BASIN 12 ASSESSMENT REPORT

DEERFIELD RIVER & CONNECTICUT DIRECT

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION

JUNE 2023

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Basin overview

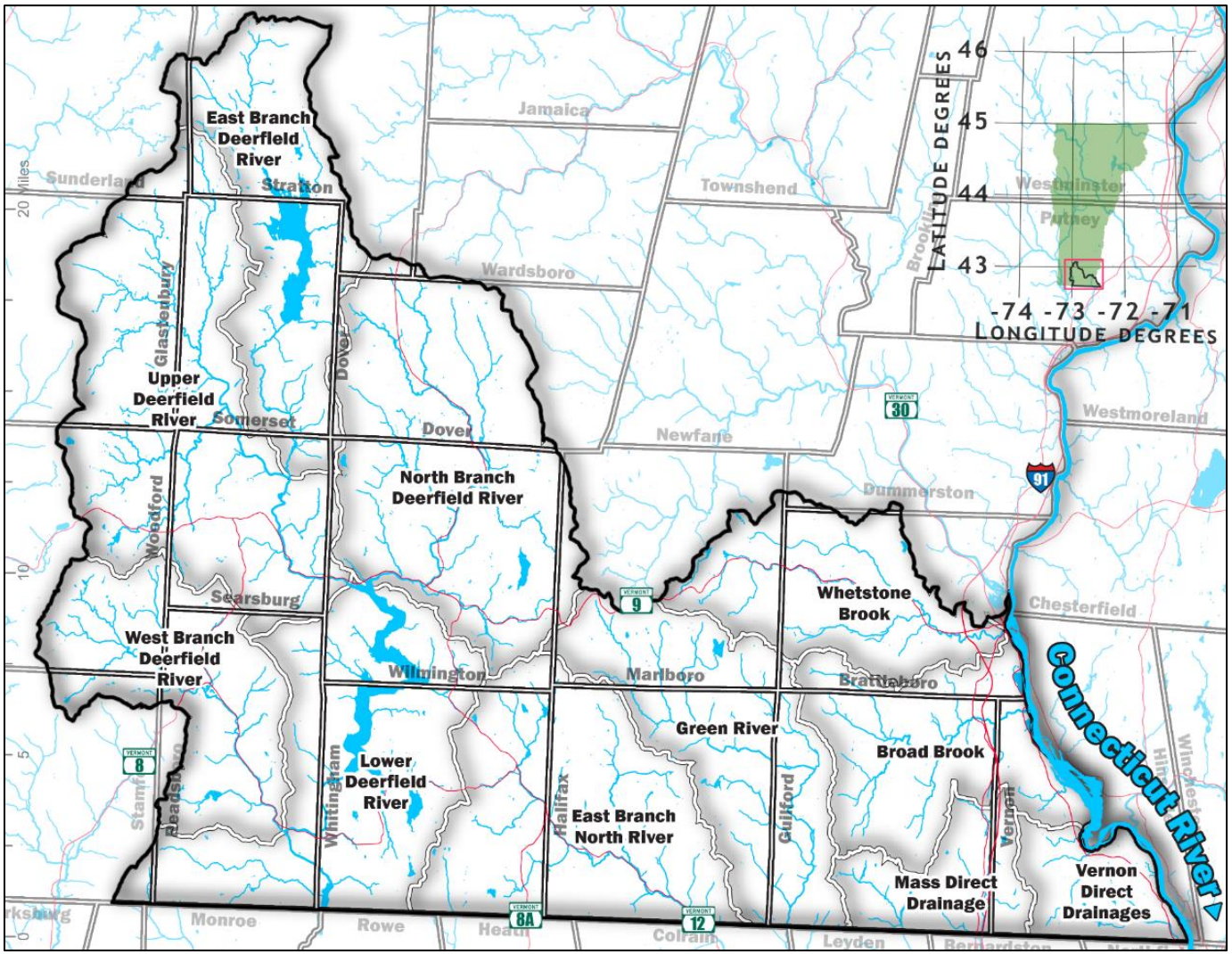

Figure 1 The 400 square mile Deerfield River-Connecticut River Direct basin encompasses waters of southern Windham County and southeastern Bennington County draining to the Connecticut River.

Table 1 Distribution of Strahler stream orders by miles across Basin 12. This data is from the High-Resolution National Hydrography Dataset Plus (NHDPlus).

Stream order (miles)						
1	2	3	4	5	6	8
526	219	131	59	22	13	13

Table 2 Distribution of lake surface area (acres) across Basin 12. Data from the High-Resolution National Hydrography Dataset Plus (NHDPlus).

Lake area (acres)			
<10	*>10<100*	*>100<500*	*>500*
23	15	12	6

Table 3 Distribution of wetland area (acres) across Basin 12. Data from the Vermont State Wetland Inventory (VSWI). Contiguous wetlands were dissolved to larger features to account for wetlands complexes containing multiple classes.

Wetland sizes (acres)				
<5	*>5<15*	*>15<70*	*>70<150*	*>=150*
3475	908	66	6	4

Table 4 Summation of town level human population over time that intersects with Basin 12.

Basin-wide human population by year				
1980	*1990*	*2000*	*2010*	*2020*
16940	19174	20375	20074	21408

Table 5 . Major waters of Basin 12.

Largest River	Deerfield River (23 miles)
Largest Lake or Reservoir	Harriman Reservoir (1949 acres)
Deepest Lake or Reservoir	Harriman Reservoir (160 feet)
Largest Wetland Complex	Glastenbury Wetlands (428 acres)

Land cover

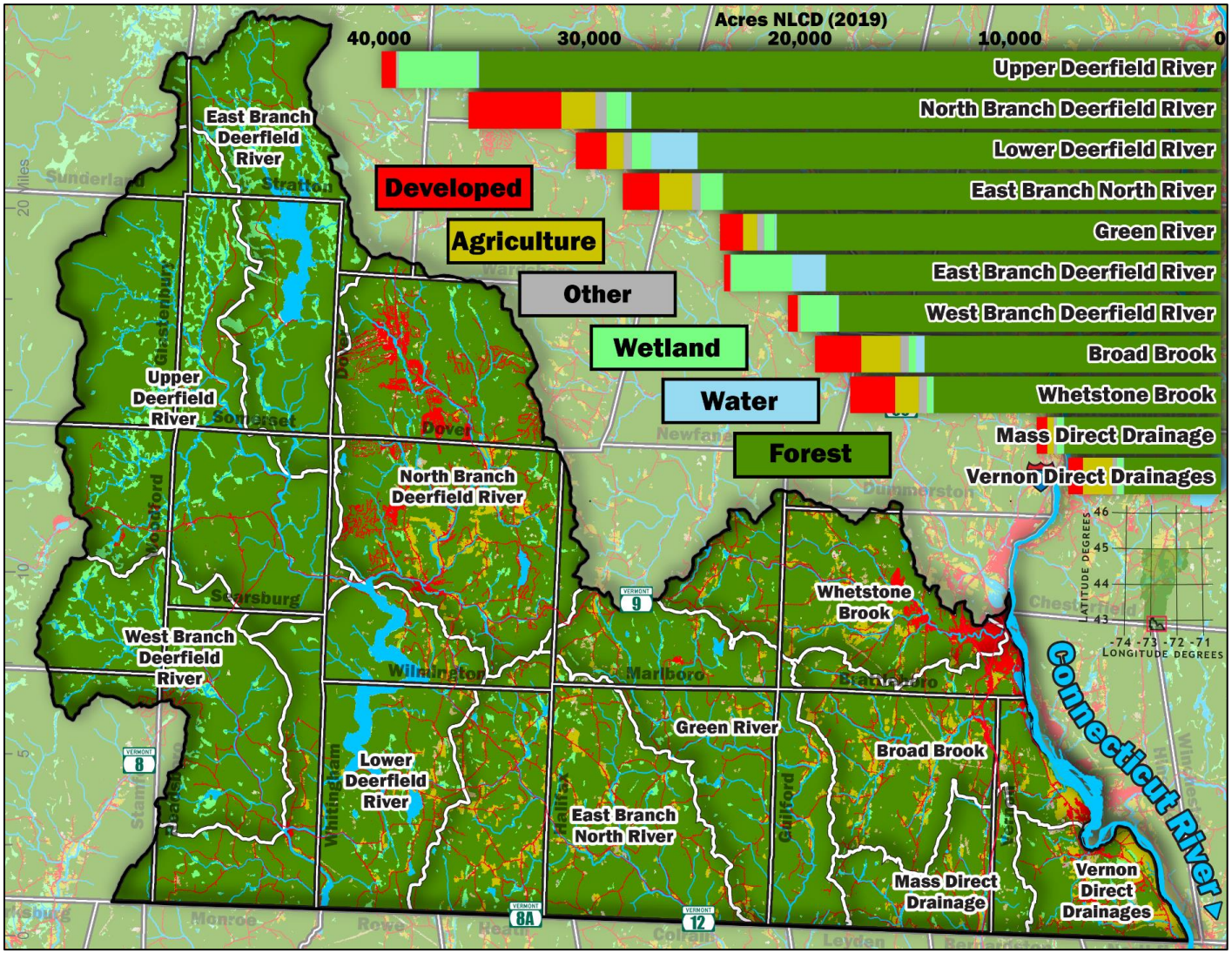

Figure 2. There are two land cover datasets available for the 255,000-acre Basin 12. The first is the 30-meter National Land Cover Database (NLCD) for 2019 (and several previous years) and the second is the 0.5-meter statewide land cover dataset produced by the University of Vermont spatial analysis laboratory. To summarize the large-scale distribution of different land covers across the Vermont WBID subwatersheds of the tactical basin, the 30-meter NLCD for 2019 was used.

Table 6 The proportion of major land cover types across the HUC12s of Basin 12. Land cover is the National Land Cover Database (NLCD) for 2019. Common land cover types were combined, for example deciduous, coniferous, and mixed forests are categorized as forest. Wetlands are found throughout other cover types.

Name	acres	Developed	Agriculture	Other	Wetland	Water	Forest
Vernon Direct Drainages	7261	9.66	19.53	2.92	3.9	0.52	63.48
Massachusetts Direct Drainage	8758	5.77	3.49	1.71	3.52	0.4	85.1
Whetstone Brook	17629	12.13	6.44	2.13	1.64	0.2	77.47
Broad Brook	19296	11.35	9.67	2.06	1.74	2.17	73.01
West Branch Deerfield River	20586	2.22	0.19	0.52	8.31	0.49	88.27
East Branch Deerfield River	23626	1.24	0.02	0.23	12.21	6.78	79.53
Green River	23822	4.6	2.83	1.4	2.08	0.39	88.7
East Branch North River	28444	6.09	5.51	1.43	3.62	0.11	83.25
Lower Deerfield River	30677	4.76	2.64	1.26	2.97	7.23	81.13
North Branch Deerfield River	35785	12.33	4.56	1.48	2.55	0.73	78.35
Upper Deerfield River	39916	1.69	0.07	0.31	9.24	0.28	88.41

Lakes and Ponds

Conditions and trends

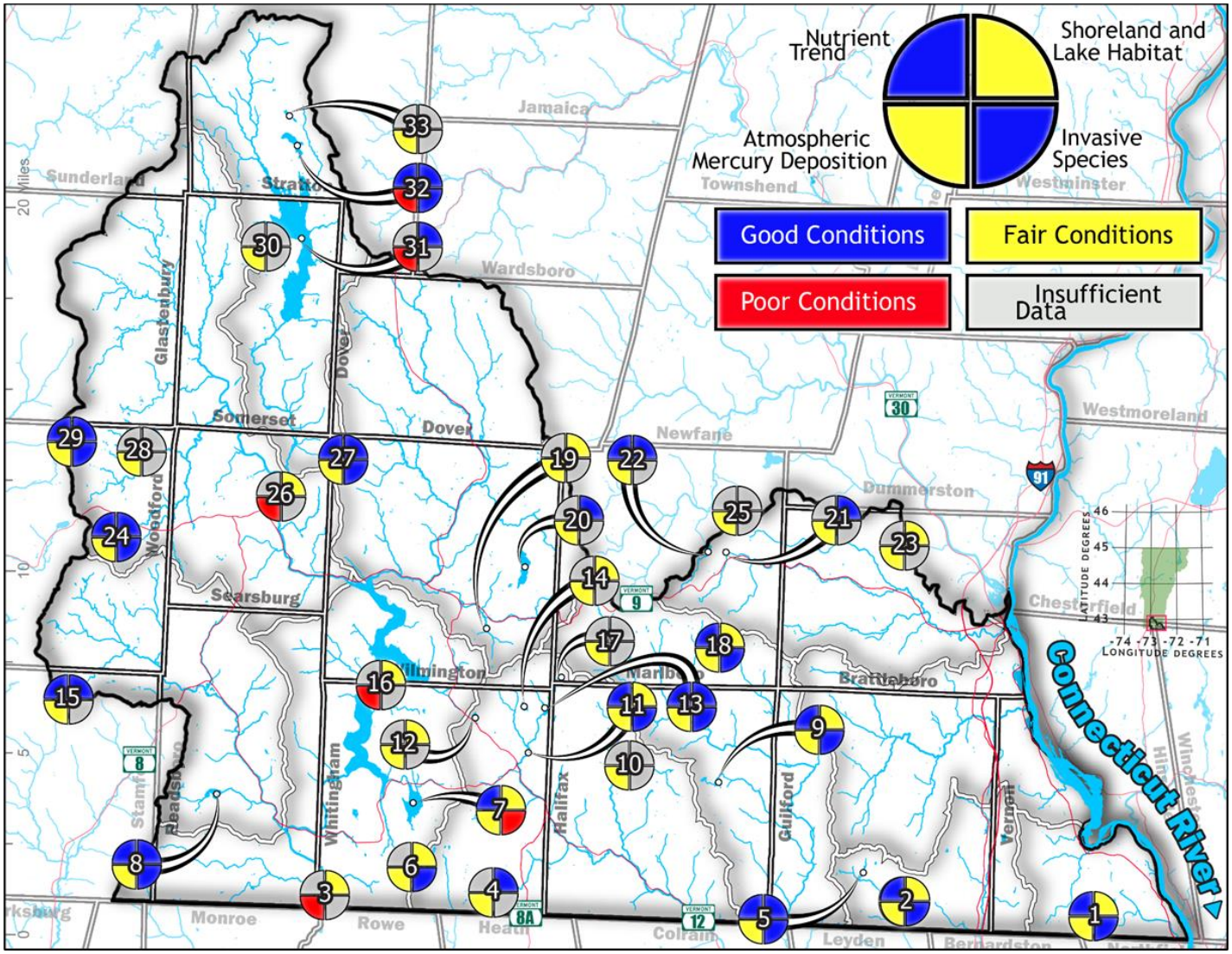

Figure 3. Lake scorecards for Basin 12. Lake IDs and additional information is provided in the table below.

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 this *Lake Score Card* links using the Lake IDs reported below.

VLMPP provides score cards for thirty-five lakes in Basin 12. 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 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 VLPP 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. AIS: Aquatic invasive species score. Mercury: mercury fish tissue contamination. WQ Status: Water quality standards status. 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	LILY (VERNON)	40.3	13	Good	Fair	Good	Fair
2	WEATHERHEAD HOLLOW	30.8	10	Good	Fair	Good	Fair
3	SHERMAN	88.2	57	Insufficient data	Fair	Insufficient data	Poor
4	SHIPPEE	23.9	6	Insufficient data	Good	Insufficient data	Fair
5	SWEET	16.0	11	Good	Good	Good	Fair
6	NORTH (WHITHM)	26.0	10	Insufficient data	Fair	Good	Fair
7	SADAWGA	191.3	10	Good	Fair	Poor	Fair
8	HOWE	53.3	33	Good	Good	Good	Fair
9	DEER PARK	18.7	9	Good	Fair	Good	Fair
10	BLUE;	11.0		Insufficient data	Insufficient data	Insufficient data	Fair
11	JACKSONVILLE	16.3	8	Good	Fair	Good	Fair
12	RYDER	13.8	12	Insufficient data	Fair	Insufficient data	Fair
13	GATES	30.2	7	Good	Good	Good	Fair
14	LAUREL	16.7	17	Insufficient data	Fair	Insufficient data	Fair
15	STAMFORD	10.6	14	Good	Good	Insufficient data	Fair

Map ID	Lake ID	Area (ac)	Max Depth (ft)	Nutrient Trend	Shoreland	AIS	Mercury
16	HARRIMAN (WHITHM)	1949.4	160	Insufficient data	Fair	Insufficient data	Poor
17	GATES-NE;	11.2		Insufficient data	Insufficient data	Insufficient data	Fair
18	SOUTH (MARLBR)	68.5	35	Good	Fair	Good	Fair
19	SPRUCE (WILMTN)	14.0	4	Insufficient data	Fair	Insufficient data	Fair
20	RAPONDA	123.8	12	Good	Fair	Good	Fair
21	MARLBORO-431;	11.4	2	Insufficient data	Good	Insufficient data	Fair
22	HIDDEN	19.6	6	Good	Good	Insufficient data	Fair
23	PLEASANT VALLEY	21.8	38	Insufficient data	Fair	Insufficient data	Fair
24	ADAMS (WOODFD)	33.6	15	Good	Good	Good	Fair
25	HALLADAY;	10.5		Insufficient data	Insufficient data	Insufficient data	Fair
26	SEARSBURG	15.5	14	Insufficient data	Fair	Insufficient data	Poor
27	HAYSTACK	28.1	30	Good	Good	Good	Fair
28	MILL (WOODFD)	10.5	0	Insufficient data	Insufficient data	Insufficient data	Fair
29	LITTLE (WOODFD)	22.0	8	Good	Good	Good	Fair
30	SOMERSET-W;	10.5		Insufficient data	Insufficient data	Insufficient data	Fair
31	SOMERSET	1525.3	85	Insufficient data	Good	Insufficient data	Poor
32	GROUT	86.1	33	Good	Good	Good	Poor

Map ID	Lake ID	Area (ac)	Max Depth (ft)	Nutrient Trend	Shoreland	AIS	Mercury
33	GROUT-N;	16.9		Insufficient data	Insufficient data	Insufficient data	Fair

Lake Reclassification

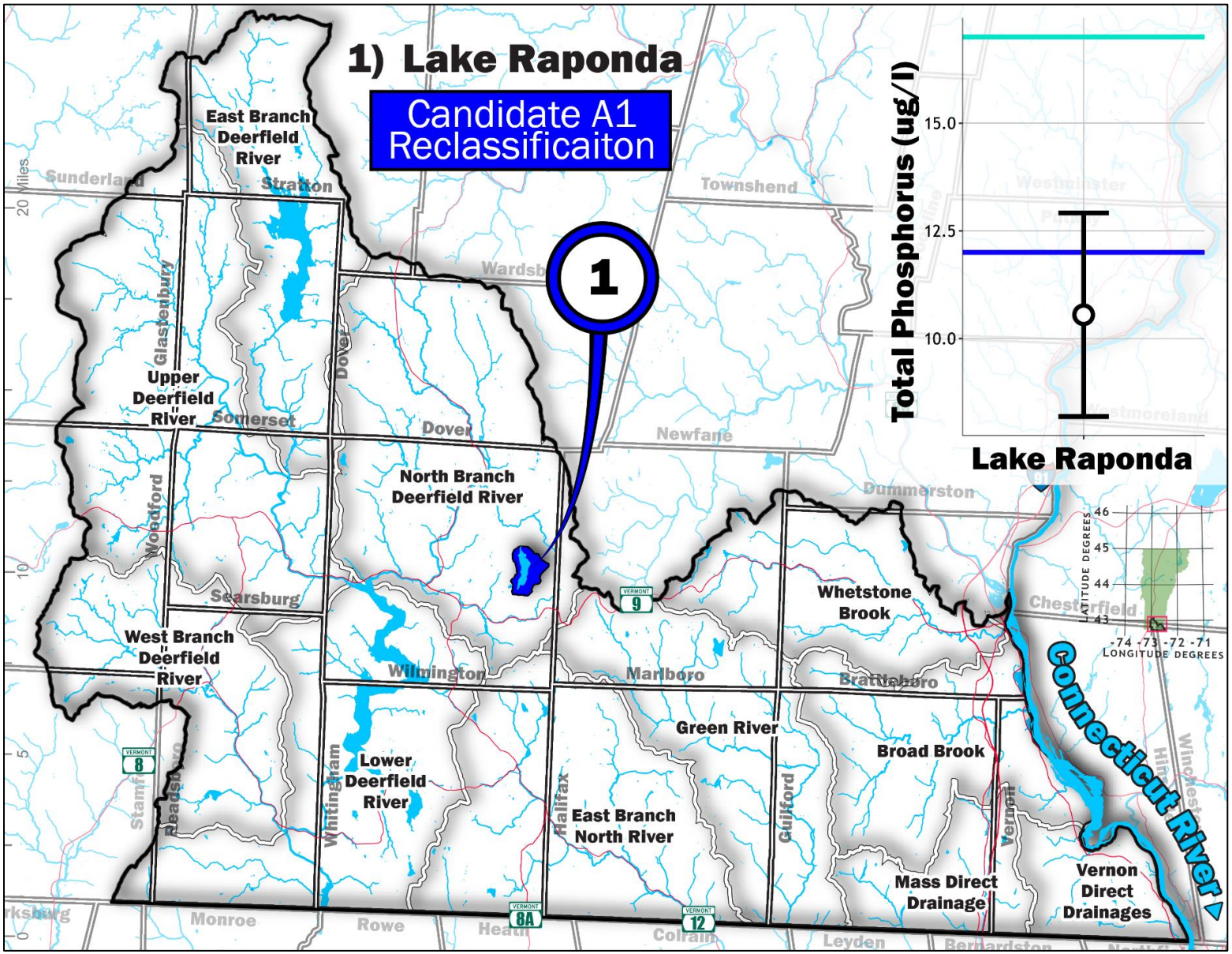

Figure 4 Lake reclassification candidates for Aesthetics and their corresponding watersheds.

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 2022 Vermont 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. Lakes with a mean annual total phosphorus concentration less than the standards for B(1) criteria are presented in Figure 5, although there are currently no lakes eligible for reclassification to A(1) based on available data. To access data for the lakes below, navigate the *report viewer* using the Lake ID.

The Lakes and Ponds Management and Protection Program has prioritized the following site for additional summer monitoring to determine if the water body is eligible for A(1) status :

- A(1): Lake Raponda (this site has a lay monitor collecting water samples for total phosphorus and chlorophyll-a in addition to Secchi depth).

Impaired Lakes

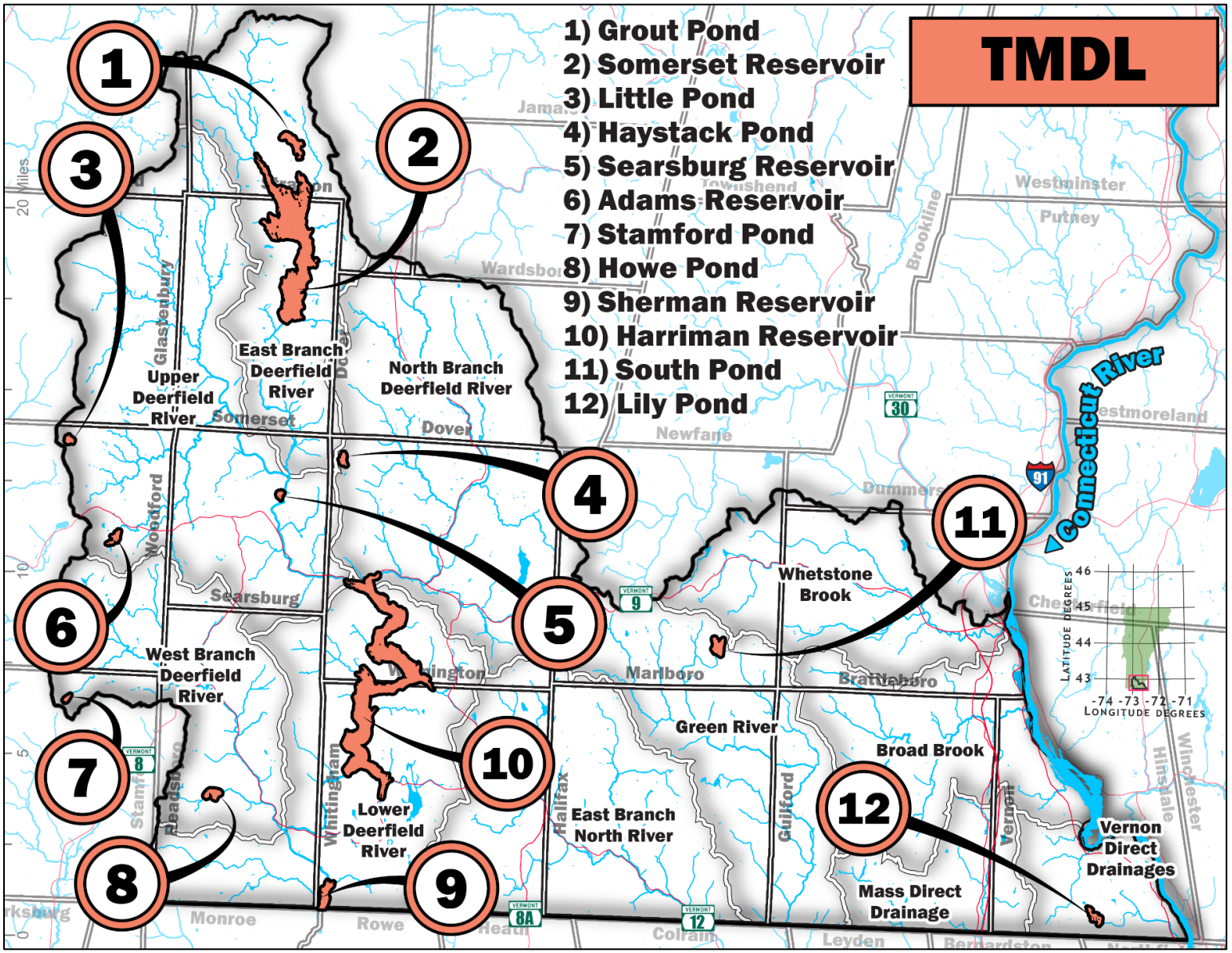

Figure 5 Map of impaired lakes across Basin 12 through 2022. Salmon color represent lakes that are on Part D of the Priority Waters List and have an approved Total Maximum Daily Load (TMDL).

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. Figure 6 presents the location of the lakes impaired by pollutants. Table 8 further describes the impairment or alteration. Use the Lake ID to find more information in the *report viewer*.

Table 8 List of impaired lakes across Basin 12. Map IDs correspond to the map above.. Part D=impaired with an EPA approved TMDL.

MAP ID	NAME	PROBLEM	POLLUTANT	PART
1	Grout Pond (Stratton)	Atmospheric deposition: extremely sensitive to acidification; episodic acidification	MERCURY IN FISH TISSUE, PH	D
2	Somerset Reservoir (Somerset)	Elevated level of mercury in all fish except brown bullhead	PH, MERCURY IN FISH TISSUE	D
3	Little Pond (Woodford)	Atmospheric deposition: critically acidified; chronic acidification	PH	D
4	Haystack Pond (Wilmington)	Atmospheric deposition: critically acidified; chronic acidification	PH	D
5	Searsburg Reservoir (Searsburg)	Elevated level of mercury in all fish except brown bullhead	MERCURY IN FISH TISSUE	D
6	Adams Reservoir (Woodford)	Atmospheric deposition: extremely sensitive to acidification; episodic acidification	PH	D
7	Stamford Pond (Stamford)	Atmospheric deposition: extremely sensitive to acidification; episodic acidification	PH	D
8	Howe Pond (Readsboro)	Atmospheric deposition: extremely sensitive to acidification; episodic acidification	PH	D
9	Sherman Reservoir (Whitingham)	Elevated level of mercury in all fish except brown bullhead	MERCURY IN FISH TISSUE	D
10	Harriman Reservoir (Whitingham)	Elevated level of mercury in all fish except brown bullhead	MERCURY IN FISH TISSUE	D
11	South Pond (Marlboro)	Atmospheric deposition: extremely sensitive to acidification; episodic acidification	PH	D
12	Lily Pond (Vernon)	Atmospheric deposition; extremely sensitive to acidification; episodic acidification	PH, LOW	D

Altered Lakes

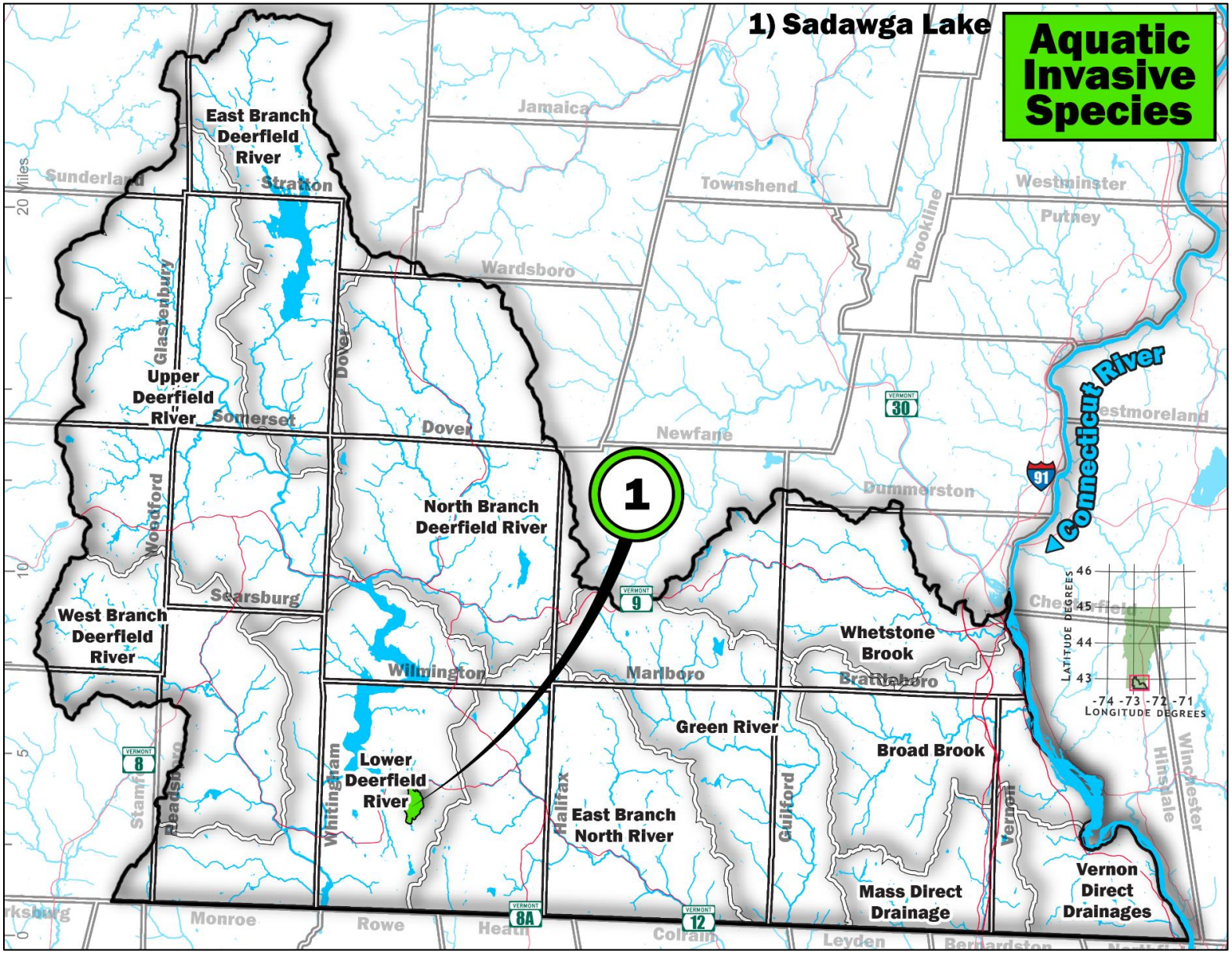

Figure 6 Map of altered lakes for Basin 12. Lakes in green are those altered by aquatic invasive species.

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 and F respectively.

Table 9. Altered lakes in Basin 12.

MAP ID	NAME	PROBLEM	PART
1	Sadawga	Locally abundant EWM growth.	E

Phosphorus Trends in Lakes

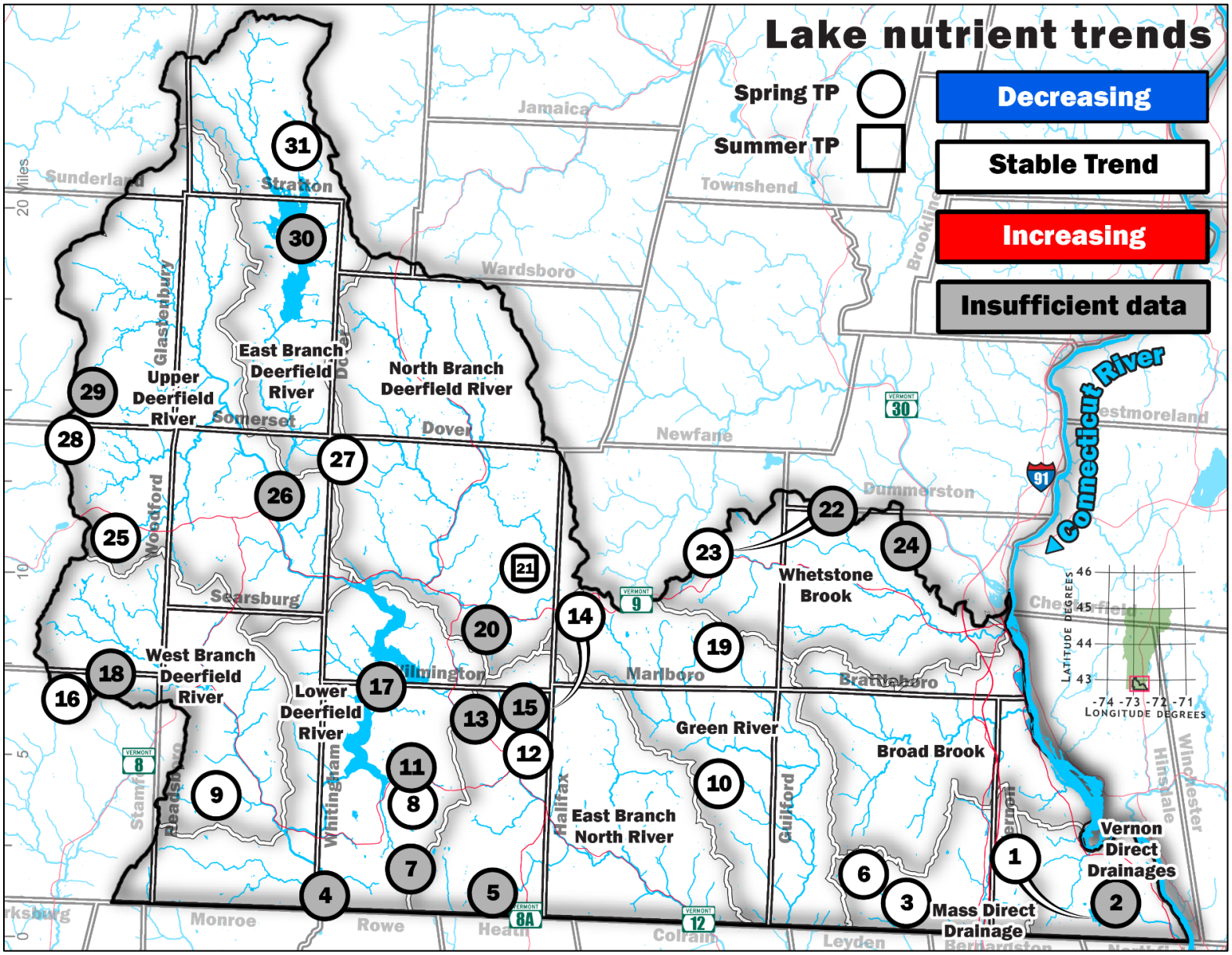

Figure 7 Total phosphorus trends for lakes in Basin 12. Note that trends can be for either spring or summer data or for both.

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* and the interactive Vermont lake data application.

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. While (?) represents lakes with data available for modeling but lack sufficient data for fitting a model.

Map ID	Lake ID	Summer	Spring
1	LILY (VERNON)		=
2	VERNON HATCHERY;		?
3	WEATHERHEAD HOLLOW		=
4	SHERMAN		?
5	SHIPPEE		?
6	SWEET		=
7	NORTH (WHITHM)		?
8	SADAWGA		=
9	HOWE		=
10	DEER PARK		=
11	CLARA		?
12	JACKSONVILLE		=

Map ID	Lake ID	Summer	Spring
13	RYDER		?
14	GATES		=
15	LAUREL		?
16	STAMFORD		=
17	HARRIMAN (WHITHM)		?
18	MUD (WOODFD)		?
19	SOUTH (MARLBR)		=
20	SPRUCE (WILMTN)		?
21	RAPONDA	=	=
22	MARLBORO-431;		?
23	HIDDEN		=
24	PLEASANT VALLEY		?
25	ADAMS (WOODFD)		=
26	SEARSBURG		?
27	HAYSTACK		=
28	LITTLE (WOODFD)		=
29	LOST (GLASBY)		?
30	SOMERSET		?

Map ID	Lake ID	Summer	Spring
31	GROUT		=

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.

Table 11. Landcover of watersheds of lakes with insufficient data to determine water quality status. These lakes are less than 10 acres and are not included in the above score card maps.

	Impervious surface		Agricultural land	
Lake ID	Percent	Acres	Percent	Acres
CRYSTAL (WILMTN)	0	0	0	0
DEER PARK-WEST;	<0.1	0.06	0	0
YAW	0.1	1.70	0	0.01

Rivers

Conditions and trends

Physical condition

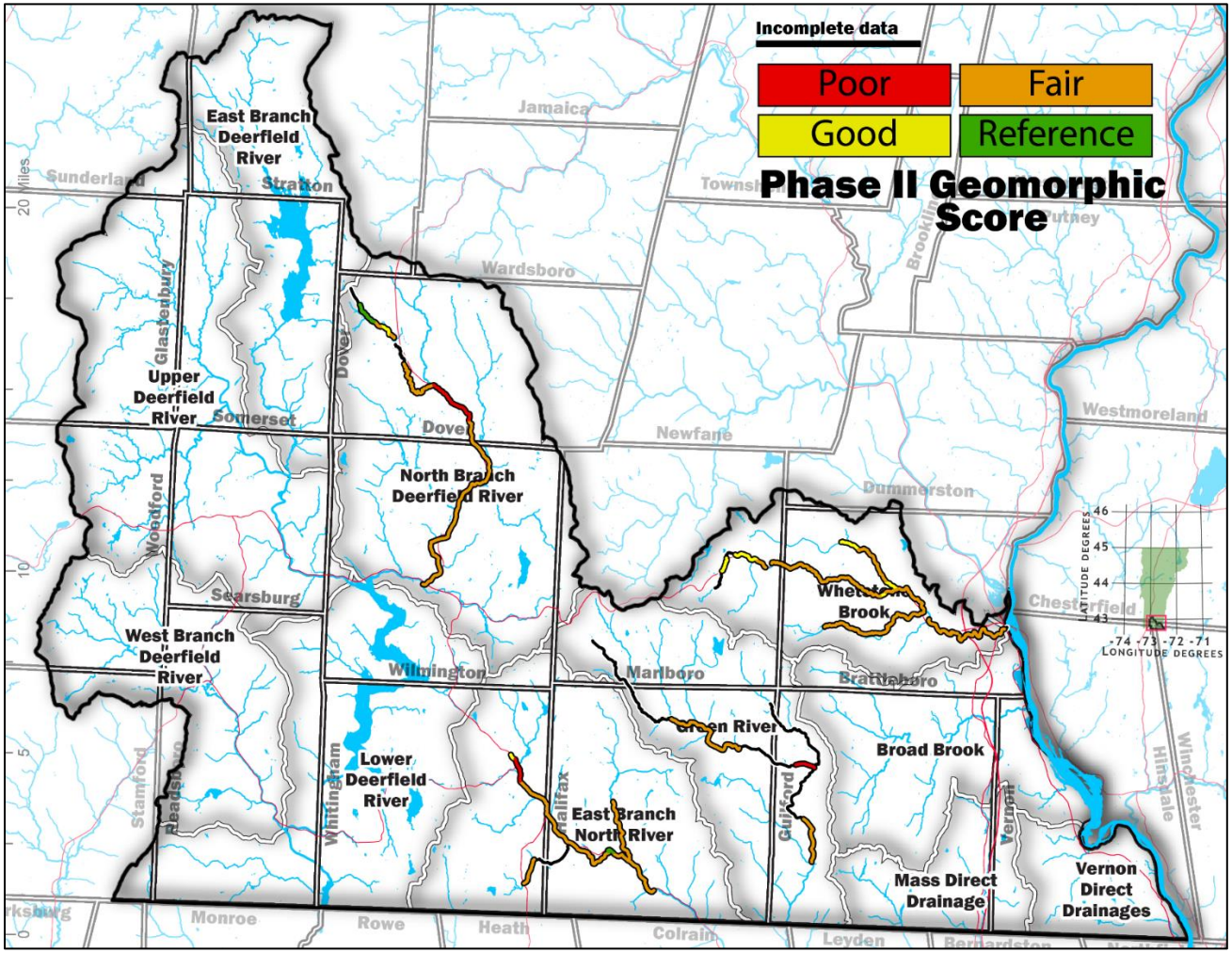

Figure 8 Map of rivers in Basin 12 with Phase II geomorphic condition scores through the present. Poor rivers have extreme departure from reference condition, fair rivers have major departure, and good rivers have minor departure. Reference rivers have no departure.

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 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. Figure 9 gives the overall Phase 2 geomorphic condition score of rivers in Basin 12. Figures displayed here are based on Phase 2 data.

The Stream Geomorphic Assessment can be used to problem solve and set priorities for river corridor conservation at a watershed scale because it allows you to ascertain how one reach may be affecting the condition of another. In the Phase 2 Rapid Field Assessment you use direct observations to evaluate stream geomorphic condition and different channel adjustment processes in each reach. In the Phase 2 Rapid Stream Assessment, 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 you have documented at assessed reaches in the watershed.

For more information on these type of assessments see the River's Assessment *webpage*[1]. To learn more about the rivers and streams with Phase 1 and Phase 2 assessments in Basin 12, final reports for each project can be found at: *https://anrweb.vt.gov/DEC/SGA/finalReports.aspx*

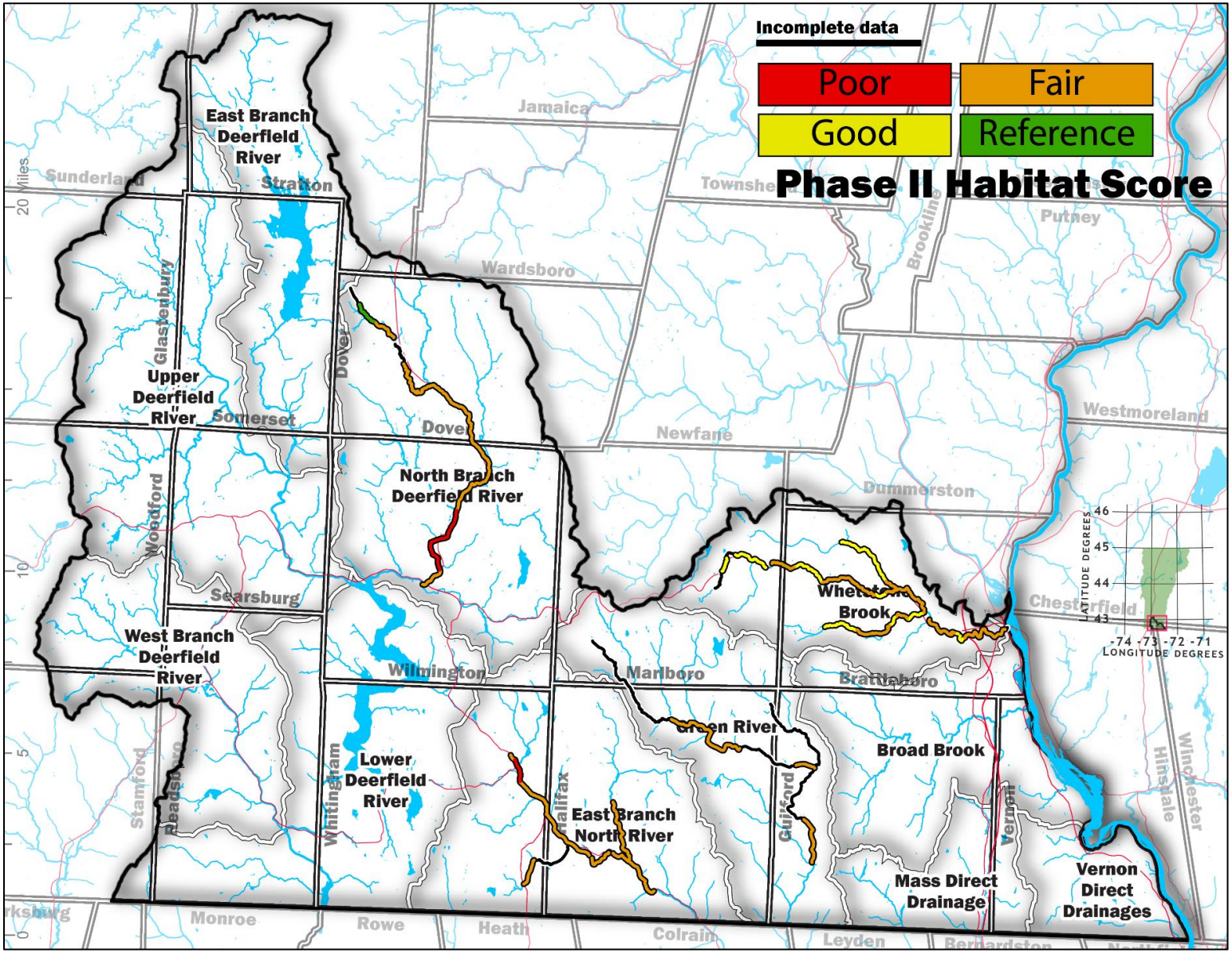

Figure 9 Map of rivers in Basin 12 with Phase II habitat condition ratings through 2020. Poor rivers have extreme departure from reference condition, fair rivers have major departure, and good rivers have minor departure. Reference rivers have no departure.

The Rapid Habitat Assessment evaluates the physical components of a channel bed, banks, and riparian vegetation and how they affect aquatic life. The Habitat condition ratings can be used to identify high quality habitat and to “red-flag” areas of degraded 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, which is important when evaluating habitat for species that move and/or migrate within a stream system to meet different needs.

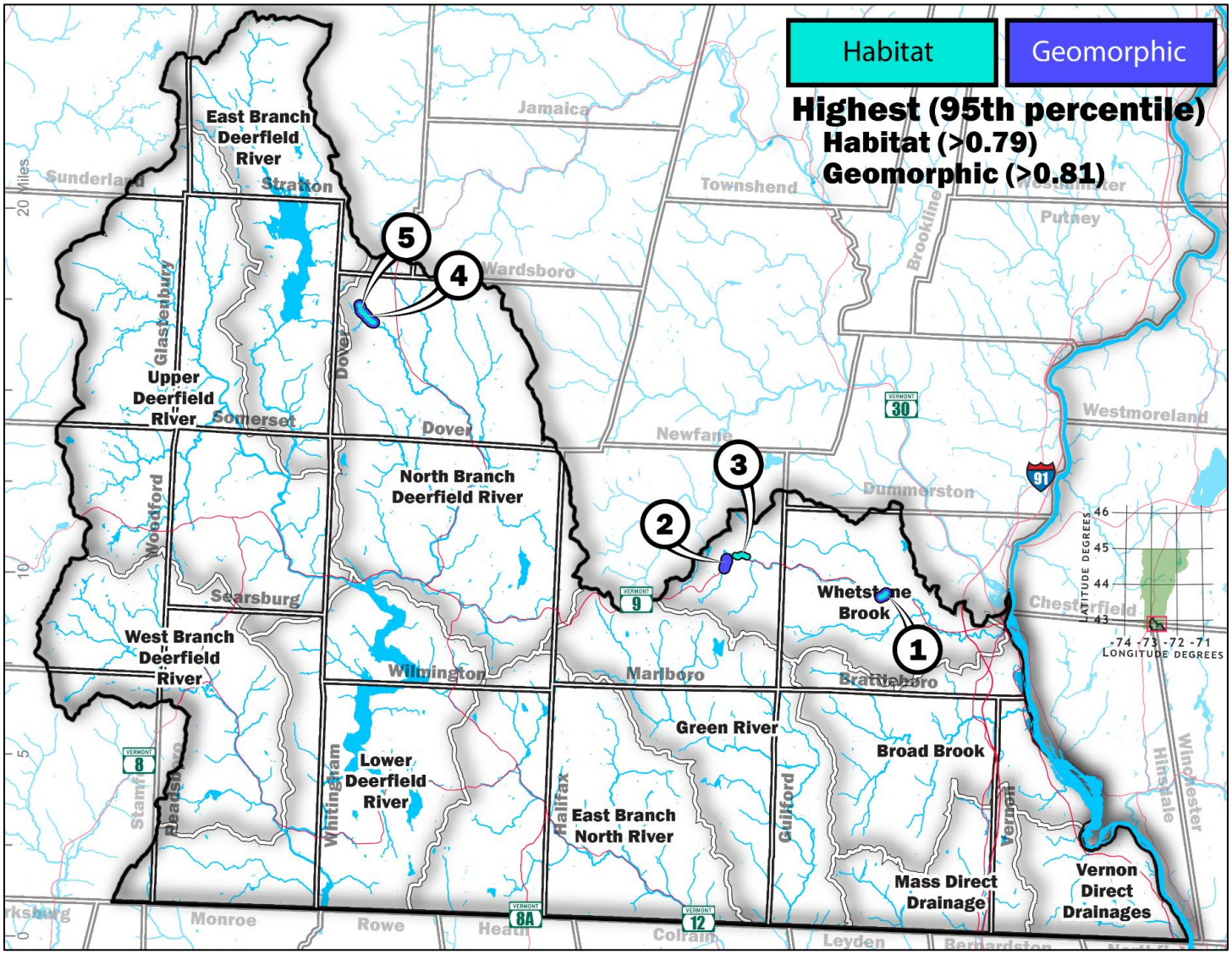

Figure 10. Map of the 95th percentile (highest) habitat and geomorphic condition scores. Map IDs correspond to the table below. Using this percentile approach identifies the reaches with the best geomorphic and habitat condition relative to conditions across the basin. Each is scored separately but overlap 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	Longitude	Latitude	Assessment
1	143_M08A	Whetstone Brook			-72.624	42.865	Link
2	143_M12B	Whetstone Brook			-72.709	42.877	Link
3	143_M11D	Whetstone Brook			-72.701	42.881	Link
4	63_T2.14B	North Branch Deerfield River			-72.904	42.975	Link
5	63_T2.14C	North Branch Deerfield River			-72.908	42.979	Link

Physical condition – restoration

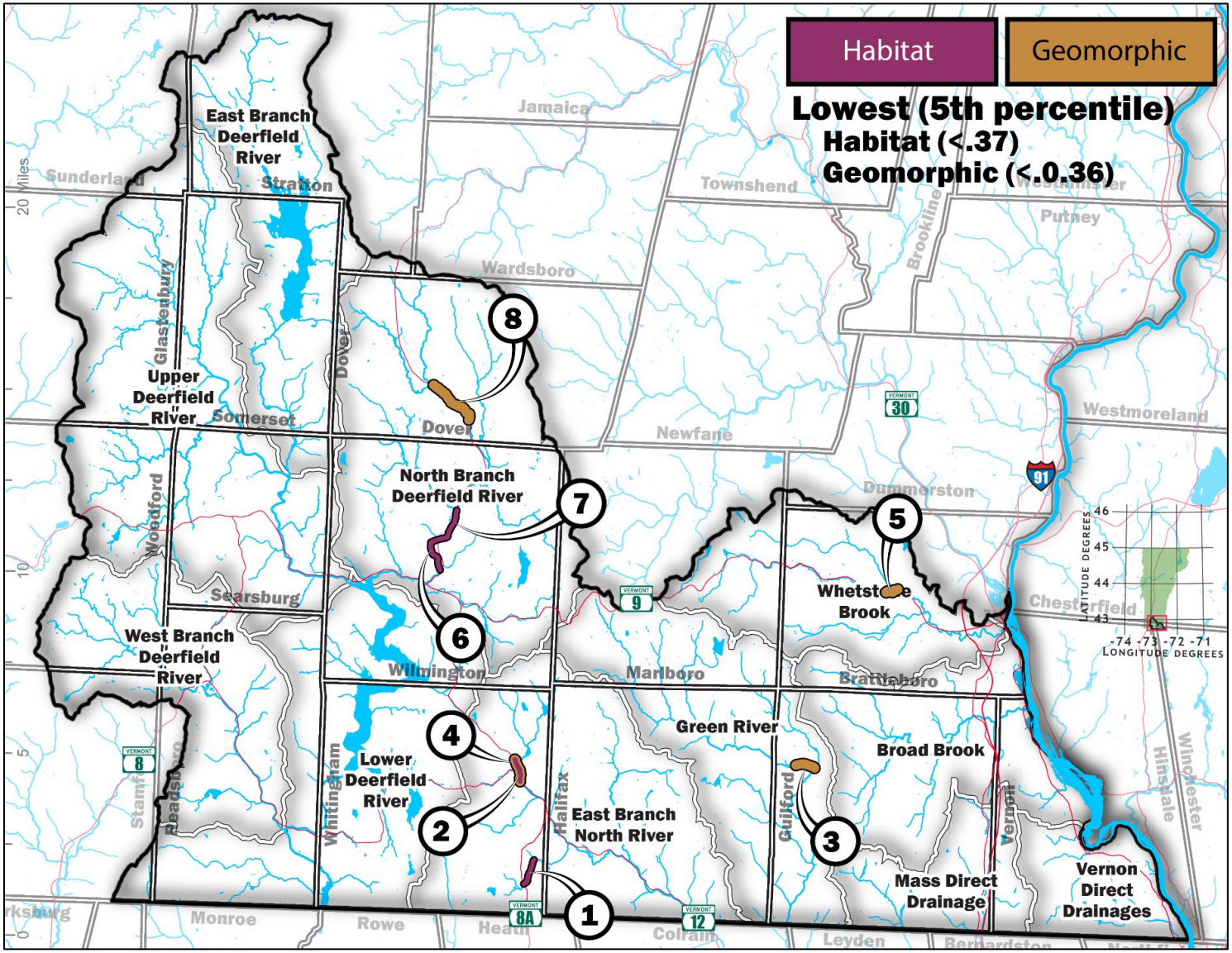

Figure 11 Map of the lowest 5th percentile habitat and geomorphic condition scores. Map IDs correspond to the table below.

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	Longitude	Latitude	Assessment
1	63_T2.02-	Hager Brook			-72.815	42.754	Link
2	191_M06B	East Branch North River			-72.820	42.793	Link
3	188_M07-	Green River			-72.665	42.797	Link
4	191_M07A	East Branch North River			-72.822	42.798	Link
5	143_M07-	Whetstone Brook			-72.619	42.866	Link
6	63_T2.04A	North Branch Deerfield River			-72.868	42.882	Link
7	63_T2.04B	North Branch Deerfield River			-72.856	42.893	Link
8	63_T2.10-	North Branch Deerfield River			-72.857	42.940	Link

Biological condition

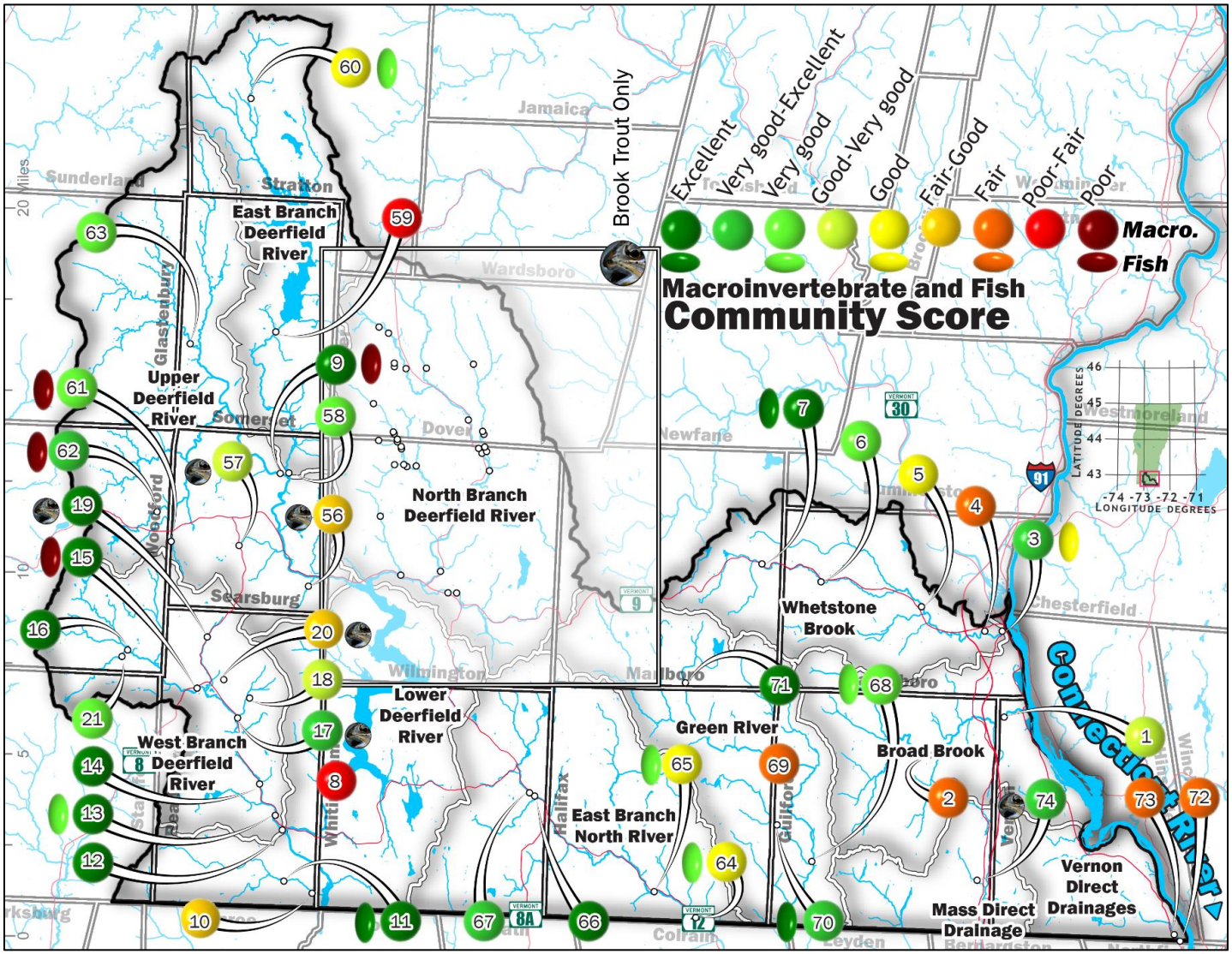

Figure 12. Map of the most recent Macroinvertebrate and Fish Community assessments for Basin 12, excluding North Branch (see below). Poor scores represent the greatest deviation from reference conditions and Excellent scores represent non-significant deviation from reference conditions. We do not have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

The Monitoring 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 by reaches where the only fish species found are 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 over the last decade for the watersheds of Basin 12 excluding North Branch Deerfield River. Blank = no data, bkt = streams with a robust brook trout community

Unable to sample or assess or BKT	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)

Stream name, river mile	Map ID	Community	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Broad Brook, 0.9	1	Bug										GVg	
Broad Brook, 4.1	2	Bug										F	F
Whetstone Brook, 0.2	3	Bug	FG	VgE									
Whetstone Brook, 0.2	3	Fish		G									
Whetstone Brook, 1.0	4	Bug										FG	F
Whetstone Brook, 2.9	5	Bug										G	
Whetstone Brook, 8.6	6	Bug	Vg										
Whetstone Brook, 10.7	7	Bug							E				
Whetstone Brook, 10.7	7	Fish							E				
Deerfield River, 52.4	8	Bug										PF	
Deerfield River, 67.5	9	Bug	VgE				Vg						
Deerfield River, 67.5	9	Fish					P						
South Branch Deerfield River, 0.3	10	Bug										FG	
South Branch Deerfield River, 1.3	11	Bug		E			E						
South Branch Deerfield River, 1.3	11	Fish		Vg			E						
West Branch Deerfield River, 0.1	12	Bug	E										
West Branch Deerfield River, 0.6	13	Bug											E
West Branch Deerfield River, 0.6	13	Fish											Vg
West Branch Deerfield River, 1.8	14	Bug		E									
West Branch Deerfield River, 5.9	15	Bug					E						
West Branch Deerfield River, 5.9	15	Fish					P						
West Branch Deerfield River, 8.5	16	Bug			Vg		E						
Lamb Brook, 0.1	17	Bug					Vg	E	GVg	VgE	VgE		
Lamb Brook, 0.1	17	Bug					BKT		BKT	BKT	BKT		

Stream name, river mile	Map ID	Community	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Lamb Brook, 0.7	18	Bug	GVg										
West Branch Deerfield River Trib 7, 1.8	19	Bug					VgE	E	GVg	VgE	E		
West Branch Deerfield River Trib 7, 1.8	19	Fish					E		U	BKT	BKT		
West Branch Deerfield River Trib 7 Trib 1, 0.7	20	Bug					F	G	F	GVg	FG		
West Branch Deerfield River Trib 7 Trib 1, 0.7	20	Fish					BKT		U	U	BKT		
Reservoir Brook, 0.4	21	Bug										Vg	
Reservoir Brook, 0.4	21	Fish										U	
Medbury Brook, 0.4	56	Bug					F	G	F	FG	FG		
Medbury Brook, 0.4	56	Fish					BKT		U	BKT	BKT		
Bond Brook, 1.7	57	Bug					GVg	E	GVg	GVg	GVg		
Bond Brook, 1.7	57	Fish					BKT	BKT	BKT	BKT			
East Branch Deerfield River, 0.1	58	Bug	FG				E						
East Branch Deerfield River, 5.3	59	Bug					PF						
East Branch Deerfield River, 12.6	60	Bug										G	
East Branch Deerfield River, 12.6	60	Fish											Vg
Rake Branch, 1.0	61	Bug					FG	Vg	G	GVg	Vg		
Rake Branch, 1.0	61	Fish					P	P	P	P	P		
Red Mill Brook, 0.7	62	Bug					VgE						
Red Mill Brook, 0.7	62	Fish					P						
Glastenbury River, 0.4	63	Bug					Vg						
East Branch North River, 10.3	64	Bug					G						
East Branch North River, 10.3	64	Fish					Vg						
East Branch North River, 11.7	65	Bug	E	E		E		E				FG	G
East Branch North River, 11.7	65	Fish						Vg					
East Branch North River, 17.6	66	Bug					E					E	
East Branch North River, 17.8	67	Bug										VgE	
Green River, 16.6	68	Bug	E	F	E	E	VgE	VgE	GVg	GVg	GVg	FG	Vg
Green River, 16.6	68	Fish	Vg	E	Vg					G			Vg
Green River, 19.9	69	Bug										F	
Green River Trib 6, 1.7	70	Bug										VgE	
Green River Trib 6, 1.7	70	Fish										E	
Pond Brook, 1.3	71	Bug			E								
Newton Brook, 0.2	72	Bug	F									F	
Newton Brook, 0.6	73	Bug	F										

Stream name, river mile	Map ID	Community	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Fall River, 15.2	74	Bug		E				VgE					
Fall River, 15.2	74	Fish		BKT									

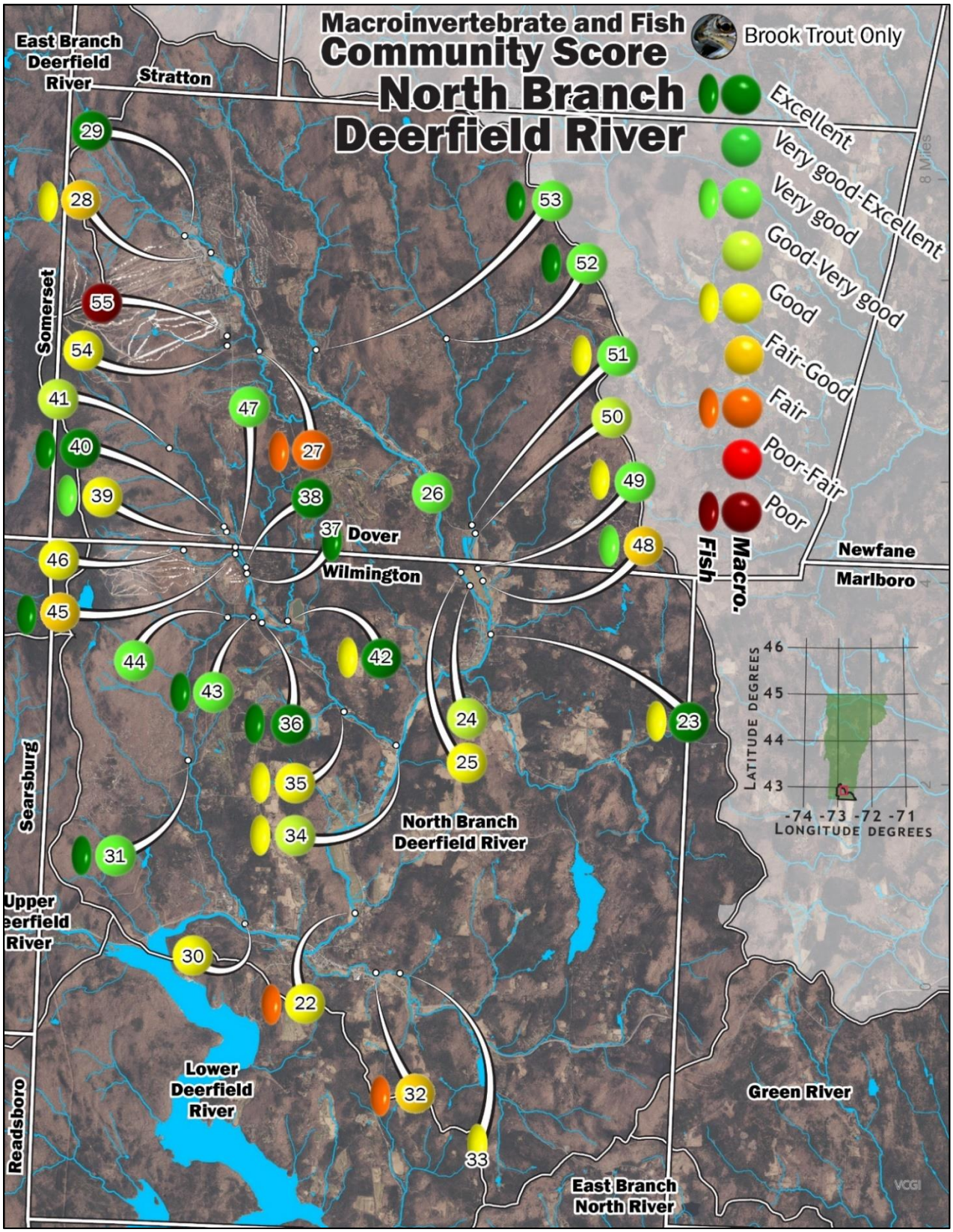

Figure 13. Map of the most recent macroinvertebrate and fish community assessments for North Branch Deerfield River. Poor scores represent the greatest deviation from reference conditions and Excellent scores represent non-significant deviation from reference conditions. We do not have criteria for assessing 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 North Branch of the Deerfield River. Blank = no data, bkt = stream reaches with only brook trout present and are not assessable using Vermont's fish IBI which requires a minimum of two native species to calculate.

Unable to sample or assess or BKT	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)

Stream name, river mile	Map ID	Community	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
North Branch Deerfield River, 2.0	22	Bug									G		
North Branch Deerfield River, 2.0	22	Fish									F		
North Branch Deerfield River, 5.8	23	Bug					E						
North Branch Deerfield River, 5.8	23	Fish					G						
North Branch Deerfield River, 6.3	24	Bug				G					GVg		
North Branch Deerfield River, 6.5	25	Bug				GVg					G		
North Branch Deerfield River, 7.6	26	Bug				G					Vg		
North Branch Deerfield River, 11.0	27	Bug				G	FG				F		
North Branch Deerfield River, 11.0	27	Fish				P					F		
North Branch Deerfield River, 12.1	28	Bug				Vg	Vg					FG	
North Branch Deerfield River, 12.1	28	Fish										G	
North Branch Deerfield River, 12.6	29	Bug					E						
Binney Brook, 0.1	30	Bug		G									
Rose Brook, 0.9	31	Bug	Vg				G	GVg				Vg	
Rose Brook, 0.9	31	Fish					F	E					
Beaver Brook, 1.0	32	Bug		E								FG	
Beaver Brook, 1.0	32	Fish		F									
Beaver Brook, 1.2	33	Fish					G						
Cold Brook, 0.1	34	Bug	Vg			Vg	GVg						
Cold Brook, 0.1	34	Fish				G							
Cold Brook, 0.7	35	Bug					G						
Cold Brook, 0.7	35	Fish					G						
Cold Brook, 2.2	36	Bug					GVg					E	E
Cold Brook, 2.2	36	Fish										E	
Cold Brook, 3.0	37	Fish				E						E	

Stream name, river mile	Map ID	Community	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cold Brook, 3.1	38	Bug				G	E					VgE	E
Cold Brook, 3.3	39	Bug				G							
Cold Brook, 3.3	39	Fish				Vg							
Cold Brook, 3.4	40	Bug					E					Vg	E
Cold Brook, 3.4	40	Fish										E	
Cold Brook, 4.3	41	Bug					GVg						
Airport Trib, 0.1	42	Bug				E							
Airport Trib, 0.1	42	Fish				G							
Haystack Brook, .1	43	Bug				E	Vg					E	Vg
Haystack Brook, .1	43	Fish				Vg						E	
Haystack Brook, 0.3	44	Bug				Vg							
Oak Brook, 0.1	45	Bug				E						GVg	FG
Oak Brook, 0.1	45	Fish										E	
Oak Brook, 0.7	46	Bug				G							
Oak Brook, 0.7	46	Fish				BKT							
Cold Brook Trib 6, 0.1	47	Bug				Vg							
Cold Brook Trib 6, 0.1	47	Fish				U							
Ellis Brook, 0.3	48	Bug					FG					FG	
Ellis Brook, 0.3	48	Fish					Vg						
Ellis Brook, 0.5	49	Bug			F	F				Vg			
Ellis Brook, 0.5	49	Fish				G							
Ellis Brook, 0.9	50	Bug									GVg		
Ellis Brook, 1.0	51	Bug			E	VgE	Vg						
Ellis Brook, 1.0	51	Fish				G							
Ellis Brook, 2.9	52	Bug										Vg	
Ellis Brook, 2.9	52	Fish										E	
Blue Brook, 0.7	53	Bug					VgE					Vg	
Blue Brook, 0.7	53	Fish					E					E	

Stream name, river mile	Map ID	Community	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Jacks Brook, 0.3	54	Bug								GVg	GVg	FG	G
Iron Stream, 0.2	55	Bug								P	P	P	P

Chemical condition

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) of select chemical parameters. Chemical monitoring associated with the ABN is used to help interpret the biological data, which is heavily relied upon 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)

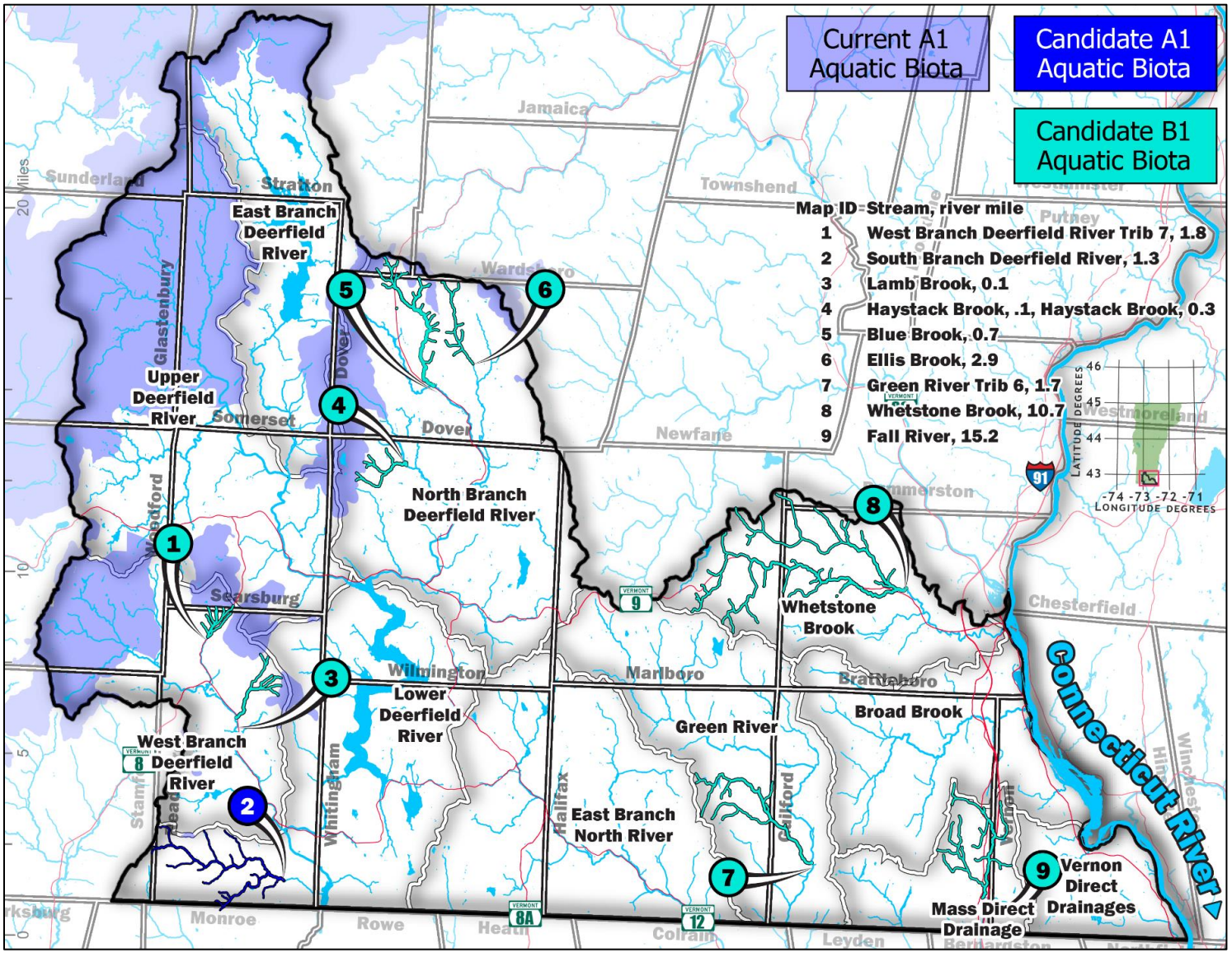

Figure 14 Map of A(1) and B(1) reclassification candidates. Map IDs correspond to the table below.

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 16 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 or BKT only		Good (G)		Good-Very good (GVg)	Very good (Vg)			Very good-excellent (VgE)			Excellent (E)			
Reclassification candidate	Map ID	Reclass	Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
West Branch Deerfield River Trib 7, 1.8	1	B1	Bug				VgE	E	GVg	VgE	E		
West Branch Deerfield River Trib 7, 1.8	1	B1	Fish				E		U	BKT	BKT		
South Branch Deerfield River, 1.3	2	A1	Bug	E			E						
South Branch Deerfield River, 1.3	2	A1	Fish	Vg			E						
Lamb Brook, 0.1	3	B1	Bug				Vg	E	GVg	VgE	VgE		
Haystack Brook, .1	4	B1	Bug			E	Vg					E	Vg
Haystack Brook, .1	4	B1	Fish			Vg						E	
Haystack Brook, 0.3	4	B1	Bug			Vg							
Blue Brook, 0.7	5	B1	Bug				VgE					Vg	
Blue Brook, 0.7	5	B1	Fish				E					E	
Ellis Brook, 2.9	6	B1	Bug									Vg	
Ellis Brook, 2.9	6	B1	Fish									E	
Green River Trib 6, 1.7	7	B1	Bug									VgE	
Green River Trib 6, 1.7	7	B1	Fish									E	
Whetstone Brook, 10.7	8	B1	Bug						E				
Whetstone Brook, 10.7	8	B1	Fish						E				
Fall River, 15.2	9	B1	Bug	E				VgE					
Fall River, 15.2	9	B1	Fish	BKT									

Impaired rivers

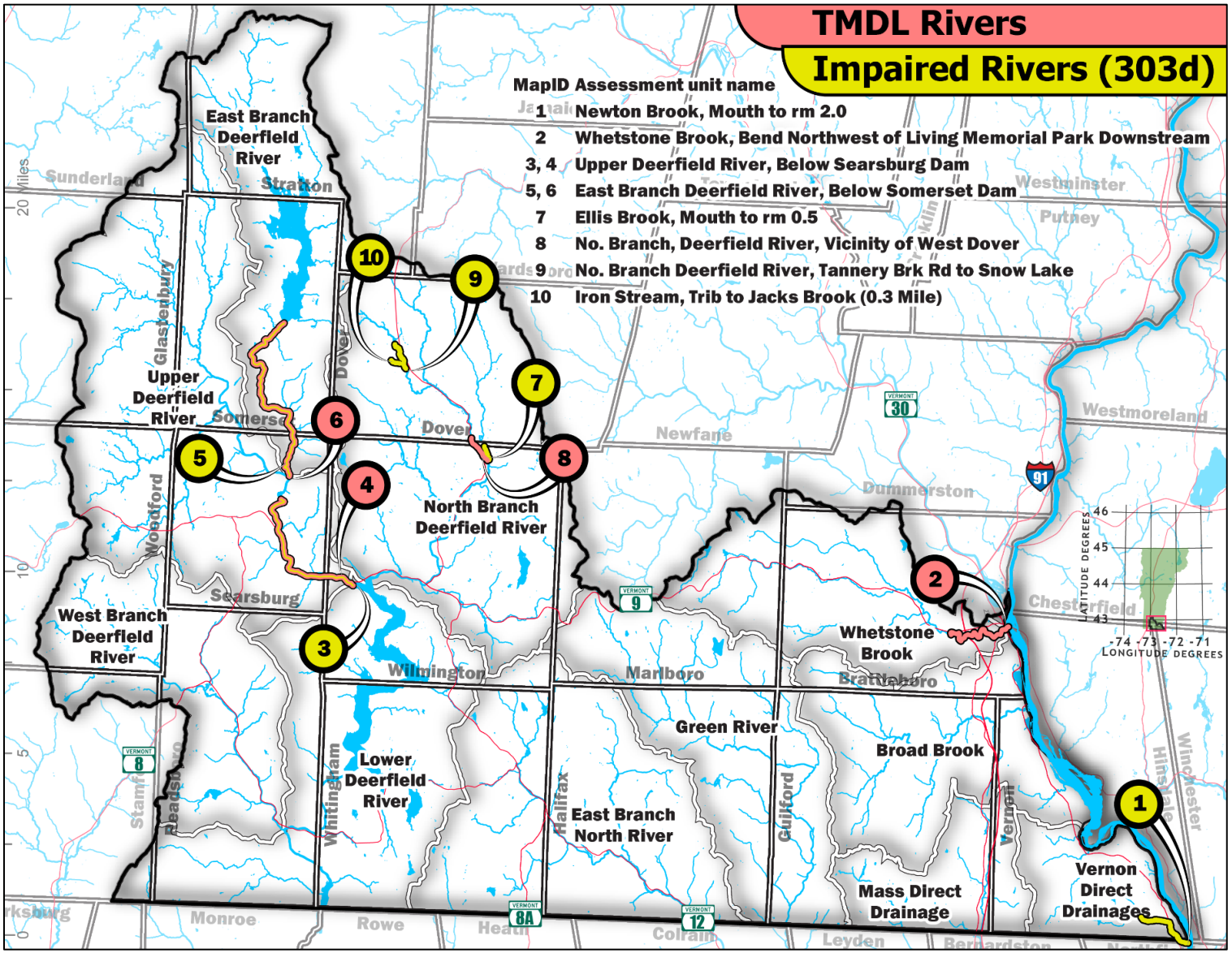

Figure 15. Map of impaired rivers in Basin 12. Yellow represents rivers that are on the 2022 303(d) list. Salmon represents rivers that have an approved TMDL but remain impaired. Use the stream name and the first seven characters of the Assessment Unit ID to find monitoring data from the reach in this report viewer.

Table 17 Table of impaired rivers in Basin 12. 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*
1	Newton Brook, Mouth to rm 2.0	VT13-16.01	SEDIMENTATION/SILTATION	Agricultural activity	ALS	A
2	Whetstone Brook, Bend Northwest of Living Memorial Park Downstream	VT13-14.01	ESCHERICHIA COLI (E. COLI)	Sources unknown, potentially faulty sewer line/septic system	CR	D
3	Upper Deerfield River, Below Searsburg Dam	VT12-04.01	PH, LOW	Atmospheric deposition: critically acidified; chronic acidification	ALS	A
4	Upper Deerfield River, Below Searsburg Dam	VT12-04.01	MERCURY IN FISH TISSUE	Elevated levels of mercury in all fish	FC	D
5	East Branch Deerfield River, Below Somerset Dam	VT12-03.01	PH, LOW	Atmospheric deposition: critically acidified; chronic acidification, low temperature dam release	ALS	A
6	East Branch Deerfield River, Below Somerset Dam	VT12-03.01	MERCURY IN FISH TISSUE	Elevated levels of mercury in all fish	FC	D
7	Ellis Brook, Mouth to rm 0.5	VT12-05.06	TEMPERATURE, NUTRIENTS	Possible impacts from NBFD WWTF, agricultural runoff and channel alterations, lack of riparian buffer; high algal cover	ALS	A
8	No. Branch, Deerfield River, Vicinity of West Dover	VT12-05.02	ESCHERICHIA COLI (E. COLI)	High E. coli levels; cause(s) & source(s) unknown; needs assessment	CR	D
9	No. Branch Deerfield River, Tannery Brk Rd to Snow Lake	VT12-05.01	TEMPERATURE	High temperatures below Snow Lake impact aquatic biota	ALS	A

MAP ID	*NAME*	*ASSESSMENT UNIT ID*	*POLLUTANT*	*PROBLEM*	*IMPAIRED USE*	*PART*
10	Iron Stream, Trib to Jacks Brook (0.3 Mile)	VT12-05.03	IRON	Land development, source(s) need further assessment	ALS, AES	A

Altered Rivers

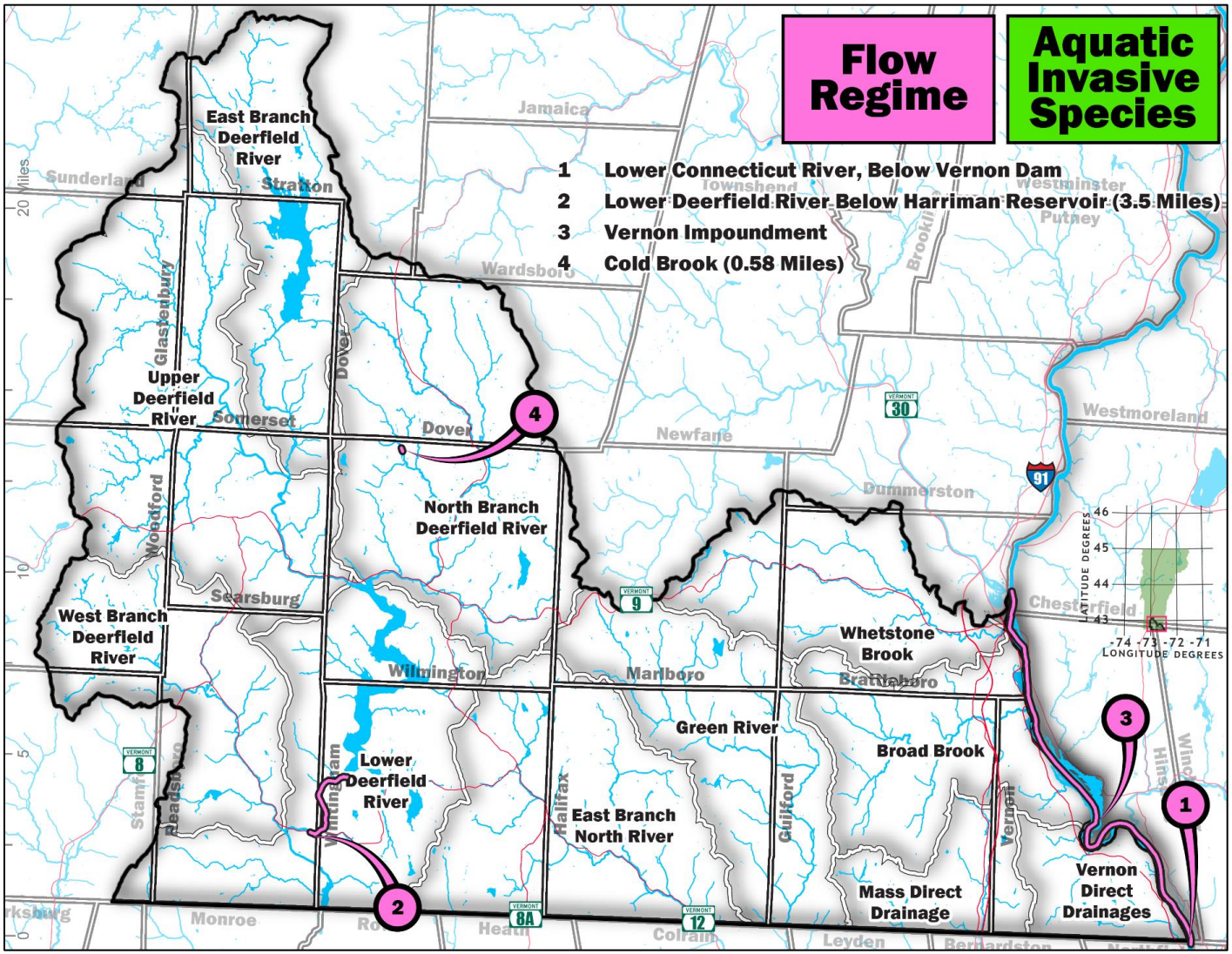

Figure 16. Map of altered rivers in Basin 12. Pink are rivers altered by flow modification. There are no altered rivers for aquatic invasive species. These are rivers that are caused to not meet the water quality standards by non-pollutants such as flow modification or aquatic invasive species. Associated with the map is a table further describing the alteration. Use the stream name and the first seven characters of the Assessment Unit ID to find monitoring data from the reach in the report viewer

Table 18. Altered rivers for Basin 12 as of 2022. All are flow modifications.

MAP ID	NAME	ASSESSMENT UNIT ID	POLLUTANT	PROBLEM	IMPAIRED USE	PART
1	Lower Connecticut River, Below Vernon Dam	VT13-05	Artificial flow condition, fluctuating flows by hydropower production	Agreement on operation of Vernon dam was reached in 2020 that will meet VWQS; FERC license and 401 WQC still pending	ALS	F
2	Lower Deerfield River Below Harriman Reservoir (3.5 Miles)	VT12-01.01	Low temperature hypolimnetic water release from reservoir affect fishery	401 certification issued (1/95); FERC license issued (4/97); DFW evaluating the effects of release.	ALS	F
3	Vernon Impoundment	VT13-04	Water level fluctuation at dam; dewatered shoreline/wetlands	Agreement on operation of Vernon dam was reached in 2020 that will meet VWQS; FERC license and 401 WQC still pending	ALS	F
4	Cold Brook (0.58 Miles)	VT12-05.07	Artificial & insufficient flow below Hermitage snowmaking withdrawal	Compliance schedule established as part of act 250 process to bring the withdrawal into compliance	ALS	F

Trending rivers

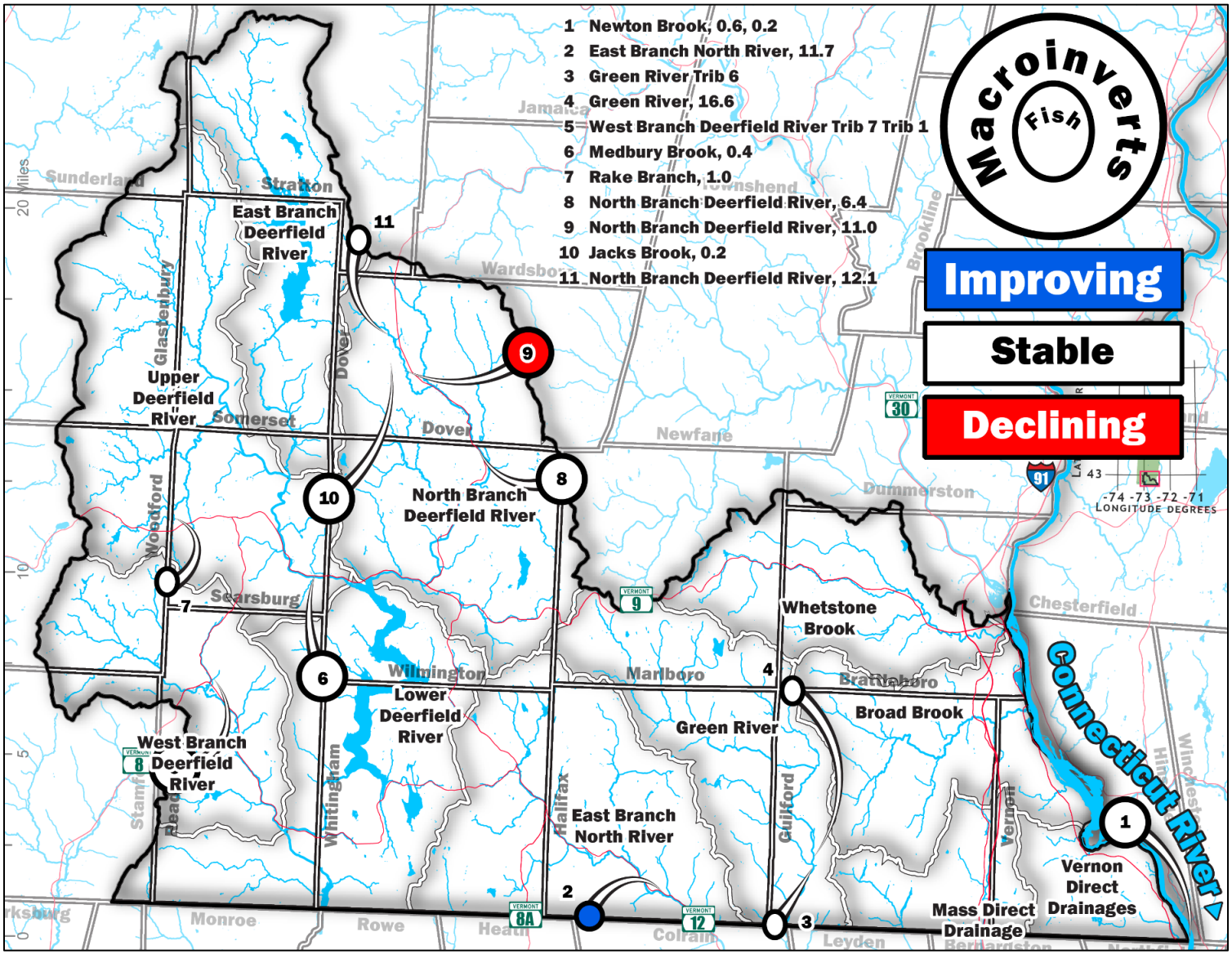

Figure 17 Map of rivers with enough biological data to model a water quality trend.

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), sites coded with a 0 were not sampled. 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 12. + Improving, - declining, = stable/no trend. B = Bug community, F = Fish 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, river mile	Map ID	Trend	Set	1994	1995	1996	1998	2002	2003	2004	2005	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Newton Brook, 0.2	1	=	B	0	0	0	0	0	0	0	0	0	0	0	F	0	0	0	0	0	0	0	0	F	0
Newton Brook, 0.6	1	=	B	0	0	0	F	0	0	0	0	0	0	0	F	0	0	0	0	0	0	0	0	0	0
East Branch North River, 11.7	2	+	F	G	G	0	0	0	0	0	0	Vg	0	0	0	0	0	0	0	Vg	0	0	0	0	0
Green River Trib 6, 1.7	3	=	F	0	0	0	0	0	E	0	0	Vg	0	0	0	0	0	0	0	0	0	0	0	E	0
Green River, 16.6	4	=	F	0	0	0	0	0	0	0	0	0	0	U	Vg	E	Vg	0	0	0	0	G	0	0	0
West Branch Deerfield River Trib 7 Trib 1, 0.7	5	=	B	0	0	0	0	0	0	0	0	0	G	0	0	0	0	0	F	G	F	0	0	0	0
Medbury Brook, 0.4	6	=	B	0	0	0	0	0	0	0	0	0	F	0	0	0	0	0	F	G	F	0	0	0	0
Rake Branch, 1.0	7	=	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	P	P	P	P	P	0	0
North Branch Deerfield River, 6.5	8	=	B	0	0	0	0	0	0	0	G	Vg	F	0	0	0	0	0	0	0	0	0	G	0	0
North Branch Deerfield River, 11.0	9	-	B	0	0	0	G	G	G	G	0	0	0	0	0	0	0	G	0	0	0	0	F	0	0
Iron Stream, 0.2	10	=	B	0	0	P	0	0	0	P	0	0	0	0	0	0	0	0	0	0	0	P	P	P	P
North Branch Deerfield River, 12.1	11	=	F	0	0	0	0	0	Vg	0	0	E	0	0	0	0	0	0	0	0	0	0	0	G	0

Rivers in need of assessment

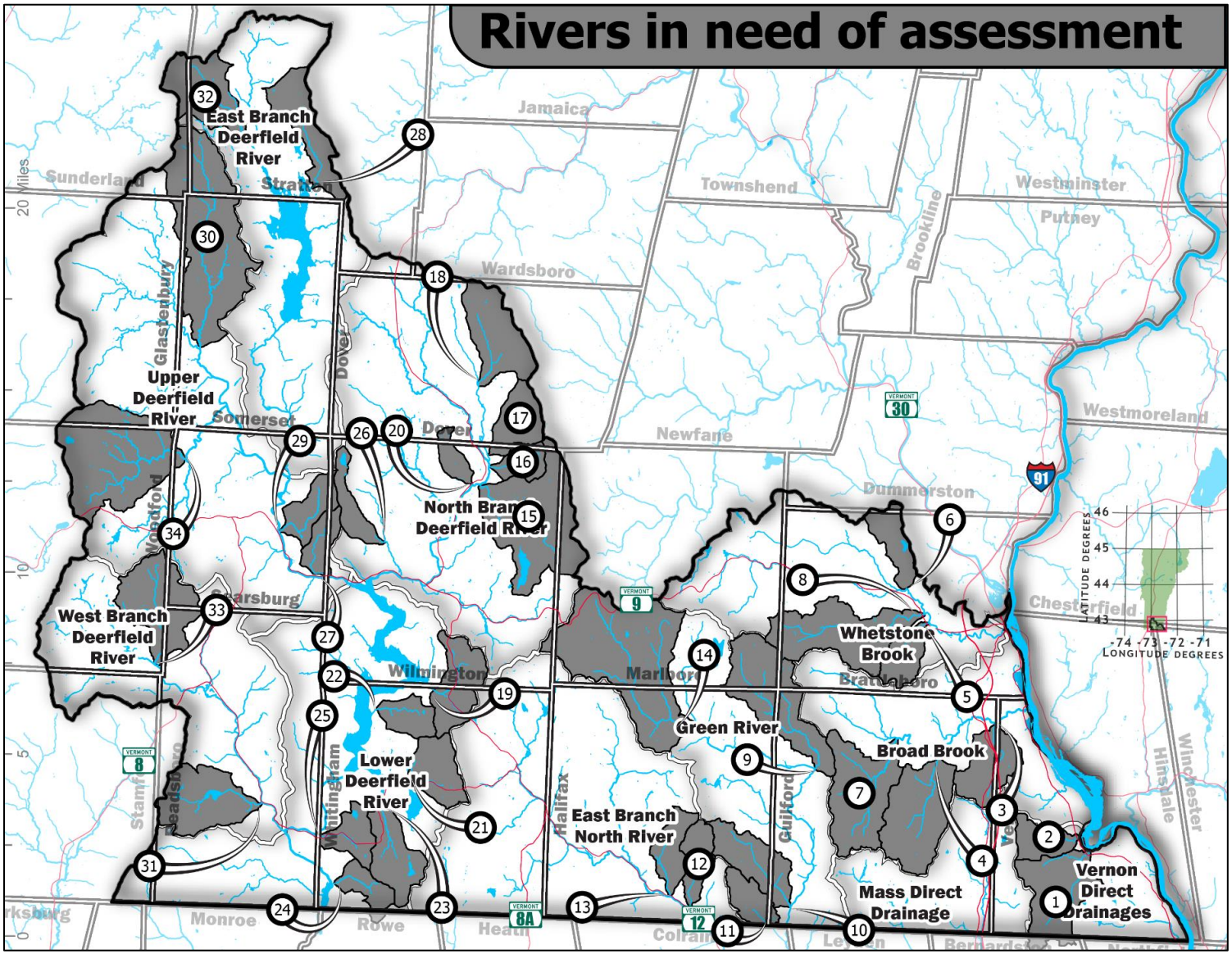

Figure 18 Map of rivers with unassessed aquatic biota use in Basin 12.

Aquatic biota health in streams is one of the primary areas of study 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. This includes streams larger than 2 square kilometers that lack biological data between 2000 and 2022. 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.

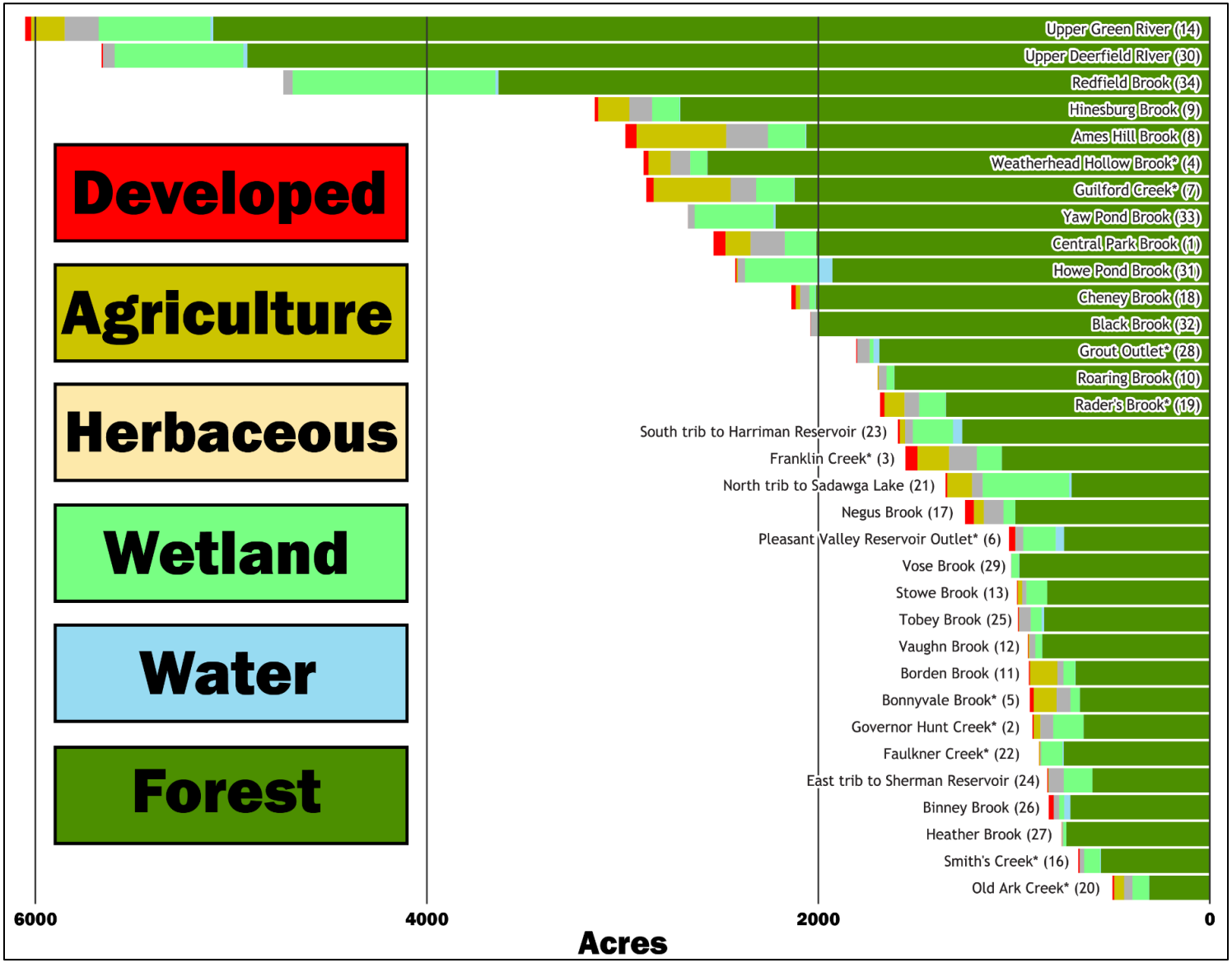

Figure 19 Land cover of unassessed waters ranked by watershed size. (#)'s associated with the stream name correspond to the map above. Asterisks are officially unnamed streams in the National Hydrography Dataset. Landcover is based on the Vermont High Resolution Land Cover dataset produced by the University 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	Developed	Agriculture	Forest	Wetland	Other	Water
Central Park Brook (1)	42.763	-72.513	2.39	5.10	79.28	6.33	6.87	0.04
Governor Hunt Creek* (2)	42.768	-72.517	0.78	3.83	71.21	17.08	7.10	0.01
Franklin Creek* (3)	42.810	-72.564	3.96	10.41	68.29	8.22	9.02	0.10
Weatherhead Hollow Brook* (4)	42.796	-72.596	0.86	3.90	88.73	3.00	3.45	0.06
Bonnyvale Brook* (5)	42.853	-72.603	2.27	12.75	72.19	5.10	7.62	0.08
Pleasant Valley Reservoir Outlet* (6)	42.875	-72.613	3.02	0.13	72.63	16.15	3.96	4.13
Guilford Creek* (7)	42.804	-72.619	1.31	13.69	73.67	6.72	4.48	0.15
Ames Hill Brook (8)	42.856	-72.612	1.93	15.34	69.03	6.43	7.13	0.14
Hinesburg Brook (9)	42.796	-72.660	0.57	5.05	86.09	4.49	3.69	0.11
Roaring Brook (10)	42.745	-72.677	0.10	0.32	94.96	2.33	2.24	0.05
Borden Brook (11)	42.734	-72.683	0.59	15.21	74.19	6.52	3.28	0.22
Vaughn Brook (12)	42.742	-72.728	0.35	0.61	92.06	3.68	3.15	0.16
Stowe Brook (13)	42.748	-72.741	0.36	2.29	84.40	10.83	2.09	0.04
Upper Green River (14)	42.813	-72.728	0.51	2.83	84.10	9.43	2.86	0.25
Smith's Creek* (16)	42.915	-72.832	1.02	0.07	82.81	12.17	3.35	0.58
Negus Brook (17)	42.932	-72.827	3.61	4.06	79.52	4.81	7.98	0.04
Cheney Brook (18)	42.951	-72.840	1.09	1.06	94.14	1.39	2.17	0.16
Rader's Brook* (19)	42.826	-72.865	1.34	6.13	80.04	8.05	4.39	0.06
Old Ark Creek* (20)	42.913	-72.852	1.91	10.12	62.34	17.03	8.47	0.13
North trib to Sadawga Lake (21)	42.787	-72.876	0.64	9.39	52.34	32.85	3.92	0.86
Faulkner Creek* (22)	42.819	-72.894	0.10	0.55	85.58	12.53	0.61	0.63
South trib to Harriman Reservoir (23)	42.773	-72.893	0.64	1.68	79.37	12.93	2.46	2.90
East trib to Sherman Reservoir (24)	42.749	-72.921	0.56	0.24	72.22	17.63	9.29	0.07
Tobey Brook (25)	42.769	-72.921	0.44	0.22	86.41	5.67	5.93	1.33
Binney Brook (26)	42.886	-72.897	3.10	0.00	86.50	3.17	3.39	3.84
Heather Brook (27)	42.879	-72.932	0.19	0.12	96.90	2.02	0.75	0.01
Grout Outlet* (28)	43.027	-72.933	0.26	0.00	93.50	1.14	3.47	1.65
Vose Brook (29)	42.891	-72.948	0.00	0.00	95.87	3.74	0.16	0.22
Upper Deerfield RIver (30)	42.966	-72.995	0.14	0.00	86.85	11.63	1.02	0.36
Howe Pond Brook (31)	42.781	-72.960	0.26	0.28	79.54	15.58	1.47	2.87
Black Brook (32)	43.049	-72.972	0.08	0.00	97.95	0.12	1.63	0.23
Yaw Pond Brook (33)	42.836	-73.016	0.02	0.00	83.22	15.11	1.26	0.39
Redfield Brook (34)	42.921	-73.007	0.00	0.00	76.78	21.88	1.00	0.33

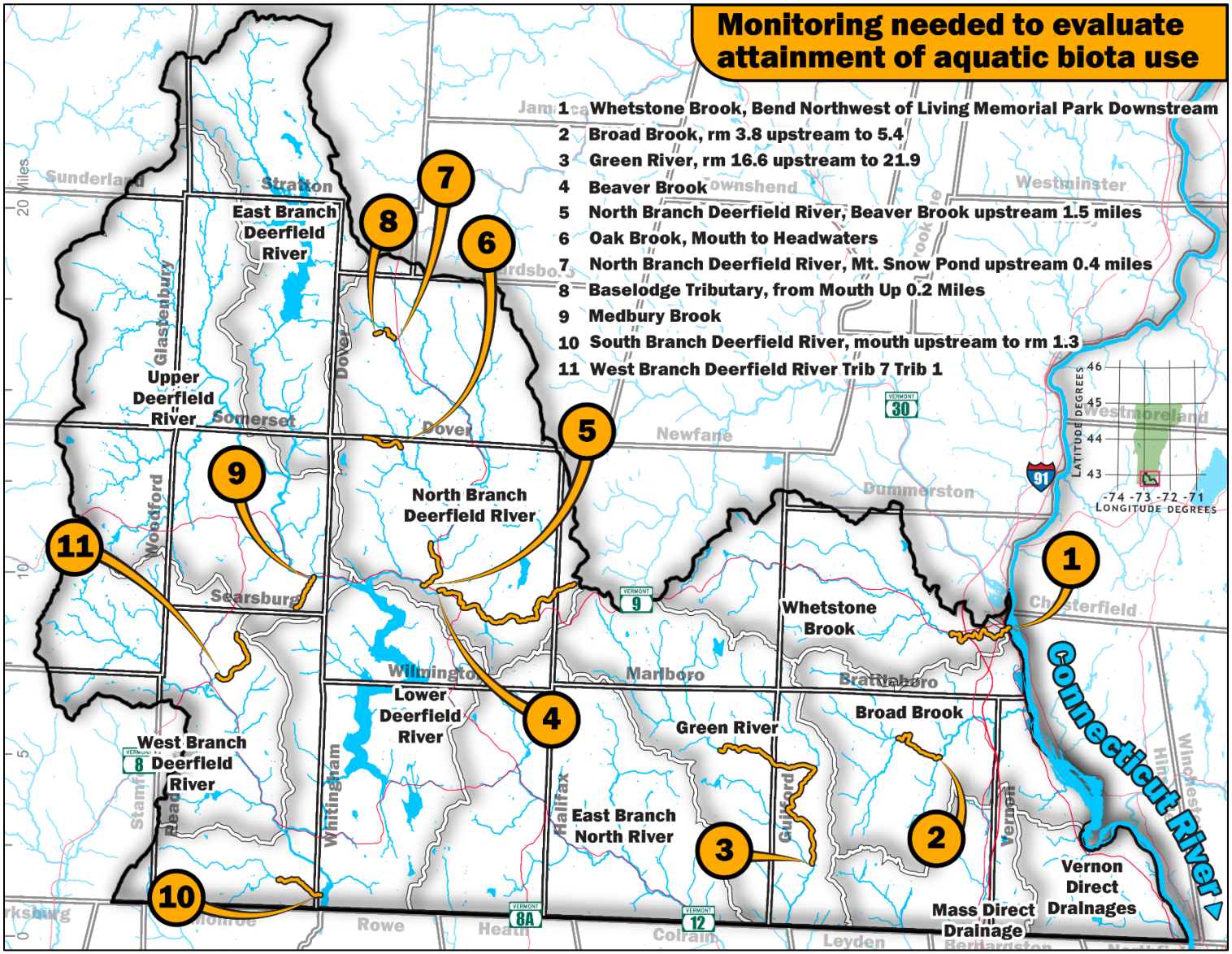

Figure 20 Map of rivers that require more monitoring to evaluate attainment of Aquatic Biota use.

Unlike the streams mentioned above with no biological monitoring data, the streams here have limited biomonitoring data that indicates indeterminate or failing (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	NAME	POLLUTANT/PARAMETER	PROBLEM
1	Whetstone Brook, Bend Northwest of Living Memorial Park Downstream	Low flow, Sedimentation/siltation	Streambank erosion, developed land runoff, channelization, altered hydrology, regional dry conditions
2	Broad Brook, rm 3.8 upstream to 5.4	Unknown	Fair macroinvertebrate community, potential sedimentation from Guilford Center Road and surrounding network. Regional dry conditions.
3	Green River, rm 16.6 upstream to 21.9	Unknown	Fair macroinvertebrate community, potential sedimentation from Green River Road, fish community potentially impacted by the timber crib dam at Green River Covered Bridge
4	Beaver Brook	Sedimentation/siltation, habitat alterations	Channel relocation, straightening
5	North Branch Deerfield River, Beaver Brook upstream 1.5 miles	Unknown	Fair fish community, potential habitat alterations
6	Oak Brook, Mouth to Headwaters	pH, low	Acid deposition, low pH
7	North Branch Deerfield River, Mt. Snow Pond upstream 0.4 miles	Habitat alterations	Ski area development
8	Baselodge Tributary, from Mouth Up 0.2 Miles	Sedimentation/siltation	Ski area development
9	Medbury Brook	pH, low, Habitat alterations	Acid deposition, scour (potentially natural due to gradient)
10	South Branch Deerfield River, mouth upstream to rm 1.3	Unknown	Low densities of macroinvertebrates, potential scour
11	West Branch Deerfield River Trib 7 Trib 1	Unknown	Macroinvertebrate community fluctuating around full support, potential low pH

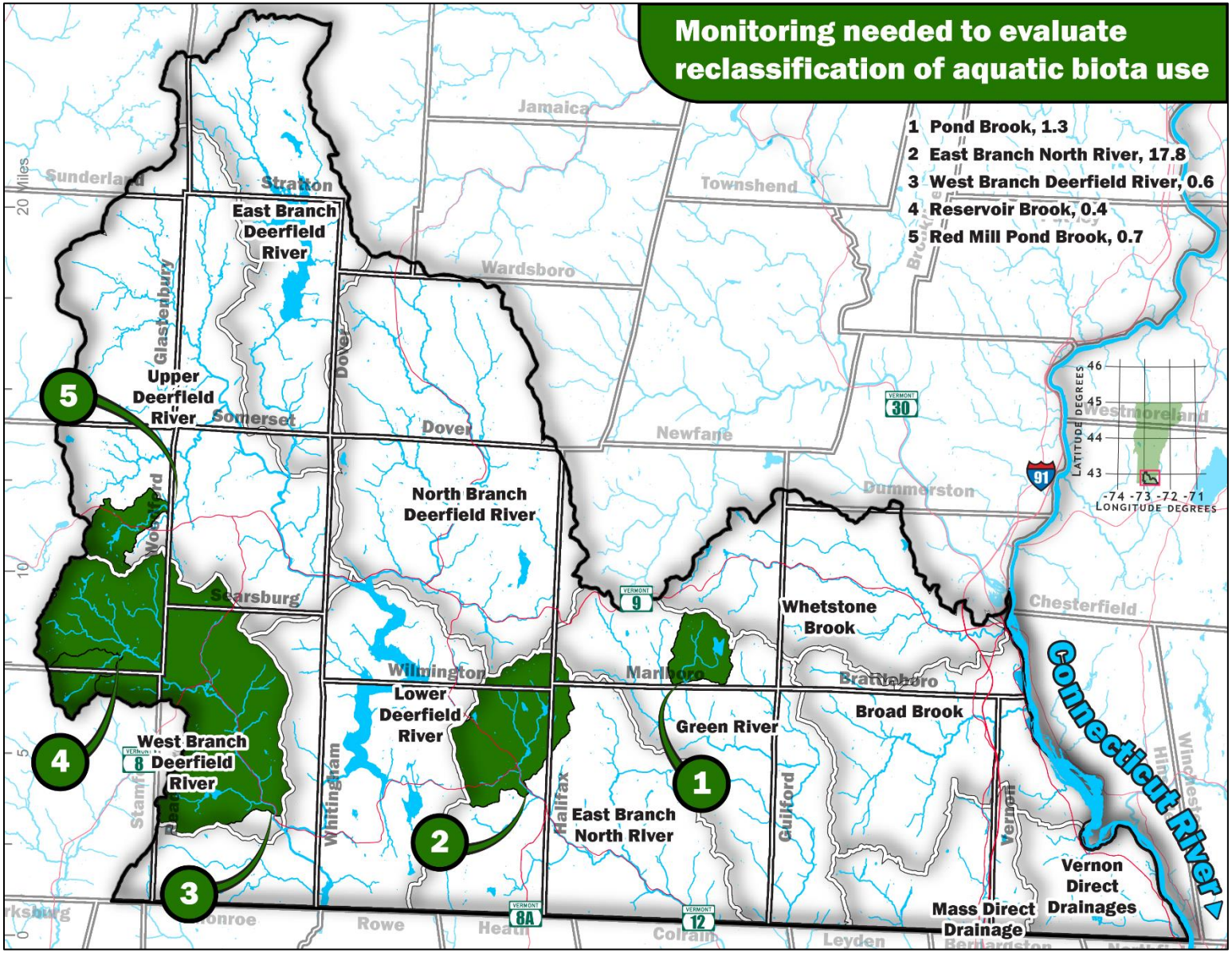

Figure 21 Map of rivers that require more monitoring to assess condition relative to A(1) or B(1) criteria for Aquatic Biota use.

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 22 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	Pond Brook, 1.3**	2023, 2024	2023, 2024
2	East Branch North River, 17.8	2025	2024, 2025
3	West Branch Deerfield River, 0.6	2026	2026
4	Reservoir Brook, 0.4	2026	
5	Red Mill Pond Brook, 0.7	2023, 2024	2023, 2024*

*Poor fish community, may be due to wetland influence.

**All data is from 2014, would require new set of data.

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 (Bioassessment Report).

Table23. Number and type of level 3 wetland assessments conducted across Basin 12. NWCA (National Wetland Condition Assessment). Heritage (Natural Heritage Inventory).

Heritage	Transect
3	3

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.

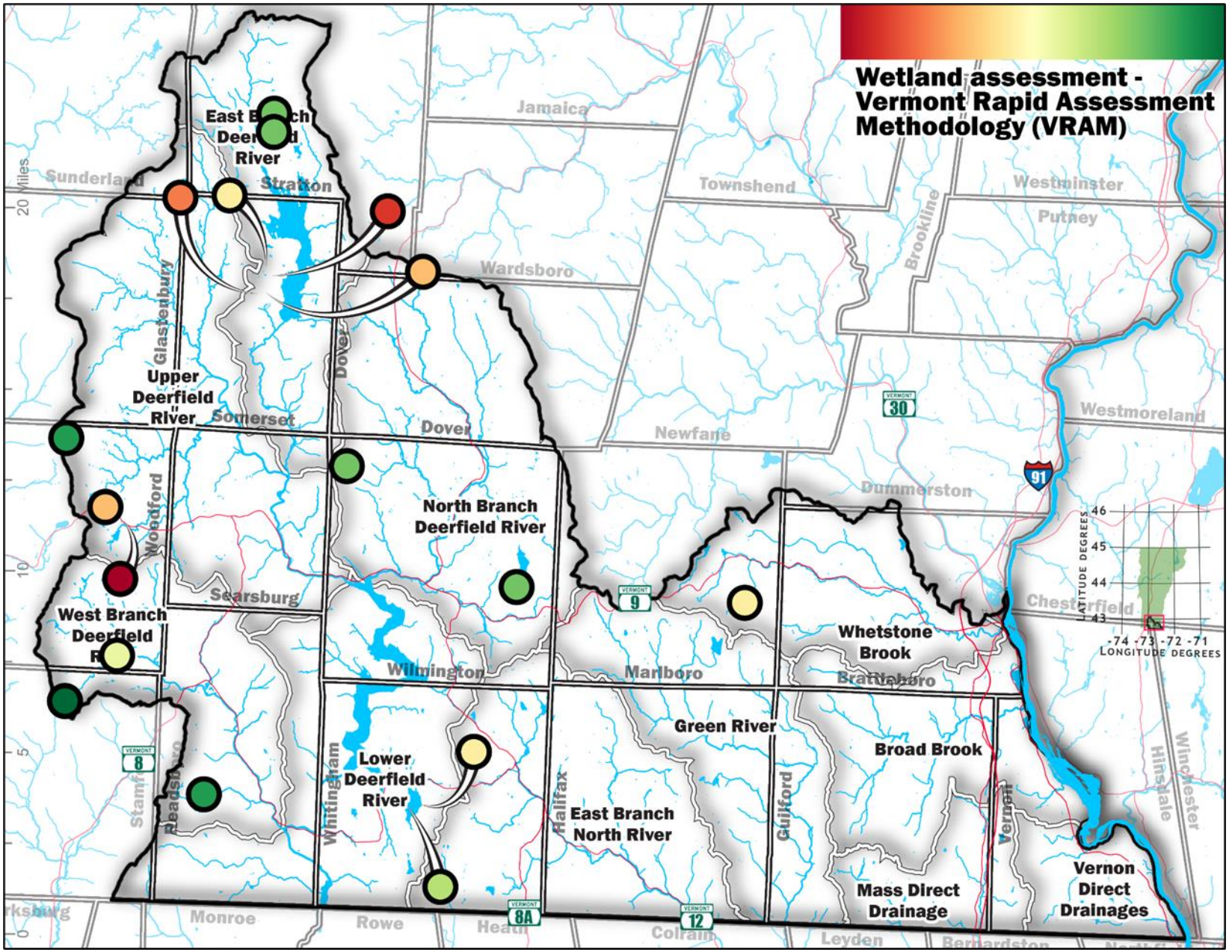

Figure 22. VRAM scores Basin 12.

Table 23 Number of VRAMs conducted in Basin 12, summarized by HUC12 sub-basins. Sub basin size in acres included for reference.

Name	Sub basin acres	VRAM Count
Broad Brook	692	0
East Branch Deerfield River	2611	6
East Branch North River	1111	0
Green River	544	0
Lower Deerfield River	953	2
Mass Direct Drainage	445	0
North Branch Deerfield River	1220	2
Upper Deerfield River	3538	4
Vernon Direct Drainages	463	0
West Branch Deerfield River	1768	3
Whetstone Brook	474	1

Wetland restoration monitoring

In 2017, the Wetlands 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).

There are no restoration sites in Basin 12.

Class I 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 no Class I wetlands in Basin 12.

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

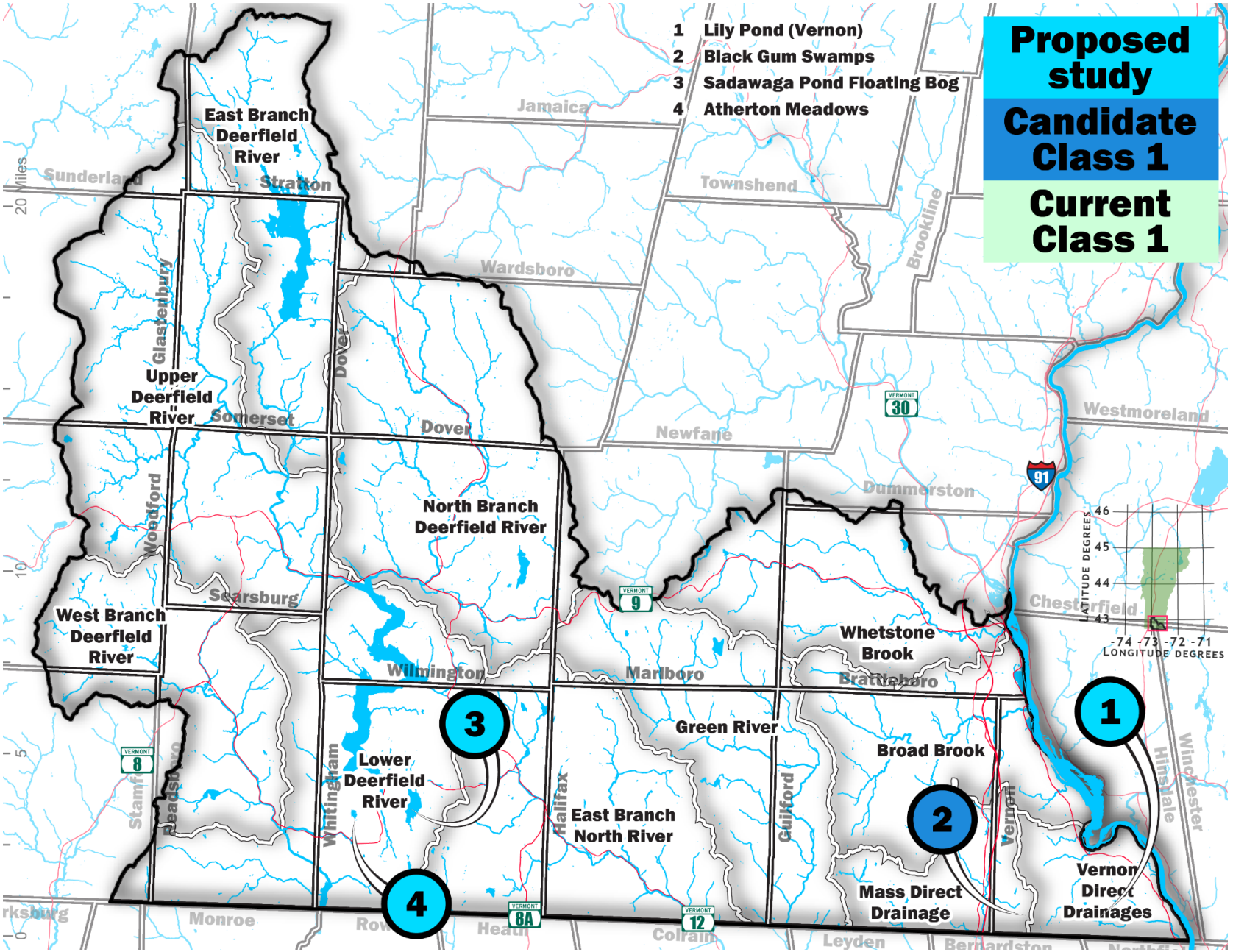

Figure 23.Class 1 wetland candidates.

Table 24. Candidate Class 1 wetlands in Basin 12

Map ID	Wetland name	Category	Towns
1	Lily Pond	Proposed for Study	Vernon
2	Black Gum Swamps	Candidate	Vernon
3	Sadawaga Pond Floating Bog	Proposed for Study	Whitingham
4	Atherton Meadows	Proposed for Study	Whitingham

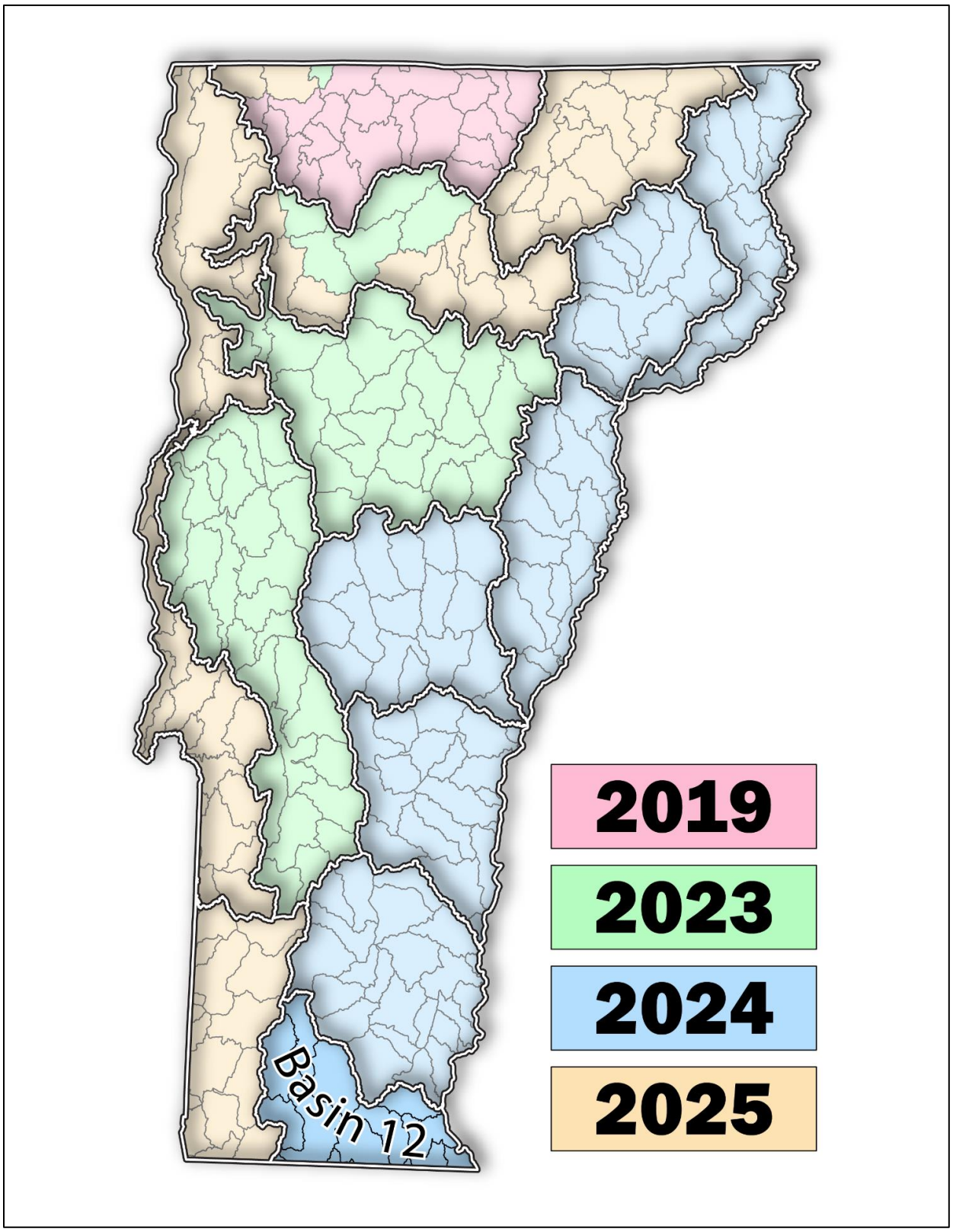

Figure 24. Wetland mapping schedule for Vermont Tactical Basins. Mapping is scheduled for 2024 in Basin 12.

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.