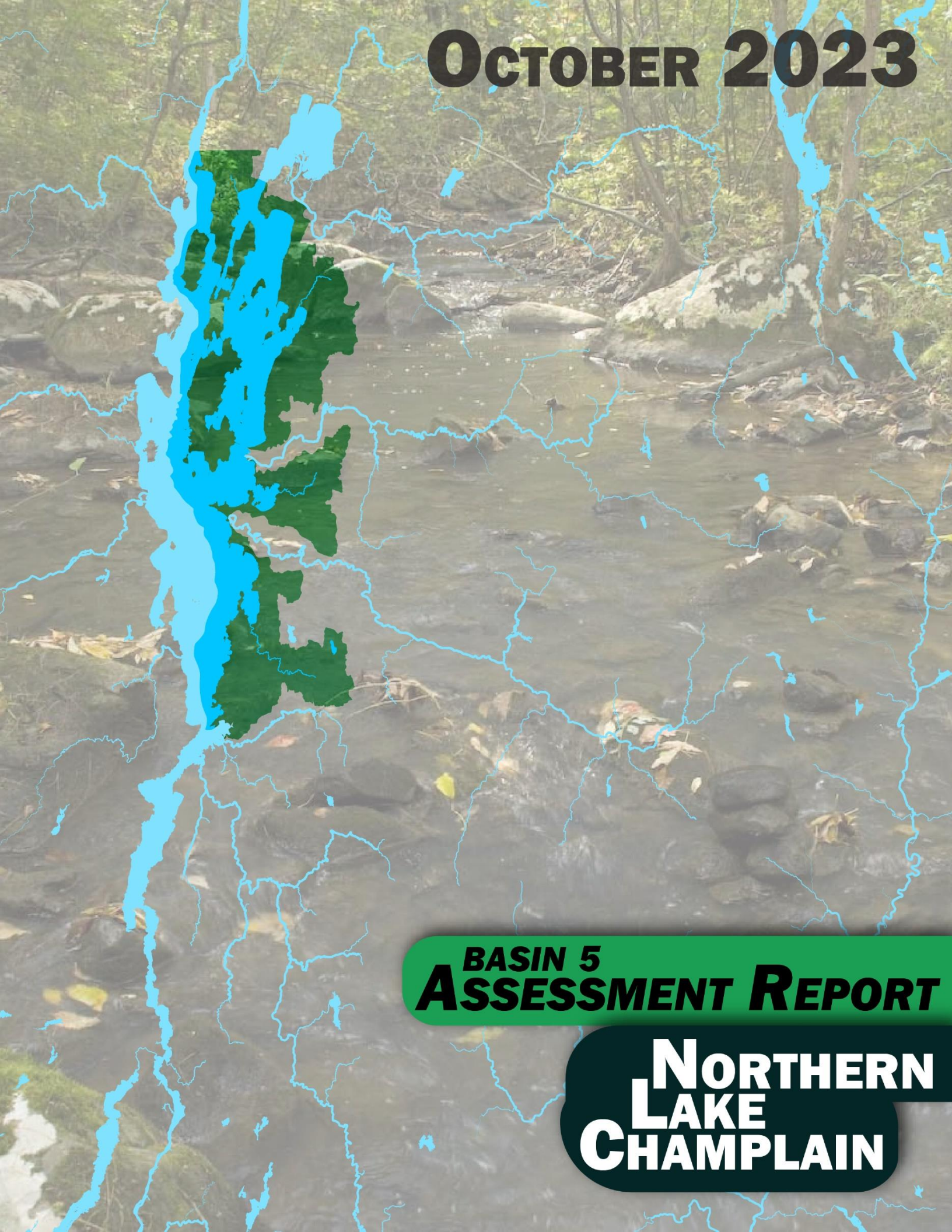

October 2023

BASIN 5

Assessment Report

Northern Lake Champlain

Contents

Basin overview

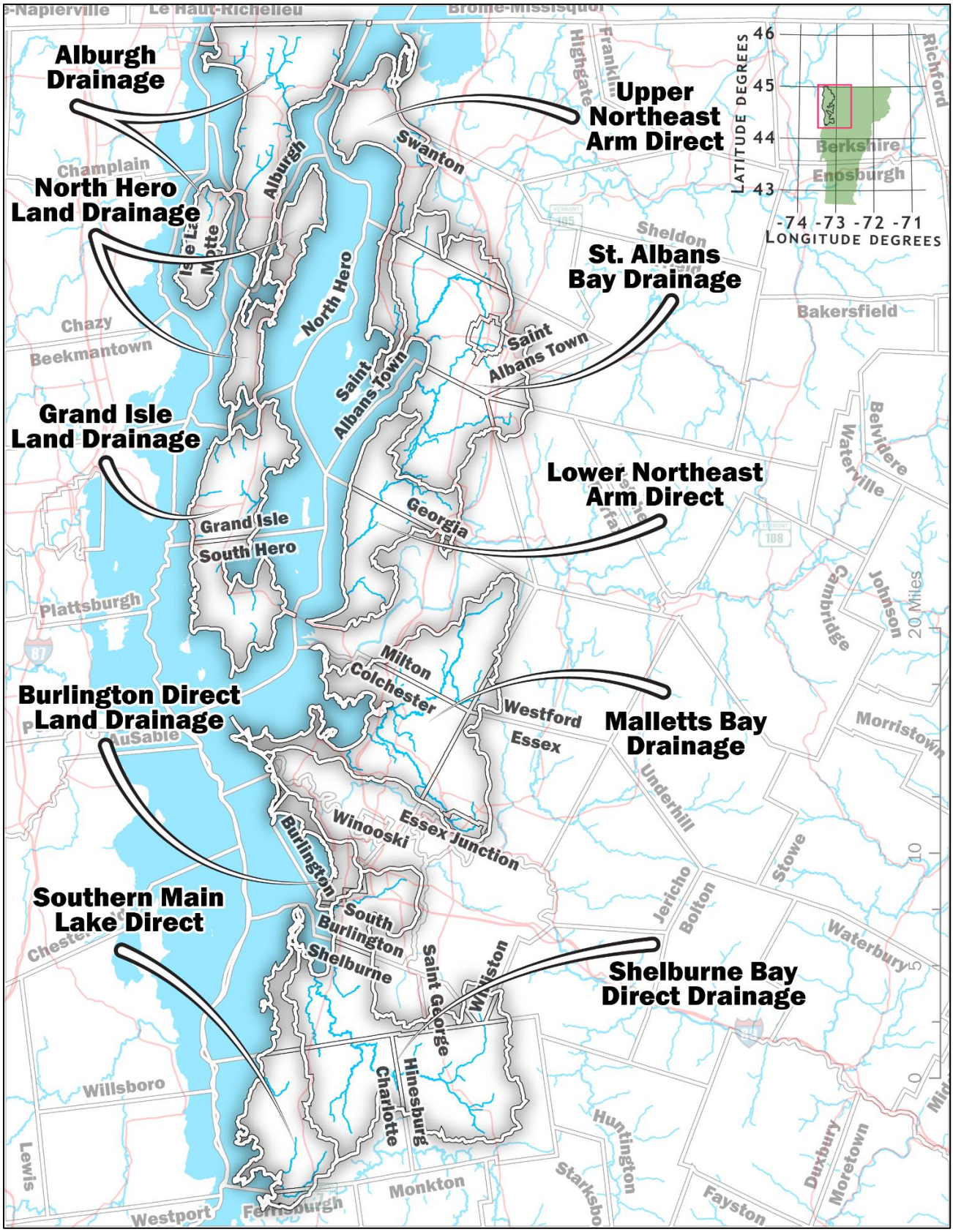

Figure 1 The 543 square mile Northern Lake Champlain basin encompasses waters of western Chittenden and Franklin counties.

Table 1 Distribution of Strahler stream orders by miles across Basin 5. This data is from the High-Resolution National Hydrography Dataset Plus (NHDPlus).

1	2	3	4	5	6
530	236	136	50	29	2

Table 2 Distribution of lake surface area (acres) across Basin 5. Data from the High-Resolution National Hydrography Dataset Plus (NHDPlus).Not including the 313,000 acre Lake Champlain.

Lake area (acres)			
<10	*>10<100*	*>100<500*	*>500*
21	16	5	0

Table 3 Distribution of wetland area (acres) across Basin 5. 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*
2754	530	93	8

Table 4 Summation of town level human population over time that intersects with Basin 5.

Basin-wide human population by year				
1980	*1990*	*2000*	*2010*	*2020*
69404	78789	88018	93628	99901

Table 5 . Major waters of Basin 5.

Largest River	La Platte River (19 miles)
Largest Lake or Reservoir (not Lake Champlain)	Lake Iroquois (247.0 acres)
Deepest Lake or Reservoir (not Lake Champlain)	Colchester Pond (42 feet)
Largest Wetland Complex	Missisquoi National Wildlife Refuge (2643 acres)

Land cover

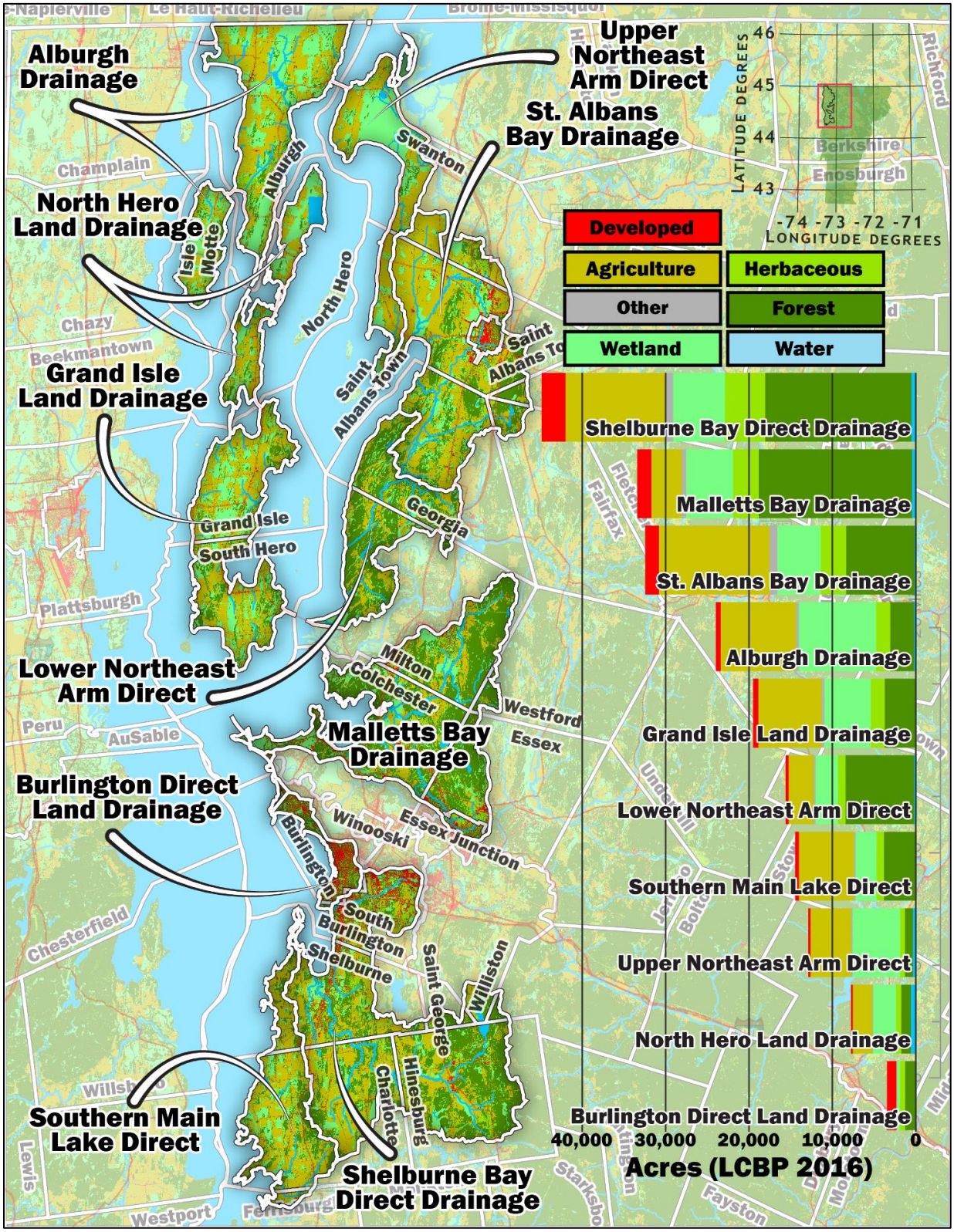

Figure 2. Landcover based on the 1-meter Lake Champlain land cover dataset produced by the University of Vermont spatial analysis laboratory and the Lake Champlain Basin program. The bar graph is a summary based on the Vermont WBID subwaterheds of the tactical basin.

Table 6 The percentage of major land cover types across the Vermont WBID subwatersheds of Basin 5. 1-meter Lake Champlain 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, coniferous, and mixed forests are categorized as forest. The other category includes shrubs and barren land. Wetlands are found throughout other cover types.

Name	acres	Developed	Agriculture	Other	Wetland	Herbaceous	Forest	Water
Shelburne Bay Direct Drainage	44900	6.4	26.8	1.9	13.8	10.7	39.1	1.3
Malletts Bay Drainage	33463	5.1	11.0	1.5	16.7	9.2	54.9	1.6
St. Albans Bay Drainage	32488	5.1	40.8	2.8	15.9	9.4	25.2	0.7
Alburg Drainage	24049	2.3	37.7	1.3	38.4	7.1	11.9	1.2
Grand Isle Land Drainage	19572	3.2	38.9	1.6	28.2	8.6	19.1	0.4
Lower Northeast Arm Direct	15688	2.4	19.2	1.4	17.0	5.9	52.3	1.8
Southern Main Lake Direct	14537	3.1	45.4	1.2	17.3	6.2	26.0	0.8
Upper Northeast Arm Direct	12961	2.0	37.6	1.5	43.8	4.4	7.5	3.3
North Hero Land Drainage	7850	2.7	29.6	1.5	34.5	7.9	15.2	8.5
Burlington Direct Land Drainage	3537	31.8	0.6	2.8	8.4	18.2	37.6	0.7

Lakes and Ponds

Conditions and trends

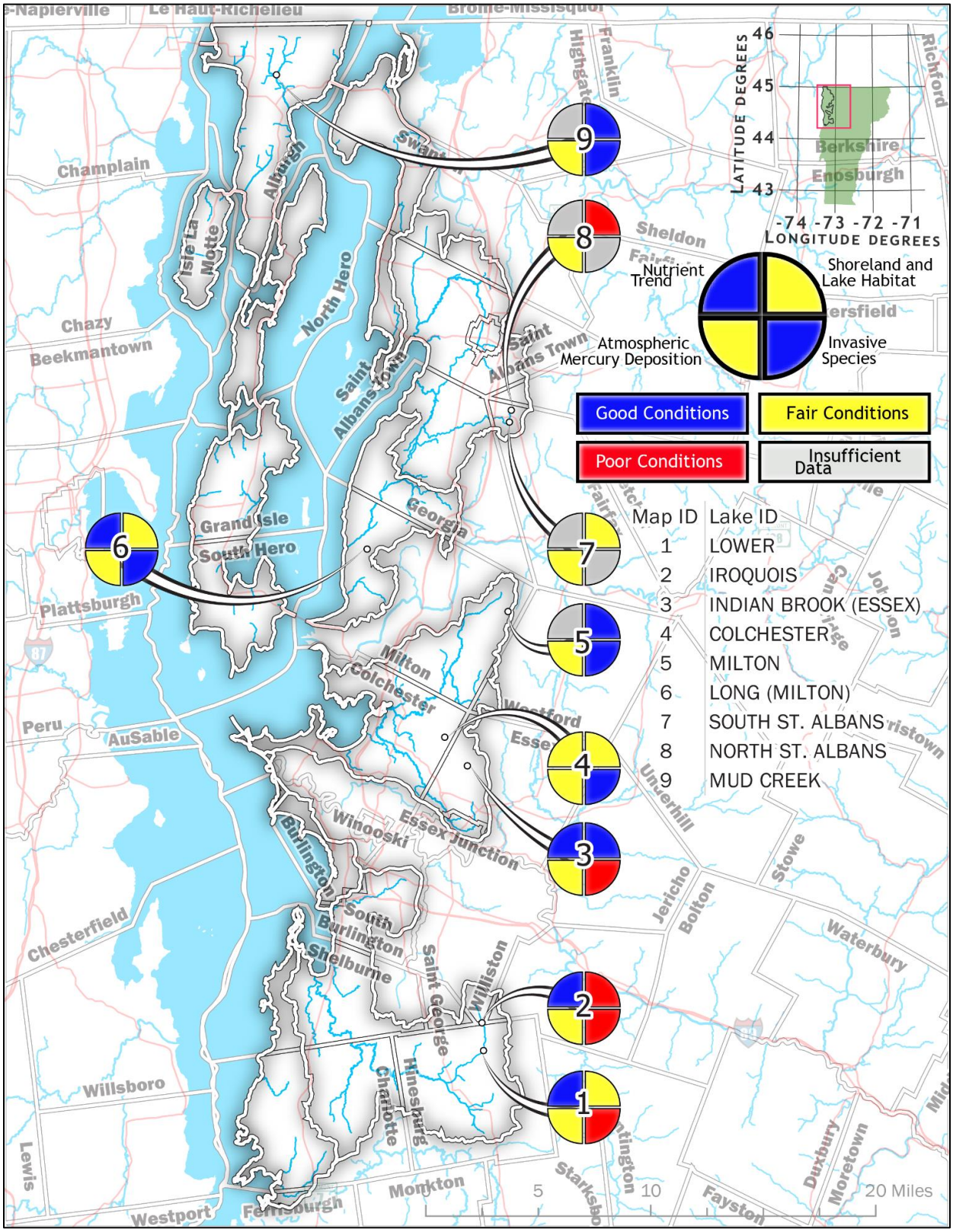

Figure 3. Lake scorecards for Basin 5. Only lakes greater than 10 acres are included. Lake IDs and additional information is provided in the table below.

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 5. 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	LOWER	44.94	10	Good	Fair	Poor	Fair
2	IROQUOIS	246.97	37	Good	Poor	Poor	Fair
3	INDIAN BROOK (ESSEX)	57.541	22	Good	Good	Poor	Fair
4	COLCHESTER	191.43	42	Fair	Fair	Good	Fair
5	MILTON	29.791	13	Insufficient data	Good	Good	Fair
6	LONG (MILTON)	81.158	36	Good	Fair	Good	Fair
7	SOUTH ST. ALBANS	24.804	23	Insufficient data	Fair	Insufficient data	Fair
8	NORTH ST. ALBANS	37.225	28	Insufficient data	Poor	Insufficient data	Fair
9	MUD CREEK	30.786	3	Insufficient data	Good	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 5.

Impaired Lakes

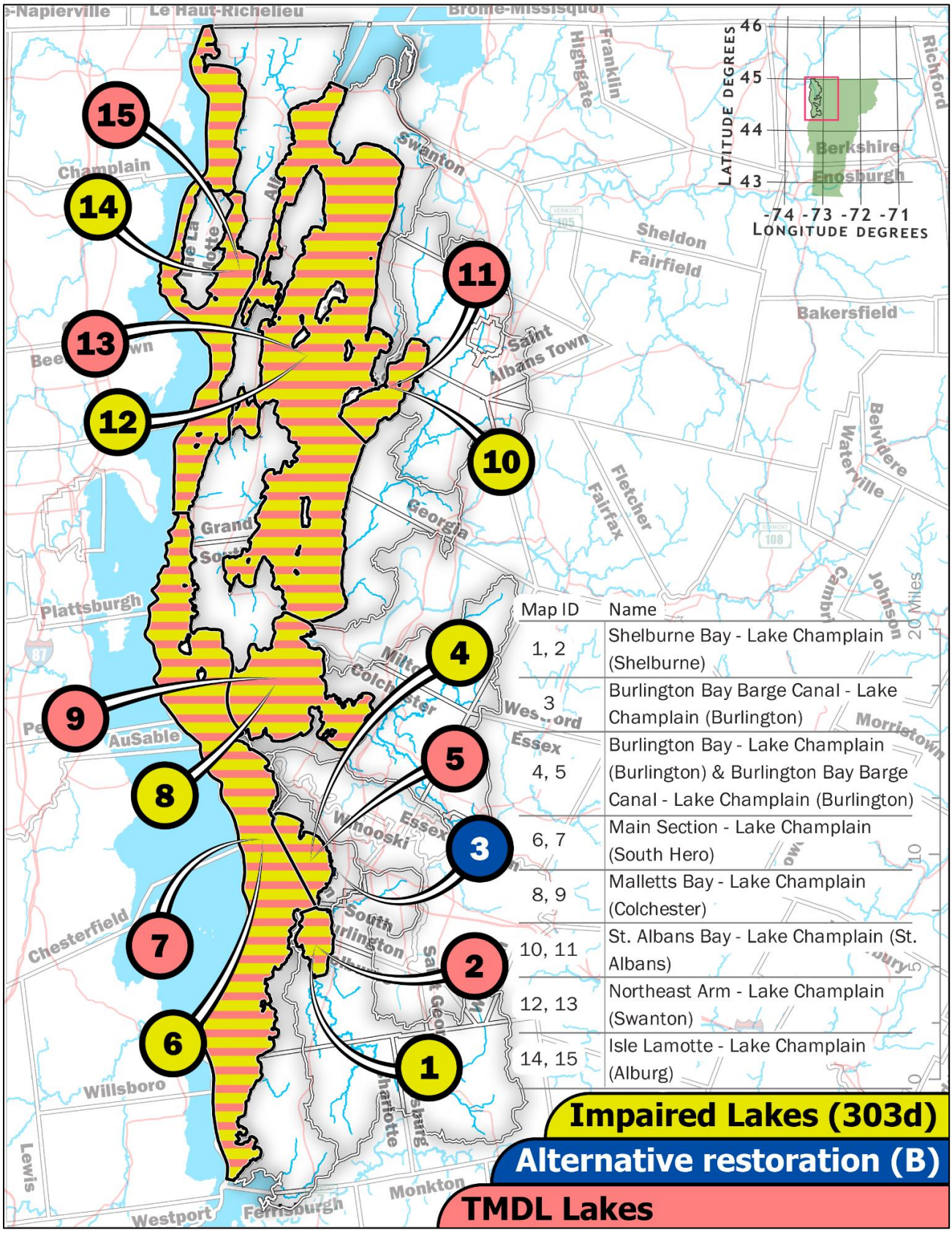

Figure 4 Map of impaired lakes across Basin 5 through 2022. Salmon color represent lakes that are on Part D of the Priority Waters List and have an approved Total Maximum Daily Load (TMDL) And blue lakes have an alternative restoration plan, in this case, the Barge Canal is a Superfund site.

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. Fifteen sections of Lake Champlain are impaired and listed in Table 8, .

Table 8 List of impaired lakes across Basin 5. 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	Shelburne Bay - Lake Champlain (Shelburne)	PCBS IN FISH TISSUE	Elevated levels of PCBs in lake trout	A
2	Shelburne Bay - Lake Champlain (Shelburne)	MERCURY IN FISH TISSUE, PHOSPHORUS	Elevated levels of mercury in walleye, Phosphorus enrichment	D
3	Burlington Bay Barge Canal - Lake Champlain (Burlington)	XYLENE, TOLUENE	Contamination from coal tar in sediments of Pine Street Barge Canal (SITE #770042)	B
4	Burlington Bay - Lake Champlain (Burlington) & Burlington Bay Barge Canal - Lake Champlain (Burlington)	PCBS IN FISH TISSUE	Elevated levels of PCBs in lake trout	A
5	Burlington Bay - Lake Champlain (Burlington) & Burlington Bay Barge Canal - Lake Champlain (Burlington)	MERCURY IN FISH TISSUE, PHOSPHORUS	Elevated levels of mercury in walleye, Phosphorus enrichment	D
6	Main Section - Lake Champlain (South Hero)	PCBS IN FISH TISSUE	Elevated levels of PCBs in lake trout	A
7	Main Section - Lake Champlain (South Hero)	MERCURY IN FISH TISSUE, PHOSPHORUS	Elevated levels of mercury in walleye, Phosphorus enrichment	D
8	Malletts Bay - Lake Champlain (Colchester)	PCBS IN FISH TISSUE	Elevated levels of PCBs in lake trout	A

MAP ID	NAME	PROBLEM	POLLUTANT	PART
9	Malletts Bay - Lake Champlain (Colchester)	MERCURY IN FISH TISSUE, PHOSPHORUS	Elevated levels of mercury in walleye, Phosphorus enrichment	D
10	St. Albans Bay - Lake Champlain (St. Albans)	PCBS IN FISH TISSUE	Elevated levels of PCBs in lake trout	A
11	St. Albans Bay - Lake Champlain (St. Albans)	MERCURY IN FISH TISSUE, PHOSPHORUS	Elevated levels of mercury in walleye, Phosphorus enrichment	D
12	Northeast Arm - Lake Champlain (Swanton)	PCBS IN FISH TISSUE	Elevated levels of PCBs in lake trout	A
13	Northeast Arm - Lake Champlain (Swanton)	MERCURY IN FISH TISSUE, PHOSPHORUS	Elevated levels of mercury in walleye, Phosphorus enrichment	D
14	Isle La Motte - Lake Champlain (Alburg)	PCBS IN FISH TISSUE	Elevated levels of PCBs in lake trout	A
15	Isle La Motte - Lake Champlain (Alburg)	MERCURY IN FISH TISSUE, PHOSPHORUS	Elevated levels of mercury in walleye, Phosphorus enrichment	D

Altered Lakes

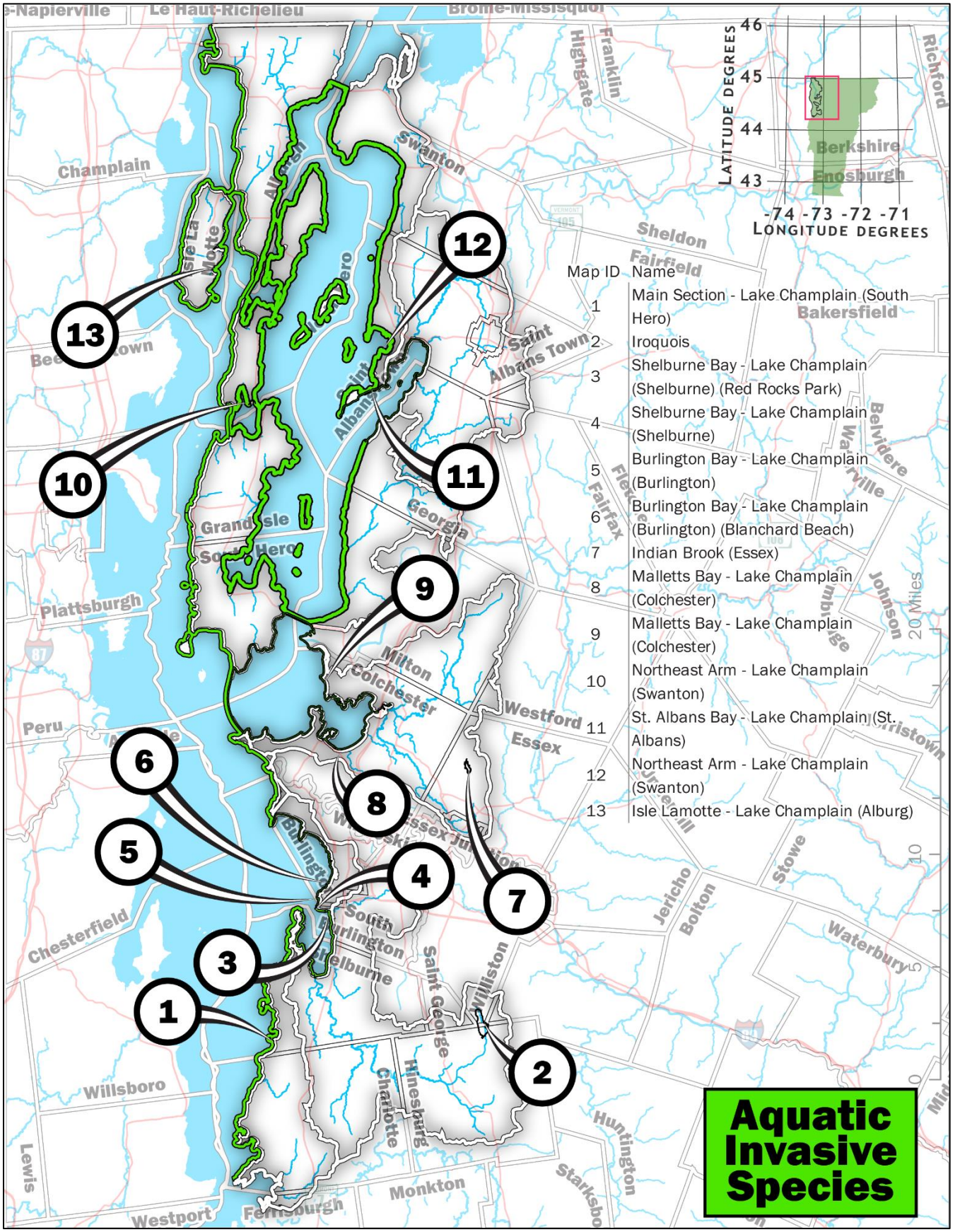

Figure 5 Map of altered lakes for Basin 5. Lakes in green are those altered by aquatic invasive species.

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 5.

MAP ID	NAME	PROBLEM	PART
1	Main Section - Lake Champlain (South Hero)	EWM and ZM infestation.	E
2	Iroquois	Abundant EWM growth.	E
3	Shelburne Bay - Lake Champlain (Shelburne) (Red Rocks Park)	ZM, EWM	E
4	Shelburne Bay - Lake Champlain (Shelburne)	ZM, EWM	E
5	Burlington Bay - Lake Champlain (Burlington)	EWM and ZM infestation.	E
6	Burlington Bay - Lake Champlain (Burlington) (Blanchard Beach)	EWM and ZM infestation.	E
7	Indian Brook (Essex)	Locally abundant EWM growth.	E
8	Malletts Bay - Lake Champlain (Colchester)	EWM and ZM infestation.	E
9	Malletts Bay - Lake Champlain (Colchester)	EWM and ZM infestation.	E
10	Northeast Arm - Lake Champlain (Swanton)	EWM and ZM infestation.	E
11	St. Albans Bay - Lake Champlain (St. Albans)	EWM and ZM infestation.	E
12	Northeast Arm - Lake Champlain (Swanton)	EWM and ZM infestation.	E
13	Isle La Motte - Lake Champlain (Alburg)	EWM and ZM infestation.	E

Phosphorus Trends in Lakes

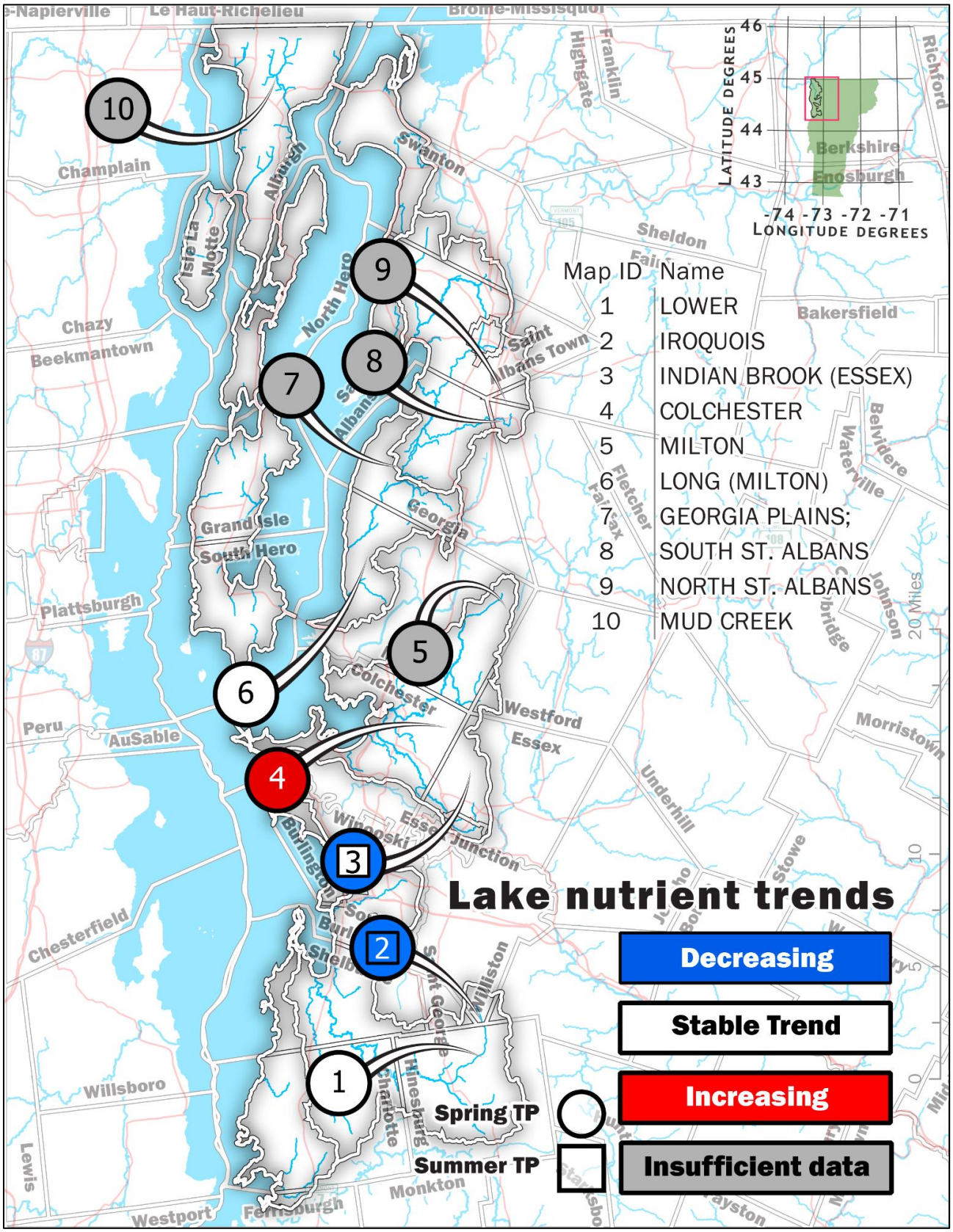

Figure 6 Total phosphorus trends for lakes in Basin 5. Note that trends can be for either spring or summer data or for both.

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	LOWER	Insufficient data	=
2	IROQUOIS	-	-
3	INDIAN BROOK (ESSEX)	=	-
4	COLCHESTER	Insufficient data	+
5	MILTON	No data	Insufficient data
6	LONG (MILTON)	No data	=
7	GEORGIA PLAINS;	No data	Insufficient data
8	SOUTH ST. ALBANS	No data	Insufficient data
9	NORTH ST. ALBANS	No data	Insufficient data
10	MUD CREEK	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.

	Watershed disturbance	Impervious surface		Agricultural land	
Lake ID		Percent	Acres	Percent	Acres
DUCK (SHELBN)	Poor	73.6	95.9	1.1	1.4
INDIAN BROOK;	Poor	3.7	239.1	2.1	137.6
EAGLE	Insufficient data	0.0	0.0	0.0	0.0
GEORGIA PLAINS;	Insufficient data	43.7	419.5	0.5	4.5
MALLETT;	Poor	4.1	116.2	0.2	4.4
DUCK (SHELBN)	Insufficient data	73.6	95.9	1.1	1.4

[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

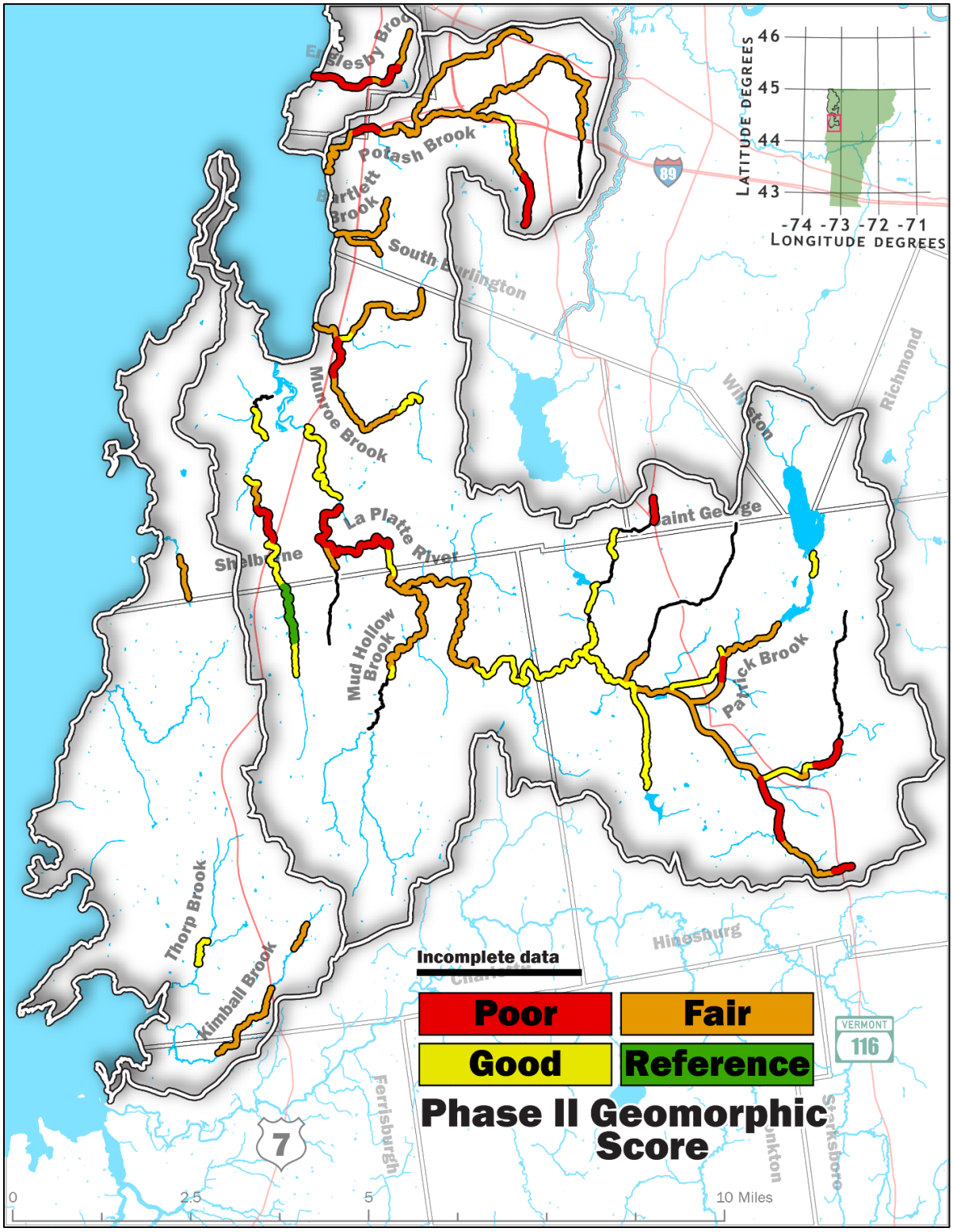

Figure 7 Map of rivers in Basin 5, southern section, with Phase II geomorphic condition scores through 2023. Poor rivers have extreme departure from reference condition, fair rivers have major departure, and good rivers have minor departure. Reference rivers have no departure.

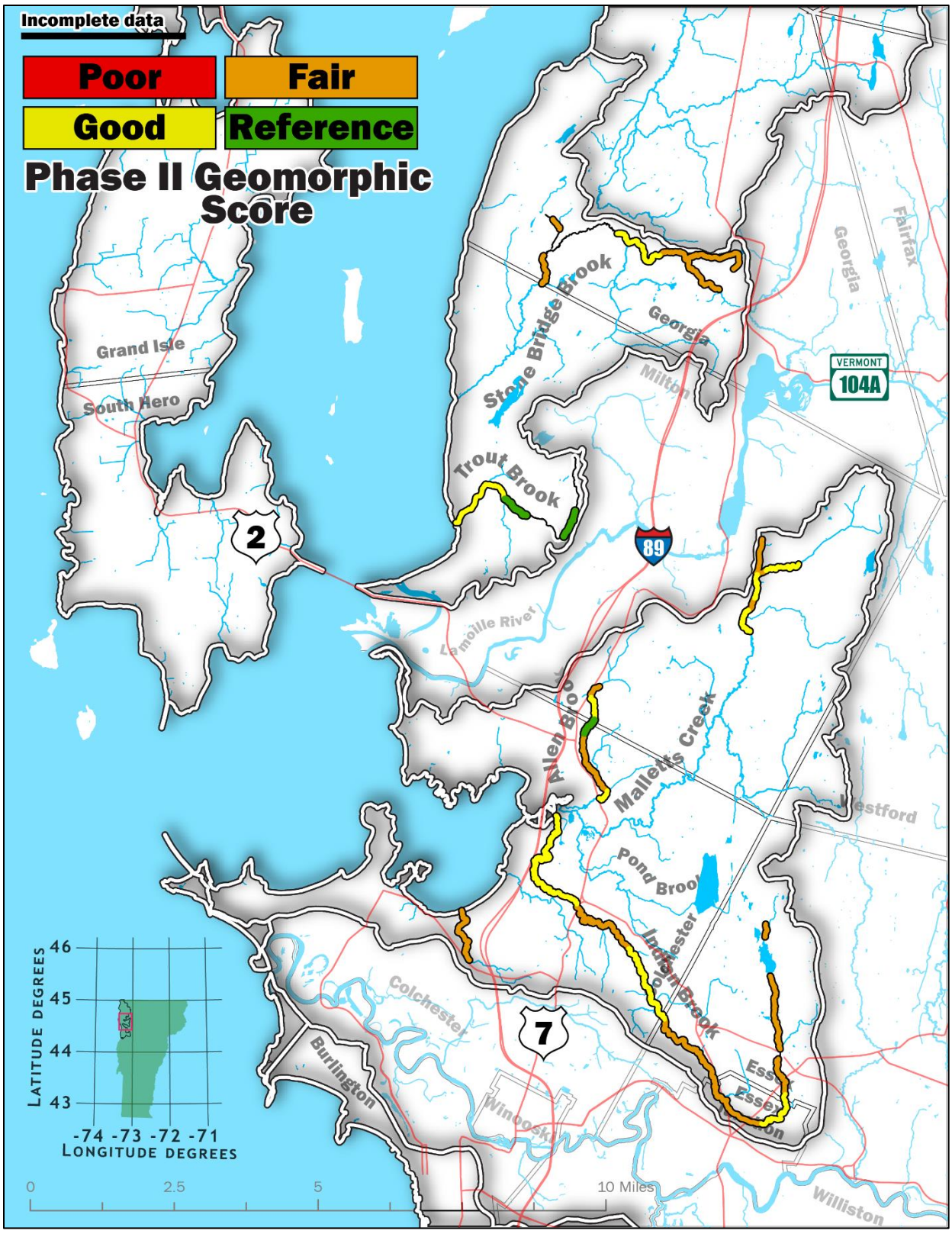

Figure 8 Map of rivers in Basin 5, middle section, with Phase II geomorphic condition scores through 2023. Poor rivers have extreme departure from reference condition, fair rivers have major departure, and good rivers have minor departure. Reference rivers have no departure.

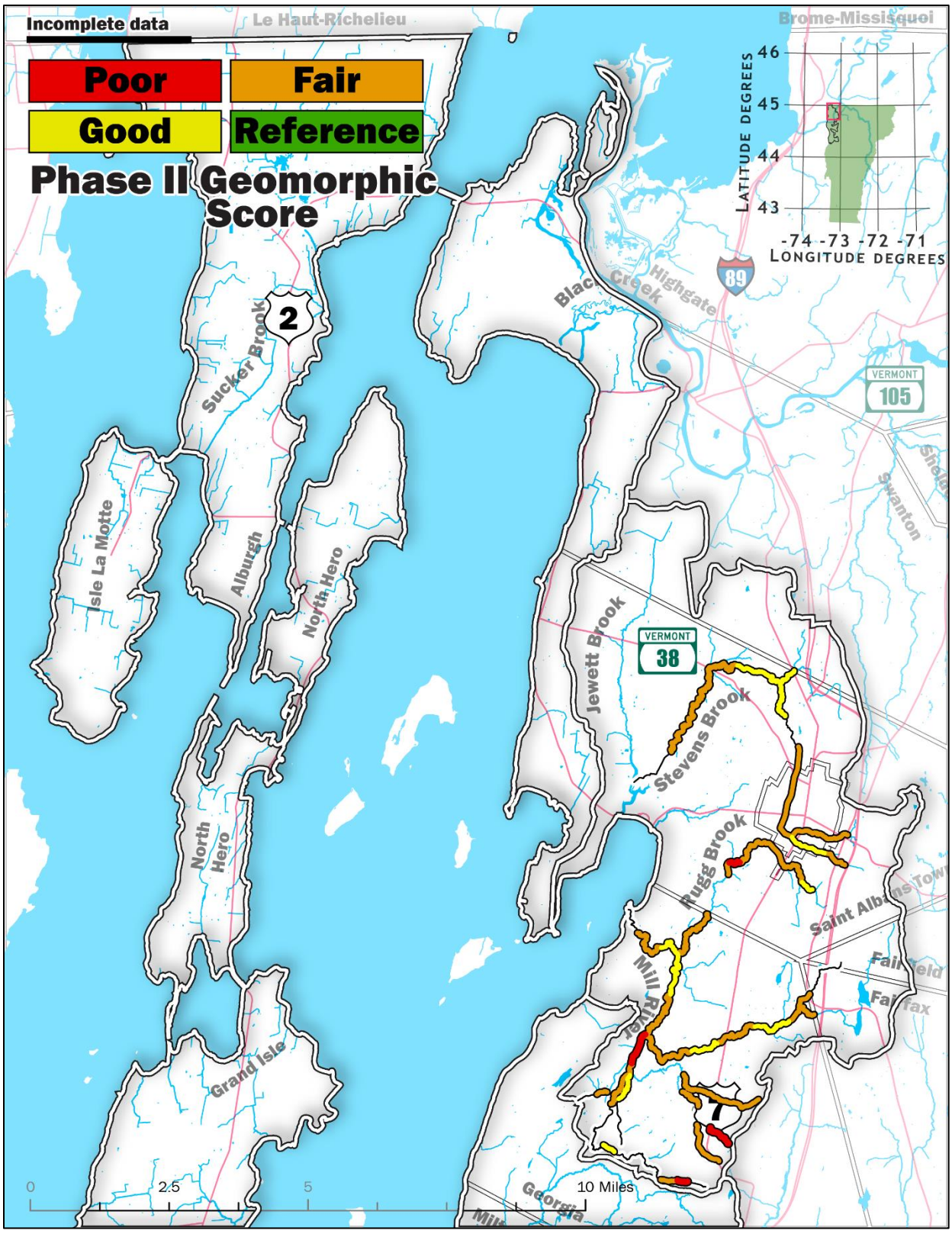

Figure 9 Map of rivers in Basin 5, north section, with Phase II geomorphic condition scores through 2023. Poor rivers have extreme departure from reference condition, fair rivers have major departure, and good rivers have minor departure. Reference rivers have no departure.

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 Stream Geomorphic Assessment 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 5. 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 5, final reports for each project can be found at: *https://anrweb.vt.gov/DEC/SGA/finalReports.aspx*.

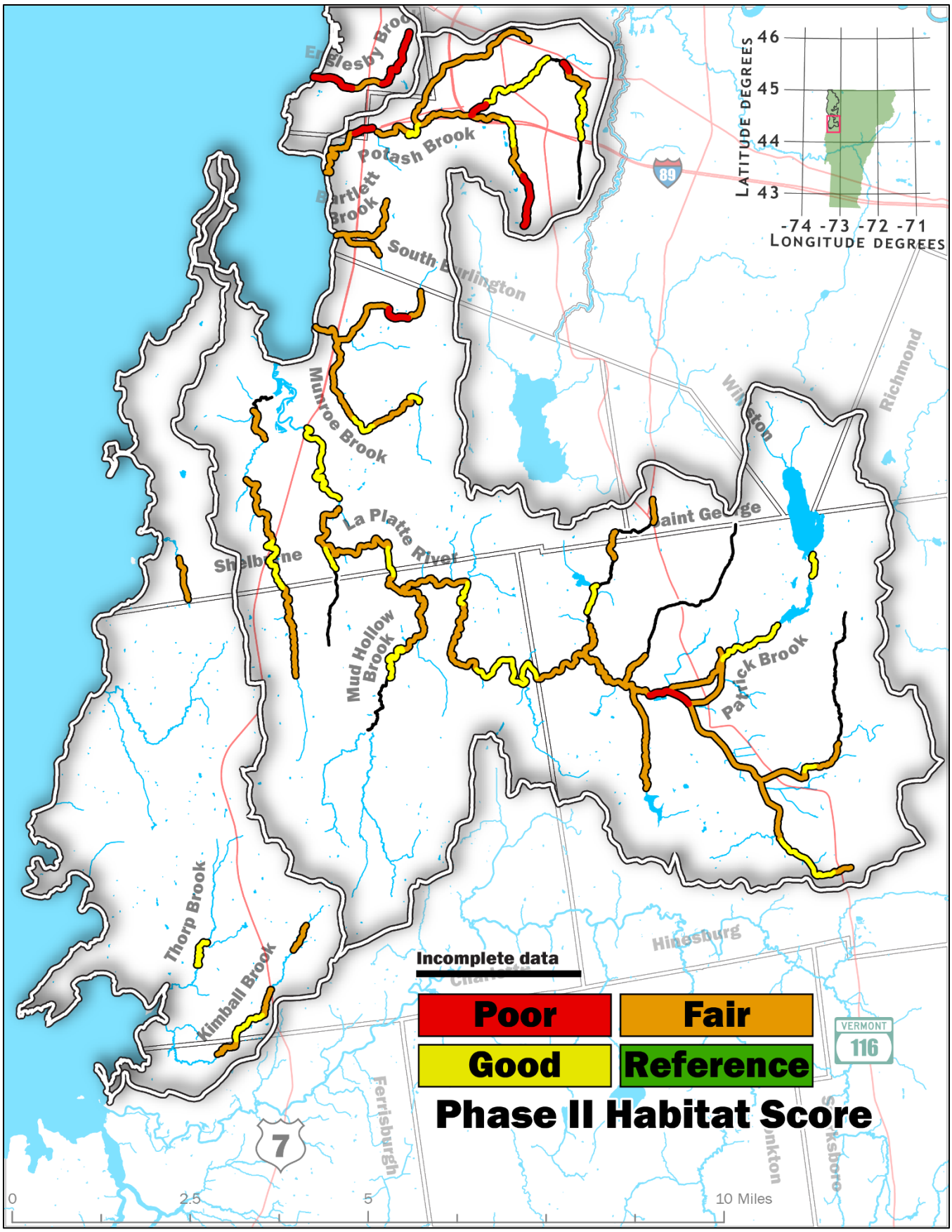

Figure 10 Map of rivers in Basin 5, south section, with Phase II habitat condition ratings through 2023. Low number ratings have extreme departure from reference conditions. High number ratings have non-significant departure from reference conditions.

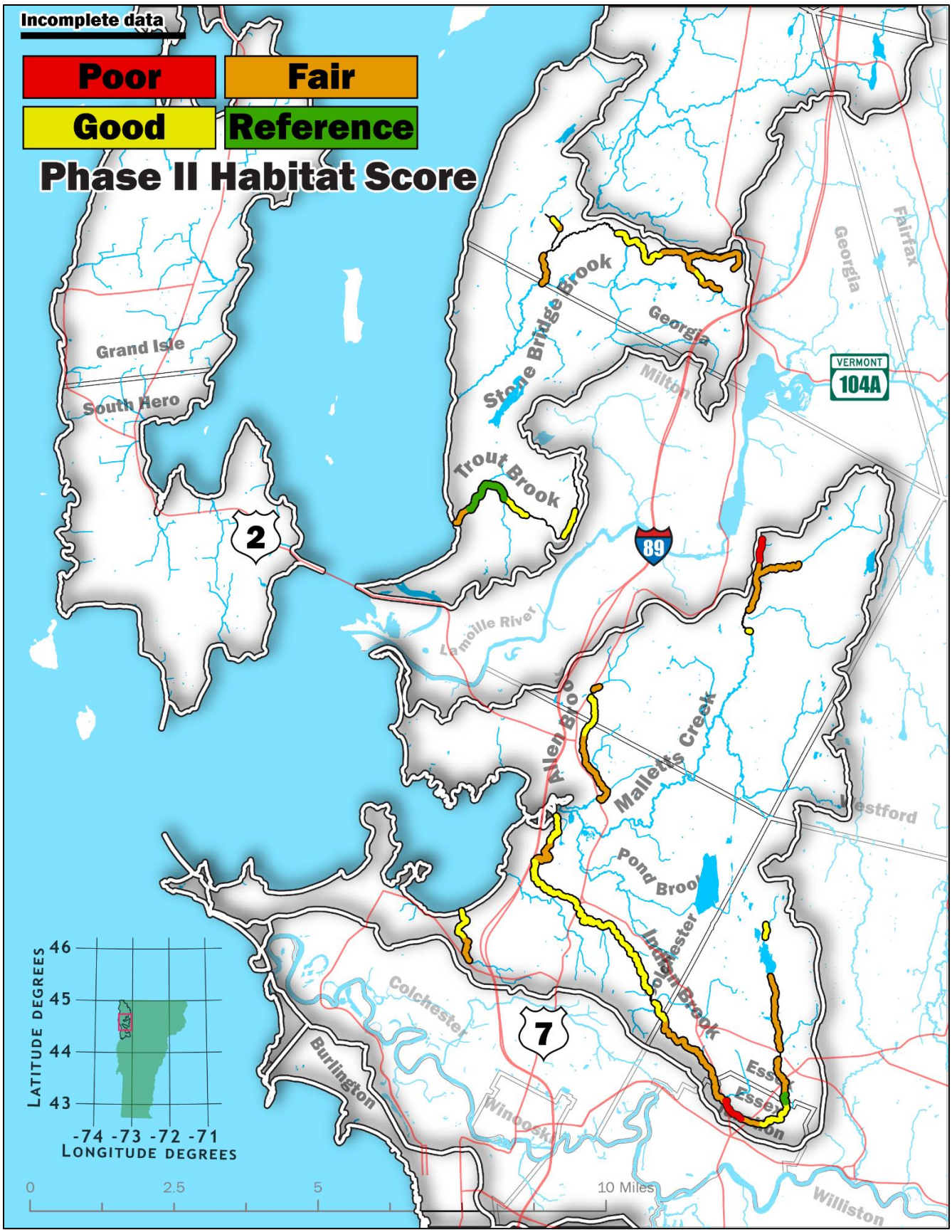

Figure 11 Map of rivers in Basin 5, middle section, with Phase II habitat condition ratings through 2023. Low number ratings have extreme departure from reference conditions. High number ratings have non-significant departure from reference conditions.

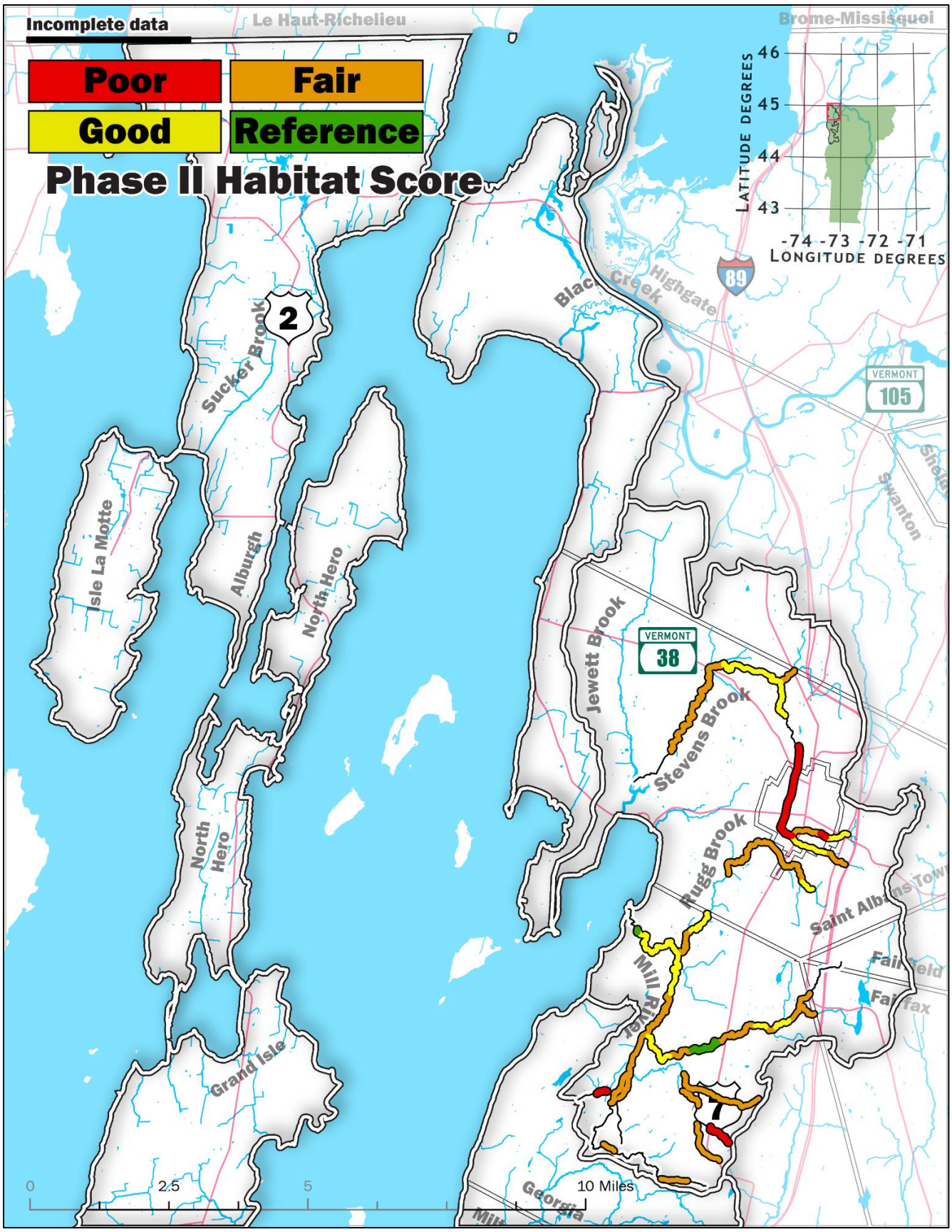

Figure 12 Map of rivers in Basin 5, north section, with Phase II habitat condition ratings through 2023. Low number ratings have extreme departure from reference conditions. High number ratings have non-significant departure from reference conditions.

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.

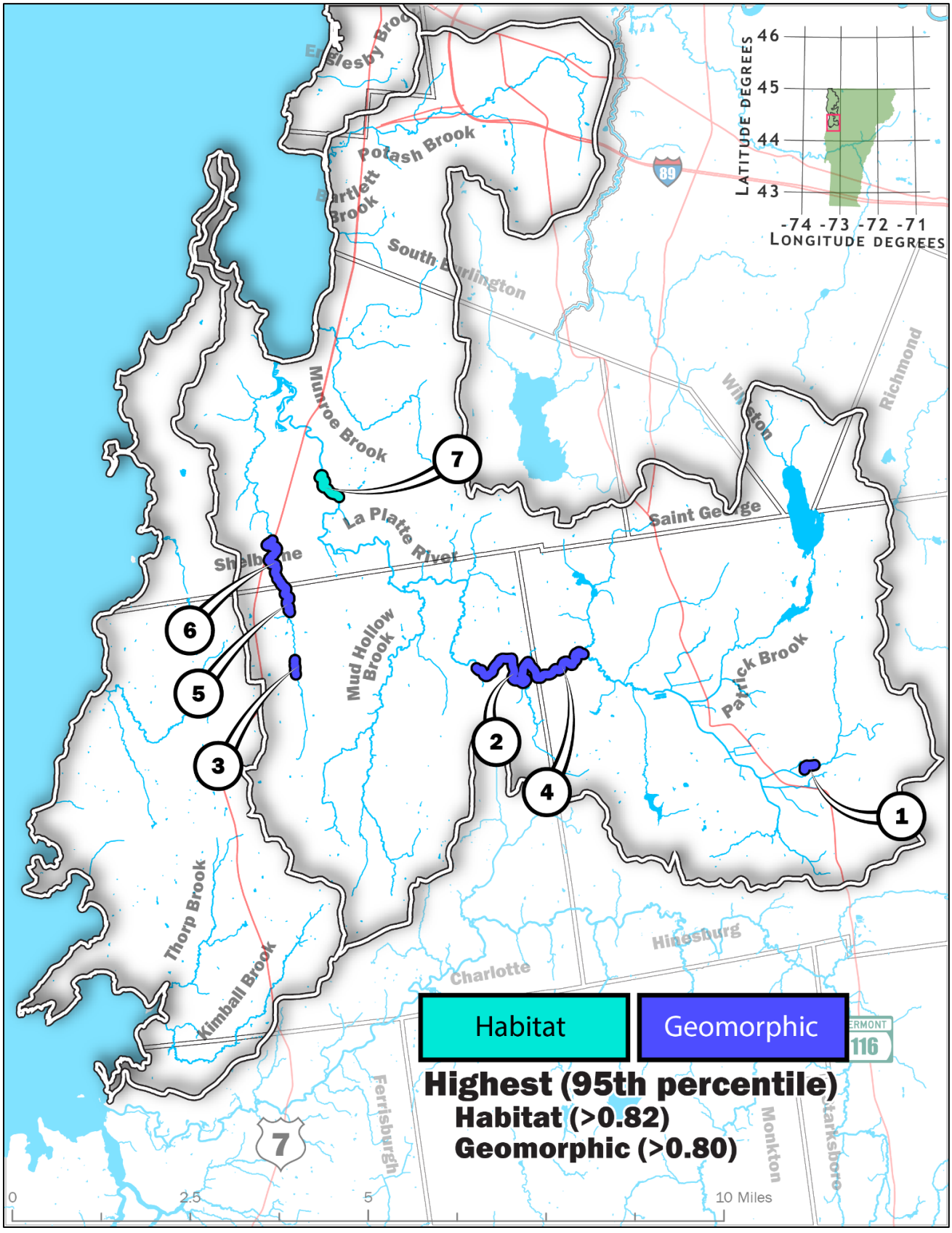

Figure 13. Map of the 95th percentile (highest) habitat and geomorphic condition scores (Basin 5 south section). Map IDs correspond to the table below. Using this percentile approach identifies the reaches with the best geomorphic and habitat condition relative to conditions across the basin. Each is scored separately but overlap does occur.

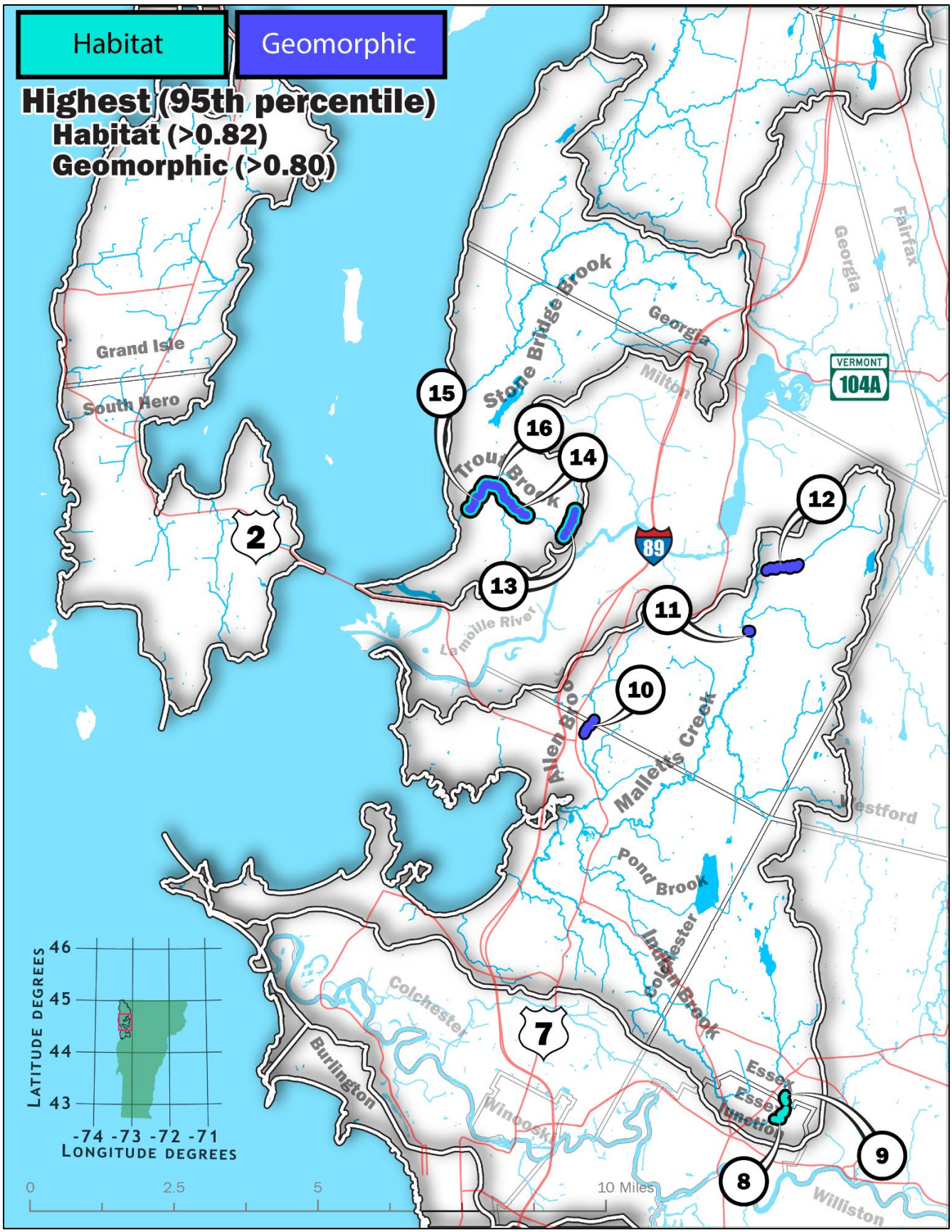

Figure 14 Map of the 95th percentile (highest) habitat and geomorphic condition scores (Basin 5 middle section). Map IDs correspond to the table below. Using this percentile approach identifies the reaches with the best geomorphic and habitat condition relative to conditions across the basin. Each is scored separately but overlap does occur.

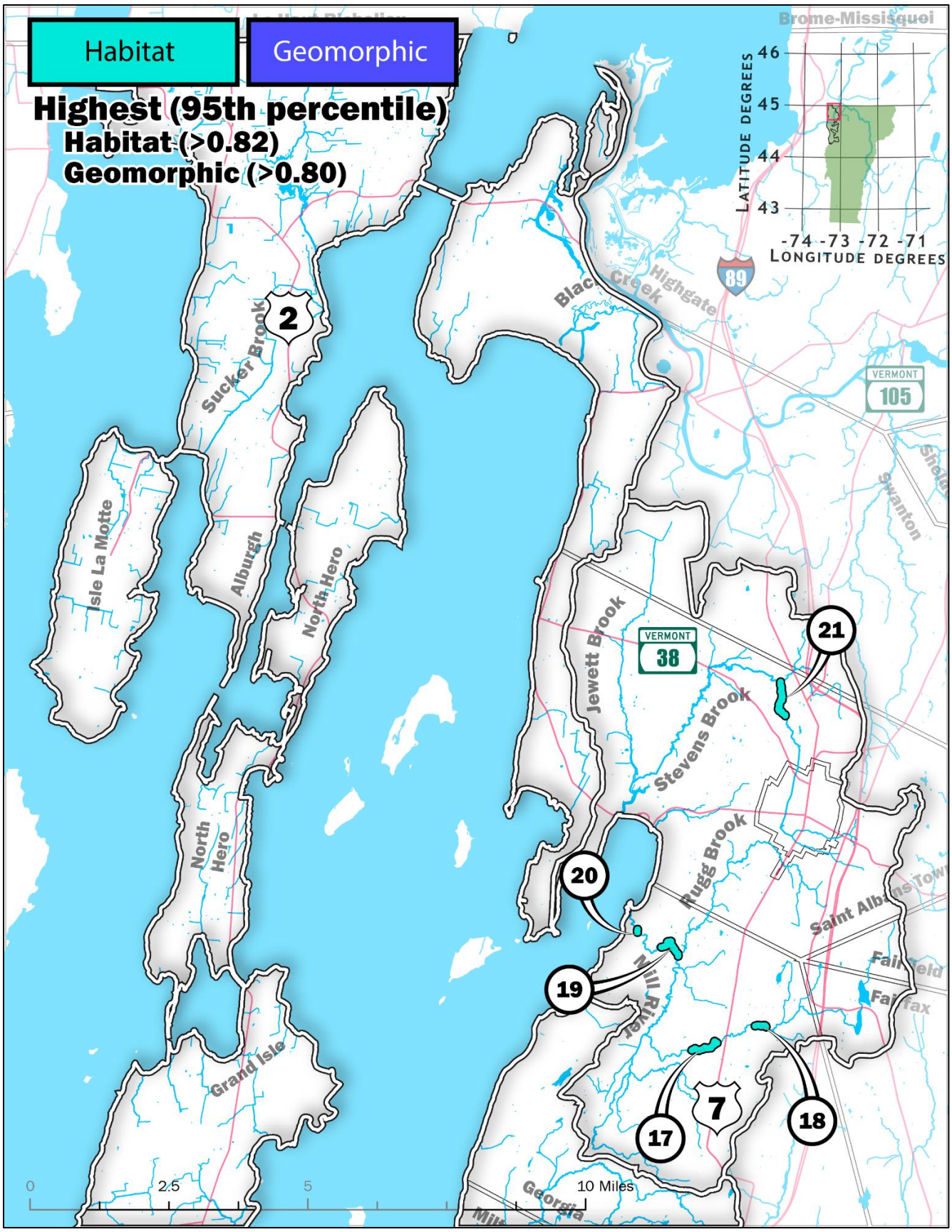

Figure 15 Map of the 95th percentile (highest) habitat and geomorphic condition scores (Basin 5 north section). Map IDs correspond to the table below. Using this percentile approach identifies the reaches with the best geomorphic and habitat condition relative to conditions across the basin. Each is 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	75_T5.01C	Beecher Hill Brook			Link	-73.082	44.319
2	75_M11-	La Platte River			Link	-73.166	44.338
3	75_T1.07B	McCabes Brook			Link	-73.228	44.338
4	75_M12-	La Platte River			Link	-73.152	44.339
5	75_T1.05C	McCabes Brook			Link	-73.230	44.352
6	75_T1.05B	McCabes Brook			Link	-73.234	44.359
7	75_M04B	LaPlatte River			Link	-73.220	44.374
8	44_M12-	Indian Brook			Link	-73.094	44.496
9	44_M13B	Indian Brook			Link	-73.092	44.500
10	171_T1.05-	Allen Brook			Link	-73.162	44.593
11	171_M14A	Malletts Creek			Link	-73.106	44.617
12	171_M17B	Malletts Creek			Link	-73.094	44.633
13	76_M07-	Trout Brook			Link	-73.169	44.644
14	76_M04-	Trout Brook			Link	-73.188	44.648
15	76_M02-	Trout Brook			Link	-73.201	44.651
16	76_M03-	Trout Brook			Link	-73.194	44.653
17	109_M04B	Mill River			Link	-73.120	44.750
18	109_M06A	Mill River			Link	-73.099	44.756
19	109_M01E	Mill River			Link	-73.132	44.776
20	109_M01B	Mill River			Link	-73.145	44.780
21	7_M04-	Stevens Brook			Link	-73.093	44.841

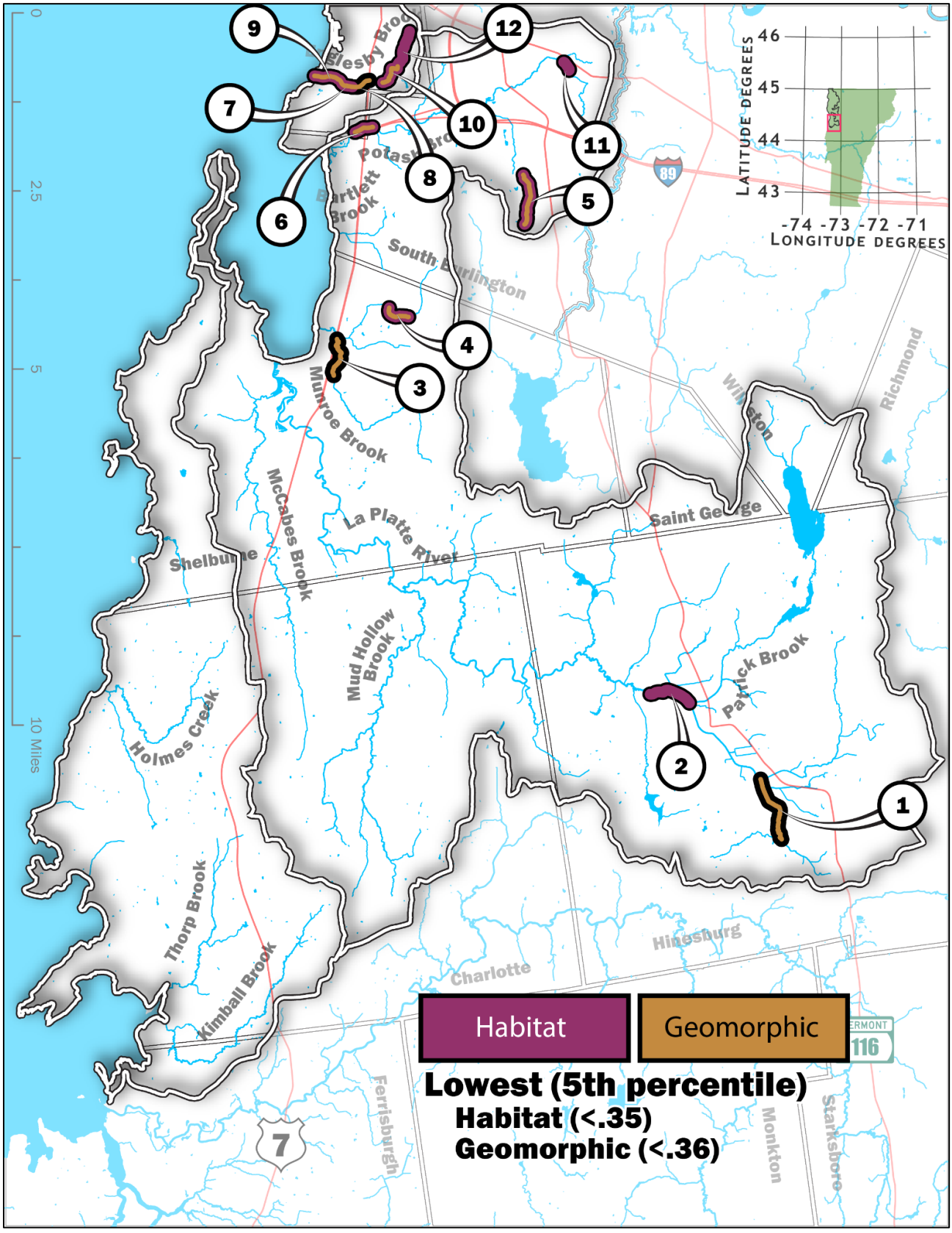

Figure 16 Map of the lowest 5th percentile habitat and geomorphic condition scores (Basin 5 south section). Map IDs correspond to the table below.

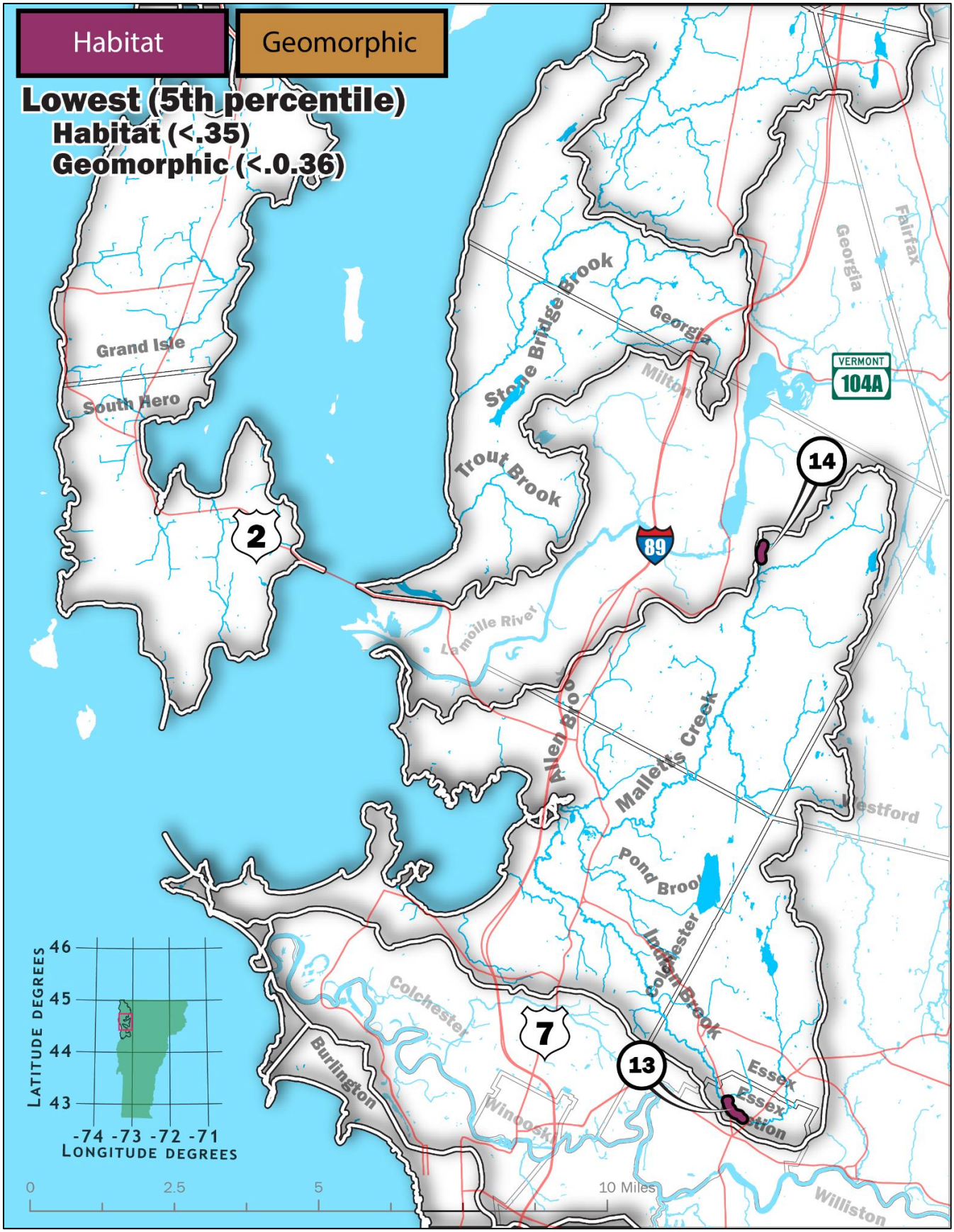

Figure 17 Map of the lowest 5th percentile habitat and geomorphic condition scores (Basin 5 middle section). Map IDs correspond to the table below.

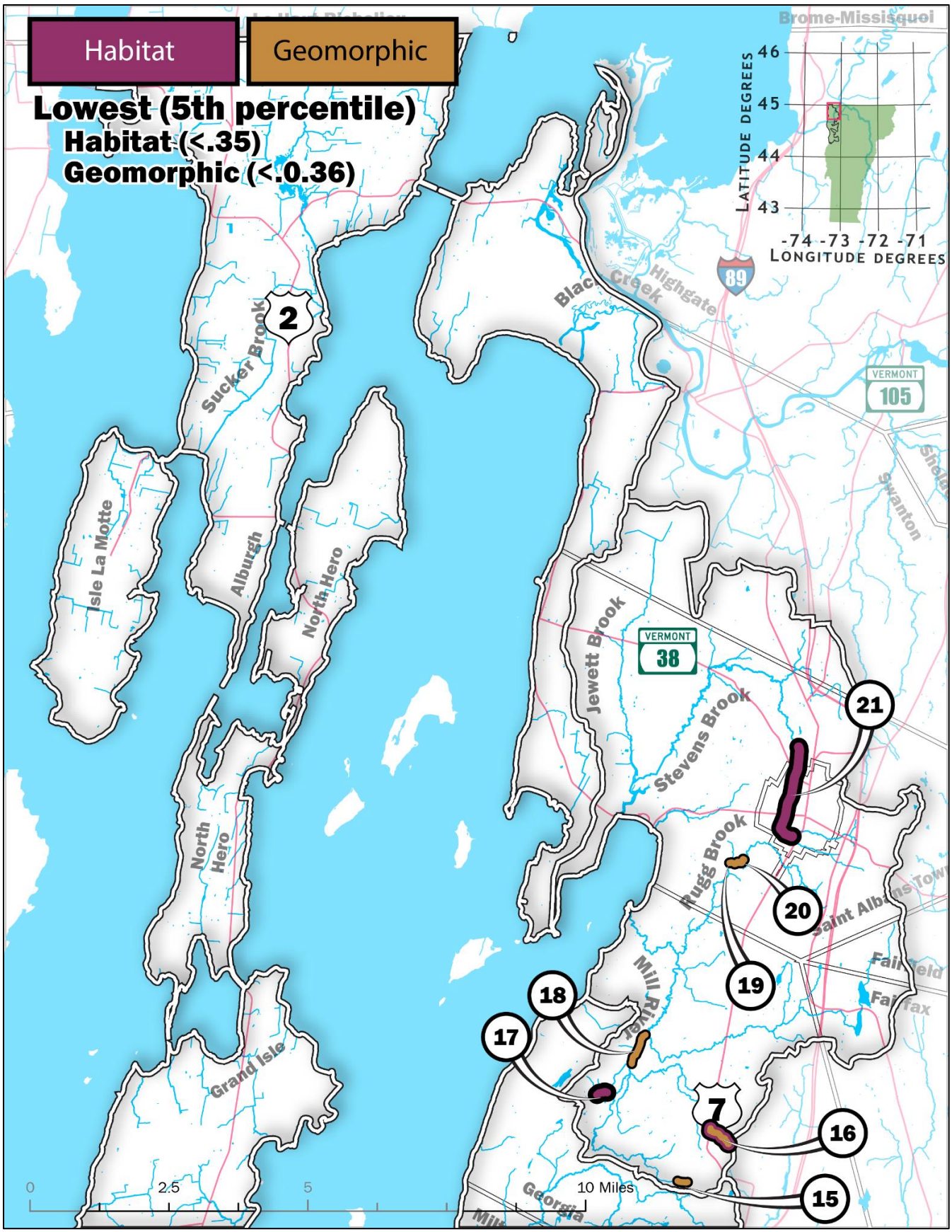

Figure 18 Map of the lowest 5th percentile habitat and geomorphic condition scores (Basin 5 south section). Map IDs correspond to the table below.

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	75_M17-	La Platte River			Link	-73.091	44.311
2	75_M15B	La Platte River			Link	-73.121	44.334
3	40_M02A	Munroe Brook			Link	-73.216	44.401
4	40_T1.03-	Munroe Brook, northern trib			Link	-73.200	44.409
5	47_T3.04B	Potash Brook Trib 3			Link	-73.163	44.433
6	47_M03-	Potash Brook			Link	-73.210	44.448
7	45_M01B	Englesby Brook			Link	-73.215	44.456
8	45_M01C	Englesby Brook			Link	-73.211	44.456
9	45_M01A	Englesby Brook			Link	-73.219	44.458
10	45_M02-	Englesby Brook			Link	-73.202	44.459
11	47_M13-	Potash Brook			Link	-73.152	44.460
12	45_M03-	Englesby Brook			Link	-73.199	44.464
13	44_M11A	Indian Brook			Link	-73.111	44.497
14	171_T6.01C	Mallets Creek			Link	-73.102	44.637
15	109_M2T2.06C	Unnamed Trib to M02			Link	-73.127	44.715
16	109_M2T2.2S1.3S3.01B	Unnamed Trib to M02			Link	-73.114	44.727
17	109_M2T2.1S1.1S1.01A	Unnamed Trib to M02			Link	-73.157	44.738
18	109_M2T2.01-	Unnamed Trib to M02			Link	-73.144	44.750
19	8_M05B	Rugg Brook			Link	-73.109	44.798
20	8_M06A	Rugg Brook			Link	-73.107	44.799
21	7_M05B	Stevens Brook			Link	-73.089	44.816

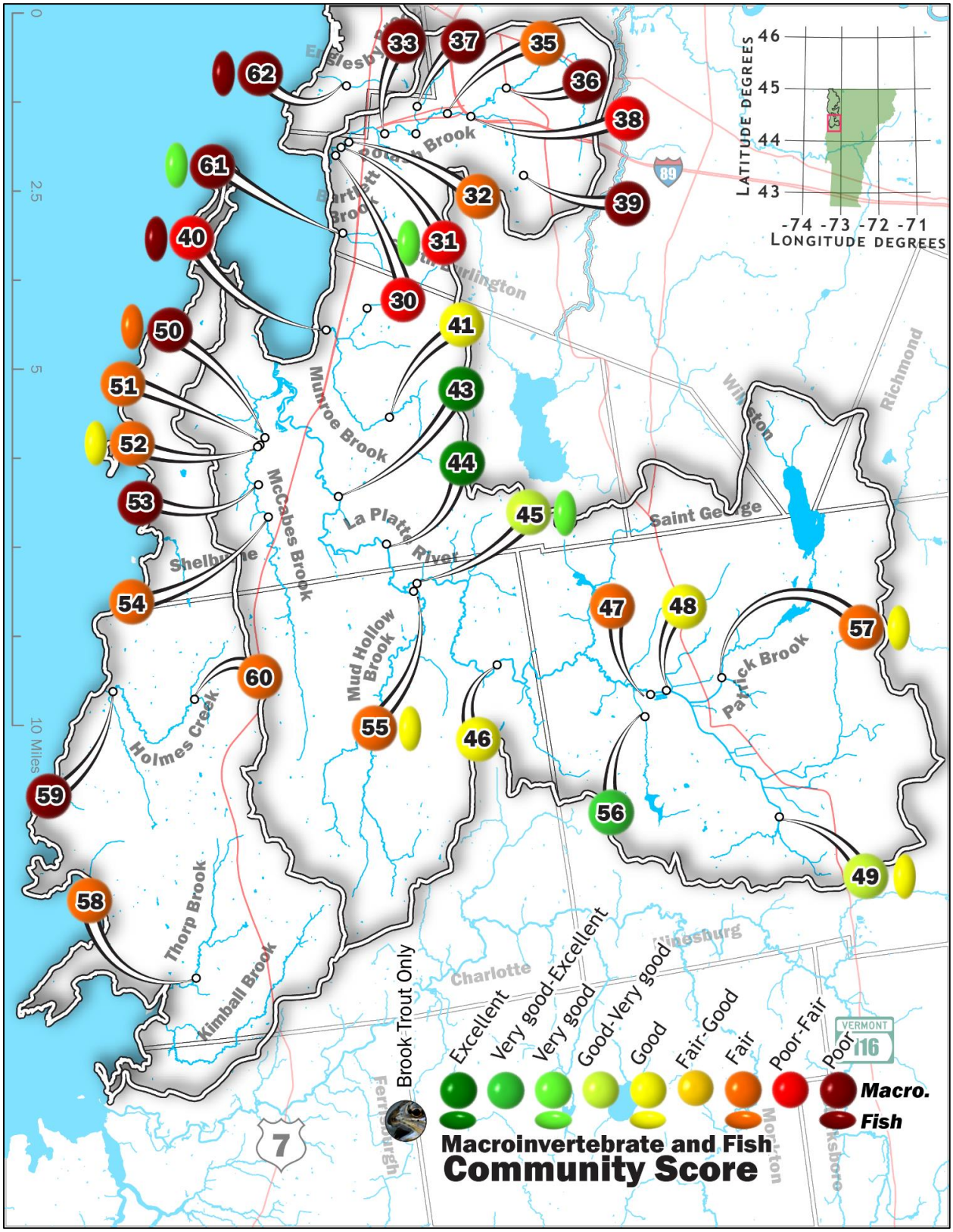

Figure 19. Map of the most recent Macroinvertebrate Community assessments over last 12 years for sites in Basin 5, south section (see below). Poor scores represent the greatest deviation from reference conditions and Excellent scores represent non-significant deviation from reference conditions. We do not have criteria for assessing Brook Trout Only streams (where brook trout are the only observed taxa). Map IDs correspond with the table below.

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 5, 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		2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022
Potash Brook, 0.4	30	Bug	PF	PF									
Potash Brook, 0.7	31	Bug	PF	P			PF				PF		
Potash Brook, 0.7	31	Fish									Vg		
Potash Brook, 1.0	32	Bug	PF				F						
Potash Brook, 1.0	32	Fish											
Potash Brook, 1.8	33	Bug	P				P						
Potash Brook, 1.8	33	Fish											
Potash Brook, 2.1	34	Bug	F										
Potash Brook, 2.1	34	Fish											
Potash Brook, 3.0	35	Bug	PF				F						
Potash Brook, 4.3	36	Bug	P				P						
Potash Brook Trib 3, 0.3	37	Bug					P						
Potash Brook Trib 7, 0.1	38	Bug					PF						
Potash Brook Trib 7, 1.7	39	Bug					P						
Munroe Brook, 0.3	40	Bug	F				F			U	PF		
Munroe Brook, 0.3	40	Fish	P										
Munroe Brook, 2.8	41	Bug	G							U			
Munroe Brook, 2.8	41	Fish											
Munroe Brook North Trib, 0.8	42	Bug	F							U	U		
Laplatte River, 3.4	43	Bug						E					

Name	Map ID		2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022
LaPlatte River, 5.2	44	Bug										E	
LaPlatte River, 5.8	45	Bug	Vg					E				GVg	
LaPlatte River, 5.8	45	Fish										Vg	
LaPlatte River, 8.6	46	Bug						G					
Laplatte River, 12.0	47	Bug						F					
Laplatte River, 12.0	47	Fish											
Laplatte River, 12.5	48	Bug						G					
Laplatte River, 12.5	48	Fish											
Laplatte River, 14.9	49	Bug						GVg					
Laplatte River, 14.9	49	Fish	F					G					
McCabes Brook, 1.2	50	Bug	P	P			P	P	P			P	
McCabes Brook, 1.2	50	Fish	G	P			F						
McCabes Brook, 1.3	51	Bug					F						
McCabes Brook, 1.4	52	Bug	PF				F	F	F			F	
McCabes Brook, 1.4	52	Fish	G				U						
McCabes Brook, 2.1	53	Bug							F	U		P	
McCabes Brook, 2.7	54	Bug					F						
Mud Hollow Brook, 0.1	55	Bug										F	
Mud Hollow Brook, 0.1	55	Fish										G	
LaPlatte River Trib #7, 0.5	56	Bug				VgE							
LaPlatte River Trib #7, 0.5	56	Fish				U							
Patrick Brook, 0.7	57	Bug										F	
Patrick Brook, 0.7	57	Fish										G	
Thorpe Brook, 0.5	58	Bug	F					F				U	
Holmes Creek, 0.1	59	Bug										P	
Holmes Creek, 2.7	60	Bug	F										
Holmes Creek, 2.7	60	Fish	U										
Bartlett Brook, 0.2	61	Bug	P	PF						P			

Name	Map ID		2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022
Bartlett Brook, 0.2	61	Fish		G								Vg	

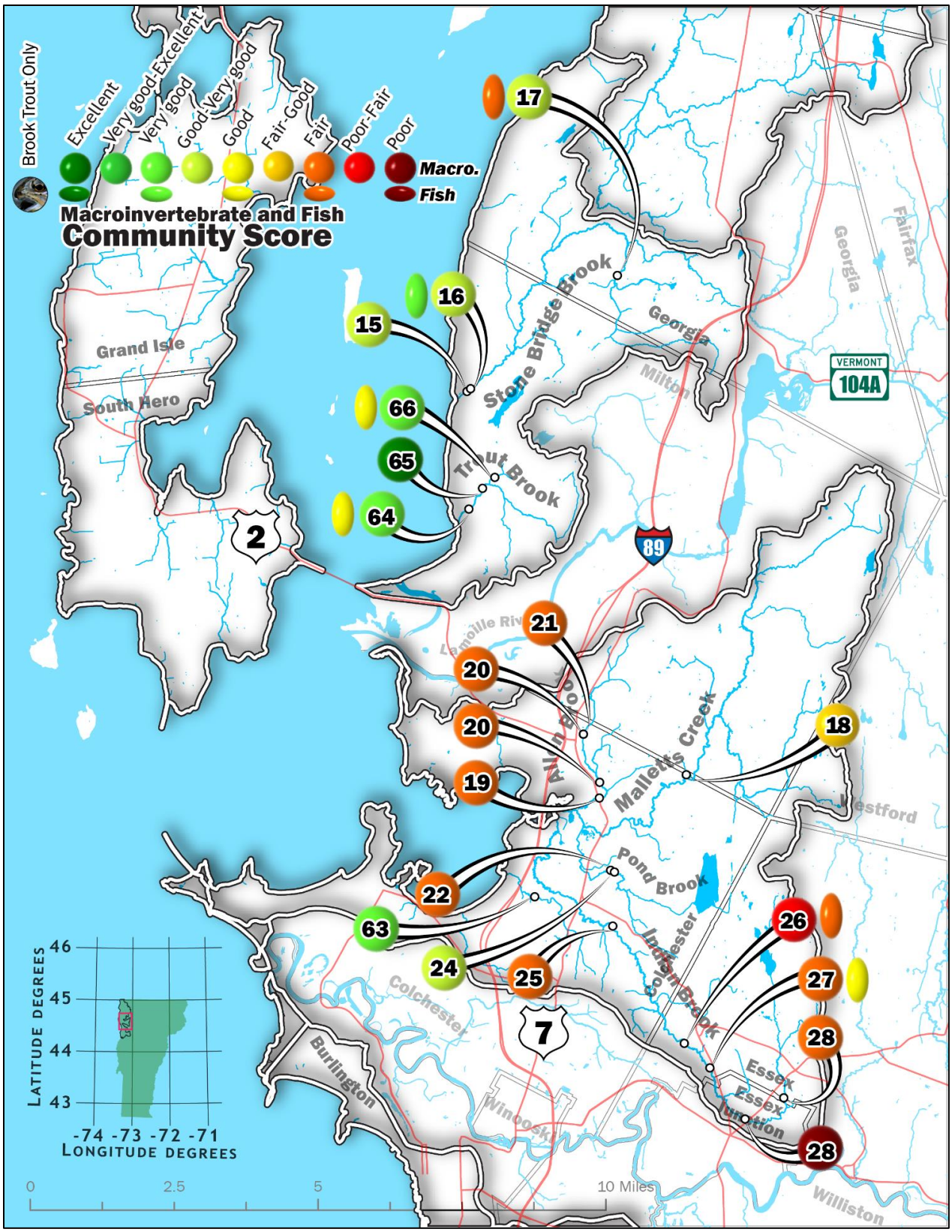

Figure 20 Map of the Macroinvertebrate Community assessment for Basin 5, middle section, (see below). Poor scores represent the greatest deviation from reference conditions and Excellent scores represent non-significant deviation from reference conditions. We do not have criteria for assessing Brook 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 5, 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		2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022
Stone Bridge Brook, 0.2	15	Bug	GVg										
Stone Bridge Brook, 0.2	15	Fish											
Stone Bridge Brook, 0.3	16	Bug										GVg	
Stone Bridge Brook, 0.3	16	Fish										Vg	
Stone Bridge Brook, 5.5	17	Bug						GVg					
Stone Bridge Brook, 5.5	17	Fish						F					
Malletts Creek, 3.5	18	Bug										FG	
Malletts Creek, 3.5	18	Fish										U	
Allen Brook, 0.9	19	Bug						F					
Allen Brook, 1.3	20	Bug						F					
Allen Brook, 2.2	21	Bug	Vg					F					
Allen Brook, 2.2	21	Fish											
Allen Brook, 2.3	22	Bug										F	
Pond Brook, 1.5	23	Bug										F	
Pond Brook, 1.5	23	Fish										U	
Pond Brook, 1.6	24	Bug	GVg										

Name	Map ID		2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022
Indian Brook, 3.1	25	Bug										F	
Indian Brook, 3.1	25	Fish											
Indian Brook, 5.8	26	Bug	F				PF					PF	
Indian Brook, 5.8	26	Fish	F									F	
Indian Brook, 7.0	27	Bug	F				F						
Indian Brook, 7.0	27	Fish					G						
Indian Brook, 8.5	28	Bug	PF					P					
Indian Brook, 8.5	28	Fish											
Indian Brook, 9.5	29	Bug	F										
Indian Brook, 9.5	29	Fish											
Englesby Brook, 0.6	62	Bug		P							U	P	
Englesby Brook, 0.6	62	Fish		P								P	
Crooked Creek, 1.0	63	Bug	Vg									U	
Trout Brook, 0.3	64	Bug			E			Vg					
Trout Brook, 0.3	64	Fish			Vg			G					
Trout Brook, 0.7	65	Bug										E	
Trout Brook, 0.7	65	Fish										U	
Trout Brook, 0.8	66	Bug	Vg										

Name	Map ID		2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022
Trout Brook, 0.8	66	Fish	G										

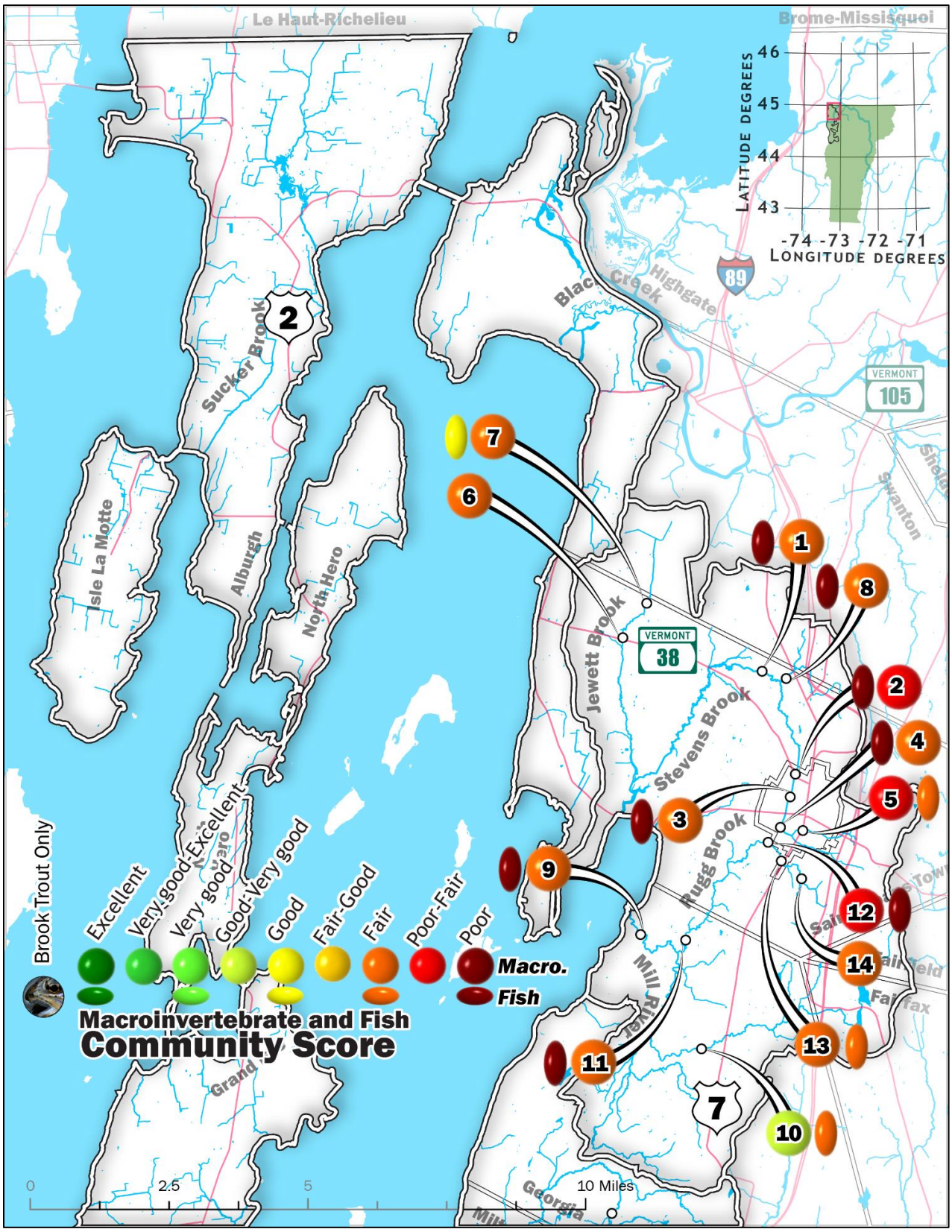

Figure 21 Map of the Macroinvertebrate Community assessment for Basin 5, north section, (see below). Poor scores represent the greatest deviation from reference conditions and Excellent scores represent non-significant deviation from reference conditions. We do not have criteria for assessing Brook Trout Only streams (where brook trout are the only observed taxa). Map IDs correspond with the table below.

Table 16 Macroinvertebrate (bug) and fish community matrix for the watersheds of Basin 5, 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		2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022
Stevens Brook, 4.2	1	Bug	F					F				F	
Stevens Brook, 4.2	1	Fish	P					F				P	
Stevens Brook, 6.5	2	Bug	PF										
Stevens Brook, 6.5	2	Fish	P										
Stevens Brook, 6.8	3	Bug						F					
Stevens Brook, 6.8	3	Fish						P					
Stevens Brook, 7.5	4	Bug	F										
Stevens Brook, 7.5	4	Fish	P										
Stevens Brook, 8.2	5	Bug				G		F				PF	
Stevens Brook, 8.2	5	Fish				F							
Jewett Brook, 3.2	6	Bug						F				U	U
Jewett Brook, 4.1	7	Bug						F					
Jewett Brook, 4.1	7	Fish						G					
Stevens Brook Trib 7, 0.2	8	Bug										F	
Stevens Brook Trib 7, 0.2	8	Fish										P	
Mill River, 0.7	9	Bug						F					
Mill River, 0.7	9	Fish						P					
Mill River, 5.2	10	Bug											GVg
Mill River, 5.2	10	Fish											F
Rugg Brook, 0.5	11	Bug		FG								F	
Rugg Brook, 0.5	11	Fish		F								P	
Rugg Brook, 4.3	12	Bug	F									PF	
Rugg Brook, 4.3	12	Fish	F									P	
Rugg Brook, 4.8	13	Bug				F							
Rugg Brook, 4.8	13	Fish				F							

Rugg Brook, 5.3	14	Bug	G	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 5.

Impaired rivers

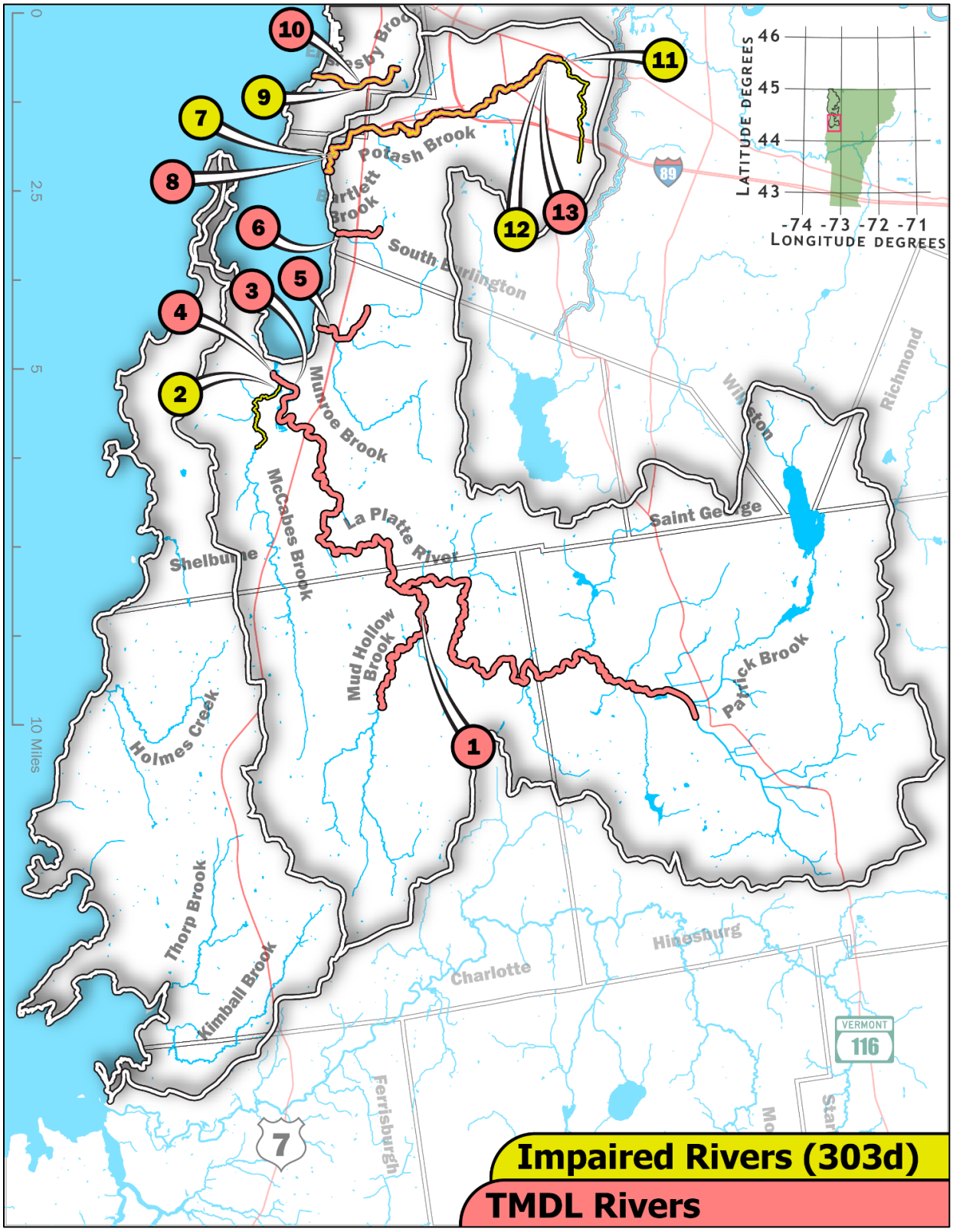

Figure 22. Map of impaired rivers in Basin 05. Yellow represents rivers that are on the 2022 303(d) list (Part A-Priority Waters List). Salmon represents rivers that have an approved TMDL but remain impaired (Part D-Priority Waters List). Use the stream name and the first seven characters of the Assessment Unit ID to find monitoring data from the reach in this report viewer.

Table 17 Table of impaired rivers in Basin 5. 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	Mud Hollow Brook, from Mouth to 3 Miles Upstream	VT05-11.05	ESCHERICHIA COLI (E. COLI)	Agricultural runoff, streambank erosion	CR	D
2	McCabe's Brook, Mouth to rm 1.4	VT05-11.06	NUTRIENTS	Includes above and below WWTF; possible toxic impact below WWTF; unstable channel above	ALS	A
3	Laplatte River from Hinesburg to rm 0.2	VT05-11.08	ESCHERICHIA COLI (E. COLI)	Agricultural runoff	CR	D
4	Laplatte River, at Mouth	VT05-11.04	MERCURY IN FISH TISSUE, ESCHERICHIA COLI (E. COLI)	Agricultural runoff	FC, CR	D
5	Munroe Brook, Mouth to rm 2.8 (Including North Trib.)	VT05-11.01	POLLUTANTS IN URBAN STORMWATER	Stormwater runoff, erosion, land development	ALS	D
6	Bartlett Brook, Mouth to rm 0.7	VT05-11.02	POLLUTANTS IN URBAN STORMWATER	Stormwater runoff, land development, erosion	ALS	D

7	Potash Brook, Mouth Upstream 1 Mile	VT05-11.03	CHLORIDE	Elevated chloride levels due to road salt	ALS	A
8	Potash Brook, Mouth Upstream 1 Mile	VT05-11.03	POLLUTANTS IN URBAN STORMWATER, ESCHERICHIA COLI (E. COLI)	Stormwater runoff, land development, erosion	ALS, CR	D
9	Englesby Brook, Mouth to rm 1.3	VT05-10.01	CHLORIDE	Elevated chloride levels due to road salt	ALS	A
10	Englesby Brook, Mouth to rm 1.3	VT05-10.01	POLLUTANTS IN URBAN STORMWATER, ESCHERICHIA COLI (E. COLI)	Stormwater runoff, Blanchard beach closure	ALS, RB, CR, AES	D
11	Upper Potash Brook, Kennedy Drive to Above Route 89	VT05-11.12	CHLORIDE	Elevated chloride levels due to road salt	ALS	A
12	Potash Brook, I189 River Upstream 4.2 Miles	VT05-11.07	CHLORIDE	Elevated chloride levels due to road salt	ALS	A
13	Potash Brook, I189 River Upstream 4.2 Miles	VT05-11.07	POLLUTANTS IN URBAN STORMWATER	Stormwater runoff, land development, erosion	ALS	D

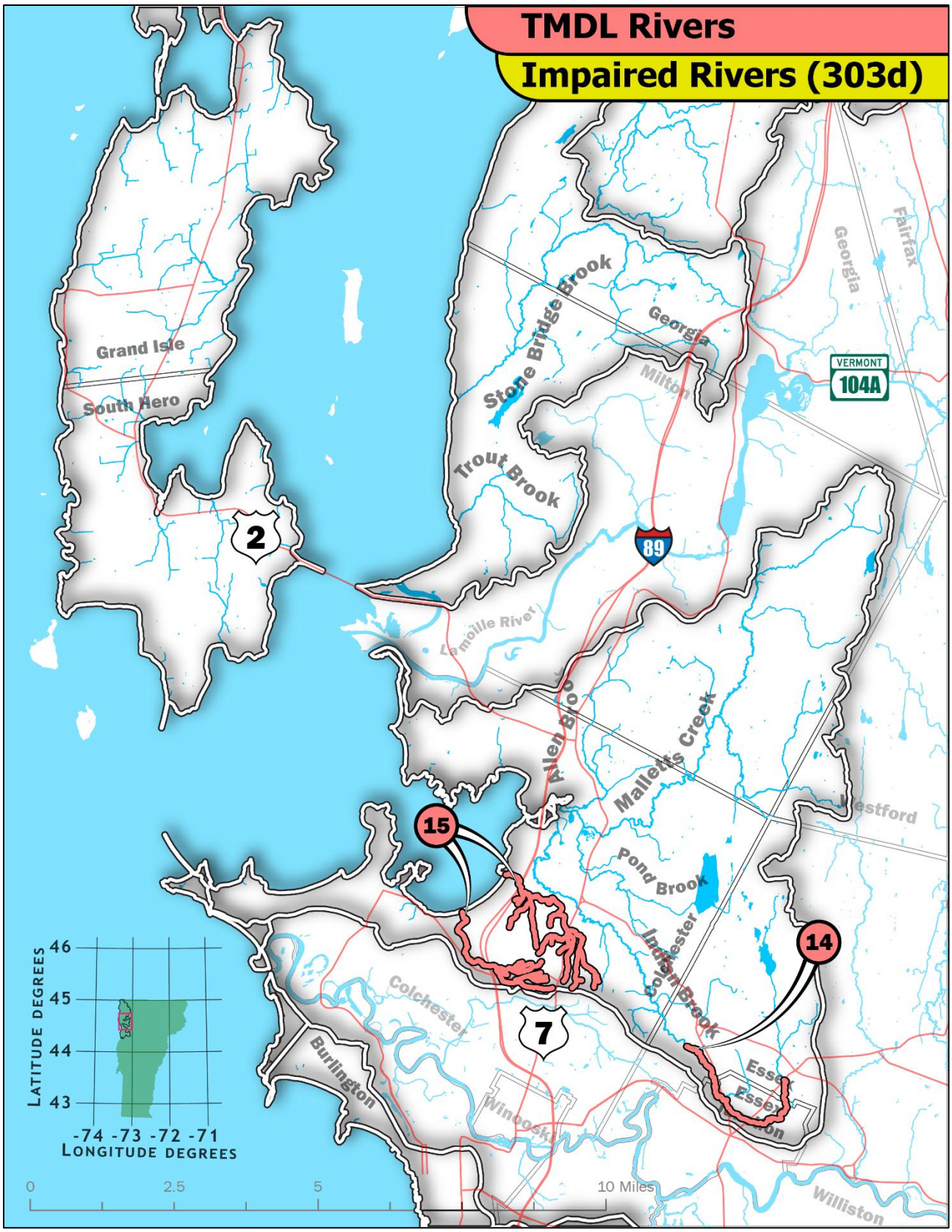

Figure 23 Map of impaired rivers in Basin 05 (middle section). Yellow represents rivers that are on the 2022 303(d) list (Part A-Priority Waters List). Salmon represents rivers that have an approved TMDL (Part D-Priority Waters List) but remain impaired. Use the stream name and the first seven characters of the Assessment Unit ID to find monitoring data from the reach in this report viewer.

Table 18 Table of impaired rivers in Basin 5 (middle section). 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 waters 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
14	Indian Brook, rm 5.8 (Suzie Wilson Rd) to rm 9.8	VT05-09.01	POLLUTANTS IN URBAN STORMWATER	Stormwater runoff, land development, erosion	ALS, AES	D
15	Direct Smaller Drainages to Inner Malletts Bay	VT05-09.02	ESCHERICHIA COLI (E. COLI)	Urban runoff, potential failed/failing septic systems; includes Smith Hollow Brook & Crooked Creek	CR	D

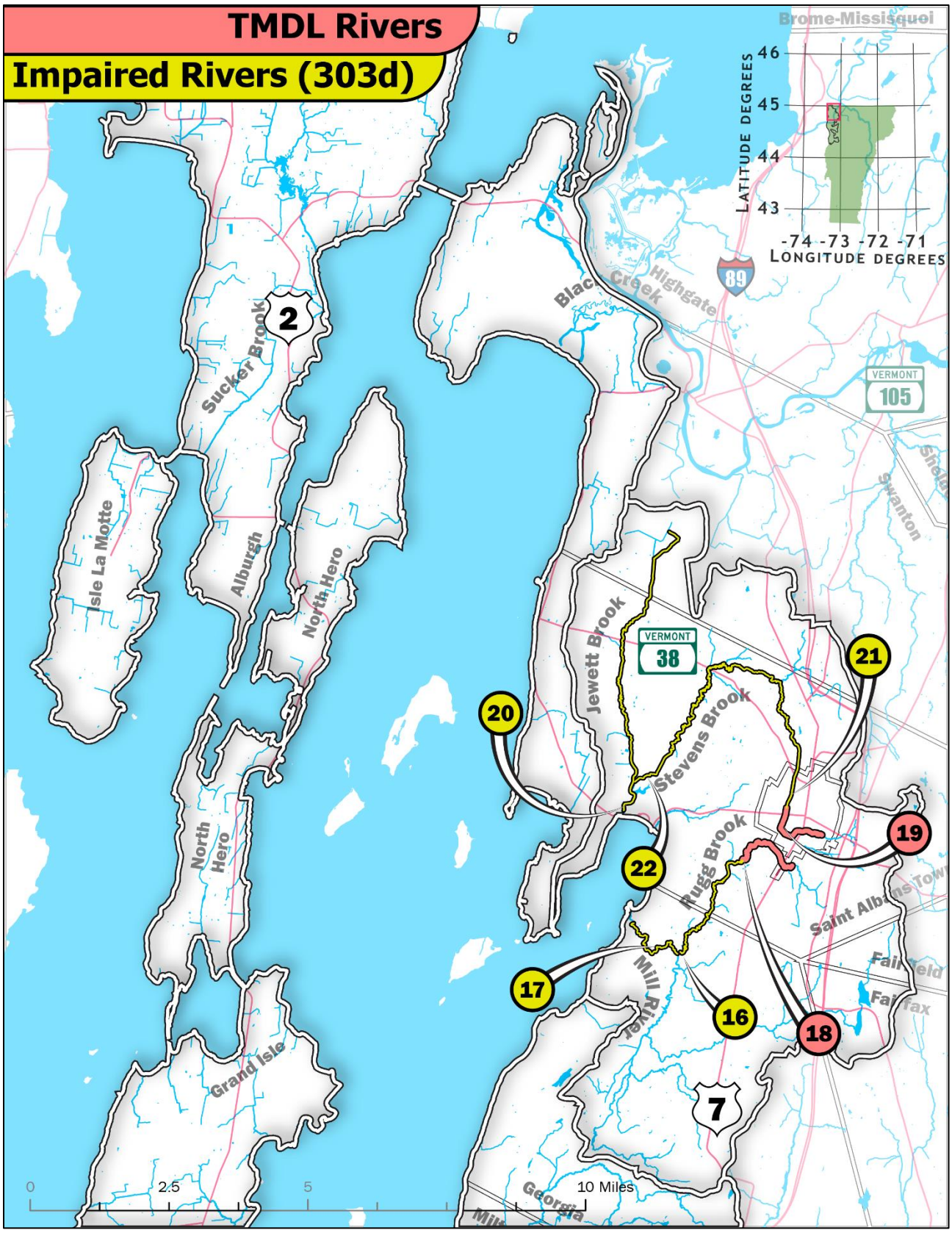

Figure 24 Map of impaired rivers in Basin 05 (north section). Yellow represents rivers that are on the 2022 303(d) list (Part A-Priority Waters List). Salmon represents rivers that have an approved TMDL (Part D-Priority Waters List) but remain impaired. Use the stream name and the first seven characters of the Assessment Unit ID to find monitoring data from the reach in this report viewer.

Table 19 Table of impaired rivers in Basin 5 (north section). 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 waters 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
16	Rugg Brook, from Mouth to Approx 3.1 Miles Upstream	VT05-07.01	NUTRIENTS, SEDIMENTATION/SILTATION, ESCHERICHIA COLI (E. COLI)	Agricultural runoff	ALS, CR, AES	A
17	Mill River, from St. Albans Bay to 1.8 Miles Upstream	VT05-07.04	SEDIMENTATION/SILTATION, NUTRIENTS	Agricultural runoff, streambank erosion	ALS	A
18	Rugg Brook, rm 3.1 to rm 5.3	VT05-07.02	POLLUTANTS IN URBAN STORMWATER	Stormwater runoff	ALS, AES	D
19	Stevens Brook, rm 6.5 (Pearl St) to rm 9.3	VT05-07.07	POLLUTANTS IN URBAN STORMWATER	Stormwater runoff, erosion/sedimentation, morphological instability	ALS	D
20	Jewett Brook (3.5 Miles)	VT05-07.03	SEDIMENTATION/SILTATION, NUTRIENTS	Agricultural runoff	ALS	A
21	Stevens Brook, Lasalle St Downstream 0.5 Miles	VT05-07.06	METALS	Sediment contamination from St Albans Gas and Light hazardous waste site	ALS, CR	A
22	Stevens Brook, Mouth Upstream 6.5 Miles	VT05-07.05	SEDIMENTATION/SILTATION, NUTRIENTS, ESCHERICHIA COLI (E. COLI)	Agricultural runoff; morphological instability; St Albans CSO	ALS, CR	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.

There are no altered rivers in Basin 5.

Trending rivers

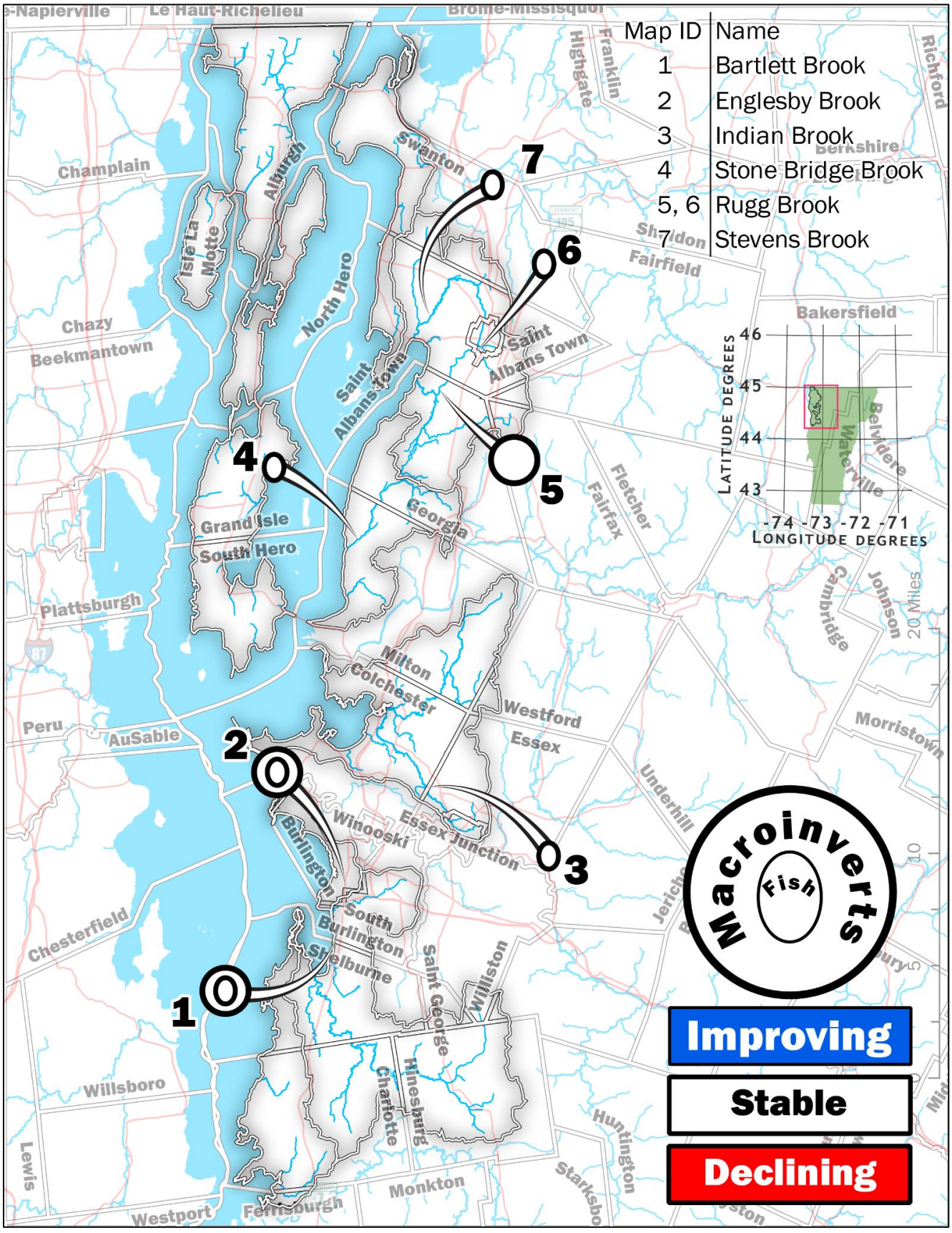

Figure 25 Map of rivers with enough biological data to model a water quality trend.

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 20 Trends in biological condition of macroinvertebrate (bug) and fish communities in Basin 5. + 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)

Name, river mile	Map ID	Trend	Community	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2003	2004	2005	2006	2008	2009	2011	2012	2014	2016	2018	2020	2021
Bartlett Brook, 0.2	1	=	B	0	0	0	P	0	0	0	0	0	0	0	0	P	P	P	0	0	0	P	0	0	0	P	0	0
Bartlett Brook, 0.2	1	=	F	0	0	0	G	U	U	0	Vg	0	0	0	F	P	G	0	0	G	0	0	G	0	0	0	0	Vg
Englesby Brook, 0.6	2	=	B	0	0	0	0	P	P	P	P	0	0	0	0	0	0	0	P	0	P	0	P	0	0	0	U	P
Englesby Brook, 0.6	2	=	F	0	0	0	0	P	0	0	0	P	0	0	0	0	0	0	P	0	0	0	P	0	0	0	0	P
Indian Brook, 5.8	3	=	F	0	0	F	G	F	0	0	0	0	G	0	0	F	0	0	0	F	0	F	0	0	0	0	0	F
Rugg Brook, 0.5	6	=	B	0	0	0	0	0	0	0	0	0	F	0	0	0	F	0	0	0	0	0	0	0	0	0	0	F
Rugg Brook, 4.3	6	=	F	0	0	0	0	0	0	0	0	0	P	P	0	0	P	0	0	0	P	F	0	0	0	0	0	P
Stevens Brook, 4.2	7	+	F	P	P	P	0	0	0	0	0	0	U	0	0	0	0	0	0	0	F	P	0	0	F	0	0	P
Stevens Brook, 6.5	7	+	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	P	P	0	0	0	0	0	0
Stevens Brook, 6.8	7	+	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	P	0	0	0
Stevens Brook, 7.5	7	+	F	0	0	0	0	0	0	0	0	0	0	0	0	0	P	0	0	0	0	P	0	0	0	0	0	0
Stevens Brook, 8.2	7	+	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F	0	0	0	0
Stone Bridge Brook, 0.2	4	=	F	0	0	0	0	0	0	0	G	0	0	0	0	0	Vg	0	0	0	0	0	0	0	0	0	0	0
Stone Bridge Brook, 0.3	4	=	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Vg

Rivers in need of assessment

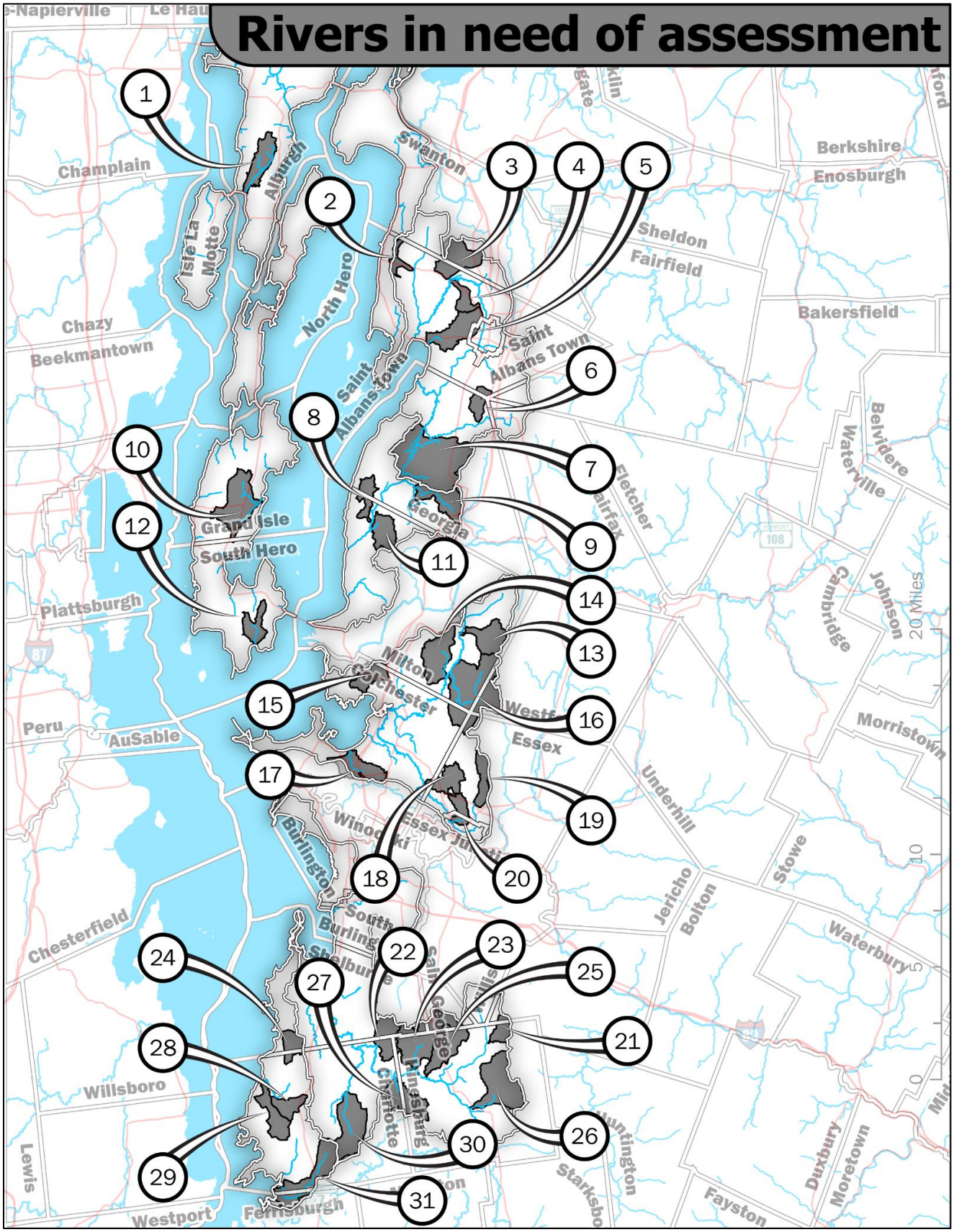

Figure 26 Map of rivers with unassessed aquatic biota use in Basin 5.

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 32 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 2022 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.

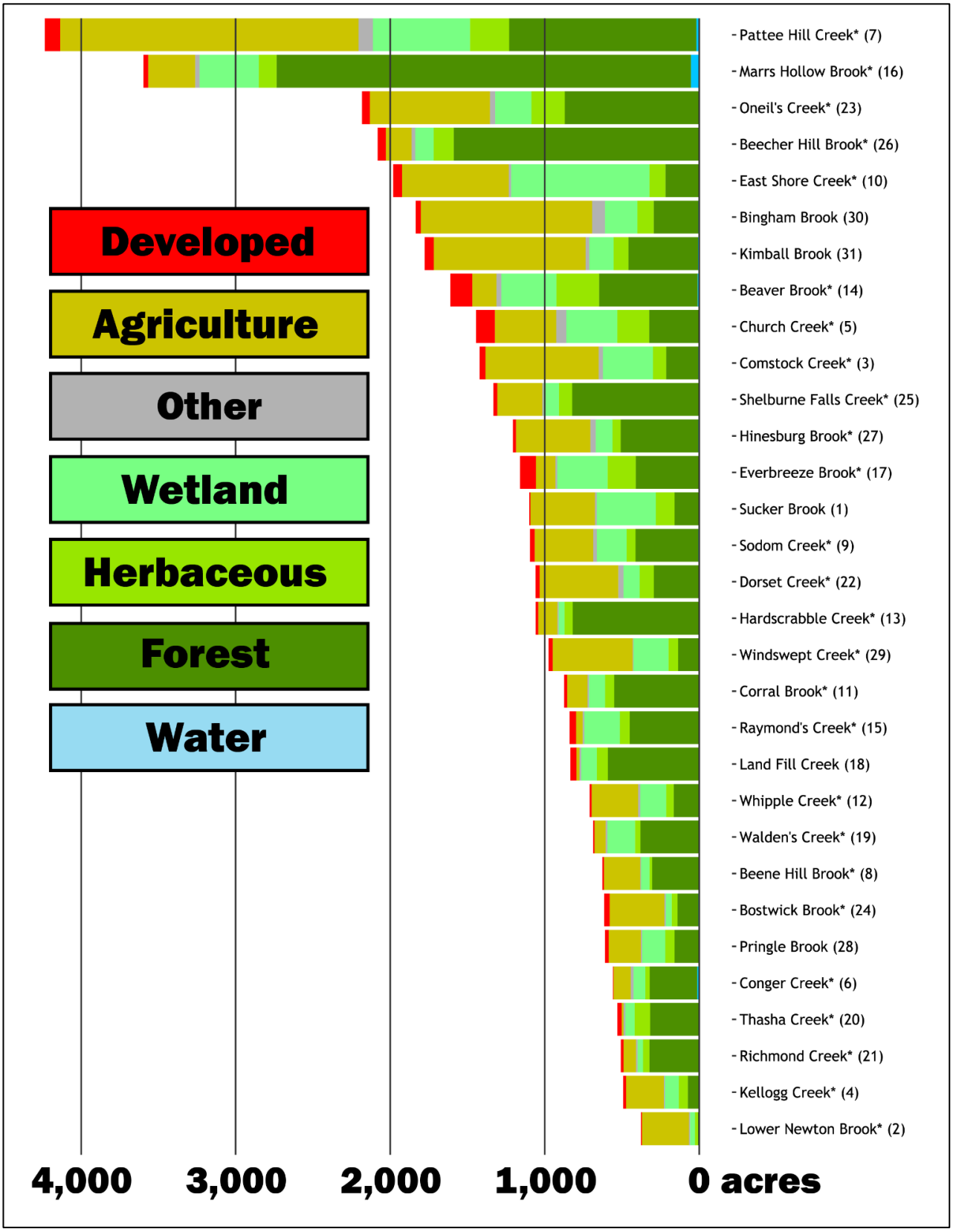

Figure 27 Land cover of unassessed waters ranked by watershed size. (#)'s associated with the stream name correspond to the map above. Asterisks are officially unnamed streams in the National Hydrography Dataset. Landcover is based on the Vermont High Resolution Land Cover dataset produced by the University of Vermont Spatial Analysis Laboratory.

Table 21. 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	Developed	Agriculture	Forest	Wetland	Other	Water
Beaver Brook (14)*	44.595	-73.121	8.75	9.80	39.69	22.09	17.14	1.92
Beecher Hill Brook (26)*	44.317	-73.092	2.52	8.04	76.34	5.69	6.23	1.14
Beene Hill Brook (8)*	44.696	-73.192	1.55	37.67	48.49	8.66	2.78	0.83
Bingham Brook (30)	44.324	-73.206	1.80	60.42	15.81	11.42	5.75	4.52
Bostwick Brook (24)*	44.364	-73.263	5.69	57.78	22.10	6.22	6.05	1.35
Church Creek (5)*	44.810	-73.134	8.40	27.52	22.31	22.87	14.30	4.49
Comstock Creek (3)*	44.850	-73.119	2.70	51.54	14.75	22.77	5.99	1.92
Conger Creek (6)*	44.765	-73.089	0.61	20.05	55.01	13.61	5.26	3.15
Corral Brook (11)*	44.689	-73.185	2.09	15.14	62.64	11.81	6.73	1.20
Dorset Creek (22)*	44.356	-73.179	2.42	48.19	27.48	9.80	8.58	3.16
East Shore Creek (10)*	44.704	-73.289	2.86	34.91	10.95	45.16	5.23	0.79
Everbreeze Brook (17)*	44.543	-73.206	8.85	10.96	35.33	27.99	15.72	1.04
Hardscrabble Creek (13)*	44.623	-73.096	1.58	11.84	77.39	3.55	4.93	0.67
Hinesburg Brook (27)*	44.335	-73.163	1.61	40.00	41.73	8.98	4.38	2.87
Kellogg Creek (4)*	44.847	-73.118	3.73	49.68	15.01	18.23	11.62	1.57
Kimball Brook (31)	44.264	-73.262	3.33	55.28	25.40	8.90	5.36	1.33
Land Fill Creek (18)	44.526	-73.134	4.52	2.53	70.75	12.08	8.54	1.37
Lower Newton Brook (2)*	44.856	-73.155	1.67	80.85	2.42	8.12	4.97	1.99
Marrs Hollow Brook (16)*	44.595	-73.115	0.83	8.47	74.60	10.66	3.18	0.79
Oneil's Creek (23)*	44.344	-73.144	2.28	35.69	39.71	10.76	9.91	1.50
Pattee Hill Creek (7)*	44.753	-73.143	2.31	45.62	28.64	14.83	5.97	2.21
Pringle Brook (28)	44.319	-73.270	3.88	34.26	25.68	24.44	9.79	1.44
Raymond's Creek (15)*	44.587	-73.193	4.89	5.23	53.34	27.38	7.51	1.27
Richmond Creek (21)*	44.365	-73.072	3.40	16.06	63.45	6.86	8.18	1.99
Shelburne Falls Creek (25)*	44.342	-73.128	1.87	21.86	61.63	7.36	6.42	0.76
Sodom Creek (9)*	44.715	-73.147	2.69	34.67	37.20	17.51	5.26	2.22
Sucker Brook (1)	44.904	-73.304	0.63	38.08	14.38	34.74	10.94	1.10
Thasha Creek (20)*	44.501	-73.110	5.03	2.56	60.03	11.39	18.80	2.13
Walden's Creek (19)*	44.519	-73.087	1.26	10.67	55.05	25.92	5.18	1.56
Whipple Creek (12)*	44.614	-73.291	1.76	42.49	23.14	23.46	6.84	2.10
Windswept Creek (29)*	44.328	-73.278	2.77	53.10	13.66	23.30	6.42	0.43

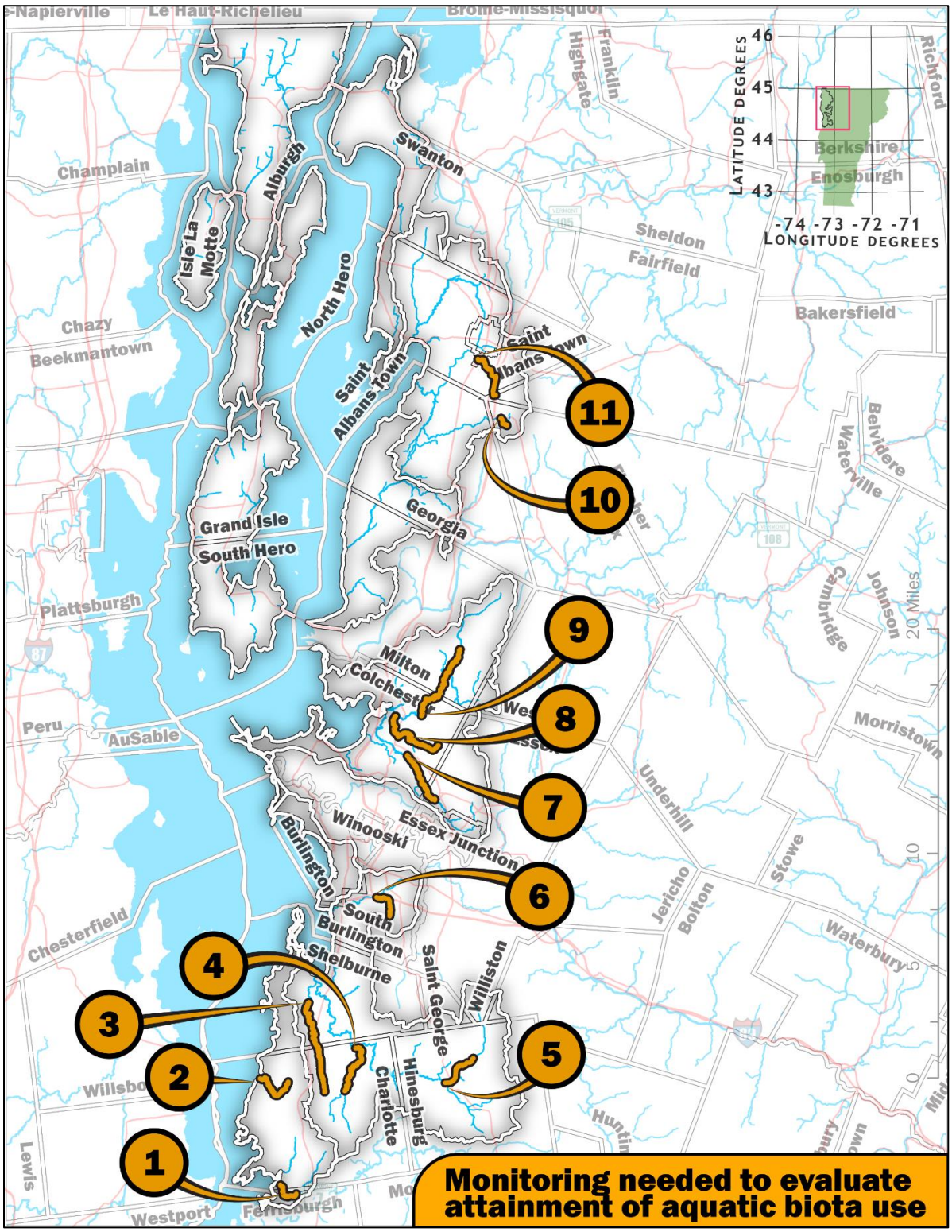

Figure 28 Map of rivers that require more monitoring to evaluate attainment of Aquatic Biota use. Unlike the streams mentioned above with no biological monitoring data, the streams here have limited biomonitoring data that indicates fair or poor condition, however, there is either not enough data to fully evaluate the attainment of Aquatic Biota use or monitoring results show volatile condition year to year.

Table 22 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	Kimball Brook, from Town Farm Bay Up 1.1 Miles	NUTRIENTS, TURBIDITY	Pasture, barnyard, lack of riparian vegetation
2	Holmes Creek, mouth upstream to Greenbush Road	PHOSPHORUS, SEDIMENT	Agricultural runoff
3	McCabes Brook, rm 1.4 upstream	NUTRIENTS, CHLORIDE, POTENTIAL LOW FLOW	Agricultural runoff, road salt
4	Mud Hollow Brook, Mouth upstream 2.5 miles	NUTRIENTS, TEMPERATURE	Agricultural runoff, lack of riparian cover, elevated turbidity and aluminum
5	Patrick Brook, from Laplatte River Up to Lower Pond	SEDIMENT, HABITAT ALTERATIONS	Land development, channelization
6	Potash Brook Trib 7	CHLORIDE	Elevated chloride levels due to road salt
7	Indian Brook, Mouth to rm 5.4	SEDIMENT, METALS, TOXICITY	potential impacts from landfill leachate, developed areas, hazardous waste site
8	Pond Brook	NUTRIENTS, CHLORIDE, TURBIDITY	Agricultural runoff, road salt
9	Malletts Creek, Middle Road upstream to Duffy Road (4 miles)	Unknown	Requires low gradient sampling
10	Mill River, 3.5 Miles in Upper Reaches	NUTRIENTS, ORGANIC ENRICHMENT, SEDIMENT, ESCHERICHIA COLI (E. COLI)	Agricultural & urban runoff, streambank erosion
11	Rugg Brook, Upstream from Route 7	HABITAT ALTERATIONS, FLOW REGIME MODIFICATION	Land development, suburban runoff

River reclassification candidates (Aquatic biota)

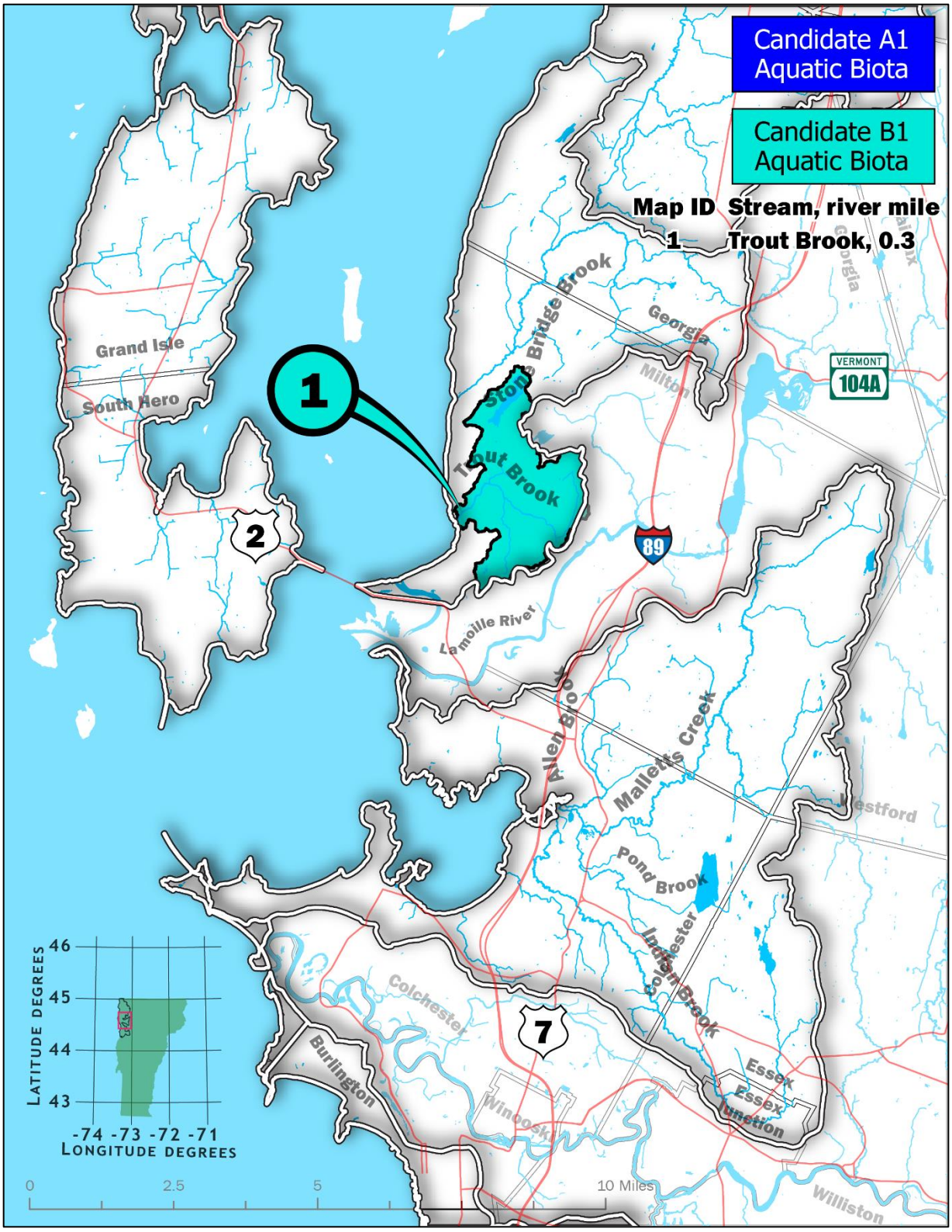

Figure 29 Map of A(1) and B(1) reclassification candidates. Map IDs correspond to the table below.

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 23 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		2011	2012	2013	2014	2015	2016	2017	2018	2020	2021	2022
Trout Brook, 0.3	64	Fish			Vg			G					
Trout Brook, 0.7	65	Bug										E	
Trout Brook, 0.7	65	Fish										U	

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). There have been 19 level 3 plots conducted in basin 5.

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 with significant functions present. 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.

Additionally, the Program is currently unable to report on basin-wide wetland conditions and trends, impairments, or altered wetlands. The following information provides an overview of the various monitoring, assessment, and mapping objectives the Program is focused on.

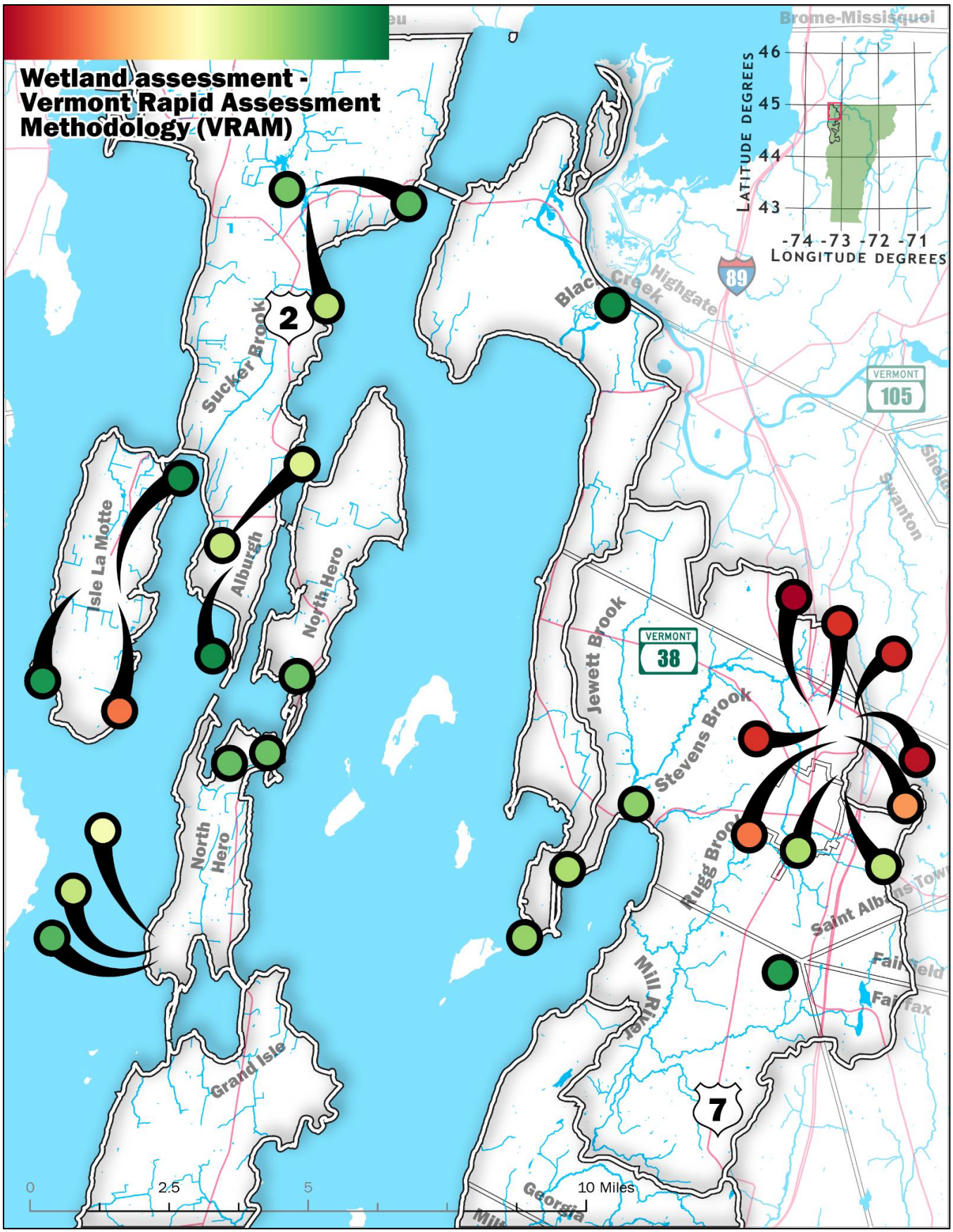

Figure 30. VRAM scores Basin 5 (North). The red to green symbology illustrates the relative wetland condition amongst VRAMs.

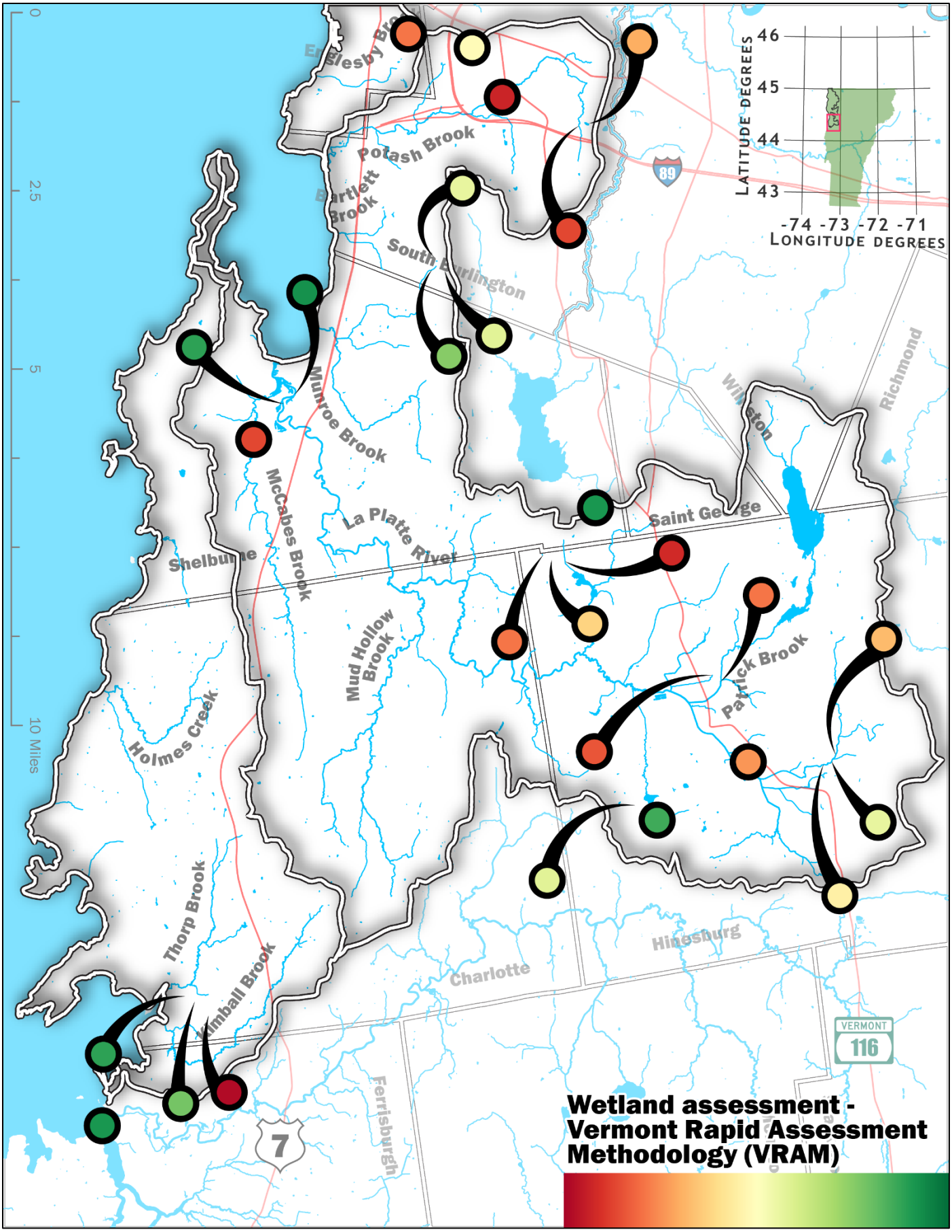

Figure 31 VRAM scores Basin 5 (South). The red to green symbology illustrates the relative wetland condition amongst VRAMs.

Table 24 Number of VRAMs conducted in Basin 5, summarized by HUC12 sub-basins. Sub basin size in acres included for reference.

Name	*Sub basin acres*	*VRAM Count*
Alburg Drainage	24050	10
Burlington Direct Land Drainage	3537.9	1
Grand Isle Land Drainage	19572.5	13
Lower Northeast Arm Direct	15688.9	2
Malletts Bay Drainage	33463.9	25
North Hero Land Drainage	7850.6	6
Shelburne Bay Direct Drainage	44900.7	24
Southern Main Lake Direct	14537.8	5
St. Albans Bay Drainage	32488.1	12
Upper Northeast Arm Direct	12961.8	4

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).

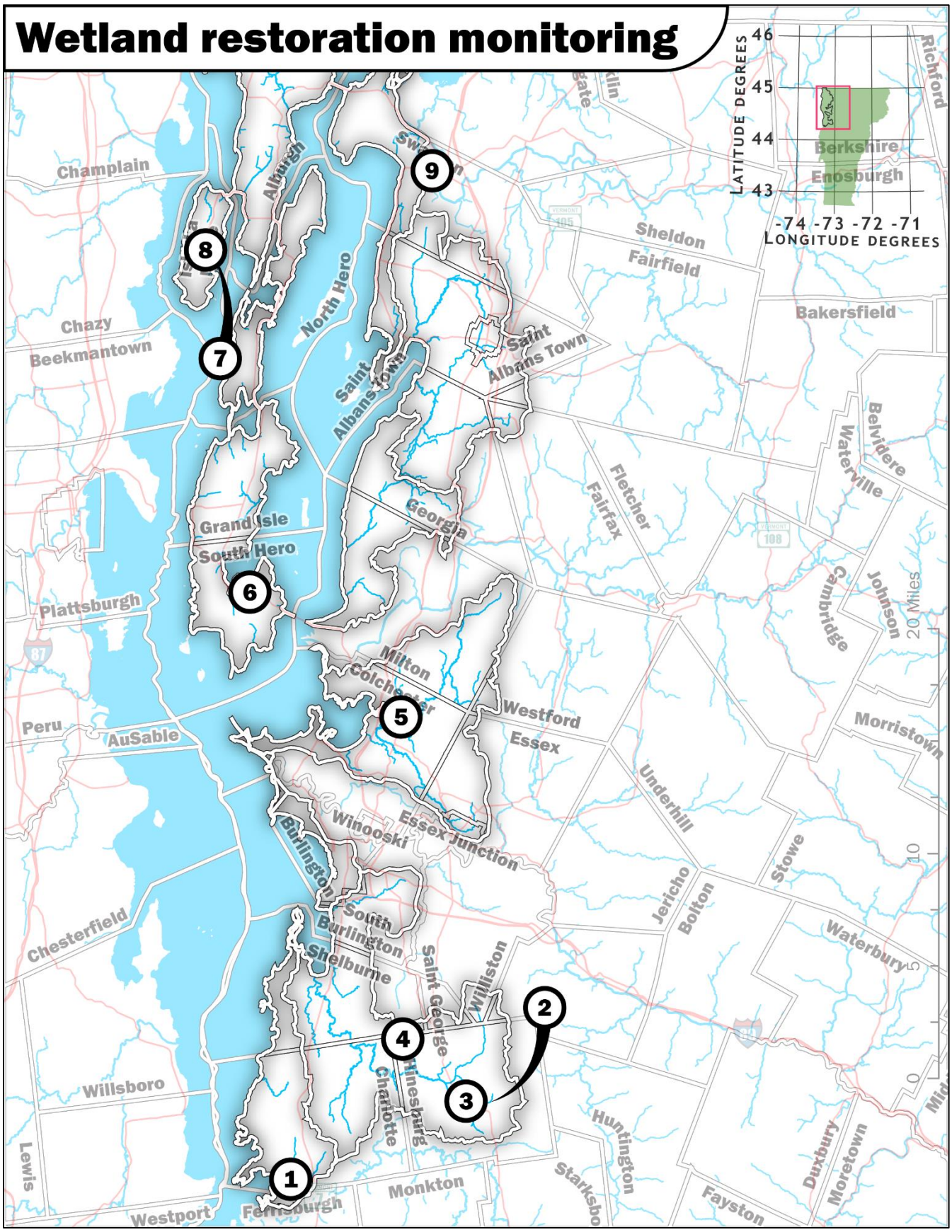

Figure 32 Distribution of wetland restoration sites in Basin 5.

Table 25 Wetland restoration monitoring sites in Basin 5.

MAP ID	LATITUDE	LONGITUDE	NAME
1	44.269	-73.254	Williams Woods Farm Field
2	44.320	-73.076	Hinesburg Garage Cattail Marsh
3	44.320	-73.097	Hinesburg Restoration Site N
4	44.360	-73.155	Lomas Scirpus Marsh
5	44.567	-73.159	MUFL01 (Munson Flats)
6	44.647	-73.296	2016-283 Swale
7	44.865	-73.335	Potvin Restoration Site
8	44.867	-73.339	Isle La Motte Marsh East
9	44.919	-73.134	Middle Road Swanton Restoration Site

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 are three class 1 wetlands in Basin 5: the LaPlatte River Marsh Complex, North Shore Wetland, and the Sandbar Wetland Complex.

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

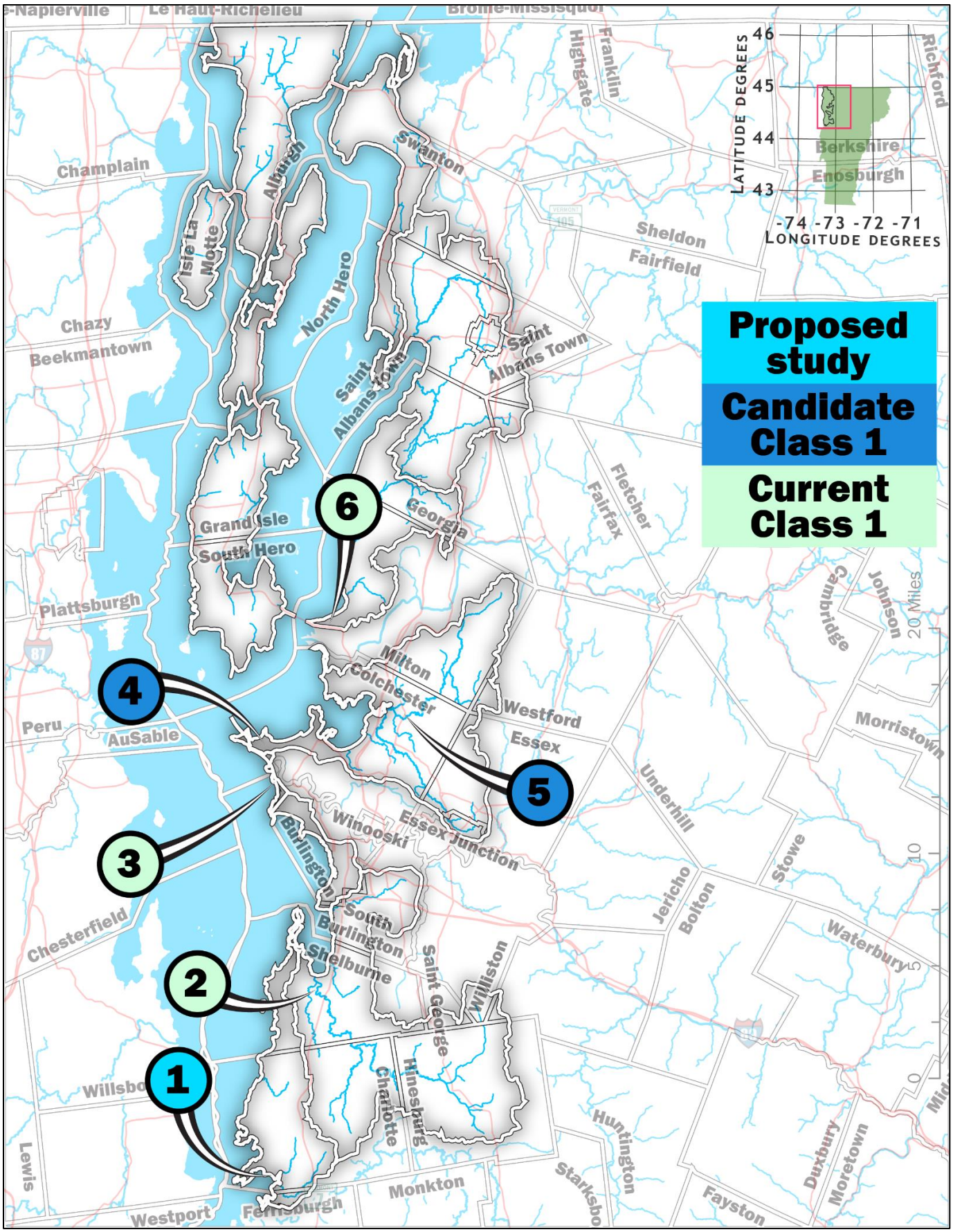

Figure 33 Class 1 wetland candidates.

Table 26 Class 1 wetland candidates.

Map ID	Latitude	Longitude	Wetland name	Category	Towns
1	44.272	-73.266	Thorp Brook	Proposed for Study	Charlotte
2	44.392	-73.235	LaPlatte River Marsh Complex	Current Class 1	Shelburne
3	44.524	-73.271	North Shore Wetland	Current Class 1	Burlington, South Burlington
4	44.549	-73.287	Colchester Bog	Candidate Class 1	Colchester
5	44.571	-73.158	Munson Flats	Candidate Class 1	Milton
6	44.621	-73.230	Sandbar Wetland Complex	Current Class 1	Milton, Colchester

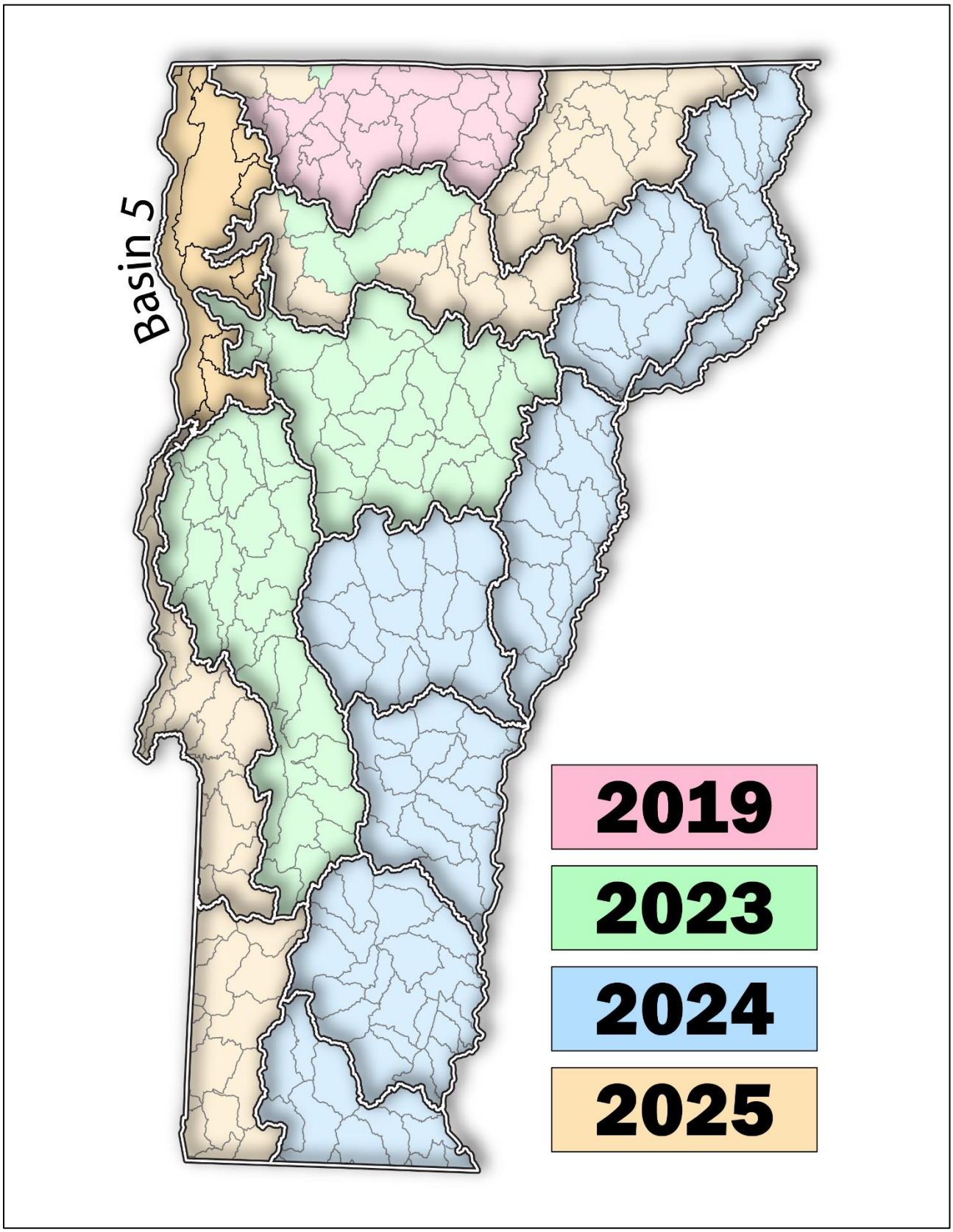

Figure 34. Wetland mapping schedule for Vermont Tactical Basins. Mapping is scheduled for 2024 in Basin 5.

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. This process has already started with updated mapping currently being added to VSWI for the Missisquoi basin.