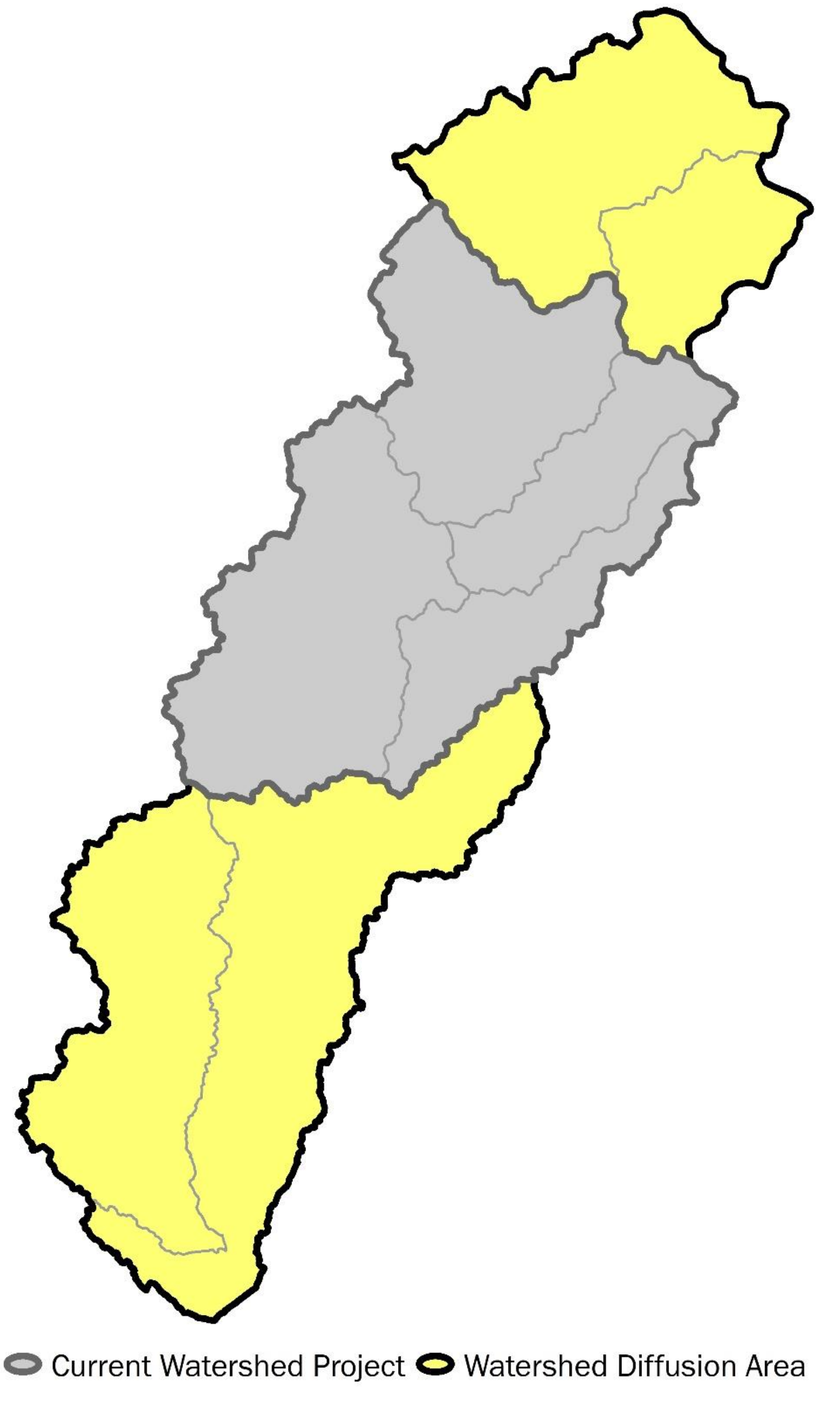
Watershed Diffusion Strategy

for the West Branch of the Floyd River



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Watershed Diffusion

Watershed diffusion is a conceptual model for expansion and scaling of watershed projects. The concept is essentially a place-based application of the theory of diffusion of innovations in the context of the watershed approach.

In Iowa there is presently a large gap in scale between current water quality improvement efforts and that needed as articulated in the Iowa Nutrient Reduction Strategy. Closing the gap and getting to scale will require continued, increased, and sustained innovations from policy makers, institutions, funders, technical conservation specialists, and farmers and landowners.

Along with other support, the concept of watershed diffusion is intended help to advance Iowa towards the ambitious goals of statewide water quality improvement and nutrient loss reduction. Currently, the State of Iowa is funding watershed projects through the Water Quality Initiative and other programs. A successful watershed project with a track record of conservation practice implementation can be thought of as a "hub" from which local knowledge, expertise, and experience can be "diffused" into nearby sub-watersheds by watershed project coordinators, farmers and landowners, and local partners.

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1. Overview

The West Branch of the Floyd River Water Quality Initiative (WQI) watershed project is piloting the concept of watershed diffusion hubs. This area was selected for this initiative given its track record of high levels of practice implementation. The implementation of the diffusion hub strategy aims to expand these proven conservation practices to HUC-12 watersheds in the surrounding area.

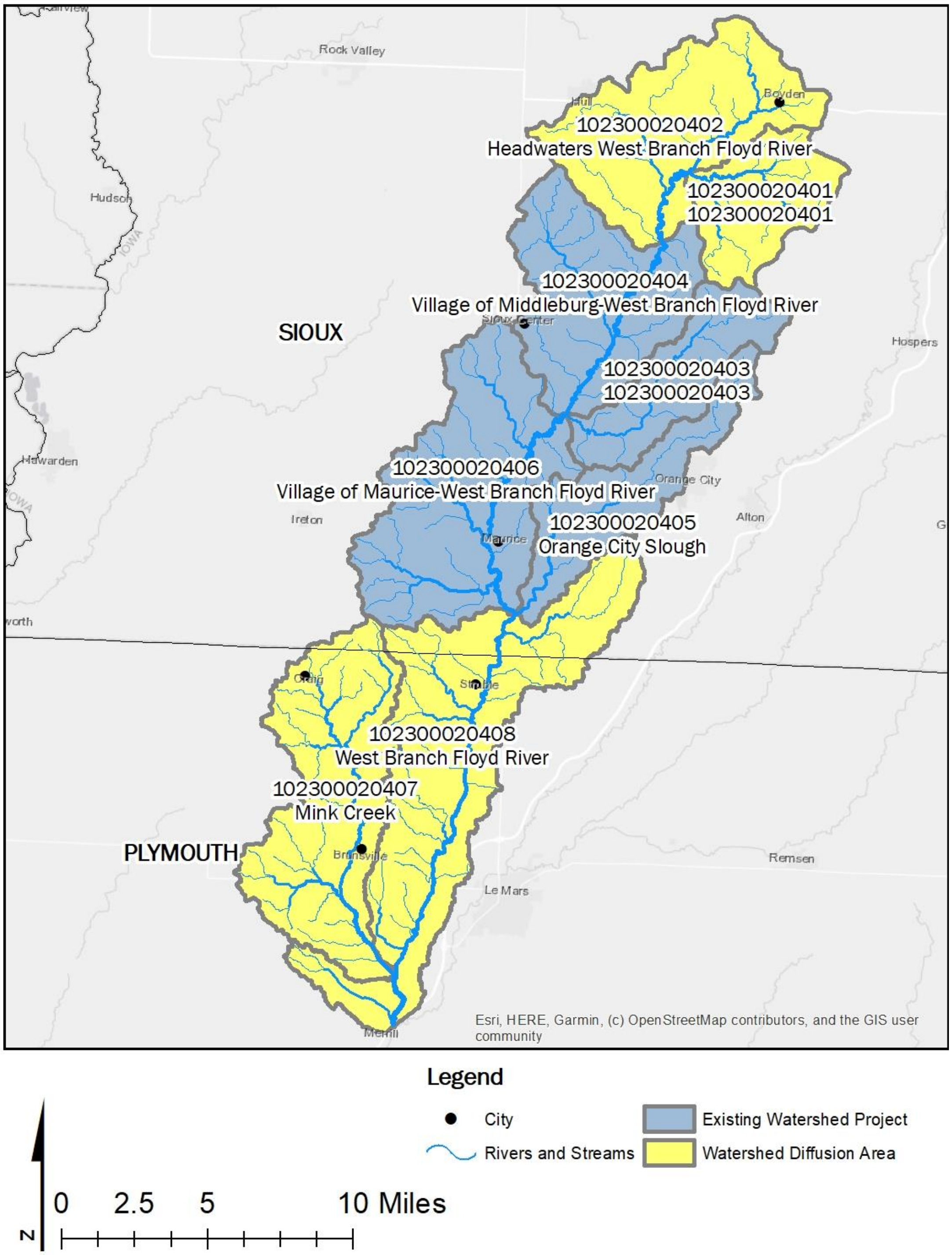

Figure 1. The West Branch of the Floyd River watershed project and diffusion area includes eight HUC-12 watersheds and encompasses 180,394 acres.

The West Branch of the Floyd River project encompasses four HUC-12 watersheds (Figure 1). The watershed project has been in progress since 2013. The project is funded by the Iowa Department of

Agriculture and Land Stewardship (IDALS) through the WQI, along with additional state and federal conservation programs. The project is incorporating in-field, edge-of-field, and land use practices to reduce nutrient loading from agriculture in an area in Sioux County that totals 78,710 acres. The region is predominantly used for farming—with 87 percent of land use devoted to row crop agriculture—and tile drainage is typical. The watershed involves a strong community dedicated to conservation practices as well as project partnership from local stakeholders and organizations.

The goals of the Iowa Nutrient Reduction Strategy (INRS) require that conservation practices are expanded across Iowa. Currently operating watershed projects could function as hubs of diffusion and expansion to meet these goals. In addition to the four HUC-12 watersheds in the current project area, four adjacent watersheds have been identified as a diffusion area for the project (Figure 1). Together these eight watersheds encompass the entire West Branch Floyd River HUC-10 watershed. The diffusion area is 101,684 acres, and the total area of the current project and diffusion HUC-12 watersheds is 180,394 acres.

2. Implementation Roadmap

The INRS calls for 41 percent and 29 percent reductions in nitrogen and phosphorus loss, respectively, from agricultural sources. Many conservation practices were identified and incorporated into the nonpoint source science assessment within the INRS. The following practices have been identified by project staff as high priorities for the West Branch of the Floyd River:

- Nutrient management
- No-till/Strip-till
- Cover crops
- Wetlands
- Bioreactors
- Saturated buffers
- Grassed waterways
- Terraces

Water quality models were utilized to develop a scenario with a combination of these conservation practices to meet INRS goals for the diffusion area. The water quality models are based on the INRS nonpoint source science assessment, and used inputs derived from the Iowa Environmental Mesonet and the Daily Erosion Project. In addition to the identified priority practices, soil health is an implicit and foundational goal for conservation and water quality improvement. One combination of the priority conservation practices that could meet INRS goals within the watershed project and diffusion area is shown below (Table 1).

Table 1. Priority conservation practices and needed implementation levels to meet Iowa Nutrient Reduction Strategy goals. Phased implementation targets are cumulative, so practice retention is important.

Practice	Unit	Goal	Phase 1: Start-Up 2020-2022	Phase 2: Speed-Up 2023-2025	Phase 3: Scale-Up 2026-2035
Nutrient management	acres/year	110,000	10,000	25,000	75,000
No-till/Strip-till	acres/year	55,000	10,000	20,000	25,000
Cover crops	acres/year	110,000	10,000	25,000	75,000
Wetlands	sites	20	2	4	14
Bioreactors	structures	200	20	50	130
Saturated buffers	structures	250	30	60	160
Grassed waterways	feet	70,000	5,000	15,000	50,000
Terraces	feet	110,000	10,000	25,000	75,000

During the initial phase, it will be essential to support farmer learning related to in-field management practices like nutrient management, no-till, and cover crops. Therefore, on-farm demonstrations, research, and peer-to-peer knowledge transfer should be implemented. Conservation practice adoption goals and progress should be regularly evaluated and adjusted as needed. At a minimum, reevaluation should be conducted between phases.

The Agricultural Conservation Planning Framework (ACPF) can be used to facilitate the selection and implementation of conservation practices in watersheds with predominately agricultural land use. The ACPF outlines an approach for conservation-oriented watershed management and also includes a GIS toolset to analyze watershed information and determine potential locations for conservation practices. Primary ACPF outputs include these potential locations. ACPF data for the diffusion area were generated using version 3 of the GIS toolset. These locations were used to inform the implementation scenario for the diffusion area (Figure 2).

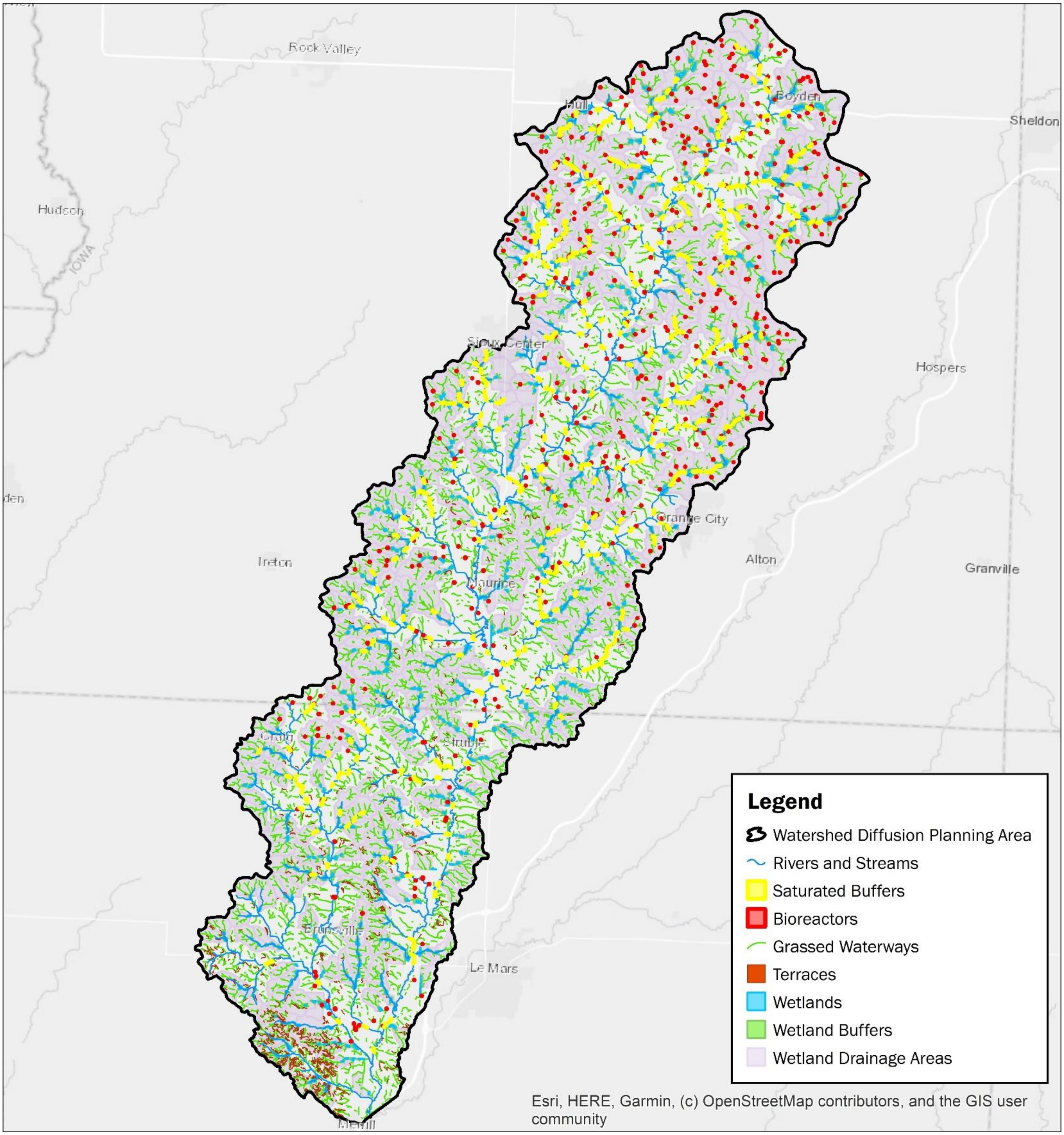

Figure 2. Potential locations for conservation practice adoption derived using the Agricultural Conservation Planning Framework GIS toolset.

Key inputs and results of the watershed modeling are shown below (Table 2).

Table 2. Primary inputs and outputs from watershed nutrient models for phosphorus (P) and nitrate-N (N). Anticipated reductions are based on the full implementation plan (Table 1).

Parameter	Value	Unit
Row crop agriculture	157,020	acres
Soil loss	3.89	tons/acre/year
Sediment delivery ratio	57%	
Baseline P load	348,160	pounds/year
Anticipated P load reduction	59%	
N (nitrate-N) yield	28.0	pounds/acre/year
Baseline N load	2,818,570	pounds/year
Anticipated N load reduction	41%	

3. Engagement Plan

3.1. Watershed Advisory Team

Implementing this diffusion strategy will require a cooperative approach amongst governmental, non-profit, and local business entities. However, participation in the diffusion and planning process should extend to local farmers and community members to develop a plan that can feasibly meet the needs of everyone. A survey of 25 watershed coordinators across Iowa indicated that in addition to a watershed plan, leadership and stakeholder awareness are key to a successful watershed project.

To satisfy these criteria, a watershed advisory team should be developed and regularly convened in order to provide a clear vision for the West Branch of the Floyd River watershed diffusion area. Potential members of the advisory committee will be identified from local stakeholders and invited to participate. Input from the advisory group, other local stakeholders, and conservation experts can be used to guide ongoing implementation of priority conservation practices.

3.2. Facilitated Community Events

Public involvement is an essential component of the watershed approach. Watershed managers and project partners should encourage public participation. One way to deepen engagement in public events is through facilitated dialogue. Facilitation methods can be utilized in community meetings in order to focus on the exchange of information and ideas, rather than simply the presentation of such. This can create a platform for collective intelligence within a group—in this case, stakeholders of the watershed project and diffusion area—to come forth and allow for innovative local solutions to the complex challenge of implementing the INRS at full scale.

3.3. Cooperative Learning

Despite the institutional, partnership, and programmatic support available, farmers and landowners will bear primary responsibility for fully implementing the INRS. There is substantial opportunity for farmers to learn from each other, particularly for in-field conservation practices such as nutrient management, minimum or zero tillage, and cover crops. A local network of farmers participating in on-farm research should be developed and supported in order to facilitate the exchange of information on best management practices along with farm financial considerations.

4. Financing Strategy

4.1. Resources Needed

To achieve the goals of this watershed diffusion strategy, significant financial resources will be needed. An estimate of resource needs is crucial to gain support from potential funding sources. Based on the conservation practice target levels identified above (Table 1), an estimated $7,405,500 is needed for one-time practice construction plus an estimated $3,300,000 per year to support annual management practices along with operations and maintenance in the watershed project and diffusion area (Table 3). Both prioritization of available funds and innovative approaches to securing additional funds will be needed to maximize the benefits of investing in water quality improvement in the West Branch of the Floyd River watershed diffusion area.

Table 3. Cost estimates for priority conservation practices. Negative costs denote anticipated cost savings by the farmer.

Practice	Unit	Goal	Unit cost	Total cost
Nutrient management	acres/year	110,000	-$5.00	-$550,000.00
No-till/Strip-till	acres/year	55,000	-$10.00	-$550,000.00
Cover crops	acres/year	110,000	$40.00	$4,400,000.00
Wetlands	sites	20	$130,000.00	$2,600,000.00
Bioreactors	structures	200	$16,000.00	$3,200,000.00
Saturated buffers	structures	250	$4,000.00	$1,000,000.00
Grassed waterways	feet	70,000	$1.97	$138,000.00
Terraces	feet	110,000	$4.25	$467,500.00

4.2. Cost Prioritization

One approach to prioritizing practices could be to consider the economic efficiency (i.e., cost-benefit ratio) of nutrient load reduction (Table 4). These benefits and costs should be aligned with the needs and goals of individual farmers and landowners that will implement each practice.

Table 4. Anticipated phosphorus (P) and nitrate-N (N) annual load reductions along with cost efficiency (dollars per pound of nutrient). Cost efficiencies were calculated using equal annualized cost to allow for comparison of annual management practices and long-term infrastructure.

Practice	Unit	Goal	P reduction (lb/yr)	P cost ($/lb/yr)	N reduction (lb/yr)	N cost ($/lb/yr)
Cover crops	acres/year	110,000	70,732	$62.21	954,800	$4.61
Wetlands	sites	20	12,860	$8.54	145,600	$0.75
Bioreactors	structures	200			120,400	$3.28
Saturated buffers	structures	250			175,000	$0.24
Grassed waterways	feet	70,000	5,543	$3.07		
Terraces	feet	110,000	17,073	$3.38		

4.3. Conservation Finance

Conservation finance is the practice of raising and managing capital to support land, water, and natural resource conservation. At the core of conservation finance is the underlying belief that it is possible to align environmental, social, and economic returns: the so-called triple bottom line. New strategies that rely on market-based mechanisms to stimulate positive environmental and social outcomes, as well as financial returns have emerged (Conservation Finance Network).

Current funding mechanisms provided by local, state, and federal units of government will not be adequate to address all goals outlined in this plan, so additional creative and sustainable approaches will be needed. To develop and deploy new approaches, project staff should work to account for the many benefits on-farm conservation can provide. Once the benefits are understood, beneficiaries should be identified. Beneficiaries could include downstream communities, supply chain companies, foundations, and others. Linking beneficiaries with outcomes may generate capital to support implementation of conservation. This approach could create new or additional revenue for farmers and landowners, while at the same time producing environmental outcomes.

Examples of linking beneficiaries with upstream conservation include the State Revolving Fund Sponsored Project program which allows municipalities to receive a lower interest rate on infrastructure loans in exchange for investing in nonpoint source water quality practices in the watershed. Another example is a supply chain company paying a portion of the cost for cover crop establishment. In all cases, the beneficiary (e.g., cities or supply chain companies) will need to value the benefits generated by the conservation practice being implemented. Understanding the value will require a shift in thinking from cost-share payments and incentives to outcome-based payments.

The implementation of conservation practices on farms also can be profitable for farmers. When managed effectively, conservation practices can enhance soil and water resources and lower operating or input costs, ultimately leading to a higher net farm revenue. Operation-scale farm accounting and adequate records management will help farmers to realize the tangible financial benefits of incorporating conservation into their standard practices.