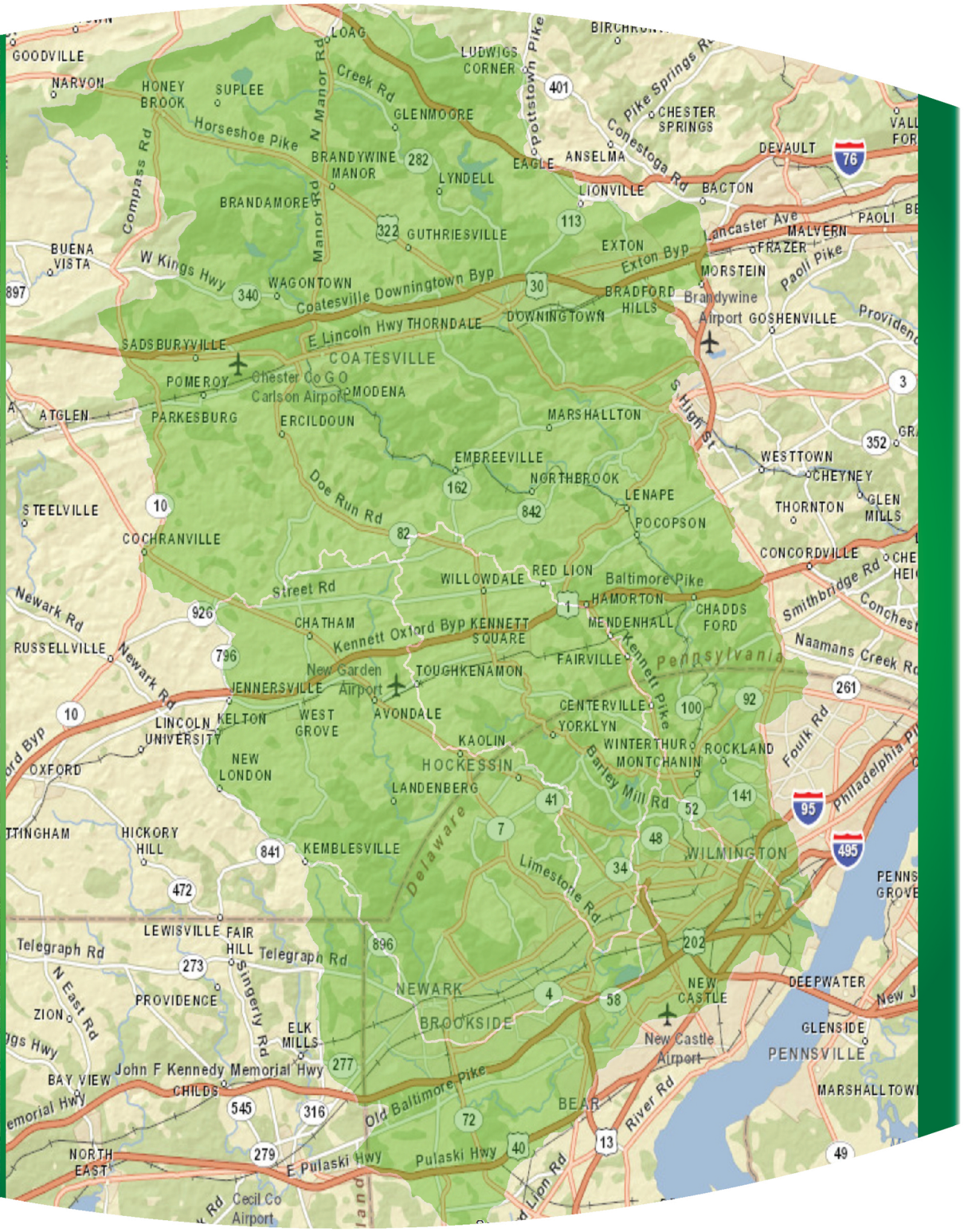
Brandywine-Christina Healthy Water Fund

Preliminary Feasibility Study
Executive Summary
April 2015



The Nature Conservancy
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William Penn Foundation

University of Delaware

Brandywine-Christina Healthy Water Fund Preliminary Feasibility Study

Executive Summary

April 2015

prepared for the
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Philadelphia, Pa.

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EXECUTIVE SUMMARY

E.S.1. Introduction

This document assesses on a preliminary basis the feasibility of establishing the Brandywine-Christina Healthy Water Fund. The Water Fund is a mechanism for engaging direct beneficiaries of freshwater and other stakeholders in making investments within the watershed to improve water quality on a least-cost basis, enhance environmental and social values, and achieve quantifiable economic benefits. This effort seeks to leverage The Nature Conservancy's global experience in developing and stewarding water funds with the quantitative expertise of the University of Delaware's Water Resources Agency in addressing water quality issues in the Brandywine-Christina watershed. To be successful, the Water Fund must creatively engage water withdrawers, stormwater managers, and agricultural stakeholders in the efficient deployment of pooled capital to achieve positive water treatment outcomes, risk mitigation, regulatory compliance, and preservation of farming as a long-term viable activity for the region.

This study consolidates research and analysis completed to date and finds sufficient preliminary evidence to conclude that a water fund offers a financially and politically viable approach to water quality (and perhaps quantity) improvement in the Brandywine-Christina watershed. This conclusion is based on the following factors (among others): (1) an opportunity exists to expand on and increase the efficiency of current conservation initiatives in the watershed, (2) regulators appear open to exploring more flexible regulatory approaches to achieving water quality (and possibly quantity) goals, and (3) water purveyors, stormwater managers, and potential public and private funders have expressed interest in exploring more cost-effective water quality (and possibly quantity) strategies, including nature-based solutions. This is a challenging and complex endeavor, but one that holds the promise of revolutionizing the way freshwater resources are managed to secure long-term benefits for people and nature.

E.S.2. Watershed Characterization

Chapter One provides an overview of the Brandywine-Christina watershed. The Brandywine-Christina is an emblematic eastern United States watershed. It covers more than 565 square miles and is home to more than 590,000 people (U.S. Census 2000–2010). The watershed includes four subwatersheds: the Brandywine, Red Clay Creek, White Clay Creek, and the Christina River. The watershed is also referred to as the Christina Basin. The majority of the land in the watershed is in Pennsylvania; however, the majority of the population is in Delaware. Approximately 39% of the watershed's land use is dedicated to agriculture, 33% is forest and wetlands, and 28% is suburban and urban (NOAA CSC 2005). The relative proportions of each land use are roughly similar in the White Clay, Red Clay, and Brandywine subwatersheds. The Christina River subwatershed, which lies almost completely in Delaware, is significantly more suburban/urban and less agricultural than the other subwatersheds (Figure ES.1).

Despite a long-standing and robust commitment to conservation in the watershed, much of the Brandywine-Christina remains impaired based on standards set by the Clean Water Act. This does not mean conservation interventions cannot restore watersheds to these standards. Indeed, conservation measures to date in the Brandywine-Christina have yielded significant water quality improvements, leading to the conclusion that increasing the pace, scale, and efficiency of conservation measures has the potential to restore the health of the watershed.

Restoration of the watershed requires removing impairments from the streams. One aspect of addressing stream health is meeting total daily maximum loads (TMDLs), which have been established for specific pollutants and apportioned among sections of the watershed, including those shown in Table ES.1. The achievement of these load limitations forms an important component of watershed restoration efforts.

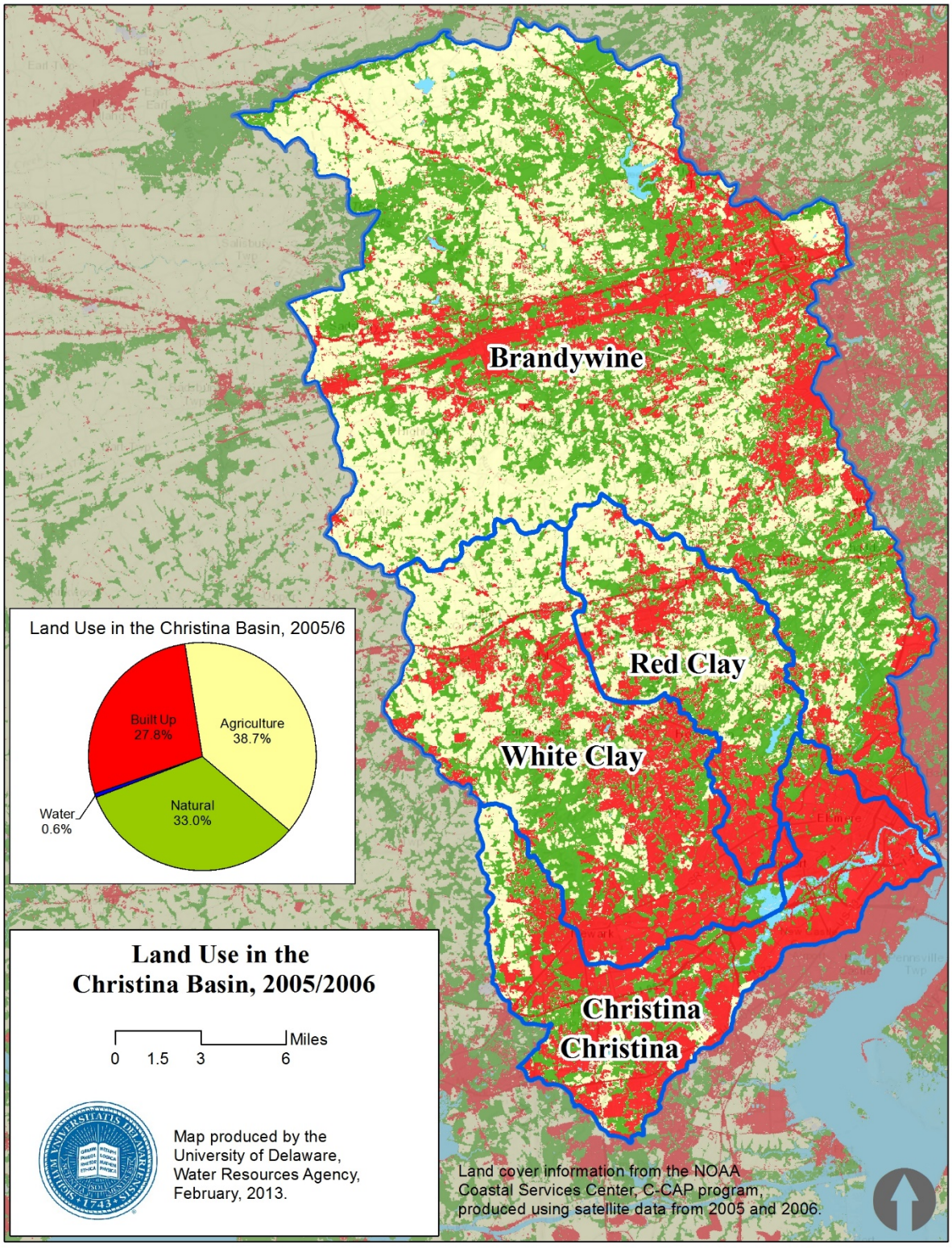

Figure ES.1. Land use in the Brandywine-Christina watershed

Table ES.1. High flow nonpoint source TMDL reductions in the Brandywine-Christina watershed (EPA, DNREC, and PADEP 2006)

Watershed	Percent Reduction (%)			
Pennsylvania–Delaware Line	**Bacteria**	**Sediment**	**Total N**	**Total P**
Brandywine Creek	93%	16 – 60%	46%	41%
Red Clay Creek	58%	45 – 52%	31%	40%
White Clay Creek	70%	26 – 70%	28%	73%
Christina River (at Md.–Del. line)	58%		73%	48%
In Delaware	**Bacteria**	**Sediment**	**Total N**	**Total P**
Brandywine Creek	88 – 94%		16%	36%
Red Clay Creek	29 – 89%		49%	54%
White Clay Creek	66 – 89%			
Christina River	61 – 91%		6%	9%
CSO Discharges, Wilmington, Del.	**Bacteria**	**Sediment**	**Total N**	**Total P**
Brandywine Creek	63%		64%	63%
Christina River	72%		72%	72%

E.S.2.1. Watershed Management Planning Documents

As discussed in Chapter One, numerous watershed management plans have been prepared for the Brandywine-Christina watershed. A review of the most recent of these plans resulted in a common set of recommended actions (Chapter 1, Table 1.6), including:

- Agricultural mitigation – nutrient management plans, cover crops, livestock fencing
- Riparian buffers – protection and restoration
- Forest preservation and reforestation
- Farmland preservation – fee and easements acquisition
- Open space preservation – fee and easements acquisition
- Headwater preservation – fee and easements acquisition
- Streambank restoration and stabilization
- Wetland/floodplain restoration and reconnection
- Stormwater retrofits in urban areas
- Stormwater runoff reduction to mitigate flooding, erosion, and sedimentation
- Increased tree canopy in urban/suburban areas

E.S.2.2. Existing Watershed Initiatives

Chapter One discusses the existing watershed initiatives in the watershed. Public and private drinking-water purveyors continue to support and contribute to watershed conservation and restoration projects throughout the watershed. Support generally goes to nonprofit conservation organizations in the watershed. The organizations have often leveraged these funds to garner additional state, federal, and private foundation

contributions, resulting in a significantly larger impact on the watershed health than would have been possible with only local funding.

E.S.3. Regional Advisory Panel Process

In Chapter Two the Regional Advisory Panel process is summarized. An important component of this feasibility study was the empanelling of the Regional Advisory Panel composed of representatives with diverse water quality, conservation, and regulatory expertise throughout the watershed. Members of the Regional Advisory Panel include federal, state, and county government representatives, experts in the agriculture community, nonprofit representatives, and business leaders. The Regional Advisory Panel met three times and provided invaluable input and feedback on the project and this feasibility study.

E.S.4. Case Studies and Models

Chapter Three discusses the case studies and models. The project team conducted an extensive review of the literature and case studies from successful market-based funding approaches to watershed conservation around the globe (See Appendices B and C). From the case studies, the following six common principles emerged:

1. Develop strong public-private partnerships.
2. Leverage state, federal, and private funding.
3. Adopt science-based conservation and strategic plans.
4. Depend on local champions and stewards.
5. Start with seed money and develop a steady funding source.
6. Adapt to the setting.

The case studies demonstrated that water purveyors are typically the "first-round" investors in successful water funds. In the Brandywine-Christina watershed, municipalities and other stormwater-regulated entities are also significant stakeholders. Future partners could include philanthropic foundations, impact investors, and public-private partnerships.

As a result of the information gathered from the key stakeholders and feedback from the Regional Advisory Panel, the project team selected four case studies to highlight. Each has at least one component of its program that is particularly relevant to the Brandywine-Christina watershed:

- The City of New York case study demonstrates the power of working with the agricultural community to reach water quality goals (American Water Works Association et al. 2004, Majanen et al. 2011, New York City Department of Environmental Protection 2006, USEPA 2007, Hulle et al. 2013).
- The Upper Neuse River Clean Water Initiatives is an example of a multi-government project that includes dedicated funding sources (Triangle Land Conservancy et al. 2010, Hart 2006, Gartner et al. 2013, American Water Works Association et al. 2004, www.pinchot.org/doc/465).

- The York County case study illustrates a multi-government agreement reached to address stormwater permit requirements (Shellenberger 2014).
- FONAG (Fondo para la Protección del Agua) is a mature water fund with multiple partners and a dedicated funding source (Arias et al. 2010, Calvache et al. 2012, The Nature Conservancy 2012).

Computer modeling has been an essential part of the planning and implementation of each of the case studies reviewed. These models are instrumental in generating information to answer questions essential to water fund design, including: what is the condition of hydrologic services in the watershed, how might the condition of those services change under various conservation schemes, and where should investments be made to maintain or improve key ecosystem services (including hydrologic services) and maximize return on investment? Four models should be considered in generating information for the Brandywine-Christina Health Water Fund: (1) Resource Investment Optimization System (RIOS), (2) Integrated Valuation of Environmental Services and Tradeoffs (InVEST), (3) Soil and Water Assessment Tool (SWAT), and (4) MapShed.

E.S.5. Economic Analysis

The economic analysis supporting this preliminary feasibility study, provided in Chapter Four, relies upon empirical data from the Brandywine-Christina and other watersheds to illustrate the economic benefits that could result from scaling-up water quality conservation. It concludes that conservation strategies often offer a lower-cost alternative to "gray infrastructure" investments. Targeting conservation interventions to specific locations within the watershed and prioritizing conservation strategies can result in significant efficiencies and cost savings. Similarly, conservation strategies help manage long-term risks.

For the purposes of the example analysis presented in the this study, nitrogen and sediment are selected as "currency" to derive pollutant reduction costs for the Brandywine-Christina watershed because: (1) water utilities are concerned about treatment costs and public-health risks from high nutrient and sediment loads, (2) the conservation strategies that reduce nitrogen and sediments reduce other pollutants such as phosphorus and bacteria, (3) good cost-reduction data is available for nitrogen and sediment, and (4) nitrogen levels continue to degrade in the watershed. Furthermore, there is significant overlap of the subwatersheds that require TMDLs for nitrogen and phosphorus, and most of those subwatersheds also require sediment reductions to meet TMDLs. While reducing the nitrogen and sediment loads to the TMDL levels will not by itself reach the goal of a swimmable, fishable, and potable watershed, it is a substantial first step toward that goal.

Pollutant load reduction costs are calculated based on 2006 TMDLs established by the United States Environmental Protection Agency (USEPA), the Delaware Department of Natural Resources and Environmental Control (DNREC), and the Pennsylvania Department of the Environment (PADEP), as listed on 2014 PADEP impaired streams maps for Chester County (Figures ES.2 and ES.3), and verified by water quality monitoring data. Agriculture, which represents a significant portion of land use in the Brandywine-Christina watershed,

accounts for approximately 80% of the nutrient loads in the watershed (USGS SPARROW). Agricultural mitigation strategies, a best management practice (BMP), are by far the most cost-effective means of achieving the water quality improvements necessary to restore the Brandywine-Christina to fishable, swimmable, and potable status (Jones et al. 2010).

The map below (Figure ES.4) shows the distribution of the nitrogen TMDL across the watershed. It illustrates that targeting conservation in specific areas of the watershed should result in significant water quality improvements. By implementing least-cost nitrogen-reducing strategies in high nitrogen load areas in the watershed, significant costs savings of up to $120 million can be achieved over a ten-year time horizon.

Similarly, targeted investments can also be used to address the sediment TMDL. Figure ES.5 shows the distribution of the sediment TMDL across the watershed. This map illustrates that conservation in these areas of the watershed should result in more effective water quality improvements. By using the least-cost strategies to reduce sediment, the cost to meet the sediment TMDL across the watershed is estimated to be $4.4 million per year for ten years. Studies in other watersheds would suggest that the cost of sediment removal by traditional sediment-removal processes would be significantly higher, although further analysis is needed to draw specific conclusions for the Brandywine-Christina watershed.

Based on work in the Chesapeake Bay watershed, buffers and restored wetlands achieve the same amount of nitrogen reduction as wastewater treatment plant upgrades and stormwater retrofits, but at a dramatically lower cost (Figure ES.6). The least-cost strategies in Figure ES.6 are comparable to agricultural mitigation or agricultural BMPs.

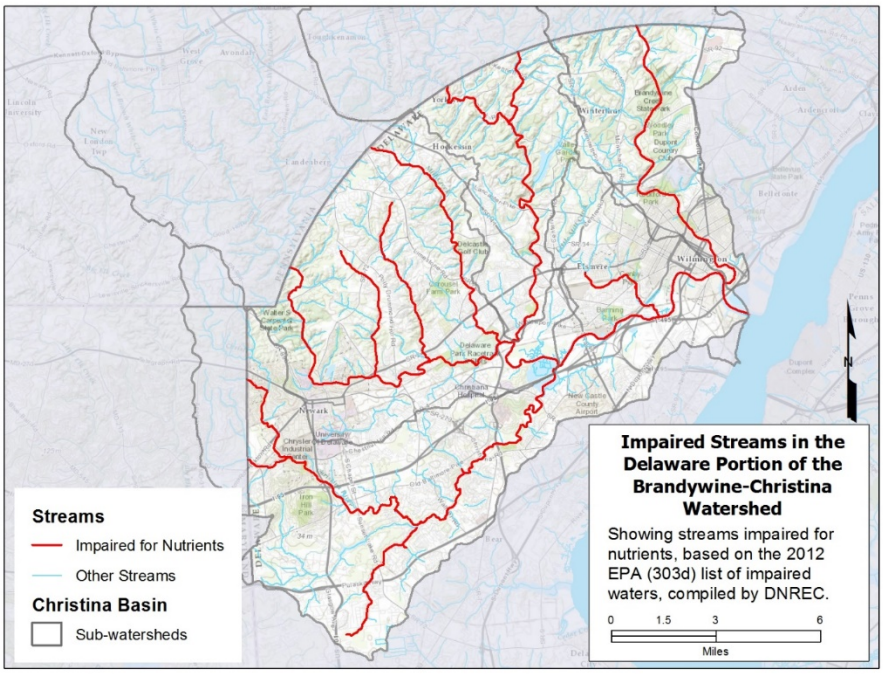

Figure ES.2. Streams impaired for nutrients in the Delaware portion of the Christina Basin, 2012 (DNREC and UDWRA)

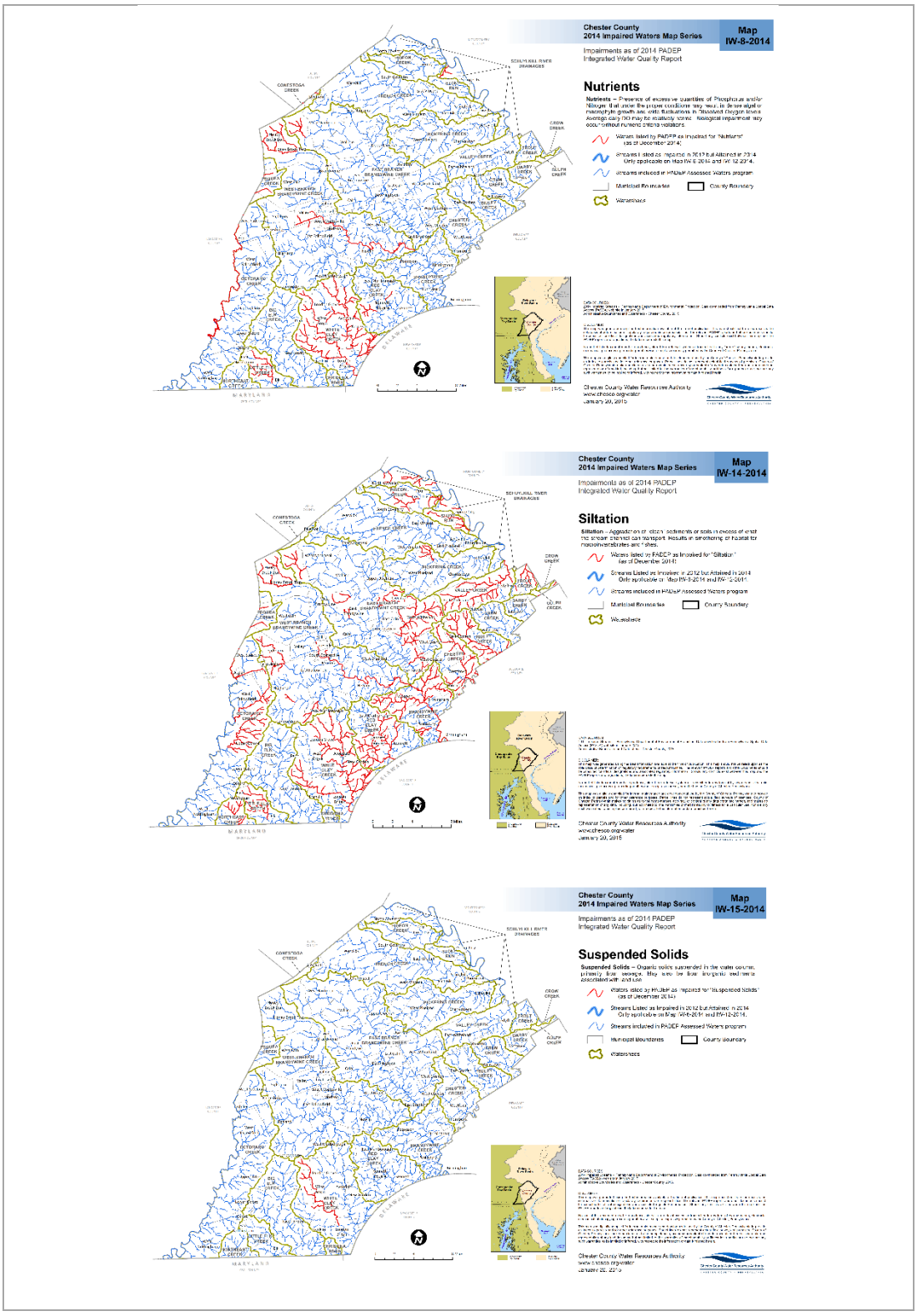

Figure ES.3. Streams impaired for nutrients, siltation, and suspended solids in Chester County, PA, 2014 (PADEP and CCWRA)

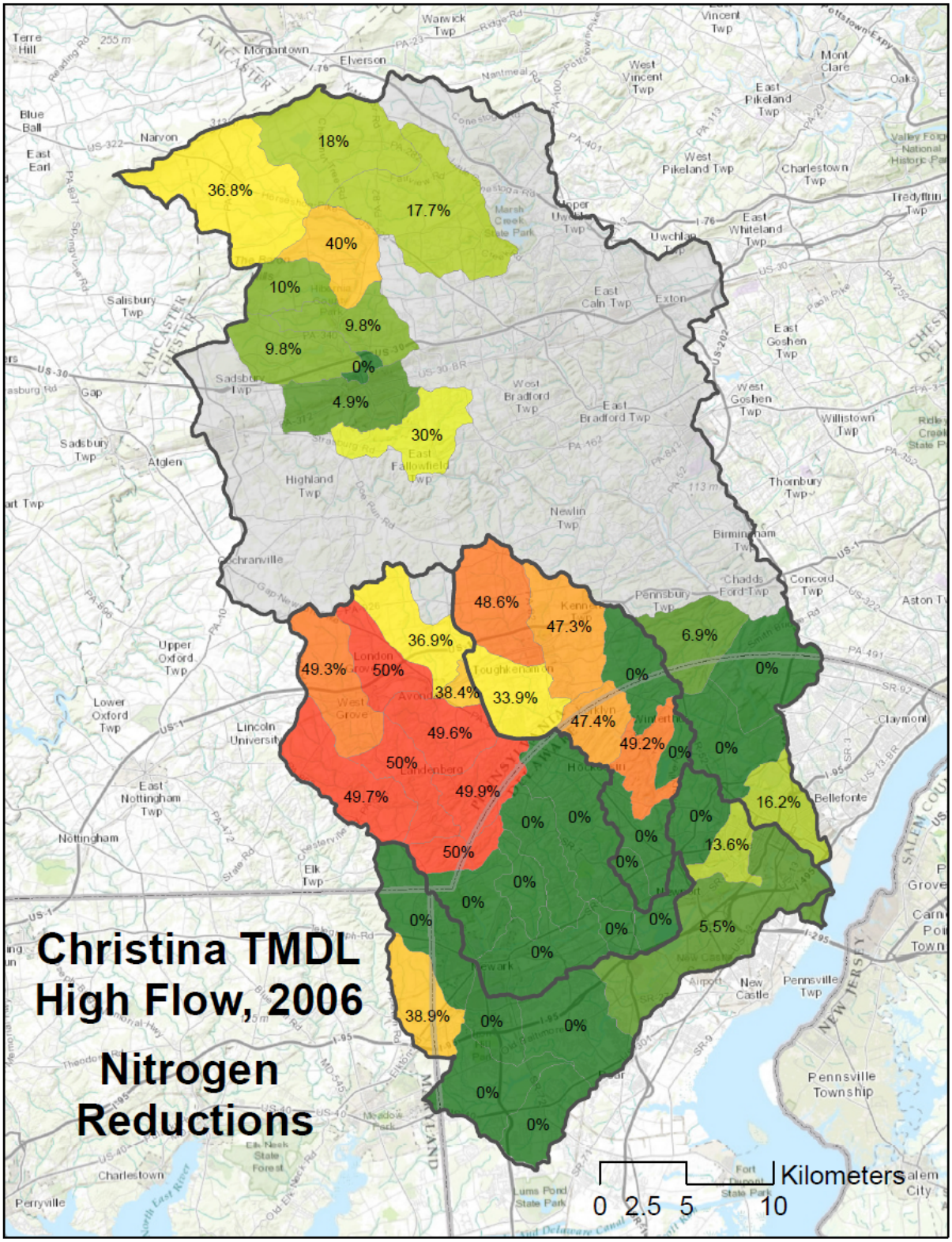

Figure ES.4. Nitrogen load TMDL reductions for Brandywine-Christina watershed (USEPA 2006)

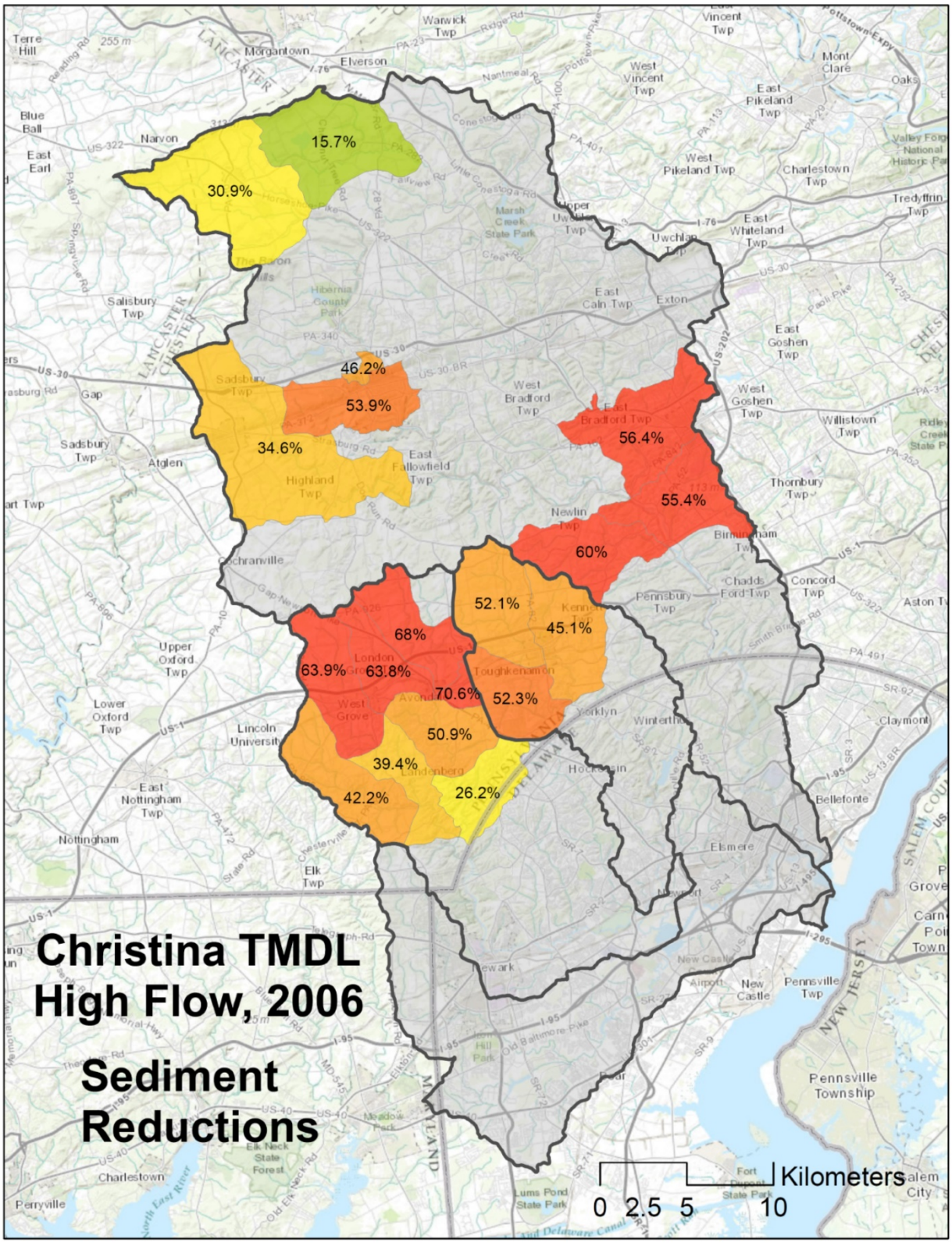

Figure ES.5. Sediment load TMDL reductions for Brandywine-Christina watershed (USEPA 2006)

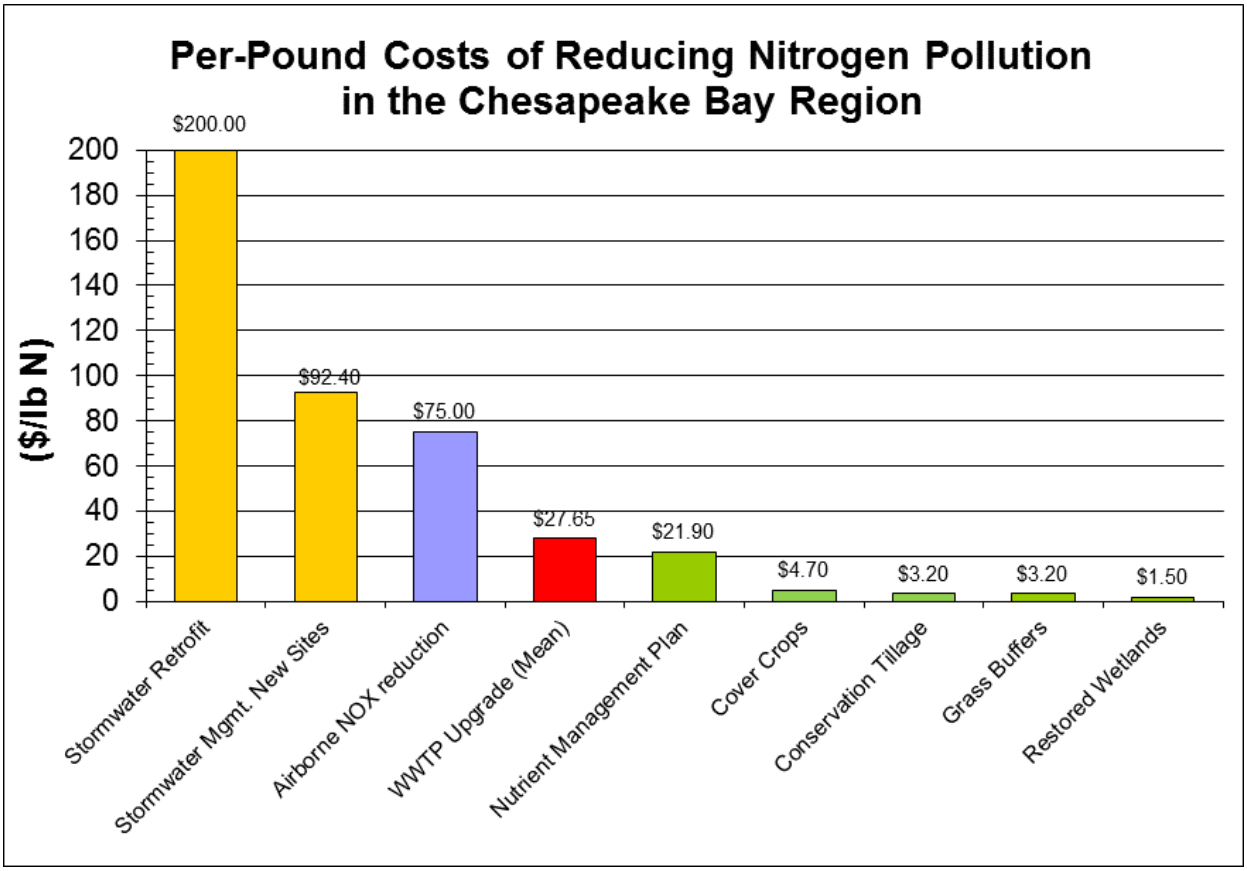

Figure ES.6. Per pound costs of nitrogen reduction for various strategies (Jones et al. 2010 and USEPA 1996)

Estimated annual costs to reduce pollutant loads in the Brandywine-Christina range from $5.5 million for nitrogen to $4.4 million for sediment over ten years between 2015 and 2025 (Table ES.2). Load reduction costs are complementary since agriculture conservation BMPs that reduce nitrogen and sediment also reduce phosphorus and bacteria.

Table ES.2. Estimated annual costs to reduce nitrogen and sediment loads in the Brandywine-Christina watershed

Watershed	Nitrogen ($ mil/yr)	Sediment ($ mil/yr)
Brandywine	1.6	0.5
Red Clay	1.4	1.3
White Clay	2.0	2.6
Christina	0.5	No DE TMDL
Brandywine-Christina	5.5	4.4

A water fund can be designed to cover some but not all of the annual costs, since existing investments are being made by federal, state, local, and nonprofit sources. For instance, if

the United States Department of Agriculture (USDA) Farm Bill provides 80% of agriculture conservation costs, then the Water Fund could be utilized to provide the 20% local share to incentivize farmers. The Water Fund might also be used to provide low-cost loans to farmers to cover up-front costs for BMP implementation.

The benefits of water quality improvement extend beyond meeting regulatory requirements. For example, reductions in sediment decrease the cost of producing drinking water. A recent global study suggests that an annual reduction of sediment load by 4% can reduce water treatment by 1% (The Nature Conservancy and International Water Association 2014). Therefore, annual water treatment costs in the Brandywine-Christina watershed could potentially be reduced by $2.5 million.

Reduced nitrogen, sediment, and associated bacteria pollutant loads can provide annual benefits that range from a low-bound estimate of $5.9 million to a high-bound estimate of $20.2 million in the water supply ($2.5 million), forest ($0.3 million), agriculture ($0.7–$7.4 million), navigation ($0.8–$0.9 million), and nonuse swimming recreation ($1.6–$9.1 million) sectors in the Brandywine-Christina watershed (Table ES.3).

Table ES.3. Estimated potential benefits of improved water quality in the Brandywine-Christina watershed

Sector	Activity	2010 ($ mil)	
		Low Bound	*High Bound*
Water Supply	Reduced sediment load by 4% decreases surface water treatment costs by 1% for water supply withdrawals of 55 million gallons per day (mgd).	2.5	2.5
Forests	10% increase in 133,760 acres of forests reduces water treatment costs (55 mgd) by 20% ($33/mgd).	0.3	0.3
Agriculture	Reduced soil erosion and avoided loss of crop and agriculture sales from 135,000 acres of farmland.	0.7	7.4
Navigation	Reduce sediment loads by 48%–56% as per TMDL to avoid dredging costs for 200,000 cubic yards (CY) of sediment at $8.09/CY.	0.8	0.9
Nonuse	Willingness to pay ($10.62 to $60.00 per person) for swimmable water quality for adult population of 461,000 in the watershed.	1.6	9.1
Total		5.9	20.2

The City of Newark along White Clay Creek, the City of Wilmington along Brandywine Creek, and other water purveyors often curtail withdrawals and incur higher treatment costs when turbidity exceeds 20 nephelometric turbidity units (NTU) at United States Geological Survey (USGS) stream gaging stations. This suggests additional savings could be achieved through turbidity reductions. A real-time turbidity station is needed along the Red Clay Creek at the state line.

Clean drinking water also provides human-health benefits through reduced mortality, cancer, illness, and neurological/reproductive risks. In the summer of 2014, nutrient-induced algal blooms along Lake Erie caused outbreaks in Milwaukee, Wisconsin, and Walkerton, Ontario, and the shutdown of Toledo, Ohio, intakes. The risk of waterborne disease should be considered in the economics of source water protection and public drinking water safety.

A recent study evidenced strong public support in Delaware for public funding of water quality improvements. The Delaware Nature Society, with support from The Nature Conservancy, commissioned a survey of 400 Delaware residents (OpinionWorks LLC 2015). The poll found that the public (without knowledge of details) profoundly supported the concept of a clean water fee by a nearly 2-to-1 margin (57% in favor, 32% opposed). Support for the fee crosses party and county lines: 66% of Democrats and 52% of Republicans support a clean water fee, and the measure enjoys support from 57%, 53%, and 58% of the residents of New Castle, Kent, and Sussex Counties, respectively.

The ultimate success of the Water Fund will also depend upon a strong working relationship with the agricultural community. Fortunately, the members of the Regional Advisory Panel and the WPF Cluster Partners already have strong relationships with the agricultural communities in the watershed. These pre-existing relationships will prove invaluable in implementing the Water Fund.

E.S.6. Stakeholder Interview Process

Chapter Five summarizes the stakeholder interview process. Stakeholders interviewed for this preliminary feasibility study included water purveyors, municipalities, and other stormwater-regulated entities in the Brandywine-Christina watershed. Appendix D includes detailed notes from each interview. After initial engagement, the following stakeholders expressed an interest in continuing a dialogue about how to work collaboratively in the watershed to achieve water quality improvements:

- City of Wilmington
- City of Newark
- New Castle County
- Delaware Department of Transportation
- Christina TMDL Implementation Plan representatives
- Aqua Pennsylvania
- Pennsylvania American
- United Water Delaware

The primary water quality stressors consistently identified in stakeholder interviews were sediments, nutrients, and stormwater volume. There was also interest in developing a more robust emergency response/early warning system with respect to water quality threats throughout the watershed.

Stakeholders expressed a general appreciation for the leverage achievable through pooling investments throughout the watershed and saw the value in taking a whole-watershed approach. At this phase of the project, there is no indication that the geographic scope of the Water Fund should be narrowed or limited to any particular portion of the watershed; though, as the development of the Water Fund progresses the issue of equitable investments across subwatersheds may need to be addressed.

For some stakeholders, regulatory drivers can provide an important incentive to increase water quality investments. The current regulatory environment offers encouraging opportunities for implementation of market-based approaches to achieving regulatory compliance in the watershed. Indeed, USEPA, PADEP, and DNREC have all expressed an interest in further exploring this collaborative effort.

Both stakeholders and the Regional Advisory Panel emphasized the importance of a robust communications and outreach plan to engage key constituencies throughout the watershed. Such communication and outreach can be targeted to specific interest groups, including ratepayers, regulators, legislators, municipalities, corporations, and members of the agricultural community.

E.S.7. Communications

Chapter Six summarizes the communications approach. As evidenced by the evaluation of case studies and feedback from stakeholders and the Regional Advisory Panel, communication and outreach are important components of a successful water fund. The project team has developed and conducted targeted communications with stakeholders and the Regional Advisory Panel. This outreach employed a variety of engagement methods, including Regional Advisory Panel meetings, development of a project website, written communication, stakeholder interviews, presentations, and informal meetings and discussions. As the project progresses, additional forms of communication and outreach will be developed and employed.

E.S.8. Conclusions

In Chapter Seven the conclusions are presented. This report reflects findings from the initial phase of analysis for a water fund to support water quality (and perhaps quantity) improvements in the Brandywine-Christina watershed. Based on the case study research, economic analysis, feedback received from the Regional Advisory Panel, and the stakeholders interviewed, the project team concludes that a water fund offers a financially and politically viable approach to water quality (and perhaps quantity) improvement in the Brandywine-Christina watershed. This conclusion is based on the following factors (among others): (1) an opportunity exists to expand on and increase the efficiency of current conservation initiatives in the watershed, (2) regulators appear open to exploring more

flexible regulatory approaches to achieving water quality (and possibly quantity) goals, (3) water purveyors, stormwater managers, and potential public and private funders have expressed interest in exploring more cost-effective water quality (and possibly quantity) strategies, including nature-based solutions. The initial analysis has not indicated any insurmountable barriers to design and implementation for a water fund and a set of key stakeholders interested in continuing discussions has been identified.

This preliminary feasibility study reaches the following conclusions:

Regulatory Structure: Based on feedback from the Regional Advisory Panel and key stakeholders, a water fund for the Brandywine-Christina watershed will have the greatest chance to accelerate the pace and increase the scale of pollution reduction if:

- The Water Fund can finance projects that are identified and prioritized based on their demonstrated ability to improve water quality (rather than on the basis of regulatory jurisdiction or other regulatory requirements).
- The Water Fund can ultimately scale up conservation finance in the watershed (e.g., through low-interest loans, grants, or matching funds).
- A regulatory structure is in place that allows municipalities that contribute to the fund to receive offsets/credits to meet their Municipal Separate Storm Sewer System (MS4) permit pollutant reduction requirements (even if implementation of those projects occurs outside of the contributing municipality's jurisdiction).

To be successful, the Water Fund must:

- Add value to conservation of the watershed and not duplicate or diminish the overall impact of preexisting initiatives.
- Measure water quality improvements in the watershed against the goals of swimmable, fishable, and potable waters, which will require removing impairments from the watershed's streams.
- Must be able to demonstrate a favorable economic return on investment.

Water Purveyors and Stormwater Managers: Water purveyors and stormwater managers in the watershed must drive the next phase of analysis, design, and implementation. These key stakeholders are making or may be making the largest local investments to protect and restore water quality. Their involvement in the design and implementation phase is essential for success.

This watershed presents the opportunity to design a program with water purveyors and stormwater managers. The case study research shows that most existing programs involve water purveyors as the main stakeholders. However, given the overlap between the areas that provide the drinking water supply for purveyors and the jurisdictions subject to MS4 permits, there is an opportunity for collaboration between these two groups in this watershed, and this opportunity should be further explored. Meeting the goals of the Water Fund will require determining the broad areas of consensus among

these groups and focusing efforts there (Figure ES.7). This area of overlap includes, among other things, identifying pollutants of concern and developing strategies for watershed protection (BMPs, prioritization of landscape position and land use type, etc.).

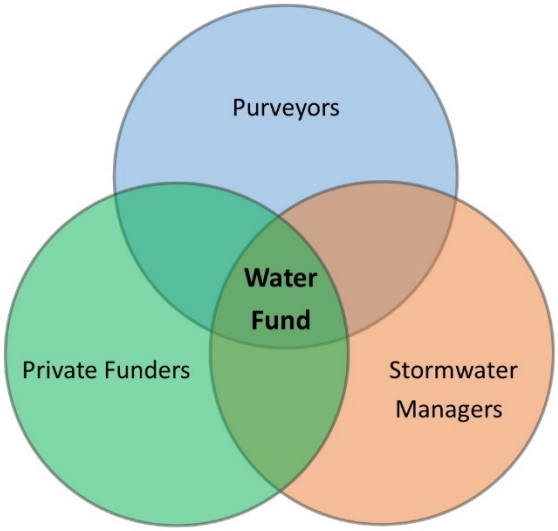

Figure ES.7. Areas of consensus for a multi-stakeholder water fund

Water Fund Structure: As demonstrated by the case studies, the financial structure for a water fund in the Brandywine-Christina watershed could be relatively simple—either one fund for the entire watershed or a fund for each of the four subwatersheds accompanied by an umbrella fund for the entire watershed. The revenue sources for contributions to the fund would be at the discretion of each contributor.

The governance structure would likely reflect the financial structure (i.e., one board for the entire watershed or a separate board for each of the four watersheds with an umbrella board). As the key stakeholders, water purveyors and stormwater managers would decide who sits on the board, how decisions are made about project selection, and whether there is a need for a technical advisory board to assist with project review. These decisions would be part of the design and implementation phases.

Given the level of existing expertise in the watershed with the design and implementation of conservation strategies, it seems unlikely that the administrative structure would include project design and implementation. Case studies demonstrated that programs such as the Quito Water Fund, which has an administrative structure that includes project design and implementation, are found in watersheds where there is no existing expertise.

Jurisdiction: As demonstrated by the case studies, these programs can cross jurisdictional lines. State lines should not prohibit the adoption of a watershed-wide

fund. If a state line restricts some funding, both restricted and unrestricted funds can be managed within the same financial structure. The case studies include examples of programs that include multiple jurisdictions, including the Upper Neuse Clean Water Initiative and the Intergovernmental Cooperation Agreement for Implementation of the York County Regional Chesapeake Bay Pollutant Plan.

Economic Analysis: The economic analysis provides an example of how selecting an interim water quality goal (meeting TMDLs) can help shape implementation of conservation strategies by helping to target the location of implementation (subwatersheds providing the largest pollutant loads) and how maximizing the least-cost approaches can reduce the costs of achieving significant water quality improvements. This conclusion is supported by the experience of New York City's source water protection program and its success working with farmers to implement whole-farm plans as a cost-effective way to reduce pollutant loads.

Estimated annual costs to reduce pollutant loads in the Brandywine-Christina range from $5.5 million for nitrogen to $4.4 million for sediment over a ten-year period between 2015 and 2025 (Table ES.4). Load reduction costs are complementary since agriculture conservation BMPs that reduce nitrogen also reduce sediment and phosphorus and bacteria.

Risk Avoidance and Other Benefits: Clean drinking water provides human-health benefits through reduced mortality, cancer risk, illness, and neurological/reproductive risks. Improving water quality could provide estimated annual benefits that range from a low-bound estimate of $5.9 million to a high-bound estimate of $20.2 million in the water supply ($2.5 million), forest ($0.3 million), agriculture ($0.7–$7.4 million), navigation ($0.8–$0.9 million), and nonuse swimming recreation ($1.6–$9.1 million) sectors in the Brandywine-Christina watershed.

Table ES.4. Estimated benefits and costs of improved water quality in the Brandywine-Christina watershed

Parameter	Low Bound ($ mil/yr)	High Bound ($ mil/yr)
Benefits (B)	5.9	20.2
Costs (C)	4.4	5.5

Agricultural Incentives: Because of the amount of agricultural land in the watershed, maximizing the benefits to be achieved through implementation of agricultural BMPs should be part of the strategic plan to improve water quality in the watershed. Given the recent announcement of new regional and state funding through the Natural Resource Conservation Service's Regional Conservation Partnership Program (RCPP), there is an important opportunity to maximize the impacts of these federal investments in the Brandywine-Christina watershed to achieve the greatest improvements in water quality possible.

Communication: As recommended by both the Regional Advisory Panel and stakeholders interviewed, there is a need for effective communication throughout the watershed as well as communications targeting key constituencies.

E.S.9. Recommendations

The conclusions lead to the following recommendations for the next phase in the design and implementation of the Water Fund:

1. Continue to draw upon the expertise, connections, and wisdom of the Regional Advisory Panel as necessary to further develop the Water Fund. Expand the panel to include additional experts in the field and managers from existing programs.
2. Encourage regulators to consider alternative and additional approaches to achieving regulatory compliance.
3. Advance the dialogue with the water purveyors and stormwater managers who have expressed interest in remaining involved in this process, focusing in particular on (1) understanding the costs stakeholders currently are facing to address water quality and quantity issues, (2) quantifying the alternative costs associated with equivalent conservation strategies, and (3) modeling the effectiveness of such conservation strategies. Build on the information gained in the above dialogue to develop a refined benefit–cost analysis and assessment of conservation strategies that will result in a comprehensive and strategic business plan for the entire Brandywine-Christina watershed. Essential components of this analysis should include:
    - Work with partners and stakeholders to consolidate the recommendations from existing watershed management plans for the Brandywine-Christina watershed and confirm their continued validity.
    - Work with partners in the watershed to evaluate the opportunities, relative implementation costs, and water quality improvements associated with three conservation strategies: land acquisition, conservation easements, and implementation of agricultural BMPs. Costs should include technical assistance and maintenance over the expected life of the projects.
    - Work with the agricultural community and partners in the watershed to conduct a subwatershed-scale analysis of existing agricultural BMPs and opportunities for implementation of additional agricultural BMPs.
    - Conduct an analysis of the most effective conservation strategies to reduce the volume of urban stormwater and identify where those strategies should be implemented.
    - Implement real-time monitoring of turbidity, nutrients, and volume at locations strategically selected to determine the sources of pollutants on a subwatershed basis.

- Develop a decision-making process for prioritizing implementation of the strategic business plan and leveraging local investments with state, federal, and private foundation investments based on experience within the watershed.

4. Recognize that water purveyors and stormwater managers will have different motivations for participating and structure the Water Fund to ensure that the needs of both stakeholder groups are met.
5. Work with the agricultural community to develop a firm understanding of its business realities, needs, and concerns and structure the Water Fund to addresses them.
6. Work with partners in the watershed who have experience implementing conservation strategies to ensure that the Water Fund adds value and momentum to these efforts as opposed to detracting from them.