FINAL WATERSHED PROJECT PLAN

FOR LEGACY SEDIMENT TREATMENT AND REDUCTION IN THE CHIQUES CREEK WATERSHED | LANCASTER COUNTY, PENNSYLVANIA

PREPARED BY:

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AUGUST 2026

NEPA Unique ID Number: PEAX-005-53-042-1214289995

Final Chiques Creek Watershed Project Plan for Legacy Sediment Removal in the Chiques Creek Watershed in Lancaster County, Pennsylvania

Pennsylvania's 11th Congressional District

Prepared By:
USDA – Natural Resources Conservation Service

In Cooperation With: Concur; percentage values included.
Lancaster County Conservation District and the Lancaster County Commissioners

AUTHORITY

This watershed project plan and program are carried out under the authority of Section 14 of the Watershed Protection and Flood Prevention Act (Public Law [PL] 83-566) of 1954 (68 Statute 666 as amended; 16 United States [U.S.] Code [U.S.C.] Section 1001 et seq.).

ABSTRACT

Chiques Creek contributes approximately 70 million pounds per year of nutrient-laden sediment (total annual load) into the Chesapeake Bay, over 60 percent of this pollution is from streambank erosion of legacy sediment (SRBC, 2019). The erosion and transport of nutrient-laden legacy sediment in Chiques Creek produces negative environmental and economic consequences both locally within Chiques Creek and regionally in the Chesapeake Bay. The purpose of the project is to reduce the nutrient-laden legacy sediment loads entering the Lower Susquehanna River and Chesapeake Bay from the Chiques Creek watershed while maintaining or improving the stream function and habitat value. The Preferred Alternative is a Legacy Sediment Treatment Program, offered by NRCS with PL 83-566 funding, to address water quality concerns from nutrient laden legacy sediment erosion and transport in the stream corridors of the Chiques Creek watershed. The specific measures installed would be driven by voluntary program participation and evaluated on a project-specific basis. Exact project sites and implementation measures have not been identified. The measures that would be considered for installation include legacy sediment removal and site restoration, reforestation and rewilding of riparian areas, stabilization of legacy sediment in place, and removal of mill dams and disposal of impounded sediments; a combination of these measures may be installed on a single project site.

The total estimated program installation cost is estimated to be **$24,846,000,** of which approximately **$18,975,000** would be paid from the Watershed and Flood Prevention Operations Program and **$5,871,000** from local, non-Federal funding sources.

COMMENTS AND INQUIRIES

Comments and inquiries must be received by **July 15, 2026**. Submit comments and inquiries to: Heather Smeltz, Assistant State Conservationist for Water Resources, USDA – Natural Resources Conservation Service, 359 East Park Drive, Suite 2, Harrisburg, PA 17111-2747, **Phone:** 717-237-2214 or **Toll Free:** 1-888-300-8379.

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ANCESTRAL LAND ACKNOWLEDGEMENT

NRCS, through the review of previous National Environmental Policy Act and National Historic Preservation Act consultations, identified five Federally Recognized Tribes that possess ancestral land claims in the State and continue to maintain ties to the project area: Absentee Shawnee Tribe of Indians of Oklahoma, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, and Shawnee Tribe. With the exception of the Shawnee Tribe, no others expressed interest in the crafting of alternative procedures (36CFR800.14(b)(1)). However, all Tribes shall be consulted on a project-by-project basis as the multiple areas of potential effect are refined. Consultation occurred throughout this plan's development and is provided in Appendix A of this plan.

OFFICE OF MANAGEMENT AND BUDGET (OMB) FACT SHEET

SUMMARY WATERSHED PROJECT PLAN FOR
CHIQUES CREEK WATERSHED
LANCASTER COUNTY, PENNSYLVANIA
11TH CONGRESSIONAL DISTRICT

Prepared by:
United States (U.S.) Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS).

Authorization:
Public Law (PL) 83-566 Stat. 666, as amended (16 United States Code [U.S.C.] § 1001 et seq.) of 1954.

Sponsors:
Lancaster County Conservation District (LCCD) and the Lancaster County Commissioners.

Proposed Action:
The Preferred Alternative is the authorization of funds to administer a watershed protection program offering technical and financial assistance to install land treatment projects that include specific measures to reduce legacy sediment erosion and transport to improve water quality in and below the Chiques Creek watershed, Lancaster County, Pennsylvania.

Purpose and Need for Action:
The purpose of the project is to address water quality concerns associated with the nutrient-laden legacy sediment loads entering the Lower Susquehanna River and Chesapeake Bay from the Chiques Creek watershed while maintaining or improving the stream function and habitat value. Chiques Creek contributes approximately 70 million pounds per year of nutrient-laden sediment (total annual load) into Chesapeake Bay. Over 60 percent, or 42 million pounds of sediment, is from streambank erosion of legacy sediment (SRBC, 2019). The erosion and transport of nutrient-laden legacy sediment in Chiques Creek produces negative environmental and economic consequences both locally within Chiques Creek and regionally in the Chesapeake Bay.

Description of the Preferred Alternative:
The Preferred Alternative would authorize program funds under PL 83-566 to provide federal technical and financial cost-share assistance for water quality improvements along at least 29,000 feet of riparian corridor within the Chiques Creek watershed. Voluntary

applicants would propose legacy sediment stabilization or removal improvements using conservation systems with demonstrated water quality benefits. As the program is voluntary and treatments will be based on applicants received, the following streambank length treated is estimated to be:

Treatment	Estimated Contracts	Streambank Treated
Dam Removal	1	1,650 ft
Floodplain Restoration	5	12,500 ft
Riparian Buffers	10	10,000 ft
Streambank Stabilization	5	5,000 ft
Total	**21**	**29,150 ft**

Resource Information:

Location

Watershed Centroid: 40.1605° N, 76.4523° W

Hydrologic Unit Codes (HUCs)

HUC8-02050306 – Lower Susquehanna River
HUC12-020503060801 – Upper Chiques Creek
HUC12-020503060802 – Little Chiques Creek
HUC12-020503060804 – Lower Chiques Creek

Watershed Size and Drainage Area

Upper Chiques Creek – 29.9 square miles
Little Chiques Creek – 44.5 square miles
Lower Chiques Creek – 34.9 square miles

Land Use

Land Cover	Little Chiques Creek		Upper Chiques Creek		Lower Chiques Creek	
	Area (acres)	% of Total	Area (acres)	% of Total	Area (acres)	% of Total
Water	7	0%	18	0%	27	0%
Developed	5,006	18%	3,671	19%	5,057	23%
Forest	3,777	13%	6,638	35%	1,970	9%
Agricultural	19,240	68%	8,164	43%	14,930	67%
Wetlands	114	0%	321	2%	50	0%
Other	321	1%	265	1%	260	1%
Total	**28,465**	**100%**	**19,077**	**100%**	**22,295**	**100%**

Climate and Topography

Lancaster County is characterized by warm, humid, and rainy summers and cold, snowy winters. The warm season generally lasts from late May to September, with average

highs of 84°F and lows of 66°F. The cold season generally lasts from December to March, with average highs of 38°F and lows of 24°F. The wet season generally lasts from April to September; the wettest month is September on average with 3.7 inches of rain. (Source: weatherspark.com)

Lancaster County is a hilly piedmont region; the rolling hills and valleys range in elevation from about 1,190 feet above sea level to 115 feet above sea level. (Source: lancastercountypa.gov)

Land Ownership

State: 4.1% of the watershed area (2,286 acres) (including one part State Game Lands)
Private: 95.6% of the watershed area (66,796 acres)
Federal: 0.0% of the watershed area

Economics and Demographics

POPULATION 2010-2020

Location	2010 (persons)	2020 (persons)	Average Annual Growth Rate (%)
Lancaster County	519,445	552,984	0.6
Pennsylvania (State)	12,702,379	13,002,700	0.2

Source: U.S. Census Bureau

CIVILIAN LABOR FORCE 2014-2024

Location	2014 (persons)	2024 (persons)	Average Annual Growth Rate (%)
Lancaster County	269,464	286,883	0.6
Pennsylvania (State)	6,421,710	6,548,147	0.2

Source: U.S. Bureau of Labor Statistics

UNEMPLOYMENT RATE 2014-2024

Location	2014 (%)	2019 (%)	2024 (%)
Lancaster County	4.9	3.4	2.5
Pennsylvania (State)	6.5	4.3	3.7

Source: U.S. Bureau of Labor Statistics

PER CAPITA PERSONAL INCOME 2019-2023 AVERAGE

Location	2019-2023 (2023 dollars)
Lancaster County	41,319
Pennsylvania (State)	43,104

Source: U.S. Census Bureau

Relevant Resource Concerns Identified Through Scoping
Soil Resources
Prime and Unique Farmland, and Farmland of Statewide or Local Importance
Water Resources
Water Quality
Floodplain Management
Waters of the U.S., Wetlands, and Special Aquatic Sites
Regional Water Resource Plans
Air Quality
Threatened and Endangered (T&E) Species
Migratory Birds
Bald and Golden Eagles
Essential Fish Habitat
Ecologically Critical Areas
Invasive Species
Fish and Wildlife
Riparian Areas
Forest Resources
Cultural Resources and Tribal Consultation
Local, Regional, and National Economy
Public Health and Safety
Parklands (including National Parks, Monuments, and Historical Sites)
Significant Scientific Resources
Land Use

Alternative Plans Considered:

No Action Alternative (Future Without Program)

NRCS would not offer a program to address water quality concerns from legacy sediment in the Chiques Creek watershed. Without additional funding from this program, implementing legacy sediment projects within the watershed would likely continue, but these projects generally do not have a broadly applied approach at the watershed-scale and are narrowly scoped, primarily due to funding limitations. The impacts of watershed scale removal and stabilization would not be measured. Therefore, the monetary benefits may not be realized as it relates to sediment and nutrient reduction, floodplain restoration, and flood prevention.

Sponsoring Local Organizations (SLOs) and other organizations will likely continue to pursue other programs to reduce the erosion and transport of legacy sediment in the watershed, and from the watershed to downstream water bodies such as the Chesapeake Bay. Legacy sediment streambank erosion and transport is likely to continue moving at least 42 million pounds of nutrient laden sediment to the Chesapeake Bay each year, exacerbating environmental impacts from reduced water quality.

Legacy Sediment Treatment Program (Future With Federal Investment) (Alternative 1)

Alternative 1 is the Preferred Alternative. Under Alternative 1, NRCS would offer a voluntary PL 83-566 Land Treatment Program to address water quality concerns from nutrient laden legacy sediment erosion and transport in the stream corridors of the Chiques Creek watershed. Landowners in the watershed would be eligible to enter a cost-share agreement and seek Federal assistance from the program to install conservation practices to address legacy sediment. Landowners would apply to the program with a proposed project and the program would implement based on the merit of the project. The program would employ methodology to screen and rank applicant projects, evaluate and compare the potential benefits, and design and construct the projects that reflect the highest net benefit based on project ranking criteria. As the program is based on voluntary participation, exact project sites have not been identified. The specific measures installed by Alternative 1 would be driven by program participation and evaluated on a site-specific basis, and could include the following land treatment measures: legacy sediment stabilization, riparian buffer installation, legacy sediment removal and site restoration, and mill dam removal.

Alternatives Considered and Dismissed

Targeted Treatment Sites
NRCS and the SLO would complete legacy sediment restoration projects on two of the highest eroding streambank sites within the watershed. This alternative would treat about 2.75 miles of streambank. However, these highest erosion rate sites in the watershed are privately owned. Project costs would be significantly higher for the SLO because of eminent domain processes, land acquisition, and O&M requirements if the landowners are unwilling to have a project on their property. Land acquisition would likely account for more of the SLO's project budget than constructing land treatment projects, and the costs for them would likely far outweigh the benefits.

Full Conservation Practice Alternative
This alternative would make the full suite of the NRCS' Pennsylvania conservation practices across all landscapes available to program applicants to achieve program objectives. Almost 140 conservation practices could be used as stand-alone or combined conservation systems, so long as they achieve the desired results of reducing sediment within the surface waters. Applicants would have the flexibility to propose more wide-ranging practices increasing the scope and extent of water quality improvement projects that could be approved for technical and financial assistance. However, this alternative did not always meet the project purpose of addressing legacy sediment erosion as this alternative would allow work on other non-riparian landscapes.

Singular Practice Alternative(s)
Similar to Alternative 1, individual alternatives were developed to include only one land treatment system based on one core conservation practice. Each project would be required to include that one core conservation practice. The individual systems examined included riparian buffer installation, streambank stabilization, and legacy sediment restoration. While each practice individually can perform well, success is dependent upon appropriate site conditions. To be able to maximize benefits across the watershed, depending upon individual voluntarily offered site characteristics, each practice type should be available for use within the program. These alternatives with one core conservation practice preclude stabilizing highly erosive sites that do not meet site criteria for that practice. Because of this, the singular practice alternatives were dismissed.

Land Use Restrictions
An alternative was considered to implement regulations to restrict the land use of the riparian and mandating a buffer width from the top of the streambank. Working with local municipalities within the watershed, ordinances would be implanted and enforced to require a minimum buffer width from the top of the creek. This alternative was dismissed as it does not address the active erosion occurring from the streambanks. This alternative was not considered in combination with any other alternatives due to Pennsylvania's Agriculture, Communities and Rural Environment (ACRE) Act 38 of 2005. ACRE prevents the development of local regulations that are more stringent than state law. To enact a local buffer requirement would require enacting a state-wide buffer requirement.

Project Costs

Project Costs for Legacy Sediment Treatment Program					
	NRCS		Sponsors		Total
	Percent	Cost	Percent	Cost	Cost
Land Treatment Measure	75%	$15,000,000	25%	$5,000,000	$20,000,000
Engineering/Technical Assistance	98%	$3,000,000	2%	$5,000	$3,005,000
Relocation	0%	$0	0%	$0	$0
Real Property Rights	0%	$0	0%	$0	$0
Project Administration	75%	$750,000	25%	$250,000	$1,000,000
Operation & Maintenance (non-federal)	0%	$0	100%	$400,000	$400,000
Other	0%	$0	100%	$241,000	$241,000
Total:	76%	$18,750,000	24%	$5,896,000	$24,646,000

Project Benefits:
Monetary Benefits
- Total benefits: $34,802,000
- Total Annual Monetized Benefits: $1,776,000

Direct Beneficiaries
The number of direct beneficiaries is currently unknown and would be determined by program participation and project site selection. Assuming an average project stream length of about 2,600 linear feet and a total stream improvement length of about 34,150 linear feet (limited by funding), about 13 properties could be direct beneficiaries; this number will vary based on project length and scope.

Beneficial Effects
The sediment reduction benefit associated with the land treatment projects under the preferred alternative is estimated to be at least 1,025 tons per year, in addition to a one-time removal benefit of 26,240 tons (29,111 cubic yards) of sediment. Other beneficial effects include the following: create and improve habitat; create and restore wetlands; reduce invasive species and reintroduce native species; reduce localized flooding; reduce land loss to erosion.

Ecosystem Services Benefited
Provisioning Services
Regulating Services
Supporting Services
Cultural Services

Benefit to Cost Ratio (current rate)
Annual Benefit-Cost Ratio: 1.40

Net Beneficial Effects
Annual Monetized Net Benefit: $508,700

Funding Schedule:

Year	PL 83-566 Funds	Other Funds	Total
2025-2026	$0	$0	$0
2026-2027	$500,000	$166,667	$666,667
2027-2028	$1,000,000	$333,333	$1,333,333
2028-2029	$2,000,000	$666,667	$2,666,667
2029-2030	$2,000,000	$666,667	$2,666,667
2030-2031	$3,000,000	$1,000,000	$4,000,000
2031-2032	$3,000,000	$1,000,000	$4,000,000
2032-2033	$2,000,000	$666,667	$2,666,667
2033-2034	$1,000,000	$333,333	$1,333,333
2034-2035	$500,000	$166,667	$666,667
TOTAL COSTS	**$ 15,000,000**	**$ 5,000,000**	**$ 20,000,000**

Period of Analysis:
30 years (20-year project life, 10-year implementation period)

Project Life:
20 years

Environmental Effects and Impacts:

Resource Concern	No-Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Soil Resources	The No-Action Alternative will have direct long-term adverse impacts to soil resources in the watershed due to continued erosion.	While there may be minor short-term adverse effects to soil resources due to construction, Alternative 1 would have a major positive direct effect on soil resources in the long-term by reducing streambank erosion.
Prime and Unique Farmland, and Farmland of Statewide or Local Importance	The No-Action Alternative will have direct long-term adverse impacts to Prime and Unique Farmland and Farmland of Statewide or Local Importance in the watershed.	Alternative 1 would have long-term, indirect beneficial effects on Prime Farmland and Farmland of Statewide importance by reducing erosion of farmland soils and reducing flood risks for farmland adjacent to streams. Long-term, direct adverse effects to Prime Farmland and Farmland of Statewide Importance will occur for projects that convert agricultural land to natural floodplains.
Water Resources	The No-Action Alternative will have direct long-term adverse impacts to Water Resources in the watershed.	While Alternative 1 may have short term minor adverse effects during construction, it would have a major direct, beneficial long-term effect on Water Resources.
Water Quality	The No-Action Alternative will have long-term direct adverse impacts on Water Quality in the watershed.	Alternative 1 may have short-term, adverse impacts to water quality during construction; however, this will be mitigated using best management practices for erosion and sedimentation control. Overall, Alternative 1 would have long-term direct, beneficial effects on water quality within and downstream of the watershed.
Floodplain Management	The No Action Alternative will have long-term, direct adverse to floodplain management.	Alternative 1 would have a long-term, direct beneficial effects on floodplain management.

Resource Concern	No-Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Waters of the U.S., Wetlands, & Special Aquatic Sites	The No Action Alternative will have long-term, direct adverse effects on Waters of the U.S. and wetlands.	Alternative 1 would have major long-term, direct beneficial effects by reducing erosion and sedimentation , reconnecting streams and wetlands to historic floodplains, and improving aquatic organism passage. Wetlands may experience short-term, adverse impacts through the removal of legacy sediment terraces, but the long-term improvements are expected to outweigh these adverse effects.
Regional Water Resource Plans	The No Action Alternative will have long-term adverse impacts on Regional Water Resource Plans.	Alternative 1 would have a major direct, beneficial effect on regional water resource plans by reducing sediment and nutrient loads from the watershed, improving the quality of streams, and reducing flood risks to meet the goals presented in the Chesapeake Bay TMDL, the PADEP WRAS, the Susquehanna River Basin Commission SRBC Watershed Alternative Restoration Plan, USACE Comprehensive Water Resources and Restoration Plan, and the Little Chiques Creek Watershed Rivers Conservation Plan.
Air Quality	The No Action Alternative will have no impact on air quality.	Alternative 1 would have short-term adverse effects on air quality during construction, and long-term benefits associated with increased carbon sequestration.
Endangered and Threatened Species	The No Action Alternative will have long-term, adverse impacts to endangered and threatened species.	Alternative 1 would have long-term, beneficial effects on aquatic and terrestrial habitats for endangered and threatened species. Any short-term adverse effects will be minimized through agency coordination and the use of best management practices.
Migratory Birds	The No Action Alternative is not expected to have impacts on migratory birds.	Alternative 1 would have long-term, indirect beneficial effects on migratory birds, as the proposed conservation practices will improve habitat for migratory birds.

Resource Concern	No-Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Bald and Golden Eagles	The No Action Alternative will have long-term, indirect adverse effects to Bald and Golden Eagles.	Alternative 1 would have long-term, indirect effects on bald eagles, as the proposed conservation practices will provide improved habitat and foraging opportunities for bald eagles.
Essential Fish Habitat	The No Action Alternative will have long-term, direct adverse effects on essential fish habitats.	Alternative 1 would have a minor, indirect beneficial effect on the Essential Fish Habitat, as the proposed reduction of sediment transport and prevention of legacy sediment terrace formation may benefit aquatic life downstream of the watershed.
Ecologically Critical Areas	The No Action Alternative will have long-term, indirect adverse impacts on Natural Heritage Core Habitat.	Alternative 1 would have long-term, indirect beneficial effects due to the proposed restoration of riparian areas and wildlife habitats. Short-term, direct adverse effects may be experienced during construction.
Invasive Species	The No Action Alternative will have long-term, indirect adverse effects on invasive species.	Alternative 1 would have long-term, direct beneficial effects as the removal of invasive species along the riparian corridor and will limit the threat of their spreading to other areas of the watershed.
Fish and Wildlife	The No Action Alternative will have long-term, indirect adverse effects on fish and wildlife.	Alternative 1 would have long-term, direct beneficial effects by increasing habitats for aquatic life throughout the watershed, removing invasive species, and introducing native species throughout the riparian corridor. Short-term, adverse effects may be experienced during construction; however, best management practices will be used to mitigate any adverse impacts.
Riparian Areas	The No Action Alternative will have long-term, direct adverse effects to riparian areas.	Alternative 1 would have long-term, direct beneficial effects due to the proposed increase in vegetative cover throughout the riparian corridor and decreased erosion.

Resource Concern	No-Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Forest Resources	The No Action Alternative will have long-term, indirect adverse effects on forest resources.	Alternative 1 would have long-term, direct beneficial effects due to the proposed reduction of bank erosion and loss of land, as well as an increase in vegetative cover throughout the riparian corridor.
Cultural Resources and Tribal Consultation	No adverse effects to properties eligible for the NRHP are expected.	Alternative 1 has the potential to have long-term, direct, adverse effects on cultural and tribal resources. However, consultation, in accordance with the Programmatic Agreement with the Pennsylvania State Historic Preservation Office and federally recognized tribes with ancestral land claims will minimize or avoid any adverse effects.
Local, Regional, and National Economy	The No Action Alternative will have long-term, indirect adverse effects on the local economy.	Alternative 1 would have long-term and short-term, indirect beneficial effects on the local and regional economy due to the potential enhancement of property values and tourism opportunities from stream bank protection measures, mitigation of flood risks, and increases in jobs and economic outputs during construction.
Public Health and Safety	The No Action Alternative will have long-term, direct adverse effects on public health and safety.	Alternative 1 would have long-term, indirect beneficial effects on public health and safety, as the Legacy Sediment Treatment Program will mitigate flood risks in surrounding communities and decrease erosion to enhance the water quality of the stream.
Parklands (including National Parks, Monuments, and Historic Sites)	The No Action Alternative will have long-term, direct adverse effects on parklands adjacent to streams.	Alternative 1 would have long-term, indirect beneficial effects on parklands throughout the watershed, as the proposed restoration of stream channel capacity and installation of riparian forest buffer will mitigate flood risks to surrounding areas.
Significant Scientific Resources	There will be no impacts to significant scientific resources.	Alternative 1 would have no effect on significant scientific resources.

Resource Concern	No-Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Land Use	The No Action Alternative will have no impacts to land use.	Alternative 1 would have long-term, direct beneficial effects on land use due to the conversion of existing land use within riparian areas to natural ecosystems that increase the health of streams.
Provisioning Ecosystem Services		
Food	The No Action Alternative will have long-term, indirect adverse effects to food production due to water quality impairments impacting fin fish and shellfish.	Alternative 1 would have long-term, indirect beneficial effects on food sources by enhancing diversity of aquatic life throughout the watershed and protecting cropland adjacent to streams from erosion and flooding.
Water	The No Action Alternative will have long-term, indirect adverse effects on the production of potable water.	Alternative 1 would have long-term, indirect beneficial effects on water due to the proposed enhancement of water quality throughout the stream and increased natural filtration by the addition of vegetative cover in riparian areas, leading to potential improved efficiency and effectiveness of water treatment plants downstream.
Navigation	The No Action Alternative will have minor, long-term, indirect adverse impacts to navigation.	Alternative 1 would have minor, long-term, direct effects on navigation throughout Chiques Creek due to the proposed removal of mill dams and legacy sediment terraces.
Regulating Ecosystem Services		
Flood and Disease Control	The No Action Alternative will have long-term, indirect adverse effects on flood and disease control.	Alternative 1 would have a long-term, indirect beneficial effect on flood and disease control, as the Legacy Sediment Treatment Program will mitigate localized flood risks and improve water quality.
Water Filtration	The No Action Alternative will have long-term, direct adverse effects on water filtration.	Alternative 1 would have long-term, direct beneficial effects on water filtration due to the proposed increase in vegetation and removal of legacy sediment terraces throughout the riparian corridor, which will promote natural filtration of runoff and reconnect streams to groundwater.
Supporting Ecosystem Services		

Resource Concern	No-Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Nutrient Cycling	The No Action Alternative will have long-term, indirect adverse effects on nutrient cycling due to streambank erosion reducing nutrient cycling in riparian areas and contributing to excess nutrients downstream.	Alternative 1 would have a long-term, indirect beneficial indirect effect on nutrient cycling by reducing sediment transport and promoting ecosystem diversity throughout the watershed that would enhance nutrient cycling. The proposed erosion reduction and water quality will assist with nutrient retention in soils, allowing vegetation to uptake and cycle nutrients more effectively. Reductions in the transport of nutrients to receiving waters will limit the potential for eutrophication and harmful algal blooms.
Soil Formation	The No Action Alternative will have long-term, indirect adverse impacts to soil formation.	Alternative 1 would have long-term, direct beneficial effects on soil formation.
Primary Production	The No Action Alternative will have minor, long-term, indirect adverse impacts on primary production.	Alternative 1 would have long-term, indirect beneficial effects on primary production due to the Legacy Sediment Treatment Program's proposed enhancement of water quality and ecosystem biodiversity, reduced erosion and sedimentation, and removal of mill dams.
Cultural Ecosystem Services		
Recreational Use	The No Action Alternative will have long-term, indirect adverse effects on recreation.	Alternative 1 would have long-term, indirect beneficial effects on recreational use throughout the watershed, as the proposed land treatment practices will enhance wildlife habitat and increase desirability for fishing, boating, trapping, and bird watching.
Aesthetic Viewsheds	The No Action Alternative will have long-term, direct adverse effects on aesthetic viewsheds.	Alternative 1 would have long-term, direct beneficial effects on aesthetic viewsheds due to the proposed increase in vegetative cover within the riparian corridor and increased water clarity throughout the stream.

Areas of Controversy:

None.

Issues to be Resolved:
None.

Evidence of Unusual Congressional or Local Interest:
None.

Compliance:
Is this report in compliance with executive orders, public laws, and other statues governing the formulation of water resource projects? **Yes**

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SECTION 1 – WATERSHED PLANNING BACKGROUND

This Watershed Project Plan (Plan) documents the planning processes and outcomes for the Chiques Creek Watershed Project (Project), conducted by the U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS), Lancaster County Board of Commissioners, and Lancaster County Conservation District (LCCD) in support of legacy sediment treatment (by stabilization or removal) in the Chiques Creek watershed.

1.1 Authority

This watershed plan and program are carried out under the authority of Section 14 of the Watershed Protection and Flood Prevention Act (Public Law [PL] 83-566) of 1954 (68 Statute 666 as amended; 16 United States [U.S.] Code [U.S.C.] Section 1001 et seq.). This Plan is prepared to meet NRCS's obligation for this Project to comply with the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. § 4321 et seq.). The authorized Project purpose is Watershed Protection as outlined in National Watershed Program Manual (NWPM) § 500.3(B).

1.2 Sponsor

The non-Federal sponsors for this study and Project are the Lancaster County Board of Commissioners and LCCD, referred to as Sponsoring Local Organizations (SLOs). The SLOs will maintain an active role in this Project and have agreed to bear the responsibilities outlined in Section 6.8.2.2 and 390 NWPM § 500.11 as applicable.

1.3 Cooperating Agencies

While partner agencies were invited to participate in the planning process, no agencies were formally invited to become Cooperating Agencies.

1.4 Planning Area

The planning area is the 101.6-square-mile (sq. mi.) portion of the Chiques Creek watershed within Lancaster County, Pennsylvania, excluding the Donegal Creek subwatershed and the 7.7-square-mile portion of the Chiques Creek watershed in Lebanon County. The planning area is shown on Figure 1.1. The work in this Plan is within Lancaster County because there is a lack of sponsorship for the Project in Lebanon County; approximately 93 percent of the Chiques Creek watershed is within Lancaster County. The Donegal Creek watershed was excluded from this plan because its confluence with the main stem of Chiques Creek is downstream of the U.S. Geological

Survey (USGS) Super Stream Gage in Marrietta, PA, and the USGS data will be used to monitor the water quality benefits of this Project.

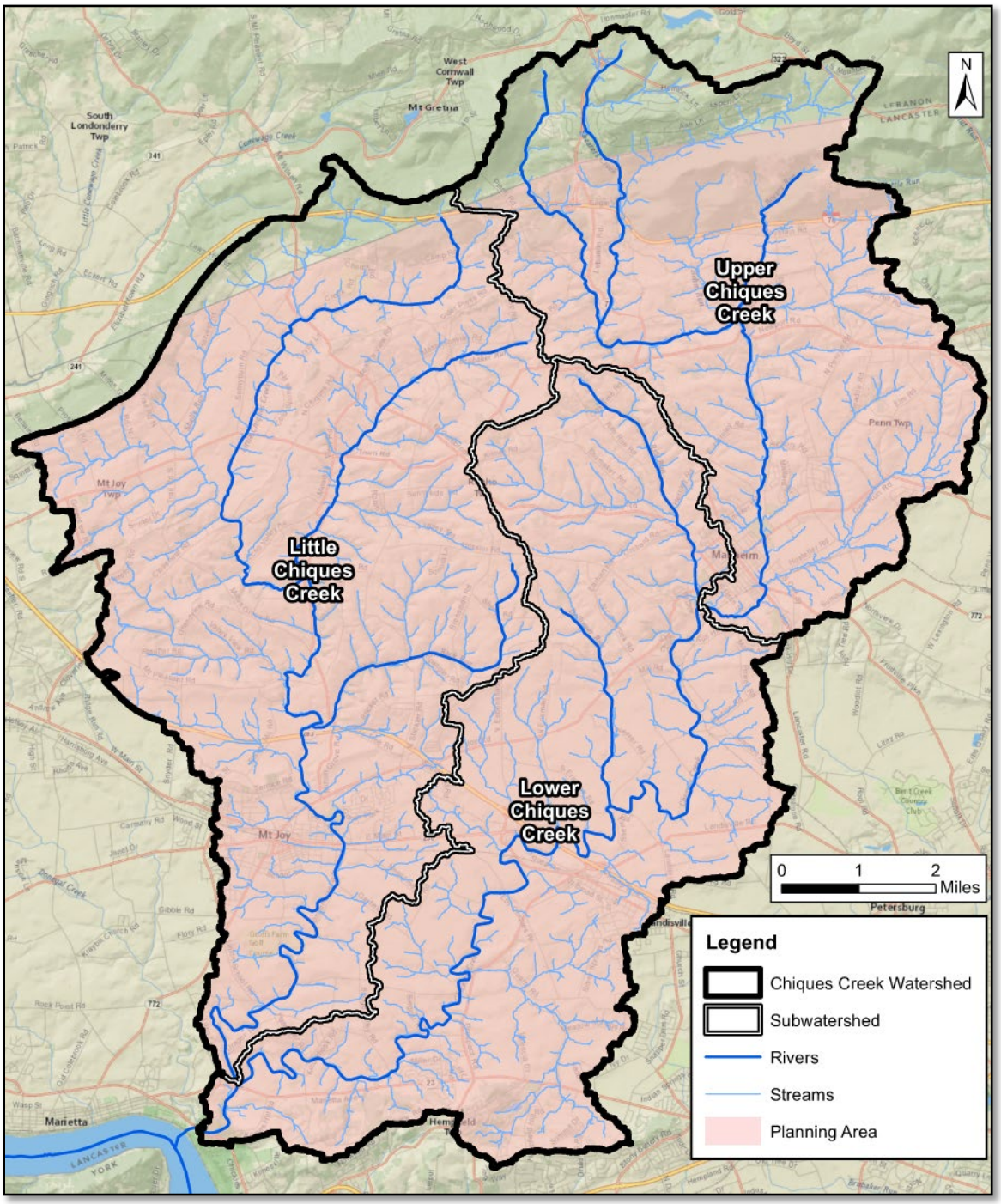

Figure 1.1 Chiques Creek Watershed Planning Area

The Chiques Creek watershed is in the Lower Susquehanna River Basin, which drains to Chesapeake Bay.

1.4.1 Selected Watershed

The Chiques Creek watershed has a 10-digit hydrologic unit code (HUC), 0205030608, and contains four 12-digit hydrologic units: Upper Chiques Creek (HUC 020503060801), Little Chiques Creek (HUC 020503060802), Donegal Creek (HUC 020503060803), and Lower Chiques Creek (HUC 020503060804). The Donegal Creek hydrologic unit was excluded from the study because its confluence with Chiques Creek is downstream of the USGS Stream Gage that will provide key water quality data to support the Project. Excluding the Donegal Creek hydrologic unit, the total watershed area is about 109.3 sq. mi. Excluding both the Donegal Creek watershed and the portions of the Chiques Creek watershed outside of Lancaster County, the total watershed area is 101.6 sq. mi. The Chiques Creek watershed drains into the Lower Susquehanna River near the borough of Marietta, PA. The Susquehanna River is the largest freshwater input to the Chesapeake Bay. HUC-12 watershed areas are provided in Table 1.1.

TABLE 1.1
CHIQUES CREEK WATERSHED AREAS

Watershed Name	HUC	Area (sq. mi.)	Area in Lancaster County (sq. mi.)
Upper Chiques Creek	020503060801	29.9	24.4
Little Chiques Creek	020503060802	44.5	42.3
Lower Chiques Creek	020503060804	34.9	34.9
	Total Area	**109.3**	**101.6**

1.4.2 Study Area

The program study area is the stream corridors of the Upper Chiques Creek, Lower Chiques Creek, and Little Chiques Creek watersheds. The total study area was estimated as the total area of the legacy sediment terraces within the planning area. The study area is shown in Figure 1.2 and encompasses about 1,800 acres.

Specific Project areas have not been identified and will be based upon accepted application to the program. The potential area of a project includes a section of stream corridor in the study area and adjacent lands as required for site access and construction staging. A 10-percent buffer was included in the total study area to account for areas adjacent to the floodplain that may impacted by a project.

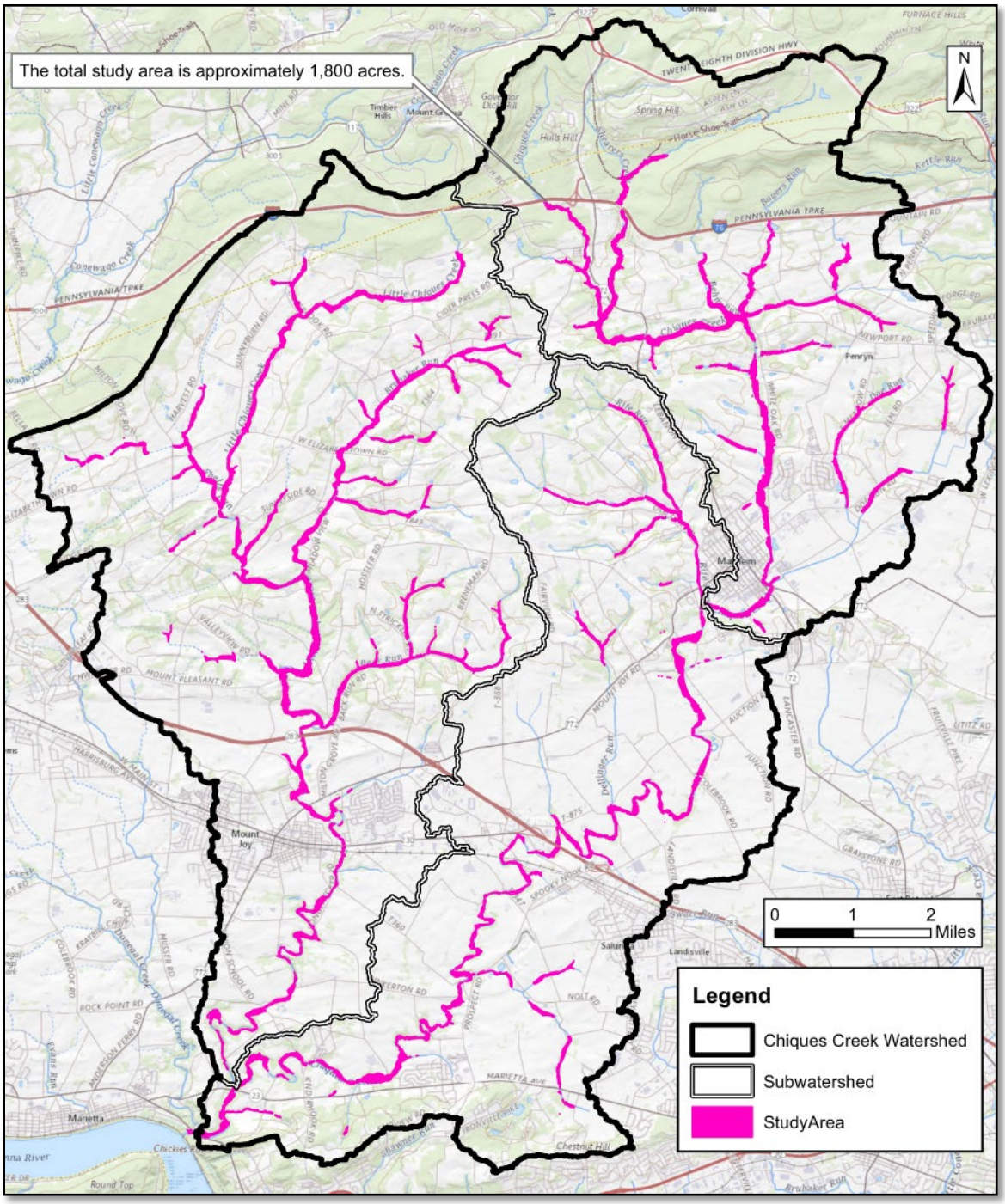

Figure 1.2 Chiques Creek Watershed Study Area

1.4.3 Areas of Potential Effect for National Historic Preservation Act (NHPA) Section 106 Compliance

The programmatic area of potential effect is predicated on the voluntary participation, and NRCS and LCCD approval, of private landowner applications and projects within the

riparian corridors of the watershed. To better understand the potential concentration and nature of cultural resources within the watershed, a Phase 1A Cultural Resources Report was prepared for the preliminary study area that area covered approximately 1 percent of the watershed. The purpose of the Phase IA desktop review was to determine the extent to which a potential Project may affect cultural resources and to estimate the potential density of unknown historic properties. The Phase 1A Report is provided in Appendix E.

1.5 Planning Process and Study Scope

In 2021, NRCS authorized the preparation of this plan on behalf of LCCD and Lancaster County Board of Commissioners. This document presents the results of the watershed planning and NEPA evaluation process, which includes the formulation and selection of alternatives, environmental assessment, and cost evaluation. This plan is the product of three inter-related planning and evaluation processes, each with its own specific goals and requirements: 1) NRCS planning process; 2) Principles, Requirements, and Guidelines (PR&G) for Federal Investments in Water Resources; and 3) evaluation of alternatives and impacts under NEPA. The process also incorporates the Clean Water Act (CWA), Endangered Species Act, and NHPA requirements, among others.

The NRCS planning process consists of nine steps to develop and implement plans that protect, conserve, and enhance natural resources. The PR&G watershed planning process is an eight-step process largely analogous to that of NRCS. These processes ensure that formulation, evaluation, and implementation of agency activities incorporates the Federal Objective, guiding principles, and general requirements within the context of an ecosystem services framework (see Section 1.5.2).

NEPA evaluation ensures that potential Federal actions consider reasonable alternatives, fairly evaluate the impact of those alternatives upon the human environment, and follow applicable local, State, and Federal regulations.

Watershed planning, NEPA, and CWA permitting all require that the NRCS follow Section 106 of the NHPA (as amended) 54USC306108 and its implementing regulations within 36 Code of Federal Regulations (CFR) Part 800. The Section 106 process requires early consultation with the Pennsylvania State Historic Preservation Office (PASHPO) and Federally recognized Tribes in the development of areas of potential effect, identification of historic properties, assessment of effects, and potential mitigation of adverse effects. This process is separate from NEPA but informs the impacts analysis.

1.5.1 Stepwise Planning Process

NRCS and the SLOs, in coordination with the public, Tribes, and other agencies, followed a step-wise, iterative planning approach that identified and refined problems, opportunities, study scope, management measures, and alternatives; evaluated the alternatives; and selected a recommended plan.

1.5.2 Ecosystem Services Framework

NRCS and the SLOs worked within the ecosystem services framework throughout the planning process that is referenced in Department Manual (DM) 9500-013. The ecosystem services framework is an analysis approach that traces the pathways of natural ecosystem processes to the quantifiable and non-quantifiable benefits that are provided to society. Ecosystem services include:

- Provisioning services: tangible goods for human use such as food, clean air, fresh water, energy, fuel, forage, fiber, and minerals;
- Regulating services: maintain natural processes which provide buffers against environmental catastrophe such as long-term storage of carbon, climate regulation, water filtration, purification, storage, soil stabilization, flood control, and disease regulation;
- Supporting services: underlying processes maintaining conditions for life such as pollination, seed dispersal, soil formation, and nutrient cycling; and
- Cultural services: services related to the cultural or spiritual needs of people such as educational, aesthetic, spiritual and cultural heritage values, recreational experiences, and tourism opportunities.

1.5.3 Period of Analysis

The period of analysis is 30 years which includes the 10-year implementation period and 20-year project life. The life for this Project was selected based on the guidance provided in the NRCS National Resource Economic Handbook, 611.0300(b)(3).

1.5.4 Project Scope

The scope of the project refers to the specific watershed program requirements which limit the application of funding based on characteristics of the study area and projects, and the specific issues considered throughout the NEPA analyses of the project per. This environmental document was initiated using the 40 CFR 1500-1508 (April 2022) and 7 CFR 650 regulations, which were recently rescinded and replaced with USDA

regulations under 7 CFR 1b. In the NRCS's expert opinion, it has thoroughly considered the factors mandated by the statute and regulatory frameworks.

PL 83-566 projects are bounded in scope by the size of the watershed area, characteristics of the benefitted area, and size of potential measures considered. The Chiques Creek watershed (excluding Donegal Creek) is about 70,000 acres, which is less than the maximum area of 250,000 acres. About 80 percent of the watershed land use is rural, which exceeds the minimum 20 percent of benefits provided directly related to agriculture, which includes rural communities with populations less than 50,000 people.

1.5.5 External Scoping

An external scoping process was performed to prioritize critical resources and environmental concerns, identify key considerations for Project alternatives, and obtain feedback on the decision documents. Resource concerns were identified in accordance with NWPM § 501.24(B) (NRCS, 2024) and based on concerns identified by the public, SLOs, or agencies during the scoping meeting and other planning meetings. A Public Participation Plan (PPP) was developed to guide outreach, solicit feedback, and create a record of public and agency interaction with this Plan. Comments and feedback from the public and agencies were used to inform the decision-making process.

Scoping Meetings

Two scoping meetings were held on July 28, 2022, one for agencies and one for the public. These meetings were held in-person at the Rapho Township Building in Manheim, PA and were broadcasted live using online meeting software. The meetings were advertised at least 14 days before the meeting on the NRCS project website, LCCD Project website, and by press release to the local newspaper of record. Federal, State, and local agencies, non-governmental organizations with identified interest in the Project, and Tribes were invited to attend via a direct mailing.

The agency meeting was attended by several State and local agencies and organizations and one Federal agency: the U.S. Environmental Protection Agency (EPA). The meeting was attended by a total of 31 individuals. The public meeting was attended by 14 individuals.

The presentation covered planning history, the purpose and need of the Project, overview of the data collection phase, introduction to some alternatives that may be evaluated, and natural resource inventory and prioritization. Meeting participants were invited to provide general written or verbal comments either during the meeting or during the comment period following the meeting. PowerPoint presentations shown in the meeting,

meeting notes, and a recording of the meeting were posted on the NRCS website for public viewing following the meeting.

A resource prioritization and scoping form was distributed to both virtual and in-person attendees to collect feedback on the potential resource concerns in the watershed. The results from the forms were aggregated, and priority resource concerns of the public and agencies were identified. The resource scoping results and their impact on environmental decision-making is outlined in Section 3.

1.6 Related Projects and Studies

No connected actions were identified during the preparation of this Plan.

The following ongoing, recently completed, or planned projects could potentially contribute interactive or cumulative impacts with this Plan:

- A USGS Super Stream Gage (Station Number 01575900) was installed in 2020 on Chiques Creek near the town of Marietta, PA. This gage provides real-time flow and water quality data that will be used to evaluate the impact of this watershed plan (Schmer, et al., 2024).

The following studies provided information and data foundational to the conception and development of this Plan:

- Chiques Creek Watershed Alternative Restoration Plan, Susquehanna River Basin Commission (SRBC), 2019.
- Chiques Creek Flood Resiliency Study, SRBC and U.S. Army Corps of Engineers (USACE), 2018.
- Little Chiques Creek Watershed Rivers Conservation Plan, ARRO Consulting, Inc., LandStudies, Inc., and Pennsylvania Department of Conservation and Natural Resources (PA DCNR), 2005.
- Chesapeake Bay Comprehensive Water Resources and Restoration Plan, National Fish and Wildlife Foundation and USACE, 2021.
- Watershed Restoration Action Strategy (WRAS), Pennsylvania Department of Environmental Protection (PADEP), 2003.
- Total Maximum Daily Loads (TMDLs) for Donegal Creek Watershed, PADEP, 2000.

USACE and the Federal Emergency Management Agency (FEMA) have no recent, concurrent, or planned studies or actions related to water resources and flood hazards in the watershed.

SECTION 2 – PURPOSE AND NEED

2.1 Purpose

The purpose of the Project is to reduce the nutrient-laden legacy sediment loads entering the Lower Susquehanna River and Chesapeake Bay from the Chiques Creek watershed while maintaining or improving the stream function and habitat value. The authorized Project purpose is Watershed Protection as outlined in NWPM § 500.3(B).

2.2 Need

Chiques Creek contributes approximately 70 million pounds per year (lbs./yr) of nutrient-laden sediment (total annual load) into Chesapeake Bay. Over 60 percent of this pollution is from streambank erosion of legacy sediment (SRBC, 2019). The erosion and transport of nutrient-laden legacy sediment in Chiques Creek produces negative environmental and economic consequences both locally within Chiques Creek and regionally in the Chesapeake Bay.

2.2.1 Funding

Traditionally, private landowners with riparian corridors containing legacy sediment that are not associated with agriculture are not eligible for funding assistance, including NRCS sources such as the Environmental Quality Incentives Program (EQIP), for a variety of reasons. Private landowners do not generally meet the criteria for Producer Eligibility, as described in 530.402 B. of the NRCS Title 440 Part 530 - Working Lands Conservation Programs Manual. Non-agricultural land, excluding non-industrial private forest land, owned by private landowners is not eligible for enrollment in EQIP (530.402 C.).

If an agricultural producer does have riparian land with legacy sediment, they may be ineligible for EQIP due to their Adjusted Gross Income, as per 7 CFR Part 1400 Subpart F. The Watersheds and Flood Prevention Operations Program offers broader eligibility criteria. This enables more individuals and entities to participate than typical Farm Bill programs. The results of this is that greater watershed levels impacts may be realized.

For those agricultural landowners that are eligible for EQIP, regulations, under 7 CFR Part 1400 Subpart A limits the payment per person or legal entity to $450,000. This is the total amount that can be received under all of the EQIP within the current Farm Bill period. Depending on the cost of the proposed legacy sediment project, this incentive payment may not be sufficient to be economically viable for the operator. Depending on the scope of these projects, the construction cost can be in the range of millions of dollars.

Without financial assistance and/or strong community support to provide the cost-matching funds, the cost of these projects can be prohibitive. The projects constructed through this Plan would be designed and implemented to meet the authorized project purpose of Land Treatment for Water Quality. These projects would allow financial assistance to address an environmental need without EQIP payment limitations.

2.3 Problems and Opportunities

2.3.1 Problems

This Plan addresses the following problems:

- **Problem 1:** More than 95 percent of the Chiques Creek overall waterway length fails to meet designated aquatic life status, primarily because of suspended sediments and nutrients such as nitrogen and phosphorous. The total annual sediment load needs to be reduced by up to 40 percent from the existing baseline to meet the targeted sediment loads for Chiques Creek (SRBC, 2019).
- **Problem 2:** The Chesapeake Bay ecosystem is degrading because of excessive sediment loads from tributary watersheds. High concentrations of suspended sediment prevent sunlight from penetrating the water column. Reduced sunlight penetration limits growth of submerged aquatic vegetation and smothers bottom-dwelling species, resulting in habitat loss and reduced population of fish, crabs, and mollusks. Economic losses in the Chesapeake Bay over the last 30 years from reduced commercial harvests and loss of recreational fishing opportunities are estimated at several billion dollars (SRBC, 2019).

The key stressors in the Chiques Creek watershed relevant to this plan include:

- The peak runoff response of the watershed and the energy of the stream flows have increased because of increasing rainfall intensity, urban development, and changing land use over the last century. The changing hydrology has increased sediment erosion.
- An estimated 53 mill dams were historically installed on waterways throughout the watershed to support agricultural and industrial development in the region. The mill dams impounded sediment, which resulted in perched alluvial terraces and disconnected stream channels from the historic floodplain. Today, 46 of the 53 mill dams have been breached, but the effects of existing and breached mill dams continue to impact the watershed (Rahnis, 2013). Photos of the Chiques Roller Mill Dam, which has a planned removal date in 2026, are provided in Figures 2.1 and 2.2.

Figure 2.1 Chiques Roller Mill Dam Photo 1

Figure 2.2 Chiques Roller Mill Dam Photo 2

Key drivers for the problems in the Chiques Creek watershed include the following:

- Historically, the watershed was largely forested and minimally developed. The predominant land use in the watershed is now agriculture, urban development has increased, and forest cover has drastically decreased.
- Long-range weather patterns indicate increasing rainfall intensity in recent years compared to the historic storm data.

2.3.2 Opportunities

The following opportunities may be realized while addressing legacy sediment in the Chiques Creek watershed:

- Partner with ongoing legacy sediment projects to increase the efficiency of implementation, allocation of financial resources, and net benefit per dollar spent in the watershed. Existing projects and programs within the watershed are relatively small-scale and fiscally constrained.
- Enhance the water quality within Chiques Creek and downstream water bodies by reducing the sediment load from eroding streambanks.
- Enhance the water quality within Chiques Creek and downstream water bodies by reducing the water temperature by uncovering springs buried by legacy sediment.
- Maintain or improve the incidental recreational and habitat values of the riparian zone within Chiques Creek.
- Improve in-stream, wetland, woodland, and riparian habitat for threatened and endangered (T&E) species and other species of concern.
- Improve stormwater retention within the watershed by restoring native floodplains.
- Enhance the public health and safety of residents and businesses of Lancaster County by improving flood resiliency in Chiques Creek and reducing localized flooding.
- Restore historic wetlands that are covered by legacy sediment.
- Depending on the size and location of land treatment projects, provide new recreational facilities such as trails.

2.4 Objectives and Constraints

2.4.1 Project Objective

The Project objective was developed in coordination with NRCS, SLOs, stakeholder agencies, and the public to reduce the sediment load for the Chiques Creek watershed, by

preventing eroded streambank sediment from entering the water column, to help meet the targeted sediment loads for the watershed. Effects of decreased legacy sediment within the streams are expected shortly after an individual land treatment project is completed, but timing may vary by treatment project (i.e. a project may require maturation of vegetation for maximum effect).

Other objectives of the action alternative include the following:

- Create and improve habitat;
- Create and restore wetlands;
- Reduce invasive species and reintroduce native species;
- Reduce localized flooding; and
- Reduce land loss to streambank erosion.

The sediment reduction effect of the Project is expected to reduce water quality concerns associated with the erosion and transport of nutrient-laden legacy sediment in both the Chiques Creek watershed and downstream water bodies, including the Lower Susquehanna River and Chesapeake Bay.

2.4.2 Constraints and Considerations

The primary constraints for this plan are as follows:

- Implementation of land treatment projects will require private and non-Federal public landowners in the planning area to apply for a project. The number of applicants is unknown.
- The Project preferred land treatment designs may conflict with the preferences of the landowner. The Project designs will require landowner approval, so a compromise or alternative design may be required to accommodate landowner preferences.
- Landowners will be responsible for long-term Operations and Maintenance (O&M) for the Project life. Neglect of O&M responsibilities would compromise the performance and durability of a land treatment project.
- Temporary land easements may be required to facilitate construction and construction staging.
- The Federal cost share of PL 83-566 funding is contingent on the non-Federal portion of the cost share. The project owner, in coordination with the SLOs, is responsible for securing non-Federal funding for up to 25 percent of a project's total construction cost.

Considerations are other obstacles that could affect costs, societal acceptability, or legal issues which should be noted and accounted for when examining and evaluating potential alternative plans. For this plan, the primary considerations are as follows:

- A project that requires land modifications in the floodplain shall not adversely impact flooding conditions on properties upstream and downstream of the project.
- A project will maintain or improve existing high-quality wetland or woodland habitat within the stream corridor and will restore habitat without causing ecological uplift in form or function.
- A land treatment project may require permanent changes in land use. For example, a project that removes a portion of legacy sediment terrace to reconnect the stream to the floodplain may reduce the land area available for other uses, such as cropping or livestock pasturing.
- Although legacy sediment projects will have on-site and local benefits, the total portfolio of work funded by this project may not reduce legacy sediment erosion and transport by a measurable amount on a watershed scale.
- If a project requires excavation and removal of legacy sediment from the floodplain, landowners may be unwilling to allow spoiling of excavated material on-site. Sediment haul and disposal is expensive, would significantly increase project cost, and may cause additional resource impacts.

2.5 Federal Objective

The Federal Objective is the fundamental goal of Federal investments in water resources and is the same for every watershed plan in accordance with PR&G. The Federal Objective specifies that Federal water resource investments shall reflect national priorities, encourage economic development, and protect the environment by: a. Seeking to maximize sustainable economic development; b. seeking to avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and c. protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems. Given the many competing demands for limited Federal resources, it is intended that Federal investments in water resources should strive to maximize public benefits, with appropriate consideration of costs. Public benefits encompass environmental, economic, and social goals, include monetary and non-monetary effects, and allow for the consideration of both quantified and unquantified measures.

SECTION 3 – AFFECTED ENVIRONMENT

This section outlines key physical, ecological, economic, and social resources identified within the watershed and areas impacted by the proposed action to provide context for determining the effects of alternatives on the resource concerns identified.

3.1 Resource Categories of Concern (Scope of the EA)

The Chiques Creek watershed encompasses approximately 101.6 sq. mi. within Lancaster and Lebanon Counties. The Chiques Creek watershed contains approximately 300 miles of streams which drain to the Susquehanna River. The watershed is primarily characterized by agriculture with more than 50 percent of the land being used for farmsteads, pasture, and row crops.

A summary of the resources categories of concern identified within the watershed is presented below in Table 3.1.

TABLE 3.1
RESOURCE CATEGORIES OF CONCERN IN THE CHIQUES CREEK WATERSHED

Item/Concern	Relevant to the Proposed Action (Yes/No)	Rationale
Soil Related Concerns		
Soil Resources	Yes	Significant streambank erosion was identified in many areas throughout the watershed. Streambank erosion has been identified as the primary cause of excessive siltation in the planning area. The streambank erosion rate occurring in the watershed project area is 0.1 acres per year.
Prime and Unique Farmland, and Farmland of Statewide or Local Importance	Yes	Many areas within the watershed contain soils designated as Prime Farmland and Farmland of Statewide or Local Importance. The proposed action will impact farmland soils and could result in removing farmland from production.
Water Related Concerns		
Water Resources	Yes	Legacy sediment can adversely affect water resources by causing transport and relocation of nutrient-laden sediment from the streambank.
Sole Source Aquifers	No	Sole Source Aquifers are not located within or downstream of the watershed.
Water Quality	Yes	Nutrient-laden sediments are transported to the streams in the watershed area by excessive erosion and freeze-thaw actions.
Floodplain Management	Yes	Legacy sediment is primarily located within the floodplain.
Coastal Zone Management Areas	No	Coastal Zone Management Areas are not located within the watershed.
Waters of the U.S., Wetlands, & Special Aquatic Sites	Yes	Within the Chiques Creek watershed, legacy sediment terraces are immediately adjacent to Waters of the U.S. Wetlands are found adjacent to streams in many areas of the watershed.
Coral Reefs	No	Coral reefs are not located within the watershed.
Regional Water Resource Plans	Yes	The planning area is within the Chesapeake Bay watershed, which has a TMDL established for nitrogen, phosphorus, and sediments. Other regional plans encompassing the Chiques Creek Watershed include the PADEP WRAS, SRBC Watershed Alternative Restoration Plan, USACE Comprehensive Water Resources and Restoration Plan, and Little Chiques Creek Watershed Rivers Conservation Plan.
Wild and Scenic Rivers	No	There are no water courses designated by the State of Pennsylvania as Scenic Rivers within the watershed.
Air Related Concerns		
Air Quality	Yes	The use of gas-powered equipment during construction may result in minor, temporary impacts to air quality in the immediate vicinity of the Project. Lancaster County is currently in attainment status for particulate matter and is in nonattainment status for 8-hour (2008) ozone.
Plant and Animal Related Concerns		
Threatened and Endangered (T&E) Species	Yes	T&E species were identified at some locations within the watershed and may be impacted by construction activities within the stream corridor.
Migratory Birds	Yes	Stream corridors within the watershed provide respite and habitat for migratory birds.
Bald and Golden Eagles	Yes	Bald eagles are often seen within the watershed and could use the streams as a food source.
Essential Fish Habitat	Yes	Essential Fish Habitat is not located within the watershed. The nearest Essential Fish Habitat is found approximately 40 miles downstream of the watershed in the Susquehanna River downstream of Conowingo Road in Darlington, MD.
Ecologically Critical Areas	Yes	Natural Heritage Area Core Habitat can be found in riparian areas throughout the watershed.
Invasive Species	Yes	Various invasive plant species were identified at many locations within the riparian corridors.
Fish and Wildlife	Yes	T&E and/or rare species were identified at some locations within the watershed and are known to inhabit the riparian corridor. Coordination with the appropriate agencies may be necessary.
Natural Areas	No	Designated Natural Areas are not found within the watershed.
Riparian Areas	Yes	Legacy sediment is found in riparian areas.
Forest Resources	Yes	Construction access could require forest resources to be impacted. Forests may have grown over legacy sediment terraces.

Human Use-Related Concerns		
Cultural Resources and Tribal Consultation	Yes	Legacy sediment is found along streams, where there are higher potential archaeological resources to be present. Legacy sediment was caused by the historic damming of streams. Historic mills, dams, and other related structures occur within the watershed.
Social Issues	No	Social issues related to this plan were not identified.
Local, Regional, and National Economy	Yes	Construction will provide a temporary increase in the local economy.
Public Health and Safety	Yes	There are health and safety concerns associated with localized flooding and surface water quality within the watershed.
Scenic Beauty	No	There are no known unique or distinctive visual elements present within the riparian areas of the watershed.
Parklands (including National Parks, Monuments, and Historical Sites)	Yes	Some local parklands are located within the watershed where legacy sediment terraces were identified.
Significant Scientific Resources	Yes	While the watershed is about 35 percent karst, there are no documented caves or fossil sites within the Chiques Creek watershed. The watershed is located within the Lancaster Seismic Zone within the Ramapo Fault System.
Land Use	Yes	Legacy sediment is present in riparian corridors. Existing land uses of these areas may include agriculture, maintained lawn, parklands, and woodlands.
Ecosystem Services of Concern		
Provisioning (tangible goods provided for direct human use and consumption)		
Food	Yes	Some land within the riparian corridor is used for agricultural production or pasturing of animals. The receiving waters are used for fishing.
Fiber	No	Land within the watershed's riparian corridor is not used for fiber production.
Water	Yes	Water treatment plant intakes are located downstream of the watershed.
Timber	No	While there is forested land within the watershed's riparian corridor, it is not used for timber production.
Biomass	No	Land within the watershed's riparian corridor is not used for biomass production.
Hydropower Production	No	Conowingo Dam, a hydropower dam, is located downstream of the watershed. However, the Chiques Creek watershed only accounts for 0.4% of the total drainage area behind the dam; therefore, the project will not have significant impacts on hydropower production.
Navigation	Yes	Receiving waters from Chiques Creek are used for boating and navigation.
Regulating (maintain world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe)		
Flood and Disease Control	Yes	Localized flooding occurs within the watershed. Streams in the watershed and receiving waters are used for swimming and fishing.
Water Filtration	Yes	Riparian corridors can have the ability to filter surface and groundwater.
Climate Stabilization	No	Significant impacts related to climate stabilization are not expected.
Crop Pollination	No	Crop pollination is not a resource concern in this watershed.
Supporting (underlying processes maintaining conditions for life on earth)		
Nutrient Cycling	Yes	Soils within the riparian corridors will be affected.
Soil Formation	Yes	While soil is not created within the riparian corridors, significant amounts of legacy sediment are lost due to freeze-thaw processes and stream bank erosion.
Primary Production	Yes	Primary production includes cropping to the edge of the stream and pasturing animals within riparian corridors. These areas also provide an important energy source for riverine food webs. Receiving waters are also sources of primary production.
Cultural (make the world a place in which people want to live)		
Recreational Use	Yes	Riparian corridors are often used for hunting, trapping, bird watching, fishing, and other forms of passive recreation. Streams in the watershed and receiving waters are used for fishing, swimming and boating.
Spiritual	No	Through consultation with partners and Tribes, no designated spiritual areas have yet been identified within the riparian corridors of the watershed.
Aesthetic Viewsheds	Yes	Stream corridors have an innate aesthetic quality. Improvements to water quality, habitat, and stream health can enhance the aesthetic viewshed of the stream corridor.
Tribal Values	No	Through consultation, no tribal values were identified within the watershed.

3.2 Inventory of Existing Resources

The following sections present an inventory of the existing resources identified within the watershed that are relevant to the proposed action.

3.2.1 Soil Resources

Legacy sediment terraces have formed throughout the watershed as a result of historic mill dam construction promoting sedimentation within the dammed streams. Legacy sediment terraces have been found to be as great as 7 feet deep in some locations and cause the stream to be perched above its historic floodplain. Soils within the legacy sediment terraces in the Chiques Creek watershed primarily consist of loams and silt loams. Significant streambank erosion has been identified along many streams, which accounts for more than 60 percent of the estimated total annual sediment load within the watershed. Transport of the material is caused by undercutting the banks in combination with freeze-thaw actions which cause calving of the material. It is estimated that 0.1 acres per year of land within the watershed is eroded away every year.

3.2.2 Prime and Unique Farmland, and Farmland of Statewide or Local Importance

Agriculture composes a significant portion of the land use within the Chiques Creek watershed. Riparian areas within the watershed contain approximately 674 acres of soils designated as Prime and Unique Farmland and 523 acres of soils designated as Farmland of Statewide or Local Importance (NRCS, 2024b).

3.2.3 Water Resources

The Chiques Creek watershed contains approximately 300 miles of streams which drain to the Susquehanna River. Streams within the watershed do not currently meet their designated uses due to sediment and nutrient concentrations. Due to legacy sediment terraces, streams are currently perched above their historic floodplains and are disconnected from groundwater flows. Legacy sediment terraces may alter stream flow and reduce channel capacity potentially resulting in localized flooding in the watershed.

3.2.4 Water Quality

Streams within the Chiques Creek watershed are impaired for aquatic life, swimming and boating, and drinking water due to bacteria and other microbes, sediment, nutrients (nitrogen and/or phosphorous), and murky water. More than 95 percent of Chiques

Creek's overall waterway length fails to meet designated aquatic life status due to nutrients and siltation. Streambank erosion has been identified as the primary cause of impairment within the watershed, as eroded banks contribute to the transport of nutrient-laden sediment to surface waters. Thermal heating of ponded surface waters is also an effect of the in-place mill dams. A summary of 303(d) impairments relevant to the Project is presented below in Table 3.2a. A summary of the designated uses of stream reaches found within the watershed are presented below in Table 3.2b.

TABLE 3.2a
303(d) IMPAIRMENTS BY RELEVANT PARAMETER (CHIQUES CREEK WATERSHED)

Stream Impairment Parameter	Length of Impaired Stream (mi.)
Impaired for Aquatic Life	224.68
Impaired for Potable Water Supply	13.51
Impaired for Recreational Use	103.51

(PADEP, 2025)

TABLE 3.2b
STREAM DESIGNATED USES IN THE CHIQUES CREEK WATERSHED

Designated Use ID	Designated Use Description	Length of Stream (mi.)
1	Cold Water Fishes	0.51
4	High Quality-Cold Water Fishes	10.66
7	Trout Stocking	74.95
8	Warm Water Fishes	87.37

(PADEP, 2025)

3.2.5 Floodplain Management

Legacy sediment terraces are found within the floodplain. Due to the presence of legacy sediment terraces within the stream corridor, streams within the watershed are disconnected from their historic floodplains, which may be buried under several feet of sediment. Legacy sediment terraces have altered stream flow which may contribute to increased flooding in some areas of the watershed. Floodplains often encompass agricultural land, maintained lawn, and woodlands. The watershed contains approximately 6.47 sq. mi. of floodplains. A summary of the flood hazard areas within the watershed are presented below in Table 3.3.

TABLE 3.3
FLOOD HAZARD AREAS IN THE CHIQUES CREEK WATERSHED

Flood Hazard Area	Area (sq. mi.)
Zone A	3.73
Zone AE	1.06
Zone AE (floodway)	1.15
Zone X	0.52

(FEMA, 2016a)

3.2.6 Waters of the U.S., Wetlands, and Special Aquatic Sites

Legacy sediment terraces are immediately adjacent to Waters of the U.S. within the Chiques Creek watershed. As discussed in Subsection 3.2.4, streams within the Chiques Creek watershed experience water quality impairments due to elevated levels of sediments and nutrients, and streambank erosion has been identified as the primary cause of water quality impairments within the watershed.

Wetlands can also be found adjacent to and within the legacy sediment terraces. Based on the U.S. Fish and Wildlife (USFWS) National Wetlands Inventory, riparian areas of the watershed contain freshwater emergent wetlands, freshwater forested/shrub wetlands, and freshwater ponds. A summary of the wetland areas found within riparian areas is presented below in Table 3.4.

TABLE 3.4
WETLANDS IN RIPARIAN AREAS IN THE CHIQUES CREEK WATERSHED

Wetland Type	Acres within Watershed	Acres within Riparian Areas
Freshwater Emergent	92.3	64.5
Freshwater Forested/Shrub	169.4	122.7
Freshwater Pond	192.8	13.1

(USFWS, 2019)

3.2.7 Regional Water Resource Plans

Several regional water resources plans encompass the Chiques Creek watershed, including the Chesapeake Bay TMDL, PADEP WRAS, SRBC Watershed Alternative Restoration Plan, USACE Comprehensive Water Resources and Restoration Plan, and Little Chiques Creek Watershed Rivers Conservation Plan. These plans provide a framework for meeting regional goals related to water quality improvements, habitat improvements, flood risk reduction, and stormwater management.

3.2.8 Air Quality

Lancaster County is currently in attainment status for particulate matter 2.5 (2006). However, the County is not in attainment for the 8-hour ozone (2008). The 8-hour ozone nonattainment classification is marginal and encompasses all of Lancaster County. Lebanon County is in attainment status for all criteria pollutants (EPA, 2023).

3.2.9 Threatened and Endangered (T&E) Species

Several State and Federally listed T&E species are reported to inhabit the Chiques Creek watershed. Table 3.5 provides a list of the T&E species that may be encountered within riparian areas of the watershed.

TABLE 3.5
THREATENED AND ENDANGERED (T&E) SPECIES IN THE CHIQUES CREEK WATERSHED

Common Name	Scientific Name	State Status	Federal Status
Animals			
Eastern bog turtle	*Glyptemys muhlenbergii*	Endangered	Threatened
Indiana bat	*Myotis sodalis*	Endangered	Endangered
Northern long-eared bat	*Myotis septentrionalis*	Endangered	Endangered
Plants			
Jeweled shooting star	Dodecatheon radicatum	Threatened	Not Listed
Torrey's rush	Juncus torreyi	Threatened	Not Listed
Virginia bunchflower	*Melanthium virginicum*	Special Concern Species (Proposed Endangered)	Not Listed
Bog bluegrass	*Poa paludigena*	Threatened	Not Listed
Clinton's wood fern	*Dryopteris clintoniana*	Special Concern Species (Proposed Threatened)	Not Listed
Bradley's spleenwort	*Asplenium bradleyi*	Endangered	Not Listed
Waterpod (Ellisia)	*Ellisia nyctelea*	Threatened	Not Listed

(Pennsylvania Natural Heritage Program, n.d.)

3.2.10 Migratory Birds

Riparian corridors within the Chiques Creek watershed provide habitat and respite for a multitude of migratory bird species. Migratory bird species that may be encountered within the watershed are presented in Table 3.6 below.

TABLE 3.6
MIGRATORY BIRDS WITHIN THE CHIQUES CREEK WATERSHED

Common Name	Scientific Name
Bald Eagle	*Haliaeetus leucocephalus*
Golden Eagle	*Aquila chrysaetos*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Cerulean Warbler	*Setophaga cerulea*
Chimney Swift	*Chaetura pelagica*
Kentucky Warbler	*Geothlypis formosa*
Prairie Warbler	*Setophaga discolor*
Prothonotary Warbler	*Protonotaria citrea*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Wood Thrush	*Hylocichla mustelina*
Grasshopper Sparrow	*Ammodramus savannarum perpallidus*
Rusty Blackbird	*Euphagus carolinus*

(USFWS, n.d.)

3.2.11 Bald and Golden Eagles

Bald eagles are often seen within the Chiques Creek watershed, including reported occurrences in the riparian areas of Chiques Creek. Riparian areas of the watershed may provide habitat and food sources for bald eagles. Bald eagles may be encountered in the watershed year-round, with their breeding season being from January to July. Golden eagles may use riparian areas within the Chiques Creek watershed for respite during migration in late winter/early spring and fall, but their probability of presence is low. Golden eagles are not known to breed within the watershed (USFWS, n.d.).

3.2.12 Essential Fish Habitat

The Chiques Creek watershed does not contain Essential Fish Habitat. However, approximately 35 miles downstream of the Chiques Creek watershed in the Susquehanna River, Essential Fish Habitat can be found downstream of Conowingo Road in Darlington, MD (National Oceanic and Atmospheric Administration [NOAA], 2024).

3.2.13 Ecologically Critical Areas

The PNHP defines Core Habitats within Natural Heritage Areas as critical for the long-term persistence of rare species, exemplary natural communities, and resilient ecosystems.

The following PNHP Core Habitat within Natural Heritage Areas can be found within riparian areas of the watershed:

- The Chiques Creek Bluff, located along Chiques Creek between Old Harrisburg Pike and Bridge Valley Road, contains limestone outcrops that support population of jeweled shooting star, a State listed threatened plant species.
- Indian Springs, located along Chiques Creek between just upstream of the confluence with Dellinger Run, provides habitat for an invertebrate species of concern. The focus of conservation for this species is the protection of groundwater quality.
- Chiques Creek and its tributaries north of Manheim Borough to the PA Turnpike contain various types of wetlands that support several species of concern.
- The Penryn Park and Walnut Run core habitat encompasses the tributary to Shearers Creek and provides habitat for 10 species of concern. Vegetation clearing along utility rights-of-way provides favorable habitat for these species.
- The Chiques Creek headwaters north of the PA Turnpike contain large expanses of forest that provide habitat for interior forest dwelling species. This area also provides habitat for one plant species of concern.
- Chickies Rock Park along Chiques Creek at the confluence with the Susquehanna River contains mostly forested habitat for two plant species of concern (PNHP, n.d.).

3.2.14 Invasive Species

Several invasive plant species were identified within riparian areas during field investigations of the Chiques Creek watershed. A list of the commonly encountered invasive species identified in the field are provided in Table 3.7.

TABLE 3.7
INVASIVE SPECIES IDENTIFIED WITHIN THE CHIQUES CREEK WATERSHED

Common Name	Scientific Name
Garlic mustard	*Alliaria petiolata*
Multiflora rose	*Rosa multiflora*
Poison hemlock	*Conium maculatum*
Amur honeysuckle	*Lonicera maackii*
Reed canary grass	*Phalaris arundinacea*
Japanese honeysuckle	*Lonicera japonica*
Common chickweed	*Stellaria media*

3.2.15 Fish and Wildlife

Several stream reaches within the Chiques Creek watershed support natural trout reproduction including: Boyer Run from the headwaters to the PA Turnpike, Behm Run from the headwaters to the PA Turnpike, the unnamed tributary to Shearers Creek from the headwaters to the confluence with Shearers Creek at river mile 2.67, and Shearers Creek from the headwaters to the confluence with Chiques Creek. The upstream portion of Shearers Creek in Lebanon County is also designated as a Class A stream, which supports a natural population of brown trout in significant size and abundance to provide long-term sport fishery (PNHP, n.d.).

Of the 53 mill dams historically present in the watershed, 46 have been breached and seven remain intact. These mill dams have disconnected the stream channel from the historic floodplain, impeding fish migration. The dams within the watershed are lower priority for removal because other dams downstream prevent anadromous fish passage (USACE, 2021). A figure showing the breached and existing mill dams within the watershed is included in Appendix C.

The Chiques Creek watershed historically provided spawning sites for American shad. However, human activities, specifically the construction of dams, have prevented these migratory fish from accessing the watershed.

3.2.16 Riparian Areas

Legacy sediment terraces are located within riparian areas of the Chiques Creek watershed. The Chiques Creek watershed contains approximately 6,078 acres (9.50 sq. mi.) of riparian areas. Riparian areas in the watershed often lack quality vegetation and habitat due to agricultural encroachments. Many riparian areas have also been found to contain invasive plant species as noted in Subsection 3.2.14. Most riparian areas lack significant forest cover.

3.2.17 Forest Resources

Approximately 29 percent of riparian areas within the Chiques Creek watershed are composed of forest. The forests within riparian areas are primarily deciduous (approximately 24 percent), with some areas containing mixed forests (approximately 5 percent) (USGS, 2024).

The terrestrial ecosystems found within riparian areas within the Chiques Creek watershed are composed of Northeastern Interior Dry-Mesic Oak Forest, Appalachian Hemlock-Northern Hardwood Forest, North-Central Interior and Appalachian Rich

Swamp, North-Central Appalachian Acidic Swamp, Laurenthian-Acadian Freshwater Marsh, and Dry Oak-Pine Forest Central Appalachians and Southern Piedmont (Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission, 2024).

3.2.18 Cultural Resources and Tribal Consultation

The Chiques Creek watershed may possess areas of cultural importance for the following Native American Tribes: Absentee Shawnee Tribe of Indians of Oklahoma, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, and Shawnee Tribe.

Historic properties can be found throughout the Chiques Creek watershed. Historic properties within the watershed that are listed on the National Register of Historic Places (NRHP) are presented below in Table 3.8. Three historic mill sites determined eligible for listing on the NRHP and containing in-place dams have been identified within the watershed. Figures showing all existing historic properties within the watershed and the location of mill sites within the watershed are included in Appendix C.

TABLE 3.8
NATIONAL REGISTER OF HISTORIC PLACES LISTED RESOURCES IN THE CHIQUES CREEK WATERSHED

Name	Type	Eligibility
John Berger & Son Company Tobacco Warehouse	Building	Listed
Forry's Mill Covered Bridge	Bridge	Listed
Flowers House	Building	Listed
Shenk's Mill Covered Bridge	Bridge	Listed
Mumma, Samuel N., Tobacco Warehouse	Building	Listed
Mount Hope Estate	Building	Listed
Shearer's Covered Bridge	Bridge	Listed
Seigrist's Mill Covered Bridge	Bridge	Listed
Central Hotel	Building	Listed
Kaufman's Distillery Covered Bridge	Bridge	Listed
Not Available	Building	Listed
Danner Store	Building	Listed
Brown's, George, Sons Cotton & Woolen Mill	Building	Listed
William Noggle & Sons, Inc. Shirt Factory	Building	Listed
D.W. Long Tobacco Warehouse	Building	Listed
Manheim Public School (Stiegel Elementary School)	Building	Listed

(PA-SHARE, 2025)

3.2.20 Local, Regional, and National Economy

The Chiques Creek watershed lies primarily within Lancaster County, with a small portion of the watershed being within Lebanon County to the north. Economic data for Lancaster County and Lebanon County are presented below in Table 3.9.

TABLE 3.9
INCOME AND POVERTY RATES IN LANCASTER COUNTY AND LEBANON COUNTY, PENNSYLVANIA

Indicator	Lancaster County	Lebanon County	Pennsylvania	U.S.
Median Household Income	$83,703	$76,350	$76,081	$78,538
Per Capita Income	$41,319	$37,701	$43,104	$43,289
Persons in Poverty	8.6%	8.7%	12.0%	11.1%

(U.S. Census Bureau, 2023)

3.2.21 Public Health and Safety

Localized flooding commonly occurs within the Chiques Creek watershed, resulting in public health and safety risks to communities. For more information on flooding within the watershed, refer to Subsection 3.2.30 Flood and Disease Control.

3.2.23 Parklands (Including National Parks, Monuments, and Historic Sites)

There are no national parks, monuments, or historic sites located within riparian areas of the watershed. However, streams within the watershed flow through several local parks, which are presented below in Table 3.10.

TABLE 3.10
PARKS ADJACENT TO STREAMS WITHIN THE CHIQUES CREEK WATERSHED

Park Name	Address
Cove Outlook Park	405 Old Market St, Mt. Joy, PA 17552
Little Chiques Park	207 Park Ave, Mt. Joy, PA 17552
Logan Park	536 W Ferdinand St, Manheim, PA 17545
Manheim Veterans Memorial Park	320 Memorial Dr, Manheim, PA 17545
Chickies Rock County Park	880 Old Chickies Hill Rd, Columbia, PA 17512
Grubb Lake Park	671 Hempfield Hill Rd, Columbia, PA 17512
Mummau Park	446-498 W Chestnut St, Manheim, PA 17545
Penn Township Park	309 Cedar Hollow, Manheim, PA 17545
Bridge Valley Park	Dahlia Ct, Mt. Joy, PA 17552
Wolgemuth Park	8741 Elizabethtown Rd, Elizabethtown, PA 17022
Rotary Park	436 Old Market St, Mt. Joy, PA 17552
Chickies Creek Day Use Area	1467 Long Ln, Columbia, PA 17515

(PNHP, n.d.)

3.2.24 Significant Scientific Resources

No documented caves or fossil sites have been identified within the watershed. However, the watershed is composed of approximately 35 percent karst geology.

The watershed is located in the Lancaster Seismic Zone within the Ramapo Fault System. This seismic area is considered currently active and experiences frequent, small earthquakes ranging from 1 to 4.5 on the Richter Scale.

3.2.25 Land Use

Agriculture (pasture/hay and cultivated crops) is the primary land use with the riparian corridors of the Chiques Creek watershed, accounting for nearly 50 percent of land use within the riparian corridors. A summary of all land uses found within the riparian corridors of the watershed is presented below in Table 3.11.

TABLE 3.11
LAND USES WITHIN RIPARIAN CORRIDORS IN THE CHIQUES CREEK WATERSHED

Land Use Description	Area (Acres)	Total Riparian Area (Percent)
Pasture/Hay	1,108	29.1
Deciduous Forest	931	24.4
Cultivated Crops	735	19.3
Woody Wetlands	324	8.5
Developed, Open Space	262	6.9
Mixed Forest	190	5.0
Developed, Low Intensity	182	4.8

Land Use Description	Area (Acres)	Total Riparian Area (Percent)
Developed, Medium Intensity	29	0.7
Shrub/Scrub	22	0.6
Open Water	11	0.3
Emergent Herbaceous Wetlands	7	0.2
Developed, High Intensity	6	0.1
Grassland/Herbaceous	3	0.1

(USGS, 2024)

3.2.26 Food

In some areas of the watershed, land within riparian corridors is used for the production of crops and pasturing of animals. Approximately 1,108 acres and 735 acres of land within riparian areas are used for hay/pasture and cultivated crops, respectively.

The Susquehanna River is a source of recreational fishing. There are consumption guidelines in place to minimize the exposure to pollutants from fish caught in the Susquehanna River.

Downstream of the watershed, the Chesapeake Bay commercially caught fin fish, including striped bass, blue catfish, and menhaden. The Chesapeake Bay is also known for crabs and shellfish.

3.2.27 Water

Several water treatment plant intakes are located downstream of the watershed on the Susquehanna River, including intakes for the Lancaster City Authority, Columbia Water Company, and Wrightsville Municipal Authority. Changes in water quality impairments within the Chiques Creek watershed could have impacts on the treatment of drinking water at these facilities.

3.2.29 Navigation

Some headwaters of the watershed are inaccessible by small, non-motorized boats due to the presence of mill dams.

Receiving waters of the Chiques Creek, specifically the Susquehanna River and the Chesapeake Bay, are used for navigation. Boating navigation can be adversely affected by sedimentation.

3.2.30 Flood and Disease Control

Localized flooding is a common occurrence within the Chiques Creek watershed. In 2018, the SRBC and USACE completed a Flood Resiliency Study for the Chiques Creek Watershed and identified that Manheim Borough experiences the greatest flood risk within the watershed. During 2011's Tropical Storm Lee, police and/or fire responded to 209 rescue calls due to flooding. Sixty-two businesses reported flood damage. Over 500 Manheim residents received over $2.3 million in FEMA grants, according to the Pennsylvania Emergency Management Agency (Fisher, 2019).

Receiving waters of the Chiques Creek, including the Susquehanna River and Chesapeake Bay, are also used for recreational swimming and fishing. Bacteria that can be found in those waters include *Enterococci*, *Virbio, Cyanobacteria,* and *Cryptosporidium* (Chesapeake Bay Foundation, 2009). Most public beaches monitor the waters to ensure the safety of swimmers (Solyst, 2021).

3.2.31 Water Filtration

Riparian corridors have the ability to filter surface water and groundwater. However, legacy sediment terraces within the stream corridors disconnect surface waters from groundwater, limiting filtration capability.

3.2.32 Nutrient Cycling

The erosion of nutrient-laden soils contained within legacy sediment terraces prevents nutrient cycling in these riparian areas. Transport of nutrient-laden sediment downstream can impact nutrient cycling in receiving waters, such as the Chesapeake Bay.

3.2.33 Soil Formation

While soil is not created within riparian corridors, significant amounts of legacy sediment are lost due to freeze-thaw processes and streambank erosion. Erosion and freeze-thaw processes contribute to the transport of sediments to surface waters within and downstream of the watershed.

3.2.34 Primary Production

Primary production occurs in riparian areas from human-related and natural activities. In some areas of the watershed, riparian corridors are used for agricultural activities, which include cropping to the edge of the stream and pasturing animals.

In addition to agricultural activities, natural plant communities within riparian corridors provide an important energy source for riverine food webs. Riparian areas in some areas of the watershed lack significant vegetation, and the establishment of more robust riparian buffers would benefit primary production within these areas.

Receiving waters are also sources of recreational and commercial fishing that is used for food.

3.2.35 Recreational Use

Streams and riparian corridors within the Chiques Creek watershed provide opportunities for recreational use, such as fishing, hunting, trapping, bird watching, and other forms of passive recreation. As discussed in Subsection 3.2.23, streams within the Chiques Creek watershed flow through several local parklands. Refer to Table 3.10 for the list of parklands located within riparian corridors.

Streams within the Chiques Creek watershed support wild and stocked fish populations that provide opportunities for recreational fishing. Little Chiques Creek and its tributaries have designated uses for trout stocking, Chiques Creek and its tributaries have designated uses for warm-water fishes, and Shearers Creek and its tributaries have designated uses for high-quality cold-water fishes (PNHP, n.d.).

There are two State Game Lands located in the northern portion of the watershed managed by the Pennsylvania Game Commission. State Game Lands 145 encompasses a portion of the unnamed tributary to Little Chiques Creek, and State Game Lands 156 encompasses the northern portion of Behms Run and Boyers Run (PNHP, n.d.).

Downstream of the Chiques Creek watershed, the Susquehanna River and Chesapeake Bay are both used for recreational fishing, boating, and swimming.

3.2.36 Aesthetic Viewsheds

Stream corridors have an innate aesthetic quality that contributes to the visual resources of the landscape. Improvements to water quality, habitat, and stream health can enhance the aesthetic viewsheds of stream corridors. Currently, stream corridors within the watershed are stressed by legacy sediment terraces that alter stream flow and contribute to degraded water quality.

Chesapeake Bay, downstream of the Chiques Creek watershed, is well-known for its aesthetic viewsheds that include expansive water vistas, lush shorelines, and diverse wildlife habitats. The bay's natural beauty continues to serve as an attraction for visitors, offering opportunities for recreational activities such as boating, fishing, and

birdwatching. These scenic viewsheds contribute to both the region's cultural and ecological significance.

3.3 Forecast Future Conditions

This forecast intends to account for all foreseeable large-scale processes in both the natural and human environments to help inform the projected impacts occurring from the No Action Alternative. The following subsections summarize the anticipated changes in environmental and socioeconomic resource conditions within the watershed.

3.3.1 Environment

The majority of streams within the Chiques Creek watershed are classified as impaired for aquatic life use, and these impairments are expected to continue or worsen without intervention. The erosion of legacy sediment terraces will continue to contribute nutrient-laden sediments to streams, ultimately degrading water quality within and downstream of the watershed. Over time, freeze-thaw conditions and storm events will intensify the erosion. Sediment and nutrient loads from the Chiques Creek watershed will continue to contribute to water quality impairments in the Susquehanna River and Chesapeake Bay.

Agricultural activity within and adjacent to riparian areas of the watershed could potentially put additional stress on stream corridors by limiting the extent and quality of riparian buffers. Agricultural encroachments on riparian areas may limit the riparian ecosystem functions of stabilizing streambanks and filtering runoff. Additionally, runoff from agricultural land may further degrade water quality, and tilling and pasturing of animals in riparian areas could further increase erosion in the watershed.

Future weather patterns in the region are expected to include increases in intense rainfall events (PADEP, 2024). Intense rainfall results in flashier and higher stream flows that increase the risk of erosion and flooding in the watershed.

3.3.2 Society

Population within the Chiques Creek watershed is expected to increase steadily over the next 50 years. With an increasing population, increased development within the watershed is expected. The development of existing agricultural land will result in flashier and greater amounts of runoff.

As populations increase, pressure on the floodplains may also increase which would exacerbate flood risks. Increased flood risks pose a direct threat to communities within

the watershed. Flooding can damage property, infrastructure, and pose health risks through waterborne diseases and contaminants. Effective floodplain management would help to mitigate these risks and protect residents.

3.3.3 Economy

Housing costs and cost of living are expected to increase over time with inflation, but it is not expected that these increases will disproportionately affect the planning area.

As erosive processes within the watershed continue, water quality degradation and increased flood risks will have economic impacts on communities. Flooding will result in property damage, increasing costs for communities and residents. Water quality degradation will lead to increased costs for drinking water treatment, as well as impacts to the recreational use of water bodies within and downstream of the watershed.

3.3.4 Ecosystem Services

Ecosystem services in the Chiques Creek watershed are expected to be stressed by the presence of legacy sediment terraces. Continued erosion and sedimentation in the watershed pose risks to food and water sources, and navigation downstream of the watershed. Regulating services relating to flood and disease control and water filtration will also be adversely impacted by legacy sediment in the watershed. Recreational uses and aesthetic viewsheds of streams and receiving waters can decline from continued erosion and water quality impairments.

SECTION 4 – FORMULATION OF ALTERNATIVES

This section describes the formulation, evaluation, and selection of alternatives. A feasible alternative must meet the Federal Objective and address the purpose and need of the Project.

4.1 Alternative Formulation Process

The SLOs, NRCS, a consultant team, agency, Tribal, and public stakeholders were invited to collaboratively participate in the Project scoping and alternative formulation process to develop a program. The alternative formulation process included the following sequence of work: watershed data collection and review; identification of feasible alternatives; scoping; site-specific screening, selection, data collection, and conceptual alternative development; environmental and economic evaluation; and identification and development of the program action alternative in this Plan. The formulation process was premised on the PR&G guiding principles and criteria, and risk and uncertainty, provided in the following sections.

4.1.1 Guiding Principles

The guiding principles of PR&G were used during the identification, formulation, and evaluation of alternatives. The specific guiding principles used include Healthy and Resilient Ecosystems, Sustainable Economic Development, Floodplains, and Public Safety, as outlined in DM 9500-013.

4.1.2 Alternative Formulation Criteria

Plan screening criteria include completeness, effectiveness, efficiency, and acceptability. These criteria were used during the formulation of alternatives to evaluate alternatives that met the purpose and need of the proposed action.

4.1.3 Risk and Uncertainty

Risk and uncertainty are inherent in water resources planning and were considered in the formulation of alternatives. Risk refers to those outcomes that can be described using reasonably well-known probability distributions, such as the chance of a rare flood event. Uncertainty refers to potential outcomes that cannot be described in probability distributions, such as changes in land use that may not be in accordance with projections based on historical trends. Risk and uncertainty impact projects because of the natural variability of complex natural, social, and economic factors. Adaptive management is

critical for mitigation of risk and uncertainty and is included in any action alternatives. The following elements of risk and uncertainty were identified in this Plan:

- Action alternatives may include projects that are designed based on the estimated probability of a flood event. Projects will be subject to future climate variability and the risk of flooding events that exceed design capacity.
- Future land use in the Project area is uncertain and may change because of increasing population and urban development. This will affect hydrology downstream of the land use change.
- Independent activities upstream and downstream of projects may impact the ability to measure and interpret water quality improvements associated with the Project.
- Legacy sediment on Project sites could be contaminated and may not meet clean fill standards, which would be significantly more expensive to handle and dispose. While contaminated sediment was not encountered in the engineering evaluation or during previous studies by others, this would be mitigated by testing the sediment at each potential Project site.
- It is assumed that a not-for-profit land conservancy would be responsible holding any long-term easements required for a legacy sediment project. NRCS may also hold long-term easements if the Project were enrolled in the Wetland Reserve Easement Program.
- The costs estimated for the proposed action are planning-level estimates based on the best data currently available and have a large margin of uncertainty. Costs will be impacted by site-specific considerations and constraints that are currently unknown. For example, the one-time sediment removal benefit in this plan (26,240 tons) was estimated based on aggregate data from many potential sites in the watershed, and assuming that only 40 percent of the projects in a program would include legacy sediment removal. This estimate is conservative because a legacy sediment program would identify and select high-benefit projects in the watershed, and over 40 percent of projects could include legacy sediment removal.
- Site-specific data was not collected to support the engineering and economic evaluation of mill dam removal. However, mill dam removal is included in the action alternative because there are intact mill dams in the watershed and it is possible that a private landowner that choses participation in the program has a mill dam on their property.
- The construction timeline is currently unknown and may vary based on funding timelines, Project availability and selection, design challenges, and permitting. Costs and timelines for construction can be impacted by the regional labor market and contractor availability.

- Land ownership may change over the life of a project. O&M and any project-specific agreements may require adaptive management in these cases.
- Long-term costs for the SLOs are unknown and may vary on a case-by-case basis. A compensatory agreement between the SLOs and the applicant may be considered for items associated with the Project. Examples could include O&M for the project life; a land lease for a permanent loss of valuable land, such as crop land displaced by a project; or other applicable costs.
- Current long-term weather forecast predictions are for increasing rainfall intensity, which increases the peak runoff response of the watershed. Designs in this plan should include an adjustment factor to account for the likely increase in precipitation intensity over the Project lifespan and the need for more water storage in wetlands.
- Economic analyses involve assumptions about future conditions including market trends, policy environments, and environmental factors. Economic projections used in this analysis, such as inflation rates, discount rates, and land prices, are based on historical data and current trends. However, future economic conditions may deviate due to market volatility, geopolitical events, technological disruptions, policy changes (e.g., tax, trade, or environmental regulations), or pandemics. Environmental regulations and compliance costs can shift due to evolving legal frameworks or public policy priorities. These changes may impact project costs, timelines, and feasibility.
- The Project team prepared rough order of magnitude (ROM) level costs for all the EUs studied to determine recommended legacy sediment treatment alternatives. These ROM level costs were prepared based on RS Means and previous Project data. These ROM level costs are an AACE Class 5 estimate and expected to have an accuracy range between -30% and +50%. Class 5 estimates are generally prepared based on limited information and subsequently have wide accuracy ranges. The erosion reduction resulting from the program was estimated based on these ROM cost estimates from the 10 EUs, among other assumptions.

4.2 Alternatives Considered

Project scoping identified the need for a cost-share program by which landowners can implement land treatment practices that reduce or stabilize legacy sediment with assistance from NRCS and the SLOs. Various formulations of this potential program were considered.

4.2.1 No Action Alternative (Future Without Program)

Under the No Action Alternative, NRCS would not offer a program to address water quality concerns from legacy sediment in the Chiques Creek watershed. Without funding from this program, existing and ongoing legacy sediment projects within the watershed would likely continue, but these projects generally do not have a broadly applied approach at the watershed-scale and are narrowly scoped, primarily due to funding limitations. SLOs and other organizations will likely continue to pursue other programs to reduce the erosion and transport of legacy sediment in the watershed, and from the watershed to downstream water bodies such as the Chesapeake Bay. Without intervention, legacy sediment erosion and transport from the erosion of streambanks is likely to continue and increase over time, and environmental impacts from reduced water quality would be exacerbated. Other Federal, State, or local resources may be required to remediate the watershed in the future.

The No Action Alternative does not meet the purpose and need of the Project but must be retained in the final array of alternatives to provide a baseline for comparison to the effects of the action alternatives. This requirement is provided in the Council on Environmental Quality regulations (40 CFR Part 1502.14(c)).

4.2.2 Legacy Sediment Treatment Program (Future with Federal Investment) (Alternative 1)

Under Alternative 1, NRCS would offer a voluntary PL 83-566 Land Treatment Program to address water quality concerns from nutrient-laden legacy sediment erosion and transport in the stream corridors of the Chiques Creek watershed. Landowners in the watershed would be eligible to enter a cost-share agreement and seek Federal assistance from the program to install conservation practices to address legacy sediment. Landowners would apply to the program with a proposed project and the program would implement projects based on merit. The program would employ methodology to screen and rank applicant projects, evaluate and compare the potential benefits, and design and construct the projects that reflect the highest net benefit based on project ranking criteria. As the program is based on voluntary participation, exact project sites have not been identified.

Based on review and evaluation of 137 NRCS' Pennsylvania conservation practices, four practices were identified as being most relevant or suitable to accomplishing the specific program objectives. These are the core conservation practices shown in Table 4-1. The applicability of these conservation practices was further validated by representative site investigations, preliminary designs, and the collection of associated cost and benefit data. An iterative approach was taken to select the core conservation practices that maximize

public benefit and minimize environmental impact. Each land treatment project would be required to include one or more core conservation practices to be eligible for the program.

TABLE 4.1
PRIMARY CONSERVATION PRACTICES FOR INCLUSION IN THE CHIQUES CREEK WATERSHED PROJECT

Conservation Practices	CPS Code
Aquatic Organism Passage	396
Channel Bed Stabilization	584
Riparian Forest Buffer	391
Riparian Herbaceous Cover	390
Streambank and Shoreline Protection	580

[1] Conservation Practice Standard.

Supporting practices can be installed with an associated primary practice to enhance a project or increase the benefits of the conservation system and are shown in Table 4.2.

TABLE 4.2
SUPPORTING CONSERVATION PRACTICES FOR INCLUSION IN THE CHIQUES CREEK WATERSHED PROJECT

Conservation Practices	CPS Code
Access Control	472
Access Road	560
Clearing and Snagging	326
Conservation Cover	327
Constructed Wetland	656
Critical Area Planting	342
Dike	356
Fence	382
Grade Stabilization Structure	410
Hedgerow Planting	422
Heavy Use Area Protection	561
Lined Waterway or Outlet	468
Livestock Pipeline	516
Mulching	484
Obstruction Removal	500
Open Channel	582
Pumping Plant	533
Restoration of Rare or Declining Natural Communities	643
Shallow Water Development and Management	646
Stormwater Runoff Control	570
Stream Crossing	578
Stream Habitat Improvement and Management	395
Structure for Water Control	587
Structures for Wildlife	649
Subsurface Drain	606

Conservation Practices	CPS Code
Trails and Walkways	575
Tree/Shrub Establishment	612
Underground Outlet	620
Water Well	642
Watering Facility	614
Wetland Creation	658
Wetland Enhancement	659
Wetland Restoration	657
Wetland Wildlife Habitat Management	644
Wildlife Habitat Planting	420

[1] Conservation Practice Standard.

The specific treatment systems installed by Alternative 1 would be driven by the land enrolled in the program and evaluated on a site-specific basis. The planned systems to result from the program are shown in Table 4.3. While other conservation practices may be implemented depending on site requirements, this table only includes the conservation practices that would be expected to be included in every installation of that specific treatment system.

TABLE 4.3
LAND TREATMENT MEASURES AND EXAMPLE CONSERVATION PRACTICES FOR INCLUSION IN THE CHIQUES CREEK WATERSHED PROJECT

Land Treatment Measure	Typical Conservation Practices and CPS (1) Code
Legacy Sediment Stabilization	Critical Area Planting (342) Mulching (484) Streambank and Shoreline Protection (580)
Riparian Buffer	Riparian Herbaceous Cover (390) Riparian Forest Buffer (391)
Legacy Sediment Removal & Site Restoration	Riparian Herbaceous Cover (390) Riparian Forest Buffer (391) Aquatic Organism Passage (396) Mulching (484) Streambank and Shoreline Protection (580)
Mill Dam Removal (2)	Obstruction Removal (500)

Notes:
1. Conservation Practice Standard.
2. Typically used in combination with either Legacy Sediment Stabilization or Legacy Sediment Removal & Site Restoration. Mill Dam Removal is not usually a stand-alone treatment alternative due to the potential for legacy sediment mobilization after the dam is removed

4.2.3 Locally Preferred Alternative

The NEPA Locally Preferred Alternative is the alternative favored by local communities, relevant local agencies, and public stakeholders. Alternative 1 is the Locally Preferred Alternative.

4.2.4 Environmentally Preferred Alternative

The NEPA Environmentally Preferred Alternative is identified as the alternative with the fewest environmental impacts of the formulated alternatives. Alternative 1 is the Environmentally Preferred Alternative.

4.3 Alternatives Considered and Eliminated from Detailed Study

4.3.1 Targeted Treatment Sites

NRCS and the SLO would complete projects on two of the highest eroding streambank sites within the watershed. These sites originally had historic, but now breached, mill dams. The sites would be treated with legacy sediment removal systems, removing the legacy sediment and restoring the native floodplain This alternative would treat about 2.75 miles of streambank.

Unlike Alternative 1, this alternative would only target the sites in the watershed with the highest sediment erosion rates or largest volume of legacy sediment terrace. The potential benefit is theoretically higher if projects are executed on these sites. However, these highest erosion rate sites in the watershed are privately owned. If the landowners are unwilling to have a project on their property, the SLO would be required to forcefully acquire the land rights by eminent domain. If the SLO acquired the property, O&M would also be the responsibility of the SLO. Not accounting for the cost of landrights, the benefit-to-cost ratio is 1.70.

This alternative was not carried forward for full analysis. Project costs would be significantly higher for the SLO because of eminent domain processes, land acquisition, and O&M requirements. Land acquisition would likely account for more of the SLO's Project budget than constructing land treatment projects, and the costs for them would likely far outweigh the benefits.

4.3.2 Full Conservation Practice Alternative

This alternative would make the full suite of the NRCS' Pennsylvania conservation practices across all landscapes available to program applicants to achieve program objectives. Almost 140 conservation practices could be used as stand-alone or combined conservation systems, so long as they achieve the desired results of reducing sediment within the surface waters. Under this alternative, applicants would have the flexibility to propose more wide-ranging practices on the uplands, as well as within the riparian corridor, increasing the scope and extent of water quality improvement projects that could be approved. However, this alternative did not always meet the project purpose of

addressing legacy sediment erosion as this alternative would allow work on other non-riparian landscapes.

4.3.3 Singular Practice Alternative(s)

Similar to Alternative 1, individual alternatives were developed to include only one land treatment system based on one core conservation practice. Each project would be required to include that one core conservation practice. These systems include riparian buffer, streambank stabilization, and legacy sediment restoration.

While each system individually can perform well, success is dependent upon appropriate site conditions. Many conservation practices have been tried over the years at various locations throughout the Chiques Creek watershed. Due to its unique soils, land uses, topography and other factors, a suite of treatment systems has historically been tried at various locations before the right fix was found for many stream projects in the watershed. To be able to maximize benefits depending upon individual voluntarily offered site characteristics, each practice type should be available for use within the program.

4.3.3.1 Riparian Buffer Installation (CPS 390 or CPS 391)

A program could be developed only for the installation of riparian buffers. It is estimated that about 50.5 miles of buffers could be installed with the proposed amount of funding. About 82% of the potential riparian projects located within the Chiques Creek Watershed would install riparian buffers. It is estimated that the benefit-to-cost ratio to install a riparian buffer is 1.76.

While installation of riparian buffers has been successfully implemented throughout the watershed, they are not ubiquitous for every riparian site. Establishment may be difficult on higher order streams. The Conservation Practice Standard (CPS) 391 notes that the conditions where the practice applies are “where channels and streambanks are sufficiently stable.” Riparian buffers are an excellent tool, but not appropriate for every legacy sediment streambank site.

There is also significant funding within the watershed, including EQIP funding through NRCS, that can be used to install riparian buffers.

4.3.3.2 Streambank Stabilization (CPS 580)

At an estimated cost of $100/LF, it is estimated that almost 38 miles of vegetative, bioengineered, or structural streambank stabilization could be installed within the

Chiques Creek Watershed. This practice should only be used when other legacy sediment treatment practices are not appropriate. It is estimated that the benefit-to-cost ratio to use hard armoring to stabilize the streambanks is 1.32. The benefit-to-cost ratio will be lower for more structural practices and higher for vegetative practices.

4.3.3.3 Legacy Sediment Restoration (CPS 396)

A program could be developed only for the removal of legacy sediment terraces and restoration of the original floodplain. It is estimated that at least 3.1 miles of streambank could be treated with the proposed amount of funding. About 13% of the potential project sites located within the Chiques Creek Watershed would be appropriate for floodplain restoration. It is estimated that the benefit-to-cost ratio is 1.44. This will increase on projects that do not require hauling legacy sediment away from the site. It may decrease on project sites that require removal of mill dams.

While legacy sediment restoration has significant benefits, the limited application throughout the watershed does not make it appropriate for its own program.

4.3.4 Land Use Restrictions

An alternative was considered to implement regulations to restrict the land use of the riparian areas by removing access by livestock and mandating a buffer width from active land use (including agricultural activities and development) to the top of the streambank. Working with local municipalities within the watershed, ordinances would be implanted and enforced to require a minimum buffer width from the top of the creek.

This alternative was dismissed as it does not meet the purpose of the project to address the active erosion occurring from the streambanks.

This alternative was not considered in combination with any other alternatives due to the Pennsylvania Right-to-Farm Act, Act of June 10, 1982 (P.L. 454, No. 133 as amended). In addition, Pennsylvania also has Agriculture, Communities and Rural Environment (ACRE) Act 38 of 2005. ACRE prevents the development of local regulations that are more stringent than state law. To enact a local buffer requirement would require enacting a state-wide buffer requirement.

4.3.5 Screening of Preliminary Alternatives

Table 4.4 outlines the screening of the alternatives to determine which moved on for detailed study.

TABLE 4.4
SUMMARY OF ALTERNATIVES PRELIMINARY SCREENING EVALUATION FOR THE CHIQUES CREEK WATERSHED PROJECT

Plan Description	Alternatives					
	No Action	Legacy Sediment Treatment Program with Selected Core Conservation Practices (Alternative 1)	Targeted Treatment Sites	Full Conservation Practice Alternative	Singular Practice Alternative(s)	Land Use Restrictions
NEPA Purpose and Need: Watershed Protection	No, existing watershed projects funded by other State and local organizations would continue, but overall degradation of the watershed is likely to continue and exceed non-Federal funding capacities.	Yes, installing land treatment projects to reduce legacy sediment erosion and transport in the watershed.	Yes, installing land treatment projects to reduce legacy sediment erosion and transport in the watershed.	Yes, installing land treatment projects to reduce legacy sediment erosion and transport in the watershed.	Yes, installing land treatment projects to reduce legacy sediment erosion and transport in the watershed.	No. Does not meet purpose of addressing water quality concerns associated with the nutrient-laden legacy sediment loads.
Contribution to Planning Objectives						
Reduce the sediment load from streambank erosion in the Chiques Creek watershed.	Sediment load in the watershed likely remains constant or increases without intervention. Does not meet objective.	Land treatment projects would reduce erosion and transport of legacy sediment in the watershed. Estimates indicate that the sediment load could be reduced by at least 1,025 tons of sediment annually.	Two land treatment projects would reduce erosion and transport of legacy sediment in the watershed. Estimates indicate that the sediment load could be reduced by at about 1,370 tons of sediment annually.	Erosion and transport of legacy sediment in the watershed would be reduced, but not to the extent of a project solely funding treatment systems within the riparian corridor.	Erosion and transport of legacy sediment in the watershed would be reduced, but not to the extent of offering multiple treatment systems as sites are limited to that treatment only.	Does not meet objective as land use restrictions address the uplands, not the actual streambanks. Erosion will continue from the streambanks.
Improve existing habitat and create habitat.	Does not meet objective.	Meets objective by including the creation and development of high-quality riparian habitat in land treatment projects.	Meets objective by including the creation and development of high-quality riparian habitat in land treatment projects.	Meets objective by including the creation and development of high-quality riparian habitat in land treatment projects but may be limited due to broader focus outside of riparian corridor.	Will not create habitat by only installing structural CPS 580. Will meet habitat objectives by installation of CPS 390, 391, 396, or vegetative 580.	Meets objective by providing buffer areas and riparian habitat.
Improve existing wetlands and create wetlands.	Does not meet objective.	Meets objective by protecting high-quality wetlands, reintroducing native species to existing wetlands, and reconnecting the stream channel with the floodplain, allowing new wetlands to develop.	Meets objective by specifically targeting treatment sites with potential for wetland restoration and/or creation.	Meets objective by including the restoration or creation of high-quality riparian habitat in land treatment projects but may be limited due to broader focus outside of riparian corridor.	Will not meet wetland objective by only installing CPS 580, 390, or 391. Will meet wetland objectives by installation of CPS 396.	Will not meet wetland objective unless a wetland is already existing within the buffer area.
Reduce invasive species and reintroduce native species.	Does not meet objective.	Invasive species removed for land treatment projects will be replaced with native species. Meets objective.	Invasive species removed for land treatment projects will be replaced with native species. Meets objective.	Invasive species removed for land treatment projects will be replaced with native species. Meets objective.	Invasive species removed for land treatment projects will be replaced with native species. Meets objective.	May or may not meet objective for invasive species depending on land treatment of buffer area.
Reduce localized flooding.	Does not meet objective.	Meets the objective by reconnecting the stream channel with the historic floodplain, which is likely to increase floodplain capacity and reduce local flooding.	Meets the objective by reconnecting the stream channel with the historic floodplain, which is likely to increase floodplain capacity and reduce local flooding.	May meet the objective depending on the practices chosen for the site, but will be limited as funding could also be used for upland practices to treat erosion.	Meets objective legacy sediment is removed to reconnect the stream channel with historic floodplain. CPS 390, 391, and 580 will not meet this objective.	Does not meet objective.
Reduce the land lost to streambank erosion.	Does not meet objective. Streams continue to erode vertical banks and reduce the land area.	Meets the objective by installing a land treatment project to reduce streambank erosion and land loss.	Meets the objective by stabilizing the most critically eroding sites within the watershed.	Meets objective, but is limited as funding could also be used for upland practices to treat erosion.	Meets objective for the sites applicable to the core practice.	Does not meet objective as does not address erosion causing the loss of streambank.

Plan Description	Alternatives					
	No Action	Legacy Sediment Treatment Program with Selected Core Conservation Practices (Alternative 1)	Targeted Treatment Sites	Full Conservation Practice Alternative	Singular Practice Alternative(s)	Land Use Restrictions
Response to Planning Constraints						
Private and non-Federal public landowners in the planning area would have to apply for a project. The number of applicants is unknown.	Avoids constraint; no applicants are required.	Would address constraint through outreach, advertisement, and coordination with landowners.	The program may need to be non-voluntary with the sponsors acquiring the land using eminent domain.	Would address constraint through outreach, advertisement, and coordination with landowners.	Would address constraint through outreach, advertisement, and coordination with landowners.	Avoids constraint; no applicants are required.
Project designs will require landowner approval, so a compromise or alternative design may be required to accommodate landowner preferences.	Avoids constraint.	If a feasible and beneficial project can be constructed and include these preferences, would address constraint by accommodating landowner preferences.	If a feasible and beneficial project can be constructed and include these preferences, would address constraint by accommodating landowner preferences.	If a feasible and beneficial project can be constructed and include these preferences, would address constraint by accommodating landowner preferences.	If a feasible and beneficial project can be constructed and include these preferences, would address constraint by accommodating landowner preferences.	Avoids constraint; no designs are required.
Landowners will be responsible for long-term O&M for the project life.	Avoids constraint.	O&M responsibilities would likely limit the number of landowners applying for a project.	O&M responsibilities would likely limit the number of landowners applying for a project.	O&M responsibilities would likely limit the number of landowners applying for a project.	O&M responsibilities would likely limit the number of landowners applying for a project.	O&M responsibilities would be required as per local regulations.
Temporary land easements may be required to facilitate construction and construction staging.	Avoids constraint.	The SLO would coordinate, acquire, and fund any temporary easements.	The SLO would coordinate, acquire, and fund any temporary easements.	The SLO would coordinate, acquire, and fund any temporary easements.	The SLO would coordinate, acquire, and fund any temporary easements.	Avoids constraint; no easements are required.
The landowner and SLOs are responsible for securing non-Federal funding for up to 25 percent of a project's total construction cost.	Avoids constraint.	The SLOs would be required to identify funding sources for the construction cost share.	The SLOs would be required to identify funding sources for the construction cost share.	The SLOs would be required to identify funding sources for the construction cost share.	The SLOs would be required to identify funding sources for the construction cost share.	Avoids constraint.
Land treatment projects in this program are unlikely to qualify for MS-4 credits.	Avoids constraint.	The SLOs would be required to identify other funding sources for the construction cost share.	The SLOs would be required to identify other funding sources for the construction cost share.	The SLOs would be required to identify other funding sources for the construction cost share.	The SLOs would be required to identify other funding sources for the construction cost share.	Avoids constraint.
Response to Evaluation Criteria						
Acceptability – The viability and appropriateness of an alternative from the perspective of the general public and consistency with existing Federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency.	Acceptable to the public; public is likely to consider this a viable alternative that is consistent with existing Federal laws, authorities, and public policies.	More acceptable to the public; initial public outreach indicates a preference for action to address the problem, although additional public outreach is expected to be required during construction. Public sentiment may shift as additional members of the public become aware of project activities.	Not acceptable to the public as the sites may need land acquisition via eminent domain. It may be viewed as forcing a project on a landowner.	Acceptable to the public; initial public outreach indicates a preference for action to address the problem.	Installation of some systems (CPS 580) may be less acceptable to the public due to the hard armoring of streambanks. Other systems are more acceptable to the public.	Not acceptable to the public and the agricultural community as this mandates land usage on private properties.
Completeness – The extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned	This alternative is complete; the effects of the No Action alternative are consistent with the lack of expenditures identified in the No Action alternative.	Largely complete as more work can be done to reduce sediment loads in stream. However, more work could be completed based on landowner willingness and additional funding.	More complete as two of the highest eroding sites will be stabilized. However, more work could be completed based on landowner	Largely complete as sedimentation can be reduced from both riparian areas as well as farm fields. However, more work could be completed based on	Less complete as more potential sites will be passed over as only one treatment system is available to address legacy sediment. Not all	Not complete as no work will be done within the stream corridor for the funds expended.

Plan Description	Alternatives					
	No Action	Legacy Sediment Treatment Program with Selected Core Conservation Practices (Alternative 1)	Targeted Treatment Sites	Full Conservation Practice Alternative	Singular Practice Alternative(s)	Land Use Restrictions
effects, including any necessary actions by others.			willingness and additional funding.	landowner willingness and additional funding.	treatments are applicable at all legacy sediment sites.	
Efficiency – The extent to which an alternative alleviates the specified problems and realizes the specified opportunities at least cost.	Not efficient despite no Federal cost because the problems are not alleviated.	Addresses the problems and constraints with a Federal investment. The Federal investment is beneficial with an estimated benefit-cost ratio of 1.40.	Addresses the problems and constraints with a Federal investment with an estimated benefit-cost ratio of 1.70.	Does not efficiently address the problems and constraints as broader scope allowing the installation of upland practices decreases the efficiency of the funding available for streambank treatment.	Does not address the problems and constraints efficiently as different sites will be ineligible for treatment depending on the selected treatment system. The estimated benefit-cost ratio varies between 1.32 and 1.76, depending on the system.	Not efficient because the problems are not alleviated.
Effectiveness – The extent to which an alternative alleviates the specified problems and achieves the specified opportunities	Not effective as does not address the problems, objectives, opportunities, and avoids constraints	Effective; addresses the problems, objectives, opportunities, and manages constraints.	Effective; addresses the problems, objectives, opportunities, and manages constraints.	Effective; addresses the problems, objectives, opportunities, and manages constraints.	Mostly effective; addresses the problems, objectives, opportunities, and manages constraints.	Not effective as does not address the problems, objectives, opportunities, and avoids constraints.
Carried Forward for Detailed analysis	**Yes**	**Yes**	**No**	**No**	**No**	**No**

4.4 Final Array of Alternatives

Table 4.5 compares the No Action Alternative (Future without Program) and Alternative 1, the Legacy Sediment Treatment Program Alternative (Future with Federal Investment).

TABLE 4.5
FINAL ARRAY OF ALTERNATIVES

ALTERNATIVE	RATIONALE OVERVIEW
No Action/FWOFI	Alternative required under NEPA and PR&G. Does not achieve the NEPA Purpose and Need. Not effective or efficient. Sediment load in the watershed likely remains constant or increases without intervention. Streams continue to erode vertical banks and reduce the land area.
Legacy Sediment Treatment Program with Selected Core Conservation Practices (Future with Federal Investment) (Alternative 1)	Achieves the NEPA Purpose and Need. Most efficient and effective to minimize damage. Reduces erosion and transport of legacy sediment in the watershed by at least 1,025 tons of sediment annually. Protects and creates high-quality wetlands, reintroducing native species to existing wetlands, and reconnecting the stream channel with the floodplain. Reduces localized flooding by increasing the floodplain capacity and reconnecting the channel with the historic floodplain. Avoids potential socioeconomic impacts and protects downstream communities and properties. Core Conservation Practices are Aquatic Organism Passage (CPS 396), Channel Bed Stabilization (CPS 584), Riparian Forest Buffer (CPS 391) Riparian Herbaceous Cover (CPS 390), and Streambank and Shoreline Protection (CPS 580).

SECTION 5 – ENVIRONMENTAL CONSEQUENCES

The following section discusses the impacts to resources of concern associated with the No Action Alternative and Alternative 1 – Legacy Sediment Treatment Program. Costs and benefits of the No Action Alternative and Alternative 1 were also assessed and are summarized in this section.

5.1 Summary and Comparison of Alternatives – Planning Process

The No Action Alternative and Alternative 1 were compared to determine the preferred alternative that maximizes net benefits and meets the guiding principles. Table 5.1 provides a summary of the comparison between the No Action Alternative and Alternative 1.

TABLE 5.1
SUMMARY AND COMPARISON OF ALTERNATIVES – PLANNING PROCESS (CHIQUES CREEK WATERSHED PROJECT)

Item or Concern	No Action	Alternative 1
Alternative Major Features / Measures by Authorized Purpose		
Authorized Purpose: Watershed Protection	Assumes that existing watershed projects funded by other State and local organizations would continue, but overall degradation of the watershed is likely to continue and exceed non-Federal funding capacities.	Designs and installs land treatment projects with systems to reduce legacy sediment erosion and transport in the watershed.
Legacy Sediment Stabilization (CPS 580 Streambank and Shoreline Protection)	N/A	Stabilizes streambanks using hard armoring, possibly in combination with natural plantings, to reduce sediment transport in the watershed.
Riparian Buffers (CPS 390 Riparian Herbaceous Buffers, CPS 391 Riparian Forested Buffers)	N/A	Stabilizes streambanks using natural plantings to reduce sediment transport in the watershed.
Legacy Sediment Removal & Site Restoration (CPS 396 Aquatic Organism Passage, CPS 584 Channel Bed Stabilization)	N/A	Remove legacy sediment terraces that impede natural stream flow and contribute to sediment transport in the watershed. Will increase floodplain runoff storage capacity.
Mill Dam Removal (CPS 500 Obstruction Removal)	N/A	Removes existing mill dams, restoring original stream low. Used in combination with another treatment measure to stabilize streambanks or remove legacy sediment terraces and reduce sediment transport in the watershed.

Item or Concern	No Action	Alternative 1
Contribution to Planning Objectives		
Reduce the sediment load in the Chiques Creek watershed.	Sediment load in the watershed likely remains constant or increases without intervention. Does not meet objective.	Treatment methods using CPS 396, CPS 584, CPS, 391, CPS 390, and CPS 580 will reduce erosion and transport of legacy sediment in the watershed. Estimates indicate that the sediment load could be reduced by at least 1,025 tons of sediment annually. Meets objective.
Improve existing habitat and create habitat.	Existing habitats will persist in their current condition. Continued erosion and sedimentation may degrade aquatic and riparian habitats. New habitats will not be created. Does not meet objective.	CPS 396 will improve aquatic habitat by removing legacy sediment terraces. CPS 584 and CPS 580 will reduce the transport of sediments in the watershed, resulting in improved water quality and aquatic habitats. CPS 391 and CPS 390 will improve habitat in riparian areas by increasing the extent and quality of vegetation. Meets objective.
Improve existing wetlands and create wetlands.	Existing wetlands will persist in their current condition and may be impacted by the presence of legacy sediment terraces and invasive species. New wetlands will not be created. Does not meet objective.	Removal of legacy sediment terraces through implementation of CPS 396 will reconnect stream corridors to their historic floodplains, allowing for the improvement or creation of wetlands. CPS 391 and CPS 390 will improve wetland areas by increasing the extent and quality of vegetation. Meets objective.
Reduce invasive species and reintroduce native species.	Invasive species are likely to increase in extent throughout the watershed. Does not meet objective.	Invasive species will be removed through implementation of land treatment practices. CPS 391 and CPS 390 will reintroduce native plant species in riparian corridors. Meets objective.
Reduce localized flooding.	Legacy sediment terraces will continue to alter stream flow, resulting in localized flooding. Does not meet objective.	CPS 396 will remove legacy sediment terraces and reconnect streams to their historic floodplains, resulting in increased channel capacity and reduced flood risks. CPS 584. CPS 391, CPS 390, and CPS 580 will stabilize stream beds and banks, which will reduce stream flow alteration occurring from sedimentation within channels.
Reduce the land lost to erosion.	Streams will continue to erode vertical banks and reduce the land area. Does not meet objective.	CPS 391, CPS 390, and CPS 580 will stabilize streambanks and prevent further erosion of land.

Item or Concern	No Action	Alternative 1
Response to Planning Constraints		
Private and non-Federal public landowners in the planning area would have to apply for a project. The number of applicants is unknown.	Avoids constraint; no applicants are required.	Would address constraint through outreach, advertisement, and coordination with landowners.
Project designs will require landowner approval, so a compromise or alternative design may be required to accommodate landowner preferences.	Avoids constraint.	If a feasible and beneficial project can be constructed and include these preferences, it would address constraint by accommodating landowner preferences.
Landowners will be responsible for long-term O&M for the project life.	Avoids constraint.	O&M responsibilities would likely limit the number of landowners applying for a project.
Temporary land easements may be required to facilitate construction and construction staging.	Avoids constraint.	The SLO would coordinate, acquire, and fund any temporary easements.
Landowners and SLOs are responsible for securing non-Federal funding for up to 25-percent of a project's total construction cost.	Avoids constraint.	The SLOs would be required to identify funding sources for the construction cost share.
Land treatment projects in this program are unlikely to qualify for MS-4 credits.	Avoids constraint.	The SLOs would be required to identify other funding sources for the construction cost share.
Response to Evaluation Criteria		
Acceptability+	Less acceptable to the public; the public prefers action to address the problem.	More acceptable to the public. The public recognizes the problem and prefers action to address the problem. However, public perception may be negative during construction, as project activities may not be fully understood by the general public. Sufficient public outreach and education can improve acceptability to the public.
Completeness	Mostly incomplete as there is public and private funding currently available in the watershed for this type of work.	Largely complete as more work can be done to reduce sediment loads in the stream. However, more work could be completed based on landowner willingness and additional funding.
Efficiency	Not efficient	Addresses the problems and constraints with a Federal investment. The Federal investment is beneficial with an estimated benefit-cost ratio of 1.40.
Effectiveness	Not effective as does not address the problems, objectives, opportunities, and avoids constraints	Effective; addresses the problems, objectives, opportunities, and manages constraints.

5.2 Summary and Comparison of Alternatives – Ecosystem Services

The No Action Alternative and Alternative 1 were compared based on their impacts to ecosystem services. Water quality impairments resulting from erosion of legacy sediment terraces can adversely impact provisioning, supporting, regulating, and cultural ecosystem services within and downstream of the watershed. Figure 5.1 shows the connection between water quality parameters and their potential to impact the value of ecosystem services.

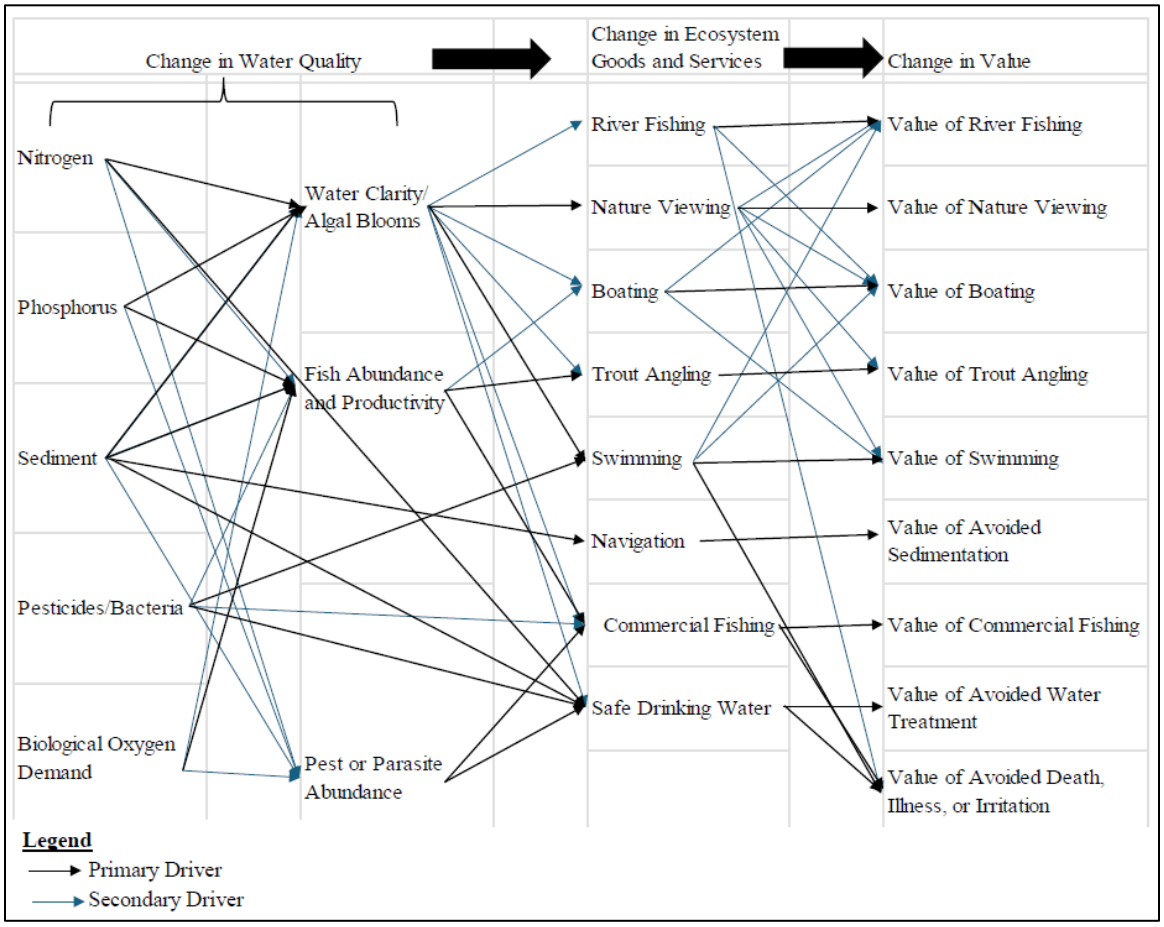

Figure 5.1 Chiques Creek Watershed Ecosystem Services Diagram

Ecosystem services impacted by the alternatives considered in this plan are summarized below in Table 5.2. The water quality improvements provided by implementation of the Legacy Sediment Treatment Program primarily focus on changes in nitrogen, phosphorus, and sediment concentrations. Where possible, the value of ecosystem services impacted were monetized. A detailed description of the methodology and assumptions used for calculating costs and benefits is provided in Appendix D.

TABLE 5.2
SUMMARY AND COMPARISON OF ALTERNATIVES – ECOSYSTEM AND TRADEOFF ANALYSIS (CHIQUES CREEK WATERSHED PROJECT)

Criterion	No Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Alternative Identification		
Locally Preferred	-	X
Non-Structural	-	X
Environmentally Preferred	-	X
Maximum Net Monetized Benefits Plan	-	X
Socially Preferred	-	X
Preferred Alternative (Maximum Net public benefits identified through tradeoff analysis)	-	X
Guiding Principles		
Healthy and Resilient Ecosystems	Does not address the guiding principle. Ecosystems impacted by legacy sediment will not be protected or restored.	Addresses the guiding principle. Riparian and aquatic ecosystems will be restored through the implementation of land treatment practices to address legacy sediment.
Sustainable Economic Development	Does not address the guiding principle. Legacy sediment can have long-term adverse impacts on economic development by contributing to water quality degradation.	Addresses the guiding principle. The Legacy Sediment Treatment Program will promote water quality improvements within and downstream of the watershed.
Floodplains	Does not address the guiding principle. Legacy sediment terraces reduce floodplain functions by disconnecting streams from their historic floodplains, altering stream flow, and decreasing channel capacity.	Addresses the guiding principle. The Legacy Sediment Treatment Program can enhance floodplain functions by reconnecting stream corridors to their historic floodplains, revegetating floodplains, and limiting agricultural encroachments.
Public Safety	Does not address the guiding principle. Legacy sediment terraces contribute nutrient-laden sediment to surface waters, resulting in degraded water quality within and downstream of the watershed. Legacy sediment terraces also alter stream flow and reduce channel capacity, which increases flood risks.	Addresses the guiding principle. Land treatment practices to address legacy sediment will protect water quality by reducing the transport of nutrient-laden sediment to the stream corridor. Reconnecting streams to their historic floodplains can reduce flood risks.
Watershed Approach	Does not address the guiding principle. Legacy sediment terraces adversely impact water quality in receiving waters downstream.	Addresses the guiding principle. The Legacy Sediment Treatment Program will provide water quality benefits to receiving waters downstream.
Ecosystem Services Effects		
Provisioning Services – Tangible good provided for direct human use (e.g., timber, food, fiber, and water).		
Commercial Fishing (non-monetized)(1) Representative Metric: Nutrient and sediment load reductions to the Chesapeake Bay.	Water quality impairments within the Chesapeake Bay will continue to degrade aquatic habitat for commercially fished species such as striped bass, blue crab, and eastern oysters.	Reductions in sediment and nutrients transported to the Chesapeake Bay will improve aquatic habitat for commercially fished species. The Legacy Sediment Treatment Program is expected to reduce sediment and nutrient loadings by approximately 1,538,000 lbs./yr of sediment, 4,000 lbs./yr of nitrogen, and 1,100 lbs./yr of phosphorus.
Drinking Water (non-monetized) Representative Metric: Nutrient and sediment load reductions to the Susquehanna River.	Sediment and nutrient loadings from the Chiques Creek watershed contribute to water quality impairments that may adversely impact drinking water treatment facilities with intakes on the Susquehanna River.	Reductions in sediment and nutrients transported to the Susquehanna River will improve source water quality for drinking water treatment facilities. The Legacy Sediment Treatment Program is expected to reduce sediment and nutrient loadings by approximately 1,538,000 lbs./yr of sediment, 4,000 lbs./yr of nitrogen, and 1,100 lbs./yr of phosphorus.
Navigation (non-monetized) Representative Metric: Sediment load reductions to the Susquehanna River and Chesapeake Bay.	Sediment accumulation in the Susquehanna River and Chesapeake Bay can adversely impact navigation by reducing water depths.	Reductions in sediment transported to the Susquehanna River and Chesapeake Bay will reduce the rate at which the reservoir storage capacity is filled. The Legacy Sediment Treatment Program is expected to reduce sediment loadings by approximately 1,538,000 lbs./yr.
Regulating Services – Services which maintain the world we live in (e.g., flood control, protecting infrastructure, crop pollination).		
Direct Flood Risk Management (non-monetized) Representative Metric: Linear feet of stream with improved floodplains	Stream corridors are currently disconnected from their historic floodplains due to the presence of legacy sediment terraces.	Floodplain improvements may occur on at least 21,878 linear feet of stream within the watershed.
Water Filtration (non-monetized) Representative Metric: Volume of sediment removed from stream corridors.	Legacy sediment terraces in the watershed cause stream corridors to be perched above their historic floodplains, disconnecting them from groundwater flows and limiting water filtration.	Removing legacy sediment terraces will reconnect stream corridors to their historic floodplains and groundwater flows, allowing for improved filtration of water. Approximately 29,000 cubic yards of legacy sediment may be removed from or stabilized in the riparian corridors within the watershed. Installation of riparian buffers can also enhance water filtration.
Cultural Services – Services which make the world a place people want to live (e.g., recreation, spiritual, habitat, aesthetics).		
Recreational Use (non-monetized)[1]	Sediment and nutrient loadings from the Chiques Creek watershed contribute to water quality impairments that adversely impact recreational activities such as fishing and swimming.	Reductions in nutrient and sediment loadings to the Chesapeake Bay watershed will improve water quality, allowing for continued recreational use of waterbodies. The Legacy Sediment Treatment

Criterion	No Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Representative Metric: Nutrient and sediment load reductions to surface waters in the Chesapeake Bay watershed.		Program is expected to reduce sediment and nutrient loadings by approximately 1,538,000 lbs./yr of sediment, 4,000 lbs./yr of nitrogen, and 1,100 lbs./yr of phosphorus.
Aesthetic Viewsheds (non-monetized)[1] Representative Metric: Nutrient and sediment load reductions to the Chesapeake Bay.	Sediment and nutrient loadings to the Chesapeake Bay contribute to eutrophication and poor water clarity, adversely impacting the aesthetic viewshed.	Reductions of nutrient and sediment loadings to the Chesapeake Bay will reduce water quality impairments impacting the aesthetic viewshed. The Legacy Sediment Treatment Program is expected to reduce sediment and nutrient loadings by approximately 1,538,000 lbs./yr of sediment, 4,000 lbs./yr of nitrogen, and 1,100 lbs./yr of phosphorus.
Supporting Services – Services which refer to the underlying processes maintaining conditions for life on Earth (e.g., nutrient cycling, soil formation, and primary production).		
Nutrient Cycling (monetized) Representative Metric: Pounds of nitrogen and phosphorous transported to surface waters	Continued erosion will result in approximately 4,000 lbs. of nitrogen and 1,100 lbs. of phosphorus transported to surface waters each year.	Land treatment practices will prevent 4,000 lbs./yr of nitrogen and 1,100 lbs./yr of phosphorus transported to surface waters, resulting in an average annual reduction benefit of $148,000 for nitrogen and $486,000 for phosphorus.
Soil Formation (monetized) Representative Metric: Pounds of sediment transported to surface waters	Continued erosion will result in approximately 1,538,000 lbs. of sediment transported to surface waters each year.	Land treatment practices will prevent 1,538,000 lbs./yr of sediment transported to surface waters, resulting in a reduction benefit of $570,000 per year.
Primary Production (monetized) Representative Metric: Acres of land lost from erosion	Continued erosion will result in a loss of approximately 0.1 ac of land per year.	Land treatment practices will prevent the loss of 0.1 acres of land per year, resulting in an average annualized reduction benefit of $2,500 per year.
Economic Analysis		
Costs		
Total Project Investment	$0	$24,846,000
Annual Project Investment	$0	$1,252,000
Annual OM and Rehabilitation Costs[(2)]	$0	$15,300
Total Annual Project Costs	$0	$1,267,300
Total Costs	$0	$24,846,000
Monetized Benefits for Ecosystem Services		
Provisioning	$0	Not monetized for this plan
Regulating	$0	Not monetized for this plan
Cultural	$0	Not monetized for this plan
Supporting	$0	$34,802,000
Total Benefits	$0	$34,802,000
Total Annual Monetized Benefits	$0	$1,776,000
Total Annual Monetized Costs	$0	$1,252,000
Annual Benefit-Cost Ratio	-	1.40
Annual Monetized Net Benefit	$0	$508,700
Regional Economic Development/Economic Impact Assessment		
Regional Employment[(3)]	-	20 Jobs Annual 200 Jobs Total
Regional Income[(4)]	-	$3,936,284 Annual $39,362,848 Total
Regional Impacts (Other)	-	N/A
Period of amortization: 30 years **Rate:** 3.0%	**Prepared July 2025**	

Notes:
1. Monetary benefits are included in the benefits calculated for nutrient and sediment load reductions to the Chesapeake Bay.
2. O&M costs are assumed to be 0.5% of construction costs (FEMA, 2016b) for the first three years, then every five years for the life of the project.
3. Jobs created during land treatment practice installation, including indirect and direct full-time, part-time, seasonal, and temporary jobs.
4. Total direct and indirect economic output.

5.3 Effects of Individual Alternatives Relative to Resource Concerns

A summary of the impacts on resource concerns within the watershed occurring from the No Action Alternative and the different land treatment practices included in the Legacy Sediment Treatment Program (Alternative 1) are provided in the following subsection.

5.3.1 Soil Resources

No Action Alternative

Bank erosion will continue to exacerbate siltation throughout the watershed. Freeze-thaw conditions and storm events will intensify the erosion of legacy sediment, contributing to excess sediment and nutrients to the stream reach. Land will continue to be lost due to erosion at a rate of 0.1 acres per year.

Determination: The No Action Alternative will have direct long-term adverse impacts to soil resources in the watershed.

Alternative 1

Construction of Streambank and Shoreline Protection (CPS 580) projects may result in short-term adverse impacts to soil resources due to compaction by the construction equipment.

Installation of Riparian Forested Buffers (CPS 391), Riparian Herbaceous Cover (CPS 390) or Streambank and Shoreline Protection (CPS 580) will stabilize streambanks and prevent the loss of land due to streambank erosion.

Aquatic Organism Passage (CPS 396) and Channel Bed Stabilization (CPS 584) may be used to remove the legacy sediment terrace and stabilize a new low-flow stream channel. Removing the legacy sediment will result in the restoration of the historic floodplain soils. These practices and Streambank and Shoreline Protection (CPS 580) will result in preventing the transport of nutrient-laden sediments downstream in the short- and long-term.

A legacy sediment treatment program can reduce the land lost due to erosion by 0.1 acres per year.

Determination: While there may be minor short-term adverse effects to soil resources due to construction, Alternative 1 would have a major positive direct effect on soil resources in the long-term.

5.3.2 Prime and Unique Farmland, and Farmland of Statewide or Local Importance

No Action Alternative

Soils within the stream corridor designated as Prime Farmland and Farmland of Statewide importance will continue to erode due to excessive bank erosion. Over time, excessive erosion may result in the loss of agricultural land adjacent to the stream corridor.

Determination: The No Action Alternative will have direct long-term adverse impacts to Prime and Unique Farmland and Farmland of Statewide or local Importance in the watershed.

Alternative 1

Installation of Riparian Forested Buffers (CPS 391), Riparian Herbaceous Cover (CPS 390), or Streambank and Shoreline Protection (CPS 580) will stabilize streambanks and limit the loss of Prime and Unique Farmlands adjacent to the stream corridor.

Aquatic Organism Passage (CPS 396) may be used to remove the legacy sediment terrace, which may result in a reduction in floodwater velocity facing adjacent farmlands. Aquatic Organism Passage (CPS 396) and Channel Bed Stabilization (CPS 584) may be used to remove the legacy sediment terrace and stabilize a new low-flow stream channel. Removing the legacy sediment will result in the restoration of the historic floodplain soils. These practices and Streambank and Shoreline Protection (CPS 580) will result in preventing the transport of nutrient-laden sediments downstream in the short- and long-term.

Determination: Alternative 1 would have long-term, indirect beneficial effects on Prime Farmland and Farmland of Statewide importance by reducing erosion of farmland soils and reducing flood risks for farmland adjacent to streams. Long-term, direct adverse effects to Prime Farmland and Farmland of Statewide Importance will occur for projects that convert agricultural land to natural floodplains.

5.3.3 Water Resources

No Action Alternative

Legacy sediment terraces will continue to impact streams by reducing channel capacity, altering stream flow, and degrading water quality.

Determination: The No Action Alternative will have direct long-term adverse impacts to water resources in the watershed.

Alternative 1

Remove existing mill dams using Obstruction Removal (CPS 500) across the stream to restore free-flowing conditions. Thermal impacts due to solar radiation of slow-moving water will decrease. Aquatic Organism Passage (CPS 396) may be used in combination with Channel Bed Stabilization (CPS 584) and CPS 500 or as a stand-alone practice, to remove the legacy sediment terrace. This may result in restoring the native floodplain, uncovering historic cold-water springs and seeps, and decreased downstream flooding.

Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) will stabilize the streambank, shade streams reducing water temperatures, filter nutrients, and increase groundwater storage throughout the watershed.

Streambank and Shoreline Protection (CPS 580) will minimize the amount of bank erosion leading to an increase in water quality through decreased nutrients and sedimentation throughout the stream. These practices may decrease the sedimentation and nutrient concentrations enough to all the streams to meet their designated use status.

Adverse effects of sediment loss during construction would be minimized and mitigated by implementing the appropriate best management practices.

Determination: While Alternative 1 may have short-term minor adverse effects during construction, it would have a major direct, beneficial long-term effect on water resources.

5.3.4 Water Quality

No Action Alternative

Unrestrained bank erosion will continue to result in the transport of nutrients and sediment to surface waters, further degrading water quality within and downstream of the

watershed. The Chiques Creek watershed is estimated to contribute 70 million lbs./yr of nutrient-laden sediment into the Chesapeake Bay.

Determination: The No Action Alternative will have long-term direct adverse impacts on water quality in the watershed.

Alternative 1

Removing existing mill dams using Obstruction Removal (CPS 500) will prevent mass erosion of the submerged sediment and legacy sediment terraces if the dams were to fail on their own.

Full implementation of Alternative 1 will reduce the annual load of nutrient-laden legacy sediment within the surface waters by at least 1,025 tons/year.

Implementation of Aquatic Organism Passage (CPS 396) and Channel Bed Stabilization (CPS 584) with or without Obstruction Removal (CPS 500) will remove the terraces formed by sediment accumulation behind historic mill dams and allow the natural movement of aquatic organisms upstream. These practices will reduce the buildup of nutrient-laden sediment within the water column and promote ecological diversity throughout the stream, leading to an increase in water quality. The one-time sediment removal benefit is estimated to be at least 26,240 tons (29,111 cubic yards). Removing the legacy sediment terraces may expose historic cold-water springs. This surfacing of groundwater can decrease the temperature of streams (USGS, 2014). Construction of this practice may result in a short-term release of sediment to surface waters which will be mitigated by implementation of best management practices.

Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) can absorb excess nutrients from farm and livestock operations. Installation of riparian forest buffer and herbaceous cover will increase the ability of the riparian corridor to naturally filter surface water.

Streambank and Shoreline Protection (CPS 580) will secure the sediment such that it will not contribute to bank erosion or the degradation of water quality.

Determination: Alternative 1 may have short-term, adverse impacts to water quality during construction; however, this will be mitigated using best management practices for erosion and sedimentation control. Overall, Alternative 1 would have long-term direct, beneficial effects on water quality within and downstream of the watershed.

5.3.5 Floodplain Management

No Action Alternative

Legacy sediment will remain present in the floodplain and continue to alter stream flow which may lead to localized flooding. Existing floodplain management provisions will continue to regulate development within the floodplain. Agricultural uses within floodplains may increase in extent and/or intensity.

Determination: The No Action Alternative will have long-term, direct adverse impacts to floodplain management.

Alternative 1

Implementation of Obstruction Removal (CPS 500) can restore free-flowing streams by removing mill dams. Aquatic Organism Passage (CPS 396) may be used in combination, or as a stand-alone practice, to remove the legacy sediment terrace which can result in restoring and reconnecting the stream to the native floodplain. Restoration of the historic floodplains can decrease downstream flooding.

Installation of Riparian Forested Buffers (CPS 391), Riparian Herbaceous Cover (CPS 390), and Streambank and Shoreline Protection (CPS 580) will hold sediment in-place and reduce the loss of land due to erosion, protecting the existing floodplains and leading to a lower risk of flooding in adjacent agricultural lands and communities.

While Alternative 1 will improve the quality of floodplains, there will be no change to existing floodplain management provisions. Landowners enrolled in the program would voluntarily limit incompatible development, such as agricultural uses, within the floodplain on their property.

Determination: Alternative 1 would have minor, short-term, direct beneficial effects on floodplain management.

5.3.6 Waters of the U.S., Wetlands, & Special Aquatic Sites

No Action Alternative

Waters of the U.S. and wetlands will continue to be impacted by the presence of legacy sediment terraces by having streams disconnected from their historic floodplain, altering stream flows, and reducing channel capacity.

Determination: The No Action Alternative will have long-term, direct adverse effects on Waters of the U.S. and wetlands.

Alternative 1

Implementation of Obstruction Removal (CPS 500) can remove mill dams which accumulate sediment and lead to the formation of legacy sediment terraces. Construction of this practice may result in a short-term release of sediment to surface waters which will be mitigated by implementation of best management practices.

Aquatic Organism Passage (CPS 396) can be used to remove the legacy sediment, adversely impacting existing wetlands. However, the sediment removal can lead to the reconnecting of streams to their historic floodplain and exposures of historic higher-quality floodplain wetlands.

Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) can assist in stabilizing the streambank, filtering pollutants, and enhancing existing lower-quality wetlands.

Streambank and Shoreline Protection (CPS 580) will decrease the amount of legacy sediment present throughout the stream due to erosion, enhancing water quality.

Determination: Alternative 1 would have major long-term, direct beneficial effects by reducing erosion and sedimentation, reconnecting streams and wetlands to historic floodplains, and improving aquatic organism passage. Wetlands may experience short-term, adverse impacts through the removal of legacy sediment terraces, but the long-term improvements are expected to outweigh these adverse effects.

5.3.7 Regional Water Resource Plans

No Action Alternative

The goals presented in the Chesapeake Bay TMDL, PADEP WRAS, SRBC Watershed Alternative Restoration Plan, and Little Chiques Creek Watershed Rivers Conservation Plan are unlikely to be achieved.

Determination: The No Action Alternative will have long-term adverse impacts on regional water resource plans.

Alternative 1

Installation of Aquatic Organism Passage (CPS 396) and Channel Bed Stabilization (CPS 584) will reduce the risk of flooding by restoring natural stream and floodplain connectivity. CPS 396 removes or modifies in-stream barriers that confine high flows, allowing water to spread into adjacent low-lying areas. CPS 584 stabilizes the channel bed and banks, reducing erosion that disconnects the stream from the floodplain. These practices increase the effective floodplain width, slow channel flow, and lower peak flooding, aligning with the goals presented in the Chesapeake Bay TMDL, SRBC Watershed Alternative Restoration Plan, and Little Chiques Creek Watershed Rivers Conservation Plan..

Streambank and Shoreline Protection (CPS 580), Riparian Forested Buffers (CPS 391), and Riparian Herbaceous Cover (CPS 390) can reduce bank erosion and the amount of sediment throughout the stream, leading to improvements in water quality in support of the regional water resource plans.

Determination: Alternative 1 would have a minor, direct, beneficial effect on regional water resource plans by reducing the annual load of nutrient-laden legacy sediment delivered by Chiques Creek into Chesapeake Bay by approximately 2.2%, improving the quality of streams, and reducing flood risks. These improvements meet the goals presented in the Chesapeake Bay TMDL, PADEP WRAS, SRBC Watershed Alternative Restoration Plan, USACE Comprehensive Water Resources and Restoration Plan, and Little Chiques Creek Watershed Rivers Conservation Plan.

5.3.8 Air Quality

No Action Alternative

Impacts to air quality are not expected. Lancaster County is likely to remain in attainment status for particulate matter and in nonattainment status for 8-hour (2008) ozone.

Determination: The No Action Alternative will have no impact on air quality.

Alternative 1

Implementation of the core conservation practices may have short-term localized adverse impacts to air quality due to construction. Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) can have long-term benefits to air quality through the increase in carbon sequestration offered by enhancing plant communities within riparian areas.

Determination: Alternative 1 would have short-term adverse effects on air quality during construction, and long-term benefits associated with increased carbon sequestration.

5.3.9 Threatened and Endangered (T&E) Species

No Action Alternative

Legacy sediment terraces can adversely impact habitat for T&E species by disconnecting stream corridors from groundwater. This limits wetland habitat for eastern bog turtles and wetland plants.

Determination: The No Action Alternative will have long-term, adverse impacts to T&E species.

Alternative 1

Implementation of Obstruction Removal (CPS 500) can restore free-flowing streams by removing mill dams. Aquatic Organism Passage (CPS 396) may be used in combination with Channel Bed Stabilization (CPS 584), or as a stand-alone practice, to remove the legacy sediment terrace which can restore and reconnect the stream to the native floodplain. This also promotes habitat fitness for aquatic life through the reconnection of stream corridors to groundwater.

Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) will provide habitats to T&E species in riparian areas along the stream, promoting wildlife diversity throughout the watershed. Plantings can improve the quality of wetlands within the riparian corridor.

Streambank and Shoreline Protection (CPS 580) will secure the sediment and enhance the water quality of groundwater and surface water for aquatic organisms and wildlife throughout Chiques Creek

Construction activities on known sites of T&E species have potential to have an adverse effect on the species. Coordination with the proper agencies and best practices will be used to minimize potential adverse effects.

Determination: Alternative 1 would have long-term, beneficial effects on aquatic and terrestrial habitats for T&E species. Any short-term adverse effects will be minimized through agency coordination and the use of best management practices.

5.3.10 Migratory Birds

No Action Alternative

Impacts to migratory birds are not expected.

Determination: The No Action Alternative is not expected to have impacts on migratory birds.

Alternative 1

Implementation of Obstruction Removal (CPS 500) by removing mill dams will allow aquatic organisms to travel upstream, creating opportunities for new habitats that could potentially attract migratory birds to more portions of the stream.

Aquatic Organism Passage (CPS 396) may be used to remove legacy sediment and increase water quality, lowering the risk of adverse effects on migratory birds throughout the stream. Native floodplain wetland habitat can be restored.

Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) will benefit wildlife throughout the stream and riparian corridor through the removal of invasive species and introduction of native species, increasing the diversity of ecosystems and migratory bird habitat throughout the watershed.

There may be minimal short-term effects to habitat and respite for migratory birds due to construction of conservation practices.

Determination: Alternative 1 would have long-term, indirect beneficial effects on migratory birds, as the proposed conservation practices will improve habitat for migratory birds.

5.3.11 Bald and Golden Eagles

No Action Alternative

Water quality impairments could adversely impact fish populations within the watershed, which may limit food sources for bald eagles.

Determination: The No Action Alternative will have long-term, indirect adverse effects to bald and golden eagles.

Alternative 1

Implementation of Obstruction Removal (CPS 500) by removing mill dams will enhance the diversity of fish populations throughout the stream, as the removal of the dams will allow fish to travel upstream which will increase food sources for bald eagles.

Installation Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would increase habitats for bald eagles and their potential food sources throughout the riparian corridor. Trees planted as part of the forested buffer may become a nest tree for the bald eagle.

Streambank and Shoreline Protection (CPS 580) will stabilize streambanks and reduce erosion and water quality degradation such that the health and fitness of bald eagles and their food sources will not be at risk.

Determination: Alternative 1 would have beneficial long-term, indirect effects on bald eagles, as the proposed conservation practices will provide improved habitat and foraging opportunities.

5.3.12 Essential Fish Habitat

No Action Alternative

Sediments and nutrients transported to surface waters may adversely impact essential fish habitat downstream of the watershed.

Determination: The No Action Alternative will have long-term, direct adverse effects on essential fish habitats.

Alternative 1

Removal of mill dams using Obstruction Removal (CPS 500) will allow fish to travel upstream and enhance the diversity of aquatic ecosystems along the stream, benefiting the biodiversity of essential fish habitat downstream of the watershed.

The other conservation practices will stabilize and remove legacy sediment from the riparian corridor, preventing streambank erosion. This will prevent downstream transportation of nutrient-laden sediment and enhance water quality which benefits the essential fish habitat located downstream of the watershed.

Construction of these practices may result in a short-term release of sediment to surface waters which will be mitigated by implementation of best management practices.

Determination: Alternative 1 would have a minor, indirect beneficial effect on the essential fish habitat, as the proposed reduction of sediment transport and prevention of legacy sediment terrace formation may benefit aquatic life downstream of the watershed.

5.3.13 Ecologically Critical Areas

No Action Alternative

Natural Heritage Areas located within riparian areas of the watershed may be adversely impacted by the presence of eroding legacy sediment terraces. Threats to habitat include water quality impairments, streambank erosion, and the disconnection of groundwater flows to the stream corridor.

Determination: The No Action Alternative will have long-term, indirect adverse impacts on Natural Heritage Areas.

Alternative 1

Implementation of the various planned conservation practices will improve water quality by stabilizing or removing nutrient-laden legacy sediment. Removing legacy sediment can strengthen the connection of groundwater flows to stream corridors and benefit the Natural Heritage Areas. Floodplain and wetland habitat can be improved by removing invasive species and introducing native species to riparian areas.

Construction of these practices may result in a short-term release of sediment to surface waters which will be mitigated by implementation of best management practices. Coordination with the partnering agencies of the PNHP will be completed to develop appropriate designs and minimize adverse effects during construction.

Determination: Alternative 1 would have long-term, indirect beneficial effects due to the proposed restoration of riparian areas and wildlife habitats. Short-term, direct adverse effects may be experienced during construction.

5.3.14 Invasive Species

No Action Alternative

Invasive species within riparian corridors may spread to other areas of the watershed. Livestock access to riparian corridors may potentially introduce new invasive species through seed dispersal on their coats or in the manure.

Determination: The No Action Alternative will have long-term, indirect adverse effects on invasive species.

Alternative 1

Invasive species will be removed in areas where these conservation practices will be implemented. The disturbed sites will be planted with native species. If properly maintained, the native species should outcompete invasive species.

Determination: Alternative 1 would have long-term, direct beneficial effects as the removal of invasive species along the riparian corridor will limit the threat of spreading to other areas of the watershed.

5.3.15 Fish and Wildlife

No Action Alternative

Water quality impairments from excess sediments and nutrients will adversely impact aquatic wildlife.

Determination: The No Action Alternative will have long-term, indirect adverse effects on fish and wildlife.

Alternative 1

Removal of mill dams using Obstruction Removal (CPS 500) will allow the diverse stock of fish to migrate throughout Chiques Creek, increasing the number of aquatic habitats for feeding, breeding, and shelter and diversifying ecosystems throughout the stream. Removal of mill dams will also help with restoring fish passage for anadromous species, such as the American shad. However, fish passage to the Chiques Creek watershed will still be restricted by dams downstream on the Susquehanna River.

Aquatic Organism Passage (CPS 396) may be used in combination with Channel Bed Stabilization (CPS 584), or as a stand-alone practice, to remove the legacy sediment terrace which can restore and reconnect the stream to the native floodplain. Cold-water seeps and springs may be uncovered that may decrease the temperature of surface waters and improve the water quality for fish and aquatic wildlife within and downstream of the watershed. Channel Bed Stabilization (CPS 584) can also be used to enhance in-stream habitat.

Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) can filter and absorb excess nutrients from farm and livestock operations, preventing agricultural runoff and its pollutants from entering the stream and harming fish and aquatic life. These practices will also benefit wildlife throughout the stream and riparian corridor by removing invasive species, introducing native species, and providing habitats for a diversity of wildlife.

Construction of some of these practices may result in a short-term release of sediment to surface waters which will be mitigated by implementation of best management practices.

Determination: Alternative 1 would have long-term, direct beneficial effects by increasing habitats for aquatic life throughout the watershed, removing invasive species, and introducing native species throughout the riparian corridor. Short-term, adverse effects may be experienced during construction; however, best management practices will be used to mitigate any adverse impacts.

5.3.16 Riparian Areas

No Action Alternative

Legacy sediment will remain present in riparian areas. Erosion along the bank will continue or worsen, destabilizing the riparian areas and potentially leading to tree collapse. Continued streambank erosion puts the quality of riparian habitats at risk.

Determination: The No Action Alternative will have long-term, direct adverse effects to riparian areas.

Alternative 1

Implementation of Obstruction Removal (CPS 500) can restore free-flowing streams by removing mill dams. Aquatic Organism Passage (CPS 396) may be used in combination, or as a stand-alone practice, to remove the legacy sediment terrace which can result in restoring and reconnecting the stream to the native floodplain.

Streambank and Shoreline Protection (CPS 580) will utilize structural, bioengineered, and vegetative measures to hold sediment in-place and decrease streambank erosion, minimizing the risk of decreasing the quality of riparian habitats.

Native plantings used for Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would introduce woody and non-woody vegetation and native species along riparian corridors, stabilizing riparian areas and benefiting wildlife habitats. Buffers

would also prevent encroachment by agriculture in these areas. Exclusion fencing could be used with CPS 390 and CPS 391 to prevent livestock grazing of riparian areas.

Determination: Alternative 1 would have long-term, direct beneficial effects due to the proposed increase in vegetative cover throughout the riparian corridor and decreased erosion.

5.3.17 Forest Resources

No Action Alternative

Excessive streambank erosion could lead to tree collapse. Agricultural encroachments on riparian areas will continue to limit forest resources.

Determination: The No Action Alternative will have long-term, indirect adverse effects on forest resources.

Alternative 1

Implementing Riparian Forested Buffers (CPS 391) would introduce woody native vegetation, stabilizing riparian areas and benefiting wildlife habitats. Buffers would also prevent encroachment by agriculture in these areas. If used, CPS 391 will increase the footprint of forests within the riparian corridor. Agricultural encroachments on riparian areas may continue, but supporting conservation practices, such as installing a Fence (CPS 382), can be implemented to limit potential impacts.

Determination: Alternative 1 would have long-term, direct beneficial effects due to the proposed reduction of bank erosion and loss of land, as well as an increase in vegetative cover throughout the riparian corridor.

5.3.18 Cultural Resources and Tribal Consultation

No Action Alternative

No new ground disturbance or modification of historic properties would occur, resulting in no direct effects on cultural resources or tribal interests. However, existing conditions such as channel instability, erosion, and flooding would continue, which could indirectly contribute to the gradual degradation or loss of historic resources over time. During extreme flood events, historic mill dams and associated structures could be undercut or lost, releasing retained sediment downstream and substantially increasing channel

incision and the potential loss of historic properties. Cumulatively, the absence of watershed restoration could increase long-term risks to cultural resources.

Determination: The No Action Alternative will have minor, indirect, adverse effects on cultural resources.

Alternative 1

Implementation of Obstruction Removal (CPS 500) will remove historic mill dams which contribute to the accumulation of legacy sediment throughout the stream. Due to the age and historic use of the dam, it may be considered NRHP-eligible, and removal would be considered an adverse effect.

Aquatic Organism Passage (CPS 396) will remove deposited legacy sediment along the stream corridor. By restoring the native floodplain, this practice may reduce flooding to downstream cultural resources. Streambank and Shoreline Protection (CPS 580), Riparian Forested Buffers (CPS 391), and Riparian Herbaceous Cover (CPS 390) will be used to stabilize the streambank, decreasing the risk of erosion of historic sites and archaeological resources within the watershed. These practices do have the potential to adversely affect existing cultural resources, including the historic viewshed.

Ground disturbance required to implement land treatment practices could potentially impact cultural resources. As the area of potential effect is refined, consultation with the PASHPO and Tribes with ancestral land claims will be required. Consultation with the PASHPO and Federally recognized Tribes with ancestral land claims will be completed for each project site as per the terms of the Programmatic Agreement to avoid, minimize, and mitigate effects to cultural and tribal resources.

The Undertaking consists of corridors covering large land areas. NRCS cannot fully determine effects to historic properties prior to receiving applications that identify which producers/properties will participate so identification of historic properties has not been fully completed. Thus, NRCS is phasing identification and evaluation of historic properties and application of the criteria of adverse effect in accordance with 36 CFR 800.4(b)(2) and 36 CFR 800.5(a)(3), respectively by implementing a Programmatic Agreement.

Determination: Alternative 1 has the potential to have long-term, direct, adverse effects on cultural and tribal resources. However, coordination with the PASHPO and Federally recognized Tribes with ancestral land claims will minimize any adverse effects.

5.3.20 Local, Regional, and National Economy

No Action Alternative

The local and regional economy may be impacted by localized flooding within the Chiques Creek watershed. Water quality impairments may also impact recreational uses within the stream corridors, which could have impacts to the local economy by limiting tourism in the area. These potential impacts to flooding and tourism are not expected to affect the national economy due to being localized to the watershed.

Determination: The No Action Alternative will have long-term, indirect adverse effects on the local economy, and no impacts on the national economy.

Alternative 1

Implementation of Obstruction Removal (CPS 500) will allow fish to travel upstream, enhancing biodiversity of aquatic organisms and ecosystem connectivity which allows species to access various habitats for feeding, breeding, and shelter. Aquatic Organism Passage (CPS 396) may be used in combination, or as a stand-alone practice, to remove the legacy sediment terrace which can result in restoring and reconnecting the stream to the native floodplain. This increased diversity can draw tourism and create more desirable locations for fishing throughout the watershed. Removing dams as well as exposing historic springs and seeps can also decrease the thermal effects on the streams resulting in higher quality, lower temperature streams.

Restoring stream channel capacity will also reduce the risk of flooding in riparian areas, further increasing recreational opportunities and lowering costs of flood damages.

Riparian Forested Buffers (CPS 391), Riparian Herbaceous Cover (CPS 390), and Streambank and Shoreline Protection (CPS 580) will prevent the loss of land adjacent to streambanks preventing erosion. This reduction in sediment may have a positive effect on water treatment plant intakes below the watershed.

Installation of land treatment practices will require material and labor for construction, which will have effects on the local and regional economy and allows for potential job creation. It is estimated that Alternative 1 would result in the creation of 20 jobs per year during the 10 years construction is assumed to take place, and regional direct and indirect income benefits of almost $4,000,000 per year based on research of economic benefits offered by non-urban stream restoration projects in the Chesapeake Bay watershed (Chesapeake Bay Foundation, 2022).

Due to the scale of the project, impacts on the national economy are not expected.

Determination: Alternative 1 would have long-term and short-term, indirect beneficial effects on the local and regional economy due to the potential enhancement of property values and tourism opportunities from streambank protection measures, mitigation of flood risks, and increases in jobs and economic outputs during construction. There will be no impact on the national economy.

5.3.21 Public Health and Safety

No Action Alternative

Flooding will continue to serve as a low-level threat to habitats along the riparian corridor as well as localized areas within the watershed. Water quality will continue to be adversely affected by sedimentation and nutrients.

Determination: The No Action Alternative will have long-term, direct adverse effects on public health and safety.

Alternative 1

Removing mill dams using Obstruction Removal (CPS 500) will prevent the risk of flooding caused by a potential breach of the structure.

Using Aquatic Organism Passage (CPS 396) to remove legacy sediment can expose the historic floodplains, reducing flooding in adjacent riparian areas and their communities.

Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would naturally filter out pollutants from urban and agricultural runoff. This may improve local and downstream waters for swimming, boating, and fishing.

Determination: Alternative 1 would have long-term, indirect beneficial effects on public health and safety, as the Legacy Sediment Treatment Program will mitigate flood risks in surrounding communities and decrease erosion to enhance the water quality of the stream.

5.3.22 Parklands (including National Parks, Monuments, and Historic Sites)

No Action Alternative

Parklands adjacent to streams may experience streambank erosion and flooding due to legacy sediment terraces limiting channel capacity and altering stream flow.

Determination: The No Action Alternative will have long-term, direct adverse effects on parklands adjacent to streams.

Alternative 1

Implementation of Obstruction Removal (CPS 500) can remove mill dams and restore free-flowing streams. This can increase fish diversity in parklands above the mill dams.

Aquatic Organism Passage (CPS 396) can remove legacy sediment and restore the native floodplain capacity and natural channel flow, reducing the risk of flooding in riparian areas and parklands adjacent to streams.

Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would support diverse plant and animal life, enriching the ecological and aesthetic value of adjacent parklands.

Determination: Alternative 1 would have long-term, indirect beneficial effects on parklands throughout the watershed, as the proposed restoration of stream channel capacity and installation of riparian forest buffer will mitigate flood risks to surrounding areas.

5.3.23 Significant Scientific Resources

No Action Alternative

Impacts to karst features or faults within the watershed are not expected.

Determination: There will be no impact to significant scientific resources.

Alternative 1

Implementation of the proposed conservation practices are not expected to have impacts on significant scientific resources. Karst features in the watershed have the potential to form caves; however, the installation of conservation practices is not expected to affect karst geology or the formation of caves. Seismic activity in the watershed is not anticipated to have an effect on any of the proposed conservation practices.

Determination: Alternative 1 would have no effect on significant scientific resources.

5.3.24 Land Use

No Action Alternative

Agriculture will continue to be the primary land use within the riparian corridors.

Determination: The No Action Alternative will have no impacts to land use.

Alternative 1

It is not expected that implementation of Obstruction Removal (CPS 500) at sites of mill dams would change the current land use in those locations.

Aquatic Organism Passage (CPS 396), Riparian Forested Buffers (CPS 391), and Riparian Herbaceous Cover (CPS 390) may cause a conversion of the existing agricultural land use to forest, wetland, grassland, or scrub/shrub areas. Assuming a 50-foot buffer along the at least 21,900 linear feet of stream projects that are expected to be installed with this program, approximately 25 acres of land will be converted.

Determination: Alternative 1 would have long-term, direct beneficial effects on land use due to the conversion of existing land use within riparian areas to natural ecosystems that increase the health of streams.

5.3.25 Food

No Action Alternative

Agricultural land within the riparian corridor will continue to be utilized for crop production and pasturing of animals. Fin fish and shellfish will continue to be affected by sedimentation and nutrients. Benefits of continued agricultural activities within riparian corridors are not expected to outweigh the adverse effects on fish populations.

Determination: The No Action Alternative will have long-term, indirect adverse effects to food production due to water quality impairments that impact fin fish and shellfish.

Alternative 1

Removing and/or stabilizing the legacy sediment within the watershed (using CPS 390, 391, or 580) reduces active erosion and the potential for future mass erosion of nutrient-laden soils. Implementing these practices may take up to 25 acres of marginal cropland and pasture out of production, and have a relatively minor effect on local food production

in the short term. However, the long-term effects of stopping the legacy sediment erosion result in the preservation of crop fields and pasture that may otherwise be lost. Using Aquatic Organism Passage (CPS 396) to restore historic floodplains could reduce the risk of flooding crops downstream.

While reducing the sedimentation downstream will positively impact the fin fish and shellfish production within the Chesapeake Bay, the full effect of implementing these practices will be diluted due to the small percentage of the watershed to the total drainage area of the bay.

Determination: Alternative 1 would have long-term, indirect beneficial effects on food sources by enhancing diversity of aquatic life throughout the watershed and protecting cropland adjacent to streams from erosion and flooding.

5.3.26 Water

No Action Alternative

Sediments and nutrients transported to surface water within the watershed could impact water treatment plants downstream resulting in increased maintenance to the intake screens and pumps. Additional filtration and treatment may be necessary to produce potable water.

Determination: The No Action Alternative will have long-term, indirect adverse effects on the production of potable water.

Alternative 1

Removing and/or stabilizing the legacy sediment within the watershed (using CPS 390, 391, or 580) reduces active erosion and the resulting sediment in the water column as well as downstream sedimentation. This can improve water quality within the stream, leading to cleaner water entering treatment plants downstream of the watershed, lowering cost and complexity of water treatment. Reducing the sediment and pollutant load reduces the burden on pumps and filtration systems at water treatment plants.

Determination: Alternative 1 would have long-term, indirect beneficial effects on water due to the proposed enhancement of water quality throughout the stream and increased natural filtration by the addition of vegetative cover in riparian areas, leading to potential improved efficiency and effectiveness of water treatment plants downstream.

5.3.28 Navigation

No Action Alternative

Navigation along streams in the Chiques Creek watershed may be reduced due to sedimentation. Sedimentation downstream can also adversely impact navigation in the Susquehanna River and Chesapeake Bay.

Determination: The No Action Alternative will have minor, long-term, indirect adverse impacts to navigation.

Alternative 1

Implementation of Obstruction Removal (CPS 500) can restore free-flowing streams by removing mill dams, allowing some of the headwaters to be accessible by small paddle-powered boats.

Installation of Riparian Forested Buffers (CPS 391), Riparian Herbaceous Cover (CPS 390), and Streambank and Shoreline Protection (CPS 580) will stabilize streambanks. This would reduce sedimentation and help maintain clearer and deeper waterways. Introducing native vegetation to the riparian corridor can enhance scenic beauty and the boating experience.

Stabilization/removal of the legacy sediment will also prevent downstream sedimentation, reducing the need for dredging in the Susquehanna River and Chesapeake Bay for navigational purposes.

Determination: Alternative 1 would have minor, long-term, direct beneficial effects on navigation throughout Chiques Creek due to the proposed removal of mill dams and legacy sediment terraces.

5.3.29 Flood and Disease Control

No Action Alternative

Localized flooding will persist within the watershed, yielding potential damage to crops, infrastructure, and aquatic life. Excessive siltation within the stream corridor may reduce channel capacities, further increasing flooding and ponding throughout the watershed.

Water quality within the watershed and Susquehanna River will continue to be affected by nutrients and sedimentation resulting in adverse effects to swimming and fishing. The

effects of nutrients and sedimentation will increase in the Chesapeake Bay as the Conowingo Dam and reservoir is filled with sediment.

Determination: The No Action Alternative will have long-term, indirect adverse effects on flood and disease control.

Alternative 1

Implementation of Obstruction Removal (CPS 500) can restore free-flowing streams by removing mill dams. Aquatic Organism Passage (CPS 396) may be used in combination, or as a stand-alone practice, to remove the legacy sediment terrace which can result in restoring and reconnecting the stream to the native floodplain. Restoration of the historic floodplains can result in a decrease of downstream flooding. Streambank and Shoreline Protection (CPS 580), Riparian Forested Buffers (CPS 391), and Riparian Herbaceous Cover (CPS 390) can be used to stabilize the streambanks and prevent erosion and associated downstream sedimentation during flood events.

Reducing nutrient-laden sediment within the stream channel can reduce the levels of sickness-inducing bacteria within waters that may be used for recreational swimming, boating, and fishing.

Determination: Alternative 1 would have a long-term, indirect beneficial effect on flood and disease control, as the Legacy Sediment Treatment Program will mitigate localized flood risks and improve water quality.

5.3.30 Water Filtration

No Action Alternative

Legacy sediment terraces disconnect the stream corridor from groundwater, which limits natural filtration.

Determination: The No Action Alternative will have long-term, direct adverse effects on water filtration.

Alternative 1

Aquatic Organism Passage (CPS 396) may be used to remove legacy sediment terraces promoting the connectivity of the stream corridor to groundwater, enhancing filtration.

Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would increase vegetation and native species to riparian areas and promote the natural filtration of surface and groundwater from agricultural fields.

Determination: Alternative 1 would have long-term, direct beneficial effects on water filtration due to the proposed increase in vegetation and removal of legacy sediment terraces throughout the riparian corridor, which will promote natural filtration of runoff and reconnect streams to groundwater.

5.3.31 Nutrient Cycling

No Action Alternative

Nutrient-laden sediments will continue to be transported to the Chiques Creek watershed through excessive streambank erosion. Erosion of sediment from riparian areas will reduce nutrient cycling from occurring within stream corridors of the watershed. The transport of nutrient-laden sediments downstream will increase nutrient cycling in receiving waters, such as the Chesapeake Bay, which can contribute to eutrophication and harmful algal blooms.

Determination: The No Action Alternative will have long-term, indirect adverse effects on nutrient cycling due to streambank erosion reducing nutrient cycling in riparian areas and contributing to excess nutrients downstream.

Alternative 1

Implementation of aquatic organism passage will improve habitat connectivity and help maintain balanced nutrient levels throughout the watershed. Diverse aquatic ecosystems throughout the stream improve the processing and cycling of nutrients.

Channel bed stabilization will reduce sediment transport downstream which can prevent excess nutrient loading and enhance water quality, reducing the risk of eutrophication and algal blooms throughout the watershed.

Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would allow added vegetation to absorb nutrients such as nitrogen and phosphorus from surface runoff and reduce nutrient loads entering the streams of the watershed.

Streambank and Shoreline Protection (CPS 580) will reduce erosion and help retain nutrients within the soil, promoting heathier vegetations along riparian corridors that can uptake and cycle nutrients more effectively.

Installation of conservation practices is expected to result in average annualized reduction benefits of approximately $148,000 per year for reductions in nitrogen and $486,000 per year for reductions in phosphorus within surface waters.

Determination: Alternative 1 would have a long-term, indirect beneficial effect on nutrient cycling by promoting ecosystem diversity throughout the watershed that would enhance nutrient cycling. Reductions in the transport of nutrients to receiving waters will limit the potential for eutrophication and harmful algal blooms.

5.3.32 Soil Formation

No Action Alternative

Legacy sediment terraces will continue to erode and transport sediments downstream.

Determination: The No Action Alternative will have long-term, indirect adverse impacts to soil formation.

Alternative 1

Aquatic Organism Passage (CPS 396) may be used to remove the legacy sediment terrace which can result in restoring and reconnecting the stream to the native wetlands and floodplain. This will enhance sediment deposition in areas where these organisms interact with substrate.

Installation of Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would contribute leaf litter and other organic materials to the soil within the riparian areas, enhancing the soil structure, fertility, and microbial activity.

Streambank and Shoreline Protection (CPS 580) will secure the sediment and prevent bank erosion throughout the watershed, helping to retain soil and prevent the loss of nutrient-rich topsoil.

Installation of conservation practices is expected to result in an average annualized reduction benefit of approximately $789,000 per year for reductions in sediment within surface waters.

Determination: Alternative 1 would have long-term, direct beneficial effects on soil formation.

5.3.33 Primary Production

No Action Alternative

Crop production and pasturing of animals within riparian corridors is likely to continue, but flooding could limit crop yields. Riparian corridors lacking significant vegetation will limit primary production for riverine food webs.

The Susquehanna River and Chesapeake Bay will continue to provide recreational and commercial fin fish and shellfish.

Over time, agricultural land may be lost due to continued erosion, and the transport of sediments can adversely impact fish populations downstream.

Determination: The No Action Alternative will have long-term, indirect adverse impacts on primary production.

Alternative 1

Removing and/or stabilizing the legacy sediment within the watershed (using CPS 390, 391, or 580) reduces active erosion and the potential for future mass erosion of nutrient-laden soils. Implementing these practices may take up to 25 acres of marginal cropland and pasture out of production and have a relatively minor effect on local food production in the short term. However, the long-term effects of stopping the legacy sediment erosion result in the preservation of crop fields and pasture that may otherwise be lost. Using Aquatic Organism Passage (CPS 396) to restore historic floodplains could reduce the risk of flooding crops downstream.

Implementation of Obstruction Removal (CPS 500) can restore free-flowing streams by removing mill dams. This conservation practice will ensure fish can reach their spawning grounds to sustain recreational and commercial fisheries downstream in the Chesapeake Bay.

Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) can promote primary production for riverine food webs and naturally filter runoff to reduce nutrient overloads, supporting healthier aquatic primary production.

Installation of conservation practices is expected to result in an average annualized reduction benefit of approximately $2,500 per year for reductions in land lost to erosion.

Determination: Alternative 1 would have long-term, indirect beneficial effects on primary production due to the Legacy Sediment Treatment Program's proposed enhancement of water quality and ecosystem biodiversity, reduced erosion and sedimentation, and removal of mill dams.

5.3.34 Recreation Use

No Action Alternative

Riparian corridors will continue to be under stress from legacy sediment, leading to threats on wildlife that support recreational activities such as fishing, hunting, trapping, and bird watching.

Determination: The No Action Alternative will have long-term, indirect adverse effects on recreation.

Alternative 1

Implementation of Obstruction Removal (CPS 500) will remove any mill dams to allow fish to travel upstream to increase connectivity, enhancing fishing and boating opportunities throughout Chiques Creek. Aquatic Organism Passage (CPS 396) will remove legacy sediment, restoring native habitat which can benefit wildlife that support recreational activities such as fishing, hunting, and bird watching.

Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would increase vegetation and remove invasive species, enhancing habitats for wildlife within the riparian corridor and making the watershed more desirable for recreation use.

Recreational benefits from these practices will be diluted as the waters move down through the Susquehanna River to the Chesapeake Bay.

Determination: Alternative 1 would have long-term, indirect beneficial effects on recreational use throughout the watershed, as the proposed land treatment practices will enhance wildlife habitat and increase desirability for fishing, boating, trapping, and bird watching.

5.3.35 Aesthetic Viewsheds

No Action Alternative

The aesthetic viewshed of stream corridors containing significant legacy sediment terraces will continue to be adversely affected by views of eroding streambanks. Excess nutrients in surface waters may cause algal blooms.

Determination: The No Action Alternative will have long-term, direct adverse effects on aesthetic viewsheds.

Alternative 1

Aquatic Organism Passage (CPS 396) may be used in combination with Channel Bed Stabilization (CPS 584) and will remove legacy sediment install in-stream habitat structures. These practices may work to improve water clarity as well as preserve the natural landscape along the stream, improving the aesthetic qualities of the viewshed.

Native plantings used for Riparian Forested Buffers (CPS 391) and Riparian Herbaceous Cover (CPS 390) would enhance the natural framing of the waterways and create a lush landscape with diverse vegetation, magnifying aesthetic viewsheds.

Determination: Alternative 1 would have long-term, direct beneficial effects on aesthetic viewsheds due to the proposed increase in vegetative cover within the riparian corridor and increased water clarity throughout the stream.

5.4 Effects of Individual Alternatives Relative to Resource Concerns

A summary of the effects on resource concerns discussed in Section 5.3 is presented in Table 5.3.

TABLE 5.3
SUMMARY AND COMPARISON OF ALTERNATIVES – EFFECTS ON RESOURCE CONCERNS (CHIQUES CREEK WATERSHED PROJECT)

Resource Concern	No Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
Soil Resources	The No Action Alternative will have direct long-term adverse impacts to soil resources in the watershed due to continued erosion.	While there may be minor short-term adverse effects to soil resources due to construction, Alternative 1 would have a major positive direct effect on soil resources in the long-term by reducing streambank erosion.
Prime and Unique Farmland, and Farmland of Statewide or Local Importance	The No Action Alternative will have direct long-term adverse impacts to Prime and Unique Farmland and Farmland of Statewide or Local Importance in the watershed.	Alternative 1 would have long-term, indirect beneficial effects on Prime Farmland and Farmland of Statewide importance by reducing erosion of farmland soils and reducing flood risks for farmland adjacent to streams. Long-term, direct adverse effects to Prime Farmland and Farmland of Statewide Importance will occur for projects that convert agricultural land to natural floodplains.
Water Resources	The No Action Alternative will have direct long-term adverse impacts to water resources in the watershed.	While Alternative 1 may have short-term minor adverse effects during construction, it would have a major direct, beneficial long-term effect on water resources.
Water Quality	The No Action Alternative will have long-term direct adverse impacts on water quality in the watershed.	Alternative 1 may have short-term, adverse impacts to water quality during construction; however, this will be mitigated using best management practices for erosion and sedimentation control. Overall, Alternative 1 would have long-term direct, beneficial effects on water quality within and downstream of the watershed.
Floodplain Management	The No Action Alternative will have long-term, direct adverse impacts to floodplain management.	Alternative 1 would have a long-term, direct beneficial effects on floodplain management.
Waters of the U.S., Wetlands, & Special Aquatic Sites	The No Action Alternative will have long-term, direct adverse effects on Waters of the U.S. and wetlands.	Alternative 1 would have major long-term, direct beneficial effects by reducing erosion and sedimentation, reconnecting streams and wetlands to historic floodplains, and improving aquatic organism passage. Wetlands may experience short-term, adverse impacts through the removal of legacy sediment terraces, but the long-term improvements are expected to outweigh these adverse effects.
Regional Water Resource Plans	The No Action Alternative will have long-term adverse impacts on regional water resource plans.	Alternative 1 would have a minor direct, beneficial effect on regional water resource plans by reducing the annual load of nutrient-laden legacy sediment from the watershed, improving the quality of streams, and reducing flood risks to meet the goals presented in the Chesapeake Bay TMDL, PADEP WRAS, SRBC Watershed Alternative Restoration Plan, USACE Comprehensive Water Resources and Restoration Plan, and Little Chiques Creek Watershed Rivers Conservation Plan.
Air Quality	The No Action Alternative will have no impact on air quality.	Alternative 1 would have short-term adverse effects on air quality during construction, and long-term benefits associated with increased carbon sequestration.
Threatened and Endangered (T&E) Species	The No Action Alternative will have long-term, adverse impacts to T&E species.	Alternative 1 would have long-term, beneficial effects on aquatic and terrestrial habitats for T&E species. Any short-term adverse effects will be minimized through agency coordination and the use of best management practices.
Migratory Birds	The No Action Alternative is not expected to have impacts on migratory birds.	Alternative 1 would have long-term, indirect beneficial effects on migratory birds, as the proposed conservation practices will improve habitat.
Bald and Golden Eagles	The No Action Alternative will have long-term, indirect adverse effects to bald and golden eagles.	Alternative 1 would have long-term, indirect effects on bald eagles, as the proposed conservation practices will provide improved habitat and foraging opportunities.
Essential Fish Habitat	The No Action Alternative will have long-term, direct adverse effects on essential fish habitats.	Alternative 1 would have a minor, indirect beneficial effect on the essential fish habitat as the proposed reduction of sediment transport and prevention of legacy sediment terrace formation may benefit aquatic life downstream of the watershed.
Ecologically Critical Areas	The No Action Alternative will have long-term, indirect adverse impacts on Natural Heritage Areas.	Alternative 1 would have long-term, indirect beneficial effects due to the proposed restoration of riparian areas and wildlife habitats. Short-term, direct adverse effects may be experienced during construction.
Invasive Species	The No Action Alternative will have long-term, indirect adverse effects on invasive species.	Alternative 1 would have long-term, direct beneficial effects such as the removal of invasive species along the riparian corridor and will limit the threat of their spreading to other areas of the watershed.
Fish and Wildlife	The No Action Alternative will have long-term, indirect adverse effects on fish and wildlife.	Alternative 1 would have long-term, direct beneficial effects by increasing habitats for aquatic life throughout the watershed, removing invasive species, and introducing native species throughout the riparian corridor. Short-term, adverse effects may be experienced during construction; however, best management practices will be used to mitigate any adverse impacts.
Riparian Areas	The No Action Alternative will have long-term, direct adverse effects to riparian areas.	Alternative 1 would have long-term, direct beneficial effects due to the proposed increase in vegetative cover throughout the riparian corridor and decreased erosion.
Forest Resources	The No Action Alternative will have long-term, indirect adverse effects on forest resources.	Alternative 1 would have long-term, direct beneficial effects due to the proposed reduction of bank erosion and loss of land, as well as an increase in vegetative cover throughout the riparian corridor. Agricultural encroachments on riparian areas may continue, but supporting conservation practices can be implemented to limit potential impacts.
Cultural Resources and Tribal Consultation	No adverse effects to NRHP-eligible properties are expected because no new ground disturbance or modification of historic properties would occur; however,	Alternative 1 has the potential to have long-term, direct, adverse effects on cultural and tribal resources. However, coordination with the PASHPO and Federally recognized Tribes with ancestral land claims will minimize any adverse effects.

Resource Concern	No Action Alternative	Alternative 1 – Legacy Sediment Treatment Program
	continued channel instability, erosion, and flooding—particularly during extreme flood events—could indirectly and cumulatively contribute to the degradation or loss of historic mill dams and associated structures, increased channel incision, downstream sediment release, and long-term risks to cultural resources in the absence of watershed restoration.	
Local, Regional, and National Economy	The No Action Alternative will have long-term, indirect adverse effects on the local and regional economy, and there will be no impact on the national economy.	Alternative 1 would have long-term and short-term, indirect beneficial effects on the local and regional economy due to the potential enhancement of property values and tourism opportunities from streambank protection measures, mitigation of flood risks, and increases in jobs and economic outputs during construction. Impacts to the national economy are not expected due to the scale of the project.
Public Health and Safety	The No Action Alternative will have long-term, direct adverse effects on public health and safety.	Alternative 1 would have long-term, indirect beneficial effects on public health and safety, as the Legacy Sediment Treatment Program will mitigate flood risks in surrounding communities and decrease erosion to enhance the water quality of the stream.
Parklands (including National Parks, Monuments, and Historic Sites)	The No Action Alternative will have long-term, direct adverse effects on parklands adjacent to streams.	Alternative 1 would have long-term, indirect beneficial effects on parklands throughout the watershed, as the proposed restoration of stream channel capacity and installation of riparian forest buffer will mitigate flood risks to surrounding areas.
Significant Scientific Resources	There will be no impacts to significant scientific resources.	Alternative 1 would have no effect on significant scientific resources.
Land Use	The No Action Alternative will have no impacts to land use.	Alternative 1 would have long-term, direct beneficial effects on land use due to the conversion of existing land use within riparian areas to natural ecosystems that increase the health of streams.
Provisioning Ecosystem Services		
Food	The No Action Alternative will have long-term, indirect adverse effects to food production due to water quality impairments impacting fin fish and shellfish.	Alternative 1 would have long-term, indirect beneficial effects on food sources by enhancing diversity of aquatic life throughout the watershed and protecting cropland adjacent to streams from erosion and flooding.
Water	The No Action Alternative will have long-term, indirect adverse effects on the production of potable water.	Alternative 1 would have long-term, indirect beneficial effects on water due to the proposed enhancement of water quality throughout the stream and increased natural filtration by the addition of vegetative cover in riparian areas, leading to potential improved efficiency and effectiveness of water treatment plants downstream.
Navigation	The No Action Alternative will have minor, long-term, indirect adverse impacts to navigation.	Alternative 1 would have minor, long-term, direct beneficial effects on navigation throughout Chiques Creek due to the proposed removal of mill dams and legacy sediment terraces.
Regulating Ecosystem Services		
Flood and Disease Control	The No Action Alternative will have long-term, indirect adverse effects on flood and disease control.	Alternative 1 would have a long-term, indirect beneficial effect on flood and disease control, as the Legacy Sediment Treatment Program will mitigate localized flood risks and improve water quality.
Water Filtration	The No Action Alternative will have long-term, direct adverse effects on water filtration.	Alternative 1 would have long-term, direct beneficial effects on water filtration due to the proposed increase in vegetation and removal of legacy sediment terraces throughout the riparian corridor, which will promote natural filtration of runoff and reconnect streams to groundwater.
Supporting Ecosystem Services		
Nutrient Cycling	The No Action Alternative will have long-term, indirect adverse effects on nutrient cycling due to streambank erosion reducing nutrient cycling in riparian areas and contributing to excess nutrients downstream.	Alternative 1 would have a long-term, indirect beneficial effect on nutrient cycling by reducing sediment transport and promoting ecosystem diversity throughout the watershed that would enhance nutrient cycling. The proposed erosion reduction and water quality will assist with nutrient retention in soils, allowing vegetation to uptake and cycle nutrients more effectively. Reductions in the transport of nutrients to receiving waters will limit the potential for eutrophication and harmful algal blooms.
Soil Formation	The No Action Alternative will have long-term, indirect adverse impacts to soil formation.	Alternative 1 would have long-term, direct beneficial effects on soil formation.
Primary Production	The No Action Alternative will have minor, long-term, indirect adverse impacts on primary production.	Alternative 1 would have long-term, indirect beneficial effects on primary production due to the Legacy Sediment Treatment Program's proposed enhancement of water quality and ecosystem biodiversity, reduced erosion and sedimentation, and removal of mill dams.
Cultural Ecosystem Services		
Recreational Use	The No Action Alternative will have long-term, indirect adverse effects on recreation.	Alternative 1 would have long-term, indirect beneficial effects on recreational use throughout the watershed, as the proposed land treatment practices will enhance wildlife habitat and increase desirability for fishing, boating, trapping, and bird watching.
Aesthetic Viewsheds	The No Action Alternative will have long-term, direct adverse effects on aesthetic viewsheds.	Alternative 1 would have long-term, direct beneficial effects on aesthetic viewsheds due to the proposed increase in vegetative cover within the riparian corridor and increased water clarity throughout the stream.

SECTION 6 – PREFERRED ALTERNATIVE

The Preferred Alternative is Alternative 1, the Legacy Sediment Treatment Program. The following sections provide justification for selection and more information about the implementation of the alternative.

6.1 Rationale for the Preferred Alternative

The SLOs have selected Alternative 1, the Legacy Sediment Treatment Program, to be the Preferred Alternative because of its ability to meet the purpose and need for the Project, to meet the Federal and local Project objectives, and to maximize net public benefit from environmental, social, and economic resource effects. Alternative 1 meets the PL 83-566 authorized purpose of watershed protection.

NRCS developed Alternative 1 in coordination with the SLOs to address urgent environmental concerns regarding water quality degradation in the Chiques Creek watershed and downstream water bodies. The program offered by Alternative 1 includes a suite of land treatment practices that improve water quality by stabilizing legacy sediment or removing it from the floodplain. Restoration of historic wetlands could result from the Project. Applicants to the program would be required to propose a land treatment project, and the projects would be evaluated and selected based on individual merit to maximize the cumulative public benefit. Projects without a positive net benefit, considering both quantifiable and non-quantifiable (i.e., habitat, cultural, social, ecosystem services, etc.) benefits, would not be considered for implementation.

As presented in Section 5, environmental benefits would outweigh the potential environmental costs of the program, which would be temporary and occur primarily during construction of individual treatment projects. Impacts to cultural and socio-economic resources would be primarily positive and minimized by project-specific systems to reduce impacts. Long-term impacts of the projects over the project life would outweigh the short-term, adverse impacts of construction. Overall, the program is estimated to provide benefit to water quality, wildlife habitat, natural areas (including wetland restoration), and other ecosystem services; and reduce flooding and negative stormwater impacts.

6.2 Works of Improvement

The Preferred Alternative is a program to install land treatment projects that include specific systems to reduce legacy sediment erosion and transport. These systems are described in Subsection 4.2.2. All land treatment projects installed by the Preferred

Alternative would be required to include at least one core conservation practice. The program would implement eligible projects based on net benefit.

6.3 Irreversible or Irretrievable Commitment of Resources

Irreversible effects are those caused by the proposed program that cannot be reversed and are considered permanent. Irretrievable effects are gains and losses of outputs such as land use and may occur in the short term or long term.

The Preferred Alternative would require construction equipment and materials and other energy in the form of labor and fossil fuels. Using these items would be generally irretrievable. A project under the Preferred Alternative would irreversibly impact soil resources and land use, such as in the removal and disposal of legacy sediments from the floodplain. The expenditure of financial resources is irretrievable in the short term, but the investment could be retrieved over the life of the projects by increasing the value of ecological resources at and downstream of the project sites.

6.4 Areas of Controversy

No areas of controversy have been identified related to the Preferred Alternative.

6.5 Permits and Compliance

The program would require that individual projects comply with all applicable Federal, State, and local laws and regulations. The SLOs and project applicant would coordinate to identify applicable laws and include all likely regulatory requirements in the project proposal. For most projects in the Preferred Alternative, the following permits may be required:

- PADEP Chapter 105
- USACE Section 404 of the CWA
- National Pollutant Discharge Elimination System permit for ground disturbance and erosion and sedimentation control plan
- Applicable municipal permits

NRCS would require that projects obtain all permits prior to construction and that minimum buffer zones for wetlands and culturally sensitive resources are observed during construction.

6.5.1 Mitigation of Potential Effects

In accordance with 36 CFR Part 800.4(b)(2), a Programmatic Agreement describing a phased approach for the identification and evaluation of effects to historic properties has been executed. The Programmatic Agreement includes provisions for the discovery and identification of historic properties potentially affected by the undertaking. As required by the Programmatic Agreement, NRCS would conduct additional consultation with PASHPO and Tribes with ancestral land claims to seek ways to avoid, minimize, or mitigate adverse effects. NRCS would bear the costs of the mitigation of Adverse Effects to Historic Properties under NHPA. However, the future cost of such mitigation has not been explicitly included in the economic analysis as these costs are expected to be avoided. In the unlikely event a project that produces an adverse and requires mitigation, costs and impacts would require evaluation on a case-by-case basis.

The proposed works of improvement are expected to impact existing wetlands within the riparian corridor. Impacts to low quality wetlands can be mitigated by removing invasive species and planting natives to lift in form and function. If the ersatz wetland is destroyed by the removal of legacy sediment, the original, native wetland of higher quality will be uncovered. Proper permitting through PADEP and USACE will be completed to avoid, minimize, and mitigate potential effects to on-site wetlands.

During construction, site mitigation measures would include erosion and sediment control, dust control, and other practices identified during the design process. Best management practices during construction would be implemented to minimize the mobilization of the sediment into stream systems. Typical best management practices include silt fencing, bank stabilization, construction entrances, sediment storage, matting, and grassing/vegetative cover.

6.6 Costs and Cost Sharing

NRCS and the Sponsor estimate that local, non-Federal funding availability is about $5,000,000 for construction. PL 83-566 funds would be provided for 75 percent of the total construction cost or 90 percent of the total construction cost if the applicant is historically underserved. If the 75 percent cost share is presumed, $15,000,000 of PL 83-566 funding would be provided to construct the Preferred Alternative, resulting in a total Project construction cost of $20,000,000.

The Preferred Alternative will require additional establishment costs during the typical three-year establishment period. Additional costs during the establishment period are expected to be $300,000, which will be a portion of the overall $20,000,000 construction budget.

Additionally, NRCS estimates that $3,000,000 would be required to provide design and technical assistance for the preferred alternative, which is about 15 percent of the total construction cost. NRCS can design smaller-scale stabilizations and restoration projects. Larger project designs may be completed using an outside firm. NRCS can generally provide on-site quality assurance during construction.

Non-Federal funding would be arranged on a project-specific basis in a cost-share agreement between the SLOs, the project applicant, and other State or local stakeholders. The non-Federal share regime may vary based on project-specific circumstances. State agencies are often in need of mitigation projects. State agencies also provide grant funding for streambank conservation projects. Local municipalities and environmental organizations are also likely sources of non-Federal funding.

The cost of each project will vary based on site-specific conditions including the volume of legacy sediment, selected land treatment method(s), and other project or environmental constraints. Therefore, the number of projects implemented by the program will depend on the size and scope of applicant projects.

Construction cost should include the following considerations for each project, as applicable:

- Invasive species control for the first year after construction is completed.
- Future (within a few years) reconstruction of the project's upstream and downstream connections to the post-construction condition.
- Replanting during a three- to five-year establishment period.

6.7 Ecosystem Services Benefits

The Preferred Alternative will reduce impacts to ecosystem services from water quality impairments caused by from legacy sediment erosion the watershed. This includes the protection of cropland from erosion and flooding, improvements to water quality of streams used for drinking water, and reductions in sedimentation that could adversely impact navigation. The Preferred Alternative will also provide benefits to flood and disease control by reducing flood risks and the erosion of nutrient-laden sediments in the watershed by reducing stormwater volumes and providing floodwater retention. Water filtration will be improved by reconnecting streams to groundwater flows, installing vegetative buffers along stream corridors, installing wetlands, and reconnecting historic floodplains. Nutrient cycling within riparian corridors will be protected by reducing streambank erosion, decreasing stream temperature, and reductions of erosion will prevent excessive nutrient cycling downstream. Benefits to soil formation will occur due to reductions in erosion and increases in vegetative cover within riparian areas. Primary production will be protected by preventing the erosion of agricultural land, improving

aquatic habitats for fish, and increasing the extent of vegetation in riparian areas. Recreational use and aesthetic viewsheds in the watershed will experience benefits from the Preferred Alternative by improving water quality and habitats along and in the uplands adjacent to the streams.

6.8 Installation and Financing

6.8.1 Installation

Works of improvement would be installed over a 10-year period following authorization of Federal assistance under the Watershed Protection and Flood Protection Act, PL 83-566. Design and installation of the works of improvement would commence upon authorization of the Plan.

Both NRCS and the Sponsor would coordinate to advertise and solicit for projects, with applications being received by both the SLO and NRCS. Applications to the program will be screened and then ranked based on the minimum criteria shown in Table 6.1. Only applications deemed feasible and effective in achieving program objectives based on project ranking would be eligible for program funding. This helps to ensure that the program implements eligible projects based on net benefit. NRCS would have final approval over applications moved forward into contracts.

TABLE 6.1
PROGRAMMATIC SCREENING AND RANKING CRITERIA FOR THE CHIQUES CREEK WATERSHED PROJECT

Screening Criteria	Ranking Criteria
Ready, willing, and able	Erosion rate
Inclusion of a core conservation practice	Sediment removal/stabilization volume
Meets minimum stream length requirement	Stream length
Land rights are obtainable	Single vs. multiple landowners
Cost-share funding available	Quality of on-site wetlands
Conservation plan in place (if applicable)	Impacts to floodplains, fish/wildlife habitat, and riparian areas
Issues with previous or active contracts, including O&M of practices	Potential construction challenges(1)

Note:
1. Construction challenges may include site access, topographic constraints, on-site utilities, permitting, mitigation, etc.

The specific systems to be installed would be determined by the proposed site and program participation. However, all systems would involve stabilization or removal of legacy sediment streambank terraces. Applicants would be required to install one or more core conservation practices (Table 4.1). Supporting practices (Table 4.4) can be

installed with a core conservation practice if they are needed to complete a system. Whether stand-alone or a collective of conservation practices, projects approved under the Preferred Alternative would function as a conservation system. It is expected that some projects that include legacy sediment removal (CPS 396 - Aquatic Organism Passage) may need additional construction efforts within two years of construction being finished to address the upstream and downstream tie-ins with the existing streambed. This construction shall be funded and completed in the same manner as the original construction.

6.8.2 Responsibilities

Responsibilities for carrying out a project would be shared between the NRCS, SLOs, and project applicant as provided in the following sections.

6.8.2.1 NRCS

- Provide overall project administration.
- Receive program applications in cooperation with the SLO.
- Provide site-specific planning, engineering design, technical assistance, and construction inspection services for small-scale projects.
- Complete all required Federal, Tribal, State, and local consultation processes.
- Bear the costs of the mitigation of Adverse Effects to Historic Properties under NHPA.
- Provide project and contract administration costs for installing works of improvement.
- Provide funds to SLOs for preparing engineering designs and construction inspection for works contracted by Sponsors (generally large-scale sediment removal projects).
- Provide either 75 or 90 percent of the funds to construct the project.
- Provide 100 percent of the funds to design the project.

6.8.2.2 Sponsors

- Lead the local planning effort.
- Receive program applications in cooperation with the NRCS.
- Provide or secure either 25 or 10 percent of the funds (non-Federal) to construct the project.
- Assist in project and contract administration costs for installing works of improvement.
- Acquire any real property or land rights necessary for installing the works of improvement.

- Bear the costs of relocating or modifying utilities.
- Secure all required Federal, State, and local permits.
- Prepare a project proposal that indicates the proposed improvements, identifies applicable permits and regulations, and presents a willingness to cost-share.
- Provide funds and oversight for continued O&M of all components of installed works of improvement or secure landowner acceptance of O&M responsibilities.
- When funded by NRCS, provide project management and engineering typically performed by NRCS to implement projects.

6.8.2.3 Applicant

- Voluntarily participate in the project.
- Provide proof of land ownership for all project lands.
- Provide O&M for the life of the conservation practices.

6.8.3 Contracting

The Federal share of design, construction, quality assurance, and program management would be awarded to the Sponsor through a cooperative agreement. The SLO would use the funding to contract directly with the contractor implementing the agreed-to conservation practices.

Contracted services may be required for services including site assessment, sampling and data collection, laboratory testing, surveying, design, construction, permitting, and O&M. The SLOs would be responsible for the administration of the contracted services on a project-specific basis. A compensatory agreement between the SLOs and the applicant may be considered for O&M for the project life and/or a land lease for a permanent loss of valuable land, such as crop land displaced by a project.

6.8.4 Real Property Rights

Real property acquisition is not expected to occur in the implementation of the Preferred Alternative because all work would take place on land owned by the applicant. The SLOs would be responsible for obtaining any temporary easements necessary to construct, operate, and maintain the works of improvement. Based on the scale and scope of a project, permanent easements may be required and the SLOs would be responsible for identifying a land trust organization to hold the easement. The SLOs would also be responsible for the satisfactory relocation or modification of any utilities disturbed by a project.

6.9 Operation, Maintenance, and Replacement

Operation includes the administration, management, and performance of non-maintenance actions needed to keep each completed project safe and functioning as planned. Maintenance includes the performance of work, preventing deterioration of installed practices, and repairing damage or replacement of the practice if one or more of its components fail. Damages to completed practices caused by normal deterioration, drought, flooding, sedimentation, or vandalism are considered normal maintenance.

O&M of each project will ultimately be the responsibility of the applicant landowner. An O&M agreement between the SLOs and the landowner would be developed for each project and signed prior to construction of the project, and the agreement would include an O&M Plan. The O&M Plan will be developed by the SLOs, in coordination with NRCS and the landowner during the design process, and will outline all necessary monitoring and maintenance activities to ensure that projects perform as designed for the project life. A general summary of likely O&M activities for the preferred alternative is provided in Table 6.2.

TABLE 6.2
SUMMARY OF OPERATIONS AND MAINTENANCE (O&M) FOR THE CHIQUES CREEK WATERSHED PROJECT

Land Treatment Measure	Typical O&M Item
Legacy Sediment Stabilization	• Vegetation – mow/maintain; remove invasive species • Streambanks – stabilize eroding soil, rills, and gullies • Riprap – replace displaced riprap, remove/dispose of debris
Riparian Buffer	• Vegetation – mow/maintain; remove invasive species, replace tree tubes
Legacy Sediment Removal & Site Restoration	• Vegetation – mow/maintain; remove invasive species • Streambanks – stabilize eroding soil, rills, and gullies
Mill Dam Removal	• Vegetation – mow/maintain; remove invasive species • Streambanks – stabilize eroding soil, rills, and gullies • Riprap – replace displaced riprap, remove/dispose of debris

The landowner's liability for O&M extends the 20-year project life. The SLOs would reserve the right to coordinate with the landowner for spot inspections and immediately following major storm events that may have impacted the project. The estimated average annual O&M costs incurred by the landowner are expected to be approximately 0.5 percent of the total construction cost of the land treatment project. The annual cost of O&M will vary based on the size of the project and the installed land treatment systems.

6.10 Economic Tables and Structural Tables

Note that because projects are unknown, there is no structural data to present. Thus, no structural tables are included in this section.

TABLE 6.3
ECONOMIC TABLE 1 – ESTIMATED INSTALLATION COST OF THE CHIQUES CREEK WATERSHED, PENNSYLVANIA [DOLLARS]

Works of Improvement	Number				Estimated Cost		
	Units	Federal Land	Non-Federal land	Total	PL 83-566	Other Funds	Total
Land Treatment Practices							
Evaluation Unit 1 Dam Removal	EA	0	1	1	$4,500,000	$1,500,000	$6,000,000
Evaluation Unit 2 Floodplain Restoration	LF	0	12,500	12,500	$9,750,000	$3,250,000	$13,000,000
Evaluation Unit 3 Riparian Buffers	LF	0	10,000	10,000	$375,000	$125,000	$500,000
Evaluation Unit 4 Streambank Stabilization	LF	0	5,000	5,000	$375,000	$125,000	$500,000
Total Land Treatment					**$15,000,000**	**$5,000,000**	**$20,000,000**
Technical Assistance					$3,000,000	$5,000	$3,005,000
Project Administration					$750,000	$250,000	$1,000,000
Total Project	**LF**	**0**	**27,500**	**27,500**	**$18,750,000**	**$5,255,000**	**$24,005,000**

Prepared: July 2025

TABLE 6.4
ECONOMIC TABLE 2 – ESTIMATED COST DISTRIBUTION - WATER RESOURCE PROJECT MEASURES
CHIQUES CREEK WATERSHED, PENNSYLVANIA [DOLLARS] (1)

Installation Cost Measure	PL 83-566					Other Funds						Total Installation Costs
	Construction (2)	Engineering	Real Property Rights	Project Admin	Total PL-83-566 Cost	Construction (2)	Engineering	Real Property Rights	Relocation Payments	Project Admin	Total Other Funds	
Land Treatment	$15,000,000	$3,000,000	$0	$750,000	$18,750,000	$5,000,000	$5,000	$241,000	$0	$250,000	$5,496,000	$24,246,000

Prepared: July 2025

Notes:
1. Price base: 2025.
2. Includes $0 of PL 83-566 funds and $0 of other funds for cultural resource protection and mitigation measures.
3. Engineering services contract cost to be borne: $3,000,000 by Public Law 83-566 funds and $5,000 by other funds.
4. Includes $241,000 of surveys, legal fees, other costs.

TABLE 6.5
ECONOMIC TABLE 4 – ESTIMATED AVERAGE PREFERRED ALTERNATIVE ANNUAL COSTS
CHIQUES CREEK WATERSHED, PENNSYLVANIA [DOLLARS] (1)

Works of Improvement	Amortization of Installation Cost	O&M and Replacement Cost	Other Direct Costs	Total
Land Treatment Practices (2)	$1,252,000	$15,300	$0	$1,267,300

Prepared: July 2025

Notes:
1. Price base: 2025, amortized over 30 years at a discount rate of 3 percent.
2. Costs for technical assistance to install measures are included.

TABLE 6.6
ECONOMIC TABLE 5a – ESTIMATED AVERAGE ANNUAL WATERSHED PROTECTION DAMAGE REDUCTION BENEFITS CHIQUES CREEK, PENNSYLVANIA [DOLLARS]

Item	Damage Reduction Benefit Average Annual Agricultural-Related	Damage Reduction Benefit Average Annual Non-Agricultural-Related
On-site		
Other - Land Lost to Erosion	$1,800	$1,900
Subtotal	$1,800	$1,900
Off-site/Public		
Sediment Damages	$379,000	$410,500
Water Treatment (Nitrogen Reductions)	$110,400	$119,600
Water Treatment (Phosphorus Reductions)	$361,400	$391,500
Subtotal	$850,800	$921,600
Grand Total	**$852,600**	**$923,500**

Prepared: July 2025

TABLE 6.7
ECONOMIC TABLE 6 – COMPARISON OF PREFERRED ALTERNATIVE BENEFITS AND COSTS CHIQUES CREEK WATERSHED, PENNSYLVANIA [DOLLARS] (1)

Works of Improvement	Agricultural-Related Sediment Reduction Benefit	Agricultural-Related Nitrogen Reduction Benefit	Agricultural-Related Phosphorus Reduction Benefit	Agricultural-Related Land Lost to Erosion Reduction Benefit	Non-Agricultural Sediment Reduction Benefit	Non-Agricultural Nitrogen Reduction Benefit	Non-Agricultural Phosphorus Reduction Benefit	Non-Agricultural Land Lost to Erosion Reduction Benefit	Average Annual Benefits	Average Annual Costs(2)	Benefit-Cost Ratio
Land Treatment	$379,000	$110,400	$361,400	$1,800	$410,500	$119,600	$391,500	$1,900	$1,776,100	$1,267,300	1.40
Total	$379,000	$110,400	$361,400	$1,800	$410,500	$119,600	$391,500	$1,900	$1,776,100	$1,267,300	1.40

Notes:
1. Price base: 2025
2. From Table 6.5 (Economic Table 4)

SECTION 7 – CONSULTATION, COORDINATION, AND PUBLIC PARTICIPATION

NEPA requires an evaluation of potential environmental impacts associated with Federal projects and actions with input from the public. A PPP for the Plan was approved in July 2022. The PPP guided outreach, solicited feedback, and created a record of public, Tribal, and agency interaction with this Plan.

54 U.S.C. 306108 requires a Federal agency to take into account the effect of the undertaking on historic properties. This requirement is reinforced through the law's implementing regulations 36 CFR Part 800 and demands consultation with PASHPO, Federally recognized Tribes, outside agencies, and the public.

7.1 Consultation

As indicated in Subsection 1.5.5, agencies identified in the PPP were invited to help scope the Project as well as consider the alternatives. A formal request for consultation on the preferred alternative was sent to FEMA, NOAA, USACE, USFWS, EPA, SRBC, and PA DCNR. A copy of the request letter and responses is included in Appendix A.

7.1.1 National Historic Preservation Act (NHPA) Section 106

The Bureau of Indian Affairs Tribal Leader Directory, Housing and Urban Development Tribal Directory Assessment Tool and the Pennsylvania Department of Transportation's Tribal Consultation website were queried to identify Tribes claiming ancestral land in the Project area. The consulting list for Federally recognized Tribes was then narrowed based on archival research and publicly available information in the cultural heritage potions of each of the Tribes' websites. The elected leadership of the Absentee Shawnee Tribe of Indians of Oklahoma, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, and Shawnee Tribe were mailed certified letters requesting participation in the scoping process, alternatives, and development of a phased approach Programmatic Assessment. The appropriate THPOs received carbon copies of the letters via their preferred method of delivery. Except for the Shawnee Tribe, no other Tribes expressed interest in the crafting of alternative procedures. All Tribes shall be consulted on a project-by-project basis as the areas of potential effect are refined through the applicant's approval for participation.

TABLE 7.1
NHPA SECTION 106 CONSULTATION TIMELINE (CHIQUES CREEK WATERSHED PROJECT)

Date	Type [1]	Purpose	Participants
June 30, 2022	Public Scoping	Invitation for participation	Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, and PASHPO
July 5, 2022	Public Scoping	Invitation for participation	Absentee Shawnee. Copy sent to Germane THPO.
May 30, 2024	Alternatives meeting	Request for participation and comment	Absentee Shawnee, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, and Shawnee Tribe, PASHPO. Copy sent to germane THPO.
February 14, 2025	PAD	Request for review and comment	Absentee Shawnee, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, and Shawnee Tribe. Copy sent to germane THPO.
February 18, 2025	PAD	Request for review and comment	PASHPO
March 17, 2025	PAD	Erin Paden email "We have no issues or concerns at this time with the Programmatic Agreement."	Shawnee Nation
March 19, 2025	PAD	Request for more info	PASHPO
March 19, 2025	PAD	NRCS response to request for more information.	PASHPO
April 4, 2025	PAD	Email from Katelyn Lucas informing the Bachor no longer works for Nation. Forwarded consult package to Lucas. NRCS extended consult due date to 5/5/2025 for all Tribes.	Delaware Nation
April 28, 2025	PAD	Final comments from PASHPO.	PASHPO
May 5, 2025	PAD	Expiration of extended deadline for review and comment	Absentee Shawnee, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, and Shawnee Tribe.
May 6, 2025	PAD	Request for Review and comment.	NWMC
November 24, 2025	PAD	PA submitted for PASHPO signature	PASHPO
January 20, 2026	PAD	PASHPO returned signed PA	PASHPO
January 22, 2026	PAD	NRCS signed PA	NRCS
February 6	PAD	Request for concurring signature on PA	Absentee Shawnee, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, and Shawnee Tribe.
March 11, 2026	PAD	Expiration of deadline for concurring party signature	Absentee Shawnee, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, and Shawnee Tribe.

Date	Type [1]	Purpose	Participants
April 6, 2026	PAD	Filing of PA with ACHP	ACHP
June 10, 2026	Interagency and public review	Review Draft Plan	Public, Agencies, Tribal Organizations, Sponsors, and Stakeholders
July 16, 2026	Interagency and public review	Erin Paden email "The Shawnee Tribal Historic Preservation Department does not know of any historic or cultural properties that would be negatively impacted by this project. We accept your invitation to consult. Please continue to share information with us as the project progresses."	Shawnee Nation
August 30, 2026	Distribution and Posting of Final Plan to NRCS Website	Inform public of Final Plan	Sponsors mail out and post Final Plan for all agencies, Sovereign Tribes and Public Stakeholders

Note:
1. PAD = Programmatic Agreement Development

7.1.2 Section 12 of the Public Law (PL) 83-566 and Section 7 of the Endangered Species Act

Communication and coordination with the USFWS was initiated in July 2022 and carried out throughout the planning process, including scoping and collaboration with the State Wildlife Agency. Consultation specifically pursuant to the stipulations of Section 12 of PL 83-566 and Section 7 of the Endangered Species Act was initiated in February 2025 with USFWS and completed upon USFWS response in February 2025. No adverse effects and no mitigation were identified. Correspondence can be found in Appendix A.

As part of USFWS consultation, Pennsylvania Natural Diversity Inventory (PNDI) and Information for Planning and Consultation (IPaC) processes were completed and submitted in June 2025 for the general planning area provided in Subsection 1.4. The PNDI tool is a geospatial species database provided by the PNHP through which projects are submitted for review, and potential project impacts to T&E species are identified. USFWS participates in the development of the tool and acknowledges the PNDI as a component of Section 7 consultation for a project. IPaC is a similar tool developed by USFWS for the Section 7 consultation process at the Federal level. Individual PNDI and IPaC submittals would be required for each project implemented by the preferred alternative.

7.2 Coordination

NRCS initiated coordination with the agencies in June 2022. Tribes and key Federal, State, and local agencies (including with USACE, EPA, and USFWS) were formally notified of the Project and invited by written correspondence to attend the scoping meeting on July 27, 2022, either virtually or in person. Agencies were invited to provide input on jurisdictional resource areas and were asked to comment on the natural resource and cultural resource impacts of the Project.

An alternatives development meeting was held July 18, 2024 to provide the agencies with an opportunity to review and comment on the alternatives and the overall approach to a watershed program for this Project. Tribes and agencies were invited with written correspondence to attend either in person or virtually via the meeting software. The meeting was attended by agencies including the USGS and several other State and local agencies and organizations. The presentation covered the alternatives that were developed, the preferred alternative, and an overview of the likely plan scope and implementation. Meeting participants were invited to provide general written or verbal comments either during the meeting or during the comment period following the meeting.

Comments received from the meetings are included in Appendix A.

7.3 Public Involvement

NRCS and the SLOs engaged the public and worked closely with Lancaster County residents and landowners to include them in the planning process, provide them accurate information on the Project, and solicit their input on key planning considerations. The public was invited to participate in the same meetings described in Subsection 7.2. The meetings had been advertised at least 14 days before the meeting on the NRCS Project website, LCCD Project website, and by press release to the local newspaper of record. PowerPoint presentations shown in the meetings, meeting notes, and recordings of the meetings were posted on the NRCS website for public viewing following the meeting.

Landowners within the watershed were invited to participate in the data collection phase of the Project. Potential land treatment project sites were identified in a desktop study, and the landowners were invited by phone and mailed letter to allow minimally invasive data collection on their property to inform this Project. Ten landowners agreed to participate. The participating landowners were interviewed about their historical observations of the stream corridor, overall sentiment toward this Project, and hypothetical preferences for a project on their site.

7.4 Plan Development and Review

This Plan was developed in close coordination with multiple agencies and the public and underwent the following informal and formal reviews, summarized below:

- Public and Agency Scoping: July 2022 & July 2024
- State-Level Preliminary Review: November 2025
- National Level Technical Review: December 2025
- Programmatic Review: May 2026
- Public and Interagency Review: June 2026

A Draft Plan was distributed for interagency and public review in June 2026. The distribution list of agencies and organizations is included in Subsection 7.5 of this Plan. Copies of the document were publicly available in https://www.nrcs.usda.gov/programs-initiatives/watershed-protection-and-flood-prevention-operations-program/pennsylvania and notices were provided to the public on the NRCS Project website, LCCD Project website, and by press release to the local newspaper of record. Notifications invited comments from the agencies and public. Comments were addressed and incorporated

into the Final Plan. Letters of comments received on the draft and NRCS responses to the comments are included in Appendix A.

7.5 Distribution List

The Draft and Final Plan were distributed to the organizations in Table 7.2 via email or hard copy.

TABLE 7.2
DISTRIBUTION LIST (CHIQUES CREEK WATERSHED PROJECT PLAN)

	Agency
Federal	Federal Emergency Management Agency, Region III National Marine Fisheries Service U.S. Army Corps of Engineers, Baltimore District U.S. Environmental Protection Agency, Region 3 U.S. Farm Service Agency U.S. Fish and Wildlife Service U.S. Geological Survey
State	Pennsylvania Department of Agriculture Pennsylvania Department of Conservation and Natural Resources Pennsylvania Department of Environmental Protection Pennsylvania Emergency Management Agency Pennsylvania Fish and Boat Commission Pennsylvania State Conservation Commission Pennsylvania State Historic Preservation Office
Local	Chiques Creek Watershed Alliance Lancaster Clean Water Partners Water Science Institute
Tribal	Absentee-Shawnee Tribe of Indians of Oklahoma Delaware Nation, Oklahoma Delaware Tribe of Indians Eastern Shawnee Tribe of Oklahoma Shawnee Tribe
Other	American Rivers, Mid-Atlantic Office Susquehanna River Basin Commission

SECTION 8 – REFERENCES

ARRO Consulting, Inc., LandStudies, Inc., and Pennsylvania Department of Conservation and Natural Resources (PA DCNR) (2005). *Little Chiques Creek Watershed Rivers Restoration Plan.* October.

Chesapeake Bay Foundation (2009). *The Impact of Human Health in the Chesapeake Bay Region*. https://www.cbf.org/document-library/cbf-reports/57298_final008c.pdf

Chesapeake Bay Foundation (2022). *Economic Impacts of Implementing the Phase III Watershed Implementation Plans: Agricultural BMPs*.

Constellation Energy Corporation (2025). *Conowingo Hydroelectric Generating Station*. https://www.constellationenergy.com/our-company/locations/location-sites/conowingo-hydroelectric-generating-station.html

Federal Emergency Management Agency (FEMA) (2016a). *Digital Flood Insurance Rate Map for Lancaster County, Pennsylvania*.

Federal Emergency Management Agency (FEMA) (2016b). *Supplemental Guidance for Conducting a Benefit-Cost Analysis (BCA) for a Floodplain or Stream Restoration Project.*

Fisher, P.E., James R. – Borough Manager, Manheim Borough. (2019).

Maryland Department of the Environment. (MDE) (n.d.). *Conowingo Dam Impacts*. https://mde.maryland.gov/programs/water/TMDL/TMDLImplementation/Pages/Conowingo-Dam-Impacts.aspx

National Oceanic and Atmospheric Administration (NOAA) (2024). *Essential Fish Habitat Mapper*. https://www.habitat.noaa.gov/apps/efhmapper/.

Pennsylvania Department of Environmental Protection (PADEP) (2000). *Total Maximum Daily Loads (TMDLs) for Donegal Creek Watershed.*

Pennsylvania Department of Environmental Protection (PADEP) (2003). *Watershed Restoration Action Strategy (WRAS).*

Pennsylvania Department of Environmental Protection (PADEP) (2024). *Pennsylvania Climate Impacts Assessment.*

Pennsylvania Department of Environmental Protection (PADEP) (2025). *Streams Chapter 93 Designated Use*. https://www.pasda.psu.edu/uci/DataSummary.aspx?dataset= 1098.

Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission (2024). *Conservation Opportunity Area Tool*. https://wildlifeactionmap.pa.gov/content/map.

Pennsylvania Natural Heritage Program (PNHP) (n.d.). *Pennsylvania Conservation Explorer*. https://conservationexplorer.dcnr.pa.gov/.

Rahnis, Michael. (2013). *Dams located from historical atlases of Lancaster County, Pennsylvania.* https://anabranch.blogspot.com/. March.

Schmer, N.K, Dozier, H.J., and L.G. Carper. (2024). *Calibration data and model archive summaries for suspended-sediment, total nitrogen, and total phosphorus concentration surrogate models at USGS station 01575900, Chiques Creek near Marietta, Pennsylvania, 2021-2023*.

Solyst, J. (2021). *Is it safe to swim in Chesapeake Bay Waters? Chesapeake Bay Program*. https://www.chesapeakebay.net/news/blog/is-it-safe-to-swim-in-chesapeake-bay-waters

Susquehanna River Basin Commission and U.S. Army Corps of Engineers (SRBC) (2018). *Chiques Creek Flood Resilience Study*.

Susquehanna River Basin Commission (SRBC) (2019). *Draft Chiques Creek Watershed Alternative Restoration Plan*. https://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/TMDL/ChiquesCreekARP.pdf. February.

U.S. Army Corps of Engineers (USACE) (2021). *Chesapeake Bay Comprehensive Water Resources and Restoration Plan: Final Commonwealth of Pennsylvania Anex*. https://usace.contentdm.oclc.org/digital/collection/p16021coll7/id/18490.

U.S. Census Bureau (2023). *American Community Survey 5-year Estimates*.

U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) (2024a). *Title 390 – National Watershed Program Manual.* June.

U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) (2024b). *Web Soil Survey*. https://websoilsurvey.nrcs.usda.gov/app/.

U.S. Environmental Protection Agency (EPA) (2010). *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus, and Sediment*. https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-document.

U.S. Environmental Protection Agency (EPA) (2023). *Green Book, Details of Criteria Pollutant Nonattainment Area Summary Report*. https://www3.epa.gov/airquality/greenbook/ancl2.html.

U.S. Fish and Wildlife Service (USFWS) (n.d.). *Information for Planning and Consulting (IPAC).* https://ipac.ecosphere.fws.gov/.

U.S. Fish and Wildlife Service (USFWS) (2019). *National Wetlands Inventory Wetlands Mapper*. https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/.

U.S. Geological Survey (USGS) (2014). *Hyporheic Flow and Transport Processes: Mechanisms, Models, and Biogeochemical Implications*.

U.S. Geological Survey (USGS) (2024). *Annual National Land Cover Database Collection 1 Land Cover Conterminous United States*.

U.S. National Park Service (USNPS) (2014). *National Register of Historic Places*. https://www.nps.gov/subjects/nationalregister/database-research.htm.

SECTION 9 – LIST OF PREPARERS

Name	Title	Education	Professional Experience (years)	Other Qualifications
U.S. Department of Agriculture, Natural Resources Conservation Service - Pennsylvania				
Mary Lynn Marks	Agricultural Economist	B.S., Food and Agricultural Business, University of Tennessee M.S., Agricultural Economics, University of Tennessee	2	
Christopher Plount	State Archaeologist	M.A., Cultural Resource Management	10	
Beth Sassaman	Supervisory District Conservationist	B.S., Biology, Cedar Crest College M.S., Biology, East Stroudsburg University of Pennsylvania	20	
Heather Smeltz	Assistant State Conservationist – Water Resources	B.S., Agricultural and Biological Engineering, Pennsylvania State University M.S., Biological and Agricultural Engineering, North Carolina State University	24	P.E.
Lancaster County Conservation District				
Matthew Kofroth	Assistant Manager	B.S., Environmental Science, Millersville University	30	
RJH				
Robert Huzjak	Project Manager	B.S., Civil Engineering Technology, Youngstown State University M.S., Civil Engineering (Geotechnical), University of Colorado, Denver	40+	P.E.
Christopher Leclair	Project Engineer	B.S., Environmental Engineering and M.S., Civil and Environmental Engineering Water Resources, California Polytechnic State University San Luis Obispo	7	P.E.
WSP				
Ghazoll Motlagh	Assistant Vice President, Project Manager	B.S., Civil Engineering, Pennsylvania State University	16	P.E., C.F.M
Scott Taylor	Vice President, Water Resources Engineer	B.S. and M.S., Civil Engineering, University of Memphis	32	P.E.
Dana Waits	Lead Consultant, Environmental Scientist	B.S., Environmental Science, Lipscomb University, Nashville TN	24	
Heather Williams	Lead Consultant, Water Resources Engineer	B.S., Civil Engineering, Purdue University	19	
Kristen Hayes	Associate Consultant, Water Resources Engineer	B.S. Environmental Engineering, Lehigh University	3	