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Environment

# Vermont Pay-for-Performance (VPFP) Program Evaluation and Recommendations

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## Executive Summary

The Vermont Pay-for-Performance (VPFP) program represents a shift in the landscape of agricultural conservation programming, in Vermont and around the world. Launched in 2022 by the Vermont Agency of Agriculture, Food and Markets (AAFAM), VPFP does not pay farmers for implementing specific conservation practices, but rather for achieving measurable environmental outcomes – specifically, reductions in phosphorus (P) losses – from their fields. This pay-for-performance approach gives farmers the autonomy and flexibility they desire *and* aligns with Vermont’s broader goal of meeting Total Maximum Daily Load (TMDL) targets for phosphorus pollution in Lake Champlain and Lake Memphremagog.

Over the first three years of its pilot phase (VPFP 1.0), the program enrolled 70 farms, covering over 41,000 acres, and distributed more than \$3.4 million in payments to farmers. Farmers enrolled in VPFP prevented the loss of an additional 35,000 pounds of phosphorus, above and beyond the performance threshold of what they are required to meet under the TMDLs. An evaluation team from the Gund Institute for Environment at the University of Vermont (UVM) conducted a comprehensive review of VPFP 1.0 in its final year to assess its effectiveness, identify areas for improvement, and offer recommendations for a potential second phase of the program (VPFP 2.0).

### VPFP 1.0 Program Overview

VPFP was designed to address multiple objectives simultaneously, in a complex regulatory environment in a state that highly values its agricultural community and its natural environment. The UVM team evaluated VPFP’s performance against its stated goals, including: reducing phosphorus pollution beyond compliance (additionality), cultivating farmer buy-in, producing verifiable outcomes, promoting equity and efficiency, and offering sufficient payments. Key program features include:

**Performance-based incentives** that correspond to how much farmers reduce P losses on their farms, rather than for implementing a certain practice on a given field.

**Modeled rather than measured outcomes** with a model based on data about current field practices, data on location-specific topography, climate and soil conditions, and assumptions about historic P losses.

**Performance thresholds and historic baselines** are used to support high achieving farmers and incentivize continued progress in reducing P losses, by setting a standard that farms can measure against (baseline) and focus payments on farms achieving above average P loss reductions (threshold).

**Additionality defined by exceptional P loss reductions**, by paying farmers a standard rate of \$100 per pound of P loss reduced above a “performance threshold” of 40%, to distinguish additional stewardship from what is achieved via other financial incentive programs (including practice-based programs) and mandatory regulations.

**“Whole farm” performance**, where participants are required to enter data on all their farm fields that are being actively managed for agricultural products, instead of selecting fields to implement certain conservation practices.

**Robust farmer-technical assistance (TA) provider engagement**, where TA providers encourage farmers to actively participate in data entry, review Farm-PREP results, and use results to plan conservation practices.

### VPFP 1.0 Report Card Summary

The evaluation assessed VPFP 1.0 using a report card framework based on the program’s original goals. Grades were assigned across five major categories through careful consideration of goal criteria that the UVM Evaluation team developed to assess the program’s design and execution.

Goal Area	Grade
TMDL Reductions and Outcome Additionality	<b>B</b>
Farmer Buy-In	<b>C</b>
Verifiable, Measurable, Location-Specific Outcomes	<b>B</b>
Sufficiency of Payment	<b>B</b>
Equity and Efficiency of Program Funding	<b>B</b>

The top-line grades represent an average of multiple criteria in each area, ranging from A (excellent performance) to D (unsatisfactory performance) and reflecting the challenge of reconciling multiple objectives embedded in each goal. While the program succeeded in engaging and supporting farmers in conservation and achieving measurable phosphorus reductions, it struggled to clearly attribute those outcomes to VPFP participation. The opaqueness of the model, the burden of data entry, and the complexity of Farm-PREP limited the program’s accessibility and effectiveness.

### VPFP 2.0 Goals and Recommendations

Looking ahead, to the next iteration of VPFP, AAFM identified four preliminary goals for VPFP 2.0:

- **Conservation Practice Tracking**
- **Behavior Change**
- **Participant Satisfaction**
- **Sustainable Program**

The UVM evaluation team provides detailed recommendations for each of the stated goals, as well metrics and indicators to guide the prioritization and implementation of these goal areas, informed by lessons gleaned during VPFP 1.0 and insights from the evaluation. To the extent possible, we mapped

the challenges to the recommendations to the indicators in all four VPFP 2.0 goal areas. One key example, in Conservation Practice Tracking, is highlighted below:

**Challenge:** The *spatial scope* of land managed by current cohort of VPFP farmers is limited. In addition, the current cohort of VPFP farmers represent many of the early adopters of conservation practices in Vermont and, as such, their mean performance is likely to be different from mean performance of the whole Vermont farming community. As such, there is room for improvement in this area to generate a dataset on conservation practices and their P loss impacts that would be more representative of current progress toward the TMDLs.

**Recommendation:** Do more outreach to potential applicants for the next round of VPFP funding. AAFM should collaborate with the Conservation Districts to encourage current VPFP 1.0 farmers to talk about their experience with farmers' groups and at conferences where potential entrants in the next iteration of VPFP are in attendance. AAFM should transparently discuss major successes, lessons learned and things they'd like to try to improve in the next round of funding.

**Indicator:** A dataset that covers a large enough portion of Vermont farms to make reliable conclusions about Vermont's progress towards the TMDLs through mitigation in the agriculture sector, *measured by* the number of farms enrolled in VPFP, and percent of agricultural acreage in Lake Champlain and Lake Memphremagog watersheds participating in VPFP and providing data.

## Big Picture Takeaways

Through this project the UVM evaluation team has learned much about VPFP 1.0's strengths, challenges, and successes. The report provides an extensive set of results from economic analysis, information from surveys and interviews, and consultation with experts. In addition to generating specific recommendations targeted to each goal area for next-phase version of VPFP, we also pulled back to consider big-picture questions and keystone takeaways, which if taken up, could address many of the existing and anticipated challenges of VPFP.

### 1. VPFP's multiple objectives can create a lack of clarity around what the program is primarily designed to achieve

By carrying multiple objectives, VPFP is forced to balance the multiple tradeoffs among them. Instead of orienting itself towards a simple benchmark of program success, it reaches for some optimal balance of achievement in each area. The targets for each of these objectives (and range of acceptable results) have yet to be concretely defined. Furthermore, managing such a multi-faceted program creates complexity and runs the risk of overextending the program's capacity. AAFM might benefit from prioritizing these objectives more explicitly. Is the main goal reducing phosphorus loss from farms in a cost-effective manner? Or rewarding higher-performing farms (or supporting farmers writ large)? Or educating and incentivizing farmers to undertake conservation practices, spurring behavior change?

Without a primary goal for VPFP, evaluators of the program are forced to hypothesize how one goal is weighted against another, complicating the assessment of success.

Our **recommendation** is to decide on a main goal (e.g., “behavior change”) that can be communicated to all stakeholders and orient the program design to that goal. When the primary goal of the program is clearly stated then challenges can be anticipated, further research can be prioritized, and all other considerations be made subordinate. Clear goals will make it easier to track progress, make corrections, and evaluate success.

## **2. VPFP has not realized the full potential of performance-based programming, for now**

VPFP is operating in an emerging and dynamic area of the Payment for Ecosystem Services landscape. While it is not a practice-based program, and while farmers are rewarded for the outcomes of their conservation efforts, program design changes are necessary to ensure that farmers are incentivized to *improve* their performance while participating in VPFP. The two key limitations are a payment structure that does not carry distinct incentives for performance improvements and challenges experienced by both TA providers and farmers in interpreting the modeled performance outcomes and using those interpretations to strategize for higher performance (i.e., additional P loss reductions) in the future. In addition, despite significant efforts to calibrate the Farm-PREP model to Vermont’s agricultural conditions, TA providers and farmers might still be wary of the accuracy of P loss predictions.

To overcome this critique, we **recommend** that AAFM re-work their current payment structure so that performance improvements made over the course of VPFP enrollment are compensated at a higher rate than sustained performance levels that farmers achieved prior to enrolling. We also recommend that AAFM and Stone Environmental find ways in which the Farm-PREP model results can be more easily communicated and practical options for performance improvements can be more easily identified. Finally, we suggest that additional calibration of Farm-PREP with a small subset of the VPFP 2.0 farmer cohort through advantageous collaborations between AAFM, Stone Environmental and UVM, could build confidence in the Farm-PREP results among the VPFP stakeholders, especially if the results of these calibration efforts can be presented in an easily understandable format.

## **3. Additionality hard to measure and ascribe to VPFP**

The surveys and interviews conducted during the evaluation demonstrated that farmer’s practices have improved during the VPFP pilot phase. While this is a great result, it remains difficult to prove additionality precipitated by the program in a comprehensive way. This should be a key indicator of program effectiveness and so the program should be designed to generate the data required to make such conclusions.

We **recommend** a more robust analysis that would result from baselines that represent each farm’s “status quo” prior to VPFP enrollment as a reference for P loss outcomes attained while participating in VPFP.

#### **4. VPFP does not (yet) show how its position in the conservation assistance landscape influences progress toward TMDLs**

Since VPFP assistance is currently limited to the small subset of farmers receiving payments for their stewardship, VPFP could be more explicit about how the existence of this program influences farmers who do not currently participate in the program. Practice-based programs help farmers adopt conservation practices and might attempt to help new farmers in each funding round such that any farm seeking assistance might expect to be supported by these programs in time. VPFP's influence over the process of change in the working landscape might look different than this, but it should still be clearly stated within the program's theory of change.

We **recommend** that VPFP develops a clear theory of change and specify how that theory might be verifiable. For instance, VPFP might argue that it supports farms that model practices for their neighbors. These neighbors, who are not direct beneficiaries, might nevertheless be inspired to replicate the practices of a VPFP. Evaluators then can investigate whether those "spill-over" effects actually occur, and show that, while VPFP does not (and cannot) directly support every farm in the state, its influence extends beyond the boundaries of its participating farms.

#### **Conclusion**

The experience of VPFP 1.0 represents a giant step forward in proving that performance-based conservation can meaningfully improve water quality in Vermont. It has engaged farmers, delivered measurable environmental benefits, and laid the groundwork for a more adaptive, data-driven approach to agricultural stewardship. By reflecting on both its achievements and challenges, VPFP is poised to come into full maturity as a program that is intuitive, equitable, and responsive to the needs of both farmers and the State. This report provides credible insights and recommendations for VPFP program designers to consider as they build future iterations of the program.

# 1. Introduction

From October 2024 to July 2025, the Gund Institute for Environment at the University of Vermont (UVM), in consultation with the Vermont Agency of Agriculture, Food, and Markets (AAFM), conducted a broad-ranging evaluation of the first three seasons of the pilot phase (2022-2024) of the Vermont Pay-for-Performance Program (VPFP).

UVM's research was contracted by AAFM to meet the "Social and Economic Analysis" and "Survey Delivery" deliverables of the United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS) Regional Conservation Partnership Program Alternative Funding Arrangement (RCPP AFA) Grant # PPA-2145-A-0123. The goal of this research was to evaluate the social and economic outcomes of the VPFP program, to report back to AAFM on the perspectives of participants and contracted TA providers, and to identify any opportunities for improvement.

VPFP was designed to incentivize responsible land stewardship practices and, in so doing, reduce phosphorus loading to Vermont waterbodies. Its objectives are linked directly to the broader goal of bringing the levels of phosphorus pollution entering Lake Champlain and Lake Memphremagog below limits deemed necessary to protect these aquatic ecosystems. These limits, established by the U.S. Environmental Protection Agency (EPA), are referred to as Total Maximum Daily Loads (or TMDLs).

VPFP is administered by the Water Quality Division of AAFM. The voluntary program's distinctive feature is that it pays farmers for the environmental *outcomes* of their conservation efforts across all their farm fields rather than for the implementation of a specific *practice* on a specific field. We describe the distinction between these two approaches in more detail in Section 2: Performance-Based Programming.

VPFP was designed as (a) an innovative departure from traditional conservation incentive approaches and (b) a response to an explicit request from a farming community under pressure to minimize the sector's environmental impact. In 2021, AAFM received a grant award from the NRCS Regional Conservation Partnership Program - Alternative Funding Arrangements (RCPP-AFA) to fund the pilot program, referred to as VPFP 1.0 in this report.

The principal outcome of VPFP is the reduction of phosphorus losses from farmers' fields (i.e., agricultural pollution) and the program is part of a broader, multi-sectoral, multi-agency effort to improve water quality in Vermont waterways, including Lake Champlain and Lake Memphremagog.<sup>1</sup> Official targets for phosphorus concentrations for these lakes – or Total Maximum Daily Loads (TMDLs) – were updated by EPA in 2016 and prompted the State of Vermont to pass the Vermont Clean Water Act (Act 64) in anticipation of the EPA update and to provide “stronger reasonable assurances” of meeting these targets within each basin (Dolan 2016).

At the time of this evaluation, VPFP 1.0 had completed three full seasons of the program (2022, 2023, 2024), and 70 farmers had participated in the program, with more than 41,000 acres of farm acres enrolled, paying out more than \$3.4 million to farmers. AAFM had already addressed some programmatic challenges that arose during implementation and were aware of others. Despite these challenges, AAFM was reasonably certain that they would pursue resources for a second round of VPFP funding (post-2025), referred to in this report as VPFP 2.0. And for a future iteration of the program, they were actively considering a modest re-orientation of the program's original goals and design.

The UVM evaluation team took up this assessment project to support AAFM decision making at this juncture. The VPFP 1.0 evaluation was carried out in four main parts:

1. Response to specific questions articulated by AAFM to provide insight into the economic and social outcomes of VPFP. (See Appendix 8.5 for economic analysis results and Appendix 8.2 and 8.3 for summaries of survey results.)
2. Evaluation of VPFP 1.0 according to both its original stated goals and to the conventionally understood advantages of performance-based programming. (See Section 5.)
3. Recommendations corresponding to AAFM's proposed (i.e., re-oriented) goals for a future iteration of the program (VPFP 2.0). (See Section 6.)
4. Placement of VPFP 1.0 within the landscape of similar payment for ecosystem services (PES) pilots in the United States, to assess VPFP's innovations. (See Section 4 and Appendix 8.4.)

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<sup>1</sup> For more information on the Vermont Clean Water Initiative Program, see: <https://dec.vermont.gov/water-investment/cwi/state-vermont-clean-water-projects>.

To work through these components, the UVM evaluation team analyzed field-scale data from the Farm Phosphorus Reduction Planner (Farm-PREP) database (provided as part of farm’s participation in VPFP to model phosphorus (P) losses), payments made to farms and budget figures for other program components, as well as survey and interview data with VPFP farmers and technical assistance (TA) providers. 33 VPFP farmers (47% of all participants) and 8 TA providers (33% of contractors) responded to a survey designed and administered by the UVM evaluation team, in consultation with AAFM. We also conducted formal interviews with 12 farmers, 8 TA providers, 1 crop consultant, and 1 AAFM team member. Since we interviewed some TA providers and farmers who did not complete the survey, the total count of participants who provided feedback was 35 VPFP farmers (50%) and 11 TA providers (46%). We also connected with scholars and practitioners (referred to as key informants) in other regions of the United States to understand perspectives on the challenges and outcomes of performance-based programming, especially in the pilot phase.<sup>2</sup>

The following report is an external evaluation of the program. The UVM evaluation team attempted to capture AAFM’s intent in the design and implementation of VPFP, noted in the report with direct quotes or paraphrasing. The report does not represent the full perspective or official views of AAFM.

## 2. Performance-Based Programming

In this section, we review some of the key advantages highlighted by proponents of performance-based programming over practice-based programming.

A 2019 Issue Paper from UVM’s Gund Institute for Environment argued that a *performance-based* Payment for Ecosystem Services (PES) approach<sup>3</sup> to conservation incentives was best suited to addressing Vermont’s “dual challenges of water quality and a struggling agricultural economy.” Such an approach would overcome the shortcomings of both regulatory approaches (i.e., mandatory requirements) and practice-based conservation incentive programs (Hammond Wagner et al. 2019).

Below we draw on the authors’ discussion of key advantages of performance-based programs and make more explicit (as in #2) some points that are implicit in their paper.

1. Under a performance-based approach, the outcome of conservation practices on P losses – considering the biophysical conditions of a given farm and a practice’s efficacy over time – can be quantified.

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<sup>2</sup> The UVM evaluation team is collecting and synthesizing perspectives on the pilot phase of performance-based programs to understand the challenges, barriers, innovations, and outcomes of such programs. Results will be presented in a peer-reviewed article in the future.

<sup>3</sup> Briefly, Payments for Ecosystem Services approaches incentivize the stewardship of key ecosystems by an individual or community such that those ecosystems continue to provide critical ‘ecosystem services’ that result in desired and sustained benefits like clean air and water, food, and lumber, or recreational, spiritual, and mental health. In the context of VPFP, the P loss outcomes of a given field is partly dependent on farmers’ stewardship of vibrant soil ecosystems, or “soil health,” and field buffers, in addition to several other factors (like P input rates). This issue paper addresses the advantages of Payment for Ecosystem Services (PES) schemes more broadly, but Box 2 (p. 13) describes the advantages of *performance-based* PES.

2. Since incentives are tied to the size of performance outcomes, public funds can be invested to “target [state] water quality resources towards the highest impact farms and fields with respect to reducing Vermont’s phosphorus losses” (VPFP website). In contrast, practice-based programs offer farmers a flat rate (per-acre) for practice implementation regardless of how intervening factors (like soil type, slope, proximity to waterbodies, and climate) might affect the practice’s environmental impact. While practice-based programs can use application data to prioritize certain farms for investment, this targeting is likely less precise than in performance-based programs.
3. By utilizing a complex model to predict performance outcomes, a performance-based approach can include all the common conservation practices that a farmer might implement on all their fields in a single season and capture the complex interactions between practices, including “stacked” effects, and associated field specific parameters. This type of comprehensive accounting with site specific characteristics such as soil type and slope is rarely practical in a practice-based program.
4. “The data needed to determine performance [outcomes] are readily available and straightforward protocols exist.”<sup>4</sup>
5. Basing payments on performance (rather than implementation of a practice with prescribed standards) empowers farmers to flexibly employ their innovativeness and choose practices tailored to their farm’s agroecosystem(s).<sup>5</sup>

In Section 3 we describe how VPFP was proposed and developed as a performance-based program, the first such full-scale program in Vermont’s agriculture sector.

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<sup>4</sup> The issue paper uses different metrics for calculating field P loss and farm P balance than VPFP ultimately chose. In this paper, the authors recommend using the Vermont P Index (VPI), but note that transport models like Farm-PREP “may prove to be more accurate and/or cost-effective than VPI (p. 16).”

<sup>5</sup>As we note below, the use of a model that relies heavily on circumscribed practice options (rather than directly measuring the outcome at field edge) would caution us against overstating this advantage of performance-based incentive programs.

### 3. VPFP Program Overview

#### 3.1. Origins of VPFP

Besides VPFP, the Vermont Agency of Agriculture, Food, and Markets (AAFM) administers a range of technical and financial assistance programs that directly support Vermont farmers in adopting conservation practices. Appendix 8.1 reviews these programs, their size, scale, year established, and what forms of assistance they offer to Vermont farmers. Since these conservation practices can address multiple natural resource concerns,<sup>6</sup> including water quality, the diverse suite of programming is integral to AAFM's and the State of Vermont's effort in meeting multiple environmental objectives, including the TMDL goals.

Several of the AAFM financial assistance programs were established after the State of Vermont passed the Vermont Clean Water Act in 2015, which required a new implementation plan for the TMDL. Farmers identified shortcomings in the menu of available programs, particularly in light of public narratives about agriculture as a major contributor to phosphorus pollution and on farmers as key actors in Vermont's progress toward the TMDLs. A January 2019 joint committee hearing on "Climate Change and Farming" featured farmer testimony on ecosystem services they provide, including contributions to water quality, soil health, and carbon sequestration.

Advocates called for a "new approach to land conservation" and the Vermont legislature passed Act 83 in 2019, which called for the Secretary of Agriculture to convene a "Soil Conservation Practice and Payment for Ecosystem Services (PES) Working Group to recommend financial incentives for farmers to implement practices to improve soil health, enhance crop resilience, and reduce runoff."<sup>7</sup> The PES Working Group met regularly throughout 2019 and 2020, refocused their efforts in 2021 on developing a PES program on soil health, submitting their final report to Vermont legislature on January 15, 2023.

During this time, AAFM staff were following the PES Working Group discussions on programmatic decisions that need to be made when developing a PES program (e.g. the ecosystem service and how to quantify and value it, practice-based or performance-based, measured or modelled, etc.). In March 2020, the USDA NRCS issued a call for proposals for "innovative" payment approaches such as pay-for-performance via the first Regional Conservation Partnership Alternative Funding Arrangement (RCPP-AFA), and AAFM staff pulled together a proposal for the Vermont Pay-for-Performance (VPFP) program.

In contrast to the existing practice-based approaches, VPFP<sup>8</sup> would provide:

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<sup>6</sup> NRCS defines a natural resource concern as "an expected degradation of the soil, water, air, plant, or animal resource base to an extent the sustainability or intended use of the resource is impaired." Learn more about these resource concerns at <https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns>.

<sup>7</sup> See <https://legislature.vermont.gov/Documents/2020/Docs/ACTS/ACT083/ACT083%20Act%20Summary.pdf>.

<sup>8</sup> This language is derived from the Narrative section of AAFM's proposal to RCPP-AFA to establish and implement VPFP 1.0.

- Better communication of the value of agricultural land stewardship provided by farmers to various stakeholders (including the public at-large)
- Payments to farmers that represent more cost-effective investments of public funds with respect to desired outcomes (e.g., phosphorus loss reductions)
- Greater flexibility and autonomy for farmers in *how* they generate desired environmental outcomes through practices that make sense for their operation

AAFM staff on the VPFP development team recognized that while the PES Working Group chose to develop a different program valuing a suite of soil health-focused environmental benefits beyond phosphorus loss reduction, the group generated knowledge that did inform the design of VPFP. “The PES Working Group really wanted to measure as many things as possible and pay for as many environmental benefits as possible, but that sounded very complicated and the experts all told us that measurements are really expensive,” an AAFM staff member involved in the creation of VPFP explained. “Having run programs before and knowing how much work it takes, we were motivated to make the program design as simple as possible: only focus on one benefit with a known value to the public (phosphorus loss reductions), and model it. But we did try to incorporate the other preferences of the Working Group as much as possible: use the best, locally-calibrated model available; develop field-by-field outputs while considering the whole farm, do not exclude high-achievers, give farmers access to their data and provide them flexibility and autonomy meet the performance goals for payment, etc. You can see that in our goals.”

The remainder of this section describes the goals, design elements, framework, and other programmatic dimensions of VPFP.

### 3.2. Program Goals

AAFM’s publicly stated goals reflect the design and administration of the program. The goals are quoted (verbatim) here:

1. **TMDL reductions and stewardship.** This program will serve Vermont’s need to reduce phosphorus loading under various Phosphorus Total Maximum Daily Loads (TMDLs).
2. **Farmer buy-in.** Farmers need autonomy over their land management decision-making and degrees of participation. This program will not be prescriptive but rather support farmers to take an active role in conservation planning on their farm and give them the ability to implement the practices that they know will work for their own operations. Farmers desire **fairness**: farmers’ stewardship efforts will be appropriately valued, and a variety of farm sizes and land use types will be eligible for payment.
3. **Verifiable, measurable, location-specific outcomes.** The system will be designed with accurate, quantifiable, location-specific outcomes and payments that are directly tied to a positive value for the state.

4. **Equity and efficiency of program funding.** The system will be maximally equitable across geographic location, farm size, and length of time as land stewards while efficiently directing funding in a way that provides the most value to the public and to the farmer. There are inherent trade-offs, but with flat baselines and equal payment rates across the state, yet ranking priority within funding pools, a compromise will be reached between these goals.
5. **Additionality of stewardship.** Farmers will be paid for voluntary stewardship that goes above and beyond their regulatorily-required levels of stewardship (i.e. threshold for payment is tied to average TMDL P-reductions expected of farms).
6. **Sufficiency of payment.** Payment level will be sufficient to compensate farmers both for their stewardship and for their efforts to gather data and input it into the system. Payment schedule will be fair, reduce risk to both the funder and the farmer, and acknowledge the upfront effort/costs of participation and the length of outcome benefits.

A full report card on VPFP 1.0 goal attainment is included in the evaluation in Section 5.

### 3.3. Program Framework and Design Features

The key design features of VPFP's programmatic framework are described below.

#### *Performance-based incentives*

Incentives correspond to the outcomes of farmer conservation efforts (i.e., the degree to which they have reduced P losses) rather than for implementing a certain practice on a given field. When predicting P losses, the model accounts for the influence of environmental factors that mediate the effect of conservation practices on the target outcome. While practice-based programs might consider environmental factors when prioritizing applicants, this prioritization is still far less systematic and precise with respect to intended outcomes than matching the incentive amount directly to the predicted outcome magnitude.<sup>9</sup>

#### *Modeled rather than measured outcomes*

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<sup>9</sup> They might also have multiple prioritization criteria (i.e., equity) that further limit their precision with respect to targeting the greatest possible return for investment.

The outcome (i.e., reduced phosphorus losses from fields) is not directly measured but is instead modeled based on data about current field practices, data on topographical, climatic and soil conditions that coincide geospatially with each field, as well as assumptions about historic phosphorus losses from those same fields (again, modeled P losses). The model chosen for VPFPP was the Agricultural Policy/Environmental eXtender model<sup>10</sup> (APEX). The Farm Phosphorus Reduction Planner (Farm-PREP)<sup>11</sup> is a web-based user-interface developed by Stone Environmental<sup>12</sup> to facilitate data entry into the APEX model and the simulation of multiple combinations of field practices. AAFM proposed to use Farm-PREP as the modeling tool if their proposal to RCPP-AFA was successful (see Section 3.1 above). In anticipation of launching a full-scale program, AAFM applied to and was awarded a Conservation Innovation Grant (CIG) in 2020, which allowed AAFM to “1. Modify FarmPREP to model phosphorus reductions from a modeled TMDL Base Load; 2. recruit 10-12 farms statewide of diverse sizes and types to work with VAAFAM staff members to input their land management data into FarmPREP and then run the FarmPREP model on those farms; and 3. Evaluate the opportunity for payments for phosphorus reductions from the TMDL Base Load.”<sup>13</sup> AAFM contracted Stone Environmental to enhance Farm-PREP (v2) for VPFPP. To the extent possible, the model covers all the primary agricultural practices and conservation strategies implemented on Vermont fields.

#### *Baseline for P loss reductions as historic TMDL assumptions about prior performance*

VPFP does not rely on an empirical baseline of recent performance (P losses prior to enrollment in VPFPP) as might be the case in other performance-based programs. Instead, the performance baseline for each field is derived from assumptions about historic field management. These assumptions indicate both the cropping system (permanent corn, permanent hay, a corn-hay rotation or pasture) that was *assumed* to have been grown on each field in the 2000s (prior to establishing the TMDLs) as well as the nature of certain field practices (e.g., tillage, fertilization, etc.). The assumptions are based on a set of rules regarding soil type, slope and other factors.<sup>14</sup> These same assumptions were used by Tetra Tech to “develop phosphorus loading estimates for sources in the Lake Champlain Basin” and to determine phosphorus load allocation for the revised Vermont Lake Champlain TMDL (Tetra Tech 2015). In Farm-PREP, these baseline scenarios are referred to as historic base management assumptions (HBMA).

#### *Incentives based on average predicted outcomes over a 30-year period*

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<sup>10</sup> For more information on APEX, please visit <https://epicapex.tamu.edu/about/apex/>.

<sup>11</sup> For a brief introduction to Farm-PREP, please visit [https://www.stone-env.com/assets/resources/6d35ca97df/E\\_17054-FarmPREP.pdf](https://www.stone-env.com/assets/resources/6d35ca97df/E_17054-FarmPREP.pdf).

<sup>12</sup> Learn more about this consultant group at <https://www.stone-env.com/>.

<sup>13</sup> See Linking Farm Phosphorus Reduction Planner to Total Maximum Daily Load (TMDL) Modeling and Phosphorus Reduction Valuation Analysis at <https://agriculture.vermont.gov/sites/agriculture/files/documents/CIG%20Report-LinkingFarmPreptoTMDL.pdf>.

<sup>14</sup> You can read more about the process of defining historic land management assumptions for the Soil and Water Assessment Tool in Tetra Tech (2015) and Winchell et al. (2011).

Performance outcomes are simulated over a 30-year timeframe to account for crop rotations and variation in weather (precipitation and temperature). Annual incentives are paid according to the annual average outcome from this timeframe. According to AAFM, “the model simulation time period is 30 years to account for long-term management decisions (e.g. crop rotations), long-term effects of management on nutrient cycles (e.g. soil P saturation), and variation in weather (precipitation and temperature). The annual average is reported for results.”

*Additionality defined by exceptional P loss reductions*

The intention of VPPFP was to reward farmers for environmental performance (i.e., P loss reduction) that went above and beyond what farmers would achieve through “other programs” or by complying with mandatory regulations (i.e., Vermont’s Required Agricultural Practices, or RAPs) while *also* incentivizing farmers to continue making improvements to their P loss performance.<sup>15</sup> This dual objective – reward high performers and incentivize improvements – presented a challenge to the program since each of these objectives are best served by different types of payment mechanisms.

In the PES Working Group meetings that preceded VPPFP, a theme of discussion were the relative merits of administering a “threshold-based” program versus a “baseline-based” program. In practice, a threshold-based program, which pays a flat rate per unit of outcome above an established performance threshold, supports “high achievers.” In the context of conservation, it can take a long time to make the transitions that allow a farm to effectively minimize P losses, so the highest achievers are typically farms that have a longer history of progressively improving their conservation practices prior to enrollment in a performance-based program. The emphasis on the threshold means that farms that can maintain a high-level of performance by simply doing what they are already doing might not be incentivized to make improvements, whereas farms that have a shorter history of adopting conservation practices might struggle to attain the performance threshold. Use of a threshold alone (without a unique baseline on past performance for each farm) could favor farms that have advantageous land conditions.

In developing VPPFP, AAFM tried to walk the line between the pros and the cons of baseline and threshold-based programs by incorporating both methodologies. According to AAFM staff, they wanted to focus on supporting the “high achievers” but to also incentivize change. The historic baseline management assumptions were used to set a standard against which farms could measure themselves, which created the opportunity for payments to grow if the farms continued to make progress in their management. Meanwhile the threshold was designed to focus payments on only the farms that were achieving above-average P loss reductions from their management.

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<sup>15</sup> For more about the Vermont RAPs, see: <https://agriculture.vermont.gov/rap>.

AAFM staff were also concerned with additionality. From the research commissioned and reviewed by the PES Working Group, AAFM wanted VPFP to be cost effective and “additional”: not to overlap excessively with practices paid for via other programs, and not to pay for farmers to comply with mandatory regulations (like the Required Agricultural Practices, or RAPs). The practice non-duplication was challenging: VPFP intended to accurately capture the interdependent effects of all practices implemented by a farm. However, AAFM staff were aware that most Vermont farms, and especially their target audience (those interested in a “next level” government payment program), would have at least some of their practices funded through other payment programs. So, they felt the need to “discount” the VPFP payments to account for that reality.

This was achieved by setting what we will refer to in this report as a “performance threshold.” In this case, farmers are paid a standard rate per degree of performance (in pounds of P loss reduced) that a farm achieves *above* the performance threshold, which in turn is based on assumptions about the farm’s historic baseline performance levels. In theory (not in practice), all P loss reductions *below* this threshold would have resulted from complying with the RAPs and from participation in practice-based programs. For high-performing farms, subtracting the P loss reductions achieved through these other policy mechanisms from the farm’s current performance above the baseline would produce a remainder of reduced P losses that were not as-of-yet compensated by public programs.

Ultimately, AAFM decided to use a 40% P loss reduction threshold, meaning that the first 40% of reductions from the baseline are uncompensated by VPFP. The 40% value is derived from the average percent of P loss reductions from non-point agricultural <sup>16</sup>~~load~~. In essence, it was assumed that practice-based programs and RAP compliance, on their own, would allow farmers to achieve performance levels necessary for attaining the TMDL requirements. In addition, it was proven from initial research under the Conservation Innovation Grant that a 40% reduction was an attainable goal for most participating farms but would still be a stretch for others. It seemed to AAFM, therefore, that this threshold would motivate improvement and support reasonable participation rates. AAFM also assumed that this margin of uncompensated P loss reductions from the baseline would ensure that the compensated P loss reductions (beyond the threshold) are “additional” to what would be achieved through practice-based programs and RAPs.

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<sup>16</sup> This figure is derived by aggregating the percentage of P concentration reductions in the multiple lake segments of Lake Champlain, but only after removing specific lake sections that are outliers. When calculating this average, the Missisquoi Bay watershed (which had an outlier reduction requirement of 82.8%) was removed from the calculation. Missisquoi Bay basin reduction requirements from agriculture are much higher than in other sub-watersheds due to the high level of internal loading in that basin. Including the Missisquoi Bay load allocations into the average would have set the threshold for most farms well above the required reductions needed in their particular basin. This seemed unfair for farmers in regions of Vermont with lower (or no) required P reductions, so the Missisquoi datapoint was removed.

### *“Whole farm” performance*

AAFM uses the term “whole farm” to emphasize that participants are required to enter data on all their farm fields that are being actively managed for agricultural products (including row crop and vegetable production fields, hayland, and pastures). A more precise term might be “all fields” since the current model does not account for P transport across the landscape encompassed by the whole farm property (or properties). This characteristic is a defining feature of VPF, since in other programs, farmers select the fields on which they commit to implement certain conservation practices. Under VPF, incentives extend to conservation practices across all their fields, while low-performing fields, which cannot be ignored under this approach, can reduce their net performance outcome.

### *Role of technical assistance (TA) providers*

In response to input from farmers during the PES Working Group and other stakeholder meetings, AAFM designed VPF to allow farmers to actively engage in entering farm data and reviewing results in Farm-PREP and using results to plan conservation practices; and recognized that TA providers would have to support this engagement. In January 2022, the Vermont Association of Conservation Districts (VACD) was contracted for this work and VACD administers sub-contracts with individual Districts across the state. TA providers are expected to perform three categories of tasks, as outlined in their contract:

1. **Planning and data entry:** TA providers work with newly enrolled farms on documentation and data entry, help farmers understand how to interpret the modeled results, and provide guidance on potential changes to management practices that would lead to additional P loss reductions.
2. **Data upkeep and implementation support:** TA providers support new and returning farms with record-keeping, updating planned assessments based actual on practice implementation, and help farmers understand the P loss reduction and payment implications of their “Planned and Actual Management Assessments, as well as any Alternative Assessments a farm may run to explore potential land management improvements.”

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The average required reduction percentage for the remaining watersheds in the Lake Champlain basin was 39.7% (or 45.6% if using the required reduction percentage weighted on the estimated phosphorus loadings of each watershed). If outlier lake segments remain, the P loss reduction requirement would be approximately 53.6%. We also note here that for the Missisquoi Bay basin, the required reduction percentage is considered to be the maximum reduction feasible for the sector, and *not* the reduction required to protect downstream ecosystems. In short, the required reduction percentages do not correlate with base load contributions from the sector, especially for the Missisquoi Bay watershed.

In developing VPF, AAFM briefly considered setting thresholds in each region to the required reductions in that specific region. However, that would have caused a very uneven playing field based on a farm’s location, which is outside of the farm’s control. It would have also necessitated excluding the Connecticut River and Hudson River watersheds from the program since neither watershed has required phosphorus reductions. Since AAFM regulates statewide and their goal is statewide water quality improvement, AAFM decided it was preferable to set a statewide (“averaged”) threshold to level the playing field for farms statewide.

3. **Checkout and verification:** TA providers verify that the data entered in Farm-PREP accurately reflects the farm’s actual management for the year; including reviewing records, conducting field visits, confirming practice standards are met, and reporting to the State of Vermont.

### 3.4. Farm Prioritization

All Vermont farms actively managing annual cropland, pasture, and/or hay fields with up-to-date Nutrient Management Plans (NMP), compliant with USDA NRCS Highly Erodible Land and Wetland Conservation rules, and eligible to participate in federal assistance programs per the USDA Farm Service Agency are eligible to participate in VPFP. VPFP used a competitive ranking process to prioritize enrollment in the program, which included the following categories:

**Farms located in areas of Vermont with the highest TMDL phosphorous reductions.** Prioritization is based on geographic location of farms and the relative required reductions for each watershed under state TMDL requirements, with a scale for each tactical basin:

Missisquoi	5
Southern Lake Champlain	4
Otter Creek-Little Otter Creek-Lewis Creek	3
Winooski	3
Lake Memphremagog	3
Northern Lake Champlain	2
Lamoille	1
Connecticut/Hudson	0

**Farms that demonstrate current and historic dedication to keeping their NMP and associated records clear, legible, and up to date.** Prioritization involves reviewing the quality of a farm’s NMP and verification that required components (e.g. manure and soil tests) are current.

**Farms with high levels of conservation practice installation and farms with the highest percentage of self-funded field conservation practices.** Prioritization of producers not currently enrolled in any state or federal assistance programs, and that are actively engaged in conservation practices on their farm.

**Farms that meet the criteria for Historically Underserved Producers, set by USDA.**

- Beginning Farmer or Rancher

- Limited Resource Farmer or Rancher
- Socially Disadvantaged Farmer or Rancher
- Veteran Farmer or Rancher

**Farms interested in learning from Farm-PREP to inform data-driven decision making and comfortable with the uncertainty and co-learning inherent to a new and innovative program.** Prioritization of producers who elected to participate in a Conservation Innovation Grant (CIG), which enabled AAFM to trial Farm-PREP with a discrete group of farms (13) before launching the statewide program.<sup>17</sup>

In practice, here is how VFPF carried out the farm enrollment prioritization process:

**Year 1 (2022):** 89 applications received, 53 farms enrolled in Phase 1: Management Planning and Data Entry, 46 farms enrolled in Phase 2: Phosphorus Reduction Grant. (Farms that do not meet the VFPF program stewardship level or phosphorus reduction threshold are not invited to continue to the grant phase.)

**Year 2 (2023):** 10 new applications received, 10 farms enrolled in Phase 1, 9 farms enrolled in Phase 2. (No competitive ranking process required, capacity to enroll all eligible applicants.)

**Year 3 (2024):** 22 new applications received, 16 farms enrolled in Phase 1, 15 farms enrolled in Phase 2. (No competitive ranking process required, capacity to enroll all eligible applicants.)

**Year 4 (2025):** VAAFAM did not open the program for new applicants in 2025 as the federal grant budget for this program was fully subscribed through existing participants.

### 3.5. Payment Rates and Limitations

Payment rates in the program are intentionally set to foster competitive enrollment. Participants can receive three types of payments through VFPF with a total payment cap of \$50,000 per year.

1. **Data Entry Payment:** A one-time payment equal to \$15 per acre<sup>18</sup> (with a per-farm cap of \$4,000) for **initial data entry** into Farm-PREP. The payment rate is intended to offset the costs taken on by a farmer to provide records and to either enter the data into Farm-PREP themselves or to work with a VFPF-appointed technical assistance (TA) provider or private crop consultant on data entry<sup>19</sup>.
2. **P-Reduction Payment:** A **payment per-pound of phosphorus losses** reduced from a baseline (i.e., historic) land use above a “performance threshold” (set at 40% of baseline P loss reduced P) that is set to account for the necessary reductions of P losses from agricultural land per the TMDL. For VFPF 1.0, the “per-pound” payment is \$100 per

<sup>17</sup> Source: AAFM, via email to UVM evaluation team.

<sup>18</sup> The data entry payment rates were consistent with NRCS payment rates for conservation activity planning.

<sup>19</sup> There were no costs to farmers for technical support from a VFPF-appointed TA provider: relying on these TA providers for data entry did not reduce the amount of data entry payment received by the farmer and the farmer did not pay any service fees to TA providers.

pound<sup>20</sup> of phosphorus loss reductions above the 40% threshold. The net pounds of phosphorus loss reduced above the threshold are calculated across all the farm's fields, such that fields where the P loss reductions do not reach the threshold decrease the total eligible loss reductions for the farm.

- 3. Stewardship Payment:** This payment recognizes farms that have achieved low levels of per-acre phosphorus losses across their entire farm (i.e., across all their acreage). There are two levels of stewardship payment. Farms with average per-acre P losses of 0.5 pounds P or less receive a bonus payment (on top of their P-reduction payment) of \$8.00 per acre. Farms with average per-acre P losses between 0.5 pounds-P and 1 pound-P receive a bonus payment of \$3.00 per acre. The \$50,000 annual payment cap still applies to these bonuses. In practice, the stewardship payment tends to be significantly smaller than the P-reduction payment: for VPFPP payments for the 2022-2024 seasons, the median ratio of stewardship payments to P-reduction payments<sup>21</sup> was approximately 1:10.

At the beginning of the farm's enrollment, VPFPP estimates that amount of money that the farm would likely earn each year (through its planned practices) and sets this amount as the obligated total payment (over the course of the farm's enrollment period) that the farm can receive through the program. This allows AAFM to budget accordingly and to determine the extent to which they can take on new program entrants in subsequent years.<sup>22</sup> However, the annual payments a farm receives are based on assessments of their *actual* practices during each participation year (which are verified on the ground) and the predicted performance that those *actual* practices produce. VPFPP will pay farmers for what they've earned through their performance *up to* the obligated total payment set at enrollment. In other words, the obligated total is the maximum a farmer can earn in the program, but it is *not* the guaranteed amount of money a farm will receive for their participation, and payments will be lower if a farm underperforms in certain years.

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<sup>20</sup> The payment rate was originally set at \$150 per pound of P loss reduction above the 40% outcome threshold per the RCPP-AFA proposal, although the rate was later reduced to \$100 per lb to engage a similar number of farms with a smaller budget than originally planned for. VAAFAM had applied for \$10 million and received \$7 million. Program staff justified this payment rate decrease between planning and implementation of the VPFPP program because it was a more cost-effective use of federal dollars, it was still competitive to the farm compared to other agricultural funding programs analyzed in the Clean Water Initiative report, and it allowed them to support more farms than they would have otherwise. Both rates were well above the median cost-effectiveness metric (\$ amount invested per pounds-P loss reduced) attributed to other state-funded "field and pasture projects" targeting non-point agricultural pollution in Vermont from 2016-2021. According to the 2021 Vermont Clean Water Initiative Performance Report, these agricultural clean water projects had a median cost-effectiveness value of \$46 per pound of estimated P loss reduced over the lifespan of each project (Vermont Clean Water Initiative 2022). (This figure excludes local and federal leveraged funds for each project.) The report also showed that agricultural clean water projects tend to be the most cost-effective intervention when compared to state-funded projects in other sectors such as natural resources (which had a median cost-effectiveness of \$117 per pound of estimated P loss reduced), transportation storm water (\$735), and stormwater (\$1,461). It bears reminding readers that VPFPP cost-effectiveness does not use the total amount of P loss reduced from baseline as its denominator, but instead the pounds of P loss reduced above the performance threshold.

<sup>21</sup> Years for which a farm only received a stewardship payment (and no P-reduction payment) are excluded here since the denominator would be zero.

<sup>22</sup> The obligated total payment (over the course of enrollment) is independent of the annual payment caps set at \$50,000 per year. It is not an expected outcome that a participant reaches their obligated total prior to finishing out the full term of their enrollment (i.e., *overperforms*), but it has happened in VPFPP 1.0. AAFM was able to use cost-savings in other parts of the VPFPP programs to extend payments to these farms to match their outcomes (up to the annual payment caps).

### 3.6. Program Funding and Expenses

VPFP was established via a 5-year Programmatic Partnership Agreement (PPA) between NRCS and AAFM (2021-2026), for ~\$7 million USD with ~\$5 million allocated for direct payments to producers.<sup>23</sup>

Table 2.7 below shows program expenses from 2021 through the 2025 farmer payments. When considering the cost-effectiveness of the program (i.e., beyond the cost-effectiveness of financial assistance to farmers), this evaluation takes into account the full program costs.

**Table 3.1.** Program expenses to date and the percentage of cumulative program expenditures for each line item

<i>Expense category</i>	<i>Total (to date)</i>	<i>Percent of total project expenses</i>
Payments to farmers (FA)		
Data entry payments	\$268,170	6%
P loss reduction & stewardship payments	\$3,214,531	71%
<b>Subtotal of FA payments</b>	<b>\$3,482,701</b>	<b>77%</b>
Technical Assistance (TA)	\$452,995	10%
Software (Farm-PREP)	\$325,000	7%
VAAFM Personnel (Technical Assistance & Program Management)	\$223,705	5%
Outcome Assessment (UVM-Gund)	\$28,000	<1%
<b>Total project expenditures</b>	<b>\$4,512,401</b>	

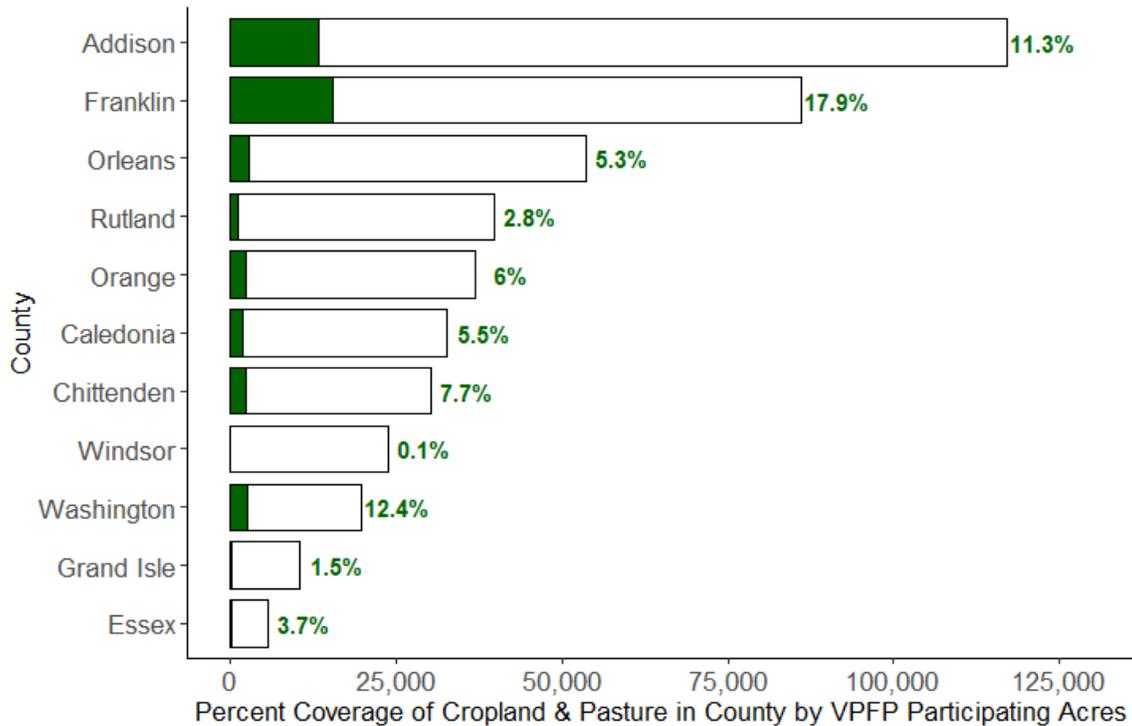
### 3.7. Geographic Scope

Farms participating in VPFP are located within 12 Vermont counties and the Lake Champlain, Lake Memphremagog and Connecticut River watersheds. Originally, AAFM set out to allocate funds as follows: 60% of funds to producers in the Lake Champlain basin, 20% to producers in the Lake Memphremagog basin, and 20% to producers in the rest of the state.<sup>24</sup>

Figure 3.1 shows the percentage of harvested cropland acres in each county that were enrolled in VPFP at any point from 2022 to 2025. Overall, for counties with VPFP participants, VPFP farmers managed 9% of the total cropland and pasture acreage (per USDA NASS (2022)).

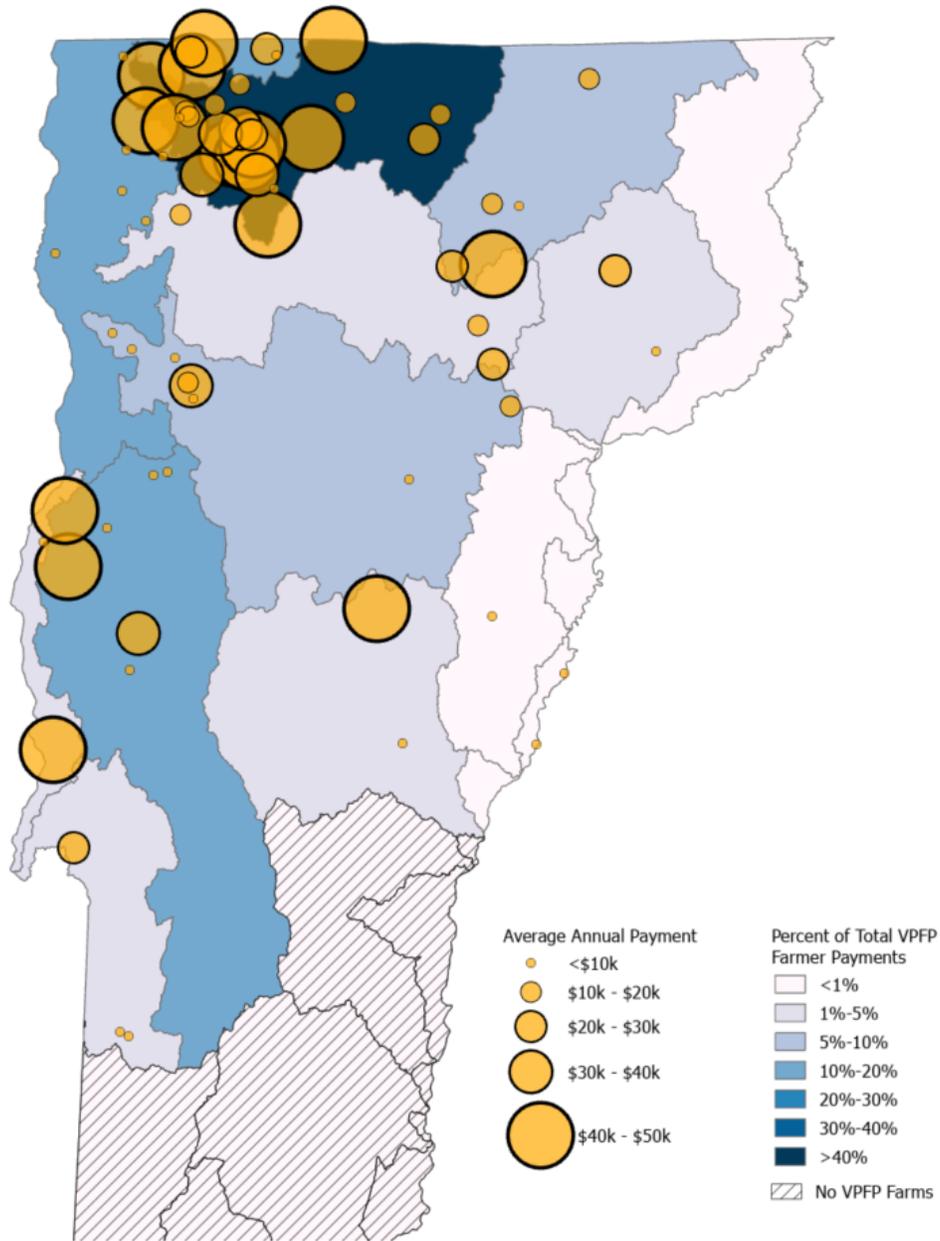
<sup>23</sup> AAFM requested \$10 million and was awarded \$7 million. AAFM chose to reduce the P-reduction payment from \$150 per pound to \$100 per pound to maintain the number of farms they wanted to engage in the program.

<sup>24</sup> Source: Narrative section of AAFM’s proposal to RCPP-AFA to establish and implement VPFP 1.0.



**Figure 3.1.** Percentage of harvested cropland and pasture in each county enrolled in VPF at any point from 2021-2025. Total cropland and pasture acreage is taken from USDA NASS 2022 Census of Agriculture by adding acres in the following categories: harvested cropland, cropland pasture, and permanent pasture or rangeland. These numbers are approximate since we did not have access to geospatial data on farmsteads to determine what acreage corresponds to each county as demarcated by county lines.

In terms of the geographic balance in the distribution of VPF benefits, payments concentrated within or near the Missisquoi watershed, as depicted in the map in Figure 3.2. The concentration of farms in this area and in Franklin County was due in large part to early buy-in among the TA providers working with the Franklin County Natural Resource Conservation District (NRC) and their outreach to local producers about the VPF program. It is important, also, that the Missisquoi Bay lake segment was required to meet the steepest P reductions – an 82.8% reduction of P loss from agricultural sources (US EPA 2015) and so the high concentration of farms here advantageously aligns with areas where P loss reductions are most pressing.



**Figure 3.2.** Average annual payments to each farm (orange circle) and percent of total VFPF payments to all farms in each watershed (2022-2025). Each circle represents a farm participating in VFPF from 2022-2025. These numbers are approximate since we did not have access to geospatial data on farmsteads to determine what acreage corresponds to each watershed.

## 4. Payment for Ecosystem Services Landscape

Payment for ecosystem services (PES) refers to payments that are offered to landowners or managers that incentivize them to manage their land in a way that provides ecological benefits to the environment. PES programs come in many forms and can focus on a variety of ecosystem services, most commonly including carbon sequestration, biodiversity protection, and watershed management. The following section is a landscape-level overview of PES programs across the United States, to provide a framework for comparing VPFP to other PES initiatives. By comparing the conceptual and logistical characteristics of 10 United States-based PES initiatives, with a focus on performance-based programs in agriculture sector, we can identify innovations that could provide insights into VPFP’s program design and administration.

Within the agricultural PES landscape, programs focus on providing incentives for a variety of conservation outcomes. VPFP is focused on mitigating the amount of phosphorus that is lost from agricultural lands and enters the Lake Champlain and Lake Memphremagog watersheds. This focus area is driven by the Total Maximum Daily Load (TMDL) regulation that has been imposed by the EPA on the state of Vermont. Programs highlighted in this landscape analysis each have unique program drivers and conservation outcomes. Phosphorus, nitrogen, and sediment are the most common conservation outcomes among agricultural PES programs in the United States and are typically driven by concerns related to water quality.

### Practice versus Performance

Practice-based programs provide farmers a flat payment for implementing practices that contribute towards the program’s conservation outcome(s). In contrast, performance-based programs only pay participants for the outcomes of conservation practices meaning the more significant the outcome the greater the payment. Performance-based programs are intended to incentivize participants to pursue additional progress on their conservation outcomes to generate higher payments. See Section 2: Performance-Based Programming for more detailed information on the theoretical efficacy of performance versus practice-based PES programs.

### 4.1. National Comparisons

Table 4.1 below provides a high-level overview of nine performance-based PES programs in the US agriculture sector, and VPFP. Logistical elements include conservation drivers and outcomes, funding sources, partners, and timeline.

Table 4.1. Basic Logistical Information						
PES Project	Watershed(s)	Project partners	Project years	Focal outcome(s)	Program Driver	Funding Source(s)

<b>Kalamazoo River Phosphorus Reduction Program</b>	Kalamazoo River (MI)	Allegan County Conservation District, Michigan Farm Bureau Delta Institute	2020-2024	Phosphorus	Information Not Available	Market Based
<b>North Fork Maquoketa River Headwaters Watershed Project</b>	Maquoketa River	Iowa State University Winrock International	2008-2011	Sediment, Nitrogen, and Phosphorus	Information Not Available	NRCS CIG
<b>Milwaukee River Pay for Performance Project</b>	Milwaukee River - West Branch	Winrock International Delta Institute Sand County Foundation	2014-2017	Phosphorus	Potential TMDL Requirements	WWTPs NRCS Great Lakes Protection Fund
<b>Ohio River Basin Trading Project</b>	Ohio River Basin	Electrical Power Research Institute (EPRI) American Farmland Trust Markit ORSANCO Ohio Farm Bureau Federation Troutman Sanders U.C. Santa Barbara Delta Institute C-AGG	2011-2020	Nitrogen Phosphorus	Power plant and POTW NPDES permit compliance Potential TMDL requirements	NRCS CIG Water Quality Credits
<b>Old Woman Creek Pay for Performance Program</b>	Old Woman Creek	Winrock International Erie County SWCD Heidelberg University Old Woman Creek National Estuarine Research Reserve	2017-2020	Nitrogen Total Phosphorus Soluble reactive phosphorus Sediment	Potential TMDL requirements	EPA Great Lake Restoration Initiative
<b>Rabbit River Watershed Project</b>	Rabbit River (MI)	Allegan County Conservation District, Michigan Farm Bureau MSU Institute of Water Research Delta Institute	2017-2020	Sediment	Information Not Available	EPA Great Lakes Restoration Initiative

<b>River Rasin Pay for Performance Program (First Iteration)</b>	River Rasin - South Branch	Winrock International Michigan State University Extension The Stewardship Network Graham Sustainability Institute at U. of Michigan Ohio State University	2015-2016	Phosphorus Nitrogen Sediment	River Raisin Watershed Management Plan (not regulatory) <i>Potential</i> TMDL requirements	EPA
<b>Saginaw Bay Pay for Performance Project</b>	Saginaw Bay	The Nature Conservancy Delta Institute Sanilac Conservation District Great Lakes Commission Michigan State University	2015-2019	Sediment	EPA priority watershed designation	EPA Great Lakes Initiative
<b>Vermont Pay for Performance Program</b>	Lake Champlain Lake Memphremagog Connecticut River	University of Vermont Vermont Association of Conservation Districts Stone Environmental	2022-2025	Phosphorus	Approved TMDL Requirements	NRCS RCPP AFA State of Vermont

A comparison of the logistical elements of these 11 performance-based conservation programs generates several high-level takeaways:

1. Water quality concerns are the primary program driver.
  - a. Several programs have federal mandates to improve water quality such as TMDL or Priority Watershed designation.
2. Federal funding supports the majority of programs.
  - a. Other funding sources include state agencies, private entities, and market-based solutions.
3. Partnering with higher education institutions (universities) is common practice.
  - a. All except one program (Kalamazoo) have at least one partner that is a part of a university or college.
4. The most common time frame is 3 years.
5. All are focused on specific watersheds where they aim to improve water quality.

VFPF is strongly aligned with other performance-based conservation programs in its logistical and conceptual design qualities. More in-depth information surrounding program scale, payment rates, and other design features can be found in Appendix 4.

## Conservation Outcome Valuation

An important point of comparison for understanding where VPFP stands in relation to other performance-based conservation programs is in the inherent valuation of phosphorus within the program. The payments participants receive in performance-based programs either directly or indirectly reflect the program administrator's valuation of the conservation outcome.

Table 4.2. Conservation Outcome Valuation		
PFP Program	Conservation Outcome	Outcome Valuation
Ohio River Basin Trading Project	Nitrogen, Phosphorus	Payments \$10/lb (N + P) loss reduced
Milwaukee River PFP Project	Phosphorus	Payments of \$50/lb-P loss reduced
Saginaw Bay PFP Project	Sediment	Payments of \$150/ton (Sed.) loss reduced
River Rasin PFP Program	Phosphorus	Payments between \$20/lb (P) and \$39/lb-(P) loss reduced
Kalamazoo River Phosphorus Reduction Program	Phosphorus	Payments between \$26.55/lb-P and \$30.00/lb-P loss reduced
Old Woman Creek PFP Project	Phosphorus, Nitrogen	Payment of \$5/lb-N loss reduced Payments of \$35/lb-P loss reduced
North Fork Maquoketa River Headwaters Watershed Project	Phosphorus	Payments of \$10/lb (P) loss reduced
Vermont PFP Program	Phosphorus	Payments of \$100/lb. (P) loss reduced above threshold

Table 4.2 above lists the conservation outcome valuation rates for each program in the landscape analysis. Many programs have different models for calculating progress on conservation outcomes and in some cases different outcomes all together. Therefore, this comparison displays a tenuous value comparison between each program. Comparing the programs that have the same conservation outcome as VPFP shows that VPFP holds a higher valuation of phosphorus than other programs. Note that due to its 40% threshold, VPFP only compensates for a portion of the P reductions captured by the program, however.

## 4.2. Program Innovations from Other PES Programs

Programs listed in Table 4.2 were chosen for their similarities to VPFP and serve as a strong point for logistical comparison. However, due to the inherent similarities of these programs substantial innovations were sourced from the broader PES landscape including practice-based programs and programs found globally. The table below identifies four key innovations from PES programs in the United States and globally that AAFM could draw on to inform the development of VPFP 2.0.

<b>Table 4.3 Program Innovations</b>			
<b>Program</b>	<b>Innovation Category</b>	<b>Innovation</b>	<b>Context</b>
<b>Phosphorus Loading Reduction Stimulus Program (PLUS-UP)</b>	Funding	DRP Credits	PLUS-UP has implemented an innovative credit-based funding system where Dissolved Reactive Phosphorus (DRP) Credits are sold to provide funding for practice implementation payments to farmers. The Bayer Carbon Program is the first buyer of PLUS-UP DRP Credits showing potential viability for this funding innovation.
<b>Saginaw Bay PFP</b>	Technology	Geospatial Technologies	The Saginaw Bay PFP administered by The Nature Conservancy has utilized the Great Lakes Watershed Management System geospatial tool to set ecologically relevant outcome-based conservation goals which will enable project partners to target practices to the areas that offer the highest ecological return on investment.
<b>RBPN (EU)</b>	Structural	Regional Outcomes	The Results Based Payment Network represents a collective of payments for ecosystem service schemes throughout Europe that employ a performance-based model. This network provides a collaborative space for sharing ideas while allowing each program to retain autonomy to have unique conservation outcomes that reflect their local needs.
<b>ESP (AU)</b>	Monitoring	Active, Third-Party Monitoring	Australia's Environmental Stewardship program utilizes an active monitoring strategy to assess the social and economic impacts of the program on its participants. The Commonwealth Scientific and Industrial Research Organization (CSIRO) oversees monitoring and actively assesses program impacts while remaining in an unbiased position as a third-party evaluator.

### Funding

According to AAFM, sustainable program funding is a goal for VPFPP's second phase (VPFPP 2.0). Looking to the landscape of performance-based conservation projects, several programs have developed unique funding solutions that break the established paradigm of securing funding from federal sources. PLUS-UP most notably has implemented the use of a credit system where Dissolved Reactive Phosphorus (DRP) credits can be sold to source funding for the program. This is seemingly an innovative market-based solution for funding conservation outcomes. However, a key informant from the PLUS-UP program surveyed by the UVM evaluation team noted that despite finding a buyer for DRP credits in the program's first iteration this funding mechanism is not viable for a long term or larger scale program.

It is unlikely that Vermont has the necessary resources to successfully implement a credit-based funding model. Lack of industry drivers and sparse population are strong indicators that a credit-based market driven funding solution would not be viable as a sole funding source for future iterations of VPFPP.

### **Technology**

The Great Lakes Watershed Management System (GLWMS) used in the Saginaw Bay Pay for Performance Project is a user-friendly online map tool that uses nutrient and sediment calculators to assess the environmental benefits of a variety of conservation practices. GLMWS helped participants of the Saginaw Bay PFP Project to identify the most impactful management practices and analyze their farms' performance towards larger scale conservation goals. Geospatial technologies have the potential to greatly enhance the efficacy and transparency of performance-based conservation programs and could be an excellent addition to VPFPP's second iteration. Ensuring that program participants have access to the necessary technical assistance to understand and use the tool is a challenge that VPFPP would need to overcome to take full advantage of this technology. The GLWMS was developed by The Nature Conservancy and the Michigan State University Water Institute. A partnership with a university and other relevant partners would be a strong first step for VPFPP to develop its own map tool.

### **Structure**

Many of the U.S. performance-based conservation programs included in this landscape analysis have a similar structure, with a regional design aimed at having impact in specific watersheds. Looking globally, we can find performance-based conservation programs that utilize vastly different programmatic structures to achieve conservation goals. The Results Based Payment Network (RBPN) in Europe is a collective of performance-based conservation programs that belong to a larger collective. RBPN allows for regional conservation outcomes to be pursued by each program with an overall focus on biodiversity preservation. Programs within the RBPN retain their operational agency while gaining a collective platform to voice challenges and source feedback. VPFPP could consider collaborating with similar programs nationwide, including programs in this analysis to contribute towards the development of a similar collective space for achieving conservation goals.

### **Monitoring**

Looking again to the global PES landscape, the Environmental Stewardship Program (ESP) in Australia has developed robust program innovation related to monitoring. The ESP utilizes Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) to facilitate monitoring of the program's goals and participant satisfaction. CSIRO acts as a third party to the program and is able to provide unbiased active evaluation. As is reflected in the *recommendations section* active monitoring is essential for managing key program goals and developing mid-stream innovations. Future iterations of VPPF could benefit from active third-party evaluation to ensure adherence to program qualities and encourage mid-stream innovations.

## **5. VPFP 1.0 Evaluation**

### **Report Card: Grades for evaluative criteria pertaining to the original goals of the VPFP program**

To organize the discussion of VPFP's performance, the UVM evaluation team developed a list of criteria derived from AAFM's language around the original VPFP program goals. These original goals were articulated at the outset of the program's current pilot phase (VPFP 1.0), and although AAFM is considering revising the goals for a second phase of the program (VPFP 2.0), we use the original goals as the theoretical framing behind the program's design and administration.

The Report Card below summarizes our conclusions, informed by participant data, survey data, and interviews (see Section 1). The letter grades follow a five-point Likert scale to indicate extent of goal attainment, from excellent performance (A) to failing to meet program needs (F). The subsequent text explains the rationale behind the "grade" given to each criterion. In this section, we describe the extent to which (and the ways in which) the program achieved each criterion of success and also consider the challenges that inhibited better program performance

<b>Major goal categories and criteria</b>	<b>Grade</b>
<i>*Sub indicators were developed by the UVM Evaluation Team</i>	
<b>1. TMDL reductions and additionality of stewardship</b>	<b>B</b>
<i>1.1: Farmers' P loss reductions above the 40% baseline</i>	<i>A</i>
<i>1.2: Farmers' P loss reductions attributable to VFPF participation</i>	<i>D</i>
<b>2. Farmer buy-in</b>	<b>C</b>
<i>2.1: Farmers would continue participating in the program if provided the opportunity</i>	<i>A</i>
<i>2.2: Program offers farmers greater flexibility to adapt their conservation practices to the unique conditions of their farm</i>	<i>C</i>
<i>2.3: VFPF does not create undue burdens</i>	<i>C</i>
<i>2.4: Farmers value the information generated by Farm-PREP</i>	<i>B</i>
<i>2.5: Farmer satisfaction with program payments</i>	<i>A</i>
<i>2.6: Farmer satisfaction with VFPF technical assistance</i>	<i>B</i>
<i>2.7: Farmers utilize the information generated to refine conservation practices on their terms</i>	<i>C</i>
<i>2.8: Payment rates motivate farmers to improve their practices</i>	<i>C</i>
<b>3. Verifiable, measurable, location-specific outcomes</b>	<b>B</b>
<i>3.1: Model represents farmers' conservation practices as closely as possible</i>	<i>B</i>
<i>3.2: Model provides indicator of overall farm performance based on location-specific attributes</i>	<i>A</i>
<i>3.3: Modeled estimates reflect actual phosphorus loss</i>	<i>B</i>
<b>4. Sufficiency of payment</b>	<b>B</b>
<i>4.1: Farmers are satisfied with program payments</i>	<i>A</i>
<i>4.2: Payments cover the costs of implementing conservation practices</i>	<i>Inc.</i>
<i>4.3: Payment rates result in incentives that are comparable to other conservation programs</i>	<i>B</i>
<b>5. Equity and efficiency of program funding</b>	<b>B</b>
<i>5.1: Equity/Equality - Distribution of payments across farm types</i>	<i>B</i>
<i>5.2: Efficiency - VFPF is a cost-effective approach to securing P loss reductions from agricultural fields</i>	<i>C</i>

Note. Grades can be interpreted qualitatively as follows: A = excellent performance; B = **good performance**; C= satisfactory performance; D = Unsatisfactory Performance; F= failing to meet program needs; Inc. = Inconclusive; N/A = Not applicable (ungraded because it was not an explicit program goal)

## Goal 1: TMDL reductions and outcome additionality attributable to VPFP

Grade: **B**

The Total Maximum Daily Loads (TMDLs) are benchmarks set by the Environmental Protection Agency (EPA) that signify the maximum amount of phosphorus (P) that can enter Lake Champlain and Lake Memphremagog water bodies daily without impairing aquatic ecosystems. This framework establishes regulatory targets for maximum load allocations from agricultural fields across various watersheds. VPFP's program goals demonstrate that it was designed to support progress toward attaining the TMDL benchmarks. We take this to mean that VPFP incentivizes farmers to minimize P losses from their fields either by sustaining their pre-enrollment performance levels or improving them. The mechanisms by which VPFP aims to support farmer action is through (a) payments tied to P loss reduction outcomes and (b) data that helps farmers identify where their performance can be improved (and, in turn, their incentive pay-outs could be increased).

VPFP farmers have demonstrated both eagerness and efficacy with respect to minimizing P losses across their farms. The data produced through VPFP shows the full impact of these practices and their contributions to the attaining the TMDLs.

For this goal, we first evaluate farmers' achievements according to the program's own definition of additionality: farmers' P loss reduction performance about the 40% performance threshold. This acknowledges the impressive commitments and performance of VPFP participants and the work of conservation districts and AAFM staff who support them.

However, as evaluators, we must also establish how much of VPFP farmers' performance outcomes (i.e., their P loss reductions) can be *attributed to* their participation in the program.

The grading criterion in this section seeks to evaluate how successful VPFP has been in decreasing P loss during its pilot phase.

### ***Criterion 1.1: Farmers' P loss reductions above the 40% baseline (Grade: A)***

The data show that VPFP participating farmers have substantially reduced P loss outcomes when compared to baseline formulated from the historic land management assumptions. To consider the *scale* of this performance, remember that VPFP only pays farmers for their pounds of P loss reductions that go above and beyond the "performance threshold"<sup>25</sup> and referred to as "additional" P loss reductions in VPFP.

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<sup>25</sup> As a reminder, the "performance threshold" is set as the P loss reduction already required of non-point agricultural sources of P pollution under the TMDLs. AAFM set this threshold as a 40% reduction from the TMDL baseline. This figure is based on the average required reduction of P losses from non-point agricultural sources across the Lake Champlain watersheds (excluding from the average the Missisquoi Bay lake segment watershed which has an exceptionally high reduction requirement). The average was used to have a single, standard threshold that all VPFP farmers had to meet, including those farming outside of the Lake Champlain catchment basin.

Between 2022 and 2024, farmers participating in VPFP provided *additional* P loss reductions that equate to the prevention of 35,000 pounds of phosphorus pollution from participants’ fields.<sup>26</sup> Table 1.1. details the extent to which the VPFP farmer cohort (by acreage and by individual farm) achieved this milestone.

**Table 1.1.** Number (and percent) of field acreage and farms that achieved *additional*<sup>1</sup> P loss reductions while enrolled in the program (by participation year<sup>2</sup>)

<i>Indicator</i>	----- <i>Program years</i> -----		
	2022	2023	2024
Acreage for <b>fields</b> achieving additional P loss reduction outcomes	16,423 (62%)	19,935 (70%)	24,010 (69%)
<b>Farms</b> achieving additional P loss reduction outcomes	37 (84%)	46 (92%)	54 (92%)

*Note.* <sup>1</sup> “Additional” reductions refer to the pounds of P loss reduced above the threshold for what Vermont farmers must achieve (on average) to meet the target for agricultural non-point sources of P pollution in the Lake Champlain watershed. <sup>2</sup> We use “participation year” here and below to refer to the year in which performance was measured, and conservation practices were implemented.

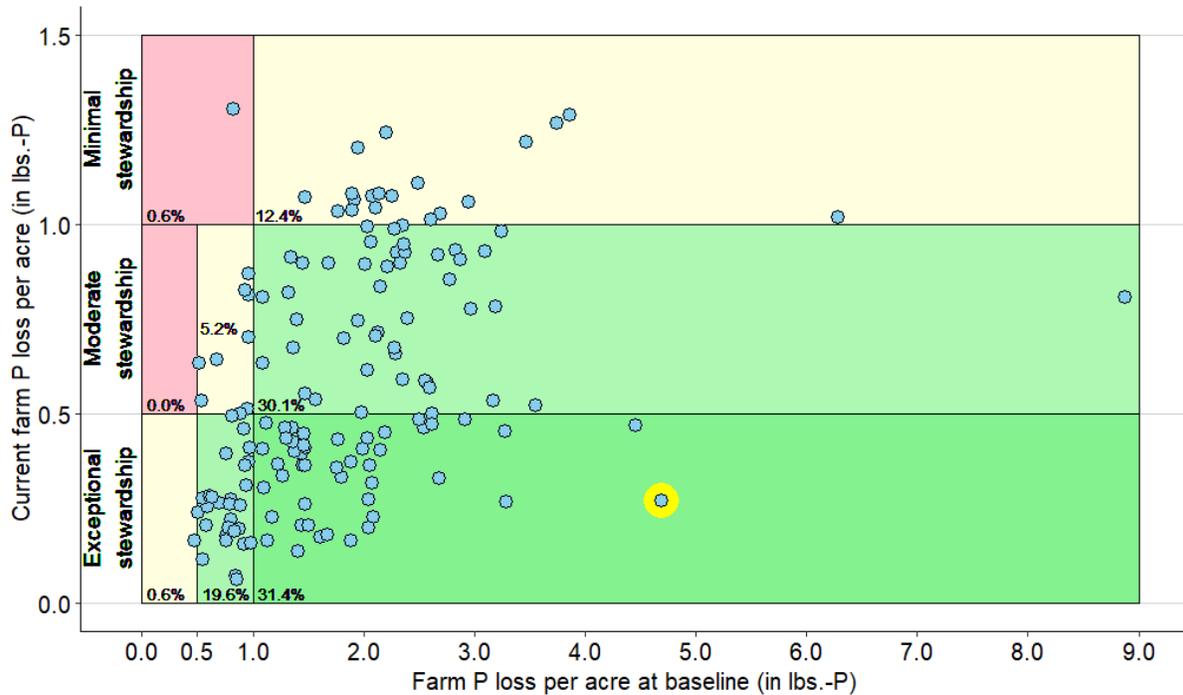
Many of the farms participating in VPFP also maintain quite low average phosphorus losses across their acreage, an outcome they have often achieved prior to enrolling in VPFP. VPFP pays an additional, tiered premium to farms that meet this benchmark – referred to as the “stewardship payment” – and in doing so have created two categories of stewardship:

- *exceptional* stewardship (average P losses below or equal to 0.5 lbs.-P per acre), and
- *moderate* stewardship (average P losses between 0.5 lbs.-P and 1 lb.-P per acre).

Figure 1.1 compares the average per-acre P losses under VPFP participants’ current practices (y-axis) to the per-acre P losses under historic land management assumptions (x-axis), which are used by VPFP as the baseline for reductions. We use colors in the background of Figure 1.1 to indicate where the shift between the baseline outcomes and the current ones reflects an improvement (or backsliding) in terms of the stewardship categories listed above. Sometimes these shifts are quite large. Note, for example, the point highlighted in yellow in Figure 1.1. for a farm that was losing nearly five lbs.-P per acre under the historic baseline assumptions and that now is predicted to be losing only 0.3 lbs.-P per acre.

However, we emphasize here that these shifts are *not* clearly attributable to VPFP. In many (if not most) cases, they reflect farmer conservation efforts that have been progressively added to their operation over several years and that preceded VPFP enrollment.

<sup>26</sup> The environmental impact predicted by Farm-PREP for VPFP farmers over the same period (2022-2024) as compared to historic baseline assumptions (HBMA) was 104,247 pounds (or over 50 tons) of P loss reduced!



**Figure 1.1.** Shifts in average P loss per acre for VPFP-participating farms between the historic baseline assumptions and the current practice scenario. While reflective of improvements, these should not be interpreted as improvements to performance made while the farmer was enrolled in VPFP. Most farmers had lowered their average annual P losses *before* joining this program. However, the graph is representative of farmers’ current performance as it compares to how the field might have been managed under historic land management assumptions. Each dot in this graph represents a particular year of a given farm’s participation in the program. The majority of dots (more than 80%) are in the light green and darker green sections of this graph indicating that they currently perform better than this baseline to the extent that they have surpassed the thresholds of what we call “moderate” or “exceptional” stewardship. A smaller contingent (18%) remained within their original “stewardship” categories (dots in yellow sections) and only one farm dropped to a lower-performing category (dot in red sections). Data from 2022-2024 participation years.

The **A grade** in this category recognizes the efforts of VPFP participants for achieving substantive outcomes while participating in the program: VPFP participants generally exhibit significant reductions in P loss compared to the historic baseline assumptions.

## ***Criterion 1.2: Farmers’ P loss reductions attributable to VPFP participation (Grade: D)***

While we find that VPFP clarifies farmers’ environmental performance, the current design of the program makes it challenging to conclude whether VPFP information, technical assistance and financial incentives are responsible for sustaining or improving this environmental performance.

That said, while VPFP may not be solely responsible for these reductions, this criterion asks whether VPFP *supports* the reduction of additional pounds of phosphorus loss from agricultural fields. It might be helpful to reframe and split this criterion so that the definition of “support” is a bit more intuitive:

1. VPFP participation supports (through information, co-planning with TA providers, and financial incentives) the improvement of farmers’ performance outcomes during their enrollment in the program
2. VPFP participation helps farmers sustain their pre-existing<sup>27</sup> performance outcomes during their enrollment in the program

The first two criteria above suggest a rather clear cause and effect relationship between VPFP participation and performance outcomes. They also translate quite neatly into counterfactuals as follows:

1. Without the benefits of VPFP participation (information, technical assistance, and financial incentives), **farmers would not have improved their performance outcomes over the same time period** (as their VPFP enrollment)
2. Without the benefits of VPFP participation, **farmers would have reverted to lower performance outcomes over the same time period** (i.e., there is a credible risk of dis-adoption of certain practices)

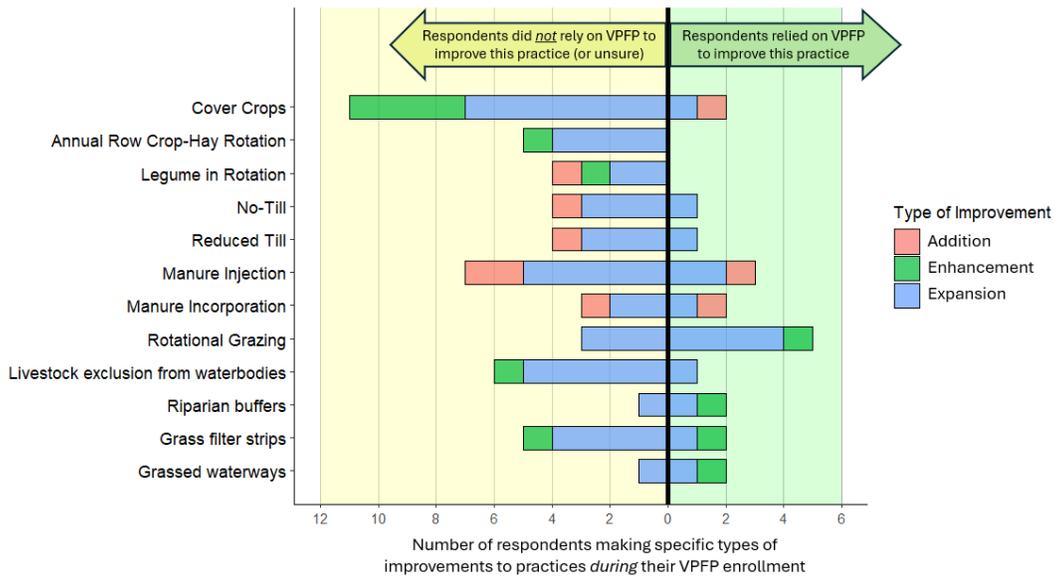
Outside of these framing’s of VPFP’s support, AAFM could argue that the program is not strictly about improving or sustaining performance, but instead it is about fairly rewarding farmers for the positive externalities<sup>28</sup> that they provide during their enrollment in the program. This statement evades the criteria that farmer actions during enrollment should be attributable to VPFP participation. It is constructed around the concept of what is “fair”: downstream beneficiaries *should* help farmers shoulder the added burdens of what it takes to farm responsibly. Given VPFP’s emphasis on progress toward the TMDLs and cost-effectiveness, this framing would appear to be a mismatch for the program’s objectives.

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<sup>27</sup> In this case, we use “pre-existing” to refer to the performance that farmers were achieving immediately prior to VPFP enrollment.

<sup>28</sup> By ‘positive externalities’, we mean the benefits that accrue to downstream beneficiaries (including monetary benefits) from farmers’ conservation actions upstream. These benefits are externalities so long as the downstream beneficiaries do not compensate farmers for them (directly or indirectly through public funds).

Our survey and interview data provide some insights into the question of whether VPFp influences farmer decisions to improve or maintain performance levels while enrolled in the program. In general, our data suggests that VPFp’s influence over improvements to performance outcomes might be limited. While survey responses demonstrated that some farmers continued to refine their conservation practices while enrolled in the VPFp program, it was *less* common for farmers to indicate that they relied on VPFp to make these improvements<sup>29</sup> (Figure 1.2).

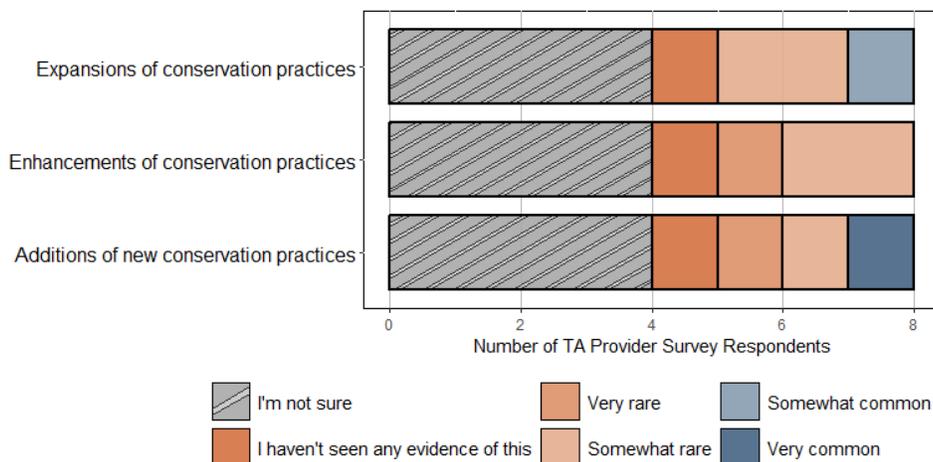


**Figure 1.2.** Number of farmer survey respondents indicating that they made specific types of practice changes during their VPFp enrollment *and* whether they attribute those improvements to VPFp participation. Farmer-reported improvements to conservation practices while enrolled in VPFp are divided into two groups depending on whether farmers relied on VPFp participation to make the improvement (right-hand side of the graph) and or if farmers would have made the improvement regardless of VPFp participation or if they were unsure (on the left-hand side of the graph). Farmers could have selected that they both expanded *and* enhanced a practice, but practice “additions” (i.e., new practices) were a mutually exclusive category. See footnote above regarding the definitions of “additions”, “enhancements” and “expansions.”

<sup>29</sup> In our survey, we categorized the types of potential improvements as additions, expansions and enhancements with the following guidance on term definitions:

- 1) **Additions**, or the implementation of a practice that was not in use in the previous 3 years on any of their fields or pastures;
- 2) **Expansions**, or the extension of an existing practice to more acres as compared to the previous 3 years; and
- 3) **Enhancements**, or the enhancement of a pre-existing practice to improve its performance in terms of phosphorus loss reductions.

Referring to the perspectives of our TA provider survey respondents on this theme (Figure 1.3), we make two observations. First, of those TA providers who could respond to this question (those who began supporting farmers at their enrollment), the median opinion suggests that TA providers observe that practice improvements (expansion or enhancement) during VPPF enrollment appear to be somewhat rare. Second, four of our eight respondents could not say confidently whether farmers had initiated new conservation practices since enrolling in VPPF. This speaks mainly to new TA providers who begin working with farmers after they've been enrolled, but it also highlights that "in-program" performance improvements that are initiated in Year 1 might not be communicated to TA providers who only begin supporting a farmer in subsequent years of their enrollment.



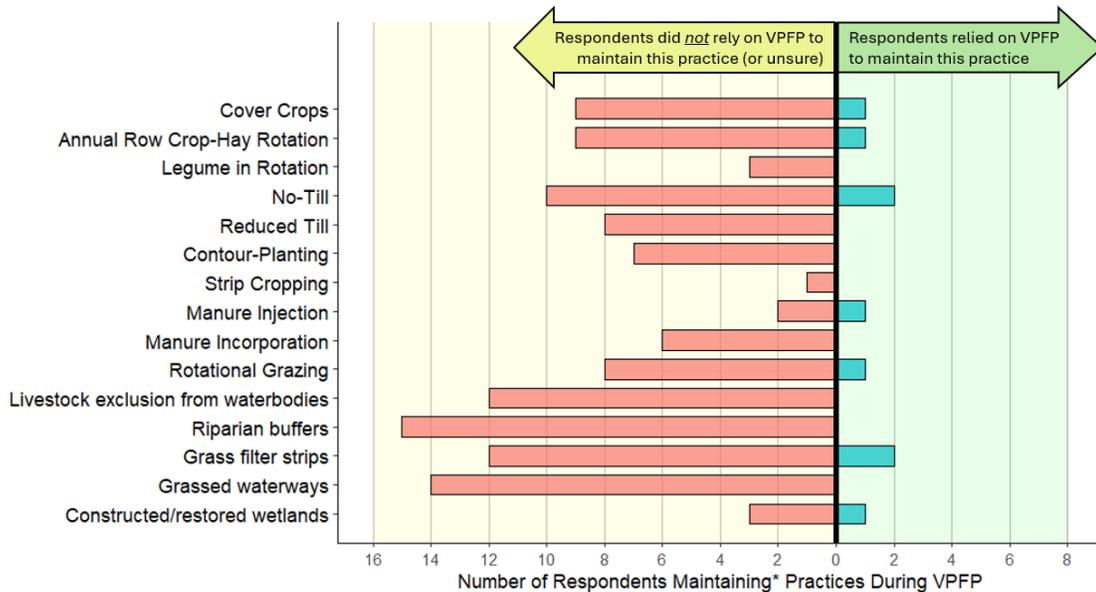
**Figure 1.3.** TA providers' responses on how commonly they have observed VPPF participants making additions and improvements to their conservation practices over the course of their VPPF enrollment period

There are several reasons to explain this including:

- the absence of a distinct incentive (or bonus) within the payment structure for improvements to performance outcomes achieved over the course of VPPF enrollment;
- the ambiguity caused by using a baseline that is formulated on historic land management assumptions rather than a baseline of what the farm was doing immediately prior to enrollment, or what a farm might reasonably be expected to do in the absence of financial assistance;<sup>30</sup>
- the more limited-than-expected engagement of farmers and TA providers with Farm-PREP as a conservation planning tool;
- the feelings of some farmers that they are already doing everything possible to minimize P loss reductions (or, at least, everything that could be picked up in the Farm-PREP model).

<sup>30</sup> While it could be argued that the HBMA's reflect this, in our conversations with AAFM, it has been noted that the HBMA's are not an exact substitute for the current "status quo." Farmers (even outside of the VPPF cohort) might be convinced that certain practices (like no-till or manure injection) simply make good economic sense (besides the positive externalities that they generate for others).

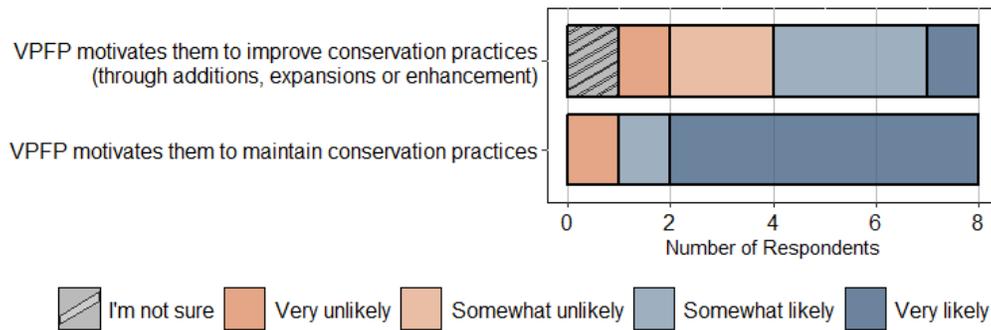
Survey data also clarified that a) many farmers were already implementing many of the conservation practices linked to their performance outcomes prior to VPFP enrollment and b) few farmers relied<sup>31</sup> on VPFP to maintain these practices (Figure 1.4).



**Figure 1.4.** The number of farmer practices that were maintained (i.e., not improved or scaled back) over the participants’ VPFP enrollment period. These practices were adopted *prior to* enrolling in VPFP. The bars are divided horizontally according to whether the farmer relied on VPFP to maintain the practice (right-hand side of the vertical axis, in blue) or whether the farmer indicated that they would have maintained the practice regardless of VPFP participation or that they were unsure (left-hand side of the graph, in red).

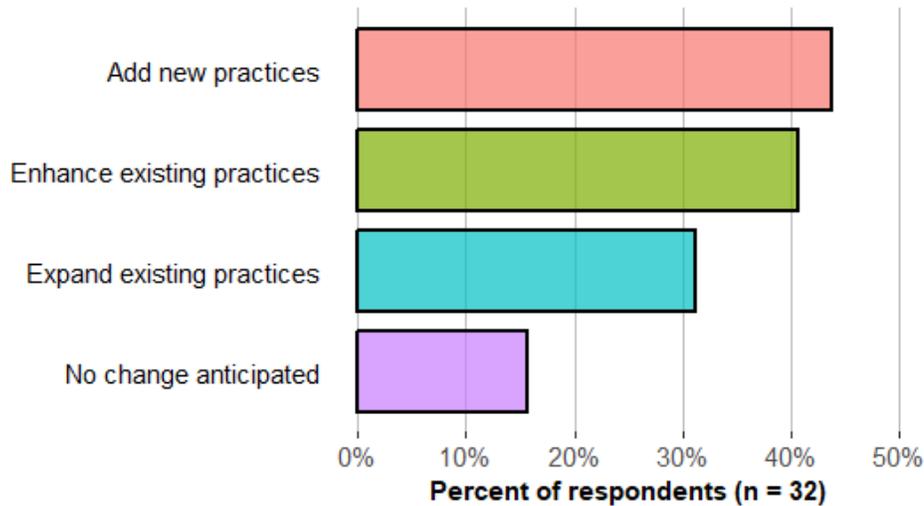
<sup>31</sup> In hindsight, “reliance” might not have been the best terminology for evaluating VPFP’s role in motivating farmers due to the common occurrence of farmers stacking multiple federal and state conservation incentive programs.

On other hand, from the perspective of TA providers, supporting farmers to maintain pre-existing conservation practices might be what VPFPP could be expected to do best (Figure 1.5).



**Figure 1.5.** TA providers’ perceptions on how likely it is that VPFPP motivates farmers to either improve their conservation practices or maintain pre-existing ones while participating in VPFPP. In this case, TA providers were asked to speculate about the likelihood of VPFPP’s current program design to do this, rather than whether they’ve observed such changes taking place on the farms that they support. This probably explains the lower number of “I’m not sure” responses to this question.

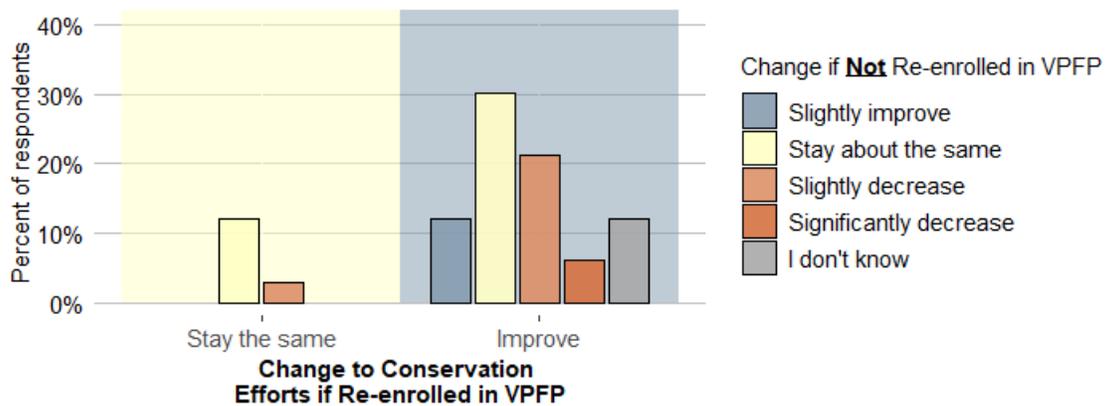
Another way to consider the potential for VPFPP to support farmer conservation performance (through practices) is to ask them what they would expect to happen to their conservation efforts if a) they were re-enrolled in a new round of VPFPP or b) they were *not* enrolled in VPFPP in the future. Most respondents were optimistic that they would either add, expand, or enhance their conservation practices if re-enrolled in VPFPP in the future. Only five respondents (16%) doubted that they would make improvements under a new VPFPP contract (Figure 1.6). Each gave their own reason for this. Three faced practical barriers to doing anything more: not enough help/labor; not enough time; or inadequate equipment. The remaining two did not believe that there were any further improvements relevant to their operation or that the potential improvements would significantly reduce P losses.



**Figure 1.6.** How farmer survey respondents suggested their conservation practices might change if they were re-enrolled in a second phase of VPF. Respondents were allowed select multiple “types” of improvements<sup>32</sup> (additions, enhancements, or expansions) while “No change anticipated” was a mutually exclusive option. No farmers indicated that they would scale back their conservation efforts under a new VPF contract.

When we cross the responses regarding future expectations about conservation practices (i.e., with VPF and without VPF), the results seem to attribute more influence to VPF over conservation efforts *in the future* than the perceived influence of VPF over conservation practice maintenance and/or improvement *in the present* (during their current enrollment period). Figure 1.7 shows that of the 27 respondents who indicated that their practices would improve under a new VPF contract, only four (15%) indicated that their practices would still improve in the future even if they were no longer enrolled in VPF (the light section at the end of the first bar). 30% of respondents suggested that their conservation efforts might decrease if they were not enrolled in VPF in the future.

<sup>32</sup> See our definitions of these categories in Footnote 29.



**Figure 1.7.** Comparison of how farmers expect their conservation practices to change if re-enrolled in VFPF (y-axis) and how they expect them to change if *not* enrolled in VFPF (color-coded sections of each bar).

This is a surprising result given that our farmer interviews reiterate the point that this group of farmers had prioritized conservation even before VFPF enrollment and are always looking for new ways to reduce their environmental impact. We might speculate that what these responses communicate is participants' positive appraisal of the VFPF program and perhaps faith that extended participation in VFPF will identify new opportunities. On the other hand, it could simply be an expression of respondents' (self-interest) that the program continues providing incentives to their operation. Whether they would truly reduce their conservation efforts is difficult to predict. It is also worth mentioning that these two questions came near the end of a long survey, and that we might hesitate before inferring too much from these results without reinforcement from our qualitative data.

For the next version of VFPF, AAFM will adjust the program's design to more explicitly encourage performance improvements over the course of a farmer's enrollment, either by requiring that participants (especially those re-enrolling in the program) plan for and commit to actions that would deliver outcomes better than what they achieved immediately prior to enrollment or by adjusting the payment structure to incentivize newer performance improvements.

Because this question was on AAFM's mind, we asked farmer interviewees how they would respond to this type of requirement, and their responses give us some additional insight into the extent to which VFPF *could* generate additional P loss reductions in the future. What we heard from farmers is both an openness to exploring and doing what is feasible to improve their environmental performance (so long as it makes economic sense) and a hesitation around if there is really much more that they can do, or how they might address some of the practical bottlenecks (lack of appropriate equipment or infrastructure like manure pipelines) preventing them from improving these practices.

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*“I would be open to [making improvements if required as part of re-enrollment in VPFPP]...**Judging from what we’ve done in the past, we continually try to make improvements** - there’s slight improvements in the equipment that we feel would reduce phosphorus and we’re doing it this year already, even without this program requiring us to...We did [multiple-species cover crops] for the first time last year. This year, we’ll continue that. And the other thing that we continually make improvements on is how we apply manure, so both of those things are in the works ‘as-is’.”*

*- VPFPP Farmer*

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Nevertheless, the data on whether the investment through VPFPP results in either sustained or improved performance is blurry. AAFM was explicit that an evaluation of the program’s efficacy should isolate the effect of program payments on the desired outcomes:

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*“Since this program is taking a pay-for-performance approach, the generation of phosphorus reductions – quantified in pounds of phosphorus – is intrinsically linked to the provision of payments to producers and will be clearly and explicitly quantified and reported through this program.”*

*- AAFM proposal for RCPP-AFA funding (Narrative section)*

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Although VPFPP is colloquially described as a program that rewards land stewards who have been voluntarily minimizing phosphorus losses for some time, the proposal was clear that AAFM’s intention was to clarify the work being done by farmers “towards the TMDLs *independent* of existing financial assistance programs”<sup>33</sup> as well as incentivize “additional conservation practice implementation.”

The **D grade** for this criterion acknowledges the limited influence of program participation on conservation outcomes. It must also be noted that in this initial phase, VPFPP lacked appropriate evaluative mechanisms for clearly determining the extent to which farmer participation in VPFPP had a role in incentivizing these outcomes.

<b>Goal 2: Farmer buy-in</b>	Grade: <b>C</b>
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We have established that VPFPP farmers are invested in minimizing P losses from their fields. VPFPP farmers had already ‘bought into’ many of the conservation practices that determine their performance outcomes in this program *prior to* their enrollment in VPFPP. Their motivations to pursue conservation, even in the absence of financial incentives, include moral and economic reasons. Many (if not all) recognize the co-benefits<sup>34</sup> of these practices.

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<sup>33</sup> That is to say: generate more comprehensive data on P loss reduction outcomes within the agricultural sector than were previously available so that the State of Vermont can more accurately represent advances in these watersheds.

<sup>34</sup> In this case, co-benefits of practices refer to benefits enjoyed by farmers outside of compensation from conservation incentive programs, including the potential to reduce fertilizer costs and build soil health.

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*“We do most of the conservation stuff because it’s made economical sense on our farm, so I’d probably do it with or without [the VPFPP incentive payments]: the no-till helps lock in the moisture with the cover crop, and then we don’t have to pay for tillage. And then the injection, I think, overall gets us slightly ahead. I think we saw a little bit of a yield boost.”*

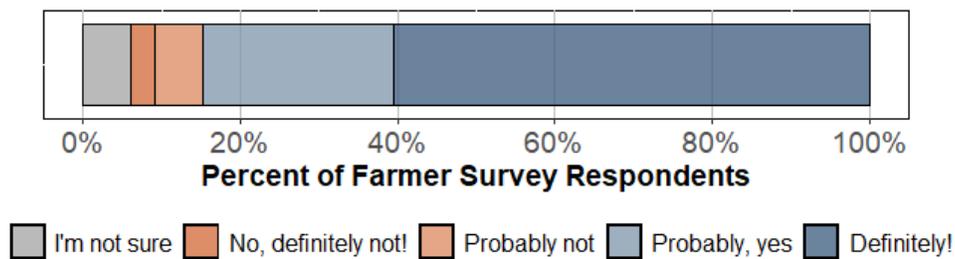
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- VPFPP farmer

In Goal 2, we assess the degree of buy-in of both farmers and TA providers for VPFPP’s approach and incentive structure by evaluating (a) farmer satisfaction with the VPFPP program in terms of three key program services: information, technical assistance, and financial incentives; and (b) whether farmers and TA providers engaged with VPFPP incentives and tools *as intended* by the original program design. A third aspect of ‘buy-in’, which we do not evaluate here, would investigate whether VPFPP sufficiently satisfies the original request from the farming community for a performance-based approach to conservation incentives and for recognition of their stewardship.

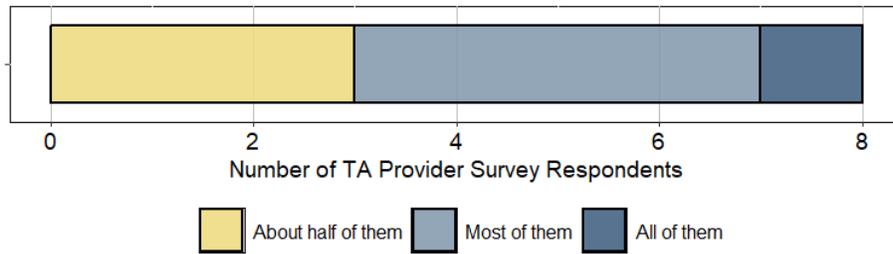
***Criterion 2.1: Farmers would continue participating in the program if provided the opportunity (Grade: A)***

One of the simplest indicators of whether farmers believe that a program’s benefits outweigh the costs of their participation is whether they would choose to continue participating with a new contract. Most farmer survey respondents *would* re-enroll in the program (Figure 2.1.), which is good evidence that farmers consider participation worth their while.



**Figure 2.1.** Percent of survey respondents who would likely re-enroll in VPFPP if presented the opportunity.

Respondents to our TA provider survey corroborated that farmers appeared to be satisfied with their participation in VPFPP overall (Figure 2.2.).



**Figure 2.2.** TA providers’ perceptions of *how many* of the farmers supported through VPFP appeared to be satisfied with their participation in this program overall.

Another simple test for “how the program sits” with the farming community would be to inquire whether neighboring farmers (or other farmers within a conservation district) have expressed interest in joining VPFP in the future. Unfortunately, we did not directly collect data on farmers’ and TA providers’ perceptions of this question. However, when asked about what programmatic changes might be necessary to persuade additional Vermont farmers to apply to VPFP, one TA provider advised:

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*“Keep the program as-is. There were more farms in our region that wanted to apply in January 2025.”*

- TA provider

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This level of general satisfaction and continued interest in participating in the program justify an **A grade** for this criterion.

In the subsequent text, we review several programmatic challenges, some of which can be addressed without a full transformation of the VPFP approach. Both farmers and TA providers believe the VPFP program has value and that their feedback was intended to strengthen future iterations of the program rather than remove it as a policy tool. This balanced recognition of the program’s value and its challenges comes close to how many current stakeholders view it:

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*“This is a good program, but it’s very complicated. That frustrates the farmers and the TA [providers].”*

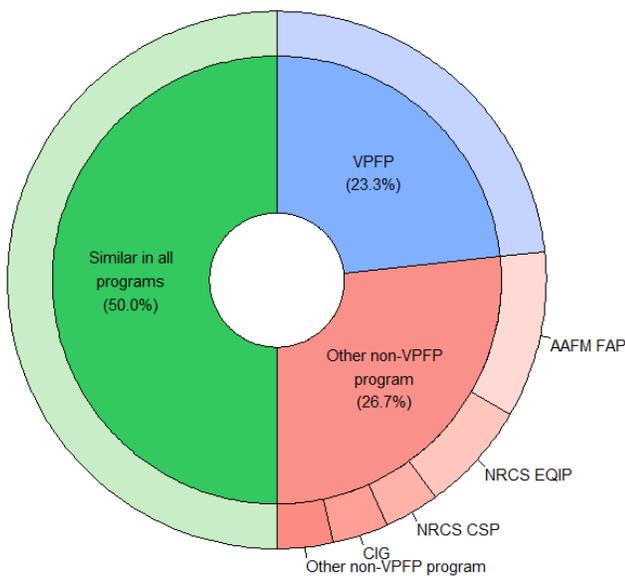
- TA provider

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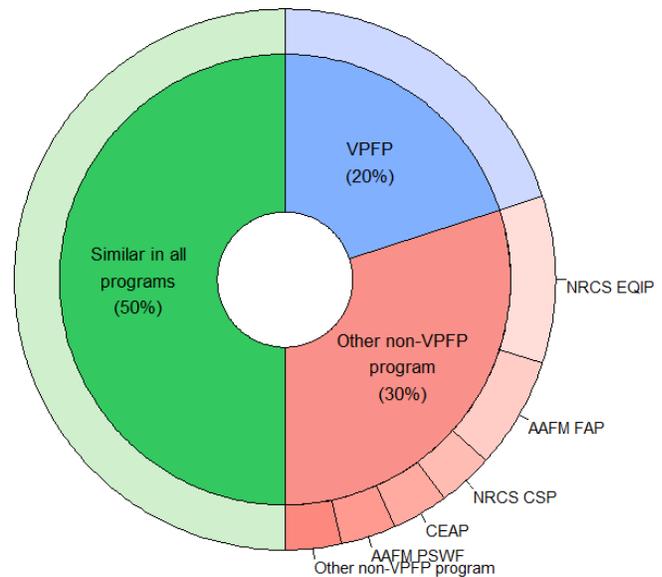
**Criterion 2.2: Program offers farmers greater flexibility to adapt their conservation practices to the unique conditions of their farm (Grade: C)**

When compared to practice-based incentive programs, performance-based approaches are presumed to give farmers greater flexibility to choose and tailor practices appropriate to the specific farm’s context while still allowing them to reap the benefits (i.e., incentives) for their conservation efforts. Relatedly, this flexibility allows farmers to adapt the conservation options available to them (as well as specific details of their implementation like seeding dates) to the unique conditions of their farm in ways that might not be possible under more prescribed conditions of practice-based programs. Here, we investigate whether farmers and TA providers perceived VPFP as offering greater flexibility and adaptability than other programs. Since these characteristics are treated as hallmarks of performance-based approaches, we have a slightly higher criterion: VPFP should perform *better than* practice-based programs in these areas. About 65% of farmer survey respondents agreed that VPFP gave them the flexibility to choose the appropriate conservation practices for their farm; another 79% of respondents comments that participating in VPFP made sense given the unique conditions of their farm. However, when we asked VPFP farmers who have experience in practice-based programs which of the programs best satisfies each of these indicators, the most common response was that the experience was similar in all programs (Figure 2.3). In other words, on the basis of response frequency, survey respondents did not distinguish VPFP from other programs for these characteristics.

(A) Flexibility with respect to my management choices

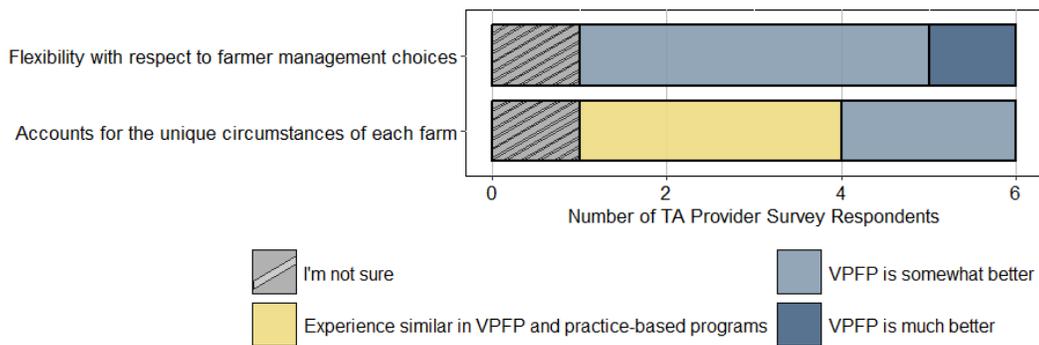


(B) Adaptable to the unique conditions of my farm



**Figure 2.3.** Comparisons by farmer survey respondents of VPF to other non-VPFP conservation incentive programs according to which program performs *best* according to two characteristics: (a) flexibility with respect to the farmer’s management choices and (b) adaptability to the unique conditions of the farm. Although survey questions tried to constrain the comparison to practice-based programs, we allowed farmers to “add” programs to the comparison that provided financial assistance for the implementation of specific practices on their fields. This explains why the Capital Equipment Assistance Program (CEAP) is included as a response above.

On the other hand, TA providers (those who had experience with practice-based programs) gave VPF more credit for the flexibility it grants farmers over their practices, although they seemed to be in less agreement over whether that flexibility translates into the program accounting for the unique conditions of the farm (Figure 2.4). Why might these differ? We know TA providers are aware of how farm characteristics (e.g., soil types, size, cropping systems, etc.) determine how a farm will perform in VPF. It is possible that their opinions about whether VPF accounts for these characteristics are more mixed because they have observed scenarios in which VPF is less remunerable to certain farm types. This could illustrate two different perspectives on what “accounting” for these characteristics should do: whether “accounting” should provide more accurate performance metrics regardless of how “fair” the resulting payments seem or whether “accounting” should have an equalizing effect on payments like when a farmers’ conservation efforts do not translate into compensable performance per the VPF threshold because of the inherent attributes of their land base. As evaluators, we could have clarified this point better.



**Figure 2.4.** TA providers’ comparisons of VPF to practice-based programs on the characteristics of flexibility and accounting for the unique circumstances of each farm. TA providers tend to agree that VPF offers farmers more flexibility, but there is more ambivalence as to whether VPF accounts for the unique circumstances of each farm.

In our TA provider surveys, we intentionally grouped practice-based programs into a stand-alone category to be able to evaluate this indicator. In reality, these characteristics might differ noticeably *among* practice-based programs. For instance, we have heard from both TA providers and farmers that they appreciate the simplicity of AAFM’s Farm Agronomic Practices program (FAP), and that might be contrasted with the relatively more rigid and burdensome requirements associated with NRCS EQIP.

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*"It is not a fair question to lump FAP with EQIP and VPFP. **FAP is an amazingly easy program** where most of the farmers are approved with straightforward expectations and a fairly quick turn-around for payment (although the payment rate is significantly less than EQIP). **That is not so with EQIP.** With EQIP there is application, farm visit, field evaluations, draft plan then the ranking process [and] many smaller farms don't rank out."*

*- TA provider*

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*"I've worked with [NRCS EQIP] and, man, [it's challenging]. ... **I've worked with FAP and they are really nice.** You just fill out their little sheet: 'I did these fields at these application rates, and the NMP showed they worked, and that's it, and they send you a check. **It's so easy.** [With] NRCS, you have to sit there and be like, 'What fields are you going to inject next year?' And I'm like 'I don't know...' [Or] you have to pick a spring or fall [manure application] with them, and if you do a fall application and you applied for the spring [than you don't receive a payment]. But FAP was a very easy program. I really liked that program."*

*- VPFP farmer*

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VPFP earns a **C grade** for this criterion in large part because farmers do not seem to highlight flexibility as a key advantage compared to practice-based programs.

### **Criterion 2.3: VPFP does not create undue burdens (Grade: C)**

Both farmers and TA providers mentioned that the program requires a considerable amount of data collection and entry. The most common complaint is that participation in this aspect of VFPP is very time-consuming (for both parties). This 'cost' is weighed against the benefit of faithfully representing farm practices in the model – less data collection could mean a less representative set of input data and, in turn, a greater margin of error around outcomes.<sup>35</sup>

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*"The data entry for VPFP is very time-consuming, and I can't help but wonder if the amount of funds going towards TA and data entry could go further in a program with a different structure."*

*- TA provider*

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Sometimes farmers are buffered by the more tedious aspects of this process, which might explain most survey respondents considered the information requirements 'reasonable.' But frustrations can arise on both sides if translations of data into the Farm-PREP structure or data errors result in protracted back-and-forth of confirming data points.

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<sup>35</sup> It can be difficult to determine how *much* increasing precision around practice representation pays off in terms of the model's accuracy in predicting outcomes. This makes it challenging to pinpoint the optimal point beyond which added granularity among the input data does not pay off in terms of accuracy. The lack of clarity can produce doubts as to whether faithfully representing a farm's practices is worth it. As one TA provider has put it, "Over the years this program has gotten significantly more complicated in terms of data entry, but I'm not sure all of these calculator tools actually result in more accurate results."

Part of the reason that this program is so data-hungry is that Farm-PREP attempts to faithfully represent farm practices and this objective demands a higher level of detail than other incentive programs. To accommodate complicated grazing patterns or different forms of manure application, the program has generated new spreadsheet tools that help to translate these details into a form Farm-PREP can accept. Figure 2.3 above shows that among TA providers responding to the survey, the amount of information required by VPFPP is one of its primary disadvantages relative to practice-based approaches. They provided various examples of how the data entry process could be made easier, both for themselves and for farmers, by minimizing the need to go back and forth to correct errors:

- Easier mechanisms to transfer data between Farm-PREP and other databases, like goCrop, that request very similar data from farmers
- Internal alerts that flag when data uploaded into Farm-PREP as a .csv file might vary considerably with data previously collected for a farm or when entered data appears to fall outside of normal ranges
- Farm-PREP outputs that present data in terms with which farmers are familiar and could easily verify (gallons of manure instead of pounds of P<sub>2</sub>O<sub>5</sub> applied)
- Improved references for TA providers on exactly what data needs to be collected

While AAFM has made improvements to alleviate the data burdens of this program, data collection and entry into Farm-PREP remains one of the primary pain points for farmers and TA providers. VPFPP earns a **C grade** in this criterion.

#### ***Criterion 2.4: Farmers value the information generated by Farm-PREP (Grade: B)***

Along with incentives and technical assistance, the quality of information produced by the predictive model is theorized as a key benefit of the performance-based approach. Farmer survey responses indicate that the information on predicted phosphorus losses from their fields *can be* perceived as valuable by farmers. In fact, 50% (!) of farmer survey participants independently brought up the value of better information and understanding about how their management practices impact water quality provided by VPFPP *before* being prompted about specific program attributes.<sup>36</sup>

Farmer interviews corroborated and expanded on this point:

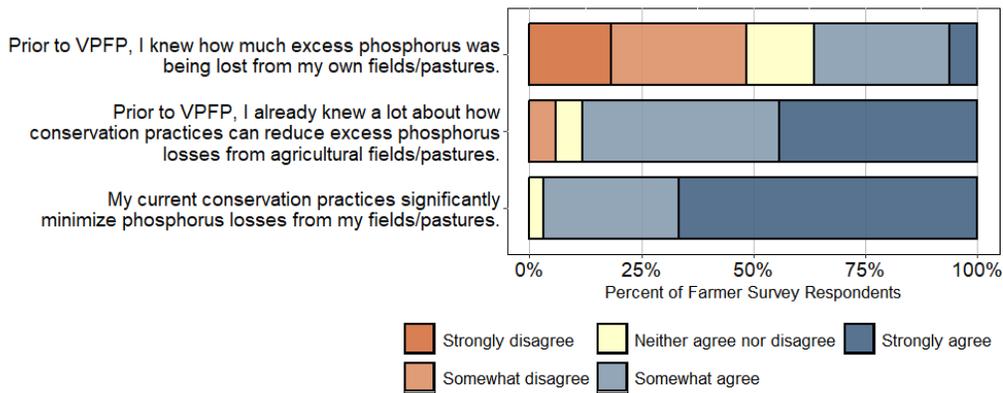
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*"I think the best thing that came out of VPFPP is actually evaluating what you were doing and whether it was working. And in our case, [the data on P loss reductions showed that] this is kind of working...Prior to that, you were doing cover cropping, no till and manure injection, and the research said it was good, but there's no way they'll evaluate it on your farm."*

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<sup>36</sup> On the advice of Alissa White (former UVM graduate student and post-doctorate affiliate and New England Deputy Director at American Farmland Trust who has designed and run surveys in this population), we began both farmer and TA provider surveys with open-ended questions about the benefits and challenges of the VPFPP program that respondents had observed during their participation in it.

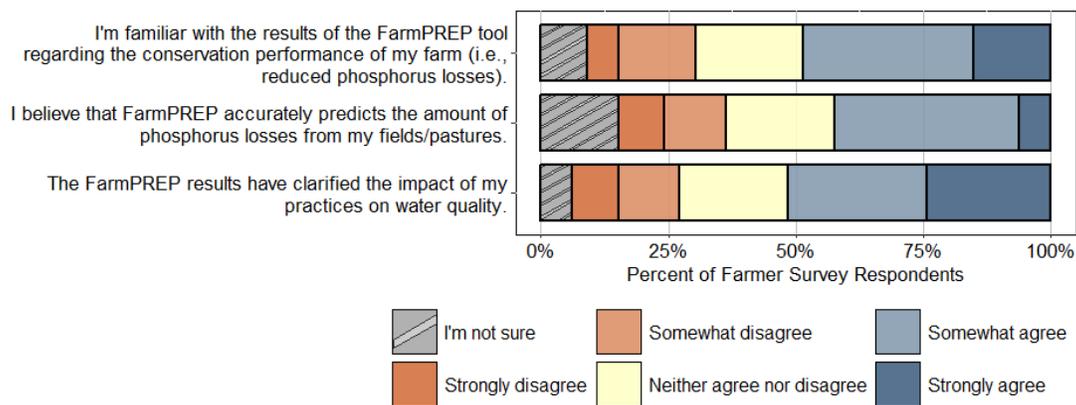
Survey respondents suggested that prior to their VPFPP participation, they did not have a clear idea of how much excess phosphorus was being lost from their fields, although they were much more confident that they knew which practices had an impact on these losses and whether their practices influenced P losses (Figure 2.5). This shows that the information provided by VPFPP potentially addresses a real knowledge gap as perceived by farmers, although it is less clear from this survey data that the information would have greatly changed their understanding of what needs to be done to address those P losses.



**Figure 2.5.** Farmer survey respondents’ perceptions of their knowledge regarding P losses prior to VPFPP participation and their evaluation of the impact of their current practices. These figures provide context for farmers’ valuation of the VPFPP information and how that information might motivate behavior change.

If farmers utilize the data offered by Farm-PREP to *refine* their practices at the margins, this might speak to the place of VPFPP within the landscape of conservation program options: practice-based programs might be better for getting farmers to implement the more “obvious” practices – those that the farmers themselves perceive as necessary to address P losses. VPFPP might be better positioned to support farmers *after* they have already adopted the “obvious” practices. The VPFPP data allows them to *tighten* their current strategies or invest the small resources left over from the implementing the more “obvious” practices to make improvements where those improvements deliver the greatest *marginal* enhancement of performance. This seems to be a restatement of what AAFM originally intended for VPFPP and why the farmers’ history of conservation is still a very important criterion for enrollment.

The qualitative data was only partially supported by other survey data that views farmers’ relationship with the program data from slightly different angles: **clarity**; farmers’ **familiarity** with the results (from Farm-PREP), perceptions of the **accuracy** of predicted P outcomes, and the **actionability** of the results) (Figure 2.6). Just over half the respondents characterized the Farm-PREP results as providing clarity on their conservation practices’ impacts. Fewer than half of the respondents agreed that they were **familiar** with their Farm-PREP results. This figure seemed surprisingly low – farmers might not spend very much time with their results, but would we expect them to have some knowledge of how their fields were performing. One explanation for this answer could be that some farmers are mainly interested in how much their participation in the program earns them, and they are less interested in (or have less time to engage more than superficially with) the metrics regarding their environmental outcomes. Another explanation is that respondents interpret “familiar” in different ways: they might, in fact, have learned which fields tend to be high- and low-performing, but they feel less familiar with the reasons for those differences. We also notice that respondents tended to respond similarly to each of these questions and wonder if survey fatigue might have had some influence over responses.



**Figure 2.6.** Farmers’ perceptions of their own familiarity with the information about their outcomes from Farm-PREP, their beliefs about Farm-PREP accuracy, their use of information to guide their practices, and their understanding of practice impacts as clarified by these results

Farmers seemed least confident in their responses to the question about Farm-PREP accuracy. In reality, it might be very hard for farmers (and everyone else) to gauge the plausibility Farm-PREP P loss predictions, although we heard a few expressions of doubt from our interviews. These might arise when farmers *do* have a reference for comparison. Farmers have projected performance outcomes from planned practices, but weather or other factors might force them to deviate slightly from their planned practices on a field. Although, intuitively, these farmers do not believe the deviations would have a large impact on practices, the predictive model produces “actual” outcomes (the outcomes calculated by farmers’ actual practices) that are quite different.

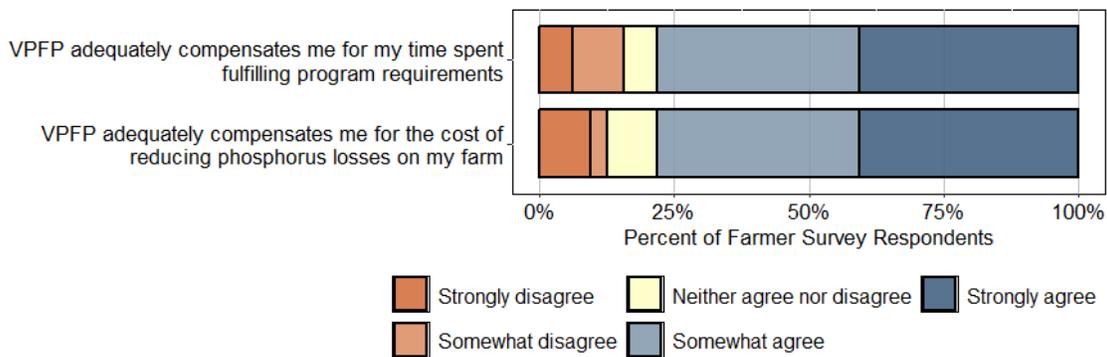
Finally, fewer than half of the respondents indicated that they agreed that the Farm-PREP results informed their P loss minimization strategies. We will return to this point below.

The **B grade** in “Farmers value the information generated by Farm-PREP” reflects farmers’ appetite for information, engagement with the technical aspects of VPFP, and collective commitment to implementing conservation practices prior to program enrollment. VPFP excels in this area, and there is strong potential for success in future iterations of this program. On the other hand, it is less clear how familiar all participants are with their Farm-PREP results, and we would expect farmers to be more in agreement with the statements above regarding Farm-PREP to conclude that the value attributable to VPFP information is generalizable to most participants.

**Criterion 2.5: Farmer satisfaction with payments (Grade: A)**

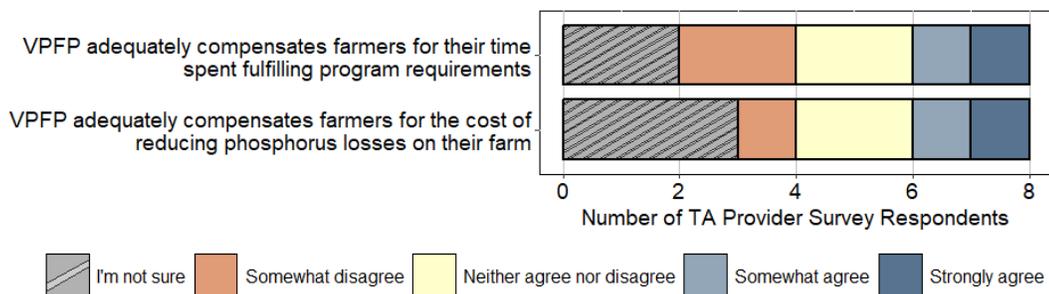
In another part of this evaluation, we consider how payments relate to the *added* costs of implementing conservation practices. Here, we are concerned mainly with how farmers judge the adequacy of their payments.

The farmer survey indicates that 75% of farmer survey respondents agreed that they were compensated adequately for their time spent fulfilling program requirements and for reducing phosphorus losses (Figure 2.8). That’s an outstanding vote of confidence for VPFP’s payment rates. Less than a fifth of survey respondents indicated they did not think they were compensated adequately.



**Figure 2.8.** Farmer perceptions of the adequacy of VPFP payments with respect to their costs.

TA providers were not as strongly convinced of VPFP’s payment adequacy with only two respondents agreeing that VPFP adequately compensates farmers both for their time in fulfilling VPFP participation requirements (like data entry) as well as for the costs of the practices employed to reach their performance goals (Figure 2.9).



**Figure 2.9.** TA provider perceptions of the VPFP adequacy of payments

In looking at farmer satisfaction, the definition of “adequacy” is more open to interpretation, (although we provide some guidance in specific questions) than in a practice-based approach. In the latter, payments are typically understood as cost-offsets (and risk mitigation) for adopting new practices or enhancing existing ones. In this case, the reference for whether the payment is adequate or not is the cost of the practice that the farmer is being asked to implement. If farmers are adopting new practices or facing costly hurdles to expanding existing practices to new fields might only be satisfied with higher payment rates that can cover the transition planning costs and to mitigate the risks to their operation (on top of the implementation costs and potential opportunity costs). Farmers shifting to grass-based farming from continuous corn silage might also face steep opportunity costs (and new transaction costs if some of their hay needs to be sold rather than fed directly to their own cows). In addition, the co-benefits often associated with conservation practices in medium and long term (like increased soil health and resilience, reduced fertilizer costs, etc.) might not accrue immediately, and so the conservation incentives might be the primary “return on investment” in the short term.

However, among the current VPFP cohort, some farmers might *not* be making large changes to their conservation practices *and* there might be less likely to abandon long-standing practices given that they now produce co-benefits for productivity (and the farm’s bottom line). These farmers might be satisfied with smaller per-acre payments than the farmers in the first group, even when the level of conservation effort appears to be similar (or even greater). Indeed, some of our interviewees have suggested that these conservation practices begin to pay for themselves. They might also interpret the adequacy of VPFP payments differently – not so much as cost offsets but as a recognition of the downstream benefits produced, year over year, by their farm. Below, we review a range of farmer survey responses related to the adequacy of payments.

Ultimately, this boils down to how farmers understand what they are being paid for in VPFP. If farmers understand the purpose of VPFP as encouraging them to make improvements to receive higher payments, they will probably see VPFP payments as cost-offsets (and will be satisfied when VPFP covers a substantive portion of those costs). This orientation is especially relevant if AAFM *requires* farmers to make improvements in VPFP 2.0. If, on the other hand, farmers view VPFP as a way of recognizing farmers for their existing practices (which they would have implemented regardless of VPFP enrollment) then they might view the payments as simply covering the costs of their engagement with a TA provider to provide records and troubleshoot any data errors with a bonus for their “continuing contributions”

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*“The question [of whether VPFP adequately compensates farmers] is hard to answer. How much is a farmer’s time worth to do paperwork? In theory, it should be fairly easy.”*

*- TA provider*

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*“[W]e initially started no-till, just because we were sick of picking rock...and if you looked at it a year after you've started, it doesn't look so pretty, but five years later, it's like, 'Okay, there might be hope in this.' The practice itself was more incentive than anything that the State could give you. [Instead], we were initially driven to do it just for those financial gains, from the business side of it. **It's just a bonus to have a program that recognizes what you've done and rewards you for that, on top of it.**”*

*- VPFPP farmer*

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The following statement ties payments to conservation practices, noting that the payment facilitate their efforts – we discuss the link between payments and conservation motivations below – but also views conservation practices as farmers’ responsibility, such that the payments can, again, be construed as a bonus, or their words “pennies from heaven.”

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*“[The] payments still make [conservation] easier to do, and we want the same things that the government wants...they're just good practices [and] we probably should be doing them all anyway! So, in some ways, **[the VPFPP payment] is pennies from heaven**, but in other ways, [other farmers] might be a little less hesitant if there were a little more money”*

*- VPFPP farmer*

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In the following case, the farmer judges payment adequacy by comparing them more directly with opportunity costs of their conservation strategy.

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*"Because the [hay] crop isn't worth as much - I'm having a hard time selling all of that as baleage or haylage - **[the VPFPP payments have] been very helpful offsetting that lost income**, the opportunity cost of switching [from annual crops to permanent hay], and made the whole thing work. I'm a little nervous, like, if the payment goes away, does my business model still work?"*

*- VPFPP farmer*

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The inability to generate an adequate performance-based reward through VPFPP can be frustrating for farmers practicing good land stewardship – perhaps not just because the time invested in participating did not result in desired payment, but for what the outcome implies about their conservation efforts.

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*“I was pretty disappointed because one of the farms...**they were already doing cover crop, they were doing no till, and they weren't scheduled to get any payment**...And I think they were excited to participate in this program, and then to find out - after we took a bunch of their time - they weren't going to receive anything...You know, that just sort of left a bad taste in my mouth, because I had spent a lot of time with them. They're doing a great job.”*

*- TA provider*

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We would remind the reader here that VPFPP does not pay farmers according to their conservation efforts, but for the environmental outcomes that those efforts generate. This is one reason why production costs are not an *ideal* reference point for the adequacy of performance payments (since performance payments should reflect instead the value of the downstream benefits to downstream buyers), but costs *are* a practical reference point since the payments might reflect a sharing of the burdens implied by the land management transitions required for shared environmental goals.

Farmers face costs relevant to on-field conservation practices beyond yearly implementation costs. In specific cases what might be standing in the way of adding or expanding practices are very expensive capital improvements (e.g. manure pipeline or satellite pits to facilitate manure injection on more distant fields).

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*“[The payment] is a drop in the bucket, I guess. ... We just bought [major infrastructure to implement a conservation practice]. So [VPFP is] kicking in [a small portion of that] and I got [another amount] from NRCS all going towards that. And I had to make up the difference. That is out of your pocket. Then I had to buy a tractor to pull that stuff, and that’s all out of my pocket there.”*

*- VPFPP farmer*

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These types of costs are not (and should not be) references for the adequacy of VPFPP payment rates, but these costs do become an obstacle for improving performance under VPFPP. When farmers consider what it would cost them to improve their performance, it makes sense that they conflate capital improvement costs with implementation costs. And farmers’ hopes of improving their performance might be frustrated when they are turned down for financial assistance in the programs that *are* designed to share the costs of capital/infrastructure improvements. This is relevant since it addressed a question of how VPFPP outcomes might be enhanced if VPFPP participation could improve farmers’ chances of accessing financial assistance in other programs.

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*“The reason we can do some of the things we’re doing is that we’ve had cost-sharing on equipment, like a big drill for putting in cover crops and planting soybeans, and we have a corn planter that [lets us] plant through [the cover crop] and reduce tillage. I don’t think we would have bought them if we hadn’t been in a program.”*

*- VPFPP farmer*

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There are some farmers who were unpleasantly surprised by the outcomes (and, in turn, payments) that they were able to achieve through the program, including farmers who felt that they were making large efforts to minimize their phosphorus losses. These disappointments might be, in part, simply the nature of participating in a performance-based program designed in this way: it is possible to invest a lot of effort into conservation practices, but biophysical realities (like soil types) might limit how much P loss can be avoided or the baseline P losses might be relatively low such that potential to improve in performance outcomes is relatively minimal. In certain cases, farmers might invest in conservation on certain fields and their efforts might produce marginal improvements, but not enough to put them over the threshold set by VPFPP.

Overall, VPFP generally achieved farmer satisfaction in regard to payments and thus receives an **A Grade** in this criterion.

**Criterion 2.6: Farmer satisfaction with VPFP technical assistance (Grade: B)**

Technical assistance is the essential “third” component (in addition to the performance-based incentives and predictive modeling) that would allow VPFP to have the impact it envisions. In contrast to the latter innovations, good technical assistance is not mathematical and deterministic, but relational and iterative. As one TA provider put it:

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*“Farmers appreciate having a sounding board for ideas and questions [and having] constant personal contact with one or two people that have a good practical knowledge of conservation practices and how those practices would fit with the farm.”*

*- TA provider*

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Many of our farmer survey respondents praised TA providers, highlighting their expertise and candor in developing collaborative relationships, as described below.

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*“We are very thankful to our TAs.”*

*“We always learn from the technical assistance providers, though a field-by-field debriefing on the phosphorus loss data would be helpful.”*

*“Our technical assistant was outstanding – knowledgeable, helpful, enthusiastic, supportive.”*

*- VPFP farmers*

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Experienced TA provision – especially with respect to working through the program data flow – appears to be an essential component to farmer buy-in within the VPFP program.

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*“That's why it's been so successful for me. [My TA provider] didn't miss anything. [They] understand [the program] and have a lot of mileage under [their] belt doing it and [they] knew what questions to ask me. And I give that a ton of credit, having those TA providers. Could I have done [the work in Farm-PREP on my own]? ... I'm sure I could have done it, but I think these [TA providers] did it better than I could have ever done it.”*

*“I found VPFP easy because we have the TA [provider]. If I didn't have a TA, would it be so easy? Probably not. ... My TA has mentioned there are certain things that are really difficult [with Farm-PREP], and I can't remember what those were, but I imagine it's a little like goCrop, which hasn't gotten too bad from an interface perspective. It's just time, yeah? A lot of time.”*

*- VPFP farmers*

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Because farmers might look to TA providers as a ‘sounding board’ and expect TA providers to make sense of their predicted performance as calculated by Farm-PREP, it can be a challenge for this relationship (on both sides) when the Farm-PREP results do not lend themselves to easy interpretation or to clear actionable alternatives for the participating farm. Sometimes farmers might relate these shortfalls to a TA providers’ background experience in farming or to their familiarity with Farm-PREP (as in the quotes below), while TA providers might point to the inscrutability of Farm-PREP or doubt as to what a farm could realistically change (under both biophysical and economic constraints) to earn a better payment through VPFP.

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*“The challenge was [our original TA provider] (who was very knowledgeable) leaving and working with [their] replacement who did not know...dairy farms.”*

*“They were unable to say what could be done differently based on the modeling in Farm-PREP.”*

*“We have not been given any recommendations on what to do to our farmland.”*

*- VPFP farmers*

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Turnover among TA providers is a parallel issue that tends to exacerbate the frustrations mentioned above. As mentioned, TA provider interactions are relational at least as much as (and usually more than) they are transactional, and turnover disrupts the rapport-building process that could be foundational for medium- and long-term transitions in agricultural conservation strategies<sup>37</sup>. There is also a steep learning curve to becoming a TA provider in VPFP and some TA providers, who have had to learn the system while they are actively working with VPFP participants, expressed that on-boarding could be improved so that they feel more competent with the program tools before engaging with farmers for the first time.

Taking together the positive experiences with TA providers as well as challenges related to turnover and the time it takes for TA providers to feel competent in their role, this criterion received a **B grade**.

### ***Criterion 2.7: Farmers utilize the information generated to refine conservation practices on their terms (Grade: C)***

VPFP provides access to the Farm-PREP software and TA providers that help farmers record field data and receive information to support decisions about conservation practices. Stone Environmental pitches the Farm-PREP software as an easy-to-use conservation planning tool:

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*“Using Farm-PREP, farmers and crop management consultants can **evaluate the impact of a number of agricultural strategies and practices**, including: evaluate the impacts of alternative fertilization, irrigation, and tillage strategies on crop yield and nutrient/soil budgets; assess potential improvements in water quality leaving a farm after the installation of vegetative buffers or grass waterways; investigate the impacts of alternative herd management on pasture land sustainability; and assess the environmental quality impacts of numerous other best management practices.*

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<sup>37</sup> Longfield, K. (2023) and Friedrich, E. L. (2022)

*Farm-PREP simplifies the user input to obtain results that help guide farmers to best farm field management.”*

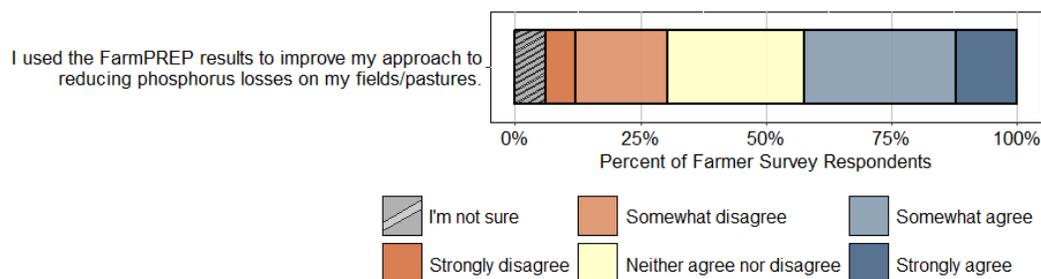
*-Stone Environmental (2018)<sup>38</sup>*

While AAFM reiterated the simplicity and capabilities of Farm-PREP in its proposal (see below), early on in the pilot phase of VPPF, they observed that the use of Farm-PREP as intended might be easier said than done.

*“Farm-PREP is fully functional, free for users, **simple to use**, and has been calibrated to common agronomic practices in Vermont...Farm-PREP runs simulations to provide practice scenarios to achieve set performance measures at the field or farm scale. For example, if a farmer wanted to achieve a 30% reduction in phosphorus loading for a specific field, **Farm-PREP outputs the top 10 practice scenarios that achieve the 30% reduction**... Additionally, Farm-PREP will indicate which fields can achieve the greatest reductions (**and how**), so that farmers can more efficiently direct conservation towards those fields.”*

*- AAFM proposal for RCPP-AFA funding*

These program components should provide sufficient information to guide farmer decision-making with respect to addressing phosphorus losses on especially problematic fields, but closer inspection revealed that program tools might not have been utilized as originally intended. Figure 2.10 shows that fewer than half of respondents agreed that they used the Farm-PREP results to improve their approach to reducing P losses. We can compare this outcome with the additional bars above (in Figure 2.6) which show that a similar percentage (about half) of respondents who agreed that they were familiar with their Farm-PREP results or that their Farm-PREP results clarified their practices’ impact.



**Figure 2.10.** The percentage of farmer survey respondents who indicated that they used the Farm-PREP results to improve their approach to reducing P losses.

<sup>38</sup> Stone Environmental. 2018. The Farm-P Reduction Planner (Farm-PREP): An integrated tool for optimizing field practices to achieve farm-scale nutrient reductions. Available at: [https://www.stone-env.com/assets/resources/6d35ca97df/E\\_17054-FarmPREP.pdf](https://www.stone-env.com/assets/resources/6d35ca97df/E_17054-FarmPREP.pdf)

Farmer interaction with the Farm-PREP platform (and even with their P loss estimates) faces real constraints. Although it was the original intention of VPFP that farmers would engage with the Farm-PREP software directly, early on it became clear that this expectation was not practical. While farmers seem to value the information that Farm-PREP produces, they are not likely to have time to use the Farm-PREP software on their own, even for those who feel comfortable navigating the platform. The farmer below had been trained to use Farm-PREP and they felt that they generally understood how to navigate the interface and enter data. But they could not find time to engage with the tool.

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*"I've been pretty busy this last year or two, so I didn't fool with [Farm-PREP] at all. I just didn't have time. **I barely have time to do my own NMP as it is.**"*

*- VPFP farmer*

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Other farmers have had even less introduction to the software and how to use it, and the lack of direct engagement with Farm-PREP by farmers has been practically universal. In lieu of this direct engagement, AAFM hoped that TA providers could fill the role of using Farm-PREP to identify and propose opportunities to farmers on how they could improve their performance outcomes. TA provider contracts, administered by the Vermont Association of Conservation Districts, lay out the responsibilities including “contractor will communicate and interpret the modeled FarmPREP phosphorus reduction results to the farmers and will help farmers become comfortable with using the application to inform conservation decision-making”.

There are a number of reasons why TA providers might not have taken on this role to its fullest extent:

1. TA providers might understand their role differently than was intended by AAFM, despite contracts laying out the terms of engagement.
2. Some TA providers might not have been aware of Farm-PREP’s full capabilities for exploring the impact of alternative conservation scenarios.
3. TA providers might not have enough time to use Farm-PREP in this way.
4. TA providers feel that it can be difficult to communicate the results from the Farm-PREP model to farmers.
5. It might not be clear to TA providers which variables are driving performance outcomes on a given field or why the model might be particularly sensitive to a change in practices.
6. TA providers might be wary of the accuracy of the Farm-PREP model and hesitant to base recommendations on its results.

*TA providers’ understanding of their roles in VPFP.*

For context to this sub-section, we review AAFM’s expectations of the role of TA providers in Section 3.3 of the VPFP Program Overview above. We note briefly that for AAFM a key part of TA providers’ role is to interpret farmers’ performance outcomes (from the Farm-PREP results) and to provide guidance on what a farmer could change to improve their P loss performance.

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*“I viewed my goal as collecting enough data to allow Farm-PREP to accurately model the practices [currently] happening on a given farm.”*

*“[I] help farmers jump through the many hoops, computer work, and data compiling that is required [by VPF].”*

*“[I] assist [the conservation district] and farms with completing [VPFP] assessments.”*

*- TA providers*

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TA providers might not always be clear on what AAFM expects of them:

*“I think TAs would benefit from knowing if we should be encouraging producers to try new practices, or if we should view ourselves more as data collectors.”*

*- TA provider*

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Or TA providers might feel strongly that it is not their place to give farmers recommendations. One TA provider mentioned that they would not feel comfortable making recommendations that are based too narrowly on phosphorus loss instead of a full accounting of what the farm needs.

*“It is not our role to encourage farmers to make or not make specific management choices on their farm, our role is to provide them with information and resources so that they can make the most informed decision for their farm. Phosphorus losses are just one small piece of the puzzle. Many of our farms are struggling with farm viability and counting on projected payments from this program is a huge gamble that may not be a good business decision when there are so many variables that can change their actual payment. **Our goals as TA providers should be to support farmers’ participation in this program, not to try and influence them.**”*

*- TA provider*

---

The sentiment here is that TA providers should not try to persuade farmers to change practices simply to achieve better outcomes within the VPF framework (and perhaps also that farmers should not expect TA providers to function as crop consultants).

Other respondents saw a broader role within VPF and mentioned that they would be open to discussing options with farmers and following up with them on their experiences with new practices.

*“[I] support farms with their conservation practices and **find areas where improvement is most beneficial.**”*

*“My goals were to keep in contact with my farmers and **keep updated with what they were doing and how that might impact VPF and advise when appropriate.**”*

*“My goals are to support farmers with participating in a program that provides them financial incentive and compensation for farm management that reduces P loss from their fields, and to **support farmers in learning about and exploring different conservation practices and the benefits they have relating to this program, water quality, soil health, and farm economic viability.**”*

*- TA providers*

---

In reality, TA providers are probably in more agreement regarding their roles than this splitting of their responses (above) would suggest. Providing farmers with high-quality information would appear to be an objective of all the respondents – the influential power of that information depends on its clarity and credibility, rather than the persuasive capabilities of the TA provider. However, for this role of “knowledgeable messenger” to be fully realized, TA providers have suggested changes to the Farm-PREP interface and the way in which Farm-PREP results are presented. Additional training and resources on using Farm-PREP as well as on the practical conservation options available to farmers could also prepare them to respond to farmers’ questions about how to improve performance.

#### *TA providers’ understanding of the full capabilities of the Farm-PREP software*

With a feature that allows Farm-PREP users to create an ‘alternative scenario’ for a field, any user can model the effect of various management changes to predict how the performance metric would shift. If this task is done by a TA provider, they can then communicate those to a farm. However, in at least two instances, TA providers did not seem like they were aware of this functionality.

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*“Directly to the point of what this program is: it’s to help farmers adjust their management to create better results. But **there’s no way in Farm-PREP to manipulate the data, to give an alternative option or model an alternative result** ... Farmers just do what they do, and then they get the score, and that’s it. But even if one of the farmers was like, ‘What are my numbers going to be if I did this differently?’ I [as a TA provider] can’t run any numbers to tell you [what would happen] if you cover-cropped that field instead of that field or if you change your rotational grazing. ... [I]f you don’t know how to change your management to reduce that [P loss] number, then what’s the point?”*

*– TA provider*

*“Farmers might be more motivated to improve practices if they had a better idea of what the resulting payment would be after those changes.”*

*- TA provider*

---

AAFM has confirmed that this functionality (running alternative scenarios to understand how different practices would change their outcomes and their payments) does, in fact, exist. If TA providers are unaware of this functionality, it would suggest a gap in on-boarding (and on-going) training.

#### *Limited time for TA providers to perform functions beyond data entry and verification*

Even for TA providers who are aware of this functionality, they might not have the time to take advantage of it. TA providers are burdened by the data-hungry nature of VFPF, not only in collecting farm records, but in translating those records into the right data type that can be accepted as inputs in Farm-PREP. In one interview, TA providers reported spending 60 to 70% of their contracted time translating data from farm records to fit into Farm-PREP, leaving much less time for exploring options for addressing conservation issues on the farms that they support.

Our survey results showed that with the current VFPF assignments, there does not seem to be much “wiggle room” for TA providers to dedicate additional hours to reviewing and packaging the conservation practice changes into cohesive proposals for the farmers that they support (Figure 2.10). This is relevant to the decisions currently being made about VFPF 2.0. because if future iterations of VFPF oblige farmers and TA providers to explore alternative scenarios (even for a selection of fields), it implies additional hours of interaction that might not fit within current workloads.



**Figure 2.10.** TA providers assessment of whether they have enough time to adequately support the farmers assigned to them. The majority of respondents indicated that they have just enough time (no more, no less) to fulfill their responsibilities as VFPF TA providers. Our data has also showed that the vast majority of this time is spent collecting data from farm records, transforming it per Farm-PREP input specifications, and then cleaning the data entered.

TA providers proposed various solutions that could streamline some of their work (and theoretically free them up to do more conservation co-planning with farmers) and that would also make them feel more confident in their role. The suggestions include:

1. More support in outlining and organizing the data we collect before it is entered into Farm-PREP
2. References that indicate what a “normal” range for each datapoint would be (for example, application rates for manure injection)
3. More introduction to practice standards and definitions: “I am still somewhat unclear what counts as ‘reduced till’”
4. More robust trainings for new hires, including a “total walk-through [of data entry for a farm] to understand the full process”
5. Hire a dedicated staff person that specializes in entering data into Farm-PREP
6. Cultivate better relationships between the program and private crop consultants: “The only frustration I experienced was with trying to work with the farms’ consultant. It was like pulling teeth to get soil sample results.”
7. Change the workflow for actual assessments so that AAFM provides feedback or requests changes on the actual assessment before the assessment is confirmed (finally) with the farmer and the annual payment calculation is finalized
8. Do not repeat the planned assessment after the initial one at enrollment
9. No verification stage

10. Allow farmers to opt-out of including their pastures in VPPF
11. Keep the participant checklist. The Gantt chart might be less useful, but this should be confirmed with the rest of the TA providers.

*TA providers' difficulties in confirming with farmers that farm practices are correctly represented in Farm-PREP*

Uncertainty in translating information between the units used in farm records to match the units of corresponding fields in Farm-PREP can make it difficult for TA providers to confirm with farmers that what they have entered accurately reflects what they are doing on the farm. In some cases, the numbers are converted to such an extent that TA providers might be skeptical that Farm-PREP's modeled outcomes truly correlate to the true impact of farmers' practices. The TA provider in the quote below articulates this uncertainty and reflects on the discrepancy of data presented in Farm-PREP with information provided in farm records.

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*"As more [data collection] tools have been introduced into this program (for pasture, manure, etc.), **it has gotten significantly more complicated to double-check with them that how we are interpreting info from farms is accurate.** When we sit down with them to review actual assessments so they can sign the claim form, everything that comes out of Farm-PREP is so far from real numbers. None of our farmers know the rate of P<sub>2</sub>O<sub>5</sub> that they are applying through manure. They just look at those numbers and have to trust that we've done our math and data input correctly since their actual records are in gallons or loads. Similarly with pasture, since everything has gone through the calculator tool, most of those numbers don't match their records."*

*- TA provider*

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*TA providers' understanding (and ability to communicate) of how Farm-PREP came up with predicted outcomes*

It is not necessary for TA providers to understand in mathematical detail how the APEX model processes data inputs, but it would be helpful if TA providers could explain which variables are driving the Farm-PREP results and why shifts in practices might generate (seemingly disproportionate) shifts in outcomes. TA providers have expressed that complicated nature of the model (and their limited ability to discuss the logic behind its predictions with farmers) can derail "evidence-based" conversations about possible changes to conservation practices.

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*"I would have liked to understand Farm-PREP more to feel more confident to use it as a conversation tool with my farmers as opposed to **feeling like it was a black box with lots of unknowns.**"*

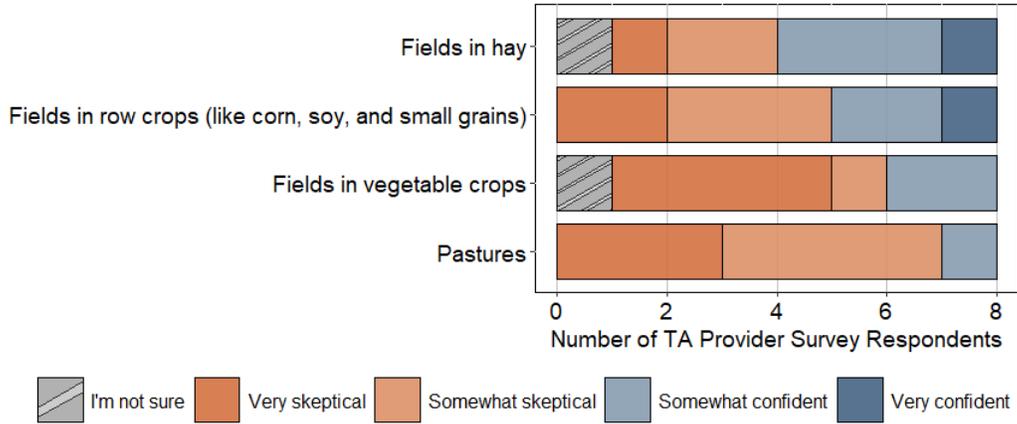
*"We need more training on how Farm-PREP works and **how to communicate how it is coming up with numbers to our farms.**"*

*- TA provider*

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*TA providers' wariness as to the accuracy of Farm-PREP*

At several points throughout the survey and interviews, TA providers raised doubts about the perceived accuracy of the model (Figure 2.11), and these doubts would be expected to lower the confidence with which they would (if they felt it *were* their role) propose an improvement that would improve a farm’s performance.



**Figure 2.11.** TA providers’ confidence in the accuracy of Farm-PREP results across different cropping systems.

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***“I think it’s a lack of trust that the model is (1) working the way it’s supposed to work [and] (2) that the way the model is supposed to work is actually useful or not to a farmer. By putting too much weight on buffers and the TMDL, it doesn’t always make sense what the model is producing or what seems to have undue influence. It’s tricky to trust it to work for something small like a sensitivity analysis or an alternative scenario.”***  
***“Over the years this program has gotten significantly more complicated in terms of data entry, but I’m not sure all of these calculator tools actually result in more accurate results.”***

*- TA providers*

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In summary, we find that the use of Farm-PREP data to make decisions about conservation practices appears to be more the exception than the rule. TA providers, who could facilitate the use of Farm-PREP data in this way, have outlined several challenges that limit both their ability (and eagerness) to perform this role within VFPF. These limitations led to satisfactory performance (**C grade**) in empowering farmers to make data-driven stewardship and conservation decisions.

## ***Criterion 2.8: Payment rates motivate farmers to improve their practices (Grade: C)***

Above (in Criterion 2.5), we discuss how farmers might have different attitudes toward VPFPP payment rates that are influenced not only by the size of their operation or the absolute costs of the conservation activities, but also by their amount of time they have been implementing conservation practice and the likelihood that they would do something different (i.e., reduce their conservation efforts) if they were not assisted financially through a program like VPFPP. These nuances also apply to the farmers' perception of the *efficacy* of VPFPP payments as motivators to entice farmers to improve their performance.

A range of responses were received to the question of how much VPFPP payments motivate farmers to maintain and improve their practices, and to a certain extent they track with what farmers can get out of the program. Some farmers note that the size of the payment is a relative symbol of the State's commitment to supporting farmers. And they agree that the funding buoys the viability of conservation strategies and a stewardship ethic, although in a less targeted way than practice-based programs. It might be difficult to express exactly how the funding *changed* farmers' practices, but there is a sense that VPFPP funds reinforce responsible practices in the context where livelihoods are constantly under the pressure of tight economic margins. For others, government assistance like VPFPP might be an integral part of their business model. It was more common for us to hear about the ways in which VPFPP payments help farmers maintain their existing practices. The link between payments and practice improvements is more ambiguous (among the current cohort of VPFPP farmers).

The first quote expresses a positive perspective on the payments motivating conservation.

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*“For us, we're doing so many of the practices, we're getting a good chunk of money out of this [Pay for Performance program], and so we are just investing in improvements every year towards that...[W]ould we have gone to the levels that we go to today? I would say ‘No, we wouldn't if it wasn't for the [program] because it's placing it at the forefront of our brains. It's at the forefront of our thinking process. **It's a big enough chunk of money to where it gets your attention, and you're like, ‘Okay, the state is serious about this. They want us to make improvements in this area.’** And every time that we've found that we've done this little thing, the impact is greater on our bottom line because of the practice itself (never mind what they reimburse you for) so it has incentivized us to go further than we would have gone.”*

*- VPFPP farmer*

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*“Vermont farmers DO need additional funds to allow them to cover their costs of production AND have enough left over to cover the management time and cost of additional good land stewardship. This program is a good first attempt at PES [(Payments for Ecosystem Services)]. **Farms are using these funds to improve and maintain good land stewardship.***

*- VPFPP farmer*

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In some cases, the payments might not incentivize changes to the farm's conservation strategy, but they do reinforce the existing ones.

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***“This program didn’t really change my practices - it just made them stronger. I just kept doing what I was doing, but doing a better job at it. It didn’t force me to go buy equipment or a lot of seed. It was just about topsoil, organic matter, and run-off and then with a grass[-based dairy], you sort of fall into that so easily. For me, the payments are right on target.”***

*- VFPF farmer*

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In effect, the current baseline might be quite good for farmers who have transitioned to all-hay production and who might now feel like there are few practical options for improving even further. A performance-based program that focused only on immediate short-term, additional performance improvements would leave these farmers at a relative disadvantage. However, the real test is whether the payments actually staved off farmers’ reversion back to practices that increase P losses (i.e., back to corn silage production).

---

***“You’ve got to keep the people engaged that are kind of at their max [(i.e., implementing all conservation options available to them)], and then for those early adopters [of novel or innovative practices], there should be additional payments. ... You can’t say, ‘Well, you’ve done it all, so now we’re not paying anything’ or people will stop, right? ... For the people who have seeded down their whole farm [in hay], I don’t know that there’s a ton more [they can] do, right? And I’d like to keep them incentivized to stay in grass.”***

*- VFPF farmer*

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Below, the farmer highlights how compensation for positive externalities brings the farm operation into greater balance.

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***“I really hope that this [program] can be a role model for the rest of the country because it’s putting value on the land and the practices you use without involving milk production. I love how it allows the land to carry some weight, some of the burden, of the farm needs and expenses without including the animals, so we’re not pushed to produce so much out of them. I do think we’re asking a lot out of the animals, but only because they’re paying 100% of the bills, right.”***

*- VFPF farmer*

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It is important for this indicator – payment amounts motivating conservation actions – that farmers understand why they are getting paid a certain amount and what they might change to earn even more. In the following example, we changed the payment amounts quoted by the farmer in the interest of confidentiality.

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***“This year, we got paid like around [\$14,000]. I still have absolutely no clue on how they came up with [\$14,000] and I don’t really know what we did or didn’t do to get to [\$14,000] and if we had done something slightly different, we would have gotten [\$15,000]. ... Since I didn’t really understand or have a real good grasp of what practices would generate what money, I can honestly say that **nothing we did was motivated by that payment at the end because by time the money comes around, it’s like mystery money.** It’s like, ‘What was that for? What did we do?’”***

- VPFPP farmer

---

Generally, the VPFPP participants responded positively to the idea of being incentivized to try to do more, year after year, to improve their outcomes. However, in some cases, there are unavoidable and costly hurdles to *improving* practices further. We cited one example of this above in Criterion 2.4. In addition, payment caps for larger farms can limit how much of the costs of any widely implemented improvement will be covered by their payment. In the face of these prerequisites, the VPFPP payment can appear to be rather miniscule.

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*“[P]art of the issue is the cost of practice implementation is so high. And on large farms, they hit the cap of pay-for-practice programs and pay-for-performance quite early, so **it’s hard to incentivize changes when payments are capped anyway just by doing what they’re already doing.**”*

- TA provider

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For now, farmers might see VPFPP as one source of assistance that needs to be complemented by assistance from other programs to generate behavior change among farmers. This has implications for how VPFPP understands its position among the other conservation programs in the landscape and whether or not it should have restrictions on concurrent participation in multiple incentive programs.

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*“You’re not making big crop decisions or farming decisions over [what VPFPP has paid us annually] but if you count that [alongside] FAP and there’s maybe one other [program] from the state, and there’s two or three federal ones. It does add up.”*

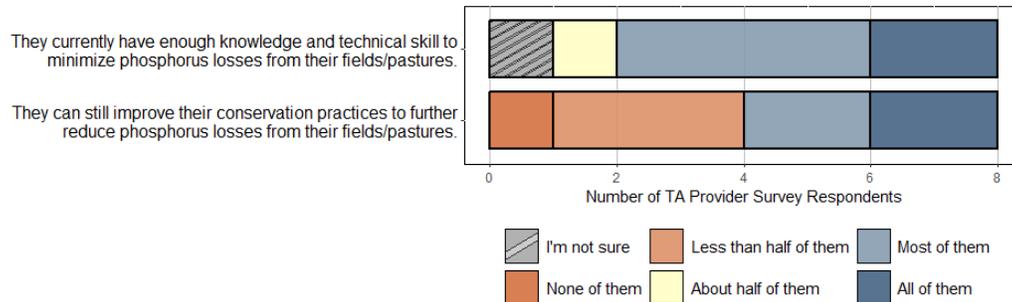
- VPFPP farmer

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TA providers also noted that certain farms might have limited options with respect to improving their practices in a way that would be recognized by Farm-PREP. Their responses (summarized in Figure 2.12) show that while TA providers believe that farmers have sufficient practical knowledge about how their practices can minimize P losses, some farms might be limited in terms of what they can conceivably add to their conservation strategy (especially in terms of practice changes that are picked up by Farm-PREP<sup>39</sup>).

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<sup>39</sup> Farm-PREP is designed to capture data on practice characteristics that are representative of the common conservation actions that are feasible for Vermont farmers. However, farmers might improve practices on the margins (take for example, certain types of adjustments or enhancements to practices like manure injection depth or cover crop species mixes) which might have smaller incremental impacts on P loss performance that do not pass as “detectable” by the Farm-PREP data framework. For many of these improvements, we might expect that the benefit of including them in the data framework outweighs the cost of adding complications to the model.



**Figure 2.12.** TA providers' perceptions of VFPF farmers' ability to make additional improvements to their current practices

This most cited scenario in which farmers appear to have already “maxed out”<sup>40</sup> the opportunities for minimizing P losses is farms that have transitioned to grass-based production.

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*“When a farm moves towards a grass-based farm there are limited [additional] conservation practices they can implement.”*

*“Many of the farms that we work with in this program are primarily grass-based so many practices like no-till, cover crop, et cetera don't apply.”*

*- TA providers*

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In several situations, the payments from VFPF help with making incremental changes as described above. However, there are limitations for improvements related to bottlenecks and land management strategies that are not necessarily overcome with the current payment rates, so we give this criterion a **C grade**.

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<sup>40</sup> The farmer quote above under Criterion 2.6, p. 37, uses this terminology.

## Goal 3: Verifiable, measurable, location-specific outcomes

Grade:

**B**

An indicator of the VFPF program's success is that its payments are based on outcomes of farm practices that are quantifiable and verifiable and take into consideration location-specific factors.

The VFPF outcomes (P loss reductions between the current management scenario and a baseline scenario) are modeled by Farm-PREP, which uses data on (assumed) baseline and current practice scenarios (including P<sub>2</sub>O<sub>5</sub> application rates), current data on field conditions (i.e., soil tests) as well as local (smoothed) climate conditions and dominant soil types to predict the annual average P losses over 30-year simulation period. Payments are generated based on the results of this model. It was outside the scope of our evaluation to test the accuracy of the model<sup>41</sup>; this section reviews some potential data quality issues raised by TA providers as well as reservations that we have with reference to the Farm-PREP data.

### ***Criterion 3.1: Model represents farmers' conservation practices as closely as possible (Grade: B)***

To the extent possible, the Farm-PREP model covers all the primary agricultural practices and conservation strategies implemented on fields in the state.

Farmers and TA providers mentioned a handful of practices that farmers are using, which are not currently accounted for within Farm-PREP, that may have an impact on phosphorus loss:

1. Depth at which farms are injecting manure. There was a perception that manure injected deeper (e.g., using a Dietrich shank injection system) than the standard depth for disk injection utilized by Farm-PREP would allow farmers to reduce more phosphorus losses than the model predicts.
2. Inter-seeding an under-producing hay field/pasture rather than total renovation.
3. The use of swales
4. The use of double cropping (e.g. harvesting over-wintered cover crops as forage)

Farmers were asked about additional practices (not those above) that control erosion and could feasibly impact P loss outcomes in the farmer survey, but there was little implementation of these (Table 3.1). Many of these practices fall outside the scope of what the VFPF definition of "whole farm", which is strictly P losses in the form of runoff or subsurface flows at the edge-of-field. Outside of field buffers and grass waterways, TA providers could address any fields that might have been "in production" at baseline and are currently left fallow (e.g., as unharvested meadow) by drawing a field over that space and modelling it as a grass field without nutrient applications. However, it is not as clear that there is a clear instruction to look for these fields or how extensive this type of transition might be.

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<sup>41</sup> A literature review of studies working with the APEX model or a summarization of improvements to accuracy resulting from Stone Environmental's series of calibrations would be possible (and perhaps would provide additional insights), but again this was outside the scope of the current evaluation.

Table 3.1. Number of farms with additional conservation practices relevant to P loss reductions that are not accounted for within the current program model<sup>1</sup>

<i>Practice</i>	<i>Farms</i>
Contour planting	7
Constructed/restored wetlands	4
Saturated buffers	2
Strip-cropping	2
End-of-tile control structures	1

*Note.* No survey respondents indicated that they added the practices above *while* enrolled in VFPF. End-of-tile control structures are not strictly non-point sources, but they handle field P losses. Nevertheless, they are very rare. On-farm wetlands are not strictly within the field or buffer area, and as such do not fit VFPF’s definition of “whole farm,” which is all of a farms’ cropland (annual crops, hay and pasture).

Several of our survey respondents (16, or 48%) also indicated that they use grassed waterways on their fields, while in datasets from Farm-PREP only four farms (or 6%) have at least one field with a grass waterway present. Our understanding is that this disparity is due to a constraint within VFPF requiring the grassed waterway to have been installed by NRCS. Since grassed waterways are seen, officially, as a construction project subject to significant additional pre-approval, they are not approved for selection within Farm-PREP unless they were originally installed by NRCS. Respondents might be referring to parts of their fields that they have left in grass (naturally) to convey and slow down water movement. These fields components might also have an effect on P losses (although it might be a relatively slight one).

More common responses had to do with doubts about the accuracy of Farm-PREP estimates for pasture, to such an extent that some TA providers feel the farmers should have the option to exclude their pastures from the program.

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*“The pasture tool in no way accommodates the complexity and nuance of how grazing actually happens on a farm.”*

*“Pasture management is difficult to record, especially if farmers are using mobile fencing and changing paddock size or have multiple herds.”*

*“[P]asture either needs to get more complicated so we can put in real numbers or it needs to be simplified, but it's in a weird in-between where it isn't able to accurately capture how farms are managing pasture but is incredibly tedious.”*

*- TA providers*

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Crop rotations are also an element within Farm-PREP that raised questions about the real **verifiability** of data entering the model. In these cases, farmers using crop rotations received predicted average P loss outcomes on future field management that is never truly verified (since the full duration of crop rotations can extend beyond a regular VPFP contract period and so the *planned* (future) management of a specific crop does not occur within VPFP timeframe to be verified). A farmer who plans to have a field in corn silage-hay rotation for the foreseeable future but only manages it in corn silage during VPFP and then later chooses not to rotate it to hay after their VPFP contract ends will have benefited (in terms of their VPFP payment) for a practice that never materialized. Other variations on this theme could be imagined (e.g., a farmer that plans to farm corn silage as no-till once it comes into rotation but then changes their mind after VPFP participation).

Of course, in order to have both corn silage and hay available as feed in any given season, most farmers with crop rotations will be staggering these rotations across different fields (e.g., of the fields that are planned as annual crop-hay rotations, some will be in annual crops and others will be in hay during any given production season). We might be reasonably confident with farmers' *plans* regarding how they will manage fields once the turn to the subsequent crop in the rotation (and after they've exited VPFP) are realistic if their current *actual* management of that crop nearby fields is the same.

Because Farm-PREP requires substantial reconfiguration and transformation of the data in farmers' records, it can be difficult to confirm with the farmer that the data entered into Farm-PREP represents what they are doing by showing the farm what their practices "look like" in Farm-PREP.

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*"You have a set number of options, and they give you ... the grazing records, you put them in, and they're like, ... 'This is not what I said'. And you're like, 'I know, I put it through this crazy calculator, and these are the numbers [that came out].' And then you [ask them], 'Does this look right?' so they can sign their claim form. And they're like, 'No.' And you're like, 'Oh my god.' ... **In this whole process where the numbers get converted so many times, they're not relatable to the farm anymore.**"*

*- TA provider*

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As a final comment in this section before closing this section, we might add to AAFM's list of data attributes that of **consistency** or standardization in the process of the methods for data collection and entry into Farm-PREP. In most cases, this consistency is controlled by the program's numerous tools. However, one area where TA providers mentioned there might be a lack of clarity was around the drawing of fields, and when it was permitted or advisable to split what might be one field into two different fields if that splitting enhanced a farmer's performance. A reason for doing this might be to bring out the impact of a more advantageous soil type that does not rank out as the dominant one in the larger (aggregated) field.

Farm-PREP has done a good faith job at optimizing what data points it collects based on the most common conservation practices utilized in Vermont and the most important management variables. Adding more complexity by including more fields to capture more granular specifications might not be recommended given the current burdens associated with data collection and input. More details are provided in the recommendation section, but VPFP receives a **B grade** in this criterion.

### ***Criterion 3.2: Model provides indicator of overall farm performance based on location-specific attributes (Grade: A)***

AAFMs' criterion states that Farm-PREP's predicted outcomes are location-specific, meaning that they account for the influence of the most important environmental variables within each field including soil conditions, topography, and climate. In general, the model is well designed to do this. There are two areas where questions might arise.

1. The model extrapolates the characteristics of the dominant soil type of the soil survey polygon the covers the greatest percentage of each field's spatial extent. From this dominant soil type, the model takes on several typical soil properties associated with soil horizons to a defined depth. Relying on soil survey polygons is the best option available for assuming within-field soil properties, but relying on a single dominant soil type could introduce significant error in some cases. It is not straightforward how the model might take on multiple dominant soil types (within each soil survey polygon) within a field – for example, as soil property values weighted on the spatial extent of each polygon's area with the field. Research on this error as it influences farmers' results should be taken on through collaborations for local partners to address doubts.
2. Farm-PREP results are currently modeled on historical climate data (1986-2015), and these data can be updated at pre-defined intervals. This is an appropriate method, although it might be worth considering that increasing heavy precipitation events and greater numbers of freeze-free days might not be fully accounted for within that historical period (Mason et al. 2020).

Farm-PREP seems to account for location-specific variables in an appropriate way, although the assumptions deserve to be investigated. In this criterion VPFM earns an **A grade**.

### ***Criterion 3.3: Modeled estimates reflect actual phosphorus loss (Grade: B)***

The accuracy of the key outcome metric in performance-based programs like VPFM is a critical indicator of program success since it is the basis for participant payments. The highest level of accuracy would come from directly measuring P losses at the edges of every field enrolled in VPFM, but this is unfeasible, as it would astronomically increase program costs.

Modeling P losses from fields is the best practical option. The model predictions do not need to be perfectly accurate in order for VPFM to succeed in improving environmental conditions and garner buy-in from relevant stakeholders. However, the performance metric derived from these predictions<sup>42</sup> – in this case, the extent to which farmer actions have mitigated P pollution from their fields – must be credible.

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<sup>42</sup> To a certain extent, it helps that fixed effects (that remain constant between the baseline and current scenarios) can control for omitted variables that remain constant between the two scenarios.

VFPF relies on an APEX model (described in Section 3.3) and Farm-PREP serves as the user interface to this model. For the model to predict P losses, farms enrolled in VFPF must submit updated Nutrient Management Plans (NMP), maps, and grazing plans at the beginning of the growing season, keep organized field-by-field records throughout the growing season, and submit soil and manure tests, and fertilizer and manure application records to AAFM at the end of the year. Most of these prerequisites align with existing regulatory standards (RAPs<sup>43</sup>) and with other Vermont programs. The model considers location-specific factors like soil type, slope, and climate. In addition, the model relies on historic land use assumptions based on a transparent set of rules<sup>44</sup>, but these historic field management assumptions should not be considered as “verified” practices that were implemented on any one field during the period to which the baseline assumptions correspond.<sup>45</sup>

An extensive amount of work has gone into preparing this predictive model for uses like VFPF. Since Stone Environmental developed the Farm-PREP tool, they have conducted a primary calibration effort using a set of edge-of-field and tile drain monitoring sites in Vermont and New York to develop a ‘global’ parameter set for APEX that targeted key model parameters affecting phosphorus loss (e.g., runoff, erosion, and total phosphorus loss to site specific data) (Winchell 2020). Stone subsequently amended that calibration using that same site data but looking at performance of soluble and sediment-bound phosphorus separately (as opposed to total phosphorus).

Currently, Stone is finishing a multi-objective calibration that looks not only at phosphorus, but many other outputs including nitrogen loss, soil health metrics, yield, and greenhouse gas metrics. With these efforts, they have produced a robust APEX model well-suited for its use in Farm-PREP. In sum, these calibration efforts have been based on how APEX is currently used in Farm-PREP: to estimate long-term annual average phosphorus loss and to use a comparison approach to analyzing results (e.g., comparing the current management scenario to the HBMA baseline scenario). While there might be other valuable approaches, this approach is well-suited for the VFPF program.

The main limitation to improving model performance is finding and accessing more robust datasets. Stone certainly acknowledges Farm-PREP’s limitations and that it is a model, not on-the-ground truth, and there is room for improving model performance, particularly for certain outputs/metrics.

In interviews, farmers and providers raised doubts about the accuracy of estimates due to the sensitivity of the model to seemingly minor adjustments. Presenting farmers with evidence from calibration studies that visualize how such shifts, in fact, do generate larger-than-expected changes in outcomes could increase confidence in the accuracy of the results, but with a model so complex and with such a limited empirical dataset, producing these simplified visuals could be very difficult.

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<sup>43</sup> Required Agricultural Practices that are state-mandated practices for Vermont farms with specific requirements that correspond to farm size categories.

<sup>44</sup> The ‘rules’ for these assumptions are outlined in Appendix A of Tetra Tech (2015).

<sup>45</sup> Since these baseline assumptions were created with geospatial data from 2006 and 2008 we might consider this as the reference period for these practices.

Without empirical data on edge-of-field P losses for fields currently participating in this program, it is beyond the scope of our evaluation to directly assess the accuracy of the model. Substantial data already exists, and it could be valuable to conduct a meta-analysis across these datasets, but that would have to be added a later date.

However, there is one section of the Farm-PREP results that we found seemed to deviate from expected ranges, and that had to do with agricultural yields. We should preface this small segment of the report by noting that the accuracy of modeled yield estimates was not a primary concern in efforts to calibrate the Farm-PREP model since the attention has primarily been on the P loss metrics. However, for those farmers more familiar with their results, doubts that stem from noticing crop productivity numbers that do not seem to track with what is actually happening in the field could bleed into doubts of the model's predictive power on the key performance metric.

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*"I wanted my yields updated because they put in [a lower yield] to the acre on my corn ground and I get [well over that]. I'd like to be able to input my yields. They say we get [the lower productivity rate], maximum, and that's not true."*

*- VFPF farmer*

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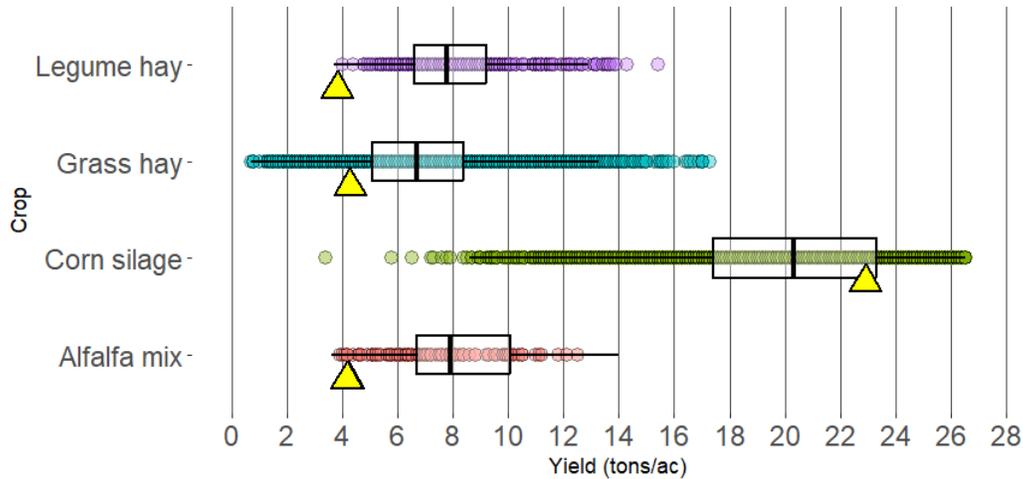
As the farmer went on to explain, the yield estimates might be a relic of outdated NRCS adjudications of the performance of their soil type that no longer apply to the current farm practices and actual yields. According to this farmer, no-till management have increased their yields by directly mitigating the limitations posed by inherent soil properties.

We also became interested in yield accuracy when analyzing changes to production costs and suspected that our method for estimating these costs was underestimating the opportunity costs of transitioning from corn silage to hay production. And while it is not the primary metric of concern, crop productivity should be as accurate as possible (and Stone Environmental is actively working on tightening their yield predictions) because biomass harvest will influence P loss outcomes.

For our purposes (in trying to estimate opportunity costs), we used crop trials conducted by UVM and Cornell agricultural extension as empirical reference points, which evaluate the productivity of specific varieties of each species in different soil types, we did a quick comparison of the median yields in these crop trials to predicted yields in Farm-PREP<sup>46</sup>. If these assumptions track sufficiently with reality, the results suggest that Farm-PREP might be over-estimating yields on hayland and underestimating (slightly) corn silage yields.

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<sup>46</sup> This comparison involved several assumptions that are outlined in Appendix 8.5.1. Future investigation should confirm and refine these assumptions. In Appendix 8.5.1, we also compare average *per cutting* yields between the crop trials and Farm-PREP results.



**Figure 3.1.** Comparison of predicted crop productivity from Farm-PREP to median productivity values derived from empirical crop trials in Vermont and New York. The productivity for each crop predicted by Farm-PREP is represented by the colored dot plots overlain by boxplots representing the same data. The yellow triangles represent the median yields for the same crop (or equivalent crop mixture) based on the data from the Cornell and UVM agricultural extension crop trials. The assumptions made in generating this comparison are outlined in Appendix 8.5.1.

In conversations with UVM experts who were involved in earlier applications of Farm-PREP, stakeholders involved in Farm-PREP’s development share doubts about how Farm-PREP yield predictions compare to reality. It is important to remember that predicting accurate yields was not initially a primary use or focus of the tool, although harvests do reflect a P transport pathway out of the field. Table 3.1 below shows the estimated pounds of P<sub>2</sub>O<sub>5</sub> removed by crop (per yield unit).

**Table 3.1.** P<sub>2</sub>O<sub>5</sub> removal rates in crop harvests

<i>Crop</i>	<i>Yield units</i>	<i>Crop P<sub>2</sub>O<sub>5</sub> removal (in lbs. per yield unit)</i>
Alfalfa	Tons (air dry)	10.8
Corn (silage)	Tons (as fed)	3.8
Grass or hay pasture	Tons (air dry)	8.9
Grass/legume	Tons (air dry)	11.2

*Notes.* Reproduced from University of Minnesota Extension (2022). [\(Link\)](#)

According to Stone Environmental, the APEX model has the capability to simulate realistic yields, and Stone has worked on yield predictions since the early phase of Farm-PREP's development to generally compare APEX results to published values for Vermont and more recently they have done additional work to use published site-specific yields as one component of a multi-objective calibration effort on APEX for Farm-PREP.<sup>47</sup>

In summary, efforts to calibrate the APEX model to Vermont agricultural conditions (and subsequent efforts to improve the performance of that model) have been significant. Doubt about the accuracy of the model might linger, but it is important to split these doubts into two categories: doubts about the quality and/or representativeness of data inputs into the model versus doubts about the model to produce accurate efforts if the data input is assumed to accurately represent the realities of field management. The best method for evaluating the latter (ability of the model to predict an accurate P loss value assuming the inputs are true) would be a meta-analysis of recent calibration efforts.

Our **grade B** here reflects an acknowledgement of the knowledge, experience, and ingenuity that has gone into efforts to tailor APEX to Vermont applications, while also emphasizing the value of future model ground-truthing.

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<sup>47</sup> (Stone Environmental, personal comm.)

## Goal 4: Sufficiency of Payment

Grade: **B**

Proponents of performance-based approaches present these approaches as ‘win-win’: farmers get paid for their contributions to environmental indicators and enjoy co-benefits like better information on their environmental impact and, over time, more sustainable productivity. In addition, they face lower “compliance” costs that might be associated with adhering to more stringent practice stipulations in practice-based programs<sup>48</sup>. Meanwhile, buyers (in this case, the State of Vermont) can invest their money in more targeted ways so that their investments achieve greater environmental impact at a lower cost.

This goal investigates whether the payments to farmers are sufficient. In Goal 2, we summarized farmer and TA provider perspectives on VPFPP payments. In this section, we use the Farm-PREP data available for each farm to compare VPFPP payments to the modeled costs of implementing the conservation practices that create P-loss reductions, and to compare VPFPP payments to what farms might have hypothetically earned in practice-based programs for the same efforts.

### ***Criterion 4.1: Farmers are satisfied with program payments (Grade: A)***

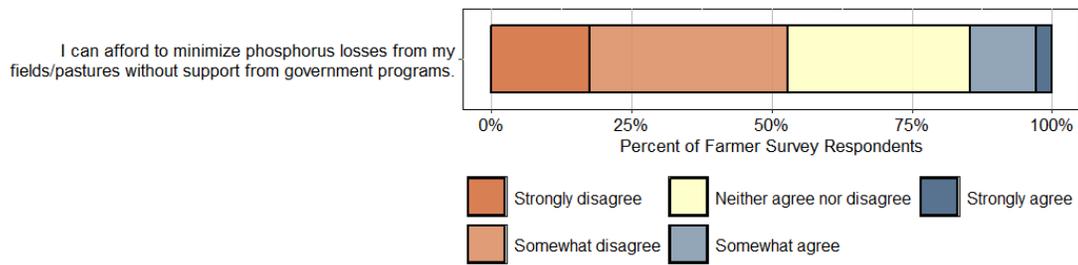
This criterion is already evaluated under Goal 2 (Criterion 2.5). The evaluation in the context of this goal is the same.

### ***Criterion 4.2: Payments cover the costs of implementing conservation practices (Grade: Inconclusive)***

Farmers take on additional costs to implement conservation practices (like adding a cover crop to field management or injecting manure with specialized equipment). They also can incur opportunity costs if conservation practices reduce crop productivity. Our farmer survey confirmed the perception that most farms cannot take on conservation practices without financial assistance (Figure 4.1).

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<sup>48</sup> We are generalizing the theory here. In reality, both farmers and TA providers seem to consider the state’s Farm Agronomic Practices (FAP) program the least burdensome program when it comes to participation requirements, even when compared to VPFPP. NRCS programs are characterized as stricter.



**Figure 4.1.** Farmer perceptions of their ability to minimize P losses without assistance from government programs.

Ideally, the payments from VPFP offset a substantial share of that added cost burden. Indeed, practice-based programs typically base their rates on the estimated costs of practice implementation (and, in some cases, forgone income).

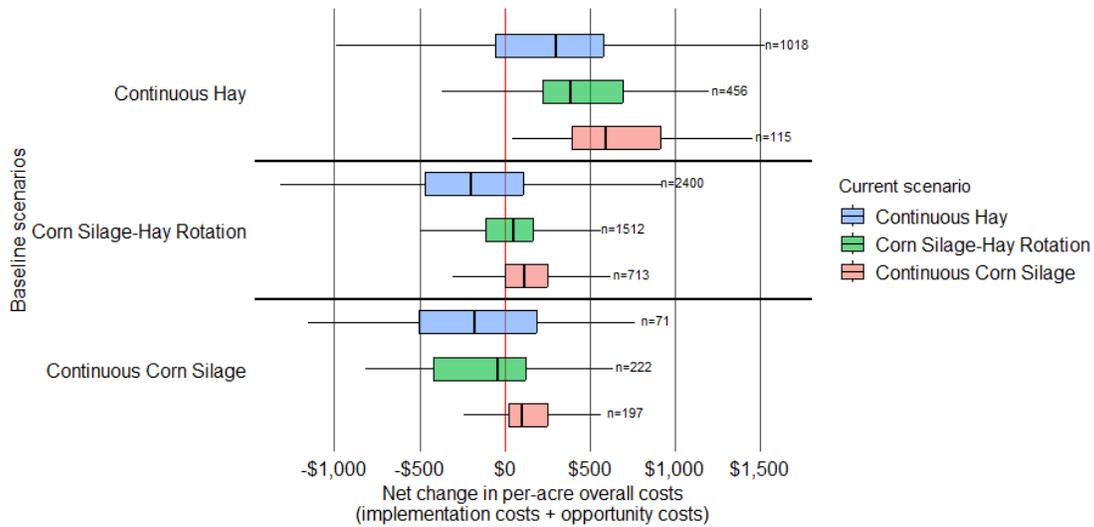
Farmer and TA provider perspectives on whether payments adequately cover costs are integrated in previous sections (Criteria 2.4 and 2.7). As we saw above (Figures 2.8 and 2.9), farmers and TA providers’ perceptions differed as to whether payments covered the costs associated with achieving performance outcomes under VPFP. Farmers generally felt that VPFP payments were adequate with respect to the costs they take on in conservation practices, but there was no general agreement among the few TA providers responding to the survey and three respondents were unsure whether payments were adequate or not. We suggested that one explanation for the discrepancy might be differing references for payment “adequacy”. If farmers are paid for practices that they would have implemented away, they might see the VPFP payments as a bonus, and evaluating the adequacy of a bonus is an ambiguous task. Other farmers observed that the payments buoyed their conservation strategy (and business model). (Refer back to these sections for a discussion of the range of viewpoints.)

In this section, we hoped to leverage the field management data available to us to analyze the relationship between VPFP payments and costs. While simple in principle, calculating the percentage of conservation-related costs covered by program payments is complicated for VPFP. We walk through these complications in more detail in Appendix 8.5.1. Here, we will be brief: While practice-based programs base their rates on the estimated costs of implementing a specific practice according to practice standards set by the programs, VPFP payments are the culmination of all of a farms’ practices including those that improve environmental performance and those that might reduce it (e.g., applying more manure than in the baseline scenario) as well as the influence of biophysical attributes of their land on P loss. For consistency, this compels us to include all costs, including those associated with actions that might have reduced performance, and how costs might vary depending on farmers’ land quality. In contrast, the average cost estimates utilized by practice-based programs focus only on actions that improve conservation outcomes and obscure the differential influences of land quality on costs. Our key takeaway from this process (and section) is that we would hesitate to use the ratio of VPFP payments-to-estimated implementation costs as a metric for evaluating program success in the future.

Nevertheless, we briefly present the findings from this process here. We used enterprise budgets to construct estimated *net changes* in costs between each field’s baseline practice scenario<sup>49</sup> and their current management scenario.<sup>50</sup> Our methods for constructing these budgets (including the various assumptions that we made along the way) are described in Appendix 8.5.1. The budgets allow us to estimate per-acre implementation costs for each scenario. Predicted crop yields for both the baseline and current scenarios and data on the monetary value of these products allow us to estimate opportunity costs. We sum up these costs and then find the net change in costs between the scenarios.

Figure 4.2 shows the results of these calculations by fields for participation years 2022-2024. Note that for those fields in which the cropping system remained the same between baseline and current scenarios, the *net change* in costs is positive (i.e., costs increased), whereas transitions towards more grass-based farming show the median value for the changes in costs reflect *cost-savings*.

As mentioned above, we should also remember that in these graphs we are *not* distinguishing between costs associated with desirable conservation improvements that generate desirable P loss outcomes and costs for actions that reduce environmental performance like applying even more manure (i.e., pounds of P<sub>2</sub>O<sub>5</sub>) compared to the baseline scenario. The calculation also includes cost savings. In short, in this figure, more costs should not be equated with more effort in terms of conservation.



**Figure 4.2.** Net change in per-acre overall costs between baseline and current scenarios by field. The baseline scenarios form the y-axis here while the current scenarios (to which farmers have transitioned these fields) are identified by the colors of the boxplots.

<sup>49</sup> These scenarios are described in Tetra Tech (2015).

<sup>50</sup> We restricted our analysis to fields that have either corn silage or hay crops (or a rotation between the two). Fortunately, this accounts for nearly 90% of the acreage enrolled in VFPF. Further investigation can include pasture and other row crops into the analysis.

One of our concerns with these estimates is that we might be grossly underestimating the opportunity costs of switching from corn silage land to hay (either permanently or as part of a rotation) if Farm-PREP is overestimating the productivity of yield. We describe this reservation in more detail above under Criterion 3.1. If yields for hay are lower in reality, our net changes in costs would shift closer to zero on both sides (positive and negative) of the graph. In other words, the cost-savings of switching to hay would be balanced out by the loss in per-acre revenue.<sup>51</sup>

The next step is to compare these net changes in costs to the payments received by the program. Table 4.1. gives a brief summary of the number (and percent) of acreage contributing to a farm’s VPFPP payment (i.e., they have P loss reductions above the performance threshold) and either 1) showing a negative net change in costs (i.e., cost savings), 2) showing a positive change in costs that are larger than their VPFPP payment, and 3) showing a positive change in costs that are smaller than their VPFPP payment.

**Table 4.1.** Distribution of VPFPP-participating acreage<sup>1</sup> according to the following categories (for fields with P loss reductions above the performance threshold)

<i>Condition</i>	<i>Percent of acres</i>
Added costs were negative (i.e. cost-savings from transition)	41.7%
Payments cover a fraction of added costs (<100%)	51.4%
Payments were higher than added costs (>=100%)	6.9%

*Note.* We only include acreage for fields for which the cropping systems of both the baseline and current scenarios are corn silage or hay (or a rotation of the two). Fortunately, this accounts for 89.9% of the acreage in our dataset

We know that a large portion of the acreage where added costs were negative were transitions from corn silage or corn silage-hay rotations to permanent hay. For this analysis, we are left with only half of the total acreage where VPFPP payments could be presented as a fraction of added costs (i.e., where the net change of costs is positive and the VPFPP payment is below 100% of these added costs). Reducing the predicted hay yields could reduce the number of fields with net cost-savings, although this acreage might end up in the last category in the table (“Payments were higher than added costs (>=100%)” than the second. These figures underscore the complicated nature of thinking of VPFPP payments as “sharing the cost burden” of practices and strengthens the argument that costs might be a poor reference point for evaluating the sufficiency of VPFPP payments.

Given the complications associated with this analysis and the dubious usefulness of the results, we present the remaining analysis in Appendix 8.5.1. for those with a particular interest in these figures. We have also decided after much deliberation to grade this criterion as **Inconclusive**.

<sup>51</sup> Obviously, the question of revenue is more complex than this since silage and forage are typically intermediary agricultural projects that serve as inputs to the dairy side of a farm’s operation, although some VPFPP farmers will sell these products directly to buyers.

### ***Criterion 4.3: Payment rates result in incentives that are comparable to other conservation programs (Grade: B)***

We can also attempt to use the payment rates of practice-based programs as a point of comparison for VPFPP payments<sup>52</sup>. In practice-based programs, the rates are based on the estimated implementation costs of conservation practices. They are rarely intended to offset the full costs, but they must cover enough of the costs to incentivize farmer adoption, expansion or enhancement of a practice. For the purposes of this analysis, we might consider the practice-based rates as the payment amount deemed *sufficient* by the programs to attain the desired effects. If VPFPP payments are similar to what farmers might hypothetically receive through the practice-based programs, then one could infer that they share these programs' sufficiency by design. However, if the VPFPP payments are well over or under the practice-based payments, we would have to investigate further whether VPFPP is truly over-paying or under-paying farmers.<sup>53</sup>

The most important caveat here is that certain practice-based programs are designed to be used at specific moments in a farmer's conservation "trajectory". EQIP helps farmers to adopt *new* practices, and so the rates cover a greater percentage of the estimated costs of practice implementation. These higher rates allow a farmer to overcome barriers to adoption and help mitigate the risks that practice adoption might pose. CSP helps farmers who are already engaging conservation activities. These applicants might want to adopt complementary practices, or to maintain or further *enhance* existing practices. In this analysis, only the CSP rates for adopting complementary practices are used. In short, EQIP and CSP payments tend to be received when farmers are either adopting practices or making improvements *on a one-time basis* and are not intended to be received by farmers in perpetuity.

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<sup>52</sup> In this case, we used VPFPP payments that were calculated on their P loss outcomes and, where noted, capped by annual payments. It is important to note that these are not necessarily the payments that participants received for these seasons (2022-2024) because several farms out-performed their projected performance and reached their contracted total payment before their period of VPFPP participation ended. AAFM was attempting to shift funds to make these farmers "whole" but at the moment of writing this report, those farmers had received less than presented here. Since we cannot place a comparable limit on the hypothetical practice-based payments, it is more appropriate for us to use these calculated VPFPP payments (i.e., as if VPFPP participants were not limited by strictly budgetary wrinkles).

<sup>53</sup> The tension we feel as evaluators is that we are still fitting VPFPP within the parameters of a practice-based "box". If VPFPP is about rewarding the positive externalities that farmers produce, than it might be more appropriate to reference the monetary value of those benefits to downstream beneficiaries. In lieu of this data, however, we fall back on other reference points (like implementation and opportunity costs or practice-based program payment rates).

In contrast, VPFPP can support farmers at different stages along their conservation trajectory: from those making major changes to their conservation practices during enrollment to those maintaining long-standing conservation with only marginal changes (if any) over the contract period. In addition, VPFPP farmers received payments for *the outcomes* of practices that a) have been supported by other practice-based programs in the past; b) are supported by practice-based program incentives *concurrent with* their VPFPP enrollment or c) were adopted without any conservation incentives long before they applied to VPFPP. In the current round of VPFPP funding, there is no requirement that farmers either adopt new practices or improve existing ones during their enrollment period. That is not to say that VPFPP farmers are not paid for improvements according to a baseline, and we've explained how VPFPP defines "additionality" above. In our analysis, we compared VPFPP payments to what VPFPP farmers *hypothetically*<sup>54</sup> would have earned if they had received the full set of payments that practice-based programs offer for each of the conservation practices that they implement<sup>55</sup>. There are a few key points to bear in mind while reading these graphs:

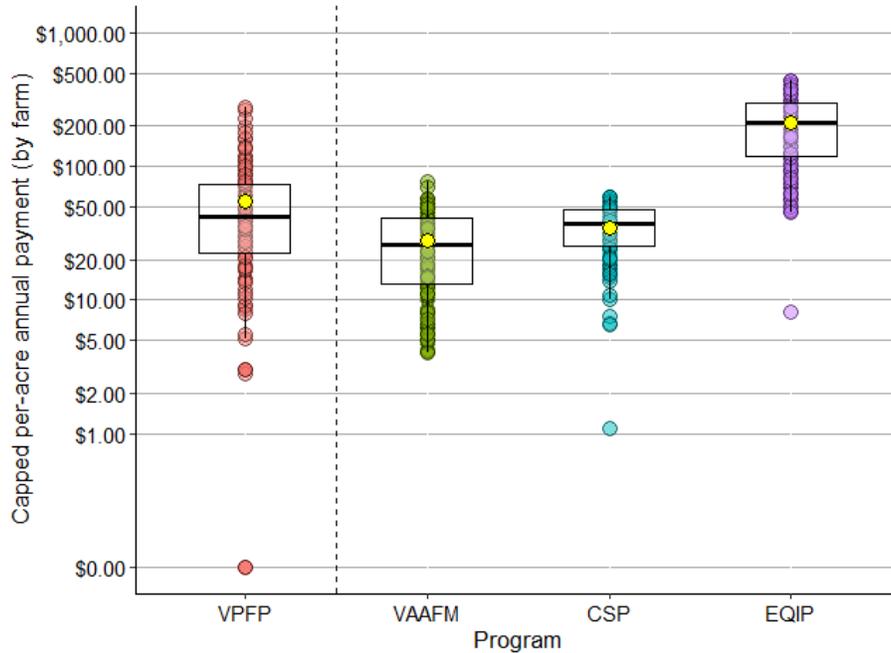
1. We specify that the payments attributed to the practice-based programs are hypothetical since they do not reflect the reality of how farmers apply for practice-based program incentives.
2. For payments from state-administered programs, the rates from the Farm Agronomic Practices Program (FAP) for most practices as well as the Seeding and Filter Strip Program (SFS) and the Conservation Reserve Enhancement Program (CREP) were integrated. EQIP and CSP rates for payments from NRCS programs were used. For a more detailed description of the payments from practice-based programs, refer to the Methods section.
3. We also emphasize that overall funding for practice-based programs is limited, and these programs would not be able to support *all* the conservation practices that VPFPP farmers implement on the extensive number of acres on which they are implemented in a single year. VPFPP, on the other hand, pays for the *outcomes* of all of these practices across all of these "participating" acres on an annual basis (up to a cap of \$50,000 per year).

Figure 4.3. shows how the capped per-acre VPFPP payments stack up against the hypothetical practice-based payments. The per-acre payments allow us to compare across farms while limiting the impact of farm size, although farm size is implicated when payment caps are applied. As expected, the median hypothetical payments from NRCS EQIP are far larger than those of the other programs. Given that many VPFPP farmers already have established conservation practices (and having a history of conservation activities is part of prioritization criteria for enrollment), it might be more appropriate to compare VPFPP payments to NRCS CSP anyway (for reasons mentioned above).

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<sup>54</sup> We specify that the payments attributed to the practice-based programs are hypothetical since a farm would not apply for support for all of these practices at the same time, within the same practice-based incentive contract. Furthermore, funding for these programs is limited and these programs do not support the number of acres supported by VPFPP in a single year.

<sup>55</sup> Our analysis takes into consideration crop rotations, as well. In other words, we compare the annualized payments that a farmer would receive in VPFPP over the course of the 30-year window (to remain consistent with how VPFPP calculates outcomes and payments) to what they would hypothetically receive from practice-based programs, annualized over the same timeframe.



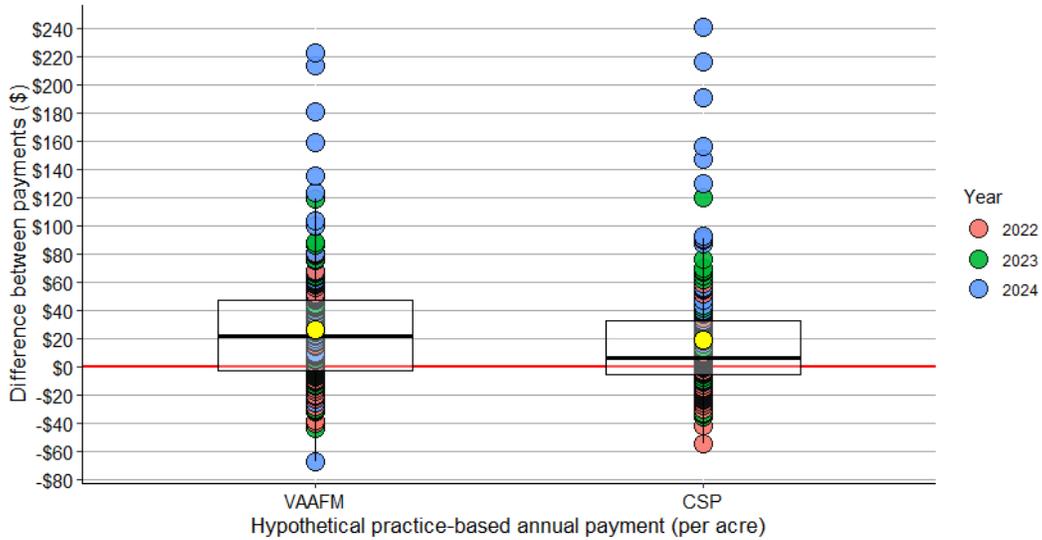
**Figure 4.3.** “Capped” per-acre payments (and hypothetical payments) applied to each farm across the different programs. Data based on farm practices and performance from 2022-2024. Each dot corresponds to the annual results for each participating farm (i.e., farms participating in VPF for three years have three dots and so on). The y axis uses a log scale.

The average and median *capped* VPF payments are marginally higher than both the AAFM and NRCS CSP payments suggested that – at least by these measures – the performance-based rates generate payments that tend to be marginally better for farmers than these practice-based programs. (We discuss how these programs compare in terms of *cost-effectiveness* in Criterion 5.2.) (Prior to applying the annual payment caps, the median values for AAFM were notably higher (detailed in Table 4.2), but the VPF and CSP median and average values shift only slightly.)

**Table 4.2.** Descriptive statistics for VPFP payments and hypothetical practice-based payments

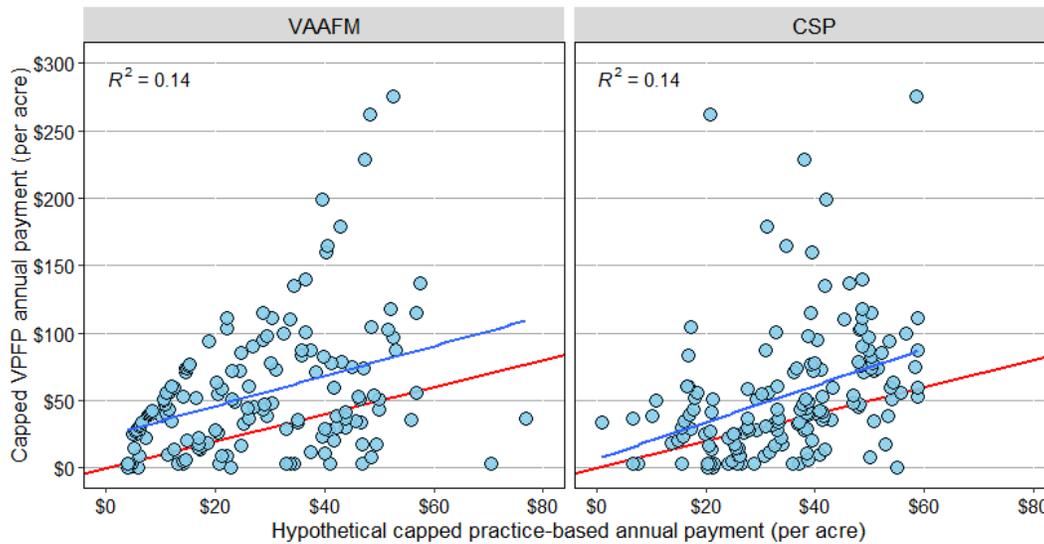
		<i>Uncapped payments</i>		<i>Capped payments</i>	
		<i>Mean</i>	<i>Median</i>	<i>Mean</i>	<i>Median</i>
Per farm					
	VPFP	\$26,678	\$14,208	\$21,535	\$14,208
<i>Practice-based hypothetical payments</i>					
	AAFM Programs	\$33,559	\$17,640	\$8,800	\$10,000
	NRCS CSP	\$19,257	\$13,181	\$18,004	\$13,181
	NRCS EQIP	\$144,002	\$98,035	\$82,986	\$98,035
Per acre					
	VPFP	\$60	\$48	\$54	\$42
<i>Practice-based hypothetical payments</i>					
	AAFM Programs	\$53	\$51	\$28	\$26
	NRCS CSP	\$36	\$38	\$35	\$37
	NRCS EQIP	\$265	\$280	\$214	\$212

However, the graph above does not specify how the payments compare for an individual farm, and how closely the outcome-based payments correlate to practice-based payments. Does generally more effort (rewarded by practice-based programs) generate better performance outcomes (rewarded by VPFP)? Figure 4.4 shows the differences in payments for each individual farm’s years of participation in VPFP as compared to what they hypothetically would have earned in AAFM practice-based programs or through NRCS CSP. Both the median and average VPFP payment were \$20 higher per-acre than the AAFM programs whereas the median VPFP payment was only slightly higher hypothetical payments from NRCS CSP. This is good news for farmers participating in VPFP (especially those on the positive side of the red line) – not only are they receiving a higher per-acre payment rate, but they’re also likely getting paid across more acreage than they would have through these other programs.



**Figure 4.4.** The calculated difference between the capped per-acre VPF payment and the capped per-acre hypothetical practice-based payments from AAFM programs and NRCS CSP. Positive values are farms for which VPF payments were higher than the hypothetical practice-based payments, and negative values reflect the opposite. Each dot on this graph corresponds to the annual results for each participating farm (i.e., farms participating in VPF for three years have three dots and so on). In this case, they are color-coded by the year for which VPF performance outcomes were assessed only to show that the 2024 season introduced a handful of outliers to the comparisons.

Figure 4.5 shows how well the two payments correlate to one another and helps us identify any patterns in these relationships with respect to the overall size of payments. If the VPF payments are consistently higher than hypothetical payments in other programs, we might conclude more confidently that VPF participation rewards farmers better than practice-based programs, and it might come as no surprise then that farmers with experience in both types of programs would be satisfied with VPF payment rates.



**Figure 4.5.** Comparison of VPFPP payments (y axis) to hypothetical payments from AAFM and CSP programs (x axes) for each individual farm. Each dot on this graph corresponds to the annual results for each participating farm (i.e., farms participating in VPFPP for three years have three dots and so on). The red line in the background is the identity, or 1:1, line: values above this line are farms for which VPFPP payments were higher than the hypothetical practice-based payments and vice versa for the values below this line. The blue line shows the correlation between the two payments.

The trendline appears to do this (parallel the red 1:1 or identity line) within the comparison of VPFPP payments to AAFM hypothetical payments while the gaps between VPFPP payments and NRCS CSP payments would seem to grow as NRCS CSP payments get larger. But the more interesting takeaway by far is that the correlations between the VPFPP and hypothetical payments for each farm do not fit closely to these trendlines (note the lower  $R^2$  value). In other words, what farmers would hypothetically earn through practice-based payments do not predict very well what they have earned in VPFPP. This underscores the effects of other variables in determining farmers' performance outcomes than conservation *effort*.

This leads to questions about what additional information the payment rates from other programs provide us in terms of reference points. Above, we noted that the use of VPFPP by the current cohort seems to suggest that it works similarly to NRCS CSP (i.e., it is good at helping farmers who have a long conservation history to find where on their farm they might make *marginal* improvements to their performance). If that makes NRCS CSP payment rates a fitting reference point, the dots above the line might suggest to the reader that VPFPP is paying more than necessary for the same outcomes (especially when you take into consideration that the VPFPP payment rate is applied to the farm's entire acreage and the NRCS CSP rate would not be).

Taking into consideration VPPF's comparability to other programs, VPPF earns a **B grade** in this grading criteria because it does not appear to pay far more nor far less than comparable practice-based programs. Participants with lower performing fields will tend to earn more in practice-based programs for their efforts but this is an inherent consequence of performance-based conservation rather than an issue with VPPF's program design.

## Goal 5: Equity and efficiency of program funding

Grade: **B**

This goal area and its subsequent grading rationale address the equity and efficiency of VPPF’s program model and the way it directs the use of funding. There are inherent tradeoffs in designing a performance-based conservation program of this scale that live up to a principle of ensuring *equal* access and opportunity while maximizing the cost-effectiveness of public investments in terms of dollars per environmental outcome generated.

### ***Criterion 5.1: Equality/Equity – Distribution of payments across farm types (Grade: B)***

AAFM’s list of VPPF goals uses the following categorizations of farms and farmers across which the program is expected to be “maximally equitable”: geographic location, farm size and length of time as land stewards. Elsewhere, it sets a standard that “a variety of farm sizes and land use types will be eligible for payment.” In general, the framing of the goal seems to get more at equality (the program is equally accessible and beneficial to a variety of farm types) than equity, which would imply that the program provides differential benefits to different farm types, and is designed to prioritize farms with greater need. Hence, the UVM team has evaluated the program in terms of equality, not in terms of equity.

When TA providers were asked to identify the types of farms that seem to have an advantage within this program, their responses included the variables shown in Figure 5.1. TA providers expressed these attributes in combination: for example, larger dairy farms that have a large percentage of their acreage in hayland. While it is not mentioned here, there is a common perception that river-bottom land also does not benefit much within VPPF, possibly due to the lower rate of phosphorus losses for these fields within the baseline scenario.

Variable	At a disadvantage ←	→ At an advantage
Farm size	Smaller farms	Larger farms
Farm type	Vegetable farms Diversified farms Longer-season annuals like soy or grain Farms with poorly managed pastures	Dairies CAFOs Most fields in corn/hay rotations, permanent hay, or well-managed pasture
Experience with conservation	Just starting with conservation practices	Already implementing conservation practices
Record-keeping status	Farms without NMPs Disorganized records	Farms with NMPs Organized records
Soil types	Steeper land More erodible soils	Flatter land Less erodible soils
Nutrient management	Farms that must apply as much manure as possible	Farms able to apply more synthetic fertilizer and less manure

**Figure 5.1.** Perceptions on which farms appear to be at an advantage or a disadvantage when it comes to benefiting from VPPF.

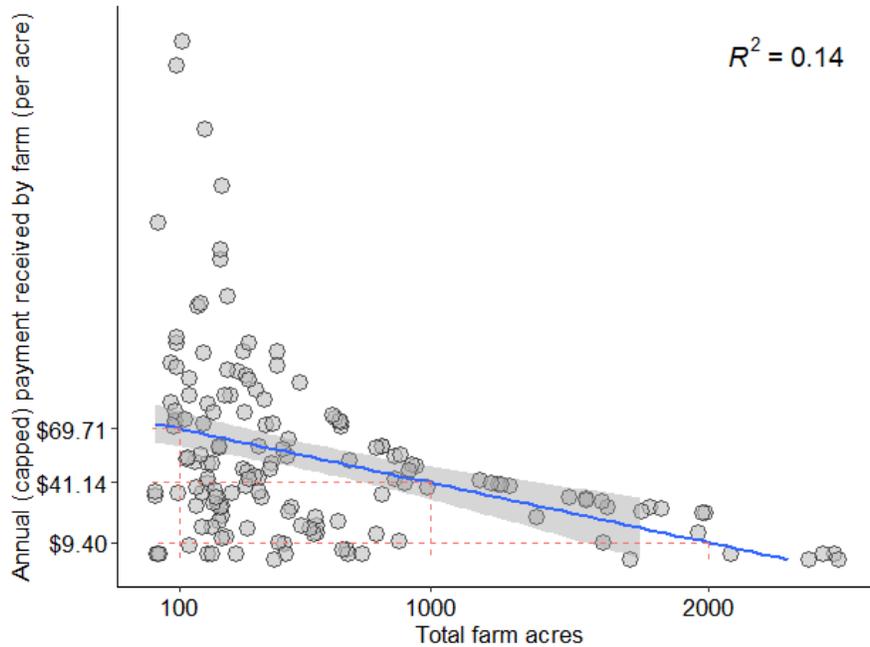
We wanted to investigate the veracity of these (and other) suppositions about whether certain conditions gave farms a clear advantage in terms of attaining remunerable levels of performance improvements under the VPF model. We used Farm-PREP data to check these suppositions and better understand the relationship between variables in Figure 5.1 and VPF payments.

VPFP has engaged a substantive number of farms (including many certified small farms operations (CSFOs)) spread across the state but with a concentration of farms in watersheds of particular concern for phosphorus loading. This seems to reflect an earnest attempt by program administrators to avoid any sort of favoritism within the enrollment process. But are there disparities in how program benefits accrue to participants according to farm size, as suggested above? We did not find a convincing linear relationship between farm size and per-acre<sup>56</sup> capped farm-scale payments.<sup>57</sup> (Figure 5.2). However, farm size likely guides decisions that *do* have an influence on outcomes.

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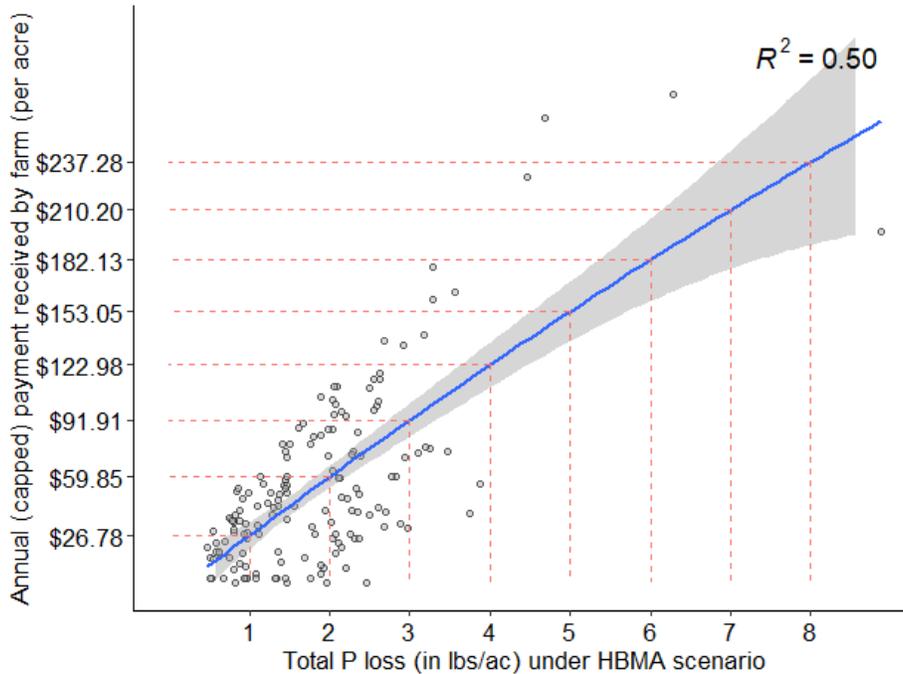
<sup>56</sup> We consider the metric of per-acre payments to be more relevant to our purposes here than absolute payments, especially since conservation costs will also increase or decrease with farm size (although not linearly). If a program conceives of its payments as offsetting conservation costs, we might evaluate this particular program outcome – per-acre payment levels by farm acreage – as “fair” when smaller farms are paid slightly more per-acre to account for economies of scale. Of course, if the program is strictly concerned with paying for performance and *disinterested* with respect to the costs that farmers face (and how the costs change as the scale of farming increases), these considerations are irrelevant.

<sup>57</sup> Incidentally, a similar relationship holds even when payment caps are removed.



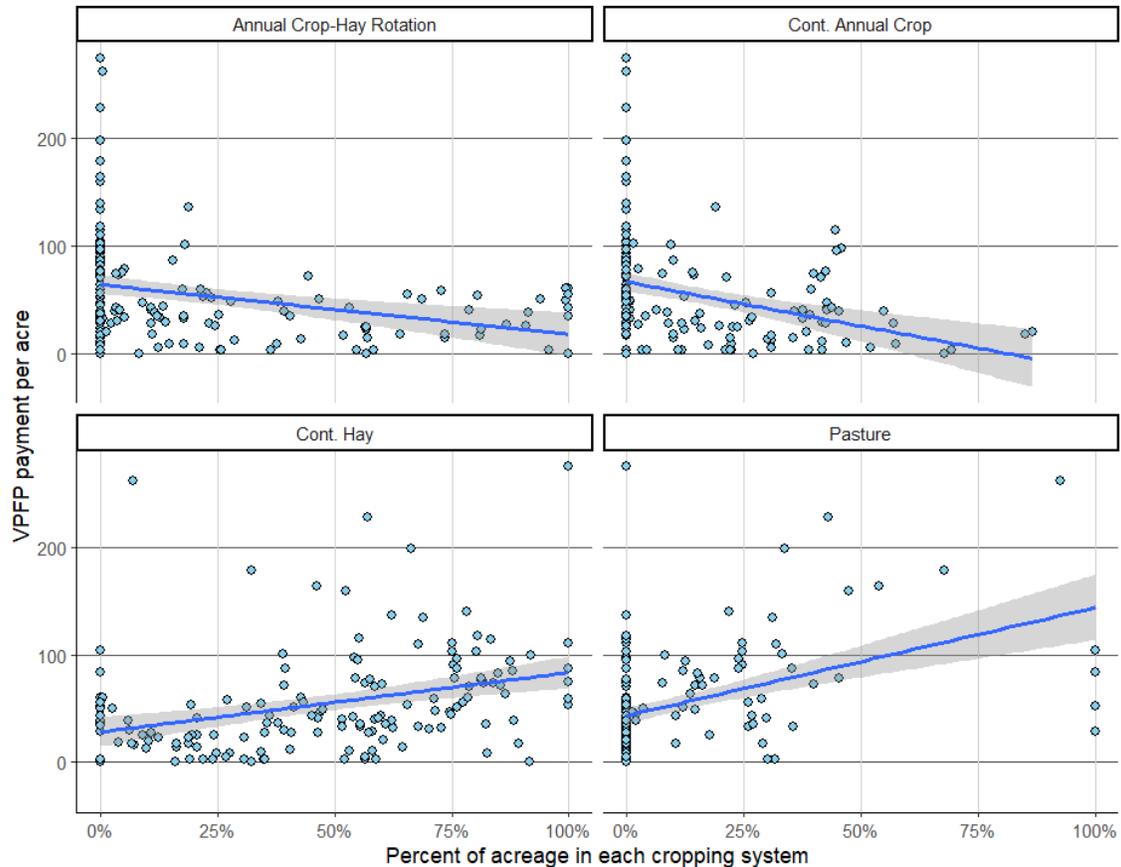
**Figure 5.2.** Per-acre annual payments received by participating farms by total farm acres (and trend line) Per-acre annual payments are the *capped* payments including both the P loss reduction payment and the stewardship payment. The (blue) trend line is based on a linear regression. Dotted red lines are used as references to indicate the predicted annual per-acre payment for each the following acreage: 100 acres, 1000 acres, and 2000 acres. Data from 2022-2024 program years.

We also found that fields with higher P losses at baseline were associated with greater reductions (i.e., better outcomes and higher payments) (Figure 5.3). In this case, the trend was much more convincing (with the data more closely aligned along the trend line and an acceptable  $R^2$  value).



**Figure 5.3.** Relationship between annual payments received by participating farms and total P losses (in lbs./ac.) in each farm’s baseline scenario. In the graph above, the y-axis markers reflect the predicted (regressed) payments for each of the x-axis intervals. Per-acre annual payments are the *capped* payments including both the P loss reduction payment and the stewardship payment. Data from 2022-2024 program years.

Cropping systems also seem to have an impact on the per-acre capped rate that farms can earn in VFPF (Figure 5.4), although the data do not neatly follow the trendline here. Generally speaking, farms with a greater percentage of their acreage in continuous hay and pasture receive higher per-acre payments than those with a higher percentage of acreage in continuous corn silage. Farms with grass-based production systems will usually earn higher per-acre payments, although other factors (field conditions, practices and baseline land use assumptions) could reduce this advantage.



**Figure 5.4.** Annual per-acre VFPF payment compared to the percent of a farm’s land acreage in each of four cropping systems. “Cont. hay” refers to continuous or permanent hay (planned over a 30-year period) and “Cont. Annual Crop” refers to continuous cropping with the same annual crop (e.g., corn silage) over a 30-year period. As the percentage of acreage in continuous annual crops and annual crop-hay rotations increases, the per-acre VFPF payments drop, whereas the percentage of land in continuous hay and pasture is positively correlated with per-acre payments.

Additional analysis on this dataset should attempt to control for each of these factors to understand their relative contributions to VFPF payments, although interaction effects should be taken into consideration in that modeling.

Grading this criterion left questions about how much equality *should* be a priority of the program, and why. If the primary objective of VFPF is to support attainment of the TMDL for Lake Champlain and Lake Memphremagog then incentivizing conservation where it matters most is logical. On the other hand, a program designed to support “on-farm conservation” or “land stewardship” writ-large might be more compelled to consider a more equal distribution of funds. Also, the political and social sustainability of the program might rely on perceptions that it serves as many farms as possible. VFPF does not exist in vacuum: any program supporting the farm sector confronts the demand by many farms for marginal support that can help keep their operations viable.

Considering the program’s focus on helping Vermont attain the TMDLs for the Lake Champlain and Lake Memphremagog waterbodies, the pilot phase for VPFP has enabled equality reasonably well, which explains the **B grade** here. As mentioned above, the degree to which any farm can benefit from the program depends largely on the P loss assumptions of the baseline scenario. Since the baseline is dubious in some cases, it might lend some unevenness to the outcomes achieved by participants. On the other hand, the use of these baselines might be optimal – VPFP must demonstrate progress towards the TMDLs in terms that are consistent with how the TMDLs were originally generated and it would be difficult to gather farm records so far in the past. Problems associated with specific farms that make substantive conservation efforts and struggle to generate notable outcomes seem to represent challenges with how the model takes in data and interprets the P pathway processes on their farms and are not strictly questions of equity or equality.

VPFP has made several program design decisions to ensure that the requirements of VPFP participation and the benefits that farmers might receive fall within a range that could be characterized as *equal* treatment and opportunity (e.g., the standard performance threshold across watersheds; the annual payment caps) and foster broader participation. This principle tempers that narrow focus on investing funds only where they generate the largest return on investment. If VPFP chooses to center behavior *change* (i.e., improvements to farm performance in the next round of funding), the tension between these two objectives will become even more pronounced and puts more onus on tuning the balance between payments for improvements and payments for on-going stewardship.

### ***Criterion 5.2: Efficiency – VPFP is a cost-effective approach to securing P loss reductions from agricultural fields (Grade: C)***

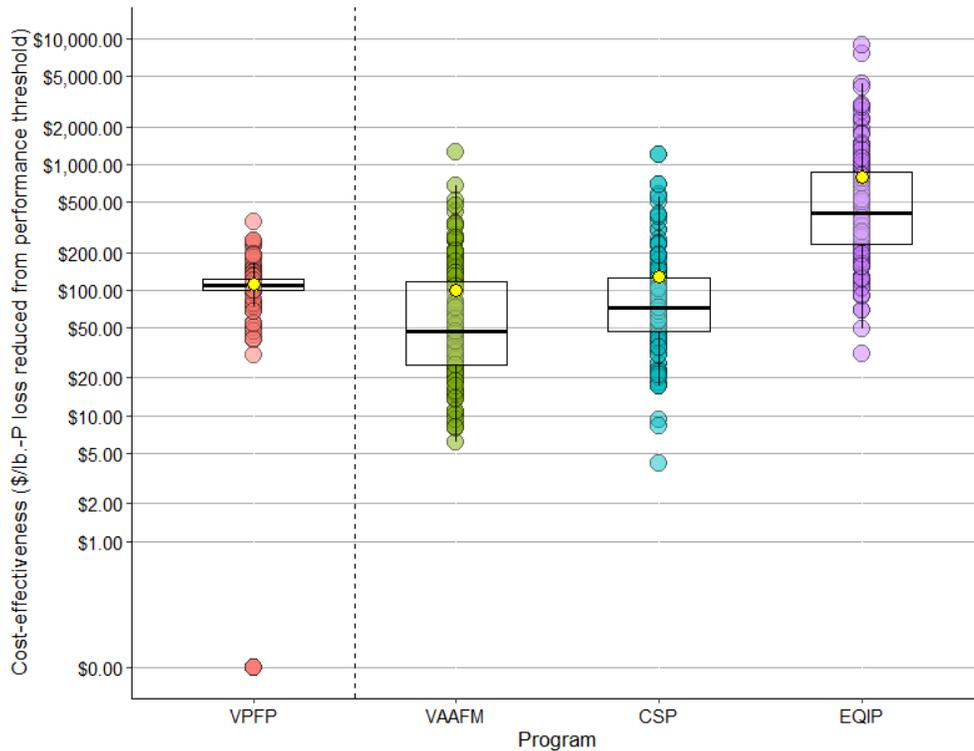
Efficiency indicates the degree to which VPFP investments generate sustainable phosphorus loss reductions at the lowest possible cost. Overall, VPFP expenditures totaled \$4,512,401 from 2021-2025 (See the budget summary in Section 3.6. of the full report). If total program costs are considered, the price tag of the additional P loss reductions was \$131 per additional pound-P reduced.<sup>58,59</sup>

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<sup>58</sup> When comparing this figure to the comparison of cost-effectiveness below, keep in mind that this figure is based on the payments *actually* made to farmers, whereas the VPFP payments below (in order to make them comparable to the hypothetical payments) are based on what VPFP farmers would have earned if their payments were not constrained by their obligated total, which was based on their projected performance at enrollment and which in some cases turned out to be an underestimate. Since this under-projection is not an intentional component of VPFP’s program design, we found it more useful to use what the “whole” VPFP payments would have been when making comparisons across these different programs. If we replace the P loss reduction payments & stewardship payments with the sum of “whole” annual payments (i.e., not restricted by the obligated total) than total program expenses would have been \$133 per additional pound-P reduced.

<sup>59</sup> Compared to the baseline performance, VPFP farmers P losses were 104,246.8 pounds-P less than P losses under the baseline scenario. The ratio of program costs to this total change in P losses (between the current and baseline scenario) was \$43 per pound-P loss reduced from baseline.

For VPF to demonstrate success on this criterion, we must demonstrate that VPF pays a lower price per pound of P loss reduced than practice-based programs. To determine this, we relied on the capped hypothetical payments that farmers would have received from practice-based programs if they were paid for all over the practices at the practice-based rates (see Criterion 4.3 for more explanation of this method). We then divided these hypothetical as well as the VPF payments by pounds-P loss reduced from the performance threshold. Since the brunt of the VPF payment comes from the P reduction payment, the rate of which is \$100 per pound-P reduced above the performance threshold, the interquartile range of the VPF boxplot is very small and positioned close to (just above) the \$100 cost-effectiveness mark. The range in these data are explained by the influence of the stewardship payment as well as the annual payment caps. Table 5.1 shows mean and median values with outliers removed.



**Figure 5.5.** Comparison of the cost-effectiveness of VPF and practice-based programs using both capped payments. For average values (yellow dot), we retain the outliers to show their impact on the averages, but we removed them in the calculations for the table below. Cost effectiveness in these graphs is calculated as the annual payments (or hypothetical payments) divided by the pounds of P loss reduced from the performance threshold. Although VPF offers no annual payment to a few farms that did not meet the performance threshold, the median values for cost-effectiveness of capped AAFM and CSP payments – \$43 and \$65, respectively – are lower than that of VPF (\$107), suggesting that these payments are more cost-effective on the basis of median values. Values are from participation years 2022-2024.

**Table 5.1.** Mean and median cost-effectiveness metrics for VPFP payments and hypothetical practice-based payments (\$/pound-P loss reduced from threshold) **with outliers removed**<sup>1</sup>

	<i>Mean</i>	<i>Capped payments Median</i>
VPFP	\$111	\$109
<i>Practice-based hypothetical payments</i>		
AAFM Programs	\$59	\$41
NRCS CSP	\$75	\$64
NRCS EQIP	\$456	\$348

*Note.* <sup>1</sup> The mean and median values shown here are only calculated on each program's range of values from which outliers have been removed. Outliers were removed by excluding values within each program's range that fell outside limits defined as 1.5 \* the interquartile range (IQR) above the third quartile (upper bound or fence) and 1.5 \* IQR below the first quartile (lower bound).

In summary, VPFP payments are slightly *less* cost-effective when compared to both AAFM practice-based programs and NRCS CSP. As mentioned above with respect to Goal 1, the internal VPFP data collected from participants does not let us reliably (and comprehensively) gauge its direct influence on P loss outcomes. This is further complicated by the fact that participants may participate in VPFP and practice-based programs simultaneously, meaning that the creativity and practices that farmers employ and which in theory generate P loss reductions might be subsidized at the same time by other programs like FAP or CSP. If a farmer is incentivized by both VPFP and FAP, for example, it might be necessary to include both payments as the numerator in the cost effectiveness metric.

There is also the question of whether the rates paid by practice-based programs are an appropriate reference for efficiency. Considering that many VPFP participants have practiced their current conservation activities for many years and that co-benefits from these activities have begun to materialize, one might question whether they might be willing to accept lower overall payments for their performance outcomes than would be necessary to incentivize farmers to initiate conservation practices for the first time (with all the associated risks). Over time, one might expect that the incentive rate needed to encourage good stewards to keep up their conservation practices will decrease (i.e., a lower likelihood of dis-adoption). From a narrow efficiency perspective, it might be worth asking whether VPFP *overpays* its participants. In the context of farmers struggling to remain viable, this might seem like a ridiculous question, although it is important to bear in mind that VPFP is not (at least, explicitly) designed to buoy the economic viability of the farm sector. Is it possible to consider the function and efficiency of the VPFP intervention independently of the question of farm viability, which might be better addressed through other policy mechanisms (including other forms of financial assistance)?

Finally, in practice, from the way that VPFPP is often pitched – as a program that reward farmers already practicing exceptional stewardship – it seems that VPFPP is designed less toward incentivizing new, additional improvements and more towards rewarding the positive externalities that farmers already generate year after year. If internalizing these externalities remains the objective, then the process of setting (and appraising) rates for VPFPP – as well as determining the “efficiency” of payments should be different. Other performance-based programs have based their rates on the costs of penalties for other polluting entities (credit trading) or through market-based mechanisms like auctions (farmers’ “willingness to accept”).

There are several other methods for determining the monetary value of the positive externalities generated by farmers for downstream beneficiaries. In a report prepared for the Vermont Soil Health and Payment for Ecosystem Services Working Group, Dube et al. (2023)<sup>60</sup> used two methods for estimating economic damage from the impairment of waterbodies due to P pollution (social costs associated with damage to water quality, reduced recreation opportunities, public health harms, etc.). The authors averaged the results from these two methods to arrive at an average downstream economic cost of \$56.60 per lb.-P that entered Lake Champlain. The positive externalities produced by VPFPP farmer conservation might represent avoided costs of this magnitude for each pound of P loss reduced. The UVM evaluation team is not recommending these approaches per se but pointing out that the method of determining the “right price” depends on clarifying what exactly is being remunerated.

The **C grade** reflects the concern about the insufficient data to determine the degree to which P loss outcomes are attributable to VPFPP participation (and distinguishable from those incentivized concurrently through other programs) and well as doubts regarding the appropriateness of defining cost-effectiveness through comparisons with practice-based programs.

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<sup>60</sup> This article can be accessed at <https://legislature.vermont.gov/assets/Legislative-Reports/PES-Working-Group-Final-Report-15Jan2023.pdf>.

## 6. VPFP 2.0 Goals and Recommendations

The VPFP 1.0 was driven by a set of six goals that guided the program's development and administration throughout its four-year pilot phase. Those goals were used as criteria for the program evaluation in the section above. Through discussions between the AAFM Water Quality Division and the UVM evaluation team, it was determined that a potential VPFP 2.0 would use a different set of preliminary goals to drive the program, which are subject to change. These preliminary goals were premiered through a Creative Exercise that was shared with TA providers enrolled in VPFP 1.0 in March 2025.

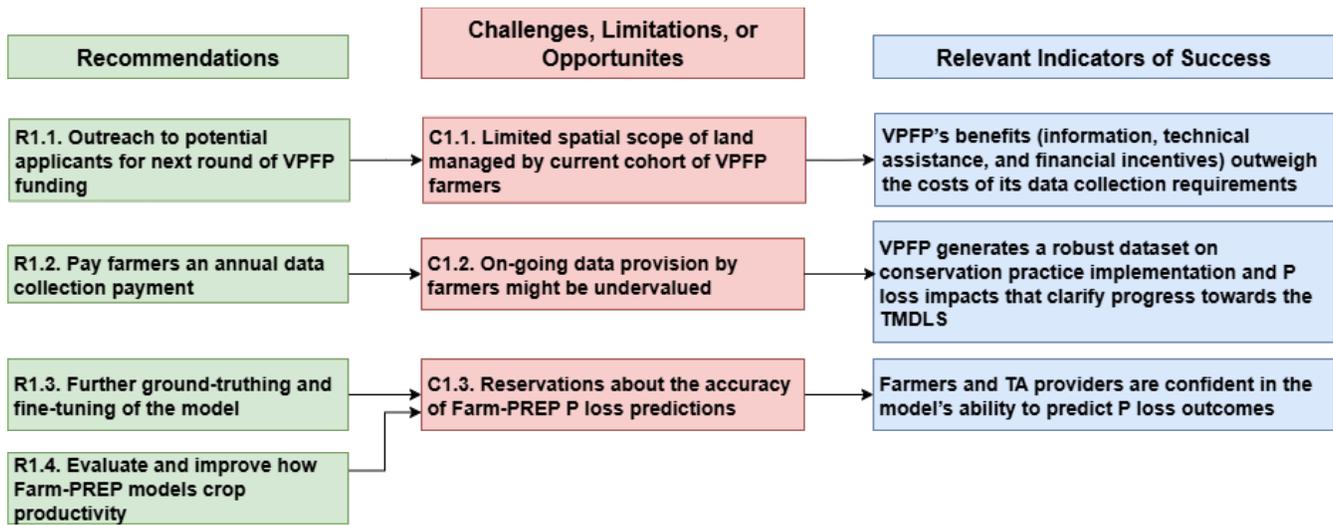
1. **Conservation Practice Tracking:** Collect, verify and track geospatially mapped data on the implementation of conservation practices on Vermont farms that will support statewide nutrient reduction accounting for Total Maximum Daily Load requirements.
2. **Behavior Change:** Incentivize and encourage Vermont farms to increase engagement with trusted conservation providers, improve compliance with nutrient management planning and reporting requirements, increase whole farm conservation planning, and increase and sustain conservation practice implementation.
3. **Participant Satisfaction:** Ensure that the program is attractive to and works for Vermont farmers.
4. **Sustainable Program:** Build a program that can continue to be funded and staffed.

For each of the goals above, the UVM evaluation team identifies:

- **Strengths:** The strengths of VPFP 1.0 that (if carried forward) would increase the likelihood of achieving each goal.
- **Challenges:** The challenges of VPFP 1.0 that (if unmitigated) could undermine success in VPFP 2.0.
- **Recommendations:** The UVM team's recommendations for using strengths, resolving challenges and taking advantage of new opportunities in VPFP 2.0. Some of these recommendations represent minor adjustments to program design and/or tools (e.g., Farm-PREP). Others might be considered deeper reforms that could take longer to operationalize and might require more preliminary analysis and scenario testing. AAFM will be able to discern between the two. There are also several recommendations in which we suggest further collaboration with UVM researchers.

Metrics, indicators, and other qualitative data specific for tracking the success of each recommendation are included in each table.

# Goal 1. Conservation practice tracking



## Strength(s)

1. Current VPFP farmers have shown both a willingness to provide extensive data on their operations as well as an interest in the information produced by the model regarding the performance of their conservation activities.

## Challenges, Limitation, or Opportunities

- C1.1. Limited spatial scope of land managed by current cohort of VPFP farmers.** The current cohort of VPFP farmers represent many of the early adopters of conservation practices in Vermont. Many are farmers who have been leaders within the farming community and frequently engaged with UVM Extension, the State of Vermont, and Conservation Districts prior to enrolling in VPFP. As such, the mean performance of these farmers (and their level of effort with respect to conservation) is likely to be quite different from mean performance (and effort) of the whole Vermont farming community. This is to be expected in a pilot program and there are not many pilots that achieve VPFP's participation rate. However, it is a current limitation of the dataset, which AAFM views as an important output of the VPFP program. In Section 3.7. (under VPFP Program Overview), we provided the percent of cropland and pasture acreage in each county managed by current or past VPFP participants. For all counties that had at least one VPFP participant, VPFP farmers manage 9% of the cropland and pasture acreage. This level of participation is considerable but could be extended through future iterations of the VPFP program.
- C1.2. On-going data provision by farmers might be undervalued.** While the current data entry payment recognizes data-related effort at enrollment, there is no annual payment that recognizes the value of on-going data provision by farmers. VPFP could more explicitly acknowledge the value to the State of

Vermont of on-going data provision by farmers throughout their participation in the program. As discussed below, it could also recognize the on-going data-related efforts required of farmers over the course of their enrollment, and in doing so ameliorate some of the frustrations about the time it takes to handle information for assessments.

- C1.3. Reservations about the accuracy of Farm-PREP P loss predictions.** Despite the sophisticated nature of the APEX model, there are still reservations about the accuracy of its P loss predictions on Vermont soils, even when there is confidence that the data inputs accurately reflect what is occurring on the farm. (There are also reservations about whether it is possible to accurately reflect what is happening on the farm in Farm-PREP and how the reliance on certain generalizations like dominant soil type influence results, but those are thematically distinct limitations.) These reservations do not necessarily come from evidence of cases in which P loss predictions have been shown to be incorrect, but in the absence of clearly communicated research that demonstrates Farm-PREP’s accuracy on Vermont farms. We envision the audience for this research to be farmers, but TA providers and other stakeholders will also be interested in what the VPFPP dataset says about progress made toward the TMDLs.

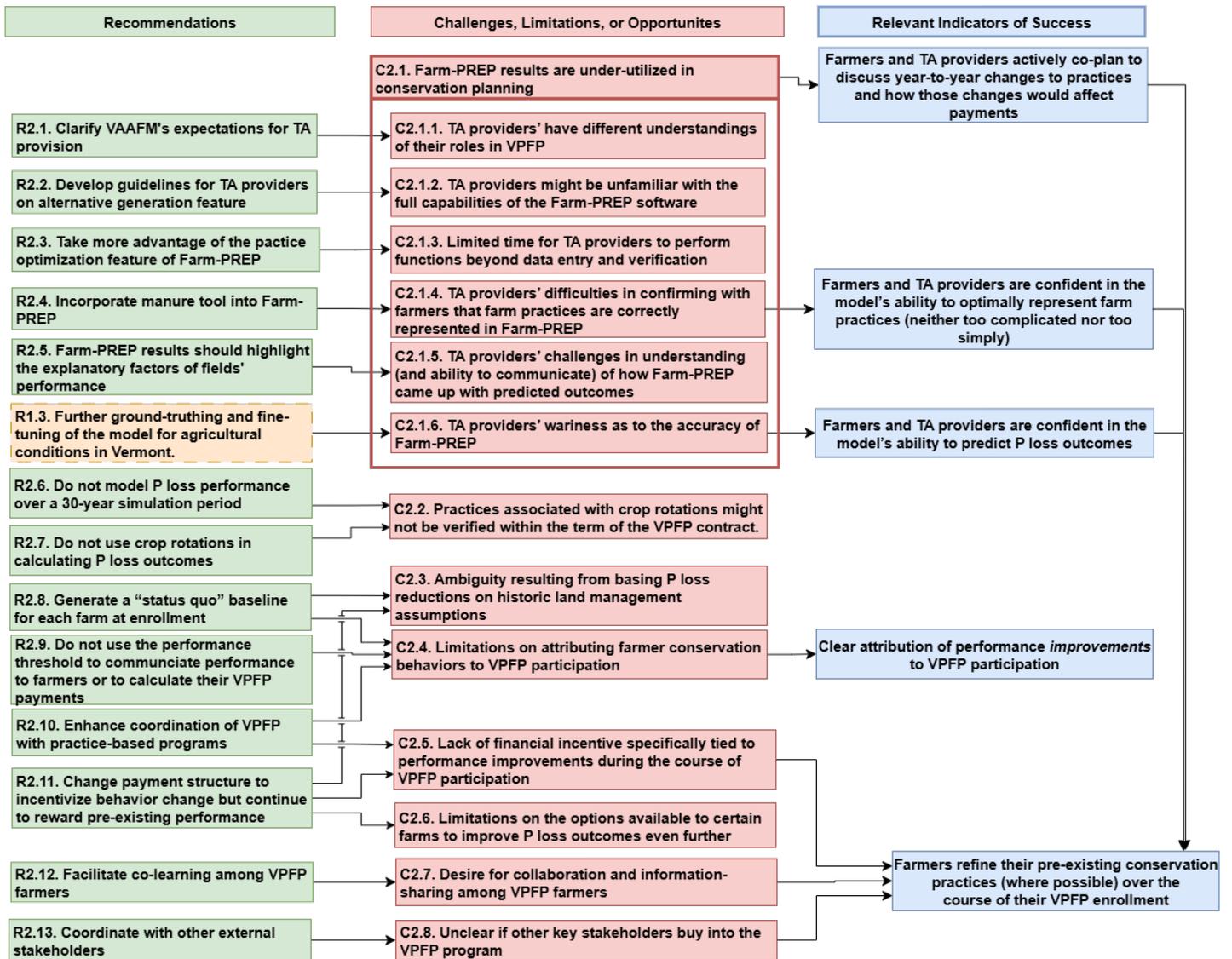
## Recommendations

- R1.1 Outreach to potential applicants for the next round of VPFPP funding.** AAFM may already be planning this, we recommend doing more outreach in collaboration with the Conservation Districts on the experience of the VPFPP pilot with farmers’ groups (e.g., Champlain Valley Farmers’ Coalition) or at conferences attended by potential entrants in the next iteration of VPFPP and, if possible, bringing in farmer-proponents of the program to talk about their own experience. These meet-ups would allow AAFM to transparently discuss what the Agency saw as major successes, lessons learned and things they’d like to try to improve in the next round of funding. It would also be an opportunity to hear questions and doubts from other farmers that might impinge on their interest in applying, and would give AAFM a chance to gauge how many new farmers might be interested.
- R1.2 Pay farmers an annual data collection payment.** Paying farmers annually for the data that they provide and for the time required in providing records and addressing data entry issues would acknowledge this contribution to the State (separate from their P loss performance – say, \$5 per acre up to a \$1,000 limit. (This additional payment could be “paid for” by lowering the payment rate proportionately for P loss reductions.) Although many farmers might not distinguish between the (several) components of their annual payments, they would know at the outset that the program provides a set amount to each farmer that pre-emptively recognizes that occasionally the data side of VPFPP might require effort on their part, on an annual basis. For farms with lower annual payments, this benefit might be more notable than large farms and those whose annual payments are currently capped.

**R1.3 Further ground-truthing and fine-tuning of the model for agricultural conditions in Vermont.** *If it would be advantageous in terms of increasing local confidence in the Farm-PREP model as well as increasing the reliability of summary figures regarding progress towards the TMDLs (and if that confidence results in more conservation effort, more interest in the program among the farming community and more program funding), then AAFM should pursue more regular ground-truthing of predicted Farm-PREP P loss outcomes in collaboration with local research partners (e.g., UVM) and Stone Environmental on a small sample of VPFPP-participating fields with conditions representative of large portions of VPFPP-participating acreage (e.g., sandy loam soils, silty river-bottom soils, Vergennes and Covington clays). Stone Environmental has expressed that it would welcome the opportunity to collaborate more with UVM and that additional robust datasets would support improving model performance even further. This work is expensive and VPFPP might only be able to offer very limited funds from its own budget for these activities, so it will be important to work with a project team to secure complementary research funding, potentially from multiple sources. The risks of such work might be finding that on certain soils (or under certain weather conditions) Farm-PREP results lack what stakeholders might consider an acceptable level of precision. And it might be difficult to explain that such a program must balance precision with practical decisions about model complexity. On the positive side, empirical results that roughly correlate with Farm-PREP predictions could improve buy-in.*

**R1.4 Work with a select group of VPFPP farmers, Stone Environmental and UVM to evaluate and improve how Farm-PREP models crop productivity.** Addressing certain perceptions (and the UVM evaluation team's doubts) that yields might not be accurately predicted in Farm-PREP is a challenge. TA providers would like the option to "write-over" the modeled yield values, but according to Stone Environmental that option is not feasible in FarmPREP because yield is an output rather than an input to the APEX model. In addition, farmers might not keep accurate yield records (e.g., from HarvestLab) in ways that overlap with each field as drawn in Farm-PREP. One future alternative would be to replace the process by which Farm-PREP currently predicts yields with yield values that are modeled through machine learning algorithms or AI processes using vegetation indices (Sunoj et al. 2024). In the study cited here, the accuracy of corn silage yield predictions was in the neighborhood of 60-90%. While the accuracy of these methods might not be that much higher than other types of models currently, their accuracy is more likely to improve soon. Nevertheless, using these technologies to predict yields of forage crops will be more challenging.

## Goal 2. Behavior change



## Strengths

1. VPFP farmers have increased engagement with trusted conservation providers as a result of the program.
2. While NMPs are now required for many farms, participation in VPFP helps make them a regular part of organized farm record management, and farmers tend to appreciate the additional support and oversight in this area. TA providers and private crop consultants are able to work with farmers on the practical implications (for operations) of their NMPs.

3. VPFP farmers have often pursued conservation activities voluntarily to both model responsible farming practices and to reap some of the co-benefits (e.g., soil health associated with these practices).
4. VPFP farmers express an appetite for information on their farm's environmental footprint and for ideas on how to improve their practices.

## Challenges, Limitations, and Opportunities

- C2.1. Farm-PREP results under-utilized in conservation planning.** Farmers utilized Farm-PREP results in conservation planning to a lesser extent than anticipated in the design of VPFP. There are several factors that have limited the use of Farm-PREP results, which we treat as separate limitations in turn.
- C2.1.1. TA providers have different understandings of their roles in VPFP.** TA providers tend to understand that a large part of their role is to support farmer participation in VPFP, especially regarding data entry into Farm-PREP. However, there might be less clarity around how TA providers are expected to communicate farmers' P loss performance as modeled by Farm-PREP and opportunities for how farmers could earn high payments through VPFP through practical changes to their conservation strategies.
- C2.1.2. TA providers might be unfamiliar with the full capabilities of the Farm-PREP software.** We heard from some TA providers that they were unaware of the functionality within Farm-PREP that allows them to generate performance results for alternative scenarios to determine whether a conservation practice improvement would be worth implementing.
- C2.1.3. Limited time for TA providers to perform functions beyond data entry and verification.** Even when TA providers are aware of the functionality to explore how conservation improvements might enhance performance, they might be limited by their own capacity to delve into the practice alternatives available to farmers in order to come up with proposals about how they might improve their performance and payments through VPFP.
- C2.1.4. TA providers' difficulties in confirming with farmers that farm practices are correctly represented in Farm-PREP.** TA providers described situations in which the process of translating farm records into Farm-PREP data inputs makes it challenging to confirm with the farmer that what is in Farm-PREP is correct since it is no longer relayed back to them in their own terms or units. In theory, TA providers could reference the copy of the pasture and manure tools that they used to translate these data, but it seems there is an interest in being able to show farmers how their data looks in the Farm-PREP platform and/or results. These doubts could lead to hesitancy about using the Farm-PREP data to propose changes that would improve P loss performance, and it might complicate conversations with farmers about what factors most influenced their predicted P loss outcomes.

- C2.1.5. TA providers’ challenges in understanding (and ability to communicate) of how Farm-PREP came up with predicted outcomes.** Most TA providers (and farmers) have minimal understanding how P losses are predicted by the model and refer to it as a ‘black box’. We do not consider it necessary for these stakeholders to understand the process-based intricacies of the model, but results could do a better job (for those interested) of illustrating *which* factors most influenced a field’s performance outcomes and what the farmer could do differently in that field (given its specific conditions) to mitigate P losses to the greatest extent possible.
- C2.1.6. TA providers’ wariness as to the accuracy of Farm-PREP.** TA providers expressed general wariness of the accuracy of the Farm-PREP predictions that result from how data is entered into the model. They pointed to several issues that they felt might undermine data quality.
- C2.2. Practices associated with crop rotations might not be verified within the term of the VFPF contract.** To acknowledge the real contribution of crop rotations to soil structure, the accumulation of P on the soil surface, and soil P saturation (more generally), VFPF collects data on how farmers might expect to manage each crop in the rotation. These expected practices are accounted for within the performance metric on which farmers are paid since this metric is derived from a 30-year simulation that includes the influence of crop rotations. Including data on crop rotations adds slightly to the burden of data entry into Farm-PREP and since the “expected” practices are not actual practices, the performance results are predicated at least partially on aspirations. A farmer who plans to have a field in corn silage-hay rotation for the foreseeable future but only manages it in corn silage during VFPF and then later chooses not to rotate it to hay after their VFPF contract ends will have benefited (in terms of their VFPF payment) for a practice that never materialized. Other variations on this theme could be imagined (e.g., a farmer that plans to farm corn silage as no-till once it comes into rotation but then changes their mind after VFPF participation). In truth, what is more likely is that farmer practices on the crops not currently in rotation will mimic what they are doing with those crops currently on other fields, but this is not guaranteed.
- C2.3. Ambiguity resulting from basing P loss reductions on historic land management assumptions.** TA providers expressed that the baseline based on historic land management assumptions might not provide concrete enough grounds on which to engage more meaningfully with the Farm-PREP information and, in particular, to motivate farmers to make practice improvements. To incentivize improvements (i.e., behavior change), they suggested that potential to improve performance might be more salient if VFPF used a baseline that is more familiar to farmers or by referring to average P losses per-acre rather than change from the historic baseline. AAFM has suggested that farmers could use the Year 1 performance as a more immediate baseline that they could “compete” against in future participation years.
- C2.4. Limitations on attributing behavior change to VFPF participation.** In some cases, farmers might be receiving conservation incentives from both a practice-based program and VFPF. This might not be perceived as a problem on its own, but if unresolved, it does complicate *how*

*VPFP can demonstrate that behavior change is attributable to farmers' participation in this program.* There is also the risk that farmers and other stakeholders begin to see these types of “double payment” arrangements as unfair.

- C2.5. Lack of financial incentive specifically tied to performance improvements during the course of VPFP participation.** A financial incentive that would reward farmers at a higher rate for behavior change is currently missing. Currently, the impact of farmers' practice improvements while in VPFP are not calculated or funded any differently than the impact of their pre-existing practices .
- C2.6. Limitations on the options available to certain farms to improve P loss outcomes even further.** We heard from some farmers that while they continue to make incremental improvements to their practices, they feel that they are currently at their “max” for what they can practically do to reduce P losses. This seems to be particularly true for farmers who have transitioned to grass-based production. Depending on the specificity of some practice enhancements, these improvements might not be “picked up” by the Farm-PREP model if there is no field that distinguishes between a “normal” condition and an “enhanced” one (for example, depth of manure injection).
- C2.7. Desire for collaboration and information-sharing among VPFP farmers.** In surveys and interviews farmers expressed a desire to share information among other VPFP participants as a means of learning and potentially enhancing conservation practices. While AAFM does not have the authority to share data between farms, they might be able to use communications that allow farmers in VPFP a view into what other farmers in the VPFP community are up to. Communications like this are often a heavier lift than they are made out to be, but an annual newsletter that shares some summarized data on the previous years' accomplishment and enhanced with some video highlighting farmers making interesting changes could be a way to build up identity within the VPFP network and foster opportunities for the one-on-one information-sharing where the most learning might ultimately occur. Small meet-ups of the VPFP community at popular conferences might also achieve this in addition to providing an opportunity to ask farmers about specific developments/proposed changes to the program.
- C2.8. Unclear if other key stakeholders buy into the VPFP program.** It is outside AAFM's scope of direct administration to account for how the advising and actions of private crop consultants and custom operators influence the success of VPFP (in terms of the program's goals).

However, since it is possible (and even likely) that there will be trade-offs between VPFP's metrics for performance (i.e., P loss reductions) and those of other actors supporting farmers (who might emphasize metrics like productivity and profit), and farmers might feel pulled in two directions. In cases where crop consultants already support (supported in the past) farmers' VPFP participation, there might be less of a distinction to overcome. But in other cases, where crop consultants are unfamiliar with VPFP, we speculate here that crop consultants might benefit from a better understanding of how VPFP works (and how VPFP payments might offset yield gaps and/or lower production costs) and could result in more balanced advising. They might also be more willing to support in other ways, like sharing soil test information more quickly. Similarly, coordination with farmers, custom operators, and AAFM might identify (and potentially remedy) bottlenecks that limit the availability of services to VPFP farmers or the implementation of specific conservation practices (e.g., cover crop sowing) in accordance with best practices (e.g., within certain data ranges).

## Recommendations

- R2.1. Clarify AAFM's expectation for TA provision** under VPFP and address obstacles to this form of engagement as expressed by TA providers.
- R2.2. Develop guidelines for TA providers on alternative scenario generation feature** (i.e., how to use the scenario generation feature in Farm-PREP and how to communicate findings to farmers.)
- R2.3. Take more advantage of the practice optimization feature of Farm-PREP** that automatically loops through alternative scenarios for each field to identify the highest-performing practice scenario(s). These results should be accessible in an easy-to-read fashion (through the app platform or as an export). Farms would likely only wish to see the top five scenarios for fields they select (e.g., fields with poorest performance). It could provide a quick reference point, especially for farms with a large number of fields.

There are several 'alternative' assessment algorithms that have been built into Farm-PREP through various projects – one that optimizes practices based on a target reduction (which was originally designed through Lake Champlain Basin Program (LCBP) work with the idea of helping to meet basin-wide phosphorus reduction targets) and one that evaluates alternative practices based on what is implemented in current management practices (developed working with AAFM). These have mostly been available, although there have been periods where the optimization has been offline. These algorithms had been developed outside of AAFM's scope of work, so it has mostly been left to Stone Environmental to keep those features working.

Other updates to Farm-PREP have affected the optimization assessments, such as adding pasture management and changing the original concept of what was the baseline. Ultimately, there are limitations on what Stone Environmental can continue to support and keep running without specific funding. It is for this reason that the algorithm has not been prioritized over the last couple years. Nevertheless, Stone Environmental is currently updating the optimization assessments (and will utilize the alternative practice assessments) as part of an ongoing LCBP project that will incorporate soil health metrics into Farm-PREP.<sup>62</sup>

- R2.4. Incorporate manure tool into Farm-PREP.** Results could then be shown to farmers both in terms of their metrics (e.g., gallons applied) and in units used by Farm-PREP (e.g., P<sub>2</sub>O<sub>5</sub> applied).
- R2.5. Farm-PREP results highlight the explanatory positive and negative factors of fields' performance.**
- R2.6. Do not model P loss performance over a 30-year simulation period** but continue using average weather conditions over the preceding 10-year period.

In VPFP, the model simulation time-period is 30 years to account for long-term management decisions (e.g. crop rotations), long-term effects of management on nutrient cycles (e.g. soil P saturation), and variation in weather (precipitation and temperature). The longer simulation period of 30-years was chosen in part to ensure a couple cycles of crop rotations, e.g. typical crop rotations are 10 years (4 corn-6 hay), so modeled 3 times within 30-year simulation period. Because of this, it would be more accurate to say that VPFP is paying farmers “today” for the long-term impacts of their actual and planned practices extrapolated into the future, and less accurate to say that it is paying them for what their *current* contributions to P loss mitigation would be if weather conditions were “average.”

We suggest that the P loss information might be more salient for farmers if instead it focused on each field's modeled performance for the current year (albeit under “smoothed” or average weather conditions from a 10-year look-back). Focusing on the current year assumes the loss of other valuable inputs into the model like crop rotations and the nutrient dynamics associated with them, which we address in R2.9. In addition, aberrant weather conditions or other unforeseen circumstances might force a farmer to deviate from their conservation plans. Using the 30-year simulation, especially if it includes a crop rotation, would mitigate the effect of these deviations on the annual payment. (AAFPM has stated that these deviations are rare and typically only affect specific fields or limited acreage for a single season.)

However, we believe the benefit in terms of interpretability of results by farmers and TA providers and the cogency of compensating farmers for the positive externalities they are *currently* generating through their conservation outweighs the losses described above.

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<sup>62</sup> Source: Stone Environmental, personal communication to evaluators.

This alternative would need to be explored further to understand its full implications since payments might be expected to look totally different.

**R2.7. Do not use crop rotations in calculating P loss outcomes.** There are very good arguments for *including* crop rotations in the calculation of average P losses. Principally, including crop rotations allows for a more accurate estimation of properties that are not directly observed through current testing protocols: the amount of P accumulating at the soil surface and especially vulnerable to P loss through runoff (in the case of surface applications of manure in no-till or hay systems) and the impact of crop rotations on impact on soil structure. If fields are instead modeled as continuous hay or continuous corn, the model will not accurately predict these two attributes.

Furthermore (and for these reasons), crop rotations are an effective conservation practice that Vermont farms frequently use as part of their erosion management toolkit and are encouraged to adopt further. If VPFP's objective is incentivizing the practices that improve P loss performance, then it would make sense that crop rotations are part of the data framework that generates the performance metric.

"If we were going to model crop/hay in the baseline, and tell farms it was a good conservation practice, we wanted to be able to give farms credit for it in VPFP," program staff involved with the design of the program explained. "We knew that the non-current management data would have to be an estimate and that introduced some potential for error, but we thought that was worth it to give a better picture of long-term management." AAFM staff believe that a well-designed farm-wide crop rotation may reduce net farm-wide phosphorus losses compared to treating each field as continuous corn or continuous hay.

This recommendation would need to be taken in tandem with other recommendations on this list to be a workable alternative.

Removing crop rotations could alleviate some of the data burden associated with Farm-PREP data entry and evades the mixture of "actual" values (what a farmer did on their fields in the current season) and "planned" values (what a farmer will do when the rotation turns to the other crop) in calculating the farm's performance. A "look-back" of previous field management (i.e., "Has this field been in a crop rotation, and what is the ratio of years between the two crops?") might be sufficient for modeling things like surface P accumulation and soil structure.

If necessary, but not recommended here, soil health testing (which could include aggregate stability and/or bulk density as indicators of soil structure) could also be incorporated. Unlike P loss, it is more economically feasible to directly measure certain soil health properties (not already covered by a basic soil test), UVM is now equipped with a Soil Health Research and Extension Center, and farmers seem genuinely interested in this information. Conducting this testing across all fields (even if just once every three years) would create new burdens for VPFPP participation. On the other hand, it would provide valuable data for soil health researchers.

**R2.8. Generate a “status quo” baseline for each farm at enrollment** (and make planned improvements at enrollment more explicit). As part of the application process, collect an actual assessment on the ‘status quo’ of the farm operation from the year immediately prior to enrollment (or an average of the last 2-3 years if the previous year is considered abnormal (heavier lift on the data side). This assessment represents what the farm was doing *prior to* Year 1 in the program. In contrast to the HBMA baseline, it might be easier for farmers to conceptualize potential improvements to performance by referring to this baseline and that understanding might translate into more engagement with the information provided. On-farm changes can take several years to implement (as planned) and using the enrollment baseline could be integral to a process of medium- and long-term learning by farmers (i.e., evaluating what seems to work and what they can maintain even beyond the duration of their VPFPP contract). For this reason, we also recommend that planned improvements over the course of enrollment be made explicit and documented (as the planned assessment) and then requiring that farmers reflect on those planned improvements in their exit survey (when the current period of enrollment ends). This practice, of co-planning with the TA provider, centers the utilization of the Farm-PREP results in conservation planning and, from a program evaluation, clarifies (somewhat) how this innovation is implicated in behavior change under VPFPP. Year 1 actual assessments might be used as a substitute for this “enrollment baseline” (especially if the process of creating an enrollment baseline proves too burdensome), but there might be similar reasons for why Year 1 is not a good representation of the farm’s “status quo” practices (e.g., aberrant weather) and in this case farmers would be not able to receive a premium payment for marginal improvements that they make to performance in Year 1 of the program.

**R2.9. Do not use the performance threshold to communicate performance to farmers or to calculate their VPFPP payments.** AAFM set up the performance threshold in order to isolate the additional contributions of VPFPP farmers to reducing P losses that went above and beyond what they would achieve through complying with the RAPs and participating in practice-based programs. It is commendable that AAFM wanted to reduce redundancy in financial assistance for farmer conservation and mitigate the risk of adding a performance-based program to the menu of assistance options available to Vermont farmers. However, this attempt has led to a payment structure that is too elaborate and does not clarify how farmer performance can be attributed to VPFPP participation. The cost of including the payment threshold is that performance cannot be described simply as how much P loss performance improves when conservation practices are implemented, but instead requires farmers and others to do an additional conversion to arrive at additional P loss performance (as defined by AAFM).

As discussed in the evaluation (Section 5), it is difficult, in general, to demonstrate that conservation incentives ‘move the needle’ on farmers’ decisions to *maintain* any given conservation practice over the term of their contract (in other words, to prove that if it were not for the payments, farmers would reduce their conservation efforts). That is not to say that incentives do not aid in the upkeep of these practices: our interviewees were clear that it reinforces them. But chasing that proof (or setting thresholds as a substitute for it) might be more trouble than it is worth, and doing so tends to overcomplicate program design and interferes with the communicability of results. We recommend communicating to farmers simply the total P reductions from baseline without referencing the performance threshold and calculating the P reduction payment from the total pounds of P loss reduction from baseline (adjusting the payment rate to account for the change in this value).

**R2.10. Enhance coordination of VPFPP with practice-based programs.** AAFM is already considering restrictions that limit dual (or simultaneous) enrollment in VPFPP 2.0. and a practice-based program. Depending on how these restrictions are standardized, farmers with existing contracts in practice-based programs might have to wait to enroll in VPFPP until those contracts were completed, assuming the VPFPP is accepting new applications at that time. Likewise, farms that need to make considerable improvements to surpass the VPFPP threshold for incentives might find that the VPFPP payment, on its own, is insufficient to take on new practice costs and risks. In this scenario, AAFM would need to clarify when a farm is a better candidate for a practice-based program or for VPFPP and which types of programs (e.g., CREP) or practice-based contracts (e.g., fencing installation) might be exempt from these restrictions. If they recommend that farms requiring considerable improvements first take advantage of practice-based programs prior to taking advantage of VPFPP payments, it reinforces the position that VPFPP is primarily a program for farms “with,” as is currently the case. Any marginal improvement that a farmer takes on voluntarily is rewarded through either the bulk P loss reduction payment (the one based on the threshold) or a new bonus payment specifically for improvements made during enrollment.

There is another option, however, that could integrate the two programs: instead of offering a separate (bonus) payment within VPFPP to reward farmers for improvements in performance made while enrolled (i.e., behavior change), the initial planned assessment at enrollment (i.e., the process of analyzing improvements that a farm *could* make while enrolled in VPFPP) could be leveraged to facilitate (and potentially fast-track) a farm’s application for financial assistance for practice-based or capital equipment cost offsets through different state and federally administered programs. Farmers continue to earn their P loss reduction payment, but another clear benefit (and incentive for applying to VPFPP) is the push it gives to their applications to *complementary* programming.

**R2.11. Change payment structure to incentivize behavior change but continue to reward pre-existing performance.** We heard from TA providers that farmers find the TMDL baseline confusing and that it does not act as a salient reference point for motivating behavior change. On the other hand, this data is very useful to the State of Vermont for demonstrating progress on addressing non-point source agricultural pollution. We recommend that AAFM continue to use the TMDL baseline to prioritize farmer applications to VPFPP: those farmers currently achieving substantive P loss reductions from the TMDL baseline or who propose bringing their performance above the 40% threshold during their prospective period of VPFPP enrollment should be considered stronger candidates.

We recommend paying VPFPP enrollees according to metrics that are more intuitive for farmers and are potentially more salient for motivating behavior change. We provide some ideas below. Table 6.1 considers how these payments might be appreciated by farmers in different circumstances.

- 1) **Keep the stewardship payment, but change how it is calculated.** Calculate the stewardship payment as the sum of incentives for high-performing fields, rather than the average across all the farm fields. Yes, the concept of VPFPP emphasizes “whole farm” performance, but averaging across all fields might mystify the contribution of any one field to a farmer’s stewardship payment, whereas summing the incentives from all high-performing fields might offer a more concrete carrot for a farmer to bring specific fields into one of the two stewardship categories. Obviously, improving performance of all fields in this way is not feasible, but the graph is intended to visualize the extent of payment improvements possible under this transition. We believe the benefit of this change in terms of clarity outweighs what is lost in the “holism” that the current calculation references. Ideally, the payment rate for performance improvements during VPFPP participation should be paid at a higher rate than the rate paid for P loss reductions from the HBMA baseline that had already been achieved prior to enrollment. This payment might favor farms whose land might allow them to achieve naturally low P loss rates with less effort, but this could be balanced by the other recommended payments.

- 2) **Create a separate “improvement” payment at a higher rate for performance improvements generated over the course of VFPF participation.** This emphasizes the co-planning component of VFPF: a farmer assesses their “status quo” baseline performance at enrollment (see R2.6 above) and makes an explicit plan to improve performance over the course of their enrollment. Given that this payment is incentivizing farmers to do something new to enhance performance, the rate per pound of new P loss reduced should be higher than the rate for pounds of P loss reduced through their pre-existing approach. This payment will favor farmers who have lower performance at enrollment and practical opportunities to improve performance. An alternative or complement to this would be to use VFPF to improve farmers’ chances of enrollment into AAFM practice-based programs to support the practice changes in their planned assessment (see R2.11).
- 3) **Keep the P loss reduction payment but change how it is calculated and lower the payment rate.** This allows VFPF to recognize the downstream benefits provided by farmers who *are* providing positive externalities, but who might either not be able to make significant marginal improvements over their ‘enrollment’ baseline (like farmers who have already transitioned to grass-based production systems) or who might not be able to attain the higher levels stewardship payments (for low average per-acre P losses) due to the biophysical nature of their farmland.

*Change how the reduction payment is calculated*

If possible, the performance metric on which this payment is based should be calculated as the total P loss reduction from baseline, and not the total P loss reduction over the performance threshold (see R2.9). (Alongside this proposal, we recommend that the rate be reduced to account for the increase in this value.)

If including an additional incentive for performance improvements generated during VFPF participation (Payment #2 above), those “new” pounds of reduced P loss should be subtracted before calculating this payment (Payment #3).

We also suggest some minor simplifications on how the P loss reductions from baseline is calculated as a departure from using the HBMA practice scenarios (although the results might be similar), reaching for a simpler way to communicate to farmers ‘this is what your performance would be without your current conservation practices’ rather than ‘this is how your performance improved as compared to these assumptions about how your fields might have been managed over a decade ago’. Again, while these changes might not be significantly different from the HBMA practice scenarios, they might provide a clearer understanding of what the outcomes mean.

Here, we provide a few examples of how the baseline scenario might be structured:

- 1) the cropping system defaults to either continuous corn silage, continuous hay, or pasture (but not to a corn silage-hay rotation);
- 2) tillage practices would revert to either reduced or conventional/reduced depending on the soil drainage class (as they currently do);
- 3) manure injection or incorporation revert to surface applications;
- 4) P<sub>2</sub>O<sub>5</sub> rates take the default recommended rate from the NMP (i.e., farms that underapply as compared to the recommended or “max”<sup>63</sup> value from their NMP get a credit; overapplying per this reference point lowers their score);
- 5) the field buffer (if proximate to water) reverts to a 25-foot width;
- 6) rotational management grazing reverts to continual grazing (only when baseline land use is also pasture)

Once again, this is not far from what Farm-PREP already does, but it includes some simplifications. The baseline would not include any of the conservation practices (except in the case of reduced tillage): for instance, we would not include cover cropping in well-drained soils in this baseline and or a corn-hay rotation as a baseline cropping system. This baseline would not be intended as representative of a “business-as-usual”, or what is currently being practiced as by most farms. It is simply how the field would perform with the conservation practices removed.

For the State’s purposes of tracking progress toward the TMDLs, the baseline HBMA scenarios could be retained in Farm-PREP, but we would recommend not involving them in the farmer-facing side of the program.

**Table 6.1.** Extent to which each type of incentive might satisfy VFPF participants according to the ability to improve their conservation practices and the inherent P loss dynamics (represented by per-acre P losses at HBMA baseline)

<i>Incentives in payment structure</i>	<i>Farm can improve performance considerably</i>		<i>Farm can only improve performance marginally</i>		<i>Supports additional progress toward the TMDLs</i>
	<i>Low baseline P loss</i>	<i>High baseline P loss</i>	<i>Low baseline P loss</i>	<i>High baseline P loss</i>	
Incentive based around performance improvements generated during VFPF enrollment	<b>Medium</b>	<b>High</b>	<b>Low</b>	<b>Low</b>	<b>High</b>
Incentive based around <i>the sum of</i> stewardship payments from fields with low per-acre P losses	<b>High</b>	<b>Medium</b>	<b>High</b>	<b>Medium</b>	<b>Medium</b>
Incentive based around the impact of <i>maintained</i> practices on P losses from the HBMA baseline	<b>Low</b>	<b>Medium</b>	<b>Medium</b>	<b>High</b>	<b>Low</b>

<sup>63</sup> Per AAFM, some TSPs write “max” NMPs that describe the worst possible way that a farm could manage their land and still meet regulations.

**R2.12. Facilitate co-learning among VPFP farmers:** In surveys and interviews farmers expressed a desire to learn from successful VPFP farmers about best practices and challenges related to maximizing payments through conservation practice implementation.

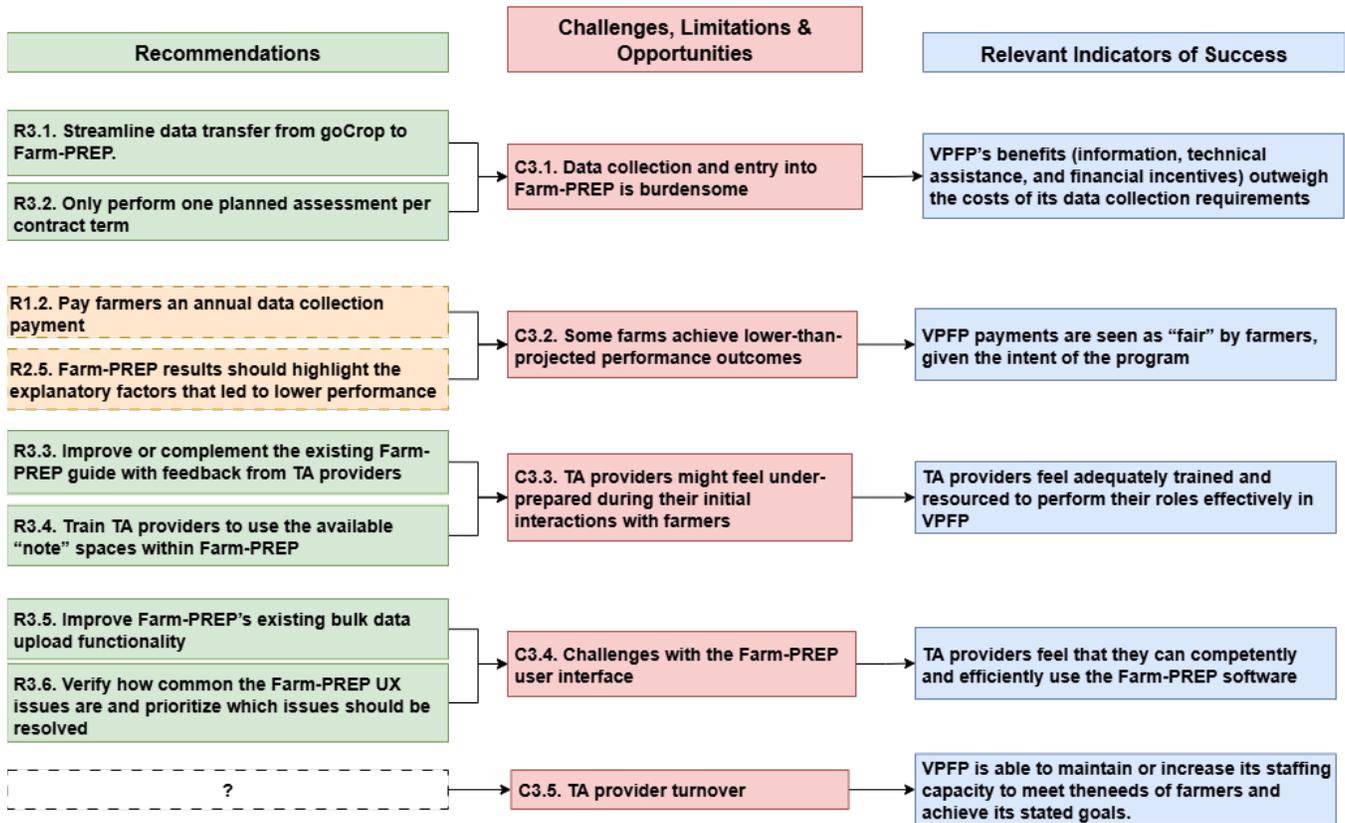
- 1) Create a series of short videos highlighting some of the farmers who have either been early adopters of conservation practices or who are trying out at practice that is still quite new in Vermont. The method used by the Washington Soil Health Initiative to highlight soil health ambassadors could serve as an example.<sup>64</sup> These farmers would exemplify the identity of the VPFP cohort and potentially raise the status of the program, although AAFM should consult with public communications experts to judge how likely it is that other VPFP farmers would watch (and appreciate) these videos. Social media might be an effective way to reach other Vermont farmers, as well.
- 2) Similarly, work with VPFP farmers who might be interested in telling their own story and who might even be willing to share some of their performance data. If presenting some data (on farm performance or economics), it might be preferable to present these ‘case studies’ as text in annual newsletters.
- 3) Take advantage of other convenings/conferences and farmer organization meetings commonly attended by VPFP farmers to hold focus groups that invite farmers to talk openly about their progress in (or frustrations with) the program and to think collectively about how they might be resolved. This is also achieved to a certain degree at the Stakeholder Advisory Group meetings, but these additional focus groups might allow the conversation to be more organic.

**R2.13. Coordinate with other external stakeholders** like private crop consultants and custom operators to facilitate farmer conservation plans and performance improvements. The information from Farm-PREP and the co-planning with technical assistance can inform decisions that are also being informed by other stakeholders who interact with farmers. Sometimes private technical service providers might more directly support a farmers’ VPFP participation with farm data provision (like soil test results or even entering data into Farm-PREP). Custom operators have supported the implementation of planned practices under VPFP and as farmers demand more of these practices (e.g., manure injection or cover crop sowing), they might rely more and more on these actors to achieve this. It was not within the scope of this evaluation to interact with these types of stakeholders. We *do* wonder if it would be helpful for AAFM to consult with these actors, either one-on-one or in focus groups, to understand their perspectives on the program and where their goals (e.g., farm profitability, corn silage plant health and productivity, or expanding their manure injection business) align with VPFP goals (e.g., conservation for P loss reductions). This also ties into a larger theme (although not explicit in the VPFP 2.0. goals) of coalition-building among stakeholders to find a common path to achieving the TMDLs.

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<sup>64</sup> See: <https://washingtonsoilhealthinitiative.com/soil-health-ambassadors/>.

## Goal 3. Participant satisfaction



## Strengths

1. Payments for data entry in the first year were widely lauded as a strength of VFPF pilot.
2. Farmers reported positive relationships with TA providers.
3. Farmers reported satisfaction with payment rates for P loss reductions and data entry.
4. 80% of surveyed farmers indicated they would reenroll in future iterations of VFPF.

## Challenges, Limitations, and Opportunities

**C3.1 Data collection and entry into Farm-PREP is burdensome.** With Farm-PREP, AAFM has tried to balance the demand for accurate P loss predictions that account for the details of field management and relevant land and climate conditions the impact P transport with the demand for conservation programs that do not create additional burdens for farmers and service providers. While the dataset generated by VFPF is clearly useful to the State of Vermont and the data collected is necessary for producing the performance metric on which VFPF hinges, collecting farm data and inputting data into Farm-PREP can be an exceedingly tedious process.

We've outlined some of the issues that seem to make data collection and entry into Farm-PREP more burdensome than necessary, but chief among them is the need to enter many of the same data into goCrop and Farm-PREP manually rather than being able to share data from one app to the other.

- C3.2 Some farms achieve lower-than-projected performance outcomes.** In a few cases, farmers' actual performance fell below their projected performance, and naturally this produced some frustration. Sometimes conditions outside of farmers' control (e.g., weather conditions) force them to make small changes to their plans, but the pilot has shown that some of these changes can result in a disappointing decrease in projected performance. As this is a performance-based program, it might be tempting to dismiss this frustration: if the goal is performance and if the farmer is not performing, why should they get paid? We present this theme as a good example of where it is useful to think of 'challenges' as issues that the program has run into (and might run into again), and not strictly as shortcomings in program design or administration. For us, the frustration seems to stem from the difficulty of understanding why their performance would have dropped *so much* below the projected value. To their minds, the deviations from the planned practices might be minimal and they are surprised to find that their P loss outcomes shift so dramatically in response. In addition, TA providers might feel that they are at a loss to provide them with satisfying answers if they (the TA providers) find it difficult to interpret the explanatory factors behind the results or to explain just how sensitive the model might be to any one change. This is one reason (but not the only one) that we proposed providing farmers with an annual data entry payment: farmers are currently participating in a program that is still in its pilot phase *and* providing data that is of value to the state. They are being asked to put a good deal of faith into the model predicting P loss outcomes accurately – a model that is enigmatic to anyone but its developers and whose results cannot be easily corroborated. Such a payment might mollify frustrations (in a limited way) that arise from underperformance.
- C3.3 TA providers might feel under-prepared during their initial interactions with farmers.** While this might be expected for a TA provider within any program (and especially for one as detail-oriented as VPPF), TA providers were able to articulate some ways in which onboarding might be improved as well as specific resources that would make their job easier.
- C3.4 Challenges with the Farm-PREP user interface.** There are also ways in which the user interface of Farm-PREP undermines the ease with which field data is input. These issues or request include the following:
- 1) TA providers noted that Farm-PREP might not notify them if the bulk data upload fails. In certain cases, user might assume data has been imported when it hasn't.
  - 2) The Farm-PREP sign-in page does not currently provide messages when the wrong credentials are used, a "forgot password" functionality, and possible other upgrades for security such as 2-factor authentication.
  - 3) Two TA providers suggested that occasionally a farm will cut a field for hay only once in the season, but that option (single cutting) is not currently available.

- 4) One user described long processing times for saving in Farm-PREP.
- 5) A request to save assessment results with custom names within Farm-PREP in order to manage adjustments that they make to data entry or scenario modifications. To control different versions of these, TA provider currently need to download the assessment each time.
- 6) A request for a change-log that allow users to view when specific datapoints were edited and by whom.
- 7) In the cover crop interface, inserting some options limits other options (in dropdown menus), and users have to use “clear all” to get their options back, clearing info they shouldn’t have had to clear. Putting the dropdowns back to a default selection should be sufficient.
- 8) Some data entry fields accept 1 decimal place when typing, but 3 decimal places when uploading from a CSV.
- 9) A request for auto-save functionality within Farm-PREP.

**C3.5 TA provider turnover.** TA provider turnover in the pilot program generated a challenge in the sense that farmers occasionally had to work with new TA providers with less experience with Farm-PREP (even though these providers were quickly trying to get up to speed). In some cases, farmers had become accustomed to a TA provider who seemed to understand their operation well and then have that relationship (and rapport) disrupted. The root causes of TA provider turnover do not necessarily lie with the program design or management, but if TA provider turnover is expected to be a risk for VPF 2.0, then strategies to mitigate these shifts should be articulated. In the end, the objective is that, even if TA providers need to be changed midstream, that transition is as seamless as possible.

## Recommendations

**R3.1 Streamline data transfer from goCrop to Farm-PREP.** Barring a more elegant solution, goCrop should be able to produce an export that can be imported into Farm-PREP, although we expect this might be easier said than done. Other colleagues at UVM are asking about the ability to get a .csv export from goCrop. We have heard this functionality was built into goCrop but might not be currently accessible in the live version of the app. Stone Environmental has indicated that they would be more than happy to develop this functionality of Farm-PREP.

**R3.2. Only perform one planned assessment per contract term.** One of the original purposes of the Farm-PREP ‘Planned Assessment’ was to support the selection of farms for the program and VPFP program budgeting. With a Planned Assessment for each farm, VPFP can see whether a farm is likely to receive payment in VPFP, allowing them to judge whether a farm would be a good fit for the program. It also allows them to estimate how much each of the applicants would be paid over the term of their contract, so that they could decide how many farms to they can afford to admit<sup>65</sup>.

Beyond the administrative purposes of the planned assessment, it was also expected that the planning phase would allow farmers and TA providers to play around with the “what if” scenarios and set an intention for the year that might be different (better, hopefully) than the year before.

We agree that the planned assessment prior to VPFP enrollment is essential for this program both for administrative reasons but also for the general expectations of what this program is about. In fact, we believe the planned assessment could be an excellent way to document that a) the farmer and TA provider have reviewed the Farm-PREP estimates of P loss performance at the enrollment baseline – what the farm was doing prior to applying to VPFP – and b) they have identified improvements that the farm can (and is willing to) make to their field management over the course of their VPFP contract term. The planned assessment shows the farmer the projected impact of those improvements (over the enrollment baseline) and incentivizes behavior change. All this work occurs as the first phase of VPFP and is compensated through the data entry payment.

However, we are less convinced that it is necessary to revisit the Planned Assessment in subsequent years, and if removing this requirement would reduce the data burden of VPFP on TA providers and is an allowable change<sup>66</sup>, than we would recommend it. TA providers should still be expected to discuss how farms’ annual performance compares to projected performance under the planned assessment, or they might find value in continuing to explore alternative practice scenarios for specific fields even after enrollment. We would also suggest that referring to the original planned assessment in a program exit interview with farmers (after the term of the contract) could provide valuable, qualitative reflections on their ability to commit to planned practice changes.

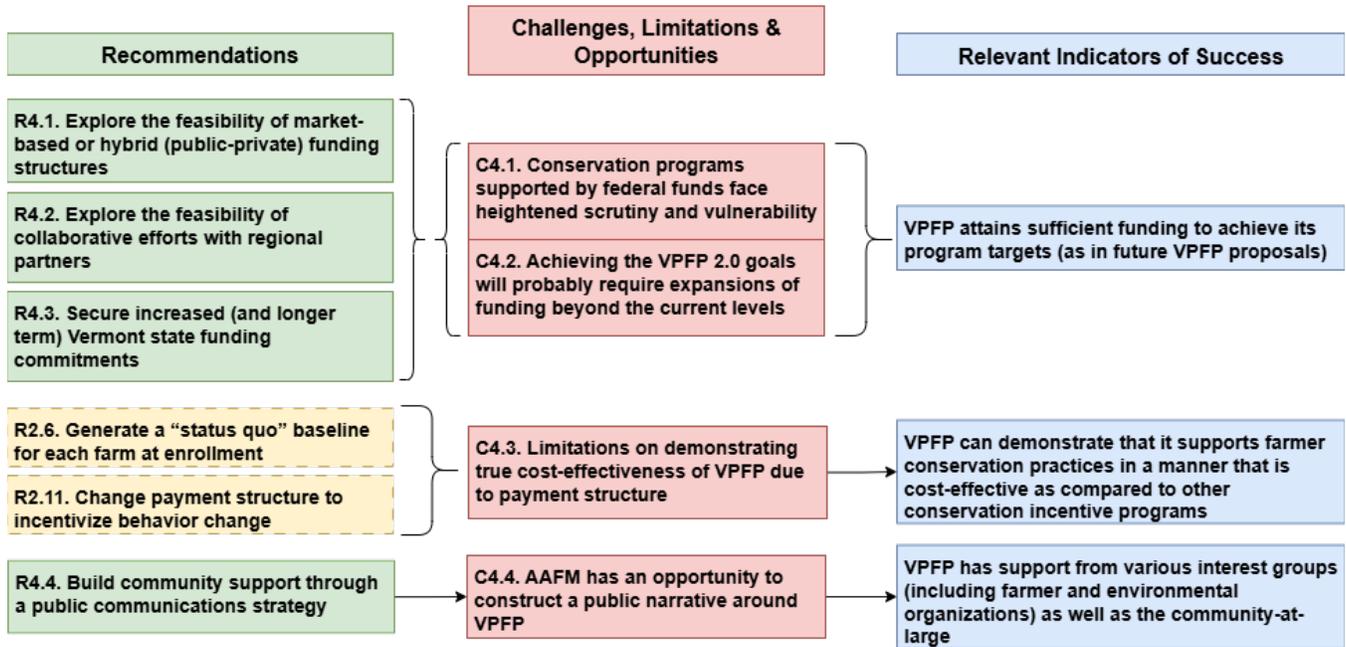
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<sup>65</sup> VPFP adds a buffer (or extra percentage of money) for each farm to account for potential improvements to performance that are not foreseen by the original planned assessment.

<sup>66</sup> Funders’ policies and expectations around conservation planning may require planned assessments to be an annual requirement.

- R3.3. Improve or complement the existing Farm-PREP guide with feedback from TA providers.** TA providers seemed to want an index of common Farm-PREP tasks and how to complete them in a step-by-step fashion. We believe this is the intention of the Farm-PREP guide, but there might be improvements to how these tasks are indexed within the guide so that TA providers can quickly find them. Short video tutorials on some tasks (posted on YouTube and hyperlinked from the guide) might be helpful in some cases. We will provide a short list of those steps mentioned in the interviews. AAFM could mockup an index or a few of these video tutorials, show them to TA providers, and then ask for feedback on a more comprehensive list of needs in this area.
- R3.4. Train TA providers to use the available “note” spaces within Farm-PREP** to clarify “work-arounds” made regarding data for certain fields (and add additional ‘note’ spaces where relevant). In some cases, TA providers might try to use “work-arounds” during data entry that they feel better reflect the reality of a farmers’ practices, which cannot be entered in a straightforward or intuitive way in Farm-PREP. For example, a TA provider might describe their decision to draw a field in a specific way. This will help other providers understand modeling decisions in the future. Some providers requested additional note spaces in other data entry areas.
- R3.5. Improve Farm-PREP’s existing bulk data upload functionality,** using goCrop’s upload feature as a model. TA providers asked if Farm-PREP could offer better options for reviewing bulk data uploads prior to formally importing them into the assessment. This intermediary step could flag potential errors (including mismatches in field names and values outside of normal ranges) and these could be double-checked by TA providers in the original dataset. This step should also remove default-zeros from the excel tools so that it does not overwrite them on top of previously entered data. TA providers mentioned that goCrop has such an intermediary step that allows you to ensure that all the data has been mapped correctly before importing.
- R3.6. Verify how common the Farm-PREP User Experience issues (described above) are and prioritize which issues should be resolved** for VPF 2.0. Some issues might be location-specific (e.g., long processing times due to localized internet issues).

## Goal 4. Sustainable Program



### Strength(s)

1. AAFM is starting off strong by incorporating sustainable funding into its goals for VPFP 2.0. With increasing uncertainty in the federal funding landscape there will certainly be a need for alternative models to ensure funding is durable.
2. A strength of VPFP 1.0 was the high degree of support that was given to TA providers through AAFM Water Quality Division staff. TA provider buy-in is necessary for sustainable program staffing.

### Challenges, Limitations or Opportunities

- C4.1. Conservation programs supported by federal funds face heightened scrutiny and vulnerability.** Future iterations of VPFP could diversify funding sources away from federal funds.
- C4.2. Achieving the VPFP 2.0 goals will probably require expansions of funding beyond the current levels.** To expand the VPFP dataset, reach more farmers (and sustain them for a full four years of participation), and still welcome back farmers from the current cohort in the pilot program (as we suggest above), it will probably be necessary to increase the amount of funding that VPFP has to work worth.

- C4.3. Limitations on demonstrating true cost-effectiveness of VPFPP due to payment structure.** A strong argument for sustaining VPFPP would be that it achieves significant environmental outcomes at a lower cost than previous conservation incentive approaches. However, as mentioned above, farmers might be receiving conservation incentives from both a practice-based program and VPFPP. This might not be perceived as a problem on its own, but if unresolved, it does complicate the extent to which *the cost-effectiveness and added value of VPFPP can be evaluated and reasonably defended*. In cases where farmers received financial assistance from both VPFPP and practice-based programs, the calculation of cost-effectiveness should be different with total reductions from baseline as the denominator and all financial assistance received by the farmer for fields practices should be in the numerator. AAFM might argue that they evade the need to include practice-based program incentives in this calculation because of how they are calculating additionality, but we still see this attribution of performance to payment as too tenuous to be treated as a concrete right on investment.
- C4.4. AAFM has an opportunity to construct a public narrative around VPFPP.** Many Vermont voters (not to mention other Vermont farmers) might still be unaware of the existence of VPFPP, what it is all about and what it means for them, and why they should support its survival. AAFM can take a proactive role in generating that public narrative through a public communications strategy in collaboration with UVM colleagues.

## Recommendations

- R4.1. Explore the feasibility of market-based or hybrid (public-private) funding structures.** The Program Innovations subsection in the PES Landscape (Section 4) details the market-based funding structure used by PLUS-UP. Assessing whether such funding models would work in the Vermont context was beyond the scope of the current evaluation. If interested, AAFM could collaborate with UVM to conduct a feasibility analysis of this sort of model. Additional organizations like Nature Conservancy with influence over prospective private “payers” might be willing to broker relationships with these parties to secure investments in VPFPP.
- R4.2. Explore the feasibility of collaborative efforts with regional partners.** Excess phosphorus loading to the Lake Champlain watershed has a wide geographic impact beyond the state of Vermont. AAFM could probe for interest among New York State and Quebec Province government counterparts to judge whether VPFPP could be expanded to a regional scale (and whether this expansion would tap larger and more sustainable funding sources).
- R4.3. Secure increased (and longer term) Vermont state funding commitments.** Leverage the data generated from VPFPP to improve the political backing from key stakeholders of the program approach and utilize that leverage to increase state funding commitments for the program.

**R4.4. Build community support through a public communications strategy.** With experience from the pilot phase of VPFP (and extensive data), AAFM along with their collaborators should begin to generate public communications materials designed to reach and inform a broad audience of other farmers, interest groups and the community-at-large on what VPFP and participating farmers have achieved in the last few years under this program. This information could be made accessible through poster or signage in the public domain with strategically placed QR codes (for instance, on a sign by the door of a farm office or at signs by public beaches – as just two examples) and attractively prepared. Support from public communications experts and UVM collaborators encouraged.

## 7. Big Picture Recommendations and Key Takeaways

Through this evaluation the UVM evaluation team has learned much about VPFP strengths, challenges, and successes. While this section has laid out an extensive set of recommendations, here we provide some big picture observations and considerations, which if taken up, could address many of the existing and anticipated challenges of VPFP.

### *Multiple program objectives create more complexity than necessary*

VPFP integrates several program objectives into its program theory (i.e., why the program should exist and what it should achieve), and the main goal is hard to decipher. The fact that there might be trade-offs in terms of achieving multiple objectives is not, on its own, problematic and there may be an optimal balance between supporting substantial P loss reductions while also seeking the participation of a sizeable cohort of Vermont farmers. Balancing multiple objectives are one of the ways that a program like VPFP establishes its legitimacy among a diverse group of stakeholders.

However, stretching the program to achieve several objectives can over-extend or over-complicate it, as in the case of demonstrating progress towards the TMDLs while also incentivizing farmers' to refine their conservation practices. The HBMA baseline, 40% performance threshold and 30-year model simulation period might be useful references when reporting on how the performance of VPFP farmers relates to the goals of reaching the TMDLs for the Lake Champlain Basin, but when they are baked into the information that farmers receive on their actual (current) performance (and the calculation of their annual payments), they seem to mystify those outcomes for farmers rather than clarify them. More straightforward or intuitive information (i.e., how much P loss is avoided through farmers' conservation practices (each year) as compared to what would happen in the absence of those practices) and payments tied to this simpler baseline and to "new" pounds of P loss reduced (compared to a farm's own pre-enrollment performance) may be more effective at motivating farmers to refine their practices.

While VPFP is not designed to address farm viability per se, the reality of farmers being pressured by low revenues and high production costs seep into discussions about how well the program is doing. When TA providers mention the high costs of conservation practices and how VPFP payments are inadequate in the face of these costs, we might question how much conservation costs are conflated with increasing costs to operate a farm in general. While VPFP payments should be fair, we would caution against extending the definition of fairness (often in unintentionally) to the notion that VPFP should compensate for other shortcomings of Vermont's agricultural economy (e.g., inadequate market prices for products). It should not be solely on the shoulders of VPFP, for instance, to make a grass-based business model work in the context of low market prices for forage and milk.

Without a primary goal for VPFP, evaluators of the program are forced to hypothesize how one goal is weighted against another, complicating the assessment of success.

**Recommendation:** Decide on a main goal that can be communicated to all stakeholders and orient the program design to that goal. The goal could be reducing phosphorus loss from farms in a cost-effective manner. Or rewarding higher-performing farms (or supporting farmers writ large). Or educating and incentivizing farmers to undertake conservation practices. When the primary goal of the program is clearly stated then challenges can be anticipated, further research can be prioritized, and all other considerations be made subordinate. Clear goals will make it easier to track progress and evaluate success.

### *Narrow farm enrollment limits VPFP's role in behavior change and progress toward the TMDLs*

The theory of how VPFP influences farming practices is currently limited to the small subset of farmers receiving payments for their contributions, and the degree to which VPFP influences (or will influence) behavior beyond that group is limited.

AAFM is already thinking about how to extend VPFP 2.0 to more farmers, and whether new applicants or current VPFP participants (or neither) should have an advantage for enrollment in the next round of funding. One option would be to acknowledge the willingness of current VPFP participants to join an experimental performance-based program still ironing out some kinks by allowing them to re-enroll in the second round of VPFP funding. AAFM is already considering whether to increase expectations of returning participants (like showing a certain amount of performance improvement in their next planned assessment). The remaining capacity, especially if funding expands, could be filled with new applicants. After VPFP 2.0, AAFM could make it a rule that VPFP participants must wait four years before re-applying and re-enrolling in VPFP. This would allow more farmers to cycle into the program.

It would also partially answer the larger question of how VPFP relates to the many other farmers who do not participate in the program. If a farmer might have an opportunity to enroll in VPFP, they might try to improve their practices in the short-term to improve their chances of getting into VPFP in the medium term (and to secure a reasonable payment once they get there). Restricting farms from participating in VPFP in consecutive funding cycles could increase the opportunities for farms with less extensive conservation histories to access the program.

**Recommendation:** AAFM should be explicit about the possible links of VPFP to the broader farming community, some of whom might be characterized as “indirect” beneficiaries. These farms do not participate in VPFP, but a neighboring farm does and there are spillover effects in terms of how the neighboring farm models practices and outcomes or shares knowledge that prompt the non-VPFP farmer to adopt similar conservation practices without ever receiving a payment from VPFP. If VPFP develops a clear theory of change, the program could track the impact of the program as it spills over into more widespread farmer behavior change.

### *Performance-based program effectiveness depends on a reliable model*

It is important to be clear that VPFP, while not a practice-based program, is also not strictly a performance-based program; the current version of the program remains somewhere in-between the two. VPFP is based on a model that has, across stakeholders, been considered a ‘black box’ without a clear validation of the outcomes (i.e. comparing model outputs with actual measurements of P reductions), and therefore not strictly performance-based. If the model, through extensive validation, were to be able predict with high accuracy P loss reductions, then the program could be considered performance-based, however there is not sufficient evidence to support this as yet.

Farmer’s practices have improved during the VPFP pilot phase. This is a great result, although it is hard to prove additionality precipitated by the program, another indicator of program effectiveness. There is qualitative evidence of additionality, but more robust analysis is needed that would stem from measured on-farm baselines and validated model outputs.

**Recommendation:** The Farm-PREP model needs to be better communicated, improved for ease of use and understanding, and transparently validated. This would be critical to overcome the critique of VPFP not being truly performance-based and overcome the reported lack of comprehensibility and trust in the model.

### *Use of “whole farm” terminology and operationalizing the concept*

Here we focus on one key design component of VPFP, which is that it accounts for all agricultural fields on a participating farm. In contrast, practice-based programs tend to incentivize conservation on only those fields selected by a farmer in their application. In extending the scope of participation to all fields (including the high and low performing ones), VPFP increases both the spatial reach and on-farm representativeness of its dataset.

We consider the whole-farm approach to be an advantage of VPFP, although some TA providers have suggested that it would be worth considering flexibility for specific areas of the farm. For example, complications with managing data in VPFP for pastures (outlined below) have led these TA providers to recommend that AAFM allow farmers to opt-out of including these fields as part of their VPFP participation.

Our suggestion (or curiousness) is directed at a different theme, and we are aware that it might be splitting hairs. AAFM is able to explain that the terminology “whole farm” or “holistic” refers strictly to farmers’ agricultural fields and that these spaces are the intended scope of the program. We wonder if external audiences, without the proper context, might mistake this term as referring to something more comprehensive and might take “whole farm” performance to mean the total P losses from the entire footprint of the farm property (or properties) to waterways. Or whether they might take it to mean that VPFP accounts for all actions of the farmer in their efforts to minimize P losses (including through structural improvements to farmsteads and manure storage areas, through conversion of land previously in agricultural production to meadows or forest (like sugarbushes), but also through other landscape improvements that could intervene in P loss pathways like restored or constructed wetlands).

**Recommendation:** We are not suggesting that this was either the original intent of VPFP or even the intent of the future iteration of the program. But the point might be worth raising for the following reasons:

1. If not already done, VPFP might consider whether it is worthwhile to account for scenarios where farmers have converted areas of their farm that were previously (per the HBMA baseline) in agricultural use to other land uses like wetlands, meadows, unmaintained forest, etc. TA providers might already be able to enter uncultivated meadows into the model as unfertilized hay fields as a work-around, although we are not sure if they are instructed to do this as a standard. Our understanding is Farm-PREP might be enhanced to model other types of land uses in the future. Given that on-farm land uses tend to track with soil conditions, we expect the land area that has been transitioned in this way over the past two decades to be minimal.
2. While more complicated, VPFP (in collaboration with Stone Environmental) could consider whether fields hydrologically linked to on-farm wetlands receive some sort of “credit” for the ecosystem services that those wetlands provide (i.e., the attenuation of P flows to open water).

On the other hand, adding these elements into an already complicated model could increase the burdens on farmers and TA providers with only a small impact on payments.

## 7.1. Metrics and Indicators for VPFP 2.0 Goals

As the UVM evaluation team worked through the VPFP assessment project, we noted a lack of proactive monitoring of the program's performance. At a high level, we note that the evaluation of VPFP has occurred in a rather *ex-post facto* way. We consider that, in an ideal world, program evaluation would begin prior to program initiation with a clear framework for how program outputs and objectives will be measured and a plan for collecting the necessary data over the course of the program such that midstream and final evaluations become a straightforward task.

**This culminates in one final, and overarching recommendation for VPFP 2.0:** Identify fundamental indicators of success that drive each goal at the onset of VPFP 2.0. Use these to develop metrics and monitoring systems.

This section reflects the UVM evaluation team's assessment of the fundamental outcomes tied to each goal and highlights key metrics and indicators for each outcome that will allow VPFP 2.0 to demonstrate success. Several indicators appear in multiple goal areas due to the nature of program goals serving to achieve similar and interconnected outcomes. The following indicators and metrics are intended to provide guidance for tracking progress in AAFM's stated goals for VPFP 2.0. The suggested targets are *a starting point* (or a placeholder) for decision-making and can be used to open discussion internally and with stakeholders. In some areas, we noted existing metrics from the Farm-PREP datasets as a reference for these targets.

## Goal 1. Conservation practice tracking

*Description:* Collect, verify and track geospatially mapped data on the implementation of conservation practices on Vermont farms that will support statewide nutrient reduction accounting for Total Maximum Daily Load requirements.

<i>Indicator</i>	<i>Metric or relevant qualitative data</i>	<i>Target</i>	<i>Method of tracking/ Data sources</i>
The state has a dataset that cover a large enough portion of VT farms to make reliable conclusions about Vermont's progress towards the TMDLs through mitigation in the ag sector	Percent of agricultural acreage in Lake Champlain and Lake Memphremagog watersheds participating in VPFPP and providing data to the state	12% <sup>1</sup>	Comparison of VPFPP farm data to USDA NASS data on cropland and pasture acreage per county or to land use maps for each watershed
	Number of farms participating in VPFPP <sup>2</sup>	120	Count of farms participating
	Number of lbs.-P reduced from HBMA baseline	0.90 lbs.-P/acre <sup>4</sup>	Farm-PREP datasets (no change needed)
The VPFPP dataset demonstrates that Vermont farmers are making substantial reductions in P losses as compared to the HBMA baselines <sup>3</sup>	Number of lbs.-P reduced above and beyond the regulatorily required threshold	0.25 lbs.-P/acre <sup>5</sup>	Farm-PREP datasets (no change needed)
	<p><i>Notes.</i></p> <p><sup>1</sup> We calculated that across all counties that currently have VPFPP participants, VPFPP farmers managed 9% of the cropland and pasture acreage. We propose that VPFPP 2.0 could increase this coverage by at least 3 percentage points.</p> <p><sup>2</sup> We have heard that more farmers are interested in the program and at the same time recognize that <i>doubling</i> the number of participants could be a real challenge.</p> <p><sup>3</sup> Although the direct output associated with this goal is the coverage (i.e., size) of the dataset (and the quality of the data), its value can also be compared against the extent to which it helps Vermont make the case that it is making progress on the TMDLs. Since these reductions are not strictly related to behavior change (at least in the present), we have shoe-horned this indicator under this goal.</p> <p><sup>4</sup> Reduction from baseline as 1.16 lbs.-P per-acre for 2022-2024 participation years.</p> <p><sup>5</sup> Reduction from threshold was 0.38 lbs.-P per-acre for 2022-2024 participation years. Bringing on new farms with less extensive conservation histories than the current cohort might be expected to lower these figures in the new iteration of VPFPP, so it might be overambitious to use these current achievements as the targets for the next round.</p>		

## Goal 2. Behavior change

*Description:* Incentivize and encourage Vermont farms to increase engagement with trusted conservation providers, improve compliance with nutrient management planning and reporting requirements, increase whole farm conservation planning, and increase and sustain conservation practice implementation.

<b>Indicator</b>	<b>Metric or relevant qualitative data</b>	<b>Target</b>	<b>Method of tracking/ Data sources</b>
Farmers refine their pre-existing conservation practices (where possible) over the course of their VPPF enrollment	Number and percent of acres on which new practices are adopted or on which practices are enhanced <sup>1</sup>	20%	Comparison of each participation year's P loss outcomes to the "enrollment" baseline
	Isolated impact of practice improvements (using the "enrollment" baseline P loss estimates) in pounds of P loss reduced (Target: 0.5 lbs.-P per acre reduced (on average) for fields with improved practices)	0.10 lbs.-P loss reduced per acre (on average) for fields with improved practices	
Practice improvements are sustainable beyond their VPPF contract (and in the absence of other financial assistance)	Responses on exit surveys	n/a	In <b>exit survey</b> <sup>2</sup> , farmers reflect on their planned improvements (at enrollment) and whether they believe the changes will be sustained beyond their VPPF contract
Improved record-keeping and nutrient management planning	Percent of farmers who somewhat agree or strongly agree that their record-keeping and nutrient management planning has improved during their VPPF enrollment	50%	<b>Exit survey</b>
	Percent of TA providers who somewhat agree or strongly agree that farmer record-keeping and nutrient management planning improves during their VPPF enrollment	75%	Biannual TA provider survey or poll at annual TA focus group/workshop
TA providers have sufficient resources and training opportunities to learn about the practices that might benefit the farmers that they support	Percent of all TA providers who agree that AAFM provides adequate training opportunities relevant to their role as TA providers	80%	Biannual TA provider survey
	Opportunities for VPPF TA provider training organized/facilitated by VPPF	n/a	List of trainings facilitated

## Goal 2. Behavior change

*Description:* Incentivize and encourage Vermont farms to increase engagement with trusted conservation providers, improve compliance with nutrient management planning and reporting requirements, increase whole farm conservation planning, and increase and sustain conservation practice implementation.

<b>Indicator</b>	<b>Metric or relevant qualitative data</b>	<b>Target</b>	<b>Method of tracking/ Data sources</b>
Farmers and TA providers actively co-plan to discuss year-to-year changes to practices and how those changes would affect payments	Percent of farmers who somewhat agree or strongly agree that they discussed potential changes to practices	60%	Mid-stream and exit survey
Farmers indicate that the Farm-PREP data was used in planning their field management	Percent of farmers who indicated that they planned to make improvements to practices in response to the VFPF data at enrollment	40%	Documented plans to address low-performing fields at enrollment in collaboration with TA providers
Farmers and TA providers are confident in the model's ability to optimally represent farm practices (neither too complicated nor too simply)	Percent of farmers who had indicated at mid-stream survey and exit survey that they had used Farm-PREP information to make changes to field management	40%	Mid-stream and exit survey
	Qualitative data on discussions with TA an annual (one per year) focus groups or workshops dedicated specifically to resolving Farm-PREP issues.	n/a	Meeting notes from annual focus group or workshop dedicated specifically to resolving Farm-PREP issues. If quantifying, a small survey (<5 minutes) could be used at this event.
	Percent of TA providers who express confidence that the <i>most</i> important aspects of a farm's conservation practices are represented clearly in the model	70%	Biannual survey OR short poll administered prior to the annual focus group or workshop dedicated specifically to resolving Farm-PREP issues
	Percent of TA providers who somewhat agree or strongly agree that the Farm-PREP model balances practice specificity with practical simplicity to produce the optimal level of predictive accuracy	60%	Biannual survey OR short poll administered prior to the annual focus group or workshop dedicated specifically to resolving Farm-PREP issues
	Farmer responses to a brief mid-stream survey (after Year 2) and exit survey (after Year 4).	80% somewhat or very satisfied	A question similar to the one posed in our farmer survey should suffice here.

## Goal 2. Behavior change

*Description:* Incentivize and encourage Vermont farms to increase engagement with trusted conservation providers, improve compliance with nutrient management planning and reporting requirements, increase whole farm conservation planning, and increase and sustain conservation practice implementation.

<i>Indicator</i>	<i>Metric or relevant qualitative data</i>	<i>Target</i>	<i>Method of tracking/ Data sources</i>
Farmers and TA providers understand each farms' levels of P loss performance and how that performance pertains to field management practices.	Percent of TA providers who somewhat agree or strongly agree that they feel comfortable interpreting Farm-PREP results and communicating them to farmers. (See above)	n/a	Biannual survey OR short poll administered prior to the annual focus group or workshop dedicated specifically to resolving Farm-PREP issues
	Percent of farmers who somewhat agree or strongly agree that their TA providers were able to clearly explain their Farm-PREP results and key variables influencing them	80% somewhat or very satisfied	Mid-stream and exit survey
Farmers and TA providers are confident in the model's ability to accurately predict P loss outcomes	Percent of TA providers who feel confident in the ability of Farm-PREP to accurately predict P loss outcomes on all the farms that they support	60%	Biannual survey OR short poll administered prior to the annual focus group or workshop dedicated specifically to resolving Farm-PREP issues
	Percent of farmers who feel confident that Farm-PREP accurately predicts that P loss outcomes from their fields	75%	Mid-stream and exit survey
Notes. <sup>1</sup> These should be enhancements that could be picked up by Farm-PREP, like earlier planting dates (or inter-seeding) for cover crops. <sup>2</sup> Exit surveys would only be conducted at the end of the term of the VFPF farmer's contract (i.e., after 4 years or sooner if the farmer does not remain in the program)			

## Goal 3. Participant satisfaction

*Description:* Ensure that the program is attractive to and works for Vermont farmers.

<i>Indicator</i>	<i>Metric or relevant qualitative data</i>	<i>Target</i>	<i>Method of tracking/ Data sources</i>
	Percent of farmers who agree that the program requirements with respect to data collection are clear	90%	Mid-stream and exit survey

### Goal 3. Participant satisfaction

*Description:* Ensure that the program is attractive to and works for Vermont farmers.

<i>Indicator</i>	<i>Metric or relevant qualitative data</i>	<i>Target</i>	<i>Method of tracking/ Data sources</i>
Farmers express that the expectations of VPPFP with respect to record provision are clear and that the program’s benefits (information, technical assistance, and financial incentives) outweigh the costs of its data collection requirements.	Percent of farmers who agree that the program benefits outweigh the costs of data collection requirements	90%	Mid-stream and exit survey
VPPFP payments contribute to farmers’ ability to implement conservation practices on their farm	Percent of farmers who agree that VPPFP payments contribute to their ability to implement conservation practices on their farm	75%	Mid-stream and exit survey
VPPFP payments are seen as “fair” by farmers, given the intent of the program	Percent of farmers who agree that the intent of the VPPFP program was clear to them at enrollment	90%	Mid-stream survey only
Farmers express satisfaction with technical assistance across various attributes including knowledge of farming operation and conservation practices as well as accessibility	Percent of farmers who agree that their VPPFP payments, given the intent of the program	75%	Mid-stream and exit survey
	Percent of farmers who agree that their TA providers were accessible	90%	Farm-PREP datasets (no change needed)
	Percent of farmers who agree that their TA providers were able to explain their performance outcomes and payments	75%	Farm-PREP datasets (no change needed)
	Percent of farmers who agree that their TA provider has/had a workable understanding of farming	75%	Mid-stream and exit survey
	Percent of farmers who agree that their TA provider discusses/discussed alternative conservation practice options for their fields/operation	75%	Mid-stream and exit survey
Farmers recognize the value of VPPFP information as a key program benefit	Percent of farmers who agree that they gained (or continue to gain) valuable information on the impact of their practices on P losses through their participation in the program	75%	Mid-stream and exit survey

### Goal 3. Participant satisfaction

*Description:* Ensure that the program is attractive to and works for Vermont farmers.

<i>Indicator</i>	<i>Metric or relevant qualitative data</i>	<i>Target</i>	<i>Method of tracking/ Data sources</i>
Farmers are glad to be enrolled in the VFPF program and would re-enroll if presented the opportunity	Percent of farmers who agree that they are glad (overall) to be enrolled in the program	75%	Mid-stream survey only
	Percent of farmers who would re-enroll in VFPF if presented the opportunity	75%	Exit survey only
Technical assistance providers feel adequately trained and resourced to perform their roles effectively in VFPF	Percent of new TA providers who agree that the on-boarding process sufficiently prepared them to perform their role in VFPF	75%	Post on-boarding survey
	Percent of all TA providers who agree that VAAFM responds to expressed training needs from TA providers	75%	Biannual TA provider satisfaction survey (every two years)
	Percent of TA providers who agree that they can competently use the Farm-PREP interface	75%	Biannual TA provider satisfaction survey (every two years)
	Number of TA provider training and resources requests addressed	n/a	<p>Polls of TA provider training and resource needs</p> <p>Running prioritization list of training/ resource needs</p> <p>Descriptions of trainings and resources provided or facilitated</p>

## Goal 4. Sustainable program

Description: Build a program that can continue to be funded and staffed.

<i>Indicator</i>	<i>Metric or relevant qualitative data</i>	<i>Target</i>	<i>Method of tracking/ Data sources</i>
VPPFP attains sufficient funding to achieve its program targets (as outlined above)	Percent of funds budgeted to meet program targets (outlined above) that are granted for VPPFP 2.0	85%	Budget proposal; grant agreement(s)
VPPFP maintains sufficient participation and performance levels such that it transfers as much grant money as possible to Vermont farmers	Percent of direct financial assistance funds from the original grant agreement that are transferred to farmers over the course of the grant	85%	Grant agreements; program budget
VPPFP has support from various interest groups (including farmer and environmental organizations) as well as the community-at-large	Qualitative data on organizations' feedback on VPPFP achievements (after sharing evaluation on pilot phase)	n/a	Meetings with representatives from these groups
Traffic to (or downloads of) VPPFP public communications postings <sup>1</sup>			
VPPFP can demonstrate that it supports farmer conservation practices in a manner that is cost-effective as compared to other conservation incentive programs	Dollar amount invested per new <sup>2</sup> pound-P loss reduced by VPPFP farmers over the course of their enrollment	\$60	Farm-PREP data (comparing actual P loss outcomes to enrollment baseline)
	Dollar amount invested per pound-P loss reduced from baseline by VPPFP farmers only receiving support from VPPFP during their enrollment <sup>3</sup>	\$35 <sup>4</sup>	Midstream and exit survey (on participation in other practice-based programs) Farm-PREP data (for P loss results)
	Percent of farmers who agree their conservation efforts might have decreased in the previous two years if they were not enrolled in VPPFP	30%	Midstream and exit survey
VPPFP is able to maintain or increase its staffing capacity to meet the needs of farmers and achieve its stated goals.	Percent of TA providers remaining involved in the program after two years	50%	TA contracts

## Goal 4. Sustainable program

Description: Build a program that can continue to be funded and staffed.

<i>Indicator</i>	<i>Metric or relevant qualitative data</i>	<i>Target</i>	<i>Method of tracking/ Data sources</i>
VPPFP attains sufficient funding to achieve its program targets (as outlined above)	Percent of funds budgeted to meet program targets (outlined above) that are granted for VPPFP 2.0	85%	Budget proposal; grant agreement(s)
VPPFP maintains sufficient participation and performance levels such that it transfers as much grant money as possible to Vermont farmers	Percent of direct financial assistance funds from the original grant agreement that are transferred to farmers over the course of the grant	85%	Grant agreements; program budget
VPPFP has support from various interest groups (including farmer and environmental organizations) as well as the community-at-large	Qualitative data on organizations' feedback on VPPFP achievements (after sharing evaluation on pilot phase)	n/a	Meetings with representatives from these groups
Traffic to (or downloads of) VPPFP public communications		TBD	TBD

*Notes.* <sup>1</sup> This is an output indicator, and does not describe a specific outcome (i.e., more public support). Public support (outcome) can be very difficult to track, so instead we suggest tracking “public interest or engagement” with these materials. <sup>2</sup> In this case, “new” refers to the additional P loss reductions a farm achieves as compared to the P loss outcomes of their practices immediately prior to enrollment. <sup>3</sup> If AAFM decides to allow farmers to continue participating in other practice-based programs while enrolled in VPPFP, the midstream and exit surveys can be used to track which farmers are solely reliant on VPPFP funding. <sup>4</sup> Over the 2022-2024 participation years, VPPFP farmers received approximately \$30 per lb.-P loss reduced *from the TMDL baseline*.

## 8. References

- Baldwin, M. 2024. Custom Rates & Fees. Cornell Cooperative Extension, Oneida County. Retrieved from:  
[https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/65854/2024\\_Custom\\_Rates.pdf](https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/65854/2024_Custom_Rates.pdf)
- Cover Crop Economic Decision Support Tool (CC-ECON). Precision Sustainable Agriculture. Access at <https://covercrop-econ.org/>.
- Darby, H. & S. Ziegler. 2024a. 2023 Summer Annual Variety Trial. Northwest Crops & Soil Program. University of Vermont Extension.
- Darby & Ziegler. 2024b. Impact of Corn Silage Variety and Seeding Rate on Interseeded Cover Crop Establishment. Northwest Crops & Soils Program, University of Vermont Extension. Retrieved from [https://www.uvm.edu/d10-files/documents/2024-08/2023\\_CornSilageVariety\\_x\\_SeedingRate\\_Report.pdf](https://www.uvm.edu/d10-files/documents/2024-08/2023_CornSilageVariety_x_SeedingRate_Report.pdf).
- Dolan, K. 2016. The importance of inter-agency collaboration and public engagement in the development of the implementation plan for the nonpoint source-focused Vermont Lake Champlain Phosphorus TMDL. *Vermont Journal of Environmental Law*, 17(4): 663-687.
- Friedrich, E. L. 2022. An Exploratory Guide to the Work, Efficacy & Potential of the USDA-Natural Resources Conservation Service in Vermont through the Perspectives of NRCS Staff. Food Systems Master's Project Reports. University of Vermont.
- Hammond Wagner, C., J. Gourevitch, K. Horner, E. Kinnebrew, B. Maden, E. Recchia, A. White, A. Wiegman, T. Ricketts, E. Roy. 2019. Payment for ecosystem services in Vermont. Issue Paper 19-01. Burlington, VT: Gund Institute for Environment.  
[https://agriculture.vermont.gov/sites/agriculture/files/documents/Water\\_Quality/PES/Gund\\_Issue\\_Paper\\_2019\\_Vermont\\_PES\\_final-10172019.pdf](https://agriculture.vermont.gov/sites/agriculture/files/documents/Water_Quality/PES/Gund_Issue_Paper_2019_Vermont_PES_final-10172019.pdf)
- Hansen, J., V. Moore, J. Chavez, J. Crawford, R. Crawford, & S. Hanson. 2024. New York Forage Legume and Grass Variety Yield Trials. Summary for 2024 – Season Totals. Cornell University, Ithaca, NY.
- Lattz, D. and G. Schnitkey. 2021. Machinery Cost Estimates: Field Operations. University of Illinois Extension. Retrieved from [https://farmdoc.illinois.edu/assets/management/machinery-costs/field\\_operations.pdf](https://farmdoc.illinois.edu/assets/management/machinery-costs/field_operations.pdf).

- Lawrence, J., A. Kerwin, T. Overton, H. Darby, M. Smith, M. Van Amburgh, E. Andreen, P. A. LaPierre, K. Workman, & S. Ziegler. 2024. New York and Vermont Corn Silage Hybrid Evaluation Program.
- Longfield, K. 2023. Farmer Attitudes Toward Conservation and Government in Vermont's Lake Champlain Basin. Master of Science Thesis. University of Vermont.
- Mason, R.E. 2020. Calibrating the APEX model for stimulations of environmental and agronomic outcomes on dairy farms in the Northeast U.S.: A step-by-step example. *Applied Engineering in Agriculture*, 36(3): 281-301.
- NRCS. 2024. Vermont Practice Scenarios – Fiscal Year 2024.  
<https://www.nrcs.usda.gov/sites/default/files/2024-01/fy24-vermont-scenarios.pdf>
- Plastina, A. & K. Magwaba. 2024. Estimated Costs of Crop Production in Iowa – 2024. Ag Decision Maker File A1-20. Iowa State University Extension and Outreach.
- Porterfield, K. & E. Roy. 2021. Lake Carmi Watershed Phosphorus Study Final Report. Accessed through: [https://dec.vermont.gov/sites/dec/files/WID/CWIP/Lake%20Carmi%20Report%20-%20October%202021\\_final.pdf](https://dec.vermont.gov/sites/dec/files/WID/CWIP/Lake%20Carmi%20Report%20-%20October%202021_final.pdf).
- Ramirez-Avila, J.J., D.E. Radcliffe, D. Osmond, C. Bolster, A. Sharpley, S.L. Ortega-Achury, A. Forsberg, & J.L. Oldham. 2017. Evaluation of the APEX Model to Simulate Runoff Quality from Agricultural Fields in the Southern Region of the United States. *Journal of Environmental Quality*, 46: 1357-1364.
- Schnitkey, G. 2004. Planter Costs for Alternative Farm Sizes. Farm Economics: Facts & Opinions. FEFO 04-05. University of Illinois Extension. Retrieved from [https://farmdoc.illinois.edu/assets/management/fefo/fefo\\_04\\_05.pdf](https://farmdoc.illinois.edu/assets/management/fefo/fefo_04_05.pdf).
- Sunoj, S., B. Polson, I. Vaish, M. Marcaida III, L. Longchamps, J. van Aardt, & Q. M. Ketterings. 2024. Corn grain and silage yield class prediction for zone delineation using high-resolution satellite imagery. *Agricultural Systems*, 18.
- Tetra Tech. 2015. Lake Champlain Basin SWAT Model Configuration, Calibration and Validation: Appendix A.
- Vermont Agency of Agriculture, Food & Markets. 2020. Project proposal for Regional Conservation Partnership Program (RCPP)-Alternative Funding Arrangements (AFA) through the Natural Resources Conservation Service.

- Vermont Clean Water Initiative. 2021. Vermont Clean Water Initiative 2021 Performance Report, January 15, 2022. Available at:  
[https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/Reports/2021CleanWaterInitiativePerformanceReport\\_FINAL\\_updated%201-20-2022.pdf](https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/Reports/2021CleanWaterInitiativePerformanceReport_FINAL_updated%201-20-2022.pdf)
- Vermont Clean Water Initiative. 2022. Vermont Clean Water Initiative 2022 Performance Report, January 13, 2023. Available at:  
<https://dec.vermont.gov/sites/dec/files/WID/CWIP/Vermont%20Clean%20Water%20Initiative%202022%20Performance%20Report.pdf>
- Winchell et al. 2011. Identification of Critical Source Areas of Phosphorus Within the Vermont Sector of the Missisquoi Bay Basin. Lake Champlain Basin Program Technical Report No. 63B.  
<https://www.lcbp.org/publications/identification-critical-source-areas-phosphorus-within-vermont-sector-missisquoi-bay-basin-technical-report-63b/>
- Winchell, J. 2020. Refinement of critically needed assessment tools for tile drainage phosphorus loading in the Lake Champlain Basin. Lake Champlain Basin Program Technical Report No. 96.
- Winsten, J. n.d. Pilot-Testing Pay-for-Performance Conservation in Ohio's Old Woman Creek Watershed. Winrock International.
- Wongpiyabovorn, O., A. Plastina. 2023. Financial Support for Conservation Practices: EQIP and CSP. Iowa State University Extension Service. Available at:  
<https://www.extension.iastate.edu/agdm/crops/html/a1-39.html>
- University of Minnesota Extension. 2022. Guidelines for manure application rates. Webpage:  
<https://extension.umn.edu/manure-management/manure-application-rates>
- UVM Extension. 2018. Nutrient Recommendations for Field Crops in Vermont. University of Vermont Extension. Retrieved from  
[https://www.uvm.edu/sites/default/files/Agriculture/NutrientRecs\\_BR1390.2.pdf](https://www.uvm.edu/sites/default/files/Agriculture/NutrientRecs_BR1390.2.pdf).

## 9. Appendices

### 9.1. Assistance Programs for Vermont Farmers

Table 7. Vermont Water Quality Programs (FY 2023)					
Program Name	Program Summary	# of Farms	# of Acres	Payments	First Year
Best Management Practices	Technical and financial assistance program focusing on engineered and structural on-farm improvements which protect or promote water quality. Up to 90% State cost share towards eligible practices & expenses.	48	NA	\$3.6M	2020
Capital Equipment Assistance Program	Financial assistance for new or innovative equipment that will improve water quality, improve manure management, separate phosphorus (P) from manure, or decrease greenhouse gas emissions. Funding limits dependent on equipment type. Up to 90% State cost share.	42 Grants	15,000	\$1.5M	2018
Conservation Reserve Enhancement Program	Technical and financial assistance program designed to reduce sediment runoff and improve water quality by removing land from agricultural production and establishing vegetative buffers. Up to 100% cost share towards annual rental, & maintenance payments. Implementation costs, plus incentive, annual rental, & maintenance payments.	7 Proj.	50	Inc.	2011
Farm Agronomic Practice Grants	Financial assistance to Vermont farms for implementation of soil-based agronomic practices that improve soil quality and reduce runoff and erosion. Financial assistance for educational or instructional activities also available. Per/acre payment rates based on practice type.	223	30,000	\$1.1M	2010
Seeding / Grassed Waterway & Filter Strip Program	Technical and financial assistance to address erosion and surface runoff through the establishment of perennially vegetated and harvestable grassed waterways, filter strips, and critical source area seedings. Per acre incentive payments and up to 90% State cost share for implementation costs.	1	23	\$8,500	2018
Pasture & Surface Water Fencing Program	Pasture management technical and financial assistance to Vermont farmers to improve water quality and on-farm livestock exclusion from surface waters statewide. Up to 90% State cost share for implementation costs.	23 Awards	NA	\$216,000	2018
Vermont Farmers Ecosystem Stewardship Program	Supplemental financial assistance to support farmers to enroll in the USDA-NRCS Conservation Stewardship program (CSP). Payment for completing CSP assessment. Additional payment for signing CSP contract.	31	NA	\$150,000	2023
Vermont Pay for Performance Program	Innovative, performance-based program which provides financial compensation for reducing phosphorus (P) losses from farms. Payment based on modeled P reductions across farm operation.	56 Awards	27,214	\$1.9M	2022

Note: # of Farms, # of Acres, and Payments are based on State FY 2023, except for the GWFS program, which is based on FY 2022 because 2023 was a redesign year.

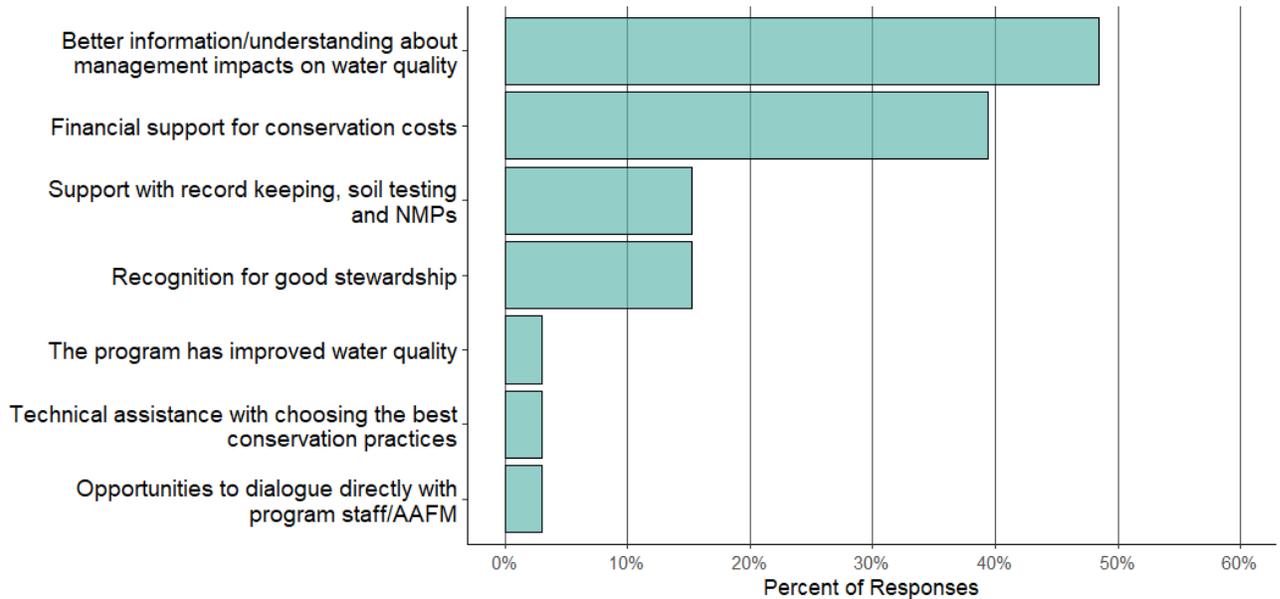
## References

- United States Department of Agriculture, Farm Service Agency. (n.d.). Conservation Reserve Enhancement Program: Vermont [PDF]. [https://www.fsa.usda.gov/Internet/FSA\\_File/crep\\_vermont.pdf](https://www.fsa.usda.gov/Internet/FSA_File/crep_vermont.pdf)
- Vermont Agency of Agriculture, Food & Markets. (2023). Annual report on financial and technical assistance for water quality [PDF]. [https://agriculture.vermont.gov/sites/agriculture/files/documents/2023\\_VAAFM\\_WQ\\_Annual\\_Report\\_on\\_Financial\\_and\\_Technical\\_Assistance\\_0.pdf](https://agriculture.vermont.gov/sites/agriculture/files/documents/2023_VAAFM_WQ_Annual_Report_on_Financial_and_Technical_Assistance_0.pdf)
- Vermont Agency of Agriculture, Food & Markets. (2024). Water Quality Programs flyer [PDF]. [https://agriculture.vermont.gov/sites/agriculture/files/documents/WQPrograms%20Flyer\\_Updated.pdf](https://agriculture.vermont.gov/sites/agriculture/files/documents/WQPrograms%20Flyer_Updated.pdf)
- Vermont Agency of Agriculture, Food & Markets. (2024, July 25). Agency of Agriculture announces new technical assistance funding to support water quality planning. Vermont Farm to Plate. <https://www.vtfarmltoplate.com/news/agency-agriculture-announces-new-technical-assistance-funding-support-water-quality-planning>
- Vermont Agency of Agriculture, Food & Markets. (2024, July 9). Conservation Stewardship Program open for applications for state funds. Vermont Agency of Agriculture. <https://agriculture.vermont.gov/agency-agriculture-food-markets-news/conservation-stewardship-program-open-applications-state-funds>
- Vermont Agency of Agriculture, Food & Markets. (2024, March 1). Best Management Practices (BMP) Program applications due April 1st. Vermont Agency of Agriculture. <https://agriculture.vermont.gov/best-management-practices-bmp-program-applications-due-april-1st>
- Vermont Agency of Agriculture, Food & Markets. (n.d.). Water quality assistance programs. Vermont Agency of Agriculture. <https://agriculture.vermont.gov/water-quality/assistance-programs>

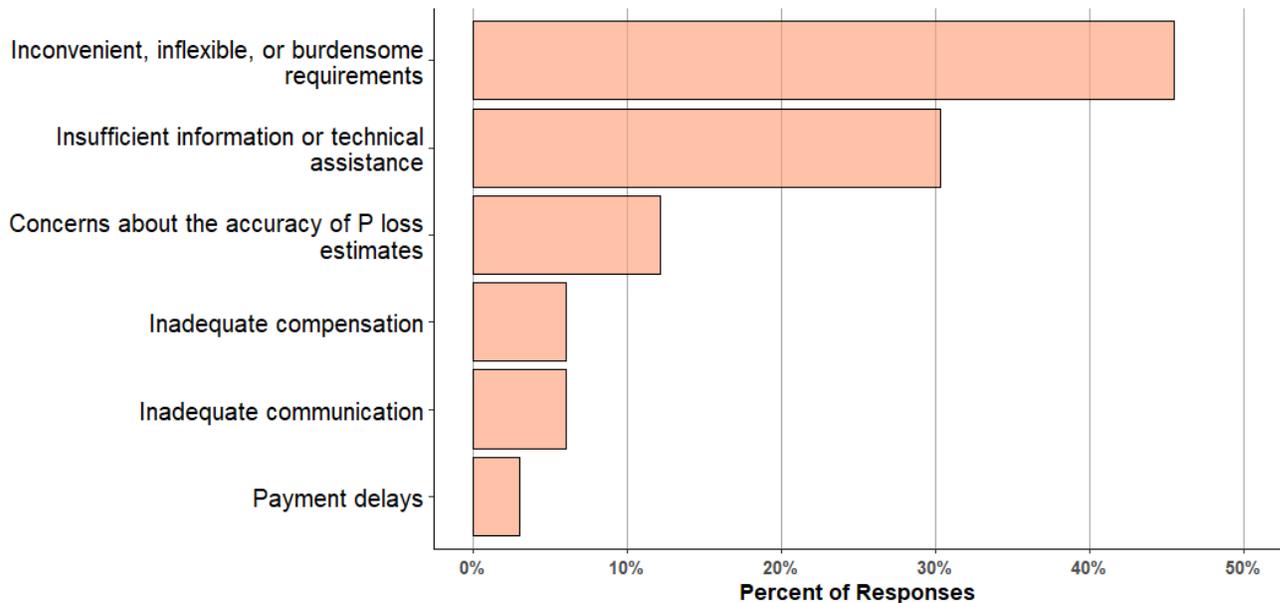
## 9.2. Farmer Survey Summary

### A. Open-ended Perspectives on VPFP

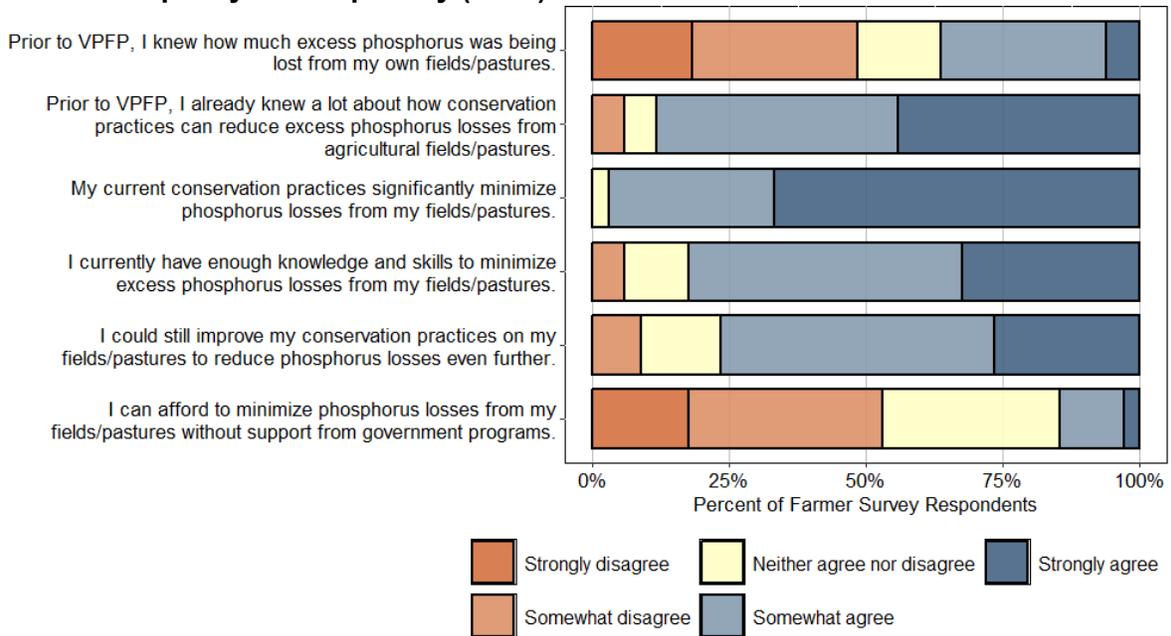
1. In brief, what are the 1-3 most meaningful **benefits** that have resulted from your participation in the Vermont Pay for Performance Program (VPFP)?



2. In brief, what are the main **challenges or inconveniences** that you have experienced as a participant in VPFP?

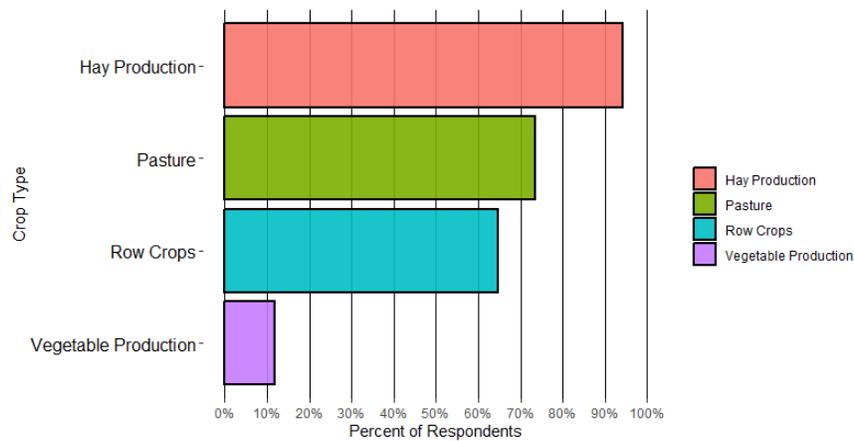


## B. Conservation Capacity and Capability (n=34)

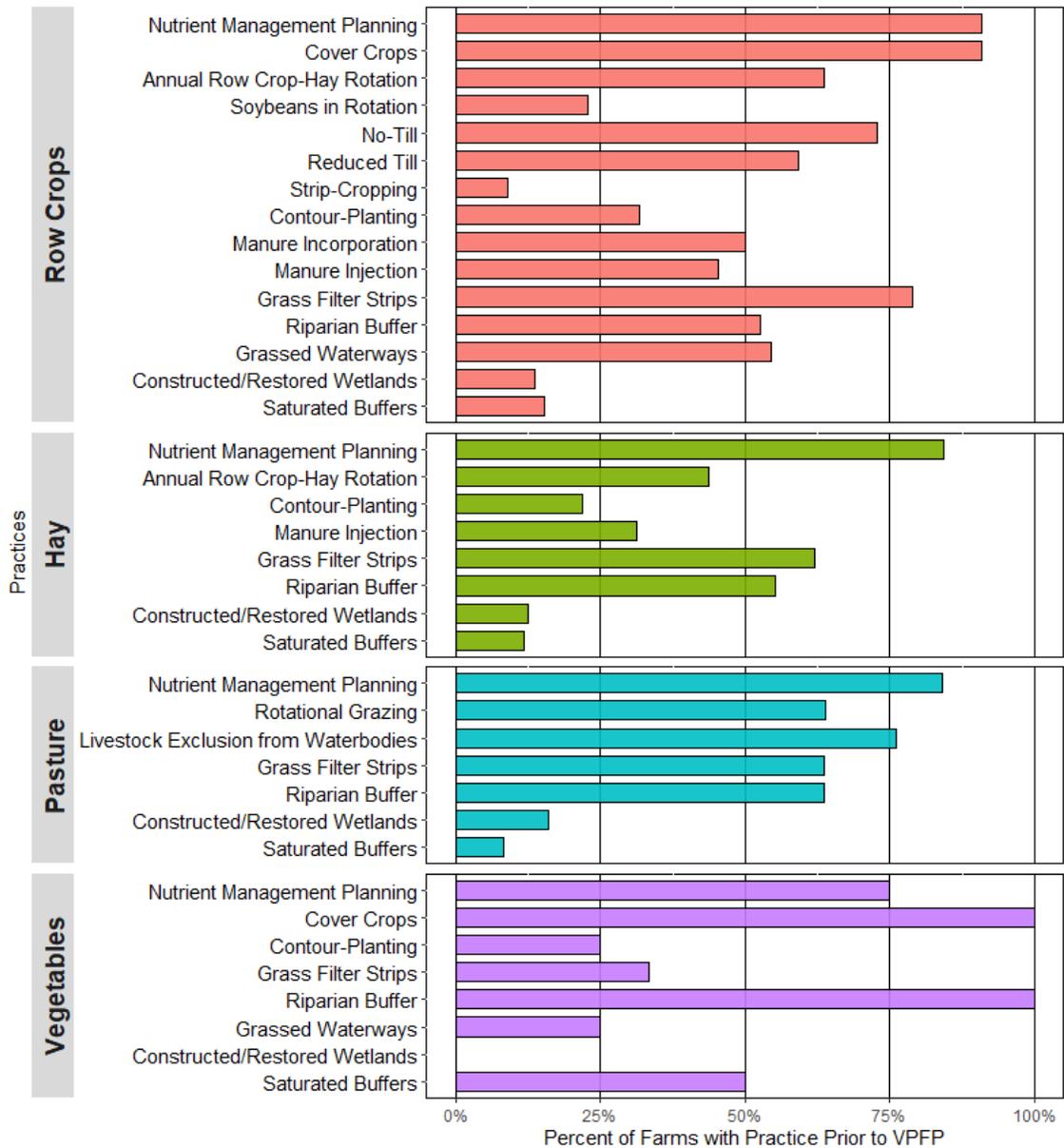


## C. Practices & Behavior Change from VPFP

### C1. Which practices were farmers already implementing prior to VPFP?

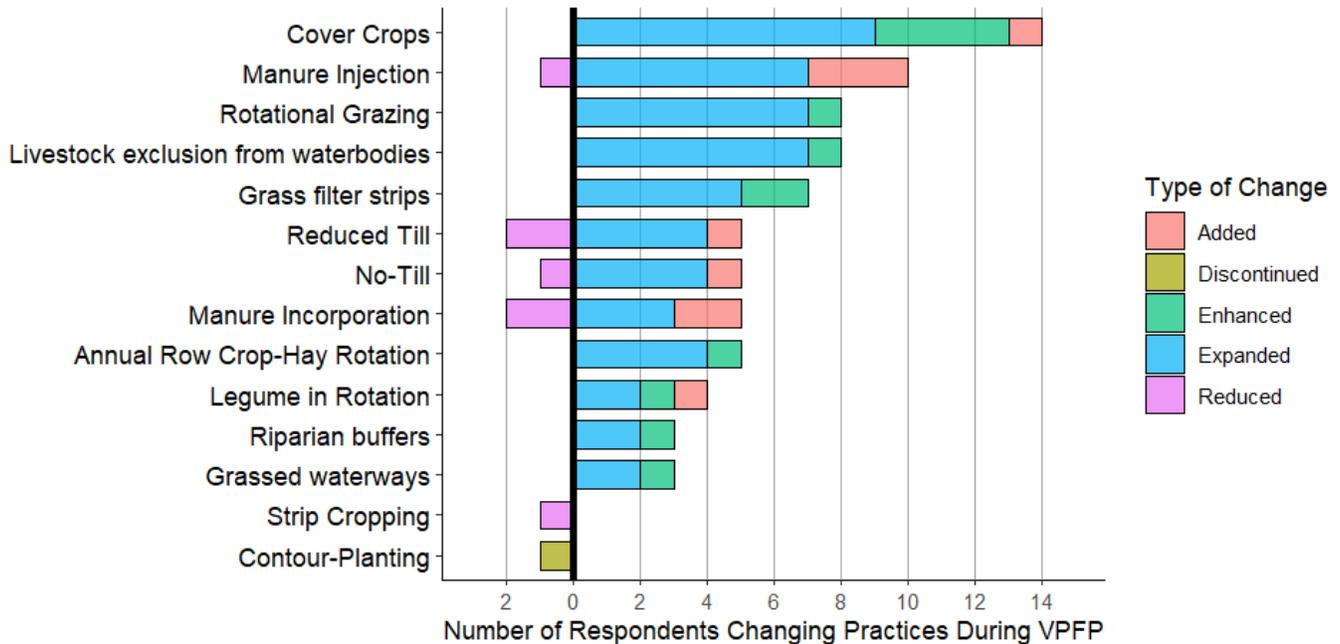


Percent of farmer survey respondents who had each land use on their farms.

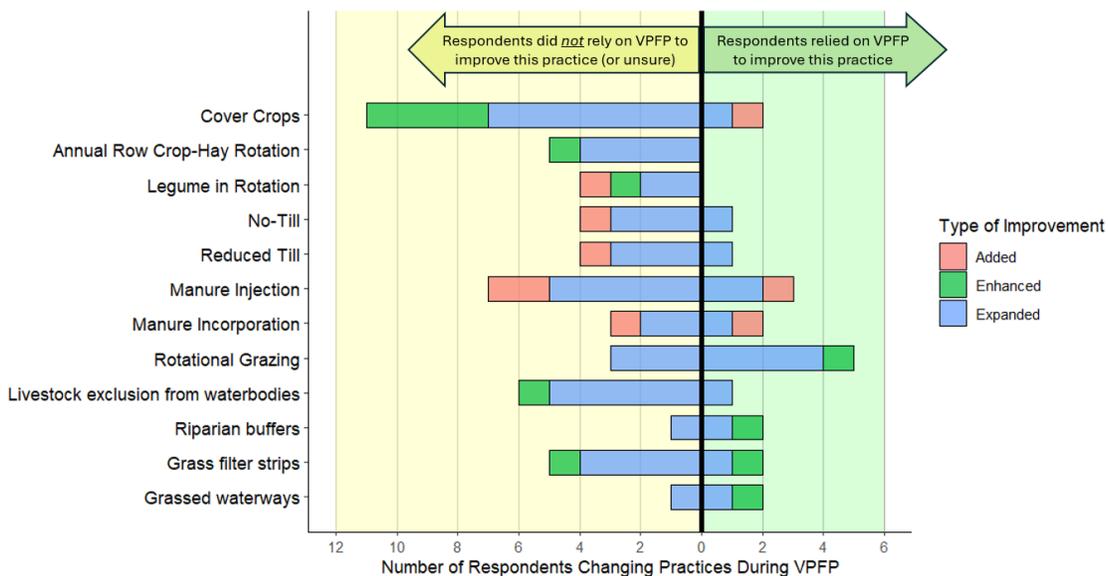


Percent of respondents with each land use who indicated that they had been implementing each practice prior to VFPF enrollment. Denominator is the number of respondents with each land use. Denominators change slightly if respondent does not have fields proximate to water (in Farm-PREP) or if they do not use tile drainage (relevant for practices like saturated buffers).

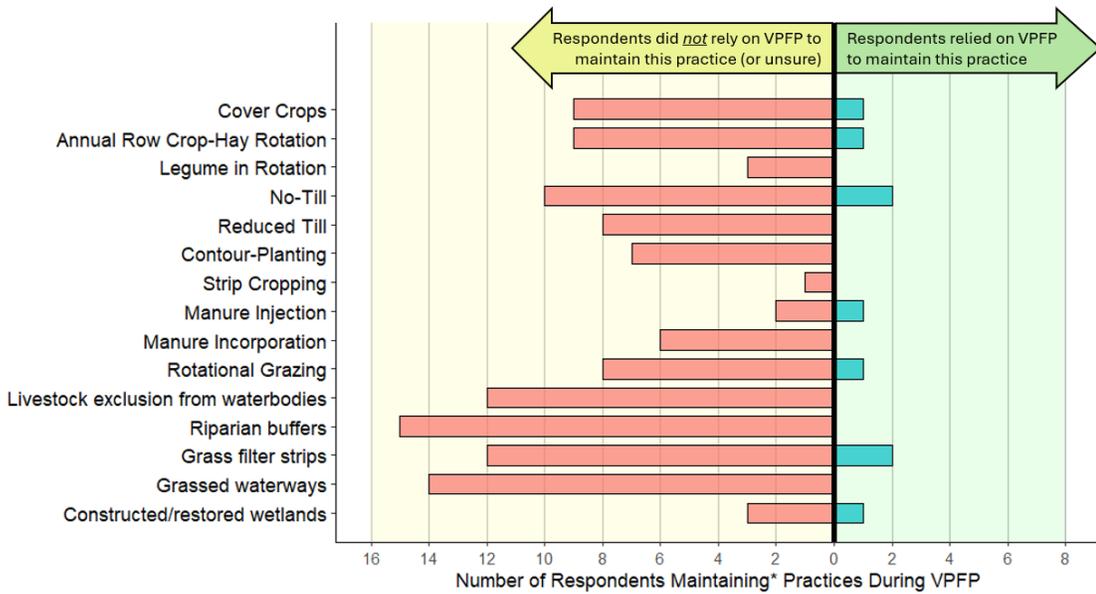
### What changes in practices coincide with participation in VFPF?



### C3. To what extent did farmers rely on VFPF to maintain practices or change practices?



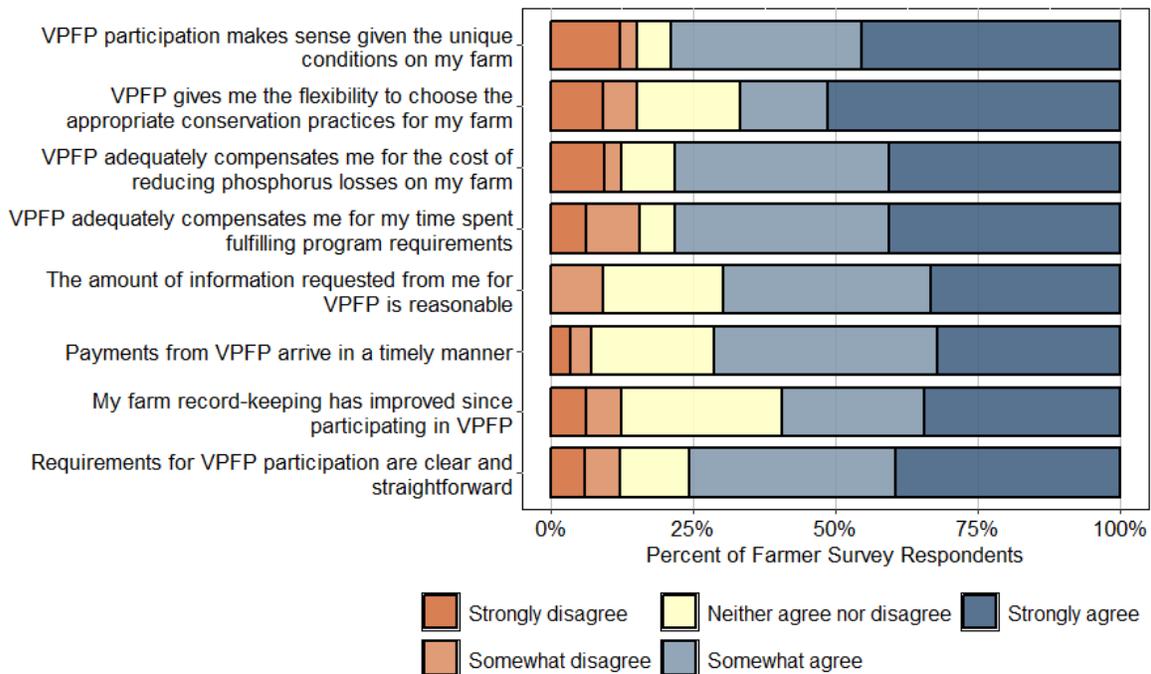
**Figure 1.2.** Number of farmer survey respondents indicating that they made specific types of practice changes during their VFPF enrollment *and* whether they attribute those improvements to VFPF participation. Farmer-reported improvements to conservation practices while enrolled in VFPF are divided into two groups depending on whether farmers relied on VFPF participation to make the improvement (right-hand side of the graph) and or if farmers would have made the improvement regardless of VFPF participation or if they were unsure (on the left-hand side of the graph). Farmers could have selected that they both expanded *and* enhanced a practice, but practice “additions” (i.e., new practices) were a mutually exclusive category. See footnote above regarding the definitions of “additions”, “enhancements” and “expansions.”



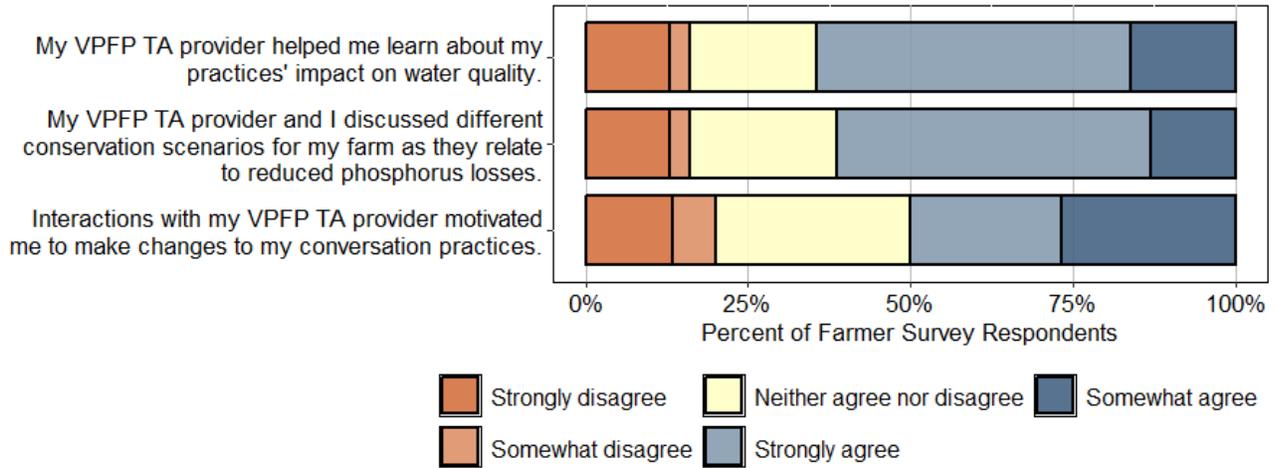
**Figure 1.4.** The number of farmer practices that were maintained (i.e., not improved or scaled back) over the participants' VPFP enrollment period. These practices were adopted *prior to* enrolling in VPFP. The bars are divided horizontally according to whether the farmer relied on VPFP to maintain the practice (right-hand side of the vertical axis, in blue) or whether the farmer indicated that they would have maintained the practice regardless of VPFP participation or that they were unsure (left-hand side of the graph, in red).

## D. Evaluation of VPFP Experience

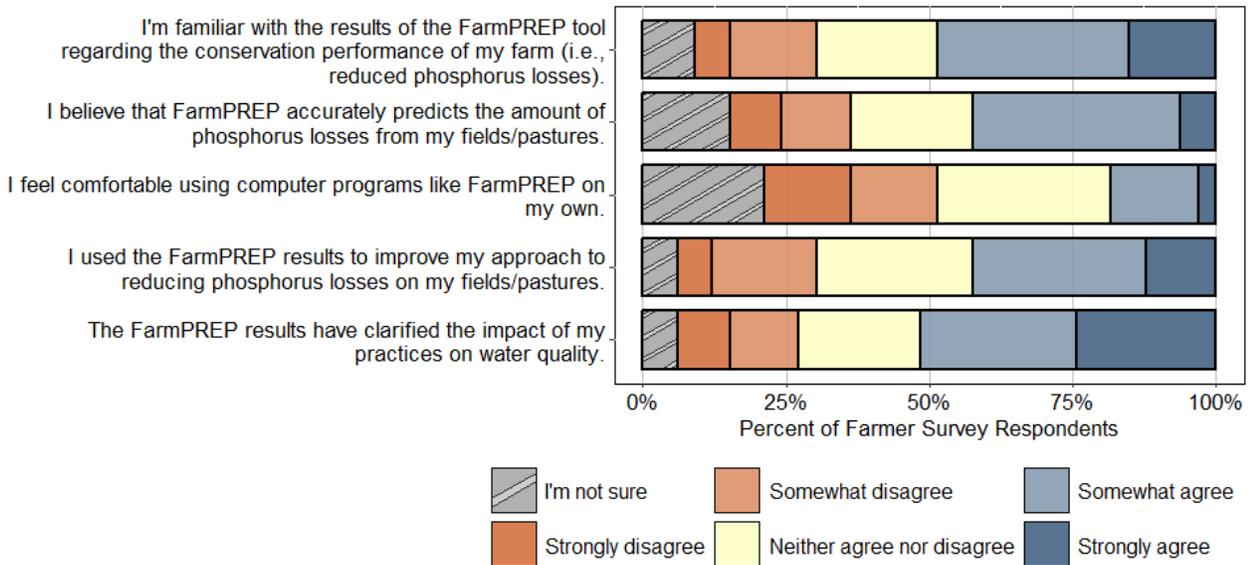
### D1. General Experience



## D2. TA Providers

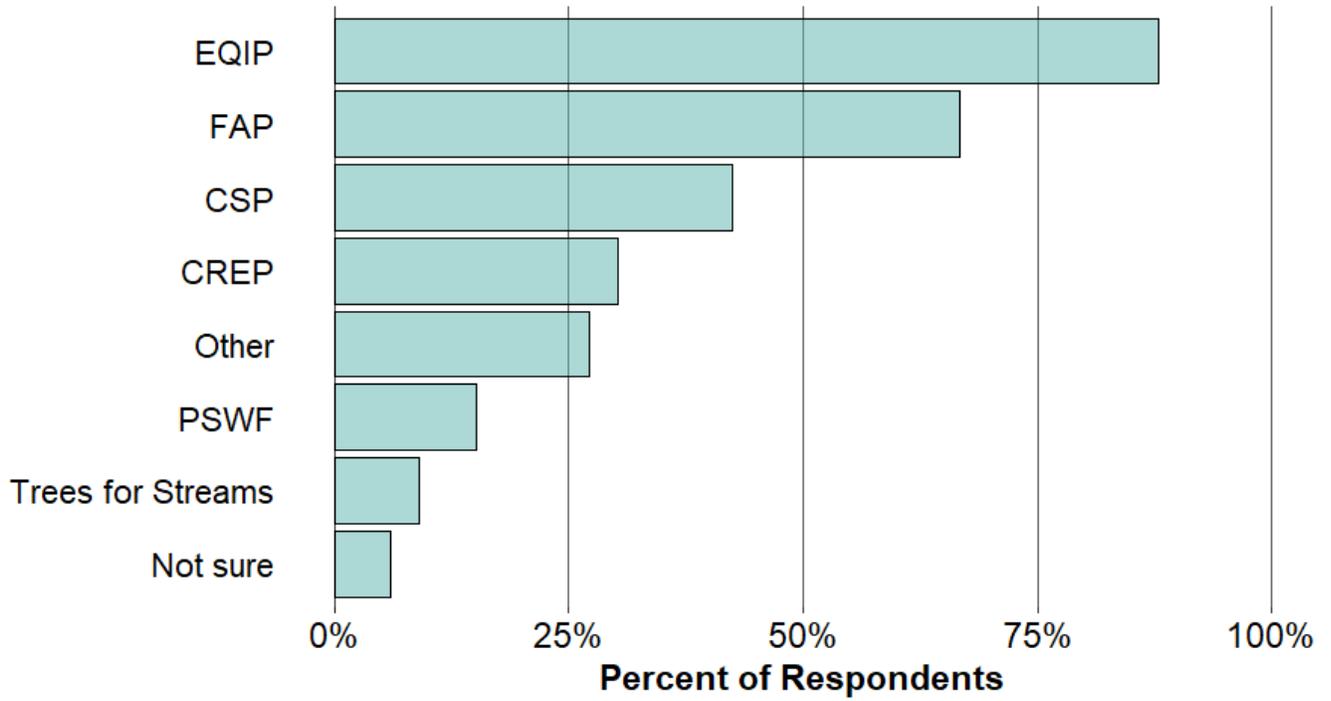


## D3. Farm-PREP

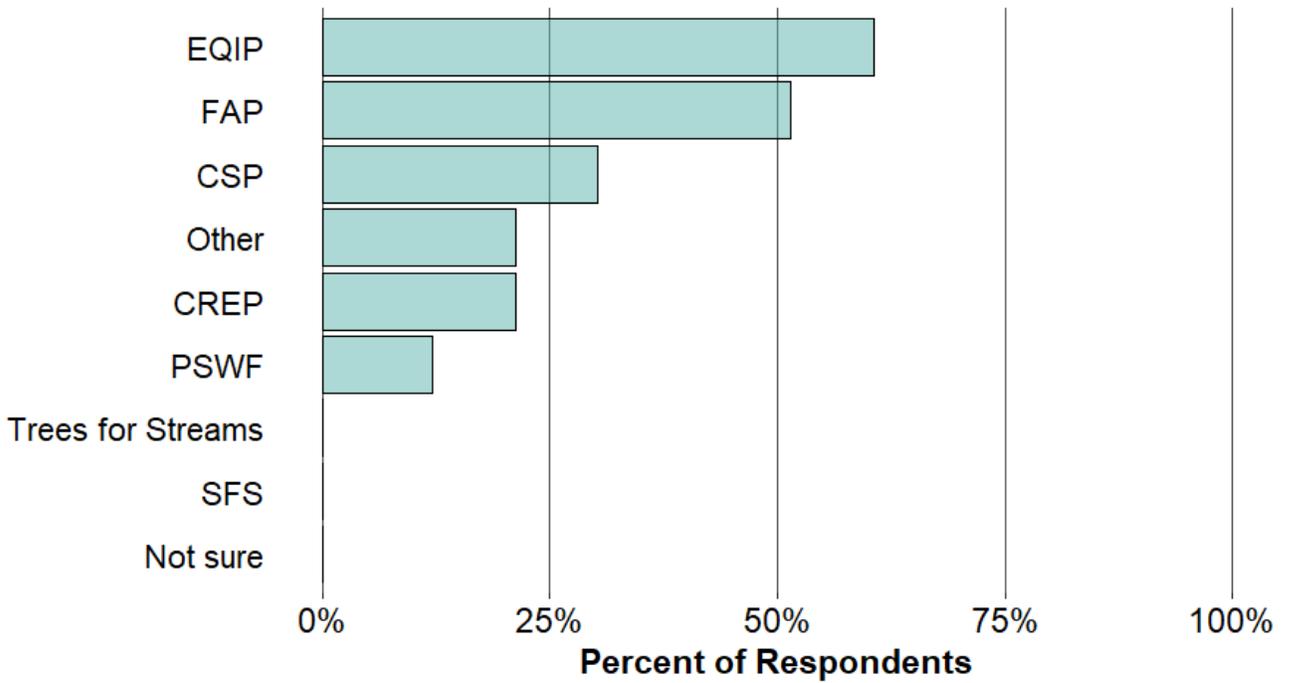


## E. Comparison of VPFP Experience to Other Programs

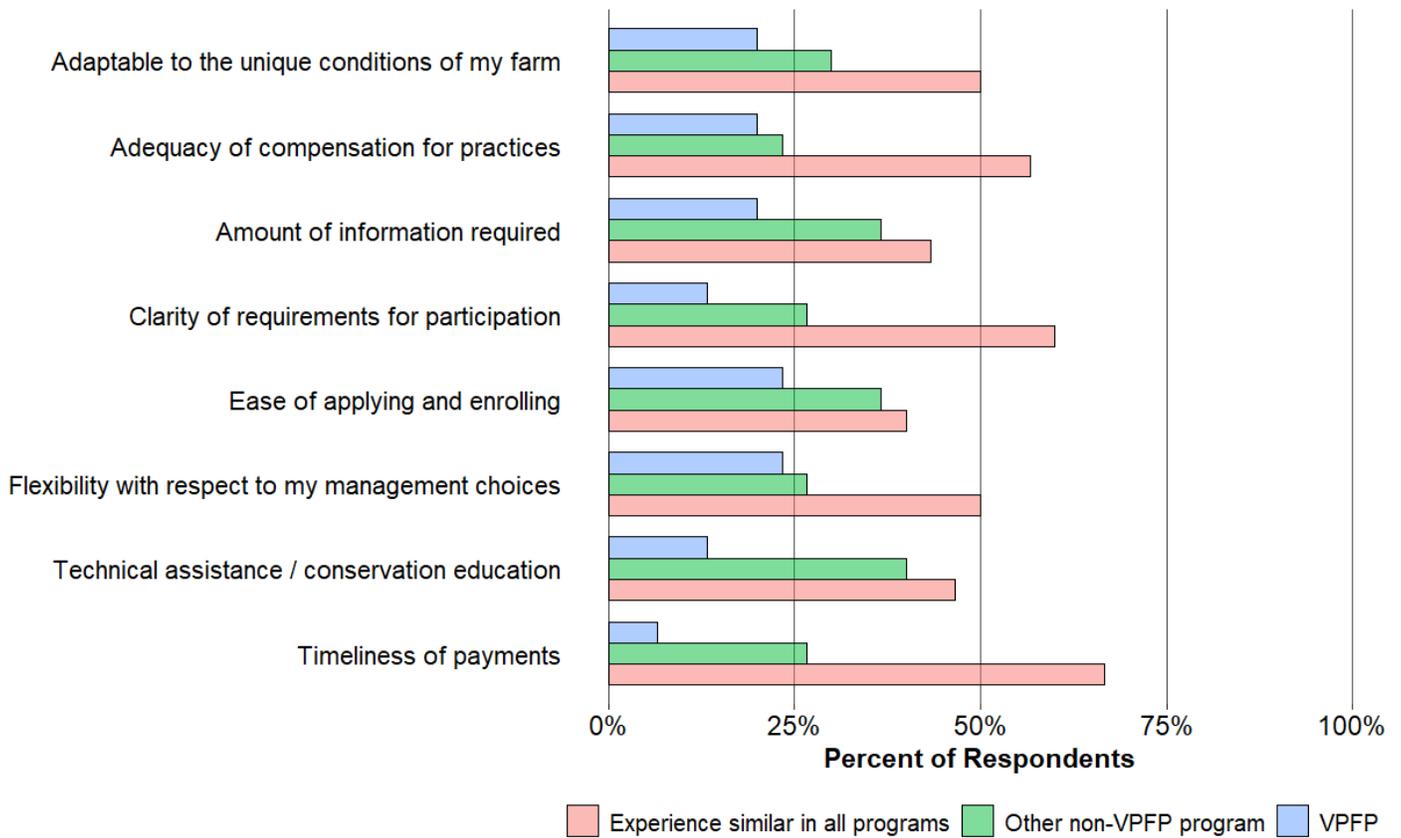
### Participation in other conservation incentive programs *at any point*



**Participation in other conservation incentive programs since 2022**



**Comparison of VFPF Program Attributes to Other Programs**



Purely on a frequency basis, VPFP is not selected as the preferred option on any of the program attributes over a non-VPFP program (i.e., a practice-based program). In all cases, a *plurality* of respondents indicated that VPFP performed similarly to other programs in each of the program attributes.

## F. Future Planning, Motivations, Support Needed & Responsibility

### F1. Would participants re-enroll in VPFP if presented the opportunity?

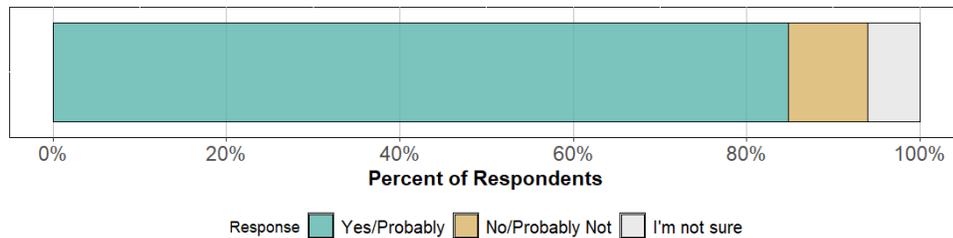
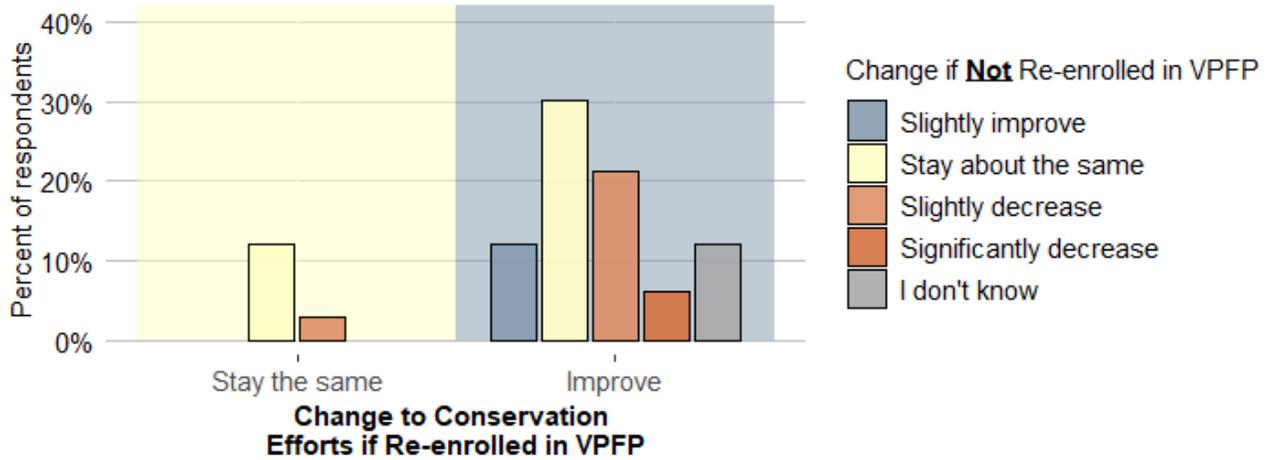
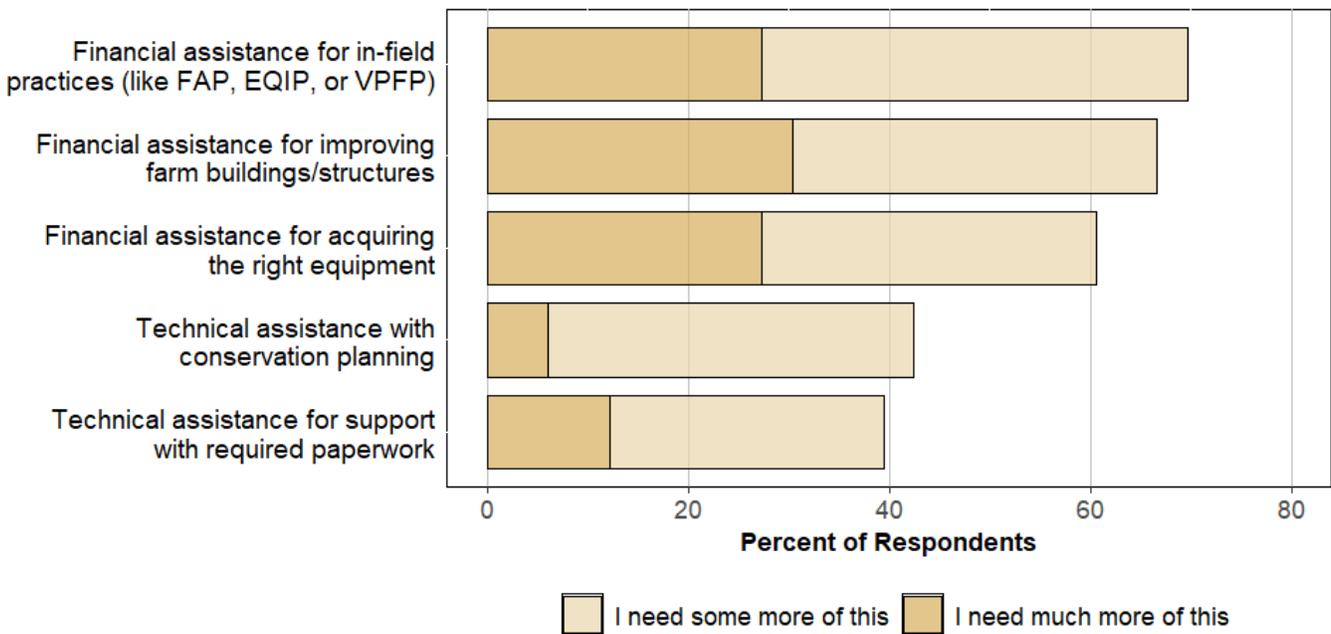


Figure 4.1.3. Percent of survey respondents who would likely re-enroll in VPFP if presented the opportunity

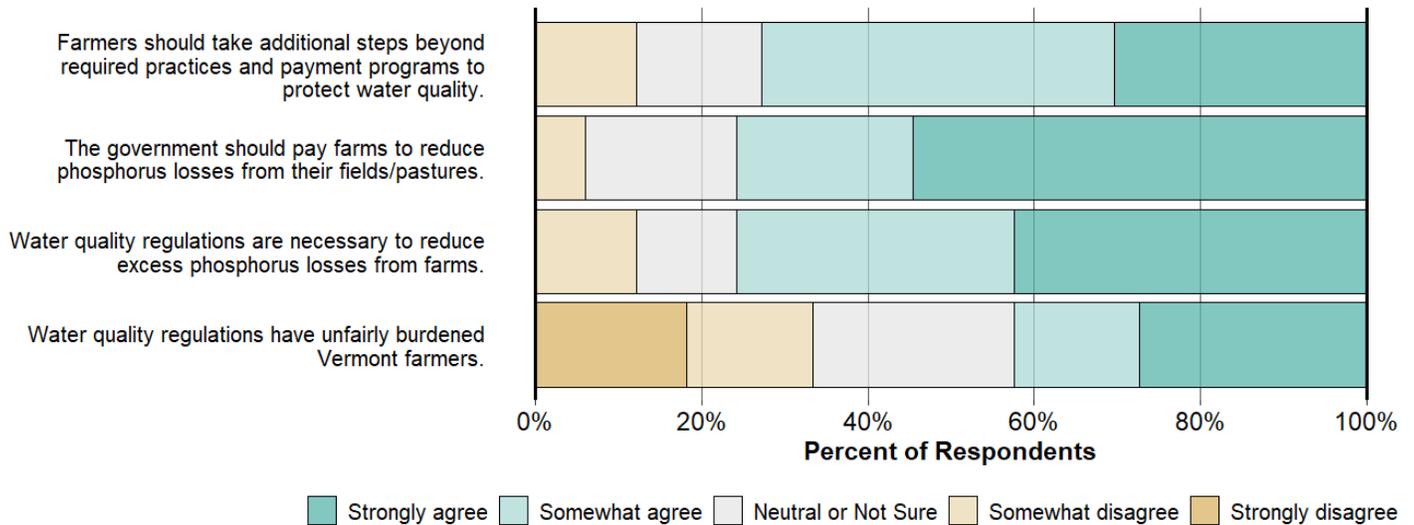
### F2. What do farmers' expect to happen to their conservation efforts if they are re-enrolled in VPFP or they are if they are not re-enrolled in VPFP?



**F4. What types of support do farmers most need?**



**F5. What are farmers' opinions on regulations and government's role in supporting conservation?**



**G. Open Comment**

**G1. Text provided in final comments section.**

“Reduce time required to complete paperwork needed for compliance.”
“There isn't a way to accurately enter grazing data for well managed pastures that don't have fixed paddock sizes and fixed rotations.” 2.) 3.)
“Please keep this program. This program has allowed our land and land management to generate income independently from our dairy. This allows us to make decisions on what is best for our land and the environment. This takes pressure off animal performance!! This is good for both land and the cattle.”
“VT farmers DO need additional funds to allow them to cover their costs of production AND have enough left over to cover the management time and cost of additional good land stewardship. This program is a good first attempt at PES. Farms are using these funds to improve and maintain good land stewardship. But in the long run we need a PES system based on accurate baseline data on the farm history/past crops, accurate TMDL, and one that allows participation by farms doing good grazing management (and can handle the complexity of the grazing records) and ideally a PES which pays on more than just P reductions.”
“Some of the historic data on previous field/crop histories is inaccurate. Someone needs to thoroughly study the TMDL for errors and inaccuracies.”
“We always learn from the technical assistance providers. A field-by-field debriefing on the phosphorus loss data would be helpful.”
“Fix the software so it applies the data correctly the first time.”
“Is there any way this practice could be tied to reducing climate change?”
“Integrate Farm-PREP with goCrop, crazy that they are not the same, makes for allot of extra work.”
“In the decision-making process going forward for this VPFP program, to remember that VPFP was put into place to reward farms that are/were already doing a lot of these practices. This in turn was meant to encourage farms that were not doing good conservation practices, to do so, and then be rewarded. This program has encouraged my farm to continue these practices as well as make improvements along the way. VPFP money that's been spent on my farm has improved water quality in the state of Vt. Without VPFP money we would not have been encouraged to make changes that in turn improved water quality.”

### 9.3. TA Provider Survey Summary

As added protection for respondent confidentiality, for the sections with quotes below, we've randomized the order of each so that it is not possible to infer that the first quote in each section is from the same respondent, and so on. In some cases, we've broken up quotes along thematic lines and grouped quotes from different respondents if they address the same theme.

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#### 1. Program benefits

“Co-benefits of phosphorus reductions that are less practice specific and rewards farmers for good practices that might be outside the practice specifications that traditional NRCS programs are structured around. This allows farmers flexibility and a way to incentivize good management that doesn't necessarily mean changing current management.”

“Significant contact between the state and farmers who are willing partners; increased use of cover crops and other conservation practices near significant bodies of water; impactful amounts of funding to farmers throughout the state”

“Data Collection, and being able to identify specific locations and/or practices that contribute to the highest P loss.”

“Cash payments for farmers reducing P loading, documenting work farmers are doing, incentive to continue practices.”

“Meaningful benefits have included: 1) Rewarding farmers for practices that reduce P loss from their fields that they are already doing, and that VAAF and TSPs want them to do (such as no till, rotational grazing, etc), and 2) this program requires that farmers have complete and organized records, which has also been helpful for NMP updates and reporting for other programs.”

“It can gather a lot of information and run a model of P reduction over time.”

“Providing a carrot to entice producers to complete an NMP, keep records, and soil and manure testing. Farms having a regular relationship with a TA provider.”

“It allowed smaller farmers to receive a financial benefit without cumbersome contracts. It prompted a farm to seed down fields that had been in annual crops for a considerable time. It had the potential to promote soil health.”

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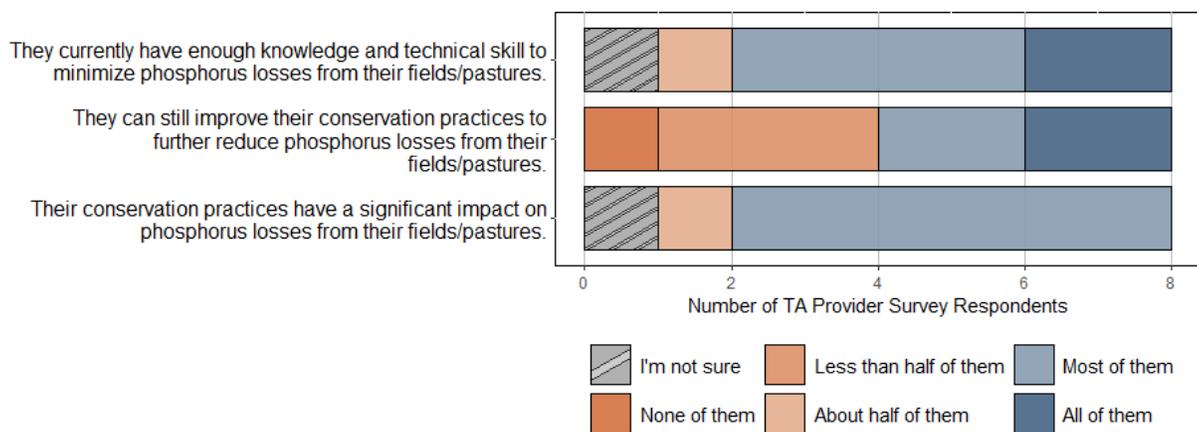
#### 2. Program challenges

“It's too much tedious work. The same company that makes FarmPrep makes GoCrop, which farmers already use. Then we and the farmers have to enter in almost all of the same data into Farm-PREP manually.”

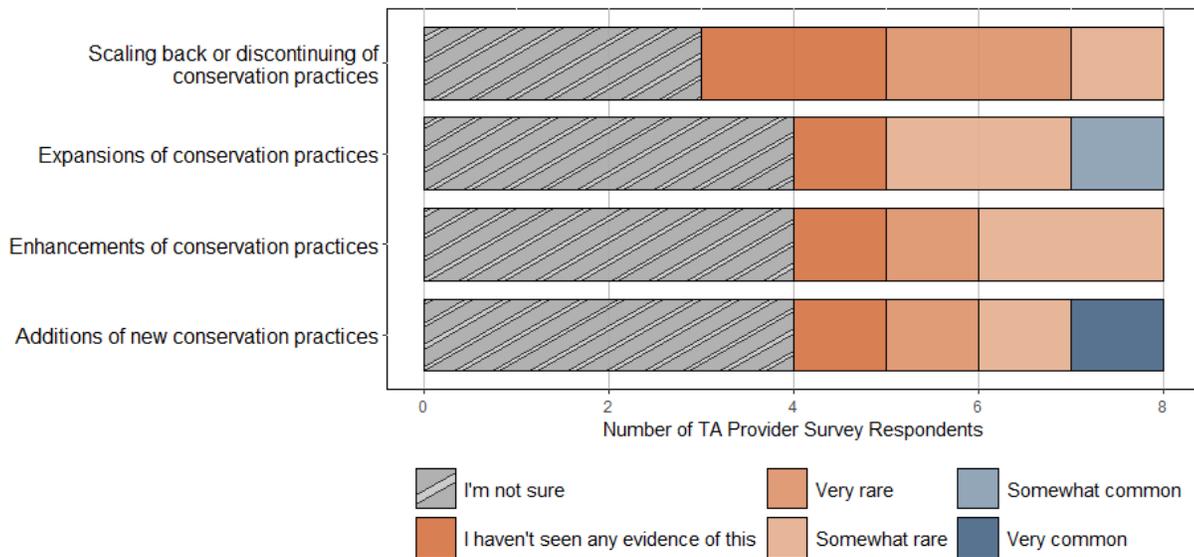
“Requires significant training for TA providers; requires significant record keeping from producers; can be challenging to enter field data in Farm-PREP because the field data entry fields are in two separate places.”

“Verification phase has been challenging and seems repetitive with the Actual Assessment phase. Farmers still aren't keeping great records. The program on the back end is very mysterious and unclear to both TA providers and farmers leading to confusion. The program has glitches that are hard to identify and explain.”
“It's a lot of work for farms, and there's no guaranteed payout”
“Another challenge relates to data entry. It is very time consuming. The manure tool helped this year with organizing records and uploading data to Farm-PREP.
“Having this program structured around the TMDL baseline is very confusing for farmers and many of them want to understand the P-loss calculations but there hasn't been a clear way to get that information to them.”
“Farm-PREP model is often confusing or could be improved. The 30-year model doesn't make sense for some rotations on farms, and buffer definitions could be more specific. The interface doesn't account well for farms with continuous corn.”
“I find Farm-PREP a challenging program. This is most likely due to the fact I only use the program a few times a year.”
“Communicating results to farmers has been challenging, because it also requires communicating how the TMDL baseline for each field was determined (which isn't super clear to TSPs), and some variables in Farm-PREP seem to have a disproportionate influence on results, meaning that some seemingly minor changes can lead to dramatic differences in anticipated payment.

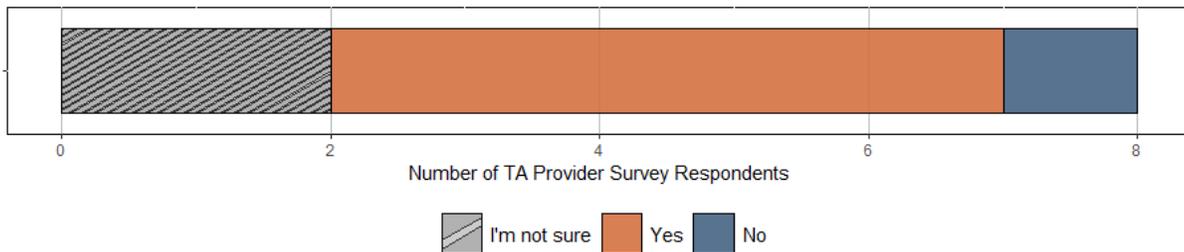
### 3. TA provider perceptions of VFPF participants' conservation capacity



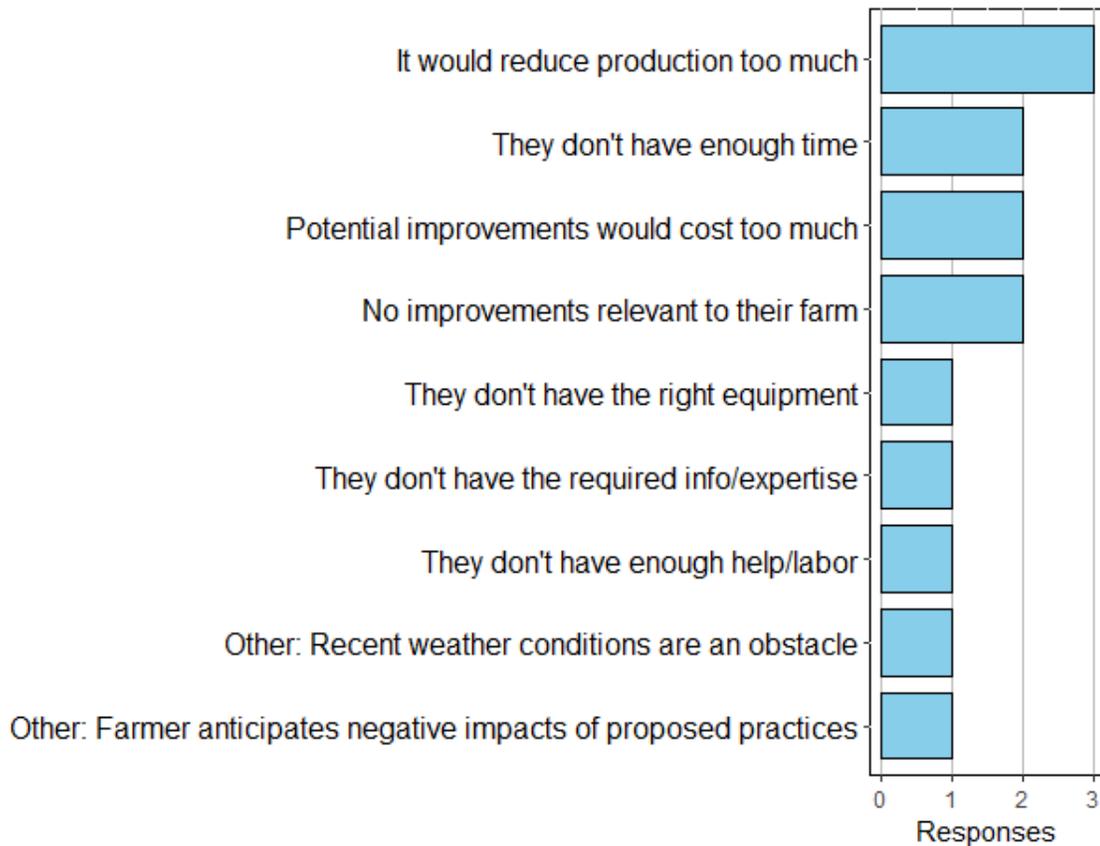
### 4. TA perceptions of change to conservation practices made by farmers during enrollment



5. Have you supported any VPFP participants who did not make improvements (i.e., addition, expansions, or enhancements) to their conservation practices while enrolled in VPFP?



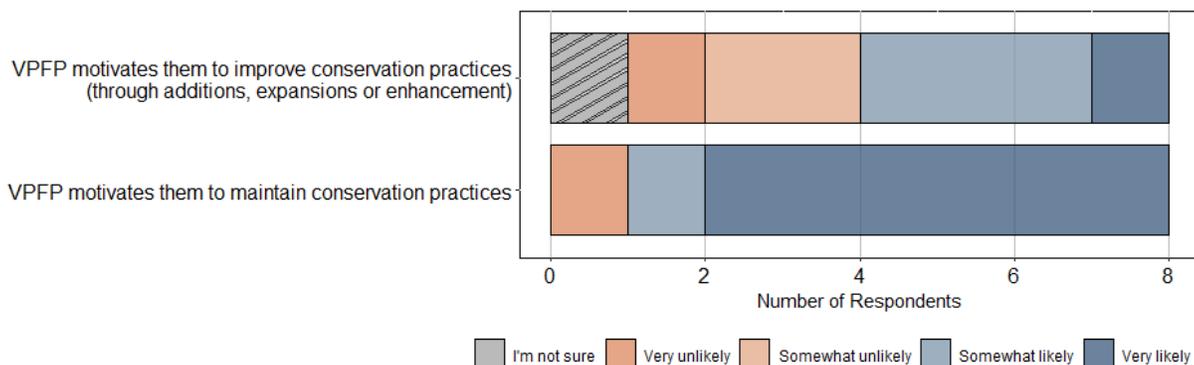
6. Among the farms that chose not to make improvements to their conservation practices while enrolled in VPFP, which of the following explanations are most common?



*“One farmer I work with has concerns about manure injection and its impact of hay quality and soil health. [They have] the opportunity to have manure injected on [their] land, but is not interested in that practice. Farmers who cover crop would like to get crops on earlier, but some of the wet conditions we've seen the past couple of summers hasn't allowed them to harvest field crops early enough to do so.”*

*- TA provider*

**7. Based on what you've observed, how likely is it that participation in VPFP motivates farmers to improve (i.e, add, expand or enhance), maintain or scale back their conservation practices?**

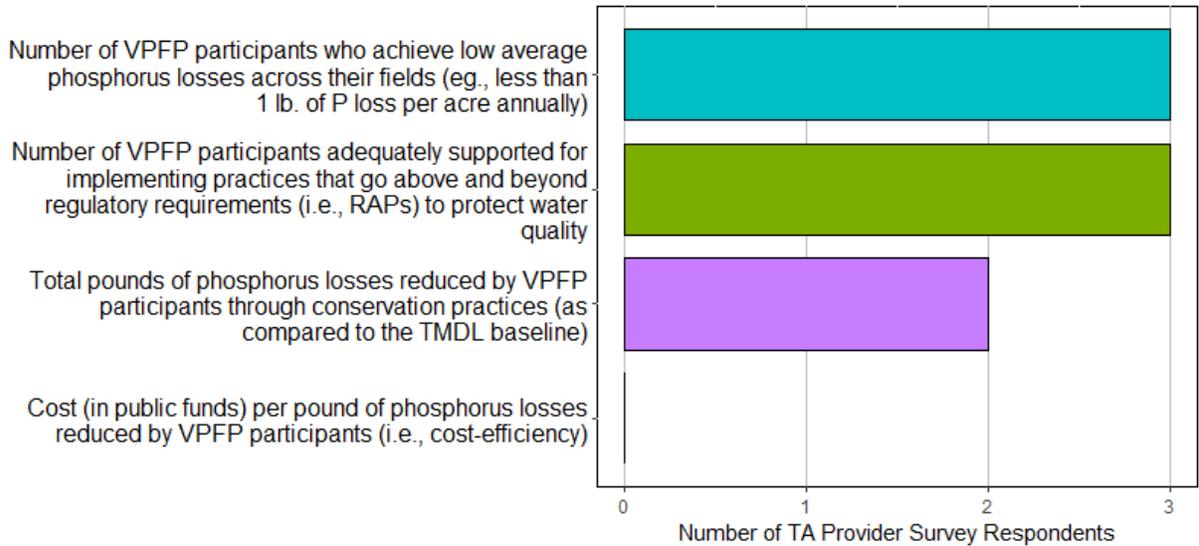


**8. How could VPF be changed to motivate participants to improve their conservation practices over the course of their enrollment?**

<p>“Rather than comparing to the TMDL baseline each year of the program, I think comparing average P loss/acre to previous years of operation while enrolled in the program would be more motivating and easier to understand for farmers. This would mean that farmers would have a baseline established in year 1 enrolled (and receive a payment for data entry and maybe some payment related to the baseline reductions), but then subsequent years of payments would be based off a comparison to their first year enrolled.”</p>
<p>“Farmers might be more motivated to improve practices if they had a better idea of what the resulting payment would be after those changes.”</p>
<p>“There could be incentives for continuous improvement, or opportunities to learn new conservation practices.”</p>
<p>“[VPFP] and Farm-PREP as they work now are not a tool that can effectively incentivize changes to management. There are so many other factors that impact the payment beyond management choices and there is no way to compare alternatives in a way that guarantees that if they change their management that the potential financial benefit they would get from the program is what they would actually receive.”</p>
<p>“Having more confidence in the Farm-PREP software and being able to explain "why" to the farmers related to P reductions. Having P [loss] reductions be compared to the farms’ own baseline as opposed to the TMDL [would also help to motivate participants].”</p>
<p>“Besides cash payouts, [there should be] clear guidelines of how practices relate to the model.”</p>
<p>“The conservation practices have to work with the farm and the farming operation. When a farm moves towards a grass-based farm, there are limited conservation practices they can implement.”</p>
<p>“It could be made to run alternative scenarios to indicate different management strategy outcomes.”</p>
<p>“[M]any of the farms we work with in this program are primarily grass-based so many practices like no-till, cover crop, etc. don't apply.”</p>
<p>“I do think more farmers are keeping NMPs updated and doing better with record keeping, but on the ground practice implementation I don't think has changed. I think weather and cost are always the limiting/controlling factor.”</p>

**9. Of the following 'measures of success,' which should be given the highest priority as a target for the design of the VPF program?**

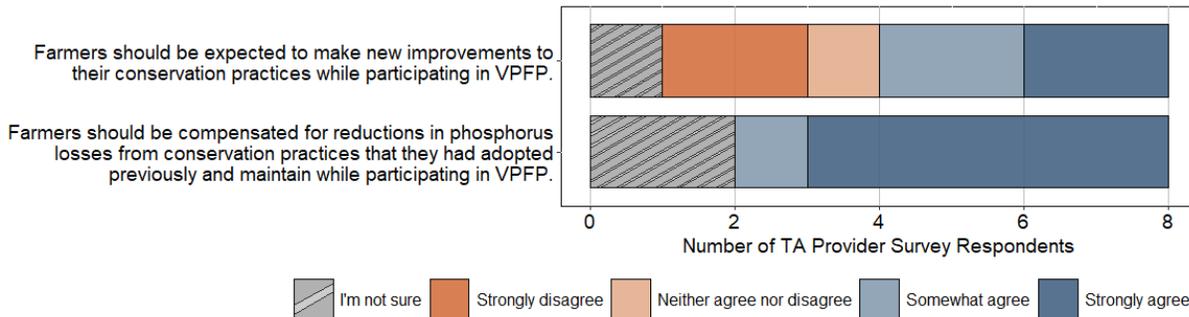
*(Respondents could only choose one option)*



**10. Indicate the extent to which you agree or disagree with the following statements.**

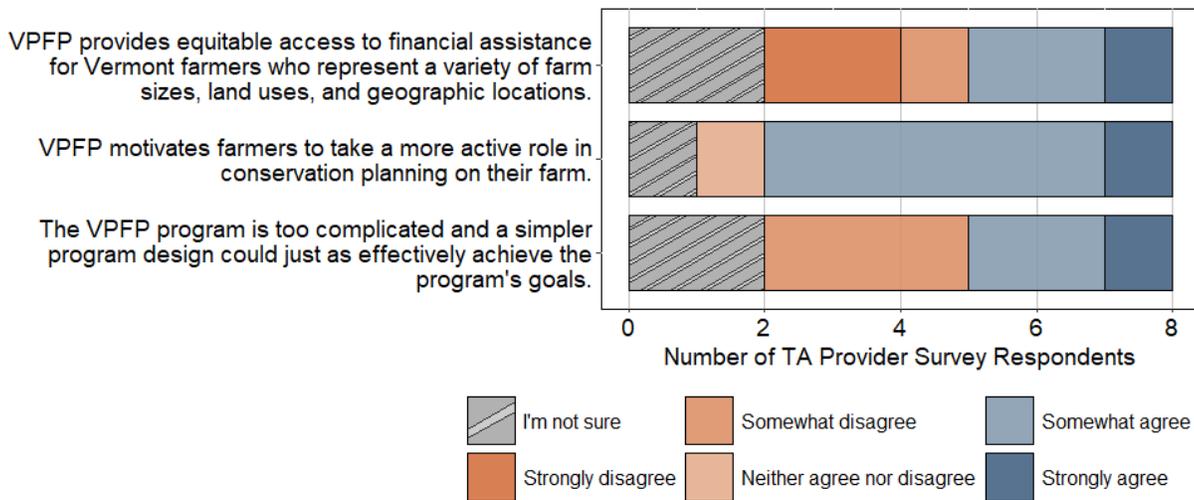
**For the purposes of this question:**

- 'make new improvements' refers to additions, expansions or enhancements of conservation practices within their current enrollment period
- 'maintain' means continuing to implement conservation practices adopted prior to the current enrollment period



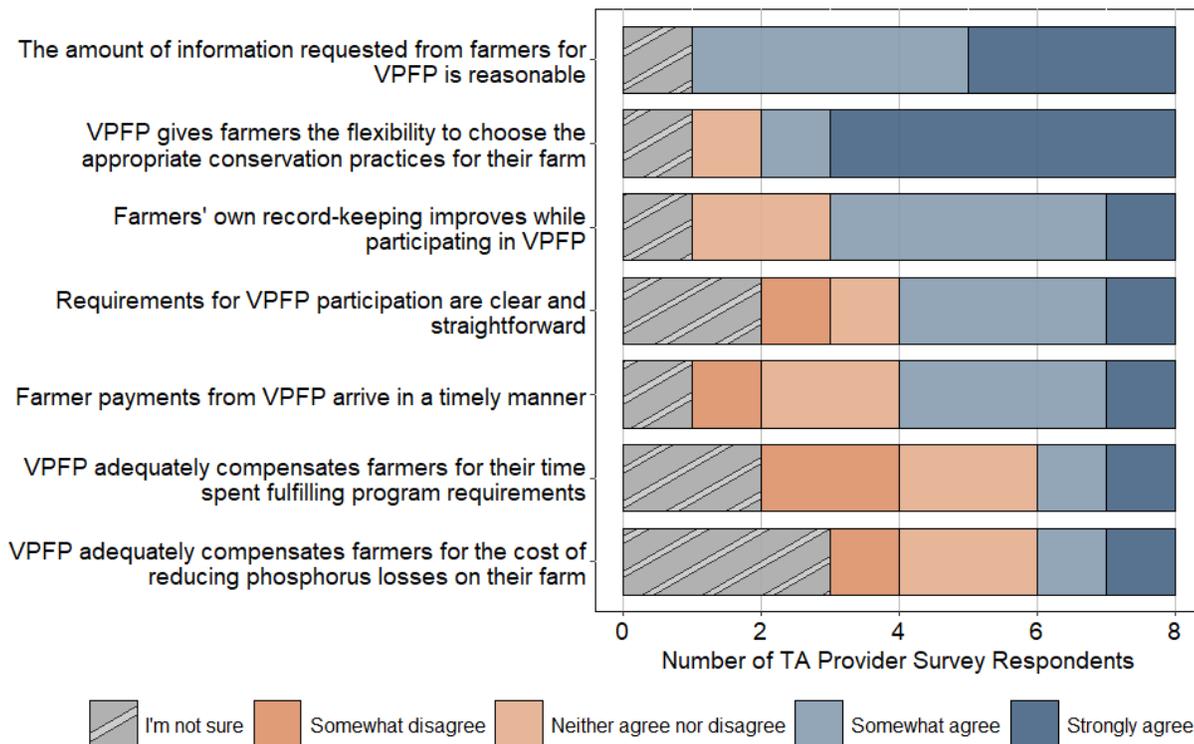
**11. Indicate the extent to which you agree or disagree with the following statements regarding VFPF's current program design.**

(In the first statement, we intentionally used 'equitable' instead of 'equal' to mean fair and appropriate to the circumstances of each farm and the goals of the program.)



**12. We'd like to know your perspectives on specific aspects of the VPFP Program.**

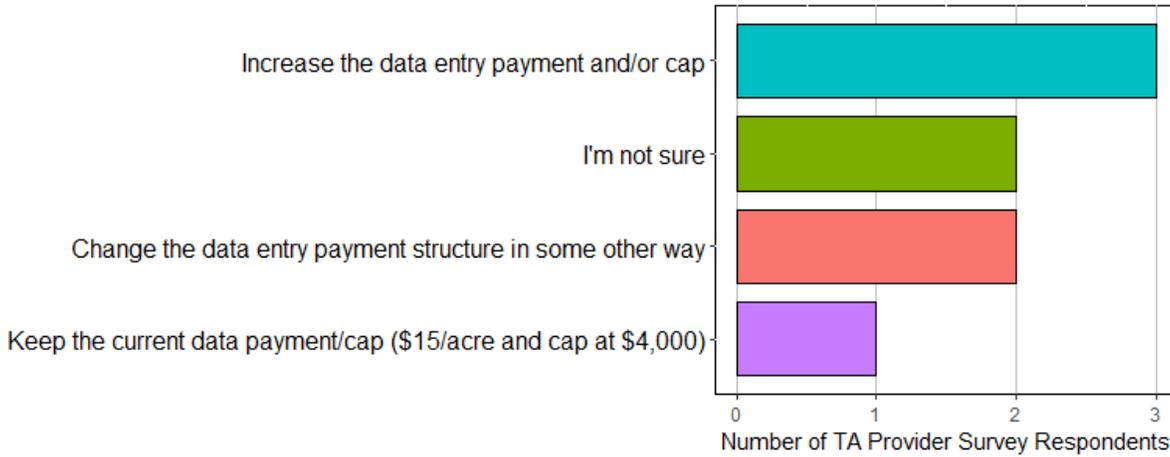
(Indicate the extent to which you agree or disagree with the following statements.)



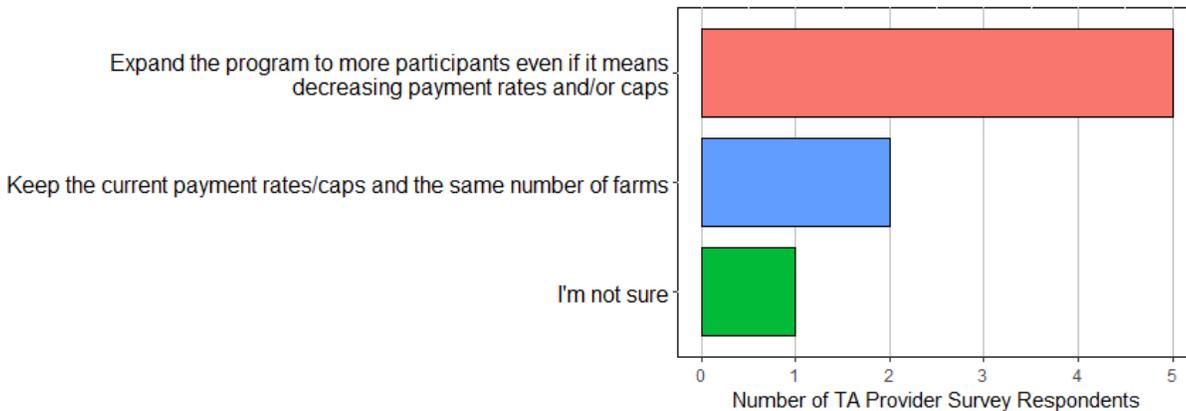
*"The question [of whether VPFP adequately compensates farmers for their time] is hard to answer. How much is a farmer's time worth to do paperwork? In theory it should be fairly easy as the info is also needed for their NMP."*

- TA provider

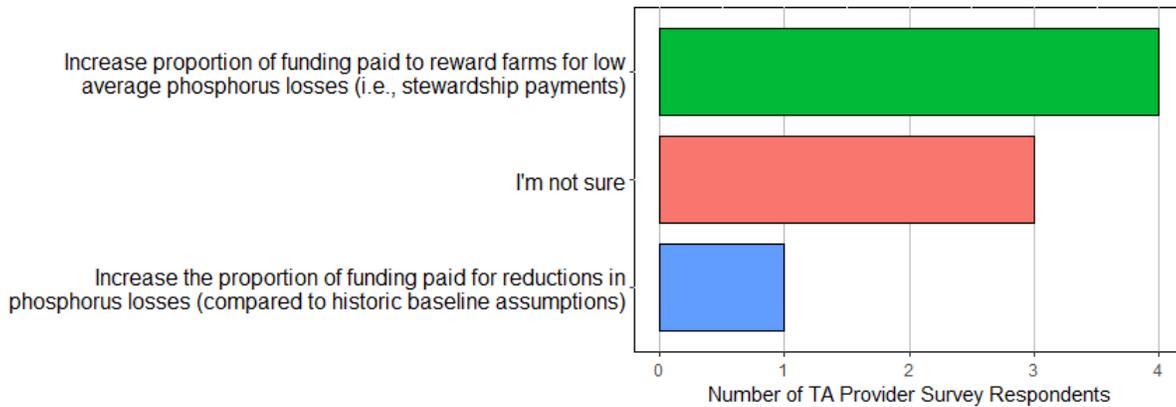
**13. In the current round of funding, VPFP applicants received a financial incentive for initial data entry of \$15 per acre with a payment cap of \$4,000 per farm. How would you change this monetary incentive for future program applicants?**



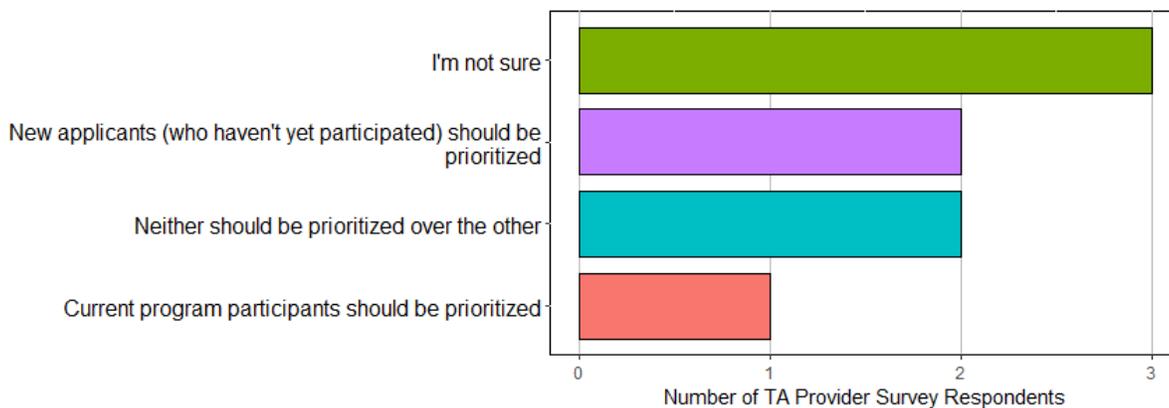
**14. In the next round of VPFP funding, AAFM will have to decide whether to extend VPFP assistance to a greater number of farmers or to increase its current payment rates. If the program budget remains the same, which of the following would you recommend?**



**15. A farm's annual VPFP payment is calculated based on reductions in the farm's phosphorus losses from historic baseline assumptions as well as an additional stewardship payment for farms that maintain low average phosphorus losses across their fields/pastures. On average, VPFP participants have earned \$19,500 annually for their phosphorus loss reductions and another \$2,500 in stewardship payments. Of the following future actions, which would you recommend?**



**16. Which of the following should be prioritized when AAFM selects farms for a second round of VPFP funding?**



**17. In brief, what types of farms appear to benefit most from VPFP participation?**

“Large CAFOs, especially those that spread synthetic fertilizers and not a lot of manure.”
“Large farms with enough acreage of hay, which typically receives a higher reductions from baseline/higher payment, to offset crop fields that may receive lower reductions or negative payment. Farms with strictly grass/pasture also do well in this program (if their pasture is managed well).”
“Flat grass-based [land uses on] nice soils, but I'm not sure.”
“Large dairy farms that have a lot of hay.”
“Grass-based farms that are not grazing.”
“Dairies.”
“Large dairies with most fields in corn/hay rotation [that are] already implementing conservation practices [and] keeping good records.”

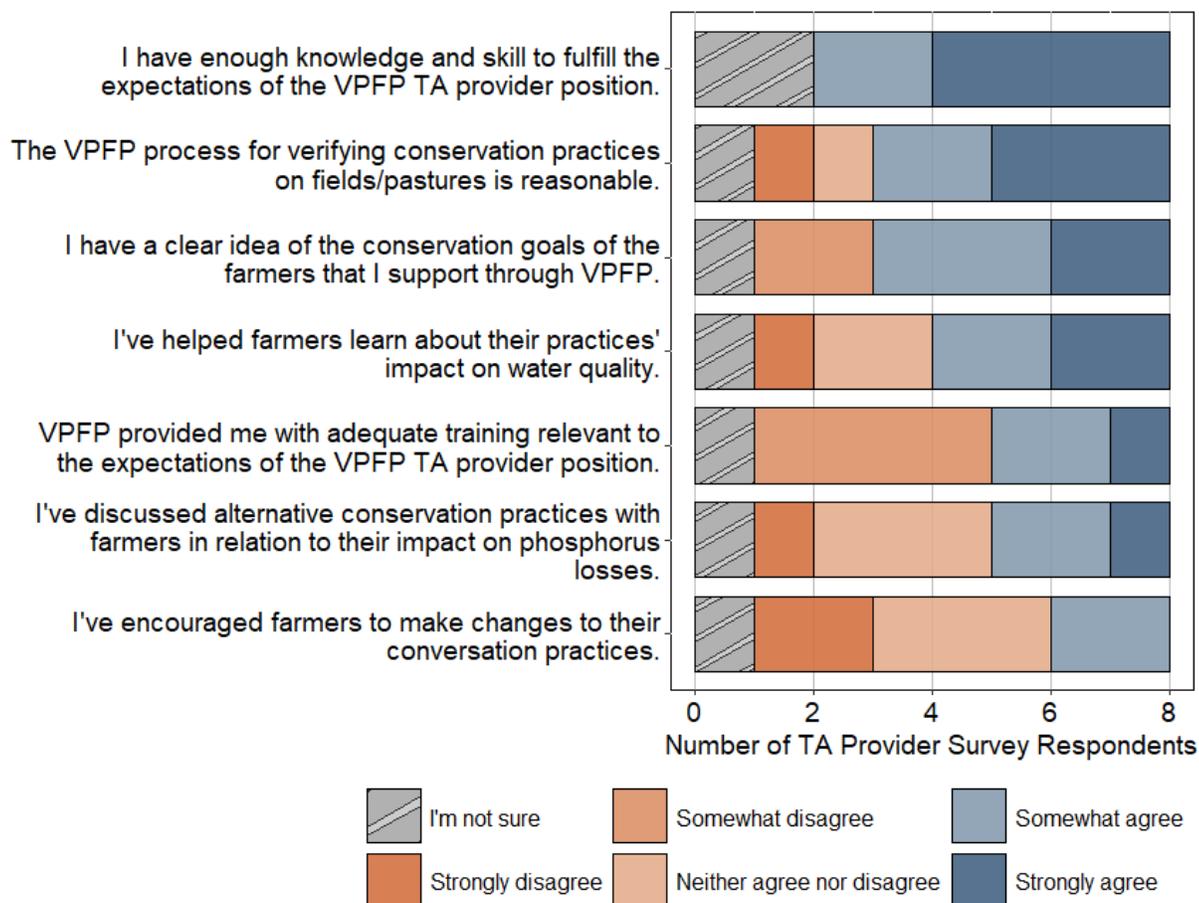
**18. In brief, what types of farms appear to benefit least from VPFP participation?**

“Farms with <b>small acreage</b> don't seem to benefit too much. Participation still requires a similar amount of work for the farmer to prepare and update their NMP and keep records, but the payment is often much lower than farms that simply have more acres.”
“ <b>Veg-only.</b> ”
“ <b>Small</b> grass-based farms. Although now that pastures are included in VPFP that could change IF they keep good pasture records.”
“Small <b>veggie producers.</b> ”
“Farms <b>without NMPs/poor record-keeping. Small diversified farms</b> are not necessarily poor performing, but the model is inaccurate for their practices.”
“Hilly farms with highly erodible soils.”
“Farms with <b>small acreage</b> ”.
“Farms that have <b>longer season crops</b> , like soy and seed corn, struggle because they are <b>not able to seed in cover crop</b> . More TA to give them alternative options to traditional winter rye might help them get cover crop down with the last pass of the tractor.”

**19. In your opinion, what types of farms should be prioritized as VPFP participants?**

“Farms with NMPs with most fields in corn and/or hay.”
“CSFOs”
“Bringing new farms into the program would be my priority. Encouraging farmers to adopt new management practices, whether they're in the program or not, would be my preference.”
“Farms doing conservation efforts as best they can.”
“Farms that are using a variety of conservation practices, and that meet low per-acre P loss thresholds [i.e., the limits established for the VPFP stewardship payments].”
“I think there should be more clear program requirements and any farm that meets those requirements is eligible. Some farms should not be prioritized over others.”

**20. Indicate the extent to which you agree or disagree with the following statements.**

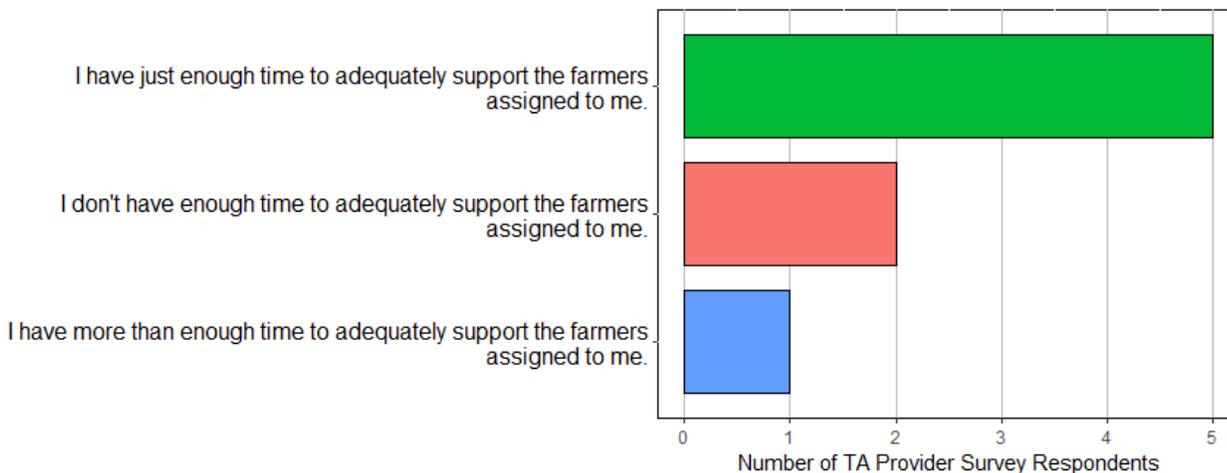


**21. In brief, how would you describe your goals as a TA provider in the VPFp program? To what extent has the design of the VPFp program hindered you or helped you in achieving these goals?**

TA provider comment	Has VPFp hindered or helped? (1 = significantly hindered; 3 = neither hindered nor helped; 5 = significantly helped)
“My goals are to support farmers with participating in a program that provides them financial incentive and compensation for farm management that reduces P loss from their fields, and to support farmers in learning about and exploring different conservation practices and the benefits they have relating to this program, water quality, soil health, and farm economic viability.”	4
“Support farms with their conservation practices and find areas where improvement is most beneficial.”	4
“I would have liked to understand Farm-PREP more to feel more confident to use it as a conversation tool with my farmers as opposed to feeling like it was a black box with lots of unknowns. I've enjoyed the experience of needing to regularly connect with my farmers, but they also seem frustrated with the program.”	3

“Assist VACD and farms with completing assessments.”	3
“My goals were to keep in contact with my farmers and keep updated with what they were doing and how that might impact VFPF and advise when appropriate.”	3
“It is not our role to encourage farmers to make or not make specific management choices on their farm. Our role is to provide them with information and resources so that they can make the most informed decision for their farm. Phosphorus losses are just one small piece of the puzzle. Many of our farms are struggling with farm viability and <b>counting on projected payments from this program is a huge gamble that may not be a good business decision when there are so many variables that can change their actual payment.</b> Our goals as TA providers should be to support farmers participation in this program, not to try and influence them.”	3
“I viewed my goal as collecting enough data to allow Farm-PREP to accurately model the practices [currently] happening on a given farm.”	3
“Help farmers jump through the many hoops, computer work, and data compiling that is required [by VFPF].”	2

**22. How would you characterize your workload as a TA provider in the VFPF Program?**



**23. What could be changed about the VFPF process to make the workload more manageable for TA providers?**

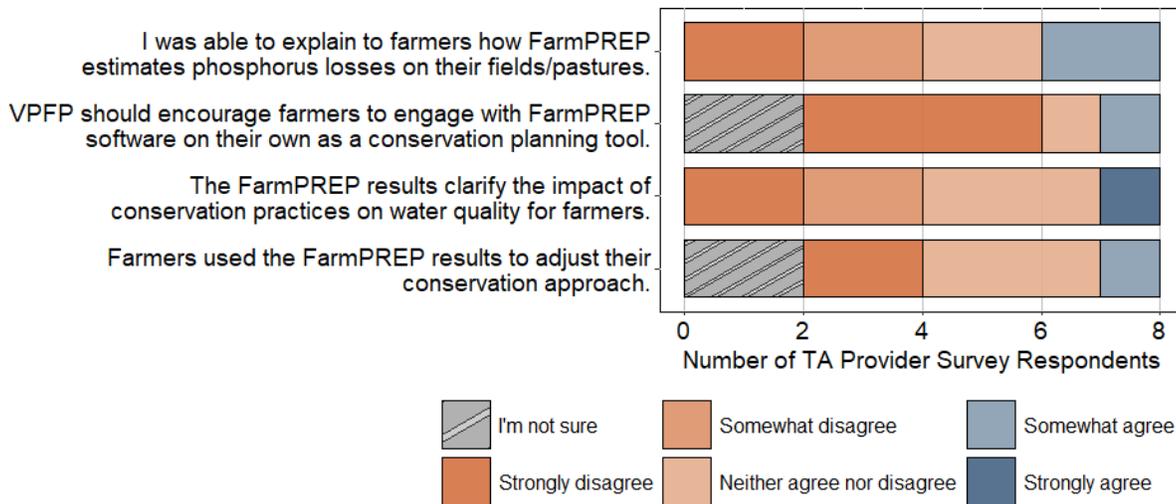
“More help in outlining the data we need to collect, organizing the data we collect before we input it into Farm-PREP, and helping us to know where a "normal" range lies for the data we collect. [For example,] is the rate of manure injection likely or did we misunderstand what a producer told us? How many bales of hay or wagons of chop is average for an acre of grassland?”

“Less manual data entry. Or maybe hire someone that specializes in Farm-PREP and they do the [VPFP data entry] and verifications.”
“There is a huge range in the amount of time working with a farm and the data input takes. [You might spend] less than 5 hours to complete their actual assessment and others take 30+ hours. This amount of variability is not built into the current structure. Over the years this program has gotten significantly more complicated in terms of data entry, but I'm not sure all of these calculator tools actually result in more accurate results.”
“The only frustration I experienced was with trying to work with the farms’ consultant. It was like pulling teeth to get soil sample results.”
“Remove/change the Planned Assessment, and to submit the Actual Assessment to VAAFMM before having farmers sign the claim form, so that we can receive feedback and make final edits before discussing AA with farmers.”
“No verification stage. More options in pasture (trying to translate pasture has taken up a LOT of time).”

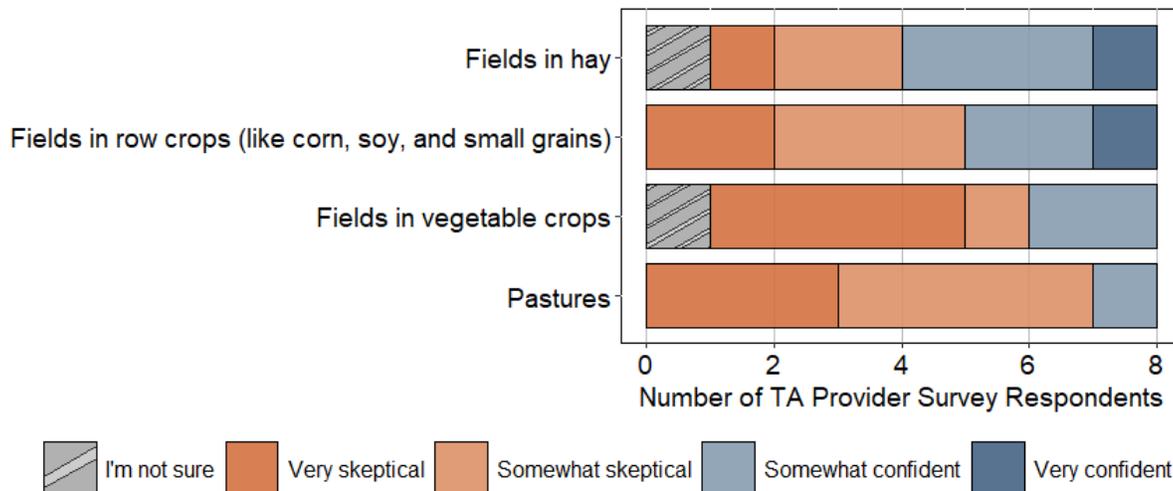
**24. What types of additional support and/or training for TA providers might improve the quality of technical assistance through VPFP?**

“We need more training on how Farm-PREP works and how to communicate how it is coming up with numbers to our farms.”
“Some more introduction to practice standards and definitions. I am still somewhat unclear what counts as "reduced till".
“Robust trainings for new hires and/or a total walk-through of one to understand the full process.”
“More, regular trainings. More info about how Farm-PREP actually works.”
“I loved the participant checklist for keeping me on track. The Gantt chart not so much.”
“I think TAs would benefit from knowing if we should be encouraging producers to try new practices, or if we should view ourselves more as data collectors.”

**25. The Farm Phosphorus Reduction Planner (FarmPREP) is a software application used in VPFP to calculate the predicted phosphorus losses from fields/pastures based on data provided about practices, soil test results and other conditions (like soil type and climate). It can be used to compare the results of different on-farm conservation strategies. Indicate the extent to which you agree or disagree with the following statements.**



**26. How confident are you that Farm-PREP accurately predicts phosphorus losses on fields with the following land uses? Indicate the extent to which you feel skeptical or confident.**



**27. In brief, which types of data have been most difficult to translate between what the farm does and the data entry protocols of the Farm-PREP tool?**

“It is my opinion that Farm-PREP is not intuitive. Trying to find a simple way to explain the math and science behind the baseline phosphorous loads, phosphorous reductions and quantifying all of that and then converting to a monetary value, etc.,... [M]any farms don’t seem to care. [T]hey just want to know how much funding they will receive.”

“Surface spreading rates when provided [by farmer] in volume (eg, "12 loads on that field")”;

<p>“[T]here should be an option to export results from Farm-PREP in the units that a farm is familiar with. If they keep their records in gallons of manure, we should be able to export their farm info in that same unit. P2O5 amounts are not helpful or meaningful numbers for the vast majority of farms. If we truly want farmers to understand this program, we need to make it more relatable and simple.”</p>
<p>“Rotational grazing practices”;  “Pasture”;  “Pasture management is difficult to record, especially if farmers are using mobile fencing and changing paddock size or have multiple herds.”  “The pasture tool in no way accommodates the complexity and nuance of how grazing actually happens on a farm.”</p>
<p>“Crop rotations”;  “Crop rotations and rates”  “Crop rotations that aren't an option in Farm-PREP”</p>
<p>“Buffers.”</p>
<p>“Vegetables”</p>

**28. What additional conservation practices do farmers implement on their fields or pastures that are not adequately accounted for within the Farm-PREP tool?**

<p>“Leaving corn residue overwinter to increase ground cover.”</p>
<p>“Planting corn into grass rather than terminating and leaving exposed soil.”</p>
<p>“[P]asture either needs to get more complicated so we can put in real numbers or it needs to be simplified, but it's in a weird in-between where it isn't able to accurately capture how farms are managing pasture, but it is incredibly tedious.”</p>
<p>“Ditch vs. stream, amount of runoff and water volume.”</p>
<p>“Yield improvements/differences”</p>
<p>“Inter-seeding a run-out hay field/pasture rather than total renovation.”</p>

**29. Do you have any specific suggestions for how the FarmPREP interface could be made more user-friendly (either for TA providers or for farmers themselves)?**

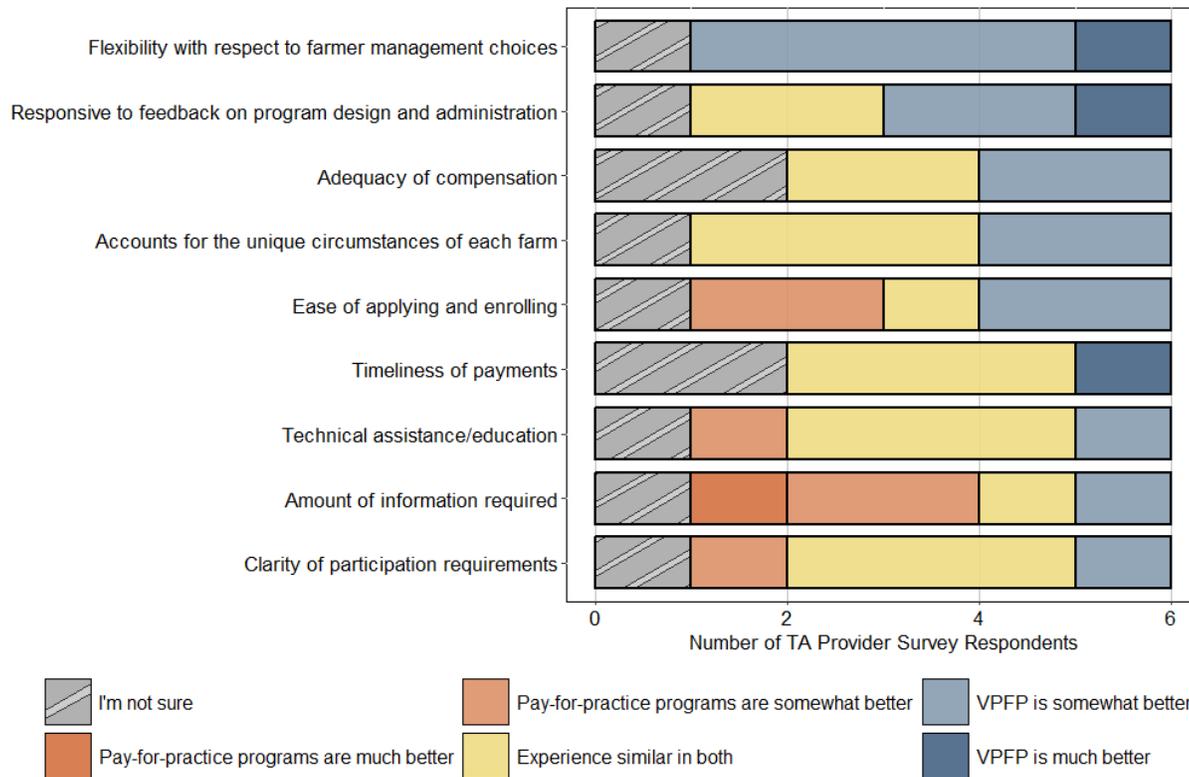
<p>“Combine the field data into one section!”</p>
<p>“goCrop compatibility [i.e., streamlining the sharing (or ease of uploading of) datapoints from the goCrop software.”</p>
<p>“Is there any way to reduce the time it takes to save changes? Data uploads from csv to Farm-PREP save time, but when I make individual changes in Farm-PREP and need to save after each it can be VERY time consuming.”</p>
<p>“It would be great if you didn't have to hit "save" after every edit per field. More options to switch between all map on a screen vs all field data entry on the user interface.”</p>
<p>“It would be great if there was a timestamp of when changes were made (easier to track).”</p>
<p>“It would also be helpful to be able to save assessment results with specific names within Farm-PREP (without having to download).”</p>

<p>“goCrop (for NMPs) has a great feature when you input soil tests from a csv, it tries to match the field names you have provided with the field names listed in the program (and it will pair them when the field names don't match exactly). Before importing anything, it lets you check that everything has matched correctly and make any edits if something didn't match up correctly. When you hit import, it then tells you everything that imported successfully and gives you a list of anything that didn't work and the reason why. It is so easy to catch errors and correct them, whereas FarmPREP you upload a csv and then just have to hope it worked. The easiest way to check your work is to download an assessment, but you can't do that until everything is filled out which is often days, weeks, or months later.”</p>
<p>“The proximity to water and buffer width should be inputted on the same page. Also, neither of these should change once they have been entered during the initial data entry.”</p> <p>“Getting rid of "proximate to water" check box on a separate screen.”</p>
<p>“[For farmers:] How FarmPREP is set up right now so that farms can't edit things or run scenarios (but can accidentally delete fields) is not helpful to them or us.</p>
<p>“[For farmers:] Because all of the numbers that we have put into FarmPREP have gone through the manure/pasture calculator, Farm-PREP is not a tool [that farmers] could even use if they had access.”</p>
<p>“[For farmers:] One must be very computer savvy to make it all work, which is a hinderance for farmers”</p>

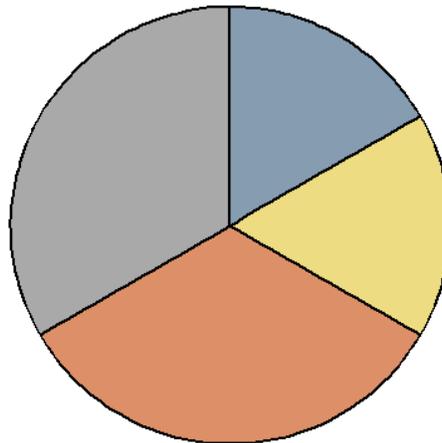
### 30. Additional comments about Farm-PREP

<p>“Comparing to the TMDL is inherently flawed and confusing for farmers.”</p>
<p>“Need to be able to incorporate yield.”</p>
<p>“The tools and data input process keep getting more complicated, but it doesn't feel like it has resulted in higher accuracy of results.”</p>
<p>“Make it import data directly/automatically from Farm-PREP [(respondent might have meant goCrop)].”</p>
<p>“As more tools have been introduced into this program for pasture, manure, etc., it has gotten significantly more complicated to double check with [farmers] that how we are interpreting info from farms is accurate. When we sit down with them to review actual assessments so they can sign the claim form, everything that comes out of Farm-PREP is so far from real numbers. None of our farmers know the rate of P<sub>2</sub>O<sub>5</sub> that they are applying through manure. They just look at those numbers and have to trust that we've done our math and data input correctly since their actual records are in gallons or loads. Similarly with pasture, since everything has gone through the calculator tool, most of those numbers don't match their records.”</p>

### 31. In general, how does VPFP compare to “pay-for-practice” programs for each of the following programmatic attributes?



**32. Imagine you're in a decision-making role with respect to public funds. You have a limited budget and the two objectives: supporting farmers and improving water quality. To address these objectives, would you invest more (proportionately) in 'pay-for-performance' programs (like VPFP) or in 'pay-for-practice' programs (like FAP, EQIP or CSP)? (n=6; respondents who indicated that they were very or somewhat familiar with practice-based programs)**



- Invest some more in 'pay-for-performance' programs (like VPFP)
- Distribute the funds evenly (i.e., 50/50) between both types of programs
- Invest some more in 'pay-for-practice' programs (like FAP, EQIP or CSP)
- I'm not sure

“The data entry for VPFP is very time consuming, and I can't help but wonder if the amount of funds going towards TA and data entry could go further in a program with a different structure.”

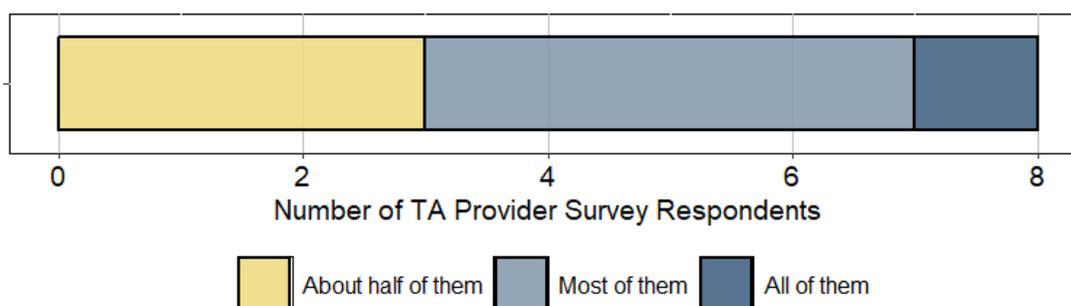
“Both are important and address different things. It doesn't feel like we are comparing apples to apples.”

“EQIP and CSP are federal programs and unless a farmer is doing a structural contract, the state doesn't provide match.”

“It was not a fair question to lump FAP with EQIP and VPFP. **FAP is an amazingly easy program where most of the farmers are approved, with straightforward expectations and fairly quick turnaround for payment** although the payment rate is significantly less than EQIP. That is not so with EQIP. With EQIP, there is an application, farm visit, field evaluations, draft plan then the ranking process [in] which many smaller farms don't rank out. For the last question, I would put **more funding into FAP and CEAP and keep VPFP the same.**”

“I think if VPFP compared farms to realistic baselines, then it would be more useful. But I think part of the issue is the cost of practice implementation is so high. And on large farms, they hit the cap of pay-for-practice programs and pay-for-performance quite early, so it's hard to incentivize changes when payments are capped anyway just by doing what they're already doing.”

**33. Think about the farmers that you've supported through the VPFP program. How many appear(ed) to be satisfied with their participation in VPFP overall?**



**34. In brief, what specific types of assistance (financial and/or technical) are needed by the farmers that you've supported in order to improve their conservation practices?**

“Constant personal contact with one or two people that have a good practical knowledge of conservation practices and how those practices would fit with the farm. Farmers appreciate having a sounding board for ideas and questions.”
“Farmers need more clarity/explanation on what causes poorer performance/payout.”
“Assistance (technical and financial) with adopting new practices such as cover cropping, rotational grazing, reduced/no till.”
“Farmers need more money and more time.”
“More funds for time and labor to implement practices and/or to just do good stewardship.”
“Better record keeping support.”
“Higher payments for products (milk).”
“Many of our farms are struggling with financial viability and working on being able to continue farming is their primary goal every day before they are able to focus on implementing new practices or can risk trying different approaches.”

**35. Setting aside funding limitations, what types of programmatic changes might be necessary to persuade additional Vermont farmers in your region to apply to VFPF?**

“Somehow changing from a per-acre payment to make payments more enticing for smaller farms.”
“Keep the program as-is. There were more farms in our region that wanted to apply in January 2025.”
“Even though they are required by law, having an up-to-date NMP seems to be a big stumbling block.”
“Better understanding of the program, and what expected payments are before signing up. Some farms I work with really had no notion of how much they might get paid when signing up for this program.”
“Less involved paperwork.”

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**36. In brief, do you have any other recommendations about how the Vermont Pay for Performance Program (VPFP) could be improved?**

“More understanding of Farm-PREP.”
“Incentivizing new practices over time.”
“Use goCrop more. Farmers are already pouring a lot of effort into that platform. Try not to make them do it twice.”
“I think that in the future, farmers enrolling should be able to decide if they want to apply to the program for their cropland and/or pasture. Farms that want to enroll pasture must have a grazing plan, soil samples for their pastures, and be keeping reasonable grazing records. If they don't have those, they are not required nor eligible to enroll pasture.”

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**37. Is there anything else you'd like to share about your experience as a VPFP TA provider?**

“VAAFAM staff and [another TA provider] have been amazing in assisting me with Farm-PREP.”
“This is a good program, but it's very complicated. That frustrates the farmers and the TA [providers].”
“I have not felt comfortable using Farm-PREP to provide any type of guidance to farmers to change payments/practices.”

## 9.4. Payment for Ecosystem Services Programming Landscape

In preparing the PES Landscape Analysis section of this report the UVM Evaluation Team set forth to collect an ambitious selection of information from the landscape of practice and performance PES programs in the US. Information was collected through review of available documentation and reporting materials and through establishing contact with individuals involved in the administration of these programs. These individuals acted as key informants providing information not available through published documentation and providing insights about program design features and innovations. Fields where information was unavailable are marked “Information Not Available” and fields that were not applicable to certain programs are marked “n/a”.

Table 1. Basic Logistical Information							
PES Program	Watershed(s)	Project partners	Project years (and status)	Focal outcome(s)	Program Driver	Performance or Practice?	Funding Source(s)
<b>Environmental Quality Incentives Program (EQIP)</b>	National	USDA, State Agriculture Agencies, Local Conservation Districts	1996-Present	Conservation, outcomes based on regional and local needs	NRCS Natural Resource Concerns	Practice	Farm Bill
<b>Kalamazoo River Phosphorus Reduction Program</b>	Kalamazoo River (MI)	Allegan County Conservation District, Michigan Farm Bureau Delta Institute	2020-2024	Phosphorus	Information Not Available	Performance	EPA GLRI
<b>North Fork Maquoketa River Headwaters Watershed Project</b>	Maquoketa River	Iowa State University Winrock International Coffee Creek Watershed Improvement Association	2008-2011	Phosphorus	Information Not Available	Performance	NRCS CIG WIRB
<b>Milwaukee River Pay for Performance Project</b>	Milwaukee River - West Branch	Winrock International Delta Institute Sand County Foundation	2013-2017	Phosphorus	Potential TMDL Requirements	Performance	Great Lakes Protection Fund, NRCS
<b>Ohio River Basin Trading Project</b>	Ohio River Basin	Electrical Power Research Institute American Farmland Trust Markit ORSANCO Ohio Farm Bureau Federation Troutman Sanders U.C. Santa Barbara Delta Institute C-AGG	2011-2020	Nitrogen Phosphorus	Power plant and POTW NPDES permit compliance	Performance	NRCS CIG Water Quality Credits
<b>Old Woman Creek Pay for Performance Program</b>	Old Woman Creek	Winrock International Erie County SWCD Heidelberg University Old Woman Creek National Estuarine Research Reserve	2017-2020	Nitrogen Total Phosphorus Soluble reactive phosphorus Sediment	Approved TMDL req'ts	Performance	EPA

<b>Phosphorus Load Reduction Stimulus Program (PLUS-UP)</b>	Western Lake Erie Basin	CTIC Heidelberg University	2022-2024	Soluble reactive phosphorus	EPA Target Reduction for Dissolved Reactive Phosphorus	Practice	Buyers of DRP credits. The Bayer Carbon Program is the first buyer of DRP Credits through PLUS-UP
<b>Rabbit River Watershed Project</b>	Rabbit River (MI)	Allegan County Conservation District, Michigan Farm Bureau MSU Institute of Water Research Delta Institute	2017-2020	Sediment		Performance	EPA GLRI
<b>River Rasin Pay for Performance Program (1<sup>st</sup> Iteration)</b>	River Rasin - South Branch	Winrock International Michigan State University Extension The Stewardship Network Graham Sustainability Institute at U. of Michigan Ohio State University	2015-2016	Phosphorus Nitrogen Sediment	River Rasin Watershed Management Plan (not regulatory) <i>Potential</i> TMDL requirements	Performance	EPA
<b>River Rasin PFP (2)</b>	River Rasin	Michigan Department of Agriculture Michigan State University Extension	2025-2032	Information Not Available	Information Not Available	Performance	.MI Dept. of Ag
<b>Saginaw Bay Pay for Performance Project</b>	Saginaw Bay	The Nature Conservancy Delta Institute Sanilac Conservation District Great Lakes Commission Michigan State University	2015-2019	Sediment	EPA priority watershed	Performance	EPA Great Lakes Initiative
<b>Vermont Farm Agronomic Practices</b>	Lake Champlain Lake Memphremagog Connecticut River Hudson River	N/A	2010-Present	soil quality, crop production, erosion and agricultural waste discharges	TMDLs	Practice	VT (General Fund, Water Quality Fund, Champlain Basin Program), Federal (incl. American Rescue Plan Act)
<b>Vermont Pay for Performance Program</b>	Lake Champlain Lake Memphremagog Connecticut River	University of Vermont Vermont Association of Conservation Districts Stone Environmental	2022-Present	Phosphorus	Approved TMDL req'ts		NRCS RCPP AFA State of Vermont

Table 2. Project design features (Pt. 1)

PES Program	Predictive model used	Data management	Baseline	Model results provided to farmers
EQIP	N/A	N/A	N/A	N/A
Kalamazoo River Phosphorus Reduction program	Information Not Available	Information Not Available	Information Not Available	Information Not Available
North Fork Maquoketa River Headwaters Watershed Project	IA P Index, Cornstalk Nitrate Test, Soil Conditioning Index,	Iowa State University	Family Biotic Index	Iowa State University Extension staff compiled informational materials detailing modeled results that were presented to program participants 5-6 times a year at Watershed Council Meetings.
Milwaukee River PFP Project	SPARROW SWAT SnapPlus	Information Not Available	Performance compared to field management “status quo” from the last 5-10 years.	Information Not Available
Ohio River Basin Trading Project	EPA Region 5 Model WARMF ALMANAC	Information Not Available	Information Not Available	Information Not Available
Old Woman Creek PFP Program	NTT CAT	Heidelberg University	Performance compared to current field management “status quo”	For each scenario on each field: <ul style="list-style-type: none"> <li>• Estimated reduction of N and P losses (in lbs./year)</li> <li>• Payment associated with reductions</li> <li>• Full economic costs to the farmer</li> <li>• Profit or loss from each scenario</li> </ul>
PLUS-UP	NTT	Heidelberg University	“no unusual conservation practices”	Information Not Available
Rabbit River Watershed Project	Information Not Available	Information Not Available	Information Not Available	Information Not Available
River Rasin PFP Program (1 <sup>st</sup> iteration)	SWAT GLWMS	CD staff used tool with farmers by proposing a practice and modeling its benefit	Performance compared to current field management “status quo”	For each scenario on each field: Estimated reduction N, P and sediment losses EQIP payment rates for each practice modeled Cost-effectiveness of practices
Saginaw Bay PFP Project	EPA Region 5 Model GLWMS	MSU Institute of Water Research	Performance compared to current field management “status quo”.	Model results available through GLWMS

			“Implementation of these practices must be within fields that currently lack the BMP and don’t currently receive cost-sharing from other programs. This project only paid for the implementation of new practices.”	
<b>Vermont FAP</b>	n/a	VAAFM	None	n/a
<b>Vermont PFP</b>	APEX	Data collected and entered by CD staff or private crop consultants	Compared to assumptions of historical (pre-TMDL) agricultural practice scenarios	For planned and current scenario on each field: <ul style="list-style-type: none"> <li>• Average estimated reduction of P losses (in lbs./year) over 30-year period</li> <li>• Payment associated with reductions</li> </ul>

EPA Region 5 Model (IN Dept. of Environmental Management; MI Dept. of Environmental Quality); WARMF = Watershed Analysis Risk Management Framework (Systech Water Resources); ALMANAC = Agricultural Land Management Alternative with Numerical Assessment Criteria (USDA-ARS); SPARROW = SPAtially Referenced Regression On Watershed attributes (USGS - Water Resources Mission Area); SWAT = Soil & Water Assessment Tool (Texas A&M University); SnapPlus = Soil Nutrient Application Planner (University of Wisconsin); GLWMS = Great Lakes Watershed Management System (MSU Institute of Water Research, among others); NTT = Nutrient Tracking Tool (Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University); CAT = Cost Analysis Tool (Winrock Int’l); IA P Index = Iowa Phosphorus Index (Iowa State University); VT P Index = Vermont Phosphorus Index (University of Vermont); APEX = Agricultural Policy/Environmental eXtender Model (Texas A&M University).

SnapPlus is a nutrient management planning software similar to University of Vermont’s goCrop.

VPFP only pays farmers for “additional” P loss reduced, or the amount of P loss reduced beyond a set threshold of P loss reduced from the baseline scenario. The threshold for this round of VPFP was 40%. If a farmer reduced P losses compared to the baseline scenario, but these reductions were less than or equal to a 40% reduction, then they did not receive a P loss reduction (i.e., outcome-based) payment.

<b>Table 3. Project design features (Pt. 2)</b>			
<b>PfP Project</b>	<b>Field selection</b>	<b>Contract terms</b>	<b>Participant selection</b>
<b>EQIP</b>	Chosen by farmers (through advising from service providers)	Payment rate for given conservation project, paid after certification that work is done to spec.	According to local resource concerns
<b>Kalamazoo River Phosphorus Reduction Program</b>	“Participants were permitted to submit multiple bid applications for all the fields they would like to implement phosphorus reducing practices.”	1- to 2-year contracts	Reverse auction

			<p>“Bids were ranked based on cost-effectiveness of the practice, i.e. the cost per pound of phosphorus loading reduced by implementing the practice. A maximum price per pound of phosphorus was set once the bids were received and changed between application periods. Once the maximum price was set, the winning bids were those that fell below maximum price.</p> <p>The program was uniform-priced, and all winning sellers were paid the same price per pound of phosphorus at the rate of the top winning bid. This means that payments may have been higher than the bid price but were never lower than the bid price.”</p>
<b>North Fork Maquoketa River Headwaters Watershed Project</b>	Information Not Available	Information Not Available	Information Not Available
<b>Milwaukee River PFP Project</b>	Information Not Available	15- to 25-year agreements	Information Not Available
<b>Ohio River Basin Trading Project</b>	Information Not Available	Information Not Available	Information Not Available
<b>Old Woman Creek PFP Program</b>	Farmers and their TA providers select which fields to enroll in the project (i.e., those fields where implementing new conservation activities would be cost-effective).	Information Not Available	Information Not Available
<b>PLUS-UP</b>	Information Not Available	Information Not Available	Information Not Available
<b>Rabbit River Watershed Project</b>	Information Not Available	Information Not Available	Information Not Available
<b>River Rasin PFP Program</b>	Information Not Available	Information Not Available	The farm would be enrolled if the cost-effectiveness of P loss reduction was \$150/lb-P or better (i.e., lower). Others (with cost-effectiveness greater than \$150/lb-P) would be waitlisted.
<b>Saginaw Bay PFP Project</b>	Information Not Available	Information Not Available	Information Not Available
<b>Vermont FAP</b>	Chosen by farmer	1 year contracts	<ol style="list-style-type: none"> <li>1. Compliant with VT Required Agricultural Practices</li> <li>2. In good standing with the State of VT</li> </ol>

<b>Vermont PFP</b>	Results modeled across all farm fields (no field selection)	From enrollment to the end of the grant period (or until the farm receives its total obligated payment established at enrollment, whichever comes first)	<p>Prioritize the following operations:</p> <ol style="list-style-type: none"> <li>1. Historically underserved producers <ol style="list-style-type: none"> <li>a. Veterans</li> <li>b. New and beginning farmers</li> <li>c. Low-resourced farmers</li> </ol> </li> <li>2. Farms in priority and strategic watersheds defined within VAWQP Organizations based on water quality monitoring data and tactical basin planning efforts.</li> <li>3. Farms likely to receive substantial payment for additional P-Reductions <ol style="list-style-type: none"> <li>a. Known conversion from Corn to Hay or to Corn/Hay Rotation</li> <li>b. Highly erosive soils with conservation practices installed</li> <li>c. Exemplary stewardship practices</li> </ol> </li> <li>4. Farms well-placed to enter necessary data: <ol style="list-style-type: none"> <li>a. Enrolled in NMP and NMP update classes</li> <li>b. Actively working with VACD and NRCS Conservation Planners</li> </ol> </li> </ol>
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<b>Table 4. Project scale</b>					
PFP Project	Number of farms enrolled	Number of farm acres enrolled	Total payments made to farms (\$)	Average annual payment by farm	Average annual payment by farm acre
<b>Kalamazoo River Phosphorus Reduction Program</b>	5	982	\$152,953	Information Not Available	\$155.84
<b>Old Woman Creek PFP Program</b>	5	1,259	\$47,481	\$9,496	\$37.71
<b>Ohio River Basin Trading Project</b>	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available
<b>Milwaukee River PFP Project</b>	Information Not Available	Information Not Available	Information Not Available		Information Not Available
<b>Saginaw Bay PFP Project</b>	Information Not Available	2213	Information Not Available	Information Not Available	Information Not Available
<b>River Rasin PFP Program (1<sup>st</sup> iteration)</b>	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available
<b>North For Maquoketa River Watershed Project (IA Pilot)</b>	29	31,071 (over 4 years)	\$225,708	Information Not Available	Information Not Available

<b>Vermont PFP</b>	70	41,880.9	\$3,311,920	\$21,646.53	\$54.31
<b>Rabbit River Watershed Project</b>	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available
<b>EQIP</b>	42,800 (2018)	13.6 Million Acres (2018)	\$1.87 Billion (2018)	\$30,000 / year	Depends on practices.
<b>Vermont FAP</b>	223 (2023)	179,000 (2016-2024)	\$5.6M total funding (2016-2024)	\$4,484 (2023)	\$27.15 (2023)
<b>PLUS-UP</b>	10	5300	\$15,900-\$53,000	Information Not Available	\$10 per acre
<p>Several figures are rounded for the sake of simplicity  Only acres on which BMPs were implemented</p>					

Table 5. Project performance						
PFP Project	Performance metric	Achieved (total)	Achieved (per farm per year)	Achieved (per acre per year)	Cost-effectiveness (Payment \$/unit)	Cost-effectiveness (Cost to farmer/unit)
<b>Ohio River Basin Trading Project</b>	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available
<b>Milwaukee River PFP Project</b>	P loss (in lbs.) reduced	Information Not Available	Information Not Available	0.54	Information Not Available	Information Not Available
<b>Saginaw Bay PFP Project</b>	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available
<b>River Rasin PFP Program (1<sup>st</sup> Iteration)</b>	Total P(?) loss (in lbs.) reduced	Information Not Available	Information Not Available	Information Not Available	\$27	Information Not Available
<b>Kalamazoo River Phosphorus Reduction Program</b>	Total P loss (in lbs.) reduced	5,453	Information Not Available	Information Not Available	\$28	Information Not Available
<b>Old Woman Creek PFP Program</b>	Total P(?) loss (in lbs.) reduced	337	67	0.27*	\$140.89	\$83.12
	N loss (in lbs.) reduced	7,213	1,427	5.67	\$5	Information Not Available
	Sediment (in tons) reduced	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available

<b>North Fork Maquoketa River Watershed Project</b>	P loss (in lbs.) reduced	Information Not Available				
<b>Vermont PFP</b>	Add.* P loss (in lbs.) reduced	35,323.08	230.87	0.52	Information Not Available	Information Not Available
<b>Rabbit River Watershed Project</b>	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available	Information Not Available
<b>Vermont FAP</b>	n/a	n/a	n/a	n/a	n/a	n/a
<b>EQIP</b>	n/a	n/a	n/a	n/a	n/a	n/a
<b>PLUS-UP</b>	Dissolved Reactive Phosphorus (DRP) loss reduced	“Nearly 500 lbs”	Information Not Available	Information Not Available	Information Not Available	Information Not Available
<b>Programs might define cost-effectiveness of achieving each unit of outcome differently: either based on the cost of “incentivizing” conservation (i.e., payments) or the costs to the farmer of implementing the practice (operation costs + opportunity costs).</b>						

## References

- Conservation Technology Information Center. (n.d.). Phosphorus Load-Reduction Stimulus Program (PLUS-UP). [https://www.ctic.org/projects/Sustainable\\_Supply\\_Chains/PLUS-UP](https://www.ctic.org/projects/Sustainable_Supply_Chains/PLUS-UP)
- Delta Institute. (2024). Market-based conservation in the Kalamazoo Watershed: Final comprehensive report. <https://delta-institute.org/wp-content/uploads/2024/12/Market-Based-Conservation-in-the-Kalamazoo-Watershed-Final-Comprehensive-Report.pdf>
- Delta Institute. (n.d.). Pay-for-performance agricultural conservation in the Rabbit River Watershed (MI). <https://delta-institute.org/project/pfp-rabbit-river/>
- Electric Power Research Institute. (2014). Ohio River Basin water quality trading project: Program summary\* (Report No. 3002001739). [https://wqt.epri.com/pdf/3002001739\\_WQT-Program-Summary\\_2014-03.pdf](https://wqt.epri.com/pdf/3002001739_WQT-Program-Summary_2014-03.pdf)
- FarmRaise. (n.d.). Farmer’s guide to EQIP: Funding for farm conservation. <https://www.farmraise.com/blog/eqip-funding-for-farm-conservation>
- Fisher, K. A., Winsten, J. R., Spratt, E., Anderson, R., & Smith, R. (2016). Pay-for-performance conservation: A how-to guide. Winrock International. <https://winrock.org/wp-content/uploads/2016/02/PfP-How-To-Guide-Final.pdf>
- Iowa Department of Natural Resources. (2011). North Fork Maquoketa River Headwaters Watershed Project: Final report (July 2008 – June 2011). <https://publications.iowa.gov/18320/1/7043-017%20North%20Fork%20Maquoketa%20FINAL%20report.pdf>

National Sustainable Agriculture Coalition. (n.d.). Environmental Quality Incentives Program (EQIP).  
<https://sustainableagriculture.net/publications/grassrootsguide/conservation-environment/environmental-quality-incentives-program/>

The Nature Conservancy. (n.d.). Pay-for-performance conservation: Saginaw Bay Watershed project factsheet.  
<https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/michigan/projects/Documents/Pay%20for%20Performance%20factsheet.pdf>

Vermont Agency of Agriculture, Food & Markets. (n.d.). Farm Agronomic Practice (FAP) Program factsheet.  
<https://agriculture.vermont.gov/fap>

## 9.5. Results from Economic Analysis

### 9.5.1. Yields

Farm-PREP predicts the productivity for different crops, including hay mixtures. Table 8.1. provides information about how Farm-PREP models cropping and productivity for hay mixtures and corn silage.

**Table 8.1.** How Farm-PREP models cropping options and reports productivity predictions

<i>Crop</i>	<i>Crop Species</i>	<i>% Legume in Stand<sup>1</sup></i>	<i>Productive Life</i>	<i>Yield reported as...</i>	
				<i>Units</i>	<i>% DM<sup>2</sup></i>
Corn Silage		0%	Annual	tons/ac	35%
Alfalfa Mix	alfalfa; tall fescue	50%	Semi-Annual	tons/ac	90%
Legume Hay	red clover; orchard grass	50%	Perennial	tons/ac	90%
Grass Hay	orchard grass; tall fescue	0%	Perennial	tons/ac	90%

Note. <sup>1</sup> From Judson's notes: "The percent of each crop is determined dynamically in the model and can change over the course of the simulation based on competition between the species for nutrients, water, etc., as well as the set tolerances of those species to temperature, water, and nutrient stress; perennial crops are not re-seeded." Unfortunately, the available dataset from Farm-PREP does not show what these ratios are for a given year. <sup>2</sup> Percent dry matter in predicted yield value

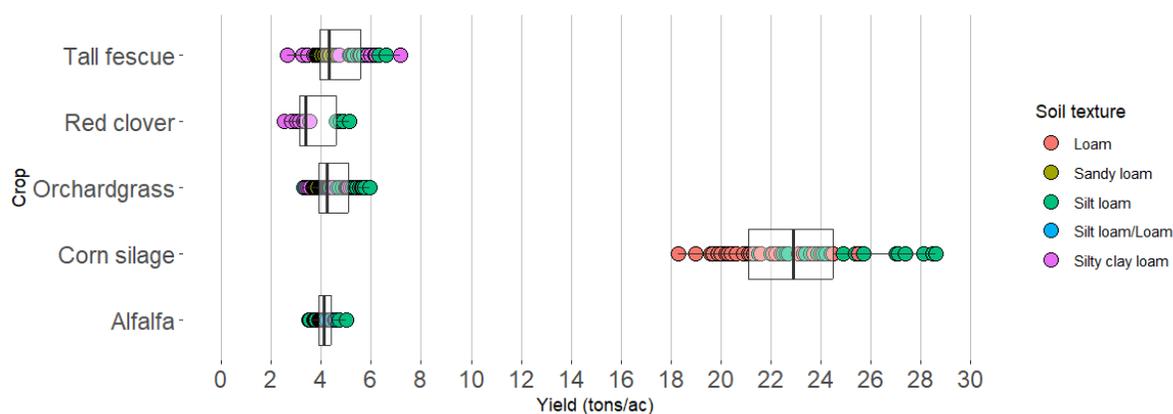
We compare the Farm-PREP predictions to the average results by variety from crop trials conducted in New York and Vermont by Cornell and UVM Extension (Darby & Ziegler, 2024a; Hansen et al., 2024; Lawrence et al., 2024). These results are reported as shown in Table 8.2.

**Table 8.2.** Information on how crop trials report productivity

<i>Crop</i>	<i>Productive Life</i>	<i>Yield reported as...</i>	
		<i>Units</i>	<i>% DM<sup>1</sup></i>
Corn Silage	Annual	tons/ac	35%
Alfalfa	Perennial	tons/ac	100%
Red clover	Perennial	tons/ac	100%
Orchard grass	Perennial	tons/ac	100%
Tall fescue	Perennial	tons/ac	100%

Note. <sup>1</sup>Percent dry matter

Figure 8.1. below shows our summary of forage and corn silage crop trial data from Cornell and UVM. We restricted this summary to yield observations in 2023 and 2024 and for stands that were at least two years old.



**Figure 8.1.** Yields from crop trials by crop type. Dot colors reflect soil texture in which crops were grown.

To compare the crop trial yields to the Farm-PREP data, we needed to a) “add moisture” to the crop trial forage yields to make them comparable to Farm-PREP (which reports forage productivity as 90% DM) and b) convert the observed productivity values for each forage crop species grown in isolation to the hay mixture productivity predicted by Farm-PREP.

For the latter, we currently estimate the total *median* yield for hay mixtures by:

- a) assuming a 50/50 ratio in aboveground biomass between legumes and grasses, and
- b) applying these 50/50 weights<sup>67</sup> to the median observed productivity of both the legume and grass species (when grown in isolation)

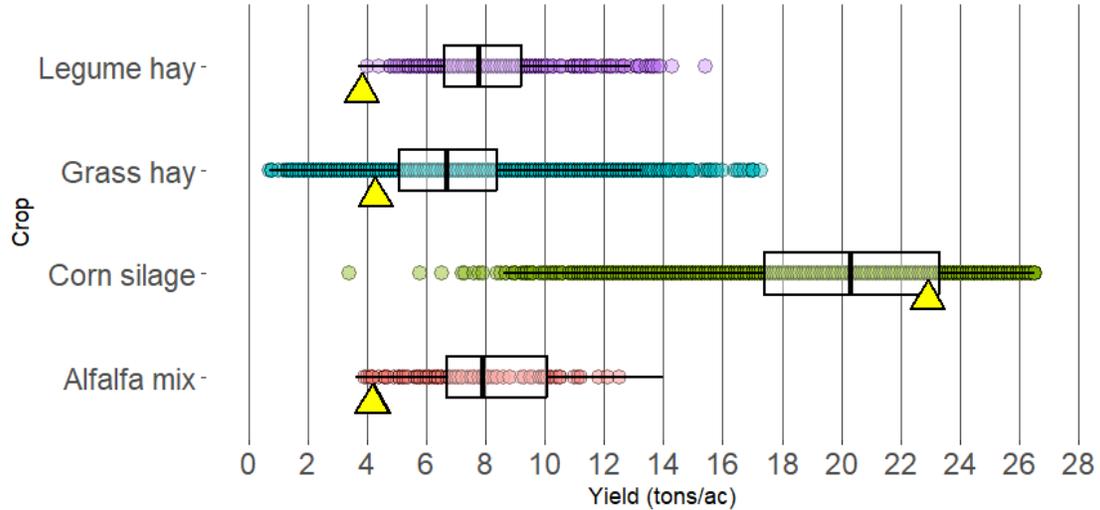
For alfalfa mixes, we also considered the effect of changing the ratio to 33/66 (tall fescue : alfalfa) but changing the ratio only negligibly changed the result.

Finally, we chose to limit the Farm-PREP data to productivity predictions for crops that were currently being managed during the seasons that farmers participated in VPFP<sup>68</sup>, and we removed any observation where the hay stand was in its first year.

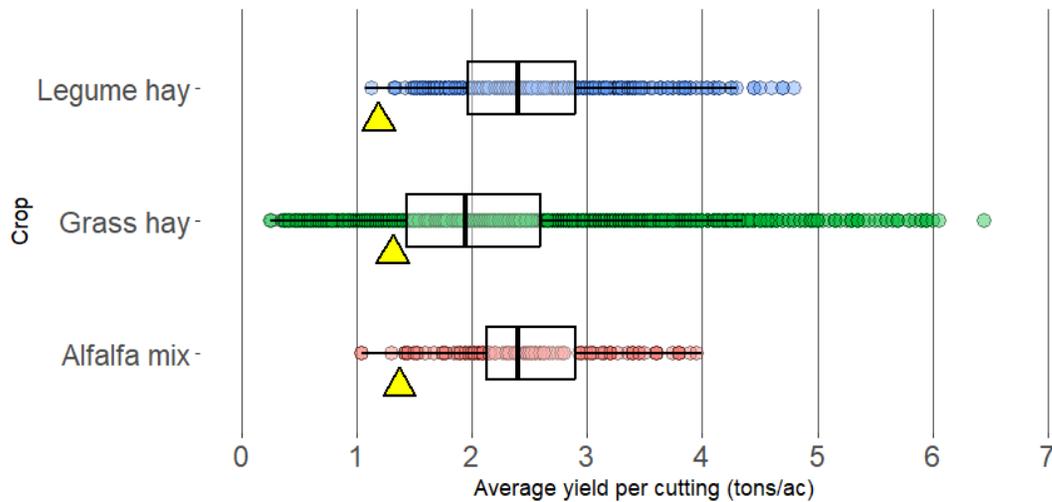
<sup>67</sup> This is a simplistic calculation, and we’re open to suggestions about how to account for interactions within a mixture, as well as patterns in how ratios tend to shift over time.

<sup>68</sup> However, the Farm-PREP predicted outcome (P loss reduction) is estimated by annualizing the 30-year effect of practices (including crop rotations) and so predicted yields for crops in rotations by not currently present on a given field are still relevant to the payments that participants receive.

In Figure 8.2, the productivity for each crop predicted by Farm-PREP is represented by the colored dot plots overlain by boxplots representing the same data. The yellow triangles represent the median yields for each crop based on the data from the Cornell and UVM crop trials. Even when comparing the average yield per cutting for hay harvest (Figure 8.3), the pattern does not change dramatically.



**Figure 8.2.** Comparison of Farm-PREP yield predictions (colored dots) and values derived from median species yields from Cornell/UVM crop trials



**Figure 8.3.** Comparison of average Farm-PREP yield per cutting predictions (colored dots) and similar values derived from median species yields from Cornell/UVM crop trials

### 9.5.2. Estimated Costs

In this section, we discuss our method for estimating the *net changes* in costs that can be used as one reference point for whether VPF payments are set at the right rates (i.e., are sufficient and fair). We chose to attempt to reconstruct enterprise budgets<sup>69</sup> for fields both under their baseline practice scenario (defined by the HBMA) and under their current management scenario.

Before entering into the calculations, we detail some of the challenges we faced in attempting to use estimated costs as a reference point for whether or not VPF payment rates are offered at the right rates.

1. Rather than comparing payments to the costs of implementing conservation activities (like injecting manure or using a no-till planter), we should compare them to the *net change* in costs that come from switching from a “business-as-usual” scenario to the more sustainable scenario defined by conservation practice adoption.
2. In this transition, conservation activities might actually result in cost-savings among implementation costs. Both reduced tillage and no-till reduce tillage costs substantially, and applying less manure than at baseline will also reduce costs. These cost-savings might (or might not) be lost when we add in opportunity costs from conservation-related reductions in yields. Farm budgets might show that the net change in costs is, in fact, slightly negative or, if positive, smaller than the absolute costs of implementing conservation activities.
3. However, this does not generate so much of a challenge on its own. We would conclude that some farms receive “bonuses” even if net change in costs was negative or negligible, and for the remaining farms, payments might still cover a substantial portion of their added costs.
4. In VPF, however, payments are not pinned to a farm’s adoption of conservation practices per se, but instead to the full outcomes of a whole suite of changes from baseline to the current scenario. In many cases, these transitions will be *net* positive: farms achieve higher performance outcomes because of the conservation practices they have adopted as compared to the baseline. In other cases, the transitions might be more mixed: on some fields, for example, farmers might have transitioned from hay to a corn-hay rotation or farmers might be applying more manure than at baseline.
5. In many cases, VPF farmers are not simply adding modifying the existing cropping system with conservation practices relevant to that system, but they are transitioning to different cropping systems (or transitioning to a rotation between two cropping systems).

Some conservation practices are already a component of the baseline scenarios available to us (since those were the standard, or status quo, practices at the time that the baselines were set. For example, corn silage on moderately or well-drained soils has a cover crop in the baseline scenario and Farm-PREP models baseline corn silage tillage poorly drained soils as reduced tillage.

## Methods

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<sup>69</sup> Enterprise budgets are utilized by agricultural economists to analyze and inform farm decisions from a strictly financial perspective. They estimate costs and returns of particular farm enterprises (those that result in an agricultural product (like corn silage or forage) that can be utilized internally within the farm operation or sold on the market). As in our enterprise budgets, they are typically constructed on a per-unit (e.g., per-acre) basis. Many university cooperative extension units offer free, publicly available enterprise budgets that provide average costs for each line item.

A simple approach to estimating costs for VPFPP-relevant practices would have been to use the NRCS Conservation Payment Rate for each of the practices, which is established as 10 percent of the costs of practice implementation and then compare VPFPP payments to these costs. However, we noticed that the NRCS rates did not sufficiently cover the full slate of activities and materials associated with adopting and, especially, maintaining conservation practices over time (i.e., line items in budgetary terms). Farm-PREP considers the impact of practices over an extended period (30 years) and then annualizes this impact on per-year basis. The payment that farmers receive in VPFPP is based on this annualized performance. When you take a conservation practice with a lifespan of more than one year - for example, adopting a hay planting within an annual crop-to-hay rotation or as a transition to permanent hay – the costs should include not only the seed-down (adoption) but the costs associated with managing the hayland (e.g., maintaining fertility and harvesting at appropriate rates). Ultimately, we decided to use the NRCS documentation as a reference for several of the costs instead of considering them a complete accounting.

We also wanted to understand how VPFPP payments mitigated the marginal increase in costs that farmers shoulder when they invest in conservation practices (or when they keep land out of production). In other words, we need to know the difference in costs between a ‘business-as-usual’ scenario (in our case, the HBMA) and the current scenario and, in turn, how much VPFPP payments made up this difference.

For these two principal reasons, we chose to construct enterprise budgets that reflect how costs (and revenues) are likely to change as farmers take on conservation practices.

There are important costs that we did not consider which are likely to vary between the two scenarios:

1. Increased time required for planning (as opposed to direct labor) for incorporating cover crops into land management (e.g., studying species options and coordinating activities)
2. Interest on short-term loans for variable-cost expenses throughout the season
3. Rental rates and the net present value of owned land assets

For Farm-PREP’s ‘baseline’ practices (which it uses to calculate estimated changes in P losses), there are a total of eight possible options that are derived from two soil drainage categories and four land management scenarios (continuous corn silage; continuous hay (red clover-orchard grass mix); a rotation of corn silage and alfalfa mix (alfalfa + tall fescue); and pasture.

For rotations:

1. On poorly drained soils: 2 years of corn silage followed by 4 years of alfalfa mix
2. On well drained soils: 4 years of corn silage followed by 4 years of alfalfa mix

**Table 8.1.** Baseline practice scenarios<sup>1</sup> in Farm-PREP

<i>Practice</i>	<i>Corn silage Poorly drained soils</i>	<i>Corn silage Well drained soils</i>	<i>Hay Poorly drained soils</i>	<i>Hay Well drained soils</i>
Spring manuring	None	4,000 gal/acre <sup>2</sup>	None	None
Spring tillage	Tandem disk plow	Chisel plow Tandem disk plow	n/a	n/a
Early spring fertilizer (commercial)	40 lbs.-N/acre 40 lbs.-P2O5/acre	40 lbs.-N/acre 40 lbs.-P2O5/acre	60 lbs.-N/acre	90 lbs.-N/acre
Late spring manuring	n/a	n/a	None	4,000 gal/acre
Planting	Conventional 12-row planter	Conventional 12-row planter	Drill (Year 1)	Drill (Year 1)
Top/side-dress N (commercial)	95 lbs.-N/acre	140 lbs.-N/acre	None	90 lbs.-N/acre
Harvest	10/1	10/1	6/1; 7/15; 8/30	6/1; 7/15; 8/30
Summer manuring	n/a	n/a	3,000 gal/acre	4,000 gal/acre
Fall manuring	8,000 gal/acre	3,000 gal/acre	3,000 gal/acre	None
Fall tillage	Chisel plow Moldboard plow	None	n/a	n/a
Cover crop	None	Seed cover crop	n/a	n/a

*Note.* <sup>1</sup>Farm-PREP also includes baseline scenarios for corn-hay rotations, but there are no effects of the rotations on the practices described above within a given year. For poorly drained soils, the baseline corn-hay rotations is 2 years of corn silage and 4 years of hay; for well-drained soils, the scenario is 4 years of corn silage and 4 years of hay. <sup>2</sup> The TetraTech (2015) document states that spring manuring is 6,000 gallons, but Farm-PREP models the spring application at 4,000 gallons.

The enterprise budgets in the tables below should the estimated costs for different cropping scenarios.

**Table 8.2.** Estimated costs of corn silage production under HBMA baseline scenario (on poorly drained and well-drained soils)

Date <sup>1</sup>	Activity or Materials	Cost type <sup>2</sup>	Condition	Per-acre costs (by soil drainage)		Qty.	References <sup>3</sup>	
				Poorly drained	Well-drained		Price	Exp. Notes
5/1	Spring manure	E & L		--	<b>\$80.00</b>	A/B	C	4
NS	Terminate cover crop	E & L		--	<b>\$6.68</b>	--	D	5
NS	Herbicide (cover crop term.)	M		--	<b>\$12.66</b>	D	D	
5/5	Spring tillage – Chisel plow	E & L		--	<b>\$12.35</b>	E	F,G	6,7,8,9
5/10	Spring tillage – Disk tillage	E & L			<b>\$13.47</b>	E	F,G	
5/15	Lime application	E & L	If lime rec. > 0		<b>\$3.05</b>	--	D	10
5/15	Lime	M			<b>(\$25.00 * Lime rec.)/3</b>	H,B	I	10
5/15	Starter commercial fertilizer application	E & L			<b>\$7.55</b>	--	D	11
5/15	Starter N fertilizer (urea)	M			<b>\$28.40</b>	A	D	12
5/15	Starter P <sub>2</sub> O <sub>5</sub> fertilizer	M			<b>\$48.00</b>	A/B	D	12
5/15	Starter K <sub>2</sub> O fertilizer	M			<b>\$10.65</b>	H	D	13
5/15	Sowing corn (conventional planter)	E & L			<b>\$17.75</b>	E	F,G	14
5/15	Seed	M			<b>\$117.85</b>	F	F	15
7/10	Topdress N fertilizer	E & L			<b>\$7.55</b>	--	D	
7/10	Topdress N fertilizer	M			<b>\$67.45</b>	A	D	
10/1	Silage harvester	E			<b>\$122.10</b>	--	F	
10/1	Haul silage	E			<b>\$82.53</b>	--	F	
10/1	Store silage	E			<b>\$18.27</b>	--	F	
10/1	Harvest and storage	L			<b>\$92.16</b>	F	G	16
10/10	Fall manure application	E & L			<b>\$160.00</b>	A/B	C	4
10/15	Fall tillage – Chisel plow	E & L			<b>\$12.35</b>	--	F,G	
10/15	Sow cover crop	E & L			--	n/a	D	
10/15	Cover crop seed	M			<b>\$55.40</b>	N	N	
n/a	Crop insurance	O			<b>\$50.00</b>	--	J	17

Notes regarding quantity and prices used in Table 8.2.

- 1 The date of activities per the practice descriptions corresponding to each HBMA (Tetra Tech 2015).
- 2 For the following tables, we use these codes for ‘Cost type’ for each line item: E = Equipment (including both fixed and variable costs); L = Labor; M = Materials (or material inputs); and O = Other.
- 3 The following tables use codes for the references consulted for both quantities and costs for each of the line-item inputs. A = Tetra Tech (2015); B = Farm-PREP dataset; C = Baldwin (2024); D = NRCS (2024); E = Lattz & Schnitkey (2021); F = Plastina & Magwaba (2024); G = BLS (2024); H = UVM (2020), I = OSU (2024); J = RMA Dataset (2024); K = MSU (2012); L = University of Wisconsin-Madison (2025), M = Darby & Ziegler (2024b); N = Cover Crop Economic Decision Support Tool (CC-ECON); O = Schnitkey (2004)
- 4 Custom operator rate of \$20.00 per 1,000 gallons of manure per Cornell Coop. Ext. – Oneida County (Baldwin 2024).
- 5 In HBMA, corn silage on well-drained soils has a winter hardy cover crop under the HBMA.
- 6 Here, quantity refers to labor hours.
- 7 91% of tandem disk rate (Lattz & Schnitkey 2021).
- 8 For the sake of simplicity, equipment costs here include both fixed and variable costs. The Iowa State reference splits these out.
- 9 When labor hours are calculated for tractor work, we apply the \$23.04 hourly rate for tractor operations in Vermont according to the Bureau of Labor Statistics (BLS 2024).
- 10 The costs of lime application (equipment, labor and materials) are annualized over three years. Based on UVM (2018) for a target pH of 6.2 (corn silage). Since these recommendations provide agrilime recommendations in a table format (rather than a formula) the full range of scenarios is not provided here. The cost is divided by 3 to assume an application every three years (after a soil test).
- 11 Assumes that commercial starter fertilizer is *not* applied in the same pass as planting (i.e., banding).
- 12 Quantities of N fertilizer and P2O5 commercial starter fertilizer application rates according to the HBMA.
- 13 Although it seems that fall manure credit might provide sufficient K2O for subsequent corn silage crops, we apply a minimum here of 15 lbs.-K2O/acre. From the notes in Table 11 of UVM (2018): “10-20 lb K2O/acre is recommended as row applied starter under conditions of early planting, limited drainage, or conservation tillage.” Farm-PREP data does not include K results from soil tests. Darby & Ziegler (2024) applied a stand-in rate of 57 lbs-K2O/acre from Darby & Ziegler (2024). For corn silage yielding between 20-25 tons/ac, this application rate corresponds approximately to soil test K levels that are already ‘Optimum’ (101-130 ppm).
- 14 Assumes a 12-row planter planting at 15.3 acres per hour (Schnitkey 2004), or 0.065 hours/acre. Labor time is calculated as 110% of hours of active tractor operation, or 0.0715 hours/acre (Lattz & Schintkey 2021).
- 15 Using a seeding rate of 32,200 kernels/acre which Iowa State budgets for at 21 tons/acre yield of corn silage.
- 16 Uses a rate of 3.5 hours per acre. Price from BLS (2024).
- 17 I used RMA data from 2024 for Franklin and Addison county on Yield Protection policies sold. We weighted the average premium amount across acres for each of the policy levels and then did a weighted average across the policy levels based on the number of policies sold.

**Table 8.3.** Estimated costs of hay production under HBMA baseline scenario (on poorly drained and well-drained soils)

Act. cat. <sup>1</sup>	Activity	Cost type	Condition (1)	Condition (2)	Per-acre cost (by soil drainage category)		Qty.	References	
					Poorly drained	Well-drained		Price	Exp. Notes
Est.	Primary tillage	E & L			\$12.35	Same	E	F,G	2
Est.	Secondary tillage	E & L			\$13.47	Same	E	F,G	
Est.	Comm. fert. app.	E & L			\$7.55	Same	--	D	3
Est.	Est. N fertilizer	M	If permanent hay If rotated		\$21.30	Same	H	D	4
Est.	Est. P2O5 fertilizer	M	If permanent hay	If STP <= 4 ppm If STP >4 & <= 7 ppm	\$1.07 \$1.20 * (P <sub>2</sub> O <sub>5</sub> rec. + 40) \$1.20 * (P <sub>2</sub> O <sub>5</sub> rec. + 20)	Same	A/B,H B,H B,H	D D D	5,6 7
			If rotated	If STP <= 4 ppm	\$0.00 \$1.20 * max(P <sub>2</sub> O <sub>5</sub> rec. - 31.2,0)	Same	B,H	D	8
				If STP >4 & <= 7 ppm	\$1.20 * max(P <sub>2</sub> O <sub>5</sub> rec. - 51.2,0)	Same	B,H	D	
Est.	Est. K2O fertilizer	M	If permanent hay If rotated	If STP > 7 ppm	--	Same	B,H	D	
Est.	Seed drill	E & L			\$42.60	\$26.00	B,H	D	
Est.	Seed	M	Legume hay Alfalfa mix		\$10.65 \$22.11 \$52.80 \$109.00	\$8.84	B,H	D	9
Maint.	Lime application	E & L			\$3.05	Same	n/a	D	
Maint.	Lime	M			\$25.00 * (Lime rec. / 3)	Same	H,B	I	11
Maint.	Spring N fertilizer	E & L			\$7.55	Same	n/a	D	
Maint.	Spring N fertilizer	M			\$42.60	\$63.90	A	D	
Maint.	Harvest	E			\$156.66	Same	n/a	3	12
Maint.	Harvest	L			\$79.80	Same	E	--	13
Maint.	Summer manure app.	E & L			\$120.00	\$160.00	A/B	C	
Maint.	Summer N fertilizer	M			--	\$63.90	A	D	
Maint.	Summer K2O fertilizer	M	If legume hay	If yields <6 tons/ac If yields 6+ tons/ac	--	Same	B,H B,H	D D	14
			If alfalfa mix	If yields <5 tons/ac b/w 5-<6 tons/ac If yields 6+ tons/ac	-- \$2.08 \$12.48	\$3.12 \$3.12 \$13.52 \$23.92	B,H B,H B,H B,H	D D D D	
Maint.	Fall manure app.	E & L			\$60.00	--	A/B	C	
n/a	Crop insurance	O			\$0.00	Same	n/a	J	

### Notes on Table 8.3.

- 1 We categorize costs for hay production into establishment and maintenance costs. For annualized hay costs, establishment costs can be divided by 30 (permanent hay) or by the number of years that rotated fields are in hay. Maintenance costs are applied every year, except that early spring fertilizers are not applied in the year of establishment. In addition, for harvest costs, we use the value of 1.5 cuttings in the first year of production (average of 1-2 cuttings) to account for lower production.
- 2 In this budget, there is only tillage at establishment (planting). This might not be the case (i.e., some farmers might drill hayseed in without tillage). In the NRCS practice scenarios, hay planting is preceded by a pass with a chisel plow and another with a tandem disk.
- 3 In this scenario we do not assume that commercial fertilizer is applied along with sowing of hay seed.
- 4 In Farm-PREP, permanent hay is entered as legume hay, whereas hay in rotation is entered as alfalfa mix. Recommendations for commercial N fertilizer at seed-down for legume-grass mixes is 30 lbs.-N/ac if there is a small grain companion crop (Table 7, UVM 2018). We assume the small grain companion crop here.
- 5 For rotations, we assume a manure N credit from the known fall manure application (8,000 gal/ac for poorly drained fields and 3,000 gal/ac for well-drained fields). We use the manure N credit using reference tables from the UVM (2018) (Tables 15,18 and 19). In the HBMA, the fields are tilled 5 days after manure application. The Farm-PREP dataset marks this type of application as “manure incorporation”. Using UVM (2018), this manure N credit would fall just 1.5 lbs.-N short of the 30 lbs.-N recommendation. While applying 1 lb.-N per acre might not be a practical activity, it’s consistent with our methods here, so we retain the value.
- 6 After manure N credit from 3,000 gallon/acre application in the fall, assumes average N application of 16 lbs.-N/acre for hay establishment.
- 7 STP = Soil (available) phosphorus concentrations per test results (“Soil Test P”). The P2O5 application recommended at establishment would vary based on soil test P.
- 8 Here, the function ‘max(value 1, value 2)’ means use whichever value in the parentheses is highest. It avoids calculating a negative cost. In the case of P2O5, the Farm-PREP dataset provides us with a known value for the HBMA.
- 9 The assumption is that the known fall manure K2O credit (under the HBMA) would be sufficient for hay establishment. For a soil with optimum K levels, the recommendations for alfalfa/grass mixes (alfalfa > 60%) are 80 lbs.-K2O/ac and for grass/legume mixes (alfalfa < 60%) is 60 lbs.-K2O/ac. In the case, where the manure K2O credit passes these figures, we apply a minimum of 15 lbs.-K2O/ac.
- 10 See Table X below for more information on seeding rates and seed prices.
- 11 In the case of alfalfa plantings, we use the UVM lime recommendation for a target soil pH of 6.8. Otherwise, a target pH of 6.2 is used.
- 12 Estimates based on large round bales as product. Equipment costs include mower-conditioner, rake, baling, and hauling. For three cuttings, these costs are \$95.33 (fixed) + \$61.33 (variable) (Plastina & Wagwaba 2024). In Farm-PREP, the HBMA practices (both permanent and in rotation) are modeled as 3 cuttings.
- 13 We use the rate from Plastina & Wagwaba (2024) of 1.33 hours per acre per cutting at rate of \$20.00/hour.
- 14 Top-dress K20 rates from Table 11 of UVM (2018) and assume optimum (101-130 ppm) K levels from soil test and vary according to yield. It is assumed that legume hay receives sufficient K2O from manure applications, except when yields are 6+ tons/acre and soil is well-drained.

**Table 8.4.** Estimated costs for current corn silage production (using actual practice data from Farm-PREP)

Activity/Material	Condition (I)	Cost type	Cost per acre	Reference		
				Qty.	Price	Exp. Notes
Spring manure app.	If incorporated/surface applied	E & L	kGLME * \$30.00	B	See note	1,2
	If conventional & reduced	E & L	kGLME * \$20.00	B	C	3
Spring tillage	If reduced	E & L	\$25.62	E	F,G	4
	If none or no-till	E & L	\$13.47	E	F,G	
Lime application	If lime rec. > 0	E & L	\$0.00	--	--	
		E & L	\$3.05	--	D	
Lime		M	\$25.00 * (Lime rec. / 3)	B	I	
Commercial fertilizer app.		E & L	\$7.55	n/a	D	5
Starter N fertilizer		M	\$0.71 * max(40 - (spring manure N credit + fall manure N credit), 0)	B,H	D	6
Starter P2O5 fertilizer		M	\$1.20 * Commercial P2O5 Applied (rate)	B	D	7
Starter K2O fertilizer		M	\$0.26 * max(57 - (spring man. K <sub>2</sub> O credit) + fall man. K <sub>2</sub> O credit), 0)	M,B,H	D	8
Planter	If no-till drill	E & L	\$24.03	E, O	F, G	9
Seed	Conventional planter)	E	\$17.75	E	F, G	10
		M	\$117.85	F	F	
Topdress N fertilizer app.		E & L	\$7.55	E	F, G	
Topdress N fertilizer	If poorly drained	M	\$67.45	6	D	11
	If well drained	M	\$99.40	6	D	11
Silage harvester		E	\$122.10	n/a	F	
Haul silage		E	\$82.53	n/a	F	
Store silage		E	\$18.27	n/a	F	
Harvest and storage		L	\$92.16	F	G	
Fall manure application	If injected...	E & L	kGLME * \$30.00	B	See note	
	If surface applied...	E & L	kGLME * \$20.00	B	C	
Fall tillage	If conventional & reduced	E & L	\$25.62	E	F,G	
	If reduced...	E & L	\$13.47	E	F,G	
Drill cover crop	If none or no-till...	E & L	\$0.00	--	--	
		E & L	\$22.00	n/a	D	
Cover crop seed	If winter hardy variety	M	\$55.40	N	N	12
	If winter kill variety	M	\$50.00	N	N	12
Terminate cover crop	If winter hardy variety	E & L	\$6.68	D	D	
Herbicide	If winter hardy variety	M	\$12.66	D	D	
Crop insurance		O	\$50.00	n/a	J	

Notes on Table 8.4.

- 1 Here, kGLME stands for “1,000 Gallons of Liquid Manure Equivalent”. Farm-PREP exports the amount of phosphate applied through manure applications, but to estimate costs we needed to translate that to a standard unit consistent with how costs are quoted in available references. We do this by dividing the pounds-P<sub>2</sub>O<sub>5</sub>/acre from Farm-PREP by 8.9 (the rate for pounds-P<sub>2</sub>O<sub>5</sub>/1,000 gallons of dairy manure in a slurry state (5-10% DM) from Table 15 in UVM (2020). Incidentally, this figure is quite close to an average rate of 9.1 pounds-P<sub>2</sub>O<sub>5</sub>/1,000 gallons from manure samples with less than 10% DM that were sent to the University of Vermont.
- 2 It was difficult to find a standard added-cost reference for manure injection (as compared to surface application) in the literature. The table below summarizes some results in this area. We chose a slightly more conservative mark-up of 50% for manure injection relative to surface spreading, but this should be investigated further.

Source	State	Percent added costs	
Howland & Karszes, 2014 <sup>1</sup>	New York	+14%	
NRCS, 2016 <sup>2</sup>	Virginia	+160%	(w/o nursing)
		+200%	(w/ nursing)
Maguire et al., 2018	Virginia	+80%	(w/o nursing)
		+140%	(w/ nursing)

Note. <sup>1</sup> Only farms using the ‘haul, transfer, and spread’ method. <sup>2</sup> These authors note that their estimates were higher than similar analyses in their region.

- 3 Cost for incorporation (post-spreading) are assumed to be covered in ‘Spring tillage’ below.
- 4 For conventional & reduced, Farm-PREP models this as a pass with a tandem disk(?) followed by a pass with a tandem disk harrow.
- 5 Assumes that commercial starter fertilizer is not applied in the same pass as planting (i.e., banding).
- 6 We calculate the N credit from manure applications in the fall and the spring. We calculate the N credit from the fall manure application as  $0.4 * (14.7 \text{ pounds/N} * \text{LME}/1000)$  (see note above for definition of LME) and the N credit from the spring manure application as  $0.9 * (14.7 * \text{kGLME})$ .
- 7 Pounds of phosphate applied through commercial fertilizer comes directly from the Farm-PREP dataset (i.e., farm’s reported/anticipated amount).
- 8 We use a rate of 57 lbs-K<sub>2</sub>O/acre from Darby & Ziegler (2024) as our stand-in maximum for corn silage. For corn silage yielding between 20-25 tons/ac, this application rate corresponds approximately to soil test K levels that are already ‘Optimum’ (101-130).
- 9 Farm-PREP assumes a 6-row planter for no-till annual crop planting. I’m not sure if this is the current (most common) reality among no-till growers, but I applied it here as well. Using Schnitkey (2004) as a reference, we assume a 6-row planter sows 7.6 acres per hour or 0.132 hours/acre. Labor time is calculated as 110% of hours of active tractor operation, or 0.144 hours/acre (Lattz & Schintkey 2021). At the BLS (2024) rate of \$23.04/hour for tractor operators this comes out to \$3.33 per acre.
- 10 Assumes a 12-row planter planting at 15.3 acres per hour (Schnitkey 2004), or 0.065 hours/acre. Labor time is calculated as 110% of hours of active tractor operation, or 0.0715 hours/acre (Lattz & Schintkey 2021).
- 11 For the sake of simplicity, I just applied the standard Topdress N figures from the HBMA here.
- 12 In Farm-PREP, cover crops are modeled as ‘oats’ if “winter kill” is selected for type and ‘winter rye’ if “winter hardy” is selected.

**Table 8.5.** Estimated costs for current hay production (using actual practice data from Farm-PREP)

Act. cat.	Activity	C.T.	Condition	Per-acre cost	Reference		
					Qty.	Price	Exp. Notes
Est.	Primary tillage	E&L		\$12.35	E	F, G	1, 2
Est.	Secondary tillage	E&L		\$13.47	E	F, G	
Est.	Comm. fert. app.	E&L	If commercial fert. rec. > 0	\$7.55	--	D	3
Est.	Est. N fertilizer	M	No fall manure	\$21.30	B, H	D	4
			If poorly drained & injected	\$0.71 * max(30 - (5.2 * Fall Manure kGLME), 0)	B, H	D	
			If poorly drained & incorporated	\$0.71 * max(30 - (4.0 * Fall Manure kGLME), 0)	B, H	D	
			If poorly drained & surface applied	\$0.71 * max(30 - (3.0 * Fall Manure kGLME), 0)	B, H	D	
			If well-drained & injected	\$0.71 * max(30 - (6.2 * Fall Manure kGLME), 0)	B, H	D	
			If well-drained & incorporated	\$0.71 * max(30 - (5.0 * Fall Manure kGLME), 0)	B, H	D	
			If well-drained & surface applied	\$0.71 * max(30 - (3.7 * Fall Manure kGLME), 0)	B, H	D	
Est.	Est. P2O5 fertilizer	M	If perm. hay...	\$1.20 * max(P2O5 input rec + 40), 0)	B, H	D	
			If STP >4 & <= 7 ppm	\$1.20 * max(P2O5 input rec + 20), 0)	B, H	D	
			If STP > 7 ppm	\$0.00	B, H	D	
			If rotated...	\$1.20 * max(P2O5 input rec + 40 - fall manure P credit), 0)	B, H	D	
			If STP >4 & <= 7 ppm	\$1.20 * max(P2O5 input rec + 20 - fall manure P credit), 0)	B, H	D	
			If STP > 7 ppm	\$0.00	B, H	D	
Est.	Est. K2O fertilizer	M	If permanent hay	\$42.60	B, H	D	
			If rotated	\$0.26 * max(100 - (Fall Manure K2O credit), 0)			
Est.	Seed drill	E&L		\$22.11	--	F	
Est.	Seed	M	If legume mix	\$59.70	K	L	
			If alfalfa mix	\$73.87	K	L	
			If grass hay	\$46.34	K	L	
Maint.	Lime app.	E&L		\$3.05	--	D	
Maint.	Lime	M		\$25.00 * Lime rec. / 3	B, H	I	
Maint.	Yearly manure app.	E&L	If permanent hay...	\$30.00 * kGLME * ((Rotation Years - 0.5)/Rotation Years)	B	C	
			If injected...	\$20.00 * kGLME * ((Rotation Years - 0.5)/Rotation Years)	B	C	
			If surface applied...	\$30.00 * kGLME * ((Rotation Years - 0.5)/Rotation Years)	B	C	
			If injected...	\$20.00 * kGLME * ((Rotation Years - 0.5)/Rotation Years)	B	C	
			If surface applied...	\$20.00 * kGLME * ((Rotation Years - 0.5)/Rotation Years)	B	C	
Maint.	Maint. N fertilizer	M	If alfalfa/legume mix and manure app...	\$0.71 * max(60 - man. N Credit, 0) * ((Rot. years - 1)/Rot. years)	B, H	See note	
			If alfalfa/legume mix & no manure app...	\$42.60	1	6	
			If grass hay and manure applied...	\$0.71 * max(150 - man. N Credit, 0) * ((Rot. years - 1)/Rot. years)	B, H	See note	
			If grass hay and no manure app...	\$106.50			
Maint.	Comm. fert. app.	E&L		\$7.55	n/a	6	
Maint.	Maint. P fertilizer	M	If permanent	\$1.20 * Comm. P fert.			
			If rotated	\$1.20 * Comm. P fert. * ((Rotation Years - 1)/Rotation Years)	2	6	
Maint.	K2O fertilizer	M		\$26.00	2	6	
Maint.	Harvest <sup>5</sup>	E		# of cuttings * \$52.22	n/a	3	5
Maint.	Harvest <sup>6</sup>	L		# of cuttings * 1.33 * \$23.04	3	5	6
n/a	Crop insurance	O		\$0.00	n/a	11	

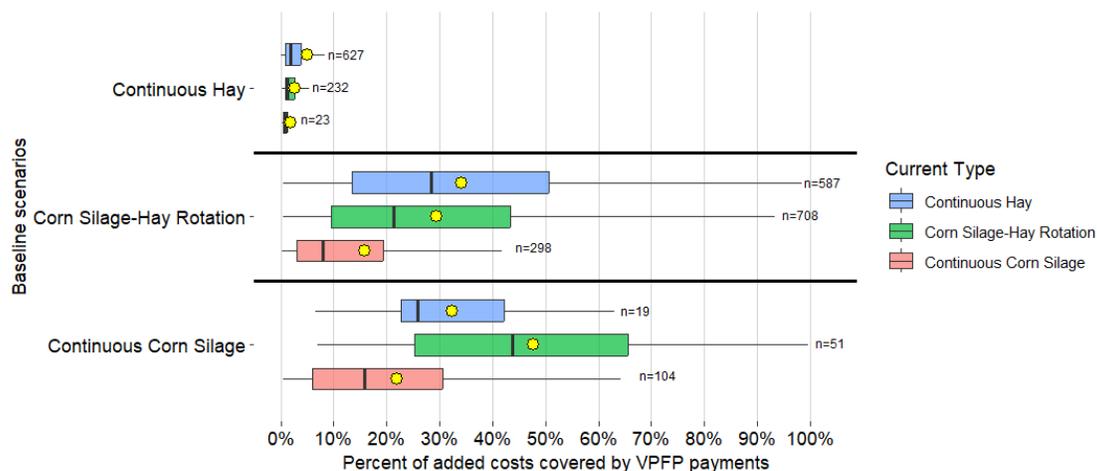
Notes on Table 8.5.

- 1** For annualized hay costs, establishment costs can be divided by 30 (permanent hay) or by the number of years that rotated fields are in hay.
- 2** In this budget, there is only tillage at establishment (planting). This might not be the case.
- 3** In this scenario we do not assume that commercial fertilizer is applied along with hay seed.
- 4** Recommendations for commercial N fertilizer at seed-down for legume-grass mixes is 30 lbs.-N/ac if there is a small grain companion crop (UVM 2018). We assume the small grain companion crop here. We also calculate the fall manure N credit in the spring as 40% of the N content in the manure when applied. Seed cost comes from NRCS (2024) as the estimate for a mix containing grasses and legumes.
- 5** Estimates based on large round bales as product. Equipment costs include mower-conditioner, rake, baling, and hauling. For three cuttings, these costs are \$95.33 (fixed) + \$61.33 (variable) (Plastina & Wagwaba 2024). In Farm-PREP, the HBMA practices (both permanent and in rotation) are modeled as 3 cuttings. For simplicity, we divide total equipment costs by 3 for a per-cutting equipment costs of \$52.22.
- 6** We use the rate from Plastina & Wagwaba (2024) of 1.33 hours per acre per cutting times a rate of \$20.00 per hour

## Results

Estimates of net changes in costs and the distributions of VPFPP fields according to whether they generated cost-savings and, in cases where the net change in costs was positive, whether VPFPP payments covered a fraction of cost or if they overshoot estimated costs (resulting in a conservation “profit”).

Below, for the payments that *were* estimated as a fraction of the net change in costs, we show the percentage of costs covered by VPFPP only for those fields where the net change in costs was positive and the VPFPP payments were lower than the added costs.



**Figure 4.2.** The percentage of estimated added costs that is covered by *uncapped* VPFPP program payments by field. This graph only considers those cases for which the net change in costs between the baseline and current scenario was positive and for VPFPP payments were greater than zero but less than the estimated added costs. This accounts for 51.4% of the acreage that was used to analyze costs and the graph is easier to interpret when the percentage of cost offsets is less than 100%.

If we focus on high-performing fields (those reducing P losses above the performance threshold) where the cropping system has *not* changed, we observe that:

- 1) the cost coverage for continuous hay fields kept in continuous hay are quite low, perhaps because there is lower room for improvement from baseline and above the performance threshold (i.e., low payments);
- 2) fields ‘kept’ in corn silage-hay rotations have a very large range in values (especially since the number years of each crop in this rotation will vary across farms) and the median is approximately 20% while the average value (closer to 30%) is influenced by the right-skewed distribution of data;
- 3) fields ‘kept’ in continuous corn silage have a smaller range than the rotations and the median cost coverage by VPFPP payments sits at 15% with an average value just over 20%.

As a reminder, NRCS CSP payments are set to cover 10% of the estimated costs of practice implementation, but these calculations do not necessarily consider the net change in costs or opportunity costs (unless explicitly stated). We would hesitate, however, to suggest that VPFP consistently covers a greater proportion of costs than NRCS CSP for all of the arguments offered above.

### 9.5.3. Payment Comparisons

Table 8.6. outlines the practices that we focused on in our comparison between VPFP and practice-based programs. We ultimately chose to retain practice-based payments that supported buffer adoption and grassed waterways, but we excluded payments that would cover important infrastructure (e.g. fencing, watering systems, etc.) that would be useful for rotational grazing (such as the incentives that might come from the Pasture and Surface Water Fencing (PSWF) program in Vermont or the Access Control (i.e. livestock exclusion) funding that would come from NRCS. Including these would potentially be a slippery slope and might oblige us also to consider potential cost-shares offered through CEAP.

**Table 8.6. Types of practices (categorized as ‘adoption’ or ‘maintenance’ associated with each conservation practice**

<i>Practice</i>	<i>Practice adoption<sup>1</sup></i>	<i>Practice “maintenance”<sup>1</sup></i>	<i>Lifespan (years)<sup>2</sup></i>
Cover crop	Seeding	Termination	1
Annual crop-to-hay rotation	Hay planting	Forage quality management	5; 1 <sup>3</sup>
Maintain permanent pasture or hay	Hayland renovation	Forage quality management	1
Corn-soybean rotation <sup>4</sup>	Planting of annual legume crop	n/a	1
No-till <sup>5</sup>	Seeding (no-till drill)	n/a	1
Reduced till <sup>6</sup>	Seeding (drill)	n/a	1
Manure injection	Pumping and injecting	n/a	1
Manure incorporation	Pumping, spreading and tilling	n/a	1
Rotational grazing	<del>Installation of fencing</del>	Movement of animals Upkeep of fencing	20 <sup>7</sup> ; 1
Livestock exclusion	<del>Installation of fencing and hardened stream crossings</del>	Upkeep of fencing and stream crossings	10
Riparian buffers	Planting buffer species	Keep out of annual crop production Harvest/graze (where permitted)	10 <sup>8</sup> ; 15
Grassed waterways	Planting grasses	Maintenance of waterway	10

Notes. <sup>1</sup>In practice, adoption or “establishment” might include activities like field prep or sowing or installation of fencing, whereas “maintenance” refers to upkeep during the lifespan of the practice like keeping buffers out of production or maintaining perennial forage quality. <sup>2</sup>NRCS practice lifespans refer to the minimum time (years) the implemented practice is expected to be fully functional for its intended purposes (including adoption and maintenance). <sup>3</sup>Hay and pasture planting is indicated for a 5-year lifespan; forage harvest management activities have a 1-year lifespan. <sup>4</sup>For financial assistance for conservation crop rotation, NRCS is primarily covering the cost of planning the rotation and not the actual planting of crops in rotation. According to NRCS documents, the crop could include soybeans, vegetables or even perennial forages. <sup>5</sup>For NRCS, no-till practices have a Soil Tillage Intensity Rating (STIR) of 30 or less throughout the crop interval. STIRs are summative across the crop interval. An NRCS Info Sheet (2008) shows a STIR calculation for a pass with chisel plow (STIR = 45.50) and a pass with a tandem disk (STIR = 32.50). These two passes alone bring the crop interval’s STIR to 78.00. Planting and harvesting passes also increase the STIR, albeit in a minor way. For reduced tillage, the STIR must be equal or less than 80, and no primary inversion tillage implements (e.g., moldboard plow) shall be used. <sup>6</sup>In Farm-PREP, reduced tillage is modeled as a tandem disk pass (32.50) and a pass with a conventional grain planter (2.43). <sup>7</sup>For rotational grazing payments we ignored the costs of installation and repairs to fencing and focused solely on the costs of rotational grazing management. The NRCS payments for these types of activities are predicated on the estimates for the costs of participating in intensive grazing educational workshops and increased labor costs for moving animals. <sup>8</sup>10 years for filter strips and herbaceous riparian buffers and 15 years for forested buffers.

Table 8.7. below describes the available practice-based payment categories that correspond to each of the cells in the table above. We color-code the table to differentiate state programs from NRCS programs. We also specify the payment schedule component that we’ll pull rates from for each of the NRCS practices.

Table 8.7. Payment categories from practice-based programs that correspond to VPPF

<i>Practice</i>	<i>Adoption (practice “establishment”)</i>	<i>Post-adoption practice “maintenance”</i>
Cover crop	<b>FAP (Cover Crop)</b> <b>NRCS (Cover Crop – 340)</b> • <i>Basic (Organic and Non-organic)</i>	n/a
Annual crop-to-hay rotation	<b>FAP (Crop to Hay)</b> <b>NRCS (Pasture and Hay Planting - 512)</b> • <i>Cool Season, Establish or Reseed</i>	<b>NRCS (Forage Harvest Management – 511)</b> • <i>Improved Forage Quality</i>
Corn-soybean rotation	<b>NRCS (Conservation Crop Rotation – 328)</b> • <i>Basic Rotation Organic and Non-Organic</i>	n/a
No-till	<b>FAP (Conservation Tillage (No-Till))</b> <b>NRCS (Residue and Tillage Management, No-Till – 329)</b> • <i>No-Till/Strip-Till</i>	n/a
Reduced till	<b>NRCS (Residue and Tillage Management, Reduced Till – 329)</b> • <i>Residue and Tillage Management, Reduced Till</i>	n/a
Manure injection	<b>FAP (Manure Injection)</b> <b>NRCS (Nutrient Management - 590)</b> • <i>Basic NM with Manure Injection</i>	n/a
Manure incorporation	<b>NRCS (Nutrient Management - 590)</b> • <i>Basic NM with Manure Injection or Incorporation</i>	n/a
Rotational grazing	<b>NRCS (Fence—382)</b> • <i>2-4 Wire Electrified, High-Tensile</i> • <i>Interior-electrified</i>	<b>FAP (Rotational Grazing)</b> <b>NRCS (Prescribed Grazing - 528)<sup>1</sup></b> • <i>Intensive</i> • <i>Twice weekly moves</i>
Livestock exclusion	<b>NRCS (Access Control—472)</b> • <i>Animal exclusion from sensitive areas</i>	n/a
Riparian buffers	<b>SFS</b> <b>NRCS (Filter Strip - 393)<sup>2</sup></b> • <i>Filter Strip, Introduced species</i>	<b>CREP</b>
Grassed waterways	<b>SFS</b> <b>NRCS (Grassed Waterway – 412)</b> • <i>Base Waterway, Seeding</i>	<b>CREP</b>

*Notes.* <sup>1</sup> In Farm-PREP, rotational grazing is defined as farms moving livestock either every 1 or 3 days. If moving them every day/every other day, then the *Intensive* rate is most relevant; if every 3 days, then the *Twice Weekly Moves* rate applies. <sup>2</sup>Since Farm-PREP does not allow us to differentiate between buffers that are planted into forest; herbaceous, non-harvested plants; or perennial forage/pasture, we’ve decided to map riparian buffers as filter strips. Farms in Vermont will occasionally implement agricultural productive buffers and when NRCS supports these efforts it is through the Filter Strips practice standard (Gage n.d.). Functionally, Farm-PREP models riparian buffers as filter strips.

**Table 8.8. Rates selected for the comparative analysis of program payments**

Conservation Practice	Activity Cat.	Qualifier	FAP	CSP <sup>1</sup>	EQIP <sup>1,2</sup>	EQIP-WP <sup>3</sup>	SFS	CREP
Cover Crop	Est.		\$45.00 <sup>4</sup>	\$8.20 <sup>5</sup>	\$61.47 <sup>5</sup>	\$73.76	n/a	n/a
Annual crop-to-hay	Est.		\$45.00 <sup>6</sup>	\$53.96	\$404.68	\$485.62	n/a	n/a
Annual crop-to-hay	Maint.		n/a	\$0.56	\$4.20	\$5.04	n/a	n/a
Transition to permanent hay	Est.		n/a	\$53.96	\$404.68	\$485.62	\$500 <sup>7</sup>	n/a
Transition to permanent hay	Maint.		n/a	\$0.56	\$4.20	\$5.04	n/a	n/a
Transition to permanent hay	Maint.		\$30.00	\$11.49	■	■	n/a	n/a
Conservation Crop Rotation	Est.		n/a	\$1.27 <sup>8</sup>	\$9.54 <sup>8</sup>	\$11.45	n/a	n/a
No Till	Est.		\$15.00	\$2.24	\$16.84	\$20.20	n/a	n/a
Reduced Till	Est.		n/a	\$2.77	\$20.80	\$24.96	n/a	n/a
Manure Injection	Est.		\$25.00 <sup>9</sup>	\$6.44 <sup>10</sup>	\$48.28	\$57.93	n/a	n/a
Manure Incorporation	Est.		n/a	\$4.16	\$31.23	\$37.48	n/a	n/a
Rotational Grazing	Maint.	Intensive	\$30.00	\$13.44 <sup>11</sup>	\$67.21	\$120.99	n/a	n/a
	Maint.	Twice weekly moves	\$30.00	\$11.12	\$55.60	\$100.09	n/a	n/a
	Maint.	Weekly moves	n/a	\$4.51	\$33.83	\$40.60	n/a	n/a
Riparian Buffers	Est.	Buffer 20-30 ft wide <sup>12</sup>	n/a	\$23.31	\$174.82	\$209.78	n/a	-- <sup>13</sup>
	Est.	Buffer 30-40 ft wide	n/a	\$23.31	\$174.82	\$209.78	\$200.00	-- <sup>13</sup>
	Est.	Buffer 40+ ft wide	n/a	\$23.31	\$174.82	\$209.78	\$1,000.00	-- <sup>13</sup>
Grassed Waterways	Est.		n/a	\$1,306.80	\$10,454.40	\$12,632.40	\$1000.00	\$415.00
	Maint.		n/a	n/a	n/a	n/a	n/a	\$80.00

Note. <sup>1</sup>These are the CSP and EQIP rates for 2023. 2025 rates had become available while preparing this report, but they were disaggregated by county, which was a level of granularity that we were not prepared to consider here. <sup>2</sup>In the case of EQIP, uses the most broadly applicable rate. Historically underserved populations as well as practices coinciding with EQIP water protection areas (NWQI & SPWA) or for high priority practices would receive higher rates. <sup>3</sup>There are specific EQIP rates in areas of specific priority for water quality resource concerns (and these areas exist in Vermont), but since we did not have the shapefiles that would allow us to define which fields were within these regions, we chose to ignore these (higher) rates since we could not confidently apply them to each field. <sup>4</sup>Farm-PRP data does not distinguish between seeding methods for cover crops, it was assumed that the reference practice (i.e., most used) is drilling rather than broadcasting. The \$45 rate corresponds to what a farmer would receive for this seeding method. <sup>5</sup>Assumes that a single-species cover crop is used and that production is not organic. <sup>6</sup>We use the higher rate from FAP, assuming that a nurse crop like oats is used at the time of planting. This practice was observed on a farm in Addison County just before our interview (oats and peas as the nurse crop). <sup>7</sup>Transition to permanent hay under SFS (i.e., required time in hayland is 10 years). We use a conservative payment of \$500/acre marked as “moderate risk”. <sup>8</sup>High risk” acreage receives hay planting payments of \$1,000/acre. <sup>9</sup>The NRCS Conservation Crop Rotation payment only covers the time needed by the producer to “plan and implement the logistics of changing the rotation” (NRCS Practice Scenarios – FY 2024). It does not appear to cover the costs of seeding the new crop as in *Pasture and Hay Planting (512)* or *Cover Crop (340)*. <sup>10</sup>Farms that apply manure through manure injection in both the spring and the fall can receive two \$25 payments, on \$50 total, per year. <sup>11</sup>We assume NRCS only pays per acre per year (and not per application like FAP). <sup>12</sup>The practice scenario refers to “design and implementation.” No fencing materials are listed among the line items. ‘Herders’ are listed as general labor. The labor cost is likely an annual estimate, but the practice scenario does not distinguish between construction labor and herding labor. <sup>13</sup>For NRCS, the filter strip must have a minimum flow length (i.e., buffer width) of 20 feet for controlling suspended solids in and associated contaminants in runoff, and 30 feet for dissolved contaminants in runoff. We do not use the rate that explicitly includes forgone income. <sup>14</sup>We chose not to apply the CREP seeding and rental rates for land in filter strips because “the seeded acreage must not be harvested or grazed by domestic livestock for the life of” the contract, and we couldn’t guarantee this for our Farm-PRP data. We also chose not to use their riparian buffer install and rental rates since the explicitly cover only forested buffers. “The cropland will be devoted (planted or natural regeneration) to trees.” No crops of any kind (including forage) can be harvested from CREP acreage during the contract period (Par. 626 of the Agricultural Resource Conservation Program FSA Handbook).

Table 8.9. Details on how the rates to calculate hypothetical annualized payments are applied

Practice	Calculation
Cover crop	<p><b>FAP (Cover Crop)</b></p> <ul style="list-style-type: none"> <li>• If the field has a cover crop at any point, then,</li> <li>• Multiply the fraction of years in the full rotation cycle that the field is cover-cropped by the field acreage and a pay rate of \$45</li> </ul> <p><b>NRCS (Cover Crop – 340)</b> <i>Basic (Organic and Non-organic)</i></p> <ul style="list-style-type: none"> <li>• If the field has a cover crop at any point in the rotation, then,</li> <li>• Multiply the fraction of years in the full rotation cycle that the field is cover-cropped by the field acreage and a pay rate of \$8.20 (CSP) or \$61.47 (EQIP);</li> </ul>
Annual crop-to-hay rotation	<p><b>FAP (Crop to Hay)</b></p> <ul style="list-style-type: none"> <li>• If the field currently <i>has</i> an annual crop-to-hay rotation, then,</li> <li>• Multiply the field acreage by a pay rate of \$35 and divide by the total years of the full crop rotation;</li> </ul> <p><b>NRCS (Pasture and Hay Planting - 512) &amp; NRCS (Forage Harvest Management – 511)</b> <i>Cool Season, Establish or Reseed</i></p> <ul style="list-style-type: none"> <li>• If the field currently has an annual crop-to-hay rotation: <ul style="list-style-type: none"> <li>• Multiply the field acreage by a pay rate of \$53.96 (CSP) or \$404.68 (EQIP) and divide by the total years of the full crop rotation; and add to</li> <li>• The fields acreage multiplied by a pay rate of \$0.56 (CSP) or \$4.20 (EQIP)</li> </ul> </li> </ul>
Transition to permanent hay	<p><b>SFS Pasture/Hayland Planting – Moderate Risk) &amp; FAP (No-Till Pasture and Hayland Renovation)</b></p> <ul style="list-style-type: none"> <li>• If the field is currently in permanent hay or pasture and the HBMA was continuous corn silage or an annual crop-to-hay rotation, then:</li> <li>• Add the following values: <ul style="list-style-type: none"> <li>○ The field acreage divided by 30 and multiplied by a pay rate of \$500 and</li> <li>○ The field acreage divided by 5 and multiplied by a pay rate of \$30</li> </ul> </li> </ul> <p><b>NRCS (Pasture and Hay Planting - 512): Cool Season, Establish or Reseed &amp; NRCS (Pasture and Hay Planting - 512): Overseed &amp; NRCS (Forage Harvest Management – 511): Improved Forage Quality</b></p> <ul style="list-style-type: none"> <li>• If the field is currently in permanent hay or pasture and the HBMA was continuous corn silage, then</li> <li>• Add the following values: <ul style="list-style-type: none"> <li>○ The field acreage divided by 30 and multiplied by a pay rate of \$53.96 (CSP) or \$404.68 (EQIP) plus</li> <li>○ The fields acreage multiplied by a pay rate of \$0.56 (CSP) or \$4.20 (EQIP) plus</li> <li>○ The field acreage divided by 3 and multiplied by a pay rate of \$11.49 (CSP) or \$86.15 (EQIP);</li> </ul> </li> </ul>
Maintenance of permanent hay or pasture	<p><b>FAP (No-Till Pasture and Hayland Renovation)</b></p> <p>If the field is currently in permanent hay or pasture and the HBMA was <i>not</i> continuous corn silage, then,</p> <ul style="list-style-type: none"> <li>• Divide the field acreage by 3 and multiply the quotient by a pay rate of \$30;</li> </ul> <p><b>NRCS (Pasture and Hay Planting - 512): Overseed &amp; NRCS (Forage Harvest Management – 511): Improved Forage Quality</b></p> <p>If the field is currently in permanent hay or pasture and the HBMA was <i>not</i> continuous corn silage, then,</p> <ul style="list-style-type: none"> <li>• Divide the field acreage by 3 and multiply by a pay rate of \$11.49 (CSP) or \$86.15 (EQIP) plus</li> <li>• The fields acreage multiplied by a pay rate of \$0.56 (CSP) or \$4.20 (EQIP)</li> </ul>
Corn-soybean rotation	<p><b>NRCS (Conservation Crop Rotation – 328)</b> <i>Basic Rotation Organic and Non-Organic</i></p> <ul style="list-style-type: none"> <li>• If the second crop is Soybeans, then</li> <li>• Divide the field acreage by the number of years in the full rotation cycle and multiply by \$1.27 (CSP) or \$9.54 (EQIP)</li> </ul>
No-till	<p><b>FAP (Conservation Tillage)</b></p> <ul style="list-style-type: none"> <li>• If the field has an annual crop in its rotation AND it uses no-till, then,</li> <li>• multiply the fraction of no-till years in the full rotation cycle by field acreage and by a pay rate of \$15, otherwise,</li> </ul> <p><b>NRCS (Reside and Tillage Management, No-Till – 329)</b> <i>No-Till/Strip-Till</i></p> <ul style="list-style-type: none"> <li>• If the field has an annual crop in its rotation AND it uses no-till, then,</li> <li>• multiply the fraction of no-till years in the full rotation cycle by field acreage and by a pay rate of \$2.24 (CSP) or \$16.84 (EQIP)</li> </ul>

Reduced till	<p><b>NRCS (Residue and Tillage Management, Reduced Till – 329)</b>  <i>Residue and Tillage Management, Reduced Till</i></p> <ul style="list-style-type: none"> <li>• If the field has an annual crop in its rotation AND it uses no-till, then,</li> <li>• multiply the fraction of no-till years in the full rotation cycle by field acreage and by a pay rate of \$2.77 (CSP) or \$20.80 (EQIP)</li> </ul>
Manure injection	<p><b>FAP (Manure Injection)</b></p> <ul style="list-style-type: none"> <li>• If the field uses manure injection, then:</li> <li>• Add the following <ul style="list-style-type: none"> <li>○ The number of injections per year for the first crop in the rotation multiplied by the fraction of years for that crop in the rotation, and</li> <li>○ The number of injections per year for the second crop in the rotation multiplied by the fraction of years for the second crop in the rotation, and</li> </ul> </li> <li>• Multiply the sum by field acreage and by a pay rate of \$25;</li> </ul> <p><b>NRCS (Nutrient Management - 590)</b>  <i>Basic NM with Manure Injection</i></p> <ul style="list-style-type: none"> <li>• If the field uses manure injection, then:</li> <li>• The fraction of years with manure injection multiplied by the number of acres and a pay rate of \$6.44 (CSP) or \$48.28 (EQIP)</li> </ul>
Manure incorporation	<p><b>NRCS (Nutrient Management - 590)</b>  <i>Basic NM with Manure Injection or Incorporation</i></p> <ul style="list-style-type: none"> <li>• If the field uses manure incorporation, then:</li> <li>• The fraction of years with manure incorporation multiplied by the number of acres and a pay rate of \$4.16 (CSP) or \$31.23 (EQIP)</li> </ul>
Rotational grazing	<p><b>FAP (Rotational Grazing)</b></p> <ul style="list-style-type: none"> <li>• If in the field, animals are moved to new paddocks at least twice weekly:</li> <li>• Multiply acres by a pay rate of \$30</li> </ul> <p><b>NRCS (Prescribed Grazing - 528)<sup>1</sup></b></p> <ul style="list-style-type: none"> <li>• Intensive</li> <li>• If contiguous days in paddock = 1, then</li> <li>• Multiply acreage by \$13.44 (CSP) or \$67.21 (EQIP)</li> <li>• If consecutive days in paddock = 3, then</li> <li>• Multiply acreage by \$11.12 (CSP) or \$55.60 (EQIP)</li> </ul>
Riparian buffers	<p><b>SFS</b></p> <ul style="list-style-type: none"> <li>• If the field has a buffer between 30-40 feet wide and the field is proximate to water, then <ul style="list-style-type: none"> <li>○ Multiply the buffer acreage by a pay rate of \$200 and divide the product by 10, else</li> </ul> </li> <li>• If the field has a buffer greater than 40 feet wide and the field is proximate to water, then <ul style="list-style-type: none"> <li>○ Multiply the buffer acreage by a pay rate of \$1000 and divide the product by 10, else</li> </ul> </li> <li>• \$0.00.</li> </ul> <p><b>NRCS (Filter Strip - 393)</b>  <i>Filter Strip, Introduced species</i></p> <ul style="list-style-type: none"> <li>• If has buffer and proximate to water,</li> <li>• Multiply the buffer acres by \$23.31 (CSP) or \$174.82 (EQIP) and divide by 10 (the NRCS lifespan of a filter strip).</li> </ul>
Grassed waterways	<p><b>NRCS (Grassed Waterway – 412)</b>  <i>Base Waterway, Seeding</i></p> <ul style="list-style-type: none"> <li>• If grassed waterway present,</li> <li>• Multiply acres by \$130.80 (CSP) or \$1045.44 (EQIP) and divide by 10 (the NRCS lifespan of a grassed waterway).</li> </ul>
<p>Notes</p> <p><sup>1</sup> This assumes an initial payment to turn annual crop land into hay and then subsequent payments to improve hayland through reseeding.</p> <p><sup>2</sup> Although the SFS program pays producers to seed down filter strips, it also requires that the filter strips be left in place for a minimum of 10 years.</p>	

## 9.6. Recommended Farm-PREP UX Improvements

### Summary

In this section, we detail our evaluation of the Farm-PREP User Experience (UX) and provide recommendations for how to improve this key component of the VFPF program. While some aspects of the current Farm-PREP (UX) are effective, others substantially impede program success. This assessment is intended to serve as a point of reference for VAAFMM as they work with the design and development staff at Stone Environmental to prioritize software improvements. Lessons learned here are relevant to the design and operation of similar programs. The contents of this report are based on a series of interviews with TA Providers who use the software to support VFPF-enrolled farmers, as well as on the direct observations and assessment of a UVM evaluation team member who has a background in the design of web-based decision-support environmental modeling tools.

### Background

Farm-PREP should allow farmers and TA Providers to interact effectively and efficiently with the APEX model to estimate P losses on a field-by-field basis and should support on-farm decision-making around practice change and continuity. The initial design process for the tool consulted a variety of participants, including over 50 TA providers/crop consultants, VAAFMM, faculty from University of Vermont Extension and University of Vermont Rubenstein School of Environmental and Natural Resources, and staff from Natural Resource Conservation Districts. These participants provided feedback on “level of specificity of user input requirement, definition of alternative conservation practices, and the reporting of model simulation results” as well as on technical modeling decisions (Winchell 2018).

In addition, 11 farmers completed a survey on Farm-PREP in 2022. It is unclear from the documentation whether designs were updated based on these survey results. Until the current evaluation, we are unaware of additional feedback provided by farmers on the software UX; however, we know that TA Providers are frequently in touch with VAAFMM and that, as a result, VAAFMM is aware of several issues described below.

### Major Areas of Concern & Recommendations

**User Group Clarity** – Research conducted by the Gund Team indicated that VFPF farmer-participants rarely use the Farm-PREP software directly, either to enter their farm’s data, to browse or export their results or to explore how they might generate better P loss (and compensation) scenarios.

This may be due in part to low interest in software solutions and low technological self-efficacy among some farmers. It is also at least partly due to the limited time available to farmers to engage with another application – especially when the pay-off for that time uncertain. Besides the initial data entry payment, this time is not directly compensated year after year under the current VFPF payment structure. In addition, the program has positioned TA providers as key support in data entry such that direct engagement with the tool for data entry purposes is optional for farmers. However, farmers might engage more with the *results* of this data entry (and might use these results to refine conservation strategies) if the UX were designed in closer alignment with specifications that they define.

In most cases, farmers provide their records to TA providers or private crop consultants will then translate and input the necessary data into Farm-PREP. Farmers might receive Farm-PREP data outputs (i.e., field-by-field P loss predictions) and/or summarized results from these service providers (as well as information about their annual incentive payments). Less consistently, these service providers might inform farmers about the more obvious opportunities that would improve their outcomes for certain fields. However, as we have reviewed in other sections, the nature of Farm-PREP results does not facilitate a clear understanding of how a farmer should make improvements (or how a service-provider ought to advise them).

Recommendation: If it is a goal for the program to increase direct farmer engagement with the tool, or at least with the reports, it would be beneficial to engage them more directly in providing feedback on the tool itself.

**Model Transparency** – TA providers indicated in interviews that they felt that Farm-PREP is a “black box” that they could not understand. They raised questions specifically about how flooding affects model accuracy, and how slope and ditches/water conveyance are modeled, and why partitioning/delineating fields in different ways has such a large impact on results.

Recommendations:

Invest in clarifying the inner workings of the model for the users (documentation, workshops, or embedded help links could be effective approaches).

Visual aids within the UI itself could also help users understand specific components that influence the outcome predictions. For instance, the model could use visual aids to show how phosphorus is modeled to move laterally across the surface of the field and where it accumulates on the field boundaries or where it enters waterbodies.

Although challenging, it would be helpful if results exported for Farm-PREP could specify which factors are most implicated in any given fields’ results (as compared to all other fields enrolled in the program), what permutation of practices would optimize P loss outcomes on a given field (and what the predicted P loss would be under that scenario), as well as what the marginal effect of adding a single *relevant* practice (e.g., adding a cover crop or planting a cover crop earlier in the season) would have. While this might generate an even wider spreadsheet as an output, it could aid TA providers in making targeted recommendations related to conservation planning.

**Representation of farm activities in Farm-PREP** - There are concerns in some cases that the process of translating farm records into Farm-PREP converts (through assumptions, simplifications, and unit conversions) the information to such an extent that neither farmers nor TA providers can confirm that the model is a faithful representation of the farm's activities. This is particularly true in vegetable farms and grazing systems (in reality there are changing numbers of groups, weights, numbers of animals, paddocks, and patterns), and to some extent in other areas such as crop rotations (few options in tool compared to many in practice), and manure (e.g., small variations in sampling technique have a huge impact, and some farmers apply manure only to certain parts of fields). While many farmers might "trust" the process – they do not have another option – improving the legibility of these activities within the UX and within the results would likely increase farmers' engagement with information generated through these processes.

Recommendations:

Re-evaluate the data inputs in light of what information is available to farmers, to ensure that models are legible to the people operating the systems being modeled.

Integrate specific tools that have been vetted by TA providers (like the manure spreadsheet tool) into the Farm-PREP user interface. On the back end, Farm-PREP will translate these into the values that are consistent with APEX model data specifications, while the Farm-PREP database retains the terms originally used in data input (e.g. manure applied in gallons, rather than pounds of  $P_2O_5$ ). When a TA provider reviews the information with the farmer (in Farm-PREP), the farmer is able to see the data in terms that are consistent with how they keep records and how they think of their activities.

As to pasture, it has been recommended by some TA providers that entering fields that are strictly used as pasture should be optional for VPFPP participants. We would recommend that if VPFPP goes this route, that more stringent requirements are put in place for VPFPP participants who opt in to including their pasture – requirements that would facilitate data entry while also potentially supporting the farm through better record-keeping. These requirements should be defined in consultation with farmers and UVM Extension, but might consist of requiring farmers to use certain types of grazing charts or applications like PastureMap.

In some cases, farmers expressed the desire to be able to "correct" the yield predictions made by the model. In cases where this yield data is kept in records that are attributable to fields in the same way that those fields are divided in Farm-PREP, this might be feasible but is like to introduce several issues outside of this optimal situation. Yield data in Farm-PREP, in general, should be calibrated through samples of farmers who are willing (and paid) to participate in these calibration efforts.

**Navigation during data entry** – Users indicated that the panels for entering data into Farm-PREP were not organized in a way that was conducive to easy data entry. In some cases, users have to switch between panels to enter or double-check information related to a single field feature. In general, there was a request that the UX be designed so that entry of all data points relevant to a single field could be entered into a single, scrollable panel.

**Data Validation** - The utilization of bulk data CSV uploads is a critical feature that saves users a lot of time. However, feedback from our respondents highlighted a handful of issues that reduce the efficiency of this feature. The requirement to have exactly matching field names makes between the CSV and the Farm-PREP database makes this particularly painful for users (they mentioned that GoCrop handles this better). There are also common errors in data entry in other parts of the app that could be addressed using validation: Lack of information on tile drainage, and large year-to-year changes in acreage under management. Users have also asked for warnings when input data fall outside of what might be considered a normal range for a specific data point.

Recommendations: Invest in enhancements of data validation for the CSV upload features and around common-error inputs to win substantial improvements in efficiency and reductions in user frustration.

**Data Collection Guidance** - In some places, key information about how to find/enter data is missing or unclear, potentially leading to inaccurately collected data and/or confused users. E.g. Variation in how buffers are measured, how manure samples are taken, or how manure is represented when a farmer applies manure to only part of a field.

Recommendation: Unobtrusively link each data-input field in the app to documentation about the meaning of the data being requested, and the proper way to collect it, to ensure greater accuracy.

**Login Process & Security** – The login mechanism sometimes provides no feedback to the user when the wrong password or no username/password is entered. There is no password reset option, and no 2-factor authentication.

Recommendations: Upgrade the login experience to meet standard expectations. A smooth login experience is critical for farmers (a sometimes tech-averse user group) to engage. Also, given that proprietary farm business data is stored in the software, the app should be assessed for security. Appropriate security standards should be identified (based on the level of data sensitivity) and then met.

**Interaction Signaling & Information Hierarchy** – Some pages (especially in the core modeling interface) are difficult to read and interact with because of unclear information hierarchy and a few input elements that do not signal that they are interactable (e.g. hoverable text with critical modeling information but no indication that it's hoverable).

Recommendations: Standardize UI element styling and state signaling, and text header levels/styling. To further refine, record first-time users interacting with the software and ask them to verbalize their stream-of-consciousness awareness of what's on the page and what they can do.

**Accessibility** – Some elements, such as Username and Password suggestion text, don't meet contrast accessibility standards.

Recommendations: Conduct a robust accessibility assessment, including visual tests (colors/contrast, font sizes, etc.) and screen-reader compatibility, to make sure that people with different needs can use the app.

**Address Frustration with Data Double-Entry** – Many users are entering similar data into Farm-PREP that have already entered into other databases for farm planning (like goCrop) and are deeply frustrated with this.

Recommendation: Either begin working on options to connect data between the tools or publicize a reason that this is not feasible.

**TA Provider Support** – While the availability of VAAF staff was lauded as a key resource for TA providers, some of them still felt that they lacked sufficient support to use Farm-PREP well. The most challenges with support were felt among newer TA Providers, but challenges were not uniquely felt by this group.

Recommendations: Providers wished for short, well catalogued videos or screenshot tutorials explaining how to do particular tasks in Farm-PREP. Some also asked for information about translating particular kinds of challenging farmer data into the app or information to share with farmers about the kinds of practices or situations that *tend* to pay the best in the program.

## Assessment & Recommendations by Page

### *Login Page*

Issue	Recommendation
Login mechanism sometimes provides no feedback to the user when the wrong password or no username/password is entered.	Make sure an appropriate message such as “Incorrect Password” or “Please Enter a Username & Password” is clearly displayed every time.
No password reset option	Add a password reset option.
Username & Password textbox suggestion text does not meet accessibility standards for contrast.	Run an accessibility assessment on the app and address issues.
The linked “Learn More” page has a broken link for a “free demo” that brings you to an ArcGIS login page.	If this is to be some users' introduction to the software by which they will decide whether to engage with the program, it should be fully functional, and ideally more polished in appearance.
Login page blurred background hurts some users eyes.	Use a different graphical approach.
Inconsistent styling/spelling of Farm-PREP (also written Farm-Prep and FarmPREP)	Unify spelling and styling of the app’s name.
Login page recommends using Chrome or Firefox and states that Internet Explorer is not supported. It does not mention whether Safari is supported.	Safari is a commonly used browser – let users know whether it is supported by Farm-PREP.

### *Landing Page*

Issue	Recommendation
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Unclear how to add farms	Add information about how farms are added to a profile.
Unclear what WQ ID is	Add hoverable icon with further information.

### *Farm Edit Page*

Issue	Recommendation
Soil names and hydro groups may not be familiar to all users.	Add information about where to learn more.
The hover text for “proximate to water” data entry contains critical information for data accuracy, but no signal indicating that there is hoverable information.	All hoverable elements should have a visual indication (such as an icon) that they are hoverable. Critical data entry information should potentially not be hidden within a hover interface.
Some users cannot initially find the assessment table below the field list table, because the page scroll action is captured by the field list.	Remove scrollability of the field list.
Hint button appears more important than the title it is next to.	Re-assess information hierarchy throughout the app, standardizing text sizes and styles.
User adding a new assessment may not notice assessment type dropdowns.	If user clicks the add button without selecting from the dropdowns, show a message prompting them to do so.
May be unclear to new users the flow / meaning of planned and actual assessments.	Include information explaining types of assessments.

### *Assessment Edit Page*

Issue	Recommendation
Bulk CSV import tools don’t indicate when upload had errors	Provide messages to the user regarding upload success and any errors.
Throughout, new users may be unsure how some terms are defined or how to collect required data.	Unobtrusively link to documentation and instructions developed by AAFM (e.g. through “learn more” links).
Easy to save impossible or improbably values	Develop validation for data inputs, e.g. if manure type is “None” a non-zero value should not be entered. Create warnings when values are negative or out of reasonable range. Etc.
Default Values: Users have to re-enter data year after year that should be default. In other cases, such as with manure defaults, users may be unsure whether the default numbers have been validated or not, especially across user handoff.	Default field values should be stylized differently than entered values. Some fields that typically don’t change year over year should receive last year’s value as default (e.g. buffer width).
Early in modeling, the interface for copying data from one field to another can be confusing (there’s no data in it and no indication as to what it will be for).	Provide a better empty state for this interface.

Hay cuttings does not have an option for 1 cutting, even though this is relatively common.	Add an option for 1 cut of hay. Additionally, providing an option to enter yield instead of cuttings would raise accuracy and is a data point some participants mentioned they believe most farmers have readily available.
In the cover crop interface, inserting some options limits other options (in dropdown menus), and users have to use “clear all” to get their options back, clearing info they shouldn’t have had to clear.	Putting the dropdowns back to a default selection should be sufficient.
Some data entry fields accept 1 decimal place when typing, but 3 decimal places when uploading from a CSV.	Standardize the number of decimal places allowed.

*Optimization Plan Pages*

While this interface could be improved (e.g. by improving the prioritization interface), further research should first be conducted to understand why users do not use this page (according to our work with TA providers).

**References**

The Farm-P Reduction Planner (Farm-PREP): An Integrated Tool for Optimizing Field Practices to Achieve Farm-Scale Nutrient Reductions and Improve Water Quality  
 Microsoft Word - WebApexFinalReport\_092718.docx (Apex Final Report)  
 97\_20200702-FarmPREP\_June-2020.pdf  
 CIG Report-LinkingFarmPreptoTMDL.pdf

Winchell, M. 2018. Development of an Approach and Tool to Optimize Farm-Scale Phosphorus Management and Achieve Watershed-Scale Loading Targets. Lake Champlain Basin Program Technical Report 89.