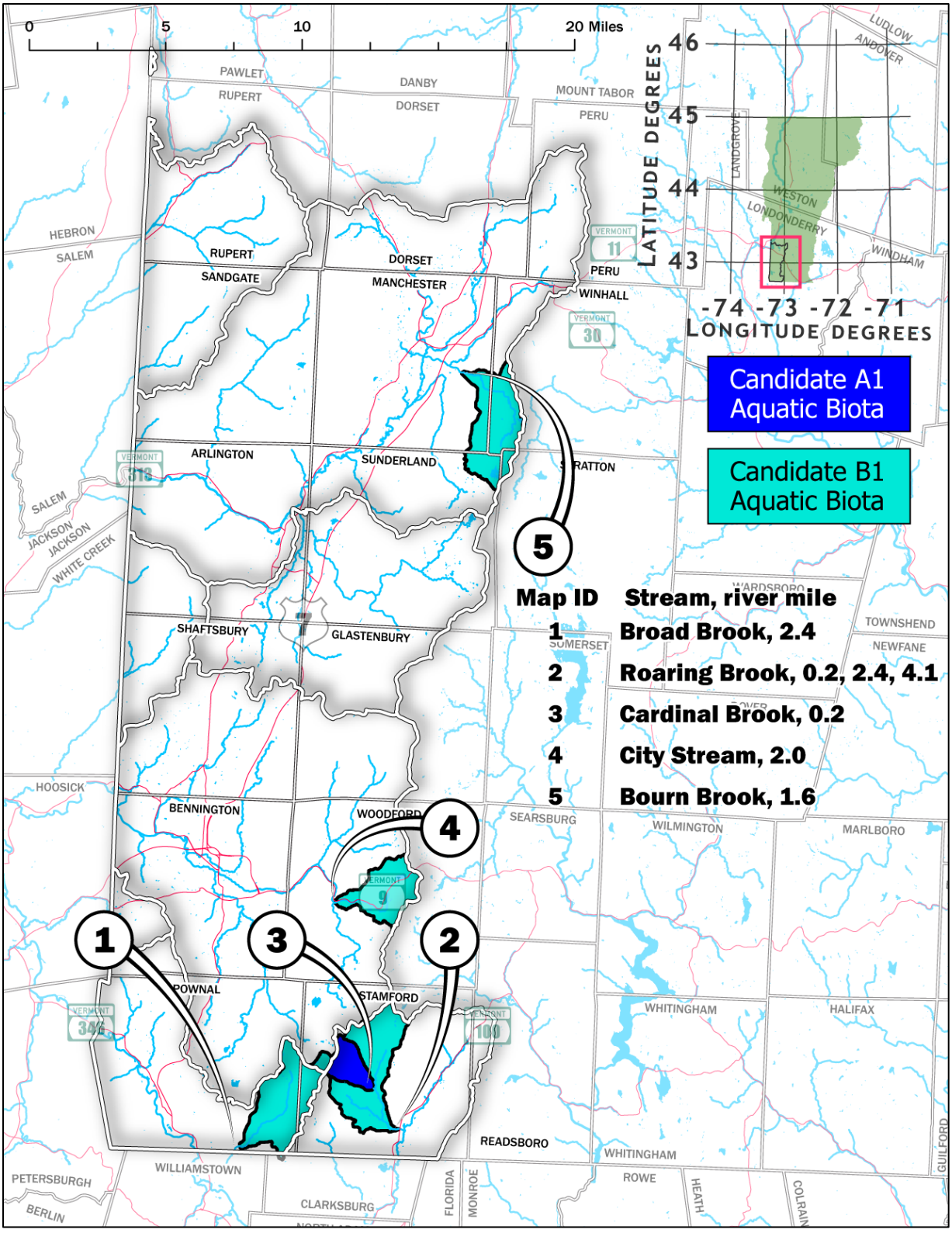

Figure 20 Map of A(1) and B(1) reclassification candidates. Map IDs correspond to the table below.

To protect aquatic biota in rivers in the State of Vermont, the Watershed Management Division can initiate reclassification for Aquatic Biota use in rivers that meet a high-quality standard. The major implication of reclassification is the application of new *Water Quality Standards*. Most rivers in the State of Vermont are classified B(2) for Aquatic Biota use and must maintain biological assessments of Good or better for both macroinvertebrate and fish communities. Rivers reclassified to B(1) must maintain biological assessments of Very Good or better, and Rivers reclassified to A(1) must maintain biological assessments of Excellent. The rivers shown here have maintained biological condition expected of either A(1) or B(1) waters and therefore, are candidates for reclassification. Candidacy is based on the propensity of data over the last ten years and the nearness of data—data must be within six years of each other. Data from both communities, macroinvertebrates and fish, is required unless land cover is overwhelmingly natural. For more information, visit the *stream reclassification webpage*.

Table 22 Table of A(1) and B(1) reclassification candidates. Map IDs correspond to the map above. The community column identifies the community assessed.

Unable to sample or assess	Poor (P)	Poor-fair (PF)	Fair (F)	Fair-good (Fg)	Good (G)	Good-Very good (GVg)	Very good (Vg)	Very good-excellent (VgE)	Excellent (E)

Name	Map ID		2015	2016	2017	2018	2020	2021	2022	2023
Broad Brook, 2.4	1	Bug	Vg	Vg		VgE				Vg
Broad Brook, 2.4	1	Fish				E				E
Roaring Brook, 0.2	2	Bug				G				
Roaring Brook, 2.4	2	Bug		VgE						
Roaring Brook, 4.1	2	Bug								Vg
Roaring Brook, 4.1	2	Fish								BKT
Cardinal Brook, 0.1	3	Fish					BKT			
Cardinal Brook, 1.1	3	Bug		VgE						
Cardinal Brook Trib 1, 0.1	3	Fish				BKT				
City Stream, 2.0	4	Bug				Vg				
City Stream, 2.0	4	Fish				E				
Bourn Brook, 1.6	5	Bug				Vg				
Bourn Brook, 1.6	5	Fish				Vg				

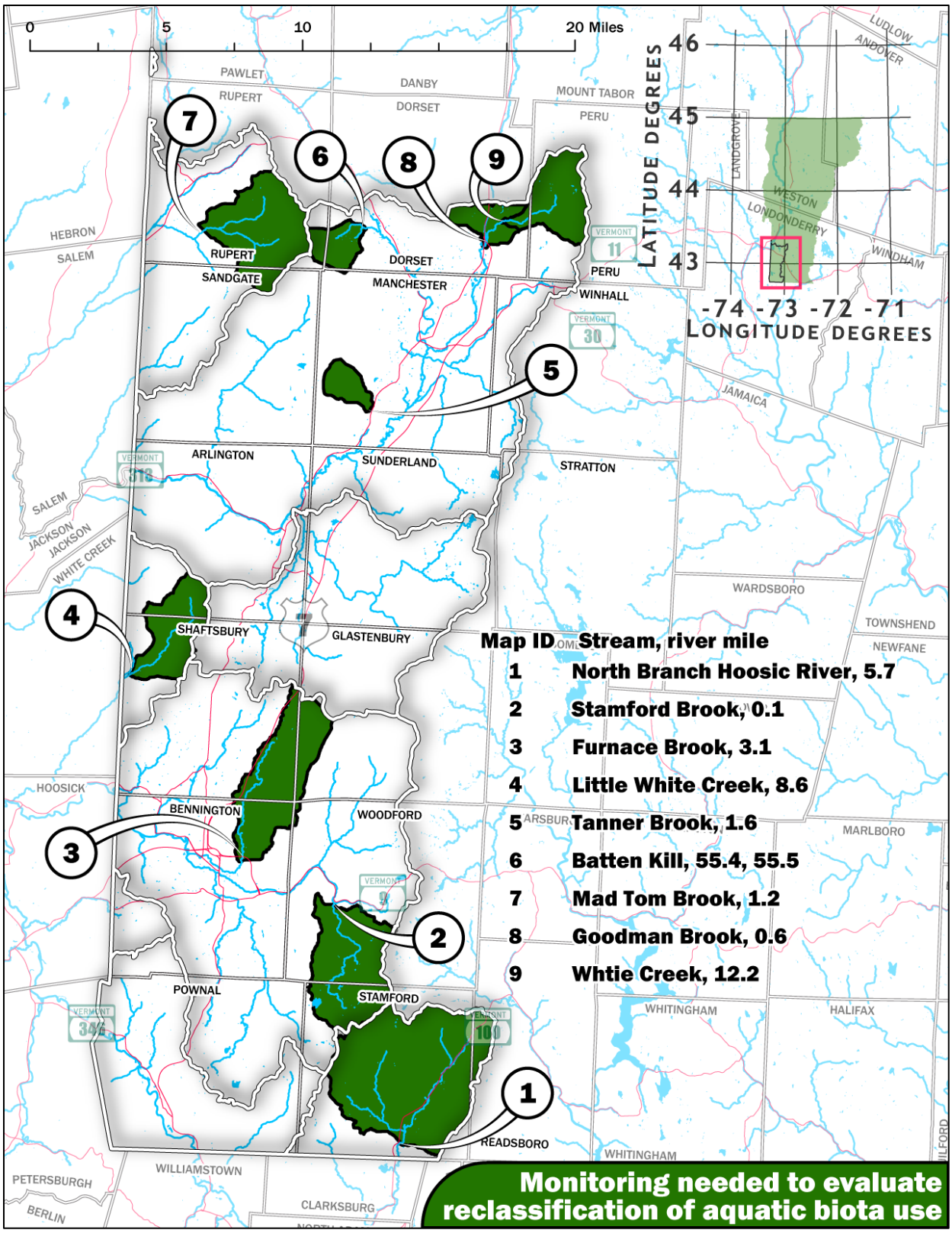

Figure 21 Map of rivers that require more monitoring to assess condition relative to A(1) or B(1) criteria for Aquatic Biota use.

The streams have biological monitoring data between 2012-2022 which suggests Very Good or Excellent. Additional data may be necessary to assess if it meets A(1) or B(1) criteria for Aquatic Biota use.

Table 23 Table of rivers that require more monitoring to evaluate reclassification candidacy. Map IDs correspond with the map above and the years associated with each community field represent additional data requirements for reclassification candidacy verification.

Map ID	Name	Macroinvertebrate	Fish
1	North Branch Hoosic River, 5.7	2024	2024
2	Stamford Brook, 0.1	2024	2024
3	Furnace Brook, 3.1	2024	2024
4	Little White Creek, 8.6	2024	2024
5	Tanner Brook, 1.6	2024, 2029	2024, 2029
6	Batten Kill, 55.4, 55.5	2027	2027
7	Mad Tom Brook, 1.2	2027	2027
8	Goodman Brook, 0.6	2024	2029
9	White Creek, 12.2	2024	2024

Wetlands

The purpose of the Wetland Bioassessment and Monitoring Program ("Program") is to build a pertinent and practical program to assess the biological integrity and ecological condition of Vermont's wetlands. The Program has adopted the EPA's wetland monitoring methodology and is organized into three levels. Level 1 assessments are performed through desktop review and rely on coarse landscape-scale inventory information. Level 2 surveys are a "rapid assessment" at the specific wetland scale and use simple and quick protocols to collect data. Level 2 protocols are calibrated and validated by more intensive assessments known as Level 3, which are rigorous biological assessments that derive multi-metric indices. The Program conducts vegetation surveys to calculate biological metrics with a strong focus on the Coefficient of Conservatism score, which is a numeric scale from 0-10 assigned to each plant species which measures its tolerance and sensitivity to disturbance (Link to latest Bioassessment Report).

Table 23. Number and type of level 3 wetland assessments conducted across Basin 1. NWCA (National Wetland Condition Assessment). Heritage (Natural Heritage Inventory).

Boundless Plot	NWCA	Species List	Wetlands Heritage	Wetlands Transect
2	2	5	17	7

Vermont Rapid Assessment Method (VRAM)

The Level 2 assessment is conducted using the Vermont Rapid Assessment Method (VRAM), which is composed of 6 qualitative metrics used to collect data on the wetland's function, value, and condition. These metrics include wetland area, buffers, hydrology, habitat, special wetland status, and plant communities. It generates a quality score on a scale of 0-100, where the higher the score equates to better wetland quality. From the VRAM information, condition indexes can be calculated that offer additional information to help evaluate human stressor impacts on the wetland and surrounding landscape or evaluate wetland restoration success.

Total VRAM scores (function and condition) are less comparable between wetlands due to the unique characteristics of a given wetland, such as the presence of a rare or threatened plant species or its size. Smaller wetlands generally receive less points than larger wetlands. Therefore, a lower total VRAM score may still demonstrate that a particular wetland is in reference or excellent condition or has high levels of function. Function scores between wetlands are also not directly comparable as these scores do not relate specifically to wetland condition nor reflect whether one wetland is exemplary for one or more functions. Condition scores do provide relative comparison of wetland health between wetlands. However, it should be noted that sampling locations are not randomized and conclusions on area-wide wetland health, based on condition scores or total VRAM scores within the basin, cannot be determined at this time.

The following information provides an overview of the various monitoring, assessment, and mapping objectives the Program is focused on.

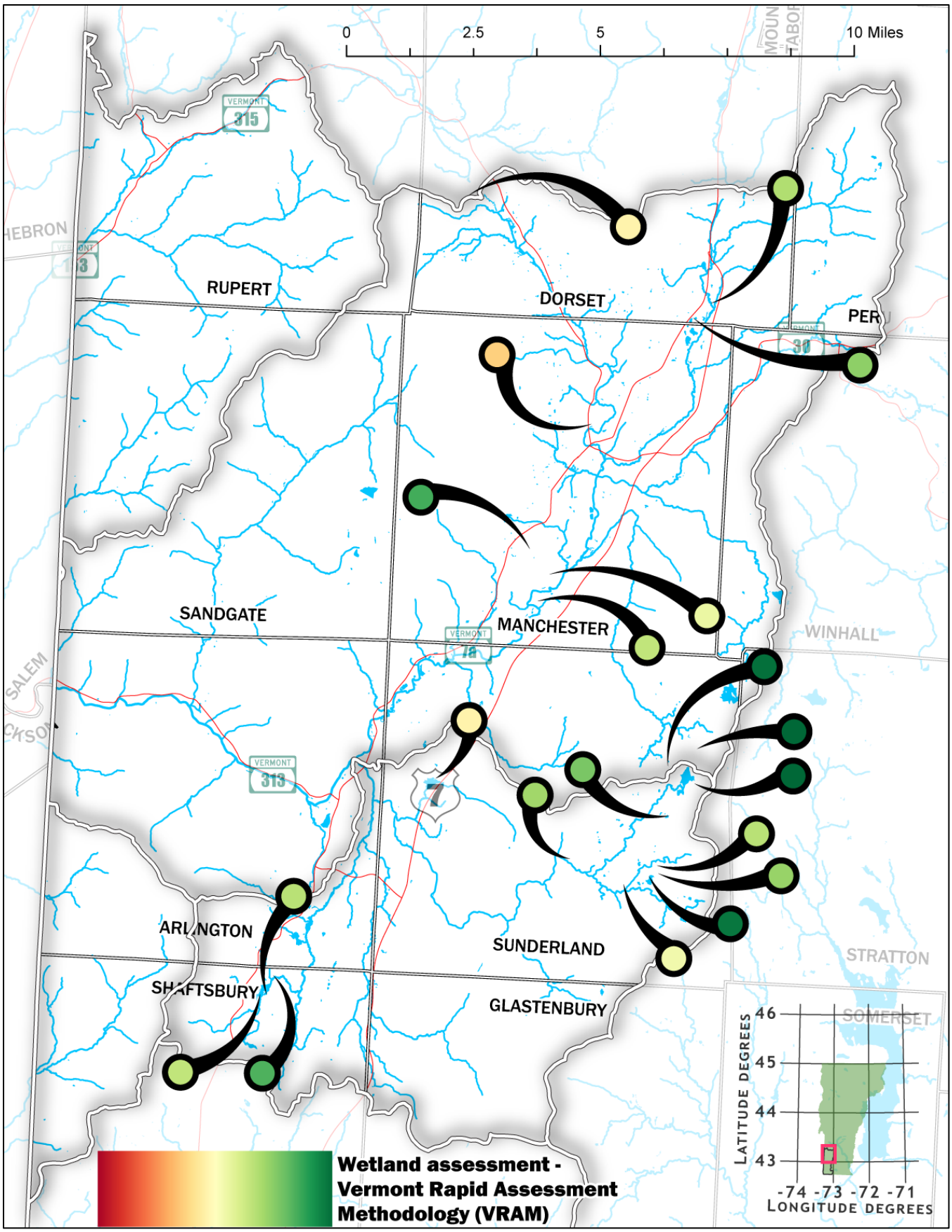

Figure 22. VRAM scores Basin 1 (North). The red to green symbology illustrates the relative wetland condition amongst VRAMs.

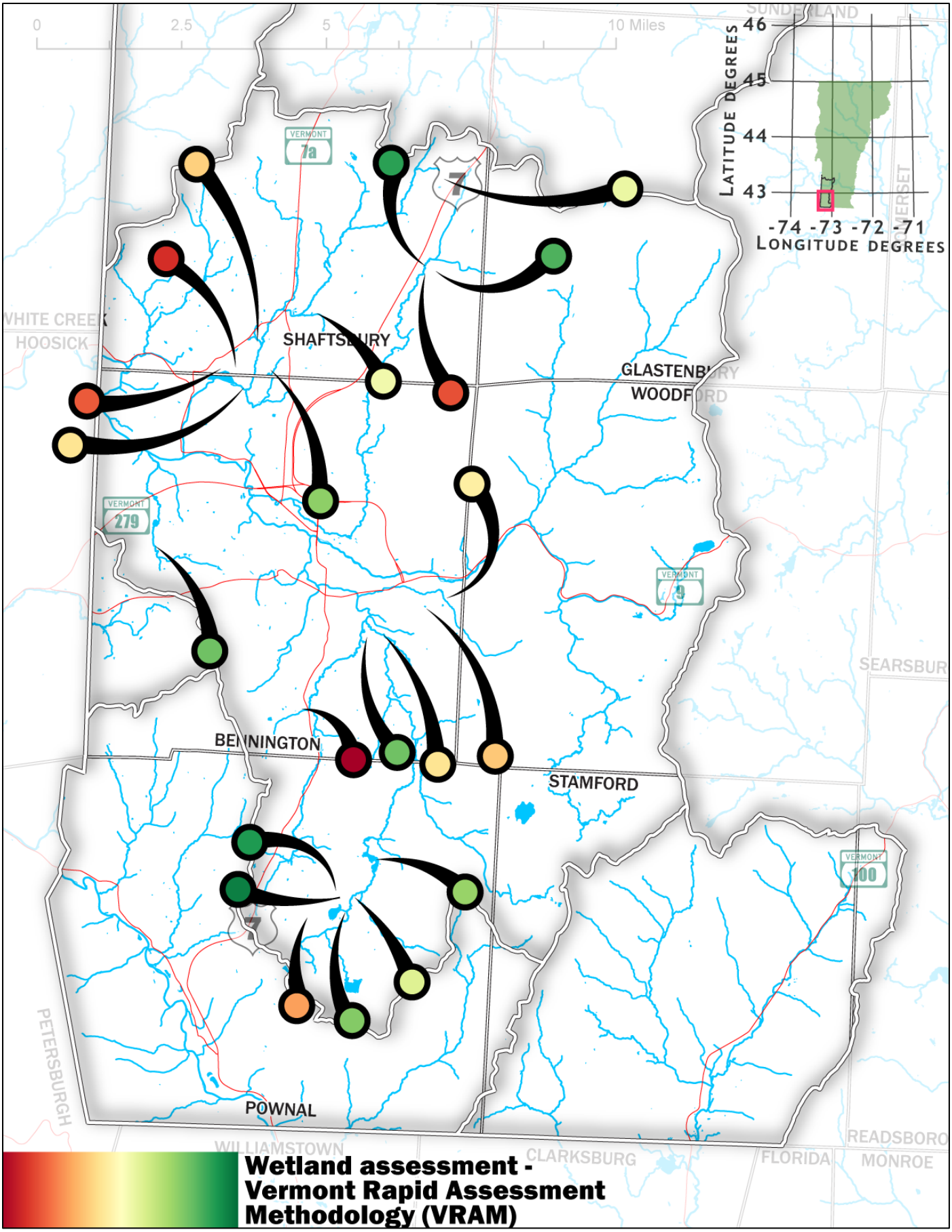

Figure 23 VRAM scores Basin 1 (South). The red to green symbology illustrates the relative wetland condition amongst VRAMs.

Table 24 Number of VRAMs conducted in Basin 1, summarized by HUC12 sub-basins. Sub basin size in acres included for reference.

Name	*Sub basin acres*	*VRAM Count*
Hoosic River	469.9	0
North Branch Hoosic River	504.4	0
Roaring Branch	2748.1	11
Tributaries direct to NY state	594.6	0
Tributaries to the Batten Kill	4661.8	9
Walloomsac River	4929.3	22

Wetland restoration monitoring

In 2017, the Program initiated a pilot project of monitoring restoration sites and associated reference sites. The project focused on sites with (1) recent restoration work; and (2) pre-restoration sites, with the intent to return to the sites as restoration progresses. Monitoring includes Level III assessments, Level II assessments using the VRAM, and tracking wetland restoration success using a metric called the Restoration Indicators of Success (RIS). This metric generates a numeric score calculated by summing the VRAM scores of metrics specifically relevant to and affected by restoration success, such as habitat development and alteration, presence of high-value habitat features, and intactness of hydrologic regime. To learn more about the RIS, and preliminary findings of the restoration monitoring project, click here: (link to RIS and Restoration Report).

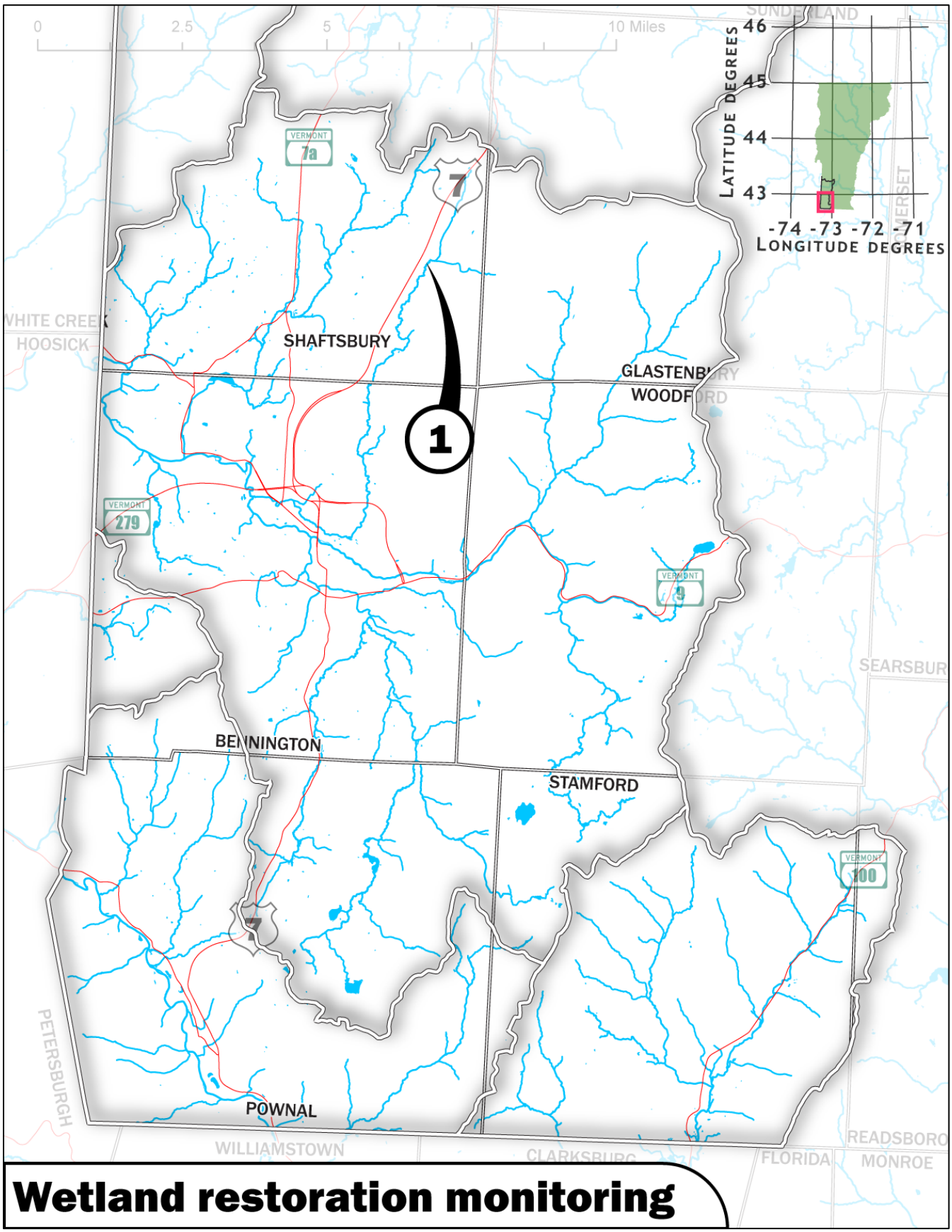

Figure 24 Distribution of wetland restoration sites in Basin 1.

Table 25 Wetland restoration monitoring sites in Basin 1.

MAP ID	LATITUDE	LONGITUDE	NAME
1	42.9617	-73.1638	Basin Brook Meadow

Class 1 wetlands

Class I wetlands are exceptional or irreplaceable in their contribution to Vermont's natural heritage. They provide unmatched environmental functions and values and therefore merit the highest level of protection. Wetlands meeting Class I criteria and sub-criteria can be petitioned for reclassification from Class II to Class I by the public. These criteria evaluate the wetland's size, location, surrounding landscape, condition, and contribution to the functions and values identified by the State of Vermont.

There is one class I wetlands in Basin 1: Dorset Marsh.

Class I candidate wetlands are those where enough data has been collected to support a petition for reclassification. An important note is there are likely to be multiple additional wetlands in the basin that meet Class I criteria and have not been proposed or have had a complete Class I assessment conducted. For more information on this process see this webpage: https://dec.vermont.gov/watershed/wetlands/class1wetlands

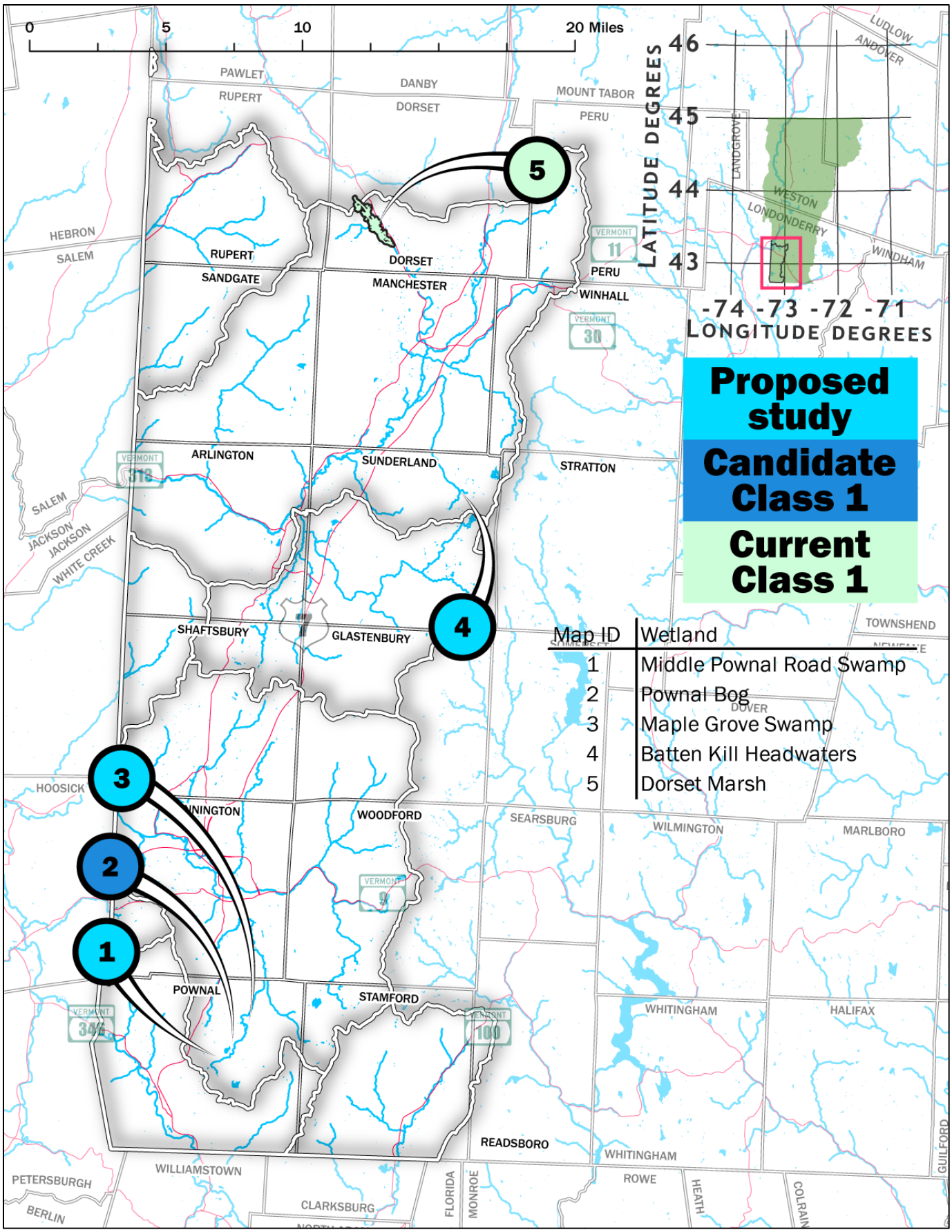

Figure 25 Class I wetland candidates.

Table 26 Class 1 wetland candidates.

Map ID	Latitude	Longitude	Wetland name	Category	Towns
1	-73.201	42.797	Middle Pownal Road Swamp	Proposed for Study	Pownal
2	-73.192	42.803	Pownal Bog	Candidate	Pownal
3	-73.178	42.812	Maple Grove Swamp	Proposed for Study	Pownal
4	-73.027	43.098	Batten Kill Headwaters	Proposed for Study	Sunderland
5	-73.091	43.240	Dorset Marsh	Current	Dorset

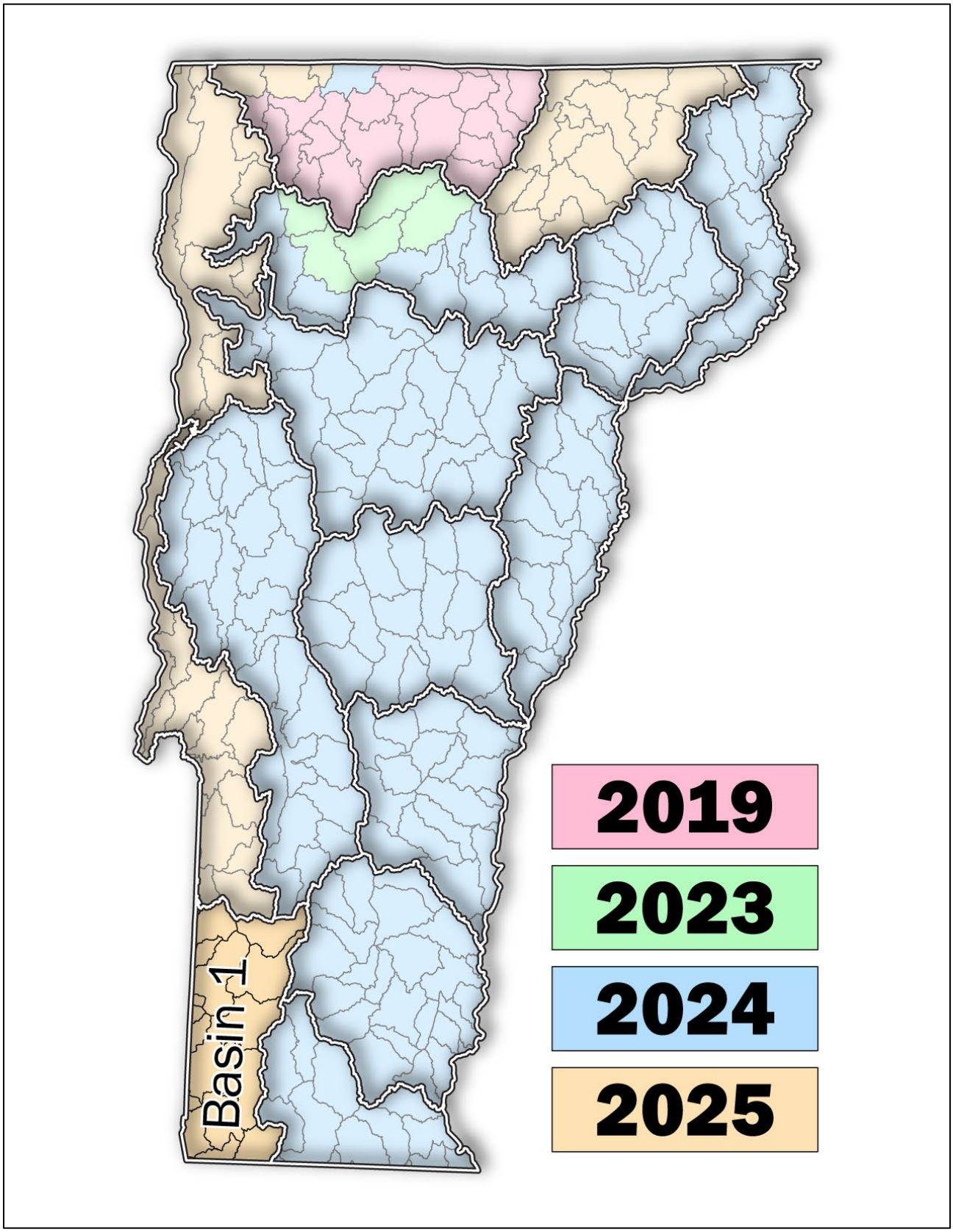

Figure 26. Wetland mapping schedule for Vermont Tactical Basins. Mapping is scheduled for 2024 in Basin 1.

The Vermont Wetlands program is currently in the process of working with contractors and federal agencies to update wetland mapping across the state. This will provide essential data as much of the current mapping is out of date and significantly under maps some types of wetlands such as seepage forests and softwood swamps. New mapping will gradually be made available in the Vermont Significant Wetlands Inventory layer over the next few years, with some basins updated sooner than others.