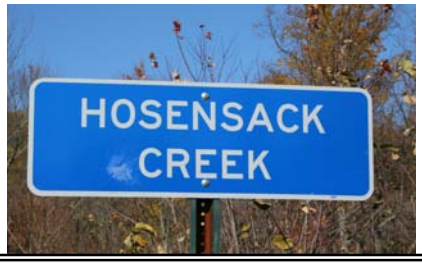
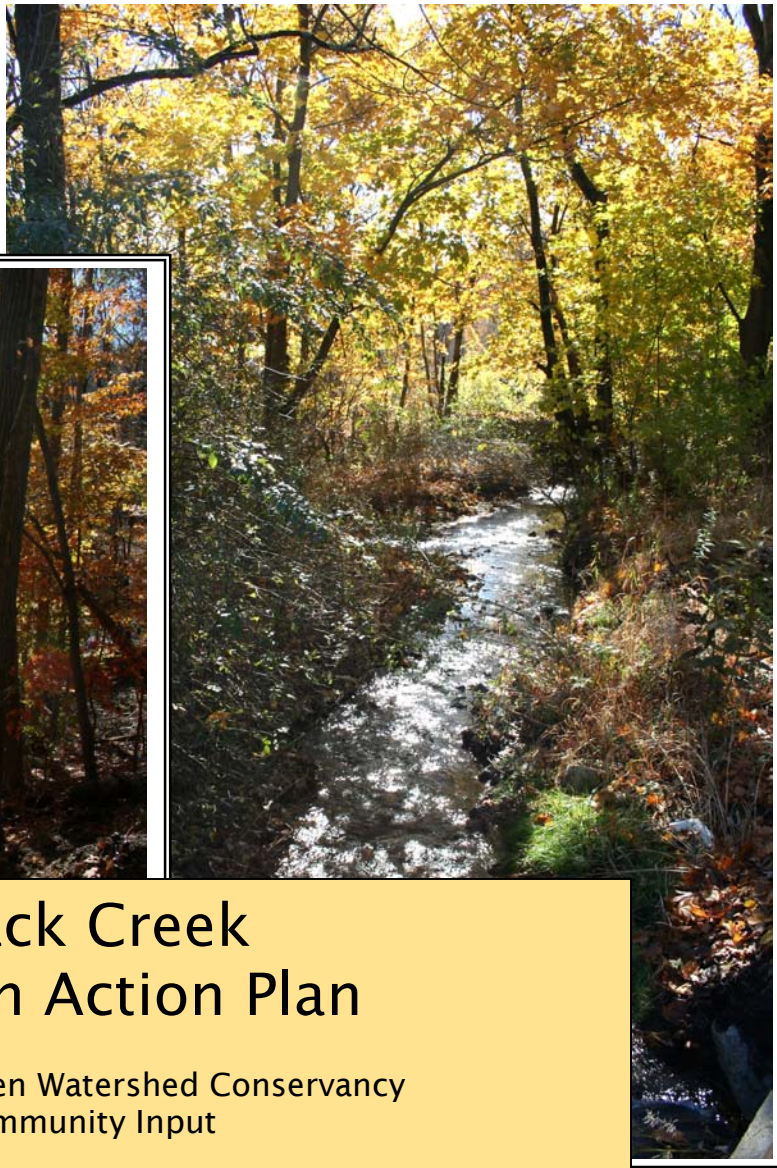
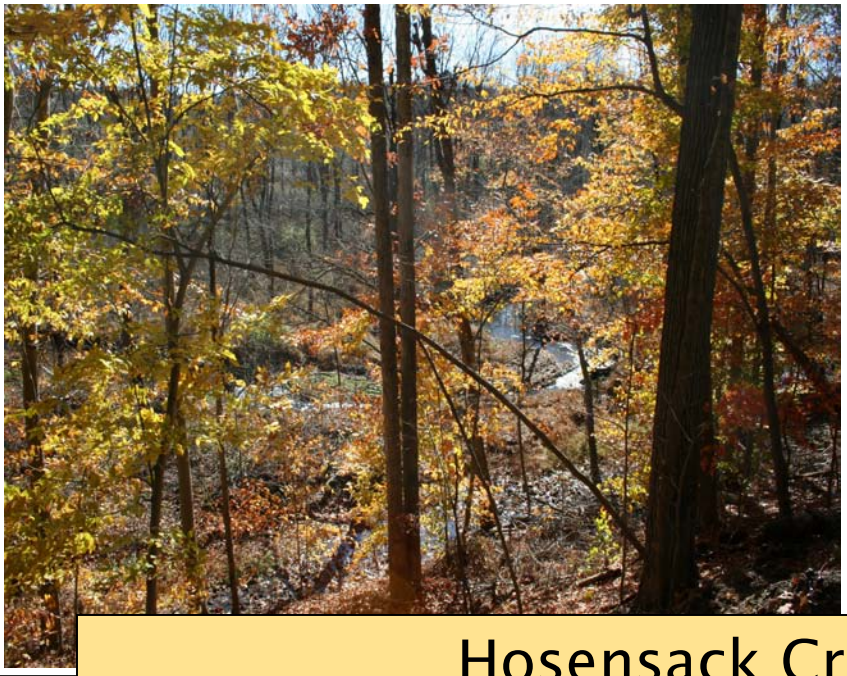


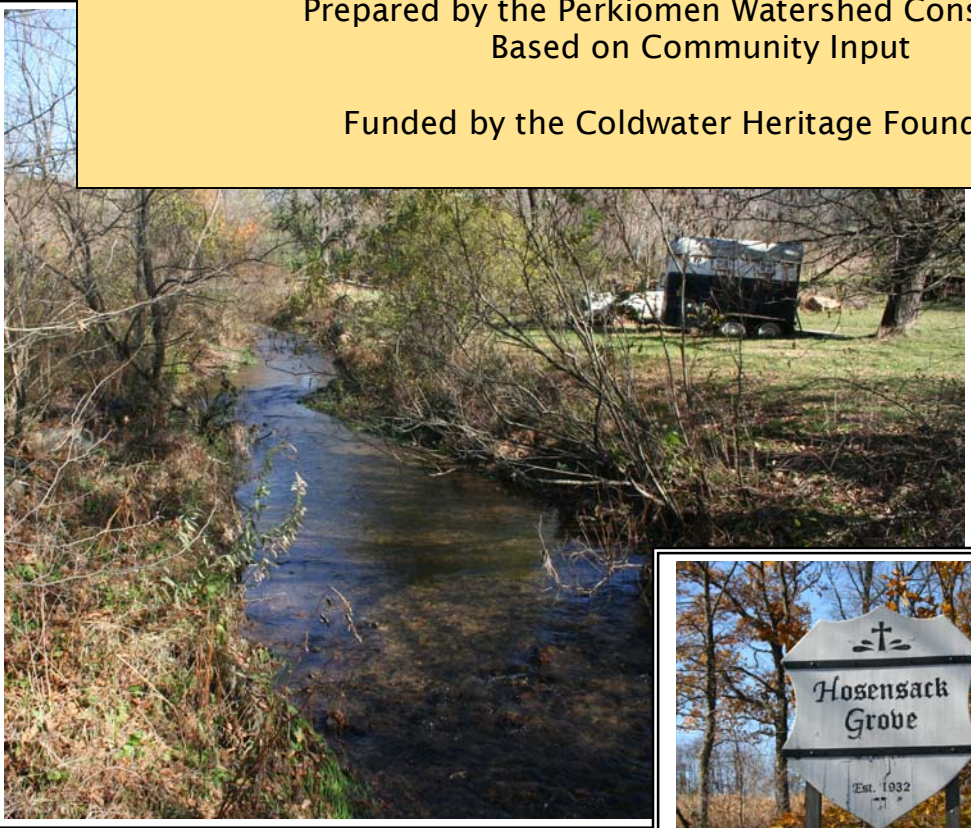




Hosensack Creek
Conservation Action Plan

Prepared by the Perkiomen Watershed Conservancy
Based on Community Input

Funded by the Coldwater Heritage Foundation



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Environmental Education ***Watershed Stewardship*** ***Conservation Programs***

Hosensack Creek Action Conservation Plan – Executive Summary

Study funded by the Coldwater Heritage Foundation *a collaborative effort between the PA Fish & Boat Commission, the PA Department of Conservation and Natural Resources, Western PA Watershed Protection Program and Pennsylvania Trout Unlimited. Special thanks to Lower Milford Township for hosting the public meetings and the Lehigh County Conservation District.*

The Hosensack Creek is a tributary to the Perkiomen Creek, the largest sub-watershed within the Schuylkill River network. The Upper Perkiomen Creek includes communities in western Montgomery County, portions of western Lehigh County and southern Berks County. The region is largely rural but the historic villages tell the story of longstanding agrarian communities and a deep connection to the land. Well-maintained properties illustrate a strong stewardship ethic among the residents. The abundance of undeveloped natural areas is a reflection of this stewardship ethic, as well as the local geology and the general distances to larger economic centers.

The Hosensack Creek rises primarily in Lower Milford Township, Lehigh County but includes headwaters areas in Upper Milford Township and a named tributary, Indian Creek, that also rises in Upper Milford Township, Lehigh County. The Hosensack Creek passes through a short section of Upper Hanover Township in Montgomery County before it joins the Perkiomen Creek at the village of Palm.

The Hosensack Creek watershed is a well-vegetated landscape that protects local water quality from the impacts of excess erosion, stormwater impacts, agricultural run-off and the other non-point source pollutants that have impacted many other areas of the Perkiomen Creek.

The goal of the Hosensack Creek Conservation Action Plan is to establish a guidance document that can be used by municipal officials, businesses and residents to ensure that the natural areas, lawns and agricultural lands are managed in ways that protect water quality in the Hosensack Creek.

The Hosensack Creek Conservation Plan contains background information about the quality of the water and terrestrial resources in the Hosensack watershed from numerous sources including the Upper Perkiomen Creek Watershed Conservation Plan, The Stroud Water Research Center, the Montgomery and Lehigh County Natural Areas Inventories and regional natural resources summaries complied by Natural Lands Trust.

In addition, stream evaluations were conducted at 8 locations by Perkiomen Watershed Conservancy staff.

Available data indicates that the Hosensack Creek's water quality is excellent, perhaps the best within the entire Perkiomen Creek watershed. The aquatic insect research completed by Stroud indicates good water quality. In addition, the landscapes that surround the creek's many small tributaries are generally well vegetated with native trees and forests that include few invasive tree species. Invasive plants of note are primarily multi-flora rose which exists in some very large stands throughout the watershed. Overall, the biodiversity of the area was good and will provide the appropriate seed stock for ongoing regeneration of the local forests.

In stream cover and flow patterns are generally varied and sedimentation, while present in most areas, was not excessive. Many streambed areas were free of silt and contained an appropriate mix of gravel and larger rocks.

The stream side vegetation, known as riparian buffers, were largely intact and consisted mainly of native species. However, there are areas property owners have reduced or replaced the native trees with lawn and pasture grasses.

The table below summarizes the conservation issues and implementation options presented in the plan.

Conservation Issues	Implementation Options
Streambank maintenance Private property management Public information Demonstration projects	• Provide public information in brochures, websites and at public meetings. • Pursue streambank restoration projects where they are most visible. • Develop voluntary guidelines for private property maintenance along streambanks and present annual acknowledgements of property owners' efforts. • Conservation easements along riparian areas
Invasive Plant Controls Private property management Public information Guidelines for development	• Provide public information in brochures, websites and at public meetings. • Include subdivision and land development ordinance regulations requiring invasive removals and restoration with native plants as part of the land development process.
Property owner information Streambank vegetation Septic system maintenance	• Provide public information in brochures, websites and at public meetings. • Establish local ordinances requiring periodic pumping of septic tanks.

Headwater and wetland protections	• Provide public information in brochures, websites and at public meetings. • Develop voluntary guidelines for private property maintenance in headwater and wetland areas and present annual acknowledgements of property owners' efforts. • Conservation easements in sensitive headwaters and wetland areas
Stormwater issues	• Identify all privately maintained stormwater facilities. • Provide guidance pertaining to stormwater issues and appropriate maintenance techniques for privately owned facilities.
Zoning and subdivision/land development protections	• Continue strengthening municipal regulations and emphasizing the importance of maintaining the environmental integrity of the Hosensack Creek resource base.

RECOMMMENDATIONS

Most of the Hosensack Creek runs through private property, therefore many of the recommendations will pertain to private property management. Municipal governments can help provide the leadership and information that will help citizens understand the issues and how different types of property management techniques can help protect the creek's water quality and the habitats that it nourishes.

Streambank Maintenance

Streambank Management Information for Property Owners

A watershed-wide information program, with information distributed through municipal newsletters or websites can be a powerful tool to help increase local understanding of issues impacting the health of the Hosensack Creek. Specific maintenance techniques to address erosion and invasive plants can be provided in this manner.

The principle issues that should be explained are the need for native vegetation in riparian buffers, the damage done by lawn grasses and mowing to the stream bank's edge and appropriate stormwater management. The principle objective should be to help property owners understand the connection between non-point source pollutants and stormwater run-off, how stormwater run-off impacts overall water quality as well as streambank stability and the ability of native plants to reduce the pollutants in stormwater run-off before it reaches local creeks.

Potential Demonstration Projects

There are many locations along the Hosensack Creek that would make excellent demonstration projects for streambank reconstruction efforts. It is likely that grant funds would be necessary to design and implement these projects. Property owner agreements would also be necessary to ensure long-term maintenance protocols. Other

sites would provide locations for stormwater demonstration projects that illustrate how native plants and slower stormwater release rates can improve water quality and reduce erosion.

Demonstration projects allow other property owners to see firsthand what can be done to protect and restore creek banks and water quality. Local non-profit organizations with an emphasis on creeks and waterways may be able to assist with project identification, grant seeking and project implementation.

Headwaters and riparian zone protections
All three municipalities have enacted policies and ordinances designed to protect waterways and other natural features. While these ordinances are quite progressive, they cannot protect against all practices that can negatively impact the Hosensack Creek. They do provide a baseline by which all land use actions are measured.

Municipal Regulations
Municipal regulations that protect forests, wetlands and other natural features are critical to protecting water quality and the habitats of the Hosensack Creek. Municipal regulations should be reviewed periodically to ensure that the greatest protections possible are included. Again, presenting information to the residents of the area about the need for waterways protections and how the municipal ordinances implement those protections is important to avoiding unintentional actions that negatively impact the creek.

Conservation Easements
Both streambank maintenance issues and the protection of headwaters and wetlands can be strengthened through the use of conservation easements. A conservation easement is a legally binding agreement between a landowner and a qualified conservation organization or government agency that places certain restrictions on a property's use in order to protect its conservation values. The easement carries forward with any deed transfers and permanently protects the land from future development. The landowner continues to own, use, and live on the land. Land can be sold or passed on to heirs.

Conservation easements can be tailored to focus on specific aspects of a property and can be limited to certain areas such as riparian zones or wetland areas.

Invasive plant controls
Reducing and eliminating invasive plants in the larger landscape is a very difficult task. These are generally either very labor-intensive efforts or require extensive use of herbicides and heavy equipment. They also require a long-term management plan.

Property Owner Information
Again, a watershed-wide information program can provide property owners with important management information about eradication techniques and what types of plants can be used to replace invasives in the landscape. Additionally, there are

conservation organizations that specialize in management techniques that focus on invasives removal and replacement with native plants.

Municipal Regulations

Municipal subdivision and land use regulations should provide requirements and/or incentives for removing invasives from riparian areas and replanting with a mix of appropriate native plants.

Subdivision regulations should specify that landscaping plant species should be native and appropriate for the local climate and soils. Specifically, planting plans for stormwater basins should include native plants only and should avoid lawn grasses that require regular mowing during the growing season.

CONCLUSIONS

The Hosensack Creek was chosen because of the natural resources and naturally clean water that abound in that watershed. The Conservancy's selection was based upon the concept that it is easier to protect existing resources than to recreate them once they have been consumed or diminished. This report is not an exhaustive review of available data but is a broad reflection of the natural resource base within the Hosensack Creek watershed.

The Hosensack Creek exhibits good water quality and healthy physical characteristics. Much of the watershed is forested which provides critical protections to creek banks and water quality. Issues affecting the overall health of the Creek are generally minor in nature. However, the Hosensack Creek is an important headwaters creek in the Perkiomen Creek network. Protection of these smallest streams is very important since small incidents can have large overall impacts.

The recommendations of the plan are general in nature and leave room for developing a broad public information campaign with numerous demonstration projects. The primary issues that should be addressed are streambank maintenance and invasive plant controls on privately owned property and consistent land use and zoning regulations.

Numerous agencies and non-profit organizations can assist with preparing materials for the public and with identifying locations, designs and funding sources for streambank restoration projects. These partnerships can provide critical assistance to local landowners and public officials as projects are developed and implemented.

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I. INTRODUCTION

The Hosensack Creek is a tributary to the Perkiomen Creek, the largest sub-watershed within the Schuylkill River network. The Perkiomen Creek provides source water for hundreds of communities within the 362 square mile watershed and throughout southeastern Pennsylvania.

The Upper Perkiomen Creek includes communities in western Montgomery County, portions of western Lehigh County and southeastern Berks County. The region is largely rural but the historic villages of the area tell the story of longstanding agrarian communities and a deep connection to the land. The well-maintained properties of the area illustrate a strong stewardship ethic among the residents. The abundance of undeveloped natural areas is a reflection of this stewardship ethic, as well as the local geology and the general distances to larger economic centers.

Overall, the Perkiomen Creek has been a hard working creek for several hundred years and has suffered the impacts of industrialization, suburban sprawl and agricultural run-off. Water quality throughout the Perkiomen is moderate with significant variability from one tributary to another.

The Hosensack Creek rises primarily in Lower Milford Township, Lehigh County but does include headwaters areas in Upper Milford Township and a named tributary, Indian Creek, that also rises in Upper Milford Township, Lehigh County. The Hosensack Creek passes through a short section of Upper Hanover Township in Montgomery County before it joins the Perkiomen Creek at the village of Palm.

The Hosensack region has an abundance of forests and meadows that blanket many of the steeper slopes of the Hosensack Creek watershed. It is this well-vegetated landscape that protects local water quality from the impacts of excess erosion, stormwater impacts, agricultural run-off and the other non-point source pollutants that have impacted many other areas of the Perkiomen Creek.

Available data for the Hosensack Creek indicates that water quality is excellent, perhaps the best within the entire Perkiomen Creek watershed. It is fitting then, that the Hosensack Creek be the first of the Perkiomen's many tributaries to be evaluated to determine how existing water quality can be protected.

The goal of the Hosensack Creek Conservation Action Plan is to establish a guidance document that can be used by municipal officials, businesses and residents to ensure that the natural areas, lawns and agricultural lands are managed in ways that protect water quality in the Hosensack Creek.

Additional details about the Hosensack Creek and the Upper Perkiomen Creek can be found in the *Upper Perkiomen Creek Watershed Conservation Plan*[1].

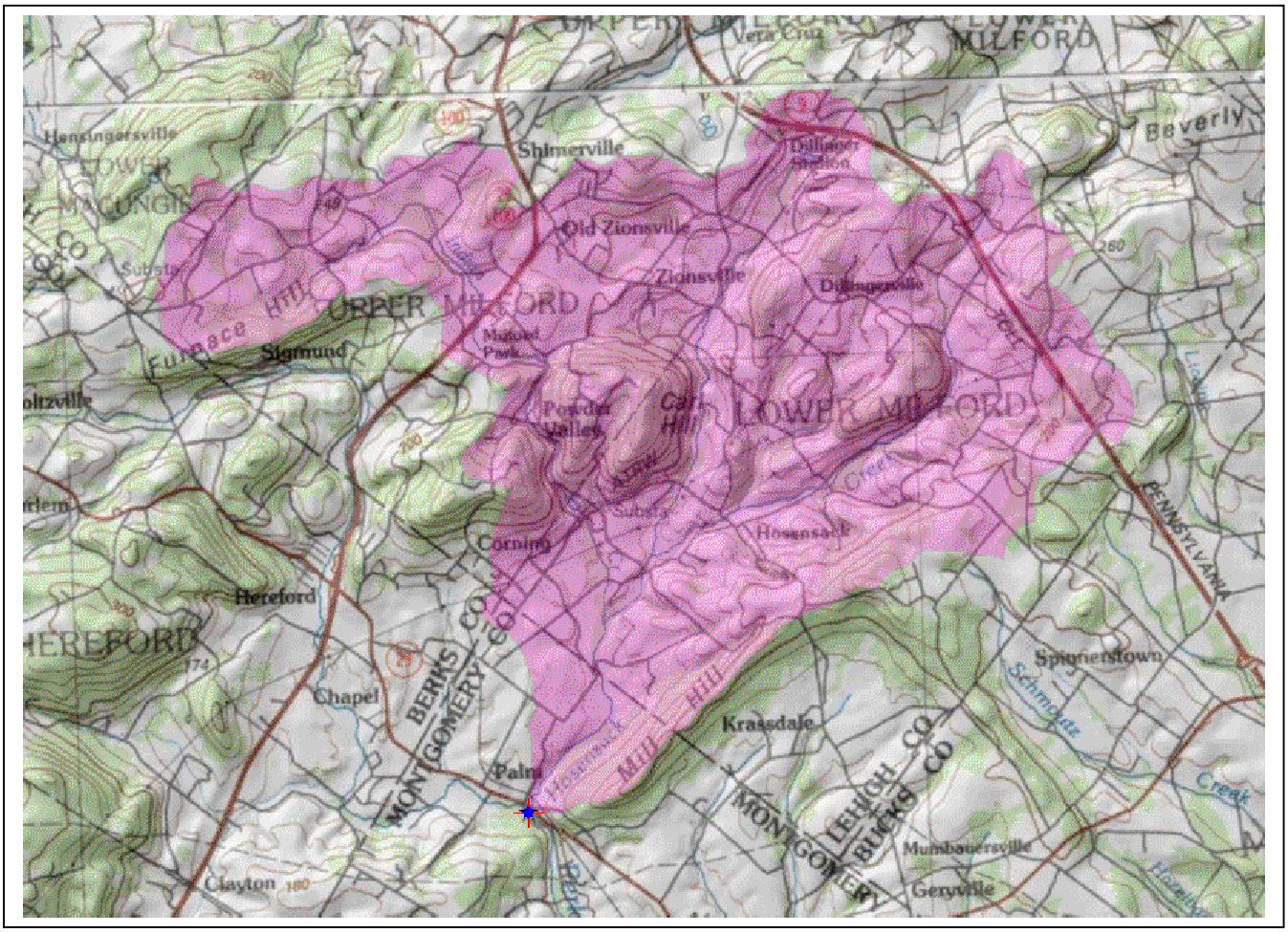

Figure 1. Hosensack Creek boundary as defined by the USGS Pennsylvania Streamstats website at http://streatstats.cr.usgs.gov. The pink outline includes Indian Creek, which is not included in this conservation plan.

[1] Upper Perkiomen Creek Watershed Conservation Plan, December 2001. Prepared by Natural Lands Trust, The Upper Perkiomen Watershed Coalition and the Pennsylvania Environmental Council

II. BACKGROUND

The Hosensack Creek Conservation Action Plan has been funded by Coldwater Heritage Foundation, a collaborative effort between the PA Fish & Boat Commission, the PA Department of Conservation and Natural Resources, Western PA Watershed Protection Program and Pennsylvania Trout Unlimited. Special thanks to Lower Milford Township for hosting the public meetings and the Lehigh County Conservation District.

The purpose of the Coldwater Heritage Partnership (CHP) is to provide leadership, coordination, technical assistance, and funding support for the evaluation, conservation and protection of Pennsylvania's coldwater streams.

While Pennsylvania has over 83,000 miles of streams, only 25% are considered high-quality coldwater fisheries. Of those, less than 2% are designated as highly productive waters that contain naturally reproducing wild trout. The CHP's primary focus is to foster protection and improvement of these streams and their watersheds.

Goals of the Coldwater Heritage Foundation program include:

- Foster a greater public understanding of watershed characteristics and how they affect coldwater ecosystems;
- Identify special areas of concern, such as areas with exceptional water quality with high potential for impacts;
- Produce conservation plans that will lead to additional planning or implementation of projects that protect and enhance our coldwater ecosystems; and
- Provide technical assistance and financial opportunities to organizations dedicated to protecting coldwater ecosystems.

In addition, the Perkiomen Watershed Conservancy's *2009 – 2014 Strategic Plan* identifies Conservancy visions, goals and objectives for achieving and maintaining excellent water quality throughout the watershed. Specifically, the Plan envisions a "A watershed landscape that supports the highest water quality possible" and "A watershed population that is inspired to protect the ecological benefits of a healthy Perkiomen Creek."

The Conservancy's Strategic Plan outlines initiatives for Conservancy actions that will:

- Strengthen the Watershed community;
- Conserve, protect and maintain the Watershed landscape;
- Develop partnerships with Watershed businesses;
- Inspire and support stewardship actions by the Watershed population.

The Conservancy's Strategic Plan Initiative II is to "Provide tools for action" for residents and businesses. The tools should help restore waterways and water quality through on-the-ground conservation projects and create opportunities for residents to undertake local conservation and stewardship actions that support water resource protection in their communities.

III. EXISTING HOSENSACK CREEK CONDITIONS

The *Upper Perkiomen Creek Watershed Conservation Plan* (UPCWCP) was completed in 2001 by Natural Lands Trust, the Upper Perkiomen Watershed Coalition and the Pennsylvania Environmental Council. The plan provides a summary of the existing physical conditions and regulatory restrictions in the watershed and was designed to serve as a guidebook for local landowners and citizens, municipalities and conservation groups who are interesting in enhancing the long-term health of the Upper Perkiomen Creek and the surrounding watershed. The following information is summarized from the UPCWCP.

Geology and Soils

The geology of the region lays the foundation for productive soils and abundant water supplies. Water and time combine with the local stone to help define the quality of the soils and the availability and quality of groundwater and surface water resources of a region.

Figure 2. The rocks in the Hosensack Creek reflect the local geology of the area; the geology in turn, defines the characteristic of the soil.

The Hosensack Creek watershed is principally composed of Granitic Gneiss and Brunswick formations with some minor areas of Hardystone and Leithsville formations. The Gneiss formations form the headwaters areas of the watershed and account for the steep ridges that define the region. The Gneiss formations also have areas of high iron content. The Brunswick formation provides the reddish brown shales of the lower Hosensack watershed and provides the parent material for highly productive agricultural soils. The small areas of Hardystone and Leithsville formations run between the Brunswick and Gneiss areas.

Prime agricultural soils are designated by the US Department of Agriculture's National Resource Conservation Service and support a variety of row crops, hay grasses and pasturage. The Hosensack watershed contains numerous areas of Prime Agricultural soils. In addition, a large number of farms have been preserved through Lehigh and Montgomery Counties' farmland preservation programs.

Local hydrology

Southeastern Pennsylvania receives approximately 45 inches of rainfall annually. Combined with the temperate climate and fertile soils, this provides rich conditions for agriculture as well as residential development.

The interplay of precipitation, climate, surface water and groundwater is a complex and interrelated natural system. Both the quality and quantity of local water resources are dependent upon how a community manages its local land uses. The removal of native groundcover and its replacement with increasing amounts of impervious surfaces can

negatively impact surface and groundwater supplies, affecting both the quality and quantity of local water resources.

Numerous wetlands and marshy areas are associated with the Hosensack Creek. When left in their natural condition, these areas act as buffers during heavy rains, filter many impurities from surface and ground water supplies and store water locally to supplement creeks and streams during times of drought.

Stream designations

Chapter 93 of the Pennsylvania Code sets forth water quality standards for surface waters of the Commonwealth, including wetlands. These standards are based on the uses of the water body and help guide the Department of Environmental Protection (DEP) as it applies the Clean Streams Law and other statutes pertaining to water quality.

Table 1 outlines the protected uses of water bodies in Pennsylvania that are applicable to the Hosensack Creek and the surrounding region. The special protection designations of High Quality and Exceptional Value are based on chemical and biological parameters that exceed those necessary for the propagation of fish, wildlife and recreation. Designations by the PA Fish and Boat Commission of Class A wild trout stream also apply to DEP's classifications.

Currently the entire Hosensack Creek including the Indian Creek tributary is designated as a Cold Water Fishery. A petition was submitted to the PA DEP in February 2008 requesting that the entire Upper Perkiomen Creek watershed, including the Hosensack Creek be upgraded to Exceptional Value. As of the date of this report, the DEP has not acted on the submission. No part of the Hosensack Creek has been designated as a Class A wild trout stream by the PA Fish & Boat Commission.

Table 1. PA Chapter 93 Stream Designations pertaining to the Hosensack Creek watershed.

Protected Use	Use Code	Definition
Cold Water Fishes	CWF	Maintenance and/or propagation of fish species included in the family Salmonidae and additional flora and fauna, which are indigenous to cold water habitats. (NOTE: the Salmonidae family of fish includes trout.)
Warm Water Fishes	WWF	Maintenance and propagation of fish species and additional flora and fauna, which are indigenous to a warm water habitat.
Trout Stocking	TSF	Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation fish species and additional flora and fauna, which are indigenous to a warm water habitat.
High Quality	HQ	Special Protection
Exceptional Value	EV	Special Protection (Highest protection designation in Pennsylvania)

Additional information

Numerous organizations have noted the conservation value of the Upper Perkiomen Creek watershed and have conducted additional research into the resources of the region. Several sources are summarized below.

Stroud Water Research Center

The Stroud Water Research Center in Avondale, PA was established by the Academy of Natural Sciences in 1966 with a mission to advance global knowledge and stewardship of fresh water systems through research and education. Since 1996, Stroud has been studying the Schuylkill River Basin in order to evaluate critical indicators of water quality, develop a better understanding of the watershed as a whole and share the information with the region's conservation organizations.

The Stroud evaluation process uses benthic (i.e. stream bottom-dwelling) macroinvertebrates such as insects, worms and crayfish to assess current water and habitat quality. Most stream segments support diverse populations of aquatic insects. Aquatic insects form a critical link in the food chain. They are dependent on plant and microbial food sources and provide a primary food source for secondary consumers, such as fish. Because many species exhibit different tolerances for environmental change and stress, the resulting environmental analysis can provide a sensitive assessment measure.

In 1996, Stroud identified 19 sites throughout the Schuylkill River network that represent the many tributaries to the Schuylkill Rive. These are considered long-term sites and are sampled annually. Additional sites are sampled periodically and were chosen with assistance from local watershed groups and interested parties. Details pertaining to the Stroud Water Research Center's sampling and evaluation process can be found at www.stroudcenter.org/schuykill.

Three sites within the Hosensack Creek watershed have been included in the Stroud efforts: at Yenkel Road, on the west branch at Palm Road and on the east branch at Limeport Pike and Shultz Bridge Road. The data is summarized from the Stroud website in Appendix A.

The individual site reports include a variety of types of information. The MAIS score is a compiled score based on the types and abundance of macroinvertebrates that are found at each site. Most macroinvertebrate creatures exhibit certain tolerances for pollution within a stream segment. An abundance of the pollution tolerant organisms will result in lower MAIS scores. The higher the MAIS score, the greater is the abundance of pollution INtolerant organisms. The pollution intolerant organisms would not be able to proliferate in the stream segment if water-polluting components were present in abundance.

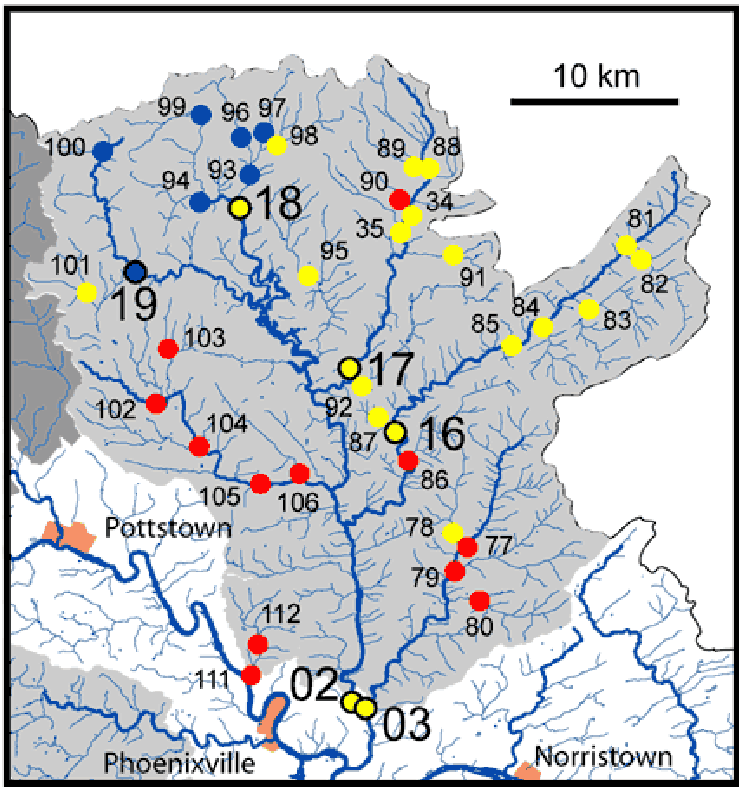

Figure 3: The map of the Perkiomen Creek watershed identifies the Stroud Water Research Center's macroinvertabrate sampling locations. Sites 93, 97 and 98 are on the Hosensack Creek.

The reports also list a few chemical indicators of creek health. References for these standards are varied. Only one reference for a limitation for phosphorous was found.[2] All three locations on the Hosensack Creek are well below both the **nitrates and phosphorus** limits. Both nitrates and phosphorous are present in varying quantities in stormwater run-off that includes lawn and agricultural fertilizers, pesticides and animal wastes.

Conductivity of streams is a measure of the ability of water to pass an electrical current and is affected by the presence of inorganic dissolved solids including nitrates, sulfates and

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[2] United States Geologic Survey (USGS) Report - NFS-118-03; December 2003; *New Studies Initiated by the U.S. Geological Survey—Effects of Nutrient Enrichment on Stream Ecosystems;* By Mark D. Munn and Pixie A. Hamilton

"How USGS information is used
Improved standards and guidelines for protecting aquatic and human health
As of 2003, only one enforceable national standard for nutrients exists—10 milligrams per liter of nitrate (as nitrogen) in drinking water—to protect human health. USEPA has established a nonregulatory desired goal of 0.1 milligram per liter of total phosphorus in surface water—to prevent overgrowth of algae and aquatic plants in streams and other flowing waters not discharging to lakes or impoundments. USEPA is continuing to develop criteria for total phosphorus and total nitrogen in streams for the protection of aquatic and human health, and is focusing on different geographic regions and types of water bodies; the goal is to have criteria that are congruent with State water-quality standards. USGS findings on nutrient conditions, biological communities, stream characteristics, and environmental settings are being used in the development of these regional nutrient criteria. "

phosphates, which carry a negative charge and sodium, calcium or iron, which carry a positive charge. According to the USEPA, "streams supporting good mixed fisheries have a range between 150 and 500 micro-omhs per centimeter."[3] All three Hosensack Creek monitoring sites are within that range.

The **pH** measures the alkalinity or acidity of a waterway[4]. pH increases from 1 (highly acidic) to 14 (highly alkaline). The pH scale is logarithmic so a single unit change in pH indicates a tenfold increase or decrease in acidity or alkalinity. According to the US EPA, "The largest variety of aquatic animals prefers a range of 6.5 – 8.0. pH outside of this range reduces the diversity on the stream because it stresses the physiological systems of most organisms", particularly trout species. The pH of water determines the solubility (amount that can be dissolved in the water) and biological availability (amount that can be utilized by aquatic life) of chemical constituents such as nutrients (phosphorus, nitrogen, and carbon) and heavy metals (lead, copper, cadmium, etc.). For example, in addition to affecting how much and what form of phosphorus is most abundant in the water, pH also determines whether aquatic life can use it. pH in all three Hosensack Creek segments is just beyond these suggested limits though these small increases in alkalinity do not appear to be harmful and may help buffer the stream from acid rain or other more acidic occasional flows.

Alkalinity refers to the capacity of water to neutralize acids and reflects the water's capacity to resist changes in pH. This buffering agent helps protect aquatic organisms from rapid changes in pH that might occur from the more acidic rains and snow melts or from discharges into the stream. Minimums of 20 mg/L are recommended; all three creek segments exceed the minimum standard.

County Natural Area Inventories

Both Montgomery County and Lehigh County have completed Natural Areas Inventories (NAI) that include the Hosensack Creek watershed. NAI sites are based on the Pennsylvania Natural Diversity Index and help identify "critical" areas of plant and animal habitats, lists of unique features and recommendations for preservation. The Natural Areas Inventory for Lehigh County was conducted by the Nature Conservancy in 2005. The Natural Areas Inventory for Montgomery County was conducted by the Morris Arboretum of the University of Pennsylvania in 2007.

[3] US Environmental Protection Agency at www.epa.gov.volunteer.stream.vms59.html; *Monitoring and Assessing Water Quality; 5.9 Conductivity.*

[4] US Environmental Protection Agency at www.epa.gov.volunteer.stream.vms59.html; *Monitoring and Assessing Water Quality;5.4 pH.*

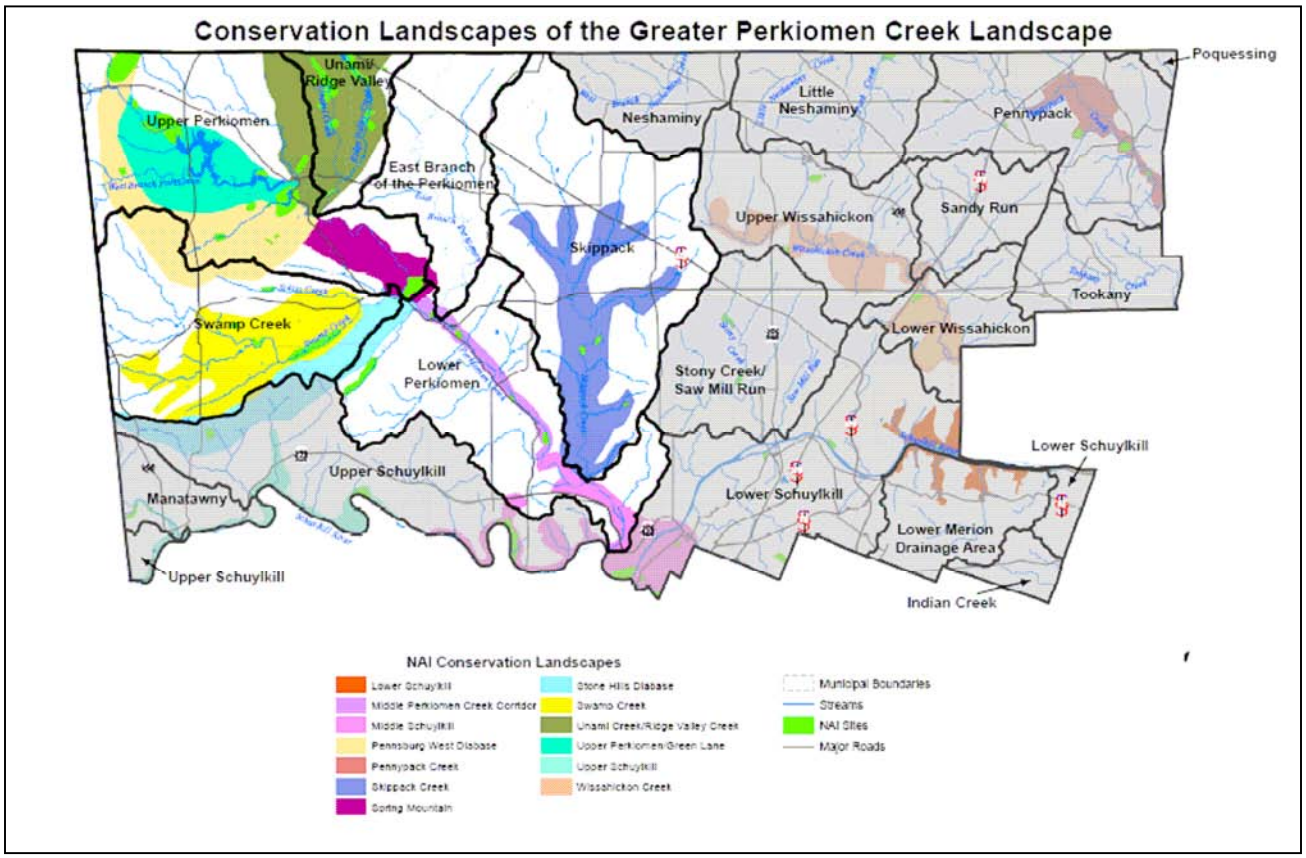


Figure 4: Montgomery County's critical landscapes, highlighted within the Perkiomen Creek watershed. The Hosensack Creek enters the County in the northwesternmost corner of the County. The area designated as an NAI site is included in the Pennsburg West diabase region and is locally known as Mill Hill.

Outstanding Natural Areas of Southwestern Lehigh County

Natural Area	Location	Priority	Unique feature
Hosensack Marsh	Lower Milford Township	Top Priority	Marsh and shrub swamp, several PA endangered animal species
Big Beech Woods	Lower Milford Township	Local Significance	Southeast facing slope facing the Hosensack Creek with maturing second growth forest. Some trees over 2 ft diameter
Lower Milford Marsh	Lower Milford Township	Statewide Significance	Fen (wetland) with potential for several plant and animal species of concern.
Mill Hill	Lower Milford Township	Local Significance	Ridge with diverse second growth forest with potential for several plant species of special concern.

Table 2: The critical natural features as detailed in the Lehigh County Natural Areas Inventory.

In addition, Natural Lands Trust, a Media, PA based conservation and preservation organization, has developed a prioritization process that evaluates habitat health and vitality based on aquatic and terrestrial resources. Parcels are ranked between 1 (lowest value) and 10 (highest value). The map in Figure 5 includes an outline of the Perkiomen Creek watershed. The area of southwestern Lehigh County and northwestern Montgomery County includes the Hosensack Creek. The abundance of dark blue values (values 9 & 10) illustrate the breadth of resources that define the Hosensack Creek watershed.

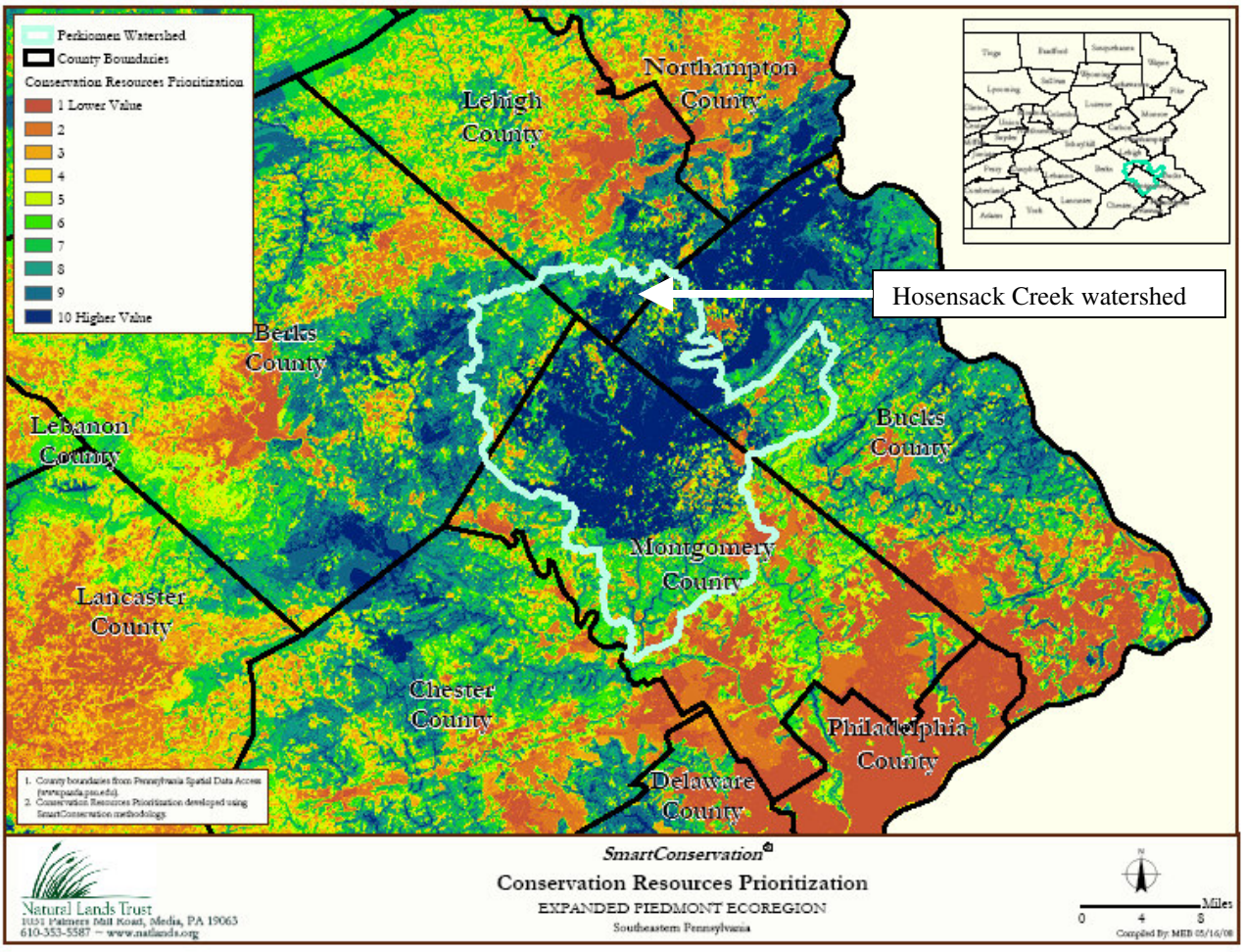


Figure 5: The Natural Lands Trust's compilation of natural resource values illustrates the exceptional resource base that exists throughout the Perkiomen Creek watershed (outlined on the map). The Hosensack Creek is a significant headwaters stream in the Upper Perkiomen.

IV. STREAM EVALUATIONS

In order to gain a first-hand understanding of the Hosensack Creek and the general watershed and conservation issues that may be specific to the area, Conservancy staff conducted eight (8) streambank and instream conditions evaluations. The visual inspections were conducted using a monitoring framework adapted from the Delaware Riverkeeper Network Adopt-a Buffer Toolkit. A sample of the datasheet and maps of the monitoring locations are attached in Appendix B.

The visual monitoring process examines a variety of stream condition indicators including instream cover, sedimentation, flow patterns, conditions of streambanks, extent of riparian disturbances, condition of the riparian buffer, overall biodiversity and pressure from invasive plants. Summaries of each monitored location are included in Appendix B. All sites were visited on August 11 or 12, 2009. Overall rainfall was above average for the month and much of the summer. Figure 6 shows the USGS stream gage on the West Perkiomen Creek in Hillegass, PA. Given the proximity of Hillegass to the Hosensack area, it is assumed that the water level in the Hosensack Creek was also above the average August levels. Except for the extent of the four basic flow patterns[5], the higher water levels did not impact the overall evaluations.

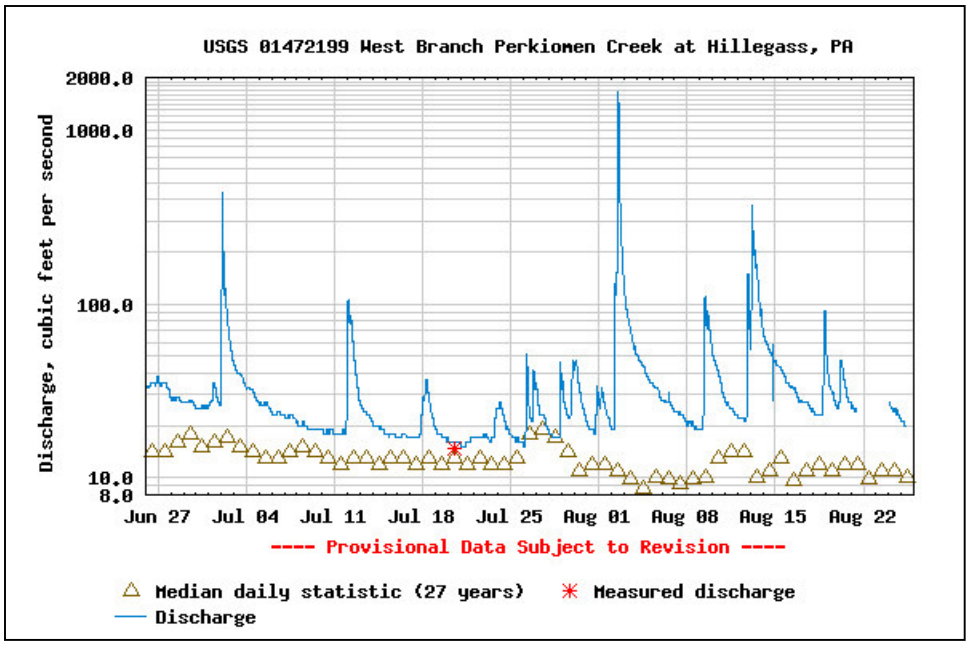


Figure 6: United States Geologic Survey stream gage indicating that the Perkiomen Creek discharge at the Hillegass gage is significantly above the median water levels at the time of the Hosensack Creek stream evaluations.

[5] Four basic water flow patterns are generally found in small creeks. These include slow and shallow, slow and deep, fast and shallow and fast and deep. All four flow characteristics are necessary to provide the diversity of habitat necessary for aquatic organisms, especially trout.

Overall, the stream evaluations presented a very healthy creek. A great deal of forested land remains intact throughout the region. This probably accounts for the health of local waterways given the generally accepted concept that streamside forests represent the best management practice for protecting aquatic ecosystems from outside pollution, sediments and other contaminants as well as reducing the erosive power of storms and high water events. The following is a summary of the findings of the stream assessments:

Exotic, Non-Native and Invasive Vegetation

The most prolific and widespread invasive plant in the Hosensack Creek watershed is multi-flora rose, followed by Japanese honeysuckle and grapevines. There are also a number of locations with Norway maples, Ailanthus (Tree of Heaven) and purple loosestrife. A proliferation of non-native and invasive plants reduces the variety and numbers of native plants that can complete, it reduces natural food sources for wildlife and aquatic organisms, it reduces access to the creek for educational or recreational uses and does little to help stabilize streambanks. Non-native plants, other than those noted above, are probably present but may not be visible late in the summer months; i.e. lesser celandine.

Native plants are preferred as streamside buffers. They are well adapted to the climate, wildlife is well adapted to using native plants for food and cover, native plants are better suited for stabilizing streambanks and greater biodiversity is possible when invasive plants are not present.

Figure 7: Multiflora rose and Japanese honeysuckle are among the more prolific invasive, non-native plants in the Hosensack Creek watershed.

In-Stream Cover and Sediments
Fish and other aquatic organisms require food and cover within the creek bed to survive. A stream with diverse rock sizes (from greater than 10 inches to gravel) as well as submerged logs and woody debris provides the best instream cover. Organisms in streams with a thick layer of silty deposits and deep gravel bars will have more difficulty finding appropriate breeding sites and food sources.

Stream segments in the Hosensack Creek appeared to have significant sedimentation and thick sandy gravel bars in a number of locations. There were also a number of significantly eroded streambank segments in the evaluated locations. Erosion of streambanks is a principle reason for sedimentation of creek beds.

In locations without sedimentation, the stream beds included a good variety of stone and gravel sizes and there was a variety of trees and shrubs providing cover and woody debris.

Figure 8: A thick layer of sediment is evident in this photo of the Hosensack Creek. Soil washes off of creek banks upstream and settles out in slow water. Sediments make it difficult for aquatic organisms to breed and feed.

Flow Patterns
Four basic flow patterns are recognized in Pennsylvania streams: slow and deep, slow and shallow, fast and deep, fast and shallow. These describe the pattern of pools and riffles that support diverse conditions necessary for fish and other aquatic organisms.

Except for the smallest headwater segments evaluated, most stream segments had a broad representation of riffles and pools with slower and faster water speeds.

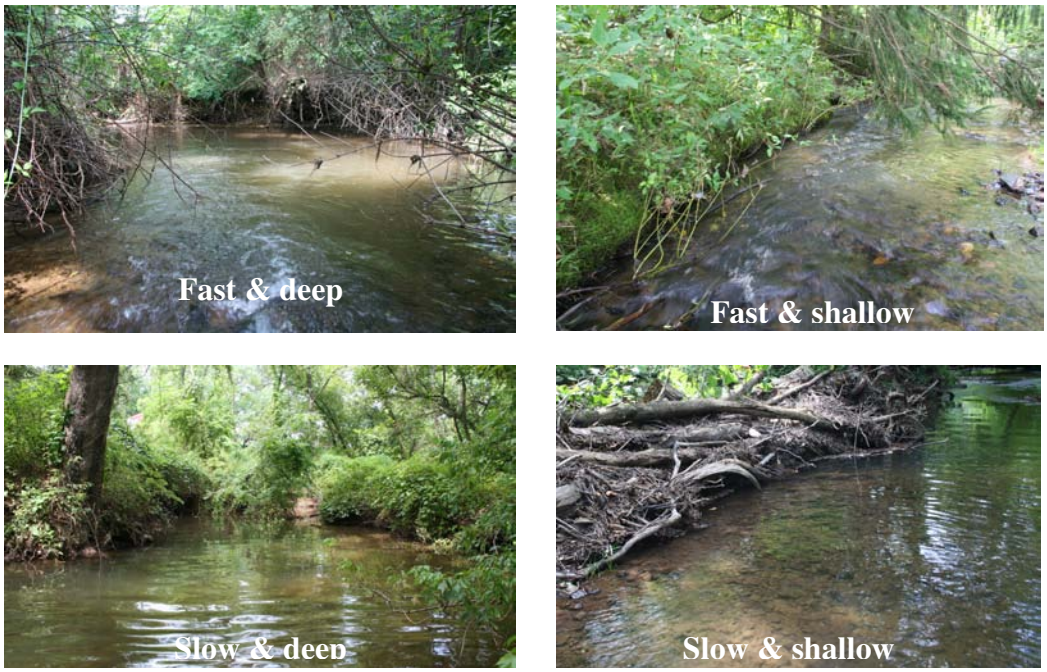


Figure 9 illustrates the four flow characteristics of healthy streams.

Streambanks and Riparian Buffers

A healthy streambank is closely related to a healthy streamside (riparian) buffer. Dense native vegetation with deep root systems is necessary to help retain soil along streambanks. Mown lawn and pasture grasses are the least preferred vegetation because the shorter root systems do not hold soil in place along streambanks. Also, trees provide important shade to smaller creeks, helping to keep water temperatures cooler.

Again, the vast areas of intact and contiguous forests currently existing throughout the Hosensack Creek watershed provide the best protection to water quality and habitats within the creek. However, the forests as well as adjacent meadows are widely compromised by the extent of multi-flora rose and vines. These invasive plants will make regeneration of the native trees more difficult and result in lost trees and degraded buffers in the future.

Biodiversity

Overall, the greater the biodiversity of the area, the greater the ability of natural areas to withstand periodic hardships such as drought or floods. Biodiversity helps ensure that the trees and shrubs that re-populate the area will be native plants. A diverse plant population provides the broadest habitat possibilities for the broadest range of creatures, including the microscopic and benthic organisms that are the beginning of the food chain in the local creeks.

Biodiversity within the Hosensack Creek watershed remains strong with many areas exhibiting more than 15 individual plant species in a small area. This diversity provides a good seed source for native plant repopulation in areas currently overrun by invasives.

V. CONSERVATION ISSUES

The current condition of the Hosensack Creek is exceptional in southeastern Pennsylvania where industrialization and suburbanization have heavily impacted most waterways. However, there are a number of threats to water quality and the overall balance of ground and surface water that could jeopardize current conditions.

Streambank Maintenance

Appropriate streambank maintenance is critical to ensuring that erosion is minimized. Erosion causes sedimentation of creek beds and inhibits the natural feeding and breeding cycles for aquatic organisms. In addition, streambank maintenance that includes an extended buffer zone (riparian buffer) can help reduce the flow of non-point source pollutants[6] into the creek.

Riparian buffers within the Hosensack watershed are generally very good, including extensive mature forests. However, areas of deep streambank erosion are evident at numerous locations; many locations coincide with areas of minimal or non-existent riparian buffers.

Figure 10. The buffer on the left consists of mown grass only and is being undercut by the creek. The result is increasing erosion, more sediments in the creek, lost frontage along the creek and degraded habitats. The buffer on the right is fully vegetated with native plants, which help keep the soil intact, provide shade and protect aquatic habitats from sedimentation.

Headwaters and wetland protections

Headwaters are the birthplaces of creeks and streams. They are the areas where a small spring may surface and create the first trickle of a stream. They may be areas of intermittent or seasonal streams that are only present during the rainier seasons. They are always small and are the most vulnerable of the stream segments. Small headwater streams can easily be degraded by even minor incidents since the volume of water is small and the areas that are part of the creek bed are generally small also. Many wetlands and marshy

[6] Non-point source pollutants are those substances that wash off of the land during rainstorms. They can include all manner of substances including lawn and agricultural fertilizers and pesticides, automotive oils and fluids that leak from cars and other vehicles, household pet and farm animal wastes, deteriorating driveway sealants, and sediments that erode from streambanks.

areas also serve as the starting point for stream segments, particularly within the Hosensack Creek watershed.

Unfortunately, small, intermittent streams and wetlands are often considered "problem areas" since they often lay wet or present other lawn maintenance issues for a property owner. These concerns can lead to regrading or filling of areas to make them "manageable" and able to support lawn grasses or agricultural crops. The loss of these intermittent streams and wetlands has had a dramatic impact on amphibians worldwide. As with the macroinvertabrates in the streambed, the amphibians are a critical link in the natural food chain and ecological balance of the area.

Headwaters areas in the Hosensack watershed are generally forested. Some sections of the headwaters areas do run through lawns and are impacted by lawn maintenance issues.

Figure 11. Small, wet areas like the one in the photograph to the left are important headwaters areas and help mitigate rainy and dry seasons by storing water and slowly releasing it into the larger creek system.

Invasives control

As with many locations throughout the northeastern US, the primary non-native, invasive plant in the Hosensack watershed is multi-flora rose. Japanese honeysuckle, Norway maples and Ailanthus trees are also evident in many locations. Non-native plants have few natural predators or consumers to keep them in check, therefore they proliferate unabated and crowd out many of the native plants. Native plants are preferred since they are well adapted to the local climate and soil conditions and provide the food and shelter that local wildlife depends on.

In addition, many non-native plants do not have the same ability to hold streambanks in place, thus adding to the erosion problems in the watershed.

Property owner info

The Hosensack Creek passes, almost exclusively, through private property. Therefore, creek maintenance issues have been primarily the responsibility of private citizens. A few property owners were present during the creek evaluations conducted by the Conservancy staff. In addition, a number of property owners attended the public meeting that announced this project. It is evident from these conversations that the local population holds the Hosensack Creek in high esteem and considers it an important focal point of the community.

Lawn Grasses

While private citizen intentions are generally good, it is common for individuals to not fully understand stream dynamics and the impacts of certain creek bank maintenance techniques. The primary maintenance technique that needs to be addressed is the installation and mowing of turf grasses along the edges of the creek.

Turf grasses are non-native vegetation that does not provide any of the stabilizing and buffering qualities of denser native vegetation. Lawn grasses have very shallow roots that allow streambank erosion to proliferate, especially where the natural meanders of the creek put additional pressure along the outside edges of the bend in the creek. Lawn grasses also do very little to filter out non-point source pollutants that are washed toward the creek during rain events.

Septic Systems and Wastewater Treatment

The Hosensack Creek watershed is primarily rural with most properties having on-site septic systems to handle their wastewater treatment needs. Overall, the density of development in the area is relatively sparse and therefore the local soils are generally able to handle the current septic load. However, septic system maintenance is important to ensure that local soils are not overloaded resulting in unintended septic discharges into the creek.

The creek evaluations conducted for this report did not indicate problems with septic systems at this time but there are large areas of the creek that were not evaluated so it is possible that some septic discharges may be impacting the stream.

In addition, the Lower Milford Elementary School maintains a small sewage treatment plant to handle the needs of the school. The stream discharge from the plant is permitted through the PA Department of Environmental Protection and must meet regular reporting standards.

Stormwater Issues

One of the main issues impacting water quality throughout the region is stormwater management. Proper stormwater management allows rain water and snow melt to slowing seep into the ground where it helps replenish groundwater supplies. The slowing of stormwater run-off also allows the soil and vegetation to filter out many non-point source pollutants that wash off of the land with the stormwater.

The most appropriate management techniques relate back to riparian buffers, headwaters and wetland protections as well as invasive plant controls. Native trees and dense streamside vegetation are best at filtering out pollutants before it can reach local streams. The protection of wetlands and floodplain areas allows these naturally absorbent areas to hold excess rainfall or snow melt and slowly release it back into the ground and surface water systems.

Slowing and absorbing stormwater also helps reduce the erosive impacts of creeks that now rise quickly with even small rainfalls. The USGS gage information in Figure 6 illustrates how quickly local waterways can rise when it rains. While this information is not available for the Hosensack Creek, it is likely that a similar pattern of quickly rising and falling creek levels after small storms exists in the Hosensack watershed.

As development continues in the Hosensack watershed, additional stormwater impacts are likely to be seen throughout the community.

Zoning and subdivision/land development protections

This report does not include a detailed analysis of zoning and land use protections established in the local municipalities, however, a brief overview of local zoning ordinances indicates that protections are in place for wetlands, streams and floodplains, including the riparian areas along stream corridors. Additional grading permit requirements call out the need to protect areas with a high water table. (These areas are often marshy and can be critical habitats for amphibians and other wildlife.)

Minor portions of the main branches of the Hosensack Creek are within Upper Milford Township in Lehigh County and Upper Hanover Township in Montgomery County. The bulk of the watershed lies within Lower Milford Township, Lehigh County.

Within Lower Milford Township, the Hosensack Creek is almost entirely within the Agricultural Conservation and Resource Conservation zones that require relatively large lot sizes or an Open Space Design Option that clusters structures to protect contiguous areas of forests, steep slopes, wetlands and other natural resource features. Central portions of the creek run through the Rural Residence - 1 District, which also has a large lot restriction. Lower Milford Township‘s zoning ordinance also establishes Natural Resource Protection Standards that identify steep slopes, wetlands and wet soils, woodlands, floodplains and even heritage trees and outlines protection standards for each resource. Large areas of the Hosensack Creek watershed in Lower Milford Township are within areas designated as Class I, II and III woodlands with maximum disturbance regulations that range from 5% disturbance to 25% disturbance.

Short portions of the Hosensack Creek headwaters arise in Upper Milford Township in the Agricultural Conservation and Rural Agriculture zoning districts. These districts are designed to promote agricultural land uses and protect water quality, habitats along creeks and promote groundwater recharge. Upper Milford Township also allows open space conservation designs that reduce disturbances of natural resource areas, steep slopes, wet soils, etc.

Within Upper Hanover Township, the Hosensack Creek runs through the R1, Agriculture – Low Density Residential district from the municipal boundary to the confluence with the Perkiomen Creek. This R-1 District requires larger lots and permits open space cluster development with the specific purpose of protecting the Hosensack Creek greenway. There are additional regulations protecting riparian corridors along creeks and adjacent to ponds.

While these ordinances provide broad protections to natural resources in the area, they do not guarantee that certain land use and zoning challenges will not occur. The ongoing zoning challenge in Lower Milford Township regarding a proposed quarry in the midst of the township's Resource Conservation district reflects the community's willingness to take on challenges to the area's natural resource base.

Figure 12. Secluded section of the Hosensack Creek.

Conservation Issues	Implementation Options
Streambank maintenance Private property management Public information Demonstration projects	• Provide public information in brochures, websites and at public meetings. • Pursue streambank restoration projects where they are most visible. • Develop voluntary guidelines for private property maintenance along streambanks and present annual acknowledgements of property owners' efforts. • Conservation easements along riparian areas
Invasive Plant Controls Private property management Public information Guidelines for development	• Provide public information in brochures, websites and at public meetings. • Include subdivision and land development ordinance regulations requiring invasive plant removals and restoration with native plants as part of the land development process.
Property owner information Streambank vegetation Septic system maintenance	• Provide public information in brochures, websites and at public meetings. • Establish local ordinances requiring periodic pumping of septic tanks.
Headwater and wetland protections	• Provide public information in brochures, websites and at public meetings. • Develop voluntary guidelines for private property maintenance in headwater and wetland areas and present annual acknowledgements of property owners' efforts. • Conservation easements in sensitive headwaters and wetland areas
Stormwater issues	• Identify all privately maintained stormwater facilities. • Provide guidance pertaining to stormwater issues and appropriate maintenance techniques for privately owned facilities.
Zoning and subdivision/land development protections	• Continue strengthening municipal regulations and emphasizing the importance of maintaining the environmental integrity of the Hosensack Creek resource base.

Table 3. Summary of the conservation issues facing the Hosensack Creek watershed and possible implementation options.

VI. RECOMMMENDATIONS

As noted previously, most of the Hosensack Creek runs through private property, therefore many of the recommendations will pertain to private property management. Municipal governments can help provide the leadership and information that will help citizens understand the issues and how different types of property management techniques can help protect the creek's water quality and the habitats that it nourishes.

Streambank Maintenance

Streambank Management Information for Property Owners

A watershed-wide information program, with information distributed through municipal newsletters or websites can be a powerful tool to help increase local understanding of issues impacting the health of the Hosensack Creek. Specific maintenance techniques to address erosion and invasive plants can be provided in this manner.

The principle issues that should be explained are the need for native vegetation in riparian buffers, the damage done by lawn grasses and mowing to the stream bank's edge, impacts of pasture access for livestock and appropriate stormwater management. The principle objective should be to help property owners understand the connection between non-point source pollutants and stormwater run-off, how stormwater run-off impacts overall water quality as well as streambank stability and the ability of native plants to reduce the pollutants in stormwater run-off before it reaches local creeks.

Potential Demonstration Projects

There are many locations along the Hosensack Creek that would make excellent demonstration projects for streambank reconstruction efforts. It is likely that grant funds would be necessary to design and implement these projects. Property owner agreements would also be necessary to ensure long-term maintenance protocols. Other sites would provide locations for stormwater demonstration projects that illustrate how native plants and slower stormwater release rates can improve water quality and reduce erosion.

Demonstration projects allow other property owners to see firsthand what can be done to protect and restore creek banks and water quality. Local non-profit organizations with an emphasis on creeks and waterways may be able to assist with project identification, grant seeking and project implementation.

Headwaters and riparian zone protections

All three municipalities have enacted policies and ordinances designed to protect waterways and other natural features within their jurisdictions. While these ordinances are quite progressive, they cannot protect against all practices that can negatively impact the Hosensack Creek. They do provide a baseline by which all land use actions are measured.

Municipal Regulations

Municipal regulations that protect forests, wetlands and other natural features are critical to protecting water quality and the habitats of the Hosensack Creek. Municipal regulations should be reviewed periodically to ensure that the greatest protections possible are

included. Again, presenting information to the residents of the area about the need for waterways protections and how the municipal ordinances implement those protections is important to avoiding unintentional actions that negatively impact the creek.

Conservation Easements

Both streambank maintenance issues and the protection of headwaters and wetlands can be strengthened through the use of conservation easements. A conservation easement is a legally binding agreement between a landowner and a qualified conservation organization or government agency that places certain restrictions on a property's use in order to protect its conservation values. The easement carries forward with any deed transfers and permanently protects the land under the easement from future development. The landowner continues to own, use, and live on the land. Land can be sold or passed on to heirs.

Conservation easements can be tailored to focus on specific aspects of a property and can be limited to certain areas such as riparian zones or wetland areas.

Invasive plant controls

Reducing and eliminating invasive plants in the larger landscape is a very difficult task. These are generally either very labor-intensive efforts or require extensive use of herbicides and heavy equipment. They also require a long-term management plan.

Property Owner Information

Again, a watershed-wide information program can provide property owners with important management information about eradication techniques and what types of plants can be used to replace invasives in the landscape. Additionally, there are conservation organizations that specialize in management techniques that focus on invasives removal and replacement with native plants.

Municipal Regulations

Municipal subdivision and land use regulations should provide requirements and/or incentives for removing invasives from riparian areas and replanting with a mix of appropriate native plants.

Subdivision regulations should specify that landscaping plant species should be native and appropriate for the local climate and soils. Specifically, planting plans for stormwater basins should include native plants only and should avoid lawn grasses that require regular mowing during the growing season.

Figure 12. This severely eroded streambank is adding sediments to the overall creek system and could jeopardize the nearby roadway if erosion is not controlled. Restoration of this section of the Hosensack Creek could be a prominent demonstration project.

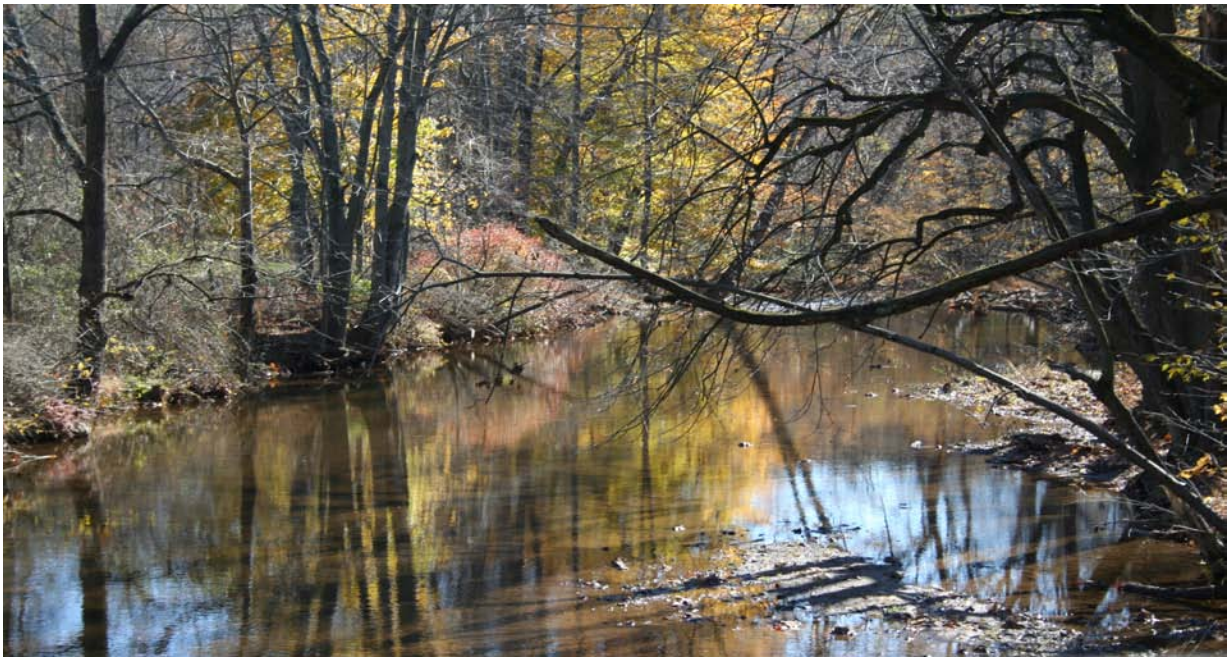
VII. CONCLUSIONS

The Hosensack Creek was specifically chosen as the location for the Conservancy's first small-scale watershed conservation plan because of the abundance of natural resources and naturally clean water that abounds in that watershed. The Conservancy's selection was based upon the concept that it is easier to protect existing resources than to recreate them once they have been consumed or diminished. The information provided within this report, while not an exhaustive review of available data, is a broad reflection of the natural resource base within the Hosensack Creek watershed.

Overall, the Hosensack Creek exhibits good water quality and healthy physical characteristics. Much of the watershed is forested which provides critical protections to creek banks and water quality. Issues affecting the overall health of the Creek are generally minor in nature, making the need for restoration actions less urgent. However, the Hosensack Creek is an important headwaters creek in the Perkiomen Creek network. Protection of these smallest streams is very important since small incidents can have large overall impacts.

The recommendations of the plan are general in nature and leave room for developing a broad public information campaign with numerous demonstration projects. The primary issues that should be addressed are streambank maintenance and invasive plant controls on privately owned property and consistent land use and zoning regulations.

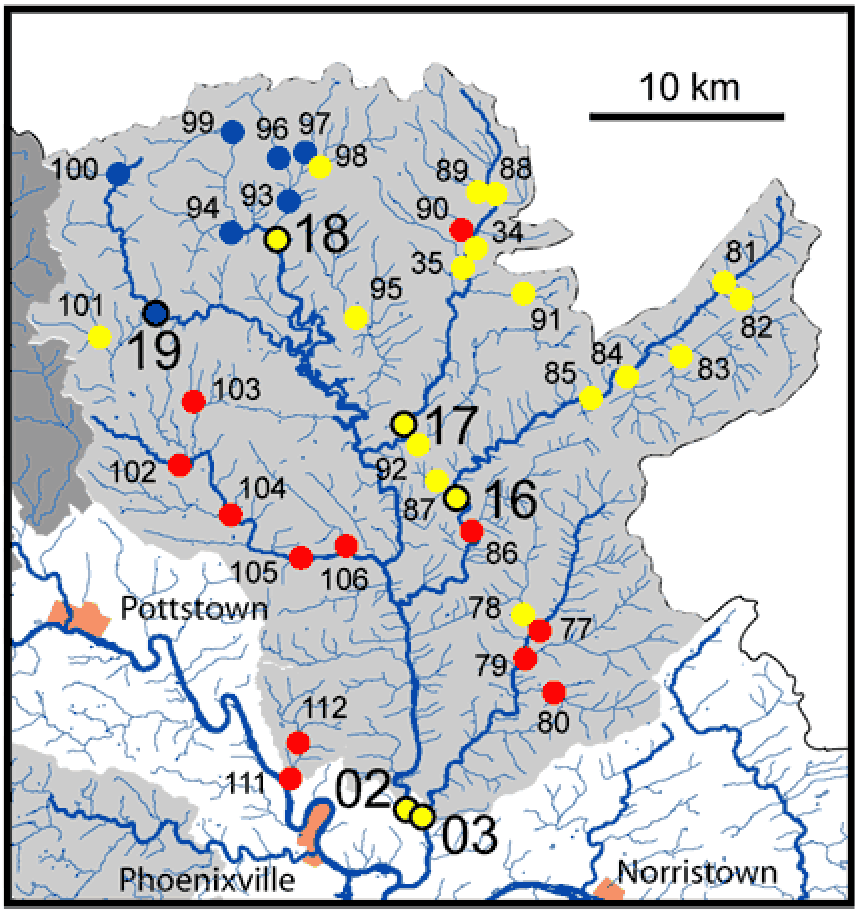
Numerous agencies and non-profit organizations can assist with preparing materials for the public and with identifying locations, designs and funding sources for streambank restoration projects. These partnerships can provide critical assistance to local landowners and public officials as projects are developed and implemented.



STROUD WATER RESEARCH CENTER

970 Spencer Road
Avondale, PA 19311
610.268.2153 / 610.268.0490
(fax)

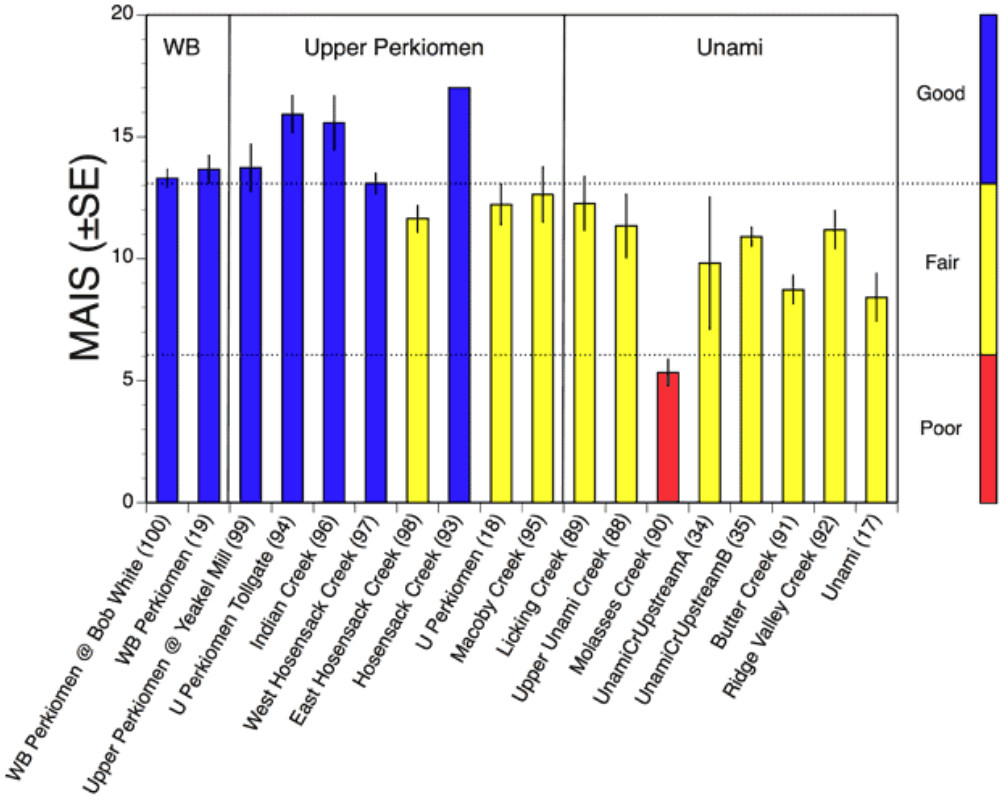
Perkiomen Creek Basin



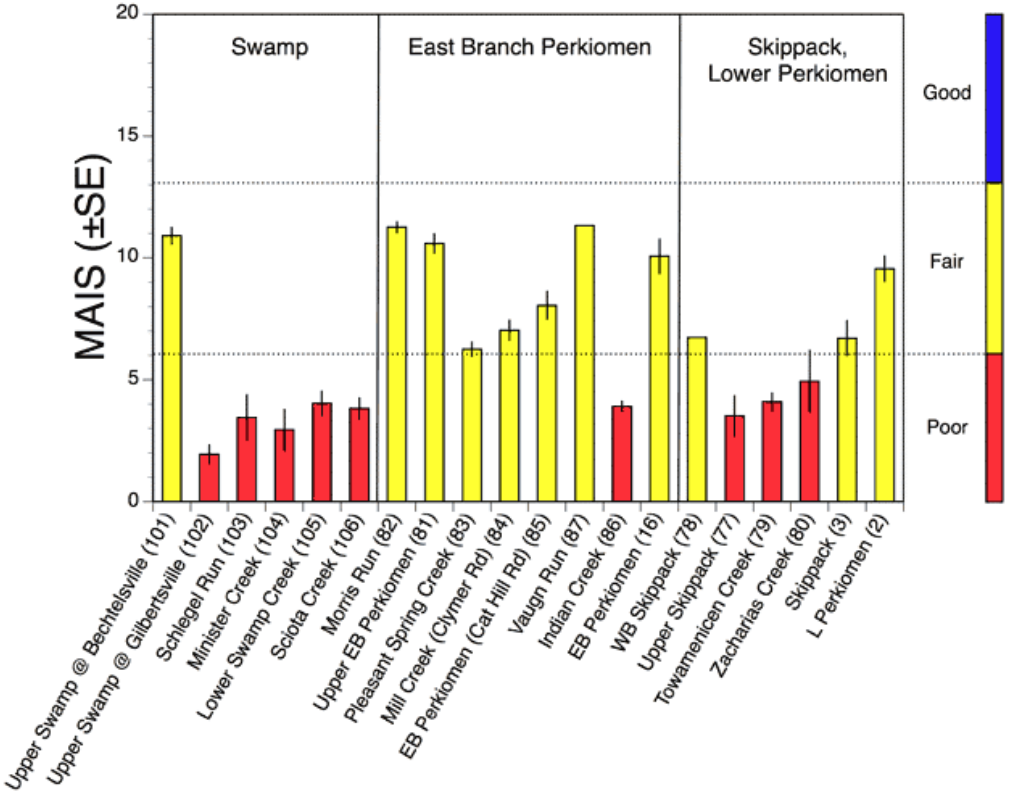
Water Quality: good fair poor

2 Perkiomen Creek
3 Skippack Creek
16 East Branch Perkiomen Creek
17 Unami Creek
18 Upper Perkiomen Creek
19 West Branch Perkiomen
34 Unami Creek (upstream A)
35 Unami Creek (upstream B)
77 Upper Skippack
78 West Branch Skippack
79 Towamenicen Creek
80 Zacharias Creek
81 Upper East Branch Perkiomen
82 Morris Run
83 Pleasant Spring Creek
84 Mill Creek
85 EB Perkiomen @ Cat Hill Rd.
86 Indian Creek
87 Vaugn Run
88 Upper Unami Creek
89 Licking Creek
90 Molasses Creek
91 Butter Creek
92 Ridge Valley Creek
93 Hosensack Creek
94 Upper Perkiomen @ Tollgate
95 Macoby Creek
96 Indian Creek
97 West Hosensack Creek
98 East Hosensack Creek
99 Upper Perkiomen @ Yeakel Mill
100 WB Perkiomen @ Bob White
101 Upper Swamp @ Bechtelsville
102 Upper Swamp @ Gilbertsville
103 Schlegel Run
104 Minister Creek
105 Lower Swamp Creek
106 Sciota Creek
111 Lower Mingo Creek
112 Upper Mingo Creek

Upper Perkiomen Basin



Lower Perkiomen Basin



Hosensack Creek – main stem	
Station number	93
description	At Treichlers Road
Latitude (decimal)	40.4384
Longitude (decimal)	-75.5161
Land Use	
Watershed area (km2)	43
Percent developed	2.0
Percent in agriculture	47.3
Percent forested	46
Percent wetland or water	1.6
Percent in quarries or mining	0.0
Chemistry	
Nitrate (mg/L)	2.2
Total Dissolved Phosphorus (mg/L)	0.012
pH	8.1
Conductivity (µmhos)	244
Alkalinity (as mg/L $CaCO_3$)	53
Macroinvertebrate Data	

years sampled	2005
MAIS score	17.0
water quality based on MAIS score	good
1st most abundant macroinvertebrate	**Chironomidae (midges)**
2nd most abundant macroinvertebrate	**Tipulidae (crane flies)**
3rd most abundant macroinvertebrate	**Ephemerellidae (spiny crawler mayflies)**
4th most abundant macroinvertebrate	**Elmidae (riffle beetles)**
5th most abundant macroinvertebrate	**Hydropsychidae (common netspinner caddisflies)**
6th most abundant macroinvertebrate	**Baetidae (small minnow mayflies)**
7th most abundant macroinvertebrate	**Uenoidae (stonecase caddisflies)**
8th most abundant macroinvertebrate	**Oligochaeta (aquatic earthworms)**
9th most abundant macroinvertebrate	**Psephenidae (water penny beetles)**
10th most abundant macroinvertebrate	**Planariidae (flatworms)**

West Hosensack Creek	
Station number	97
description	At Palm Road
Latitude (decimal)	40.4583
Longitude (decimal)	-75.5047

Land Use	
Watershed area (km2)	10
Percent developed	2.4
Percent in agriculture	46.4
Percent forested	45
Percent wetland or water	2.0
Percent in quarries or mining	0.0
Chemistry	
Nitrate (mg/L)	2.4
Total Dissolved Phosphorus (mg/L)	0.015
pH	8.1
Conductivity (µmhos)	298
Alkalinity (as mg/L CaCO3)	53
Macroinvertebrate Data	
years sampled	2006
MAIS score	13.1
water quality based on MAIS score	good
1st most abundant macroinvertebrate	**Ephemerellidae (spiny crawler mayflies)**
2nd most abundant macroinvertebrate	**Chironomidae (midges)**

3rd most abundant macroinvertebrate	**Elmidae (riffle beetles)**
4th most abundant macroinvertebrate	**Hydropsychidae (common netspinner caddisflies)**
5th most abundant macroinvertebrate	**Oligochaeta (aquatic earthworms)**
6th most abundant macroinvertebrate	**Tipulidae (crane flies)**
7th most abundant macroinvertebrate	**Nemouridae (nemourid stoneflies)**
8th most abundant macroinvertebrate	**Simuliidae (black flies)**
9th most abundant macroinvertebrate	**Empididae (aquatic dance flies)**
10th most abundant macroinvertebrate	**Plecoptera (unidentified stoneflies)**

East Hosensack Creek	
Station number	98
description	Limeport Pike and Shultz Bridge Road
Latitude (decimal)	40.4547
Longitude (decimal)	-75.4992
Land Use	
Watershed area (km2)	16
Percent developed	2.1
Percent in agriculture	51.9
Percent forested	42

Percent wetland or water	0.4
Percent in quarries or mining	0.0
Chemistry	
Nitrate (mg/L)	2.8
Total Dissolved Phosphorus (mg/L)	0.012
pH	8.5
Conductivity (µmhos)	323
Alkalinity (as mg/L CaCO3)	84
Macroinvertebrate Data	
years sampled	2006
MAIS score	11.6
water quality based on MAIS score	fair
1st most abundant macroinvertebrate	**Chironomidae (midges)**
2nd most abundant macroinvertebrate	**Ephemerellidae (spiny crawler mayflies)**
3rd most abundant macroinvertebrate	**Elmidae (riffle beetles)**
4th most abundant macroinvertebrate	**Hydropsychidae (common netspinner caddisflies)**
5th most abundant macroinvertebrate	**Oligochaeta (aquatic earthworms)**
6th most abundant macroinvertebrate	**Helicopsychidae (snailcase caddisflies)**
7th most abundant macroinvertebrate	**Tipulidae (crane flies)**

8th most abundant macroinvertebrate	**Empididae (aquatic dance flies)**
9th most abundant macroinvertebrate	**Philopotamidae (fingernet caddisflies)**
10th most abundant macroinvertebrate	**Nematoda (nematodes)**

Appendix B:

Streambank and Instream Conditions Visual Monitoring Results:
Site 1:

Criteria	Findings	Notes:
Location	Rt 29 Bridge over the Hosensack Creek	Residential on one side, forest on opposite side
Invasive/Exotic Vegetation	Medium	Primarily multi-flora rose(mfr) (35 – 40% of invasives)
Instream cover	Good	
Particulate/sediments	Good	
Flow patterns	Excellent	All flow patterns present
Streambank conditions	Good	Lots of tree cover despite presence of multi-flora rose
Riparian conditions and disturbances	Excellent – Good	Natural buffer largely intact, tho' narrower near residences, some mowing but not to edge of creek, understory dominated by mfr
Biodiversity	Excellent - Good	
Overall Visual Assessment Rating	Good	Overall a good naturalized site, some residential management of native plants in riparian buffer

Site 2:

Criteria	Findings	Notes:
Location	Buhman Rd & Schultz Bridge Rd	Narrow strip of mown lawn between road and creek
Invasive/Exotic Vegetation	Good - Marginal	Primarily multi-flora rose(mfr) Purple Loosestrife
Instream cover	Excellent	Except for eroded area along mowed frontage
Particulate/sediments	Good - Marginal	Deep areas of sandy gravel bars

Flow patterns	Excellent	All flow patterns present
Streambank conditions	Good	Lots of tree cover despite presence of multi-flora rose
Riparian conditions and disturbances	Good - Marginal	Good buffer along pasture, mown grass along severely eroded & slumping area, deep forest opposite eroded area, adjacent intact wetland
Biodiversity	Excellent	
Overall Visual Assessment Rating	Good	Frontage along Schultz Bridge Road shows significant erosion and slumping of the bank

Site 3:

Criteria	Findings	Notes:
Location	Palm Rd @ PPL Sub-station	Large electric sub-station as well as railroad bridge
Invasive/Exotic Vegetation	Good	Primarily Japanese honeysuckle & grape vine
Instream cover	Marginal	Lots of silt
Particulate/sediments	Marginal - Poor	Heavy siltation, very little cobble and larger stones
Flow patterns	Good	Lacking fast/deep sections
Streambank conditions	Good	Minimal trees, needs shade
Riparian conditions and disturbances	Good - Marginal	PPL easement maintenance allowing taller shrubs to grow, Sub-station limits number & height of potential trees
Biodiversity	Excellent	Very diverse shrub and herbaceous layer
Overall Visual Assessment Rating	Good - Marginal	Biodiversity good tho' insufficient tree cover and shade, heavy siltation of streambed.

Site 4: King's Highway at Schultz Bridge Rd – Evaluation not conducted due to bridge reconstruction

Site 5:

Criteria	Findings	Notes:
Location	Scout Rd and School House Rd	Primarily a residential lawn with narrow creek running through
Invasive/Exotic Vegetation	Good - Marginal	No invasives in lawn area, pasture and natural areas have multi-flora rose
Instream cover	Marginal	Mostly small gravel in lawn area, larger diversity of cover in non-lawn areas.
Particulate/sediments	Good	Sandy sediments but not too fine
Flow patterns	Good	Lacking deep/fast segments
Streambank conditions	Marginal - Poor	Erosion within the mown lawn areas, erosion upstream of lawn, less downstream.
Riparian conditions and disturbances	Marginal	Mown lawn to edge of creek, pasture not mown recently but animal access to creek.
Biodiversity	Good – Marginal	Large area of lawn reduces biodiversity
Overall Visual Assessment Rating	Marginal	Main issue – mowing to edge of creek bank

Site 6:

Criteria	Findings	Notes:
Location	Limeport Rd, School House Ln & Spring Rd	PPL power lines cross this area
Invasive/Exotic Vegetation	Good - Marginal	Primarily multi-flora rose (mfr)
Instream cover	Good	Good variety of large & small stones, some sedimentation
Particulate/sediments	Good	Clay stream bottom, little silt

Flow patterns	Excellent	All flow patterns present
Streambank conditions	Good - Marginal	Mostly stable with some areas of deeply eroded banks, esp under PPL right of way.
Riparian conditions and disturbances	Good - Marginal	Mowing under right of way, footing for PPL tower eroding, intact adjacent wetland
Biodiversity	Good - Marginal	
Overall Visual Assessment Rating	Good - Marginal	Some significant eroded areas,
NOTE: A rusty orange discharge was noted at several locations. Additional investigation indicates that it is probably one of a small group of Iron Bacteria (Ferrobacillus, Gallionella, Thiobacillus, Leptothrix and Sphaerotilus) that pose no environmental harm.		

Site 7:

Criteria	Findings	Notes:
Location	King's Hwy & Vera Cruz Rd	Residential backyards along Vera Cruz
Invasive/Exotic Vegetation	Good - Marginal	Primarily multi-flora rose(mfr) Japanese honeysuckle
Instream cover	Excellent	
Particulate/sediments	Good - Marginal	Lots of silt, few rocks visible
Flow patterns	Excellent	All flow patterns present
Streambank conditions	Excellent - Good	Lots of tree cover along west side of creek and below King's Hwy, erosion noted near lawns
Riparian conditions and disturbances	Good	Good buffer along most of creek frontage, lawns mown to edge in backyards
Biodiversity	Excellent	
Overall Visual Assessment Rating	Good	Main issue is mown grass to stream edge

Site 8:

Criteria	Findings	Notes:
Location	Dillingersville Rd	Small headwaters tributary, Agricultural fields adjacent
Invasive/Exotic Vegetation	Good - Marginal	Primarily multi-flora rose, honeysuckle and grape vine, good intact upland oak forest adjacent
Instream cover	Good	Visibility limited by multi-flora rose
Particulate/sediments	Excellent – Good	Upstream of road very good, downstream segment inaccessible due to multi-flora rose.
Flow patterns	Marginal	No slow/deep or fast/deep segments however, this is a very small headwaters creek.
Streambank conditions	Excellent - Good	Lots of tree cover despite presence of multi-flora rose, difficult to see streambanks downstream.
Riparian conditions and disturbances	Good	Good buffer intact along ag fields, intact oak forest along upstream segment.
Biodiversity	Good	Lots of competition from invasive plant species.
Overall Visual Assessment Rating	Good	Good riparian buffer tho' heavily laden with multi-flora rose.

Site 9:

Criteria	Findings	Notes:
Location	Limeport Pike & Spinnerstown Rd	Small, residential horse farm adjacent
Invasive/Exotic Vegetation	Good - Marginal	Primarily multi-flora rose and Japanese honeysuckle
Instream cover	Excellent	Small stream, some siltation but mostly pretty good
Particulate/sediments	Good	Most sediments noted under the bridge

Flow patterns	Good	Lacking slow/shallow segments
Streambank conditions	Good	Lots of tree cover despite presence of multi-flora rose
Riparian conditions and disturbances	Good	Some erosion under multi-flora rose areas, riparian buffer mostly intact near horse pasture, mostly wide buffer except where Limeport Pike comes close to creek.
Biodiversity	Good	Lots of multi-flora rose and honeysuckle
Overall Visual Assessment Rating	Good	Invasives are an issue but pasture has small, dedicated livestock access with intact buffer adjacent.

Site 10A

Criteria	Findings	Notes:
Location	Elementary Road	Adjacent to elementary school
Invasive/Exotic Vegetation	Marginal	Very dense multi-flora rose, esp adjacent to school grounds
Instream cover	Good	Larger boulders are not evident
Particulate/sediments	Good	Few noted areas of sedimentation
Flow patterns	Marginal	Lacking slow/shallow and fast/deep segments
Streambank conditions	Good	Lots of tree cover despite presence of multi-flora rose
Riparian conditions and disturbances	Excellent - Good	Deep buffer maintained throughout, esp adjacent to school, small foot path noted through buffer to creek
Biodiversity	Good	Multi-flora and honeysuckle crowd out other species
Overall Visual Assessment Rating	Good	Primary issue is invasives, esp multi-flora rose.