PROGRESS REPORT ON
RIVER BASIN WATER QUALITY MANAGEMENT PLANNING
(TACTICAL BASIN PLANNING)

DURING 2016

10 VSA 1253(d)

Submitted to the

HOUSE COMMITTEES ON:
AGRICULTURE AND FOREST PRODUCTS
NATURAL RESOURCES AND ENERGY
FISH, WILDLIFE AND WATER RESOURCES

SENATE COMMITTEES ON:
AGRICULTURE
NATURAL RESOURCES AND ENERGY

VERMONT AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

JANUARY 3, 2017

Section 1) Introduction and Summary

In 2015, the Vermont Agency of Natural Resources, Department of Environmental Conservation (DEC, or Department) and its federal, state, municipal, regional and local watershed partners continued to be engaged in tactical basin planning process in all of Vermont's planning basins. The goal of the process is to develop tactical water quality watershed management plans for each of 15 planning basins that are built within a two-year timeframe, are revisited every five years, and for which implementation tables of priority actions are continually updated. Tactical basin planning is carried out for the Department by the Watershed Management Division (Division). The Monitoring, Assessment and Planning Program (MAPP) bears primary responsibility for implementing the basin planning process, and fostering effective partnerships, particularly with the Agency of Agriculture, the Natural Resources Conservation Service, Regional Planning Commissions, and the Conservation Districts of the Natural Resources Conservation Council.

The overall goal for each tactical basin water quality management plan is to establish and carry out strategies that will protect, maintain, enhance or the surface waters of the basin by directing regulatory, technical assistance, and funding to highest-priority sub-watershed areas. This report is prepared in fulfillment of 10 VSA §1253(d)(1), which states:

"The Secretary shall prepare and maintain an overall surface water management plan to assure that the State water quality standards are met in all State waters. The surface water management plan shall include a schedule for updating the basin plans. (...) On or before January 15 of each year, the Secretary shall report to the House Committees on Agriculture and Forest Products, on Natural Resources and Energy, and on Fish, Wildlife and Water Resources, and to the Senate Committees on Agriculture and on Natural Resources and Energy regarding the progress made and difficulties encountered in revising basin plans. The report shall include a summary of basin planning activities in the previous calendar year, a schedule for the production of basin plans in the subsequent calendar year, and a summary of actions to be taken over the subsequent three years."

Basin plans and the basin planning process are required by Vermont Statute in 10 V.S.A. 1253(d), Section 29A-103(e) of the Vermont Water Quality Standards, and the U.S. EPA 40 Code of Federal Regulations Part 130, Section 130.6 – Water Quality Management Plans. The surface water management plan described by 10 V.S.A. 12453(d), called the Vermont Surface Water Management Strategy, or "SWMS," was updated in 2016 to incorporate several new regulatory authorities conferred to the Vermont pursuant to the Vermont Clean Water Act (Act 64 of 2015). The SWMS was also amended to incorporate by reference the allocations of the Lake Champlain Phosphorus TMDL, as required by 40 Code of Federal Regulations Part 130, Section 130.7(d)(2). Lastly, the SWMS was updated to incorporate the water quality commitments embedded in the September, 2016 Lake Champlain Phase I Implementation Plan. The complete SWMS may be found at http://dec.vermont.gov/watershed/map/strategy.

During 2016, substantial progress was achieved in basin planning. In addition to the public review, responsiveness revisions, and approval by ANR Secretary Markowitz of the tactical basin plans listed below, the Department continued to modernize and evolve the tactical planning process to meet the challenges of the Lake Champlain TMDL, and a forthcoming phosphorus TMDL for Lake Memphremagog. This evolution, is described in section two of this report, and comprises the Department's statement of 'progress and difficulties.' The summary of expected basin plan production

over the coming year and three-year projection of actions is found in section three. Section four provides an overview of basin specific highlights.

Basin plans that were approved or issued for comment during the reporting period include:

Battenkill, Hoosic, Walloomsac Tactical Basin Plan. Approved January, 2016

Lamoille Basin Tactical Plan and Phase II Lake Champlain TMDL Implementation Plan. Approved December, 2016

Missisquoi Bay Basin Tactical Plan and Phase II Lake Champlain TMDL Implementation Plan. Approved December, 2016

West, Williams, Saxton's Tactical Basin Plan. Approved January, 2016.

The Lake Memphremagog Phosphorus TMDL and Lake Memphremagog and Coaticook Basin Tactical Basin Plan. Public Review Draft January, 2017

Section 2) Tactical Basin Planning Process – Progress in 2016.

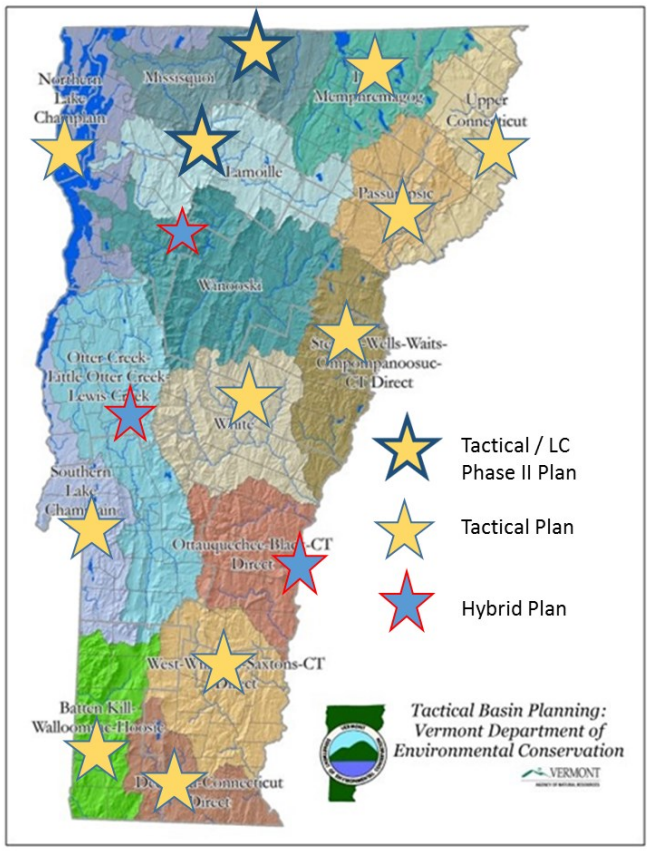


Figure 1. Vermont's 15 Tactical Planning Basins, and the status of each basin plan.

Tactical Basin Plans integrate watershed modeling, water quality monitoring, sector-specific pollution source assessments, water quality modeling, and stakeholder input to document geographically-explicit actions necessary to protect, maintain, enhance, and restore surface waters. These efforts are implemented through a combination of federal and state funding sources, partner support, internal agency support, and for certain protection efforts, the public rulemaking process.

In 2016, MAPP supported tactical planning across all basins in Vermont. Figure 1 indicates the current basin plan type that is available within each of Vermont's 15 planning basins. Tactical basin plans are considered the modern standard, which present precise, geographically-explicit implementation tables identifying those projects necessary to protect, maintain, enhance, and restore surface waters. In Lake Champlain watersheds, tactical plans also will feature so-called "Phase II" content to support the Lake Champlain Phosphorus TMDLs issued by USEPA (see below in this report). There are no-longer basins that feature traditional basin plans, and only three basins remain that are covered by

hybrid traditional-tactical plans. Prior year Legislative Reports discuss the differences between the old traditional basin plans, the ~ 2010-2012 hybrid plans, and modern tactical basin plans.

Table 1 (below) provides an indication of the planning status for each Vermont basin for the reporting period, with a more detailed view of activities in each planning basin provided in Section four. Below, we describe the results of business process improvement efforts which the Division led, using Lean business process improvement approaches, to further modernize the tactical planning process, and to align planning and funding activities. In addition, new modeling capabilities that have been developed using resources conferred by Act 64 and other partners are also described. The required plan production schedule is shown below and in Section 3 of this report.

Table 1. Overall Status of Basin Planning as of 1/15/2017.

Basin	Year of most recent plan issuance	Planning phase for 2017
Basin 1 Battenkill, Walloomsac, Hoosic	2016	Implementation
Basin 2 and 4 Poultney, Mettawee, Lower Champlain Direct	2014	Planning – draft due fall, 2017, to include Lake Champlain Phase II Implementation Plan.
Basin 3 Otter, Little Otter, Lewis	2012	Implementation Lake Champlain Phase II Implementation Plan to be developed during 2017.
Basin 5 Upper LC, LaPlatte, Malletts Bay, St. Albans Bay, Rock, Pike	2015	Implementation Lake Champlain Phase II Implementation Plan to be developed during 2017.
Basin 6 Missisquoi	2016	Implementation
Basin 7 Lamoille	2016	Implementation
Basin 8 Winooski	2012	Planning Lake Champlain Phase II Implementation Plan to be developed during 2017.
Basin 9 White	2013	Planning
Basin 10 (13) Ottauquechee, Black	2012	Planning
Basin 11 & 13 Williams, West, Saxton's, Lower CT,	2016	Monitoring, Implementation
Basin 12 & 13 Deerfield, Lower CT, Mill	2014	Implementation

Basin	Year of most recent plan issuance	Planning phase for 2017
Basin 14 Stevens, Wells, Waits, Ompompanoosuc	2015	Monitoring, Implementation
Basin 15 / 16 – Northern CT River Watersheds	2014	Monitoring, Implementation
Basin 17 Memphremagog, Coaticook, Tomifobia	2012	Lake Memphremagog phosphorus TMDL and new Tactical Plan in public review as of this publication.

Lean – Improvements in Tactical Basin Planning and in the Integration of Clean Water Initiative (CWI) Funding for Enhanced and Restored waters

Last year, this report described the outcomes of Lean business process improvement analysis aimed at streamlining and rendering transparent the process of identifying prospective water quality improvement projects. The subsequent Lean business process improvement plan focused on five major outcomes:

1) Standardize the process by which tactical plans are developed, based on a common approach to analyzing water quality monitoring data, and sector-specific assessment reports.
2) Construct a new database system that will be made publicly available, into which all projects identified by any given tactical basin plan may be entered;
3) Populate this database with existing tactical plan implementation table items, and for those basins in active planning, create the implementation tables from whole-cloth within the database;
4) Develop a process by which prospective projects are evaluated for readiness and funding priority based on readily defined criteria (or gates), and a sequence of planned project lifecycle stages. These are known as the stage-gate criteria;
5) Align grant allocation mechanisms of Ecosystem Restoration and related Clean Water Initiative (CWI) grants issued by DEC with the stage-gate criteria to ensure that high-priority projects within implementation tables are funded at the earliest time appropriate.

Substantial progress was made towards these efforts during 2016. The process of standardizing tactical basin plans was completed, and was further complemented by new water quality modeling analyses that are described subsequently in this report. The database, which was simply a vision in as of 2015, has been completed, and is in use to support all 15 tactical basin plans. Called the Watershed Projects Database, this system houses the complete implementation tables of the newly issued Missisquoi and Lamoille tactical basin plans, and available projects and implementation actions from other tactical basin plans are being entered on an on-going basis. At present, the reader may review the current "beta" form of the Watershed Projects Database, by clicking this link to see specific identifiable projects.

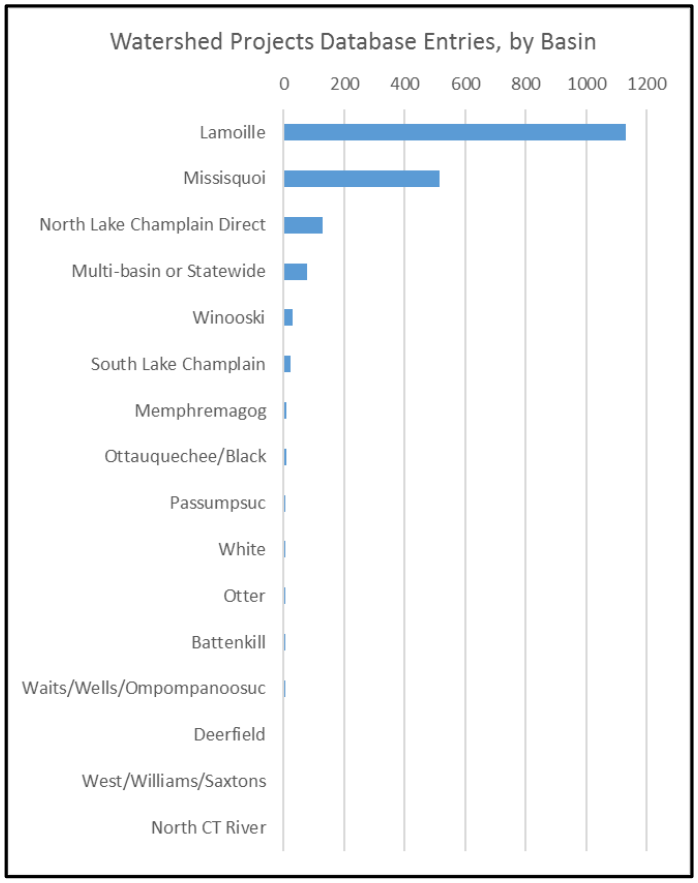


Figure 2. Count of water quality projects in the Watershed Projects Database, as of this writing. The lack of identified projects in any given basin only indicates that data-entry is not yet complete.

Within the database, each specific project is attributed the stage-gate criteria, which are manipulated by DEC's basin planners and key planning partners such as Regional Planning Commissions based on factors such as nutrient reduction benefit, hazard mitigation or other co-benefits, municipal factors, and compliance with State water quality policies. DEC planning staff are working with Regional Planning Commissions and Natural Resources Conservation Districts to populate the database with "shovel-ready" projects for all basins, and all implementation table projects that may exist for each basin for which new plans are due this year. DEC envisions that the Watershed Projects Database will be populated to contain existing projects for these two basins (South Lake Champlain, Ottauquechee/Black by the end of 2017, and remaining areas of the State in the subsequent year.

The value of the Watershed Projects database extends beyond tactical basin planning. Indeed, the same system is also being used to track the execution of projects, and for the Lake Champlain (and soon Lake Memphremagog) basins, to document on-going phosphorus reductions. The 2016 Clean Water Initiative Funding Report, coordinated by the Watershed Management Division's Clean Water Initiative Program pursuant to Act 64 provides a set of financial, social, programmatic, and environmental indicators that are being produced by the Watershed Projects Database. As of this writing, there are 1,954 projects contained in the Watershed Projects database, which are distributed among tactical planning basins as shown by Figure 2.

Water Quality Modeling to support Tactical Planning, and Phase II Implementation Plans for the Lake Champlain TMDL

Under the US Environmental Protection Agency's TMDL process, the programs and management approaches spelled out by the Lake Champlain TMDL Phase I Implementation plan are being expanded into geographically-explicit planning-level load and wasteload sub-allocations, by subwatershed. These explicit, "Phase-II" plans comprise the blueprints by which the TMDL is to be accomplished.

As described in the final Champlain Phase I Plan, this work has required a significant investment of water quality modeling capacity into the planning process. Two complementary efforts have come together to provide for high-resolution phosphorus discharge modeling for very fine scale sub-watersheds of the Lake Champlain Basin. These are 1) the forthcoming Clean Water Roadmap, and 2) the publication of the first Phase II TMDL plans within the tactical plans for the Lamoille and Missisquoi Basins.

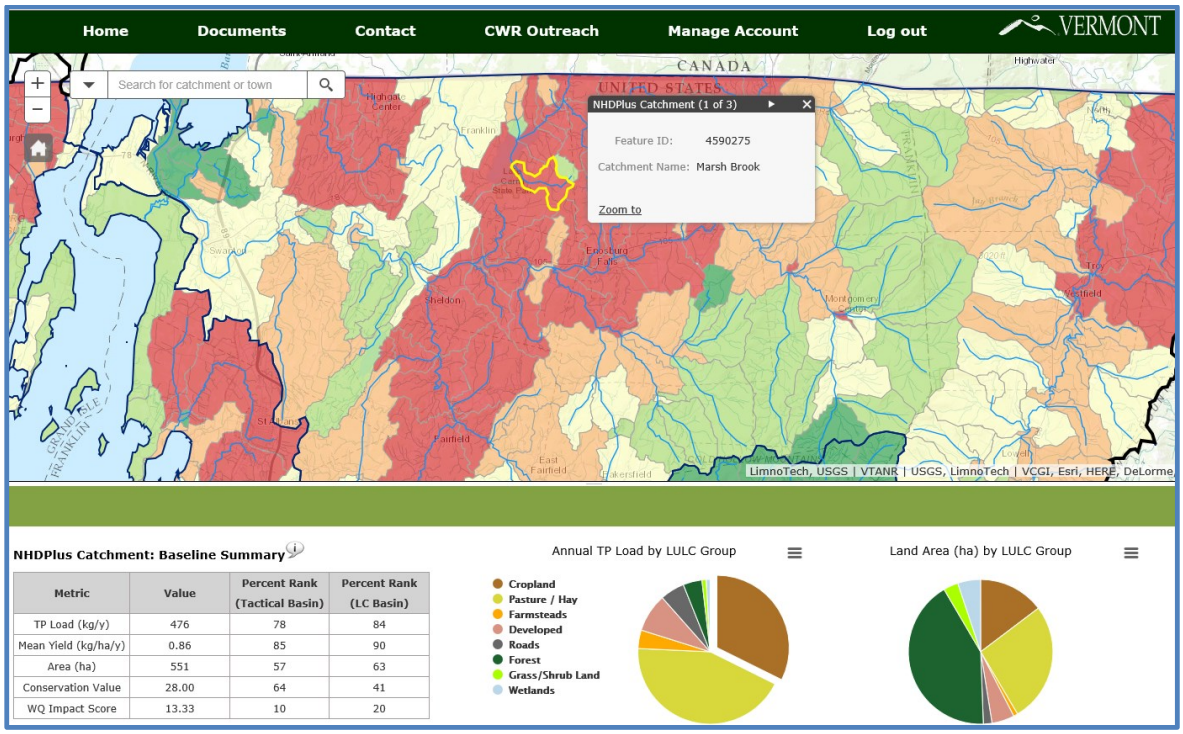
Clean Water Roadmap

The Clean Water Roadmap Tool (CWR) is a partnership between DEC, Keurig-Green Mountain Coffee Roasters, the Nature Conservancy (TNC), and other stakeholders. The overall goal of the CWR is to 'map' the results of the Lake Champlain Soil Water Assessment Tool (SWAT) model and associated follow-on products, especially EPA's Best Management Practices (BMP) Scenario Tool, along with management actions contained in DEC's Tactical Basin Plan implementation tables and tracking systems. The CWR will provide a description of *one way* the LC TMDL phosphorus reductions can be achieved, largely based on EPA's reasonable assurance scenario.

The CWR will be a map-based application that allows users to click on a specified watershed and receive a summary report of relevant best management practices (BMPs) and ultimately, associated implementation table activities in the selected area. BMP suitability will be assessed using the landscape criteria in SWAT and EPA's Scenario Tool, while implementation table activity locations will be based on data in DEC's BMP tracking database. The summary data will also include estimated phosphorus loadings based on SWAT modeling. Additional relevant spatial information, such as township boundaries, partner data (TNC's Conservation Blueprint for Water Quality), hydrologically connected backroads, etc., may also be included. The CWR can be used by regional planners, the public, and DEC staff to identify priority areas and actions for Lake Champlain phosphorus reductions.

Figures 3 and 4 provide one example of the functionality of the Clean Water Roadmap to estimate phosphorus runoff and practice effectiveness. In this example, the Marsh Brook tributary to Lake Carmi, in Franklin VT was selected. Figure three shows baseline estimated phosphorus loading to Lake Carmi of 476 kg/yr. In Figure 4, three hypothetical practices were applied: cover crop to 100% of corn land; ditch buffers applied to 100% of hay land (a Required Agricultural Practice (RAP)), barnyards are managed to minimize runoff. The model estimates a 126 kg reduction in annual phosphorus loading.

Figures 4 and 5 provide a second example of the functionality of the Clean Water Roadmap. In this example, road runoff practices addressing road ditches were applied to roads in the catchment. The baseline loading was 126 kg/year, and the practices are modeled to achieve a phosphorus reduction of 18%.



Metric	Value	Percent Rank (Tactical Basin)	Percent Rank (LC Basin)
TP Load (kg/y)	476	78	84
Mean Yield (kg/ha/y)	0.86	85	90
Area (ha)	551	57	63
Conservation Value	28.00	64	41
WQ Impact Score	13.33	10	20

Figure 3. Clean Water Roadmap, showing total phosphorus loading from the Marsh Brook sub-watershed of Lake Carmi, Franklin, VT. This is the scale at which total phosphorus loads have been estimated for every sub-watershed in the Lake Champlain basin.

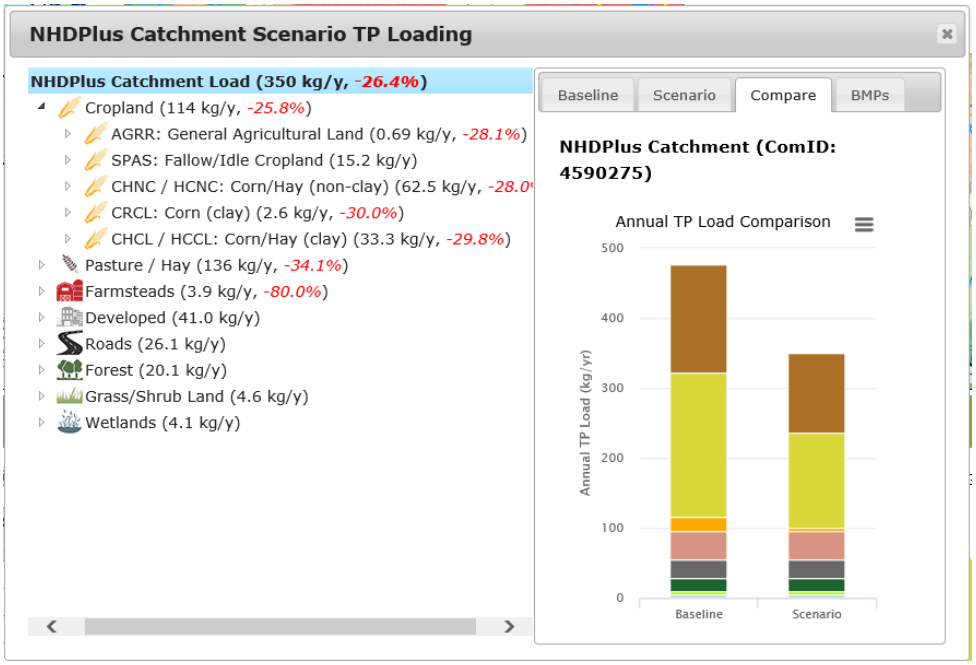


Figure 4. Clean Water Roadmap, example scenario whereby cover crop is applied to 100% of corn land in the Marsh Brook sub-watershed of Lake Carmi, Franklin, VT, RAP-compliant buffers are applied to all hayfields, and all barnyards are managed to minimize runoff. A substantial total phosphorus load is modeled to be achievable based on this practice.

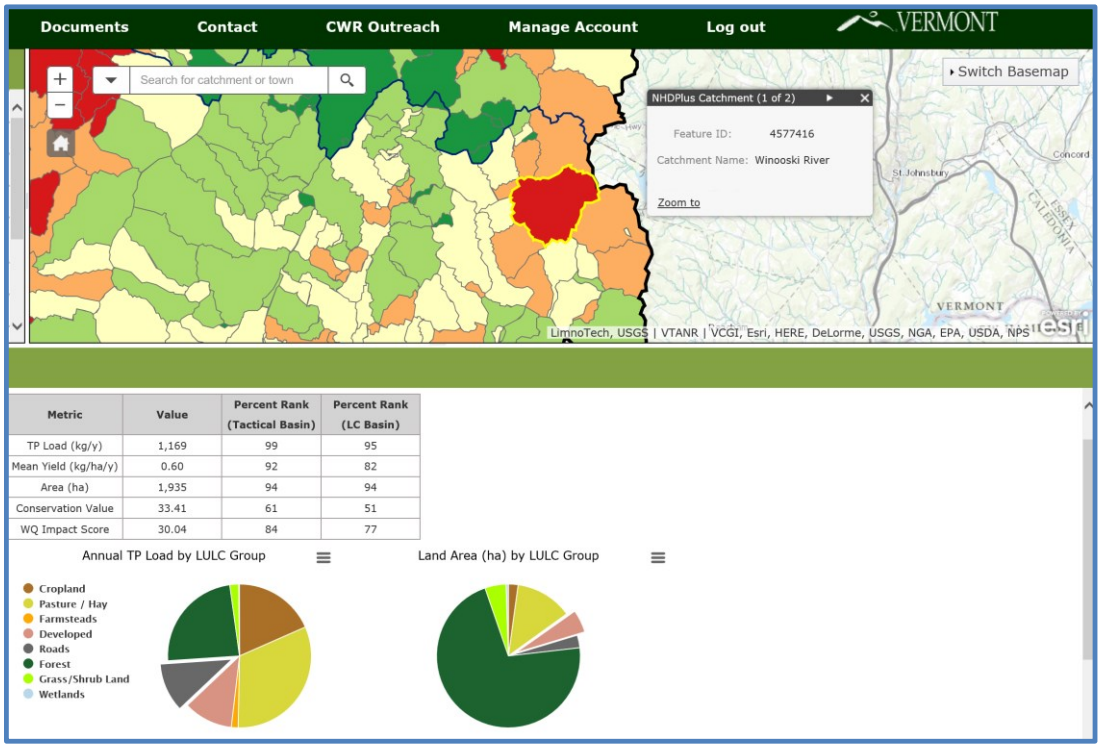


Figure 5. Clean Water Roadmap, showing total phosphorus loading from a small area of the upper Winooski River basin, in Calais. A substantial proportion of phosphorus loading is attributable to the road network in this catchment.

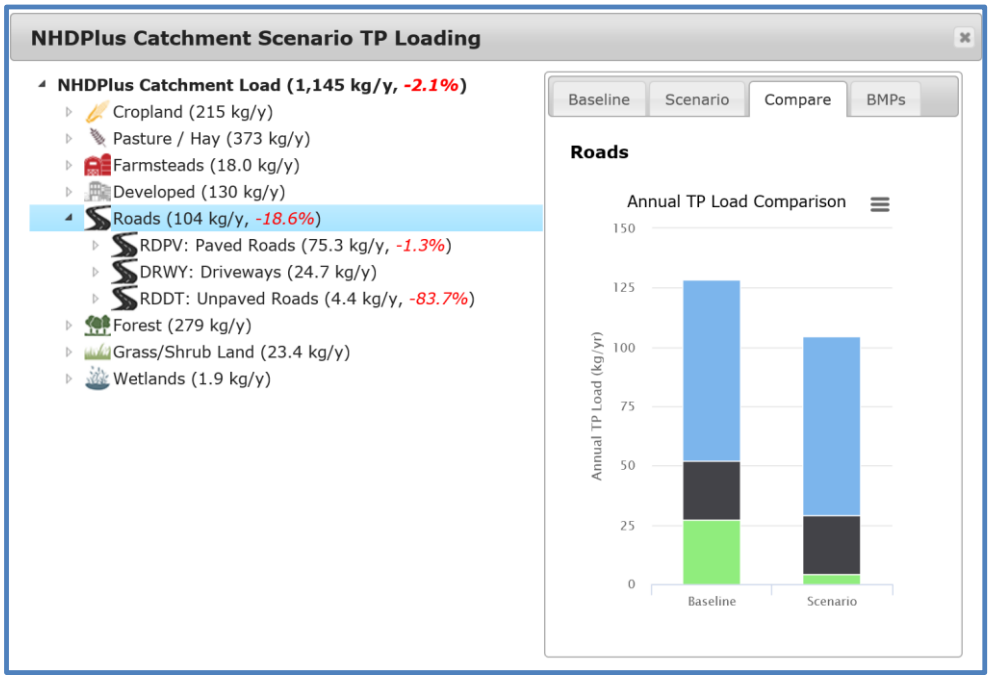


Figure 6. Clean Water Roadmap, example scenario whereby road practices are applied to 10% of connected roads, in a small sub-watershed of the Winooski River, in Calais. This is one practice that will be required by the Municipal Roads General Permit. A substantial total phosphorus load is modeled to be achievable based on this practice.

Phase II TMDL Plans

The new Lamoille and Missisquoi Tactical Basin Plans, and all subsequent Lake Champlain and Lake Memphremagog basin plans do or will contain content as described below. Using the modeling analyses provided by the Clean Water Roadmap, MAPP's planners and scientists have developed downscaled, planning-level estimates of required nutrient reductions at geographic scales that are appropriate to the regulatory program under which the reductions are to be compelled. For example, planning estimates of total phosphorus reductions that may be achieved by controlling runoff from municipal roads under the Municipal Roads General Permit are most useful at the municipal scale. By contrast, the scale of analysis relevant to the management of State highways is larger – reflective of a moderate sized stream watershed (called a "HUC 12" watershed, such as the Lewis Creek, or Huntington River). In some instances, the finer resolution "catchment" scale, which is a small stream watershed, is appropriate.

Table 2 shows the analyses that are being developed for every Lake Champlain basin, broken down by land use sector, the category of allocation, regulatory program, and scale of analysis. It is important to note that the resulting phosphorus reduction targets are not intended to be binding to each geographic area simply because of publication in a tactical basin plan. The USEPA's TMDLs set the allocations and required reductions at the whole-basin scale. The smaller-scale phosphorus load estimates and target reductions provide planning tools for municipalities or other affected jurisdictions, and identify appropriate BMPs or regulatory programs to achieve the reductions. DEC will track the ongoing implementation of projects accomplished across all sectors by means of the Watershed Projects database described above, to determine incremental progress towards attainment of the allocations of the TMDL. More information about project tracking is provided in the Clean Water Initiative Funding Report. The reader can see a complete Phase II TMDL plan in either the Lamoille or Missisquoi Tactical Basin Plan.

Table 2. Phase II TMDL sub-allocation analyses presented in tactical basin plans.

Land Use Source	Category	Allocation Category	Regulatory Program	Scale of Analysis
Forest	All lands	Load	Accepted Management Practice Rule	Catchment
Stream Channels	All streams	Load	Act 138	HUC 12*
Agriculture	Fields/pastures	Load	Required Agricultural Practice Rule, LFO Rule, MFO Rule	HUC 12
	Production Areas	Wasteload		
Developed Land	VTRANS owned roads and developed lands	Wasteload	TS4 Permit Rule	HUC 12
	Roads MRGP		MRGP Permit	Municipality
	MS4		MS4 Permit	Municipality
	Larger unregulated parcels		Three-acre permit	Catchment / municipality
Wastewater	WWTF discharges		NPDES Direct Discharge Permit	Facility

*) HUC12 refers to a moderate-sized watershed such as the upper Mad River, or Whetstone Brook

The Role of Regional Planning Commissions in Tactical Basin Planning

During the past year, and as part of the implementation of Act 64 (Sec. 43), DEC continued to contract with Regional Planning Commissions to fulfill the specific roles and responsibilities around the development of tactical basin plans as articulated in Sections 26 and 27 of Act 64. Through this cooperative process, the Vermont Association of Planning and Development Agencies (VAPDA) and DEC have set forth a series of activities that each Regional Planning Commission (RPC) shall undertake in support of tactical planning for all watersheds in the State. This new organizational alignment recognizes that significant municipal outreach is now needed to develop understanding of Act 64 authorities, develop tactical basin plans, assist municipalities, and ultimately to track the implementation of the projects and BMP installations that are carried out by municipalities or RPC and municipal partners. The roles and responsibilities articulated in the SFY2016 and SFY 2017 performance contract with RPCs specifically acknowledges the strengths of the RPCs in supporting municipal activities aimed at water quality protection and restoration. The contracted activities under the SFY2016 and SFY2017 contract include:

1) Increase municipal awareness and readiness to implement Act 64 by conducting municipal outreach and education, and cross-program integration and coordination;
2) Promote resilience and water quality protection and improvement by providing municipal planning assistance;
3) Develop better information for municipalities by providing coordination of water quality monitoring, and oversight of independently funded assessments;
4) Provide municipal and regional input to assist in tactical basin plan development, including project prioritization;
5) Assist in the protection of high quality resources and documentation of restoration efforts by participating in tactical basin plan implementation.

For each RPC, the specific scope of work has been tailored to the status of each tactical plan, and to the constituencies of each RPC. There are performance tasks that are required statewide, certain tasks that are required in Champlain watershed RPCs, and still other tasks that an RPC may elect as optional but valuable activities. RPC staff and leadership highlighted the following successful aspects of the partnership this year:

- Progress towards prioritization of individual projects incorporating municipal considerations.
- Substantially augmented communication between DEC and RPC's over implementation of Act 64, focused thru the tactical planning process.
- Increased incorporation of DECs monitoring and assessment information in RPC-led outreach.
- Augmented collaboration with municipalities, prompted by the requirements of Act 64.
- Integration of tactical basin planning with other important planning activities, such as flood resiliency planning.
- Opportunity to enhance reclassification and designation of surface waters to achieve higher levels of protection.

The RPCs are providing tactical planning services that should substantially enhance DEC's ability to reach municipalities and other relevant stakeholders. Further, the contracted activities are developing augmented capacity in RPC's to support water quality protection and restoration. The outreach process undertaken in late 2016 by RPCs in support of tactical plan release and public comment has benefitted the Department by bringing municipalities into the planning process in a more forthright manner. In coming years, RPCs anticipate the opportunity to also assist municipalities with implementation of requirements of Act 64, including project management services. Thus, subject to the availability of funding that does not compete with other necessary support under Section 43 of Act 64, it is recommended that this partnership be expanded to maintain the momentum and capacity that is now becoming cemented through the DEC-RPC partnership.

An Added Focus on Protection

In addition to phosphorus reduction and other restoration priorities, tactical basin plans also identify surface waters that merit augmented protections through surface water reclassifications, Class 1 Wetland designation, or Outstanding Resource Water designation. During 2016, DEC worked with the General Assembly to support passage of Act 79, which amended §§10 VSA1251-1253. These amendments created a new classification of surface water uses, and allow for the independent classification of individual designated uses based on the quality exhibited by those uses.

Following passage of Act 79, the Department carried forth the rulemaking necessary to update the Vermont Water Quality Standards to be in alignment with Act 79. The Legislative Committee on Administrative Rules approved the new Water Quality Standards Rule in November of 2016, and the rule became effective December 15, 2016. As part of the Rule updates, the Department completed an ongoing and previously-reported reclassification effort to designate several dozen miles of streams in the Green Mountain National Forest from Class B to Class A(1). This action marks the first time a surface water was classified to a higher tier of water quality protection since 1989. The DEC Wetlands Program also initiated rulemaking to designate four high-quality wetlands of particularly rare types to Class 1. The MAPP will continue to identify surface waters where Class B(1) management objectives are demonstrably and consistently attained, and promote these for reclassification through the tactical basin planning process. Likewise, the Program will continue to identify surface waters that are suitable for Class A(1), Class 1 Wetland, or ORW designation.

Section 3) Schedule for the development of Tactical Basin Plans and Subsequent Actions

In this section, a five-year schedule for tactical basin plan production is provided, along with a statement of action items that are being undertaken over the coming three years. Table 2 provides the 2017 status of planning across all watersheds, while Table 3 provides an overview the coming years.

Chapter 10 VSA 1253 also directs that this annual legislative report present a summary of actions to be undertaken over the subsequent three years. In any given tactical basin plan implementation table, those actions identified as required assessments to implement a regulatory requirement (e.g., municipal roads inventory, or phosphorus control plan for an community that is regulated under the municipally-separated storm sewer permit program), will necessarily be accomplished during the initial stages of basin plan implementation, in compliance with the requirements of the permit programs. For follow-up implementation projects, it is difficult to project with specificity which actions from any given basin plan's implementation table will be executed over the coming year, and thus summarizing those actions in a report of this nature presents guesswork. We interpret the legislative intent of this charge as a requirement to document the overall "game plan" at a high-level. The Implementation Table Summaries presented in the new Lamoille and Missisquoi Tactical Basin Plans give a strategic-level view of actions at the basin scale, and these are supplemented by expansive project and assessment lists in the Watershed Projects Database. In an effort to provide useful information to the Committees and other stakeholders at the level of specificity appropriate to an annual legislative report, the following is offered.

Generally, the Lake Champlain and forthcoming Lake Memphremagog TMDLs are envisioned to be implemented over a 20-year timeframe. Figure 7 provides a hypothetical representation of the pace at which nutrient reductions may be achieved under those TMDLs, juxtaposed against the timelines during which each new Act 64 regulatory program is being put into place.

Table 3. Tactical basin plan production schedule.

Basin and Most Recent Plan Status	Major Watershed	Planner	Activity	2015	2016	2017	2018	2019	2020
Basin 15 – Passumpsic June 2014 – Tactical Plan	CT RIVER	Ben Copans	M+A	Mon	Assess				Mon
			Planning			Start	Finish		
Basin 16 – Northern Conn June 2014 – Tactical Plan			M+A			Mon	Assess		
			Planning					Start	Finish
Basin 17 - Memphremagog June 2012 – Tactical Plan			M+A	Assess				Mon	Assess
			Planning	Start	Finish				»
Basin 1 – Hoosic, Battenkill Draft due Oct. 2015		Ethan Swift	M+A				Mon	Assess	
			Planning	Finish					
Basin 2 and 4 – Poultney, Mettawee, South Lake June 2014 - Tactical	CHAMPLAIN		M+A	Mon	Assess				Mon
			Planning		Start	Finish			
Basin 3 – Otter, Lewis, Little Otter May 2012 – Traditional/Tactical Hybrid			M+A		Mon	Assess			
			Planning				Start	Finish	
Basin 7 – Lamoille February 2009 – Traditional Plan	CHAMPLAIN	Danielle Owczarski	M+A	»			Mon	Assess	
			Planning	Start	Finish				
Basin 9 – White July 2013 – Tactical Plan	CT RIVER		M+A	Assess				Mon	Assess
			Planning			Start	Finish		
Basin 14 – Stevens, Wells, Waits, Ompompanoosac			M+A			Mon	Assess		
			Planning	Finish				Start	Finish
Basin 5 – Northern L.C. Direct August, 2015 – Tactical Plan	CHAMPLAIN	Karen Bates	M+A		Mon	Assess			
			Planning	Finish			Start	Finish	
Basin 6 – Missisquoi, Rock & Pike March 2013 – Traditional Plan			M+A	»			Mon	Assess	
			Planning	Start	Finish				
Basin 8 - Winooski May 2012 – Traditional/Tactical Hybrid			M+A	Mon	Assess				
			Planning			Start	Finish		
Basin 10 (13) – Black, Ottauquechee May 2012– Traditional/Tactical Hybrid	CT RIVER	Marie Caduto	M+A	Assess				Mon	Assess
			Planning		Start	Finish			»
Basin 11 & 13 –West, Williams, Saxtons Draft due Oct. 2015			M+A			Mon	Assess		
			Planning	Finish					Start
Basin 12 & 13 – Deerfield, Broad Brook March 2014– Tactical			M+A		Mon	Assess			
			Planning				Start	Finish	

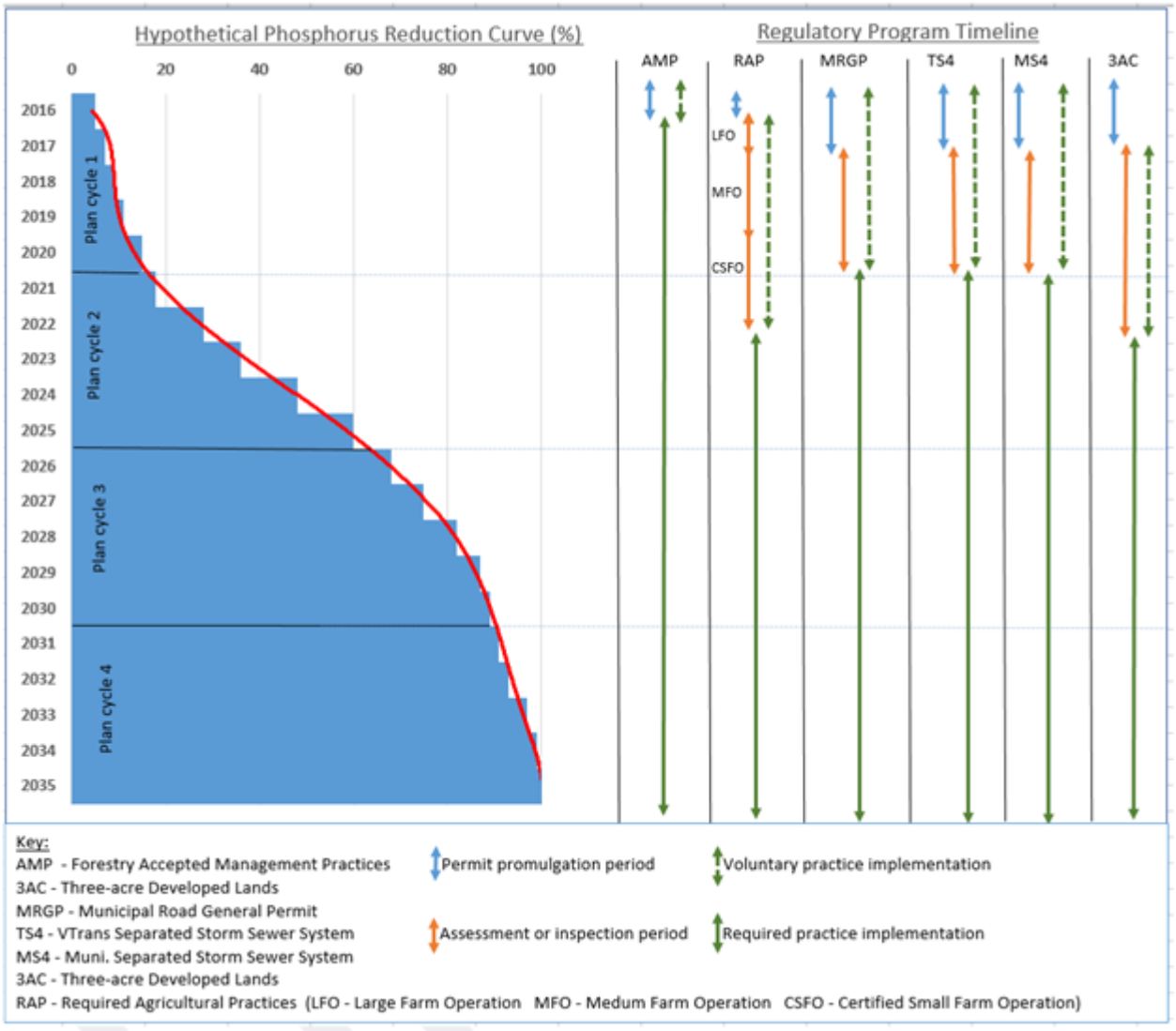


Figure 7. Theoretical phosphorus reduction, relative to the load and wasteload reductions required by the LC TMDL. The timelines for regulatory programs and basin plan updates are also shown.

The capability for the State to compel reductions in the first five-year iteration of tactical plans for these TMDL watersheds is limited by the timelines set forth by Act 64 for the establishment and promulgation of the permit programs. In other words, the State cannot compel, for example, the reduction of phosphorus from specific municipal road segments, until: 1) that permit program has been established; 2) the municipality has applied for coverage under that program; and, 3) the municipality has completed their road assessment, and staged a plan for implementation based on the most effective phosphorus reduction efforts. Figure TMDL 4 provides the timelines for permit promulgation, permit application and assessment/inspection, and implementation. These timelines do not, however, preclude any particular landowner or municipality from taking action sooner on specific projects, and many owners or municipalities have done so. These caveats provided, Table 4 presents the categories of priority actions that are identified by tactical basin plan implementation tables that will be conducted in the initial years of a basin plan implementation cycle, by sector.

Table 4. Three-year outlook for actions established by tactical basin plans.

Land Use Source	Category	State actions	Permittee / municipal / landowner actions
Forest	All lands	-Implement AMP rule -Identify landowners with upcoming harvests, and conduct targeted outreach	-Implement provisions of AMPs -Engage with Conservation Districts and State Foresters to employ WQ friendly practices such as portable skidder bridges -Consider modifications to forest management plans to emphasize use of ESTAs.
Stream Channels	All streams	-Support funding of highest-priority floodplain or corridor protection projects -Implement Floodplain and River Corridor Rule	-Adopt municipal zoning to protect river corridors -Enter into agreements to secure easements for key corridor protection of flood attenuation assets
Agriculture	Fields/pastures	-Promulgate RAP Rule -Conduct inspections annually for LFO, every three years for MFO, every seven years for CSFO -Publish results of North Lake Farm Survey and other similar surveys -Conduct high-resolution targeted BMP planning to assist landowners. -Engage watershed teams to provide technical assistance -Provide financial assistance	-Implement RAPs -Engage in AAFM or NRCS cost-share programs to offset costs of BMP installations.
	Production Areas		
Developed Land	VTrans owned roads and developed lands	-Promulgate "TS4" permit program 2016-2017	-Conduct assessments on a HUC12 basis -Implement priority projects resulting from assessments -Sequence implementation with planned major road upgrade projects.
	Roads MRGP	-Promulgate MRGP permit program by end of 2017 -Provide funding for targeted municipalities to conduct road inventories through Better Roads or other funding sources	-Conduct inventories to derive capitol road improvement plans. -Apply for coverage for MRGP by 2021 -Implement capital improvement plans over 20-year timeframe.
	MS4	-Reissue MS4 permit program by end of 2017 -Provide financial support thru Clean Water Initiative or SRF funding	-Develop phosphorus control plans coincident with revised MS4 permit. -Implement Phosphorus Control Plans and Flow Restoration Plans over 20-year timeframe.

	Larger unregulated parcels	-Promulgate “Three-acre” permit -Provide financial support for designs	-Inventory three-acre parcels -Develop and implement designs to manage runoff in accordance with Stormwater manual.
	ALL	-Provide financial and technical support for stormwater master plans to identify highest priority stormwater management actions	-Apply for support to implement priority projects.
Wastewater	WWTF discharges	-Update NPDES direct discharge permits in accordance with wastewater policy set forth in TMDL, within two year after basin plan issuance	-Operate WWTF in accordance with permit conditions. -Initiate engineering performance reviews when capacity approached TMDL threshold trigger for augmented phosphorus reduction.

Section 4) Individual Basin Plan Contacts and Statements of Progress

Watershed Planning Basin	Contact and web links
• Basin 1 Battenkill, Walloomsac, Hoosic: • Basin 2 and 4 Poultney, Mettawee, Lower Champlain Direct • Basin 3 Otter, Little Otter, Lewis	Ethan Swift, Watershed Coordinator Department of Environmental Conservation 430 Asa Bloomer Building Rutland, Vermont 05701 802 490 6141 Ethan.Swift@vermont.gov
• Basin 5 Upper LC Direct, including LaPlatte, Malletts Bay, St. Albans Bay • Basin 6 Missisquoi Bay, including Pike and Rock • Basin 8 Winooski	Karen Bates, Watershed Coordinator DEC Regional Office 111 West Street, Essex Junction, VT 05452 802 490 6144 karen.bates@ vermont.gov
• Basin 7 Lamoille • Basin 9 White • Basin 14 (+16) Stevens, Wells, Waits, Ompompanoosuc, CT River Direct	Danielle Owczarski, Watershed Coordinator Department of Environmental Conservation 1 National Life Drive 2 Main Montpelier, VT 05620-3522 802 490 6167 danielle.owczarski@vermont.gov
• Basin 10 Ottauquechee, Black, CT River Direct (Mill, Lulls, Hubbard) • Basin 11 (+13) Williams, West, Saxton's, Lower CT Direct (Commissary, Morse, East Putney, Sacketts) • Basin 12 (+13) Deerfield, Lower CT Direct, (Crosby, Whetstone, Broad, Newton)	Marie Levesque Caduto, Watershed Coordinator 100 Mineral Street, Suite 303 Springfield, VT 05156 802 490 6142 Marie.Caduto@vermont.gov
• Basin 15 Passumpsic • Basin 16 Northern CT River Watersheds • Basin 17 Memphremagog, Coaticook, Tomifobia	Ben Copans, Watershed Coordinator Department of Environmental Conservation 1229 Portland Street St. Johnsbury, VT 05819 802 490 6143 ben.copans@vermont.gov
All tactical basin plans may be found online at this link: http://dec.vermont.gov/watershed/map/basin-planning	

Basin 1: Battenkill, Walloomsac, Hoosic

The Tactical Basin Plan for the the Batten Kill, Walloomsac, and Hoosic Rivers (tributaries to the Hudson River in New York) was approved in January 2016 and represented the first Tactical Basin Plan that has been developed for this basin. This plan identifies high priority actions to protect and restore surface waters for those watersheds, which includes all the land in Vermont that drains to the Hudson River in New York. The restoration and improvement opportunities address high elevation surface waters that are impaired due to acidity, and other surface waters with elevated levels of sediment and nutrients. In addition, there is a good deal of focus on protection opportunities that would attenuate flood and erosion hazard risks in basin waterways. The heart of this plan is the implementation table in Chapter 4, which includes actions to protect or restore surface waters in the basin. High priority stressors in the Hudson River Basin include Acidity (atmospheric deposition), Encroachment, Channel Erosion, Invasive Species, Thermal Modification, and Land Erosion.

In general, the Batten Kill, Walloomsac, and Hoosic Rivers are targeted for protection and restoration strategies while various tributaries are targeted for additional water quality and aquatic habitat monitoring and assessment work. This and all Tactical Basin Plans benefit from biennial implementation table updates. For this Hudson River Tactical Plan, ongoing efforts to build flood resiliency will be a featured priority in the first biennial review, to implement priority actions related to ongoing restoration efforts due to Tropical Storm Irene.

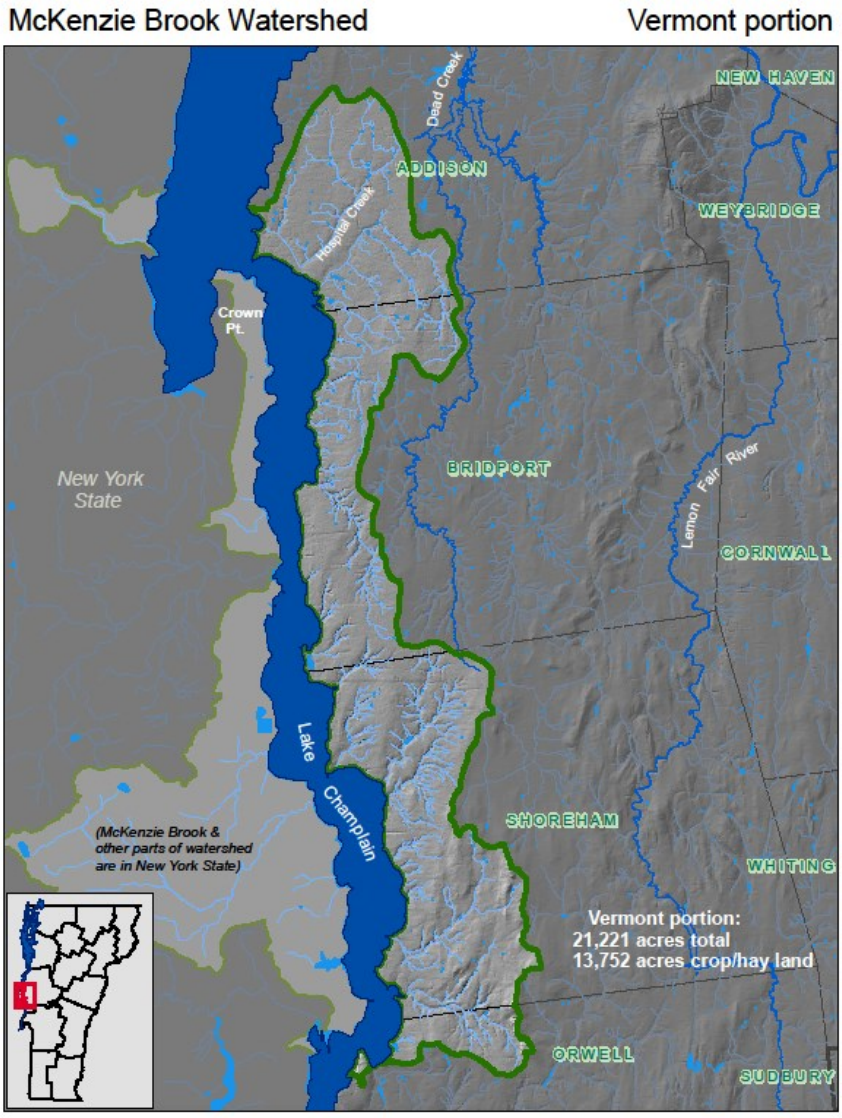
The Hudson River Tactical Basin Plan presents the integrated recommendations of State and Federal resource agencies (such the US Forest Service), the Bennington County Regional Planning Commission, Bennington County Conservation District, watershed organizations such as the Batten Kill Watershed Alliance and the Hoosic River Watershed Association, the Bennington County Regional Planning Commission, and individual citizens.

Recently funded projects through the State's Clean Water Initiative program include an alternatives analysis for a floodplain restoration project along the Roaring Branch of the Walloomsac River in Bennington (with the Bennington County Natural Resource Conservation District), and the development of a river cooridor plan for the Hoosic River with the Bennington County Regional Planning Commission. In addition, a Stormwater Master Plan was developed for the Town of Rupert that included a rural road focus to identify and mitigate sediment and nutrients from stormwater runoff into the White Creek and Mill Brook. Forthcoming projects funded under the FY17 Ecosystem Restoration Program include Stormwater Master Plans for the towns of Sandgate and Sunderland, and a gully stabilization project that was identified in the aforementioned Stormwater Master Plan developed for the Mill and White Brooks in Rupert.

Basin 2 and 4: South Lake Champlain Basin, including the Poultney and Mettawee Rivers

Recent focus on the South Lake and priority sub-basins has led to a multi-partner planning and BMP implementation effort as a result of the Lake Champlain Basin Regional Conservation Partnership Program (RCPP). The resource concerns addressed in this proposal include the national priorities of water quality and soil health. The primary resource concern is for water quality, due to excess nutrients and sediment pollution. The funding through the USDA has been awarded for the accelerated implementation of agricultural and forestry conservation practices in the Lake Champlain Watershed of Vermont and New York. Within the South Lake Basin, the McKenzie Brook watershed was selected due in part to the high percentage of agricultural land use and available water quality monitoring and assessment data in order to develop a targeted Watershed Improvement Plan for the McKenzie Brook sub-basin within the South Lake. In coordination with USDA-NRCS and UVM Extension, a Resource Assessment and Watershed Level Plan for Agriculture in the McKenzie Brook Watershed has been developed and is in the process of implementation.

This watershed plan, developed by Vermont USDA-NRCS and partners (State of Vermont Agency of Agriculture, Food and Markets, and Agency of Natural Resources as well as UVM-Extension) is meant to address the need for more effective practice implementation of conservation plans on agricultural lands in the Lake Champlain Basin. Past conservation practice implementation efforts have been broad in scope and have not resulted in any measurable improvements in water quality. In response to the revised and EPA-approved phosphorus TMDL for Lake Champlain and the availability of increased NRCS funding for the near term, NRCS in Vermont has decided to use a more strategic and focused process for conservation practice implementation. Under this new process NRCS will collaborate with the Vermont Department of Environmental Conservation (VTDEC) to contribute information to the agricultural sections of Tactical Basin Plans (TBP's). These agricultural watershed plans will provide a comprehensive inventory of land use and resource conditions in each of the targeted watersheds.



This information is currently being used by Local Watershed Teams working in each sub-watershed to identify and target specific farms and fields for further resource assessment and the development of practice alternatives, as these will become specific Local Watershed Team actions to be implemented within the McKenzie Brook watershed. These Local Watershed Teams are coordinated by NRCS and key resource providers to bring all agricultural partners together to work in a coordinated and strategic effort. The Local Watershed Teams have been determining the length of the project for each watershed and what amount of phosphorus reduction they would like to achieve during that time period. The timeline and amount of practice implementation may be determined to some extent by the amount of funds likely to be available and the staff available to implement the Local Watershed Team Action Plan for the McKenzie Brook watershed.

Accomplishments and priority projects funded during 2016 include:

- A Stormwater Master Plan for the Castleton River headwaters and Town of Castleton including those portions of the Lake Bomoseen watershed that haven't yet been addressed under the Sucker Brook Stormwater Master Plan (a tributary to Lake Bomoseen) with the Poultney Mettawee Natural Resource Conservation District.

The rewrite of the South Lake Champlain Tactical Basin Plan is underway following on refreshed surface water quality monitoring and assessment data to take stock of known priority water quality issues and identify emerging trends. Stakeholders in the tactical basin planning process are many, but include the Regional Planning Commission and relevant Conservation Districts, among others. They have been engaged to contribute to and inform our understanding of surface water conditions and management strategies. In coordination with the Rutland Regional Planning Commission and per our obligations to provide enhanced assistance with public outreach, gathering municipal input and to provide input on project prioritization under the Vermont Clean Water Act, a Clean Water Advisory Committee has been meeting regularly to inform the revisions and updates to the South Lake Tactical Basin Plan, due out for public review in Fall of 2017.

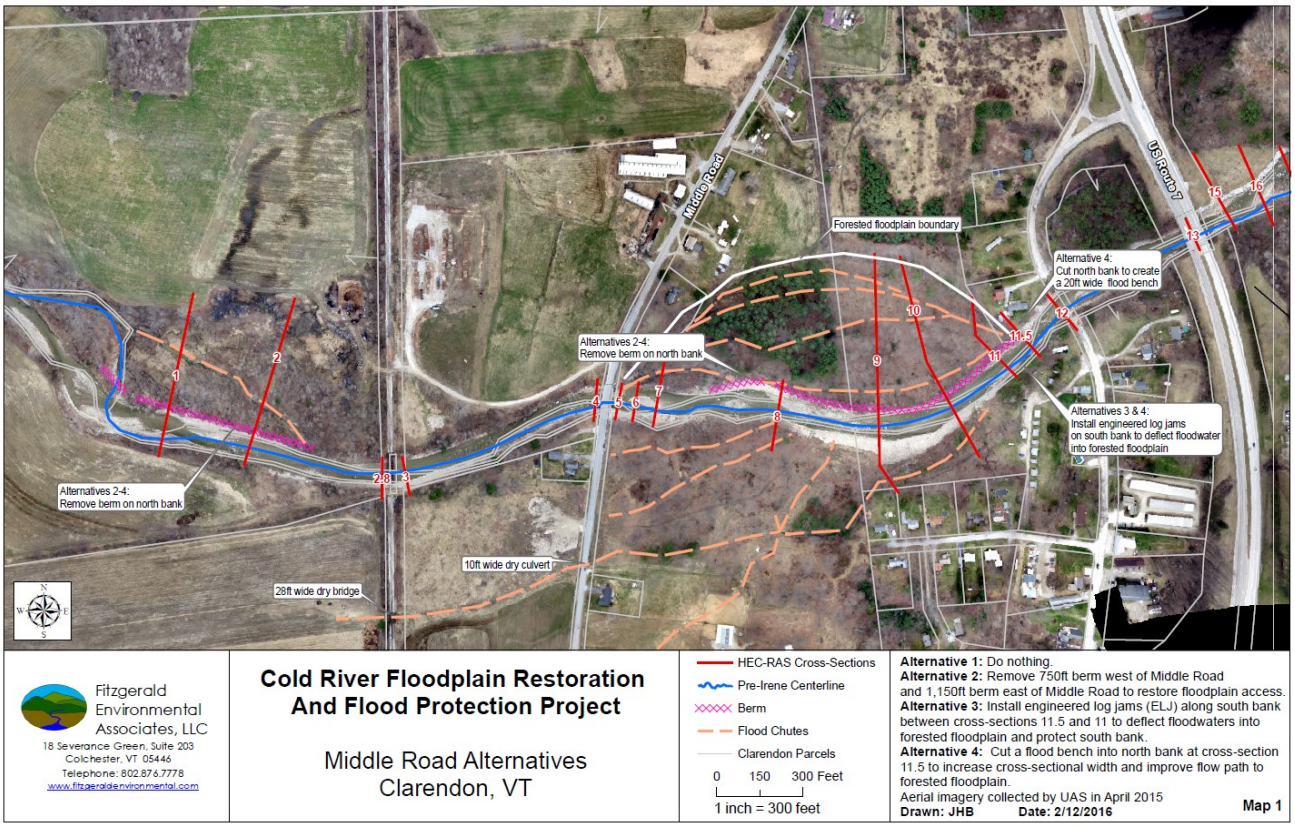
Basin 3: Otter Creek, Little Otter Creek, Lewis Creek

The Otter Creek Basin – Water Quality Management Plan was completed and approved by the Secretary of the Agency of Natural Resources and DEC Commissioner in May of 2012. This Plan was one of the last "hybrid" versions of watershed planning between the older "Watershed Initiative" basin plan format and the current tactical basin planning process. The Otter Creek Basin Plan contains priority recommended actions for improving and protecting surface waters in the Otter Creek Basin (including several large tributaries), as well as identifying dozens of potential river restoration projects designed to build flood resiliency and reduce private property losses that occurred following Tropical Storm Irene. The Otter Creek Basin Plan addresses the priority water quality stressors that affect surface waters in the Otter Creek Basin as well as the specific water quality concerns identified by the stakeholders in the basin planning process.

The Otter Creek Basin Tactical Basin Plan is slated for a rewrite following a comprehensive water quality monitoring and assessment data review process that will commence in 2018. A comprehensive rotation of biomonitoring and biological assessment was conducted throughout the basin during the 2016 field season.

Accomplishments and priority projects funded during 2016 include:

- A large Stormwater Mitigation Project has been funded under the ecosystem restoration program and is slated for implementation at Georgetti Park along the East Creek in City of Rutland.
- An engineered design for a berm removal project and river corridor easement along the lower reaches of the Cold River in Clarendon will enhance flood resiliency and attenuate sediment and nutrients.
- Stormwater mitigation best management practices have been implemented at the Rutland Northwest Elementary School in Rutland City along the East Creek.
- A Stormwater Master Plan has been developed for Middlebury's downtown area in coordination with the Town and the Addison County Regional Planning Commission.
- Stormwater Master Planning is underway in the Town of Brandon
- A Green Stormwater Infrastructure project in Rutland Town is underway to mitigate stormwater runoff from the Rutland Town Elementary School.
- High priority projects have been identified and developed in the Lewis Creek Association's "Ahead of the Storm Project" - Preparing Local Watersheds for Flood Resilience and Reducing Runoff in the towns of Shelburne, Charlotte and Hinesburg.



An engineered design for berm removal along the Cold River in Rutland County

Basin 5 Upper LC Direct, including LaPlatte, Malletts Bay, St. Albans Bay

The plan was signed in August 2015. The planning process drew heavily from assessment information including water quality results obtained this year with the help of volunteers working with the Regional Stormwater Education Program and the South Chittenden County River Watch (formerly the LaPlatte Watershed Partnership) who have received financial and technical assistance from the WSMD. This Basin 5 plan presents discrete, geographically explicit project implementation opportunities. This Plan is also the first that will be entered into the project tracking database described in Section 2 of this report.

Completed projects this year have already addressed strategies in the plan including:

- Crooked Creek gully stabilization project using materials from on-site logging operation.
- The *Ahead of the Storm* project, headed by the Lewis Creek Assn and other partners, has continued to develop designs for the installation of more optimal stormwater management practices for a variety of properties listed in the tactical basin plan.
- Assessments of farms in the St. Albans bay by AAFM and mapping of ditches
- Monitoring of pollutant removal from two constructed experimental treatment systems to reduce phosphorus loading from a tile drain on a Franklin County farm with the Friends of Northern Lake Champlain.
- Project designs for projects in the Shelburne, South Burlington and Williston's Flow Restoration Plans
- Installation of a bioretention basin at Lake Iroquois Recreation District to reduce erosion of beach into lake.

- Green stormwater infrastructure designs for Colchester High School by the WNRCD with help from a high school class

Figure 1. Lake Iroquois Recreation District bioretention basin

Figure 2. Gully restoration using on-site woody vegetation

Basin 6 Missisquoi Bay, including Pike and Rock

The present plan dated March 2013, will be replaced in late 2016 with a new Tactical Basin Plan. Presently, the water quality assessment and internal review process for the 2016 tactical basin plan is underway. During the year, assessment work supported in the plan included Missisquoi River Basin Association and the Franklin Watershed Committees (Lake Carmi watershed) volunteer water quality monitoring program with financial and technical assistance from the WSMD. WSMD also provided resources to analyze over five years of data to provide a list of priority areas for remediation based on high phosphorus and sediment levels. The Missisquoi Tactical Basin Plan will also be one of two that will present a completely staged electronic implementation table as described in Section two of this report, providing the "Phase II" implementation scenarios for this basin to begin implementation of the Lake Champlain TMDL. Further, the first local implementation action team was convened by WSMD staff for the Lake Carmi watershed, to assist with the development of strategies for the 2016 plan, and to help coordinate implementation of the plan among interested partners.

Examples of a few of the plan strategies that were completed this year included:

- AAFM continues to assess ***all*** farmsteads in the Franklin County
- The Franklin Watershed Committee was supported in its effort to improve roads around Lake Carmi, including designing upgrade of four culverts on town roads as well as culvert stabilization and plunge pool work along private roads along the shoreline. They were also supported in their efforts to help 11 lakeshore residents implement Lakewise practices to control stormwater runoff from their properties into Lake Carmi.
- The Missisquoi River Basin Association continued to work on riparian plantings averaging 50 feet in width to cover a total of 12 acres, or two miles of stream.
- The Friends of Northern Lake Champlain provided one on one technical support to eight farmers in the Hungerford Brook watershed, resulting in 6 EQIP applications to fund BMP implementation.

Figure 3. Riparian buffer planting in Bakersfield by MRBA and school kids

Basin 7 Lamoille

2016 has been a busy year for the watershed partners, municipalities, and regional planning commissions in the Lamoille Basin. After an extensive internal review process and hours of partner collaboration, public meetings, and municipal outreach, the 2016 Lamoille Tactical Basin plan is out for public comment, which closed on December 2nd, 2016. The previous Lamoille basin plan was completed in 2009. A "report card" summarizing completed projects from the 2009 basin plan is included in the 2016 plan, in Appendix C.

Four public forums were held in the three major sub-basins, which provided an overview of the top priorities identified in the plan. The plan includes the top ten targeted priorities in the basin, a project implementation table summary with over 157 actions, a watershed project database with over 1000 projects, and the Lake Champlain Phosphorus TMDL Phase II Implementation Plan for the Lamoille Basin. During the planning process, coordination with partners to apply for and carry out priority projects was ongoing.

Priority watershed protection and restoration projects completed, technical assistance provided, and funding received in 2016 include:

- Flood resiliency workshops completed by the Lamoille County Planning Commission (LCPC) for Johnson, Cambridge, Wolcott and Jeffersonville. The flood resiliency grant was received through the High Meadows Fund.
- The Town of Hyde Park completed stormwater survey, design, cost estimates and implementation of Low Impact Development and gully stabilization practices to address water quality concerns in Centerville Brook in coordination with the Lamoille County Conservation District (LCCD) with Ecosystem Restoration Program grant funds.
- A Stormtech Chamber System installed to mitigate 100% of stormwater received from a VTrans Maintenance Garage and adjacent paved areas. The stormwater is now treated and infiltrated before

entering Wilkins Ravine and the Lamoille River in Morrisville. This project was funded by the Lake Champlain Basin Program in coordination with LCCD and VTrans.

- Two priority projects identified in the Brewster River Corridor plan, completed in 2015, received funding through the Ecosystem Restoration Program. These projects will be implemented with coordination from Smuggler's Notch Resort, VTDEC Rivers Management Program (RMP), LCCD and LCPC.
- Increased recreational opportunities for the Lamoille River mainstem by the Lamoille River Paddlers Association. These projects include primitive campsites established for paddlers in Fairfax, flood damaged stairs replaced at the Morrisville Rotary Access, timber crib stairs added to address erosion concerns at the Elmore Pond Road Access in Wolcott, and a new public river access established at the Landmark Tavern in Johnson.
- 11 Better Road grants received for culvert upgrades, ditch repairs, and streambank stabilization within 50-ft of surface waters.
- 6 Better Road grants received for 4 road erosion inventories, including Fletcher and Hyde Park, and 2 culvert inventories, including Wolcott.
- Funding received for Jericho and Hardwick Stormwater Master Plans to identify and address non-point stormwater inputs into the Browns River and the Lamoille River mainstem. Phosphorus reductions will be estimated per project.
- Funding received to complete a Stream Geomorphic Assessment on the stressed section of the Seymour River, which will identify sources of pollution and projects to mitigate the pollution. The Lamoille County Planning Commission is working on Phase 1 of the plan now and will start phase 2 in the summer and fall of 2017.
- Regional Hydroseeder program was expanded to two additional counties and money was secured through an Ecosystem Restoration Program grant to purchase 3 new machines.
- Funding received for a high priority River Corridor Easement at North Branch and Lamoille

Gully restoration phase of a five part stormwater project to improve water quality in Centerville Brook in Hyde Park.

confluence to support stream equilibrium in this stressed reach of the North Branch of the Lamoille River.

Basin 8 Winooski

The Basin 8 plan was completed in May 2012. Ongoing assessments supported by strategies in the plan include the development of a stormwater master plan for the upper Winooski River for the towns of Plainfield, Calais and Marshfield. The plan will prioritize culvert replacements, and projects that will address stormwater runoff from roads and other impervious areas in the villages. The planning process also includes an illicit discharge

detection and elimination plan. The Friends of the Winooski River, Huntington River group, and Friends of the Mad River continued their volunteer water quality monitoring of rivers in the basin with financial and technical assistance from the WSMD. The process to update the Winooski Tactical Basin Plan is starting in 2017.

Examples of completed strategies that were supported by the Clean Water Fund include:

- Winooski Natural Resource Conservation District planted 5.3 acres of riparian buffers on private land as part of its Trees for Streams program;
- The City of Montpelier supported stormwater management planning along with preliminary design of a stormwater management practices;
- Friends of the Mad River coordinated the design of a rain garden at Harwood High School
- The Central Vermont Regional Planning Commission supported a green stormwater infrastructure project installation in Northfield at Kenyon Hardware that was identified in the town's stormwater master plan.
- Waitsfield included five bioretention basins as part of the town office construction.
- Sherman Hollow Road culvert upgraded, stream channel restored and stormwater treated in Huntington River watershed
- The Friends of the Winooski designed and installed a stormwater swale implemented per the Cabot school stormwater plan
- Town of Northfield and the Friends of the Winooski River have completed an alternatives analysis and conceptual design that will guide floodplain restoration options along Water Street in Northfield

One of five rain garden pockets installed at the Waitsfield town offices to treat impervious surfaces.

Kenyon hardware store rain garden in Dog River watershed

Basin 9 White

Planning for the White River Basin will begin in January 2017. The previous tactical basin plan was completed in July 2013. The planning for the White River Basin will include a review of projects that have been completed since 2013. This year there was much activity happening in the basin with our partners to address the high priorities in the White River Basin, which include stormwater master planning in Ayers Brook Watershed, river corridor protection and restoration in target areas, identification of E. coli nutrient sources in the Branches, and re-classification of very high quality waters Bingo and Smith Brooks. The White River Partnership was active in a dam removal, riparian plantings with school groups, and river habitat restoration along the East Branch

parallel to Route 73 in Rochester. These projects were identified in coordination with the basin planner during the basin planning process and iteratively throughout the past year.

Priority watershed protection and restoration projects completed, technical assistance provided, and funding received in 2016 include:

- Two River Corridor Easements secured on the First Branch of the White River in Tunbridge and the Second Branch of the White River in South Randolph to provide floodplain area for sediment attenuation, stream stabilization and riparian restoration on a total of 32 acres
- Removal of Sargent, Osgood, and Roundy dam and restoration of in-stream habitat and riparian buffers in the dam project area on the Third Branch of the White River, in Randolph Village. This dam had been identified as a high priority for removal by VDEC, Vermont Fish and Wildlife Department, the White River Partnership, and American Rivers. The removal is specifically identified in the Tactical Basin Plan and the removal of the dam restored fish passage to 98 miles of cold-water fish habitat. Video link here: https://vimeo.com/190736360
- Funding received and projects partially completed for both the Middle and Upper White River Corridor Restoration projects. The purpose of the restoration was to restore channel dimension and profile by digging pools, building riffles, and creating bends; to stabilize disturbed riverbanks by wrapping coir and coconut fabric around exposed soils and holding the fabric in place with shrub willow stakes; and to reconnect floodplain and flood chutes by removing berms and lowering riverbanks. Video link here: https://youtu.be/mDGhM72GF3k
- 6 Better Road grants received for culvert upgrades, bridge replacement, ditch repairs, and slope and streambank stabilization within 50-ft of surface waters.
- 4 Better Roads grants received for 3 road erosion inventories and 1 culvert inventory.
- The completion of the Ayers Brook Stormwater Master Plan with high priority project identified and ready to be scoped.
- Source to Sea Cleanup completed on Mill Brook in Pomfret.
- White River Partnership water quality monitoring for E. coli was completed for 2016 and the 2015 report was submitted and reviewed by VDEC.
- Basin planner provided USFS (Rochester Ranger District) with priorities from the White River Basin in the Upper White, Tweed, and West Branch watersheds for their White River Robinson Integrated Resource Plan.
- Four agricultural best management practices installed in coordination between local farmers and the White River NRCD. The installations included two livestock exclusions from eroding rivers and two compost bins to prevent manure from leaching into surface waters.
- Basin Planner provided support by running the stream simulation demonstration and provided outreach to the locals about river dynamics, good river management, and the importance of river corridor protection at the White River Resilience Festival.
- The 5-town Quintown Collaborative held a White River Food Resiliency Tour for the "Quintown Collaborative: Preparing for the next flood together" Project. The goal of the project is to raise awareness about and to generate support for on-the-ground flood resilience projects in the Upper White River watershed. The bus tour visited sites in Granville, Hancock and Rochester that had been part of public building infrastructure upgrades and re-location; floodplain buyouts and restoration; and building removal sites to increase resilience in this area.
- The Watson Park White River access area was upgraded with new stone stairs and wayfinding signage was added to access trails.

Basin 10 Ottauquechee, Black, CT River Direct

The Basin 10-13 Basin Plan was adopted in 2012 and the draft plan expected in 2017 is in progress. On-going project work is taking place on both the Black and Ottauquechee rivers.

In the Ottauquechee watershed, final design plans for the restoration of a portion of Pinney Hollow Brook in Plymouth have been completed with restoration planned for 2017 and a completed study of Kedron Brook, focused on nutrient management and resiliency, has developed a list of projects for implementation. Both streams were severely impacted by TS Irene and restoration of water quality and habitat are needed.

Along the Black River two important river corridor easements were completed covering over 3275 feet of river. 650 feet of buffer were also planted to enhance the function of the river corridor.

The Town of Springfield is participating in work to address stormwater treatment at the town transfer station that currently runs untreated into the Black River. Final plans are being developed to treat this discharge and establish a treatment buffer along the riverbank.

An exciting project on the Black River is the acquisition of a river corridor easement on the alluvial fan of Money Brook where TS Irene inundated the property, destroyed two structures and covered Route 100 with feet of sediment and boulders. This easement agreement has also allowed removal of a berm along the brook that was blocking high flows from accessing the field floodplain and has allowed wetland vegetation to re-establish along the river. In the next phase much of the field will be restored to wetland. Upstream on Money Brook the bottom slopes of extensive mass failures have been planted with willows to stem the discharge of sediment and begin to establish slope vegetation.

Further work in the Black River watershed has improved 4,300 linear feet of roads and trails in Camp Plymouth Sate Park & Coolidge State Forest to mitigate erosion by installing 9 broad-based dips, 35 water bars, and 1 pole culvert and re-vegetating slopes for increased infiltration.

Projects identified in the Mill Brook Corridor Plan are being implemented through both state and private funding. Two dams are slated to be removed next season in West Windsor which will restore aquatic organism passage, remove blockage to sediment transport downstream and reduce flooding pressure in the village.

Working with the Town of Ludlow, Grant Brook has been reclassified to Class A(1) from A(2). The brook is no longer used as a water supply source but drains to the town wells and the town, wanting to insure high quality water, elected to increase protection of the watershed through reclassification.

Volunteer water quality monitoring continues on both the Ottauquechee and the Black by the Black River Action Team and Ottauquechee River Group.

Basin 11 and 13 Williams, West, Saxtons, Lower CT, Mill

The Tactical Basin Plan for Basin 11 was signed in January 2016.

Working with the US Forest Service, Mount Tabor Brook and Moses Pond within the Green Mountain National Forest were reclassified to Class A(1).

Completion of the Williams River Corridor plan has resulted in a list of prioritized projects for which funding is now being sought. Work will likely begin next season on Trout Brook in the upper watershed to address erosion, channel stability and increase floodplain access.

The Saxtons River Watershed Collaborative has been established with all towns in the watershed being represented. The project emerged from an initial High Meadows resiliency grant and has grown into a strong diverse organization working to increase resiliency along the entire Saxtons River.

Work in the West River watershed includes completion of a 600-foot riparian buffer on the Winhall River, the planned removal of a dam in Dummerston next season, the final approved design of a major channel restoration project on Adams Brook in Newfane.

Volunteer water quality monitoring by the Southeastern Vermont Watershed Alliance (SeVWA) continues on all three major rivers in the Basin. This monitoring work is helping to identify reaches where follow-up state monitoring is needed to identify suspected pollutant discharges.

SeVWA data revealed high levels of bacteria in the lower Sacketts Brook in Putney prompting the town Conservation Commission under guidance from the watershed coordinator, to undertake a monitoring blitz to try to locate the source of the pollutant. Working with SeVWA and town volunteers the one-day event revealed that the issues impact the lower portion of the brook. Follow-up work will commence next season to track the source and try to identify the problem.

Basin 12 and 13 Deerfield, Lower CT, Mill

The Deerfield River Tactical Basin Plan was completed in 2014 and is now being implemented.

Reclassification to Class A(1) in the Deerfield watershed has increased protections to the Deerfield River and its tributaries downstream to GMNF boundary north of Searsburg-Somerset town line, including Castle and Redfield Brook watersheds and Rake Branch Watershed below the confluence with Redfield Brook as well as Stamford Pond.

The River Corridor Plan for the East Branch of the North River is underway and is being enhanced by work of the Deerfield River Cooperative and the Department of Fish & Wildlife which has funded and completed a bridge and culvert assessment of the entire Deerfield River watershed with the assistance of Trout Unlimited.

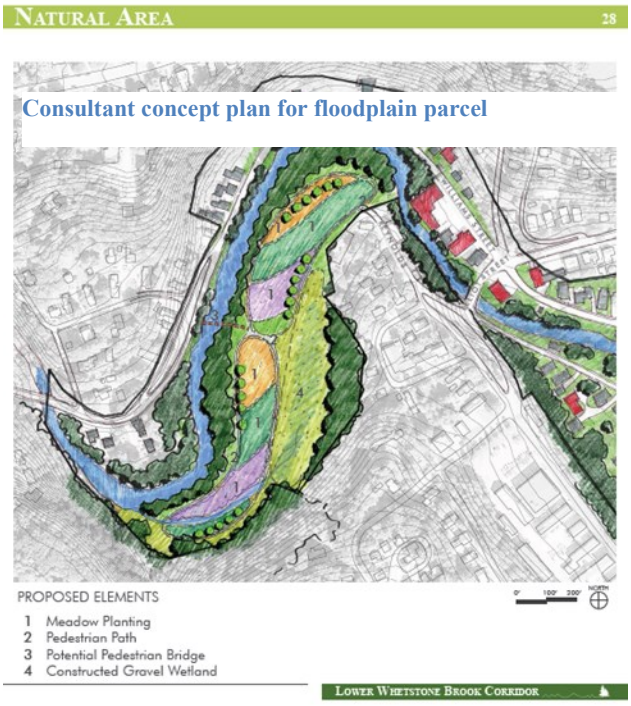
Projects resulting from the Green River Corridor Plan have resulted in the removal of several flood damaged structures on a TS Irene-created island and restoration of the entire site to natural conditions.

More work is planned to re-establish the riparian buffer and address unstable in-stream conditions. A river corridor easement is being but in place as well.

Removal of a berm for improved floodplain access, wetland restoration and a corridor easement are in progress for a parcel downstream of this site.

Significant work is being done along the Whetstone Brook in Brattleboro with two recent EPA grants, FEMA funding and Ecosystem Restoration funds.

An EPA's Smart Growth grant had funded the "Design for Resilience in Brattleboro's Whetstone Brook Corridor" project which has involved many community groups and citizens in planning for improved flood resiliency designs for the downtown Brattleboro area while maintaining the residential and economic needs of the town. DEC involvement and basin planning are working to conserve open space floodplain parcels to decrease flooding in downtown Brattleboro and plant riparian buffers.



Consultant concept plan for floodplain parcel

The Long Island Sound (LIS) Dissolved oxygen/nitrogen TMDL is being addressed through the LIS Regional Conservation Partnership Program to which the Watershed Coordinator is an active participant on the technical steering committee and the resiliency subcommittee.

The FERC relicensing process for the three lower Connecticut River hydroelectric dams continues. Finally, efforts to control the invasive plant water chestnut are having the intended effect on the lower Connecticut River with the population decreasing every year.

Basin 14 Stevens, Wells, Waits, Ompompanoosuc, CT River Direct

The development of the Tactical Basin plan for Basin 14 was completed in 2015. This year work was related mostly to nutrient and E. coli evaluation, riparian restoration, stormwater runoff, and agricultural assessment development. A report submitted by the White River Natural Resources Conservation District on E. coli monitoring in the Ompompanoosuc River watershed recommended to: conduct a septic survey around West Fairlee, VT; conduct farm visits to identify and address any potential E. coli sources associated with small farms in West Fairlee and Thetford, and evaluate any possible storm water treatment opportunities in the Village of West Fairlee.

Priority watershed protection and restoration projects completed, technical assistance provided, and funding received in 2016 include:

- 2 Better Roads grants received for 1 road erosion inventory and 1 culvert inventory
- 10 Better Roads grants received for culvert replacements, ditch repairs, and slope and streambank stabilization within 50-ft of surface waters.

- Ompompanoosuc E. coli water quality monitoring report reviewed by VDEC and summary completed and shared with local communities. The town of West Fairlee is working on developing the next steps to address potential E. coli sources as identified by the monitoring.
- Funding received through an Ecosystem Restoration Program grant for Agricultural Best Management Practice Planning in the Ompompanoosuc River to identify and implement agricultural best management practices to improve water quality. This is also a follow-up project from the E. coli water quality monitoring report.
- Final treatment of *Phragmites australis*, an invasive species, was completed on the Ompompanoosuc in Norwich.
- Geer Dam removal engineering completed for the Ompompanoosuc in West Fairlee
- Riparian buffer plantings completed at a former dam site on the Wells River in Groton
- A Phase 2 Stream Geomorphic Assessment funded by an Ecosystem Restoration Program grant for the Wells River in Ryegate and Groton

Basin 15 /16 Passumpsic and Northern CT River Watersheds

A number of the actions identified in the 2014 Passumpsic and Northern Connecticut River Basin Plan were completed or initiated in 2016. Many of these actions are a result of strong partnerships between DEC, the Essex and Caledonian County NRCD's, NVDA, NorthWoods Stewardship Center as well as private landowners in the basin.

- Several high-priority retrofit projects were identified though Dish Mill Brook watershed stormwater master planning effort and a second rain garden installed at the base lodge at Burke Mountain resort.
- A roads and rivers workgroup supported road erosion inventories for 5 communities in the basin along with assisting towns in applying for several Better Roads grants to address priority road erosion issues.
- An ERP grant supported the Northwoods Stewardship Center Conservation Corps installing 12 road erosion BMP's, addressed erosion at two river access.
- The St Johnsbury stormwater master planning effort was completed through ERP funding and an ERP proposal was submitted to infiltrate runoff from a neighborhood with well drained soils where sewer separation is occurring which would save substantially on instillation costs for these practices.
- A major stormwater retrofit project in St Johnsbury was installed in 2016.
- A stormwater mater plan for the town of Lyndon was initiated.
- Buffer plantings were completed on Passumpsic and Connecticut Rivers and conservation projects and strategic wood placement along the Nulhegan River and Paul Stream.
- A major river clean-up was held on the Sleepers River in St Johnsbury which removed tons of metal and trash from the river bed and riparian areas

Basin 17 Memphremagog, Coaticook, Tomifobia

One of the most significant accomplishments of 2016 was progress made on a phosphorus TMDL for Lake Memphremagog. Modeling to support the TMDL was completed as well as the development of a best management practice scenario tool that allowed for a collaborative process to create a roster of BMP's that would meet the necessary load reductions in this watershed to restore the lake over a 20-year timeframe. Five well-attended public meetings were held to get public input across different target audiences on the TMDL and the tactical basin plan for the basin that is being developed concurrently. The draft tactical basin plan will be developed in 2016 with the final tactical basin plan and draft TMDL to be developed in early 2017.

Since release of the previous Basin 17 water quality management plan in January of 2012, more than three quarters of the actions identified in the plan have been initiated or completed. Several specific projects have been implemented in 2015 including:

- The NorthWoods Stewardship Center planted riparian buffers at ten sites covering over 4 acres within the Lake Memphremagog watershed through the Trees for Streams Memphremagog (TFSM) program and the Lakeshore Buffering (NEKLB).
- The Town of Brighton received an ERP grant to complete a stormwater retrofits covering a large portion of the downtown area and construction on this project began in the fall of 2016.
- A tributary water sampling program was continued and directly supported farmers in addressing barnyard runoff issues, installing cover cropping, filter strip and no till practices to address nutrient runoff issues where water sampling identified elevated levels phosphorus runoff.
- A stormwater master planning grant was completed for all major communities in the basin by the Memphremagog Watershed Association, which identified a number of high priority retrofit opportunities with large phosphorus reduction potential at a relatively low cost. The watershed association is working with the City of Newport to apply for ERP funding next spring to install one of these projects with the potential to address over 100 lbs of phosphorus per year.
- A $674,000 Regional Conservation Partnership Program grant was received by the Orleans County NRCD, with support from VT DEC to technical and financial assistance to support the implementation of targeted agricultural best management practices and nutrient management planning in priority areas of the Lake Memphremagog Watershed. The project involves a large collaboration of partners in the basin and will use water quality sampling results to target projects with the largest load reduction potential and to evaluate load reductions achieved through BMP implementation.