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AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Water Quality Restoration Formula Grant Target and Fund Allocation Methodology – Draft for Public Comment

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Table of Contents

VERMONT
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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Summary of Key Changes

- Updated dataset includes projects reported to the Clean Water Reporting Framework (CWRF) between SFY 2016 – 2024.

- Adjusted all project costs to January 2025 dollars using standard Consumer Price Index (CPI) inflation adjustment. This change addresses two factors, both to normalize all project cost data from historical cost to present cost (or replacement cost), and also to acknowledge the impact of higher than average rates of inflation that occurred between 2021 – 2023 with annual inflation rates between 5-8% per year compared to historical average rate of inflation between 2-3%.

- Updated and simplified the approach to cost rate calculations. Where sufficient data is available, cost rate has been calculated as the median cost per unit of estimated phosphorus reduction. Where estimated phosphorus reduction data and/or cost data is not available or sufficient, an alternate methodology is applied. Alternate methods to arrive at an assumed phosphorus reduction vary slightly based on project cost category and are described in the applicable section.

- Updated project types included in the cost rate analysis to align with project types currently eligible for formula grant funding and phosphorus accounting where project implementation is actionable. Changes include removing wetland restoration from the cost rate due to limitations in current phosphors accounting and removing river corridor easements due to limitations in CWSPs ability to engage in easements at this time. These project types will be re-integrated into a future cost rate update.

- In some cases, an estimated phosphorus reduction may be calculated for wetland restoration projects located within a river corridor following the floodplain and stream phosphorus accounting methodology, however this is not applicable in all contexts and a more complete accounting methodology to estimate phosphorus reduction achieved through wetland restoration is forthcoming (expected 2027).

- Updated the approach to estimating sector cost rates to either select a single representative project category cost rate for the sector cost rate, or where more than one project category cost rate is applicable to the sector, included project category level weighting of cost rates to reflect the distribution of project opportunity and rate of expected implementation within the sector based on analysis of completed project data and assessment of the known universe of potential projects.

- Updated funding for project identification and development from 8% to 10% of project funding based on an updated analysis of costs, and funding for operations and maintenance to $10,000 per CWSP plus 2.8% of the value of projects funded for implementation.

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table 1. Clean water project category cost rates correlated to non-regulatory target land use sector.

Non-regulatory Land Use Target Sector	Project Category	2025 Project Category Cost Rate ($/kg/yr)	Weighting	2025 Sector Weighted Cost Rate ($/kg/yr)	2023 Sector Average Cost Rate ($/kg/yr)[1]
Streams	Floodplain and Stream Restoration	$13,241	75%		
Streams	Dam Removal and Associated Restoration	$46,114	25%		
Streams*	weighted average			$21,459	$10,601
Agriculture**	Riparian Buffer Restoration	$4,072		$4,072	$6,725
Forest***	Forest Road Erosion Control	$18,897		$18,897	$9,565
Developed	Structural Stormwater Treatment	$78,051	50%		
Developed	Road Erosion Control	$22,397	35%		
Developed	Lake Shoreland Stormwater Treatment	$75,217	2.5%		
Developed	Riparian Buffer Restoration	$4,072	10%		
Developed	Lake Shoreline Stabilization	$10,809	2.5%		
Developed****	weighted average			$49,422	$15,822

[1] 2023 sector average cost rates are provided here for comparison purposes only. The approach for calculating 2025 sector weighed cost rates has been revised from the approach used to calculate the 2023 sector average cost rates.

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Water Quality Restoration Formula Grant Overview

The Clean Water Service Delivery Act (Act 76 of 2019) restructures the administration and implementation of clean water funds in the State of Vermont, effective in State Fiscal Year (SFY) 2023. Act 76 of 2019 requires the establishment of Clean Water Service Providers (CWSPs) and the Water Quality Restoration Formula Grant Program.

CWSPs were established for watersheds draining to Lake Champlain and Lake Memphremagog by rule, effective August 12, 2021. CWSPs are responsible for administering funds and, along with Basin Water Quality Councils (BWQCs), for overseeing the identification, prioritization, development, implementation and maintenance of projects to meet a five-year phosphorus reduction target. CWSPs' targets are meant to ensure that voluntary measures (i.e., those not driven by regulations) are implemented and maintained to achieve and sustain the required phosphorus reductions under the Lake Champlain and Lake Memphremagog Total Maximum Daily Loads (TMDLs).

The Water Quality Restoration Formula Grant annual funding allocation is based on the annual pollutant reduction goal in each sub-basin, a standardized unit cost of pollutant reduction by sector, and the total funds available to award based on the budget year. The project and sector level cost rates include costs associated with design and engineering (if applicable) as well as implementation. The fund allocation is adjusted to account for costs associated with project identification, project development and operation & maintenance. Formula Grants' fund allocations include the costs of administration and reporting.

Clean water project types eligible for funding under Formula Grants are non-regulatory project types described in the Clean Water Initiative Program's Funding Policy[2] and Formula Grant Guidance[3]. Eligible projects include non-regulatory activities to address sediment and nutrient pollution occurring across land use sectors. Formula Grant funding allocations may be refined over time based on availability of new data and feedback from program partners (see section titled **Error! Reference source not found.** for more information). CWSPs and BWQCs are responsible for overseeing how Formula Grant funding allocations are apportioned and awarded to projects within their respective basins following state-issued Guidance.

The following sections document methods used to establish:

1. Standard cost for pollutant reduction by project type;

2. Weighted average cost rate for pollutant reduction by land use sector

3. Non-regulatory total phosphorus load reduction targets for watersheds in the Lake Champlain and Lake Memphremagog basins; and

4. Water Quality Restoration Formula Grant fund allocation by watershed.

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[2] https://dec.vermont.gov/water-investment/cwi/clean-water-grants

[3] https://dec.vermont.gov/water-investment/statues-rules-policies/act-76/background-law-rule-and-guidance

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

The above listed steps are illustrated in Figure 1. Where Formula Grant need (or demand) exceeds available funds, targets will be scaled to align with available funds. The Vermont Clean Water Board recommends funding levels for the Formula Grants when making its annual Clean Water Budget recommendation, and while balancing other statutory clean water funding priorities.[4]
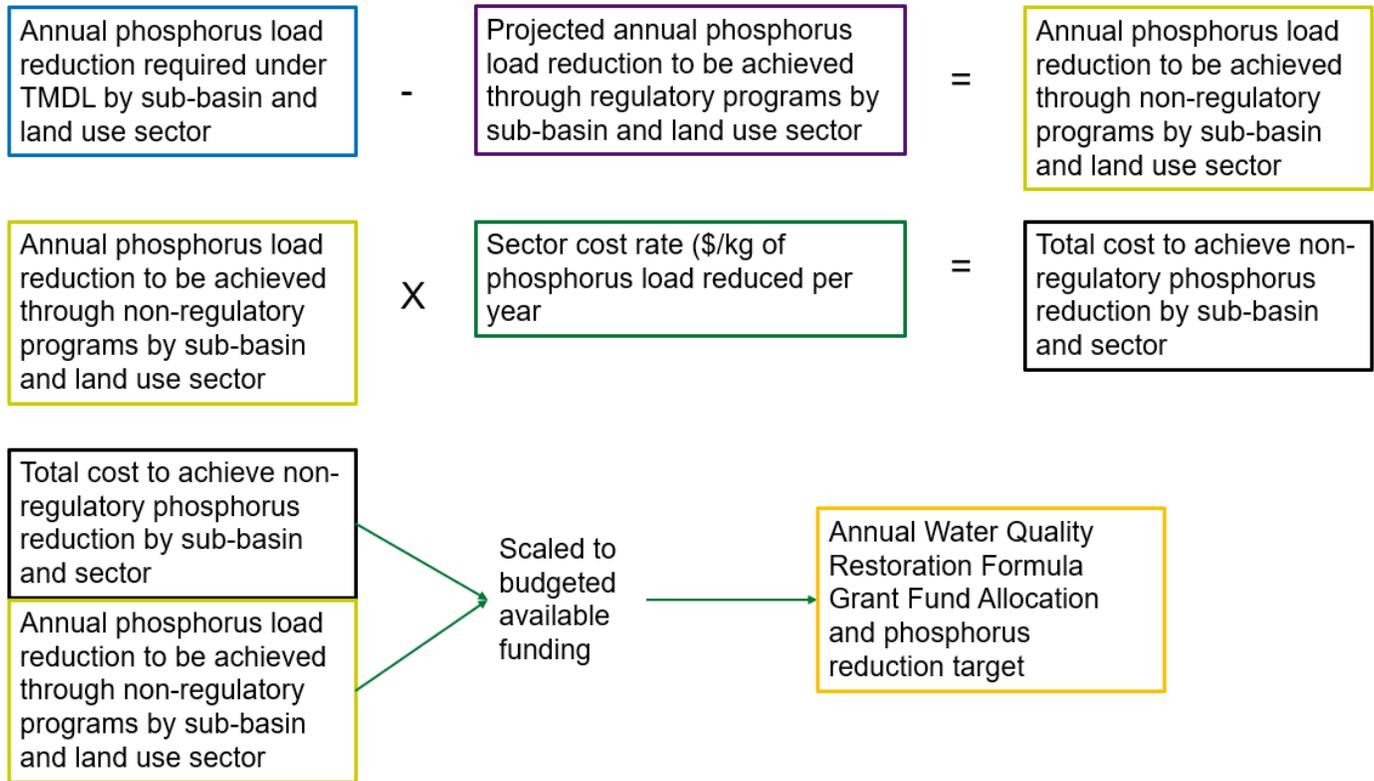
Annual phosphorus load reduction required under TMDL by sub-basin and land use sector	-	Projected annual phosphorus load reduction to be achieved through regulatory programs by sub-basin and land use sector	=	Annual phosphorus load reduction to be achieved through non-regulatory programs by sub-basin and land use sector
Annual phosphorus load reduction to be achieved through non-regulatory programs by sub-basin and land use sector	X	Sector cost rate ($/kg of phosphorus load reduced per year)	=	Total cost to achieve non-regulatory phosphorus reduction by sub-basin and sector

Total cost to achieve non-regulatory phosphorus reduction by sub-basin and sector

Annual phosphorus load reduction to be achieved through non-regulatory programs by sub-basin and land use sector

→ Scaled to budgeted available funding → Annual Water Quality Restoration Formula Grant Fund Allocation and phosphorus reduction target

Figure 1. Process map of Water Quality Restoration Formula Grants phosphorus reduction target and fund allocation methodology.

Cost Rate Calculation Methodology

Pursuant to 10 V.S.A. § 922, the Secretary of Natural Resources shall publish a methodology for determining standard cost of pollutant reductions for phosphorous in the Lake Champlain watershed not later than November 1, 2021. A methodology for determining standard cost pollutant reductions for phosphorous in the Lake Memphremagog watershed shall be published not later than November 1, 2022. The standard cost shall include the costs of project identification, project design, and project construction. The CWSP Rule further requires definition of standard project costs be developed for different clean water project types by contributing land use sector. The following methodology was applied to estimate cost rates associated with non-regulatory total phosphorus load reductions.

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[4] https://dec.vermont.gov/water-investment/cwi/clean-water-board

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Cost Rate Calculations at the Project Category Level

The Vermont Department of Environmental Conservation (VTDEC) identified the following project categories as representative of anticipated costs associated with implementing non-regulatory total phosphorus load reductions required under the Lake Champlain and Lake Memphremagog TMDLs, across contributing land use sectors.

- Floodplain/stream restoration (phosphorus reduction through floodplain storage and improved stream stability)

- Dam removal and associated restoration (phosphorus reduction through floodplain storage and improved stream stability)

- Riparian buffer restoration (phosphorus reduction through treatment of runoff and change in land use)

- Sub-jurisdictional (non-regulatory) forest road erosion control (phosphorus reduction through erosion control)

- Sub-jurisdictional (non-regulatory) stormwater treatment (phosphorus reduction through treatment of runoff)

- Sub-jurisdictional (non-regulatory) road erosion control (phosphorus reduction through erosion control)

- Lake shoreline restoration (phosphorus reduction through bank stabilization and restoring living shorelands)

- Lake shoreland stormwater treatment (phosphorus reduction through treatment of runoff)

VTDEC calculated a project level cost per unit of annual phosphorus reduction where sufficient data is available, by compiling the data from the VTDEC's statewide Clean Water Reporting Framework (CWRF) database (in some cases limited to a subset of CWRF – the VTDEC Watershed Projects Database (WPD)), and other available cost estimates applicable to the Vermont context. This analysis uses data on projects completed and reported to DEC as of the end of SFY 2024 (June 30, 2024).

- Project level cost per unit of annual phosphorus reduction is calculated based on CPI adjusted project cost (including design and engineering adjustment if applicable) divided by the estimated annual phosphorus reduction achieved through implementation to generate a cost rate in $/kg/year. Project level cost per unit of annual phosphorus reduction is calculated for the following project categories:

    o Riparian Buffer Restoration

    o Sub-jurisdictional Stormwater Treatment Practices

    o Lake Shoreland Stormwater Treatment Practices

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

- As part of this step, VTDEC identified project types and best management practice (BMP) types representative of the project categories .

  - In some cases, a project category includes multiple representative BMP types. For example, sub-jurisdictional stormwater treatment practice category is based on cost rates of multiple stormwater treatment practice types.

  - In other cases, a single BMP type is representative of the project category. For example, riparian buffer planting practice category contains only data on riparian buffer plantings.

- For project categories where some but not all projects in the sample have estimated phosphorus reduction data, a phosphorus reduction per project output unit (e.g. kg/acre/year) was calculated for each project with a phosphorus reduction estimate. The median phosphorus reduction per project output unit for the project category was applied to calculate an assumed phosphorus reduction (e.g. median kg/acre/year * acres) for each project where a phosphorus reduction estimate is not available. The results of this analysis are provided for comparison but were not used in assigning cost rates to project categories.

Where there are currently insufficient data in CWRF on project costs, estimated phosphorus reductions, or both, VTDEC applied standardized assumptions and estimates to generate a representative project level cost per unit of annual phosphorus reduction. Phosphorus reduction assumptions are based on phosphorus reduction methodologies outlined in VTDEC's phosphorus accounting methods for estimating total phosphorus load reductions at the project-level.[5]

- This alternative approach was applied to cost estimates for the following project category:

  - Lake Shoreline Stabilization

- This alternative approach was applied to phosphorus reduction estimates for the following project categories:

  - Floodplain/Stream Restoration

  - Sub-jurisdictional Forest Road Erosion Control

  - Sub-jurisdictional Road Erosion Control

  - Lake Shoreline Stabilization

Estimated phosphorus load reductions are expressed as an average annual rate of reduction to be consistent with the TMDLs' base load and target units. In both Lake Champlain and Lake Memphremagog basins, phosphorus reductions presented in this document are based on source load rather than delivered load. Source load estimates are higher than delivered load estimates published in the TMDL because delivered load estimates account for attenuation between the watershed source

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[5] Tracking & Accounting Standard Operating Procedures available here: https://dec.vermont.gov/water-investment/cwi/state-vermont-clean-water-projects/clean-water-project-tracking-accounting

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

and receiving surface water.[6] Using the source load is in accordance with EPA guidance and existing tracking and accounting methodologies.

Project implementation costs, whether actual or estimated, are adjusted to account for design and engineering work (where applicable) prior to implementation, and normalized from cost at implementation to current day costs to account for inflation. All costs presented in this paper are rounded to the nearest dollar.

- Where applicable, estimated cost rates include an assumed cost associated with completing design and/or engineering work required prior to implementation. All project category cost rates account for design and/or engineering costs assumed to be 20% of implementation costs except riparian buffer plantings, which generally require very little design work prior to implementation.

- Design/engineering and implementation costs are frontloaded and not annualized over the project design life, reflecting the need for upfront capital investment to implement clean water projects.

- Project implementation costs, whether actual or estimated, have been normalized to account for inflation. Costs are adjusted at the project level based on month and year of project completion to January 2025 dollars using standard Consumer Price Index for All Urban Consumers (CPI-U) published by the Bureau of Labor Statistics.[7]

$$Cost\ per\ unit\ of\ phosphorus\ load\ reduction\ \left(\frac{\$}{kg/yr}\right)$$
$$=\frac{total\ project\ implementation\ cost + assumed\ design\ and\ engineering\ costs\ (if\ applicable)}{estimated\ phosphorus\ load\ reduction}$$

Estimated cost rates do not include the cost of project identification and development activities at the project category level. Project identification and development costs are estimated as a percentage of total funds available, described in the

section and Appendix A: Annual Award Justification Memo, Clean Water Service Provider Annual Phosphorus Reduction Targets and Fund Allocations. However, CWSPs and BWQCs are encouraged to factor long term O&M costs as part of a project's cost effectiveness in project selection.

VTDEC correlated clean water project categories' cost rates to TMDL land use sector to estimate a representative cost rate for phosphorus reductions from each TMDL land use sector. Where more than one project category cost rate is included at the sector level, a weighting schema is applied to estimate a weighted average sector cost rate based on observed and/or anticipated rates of project category implementation. Sector cost rates are correlated to non-regulatory targets to arrive at the

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[6] For more on the distinction between source load and delivered load, see: https://dec.vermont.gov/document/source-versus-delivered-phosphorus-load

[7] Consumer Price Index (CPI) data available here: https://www.bls.gov/data/tools.htm

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Water Quality Restoration Formula Grant fund allocations, described in the Correlating Cost Rates to Non-Regulatory Targets for Water Quality Restoration Formula Grant Fund Allocations section.

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Cost Rate Calculation Methodology by Clean Water Project Category

Floodplain and Stream Restoration

This project category captures the anticipated median cost per unit of annual phosphorus reduction for projects that increase floodplain storage and improve stream stability. This project category includes several individual practices types and variation in costs associated with different practices is expected. Cost data included in this analysis includes project costs to implement the following practices: berm removal, strategic wood addition, flood chute stabilization, floodplain restoration, encroachment removal, channel restoration, and bridge removal/replacement. [8]

Phosphorus accounting for floodplain and stream restoration projects in the Lake Champlain basin is determined through the Functioning Floodplains Initiative web application.[9] For a full summary of the phosphorus accounting methodology in the Functioning Floodplains Initiative application, see the Standard Operating Procedures for Tracking & Accounting of Natural Resource Restoration Projects.[10] For the purposes of this analysis, simulated median values for stream channel and floodplain restoration practices the Lake Champlain basin were used as a representative median estimated phosphorus reduction achieved through increased stream stability. Estimated phosphorus reduction associated with improved floodplain storage is dependent on the degree of change to floodplain connectivity. The FFI methodology assigns an acreage-based floodplain storage rate based on three different changes in floodplain connectivity: low to high, moderate to high, low to moderate. For the purposes of this analysis, an assumption for change in floodplain connectivity from low to moderate was used as the median assumed floodplain storage value.

Table 2. Floodplain and stream restoration project metrics, values and explanations.

Metric	Value	Explanation/Assumption
Project output unit	Acres of floodplain reconnected/restored	

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[8] In some cases, an estimated phosphorus reduction may be calculated for wetland restoration projects located within a river corridor following the floodplain and stream phosphorus accounting methodology, however this is not applicable in all contexts and a more complete accounting methodology to estimate phosphorus reduction achieved through wetland restoration is forthcoming (expected 2027). Wetland restoration will be incorporated into the cost rate methodology as a distinct project category once methods are in place to estimate phosphorus reductions associated with wetland restoration projects.

[9] Functioning Floodplains Initiative: https://ffi.stone-env.net/home

[10] Standard Operating Procedures for Tracking & Accounting of Natural Resource Restoration Projects, available here: https://dec.vermont.gov/water-investment/cwi/state-vermont-clean-water-projects/clean-water-project-tracking-accounting#SOP

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AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Project type(s)	Floodplain/stream restoration – Implementation	
Sample size (n)	17	Includes projects reported to the Clean Water Reporting Framework (CWRF) SFY 2016 – 2024, statewide. Each project in the project category contained within the CWRF database was reviewed for suitability in this analysis.
Median $/output unit	$54,022	$ per acre of floodplain reconnected/restored. Costs presented in 2025 dollars. Includes +20% design/engineering adjustment
Median phosphorus reduction per output unit kg/acre/year (actual)	N/A (insufficient data)	
Median $/kg/year (actual)	N/A (insufficient data)	
Median phosphorus reduction per output unit kg/acre/year (assumed)	**4.08 kg/acre/year** Stream stability = 0.88 kg/acre/year + Floodplain storage = 3.2 kg/acre/year	Stream stability simulated median phosphorus reduction value for channel and floodplain restoration practices (create flood bench, lower floodplain, raise channel, reconnect flood chute, remove berm, and restore channel slope) in all drainages in the Lake Champlain basin.[11] Floodplain storage in year 2+ associated with a change in floodplain connectivity for floodplain acres within the river corridor from low to moderate reconnection achieved. Phosphorus reduction per output unit applied to project level reported output unit value to calculate assumed project level phosphorus reduction.

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[11] Simulated median values for listed practices account for an assumed buffer planting and change in corridor protection.

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Median $/kg/year (assumed)	$13,241	Median of estimated cost per kg of assumed phosphorus reduction calculated at the project level for representative floodplain/stream projects adjusted to 2025 dollars and accounting for 20% design costs. n = 17 Min: $1,314 Max: $469,529
Design life	10 years	Active restoration floodplain and stream practices are assigned an initial 10-year design life to account for post-implementation process-based restoration to be achieved. Lifespan may be extended upon verification and subject to continued operation and maintenance to support project performance.

Sensitivity analysis for storage and stability assumptions

A range of variance is anticipated in the potential phosphorus reduction per acre of floodplain reconnected/restored. The table below provides a sensitivity analysis showing the calculated cost rate for floodplain and stream restoration projects based on different combinations of assumed stream stability and floodplain storage phosphorus reductions (kg/acre/year). Values presented in the table are representative of actual year 2+ floodplain storage phosphorus reduction values (kg/acre/year) associated with the three types of floodplain connectivity change that are possible (low to moderate, moderate to high, low to high). Values presented in the table for stream stability are selected simulated median values from the Lake Champlain basin wide modeling and sub-basin scale modeling.[12]

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[12] Methodology described in detail in the FFI user manual, available here: https://stone-env-public.s3.amazonaws.com/FFI_User_Guide_2.1.pdf

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table 1: Floodplain and stream restoration project category median cost rate variance based on assumed phosphorus reductions attributed to floodplain storage and stream stability. Cost rates are presented in $/kg/year.

			Stream stability (kg/acre/yr)		
			Channel and floodplain restoration sub-basin minimum	*Channel and floodplain restoration Lake Champlain basin-wide median*	*Channel and floodplain restoration sub-basin maximum*
			0.29	0.88	1.57
Floodplain storage (kg/acre/yr)	*Moderate to high*	2.3	$20,858	$16,988	$13,959
	Low to moderate	3.2	$15,479	$13,241	$11,325
	Low to high	4.5	$11,278	$10,041	$8,900

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Dam Removal and Associated Restoration

This project category captures the anticipated median cost per unit of annual phosphorus reduction for projects that increase floodplain storage and improve stream stability, specifically through implementation of dam removal projects and associated floodplain and stream restoration. This project category is distinguished from other floodplain and stream restoration project costs because the cost to implement a dam removal tends to be higher compared to most other practices within the stream sector.

Phosphorus accounting for floodplain and stream restoration projects in the Lake Champlain basin is determined through the Functioning Floodplains Initiative web application.[13] For a full summary of the phosphorus accounting methodology in the Functioning Floodplains Initiative application, see the Standard Operating Procedures for Tracking & Accounting of Natural Resource Restoration Projects.[14] For the purposes of this analysis, simulated median values for dam removal plus restoration practices the Lake Champlain basin were used as a representative median estimated phosphorus reduction achieved through increased stream stability. Estimated phosphorus reduction associated with improved floodplain storage is dependent on the degree of change to floodplain connectivity. The FFI methodology assigns an acreage-based floodplain storage rate based on three different changes in floodplain connectivity: low to high, moderate to high, low to moderate. For the purposes of this analysis, an assumption for change in floodplain connectivity from low to moderate was used as the median assumed floodplain storage value.

Table 4. Dam removal and associated restoration project metrics, values and explanations.

Metric	Value	Explanation/Assumption
Project output unit	Acres of floodplain reconnected/restored	
Project type(s)	Dam removal – Implementation	
Sample size (n)	6	Includes projects reported to the Clean Water Reporting Framework (CWRF) SFY 2016 – 2024, statewide. Each project in the project category contained within the CWRF database was reviewed for suitability in this analysis.
Median $/output unit	$195,985	$ per acre of floodplain reconnected/restored. Costs presented in 2025 dollars. Includes +20% design/engineering adjustment

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[13] Functioning Floodplains Initiative: https://ffi.stone-env.net/home

[14] Standard Operating Procedures for Tracking & Accounting of Natural Resource Restoration Projects, available here: https://dec.vermont.gov/water-investment/cwi/state-vermont-clean-water-projects/clean-water-project-tracking-accounting#SOP

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Metric	Value	Explanation/Assumption
Median phosphorus reduction per output unit kg/acre/year (actual)	N/A (insufficient data)	
Median $/kg/year (actual)	N/A (insufficient data)	
Median phosphorus reduction per output unit kg/acre/year (assumed)	**4.25 kg/acre/year** Stream stability = 1.05 kg/acre/year + Floodplain storage = 3.2 kg/acre/year	Stream stability simulated median phosphorus reduction value for various types of dam removals in all drainages in the Lake Champlain basin.[15] Floodplain storage in year 2+ associated with a change in floodplain connectivity for floodplain acres within the river corridor from moderate to high reconnection achieved. Phosphorus reduction per output unit applied to project level reported output unit value to calculate assumed project level phosphorus reduction.
Median $/kg/year (assumed)	$46,114	Median of estimated cost per kg of assumed phosphorus reduction calculated at the project level for representative dam removal projects adjusted to 2025 dollars and accounting for 20% design costs. n = 6 Min: $7,778 Max: $187,868
Design life	10 years	Active restoration floodplain and stream practices are assigned an initial 10-year design life to account for post-implementation process-based restoration to be achieved. Lifespan may be extended upon verification and subject to continued operation and maintenance to support project performance.

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[15] Simulated median values account for an assumed floodplain restoration post dam removal.

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Sensitivity analysis for storage and stability assumptions

A range of variance is anticipated in the potential phosphorus reduction per acre of floodplain reconnected/restored. The table below provides a sensitivity analysis showing the calculated cost rate for dam removal projects based on different combinations of assumed stream stability and floodplain storage phosphorus reductions (kg/acre/year). Values presented in the table are representative of actual year 2+ floodplain storage phosphorus reduction values (kg/acre/year) associated with the three types of floodplain connectivity change that are possible (low to moderate, moderate to high, low to high). Values presented in the table for stream stability are selected simulated median values from the Lake Champlain basin wide modeling and sub-basin scale modeling.[16]

Table 5: Dam removal project category median cost rate variance based on assumed phosphorus reductions attributed to floodplain storage and stream stability. Cost rates are presented in $/kg/year.

			Stream stability (kg/acre/yr)		
			Dam removal Lake Champlain sub-basin minimum	*Dam removal Lake Champlain basin-wide median*	*Dam removal Lake Champlain sub-basin maximum*
			0.26	1.05	2.39
Floodplain storage (kg/acre/yr)	*Moderate to high*	2.3	$76,556	$58,503	$41,788
	Low to moderate	3.2	$56,643	$46,114	$35,060
	Low to high	4.5	$41,173	$35,313	$28,445

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[16] Methodology described in detail in the FFI user manual, available here: https://stone-env-public.s3.amazonaws.com/FFI_User_Guide_2.1.pdf

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Riparian Buffer Restoration

This project category captures the anticipated median cost per unit of annual phosphorus reduction for projects that treat overland flow and convert land use through implementation of riparian buffer planting. Phosphorus reductions are estimated at the project level using location specific loading rates based on two components: treatment of drainage area runoff and conversion of land area to forest/brush. Some buffer plantings may also contribute phosphorus reduction through increased stream stability, however the project minimum standards differ (35ft minimum width for buffer planting, 50ft minimum width for buffer planting providing stream stability), so the stream stability component of estimated phosphorus reduction has been left out of the calculation for this project category. The riparian buffer planting project dataset assumes projects were implemented to the 35ft minimum width standard.

The dataset includes some projects for which data is available to estimate the phosphorus reduction achieved through implementation, and includes some projects for which cost data is available, but estimated phosphorus reduction has been assumed. For assumed estimated phosphorus reduction, the median phosphorus reduction (kg/yr) per output unit (acre of riparian corridor buffer planted/restored) was applied to the project reported output unit to estimate an assumed phosphorus reduction. The results of both analyses are included below, however only the sample of projects with actual phosphorus reductions has been applied to the project category cost rate.

This project category cost rate does not include an adjustment for design and engineering costs, because buffer plantings generally require minimal design work prior to implementation.

Table 6. Riparian buffer restoration project metrics, values and explanations.

Metric	Value	Explanation/Assumption
Project output unit	Acres of riparian corridor buffer planted/restored	
Project type(s)	River – Planting Floodplain/stream Restoration – Implementation	Floodplain/stream restoration – implementation projects included in this analysis are best represented as riparian buffer planting and were excluded from the floodplain/stream project cost rate.

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Sample size (n)	208	Includes projects reported to the Clean Water Reporting Framework (CWRF) SFY 2016 – 2024, statewide. Each project in the project category contained within the CWRF database was reviewed for suitability in this analysis. Projects excluded from analysis include multi-outcome projects where cost data is not representative of buffer planting costs alone. 61 projects (actual phosphorus reduction) 147 projects (assumed phosphorus reduction)
Median $/output unit	$6,366	$ per acre of riparian corridor buffer planted/restored. Costs presented in 2025 dollars. No design/engineering adjustment. n = 208
Median phosphorus reduction per output unit kg/acre/year (actual)	1.61	n = 61 Min: 0.13 Max: 7.63
Median $/kg/year (actual)	$4,072	n = 61 Min: $785 Max: $70,239
Median phosphorus reduction per output unit kg/acre/year (assumed)	1.61	For projects without reported phosphorus reduction at the practice level, assumed phosphorus reduction = actual median phosphorus reduction (kg/acre/year) [1.61] * acres of riparian corridor buffer planted/restored n = 147 Min: 0.06 Max: 20.15

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Median $/kg/year (assumed)	$4,091	n = 147 Min: $506 Max: $57,364
Design life	20 years	VTDEC phosphorus accounting methodology assumes riparian buffer restoration design life is 20 years. Lifespan may be extended upon verification and subject to continued operation and maintenance to support project performance.

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Sub-jurisdictional Forest Road Erosion Control Practices

This project category captures the anticipated median cost per unit of annual phosphorus reduction for projects that implement the Acceptable Management Practices (AMPs)[17] in sub-jurisdictional settings to address forest truck road and skid trail erosion. Cost data included in this analysis is primarily costs associated with forest truck road improvement work implemented on Agency of Natural Resources owned lands (state forests), and two projects have been reported to VTDEC for sub-jurisdictional forest road and trail erosion control work implemented on private lands. VTDEC consulted with VT Department of Forests Parks & Recreation (VTFPR) on expected and actual project costs. Some data on VTFPR implementation costs was excluded from analysis because project work focused on substantial infrastructure (e.g. bridge building and repair) that is not expected to be representative of project work on private lands in sub-jurisdictional settings. VTDEC does not currently have cost data for erosion control and drainage improvement work on forest skid trails. VTFPR is prioritizing work on highest priority road segments first, which are among the most expensive to fix. Costs associated with erosion control on skid trails, while not currently quantified in the available dataset, are expected to be lower on average than costs to address drainage and erosion on truck roads. To account for these factors, project costs used in this analysis were adjusted to 75% of actual costs to balance the assessment that available cost data skews high.

This project category cost rate will be updated, or a new project category cost rate will be added, in the future to reflect the median cost per unit of phosphorus reduction associated with skid trail erosion control and drainage improvement once cost data is available. In the meantime, the cost rate for forest truck road erosion control and drainage improvement should be applied to forest skid trails as the best available estimate.

Phosphorus reduction estimates represent a median reduction per mile of hydrologically connected forest road improved to AMP standards following existing implementable phosphorus accounting methodologies. Future improvements to the specificity of phosphorus accounting methodologies for forest truck road and skid trail projects may be reflected in a refined cost rate estimate for this project category in the future. A wide range of practices may be implemented to achieve compliance with AMP standards. Phosphorus accounting methodology for forest truck road and skid trail projects is not dependent on individual practices implemented, rather the suite of practices installed to fully meet AMP standards for drainage and erosion control, in line with the methodological approach for other road types (e.g. municipal roads, private residential roads).

Table 7. Forest road erosion control practice project metrics, values and explanations.

Metric	Value	Explanation/Assumption
Project output unit	Linear feet of forest road drainage improved	Adjusted to miles (mi) for analysis
Project type(s)	Forestry – Implementation	

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[17] More information on Vermont's Acceptable Management Practices is available here: https://fpr.vermont.gov/forest/managing-your-woodlands/acceptable-management-practices

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Sample size (n)	14	Includes projects reported to the Clean Water Reporting Framework (CWRF) SFY 2016 – 2024, statewide. Excludes projects that focus on bridge construction and/or rebuilding roads on ANR lands.
Median $/output unit	$54,934[18]	$ per mile of forest road/trail drainage improved. Costs presented in 2025 dollars. Includes +20% design/engineering adjustment.
Median phosphorus reduction per output unit kg/mile/year (actual)	N/A (insufficient data)	
Median $/kg/year (actual)	N/A (insufficient data)	
Median phosphorus reduction per output unit kg/mile/year (assumed)	2.18	Average hydrologically connected truck road linear loading rate (kg/mile/year) across Lake Champlain and Lake Memphremagog drainages = 2.73 Reduction efficiency representative of road segments brought from 'does not meet' to 'fully meets' standard = 80%[19]
Median $/kg/year (assumed)	$25,196	Estimated cost per kg of phosphorus reduction for based on assumed average phosphorus load and phosphorus reduction efficiency on hydrologically connected forest truck road segments. Adjusted to 2025 dollars and accounting for 20% design costs. n = 14 Min: $3,509 Max: $116,061

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[18] As part of the cost rate analysis, VTDEC consulted with VTFPR on estimated project costs per output unit. VTFPR assumes $60,000 per mile of forest road improved for planning purposes, based on estimates provided by the Vermont Agency of Transportation.

[19] Assumptions based on Standard Operating Procedures for Tracking & Accounting: https://dec.vermont.gov/water-investment/cwi/state-vermont-clean-water-projects/clean-water-project-tracking-accounting

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Design life	5 years	VTDEC phosphorus accounting methodology assumes forest truck road design life is 5 years. Non-regulatory forest truck road erosion control projects are assigned an initial 5-year design life. Lifespan may be extended upon verification and subject to continued operation and maintenance to support project performance.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Sub-jurisdictional Stormwater Treatment Practices

This project category captures the anticipated median cost per unit of annual phosphorus reduction for projects that treat stormwater runoff in sub-jurisdictional developed lands settings. Phosphorus reductions are estimated at the practice level using location specific land use loading rates and practice specific reduction efficiencies.

The dataset includes some projects for which data is available to estimate the phosphorus reduction achieved through implementation, and includes some projects for which cost data is available, but estimated phosphorus reduction has been assumed. For assumed estimated phosphorus reduction, the median phosphorus reduction (kg/yr) per output unit (acre of existing impervious surface treated) was applied to the project reported output unit to estimate an assumed phosphorus reduction. The results of both analyses are included below, however only the sample of projects with actual phosphorus reductions has been applied to the project category cost rate.

Cost data included in this analysis includes project costs to implement the following practices: gravel wetland, porous pavement, hydrodynamic swirl separation, sand filter, infiltration trench, surface infiltration, bioretention, extended dry detention pond, grass swale (conveyance), bioretention with underdrain, and infiltration basin.

Table 8. Stormwater treatment practice project metrics, values and explanations.

Metric	Value	Explanation/Assumption
Project output unit	Acres of existing impervious surface treated	
Project type(s)	Stormwater - Implementation	
Sample size (n)	117	Includes projects reported to the Clean Water Reporting Framework (CWRF) SFY 2016 – 2024, statewide. Project data excluded from analysis includes 22 projects that implemented a non-Tier1/Tier2 stormwater BMP, involved retrofit of existing treatment, or were implemented as a regulatory requirement. 85 projects (actual phosphorus reduction) 32 projects (assumed phosphorus reduction)

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Median $/output unit	$55,354.11	$ per acre of existing impervious surface treated. Costs presented in 2025 dollars. Includes +20% design/engineering adjustment.
Median phosphorus reduction per output unit kg/acre/year (actual)	0.80	n = 85 Min: 0.12 Max: 5.28
Median $/kg/year (actual)	$78,051	Estimated cost per kg of phosphorus reduction for representative stormwater treatment practices adjusted to 2025 dollars and accounting for 20% design/engineering costs. n = 85 Min: $1,215 Max: $2,344,181
Median phosphorus reduction per output unit kg/acre/year (assumed)	0.52	For projects without reported phosphorus reduction at the practice level, assumed phosphorus reduction = actual median phosphorus reduction (kg/acre/year) [0.80] * acres of existing impervious surface treated n = 32 Min: 0.02 Max: 32.97
Median $/kg/year (assumed)	$78,965	Estimated cost per kg of phosphorus reduction for representative stormwater treatment practices adjusted to 2025 dollars and accounting for 20% design/engineering costs. n = 32 Min: $5,335 Max: $1,442,570

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Design life	10 years	VTDEC phosphorus accounting methodology assumes non-regulatory stormwater treatment practice design life is 10 years. Lifespan may be extended upon verification and subject to continued operation and maintenance to support project performance.

Sub-jurisdictional Road Erosion Control Practices

This project category captures the anticipated median cost per unit of annual phosphorus reduction for projects that implement private residential road erosion control and drainage improvement projects in sub-jurisdictional settings. An assessment methodology is currently under development to support consistent application of private residential road standards, which will inform a more refined approach to phosphorus accounting in the future. In the meantime, the standards and generalized loading rates for unpaved municipal roads subject to the Municipal Roads General Permit (MRGP) are used as a proxy to support development of the cost rate for this project category.

Project costs used in this analysis are representative of grant funding awarded and spent towards MRGP compliance through the Municipal Roads Grants in Aid and Better Roads grant programs. Analysis

The dataset includes some projects for which data is available to estimate the phosphorus reduction achieved through implementation, and includes some projects for which cost data is available, but estimated phosphorus reduction has been assumed. Projects with estimated phosphorus reduction achieved through implementation are included below for comparison, but are not applied to the project category cost rate. In this case, the assumed project level phosphorus reduction is expected to be more representative of potential phosphorus reduction per output unit because the actual phosphorus reductions have been calculated using adjusted loading rates that are specific to the Municipal Roads General Permit and not applicable to the sub-jurisdictional context at this time.

For assumed estimated phosphorus reduction, the median linear loading rate for unpaved roads in the Lake Champlain and Lake Memphremagog basins (kg/yr) per output unit (miles of road drainage improved) was multiplied by a generalized reduction efficiency to estimate a phosphorus production. Phosphorus production multiplied by an assumed reduction efficiency results in the estimated phosphorus reduction per mile of road drainage improved. Reduction efficiencies vary based on the change in segment condition. Segments that are improved from 'partially meets' to 'fully meets' standards are assigned a 40% reduction efficiency and segments that are improved from 'does not meet' to 'fully meets' standards are assigned an 80% reduction efficiency. Based on available MRGP data, there is a relatively equal distribution of baseline road segment inventory results with scores of 'does not meet' and 'partially meets' which informed the 60% average reduction efficiency is used in this analysis.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table 9. Road erosion control practice project metrics, values and explanations.

Metric	Value	Explanation/Assumption
Project output unit	Linear feet of road drainage improved	Adjusted to miles (mi) for analysis
Project type(s)	Road Project - Implementation	Includes only Municipal Roads Grants in Aid and Better Roads funded projects.
Sample size (n)	1,367	Includes projects reported to the Clean Water Reporting Framework (CWRF) SFY 2016 – 2024, statewide. Excludes 120 projects that only completed/reported culvert replacement as that practice is not compatible with the linear loading rate and segment based accounting used to estimate phosphorous reduction. 380 projects (actual phosphorus reduction) 1,367 projects (assumed phosphorus reduction)
Median $/output unit	$122,626	$ per mile of road drainage improved. Costs presented in 2025 dollars. Includes +20% design/engineering adjustment.
Median phosphorus reduction per output unit kg/mi/year (actual)	3.75	Provided for comparative purposes - estimated phosphorus reduction based on road segment compliance with Municipal Road General Permit standards calculated using adjusted phosphorus loading rates that are not applicable/transferable to sub-jurisdictional road segments. n = 380 Min = 0.06 Max = 73.51

VERMONT

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Median $/kg/year (actual)	$28,451	Estimated cost per kg of phosphorus reduction for regulatory municipal road erosion control projects. adjusted to 2025 dollars and accounting for 20% design costs. n = 380 Min = $1,666 Max = $923,773
Median phosphorus reduction per output unit kg/mi/year (assumed)	5.47	Median unpaved road linear loading rate across Lake Champlain and Lake Memphremagog drainages = 9.12 kg/mi/year Median reduction efficiency based on equal proportion of road segments with baseline condition of 'does not meet' or 'partially meets' improved to 'fully meets' standard = 60%[20]
Median $/kg/year (assumed)	$22,397	Estimated cost per kg of phosphorus reduction for based on assumed median phosphorus reduction on sub-jurisdictional road segments. Adjusted to 2025 dollars and accounting for 20% design costs. n = 1,367 projects Min = $1,553 Max = $1,874,874
Design life	8 years	VTDEC phosphorus accounting methodology assumes road BMPs design life is 8 years. Non-regulatory road erosion control projects are assigned an initial 8-year design life. Lifespan may be extended upon verification and subject to continued operation and maintenance to support project performance.

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[20] Assumptions based on Standard Operating Procedures for Tracking & Accounting: https://dec.vermont.gov/water-investment/cwi/state-vermont-clean-water-projects/clean-water-project-tracking-accounting

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Sub-jurisdictional Lake Shoreland Stormwater Treatment Practices

This project category captures the anticipated median cost per unit of annual phosphorus reduction for projects that treat stormwater runoff in sub-jurisdictional lakeshore developed lands settings. Stormwater treatment in lakeshore settings tends to be implemented at a smaller scale and thus is accounted for with a distinct cost rate project category from sub-jurisdictional stormwater treatment practices. Phosphorus reductions are estimated at the practice level using location specific land use loading rates and practice specific reduction efficiencies.

The dataset includes some projects for which data is available to estimate the phosphorus reduction achieved through implementation, and includes some projects for which cost data is available, but estimated phosphorus reduction has been assumed. For assumed estimated phosphorus reduction, the median phosphorus reduction (kg/yr) per output unit (acre of existing impervious surface treated) was applied to the project reported output unit to estimate an assumed phosphorus reduction. The results of both analyses are included below, however only the sample of projects with actual phosphorus reductions has been applied to the project category cost rate.

Cost data included in this analysis includes project costs to implement the following practices: bioretention, surface infiltration, and infiltration trench.

Table 10. Lake shoreland stormwater treatment practice project metrics, values and explanations.

Metric	Value	Explanation/Assumption
Project output unit	Acres of existing impervious surface treated	
Project type(s)	Lake Shoreland - Implementation	
Sample size (n)	16	Includes projects reported to the Clean Water Reporting Framework (CWRF) SFY 2016 – 2024, statewide. 5 projects (actual phosphorus reduction) 11 projects (assumed phosphorus reduction)
Median $/output unit	$23,488	$ per acre of impervious surface treated. Costs presented in 2025 dollars. Includes +20% design/engineering adjustment.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Median phosphorus reduction per output unit kg/acre/year (actual)	0.76	n = 5 Min = 0.01 Max = 0.90
Median $/kg/year (actual)	$75,217	Estimated cost per kg of phosphorus reduction for representative stormwater treatment practices that treat stormwater runoff in sub-jurisdictional lakeshore developed lands settings. Adjusted to 2025 dollars and accounting for 20% design costs. n = 5 Min = $6,229 Max = $148,777
Median phosphorus reduction per output unit kg/acre/year (assumed)	0.34	For projects without reported phosphorus reduction at the practice level, assumed phosphorus reduction = actual median phosphorus reduction (kg/acre/year) [0.76] * acres of existing impervious surface treated n = 11 Min = 0.08 Max = 0.74
Median $/kg/year (assumed)	$62,023	n = 11 projects Min = $22,623 Max = $1,465,931
Design life	10 years	VTDEC phosphorus accounting methodology assumes non-regulatory stormwater treatment practice design life is 10 years. Lifespan may be extended upon verification and subject to continued operation and maintenance to support project performance.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Lake Shoreline Stabilization

This project category captures the anticipated median cost per unit of annual phosphorus reduction for projects that implement bioengineered lake shoreline stabilization techniques. Practices may include: stone toes, regrading, and coir logs or encapsulated soil lifts.

Cost and phosphorus reduction data for this project category are limited in the current CWRF dataset, and alternative assumptions used in this analysis are explained below.

Unlike other clean water project types, TMDL Soil and Water Assessment Tool (SWAT) model phosphorus loading rates are not used in the phosphorus accounting calculations for bioengineered shoreline stabilization practices.[21]

For the purpose of this analysis, estimated total phosphorus base load per 1 foot of lakeshore restored assumes 1 foot of shoreline length, 3 feet of shoreline height, and a moderate erosion rate of 0.33 feet per year for estimated 0.99 cubic feet volume of sediment erosion. Volume of sediment erosion is converted to total phosphorus baseload by multiplying sediment bulk density and sediment phosphorus concentration rates to estimate total phosphorus load of 0.021 kg/foot/year base load. An 85% reduction efficiency is applied to the baseload for lake shoreline stabilization, resulting in an estimated phosphorus reduction of 0.018 kg/ft/year.

In 2022, the VTDEC Lakes and Ponds Program estimated project costs for lake shoreline restoration using bioengineered stabilization techniques to be approximately $150 per foot of lakeshore restored based on a sample of case studies representing 10-15 foot project restoration site width. This cost estimate is carried forward from the previous publishing to this updated cost rate analysis, but has been adjusted to January 2025 dollars and to account for 20% design and engineering costs.

Table 11. Lake shoreland stabilization practice project metrics, values and explanations.

Metric	Value	Explanation/Assumption
Project output unit	Linear feet of lakeshore restored	
Project type(s)	Lake Shoreland – Implementation	
Sample size (n)	N/A (insufficient data)	
Median $/output unit	N/A (insufficient data)	

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[21] Accounting methods for shoreline stabilization are described in detail in the Standard Operating Procedures for Tracking & Accounting: https://dec.vermont.gov/water-investment/cwi/state-vermont-clean-water-projects/clean-water-project-tracking-accounting

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Metric	Value	Explanation/Assumption
Median phosphorus reduction per output unit kg/ft/year (actual)	N/A (insufficient data)	
Median $/kg/year (actual)	N/A (insufficient data)	
Median phosphorus reduction per output unit kg/ft/year (assumed)	0.018	Assumed median phosphorus reduction per foot[22] based on: 1 foot of shoreline length 3 feet of shoreline height moderate erosion rate of 0.33 feet per year
Median $/kg/year (assumed)	$10,809	Applies estimated project cost of $193 per linear foot of lakeshore restored. Based on Lakes and Ponds Program unit cost estimate of $150 per foot adjusted to January 2025 dollars and including +20% design/engineering adjustment
Design life	20 years	VTDEC phosphorus accounting methodology assumes riparian buffer restoration design life is 20 years. Lifespan may be extended upon verification and subject to continued operation and maintenance to support project performance.

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[22] Phosphorus accounting methodology for bioengineered lake shoreline stabilization is available in the Standard Operating Procedures for Tracking & Accounting of Natural Resources Restoration Projects, here: https://dec.vermont.gov/water-investment/cwi/state-vermont-clean-water-projects/clean-water-project-tracking-accounting#SOP

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Correlating Cost Rates to Non-Regulatory Targets for Water Quality Restoration Formula Grant Fund Allocations

VTDEC identified the project categories representative of implementing non-regulatory targets by sector, shown in Table 12. ***These project categories were identified as representative of project costs in each TMDL land use sector and do not define/limit Water Quality Restoration Formula Grant eligible project types.*** For agriculture and forest sectors, a single project category cost rate has been determined to be a representative estimate of median cost per unit of phosphorus reduction achieved through practice implementation in these sectors. For the streams sector, project category cost rates for dam removal and floodplain and stream restoration have been calculated separately, and weighted to calculate the sector cost rate based on the relative proportion of implementation of each project type within the data sample. For the developed lands sector, several project category cost rates may be implemented to address phosphorus loading. Each of these project category cost rates was assigned a weighting factor based on analysis of proportions of recently implemented practices and VTDEC assessment of the relative scale of opportunity to implement practices contained within each project category.

Water Quality Restoration Formula Grant fund allocations are for budget-level allocation purposes to disperse funds to CWSPs. This exercise does not dictate the Formula Grant implementation at the project-level but may provide a reference point for CWSPs and BWQCs to evaluate projects' cost effectiveness in reducing phosphorus pollution. CWSPs, BWQCs, and project implementers will identify actual projects in their watershed of focus that will contribute toward achieving non-regulatory phosphorus reduction targets, considering other co-benefits and project feasibility factors.

Table 12: Clean water project category cost rates correlated to non-regulatory target land use sector.

Non-regulatory Land Use Target Sector	Project Category	Project Category Cost Rate ($/kg/yr)	Weighting	Sector Weighted Cost Rate ($/kg/yr)
Streams	Floodplain and Stream Restoration	$13,241	75%	
Streams	Dam Removal and Associated Restoration	$46,114	25%	
Streams*	weighted average			$21,459
Agriculture**	Riparian Buffer Restoration	$4,072		$4,072
Forest***	Forest Road Erosion Control	$18,897		$18,897
Developed	Structural Stormwater Treatment	$78,051	50%	

VERMONT

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Developed	Road Erosion Control	$22,397	35%	
Developed	Lake Shoreland Stormwater Treatment	$75,217	2.5%	
Developed	Riparian Buffer Restoration	$4,072	10%	
Developed	Lake Shoreline Stabilization	$10,809	2.5%	
Developed****	*weighted average*			$49,422

* Streams: the Functioning Floodplains Initiative (FFI) methodology for estimating phosphorus reductions associated with floodplain and stream restoration projects is highly location dependent and subject to a wide range in variance dependent on reach allocation and anticipated geomorphological evolution. Costs to implement floodplain and stream restoration projects are also subject to a high degree of variance depending on the project components. While a sector cost rate is necessary to support the fund allocation and target setting steps of this methodology, a range of median unit costs is provided in the project category cost rate sections to provide additional context for anticipated range of costs for projects treating phosphorus loading in the stream sector. Weighting factors were determined based on the distribution of the sample. Of the 23 projects in the sample dataset that reported the performance measure "acres of floodplain reconnected restored", 6 (26%) are dam removals and 17 (74%) are other types of floodplain and stream restoration. The distribution in the sample dataset is assumed to be representative of the distribution in overall project implementation. The FFI interface and accounting systems continue to be developed and improved.

River corridor easments were not included in the stream sector cost rate update due to limitations in CWSPs ability to engage in easements at this time. River corridor easements are currently administered and overseen by the State of Vermont and deeded land use restrictions required under a river corridor easement can only be held by a qualified easement holder. At this time, CWSPs are not able to execute River Corridor Easements with Formula Grant funding, and work to address this gap will be prioritized as staff capacity allows. When this project type becomes available for CWSPs it will be re-integrated into a future cost rate update.

** Agriculture: at this time, only a subset of projects that treat the agricultural sector load are eligible for CWSPs to fund with Water Quality Restoration Formula Grants. Forested riparian buffers implemented to treat overland flow from agricultural land uses is the most representative project category cost rate to assign to the agricultural sector when considering project type eligibility, currently available project category cost rates, and phosphorus accounting approaches related to the TMDL land use loading assignments.

*** Forests: at this time, forest truck roads are the only project category cost rate that is applicable to represent the cost of treating the phosphorus loading from the forested land use sector. Data is not yet available on costs associated with forest skid trail erosion control and phosphorus reduction, however a project category cost rate and weighting will be incorporated into the sector cost rate in the future as data availability allows. Based on the standards and expectations for conforming with the AMPs on forest skid trails, it is anticipated that the cost to address drainage issues and implement

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

erosion control measures on forest skid trails will be equal to or lower per unit than the current cost data available for forest truck roads.

**** Developed: treating phosphorus loading from the developed lands sector can currently be achieved through implementation of several different types of projects representing distinct project category cost rates. The cost to implement these different types of projects varies widely, as does the potential phosphorus reduction to be achieved and the relative scale of opportunity to implement. Because of this, VTDEC has assigned a weighting factor to each project category cost rate applicable to treating phosphorus loading in the developed lands sector. The weighting factors were determined based on VTDEC estimates of the relative proportion of project category implementation opportunities given currently available tools and assessment protocols. In this case, past implementation is not necessarily representative of future opportunity at the project category level. For example, very few non-regulatory projects have been completed to date to address sub-jurisdictional road erosion control, however this is anticipated to be a growing segment of developed lands phosphorus reduction project opportunity in the future as an assessment framework is currently under development and expected by 2027. Lake shoreland stormwater treatment and shoreline stabilization are an important component of overall implementation in the developed lands sector, but the scope of these project implementation opportunities remains limited to specific geographic areas around lakes and the scale of implementation opportunities is smaller than other project categories treating the developed lands sector.

Non-Regulatory Total Phosphorus Load Reduction Targets and Fund Allocation

The starting point for setting CWSP phosphorus reduction targets is the basin-specific TMDL required reductions **(Appendix A Table A-1)**. The Lake Champlain basin required phosphorus reductions were summarized by the Watershed Planning Program based on the original SWAT modeling used in the development of the Lake Champlain TMDL. Reduction estimates for the watersheds within the Lake Champlain basin were derived from TMDL lake segment assignments and associated land use sector-specific percent reductions. Reduction estimates have been aggregated at the tactical basin scale (basin and sub-basin loading and reduction targets by land use sector have been summarized in this Power BI report). The Lake Memphremagog basin required phosphorus load reductions are based directly on the Lake Memphremagog TMDL reduction targets.

Act 76 identifies CWSP phosphorus reduction targets as the required phosphorus load reduction remaining after accounting for reductions anticipated to be achieved through the implementation of regulatory programs. However, CWSPs are not the only entities working to achieve non-regulatory phosphorus reductions in the Lake Champlain and Lake Memphremagog basins. Each land use sector that contributes phosphorus loading has a unique set of regulatory programs that address some portion of the TMDL reduction goal. These sector specific regulations, or their surrogates, are described below and estimated phosphorus reductions expected to be achieved through regulatory programs are shown in Appendix A Table A-2.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

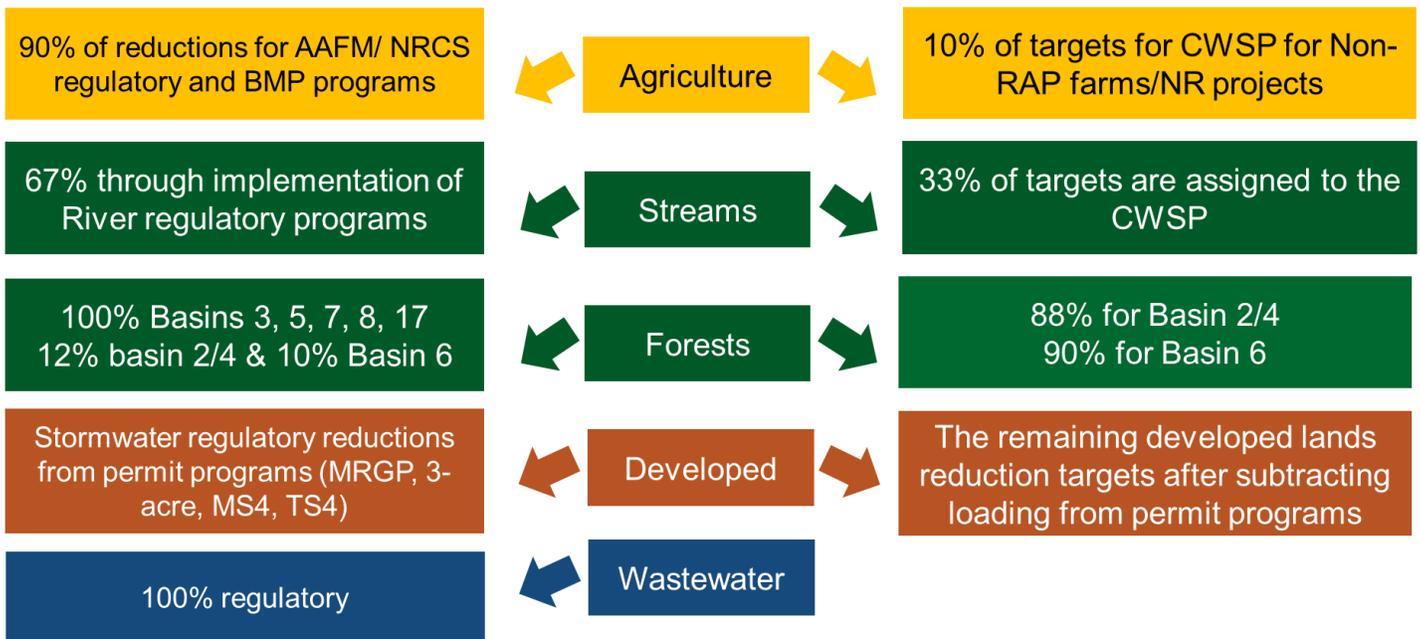| Regulatory		Non-regulatory
90% of reductions for AAFM/ NRCS regulatory and BMP programs	Agriculture	10% of targets for CWSP for Non-RAP farms/NR projects
67% through implementation of River regulatory programs	Streams	33% of targets are assigned to the CWSP
100% Basins 3, 5, 7, 8, 17 12% basin 2/4 & 10% Basin 6	Forests	88% for Basin 2/4 90% for Basin 6
Stormwater regulatory reductions from permit programs (MRGP, 3-acre, MS4, TS4)	Developed	The remaining developed lands reduction targets after subtracting loading from permit programs
100% regulatory	Wastewater	

Figure 2. Regulatory vs non-regulatory phosphorus reductions for the agricultural, stream, forest, developed land, and wastewaters sectors.

- **Agricultural land**. To date, field based agricultural load allocations in Vermont have not been broken down into clear regulatory and non-regulatory reduction categories.[23] A brief 2021 legislative report allocated 10% of the agricultural load allocation for each lake segment to the CWSP, with the other 90% remaining under the jurisdiction of AAFM. For the purposes of developing initial targets, the 90% load reductions associated with AAFM serve as the surrogate for the regulatory load reductions in each basin (Table A-2).

- **Forests**. Preliminary analysis during TMDL development and subsequent forestlands consultant work suggests that a 5% load reduction can be achieved via compliance with Acceptable Management Practices administered by the State of Vermont. For the purposes of developing initial targets, regulatory forestland phosphorus reductions were set at 5% in all basins. The assumption of 5% reduction in forestland loading is sufficient to reach the TMDL load allocation in the Lake Memphremagog basin and in all Lake Champlain watersheds other than South Lake (Basin 2/4) and Missisquoi Bay (Basin 6). The Lake Champlain TMDL assigns Basins 2/4 a forestland phosphorus reduction target of 40% so the 5% regulatory reduction achieves 12% of the loading target for forestland for this basin leaving 88% to be assigned as part of the CWSP target. The Lake Champlain TMDL assigns Basins 6 a forestland phosphorus reduction target of 50% so the 5% regulatory reduction achieves 10% of the loading target for forestland for this basin leaving 90% to be assigned as part of the CWSP target.

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[23] In contrast, production area agricultural waste load allocation reductions will be met solely through regulation.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

- **Streams**. Stream load reductions achieved by regulatory and non-regulatory programs can be approximated but not precisely assigned at this time. The Phase 1 TMDL Implementation Plan for Lake Champlain identifies passive restoration achieved through regulation as the primary mechanism to address phosphorous loading due to stream instability. The Rivers Program has estimated that two-thirds of future stream reductions will be achieved through implementation of regulatory programs aimed at restoring stream equilibrium conditions over time. Specifically, regulatory programs that limit new encroachments and channelization practices facilitate larger scale passive restoration as rivers reconnect to floodplains and achieve a stable slope through the channel evolution process. These programs include the stream alteration permit program and flood hazard area/river corridor regulations implemented at the state and local levels. The potential for regulatory reductions will be refined through continued research, developments of the Functioning Floodplains Initiative tools, additional geospatial analysis, and considerations for strengthened regulations that further support the restoration of equilibrium conditions. The remaining 33% of the stream reduction targets were attributed to the CWSP for the implementation of stream restoration and protection projects annually, until such time that the estimates can be refined. Following the passage of Act 121 in 2024, the state is implementing several changes to the regulation and management of river corridors, flood hazard areas, wetlands, and dams. New information to inform updated assumptions on the proportion of stream load reduction that will be achieved by regulatory programs is expected to be available by 2028 and will be considered in updated assumptions for this sector.[24]

- **Developed Lands**. Regulatory load reductions for developed lands have been estimated by staff in DEC's Stormwater Program. Sites and activities encompassed by the estimates include those governed by the Municipal Roads General Permit (MRGP), the 3-acre permit, as well as the Municipal Separate Storm Sewer System General Permit (MS4) and Transportation Separate Storm Sewer System General Permit (TS4). A summary of this analysis is included below:

    o **Three-acre permit:** Load reductions anticipated through implementation of the 3-acre permit were calculated based on an estimated 35% reduction efficiency applied across the 3-acre properties in each basin.[25] For the purposes of the funding formula, this data has been summarized by basin.

    o **Municipal Roads General Permit (MRGP):** Previous analyses have estimated the load reduction anticipated to be achieved through compliance with the MRGP permit. These estimates, which assume conversion of road segments with a baseline inventory assessment result of not meeting or partially meeting to fully meeting standards, are the basis for the reduction estimates used in this analysis. This data has been summarized by basin. The total land area attributed to roads in the Lake Champlain TMDL SWAT model was based on older land-use dataset (2006 NLCD) and is as much as double more recent and precise estimates of impervious road area based on land-use data published by the Lake Champlain Basin Program in 2011 (LCBP 2011). The original TMDL road surface

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[24] Act 121 of 2024 available here: https://legislature.vermont.gov/bill/status/2024/S.213

[25] Estimated reduction efficiency is based on the assumption that practices are designed to meet the water quality standard of the 2017 Vermont Stormwater Management Manual (VSMM) which, on average, reduce phosphorus by 70%. This is then multiplied by the requirement that 50% of the water quality volume will be treated on 3-acre sites.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

area results in larger estimates of phosphorus loading, and associated load reduction potential than current tracking and stormwater permit reduction estimates, which are based on the smaller areas from the LCBP 2011 impervious surface analysis. This difference in area and loading is the source of the majority of the developed lands non-regulatory reduction targets for all basins except for Missisquoi Bay which has significantly higher developed lands reduction targets.

The Municipal Roads General Permit was reissued effective January 26, 2023, and the updated permit standards include a change to the segment-based compliance assessment to focus permit compliance on addressing road drainage and erosion issues. To conform with the updated compliance standard segment scoring, VTDEC is in the process of updating the adjusted loading rates and will incorporate more refined estimates of expected phosphorus reduction to be achieved through the MRGP once updated information is available (expected by 2026). During this revision, VTDEC will consider the impact of using updated 2016 1-meter resolution land use/ land cover dataset which may contribute to a refined estimate of current road surface areas, associated loading, and load reduction potential through MRGP implementation.

- **Transportation Separate Storm Sewer System (TS4):** Currently, TS4 estimates are provided at the lake segment scale only. Exact locations (and associated basin load reduction estimates) may shift as implementation of projects under the TS4 permit progress. For the purposes of the funding formula, VTDEC proposes that loading for lake segments to the basins be based on where most of the loading would flow. Total load reductions for this permit program are small in the context of overall CWSP targets. Thus, these assumptions would not be expected to impact load reduction targets or costs substantially for interim load reduction targets and will be refined in the future.

- **Municipal Separate Storm Sewer System (MS4):** MS4 estimates are provided based on reasonably detailed studies conducted to date. Exact locations (and associated basins) may shift as phosphorus control plans are developed or refined. This data has been provided at the town and basin scale based on analysis of the proportion of town area falling within each lake segment. Total load reductions for this permit program are small in the context of overall CWSP targets so these assumptions would not be expected to impact load reduction targets or costs substantially and will be refined in the future as new information is available.

- **Wastewater.** Wastewater related phosphorus load reductions fall fully within the regulatory sphere and are not included in the target setting and fund allocation methodology.

The phosphorus reductions estimated for stormwater permit programs may continue to be revised in future updates to this methodology as permit programs are implemented and site-specific phosphorus reductions are calculated.

Anticipated phosphorus reductions associated with developed lands regulatory permit programs are not available for the Lake Memphremagog Basin at this time. To approximate, an average of regulatory reductions (excluding the MS4 permit which is not in place in the Lake Memphremagog Basin) for the Lake Champlain basins excluding the Missisquoi basin was used. The non-Missisquoi basin segments can be used as a proxy because the TMDL reduction targets were based on a similar

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

BMP scenario, and regulatory programs are similar except for the MS4 permit which is not in place in the Lake Memphremagog Basin.

Table 13: Allocation of MS4 loading (kg/year) to specific basins based on proportion of town land area within each lake segment.

MS4	Basin 3	Basin 5	Basin 6	Basin 7	Basin 8
BTV (Airport)		75.1			
Burlington[1]		81.4			34.9
Colchester		57.0			14.2
Essex Junction		9.5			22.2
Essex Town		18.7		26.1	29.8
Milton		47.9		31.9	
Rutland City	43.3				
Rutland Town	30.5				
Shelburne		38.7			4.3
South Burlington		102.6			25.7
St. Albans City		45.5			
St. Albans Town		58.7	10.4		
UVM		39.3			
Williston					119.8
Winooski		23.6			
Total	73.8	598.0	10.4	58.0	250.9

[1] Permitted through the Burlington Integrated Plan

Table 14: The estimated total annual phosphorus reductions (kg/year) that stormwater permit programs will achieve by 2036 for each CWSP basin.

Basin / Lake Segment	Stormwater Permit Type				Total
	3-acre	MRGP	TS4[1]	MS4	
Basin 2 & 4 – or South Lake A&B, Port Henry segments for TS4 permit	84.1	1,031.4	158.2	0	**1,273.7**
Basin 3 – or Otter Creek segment for the TS4 permit	318.7	1,504.6	248.3	73.8	**2,145.4**
Basin 5 – or Shelburne, NE arm, St Albans, Isle le Mott for the TS4 permit	390.1	206.1	103.8	598.0	**1,298.0**
Basin 6 – or Missisquoi Bay segment for the TS4 permit	62.4	1,335.5	412.1	10.4	**1,820.4**
Basin 7 – or Mallets Bay Lake Segment for the TS4 permit	189.6	1,546.8	247.9	58.0	**2,042.3**
Basin 8 – or Main Lake Segment for theTS4 permit	677.8	3,676.2	463.4	250.9	**5,068.3**
Total	**1,722.7**	**9,300.6**	**1,633.7**	**991.1**	**13,648.1**

[1] The Transportation Separate Storm Sewer System (TS4) permit program is calculated at the lake segment scale and these reductions have been applied to the basin that best aligns to the lake segment.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Appendix A Table A-3 subtracts the regulatory load reductions from the total load reduction targets to show the CWSP loading targets per basin. At this time, load reductions from completed non-regulatory projects are not accounted for in the CWSP target setting. Expanded quantification of load reductions achieved through implemented non-regulatory projects is underway, however the data remains incomplete at this time. Following steps (described below) which require scaling of targets to available funding make the adjustment of non-regulatory targets based on estimated phosphorus reductions achieved to date at this stage of the methodology inconsequential to final target setting at this time. As implementation of non-regulatory projects progresses, and quantification of results achieved to date is expanded, future updates to the methodology will reassess the impact on final reduction targets of accounting for non-regulatory phosphorus reductions achieved.

Appendix A Table A-4 divides the total CWSP load reductions by 12 years to show the annual increase in annual phosphorus reductions necessary for CWSPs to implement their portion of the TMDL targets. This table assumes that all projects implemented by the CWSP have an effective lifespan of 12 years or more. Formula Grant Guidance Chapter 6 includes instructions on how to adjust assessment of cost effectiveness for projects that have a functional life of less than 15 years to account for potential re-implementation to maintain phosphorus reductions.

Each sector's cost rate is multiplied by the non-regulatory total phosphorus load reduction targets to estimate the average annual funding need to meet non-regulatory total phosphorus reduction targets **(Appendix A Table A-5)**. Targets are scaled to meet available funds, as needed **(Appendix A Table A-6)**. Targets may be accelerated/decelerated in some CWSP watersheds to achieve a minimum funding level of approximately $700,000 per CWSP watershed to maintain an efficient operational scale per CWSP **(Appendix A Tables A-7 and A-8)**. A summary table **(Appendix A Table A-9)**, combines the funding information from Table A-7 and targets from Table A-8 into one table that serves as the basis of SFY 2026 awards.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Adjustments for Project Identification, Development, and Operation & Maintenance Costs

Project identification and development cost rate calculations are not tied to individual project phosphorus reductions, as one project identification effort (e.g., stormwater master plan) may identify and prioritize dozens of project opportunities for further development. Not all projects identified will be considered high priority/cost-effective and may encounter barriers as part of project development (e.g., lack of landowner commitment). Acknowledging this complexity, the cost rate methodology estimates project identification and development funding need through a percentage cost rate of total Formula Grant funds. The approach to estimating the percentage of funding awards assigned to project identification and development may be adjusted annually at the time of fund allocation and target setting. The justification and associated assumptions for this component of fund allocation and target setting will be provided in the annual award justification memo published with Appendix A.

Operations & maintenance (O&M) expenses are also not tied to annual phosphorus reduction targets as spending on O&M is intended to maintain, and in some cases, extend the functional life of projects. At this time, data on costs associated with maintaining clean water projects is not available to support incorporation into the cost rate and fund allocation methodology. Incorporation of allowance for O&M costs will also be considered annually as part of the fund allocation and target setting exercise. The approach and justification to annual O&M funding award levels will be provided in the annual award justification memo published with Appendix A. Future updates to this methodology will consider an updated approach to incorporate O&M costs as data availability allows. O&M reporting requirements have been designed and are being implemented to capture data associated with the cost to maintain projects at the project category level which will be used to refine this component of the methodology over time.

This cost rate methodology is intended to reflect, at a high-level, the median unit cost of reducing annual phosphorus loading. It is anticipated that individual project cost effectiveness will exhibit a reasonable degree of variance from the median cost rates. Implementation across a range of project level cost effectiveness will be necessary to achieve target outcomes, with some projects likely below median cost rates and some above median cost rates. The methodology also does not dictate how Formula Grants are allocated year-to-year at the project-level, acknowledging that the proportion of dollars awarded by project step (identification, design, construction, operation & maintenance) will vary year-to-year. For example, CWSPs and BWQCs may choose in some years to invest a greater percentage of funds in project identification and development work to build up a portfolio of projects to move towards implementation, and in other years, increase the percentage of funds awarded to design/engineering and implementation. As the CWSP's portfolio of projects increases, it is anticipated that O&M spending will grow as a proportion of total funds awarded and that will be reflected in annual updates to Appendix A. Guidance defines how reasonable progress is monitored as projects progress through steps from identification to implementation and maintenance.[26]

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[26] Water Quality Restoration Formula Grant Guidance available here: https://dec.vermont.gov/water-investment/statues-rules-policies/act-76/background-law-rule-and-guidance

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Current Limitations, Uncertainty, and Future Recommendations

VTDEC acknowledges that the Water Quality Restoration Formula Grant non-regulatory total phosphorus load reduction targets, cost rates, and fund allocations methodology will need to be maintained and updated over time. There are several components of this methodology where new/improved data may warrant future updates. There are also areas of uncertainty associated with the methodology that limit VTDEC's ability to precisely estimate Formula Grant total funding need in both the near term and long term. The following list summarizes components of the analysis that may need to be updated to incorporate new data and address areas of uncertainty.

- Non-regulatory total phosphorus load reduction targets are subject to revision in the future based on changes to data and information available on:

  - Total phosphorus load reductions that have been or are expected to be achieved through regulatory programs;

  - Non-regulatory phosphorus load reductions that have been or are expected to be achieved through non-Formula Grant funding sources; and

  - Shifts in the proportion of total phosphorus load reduction expected to be achieved from each land use sector.

- Project category cost rates, land use sector cost rates, and fund allocation are subject to revision in the future based on:

  - Updated and expanded data on actual project level costs as implementation continues;

    - Additional data on actual project costs capturing the cost of current project requirements (e.g., Vermont Department of Historic Preservation review costs);

    - Costs associated with project level O&M that may be used to forecast O&M expenses based on actual project implementation;

    - Impacts of regional variation in cost, market volatility, and/or future inflation on cost rates;

    - Further refinement of methods to estimate the cost of project identification and development activities; related, the cost of establishing and maintaining an adequate and actionable "project pipeline";

  - Further refinement and expanded implementation of phosphorus accounting methods;

    - Further refinement of tracking systems to isolate project costs to implement project components that generate a quantifiable estimated phosphorus reduction. Some projects included in this analysis may include implementation of project

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

components that cannot be directly tied to an estimated phosphorus reduction. Project costs were reviewed at the project level and the dataset used in analysis is a best representation of actual project costs for applicable project categories removing outliers and anomaly projects;

- o Additional data available on project type implementation to treat sector-based loading to inform updated sector-based cost rates including project types considered, weighting of project categories within sector-based cost rates, and overall anticipated cost to implement phosphorous reductions;

- o Availability and applicability of cost estimates and/or cost effectiveness from sources other than VTDEC's Clean Water Reporting Framework (CWRF). Data on BMP costs and cost effectiveness based on pollutant reduction are available from other sources developed for other regions, however, those estimates were determined to not be more representative of costs and cost effectiveness of project implementation in Vermont than available data in CWRF at the time of this analysis;

- o Project categories not included in this cost rate methodology update which may be reviewed and considered for applicability to a future update to the cost rate methodology, sector-based cost rates, and fund allocation include:

  - River corridor easements

  - Wetland restoration

Funding limitations are not the only factor that may limit the state's ability to meet non-regulatory total phosphorus load reduction targets. Other limitations may include (and may vary by region) staff capacity of project implementers, willing landowners for project implementation, viable projects, cost and availability of necessary equipment and materials, and more.

VTDEC will continue to refine the data tracking and accounting systems that support this methodology. Based on the availability of new data, accounting methodologies, cost estimates, or project categories, VTDEC will publish updated cost rate and fund allocation methodologies to inform the distribution of Water Quality Restoration Formula Grant Funds and the determination of CWSPs' phosphorus reduction targets.

VERMONT

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Appendix A: Annual Award Justification Memo, Clean Water Service Provider Annual Phosphorus Reduction Targets and Fund Allocations

The following memo provides an explanation to support the SFY26 Water Quality Restoration Formula Grant Fund Allocation and Target Setting.

Project Identification and Development

VTDEC estimates that 8% of total Formula Grant funds may be used for project identification activities. The 8% estimate is based on analysis of Clean Water Initiative funding programs' data, which shows 8% of total Clean Water Initiative funding program investments were awarded to support project identification between SFY 2016 – 2024 (July 1, 2015 – June 30, 2024).

VTDEC estimates that 2% of total Formula Grant funds may be used for project development activities. The 2% estimate is based on analysis of Clean Water Initiative funding programs' data, 5which shows 2% of total Clean Water Initiative funding program investments were awarded to support project development between SFY 2016 – 2024 (July 1, 2015 – June 30, 2024). Project development activities include supporting project implementers' capacity to conduct general project scoping to select identified projects for development, as well as specific project development to gather the information and commitments needed to bring an identified project successfully to the launch of design and/or implementation phases.

VTDEC distributed project identification and development funds to CWSP watersheds proportionately based on total annual phosphorus reduction target per watershed (target based on available funds and adjusted to achieve minimum CWSP funding level of approximately $700,000). This approach factors variability in magnitude of phosphorus reduction targets per watershed, but does not weight by land use sector, acknowledging project identification and development costs do not vary significantly by land use sector. In other words, project identification and development costs are not necessarily correlated directly with individual project categories' design/engineering and construction costs — some lower cost project types may require as much funding for identification and development as higher cost project types.

Operation and Maintenance

Costs associated with project operation and maintenance (O&M) are anticipated to vary based on project type, site conditions, and other factors that are not directly tied to annual phosphorus reductions. Until more data is available on O&M costs at the project level, VTDEC has applied the following assumptions to inform allocation of funds for O&M activities, and associated adjustments to target setting. For SFY2026, $210,000 is available to allocate to O&M activities. Each basin is allocated an annual base funding amount of $10,000 to support O&M functions, including the establishment and expansion of the basins' O&M program. The remaining funds available to award for O&M are distributed by basin proportional to each basins' project implementation awards and documented matching funds through third quarter SFY 2025 reports. For SFY 2026 the proportion of funds was 2.8% plus the associated administrative costs.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table A-1. Phosphorus reduction targets by basin and landuse (kg/yr)

	Farm Field	Developed	Forest	Stream	Total
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	33,731	2,999	5,860	4,694	47,284
Basin 3 - Otter, Lewis, Little Otter	48,390	5,085	1,331	14,314	69,120
Basin 5 - Northern Lake Champlain Direct	10,992	3,108	137	1,516	15,753
Basin 6 - Missisquoi, Rock, Pike	49,114	7,371	11,415	30,695	98,595
Basin 7 - Lamoille	7,455	4,499	491	3,278	15,723
Basin 8 - Winooski	13,937	8,632	1,904	16,638	41,111
Lake Memphremagog	10,557	2,580	327	2,489	15,953
Total	174,176	34,274	21,465	73,624	303,539
Percent of reduction for CWSP - typical basin	10%	Permit based	0%	33%	

Table A-2. Regulatory phosphorus reductions (kg/yr)

	Farm Field	Developed	Forest	Stream	Total
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	30,358	1,274	733	3,145	35,509
Basin 3 - Otter, Lewis, Little Otter	43,551	2,145	1,331	9,590	56,618
Basin 5 - Northern Lake Champlain Direct	9,893	1,298	137	1,016	12,344
Basin 6 - Missisquoi, Rock, Pike	44,203	1,820	1,142	20,566	67,730
Basin 7 - Lamoille	6,710	2,042	491	2,196	11,439
Basin 8 - Winooski	12,543	5,068	1,904	11,147	30,663
Lake Memphremagog	9,501	1,151*	327	1,668	12,647
Total reduction	156,758	14,799	6,064	49,328	226,949

* Memphremagog reductions are assumed to be the average of the percent reductions (excluding MS4 permit) across all Lake Champlain Basins except for Missisquoi Basin or 44.6%.

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table A-3. CWSP total phosphorus load reduction targets based on basin load reduction targets minus expected regulatory reductions (kg/yr).

	Farm Field	Developed	Forest	Stream	Total	Percent
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	3,373	1,725	5,128	1,549	11,775	15.4%
Basin 3 - Otter, Lewis, Little Otter	4,839	2,940	-	4,724	12,502	16.3%
Basin 5 - Northern Lake Champlain Direct	1,099	1,810	-	500	3,409	4.5%
Basin 6 - Missisquoi, Rock, Pike	4,911	5,551	10,274	10,129	30,865	40.3%
Basin 7 - Lamoille	746	2,457	-	1,082	4,284	5.6%
Basin 8 - Winooski	1,394	3,564	-	5,491	10,448	13.6%
Lake Memphremagog	1,056	1,429	-	821	3,307	4.3%
Total	17,418	19,475	15,401	24,296	76,590	
Percent of total load reduction target for all basins	22.7%	25.4%	20.1%	31.7%		

Table A-4. CWSP annual increase in phosphorus load reductions needed to meet TMDL targets over the next 12 years (kg/yr)

	Farm Field	Developed	Forest	Stream	Total	Percent
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	281.1	143.8	427.3	129.1	981.2	15.4%
Basin 3 - Otter, Lewis, Little Otter	403.3	245.0	0.0	393.6	1041.9	16.3%
Basin 5 - Northern Lake Champlain Direct	91.6	150.8	0.0	41.7	284.1	4.5%
Basin 6 - Missisquoi, Rock, Pike	409.3	462.6	856.1	844.1	2,572.1	40.3%
Basin 7 - Lamoille	62.1	204.7	0.0	90.1	357.0	5.6%
Basin 8 - Winooski	116.1	297.0	0.0	457.5	870.7	13.6%
Lake Memphremagog	88.0	119.1	0.0	68.5	275.5	4.3%
Total	1,451.5	1,622.9	1,283.4	2,024.7	6,382.5	100.0%

VERMONT

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table A-5. CWSP annual funding level to needed to meet reduction targets

	Farm Field	Developed	Forest	Stream	Total annual cost design/ engineering and construction	10% total annual cost project ID/dev	Total annual cost all project steps (excludes O&M)	15% admin	Total project + 15% admin
Sector cost rate $/kg/yr	$4,072	$49,422	$18,897	$21,459					
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	$1,144,605	$7,105,648	$8,074,531	$2,770,035	$19,094,819	$2,121,647	$21,216,466	$3,744,082	$24,960,548
Basin 3 - Otter, Lewis, Little Otter	$1,642,034	$12,106,866	$-	$8,447,013	$22,195,914	$2,466,213	$24,662,126	$4,352,140	$29,014,266
Basin 5 - Northern Lake Champlain Direct	$372,995	$7,454,460	$-	$894,626	$8,722,081	$969,120	$9,691,201	$1,710,212	$11,401,413
Basin 6 - Missisquoi, Rock, Pike	$1,666,602	$22,860,303	$16,178,194	$18,113,810	$58,818,909	$6,535,434	$65,354,343	$11,533,119	$76,887,462
Basin 7 - Lamoille	$252,973	$10,117,729	$-	$1,934,422	$12,305,124	$1,367,236	$13,672,360	$2,412,769	$16,085,129
Basin 8 - Winooski	$472,929	$14,676,991	$-	$9,818,458	$24,968,378	$2,774,264	$27,742,643	$4,895,760	$32,638,403
Lake Memphremagog	$358,234	$5,886,654	$-	$1,469,015	$7,713,904	$857,100	$8,571,004	$1,512,530	$10,083,535
Total	$5,910,372	$80,208,652	$24,252,725	$43,447,379	$153,819,129	$17,091,014	$170,910,143	$30,160,613	$201,070,757

VERMONT

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table A-6. CWSP annual funding based on $7,000,000 in funding available (excluding O&M)

	Farm Field	Developed	Forest	Stream	Total annual cost for design and construction	10% Annual cost for project ID and development	Annual costs for all project steps excluding O&M	15% admin	Total project + 15% admin
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	$39,848	$247,373	$281,104	$96,435	$664,760	$73,862	$738,622	$130,345	$868,967
Basin 3 - Otter, Lewis, Little Otter	$57,165	$421,484	$0	$294,071	$772,720	$85,858	$858,578	$151,514	$1,010,092
Basin 5 - Northern Lake Champlain Direct	$12,985	$259,517	$0	$31,145	$303,647	$33,739	$337,386	$59,539	$396,924
Basin 6 - Missisquoi, Rock, Pike	$58,020	$795,850	$563,221	$630,607	$2,047,699	$227,522	$2,275,221	$401,510	$2,676,731
Basin 7 - Lamoille	$8,807	$352,235	$0	$67,344	$428,386	$47,598	$475,984	$83,997	$559,982
Basin 8 - Winooski	$16,464	$510,959	$0	$341,816	$869,240	$96,582	$965,822	$170,439	$1,136,261
Lake Memphremagog	$12,471	$204,936	$0	$51,142	$268,549	$29,839	$298,388	$52,657	$351,044
Total	$205,761	$2,792,353	$844,325	$1,512,560	$5,355,000	$595,000	$5,950,000	$1,050,000	$7,000,000

VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table A-7. CWSP annual funding based on funds available & min funding set to $700,000 before ID and development and O&M adjustments.

	Farm field	Developed	Forest	Stream	Total annual cost design, engineering and construction	10% Annual cost for project ID and develop-ment	Annual costs for all project steps excluding O&M	O&M based on 10k per Basin plus 2.79% of funded implement-ation	Total project, project id and development and O&M	15% admin	Total project + O&M + 15% admin
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	$34,636	$215,018	$244,336	$83,822	$577,811	$64,201	$642,012	$23,154	$665,166	$117,382	$782,549
Basin 3 - Otter, Lewis, Little Otter	$49,688	$366,355	$0	$255,607	$671,651	$74,628	$746,278	$25,702	$771,981	$136,232	$908,213
Basin 5 - Northern Lake Champlain Direct	$22,382	$447,311	$0	$53,683	$523,376	$58,153	$581,528	$18,461	$599,989	$105,880	$705,870
Basin 6 - Missisquoi, Rock, Pike	$50,432	$691,755	$489,554	$548,126	$1,779,866	$197,763	$1,977,629	$42,788	$2,020,417	$356,544	$2,376,961
Basin 7 - Lamoille	$10,760	$430,339	$0	$82,277	$523,376	$58,153	$581,528	$13,472	$595,000	$105,000	$700,000
Basin 8 - Winooski	$14,311	$444,127	$0	$297,108	$755,546	$83,950	$839,495	$14,161	$853,656	$150,645	$1,004,301
Lake Memphremagog	$24,306	$399,400	$0	$99,670	$523,376	$58,153	$581,528	$40,762	$622,291	$109,816	$732,107
Total	$206,514	$2,994,304	$733,890	$1,420,292	$5,355,000	$595,000	$5,950,000	$178,500	$6,128,500	$1,081,500	$7,210,000

VERMONT

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Table A-8. Reduction targets based on $7,210,000 in available and $700,000 in minimum funding for each CWSP (kg/yr)

	Farm field (kg/yr)	Developed (kg/yr)	Forest (kg/yr)	Stream (kg/yr)	Total (kg/yr)	Total annual cost for all project steps excluding O&M	Average $/kg excluding O&M
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	8.5	4.4	12.9	3.9	29.7	$642,012	$21,622
Basin 3 - Otter, Lewis, Little Otter	12.2	7.4	0.0	11.9	31.5	$746,278	$23,671
Basin 5 - Northern Lake Champlain Direct	5.5	9.1	0.0	2.5	17.0	$581,528	$34,109
Basin 6 - Missisquoi, Rock, Pike	12.4	14.0	25.9	25.5	77.8	$1,977,629	$25,409
Basin 7 - Lamoille	2.6	8.7	0.0	3.8	15.2	$581,528	$38,299
Basin 8 - Winooski	3.5	9.0	0.0	13.8	26.3	$839,495	$31,864
Lake Memphremagog	6.0	8.1	0.0	4.6	18.7	$581,528	$31,106
Total	50.7	60.6	38.8	66.2	216.3	$5,950,000	$27,505

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Table A-9. CWSP SFY26 Awards and Targets Summary Table

	SFY 2026 phosphorus reduction target (kg/yr)	Total annual cost for design, engineering and construction	10% total annual cost project ID and development	O&M (10k per basin + 2.79% of funded implementation through SFY 2025 Q3)	Total Project completion Funding	Admin (15% of award)	SFY 26 Water Quality Restoration Formula Grant award
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	29.7	$577,811.14	$64,201.24	$23,153.85	$665,166	$117,382	$782,548
Basin 3 - Otter, Lewis, Little Otter	31.5	$671,650.58	$74,627.84	$25,702.32	$771,981	$136,232	$908,213
Basin 5 - Northern Lake Champlain Direct	17.0	$523,375.52	$58,152.84	$18,460.86	$599,989	$105,881	$705,870
Basin 6 - Missisquoi, Rock, Pike	77.8	$1,779,866.09	$197,762.90	$42,787.98	$2,020,417	$356,544	$2,376,961
Basin 7 - Lamoille	15.2	$523,375.52	$58,152.84	$13,471.77	$595,000	$105,000	$700,000
Basin 8 - Winooski	26.3	$755,545.64	$83,949.52	$14,160.92	$853,656	$150,645	$1,004,301
Lake Memphremagog	18.7	$523,375.52	$58,152.84	$40,762.31	$622,291	$109,816	$732,107
Total	216.3	$5,355,000.00	$595,000.00	$178,500.00	$6,128,500	$1,081,500	$7,210,000

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Appendix B: Revision of SFY 2023, 2024, and 2025 CWSP Targets

The following memo provides an explanation to support the revision of SFY23-25 Water Quality Restoration Formula Grant Targets based on the revised cost rate methodology.

Revision of CWSP targets

Due to the large adjustments in cost rates in the 2025 cost rate methodology the previous CWSP targets will be adjusted to reflect these cost rates and updated estimate of the percent of project funding for project identification and development. CWSP target revisions were based on the total project funding awarded to each CWSP each fiscal year. Before applying the updated cost rates to the project funding CWSPs received the project funding was reduced by the actual operations and maintenance costs submitted through SFY 2025 O&M reporting. The remaining project funding was adjusted to account for 10% funding for identification and development. For SFY 2023 and SFY 24 awards the funding was adjusted to SFY 2025 dollars using the CPI adjustment used in the cost rate methodology. The cost rates were then applied for each CWSP based on the percentage of funding related to each sector to meet non regulatory reduction targets to calculate the phosphorus reduction for each sector. These sector phosphorus reduction estimates were then summed up to calculate the total phosphorus reduction target for SFY 2023, 2024, 2025 awards. This results in reductions of original targets for each CWSP from 45% to 59% as shown in Table B-1, with larger reductions for those basins that have a higher percentage of targets tied to developed lands which saw the largest increase in the updated cost rate methodology.

Table B-1. Revised SFY 2023, 2024, 2025 CWSP targets by basin applying the 2025 cost rate methodology

Basin	Revised SFY 23-25 targets (kg/yr)	Original SFY 23-25 targets (kg/yr)	Reduction in SFY 23-25 targets (kg/yr)	Percent reduction in targets	Total Revised SFY 23-26 targets (kg/yr)
Basin 2 & 4 - Poultney, Mettawee, South Lake Champlain	124.5	216.8	92.3	43%	154.2
Basin 3 - Otter, Lewis, Little Otter	126.6	231.0	104.4	45%	158.1
Basin 5 - Northern Lake Champlain Direct	54.2	121.8	67.6	56%	71.2
Basin 6 - Missisquoi, Rock, Pike	264.3	509.0	244.7	48%	342.1
Basin 7 - Lamoille	48.1	115.8	67.7	58%	63.3
Basin 8 - Winooski	88.6	193.2	104.6	54%	114.9
Lake Memphremagog	60.0	128.7	68.7	53%	78.7
Total	766.3	1516.4	750.1	49%	982.6

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