

MINOW

Management and Implementation for Neshaminy(Creek) Optimal Watershed



Report By:

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Mission Statement:

To reduce Neshaminy Creek flow for a 2-year design storm by 10% before January 2020, thus improving water quality, preventing erosion, and preventing habitat loss.

Goals:

G1: To minimize flood events and protect from property damage

G2: To minimize major erosion of stream banks

G3: To secure floodplain land as habitat for wildlife

G4: To ensure fishable and drinkable water by improving water quality in the Neshaminy Creek.

Introduction:

Background/Characteristics

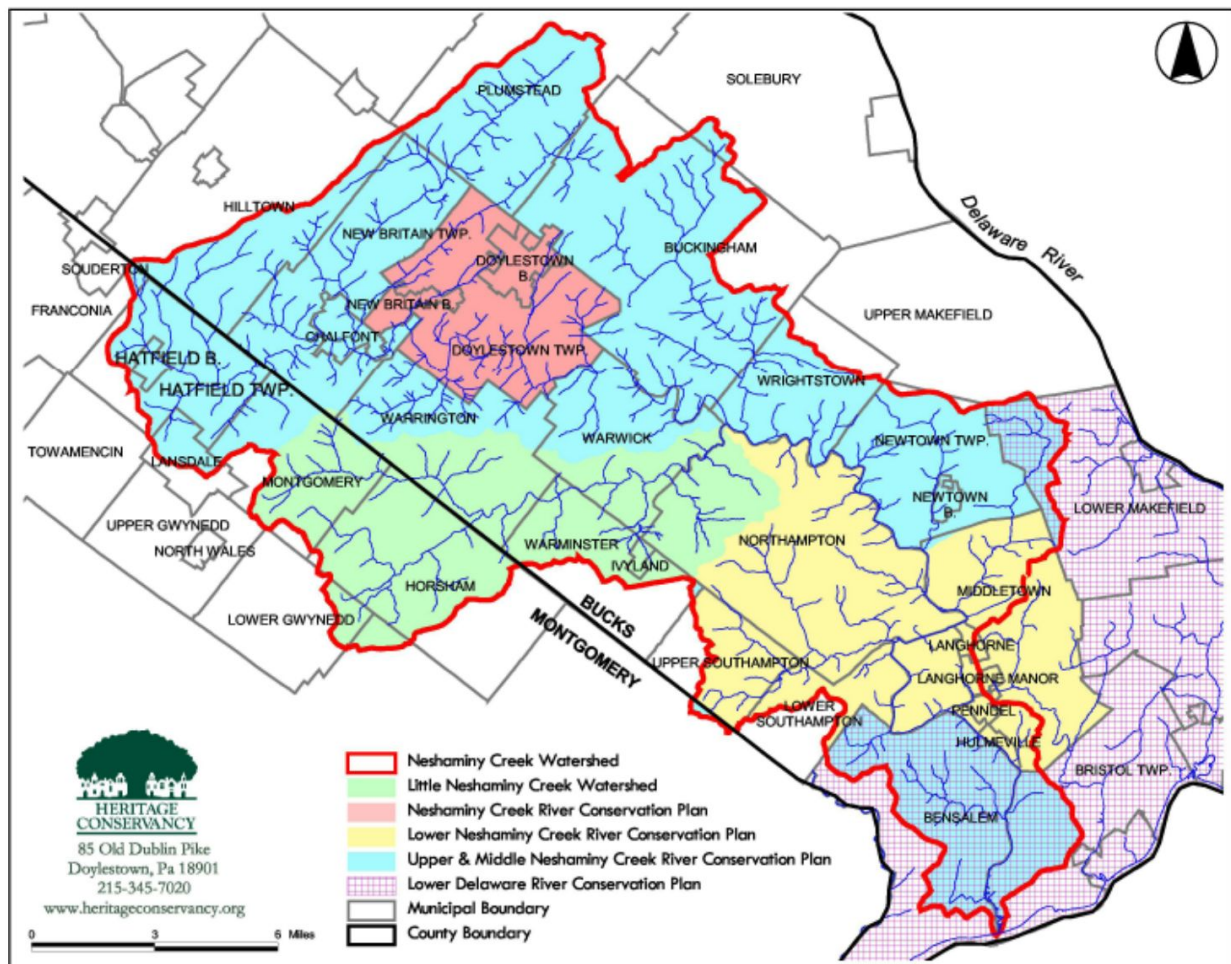


Figure 1: Map of Neshaminy Creek Watershed

The Neshaminy Creek is 41 miles long, has headwaters starting in Bucks and Montgomery counties and extends to its mouth, on the Delaware River, in Bensalem Township. The entire drainage area is 233 square miles and held a population 256,000 in 1990, 333,297 in

2000 and is projected to reach 368,000 by 2040. The watershed has many population dense boroughs with some surrounding lower density townships. The following displays the population growth of some townships in the watershed.

Table 1: Population of Neshaminy Watershed Municipalities

Neshaminy Watershed Municipalities	1990 Population	2000 Population	% Change, 1990-2000	2025 Projection	% Change, 2000-2025
Buckingham Twp.	9,364	16,442	75.59%	22,870	39.10%
Hatfield Boro.	2,650	2,605	-1.70%	2,510	-3.65%
Hatfield Twp.	15,357	16,712	8.82%	19,320	15.61%
Hilltown Twp.	10,582	12,102	14.36%	16,820	38.99%
Lansdale Boro.	16,362	16,071	-1.78%	15,490	-3.62%
Montgomery Twp.	12,179	22,025	80.84%	28,210	28.08%
New Britain Twp.	9,099	10,698	17.57%	16,640	55.54%
Newtown Boro.	2,565	2,312	-9.86%	2,160	-6.57%
Newtown Twp.	13,685	18,206	33.04%	24,070	32.21%
Northampton Twp.	35,406	39,384	11.24%	44,670	13.42%
Plumstead Twp.	6,289	11,409	81.41%	17,500	53.39%
Warrington Twp.	12,169	17,580	44.47%	29,790	69.45%
Warwick Twp.	5,915	11,977	102.49%	22,210	85.44%
Wrightstown Twp.	2,426	2,839	17.02%	4,240	49.35%
TOTALS	154,048	200,362	30.06%	266,500	466.73%

Land use



Figure 2: Pennsylvania Land Use

The land use for Pennsylvania is mostly forested with regions of low and high intensity residential surrounding major city. The land use composition for the entire area of Neshaminy Creek Watershed is summarized in Table X below.

Table 2: Land Use Distribution of Neshaminy Creek Watershed

LAND USE CATEGORY	ACRES	PERCENTAGE
Agriculture	28,290	33.9%
Community Service	850	1.0%
Commercial	1,689	2.0%
Wooded	17,899	21.5%
Industrial	1,300	1.6%
Mining	628	0.8%
Low Density Residential	23,003	27.6%
Medium Density Residential	576	0.7%
High Density Residential	1,188	1.4%
Recreation	1,345	1.6%
Transportation	1,491	1.8%
Utility	743	0.9%
Vacant	3,506	4.2%
Water	900	1.1%
Total	83,408	100.0%

The table above indicates that the land use of the surrounding area is predominantly agriculture, low density residential, and forest, respectively. Therefore, when flooding and runoff occur in this region, pesticides and manure, which are rich in nitrogen and phosphorous, from farm land and household lawns will heavily impact the watershed due their high area percentage.

Water Use:

The waters in the Neshaminy Creek Watershed are mainly used to supply drinking water to the surrounding neighborhoods and commercial areas. Most of the withdrawn water comes is taken from surface water. Although there are four dams in the watershed, none have a direct withdrawal from the stored water. They are instead used to help during times of low flows downstream. The withdrawals of both surface water and groundwater total 44.42 Mgal/d. Unregistered withdrawals from the watershed were estimated and are suspected to be underreported. There are roughly 1,427 estimated unregistered users, allowing for fluctuations in the data. Registered groundwater withdrawals account for roughly 37% of the total, while registered surface withdrawals are 58%, and unregistered account for 5%. Further breakdown of the data can be seen in the table below.

Table 3: Summary of water discharges and withdrawals in the Neshaminy Creek watershed, Bucks and Montgomery Counties, Pennsylvania, 2003

Water Use	Number of water use points	Number of values >= 0.01 Mgal/d	Water use, in Mgal/d			Total	Percent of total water use
			Mean	Minimum	Maximum		
DISCHARGES							
ALL DISCHARGES	47	40	0.70	0.00	7.13	32.78	--
WITHDRAWALS							
ALL WITHDRAWALS	1,662	193	0.03	0.00	15.09	44.42	--
SUMMARY OF WITHDRAWALS BY SOURCE							
Ground water ¹	219	131	0.07	0.00	1.73	16.42	37
Surface water ¹	16	16	1.62	0.02	15.09	25.87	58
Estimation	1,427	46	0.00	0.00	0.19	2.13	5
SUMMARY OF WITHDRAWALS BY WATER-USE CATEGORY							
REGISTRATION							
Water supplier	147	101	0.24	0.00	15.09	34.75	78
Industrial	11	7	0.04	0.00	0.28	0.45	1
Commercial	37	26	0.04	0.00	0.18	1.59	4
Agriculture	10	4	0.04	0.00	0.19	0.40	1
Mineral	32	10	0.17	0.00	1.73	5.29	12
ESTIMATION							
Evaporation	36	36	0.03	0.03	0.06	1.17	3
Self-supplied residential	559	0	0.00	0.00	0.01	0.17	0
Industrial	39	8	0.01	0.00	0.04	0.26	1
Commercial	791	1	0.00	0.00	0.08	0.35	1
Agriculture	0	0	0.00	0.00	0.00	0.00	0
Irrigation	0	0	0.00	0.00	0.00	0.00	0
Livestock	0	0	0.00	0.00	0.00	0.00	0
¹ as described in registration data; does not include estimated water use							

The public water supply (PWS) sector has the most water use, accounting for 78% of all withdrawals, followed by mineral and agricultural uses. The breakdown of water use can be seen further in the diagram below.

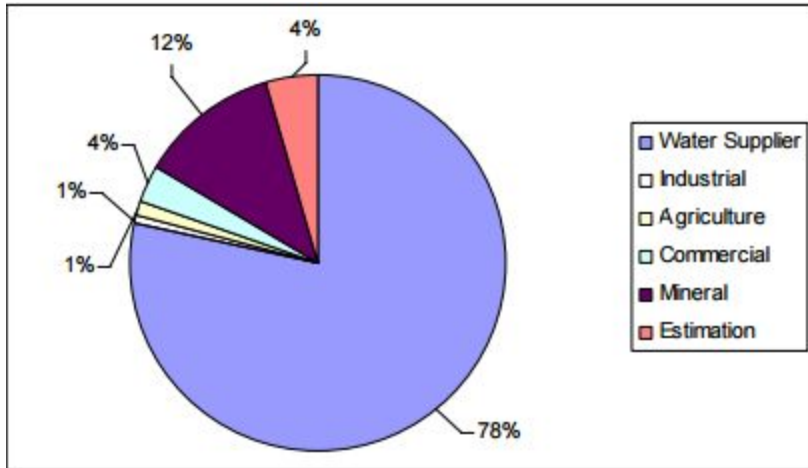


Figure 3: Water withdrawn in the Neshaminy Creek watershed, Bucks and Montgomery Counties, Pennsylvania, 2003.

Environmental Concerns and Other Issues:

Storms and Flooding:

Most of the Neshaminy Creek Watershed is in a low-lying area, making it naturally prone to flooding not just from extreme weather events, but also seasonal storms. Steep slopes outline the watershed leading to low-lying areas where surface runoff will pool. The steep slopes also increase velocity of surface runoff, creating flash floods during storm events. This pooled water will eventually reach the streams or recharge groundwater aquifers in a natural system.

While floodplains are usually not considered a problem and are actually a healthy part of a natural ecosystem, the Neshaminy Creek floodplain has very little open space and has become highly developed. Inadequate management of stormwater runoff is a repercussion of the development and redevelopment of the watershed without keeping stormwater in mind for the plans. Construction and development has led to an increase in impervious surfaces, preventing surface water from leaching into the soils. Leaching naturally slows the movement of surface and subsurface water and decreases the quantity of runoff that reaches a stream immediately following a storm. Water travel is accelerated over impervious surfaces, bringing more water to the streams and low lying areas at a faster rate during precipitation events. The augmentation of the surface runoff that is reaching the Neshaminy Creek amplifies the flood water depth and increases the size of the floodplain.

Each time a large storm occurs, much of the lower-lying areas are flooded, and in the Neshaminy Creek Watershed, most of these areas are fully developed neighborhoods and commercial areas. The flooding causes large amounts of damage to both private and municipal properties, is a hazard to public health and safety, and damages roadways, creating a hazard for travelers and pedestrians. The cost of reconstruction and damage control is large, and many times cannot be paid so buildings are left to rot. However, the biggest cost is the cost of the public's safety.



Figure 4: Flooding from Hurricane Irene in Neshaminy Creek
Streambank Erosion and Habitat Loss

Currently the Neshaminy Creek has severe streambank erosion on the main branch. This is due to frequent large and sustained floods moving southwest from New Jersey. In fact at one point, located at the drainage divide between Neshaminy Creek and Little Neshaminy Creek there is a large elevation drop that is due to this erosion. Much like a domino effect, these prolonged floods cause erosion in the headwaters of the Brandywine Creek, Schuylkill River, and Wissahickon Gorge which in turn contribute to the erosion of the Neshaminy Creek headwaters. Aside from decreasing streambank stability, erosion is a major source of phosphorous and sediment contamination in the Creek.

Some practices have already been implemented which would reduce this erosion. For example several parks are already in place which act as a riparian buffer, slowing stormwater and therefore protecting the banks of the Neshaminy Creek. Some of these parks include Peace Valley County Park on the Northern Branch, Dark Hollow Park which runs along the Creek for multiple miles, and Playwicki Park in Bucks County. Creating more riparian buffers, whether it be through a park, a simple vegetation buffer, walking trails, or nature preserve would further prevent erosion as well as address other environmental problems.

Erosion can also be prevented by educating and enlisting the help of residents. For examples farmers can make sure to leave 75-90 ft of space from the edge of the stream, as well as keeping livestock away from the stream and buffer zone.

The quality of the Neshaminy Creek watershed is assessed based on the condition of embedded substrate, streambank erosion, riparian vegetation and sediment concentrations. Habitat is also greatly impacted by urbanization with as little as 2% increase in impervious cover greatly decreasing the quality of aquatic life. While solutions that are normally focused on reducing flooding and erosion, use stormwater controls to decrease the peak flow, this does not improve the habitat. To have a meaningful impact on the ecosystem riparian buffers can be installed, and efforts should be made to slow urbanization. A continuous greenway, which could also be used as a park, could be created alongside the creek.

Water Quality

The major water quality concern for Neshaminy Creek is the concentration levels of sediment, nitrogen, and phosphorous. From the increased runoff and erosion of the area surrounding the creek, there is a high concentration of sediment and nutrients, such as nitrogen and phosphorous. This influx of nutrients resulted in large algal blooms and high levels of phytoplankton biomass along standing waters in the watershed. The algal blooms decreased the water clarity and caused taste and odor problems. In combination, these resulting organisms deplete the dissolved oxygen concentration in the waters making the water conditions less habitable for fish and other wildlife. Besides livability, low oxygen levels allow for toxic ammonia nitrogen and exacerbate the internal release of sediments.

Table 4: Problem Summary

Problem	Cause	Result
Flooding	Increased Development	Damage to infrastructure and a hazard to human health
Streambank Erosion	Flooding from increased runoff	Steep, unstable banks, increased sediments into creek, loss of habitat.
Loss of Habitat	Streambank erosion, urbanization	Decrease in diversity and total population of aquatic, and other creek wildlife.
Increased Sediment, Nitrogen, and Phosphorous concentration	From increased runoff and erosion	large algal blooms and high levels of phytoplankton biomass which decreases the dissolved oxygen concentration and increases the toxic ammonia nitrogen

Existing Organizations and Regulations:

North Branch Watershed Association: The NBWA works to improve the quality of the North Branch of the Neshaminy Creek through environmental education, promoting sound land use practices and conservation efforts.

Bucks County Conservation District: A unit of the state government dedicated to the conservation of the soil, water and other natural resources in Bucks County, where the mouth of the Neshaminy is located.

Water Resource Education Network: A project of the League of Women Voters of Pennsylvania dedicated to protect and improve water as a natural resource.

NPDES Phase II: The National Pollution Discharge Elimination System Phase II stormwater plan and permit requirements for Municipal Separate Storm Sewer Systems will influence all municipalities in the Neshaminy Creek. If the municipality population is over a certain threshold population density, the municipality must be permitted under this program. The permit requirements are under the administration of the PADEP and the US Environmental Protection Agency. To obtain this permit, detailed Phase II plans must be prepared and submitted to the affected municipality.

River Conservation Plan: The River Conservation Plan is a critical tool in creating new partnerships within the watershed to promote inter-municipal cooperation and planning. The goal of this plan is to use it as a way to implement environmental change as if the groups were doing business. Its success is a direct result of the combined effort and communication of the local government bodies and the public.

Act 167 Stormwater Management Plan: The Act 167 plan looks to reduce future stormwater impacts from new development, such as model ordinances and stormwater BMP information. However development in the watershed has not followed the recommendations of the plans, thus the Bucks County Planning Commission is working on updating the Act 167 for the Neshaminy Creek.

Neshaminy Creek Watershed Work Plan Number 5: This work plan is to implement nonstructural alternatives opposed to flood control dams to provide the most protection from flood damage.

Solutions:*Table 5: Solution Summary*

Problem	Goal	Solution
Flooding	G1: To minimize flood events and protect from property damage	Impervious surfaces Riparian Buffers Individual Stormwater Management Programs
Streambank Erosion	G2: To minimize major erosion of stream banks	Riparian Buffers Stormwater Best management practices
Loss of Habitat	G3: To secure floodplain land as habitat for wildlife	Riparian Buffers-continuous greenway
Increased Sediment, Nitrogen, and phosphorous concentration	G4: To ensure fishable and drinkable water by improving water quality in the Neshaminy Creek.	Reduce runoff and erosion by riparian buffers and better stormwater management Filtration of stormwater before it enters the natural system

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