Wye Mills Watershed Water Quality and Stormwater Action Plan

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Contents

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1.0 Introduction

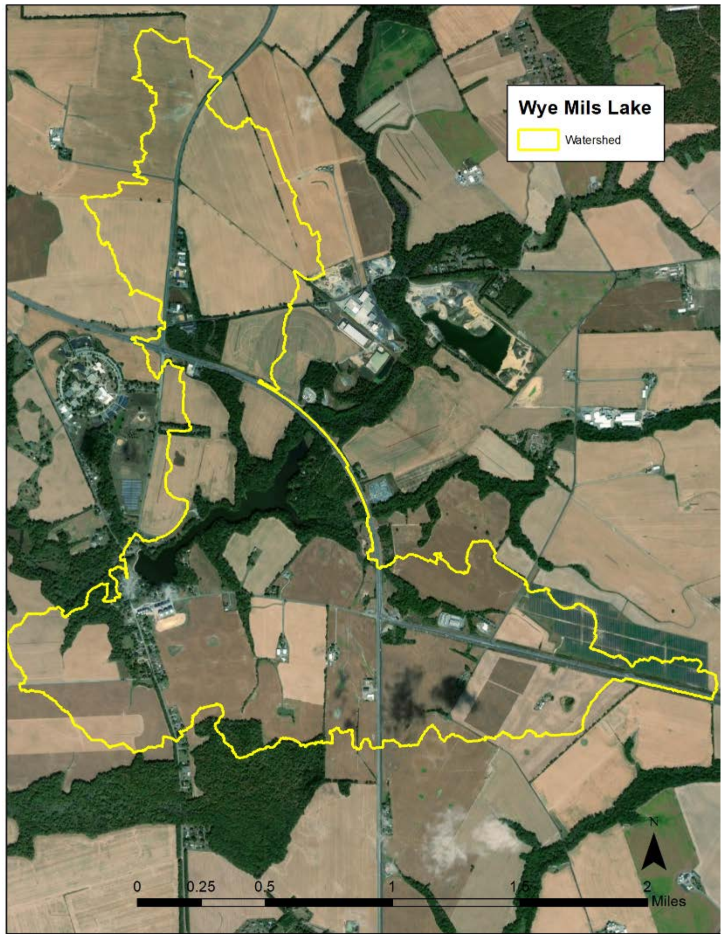

Figure 1. Wye Mill Lake watershed. This watershed only includes the drainage adjacent to the lake and not the Upper Wye East and an unnamed tributary to the Upper Wye East, which were included in the Upper Wye East Watershed Action Plan, ShoreRivers 2019.

The purpose of this plan is to provide guidance on potential water quantity and water quality related restoration projects within the Wye Mills community and Wye Mills Lake watershed, located in the headwaters of the Wye East River. The Watershed Action Plan outlines a series of recommendations for watershed restoration, describes management strategies, and identifies stormwater projects and green infrastructure opportunities within the community. These recommendations will better control stormwater, reduce flooding impacts in the community and at the Old Wye Mill, and reduce runoff and pollutants in stormwater from entering the Wye East River. The plan suggests financial and technical partners to help with implementation of various project types. The watershed plan is intended to assist ShoreRivers, the town of Wye Mills, Talbot County, and Queen Anne's County in moving forward toward restoration of the Wye Mills Lake and Wye East River.

1.1 U.S. EPA Watershed Planning

In 2003, the U.S. Environmental Protection Agency (EPA) required that all watershed restoration projects funded under Section 319 of the federal Clean Water Act be supported by a watershed plan.[1] The EPA identified nine key elements that are critical for improving water quality and should be included in watershed plans that address water quality impairments. These nine elements have come to be known as the "A-I criteria," as detailed below.

[1] For more information, visit MDE's Nonpoint Source Program (319) Management and Financial Assistance website at http://www.mde.state.md.us/programs/Water/319NonPointSource/Pages/index.aspx

EPA A-I Criteria[2]

A. Identification of Causes and Sources of Impairments

B. Expected Load Reductions

C. Proposed Management Measures

D. Technical and Financial Assistance Needs

E. Information, Education, and Public Participation Component

F/G. Schedule and Milestones

H. Load Reduction Evaluation Criteria

I. Monitoring Component

This watershed plan meets the A-I criteria and Table 1 shows where this watershed plan addresses these criteria.

Table 1: Location of A-I Criteria Within this Report

Section of the Report	A	B	C	D	E	F	G	H	I
Section 1	X								
Section 2			X						
Section 3			X						
Section 4		X	X					X	
Section 5				X		X	X		
Section 6					X				X
Appendix A									
Appendix B				X					

[2] For a more detailed description on the nine key elements, review Chapter 2 of the EPA's Handbook for Developing Watershed Plans to Restore and Protect Our Waters https://www.epa.gov/sites/production/files/2015-09/documents/2008_04_18_nps_watershed_handbook_handbook-2.pdf

1.2 Background

Wye Mills is an unincorporated community straddling Talbot County and Queen Anne's County, with the Wye East River acting as a border line between the two counties. Wye Mills is home to Wye Mills Lake, the largest impoundment on Maryland's Eastern Shore at about 50 acres in size. The lake serves as a popular recreational fishing spot and is managed by the State as a bass and bluegill lake.

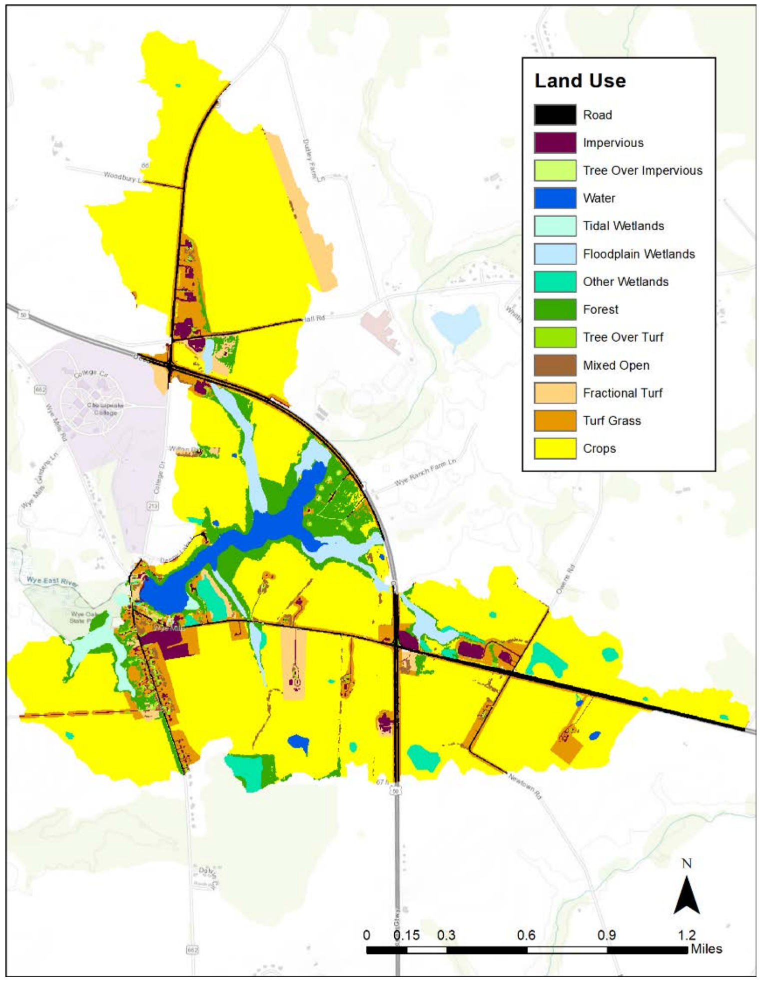

Figure 2. Land use of the Wye Mills Lake watershed.

The Wye Mills community has a rich history: it is home to Wye Oak State Park, the site of the once historic Wye Oak; Old Wye Church; and the Old Wye Mill, which was founded in 1682. The Old Wye Mill is the oldest continuously operated water powered grist mill in the United States and the oldest commercial structure in continuous use in Maryland. The community, and Old Wye Mill in particular, are at risk from increased and frequent flooding events. The community as a whole has a lack of stormwater practices to abate stormwater flow. The frequent flooding is caused by a combination of tidal influence from the Wye East River and heavy rainfalls. The grist mill has lost historic artifacts due to floodwaters in the building, having experienced flooding up to 8 feet. Stormwater travels downhill from the center of town to where the mill and Wye East River are located at the bottom of the hill. This area experiences significant flooding

Table 2. Land use for Wye Mills Lake watershed. Mixed Use/Pervious includes Tree over Turf, Mixed Open, Fractional Turf, and Turf Grass.

Land Use	**Percent of Watershed**	**Acres**
Urban/Impervious	5.1%	86
Mixed Use/Pervious	11.9%	203
Forest	6.6%	112
Water	3.1%	52
Wetland	5.9%	100
Agriculture	67.4%	1,144
Total Watershed	100.0%	1,697

during large storm events to the point where water has breached the main road, flowing over the bridge.

Friends of the Wye Mill, a nonprofit community group, approached project partners with concerns for the future of the Old Wye Mill and the community from increased flooding events. This plan was initiated by the Wye Mills community and will continue to incorporate their feedback throughout the project timeline as projects are designed and installed. This plan will provide a blueprint to help preserve the historic Old Wye Mill, to improve Wye East water quality, and to enhance the future of the Wye Mills community through the ultimate implementation of stormwater and water quality best management practices.

The Wye River Complex (comprised of the Wye River mainstem, the Wye Narrows, and the Wye East River) was first identified as impaired by the Maryland Department of Environment as part of the 1996 303(d) list submitted to EPA. As of 2004, the Wye River Complex is impaired by sediments, nutrients, and fecal coliform. The non-tidal sections are impaired for biological impacts. Currently, the waters of the Wye River are impaired for nitrogen, phosphorus, sediment and seasonally for bacteria. Impacts include shellfish closures, decreased recreation, and human health and safety issues. As a threat to public health, these closures directly impact recreational opportunities, commercial and recreational harvest opportunities, tourism, and overall aquatic habitat. In 2014, ShoreRivers conducted an assessment of the Wye River watershed for the purpose of identifying opportunities to reduce pollution loads. The Wye River Watershed Assessment: Pollution Reduction Opportunities and Community Engagement Plan is a detailed report on the sources of pollution in the watershed and the necessary tools needed to ensure successful reduction in pollution loads. Under the guidance of this plan, ShoreRivers has created successful collaborative agreements with multiple landowners and partners, and received funding to implement a dozen highly prioritized pollution-reduction projects, mostly centered around Chesapeake College. Following this assessment, ShoreRivers completed a large-scale Wye-Subwatershed study in 2019, which identified the Wye Mills community as a priority for the Wye East watershed, which had the poorest water quality of all of ShoreRivers' watersheds in 2018.

Ambient Conditions

Water quality and stormwater data are limited or non-existent for the town of Wye Mills and the Wye Mills Lake. There are no published stormwater reports for the town and there is minimal existing stormwater infrastructure.

Maryland Department of the Environment (MDE) periodically samples the lake, the outfall of the lake, and minor tributaries to the lake. This sampling is not consistent and is associated with the development of Maryland's Integrated Reports (IR) for Surface Water Quality created to be in compliance with Sections 303(d), 305(b), and 314 of the Clean Water Act.[3] As of the 2018 IR report, Wye Mills Lake was listed as category 3 (insufficient data to determine if a water quality standard is being attained) waterbody. The category 3 listing is referencing total phosphorus, which dissolved oxygen was being used to indicate potential impairment. As of the writing of this plan, there has not been additional data collected to address whether or not this impairment exists.

Table 3. General water quality parameters summarized from 5 locations within Wye Mills Lake

	Mean	Min	Max
Dissolved Oxygen (mg/L)	9.77	0.7	16.9
Chlorophyll *a* (µg/L)	57.05	2.44	145.96
Nitrate and Nitrite (mg/L)	2.49	0.12	4.83
Orthophosphate (mg/L)	0.01	0	0.1
Total Nitrogen (mg/L)	3.64	1.64	5.52
Total Phosphorus (mg/L)	0.14	0.04	0.26

The data collected by MDE is provided in an aggregated form in Table 3 and depicts a lake that is eutrophic with elevated nitrogen and phosphorus levels that support a robust algal community. It is also clear there are seasonal effects on the algal community with peak concentrations occurring in the spring and summer resulting in loss of dissolved oxygen in the following weeks or months associated with warming lake waters and decomposition of the algae in the bottom of the lake (Figure 3). The algal abundance also affects the cycling of nutrients in the lake, with nitrate and orthophosphate dropping in association with increasing chlorophyll *a* (algae) concentration and then rebounding once the algae bloom starts to diminish (Figure 4). Winter peaks of nutrients are most likely associated with increased discharge from tributaries and a lack of nutrient processing due to cold temperatures inhibiting biological processes.

[3] Maryland's Final 2018 Integrated Report of Surface Water Quality, https://mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/2018IR.aspx

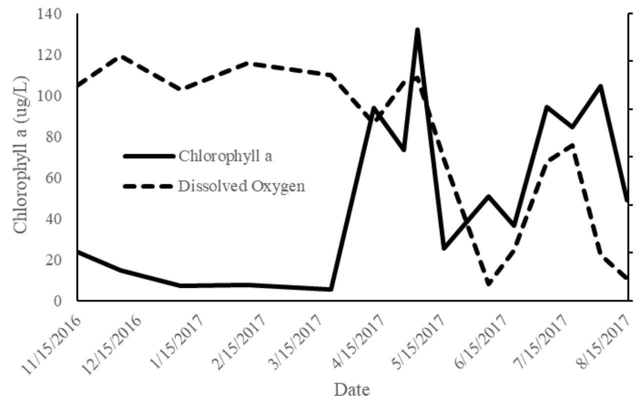

Figure 3. Mean chlorophyll *a* concentration and minimum dissolved oxygen concentration in Wye Mills Lake. Mean data is from 5 locations and minimum represents lowest value recorded for that date from 1 of the 5 sampling locations.

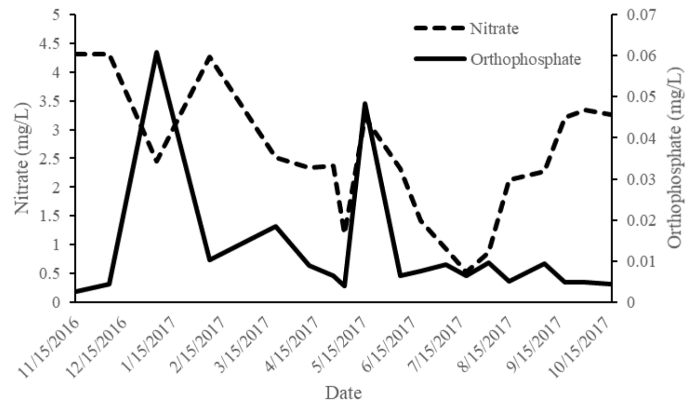

Figure 4. Mean nitrate and orthophosphate concentrations in Wye Mills Lake from November 2016 to October 2017. Mean data from 5 locations in the lake.

Causes and Sources of Pollution

Nonpoint Source Pollution Sources and Stormwater: The largest percent of land cover in the Wye Mills Lake watershed is agriculture, covering 67% of the land area. With agriculture being the largest land use, it will also be the largest source of nutrient and sediment pollution entering the lake. Within the town of Wye Mills, the majority of the watershed area is impervious. These impervious surfaces generate stormwater runoff and carry sediment directly to Wye East, directly below the lake spillway. A portion of the stormwater generated from the impervious surface in and around the Nagel Grain facility and MD Route 404 spills across MD Route 404 and across a private residence, where it has created a large head cut and ravine that is detrimental to private property by compromising a septic field and a barn.

The watershed can be broken up into 13 subbasins (Figure 5) to better understand stormwater volumes and to estimate nutrient and sediment loads entering the lake and Upper Wye East. Table 4 provides estimates of nitrogen, phosphorus, and sediment loading per acre for each subbasin. The table also provides a comparison of stormwater estimates per acre for current conditions against if each subbasin was in pristine condition (natural conditions would be completely forested). Percent increase in stormwater reflects how land use change has increased stormwater volumes leaving the subbasin when compared to pristine conditions. On a per acre basis, subbasins 10, 9, and 11 provide the largest nutrient and sediment loads. These subbasins are predominately agricultural land use. For stormwater volume on a per acre basis, subbasins 11, 9, and 8 contribute the most stormwater volume. Subbasin 11 and 9 are poorly drained agricultural fields. Subbasin 8 is the largest subbasin assessed in the watershed (494 acres) and has a mixture of poorly drained agricultural soils and impervious surfaces (U.S Route 50 and MD Route 213), and small commercial businesses. The subbasins with the greatest stormwater percentage change from pristine conditions are 1, 2, and 13, which are all in the town of Wye

Mills. These subbasins are largely impervious. Such large changes in the stormwater volume documents how land use change can dramatically change the hydrology and reduce the ability of the landscape to infiltrate water to attenuate stormwater volumes. It also highlights why the town of Wye Mills is having stormwater issues and will face challenges in reducing stormwater volumes due to the small amount of pervious acres to work within.

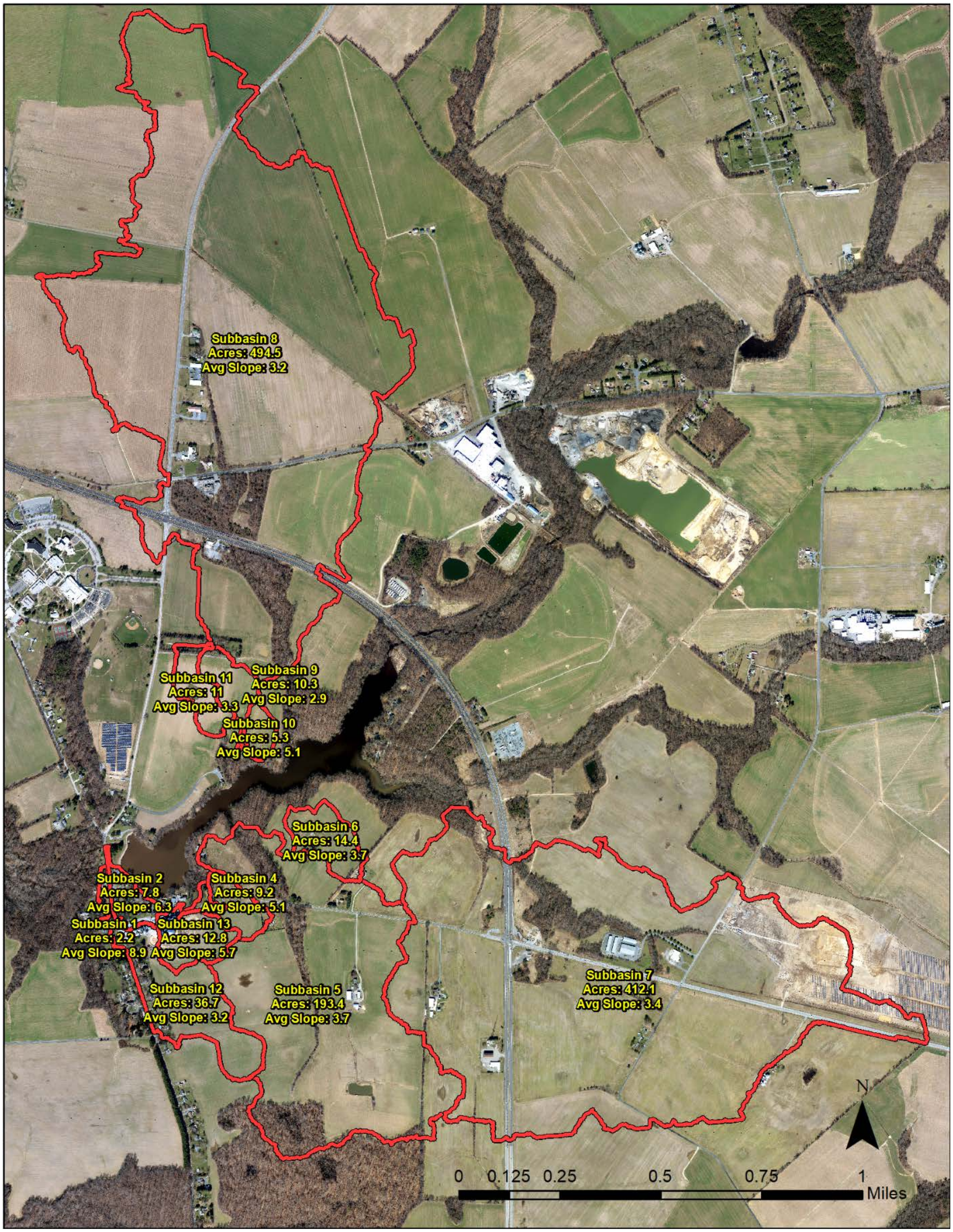

Figure 5. Subbasins that make up the Wye Mills Lake watershed. These subbasins were used to calculate nutrient and sediment loading and stormwater volume.

Photos of stormwater taken from three different problem locations in the Wye Mills watershed.

Table 4. Subbasin loading and stormwater conditions based on the Chesapeake Model land use loading (nutrients and sediment) and runoff curve numbers (RCN) for 10-yr 24-hr stormwater estimations. Pristine conditions references if the subbasin were entirely forest.

		Based on Chesapeake Bay Model Land Use Loading			Current	Pristine Conditions	Percent Increase
Subbasin	**Acres**	**Nitrogen (lbs/ac)**	**Phosphorus (lbs/ac)**	**Sediment (tons/ac)**	**10-yr Stormwater (cf/ac)**	**10-yr Stormwater (cf/ac)**	**Stormwater**
1	2	10.35	0.61	0.61	8,515	61	13917%
2	8	11.78	0.70	0.92	9,459	113	8265%
3	3	13.07	0.65	0.88	9,459	1,110	752%
4	9	17.27	1.06	1.13	6,179	689	797%
5	193	22.91	1.40	1.62	8,515	3,414	149%
6	14	27.67	1.69	2.05	8,209	1,601	413%
7	412	25.47	1.52	1.80	10,439	4,603	127%
8	494	26.34	1.60	1.85	11,804	7,314	61%
9	10	29.30	1.77	2.11	12,156	8,209	48%
10	5	30.42	1.84	2.18	10,439	5,371	94%
11	11	28.29	1.73	2.09	12,156	8,209	48%
12	37	23.86	1.45	1.72	8,826	961	818%
13	13	20.88	1.18	1.43	11,114	566	1864%

Point Source Pollution and Sources: In 1972, a component of the Clean Water Act was established to control point source water pollution through a permitting system. Point sources are defined as any conveyance such as a pipe or manmade ditch that eventually discharges directly into surface water. Municipal, industrial, and other facilities must obtain a National Pollution Discharge Elimination System (NPDES) permit if their discharges go directly to surface waters. MDE issues NPDES permits in Maryland as a means of limiting the amount of pollution entering surface waters from industrial and municipal facilities. There are four permitted facilities that discharge into the Upper Wye East watershed (Table 5).

Table 5. NPDES permitted facilities in the Upper Wye East watershed

Facility Name	Address	Permit Type	Permit No.
S.E.W. Friel	120 Friel's Rd. Wye Mills, MD 21679	[Individual Permit] Discharge Permit	MD0000043
Chesapeake College WWTP	MD Route 213/Route 50 East, Wye Mills, MD 21679	[Individual Permit] Discharge Permit	MD0024384
		[General Permit] Discharge associated with water supply	MDG766648
David A. Bramble – Wye Mills Plant	451 Grange Hall Rd., Wye Mills, MD 21679	[General Permit] Discharges associated with asphalt paving mixtures and blocks	MDG490766
David A. Bramble – Dudley Pit	Starr Grange Hall Rd Wye Mills, 21679	[General Permit] Discharges from Mineral Mines, Quarries, Borrow Pits and Concrete and Asphalt Plants	MDG499886

The discharge or "effluent" from these facilities includes toxics, nutrients, and organic and inorganic materials that can have a devastating impact on the water quality of the Upper Wye East if permit limits are exceeded. All permitted facilities have been inspected by Maryland Department of the Environment (MDE) in the past five years, with the exception of the Dudley Pit, and all four have had Significant/Category 1 Noncompliance, the most serious level of violation noted in EPA databases. At the publication of this watershed plan, Chesapeake College WWTP was, as of the most recent quarter (04/01/20 - 06/30/20), in Significant/Category 1 Noncompliance for failing to submit a discharge monitoring report (DMR) and in violation of total suspended solids (TSS) concentration. Chesapeake College WWTP was in Significant/Category 1 Noncompliance for TSS concentration for two out of the four quarters in 2018 and had violations identified for TSS concentration for one of the four quarters in 2019.

David A. Bramble – Wye Mills Plant was also in Significant/Category 1 Noncompliance for failing to report a DMR in the most recent quarter as well as the seven previous quarters. S.E.W Friel was in compliance at the publication of this report, but was in Significant/Category 1 Noncompliance for two quarters in 2017 for total nitrogen and nitrate. The two quarters for noncompliance were 07/01/17 – 09/20/17 and 10/01/17 – 12/31/17, which is the timeframe when the plant is processing corn for canning. This operation discharges directly into the mainstem non-tidal Wye East (watershed not included in Figure 1, included in Upper Wye East Watershed Action Plan, ShoreRivers 2019), which has the highest ammonium concentration of any of the Upper Wye East streams (Table 6). Ammonium is a strong indicator of waste from a food processing facility. The David A. Bramble—Dudley Pit was also in Significant/Category 1 Noncompliance for failing to report DMRs for all four quarters of 2018. Additionally, the facility has frequently received limit violations for pH pollutant and currently in Reportable Non-compliance.

Table 6. Ammonium (NH^{+}_{4} -N) concentrations (mg/l)

Site	Average (mg/l)	Min (mg/l)	Max (mg/l)
Non-Tidal Upper Wye East	0.25	0.02	0.53
Unnamed Tributary to Upper Wye East	0.03	0.005	0.35

Maryland's NPDES program offers key avenues for public participation in the permit issuing process. By being involved, citizen and watershed groups can advocate for permit limits that protect local water quality and enforceable conditions that provide accountability when permit limits are violated. For a full description of this process, basic information, tools and tips to assist anyone in analyzing and commenting on NPDES permits in Maryland, reference the Citizens Guide to Public Participation in Maryland's NPDES Permitting Program. In terms of protecting the Upper Wye East from point sources of pollution, it is critical that citizen advocacy and enforcement groups monitor the permitted facilities mentioned in Table 5 and reference the Citizen Guide to effectively navigate the process and advocate for strong, enforceable permits.

2.0 Watershed Goal, Strategies and Recommendations

Addressing the stormwater and water quality issues in the town of Wye Mills and within the Wye Mills Lake is a community-wide effort that requires participation from a number of stakeholders. This plan has involved local landowners and local community groups, as well as input from the largest stakeholders within the town, such as the Friends of the Wye Mill, MD Dept. of Natural Resources, and the largest business, Nagel Farm Service. This has shaped the plan to be as comprehensive as possible in tackling water quality and quantity issues at a subbasin scale.

2.1 Watershed Goal and Stormwater Goal

Watershed Goal: A healthy Wye Mills Lake that is safe for swimming, recreational boating, and recreational fishing, that is free from all water quality impairments, so that healthy human and wildlife communities can be sustained for generations.

Stormwater Goal: Reduce the impacts of stormwater on the town, mill, and Upper Wye East to ensure the community is resilient to an uncertain climate future.

2.2 Strategies

1. **Quantify the problem in terms of nutrient loads and stormwater.** Identify the quantities and sources of nutrients, as well as the flow path from the pollution sources to the water, and areas where stormwater needs to be addressed.
2. **Public-private partnerships.** Leverage both Talbot and Queen Anne's Counties' resources in collaboration with the technical skills and expertise from the diverse group of watershed partners including farmers, NGOs, landowners, nutrient management specialists, and Chesapeake College.
3. **Increase the knowledge of farmers, property owners, local government, private businesses, and agricultural consultants.** Use education to change behavior and increase the likelihood that individuals will be mindful of the impact of land management on downstream water quality and stormwater.
4. **Manage nutrient application according to the best available science.** Applying nutrients using the 4R Nutrient Stewardship[4] concept (right fertilizer source, right rate, right time, right place) and the Phosphorus Management Tool[5] will increase efficiency and reduce runoff.
5. **Implement the appropriate nutrient and stormwater best management practices wherever space and site conditions allow.** Site-specific conservation planning, also referred to as *full-farm conservation planning,* is the best way to efficiently manage agricultural runoff. Updated stormwater practices take into account larger storm events and utilize better design criteria to ensure long-term practice efficacy.
6. **Maintain and update septic systems within the watershed.** Properly maintained systems and Best Available Technology (BAT) systems are proven to remove the greatest amount of nutrients from the wastewater.
7. **Ensure all NPDES are following their permits.** Point sources can be easily managed through the NPDES process, but it is important that the facilities do not exceed their discharge allocations and concentrations and that the permits are stringent enough to ensure no water quality impacts.

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[4] To learn more about the 4Rs, visit the Nutrient Stewardship website: https://www.nutrientstewardship.com/4rs/

[5] To learn more about Maryland's agricultural phosphorus initiative, the Phosphorus Management Tool, visit Department of Agriculture's website: https://mda.maryland.gov/Pages/PMT.aspx

8. **Incorporate climate change adaptation strategies in project planning and implementation.** Impacts of climate change will affect how stormwater and restoration practices perform into the future.

2.3 Recommendations

This section describes seven recommendations for addressing stormwater and pollution from the town of Wye Mills and the adjacent lake watershed. Not listed in order of priority, these recommendations are a result of modeling and firsthand knowledge of the watershed generated by ShoreRivers staff and stakeholders through the development of this plan. When possible, multiple recommendations should be implemented simultaneously in order to effectively bring about restored water quality. Combining these efforts with education and pollution prevention can lead to long-term behavioral change. Targeted outreach to landowners and farmers can have a beneficial impact, while additional funding can be secured for the costlier recommendations.

1. **Utilize federal and state cost-share programs to accelerate the rate of project implementation**. Work with Talbot and Queen Anne's Counties Soil Conservation Districts (SCDs) and Natural Resource Conservation Services (NRCS) to utilize cost-share funding for applicable projects. To further incentivize the implementation of these practices, look for additional grant funding to pay for costs that exceed what the cost-share covers.
2. **Full-farm management.** Approach the management of the farm property holistically. Utilize water control structures on the outlets of tile drains and ditches, and filtering practices on the inlets. Identify areas of erosion adjacent to the lake and create a plan to address the issues before the erosion becomes untenable. Prioritize cover cropping and no-till farming to reduce runoff, increase infiltration, and reduce nutrient loss.
3. **Implement "demonstration" projects.** Demonstration projects are a great tool to encourage other landowners to utilize a nutrient removal project. When working with a landowner, ask for permission to access their property to show the project to stakeholders, funders, and other landowners. This is effective at both large farm and small residential scales.
4. **Provide outreach and technical assistance to landowners and farmers.** Use the projects identified in this plan as a guide for landowner outreach. Providing direct outreach and landowner technical assistance will help encourage greater participation in these plans. When possible, partner with NRCS and SCDs for a more targeted approach to landowners and better understanding of the available resources at the state and federal level. For residential and commercial areas, work with University of Maryland Extension and other NGOs that can assist with "river-friendly" yards.
5. **Provide resources to periodically maintain and upgrade septic systems.** Work with the Queen Anne's and Talbot Health Departments to identify failing septic systems within the watershed. Provide education to the homeowners of those failing systems and

encourage regular pump-outs and manufacturer-recommended maintenance. When it is time for an upgrade or new system, encourage the use of BAT systems and identify opportunities to use Bay Restoration Funds for the upgrades.

6. **Plan for increased rainfall amounts, rainfall intensity, and regional plant species migration due to changing climate patterns.** By planning for these expected changes, we will be able to implement projects that are more resilient to the effects of climate change. These effects include rainfall that is more intense and more frequent, while we are also experiencing longer periods of drought-like conditions. These changes will have an effect on the size of water quality practices, as well as the plants that are used in natural filtration projects.
7. **Monitor the health of Wye Mills Lake as a means of tracking progress.** Keep a pulse on the health of Wye Mills Lake by conducting an ongoing water quality monitoring program. Test the water for physical degradations as well as chemical impairments. Test the dissolved oxygen levels at the surface and the bottom of the water column. Test the nutrients and bacteria levels from different areas throughout the water body and the surrounding watershed. Identify emerging hotspots of pollution. Utilize partners like the Department of Natural Resources (DNR) and local watershed organizations to facilitate the effort.

3.0 Watershed Restoration Practices

This section provides an overview of the practices recommended for addressing stormwater and pollution from the town of Wye Mills and the surrounding watershed. Successful restoration requires collaboration among local, county and state government, watershed partners, landowners, and farmers. Local and state governments are able to implement projects on public property, as well as financially support efforts on private property through cost-share programs and other incentives. Watershed partners, landowners, and farmers are encouraged to implement projects and programs on private property, where they will be most effective. The variety of practices recommended address both stormwater and agricultural pollution and are suggested for projects identified in this plan, as well as any new development in the watershed or conservation work that occurs within the watershed not explicitly identified in this plan.

Urban/Suburban Stormwater Practices

1. **Regenerative Stormwater Conveyance (RSC)** – Also known as regenerative streamwater conveyance, coastal plain outfall, or regenerative step pool storm conveyance is a series of riffles, pools, and weirs that use surface pools and a subsurface sand seepage filter to reduce storm flows and infiltrate as much water as possible into shallow groundwater. RSCs are designed to safely convey stormwater from concentrated flow points (culvert, stream, or

ditch) to a receiving waterbody while mitigating erosion and providing some degree of water quality improvement. They are implemented in steep topographies that are incised and present erosion issues that cannot be addressed using typical stream restoration techniques.

Figure 6. RSC step pools in Wye Mills, MD.

2. **Impervious Surface Reduction/Management** – Impervious surfaces are land surfaces that repel rainwater and do not permit it to infiltrate (soak into) the ground. Development in the town of Wye Mills has altered natural flow paths through the paving of roads and compaction of soils, thus reducing natural filtration through the soil and nutrient uptake by plant roots. Efforts to remove or alter unnecessary or failing impervious surface areas are being undertaken all over the bay watershed and range in capacity from volunteer community groups to local government capital improvement projects. The town of Wye Mills has no dedicated stormwater systems, thus runoff reduction through better management of impervious surfaces is critical to reducing negative impacts of stormwater.

Figure 7. Depave, a non-profit from Seattle, WA, organizes volunteer groups to manually remove impervious surfaces.

3. **Urban Tree Planting** – Urban tree planting refers to cityscape street tree plantings that are arranged throughout a city's roadways and residential and business properties. This practice is different than urban forest buffers in that the plantings aren't necessarily buffering a waterway or large amounts of impervious surfaces. Urban tree plantings are considered fillers in a city's urban tree canopy. In addition to providing stormwater management benefits, they reduce the urban heat island effect, reduce heating and cooling costs, lower air temperature, reduce air pollution, increase property values, and provide wildlife benefits.

Figure 8. Street trees along an urban center.

4. **Bioretentions** – Bioretentions are stormwater treatment facilities that capture and temporarily store runoff. Once it enters the bioretention area, water is slowly released and passed through a filter bed of sand, organic matter, and soil, often referred to as a bioretention mix. Depending on the design, filtered runoff may continue to filter into the

groundwater, or may be returned to the stormwater conveyance system via an underdrain. The treatment areas are typically planted with native grasses and plants that help filter out pollutants, as well as provide aesthetic and habitat benefits. Native pollinator plants are often used to attract butterflies and other beneficial pollinator species.

Figure 9. Bioretention project at a church in Easton, MD.

5. **Bioswale** – A bioswale is a landscape best management practice (BMP) designed to remove nutrients and sediment while transporting rainwater. A bioswale typically consists of a soil medium that includes sand, organic matter like compost, and soil, native vegetation, sloped banks, and sometimes riprap. Bioswales can be meandering or straight lines depending on the landscape and the amount of time that water stays within the channel is maximized up to 24 hours to allow for sufficient nutrient and sediment removal.

Figure 10. A bioswale on the campus of California State University.

6. **Vegetated Open Channel** – This practice is similar to a bioswale in that it is used to remove nutrients and sediment as water is transported through a channel. Unlike bioswales, vegetated open channels do not necessarily include the same soil medium consisting of

organic matter and sand, but they do include native vegetation, sloped banks, and sometimes riprap as needed. Vegetated open channels are a less expensive alternative retrofit option than a bioswale.

Figure 11. Example of a vegetated open swale in Maryland.

7. **Stormwater Wetlands/Ponds –** Stormwater wetlands are practices that include significant shallow wetland areas to treat urban stormwater runoff, but often may also incorporate small permanent pools and/or extended storage to achieve the full water quality benefit. Often referred to as pocket wetlands in urban areas, this BMP includes a variety of native wetland plants that help to absorb and filter stormwater runoff. As opposed to a bioretention area, stormwater wetlands are designed to hold water for a longer period of time to allow for adequate filtering. These wetlands provide an aquatic habitat in an otherwise terrestrial area.

Figure 12. Example of Wetlands at Worton Park in Worton, MD.

8. **Rain Garden** – A rain garden is a constructed shallow depression adjacent to structures that collects rainwater from roofs, driveways, parking lots, or streets, and allows water to soak into the ground. Planted with native species, rain gardens can be a cost effective and

aesthetically pleasing way to reduce runoff from residential properties or businesses. Rain gardens also help filter out pollutants in runoff and provide food and shelter for butterflies, song birds, and other wildlife.[6]

Figure 13. Rain garden example at Wilmer Park in Chestertown, MD.

9. **Downspout Disconnection** – Downspouts that discharge directly into a driveway or road contribute to stormwater issues downstream. Disconnecting or redirecting the downspout away from impervious surfaces and allowing water to fill a rain barrel or soak into adjacent grass reduces stormwater volume and is a simple way for local residents to do their part in helping resolve stormwater issues.

Figure 14. Example of a downspout disconnected from the driveway and redirected to a rain barrel. Downspout disconnections can also be redirected to lawn or other vegetated spaces rather than into a barrel.

[6] Soak Up the Rain: Rain Gardens, EPA, https://www.epa.gov/soakuptherain/soak-rain-rain-gardens

Agricultural Best Management Practices

10. **Blind Inlet (Vertical Drain), NRCS Standard 630** – Also known as a "French drain," a blind inlet is constructed by placing small aggregate and sand over perforated pipe which is connected to an underground outlet. Because the blind inlet acts as a filter, it can reduce the amount of sediment and other contaminants discharged through the outlet compared with perforated risers or flush inlets. Blind inlets also provide obstruction-free equipment operations because they eliminate the perforated riser inlet.

Figure 15. Blind inlet example showing the filter (gravel) being placed over the subsurface perforated drainage pipes.

11. **Cover Crops, NRCS Standard 340** – Growing a crop of grass, small grain, or legumes primarily for seasonal protection and soil improvement. Cover crops reduce erosion from wind and water while also utilizing excessive soil nutrients and increasing soil health by adding organic matter. It is critical to get these crops planted by late summer or early fall and to either plant green or terminate just before planting the next crop. Mixed cover crops also provide the added benefit of diversity and help develop better soil structure.

Figure 16. Cover crop example showing vegetation covering the soil. (photo: Farmfuture.com)

12. **Denitrifying Bioreactor, NRCS Standard 605** – A structure that uses a carbon source to reduce the concentration of nitrate-nitrogen in subsurface tile or ditch agricultural drainage flow via denitrification. This edge-of-field subsurface practice improves water quality by reducing nitrogen content of agricultural drainage water. This practice usually involves a water control structure.

Figure 17. Denitrification Bioreactor example showing the subsurface woodchip-filled pit.

13. **Grassed Waterway, NRCS Standard 412 –** A graded or shaped channel established with vegetation suitable to convey water at a non-erosive velocity using a broad and shallow cross section. Grassed waterways protect and improve water quality by filtering runoff and maintaining vegetative cover on water conveyance channels.

Figure 18. Grassed Waterways example showing the vegetative cover over the drainage channel. (Photo: NRCS)

14. **Nutrient Management [Plans], NRCS Standard 590 –** The certified plan and subsequent actions to manage the amount, source, placement, form and timing of the application of nutrients. Obtaining and following a nutrient management plan helps minimize agricultural nonpoint source pollution and properly utilize manure and other organic fertilizers.

15. **Phosphorus Sorbing Materials in Agricultural Ditch**[7] – The application of "Phosphorus sorbing" materials to absorb available dissolved phosphorus in cropland drainage systems for removal and reuse as an agricultural fertilizer. These in-channel engineered systems can capture significant amounts of dissolved phosphorus in agricultural drainage water by passing them through phosphorus sorbing materials, such as gypsum, drinking water treatment residuals, or acid mine drainage residuals.

16. **Riparian Forest Buffer, NRCS Standard 391** – A corridor of trees and/or shrubs planted adjacent to a river, stream, wetland, or water body. The planting is of sufficient width, up-gradient, and proximity to the water body to ensure adequate functioning. The primary purposes for installing a riparian forest buffer include protecting near-stream soils from over-bank flows, trapping harmful chemicals or sediment transported by surface and subsurface flows from adjacent land uses, or providing shade, detritus and large woody debris for the in-stream ecosystem.

Figure 19. Riparian forest buffer example showing shorelines buffered from farm field by thick stands of trees.

17. **Saturated Buffer, NRCS Standard 604** – A subsurface, perforated distribution pipe used to divert and spread drainage system water to a vegetated area to increase soil saturation. This practice helps reduce nitrate loading to surface water from subsurface drain outlets.

[7] For more on Phosphorus Sorbing Materials visit the Maryland Department of Agriculture's website. https://mda.maryland.gov/resource_conservation/WIPCountyDocs/bmpdef_pg.pdf

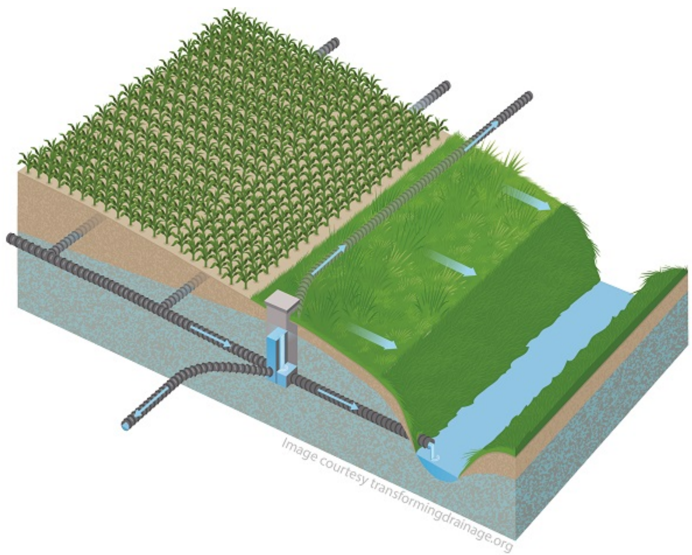


Figure 20. Saturated buffer example showing a tile drain distributing water underground to a riparian buffer before it enters a drainage ditch or stream channel.

18. **Streambank and Shoreline Protection, NRCS Standard 580 –** The use of plants and other natural elements to stabilize and protect the banks of streams and drainage ditches. The benefit of streambank and shoreline stabilization is the ability to maintain the flow capacity of a stream, reduce sediment erosion impacting downstream habitats, and improve the stream corridor for fish and wildlife habitat.

19. **Structure for Water Control, NRCS Standard 587 –-** A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation, or measures water. This structure allows a farmer to control the stage, discharge, distribution, delivery, and direction of water flow.

Figure 21. Structure for water control installed in a ditch to help control water level and increase nutrient removal within the ditch.

20. **Two-Stage Ditch (Open Channel), NRCS Standard 582 –** A design conversion that modifies the geometry of a ditch to establish benches within the ditch. The ditch provides a low-flow channel and then a vegetated bench that is flooded during higher flows. The vegetation provides some slowing of water flow where sediments and other heavier material in the water might settle. A two-stage ditch is an in-channel practice.

Figure 22. Two-stage ditch example showing the extended benches within the ditch. This two-stage ditch is located in Talbot County, MD.

21. **Wetland Restoration, NRSC Standard 657, Created Wetland, NRCS Standard 656 –** The return of a wetland to an area with hydric (very wet) soils. This involves managing the drainage volume, water table volume and vegetation at a site suitable for wetland restoration. The benefits of this practice are to filter nutrients from runoff while providing fish and wildlife habitat.

Figure 23. Wetland creation adjacent to a farm field in Cecil County, Sassafras River watershed

22. **Water and Sediment Control Basin (WASCOB), NRCS Standard 638 –** A WASCOB is an earthen embankment that crosses the slope of a drainageway (concentrated flow path) to trap stromwater and sediment and relase the water in a less erosive manner using a pipe to a stablized outlet. This practice helps reduce gully erosion, trap sediment, and reduce and manage stormwater runoff.

Figure 24. This photo depicts a WASCOB with a berm running across a grassed drainage area and two orange risers that help convey stormwater in a less erosive manner. Photo from Essex Soil and Crop Improvement Association, http://escia.ca/2019-conservation-farm-award/wascob/

4.0 Project Selection and Site Planning

4.1 Project Selection and Plans

A basic hydrology model of the watershed was created using Light Detection and Ranging (LIDAR) data downloaded from Maryland iMAP[8]. Queen Anne's County LIDAR data was captured in 2013 (10 cm vertical accuracy) and Talbot County LIDAR data was captured in 2015 (8.6 cm vertical accuracy). The two data sets are downloaded as a processed digital elevation (DEM) raster. The DEMs were merged and then cut to slightly larger than the watershed boundary. This DEM was then processed using an ESRI ArcGIS toolbox add-on created by NRCS that contains engineering tools that streamline DEM processing, stream and surface water flow path identification, and watershed delineation. This toolbox was used to generate subbasins with the Wye Mills Lake watershed and helped with the estimation of storm water volume using land use data (Chesapeake Conservancy, 2014[9]) and soils data. Runoff Curve Numbers (RCN) were estimated using area weighting to calculate an average RCN for each subbasin.

Using this desktop analysis, certain areas within the watershed were pinpointed for more field investigation. Discussions with Queen Anne's SCD also brought to light some landowner resource concerns that were investigated in the field as well. After field investigations were completed, potential best management practices were mapped to estimate watershed area captured by each practice and help to inform concept level designs.

The next pages describe each best management practice opportunity identified through the desktop analysis and through field investigations.

[8] Maryland Mapping and GIS Portal, MD iMAP, https://imap.maryland.gov/Pages/lidar.aspx

[9] Chesapeake Conservancy, Conservation Innovation Center. https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/land-use-data-project/

Overview Map of All Projects

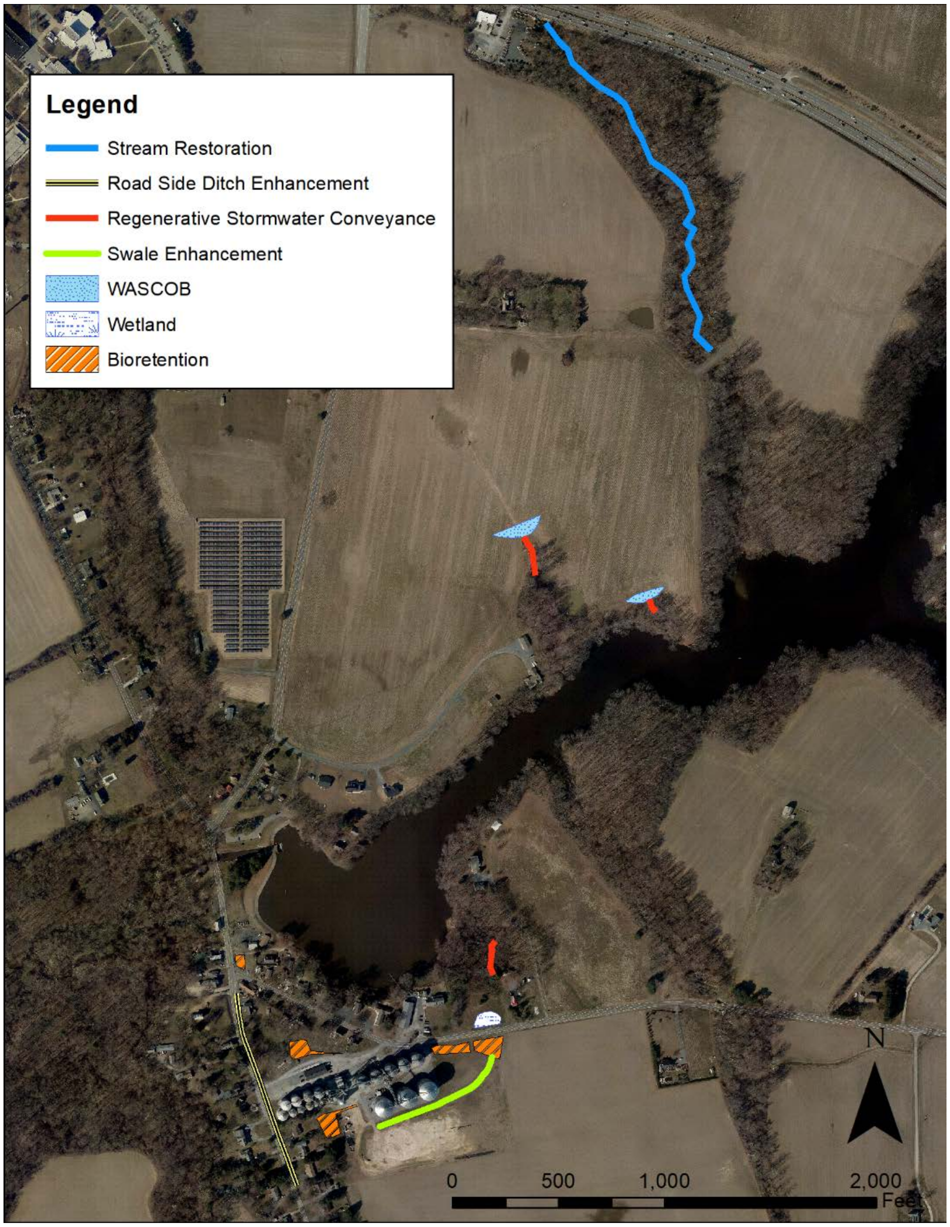
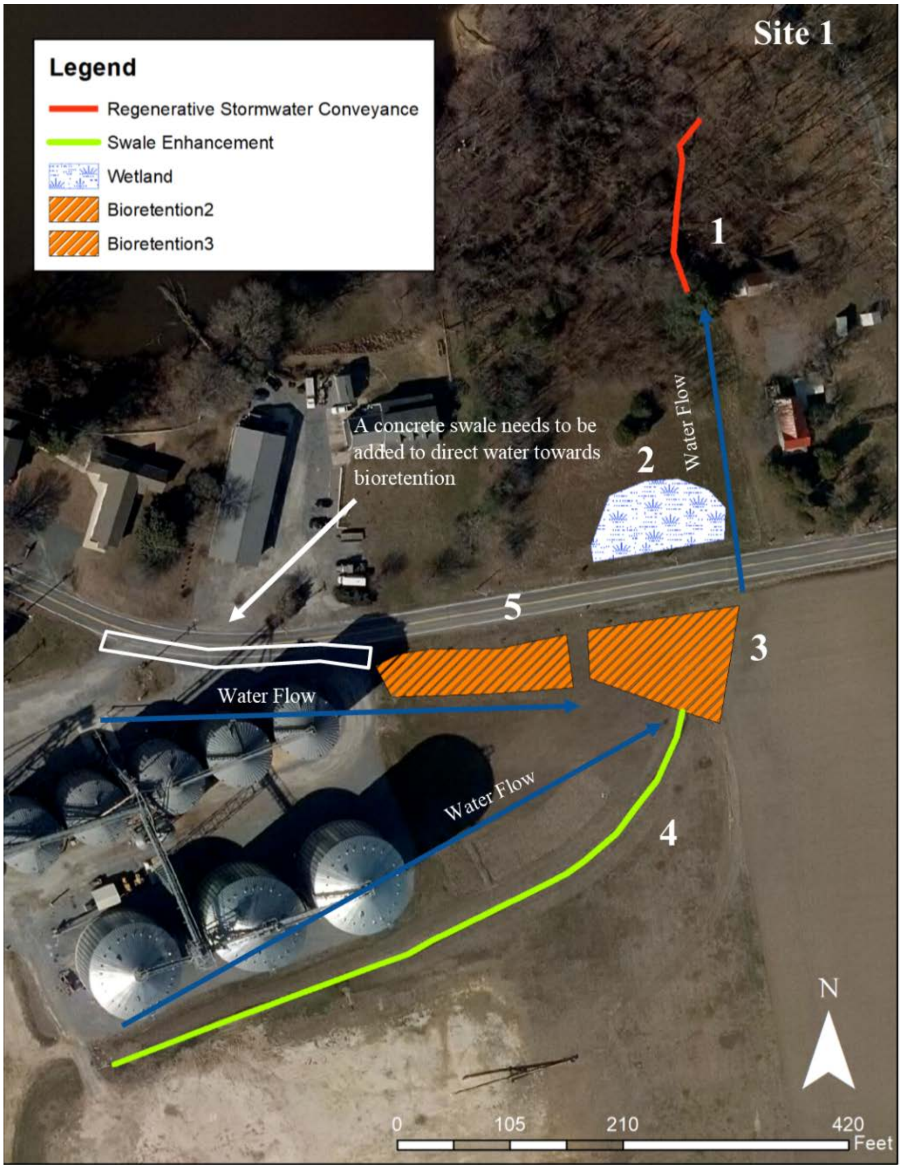


Table 7. Nutrient, sediment, and stormwater reductions for each site

Site	Num. of Practices	Subbasins	Nitrogen Reduction (lbs./yr)	Phosphorus Reduction (lbs./yr)	Sediment Reduction (tons/yr)	Stormwater Reduction (cf) per storm
1	5	3, 13	295.79	35.97	17.84	41,470
2	4	1, 2, 12	649.41	68.24	30.71	47,330
3	2	11	68.12	7.60	4.15	20,460
4	2	10	33.03	3.65	2.0	12,210
5	1	8	142.5	129.2	235.6	0



Site 1 consists of complementary stormwater practices that help reduce stormwater volume stemming from the Nagel Grain facility and Route 404. There is an existing bioretention facility and swale with check dams that capture stormwater from the three large grain bins as well as a temporary grain storage facility at the bottom of the image. The additional proposed practices will either capture untreated stormwater (5) or help better store, infiltrate, and convey stormwater (1,2,3,4) to reduce flooding and erosion.

Table 8. Potential nutrient, sediment, and stormwater reductions from the practices proposed at Site 1

Project	Practice	Drainage Acres	Nitrogen Reduction (lbs./yr)	Phosphorus Reduction (lbs./yr)	Sediment Reduction (tons/yr)	Stormwater Reduction (cf/storm)
1	RSC	15.6	87.32	10.27	11,109.91	0
2	Wetland	14.6	35.12	8.78	9,617.56	13,900
3	Bioretention	9.1	69.34	6.93	6,132.99	20,000
4	Swale	9	88.01	8.38	7,413.51	2,600
5	Bioretention	2.1	16.00	1.60	1,415.31	14,970

1. Regenerative Stormwater Conveyance

Figure 25. At Site 1 the outlet is currently a severely eroded gully that is compromising the structural integrity of a barn and septic system. The regenerative stormwater conveyance would stabilize this gully and allow the excess stormwater that is not stored or infiltrated by the best management practices above it in the watershed to be conveyed with less erosive energy, reducing sediment loss and protecting the nearby structures.

2. Wetland/Stormwater Storage

Figure 26. This potential wetland area is already enrolled in a continuous Conservation Reserve Program (CRP) easement. At present, the area is grassed. The proposed wetland/stormwater storage area is located where stormwater enters the field from the road. This project would fit within CRP guidelines and also provide necessary stormwater retention to reduce/meter water volume entering the RSC.

3. Bioretention

Figure 27. This bioretention would receive water from an existing grassed swale that collects water from the Nagel Grain facility. The bioretention could potentially be designed to intercept water from the adjacent farm field. The outlet of the bioretention would need to go under Route 404 in a pipe with an outlet into the proposed wetland area. The bioretention to the west of this site could be tied into this bioretention if elevations permit.

4. Bioretention

Figure 28. This bioretention is one of the most important projects. It will intercept water from Nagel Grain and Route 404, which currently goes untreated across the road and down the roadside ditches. To make this bioretention work, a concrete swale would need to be installed along Route 404 in front of Nagel Grain. This would ensure that stormwater does not sheet flow across the road and is instead directed to the bioretention. The bioretention would either outlet into the roadside ditch or could be tied to the next bioretention cell.

5. Swale Enhancement

Figure 29. The grassed swale with check dams is already existing. This project would simply enhance the swale to act more like a bioswale by enhancing portions of the swale with more permeable media.

Site 2 consists of four complementary projects intended to reduce the stormwater volume coming from Nagel Grain and the town of Wye Mills. At present, there are no stormwater practices in this portion of the town. Stormwater travels down Route 404 and Old Wye Mill Rd., ending up at the Old Wye Mill or at the outlet of the lake. A significant amount of sediment is carried from the Nagel Grain parking lot down the roadside ditches along Old Wye Mill Rd., and eventually turning into sheet flow at the intersection of Old Wye Mill Rd. and Route 404. To make these projects work correctly, it is recommended that the parking lot at Nagel Grain be paved with concrete to reduce the sediment coming from the gravel currently in use.

Table 9. Potential nutrient, sediment, and stormwater reductions from the practices proposed at Site 2

Project	Practice	Drainage Acres	Nitrogen Reduction (lbs./yr)	Phosphorus Reduction (lbs./yr)	Sediment Reduction (tons/yr)	Stormwater Reduction (cf/storm)
1	Bioretention	1.1	8.38	0.84	741.35	16,400
2	Bioretention	4.5	11.43	1.14	1,010.93	20,180
3	Ditch Retrofit	37.4	299.22	28.50	25,205.93	1,900
4	Bioretention	43.1	330.38	37.76	34,465.27	8,850

1. Bioretention

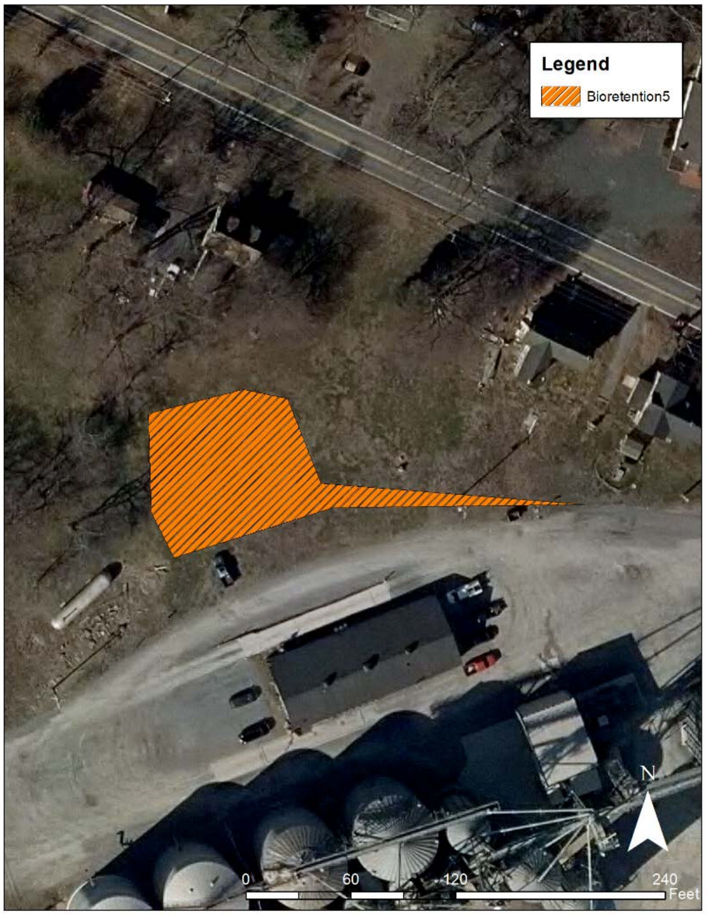


Figure 30. This bioretetnion would collect water from the parking area at Nagel Grain. There are no stormwater practices in this area at present, and water goes down a small hill toward Route 404.

2. Bioretention

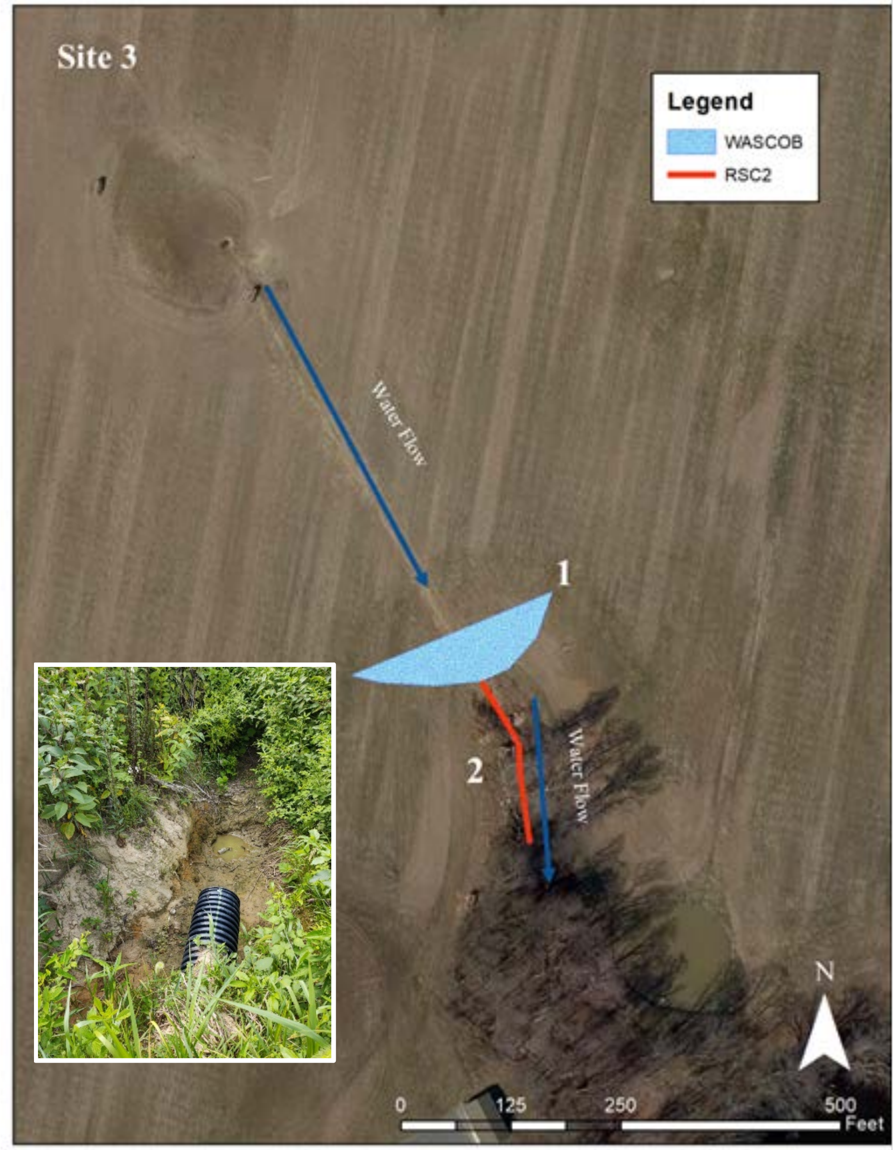
Figure 31. This area receives water from the Nagel Grain facility, and at present there are no stormwater practices. The water sits in small a grassy area and when it builds up high enough it will flow down along the property line to Old Wye Mills Rd. The proposed bioretention will help better infiltrate the water and also reduce the stormwater volume flowing off the property onto the road.

3. Road Side Ditch Enhancement

Figure 32. The current roadside ditch is shallow and in need of repair. There are multiple culverts for each driveway that in some instances are blocked. The ditch abruptly ends at the intersection of Old Wye Mills Rd. and Route 404, causing sheet flow across the roads during storm events. This ditch enhancement would reshape the ditch so that it can convey water in a less problematic manner, help better infiltrate water to reduce stormwater volume, and add a stormwater drain at the end so water does not sheet flow across the road.

4. Bioretention

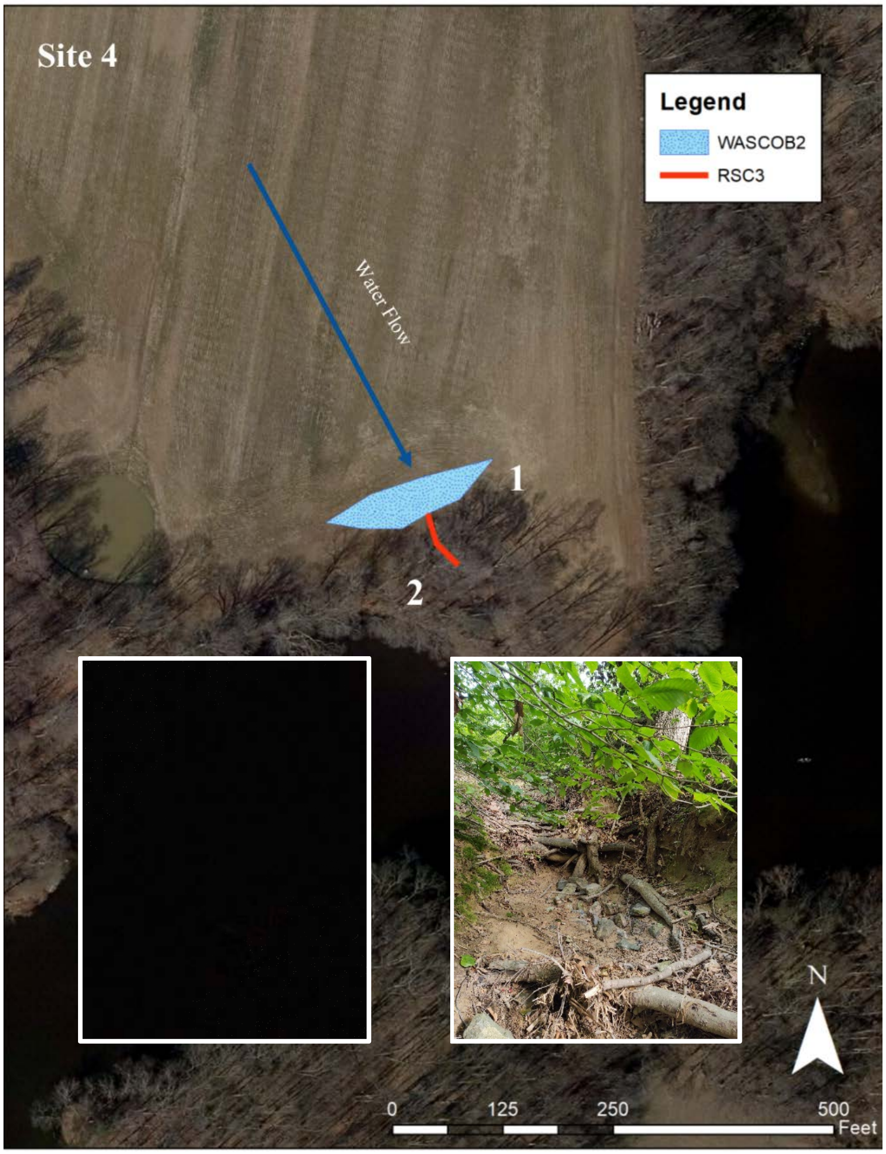
Figure 33. This bioretention would be located on a property owned by the Maryland State Highway Authority. At present, the area is just gravel. Stormwater from Old Wye Mills Rd. and Route 404 sheet flows across the gravel. The bioretention would capture and infiltrate the stormwater. It is suggested that a stormwater sewer be added to this area to help convey any excess stormwater not handled by the bioretention.



Site 3 consists of two projects. At present, there is a pipe that connects a farmed depression in the field to a gully in the forest. This pipe is for managing the water in the depression for hunting. The outlet of the pipe has become destabilized from erosion associated with overland flow from the field. The pipe could also be contributing to the erosion because it is set at a higher grade then the gully that it discharges into. It suggested that a water and sediment control basin (WASCOB) be built to temporarily store water during storm events, allow infiltration, and control stormwater volume leaving the field before it enters the gully. The gully needs to be repaired, and it is suggested regenerative stormwater conveyance techniques be used to raise the elevation of the gully and to stabilize the banks.

Table 10. Potential nutrient, sediment, and stormwater reductions from the practices proposed at Site 3

Project	Practice	Drainage Acres	Nitrogen Reduction (lbs./yr)	Phosphorus Reduction (lbs./yr)	Sediment Reduction (tons/yr)	Stormwater Reduction (cf/storm)
1	WASCOB	10.9	4.87	0.16	260.00	20,460
2	RSC	11.3	63.25	7.44	8,047.56	0



Site 4 receives overland flow from the farm field. There is a gully starting to form and it is migrating up into the field. This site would benefit from a water and sediment control basin (WASCOB) (1) to help infiltrate and temporarily store stormwater and release it with less energy into the gully. The gully erosion (2) is not severe yet and it is suggested that it would only need light armoring or stabilization techniques to ensure that the erosion does not progress further.

Table 11. Potential nutrient, sediment, and stormwater reductions from the practices proposed at Site 4

Project	Practice	Drainage Acres	Nitrogen Reduction (lbs./yr)	Phosphorus Reduction (lbs./yr)	Sediment Reduction (tons/yr)	Stormwater Reduction (cf/storm)
1	WASCOB	5.2	2.80	0.09	149.70	12,210
2	RSC	5.4	30.23	3.56	3,845.74	0

Site 5 is a stream that has an approximately 495-acre drainage. The stream has varying degrees of incision (measured in the field ~3.0') causing the stream to disconnect from the floodplain. Only the downstream portion of the stream was assessed in the field, but LIDAR elevation indicates the incision might get worse closer to Route 50. It is suggested that this stream undergo a complete assessment using Bank Erosion Hazard Index (BEHI) or other similar methods to document whether it is worth completing full scale stream restoration. The stream restoration largest impacts would be a reduction of sediment transport from the stream channel to the lake.

Table 12. Potential nutrient, sediment, and stormwater reductions from the practices proposed at Site 5

Project	Practice	Drainage Acres	Nitrogen Reduction (lbs./yr)	Phosphorus Reduction (lbs./yr)	Sediment Reduction (tons/yr)	Stormwater Reduction (cf/storm)
1	Stream Restoration	494.5	142.5	129.2	235.6	0

4.2 Potential Options to Safeguard Old Wye Mill

The projects listed in section 4.1 detail options to help reduce stormwater volumes stemming from the impervious areas in the town of Wye Mills. This will reduce stormwater impacts to the town and ultimately to the Old Wye Mill that is at the bottom of the hill downstream from the town. If all the practices are implemented, there should be less impacts from stormwater runoff at the mill, alleviating stormwater as a flood risk; but there are still issues with tidal flooding from the Upper Wye East. Tidal flooding is due to prevailing winds that push storm surges up the Upper Wye East.

Figure 34. Flooding of the Old Wye Mill during a storm event in 2017. Photo from The Old Wye Mill Facebook page.

To safeguard the Old Wye Mill from tidal flooding is a much tougher task due to site constraints, which limit options. There are only two feasible options.

1) ***Building a small retaining wall/dyke.*** This option has been discussed in the past and presents the only viable option to protect the mill at its current location. Unfortunately, the landscape adjacent to the mill does not have enough room to complete a more natural barrier approach without having larger environmental impacts that would outweigh the protection benefits.

The small retaining wall could be built to complement the mill by using design/architectural cues from the existing structures. The wall would only need to surround the mill building.

This fix is not a permanent solution as it will need maintenance overtime and does not guarantee to stop flooding if a storm exceeds the design specifications. This structural approach is also harder to find outside grant funding for and it may take time for fundraising efforts to raise enough funds to design and build the wall.

2) ***Move Old Wye Mill.*** The mill at the current Old Wye Mill location has changed location and structures several times over its history due to storm damage or changes in operations. Across the street from the mill is a DNR property. The headrace for the mill is also located on the DNR property. This property is located at a higher elevation than the mill property and provides a potential site to relocate the Old Wye Mill. There would need to be a feasibility study completed, but moving the mill to this location would provide a long-term solution to the tidal flooding issues.

4.3 Load reductions

Table 13. Total nitrogen, total phosphorus, suspended sediment, and stormwater load and volume at present conditions, reductions expected at each site after implementation, and nutrient/sediment load and stormwater volume after implementation

Site	Scenario	Total Nitrogen Load (lbs/yr)	Total Phosphorus Load (lbs/yr)	Suspended Sediment Load (tons/yr)	Stormwater (CF, 10 yr-24 hr)
1	Current	309	17	21	172,394
	Implementation Reduction	296	36	18	41,470
	After Implementation	13	0	3	130,924
2	Current	990	60	72	416,426
	Implementation Reduction	649	68	31	47,330
	After Implementation	341	0	41	369,096
3	Current	311	19	23	133,815
	Implementation Reduction	68	8	4	20,460
	After Implementation	243	11	19	113,355
4	Current	162	10	12	55,667
	Implementation Reduction	33	4	2	12,210
	After Implementation	129	6	10	43,457
5	Current	13,022	790	915	5,836,966
	Implementation Reduction	143	129	236	0
	After Implementation	12,879	661	679	5,836,966

5.0 Wye Mills Watershed Restoration Practices

5.1 Implementation Schedule

Table 14: Implementation Timeline – Percentage of Implementation Achieved by Year

Goal	2021	2022	2023	2024	2025	2026	2027
Design of Projects	20%	40%	60%	100%	100%	100%	100%
Projects implemented	0%	20%	40%	60%	80%	100%	100%

5.2 Funding Strategy

The Wye Mills Action Plan was designed to provide the necessary information to have discussions with landowners and partners with the goal of applying for design and implementation funds for projects. To best prepare the watershed partners for implementing the projects and strategies identified in this plan, Appendix B provides a list of funding sources that have historically supported efforts similar to those proposed. By identifying the funder, the intended purpose of the funding, the funding limit, and the date of the last Request for Proposals for each program, partners are encouraged to plan accordingly to seek additional resources for design and implementation of these projects.

The first set of resources are environmental grant programs that seek to fund projects that reduce nutrient loads from entering local waterways. In general, these grants are applied for by nonprofit organizations and local governments as a means of addressing issues on private and public properties. The grant programs are made available state- and nation-wide depending on the program; therefore it is a very competitive process. To prepare the most competitive applications to fund the projects in this action plan, watershed partners are encouraged to collaborate and bring forth a diverse set of technical skills. In addition to engaging each other, partners should also engage local governments and form public-private partnerships.

The second and third set of resources provided in this Appendix B include information about the Maryland Agricultural Cost-Share Program (MACS), Conservation Reserve Enhancement Program (CREP), and the federal Environmental Quality Incentive Programs (EQIP). The resources are available directly to the farmer or landowner on whose property the project will be installed. Diverse partnerships should be formed to utilize cost-share funding when available, and then should seek any remaining funds from the previously mentioned grant programs. The cost-share opportunities listed are current as of the date of this plan, although payment rates may differ.

6.0 Monitoring and Reporting Progress

Maryland has adopted the Chesapeake Bay Total Maximum Daily Load (TMDL), which calls for a specific amount of reduction of nitrogen, phosphorus, and sediment loads by 2025. Pursuant to this strategy, the State divided the necessary load reduction up by sector and by county. Maryland Department of the Environment and Maryland Department of Agriculture are responsible for consolidating BMP implementation information that is shared with the Chesapeake Bay Program annually. This information provides an intermediate measure of implementation progress, including the rate and type of projects being installed. ShoreRivers conducts tidal water quality monitoring of the Upper Wye East from April through October to assess nutrient and overall health of the tidal waterway. In addition to nitrogen and phosphorus, ShoreRivers also monitors temperature, dissolved oxygen, salinity, chlorophyll *a*, and clarity. Monitoring started in 2012. Continuing this monitoring will allow for the tracking of changes in water quality. Maryland Department of Natural Resources and Maryland Department of the Environment conduct minimal monitoring of Wye Mills Lake. It would be beneficial for DNR, MDE, or ShoreRivers to establish a sustained monitoring station within the lake to assess nutrient and overall health of the waterway over time.

APPENDICES:

Appendix A: Stormwater and Load Calculations

Stormwater: Stormwater volume was calculated using the TR-55 method.[10] For each of the 13 subbasins, land use was delineated using Chesapeake Conservancy land use data (2013/2014).[11] This land use dataset was updated to include the expansion of Route 404 and also the expansion of the Nagel Grain Operation after 2014. In both instances, this entailed changing the land use designation from agriculture or mixed open to road or impervious. Once the land use data was updated, each subbasin's land use was extracted using the watershed boundary for that subbasin. Soil type information was obtained from the NRCS Soil Survey Geographic (SSURGO) database.[12] The dominant hydrologic soil group for each unique soil series within the watershed was also extracted using each subbasin's watershed boundary. The surface area, land use classifications, and hydrologic soil group data for each subbasin's watershed were then used to calculate a weighted runoff curve number (CN) for each subbasin. This was completed using the NRCS Engineering Tools ArcGIS toolbox.[13]

The generated CNs were then applied to the TR-55 formula for estimating runoff volumes during different storm events. This formula uses the provided weighted CN, area of the watershed, and rainfall amount in inches for each different rain event.[10] In order to have an idea of potential runoff volumes resulting from various storm events, runoff volumes were calculated for 1-, 2-, 10-, and 100-year 24-hour storm events. Tables 15 and 16 identify the different runoff volumes.

Landuse Loading Rates: Nutrient and sediment loads were estimated for each subbasin using Chesapeake Bay Program Phase 6 Watershed Model loading rates.[14] Total nitrogen and total phosphorus were in pounds per acre per year, and sediment was in tons per acre per year. Each land use class in this assessment was paired with the closest land use class used in the Phase 6 watershed model. The loading rates for each class were multiplied by the acres of each land use class in each subbasin to estimate the annual load of each land use in each subbasin. These loading rates were then summed per subbasin to estimate total nutrient and sediment loads coming from each subbasin. Land use loading rates are described in Table 17.

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[10] Urban Hydrology for Small Watersheds, TR-55. 1986. United States Department of Agriculture, Natural Resource Conservation Service. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044171.pdf

[11] Chesapeake Conservancy, Conservation Innovation Center. https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/land-use-data-project/

[12] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at https://websoilsurvey.nrcs.usda.gov/.

[13] NRCS GIS Engineering Tools Version 1.1.14a / January 26, 2018

[14] Chesapeake Bay Program, 2020. Chesapeake Assessment and Scenario Tool (CAST) Version 2019. Chesapeake Bay Program Office, Last accessed [Nov, 2020], https://cast.chesapeakebay.net/Documentation/ModelDocumentation

Table 15. Stormwater runoff volumes for each subbasin calculated using weighted runoff curve numbers for different storm event frequencies						
Queen Anne's	Talbot		Runoff Volume (cu. ft.)			
Subbasin	Acres	RCN	1 yr 24 hr storm	2 yr 24 hr storm	10 yr 24 hr storm	100 yr 24 hr storm
1	2.20	71	5,184.79	8,005.19	18,765.36	33,867.41
2	7.78	74	22,133.19	33,071.88	73,568.26	129,009.87
3	3.19	74	9,067.29	13,548.54	30,138.67	52,851.41
4	9.21	63	11,776.54	20,440.11	56,894.28	112,206.77
5	193.38	71	454,984.01	702,484.79	1,646,728.40	2,971,989.38
6	14.44	70	31,772.34	49,644.37	118,559.81	216,134.76
7	412.06	77	1,398,307.08	2,029,266.83	4,301,682.27	7,342,379.58
8	494.48	81	1,951,917.79	2,778,760.08	5,836,966.18	9,462,970.43
9	10.26	82	42,709.71	60,270.18	124,672.86	200,535.44
10	5.33	77	16,813.29	24,848.78	55,666.79	93,254.71
11	11.01	82	45,841.44	64,689.54	133,814.61	215,239.87
12	36.72	72	92,216.04	140,767.28	324,091.96	579,208.64
13	12.80	79	48,528.52	69,171.94	142,255.48	238,669.71

Table 16. Stormwater runoff volumes for each subbasin under forested (pristine) conditions calculated using weighted runoff curve numbers for different storm even frequencies						
Queem Anne's	Talbot		Runoff Volume (cu. ft.)			
Subbasin	Acres	RCN	1 yr 24 hr storm	2 yr 24 hr storm	10 yr 24 hr storm	100 yr 24 hr storm
1	2.20	30	0.00	0.00	133.88	2,620.46
2	7.78	31	0.00	0.00	879.43	11,014.90
3	3.19	40	0.00	120.17	3,536.66	12,486.56
4	9.21	37	0.00	0.00	6,340.78	27,712.11
5	193.38	52	62,710.01	157,157.91	660,166.58	1,550,942.71
6	14.44	43	86.64	2,099.22	23,128.23	70,530.98
7	412.06	57	282,268.31	567,033.78	1,896,714.67	4,070,229.07
8	494.48	67	794,979.03	1,328,526.87	3,616,707.61	6,659,388.58
9	10.26	70	20,630.69	33,018.92	84,192.06	150,326.68
10	5.33	60	4,500.43	8,671.77	28,642.23	57,356.99
11	11.01	70	22,143.45	35,440.06	90,365.52	161,349.51
12	36.72	39	0.00	618.81	35,295.78	132,528.29
13	12.80	36	0.00	0.00	7,242.79	34,828.89

Table 17. Land use loading rates based on the Phase 6 Chesapeake Bay Model				
		Pounds per Acre per Year		**Tons per Acre per Year**
Land Use Wye Mills	**Land Use Phase 6 Model**	**Total Nitrogen**	**Total Phosphorus**	**Sediment**
Road	Non-Regulated Roads: Reference Land Use	22.45	0.83	1.49
Impervious	Non-Regulated Buildings and Other	18.08	0.69	1.38
Tree Over Impervious	Non-Regulated Tree Canopy over Impervious	20.49	0.75	0.3
Water		0	0	0
Tidal Wetlands		0	0	0
Floodplain Wetlands	Non-tidal Floodplain Wetland	1.68	0.08	0.04
Other Wetlands	Headwater or Isolated Wetland	1.68	0.08	0.04
Forest	True Forest: Reference Land Use	1.68	0.08	0.07
Tree Over Turf	Non-Regulated Tree Canopy over Turfgrass	8.53	0.65	0.1
Mixed Open	Mixed Open	2.45	0.43	2.36
Fractional Turf	Non-Regulate Turf Grass	11.19	0.86	0.47
Turf Grass	Non-Regulate Turf Grass	11.19	0.86	0.47
Crops	Double Cropped Land	30.87	1.87	2.21

Appendix B: Funding Sources

Funder	Grant Program	Grant Purpose	Last RFP Due Date	Grant Limit or Range	Notes
Chesapeake Bay Trust	Non-Tidal Wetland Restoration	Implement cost-effective wetland projects to provide valuable wetland functions, including habitat for a wide range of species and improved water quality, flood attenuation, recharge of groundwater, and aesthetics in the state's local watersheds	1-June-17 mandatory site visit. 6-Jul-17 Proposal	$500,000, or greater upon approval $7,000-$9,000 per acre easement acquisition value available*	All proposed projects must acknowledge and confirm the ability to adhere to Performance Standards and Monitoring (attached to this RFP) *A recent appraisal is needed to show eligibility for easement acquisition funding.
Chesapeake Bay Trust	Outreach & Restoration	Supports outreach and community engagement activities that increase stewardship ethic of natural resources and on-the-ground restoration activities that demonstrate restoration techniques and engage Maryland citizens in the restoration and protection of the Chesapeake Bay rivers.	Aug 2020	$5,001-$75,000 depending on the track*	*Track 1: Outreach: up to $30,000 for projects focused on education and awareness as project outcomes, up to $50,000 for behavior change projects. Track 2: Restoration: up to $50,000 for implementation projects Track 3: Outreach and Restoration: up to $75,000 for projects that combine restoration and outreach elements to measurably build knowledge within the community served.
Chesapeake Bay Trust & Maryland Dept of Natural Resources	Watershed Assistance Grant Program	Supports design assistance, watershed planning and programmatic development associated with protection and restoration program and project that lead to improved water quality in the Maryland portion	Aug 2020	$5,001 - $200,000	Leverage resulting designs, plans, or projects to craft future proposals for implementation funding to the Maryland Chesapeake and Atlantic Coastal Bays Trust Fund, grant programs at the Chesapeake Bay Trust, or other sources of support; Develop deliverables that will support local

Funder	Grant Program	Grant Purpose	Last RFP Due Date	Grant Limit or Range	Notes
		of the Chesapeake Bay watershed.			planning efforts such as Watershed Implementation Plan (WIP) strategies and associated Two-year Milestones (see Appendix C for more information), Financial Assurance Plans (FAPs), Total Maximum Daily Load (TMDL) Implementation Plans, county-wide Green Infrastructure Plans, and watershed action plans.
FEMA	**Building Resilient Infrastructure Communities (BRIC)**	Supports hazard mitigation projects, reducing the risks communities face from natural hazards.	Sept 2020	Up to $600,000	Non-profit organizations cannot apply directly to FEMA, but can be included in a subapplication submitted by an eligible subapplicant such as a local government or state agency. Non-federal cost share is required.
Maryland Historical Trust	**Historic Preservation Capital Grant Fund**	Promotes the acquisition, restoration, and rehabilitations of historic properties in Maryland.	Mar 2020	Up to $100,000	Projects must aim to protect a historical structure. The historical property must be registered as a Maryland Historical Site, of which the Old Wye Mill currently is.
National Fish and Wildlife Foundation	Chesapeake Bay Stewardship Fund – Small Watershed Grant (SWG)	Projects that promote community-based efforts to protect and restore the diverse natural resources of the Chesapeake Bay and its tributary rivers and streams. SWG Implementation grants are awarded for projects that result in direct, on-the-ground actions to protect and restore water quality, species, and habitats in the Bay watershed; SWG Planning and	May 2020	$50,000-$500,000 depending on the program**	*Prior to 2017, the deadline for this grant was early May. **SWG Implementation program will range from $50,000-$500,000 for two year projects and requires a one-third non-federal match. SWG Planning and Technical Assistance grants will not exceed $50,000 for a one year project.

Funder	Grant Program	Grant Purpose	Last RFP Due Date	Grant Limit or Range	Notes
		Technical Assistance grants are awarded for projects that enhance local capacity to more efficiently and effectively implement future on-the-ground actions through assessment, planning, design, and other technical assistance-oriented activities.			
National Fish and Wildlife Foundation	Chesapeake Bay Stewardship Fund – Innovative Nutrient & Sediment Reduction Grant (INSR)	A program designed to accelerate the implementation of water quality improvements specifically through the collaborative and coordinated efforts of sustainable, regional-scale partnerships and networks of practitioners with a shared focus on water quality restoration and protection.	May 2020	$750,000 - $1 million	These grants encourage non-federal matching contributions equal to the grant request. All 2018 INSR-RSI grants must be completed within three years of grant award.
Maryland Department of the Environment	319 Nonpoint Source Program	Provides financial assistance to local and state entities for the implementation of nonpoint source best management practices and program enhancements as a means of controlling the loads of pollutants entering the state's waterways.	Every summer		§319(h) Grant funds can pay for planning, design, construction, monitoring and analysis. However, the majority of §319(h) Grant funding in Maryland is intended for implementation of projects that will: Reduce or eliminate water quality impairments listed in the Maryland's List of Impaired Water (303(d) List), particularly in watersheds where Total Maximum Daily Loads (TMDLs) have been approved; and result in quantifiable or measurable improvements in water quality and habitat, including, pollutant load reductions for impairments addressed in TMDLs or identified in the 303(d) List. A prerequisite for §319(h) funding of implementation projects (any

Funder	Grant Program	Grant Purpose	Last RFP Due Date	Grant Limit or Range	Notes
					project involving in-the-ground construction) is EPA acceptance of a watershed plan.
Maryland Dept of Natural Resources	Chesapeake & Atlantic Coastal Bays Trust Fund	Fund the most cost-effective, efficient nonpoint nutrient and sediment reduction project proposals in geographic targeted areas of the State. The Trust Fund encourages projects that will achieve the greatest reduction per dollar invested	Dec 2020	Typically $100,000-$750,000	

Maryland Agricultural Water Quality Cost-Share Program (MACS)					
Code	**Practice Name**	**Notes**	**Unity Type**	**Unit Cost**	**Limit**
340	Cover Crops	Applications accepted June 21 to July 17. Payments are no longer offered for harvested cover crops.	Acre	$75	$22.5 M state-wide
412	Grassed Waterway	Cost-share authorized for Site preparation, grading, shaping, filling, and lime, fertilizer and seed for establishing a permanent vegetative cover, filter cloth, mulch and/or erosion control matting plus anchoring materials	Total	87.5%	$50,000
391	Riparian Forest Buffer	Required 35’-100’ buffer	Total	87.5%	$50,000
390	Riparian Herbaceous Cover	Required 35’-100’ buffer	Total	87.5%	$50,000

Maryland Agricultural Water Quality Cost-Share Program (MACS)					
587	Structure for Water Control		Total	87.5%	$50,000
657	Wetland Restoration	Practice must meet standards and applied on farmland	Total	87.5%	$50,000
658	Wetland Restoration for Water Quality	An area of vegetated wetland to remove sediment, nutrients, organic matter and other pollutants from ground water associated with agricultural operations.	Total	87.5%	$50,000
604	Saturated Buffer	A subsurface, perforated distribution pipe used to divert and spread drainage water to a vegetated area to increase soil saturation.	Total	87.5%	$50,000
605	Denitrifying Bioreactor	A structure that uses a carbon source to reduce the concentration of nitrate nitrogen in agricultural drainage water via enhanced denitrification	Total	87.5%	$50,000
606	Subsurface Drain	A conduit installed beneath the ground surface to collect and convey excess water.	Total	75%	$15,000
620	Underground Outlet	A conduit or system of conduits installed beneath the surface of the ground to convey surface water to a suitable outlet.	Total	87.5%	$50,000

NRCS Environmental Quality Incentive Program (EQIP).					
Code	**Practice Name**	**Component**	**Unity Type**	**Unit Cost**	**Share Rate**
630	Vertical Drain	Sand Filled Pit	cu yd	$63.39	100
630	Vertical Drain	HU-Sand Filled Pit	cu yd	$76.07	100
340	Cover Crop	Cover Crop - Adaptive Management	ea	$1,885.28	100
340	Cover Crop	HU-Cover Crop - Adaptive Management	ea	$2,262.33	100

NRCS Environmental Quality Incentive Program (EQIP).					
340	Cover Crop	Cover Crop - Basic (Organic and Non-organic)	ac	$63.47	100
340	Cover Crop	HU-Cover Crop - Basic (Organic and Non-organic)	ac	$76.16	100
340	Cover Crop	Cover Crop - Basic Organic	ac	$76.34	100
340	Cover Crop	HU-Cover Crop - Basic Organic	ac	$91.61	100
340	Cover Crop	Cover Crop - Multiple Species (Organic and Non-organic)	ac	$74.18	100
605	Denitrifying Bioreactor	Denitrifying Bioreactor	cu yd	$36.83	100
605	Denitrifying Bioreactor	HU-Denitrifying Bioreactor	cu yd	$44.19	100
554	Drainage Water Management	Drainage Water Management (DWM)	ea	$80.76	100
554	Drainage Water Management	HU-Drainage Water Management (DWM)	ea	$96.91	100
130	Drainage Water Management Plan - Written	DWMP - Tile Map Available	no	$2,049.37	100
130	Drainage Water Management Plan - Written	HU-DWMP - Tile Map Available	no	$2,459.25	100
130	Drainage Water Management Plan - Written	DWMP - No Tile Map Available	no	$2,444.86	100
130	Drainage Water Management Plan - Written	HU-DWMP - No Tile Map Available	no	$2,933.83	100
412	Grassed Waterway	Grass Waterway with Stone Checks	ac	$5,032.97	100
412	Grassed Waterway	HU-Grass Waterway with Stone Checks	ac	$5,987.68	100
412	Grassed Waterway	Waterway, small, 0.2 Acres or less	sq ft	$0.11	100
412	Grassed Waterway	HU-Waterway, small, 0.2 Acres or less	sq ft	$0.14	100

NRCS Environmental Quality Incentive Program (EQIP).					
412	Grassed Waterway	Waterway, over 0.2 acres	ac	$3,516.21	100
412	Grassed Waterway	HU-Waterway, over 0.2 acres	ac	$4,167.58	100
449	Irrigation Water Management	1st Year, Computer Record Keeping System	ac	$223.04	100
449	Irrigation Water Management	HU-1st Year, Computer Record Keeping System	ac	$267.64	100
449	Irrigation Water Management	Annual Crops, Vegetables, 1st Year	ac	$47.77	100
449	Irrigation Water Management	HU-Annual Crops, Vegetables, 1st Year	ac	$57.33	100
449	Irrigation Water Management	Annual Crops, Vegetables, 1st Year, with Data Logger	ac	$95.33	100
449	Irrigation Water Management	HU-Annual Crops, Vegetables, 1st Year, with Data Logger	ac	$114.39	100
449	Irrigation Water Management	Annual Crops, Vegetables, 2nd and 3rd Year	ac	$25.81	100
449	Irrigation Water Management	HU-Annual Crops, Vegetables, 2nd and 3rd Year	ac	$30.97	100
449	Irrigation Water Management	Basic IWM 30 acres or less	ac	$21.66	100
449	Irrigation Water Management	HU-Basic IWM 30 acres or less	ac	$25.99	100
449	Irrigation Water Management	Basic IWM over 30 acres	ac	$11.68	100
449	Irrigation Water Management	HU-Basic IWM over 30 acres	ac	$14.01	100
449	Irrigation Water Management	Field Crops, Grains, 1st Year	ac	$13.38	100
449	Irrigation Water Management	HU-Field Crops, Grains, 1st Year	ac	$16.05	100
449	Irrigation Water Management	Field Crops, Grains, 1st Year, with Data Logger	ac	$32.40	100
449	Irrigation Water Management	HU-Field Crops, Grains, 1st Year, with Data Logger	ac	$38.88	100
449	Irrigation Water Management	Field Crops, Grains, 2nd and 3rd Year	ac	$6.72	100
449	Irrigation Water Management	HU-Field Crops, Grains, 2nd and 3rd Year	ac	$8.06	100

NRCS Environmental Quality Incentive Program (EQIP).					
590	Nutrient Management	Adaptive NM	ea	$2,045.66	100
590	Nutrient Management	HU-Adaptive NM	ea	$2,454.80	100
590	Nutrient Management	Basic NM with Manure and/or Compost (Non-Organic/Organic)	ac	$14.00	100
590	Nutrient Management	HU-Basic NM with Manure and/or Compost (Non-Organic/Organic)	ac	$16.81	100
590	Nutrient Management	Basic NM with Manure Injection or Incorporation	ac	$26.61	100
590	Nutrient Management	HU-Basic NM with Manure Injection or Incorporation	ac	$31.93	100
590	Nutrient Management	Basic Precision NM (Non-Organic/Organic)	ac	$38.27	100
590	Nutrient Management	HU-Basic Precision NM (Non-Organic/Organic)	ac	$45.93	100
590	Nutrient Management	Small Farm NM (Non-Organic/Organic)	ea	$217.16	100
590	Nutrient Management	HU-Small Farm NM (Non-Organic/Organic)	ea	$260.59	100
104	Nutrient Management Plan - Written	Nutrient Management CAP Less Than or Equal to 100 Acres (Not part of a CNMP)	no	$1,766.27	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP Less Than or Equal to 100 Acres (Not part of a CNMP)	no	$2,119.53	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104- 101-300 Acres (Not part of a CNMP)	no	$2,355.03	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104- 101-300 Acres (Not part of a CNMP)	no	$2,826.04	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104 Greater Than 300 Acres (Not part of a CNMP)	no	$2,943.79	100
104	Nutrient Management Plan -	HU-Nutrient Management CAP 104 Greater Than 300 Acres (Not	no	$3,532.55	100

NRCS Environmental Quality Incentive Program (EQIP).					
	Written	part of a CNMP)			
104	Nutrient Management Plan - Written	Nutrient Management CAP 104 Less Than or Equal to 100 Acres (Element of a CNMP)	no	$2,943.79	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104 Less Than or Equal to 100 Acres (Element of a CNMP)	no	$3,532.55	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104 - 101-300 Acres (Element of a CNMP)	no	$4,121.31	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104 - 101-300 Acres (Element of a CNMP)	no	$4,945.57	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104 Greater Than 300 Acres (Element of a CNMP)	no	$5,004.44	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104 Greater Than 300 Acres (Element of a CNMP)	no	$6,005.33	100
104	Nutrient Management Plan - Written	Nutrient Management CAP Less Than or Equal to 100 Acres (Not part of a CNMP)	no	$1,766.27	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP Less Than or Equal to 100 Acres (Not part of a CNMP)	no	$2,119.53	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104- 101-300 Acres (Not part of a CNMP)	no	$2,355.03	100
782	Phosphorous Removal System	Ditch	ea	$3,452.45	100
782	Phosphorous Removal System	HU-Ditch	ea	$4,142.94	100
391	Riparian Forest Buffer	Bareroot, hand planted with tube	ac	$2,909.57	100
391	Riparian Forest Buffer	HU-Bareroot, hand planted with tube	ac	$3,439.61	100

NRCS Environmental Quality Incentive Program (EQIP).					
391	Riparian Forest Buffer	Large container, hand planted	ac	$4,690.10	100
391	Riparian Forest Buffer	HU-Large container, hand planted	ac	$5,472.49	100
391	Riparian Forest Buffer	Small container, hand planted	ac	$2,482.51	100
391	Riparian Forest Buffer	HU-Small container, hand planted	ac	$2,927.13	100
604	Saturated Buffer	Saturated Buffer	ft	$6.27	100
604	Saturated Buffer	HU-Saturated Buffer	ft	$7.52	100
580	Streambank and Shoreline Protection	Bioengineered	sq ft	$0.99	100
580	Streambank and Shoreline Protection	HU-Bioengineered	sq ft	$1.19	100
580	Streambank and Shoreline Protection	Bioengineered with Toe Protection	sq ft	$2.79	100
580	Streambank and Shoreline Protection	HU-Bioengineered with Toe Protection	sq ft	$3.35	100
580	Streambank and Shoreline Protection	Geotextile Wrapped	sq ft	$24.43	100
580	Streambank and Shoreline Protection	HU-Geotextile Wrapped	sq ft	$29.32	100
580	Streambank and Shoreline Protection	Structural small, banks less than 4 ft	cu yd	$90.72	100
580	Streambank and Shoreline Protection	HU-Structural small, banks less than 4 ft	cu yd	$108.87	100

NRCS Environmental Quality Incentive Program (EQIP).					
580	Streambank and Shoreline Protection	Structural, >5 ft bank	cu yd	$89.08	100
580	Streambank and Shoreline Protection	HU-Structural, >5 ft bank	cu yd	$106.90	100
580	Streambank and Shoreline Protection	Vegetative	sq ft	$0.61	100
580	Streambank and Shoreline Protection	HU-Vegetative	sq ft	$0.73	100
587	Structure for Water Control	Basin, earthen	LF	$22.57	100
587	Structure for Water Control	HU-Basin, earthen	LF	$27.09	100
587	Structure for Water Control	CMP Turnout	ea	$749.09	100
587	Structure for Water Control	HU-CMP Turnout	ea	$898.90	100
587	Structure for Water Control	Commercial Inline Flashboard Riser	LF	$3.34	100
587	Structure for Water Control	HU-Commercial Inline Flashboard Riser	LF	$4.01	100
587	Structure for Water Control	Concrete Turnout Structure	ea	$2,873.05	100
587	Structure for Water Control	HU-Concrete Turnout Structure	ea	$3,447.66	100
587	Structure for Water Control	Concrete Turnout Structure - Small	ea	$1,086.26	100
587	Structure for Water Control	HU-Concrete Turnout Structure - Small	ea	$1,303.51	100
587	Structure for Water Control	Culvert <30 inches CMP	LF	$2.33	100
587	Structure for Water Control	HU-Culvert <30 inches CMP	LF	$2.79	100
587	Structure for Water Control	Culvert <30 inches HDPE	LF	$2.17	100

NRCS Environmental Quality Incentive Program (EQIP).					
587	Structure for Water Control	HU-Culvert <30 inches HDPE	LF	$2.60	100
587	Structure for Water Control	Flap Gate	ft	$1,379.61	100
587	Structure for Water Control	HU-Flap Gate	ft	$1,655.53	100
587	Structure for Water Control	Flap Gate w/ Concrete Wall	cu yd	$924.98	100
587	Structure for Water Control	HU-Flap Gate w/ Concrete Wall	cu yd	$1,109.98	100
587	Structure for Water Control	Forestland Waterbar	ea	$119.07	100
587	Structure for Water Control	HU-Forestland Waterbar	ea	$142.89	100
587	Structure for Water Control	Gated Pipe	ft	$10.80	100
587	Structure for Water Control	HU-Gated Pipe	ft	$12.96	100
587	Structure for Water Control	Grated Dropbox	ea	$941.61	100
587	Structure for Water Control	HU-Grated Dropbox	ea	$1,129.93	100
587	Structure for Water Control	Inlet Flashboard Riser, Metal	LF	$2.78	100
587	Structure for Water Control	HU-Inlet Flashboard Riser, Metal	LF	$3.33	100
587	Structure for Water Control	Inline Flashboard Riser, Metal	LF	$2.94	100
587	Structure for Water Control	HU-Inline Flashboard Riser, Metal	LF	$3.52	100
587	Structure for Water Control	In-Stream Structure for Water Surface Profile	ft	$207.10	100
587	Structure for Water Control	HU-In-Stream Structure for Water Surface Profile	ft	$248.52	100
587	Structure for Water Control	Rock Checks for Water Surface Profile	Ton	$46.83	100
587	Structure for Water Control	HU-Rock Checks for Water Surface Profile	Ton	$56.19	100
587	Structure for Water Control	Slide Gate	ft	$1,587.75	100

NRCS Environmental Quality Incentive Program (EQIP).					
587	Structure for Water Control	HU-Slide Gate	ft	$1,905.30	100
587	Structure for Water Control	Trench Drain with grate	ea	$1,254.65	100
587	Structure for Water Control	HU-Trench Drain with grate	ea	$1,505.57	100
587	Structure for Water Control	Water Bar	ea	$645.96	100
587	Structure for Water Control	HU-Water Bar	ea	$775.15	100
657	Wetland Restoration	Depression Sediment Removal (Pothole)	ea	$2,275.12	100
657	Wetland Restoration	HU-Depression Sediment Removal (Pothole)	ea	$2,730.15	100
657	Wetland Restoration	Drain Tile Plug	ft	$1.46	100
657	Wetland Restoration	HU-Drain Tile Plug	ft	$1.75	100
657	Wetland Restoration	Estuarine Fringe Levee Removal	ac	$12.89	100
657	Wetland Restoration	HU-Estuarine Fringe Levee Removal	ac	$15.47	100
657	Wetland Restoration	Hydrologic restoration with embankment or ditch plug	ft	$22.73	100
657	Wetland Restoration	HU-Hydrologic restoration with embankment or ditch plug	ft	$27.27	100
657	Wetland Restoration	Riverine Channel and Floodplain Restoration	ac	$363.67	100
657	Wetland Restoration	HU-Riverine Channel and Floodplain Restoration	ac	$436.41	100
657	Wetland Restoration	Riverine Levee Removal	cu yd	$2.58	100
657	Wetland Restoration	HU-Riverine Levee Removal	cu yd	$3.09	100
658	Wetland Creation	Wetland Creation	ac	$2,664.13	100
658	Wetland Creation	HU-Wetland Creation	ac	$3,196.95	100
659	Wetland Enhancement	Depression Sediment Removal and Ditch Plug	ac	$1,164.91	100

NRCS Environmental Quality Incentive Program (EQIP).					
659	Wetland Enhancement	HU-Depression Sediment Removal and Ditch Plug	ac	$1,346.02	100
659	Wetland Enhancement	Enhanced wetland Topography	ac	$1,026.65	100
659	Wetland Enhancement	HU-Enhanced wetland Topography	ac	$1,180.10	100
659	Wetland Enhancement	Estuarine Fringe Levee Removal	ac	$272.27	100
659	Wetland Enhancement	HU-Estuarine Fringe Levee Removal	ac	$274.85	100
659	Wetland Enhancement	Mineral Flat	ac	$270.84	100
659	Wetland Enhancement	HU-Mineral Flat	ac	$273.13	100
659	Wetland Enhancement	Riverine Channel and Floodplain Restoration	ac	$623.05	100
659	Wetland Enhancement	HU-Riverine Channel and Floodplain Restoration	ac	$695.79	100
659	Wetland Enhancement	Riverine Levee Removal and Floodplain Features	ac	$570.72	100
659	Wetland Enhancement	HU-Riverine Levee Removal and Floodplain Features	ac	$632.99	100