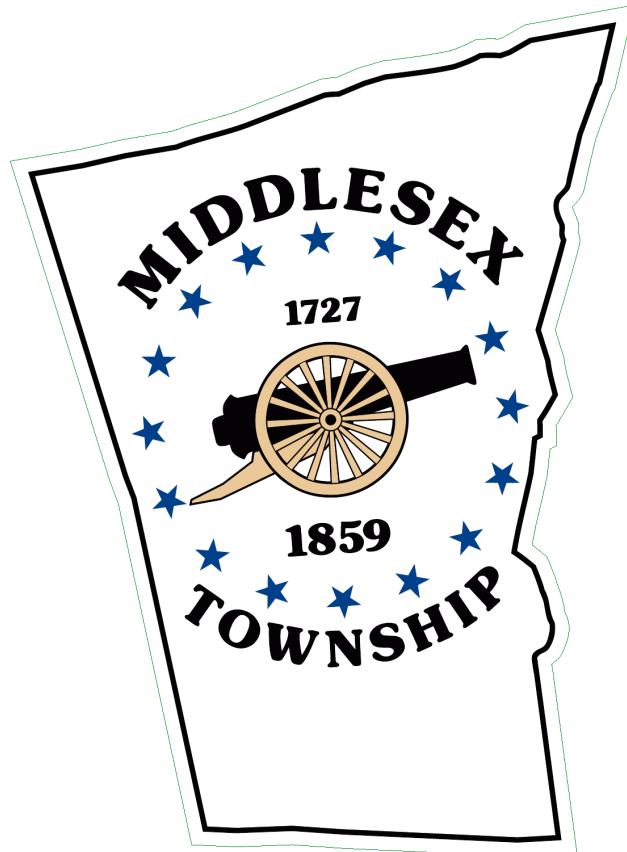


**MIDDLESEX TOWNSHIP  
COMBINED POLLUTANT REDUCTION PLAN  
FOR THE  
CHESAPEAKE BAY BASIN, WERTZ RUN, AND HOGESTOWN RUN**



**MIDDLESEX TOWNSHIP,  
CUMBERLAND COUNTY, PENNSYLVANIA  
AUGUST 2017**

**PREPARED BY  
SKELLY AND LOY, INC.  
HARRISBURG, PENNSYLVANIA**

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# MIDDLESEX TOWNSHIP

350 N. MIDDLESEX ROAD, SUITE 1 • CARLISLE, PA 17013 • 717-249-4409 Or 844-256-7024 • FAX 717-249-8564

Board of Supervisors:  
Donald S. Geistwhite, Jr., Steven Larson, William Goodhart

Municipal Manager  
Eileen M. Gault

Zoning Officer:  
Mark D. Carpenter

August 25, 2017

Carrol F. Ehrhart, RLA  
Skelly and Loy, Inc.  
449 Eisenhower Boulevard  
Suite 300  
Harrisburg, PA 17111

Dear Carrol,

At the Workshop meeting on August 25, 2017, the Middlesex Township Board of Supervisors approved and adopted the proposed Middlesex Township Combined Pollutant Reduction Plan for the Chesapeake Bay Basin, Wertz Run and Hogestown Run.

In closing, I would like to take this opportunity to thank you on behalf of the Board of Supervisors for your diligence in completing this portion of the MS4 program. We look forward to continuing this working relationship in completing the established projects.

Sincerely,

A handwritten signature in blue ink that reads "Eileen M. Gault".

Eileen M. Gault  
Manager

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**MIDDLESEX TOWNSHIP  
COMBINED POLLUTANT REDUCTION PLAN  
FOR THE  
CHESAPEAKE BAY BASIN,  
WERTZ RUN AND HOGESTOWN RUN  
MIDDLESEX TOWNSHIP,  
CUMBERLAND COUNTY, PENNSYLVANIA**

**PREPARED FOR**

**MIDDLESEX TOWNSHIP  
350 NORTH MIDDLESEX ROAD  
CARLISLE, PENNSYLVANIA 17013**

**PREPARED BY**



**449 EISENHOWER BOULEVARD, SUITE 300  
HARRISBURG, PENNSYLVANIA 17111**

**AUGUST 21, 2017**

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## LIST OF ACRONYMS

BMP	Best Management Practices
CAST	Chesapeake Assessment Scenario Tool
CBPRP	Chesapeake Bay Pollutant Reduction Plan
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
GWLF	Generalized Watershed Loading Function
HUC	Hydrologic Unit Codes
IDD&E	Illicit Discharge Detection and Elimination
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PA DEP	Pennsylvania Department of Environmental Protection
PA DCNR	Pennsylvania Department of Conservation and Natural Resources
PCSM	Post-Construction Stormwater Management
PennDOT	Pennsylvania Department of Transportation
PRP	Pollutant Reduction Plan
PTC	Pennsylvania Turnpike Commission
TMDL	Total Maximum Daily Load
U.S. EPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation

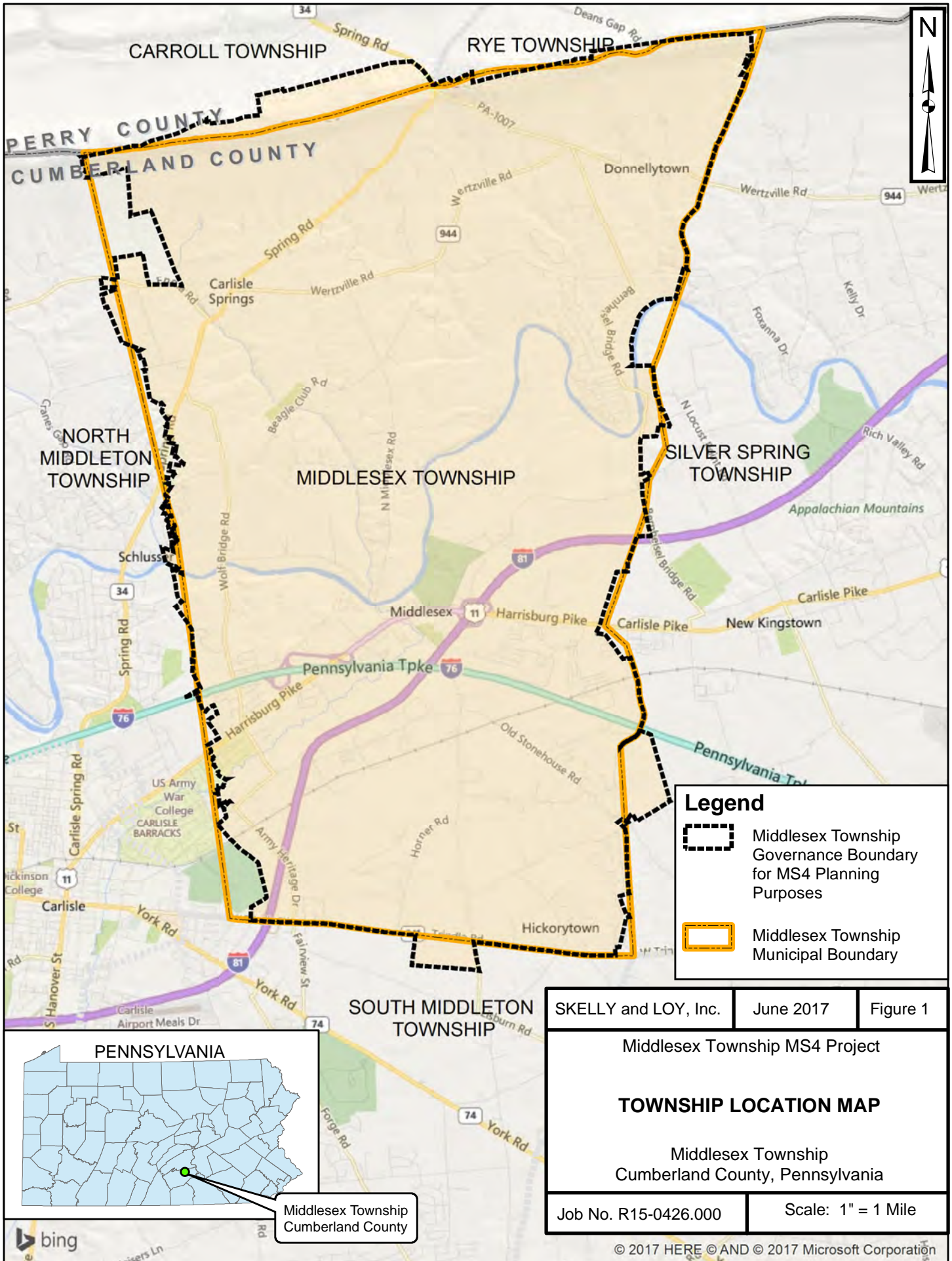
## **EXECUTIVE SUMMARY**

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## EXECUTIVE SUMMARY

### LOCATION

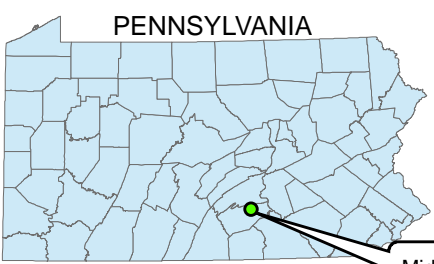
Middlesex Township is a 26-square-mile municipality in Cumberland County, Pennsylvania. The Township is located northeast of the Borough of Carlisle and approximately 16 miles west of the state's capitol, Harrisburg. The northern border follows the ridgeline of the Blue Mountains that separate Cumberland and Perry Counties and it is surrounded to the north by Carroll and Rye Townships, to the east by Silver Spring Township, to the south by South Middleton Township, and to the west by North Middleton Township. (Approximate municipality center is Latitude N40°14'50", Longitude W77°08'10". (See **Figure 1**, Location Map.)



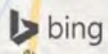
**Legend**

- Middlesex Township Governance Boundary for MS4 Planning Purposes
- Middlesex Township Municipal Boundary

SKELLY and LOY, Inc.	June 2017	Figure 1
Middlesex Township MS4 Project		
<b>TOWNSHIP LOCATION MAP</b>		
Middlesex Township Cumberland County, Pennsylvania		
Job No. R15-0426.000	Scale: 1" = 1 Mile	



Middlesex Township  
Cumberland County





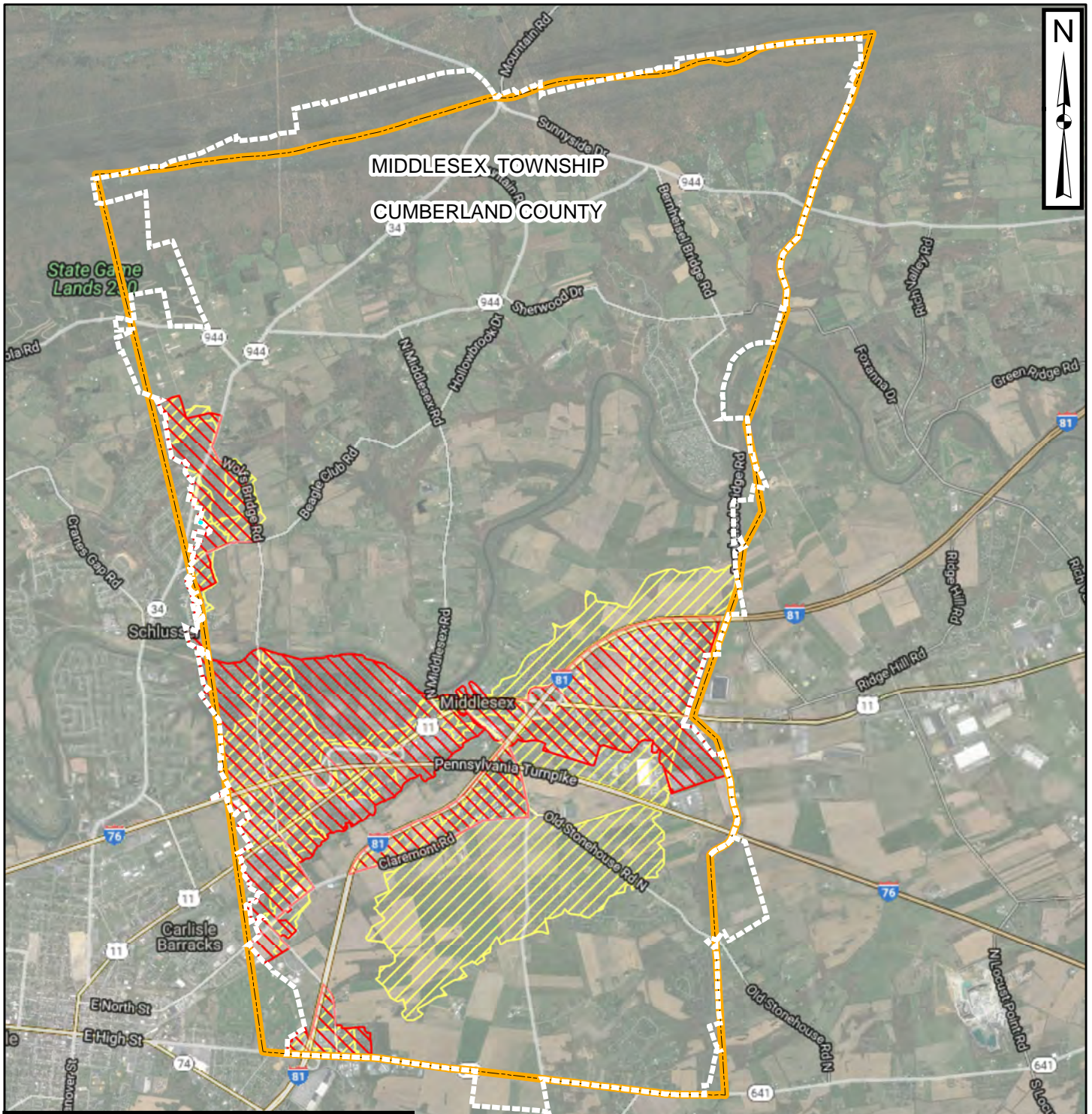
## **PURPOSE**

The ultimate purpose of the Pollutant Reduction Plan (PRP) is to activate implementation of specific projects to capture and reduce pollutants conveyed by stormwater runoff before they reach streams, rivers, lakes, etc. (a.k.a., surface waters). The PRP provides the background, assumptions, analysis, and methodology to establish a justifiable baseline of current pollutant load generation and then identifies Best Management Practices (BMP) with site locations, planning-level concept designs, costs, and implementation schedules. It also provides a framework for funding installation, operation, and maintenance activities that provides regulators with assurance that the identified projects will materialize within the scheduled timeframe. This Middlesex Township Combined Pollutant Reduction Plan for the Chesapeake Bay Basin, Wertz Run, and Hogestown Run is a “Combined PRP.”





## MS4 REGULATED AREA

The Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit applies only to urban runoff that flows through municipally owned and operated stormwater infrastructure with an identifiable concentrated discharge (outfall) to a surface water. The urbanized area is the portion of the Township that is located within the Urbanized Area boundaries defined by the U.S. Census Bureau in the most recent decennial (2010) census. The regulated portion of the Township consists of the urbanized area and the contributory region upgradient of the urbanized area flowing to and through the Township's storm sewer system. The storm sewer system consists of the municipally owned and operated stormwater conveyance network including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains.

Regulated Middlesex Township MS4 area includes 4.4 square miles of the municipality as shown by **Figure 2**, Middlesex Township Urbanized and MS4 Regulated Areas.



**Legend**

-  Middlesex Township Governance Boundary for MS4 Planning Purposes
-  Middlesex Township Municipal Boundary
-  Urbanized Area
-  MS4 Regulated Area

GOOGLE IMAGE

SKELLY and LOY, Inc. June 2017 Figure 2

Middlesex Township MS4 Project

**MIDDLESEX TOWNSHIP URBANIZED AND MS4 REGULATED AREAS**

Middlesex Township  
Cumberland County, Pennsylvania

Job No. R15-0426.000

Scale: 1" = 1 Mile

## APPLICABLE SURFACE WATERS AND POLLUTANTS OF CONCERN

According to the Pennsylvania Department of Environmental Protection (PA DEP) Requirements Table dated June 21, 2017, Middlesex Township is obligated by the regulation to provide PRPs to address **Appendix D** (Chesapeake Bay Nutrients and Sediment) and **Appendix E** (Impaired Waters Sediment/Nutrient) because the Township is located in the Chesapeake Bay Basin and has stormwater discharges to Wertz Run, a local surface water listed as having impairment caused by siltation (surrogate name for sediment). Middlesex Township's Urbanized Area also discharges to Hogestown Run and one of its unnamed tributaries listed as having impairments caused by siltation, organic enrichment/low D.O. (surrogate name for nutrients), and pathogens. Since the requirement for sediment and nutrient reduction for MS4s within the Chesapeake Bay Basin applies to MS4 discharges to all surface waters (that therefore includes surface waters with impairments), this PRP is presented as a combined Chesapeake Bay and impaired waters pollutant reduction plan.

The pollutants of concern are sediment, phosphorus, and nitrogen. PA DEP has established a uniform pollutant reduction target for MS4s not identified in an existing approved Total Maximum Daily Load (TMDL) plan. Such is the case with Middlesex Township. The reduction targets are listed in **Tables 1 and 2**.

**TABLE 1  
CHESAPEAKE BAY BASIN POLLUTANT REDUCTION TARGETS**

<b>POLLUTANT</b>	<b>REDUCTION TARGET</b>
Sediment (TSS)	10%
Phosphorus (TP)	5%
Nitrogen (TN)	3%

**TABLE 2  
POLLUTANT REDUCTION TARGETS FOR  
SURFACE WATERS IMPAIRED BY SEDIMENT AND/OR NUTRIENTS**

<b>POLLUTANT</b>	<b>REDUCTION TARGET</b>
Sediment (TSS)	10%
Phosphorus (TP)	5%

In addition to the impaired surface waters, Middlesex Township’s MS4 discharges to two other named surface waters (Conodoguinet Creek and Letort Spring Run) and a total of nine tributaries. (See **Figure 3: Watersheds and MS4 Surface Waters**, p. 14.)

All the surface waters receiving runoff from the Middlesex Township MS4 flow to Conodoguinet Creek. The Conodoguinet discharges to the Susquehanna River, which culminates in the Chesapeake Bay. (For additional information regarding hydrology of the MS4, see Hydrology under Section I, Background, p. 13.)

Pollutant load modeling was completed on the HUC 12 Watershed Scale. The HUC 12 watersheds and their respective subject surface waters are listed in **Table 3**.

**TABLE 3  
HUC 12 WATERSHEDS AND SURFACE WATERS**

<b>HUC 12 CODE</b>	<b>HUC 12 WATERSHED NAME</b>	<b>SUBJECT SURFACE WATERS WITHIN HUC 12 WATERSHED</b>
020503050403	Wertz Run-Conodoguinet Creek	Conodoguinet Creek
		Wertz Run
		3 Unnamed Tributaries to Wertz Run
020503050404	Letort Spring Run	Letort Spring Run
		1 Unnamed Tributary to Letort Spring Run
020503050405	Hogestown Run	Hogestown Run
		1 Unnamed Tributary to Hogestown Run



## PRP LAYOUT

The Executive Summary is followed by two sections. Section I, Background, describes Middlesex Township's characteristics influencing PRP decisions. Topics within Section I include Hydrology, Topography and Geology, Soils, Land Use, and Demographics.

Section II, Required PRP Components, provides technical data, analysis and substantiation, and proposed BMP specifics. It is organized and titled according to PA DEP's PRP Instructions. The subsections are:

- A. Public Participation
- B. Map
- C. Pollutants of Concern
- D. Existing Loading for Pollutants of Concern
- E. BMPs to Achieve the Minimum Required Reductions in Pollutant Loading
- F. Funding Mechanism(s)
- G. Responsible Parties for Operation and Maintenance (O&M) of BMPs

Middlesex Township has opted to use the presumptive approach to report pollutant reduction. Under this approach, it is assumed that if the required sediment reduction is achieved, phosphorus and nitrogen reductions are also reached. Therefore, only sediment load reduction is reported.

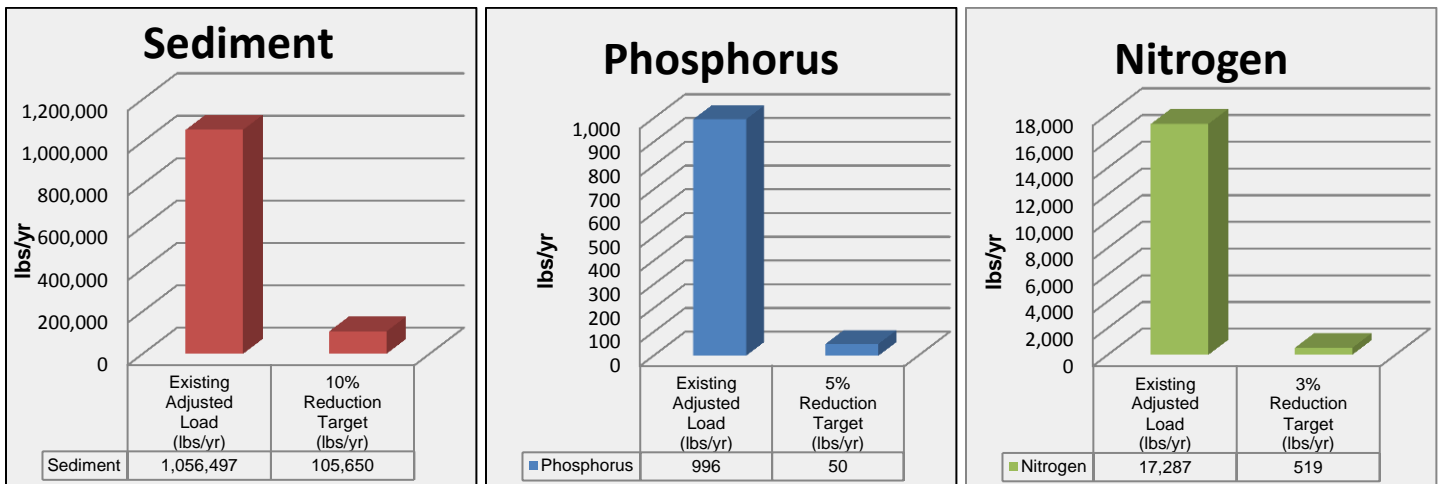
### Essential Statistics

Concise at-a-glance summaries of the information gleaned from the research, mapping, analysis, and planning effort are provided below (**Tables 4 through 7**). Please refer to the corresponding narratives in Sections I and II of the PRP for the expanded discussions.

**TABLE 4  
OUTFALLS**

DESCRIPTION	NUMBER
<b>OUTFALLS RECEIVING RUNOFF FROM MIDDLESEX TOWNSHIP MS4 LOCATED OUTSIDE MIDDLESEX TOWNSHIP</b>	
Number of Outfalls to Attaining Surface Waters	8
Number of Outfalls to Impaired Surface Waters	3
Total Number of Outfalls	11
<b>OUTFALLS UNDER MIDDLESEX TOWNSHIP JURISDICTION LOCATED IN MIDDLESEX TOWNSHIP</b>	
Number of Outfalls to Attaining Surface Waters	52
Number of Outfalls to Impaired Surface Waters	1
Total Number of Outfalls	53

**CHESAPEAKE BAY BASIN EXISTING SEDIMENT LOADS AND REDUCTION TARGETS**



**TABLE 5  
CHESAPEAKE BAY POLLUTANT LOADS**

<b>DESCRIPTION</b>	<b>CHESAPEAKE BAY BASIN (LBS/YR)</b>
<b>SEDIMENT</b>	
Sediment Adjusted Existing Load	1,056,497.0
Sediment Load Reduction Target (10%)	105,650
Sediment Reduction Achieved	106,215
Sediment Over Reduction	565
<b>PHOSPHORUS</b>	
Phosphorus Adjusted Existing Load	995.8
Phosphorus Load Reduction Target (5%)	50
Phosphorus Reduction Achieved	Presumed
<b>NITROGEN</b>	
Nitrogen Adjusted Existing Load (3%)	17,287.3
Nitrogen Load Reduction Target	519
Nitrogen Reduction Achieved	Presumed

**TABLE 6  
IMPAIRED SURFACE WATERS' POLLUTANT LOADS  
BY HUC 12 WATERSHED**

<b>DESCRIPTION</b>	<b>WERTZ RUN- CONODOGUINET CREEK WATERSHED (LBS/YR)</b>	<b>HOGESTOWN RUN WATERSHED (LBS/YR)</b>
<b>SEDIMENT</b>		
Sediment Adjusted Existing Load	181,026.4	283.6
Sediment Load Reduction Target (10%)	18,103	28
Sediment Reduction Achieved	18,280	60
Sediment Over Reduction	177	32
<b>PHOSPHORUS</b>		
Phosphorus Adjusted Existing Load	118.9	0.2
Phosphorus Load Reduction Target (5%)	6	0.01
Phosphorus Reduction Achieved	Presumed	Presumed
<b>NITROGEN</b>		
Nitrogen Adjusted Existing Load (3%)	3,250.8	1.2
Nitrogen Load Reduction Target	98	0.04
Nitrogen Reduction Achieved	Presumed	Presumed



**TABLE 7  
PROPOSED BMP PROJECTS**

<b>DESCRIPTION</b>	<b>NUMBER</b>
<b>Chesapeake Bay Basin Total</b>	<b>9</b>
Wertz Run-Conodoguinet Creek HUC 12 Watershed Vegetated Open Channel Projects	6
Letort Spring Run HUC 12 Watershed Rain Garden/Bioretenation Stream Restoration	1 1
Hogestown Run HUC 12 Watershed Vegetated Open Channel Projects	1

<b>Estimated Cost:</b>	<b>\$815,600 to \$1,165,125</b>
------------------------	---------------------------------



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## **I. BACKGROUND**

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## I. BACKGROUND

### A. HYDROLOGY

The distinctively sinuous Conodoguinet Creek is the principal watercourse of Middlesex Township. All other surface waters ultimately discharge to this stream. The 106-mile long Conodoguinet empties into the Susquehanna River just north of Harrisburg, and the Susquehanna River enters the north end of the Chesapeake Bay at Havre de Grace, Maryland.

The United States Geological Survey (USGS) developed a hierarchical system to classify hydrology by the region size draining to the watercourse. The Hydrologic Unit Codes (HUC) are comprised of 2 to 12 digits and include regions (2 digits), subregions (4 digits), basins (6 digits), subbasins (8 digits), watershed (10 digits), and subwatershed (12 digits). The PRP has been prepared based on subwatersheds (HUC 12s) generally in the 40- to 60-square-mile size (but can be larger or smaller).

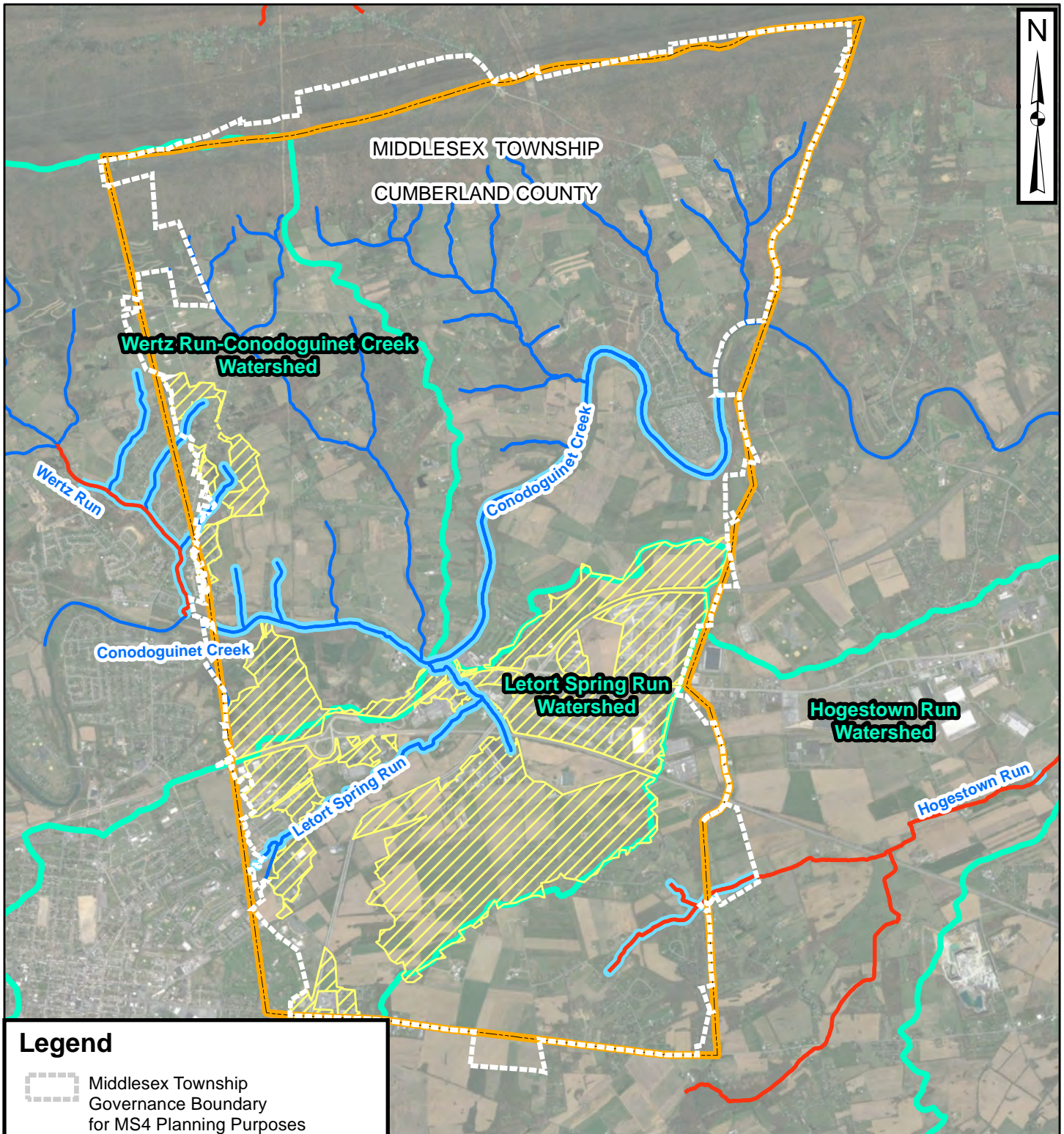
Middlesex Township drains to four HUC 12s, but the MS4 drains only to three of them:

- Wertz Run-Conodoguinet Creek (HUC 12: 020503050403),
- Letort Spring Run (HUC 12: 020503050404), and
- Hogestown Run (HUC 12: 020503050404).

The watershed names aptly refer to the main watercourses. Of the numerous tributaries to each of the surface waters, 9 tributaries support Middlesex Township's outfalls. The HUC 12s and receiving watercourses are highlighted on **Figure 3, Watersheds and MS4 Surface Waters** (p. 14).

The majority of watercourses in Middlesex attain their Designated Use. Only three receiving waters are identified as nonattaining by the Pennsylvania Title 25 Environmental Protection, Chapter 93 Water Quality Standards (Chapter 93) list. Wertz Run's main stem is impaired for siltation (a surrogate name for sediment), and Hogestown Run and its unnamed tributary are listed as having impairments caused by siltation, organic enrichment/low D.O. (surrogate name for nutrients), and pathogens.

**Table 8, Middlesex MS4 Surface Water Summary**, includes pertinent information for the MS 4 surface waters.



**Legend**

-  Middlesex Township Governance Boundary for MS4 Planning Purposes
-  Middlesex Township Municipal Boundary
-  MS4 Regulated Area
-  HUC 12 Watersheds
-  Streams, Attaining Streams
-  Streams, Impaired
-  MS4 Receiving Streams, Attaining
-  MS4 Receiving Streams, Impaired

SKELLY and LOY, Inc.

June 2017

Figure 3

Middlesex Township MS4 Project

**WATERSHEDS AND SURFACE WATERS**

Middlesex Township  
Cumberland County, Pennsylvania

Job No. R15-0426.000

Scale: 1" = 1 Mile

GOOGLE IMAGE

**TABLE 8  
MIDDLESEX MS4 SURFACE WATERS SUMMARY**

SURFACE WATER NAME	HUC 12 CODE	REACH CODE AT MOST DOWNSTREAM OUTFALL	CHAPTER 93 DESIGNATED USE	STATUS A (ATTAINING) I (IMPAIRED)	IMPAIRMENT CAUSE	TOTAL LENGTH (MILES)	DISTANCE MOST DOWNSTREAM OUTFALL TO MOUTH (MILES)	DOWNSTREAM RECEIVING SURFACE WATER NAME
<b>Condoguinet Creek</b>	020503050403	02050305000204	WWF <sup>3</sup>	A		106.02	33.03	Susquehanna River
Condoguinet Creek, Unnamed Tributary		02050305003363	WWF <sup>3</sup>	A		0.44	0.43	Condoguinet Creek
Condoguinet Creek, Unnamed Tributary		02050305003369	WWF <sup>3</sup>	A		0.42	0.38	Condoguinet Creek
Condoguinet Creek, Unnamed Tributary		02050305000844	WWF <sup>3</sup>	A		1.12	0.66	Condoguinet Creek
<b>Hogestown Run</b>	020503050405	02050305000403	CWF <sup>2</sup>	I	Siltation Organic Enrichment/ Low D.O. Pathogens	7.48	6.17	Condoguinet Creek
Hogestown Run, Unnamed Tributary		02050305003499	CWF <sup>2</sup>	I	Siltation Organic Enrichment/ Low D.O. Pathogens	0.23	0.2	Hogestown Run
<b>Letort Spring Run</b>	020503050404	02050305000421	HQ-CWF <sup>1</sup>	A		12.66	0.03	Condoguinet Creek
Letort Spring Run, Unnamed Tributary		02050305003413	HQ-CWF <sup>1</sup>	A		0.42	0.09	Letort Spring Run
Letort Spring Run, Unnamed Tributary		02050305003537	HQ-CWF <sup>1</sup>	A		0.49	0.09	Letort Spring Run
<b>Wertz Run</b>	020503050403	02050305000494	WWF <sup>3</sup>	I	Siltation	3.91	0.28	Condoguinet Creek
Wertz Run, Unnamed Tributary		02050305003339	WWF <sup>3</sup>	A		0.75	0.07	Wertz Run
Wertz Run, Unnamed Tributary		02050305003322	WWF <sup>3</sup>	A		0.91	0.2	Wertz Run
Wertz Run, Unnamed Tributary		02050305003313	WWF <sup>3</sup>	A		0.95	0.69	Wertz Run

1. CWF Cold-Water Fishes
2. HQ-CWF High Quality-Cold Water Fishes
3. WWF Warm Water Fishes



## **B. TOPOGRAPHY AND GEOLOGY**

Other than the steeply sloped mountain range along the Township's northern border and stream valley ravines in the north portion of the municipality, the Township is characterized by flat, undulating topography.

North of Conodoguinet Creek, the geology is predominately shale with a sliver of Graywacke running just north and parallel to the Conodoguinet. (Graywacke is a variety of very hard sandstone containing poorly sorted quartz, feldspar, and small rock fragments) South of Conodoguinet Creek, the Township is primarily underlain by limestone. The region bounded by Interstate 81, Appalachian Drive, Old Stonehouse Road, and South Middlesex Road is particularly pocketed with Karst features (enclosed depressions) typical of limestone geology. Pre-construction site evaluation and a cautious approach to design and implementation of BMP projects should be employed in this region since it contains a few known sinkholes and is subject to new sinkhole formation that could open a conduit to the groundwater table for pollutant entry.



## C. SOILS

Excluding the land enveloping streams, soils north of U.S. Route 11 are classified as being of statewide importance and soils south of U.S. Route 11 are classified as prime farmland.

Since reduction of sediment is the primary focus of pollutant reduction effort, soil erodibility is of utmost importance. The National Resources Conservation Service (NRCS) developed the soil erodibility factor, expressed in K value, to be used in the Universal Soil Loss Equation (USLE) to estimate soil losses. K values range from the lowest erodibility, 0.02, to the highest, 0.69. Generally, highly organic soils with greater permeability resist erosion best and have lower K values. Silty soils, very fine sands, and clays with high shrink-swell capacity have higher K values.

North of Conodoguinet Creek, soils consist of largely of Bedington, Berks, and Weikert. While these northern soils have low erodibility (Erodibility K factor: 0.10 to 0.20), the Brinkerton soils, characteristic of most of the stream and gully valleys are highly erodible (Erodibility K factor: 0.43). Hagerstown soils dominate the area south of the Conodoguinet. Hagerstown soils have an erodibility K factor of 0.37, which suggests a high erosion potential.

It appears that projects within the northern valleys and almost anywhere in the south part of the MS4 should be effective for reducing erosion and sedimentation but will also require liberal use of erosion-control measures until BMP construction projects are stabilized.

#### D. LAND USE

Major east-west arterial roads, the Pennsylvania Turnpike (I-76) and U.S. Route 11 bisect Middlesex Township, dividing the southern third from the remaining Township territory. The north-south Interstate 81 (I-81) angles across the Township from its southwest corner to the middle of the eastern municipal boundary. The nexus of these roads defines the most intensive land uses in the region with high concentrations of long-haul trucking terminals, service plaza, hotels, eateries, and several transportation-dependent headquarters (such as Giant Foods and AHOLD, Inc.). The Turnpike and I-81 have interchanges along U.S. Route 11 separated by a little over one mile. This area is known locally as “the Miracle Mile.”



**Photograph No. 1** – Typical Truck Service Area along Middlesex Township’s Miracle Mile

Land use north and south of the Miracle Mile has a rural character dominated by farmland. According to the *Middlesex Township Comprehensive Plan* (Gannett Fleming, 2003), 46.3% of the Township supports agriculture. The agrarian land use character has not changed over the ensuing years between the *Comprehensive Plan* publication and 2017. Pastoral landscapes intermingle with mostly suburban residential development and a few clusters of compatible businesses, community services, and institutions.



**Photograph No. 2** – Typical view of rural land within the MS4, along Wolf’s Bridge Road, north of West Middlesex Road (Google Earth Street View)

MapShed, the pollutant reduction software, was originally developed to address agricultural runoff. It was refined to include urban runoff. As a result, the model features many land use categories necessary for the program’s calculations. **Table 9** presents the existing land use distribution derived from the MapShed Urban Area Tool. In accordance with PA DEP PRP directions, the land uses are to reflect the names and definitions promulgated by the Chesapeake Assessment Scenario Tool (CAST). **Table 9** provides crosswalk names between MapShed and Cast classifications. Information is provided for the total Township area within each of the three HUC 12 watersheds and the land use truncated to the planning area used for required MS4 pollutant reduction modeling.

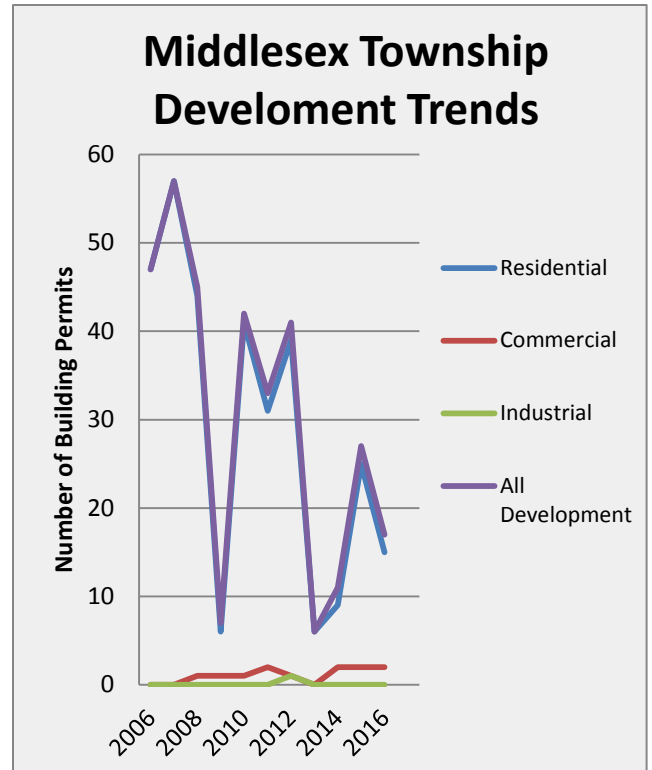
**TABLE 9  
LAND USE DISTRIBUTION TABLE**

LAND USE		HOGESTOWN		LETORT		WERTZ-CONODOGUINET		TOTAL STUDY AREA	
MAPSHED NAME	CAST NAME	WATERSHED	PLANNING AREA	WATERSHED	PLANNING AREA	WATERSHED	PLANNING AREA	WATERSHED	PLANNING AREA
Hay/Pasture	Pasture	2,938	0	2,002	292	7,480	203	12,420	495
Cropland	Hightill with Nutrients	3,786	0	3,548	687	3,403	22	10,737	709
Forest	Forest	840	2	1,107	84	8,535	44	10,482	130
Wetland	No Equivalent	47	0	77	7	316	0	440	7
Disturbed	Regulated Construction	0	0	0	0	0	0	0	0
Turfgrass (includes golf courses and large expanses of turf)	Regulated Pervious	116	0	195	15	195	0	506	15
Open Land	Nonregulated Pervious Developed	724	0	746	101	1,552	40	3,022	141
Bare Rock	Nonregulated Impervious	0	0	0	0	0	0	0	0
Sandy Areas	Nonregulated Extractive	0	0	0	0	0	0	0	0
Unpaved Roads	No Equivalent	0	0	0	0	0	0	0	0
Low-Density (LD) Mixed	Regulated Impervious	334	2.5	640	96	714	25	1,688	123.5
Medium Density (MD) Mixed	Regulated Impervious	764	0	1,974	724	608	49	3,346	773
High-Density (HD) Mixed	Regulated Impervious	479	0	1,268	131	534	12	2,281	143
Low-Density (LD) Residential	Regulated Impervious	684	0	400	111	1,488	44	2,572	155
Medium Density (MD) Residential	Regulated Impervious	630	0	1,772	109	1,292	0	3,694	109
High-Density (HD) Residential	Regulated Impervious	0	0	217	0	0	0	217	0
Water	Water	7.86	0	7.79	0	451.79	0	467.44	0
<b>TOTAL</b>		<b>11,350</b>	<b>4.5</b>	<b>13,954</b>	<b>2,357</b>	<b>26,569</b>	<b>439</b>	<b>51,872</b>	<b>2,800.5</b>

Note: All areas are provided in acres.



While existing land use describes the essential character of the municipality, trends in development pattern directly influence stormwater runoff and associated pollutant-to-stream delivery. Specifically, increases in earth disturbance and impervious surface that accompany land use intensification exacerbate erosion due to increased runoff rates. The Middlesex Township *Comprehensive Plan* indicated that in the decades preceding publication (1982-1999), Middlesex Township was experiencing steady growth. However, the *Building Activity Report 2016* (Tri-County Regional Planning Commission, 2016) shows a generally declining rate of development in Middlesex Township for the period of 2006 to 2016, with especially anemic activity in the commercial and industrial sectors. While the trend for Cumberland County as a whole seems to be recovering from the low point of development in 2009, Middlesex Township is still experiencing low development rates despite a spike of building in 2015 and an abundance of appropriately zoned land.



Impacts of the development rate are two-fold in terms of implementing the PRP:

- + The low rate of development might allow the Township to implement BMP projects for pollutant mitigation that keep pace with the potential deleterious effects of increased runoff.
- The existing population will bear the entirety of the financial obligations associated with implementation of the Pollutant Reduction Plan; extra municipal income from new development to defray costs for required stormwater improvements is uncertain.



## E. DEMOGRAPHICS

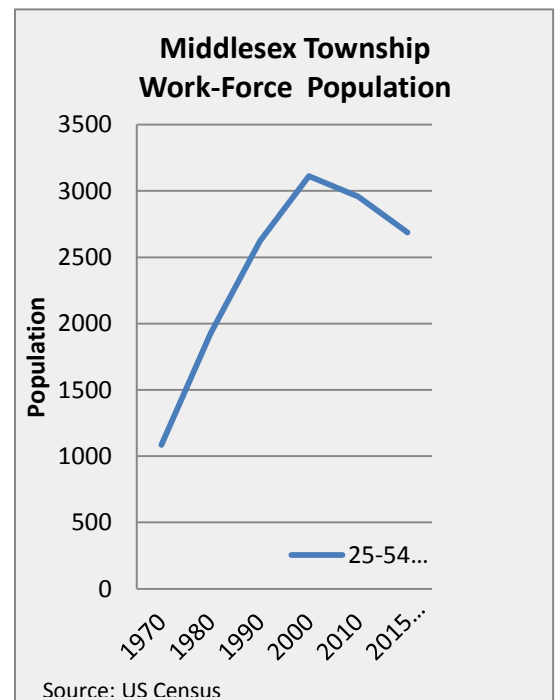
Through the MS4 permit process, stormwater management essentially is elevated to the equivalent of a public utility that has obligatory performance thresholds and associated costs. Like land use trends, population trends are important in projecting anticipated water quality impacts and associated expenses as well as potential revenue opportunities.

Middlesex Township's population growth has increased for the last several decades, but it has slowed since the 2000 U.S. Census (**Table 10**).

**TABLE 10  
MIDDLESEX TOWNSHIP POPULATION BY AGE GROUP  
(1970 TO 2015)**

AGE GROUP	1970	1980	1990	2000	2010	2015 ESTIMATES
0-14	978	1,003	1,122	1,298	1,102	1,210
15-24	445	866	709	736	757	894
25-54	1,084	1,926	2,621	3,113	2,957	2,687
55-64	184	431	535	625	972	1,127
65+	166	280	792	897	1,137	1,315
<b>Total</b>	<b>2,857</b>	<b>4,506</b>	<b>5,779</b>	<b>6,669</b>	<b>6,925</b>	<b>7,233</b>

Notable information from the demographic statistics is the decline in population of certain age groups. According to the Bureau of Labor Statistics, the bulk of the labor force is best represented by the 25- to 54-year-old age group. In Middlesex Township this age group expanded until the 2000 U.S. Census. In 2010 the labor-force age group had decreased by 5%, and the U.S. Census Bureau estimated an additional 9% decrease between 2010 and 2015. This is significant because this is the same age group that contributes to the municipal budget through tax payment. Because this important revenue-producing population is becoming smaller, the financial burden for ongoing support of the stormwater program represents a larger per capita expense for the tax-paying residents.



## **II. REQUIRED PRP COMPONENTS**

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## II. REQUIRED PRP COMPONENTS

### A. PUBLIC PARTICIPATION

The Combined PRP was introduced at a public meeting of the Board of Supervisors on June 7, 2017, at 7:00 P.M. The 30-day review period for the Combined PRP was advertised in the local newspaper, *The Sentinel*, on July 10 and July 17, 2017. The verbiage of the advertisement is provided below. A copy of the advertisement and proof of publishing are provided in **Appendix A**.

#### 1. Advertisement Announcing the Middlesex Township Combined PRP

A copy of the Middlesex Township Combined Pollutant Reduction Plan (the "Plan") for the Chesapeake Bay Basin, Wertz Run and Hogestown Run is available for public review and comment at the offices of Middlesex Township, 350 North Middlesex Road, Carlisle, PA 17013 beginning July 18, 2017 through and including August 18, 2017 weekdays, during regular business hours of 8:00 a.m. to 4:00 p.m. The Plan is also available for review beginning July 18, 2017 at the Middlesex Township website at <http://middlesextwp.com/>. The Plan describes the MS4 regulated Middlesex Township areas, applicable surface waters and pollutants of concern, targeted Chesapeake Bay basin pollution reduction targets, pollution reduction targets for surface waters impaired by sediment and/or nutrients, HUC 12 watersheds and subject surface waters, Chesapeake Bay pollutant loads, impaired surface water pollutant loads, and proposed BMP projects. Comments are requested to be placed in writing and submitted to Middlesex Township at the office address above no later than August 18, 2017. The proposed adoption of the Plan by the Board of Supervisors will be considered at a public meeting on August 25, 2017 at 7:30 a.m. during the Supervisors' regularly scheduled workshop meeting, at which time public comment concerning the Plan will also be accepted.

Eileen Gault, Manager and Secretary, Middlesex Township

Additionally, the Combined PRP was placed on the Township's web page (<http://middlesextwp.com/>) for review beginning on July 18, 2017, where it remained for the entirety of the 30-day review period. Interested parties had the option to provide written comments to the Township Secretary at the Township Building on or before August 18, 2017, or to attend any of the regularly scheduled meetings of the Board of Supervisors (July 28, 2017, at 7:30 A.M. and August 2, 2017, at 7:00 P.M.) to discuss their concerns in the public forum. Comments received and considerations are provided in **Appendix G**.

The finalized Combined PRP was presented and adopted at a regularly scheduled public meeting of the Middlesex Township Board of Supervisors on August 25, 2017, at 7:30 A.M.

## B. MAP

The Middlesex MS4 Map serves the following purposes:

1. Inventory of the Existing Middlesex Township stormwater network
2. Delineation of the components required by regulation including:
  - a. Land uses and/or impervious and pervious surfaces
  - b. Outfalls
  - c. Storm sewershed boundaries
  - d. Planning areas
  - e. Locations of proposed BMPs
3. Framework for documenting maintenance practices and Illicit Discharge Detection and Elimination (IDD&E) activities
4. Location of proposed pollutant-reducing projects

### MS4 Map Bullets

- **Map Fulfills Multiple Purposes**
  - Inventory
  - Regulated area identification
  - Inspections
  - Future project identification
- **GIS-Based**
- **Base Map**
  - Compiled from publicly available sources
- **Stormwater Sewer Collection System**
  - Digitized from aerial photographs
- **Outfalls and Sewersheds**
  - Produced by professionals
  - Color-coded:
    - Green for Attaining
    - Red for Non-Attaining
- **Planning Areas**
  - Demarcated through GIS Analysis

The map is a Geographic Information System (GIS) product created using ESRI Arc Map.

### 1. Base Map

The base map information was acquired from various publicly available sources including Bing Maps, Cumberland County GIS, Cumberland County Tax Maps, PA DEP, Pennsylvania Department of Conservation and Natural Resources (PA DCNR), Pennsylvania Department of Transportation (Penn DOT) and the U.S. Census Bureau that are detailed in **Appendix B**, MS4 Map Layers and Data Sources. The information from these sources is shown on the map unedited. Therefore, there are variations in the locations of duplicated information. However, the composite of the information sufficiently provides the required data elements including land uses, impervious/pervious surfaces, locations and names of surface waters that receive discharges from the MS4 outfalls, public and private property lines,

municipal boundaries, and the Urbanized Area Boundary according to the 2010 U.S. Census. Middlesex Township and its consultant, Skelly and Loy, Inc., make no claims as to the accuracy of the data.

## **2. Municipal Separate Storm Sewer System**

The stormwater sewer collection system (including publicly owned streets, ditches, swales, inlets, pipes, manholes, intakes, and discharges and privately owned components that are connected to the system) were digitized based on desktop analysis of aerial photographs and supplemented with information provided by Middlesex Township staff.

The stormwater sewer collection system depicted will be field-verified as a separate work effort during the permit term.

## **3. Outfalls**

Outfalls were located by plotting the path that storm runoff will follow by gravity between the Middlesex Township MS4 and the receiving surface water (a.k.a., rain traces). Surface topography with enclosed depression characteristics (such as stormwater basins, sinkholes, and ponds) were ignored, in accordance with PA DEP directions, to assume flooded conditions.

**PA DEP 3800-PM-BCW0200A  
dated 1/2017 (page 6, note 2)**

“For discharges to the ground surface rather than directly to surface waters the location where stormwater would likely enter a surface water as a result of a significant storm event is to be identified as the outfall. All stormwater discharges from MS4s are point sources to surface waters unless the stormwater is intentionally directed to the subsurface under a permit.”

The outfall identification numbering follows the recommendation from PA DEP with the lowest number located at the furthest downstream location and increasing sequentially for upstream locations.

Middlesex Township has 64 outfalls. Of these, 60 outfalls discharge to surface waters attaining their designated use and 4 outfalls discharge to surface waters impaired by sediment or nutrients. Of the 64 total outfalls, 53 are located in Middlesex Township. The remaining 11

outfalls discharge beyond the municipal limits and include 8 outfalls at attaining surface waters and 3 (of the total 4) outfalls at non-attaining surface waters.

#### **4. Storm Sewersheds**

Storm sewersheds were produced by qualified staff using professional judgement to delineate contributory drainage area to each outfall. Since Middlesex Township is located entirely in the Chesapeake Bay Basin, sewersheds were mapped for every outfall regardless of impairment status; the required sediment and the presumed nutrient reduction apply to all surface waters within the Chesapeake Bay Basin. Sewersheds were color-coded to correspond to the impairment/attainment status (in accordance with PA DEP's 2014 Integrated Water Quality Monitoring and Assessment Report) of the receiving surface water at the Middlesex MS4 outfall location. Sewersheds discharging to surface waters attaining their designated Chapter 93 use, relative to sediment and/or nutrients, are color-coded "green." Sewersheds discharging to non-attaining surface waters, impaired by sediment and/or nutrients, are color-coded "red."

#### **5. Planning Areas**

Planning Areas were derived through GIS analysis that merged and clipped the sewershed, the 2010 Urbanized Area, and the upstream contributory area. Parcels where development was authorized by an NPDES permit for stormwater discharges from construction activity and determined to have limited capacity for additional pollutant removal from the MS4-regulated area were excluded (parsed) from the planning areas. The resulting region is the regulated portion of Middlesex Township that is subject to pollutant reduction removal.

### C. POLLUTANTS OF CONCERN

Pollutants of concern within the overall PRP Planning Area are sediment, total nitrogen, and total phosphorus. The PA DEP-established pollutant removal targets are listed in **Tables 11 and 12**.

**TABLE 11  
CHESAPEAKE BAY BASIN POLLUTANT REDUCTION TARGETS**

<b>POLLUTANT</b>	<b>REDUCTION TARGET</b>
Sediment (TSS)	10%
Phosphorus (TP)	5%
Nitrogen (TN)	3%

**TABLE 12  
POLLUTANT REDUCTION TARGETS FOR  
SURFACE WATERS IMPAIRED BY SEDIMENT AND/OR NUTRIENTS**

<b>POLLUTANT</b>	<b>REDUCTION TARGET</b>
Sediment (TSS)	10%
Phosphorus (TP)	5%

#### 1. MS4 Reduction Goals

Middlesex Township has opted to use the presumptive approach. BMP projects to reduce pollutants will report only sediment reduction required to achieve 10% sediment reduction.

##### a. Presumptive Approach to Pollutant Reduction

In accordance with PA DEP's PRP Instructions (3800-PM-BCW0100k, Re. 3/2017) Section I.B., a presumption of nutrient removal compliance may be assumed if 10% sediment removal is achieved.

**PA DEP's PRP Instructions  
(3800-PM-BCW0100k, dated 3/2017) Section I.B.  
CBPRP**

"Permittees are encouraged to select appropriate BMPs to achieve the 10% sediment loading reduction objective, as it is expected that, overall within the Bay watershed, the TP (5%) and TN (3%) goals will be achieved when a 10% reduction in sediment is achieved."

**PA DEP's PRP Instructions  
(3800-PM-BCW0100k, dated 3/2017) Section I.B.  
PRPs**

"PRPs may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish a 5% TP reduction. However, MS4s may not presume that a reduction in nutrients will accomplish a commensurate reduction in sediment."

## D. EXISTING LOADING FOR POLLUTANTS OF CONCERN

### 1. Summary

Existing loading totals for sediment, phosphorus, and nitrogen were calculated by HUC 12 watershed using the MapShed model. Analysis at HUC 12 watershed scale is consistent with the requirement to apply the MapShed model to sufficiently sized (>10-square-mile) watersheds. Middlesex Township is contributory to four HUC 12 watersheds. The MS4 regulated area is located in three of them: Wertz Run-Conodoguinet Creek, Letort Spring Run, and Hogestown Run. **Table 13** lists the total loads for each of the HUC 12 watersheds in which the Middlesex Township MS4 is located. (Also see MapShed Urban Area Tool Results, **Appendix D1-HUC Watershed Total.**)

**TABLE 13  
EXISTING POLLUTANT LOAD BY HUC 12 WATERSHED  
TOTAL FROM MAPSHED**

HUC 12 WATERSHED NAME	HUC 12 CODE	SEDIMENT TSS (LBS/YR)	PHOSPHORUS TP (LBS/YR)	NITROGEN TN (LBS/YR)
Wertz Run-Conodoguinet Creek	020503050403	10,596,790	6,929	148,895
Letort Spring Run	020503050404	5,361,532	4,951	77,318
Hogestown Run	020503050405	4,200,348	4,715	73,110
<b>Total HUC 12 Watershed Contribution to the Chesapeake Bay Basin</b>		<b>20,158,670</b>	<b>16,595</b>	<b>299,323</b>

**Table 14** reports the adjusted existing pollutant load and reduction targets. A detailed discussion of the approach, the computer model, and other supporting calculations are provided below.

**TABLE 14**  
**FINAL ADJUSTED EXISTING POLLUTANT LOAD BY HUC 12 WATERSHED**  
**FOR REGULATED MIDDLESEX MS4**

WATERSHED NAME (HUC CODE)	SEDIMENT TSS (LBS/YR)		PHOSPHORUS TP (LBS/YR)		NITROGEN TN (LBS/YR)	
	ADJUSTED EX. LOAD	REDUCTION TARGET (10%)	ADJUSTED EX. LOAD	REDUCTION TARGET (5%)	ADJUSTED EX. LOAD	REDUCTION TARGET (3%)
Wertz Run- Conodoguinet Creek (020503050403)	181,026.4	18,026	118.9	6	3,250.8	98
Letort Spring Run (020503050404)	875,187.0	87,519	876.7	44	14,035.3	421
Hogestown Run (020503050405)	283.6	28	0.2	0.01	1.2	0.04
<b>Chesapeake Bay Basin Middlesex Township MS4 Total</b>	<b>1,056,497.0</b>	<b>105,650</b>	<b>995.8</b>	<b>50</b>	<b>17,287.3</b>	<b>519</b>

## 2. Calculating MS4 Existing Pollutant Load

The calculations to determine the existing pollutant load for Middlesex Township include (1) reducing the Planning Area through parsing and (2) reducing the modelled Planning Area load by deducting pollutant volume captured by existing BMPs from the modelled load results. Section (a.) discusses parsing and the modeled pollutant load. Section (b.) identifies further existing load reduction achieved by existing BMPs.

### a. Planning Area Deductions (Parsing)

As stated in Section II.B, Map, the planning areas were created using GIS analysis to identify the portion of the Township within and contributing to the 2010 Urbanized Area that is also served by municipal separate storm sewer system. The area from the first analysis was decreased by exclusion/parsing of properties that possess their own NPDES permit with Post-Construction Stormwater Management (PCSM) obligations and were determined to have limited potential for additional pollutant removal from the MS4-regulated area.

Other properties within the Township were excluded because they are entirely under private ownership that did not contribute runoff to or through the municipal stormwater sewer collection/conveyance system. This group included developments with private streets, regions whose runoff passed only through a stormwater sewer collection/conveyance system owned and operated by the Pennsylvania Department of Transportation (PennDOT) and/or the Penn-



sylvania Turnpike Commission (PTC), and properties with drainage that discharged directly to a surface water.

The adjusted planning area is the regulated Middlesex MS4 and is the region substituted for the Urban Area data layers in the MapShed model. Parsed NPDES-permitted parcels include the properties listed in **Table 15**.

**TABLE 15  
PARSED PROPERTIES EXCLUDED FROM  
MIDDLESEX TOWNSHIP MS4 PLANNING AREA**

IDENTIFICATION	ADDRESS/LOCATION	LATITUDE	LONGITUDE	ACRES WITHIN PLANNING AREA
<b>NPDES PERMITTED SITES</b>				
Blue Beacon of PA Truck Wash	1240 Harrisburg Pike	N040° 14' 09"	W077° 08' 11"	0.7
Carlisle Sports Emporium	29 South Middlesex Road	N040° 13' 56"	W077° 08' 00"	17.0
Comfort Inn - Carlisle	77 Shady Lane	N040° 13' 33"	W077° 08' 52"	11.7
Hardees	1808 West Trindle Road	N040° 11' 58"	W077° 09' 19"	1.3
Holiday Inn Express	1152 Harrisburg Pike	N040° 13' 39"	W077° 09' 09"	2.5
Keystone Arms	Harrisburg Pike and MacArthur Drive	N040° 13' 06"	W077° 09' 50"	48.0
Liberty At Middlesex	1701 Harrisburg Pike	N040° 14' 13"	W077° 07' 09"	63.9
PennDOT Maintenance Building	Claremont Drive north of West Trindle Road	N040° 12' 03"	W077° 09' 23"	12.7
Pine Hill Industrial Park Lot 6A	10 Pine Hill Drive	N040° 13' 28"	W077° 10' 04"	6.0
Rutters	1150 Harrisburg Pike	N040° 13' 37"	W077° 09' 14"	5.7
Toigo	305 North Old Stonehouse Road	N040° 13' 28"	W077° 07' 30"	109.2
<b>PRIVATE DEVELOPMENTS</b>				
Fetrow Acres	West Trindle Road east of Conrad Road	N040° 12' 03"	W077° 09' 04"	22.3
Mountain View Development	South of Spring Road and Wolf's Bridge Road	N040° 15' 29"	W077° 10' 16"	12.6
<b>Total</b>				<b>313.6</b>

**Appendix C**, Properties with Individual Chapter 102 NPDES Permits, provides a complete list NPDES-permitted properties within the Township.

i. MapShed Model

MapShed was a natural choice for completion of the PRPs. The model's longevity speaks to its acceptability for regulatory compliance. MapShed is the second generation of the Generalized Watershed Loading Function (GWLf) Model that was used in a majority of the approved Pennsylvania TMDL studies, and it is foundational for the Web-based version, Model



My Watershed, currently under development. Since the model enjoys such wide-spread acceptance, data layers (with the program's December 19, 2016, updates) as downloaded from the MapShed website (<http://www.mapshed.psu.edu/>) were utilized to the greatest extent possible to ensure consistency with MapShed data previously accepted by PA DEP and the Chesapeake Bay Program. However, the program was unstable and the built-in municipal layers did not reflect the planning area required to assess the MS4 reduction responsibility. Therefore, the following limited adaptations were made.

#### Modifications to MapShed

- MapShed-provided data layers were re-projected and clipped to the municipal boundary to gain performance, reduce inconsistencies, and provide platform stability.
- Consultant-created Planning Areas were substituted for the MapShed-provided Urbanized Area data layer.
- HUC 12 watersheds from the USGS were substituted for MapShed-provided Small Sheds.

#### ii. MapShed Urban Area Tool

MapShed's Urban Area Tool was used to determine the existing pollutant loads generated by the Middlesex MS4 regulated area (Planning Areas). The Urban Area Tool provides four categories of information:

1. **Watershed Total Pollutant Load** – The annual load of sediment, phosphorus, and nitrogen generated by the entire HUC 12 watershed expressed in pounds/year
2. **MS4 Total Pollutant Load** – The MS4 portion of the watershed's pollutant load
3. **MS4 Regulated Pollutant Load** – Subset of MS4 total load reflecting any additional acreage reductions from the Planning Areas
4. **Unregulated Pollutant Load** – Counterpart to the Regulated Pollutant Load that represents the portion of the pollutant load not conveyed through the subject MS4 stormwater sewer system

The Regulated Pollutant Load portion of the Urban Area Tool allows the user to simulate parsing by inputting an adjusted percentage of land area within land use categories to reflect a smaller regulatory area resulting from exclusions. Since GIS analysis was used to generate a substitute boundary for the Urban Area Data Layer, the parsing was incorporated into the GIS analysis process and was completed in a single step. Adjustments were unnecessary for the Wertz Run-Conodoguinet and Letort Run watersheds. (The Regulated Pollutant Load sheets in **Appendix D3** for the Wertz Run-Conodoguinet and Letort Run Watersheds show that 100% of acreage in all land use categories was included in the pollutant reduction modelling.) However, the planning area for Hogestown Run capitalized on MapShed's option to adjust the regulated area.

The Hogestown Run planning area is an urbanized area extending along Appalachian Drive to a single structure south of the Pennsylvania Turnpike. It consists of the roadway itself, so it is narrow, linear, and located on a ridgetop. Because of these features and the scale at which MapShed performs its analysis, the Hogestown Run regulated acreage was significantly overestimated by MapShed's Urban Area Tool and required refinement. Specifically, the underlying data (elevation, precipitation, soils, land use, etc.) that MapShed uses for computation is extracted from a grid whose pixel size is 30 meters square (98.4 feet by 98.4 feet). The program includes quantitative data for a whole pixel; it does not cleanly truncate a study area precisely at a boundary. Instead, it processes data from a whole pixel, even though only a small portion of that pixel might be in the study area. The effect is similar to a low-resolution digital photograph that shows a sharply defined edge as a zig-zag of interconnected blocks.

The pixel size is roughly three times the width of most of the Hogestown Run planning area that generally consists of a 33-foot road right-of-way; the disparity is far too coarse for this study sample. In a large area, the coarseness of the data grid makes little difference in the results because the edges where pixels "bleed" over a boundary represents a small percentage of the large study area. On the other hand, the Hogestown Run planning area is narrow, long, and linear with a few curves (Appalachian Drive).

The actual Hogestown Run planning area is five acres in size. The automated MapShed result estimate was 31 acres. The discrepancy can be attributed to the alignment of the data grid overlaid on the planning area that included acreage beyond the real boundary and a similar issue along the mutual boundary between the Hogestown watershed and the adjacent Letort Spring Run HUC 12 watershed. Therefore, professional judgment was used to adjust the Urban Area Tool results based on representative land uses and accurate planning area size.

**Table 16** reports the results from MapShed’s Urban Area Tool. The results tables generated by the model are provided in **Appendix D**.

**TABLE 16  
MAPSHED EXISTING POLLUTANT LOAD  
BY HUC 12 WATERSHED WITH PARSING ADJUSTMENT**

<b>WATERSHED NAME</b>	<b>HUC 12 CODE</b>	<b>SEDIMENT TSS (LBS/YR)</b>	<b>PHOSPHORUS TP (LBS/YR)</b>	<b>NITROGEN TN (LBS/YR)</b>
Wertz Run-Conodoguinet Creek	020503050403	181,026.4	118.9	3,250.8
Letort Spring Run	020503050404	982,447.6	917.1	14,589.6
Hogestown Run	020503050405	283.6	0.2	1.2
<b>Total Chesapeake Bay Basin</b>		<b>1,163,658.6</b>	<b>1,036.2</b>	<b>17,841.6</b>

**b. Existing Stormwater Facility Pollutant Load Adjustments**

In addition to land area excluded from the MS4 regulated area, the pollutant load was further decreased to reflect the treatment provided by the municipality’s existing stormwater management facilities (basins and ponds). All identified stormwater management facilities currently treating the MS4’s runoff are located in the Letort Spring Run watershed; there are no stormwater basins that intercept and treat MS4 runoff in the Wertz Run-Conodoguinet or Hogestown Run watersheds resulting in pollutant deductions.

Letort Spring Run watershed contains 19 stormwater basins that were analyzed for pollutant removal. There are 15 detention basins, 3 infiltration basins, and 1 wet pond. Contributory areas to each basin were delineated and measured. The effectiveness rates, according to PA DEP’s NPDES Stormwater Discharges from Small Municipal Separate Storm Sewer Systems BMP Effectiveness Value (Form Number 3800-PM-BCW0100m dated 5/2016), were applied to the treated acreage. (The BMP effectiveness values are provided in **Appendix F6.**) The facility removal statistics are listed below.

**Pollutant Reduction Achieved by Existing BMPs Statistics**

Treated Area:	617 acres
Sediment Removed:	107,261 pounds/year
Phosphorus Removed:	40 pounds/year
Nitrogen Removed	554 pounds/year



A complete listing that includes a description, location by latitude and longitude, applicable permit numbers, approximate date of installation, functionality, operations and maintenance, and the pollutant load computation is provided in **Appendix E. Table 17** summarizes the adjusted existing pollutant load reflecting parsing and the additional load reductions within the Letort Spring Run HUC 12 Watershed achieved by existing BMPs.

**TABLE 17  
FINAL ADJUSTED EXISTING POLLUTANT LOAD**

HUC 12 WATERSHED/ BASIN	MAPSHED ADJUSTED PLANNING AREA LOAD (POUNDS/YEAR)			EXISTING STORMWATER FACILITY REDUCTIONS (POUNDS/YEAR)			FINAL ADJUSTED EXISTING LOAD (POUNDS/YEAR)		
	TSS	TP	TN	TSS	TP	TN	TSS	TP	TN
Wertz Run- Conodoguinet Creek (020503050403)	181,026.4	118.9	3,250.8	0	0	0	181,026.4	118.9	3,250.8
Letort Spring Run (020503050404)	982,447.6	917.1	14,589.6	107,260.6	40.4	554.3	875,187.0	876.7	14,035.3
Hogestown Run (020503050405)	283.6	0.2	1.2	0	0	0	283.6	0.2	1.2
<b>Chesapeake Bay Basin</b>	<b>1,163,757.6</b>	<b>1,036.2</b>	<b>17,841.6</b>	<b>107,260.6</b>	<b>40.4</b>	<b>554.3</b>	<b>1,056,497.0</b>	<b>995.8</b>	<b>17,287.3</b>

Based on the Final Adjusted Existing Load reported above, the required sediment reduction target is as follows (**Table 18**).

**TABLE 18  
MIDDLESEX MS4 MIDDLESEX MS4 SEDIMENT REDUCTION TARGET**

HUC 12 WATERSHED/BASIN	FINAL ADJUSTED EXISTING SEDIMENT LOAD	MIDDLESEX MS4 SEDIMENT REDUCTION TARGET
Wertz Run-Conodoguinet Creek (020503050403)	181,026.4	18,103
Letort Spring Run (020503050404)	875,187.0	87,519
Hogestown Run (020503050405)	283.6	28
<b>Chesapeake Bay Basin</b>	<b>1,056,497.0</b>	<b>105,650</b>



## **E. BMPs TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING**

Middlesex Township is planning nine BMP projects to meet the required sediment reduction targets. Projects will be dispersed to address the corresponding sediment reduction goal in each of the three watersheds. Cumulatively, the projects will meet the reduction goal for the Chesapeake Bay Basin. The BMPs include 7 roadside Vegetated Open Channels, 1 Rain Garden, and 760 linear feet of Stream Restoration.

**Table 19** summarizes the proposed BMPs in Middlesex Township. Detailed tables titled BMP Cost and Reduction Analysis contain specific project, watershed, and basin-wide scale summaries of costs, schedules cross-referenced to maps, pollutant loads, and reductions are located in **Appendix F**, BMP Cost and Reduction Analysis Spreadsheets. Additional descriptions of the background calculations for pollutant reduction and costs are also provided in **Appendix F**.

It is worth noting sediment load calculations for the contributing drainage area to the BMPs use the same methodology exercised for calculating the regulated planning area pollutant loads. The spreadsheet produces the pollutant rate using the MapShed-generated sediment load for the regulated planning area as reported on the Urban Tool summary sheets in **Appendix D**, MapShed Urban Area Tool Results. The consistent use of MapShed-generated loading rates ensures that pollutant load computations for existing condition and treated-acre loads are consistent and the spreadsheet results remain analogous to the computer model.

### **1. Alternatives Considered**

Properties owned or operated by the Township were considered to be the highest priority opportunity sites because landowner coordination and land and/or easement acquisition expenses could be minimized. Property under municipal control within the regulated planning area is limited, consisting primarily of road rights-of-way and one small neighborhood park (Anderson Park). Anderson Park is located west of the intersection of Hill Drive and Valley Drive in the Cloverleaf Acres subdivision. The municipal building that houses administration, police, and maintenance as well as the Township's other two municipal parks (Main Park and Letort Falls Park) are outside the regulated MS4 area.

**TABLE 19  
PROPOSED BMP PROJECTS AND SEDIMENT REDUCTION**

PROJECT NUMBER	PROPOSED BMP BY WATERSHED	LATITUDE LONGITUDE	LOCATION DESCRIPTION	RATIONALE	EXISTING SEDIMENT LOAD TO BMP (LBS/YR)	BMP SEDIMENT REDUCTION (LBS/YR)
1	Vegetated Open Channel	N40° 15' 47" W77° 10' 31"	North side of Wagner Road between the Township Boundary with North Middleton Township and Shaeffer Road	<ul style="list-style-type: none"> <li>Project will also address an existing stormwater flooding issue</li> <li>Project largely within the Township road right-of-way</li> </ul>	701	490.7
2	Vegetated Open Channel	N40° 15' 49" W77° 10' 20"	North side of Wagner Road between Shaeffer Road and Spring Road	<ul style="list-style-type: none"> <li>Logical extension of Project 1</li> <li>Retrofit - modification to an existing roadside swale</li> <li>Project largely within the Township road right-of-way</li> </ul>	2,639	1,847.4
3	Vegetated Open Channel	N40° 15' 20" W77° 09' 57"	East side of Wolf's Bridge Road between Spring Road and West Middlesex Road	<ul style="list-style-type: none"> <li>Strategic location at the headwaters of an unnamed tributary to Wertz Run (Wertz Run is impaired for sediment)</li> <li>Intercepts agricultural runoff from cropland</li> <li>Project largely within the Township road right-of-way</li> </ul>	4,866	3,406.1
4	Vegetated Open Channel	N40° 14' 56" W77° 09' 51"	West side of Wolf's Bridge Road near its intersection with West Middlesex Road	<ul style="list-style-type: none"> <li>Project will further address stormwater conveyance capacity issue</li> <li>No apparent utility obstructions</li> <li>Addresses agrarian runoff</li> <li>Project largely within the Township road right-of-way</li> </ul>	8,701	4,350.4
5	Vegetated Open Channel	N40° 14' 06" W77° 09' 52"	West side of the Wolf's Bridge Road; south of Conodoguinet Creek north of Gasoline Alley	<ul style="list-style-type: none"> <li>No apparent utility obstructions</li> <li>Will alleviate sediment deposition on road shoulder</li> <li>Project largely within the Township road right-of-way</li> </ul>	6,350	3,175.2
6	Vegetated Open Channel	N40° 13' 48" W77° 09' 52"	East side of the Wolf's Bridge Road; south of Conodoguinet Creek immediately north of Gasoline Alley	<ul style="list-style-type: none"> <li>Expect to address low-lying area capacity issue</li> <li>Collects runoff from automotive salvage operation</li> <li>Project largely within the Township road right-of-way</li> </ul>	10,020	5,010.2
<b>Wertz Run-Conodoguinet Creek Watershed Subtotal</b>					<b>33,277</b>	<b>18,280</b>
7	Bioretention-Raingarden (A/B soils with underdrain)	N40° 13' 35" W77° 09' 36"	Anderson Park –West of the intersection of Valley Drive and Hill Drive	<ul style="list-style-type: none"> <li>Township-owned park</li> <li>High visibility provides opportunity for education and promoting resident enthusiasm</li> </ul>	594	475.3
8	Stream Restoration	N40° 13' 57" W77° 08' 12"	Letort Spring Run stream channel from U.S. Route 11 south along channel for 760 linear feet	<ul style="list-style-type: none"> <li>Stream channel identified as a priority stream reach by a previous comprehensive stream assessment (overly widened and sediment source)</li> <li>Continuation of a previous restoration with receptive land owners</li> <li>Close to most intensive land use and highest degree of imperviousness in the Township (a.k.a., Miracle Mile)</li> </ul>	720,349	87,400
<b>Letort Spring Run Watershed Subtotal</b>					<b>720,943</b>	<b>87,875</b>
9	Vegetated Open Channel (C/D Soils)	N40° 13' 46" W77° 06' 12"	East side of Appalachian Drive, south of the Pennsylvania Turnpike	<ul style="list-style-type: none"> <li>Project largely within the Township road right-of-way</li> <li>Evidence of erosion adjacent to road</li> <li>Treats the majority of the MS4 regulated area within the watershed</li> </ul>	78	38.8
<b>Hogestown Run Watershed Subtotal</b>					<b>78</b>	<b>39</b>
<b>MIDDLESEX MS4 CHESAPEAKE BAY BASIN TOTAL</b>					<b>754,298</b>	<b>106,215</b>



Middlesex Township preferred to capitalize on locating projects within its roads' rights-of-way and on its property where such construction was pragmatic. A number of roadside sites were evaluated for installation of new or retrofit open Vegetated Open Channels or Bioswales. Several sites, particularly in the Letort Spring Run watershed, were rejected due to conflicts with underground utilities. Claremont Road is an example of this type of site. A waterline and fiber optics cable are located in the road shoulder. Both utilities are sensitive to excavation above them and also need to maintain unfettered access for repair and maintenance. In order to develop a Vegetated Open Channel in this location, it is very likely that purchase of additional right-of-way from adjacent property owners would be required. Additional anticipated design review, approval, and construction complexities made the site less attractive than selected sites.

After discussion of the differences between Bioswales and Vegetated Open Channels, it was determined that the Township Road Crew skills for construction and ongoing maintenance were better matched to the Vegetated Open Channels at this time. Skill learned through the installation and maintenance of this variation of a familiar roadside treatment could then be applied to more-involved bioretentive BMPs in the future.

The municipality selected roadside improvements in the form of Vegetated Open Channels along a number of roads in the Wertz Run Conodoguinet Creek and Hogestown Run watersheds. Vegetated Open Channels are planned at the following locations:

- along the north side of Wagner Road between the Township Boundary and Spring Road;
- the east side of Wolf's Bridge Road between Spring Road and West Middlesex Road;
- the west side of Wolf's Bridge Road near its intersection with West Middlesex Road;
- both sides of the Wolf's Bridge Road north of Gasoline Alley; and
- the east side of Appalachian Drive south of the Turnpike.

These improvements will reduce sediment from adjacent farmland and improve driver safety by addressing a few locations where stormwater runoff floods roadways and deposits sediment, creating less-than-optimal driving conditions.



In the Letort Spring Run watershed, the selected proposed rain garden in Anderson Park provides sediment reduction as well as affording the opportunity to educate residents and promote enthusiasm for environmental stewardship with a very visible project.

Since any projects other than roadside conveyance improvements and special opportunity sites like the one at Anderson Park required extra coordination with the municipality's residents and businesses, the next level of opportunities focused on projects that provided the largest quantity of sediment reduction for the lowest cost. Stream restoration best met this criteria.

The selected stream restoration project features a segment of the Letort Spring Run main stem. The Letort was comprehensively assessed in the early 2000s. Two segments east of Shady Lane were restored in the mid-2000s. However, more of the reach from the end of that restoration to the confluence with the Conodoguinet was also identified as a high-priority restoration project. The stream was eroding laterally and becoming overly wide. This situation has not been remedied to date. Widening results in shallow normal water depths which is deleterious to aquatic life due to elevated water temperatures and the loss of habitat. The erosion also causes a steady delivery of sediment to downstream watercourses, and ultimately to the Chesapeake Bay.

The original Shady Lane stream restoration was well-received by residents, and the site location is adjacent to the most intensively used, highly paved part of the Township, the Miracle Mile. The stream restoration site's close proximity to this impactful land use made it an ideal candidate for continuation of the stream restoration activity to protect and preserve the high-quality Letort Spring Run.

## 2. Summary

The selected projects will slightly exceed the Middlesex MS4 obligation to reduce sediment by 10% in each individual watershed and for the Chesapeake Bay Basin as well. (See **Table 20.**)

**TABLE 20  
ACHIEVED SEDIMENT REDUCTION BY WATERSHED AND MAJOR BASIN**

<b>WATERSHED</b>	<b>MINIMUM REQUIRED SEDIMENT LOADING REDUCTION (LBS/YR)</b>	<b>ESTIMATED SEDIMENT LOADING REDUCTION (LBS/YR)</b>
Wertz Run-Conodoguinet	18,103	18,280
Letort Spring Run	87,519	87,875
Hogestown Run	28	39
<b>CHESAPEAKE BAY BASIN TOTAL</b>	<b>105,650</b>	<b>106,215</b>



## F. FUNDING MECHANISM(S)

The estimated capital costs of the proposed projects are provided in **Table 21**. Estimates were derived from the referenced Pennsylvania unit prices in the BayFAST Web-based pollutant reduction model and adjusted to 2017 values using the U.S. Inflation Calculator ([www.usinflationcalculator.com](http://www.usinflationcalculator.com)). BayFAST is one of the U.S. Environmental Protection Agency's (U.S. EPA) Chesapeake Bay Program approved pollutant removal scenario tools, and the embedded costs that were established through a U.S. EPA grant are acknowledged to be reliable for planning-level use. Capital costs include budget values for design, permitting, and construction and are buffered sufficiently to allow for potential expenses associated with land access/acquisition. Expanded cost information including estimates for operation and maintenance, opportunity costs (that represent revenue lost due to the degree the exclusive stormwater use prevents revenue producing activity), and the annualized cost (annual cost of the project over useful life) are provided in **Appendix F**, BMP Cost and Reduction Analysis Spreadsheets.

**TABLE 21  
ESTIMATED PROJECT COSTS**

PROJECT NUMBER	PROJECT DESCRIPTION	WATERSHED	CAPITAL COST
1	Vegetated Open Channel – Wagner Road: west of Shaeffer Road	Wertz Run- Conodoguinet Creek	\$13,963
2	Vegetated Open Channel – Wagner Road: east of Shaeffer Road		\$52,565
3	Vegetated Open Channel – Wolf's Creek Road: between Spring Road and West Middlesex Road		\$96,917
4	Vegetated Open Channel – Wolf's Creek Road: intersection with West Middlesex Road		\$143,604
5	Vegetated Open Channel – Wolf's Creek Road: south of Conodoguinet Creek, north of Gasoline Alley		\$104,811
6	Vegetated Open Channel – Wolf's Creek Road: immediately north of Gasoline Alley		\$165,383
<b>Wertz Run-Conodoguinet Creek Watershed Subtotal</b>			<b>\$577,243</b>
7	Bioretention-Raingarden (A/B soils with underdrain) – Anderson Park	Letort Spring Run	\$26,030
8	Stream Restoration – Letort Spring Run main stem		\$547,553
<b>Letort Spring Run Watershed Subtotal</b>			<b>\$573,583</b>
9	Vegetated Open Channel (C/D Soils) – Appalachian Drive	Hogestown Run	\$14,292
<b>Hogestown Run Watershed Subtotal</b>			<b>\$14,292</b>
<b>Chesapeake Bay Basin Total</b>			<b>\$1,165,118</b>

Middlesex intends to further reduce costs by relying on its skilled Road Crew for construction. Since the estimates are based on a planning tool that assumes construction will

be performed primarily by professional contractors and supplemented by community organizations, the Township believes that use of the Township Road Crew with professional oversight could conservatively reduce the capital cost by 30%. If accurate, the savings would be \$349,535 for the Chesapeake Bay Basin, reducing the total capital cost to approximately \$815,600.

Middlesex Township is ultimately responsible to pay for implementation of the project and will add the improvements to its capital budget, \$163,000 to \$233,000 annually, subject to detailed design, accurate construction cost estimates, and selection of contractor vs. Road Crew for construction. However, the Township also will seek to leverage its investment by pursuing grants and looking for potential partners. For example, Letort Spring Run is a nationally noted trout stream. Maintaining its health is not only valuable to the environment, it supports both fishing and tourist-related businesses. The Cumberland Valley Chapter of Trout Unlimited spearheaded the previous Letort Spring Run stream restoration project east of Shady Lane which received PA DEP Growing Greener Grant funding. Trout Unlimited will be approached for potential partnering. Another potential partner is the PTC since Letort Spring Run crosses the Pennsylvania Turnpike and the PTC is also an MS4 permittee.



## **G. RESPONSIBLE PARTIES FOR OPERATION AND MAINTENANCE OF BMPs**

The Middlesex Township Road Crew will be the party primarily responsible for the operation and maintenance of all BMPs described in the PRP. Maintenance services beyond the expertise of the Road Crew will be performed by contractors. As listed above, Middlesex Township will rely on three types of BMPs: Bioretention/Rain Gardens, Stream Restoration, and Vegetated Open Channels. **Tables 22 through 24** summarize the maintenance activity and responsible party for each of the BMPs proposed in this plan.

**TABLE 22**  
**BMP MAINTENANCE INSTRUCTIONS**  
**BIORETENTION/RAIN GARDEN – PA STORMWATER BMP MANUAL #6.4.5**

Inspection Schedule: 2x annually (minimum)

Inspection Responsible Party: Road Master

<b>ROUTINE AND PREVENTATIVE MAINTENANCE ACTIVITY</b>	<b>MAINTENANCE SCHEDULE</b>	<b>NOTES</b>	<b>RESPONSIBLE PARTY</b>
Remove litter.	Prior to Mowing	<ul style="list-style-type: none"> <li>Dispose of litter at an approved facility.</li> </ul>	Road Crew
Mow/trim.	1x annually (minimum)	<ul style="list-style-type: none"> <li>Remove and dispose of excessive vegetation.</li> <li>Mow when facility is dry to avoid rutting and compaction.</li> </ul>	Road Crew
Test backup underdrain (if present).	1x annually		Road Master
Clear inlet and discharge obstructions.	In conjunction with mowing	<ul style="list-style-type: none"> <li>Remove obstructing debris, litter, or sediment from facility inlet and discharge.</li> <li>Dispose of material at an approved facility or composting center, as appropriate.</li> </ul>	Road Crew
Water.	Weekly during establishment period and during periods of drought		Road Crew
Mulch.	1x every 3 years or as needed		Road Crew
Apply fertilizer, pesticides, and herbicides.	Apply only when absolutely necessary		Road Crew
<b>CORRECTIVE MAINTENANCE ACTIVITY<sup>1,2</sup></b>	<b>MAINTENANCE SCHEDULE</b>	<b>NOTES</b>	<b>RESPONSIBLE PARTY</b>
Remove accumulated sediment, debris, and winter road treatment residuals.	1x annually (minimum) in the spring after snow melt and any other time accumulation depth >3 inches or buried vegetation is discovered	<ul style="list-style-type: none"> <li>Remove accumulation when facility is dry. Avoid compaction of soils. Do not operate heavy equipment in the bioretention/rain garden.</li> <li>Dispose of material at an approved facility.</li> </ul>	Road Crew
Correct erosion problems including rill and gully formation. Reseed bare areas. Install erosion-control measures, as required.	As needed		Road Crew
Replace damaged, dead, or missing plants. Use alternative species, if warranted.	As needed		Road Crew
Maintain 85% vegetative cover.	As needed	<ul style="list-style-type: none"> <li>If vegetative cover is reduced by 10%, vegetation should be reestablished.</li> </ul>	Road Crew
Remove exotic/invasive species.	2x annually (minimum) Years 1 through 3; as needed thereafter	<ul style="list-style-type: none"> <li>Minimize landscape disturbance.</li> <li>Protect healthy native plant communities.</li> <li>Manually pull or dig invasives that can be entirely extracted safely.</li> <li>Use herbicides for control of plants that will spread if not entirely removed manually or on plants that pose a health hazard.</li> <li>Replace invasives with native, non-invasive species.</li> <li>Properly dispose of invasive plants.</li> </ul>	Road Crew or Contractor
Restore soil structure through aeration, rototilling, mulching, or amendment.	As needed		Road Crew
<p>1. Follow protocols for scheduling prompt repair of minor deficiencies upon discovery</p> <p>2. Establish schedule for significant repairs for publication in Annual Report</p>			



**TABLE 23**  
**BMP MAINTENANCE INSTRUCTIONS**  
**STREAM RESTORATION – PA STORMWATER BMP MANUAL #6.7.4**  
**(FLOODPLAIN RESTORATION)**

**Inspection Schedule:** If not specified by state and federal regulators through a permitting process, 1x annually for 2 years then 1x every 5 years and within 1 year following catastrophic storm of 25-year magnitude (5.13 inches/24-hour period per NOAA Atlas 14)

**Inspection Responsible Party:** Road Master

<b>ROUTINE AND PREVENTATIVE MAINTENANCE ACTIVITY</b>	<b>MAINTENANCE SCHEDULE</b>	<b>NOTES</b>	<b>RESPONSIBLE PARTY</b>
Remove litter.	Prior to mowing	Dispose of litter at an approved facility.	Road Crew
Mow.	2x per growing season until tree canopy is established (generally, 3 to 5 years); as needed thereafter	Set mower height at 8 to 12 inches.	Road Crew
Remove exotic/invasive species (aquatic and terrestrial).	2x annually (minimum) Years 1 through 3; as needed thereafter	<ul style="list-style-type: none"> <li>• Minimize landscape disturbance.</li> <li>• Protect healthy native plant communities.</li> <li>• Manually pull or dig invasives that can be entirely extracted safely.</li> <li>• Use herbicides for control of plants that will spread if not entirely removed manually or on plants that pose a health hazard.</li> <li>• Replace invasives with native , non-invasive species.</li> <li>• Properly dispose of invasive plants.</li> </ul>	Road Crew or Contractor
Use weed mats.	1x preventative	<ul style="list-style-type: none"> <li>• Install in conjunction with vegetation planting.</li> <li>• Remove following tree canopy development (generally 3 to 5 years).</li> </ul>	Road Crew
<b>CORRECTIVE MAINTENANCE ACTIVITY<sup>1,2</sup></b>	<b>MAINTENANCE SCHEDULE</b>	<b>NOTES</b>	<b>RESPONSIBLE PARTY</b>
Repair in-channel structures (grade-controls [steps, piles, drops], sills, weirs, vanes, barbs, spurs, bank toe, etc.).	As needed	Repair during low water consistent with permit.	Road Crew or Contractor
Repair bank-armoring structures (revetments, soil-covered riprap, cellular blocks, geogrid, gabions, bulkheads, etc.).		Repair during low water consistent with permit.	Road Crew or Contractor
Repair habitat structures (habitat logs, fish cover structures, pool/riffle rocks and structures).		Repair during low water consistent with permit.	Road Crew or Contractor
Correct irregularities in cross section and longitudinal slope. Reestablish design grades and configuration.	As needed	Reestablish cross section when the channel pattern and dimensions are discernably different from the design.	Road Crew or Contractor
Stabilize eroding and undercut banks.	As needed		Road Crew or Contractor
Maintain 85% vegetative cover.	As needed	If vegetative cover is reduced by 10%, vegetation should be reestablished.	Road Crew
1. Follow protocols for scheduling prompt repair of minor deficiencies upon discovery 2. Establish schedule for significant repairs for publication in Annual Report			



**TABLE 24**  
**BMP MAINTENANCE INSTRUCTIONS**  
**VEGETATED OPEN CHANNELS – PA STORMWATER BMP MANUAL #6.4.8**

**Inspection Schedule:** 1 x annually (minimum) and during routine maintenance and within 48 hours of rainstorm events > 1" in a 24-hour period

**Inspection Responsible Party:** Road Master

ROUTINE AND PREVENTATIVE MAINTENANCE ACTIVITY	MAINTENANCE SCHEDULE	NOTES	RESPONSIBLE PARTY
Remove litter.	Prior to mowing	Dispose of litter at an approved facility.	Road Crew
Mow/trim.	3x per growing season, or to ensure: <ul style="list-style-type: none"> <li>• safety</li> <li>• aesthetics (compatibility with surroundings)</li> <li>• proper swale operation</li> <li>• suppression of weeds and invasive vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• Mow more frequently in locations along roads where vegetation height impedes driver's line of sight.</li> <li>• Maintain vegetation height at least equal to design flow depth (6-inch minimum if design depth if unknown).</li> <li>• Dispose of clippings at a composting facility.</li> <li>• Mow when swale is dry to avoid rutting.</li> </ul>	Road Crew
Clear inlet and discharge obstructions.	In conjunction with mowing	<ul style="list-style-type: none"> <li>• Remove obstructing debris, litter, or sediment from swale inlet and discharge.</li> <li>• Dispose of material at an approved facility or composting center, as appropriate.</li> </ul>	Road Crew
Plant salt-tolerant vegetation.	As needed		Contractor-Design Engineer
Water.	Weekly during establishment period and during periods of drought		Road Crew
Apply fertilizer, pesticides, and herbicides.	Apply only when absolutely necessary		Road Crew
Use nontoxic, organic deicing agents, applied either as blended magnesium chloride-based liquid or as pretreated salt.	As required for winter weather event		Road Crew
CORRECTIVE MAINTENANCE ACTIVITY <sup>1,2</sup>	MAINTENANCE SCHEDULE	NOTES	RESPONSIBLE PARTY
Remove accumulated sediment, debris, and winter road treatment residuals.	1x annually (minimum) in the spring after snow melt and any other time accumulation depth >3 inches or buried vegetation is discovered	Dispose of material at an approved facility.	Road Crew
Correct erosion problems including rill and gully formation. Reseed bare areas. Install erosion-control measures.	As needed		Road Crew
Replace damaged, dead, or missing plants. Use alternative species, if warranted.	As needed		Road Crew
Dewater pools of water standing for more than 48 hours after rain event. Discharge to an approved location and restore design grade.	As needed		Road Crew
Correct irregularities in cross section and longitudinal slope. Reestablish design grades and configuration.	As needed		Road Crew
Repair check dams exhibiting channelization, obstructions, erosion, etc.	As needed		Road Crew
Restore soil structure through aeration, rototilling, mulching, or amendment.	As needed		Road Crew
1. Follow protocols for scheduling prompt repair of minor deficiencies upon discovery 2. Establish schedule for significant repairs for publication in Annual Report			





## **APPENDICES**

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**APPENDIX A -  
COPY OF PUBLIC NOTICE  
AND PROOF OF PUBLICATION**

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# PROOF OF PUBLICATION

State of Pennsylvania, County of Cumberland

Kimberly Kamowski, Print Sales & Marketing Manager, of The Sentinel, of the County and State aforesaid, being duly sworn, deposes and says that THE SENTINEL, a newspaper of general circulation in the Borough of Carlisle, County and State aforesaid, was established December 13<sup>th</sup>, 1881, since which date THE SENTINEL has been regularly issued in said County, and that the printed notice or publication attached hereto is exactly the same as was printed and published in the regular editions and issues of THE SENTINEL on the following day(s):

July 17, 2017


## COPY OF NOTICE OF PUBLICATION

### NOTICE

A copy of the Middlesex Township Combined Pollutant Reduction Plan (the "Plan") for the Chesapeake Bay Basin, Wertz Run and Hogestown Run is available for public review and comment at the offices of Middlesex Township, 350 North Middlesex Road, Carlisle, PA 17013 beginning July 18, 2017 through and including August 18, 2017 weekdays, during regular business hours of 8:00 a.m. to 4:00 p.m. The Plan is also available for review beginning July 18, 2017 at the Middlesex Township website at <http://middlesextwp.com/>. The Plan describes the MS4 regulated Middlesex Township areas, applicable surface waters and pollutants of concern, targeted Chesapeake Bay basin pollution reduction targets, pollution reduction targets for surface waters impaired by sediment and nutrients, HUC 12 watersheds and subject surface waters, Chesapeake Bay pollutant loads, impaired surface water pollutant loads, and proposed BMP projects. Comments are requested to be placed in writing and submitted to Middlesex Township at the office address above no later than August 18, 2017. The proposed adoption of the Plan by the Board of Supervisors will be considered at a public meeting on August 25, 2017 at 7:30 a.m. during the Supervisors' regularly scheduled workshop meeting, at which time public comment concerning the Plan will also be accepted.

Eileen Gault, Manager and Secretary, Middlesex Township

Affiant further deposes that he/she is not interested in the subject matter of the aforesaid notice or advertisement, and that all allegations in the foregoing statement as to time, place and character of publication are true.



Sworn to and subscribed before me this

19<sup>th</sup> day of July 2017

Bethany M. Holby  
Notary Public

My commission expires:

COMMONWEALTH OF PENNSYLVANIA  
NOTARIAL SEAL  
Bethany M. Holby, Notary Public  
Carlisle Boro, Cumberland County  
My Commission Expires Sept. 26, 2019  
MEMBER, PENNSYLVANIA ASSOCIATION OF NOTARIES

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**APPENDIX B -  
MS4 MAP LAYERS AND DATA SOURCES**

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**MIDDLESEX TOWNSHIP**  
MS4 Map Layers and Data Sources

<b>LAYER</b>	<b>SOURCE</b>
2010 Urbanized Area	PA DEP (Referenced to US Census Bureau)
Basemap	Microsoft Bing Aerial photography
BMP -Existing	Skelly and Loy, Inc.
Discharge Point	Skelly and Loy, Inc.
Discharge Point Other	Skelly and Loy, Inc.
Elevation Data (contours)	PA DCNR
Flow Arrows	Skelly and Loy, Inc.
Inlets	Middlesex Township, Skelly and Loy, Inc.
Inlets - Other	Middlesex Township, Skelly and Loy, Inc.
Intake Points	Middlesex Township, Skelly and Loy, Inc.
Intake Points-Other	Middlesex Township, Skelly and Loy, Inc.
Lakes	Pennsylvania Fish and Boat Commission
Manholes	Middlesex Township, Skelly and Loy, Inc.
Middlesex Township Governance Boundary	Cumberland County Tax Maps
Municipal Boundary	Penn DOT
NWI (Wetlands)	US Fish and Wildlife Service
Observation Points	Skelly and Loy, Inc.
Outfall - Impaired	Middlesex Township, Skelly and Loy, Inc.
Outfall - Unimpaired	Middlesex Township, Skelly and Loy, Inc.
Parcels	Cumberland County GIS
Pipes	Middlesex Township, Skelly and Loy, Inc.
Pipes-Other	Middlesex Township, Skelly and Loy, Inc.
Planning Area	Skelly and Loy, Inc.
Proposed Bioretention/Rain Garden	Skelly and Loy, Inc.
Proposed Drainage Area	Skelly and Loy, Inc.
Proposed Stream Restoration	Skelly and Loy, Inc.
Proposed Vegetated Open Channel	Skelly and Loy, Inc.
Rain Traces	Skelly and Loy, Inc.
Storm Sewershed - Impaired	Skelly and Loy, Inc.
Storm Sewershed - Unimpaired	Skelly and Loy, Inc.
Stream	PA DEP
Stream Impaired	PA DEP
Surface Water Conveyance	Middlesex Township, Skelly and Loy, Inc.

1. The projection of information shown on the Maps is NAD 1983 State Plane Pennsylvania South US Feet



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**APPENDIX C -  
PROPERTIES WITH INDIVIDUAL  
CHAPTER 102 NPDES PERMITS**

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**PROPERTIES WITH INDIVIDUAL CHAPTER 102 NPDES PERMITS**

(PCSM reviewed by County Conservation District)

<b>SITE NAME</b>	<b>PERMITTEE</b>	<b>DESCRIPTION</b>	<b>PERMIT NUMBER</b>	<b>ISSUE DATE</b>	<b>PARSED</b>
<b>Blue Beacon of PA Truck Wash</b>	Blue Beacon Intl		PAI032111003	9/20/2011	Y
<b>Camping World Subdivision</b>	KTJ LP One Hundred Eighty	Camping World Subdivision NSD SF	PAI032108009	8/24/2012	N
<b>Carlisle Barracks HQ</b>	US Army Carlisle Barracks	Army Heritage Ed Center E&S SF	PAI032108018	7/8/2009	N
<b>Carlisle Barracks HQ</b>	US Army Carlisle Barracks	Carlisle Barracks Development Construction	N/A	4/2/2007	N
<b>Carlisle Barracks HQ</b>	US Army Carlisle Barracks		PAI032106010	4/3/2007	N
<b>Carlisle Barracks HQ</b>	US Army Carlisle Barracks	Carlisle Barracks 150 Youth Center	PAI032111002	6/20/2012	N
<b>Carlisle Barracks HQ</b>	US Army Carlisle Barracks		PAI032106010R	10/17/2012	N
<b>Carlisle Barracks HQ</b>	US Army Carlisle Barracks	Carlisle Barracks 150 Youth Center	PAI032111002	3/21/2013	N
<b>Carlisle Barracks HQ</b>	US Army Carlisle Barracks	Carlisle Barracks Project	PAI032113001	10/9/2013	N
<b>Carlisle Barracks HQ</b>	US Army Carlisle Barracks		PAI032108018R	7/16/2015	N
<b>Carlisle Moose Lodge 761 Development</b>	Carlisle Moose Lodge 761	New Lodge	PAI032112003	4/13/2013	N
<b>Carlisle Sports Emporium Entertainment and Amusement Facility</b>	Carlisle Sports Emporium Inc	Sports Complex Center Go Kart Track Batting Cages Facility	PAI032112001	1/31/2013	Y
<b>Comfort Inn - Carlisle</b>	Rostan Associates	Comfort Inn - Carlisle Project	PAI032113003	1/6/2014	Y
<b>Cumberland County Maintenance Garage</b>	PA DGS	993018 PennDOT Maintenance Facility NSD SF	PAI032109001	1/8/2010	Y
<b>Cumberland County Prison</b>	Cumberland County	Cumberland County Prison Expansion Project	PAI032108001	6/16/2008	N
<b>Eastbound 103</b>	Pennsylvania Turnpike Commission	Public Road Construction	PAI032115006	6/1/2016	N
<b>Hardees Restaurant</b>	Restaurant Management Corp	Commercial or Industrial Development	PAI032115005	9/1/2016	Y
<b>Holiday Inn Express &amp; Suites</b>	Rays Hospitality LLC	Holiday Inn Express & Suites Dev	PAI032111008	6/4/2012	Y



**PROPERTIES WITH INDIVIDUAL CHAPTER 102 NPDES PERMITS**  
(PCSM reviewed by County Conservation District)

<b>SITE NAME</b>	<b>PERMITTEE</b>	<b>DESCRIPTION</b>	<b>PERMIT NUMBER</b>	<b>ISSUE DATE</b>	<b>PARSED</b>
<b>Kensington Res Subdivision</b>	KABRO of Middlesex LLC	Kensington Residential Subdivision Project Development	PAI032107003	Withdrawn	N/A
<b>Keystone Arms Development</b>	Keystone Arms LLC		PAI032114008	5/27/2015	Y
<b>Liberty At Middlesex</b>	Liberty Prop LP	Liberty at Middlesex Project	PAI032116004	3/28/2017	Y
<b>Pine Hill Industrial Park - PHI Lot 6A</b>	Lutz David W & June B Irrevocable Trust	Tex Visions At Pine Hill Lot 6a	PAI032111004	3/30/2012	Y
<b>PPL Carlisle Area 69KV</b>	PPL Elec Utilities Corp	PPL Carlisle Area 69KV Upgrades	PAD210004	3/27/2017	N
<b>Public Safety Building &amp; Coroners Office</b>	Cumberland County	Public Safety Bldg & Coroners Office NSD SF (Army Heritage Refurbish Center)	PAI032108016	8/3/2009	N
<b>Roadway Harrisburg Breakbulk Facility</b>	YRC Inc.	Roadway Hbg Breakbulk Facility NSD SF	PAI032108008	Withdrawn	N/A
<b>Rutters Farm Store 64</b>	CHR Corporation	Rutters Farm Store 64 NSD SF	PAI032108002	7/31/2008	Y
<b>Sheetz Store Middlesex Twp</b>	Sheetz Inc	Proposed Sheetz Store Middlesex Twp	PAI032116002	Pending	N
<b>Toigo Organic Farms LLC</b>	Toigo Organic Farms Inc	Toigo Organic Farms LLC Project	PAI032114001	4/3/2014	Y
<b>Toigo Organic Farms LLC</b>	Toigo Organic Farms Inc	Toigo Organic Farms LLC Construction	PAI032114001(1)	2/23/2015	



**APPENDIX D -  
MAPSHED URBAN AREA TOOL RESULTS**

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## **D1 - HUC Watershed Total**

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Watershed Totals

Municipality Loads

Regulated Loads

Unregulated Loads

**GWLf-E Average Loads by Source for Watershed 154**

Wertz Run - Conodoguinent Creek  
HUC Watershed Total

Source	Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	7480	493703.19	66.00	4294.01	0.57	1255.97	0.17
Cropland	3403	2722356.20	800.00	15552.29	4.57	2590.37	0.76
Forest	8535	125354.84	14.70	1069.59	0.13	128.97	0.02
Wetland	316	970.03	3.10	54.34	0.17	3.42	0.01
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	195	4938.35	25.30	85.32	0.44	10.21	0.05
Open Land	1552	162943.66	105.00	1539.07	0.99	135.87	0.09
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	714	9876.71	13.80	244.03	0.34	26.46	0.04
MD Mixed	608	38933.64	64.00	809.23	1.33	89.88	0.15
HD Mixed	534	34171.65	64.00	710.55	1.33	78.93	0.15
LD Residential	1488	20569.13	13.80	508.32	0.34	55.09	0.04
MD Residential	1292	82761.53	64.10	1720.44	1.33	191.07	0.15
HD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
Water	451.786749						
<b>Farm Animals</b>				0.0		0.0	
<b>Tile Drainage</b>		0.0		0.0		0.0	
<b>Stream Bank</b>		6900210.9		3450.2		1181.7	
<b>Groundwater</b>				107322.7		1181.5	
<b>Point Sources</b>				0.0		0.0	
<b>Septic Systems</b>				11534.8		0.0	
<b>Totals</b>	<b>26569</b>	<b>10596790</b>		<b>148895</b>		<b>6929</b>	

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Watershed Totals

Municipality Loads

Regulated Loads

Unregulated Loads

**GWLF-E Average Loads by Source for Watershed 144**

Letort Spring Run  
HUC Watershed Total

Source	Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	2002	152824.44	76.30	1190.50	0.59	348.40	0.17
Cropland	3548	3124457.32	880.60	16789.57	4.73	2877.85	0.81
Forest	1107	8487.80	7.70	123.19	0.11	11.38	0.01
Wetland	77	110.23	1.40	22.99	0.30	1.28	0.02
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	195	6393.41	32.80	223.99	1.15	23.32	0.12
Open Land	746	59987.78	80.40	703.36	0.94	52.45	0.07
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	640	8421.66	13.20	218.70	0.34	23.92	0.04
MD Mixed	1974	132255.31	67.00	2832.63	1.43	307.54	0.16
HD Mixed	1268	84900.02	67.00	1818.70	1.43	197.47	0.16
LD Residential	400	5269.05	13.20	136.80	0.34	14.97	0.04
MD Residential	1772	118674.84	67.00	2541.93	1.43	276.00	0.16
HD Residential	217	14572.56	67.20	311.98	1.44	33.86	0.16
Water	7.78674900						
<b>Farm Animals</b>				0.0		0.0	
<b>Tile Drainage</b>		0.0		0.0		0.0	
<b>Stream Bank</b>		1645177.6		822.3		280.0	
<b>Groundwater</b>				45075.8		502.3	
<b>Point Sources</b>				0.0		0.0	
<b>Septic Systems</b>				4505.1		0.0	
<b>Totals</b>	<b>13954</b>	<b>5361532</b>		<b>77318</b>		<b>4951</b>	

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Watershed Totals

Municipality Loads

Regulated Loads

Unregulated Loads

**GWLF-E Average Loads by Source for Watershed 143**

Hogestown Run  
HUC Watershed Total

Source	Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	2938	166493.10	56.70	1631.82	0.56	515.48	0.18
Cropland	3786	3069407.89	810.70	17384.13	4.59	3225.21	0.85
Forest	840	4012.41	4.80	88.63	0.11	7.32	0.01
Wetland	47	132.28	2.80	14.22	0.30	0.84	0.02
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	116	1455.05	12.50	128.55	1.11	13.87	0.12
Open Land	724	56306.06	77.80	678.65	0.94	54.56	0.08
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	334	4607.66	13.80	114.00	0.34	12.35	0.04
MD Mixed	764	50970.87	66.70	1096.40	1.44	118.26	0.15
HD Mixed	479	32011.12	66.80	688.35	1.44	74.25	0.16
LD Residential	684	9457.83	13.80	233.89	0.34	25.35	0.04
MD Residential	630	42064.20	66.80	904.80	1.44	97.60	0.15
HD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
Water	7.86047092						
<b>Farm Animals</b>				0.0		0.0	
<b>Tile Drainage</b>		0.0		0.0		0.0	
<b>Stream Bank</b>		763429.9		381.4		145.5	
<b>Groundwater</b>				44442.1		424.1	
<b>Point Sources</b>				0.0		0.0	
<b>Septic Systems</b>				5323.2		0.0	
<b>Totals</b>	<b>11350</b>	<b>4200348</b>		<b>73110</b>		<b>4715</b>	

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**D2 - Planning Area Load:  
Initial Existing Load**

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Watershed Totals

**Municipality Loads**

Regulated Loads

Unregulated Loads

View loads for municipality:

Middlesex Twp (49072)

Wertz Run - Conodoguinent Creek  
Planning Area Load- Initial

Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	203	13398.00	66.00	115.70	0.57	34.50	0.17
Cropland	22	17600.00	800.00	100.50	4.57	16.70	0.76
Forest	44	646.80	14.70	5.70	0.13	0.90	0.02
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	40	4200.00	105.00	39.60	0.99	3.60	0.09
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	25	345.00	13.80	8.50	0.34	1.00	0.04
MD Mixed	49	3136.00	64.00	65.20	1.33	7.40	0.15
HD Mixed	12	768.00	64.00	16.00	1.33	1.80	0.15
LD Residential	44	607.20	13.80	15.00	0.34	1.80	0.04
MD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
Water	0						
							<b>Source Weighting</b>
<b>Farm Animals</b>				0.0		0.0	0.000
<b>Tile Drainage</b>		0.00		0.0		0.0	0.000
<b>Stream Bank</b>		140325.39		70.2		24.0	0.026
<b>Groundwater</b>				2468.4		27.2	0.023
<b>Point Sources</b>				0.0		0.0	0.000
<b>Septic Systems</b>				346.0		0.0	0.030
<b>Totals</b>	<b>439</b>	<b>181026.4</b>		<b>3250.8</b>		<b>118.9</b>	

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Watershed Totals

**Municipality Loads**

Regulated Loads

Unregulated Loads

View loads for municipality:

Middlesex Twp (49072)

Letort Spring Run  
Planning Area Load- Initial

Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	292	22279.60	76.30	172.30	0.59	49.60	0.17
Cropland	687	604972.20	880.60	3249.50	4.73	556.50	0.81
Forest	84	646.80	7.70	9.20	0.11	0.80	0.01
Wetland	7	9.80	1.40	2.10	0.30	0.10	0.02
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	15	492.00	32.80	17.30	1.15	1.80	0.12
Open Land	101	8120.40	80.40	94.90	0.94	7.10	0.07
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	96	1267.20	13.20	32.60	0.34	3.80	0.04
MD Mixed	724	48508.00	67.00	1035.30	1.43	115.80	0.16
HD Mixed	131	8777.00	67.00	187.30	1.43	21.00	0.16
LD Residential	111	1465.20	13.20	37.70	0.34	4.40	0.04
MD Residential	109	7303.00	67.00	155.90	1.43	17.40	0.16
HD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
Water	0						
<b>Farm Animals</b>				0.0		0.0	0.000
<b>Tile Drainage</b>		0.00		0.0		0.0	0.000
<b>Stream Bank</b>		278606.36		139.3		47.4	0.170
<b>Groundwater</b>				8203.8		91.4	0.182
<b>Point Sources</b>				0.0		0.0	0.000
<b>Septic Systems</b>				1252.4		0.0	0.278
<b>Totals</b>	<b>2357</b>	<b>982447.6</b>		<b>14589.6</b>		<b>917.1</b>	

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Watershed Totals

**Municipality Loads**

Regulated Loads

Unregulated Loads

View loads for municipality:

Middlesex Twp (49072)

Hogestown Run  
Planning Area Load- Initial

Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	12	680.40	56.70	6.70	0.56	2.20	0.18
Cropland	5	4053.50	810.70	23.00	4.59	4.30	0.85
Forest	2	9.60	4.80	0.20	0.11	0.00	0.00
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	2	155.60	77.80	1.90	0.94	0.20	0.08
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Residential	10	138.00	13.80	3.40	0.34	0.40	0.04
MD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
Water	0						
<b>Farm Animals</b>				0.0		0.0	0.000
<b>Tile Drainage</b>		0.00		0.0		0.0	0.000
<b>Stream Bank</b>		1596.81		0.8		0.3	0.001
<b>Groundwater</b>				133.3		1.3	0.003
<b>Point Sources</b>				0.0		0.0	0.000
<b>Septic Systems</b>				74.5		0.0	0.014
<b>Totals</b>	<b>31</b>	<b>6633.9</b>		<b>243.8</b>		<b>8.7</b>	

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**D3 - Parsing Adjusted Load  
(Required for Hogestown)**

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Watershed Totals

Municipality Loads

**Regulated Loads**

Unregulated Loads

Alter regulated loads for municipality:

Middlesex Twp (49072)

Wertz Run - Conodoguinent Creek  
Planning Area w/o add'l adjustment

Source	Source Area (ac)	Percent Regulated	Regulated Area (ac) and Loads (lb)			
			Area	Sediment	Nitrogen	Phosphorus
Hay/Pasture	203	100	203.0	13398.00	115.70	34.50
Cropland	22	100	22.0	17600.00	100.50	16.70
Forest	44	100	44.0	646.80	5.70	0.90
Wetland	0	100	0.0	0.00	0.00	0.00
Disturbed	0	100	0.0	0.00	0.00	0.00
Turfgrass	0	100	0.0	0.00	0.00	0.00
Open Land	40	100	40.0	4200.00	39.60	3.60
Bare Rock	0	100	0.0	0.00	0.00	0.00
Sandy Areas	0	100	0.0	0.00	0.00	0.00
Unpaved Roads	0	100	0.0	0.00	0.00	0.00
LD Mixed	25	100	25.0	345.00	8.50	1.00
MD Mixed	49	100	49.0	3136.00	65.20	7.40
HD Mixed	12	100	12.0	768.00	16.00	1.80
LD Residential	44	100	44.0	607.20	15.00	1.80
MD Residential	0	100	0.0	0.00	0.00	0.00
HD Residential	0	100	0.0	0.00	0.00	0.00
Water	0					
<b>Farm Animals</b>		100			0.00	0.00
<b>Tile Drainage</b>		100		0.00	0.00	0.00
<b>Stream Bank</b>		100		140325.39	70.20	24.00
<b>Groundwater</b>		100			2468.40	27.20
<b>Point Sources</b>		100			0.00	0.00
<b>Septic Systems</b>		100			346.00	0.00
<b>Totals</b>	<b>439</b>		<b>439</b>	<b>181026.4</b>	<b>3250.8</b>	<b>118.9</b>

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Select input data file: C:\MapShed\Runfiles\20170530MDSX\Output\Letort\_144-144\_ua.csv



Watershed Totals

Municipality Loads

**Regulated Loads**

Unregulated Loads

Alter regulated loads for municipality:

Middlesex Twp (49072)

Letort Spring Run  
Planning Area w/o add'l adjustment

Source	Source Area (ac)	Percent Regulated	Regulated Area (ac) and Loads (lb)			
			Area	Sediment	Nitrogen	Phosphorus
Hay/Pasture	292	100	292.0	22279.60	172.30	49.60
Cropland	687	100	687.0	604972.20	3249.50	556.50
Forest	84	100	84.0	646.80	9.20	0.80
Wetland	7	100	7.0	9.80	2.10	0.10
Disturbed	0	100	0.0	0.00	0.00	0.00
Turfgrass	15	100	15.0	492.00	17.30	1.80
Open Land	101	100	101.0	8120.40	94.90	7.10
Bare Rock	0	100	0.0	0.00	0.00	0.00
Sandy Areas	0	100	0.0	0.00	0.00	0.00
Unpaved Roads	0	100	0.0	0.00	0.00	0.00
LD Mixed	96	100	96.0	1267.20	32.60	3.80
MD Mixed	724	100	724.0	48508.00	1035.30	115.80
HD Mixed	131	100	131.0	8777.00	187.30	21.00
LD Residential	111	100	111.0	1465.20	37.70	4.40
MD Residential	109	100	109.0	7303.00	155.90	17.40
HD Residential	0	100	0.0	0.00	0.00	0.00
Water	0					
<b>Farm Animals</b>		100			0.00	0.00
<b>Tile Drainage</b>		100		0.00	0.00	0.00
<b>Stream Bank</b>		100		278606.36	139.30	47.40
<b>Groundwater</b>		100			8203.80	91.40
<b>Point Sources</b>		100			0.00	0.00
<b>Septic Systems</b>		100			1252.40	0.00
<b>Totals</b>	<b>2357</b>		<b>2357</b>	<b>982447.6</b>	<b>14589.6</b>	<b>917.1</b>

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Watershed Totals

Municipality Loads

**Regulated Loads**

Unregulated Loads

Alter regulated loads for municipality:

Middlesex Twp (49072)

Hogestown Run  
Planning Area w/ add'l adjustment

Source	Source Area (ac)	Percent Regulated	Regulated Area (ac) and Loads (lb)			
			Area	Sediment	Nitrogen	Phosphorus
Hay/Pasture	12	0	0.0	0.00	0.00	0.00
Cropland	5	0	0.0	0.00	0.00	0.00
Forest	2	100	2.0	9.60	0.20	0.00
Wetland	0	0	0.0	0.00	0.00	0.00
Disturbed	0	0	0.0	0.00	0.00	0.00
Turfgrass	0	0	0.0	0.00	0.00	0.00
Open Land	2	0	0.0	0.00	0.00	0.00
Bare Rock	0	0	0.0	0.00	0.00	0.00
Sandy Areas	0	0	0.0	0.00	0.00	0.00
Unpaved Roads	0	0	0.0	0.00	0.00	0.00
LD Mixed	0	0	0.0	0.00	0.00	0.00
MD Mixed	0	0	0.0	0.00	0.00	0.00
HD Mixed	0	0	0.0	0.00	0.00	0.00
LD Residential	10	25	2.5	34.50	0.85	0.10
MD Residential	0	0	0.0	0.00	0.00	0.00
HD Residential	0	0	0.0	0.00	0.00	0.00
Water	0					
<b>Farm Animals</b>		0			0	0
<b>Tile Drainage</b>		0		0	0	0
<b>Stream Bank</b>		15		239.52	0.12	0.05
<b>Groundwater</b>		0			0	0
<b>Point Sources</b>		0			0	0
<b>Septic Systems</b>		0			0.00	0.00
<b>Totals</b>	<b>31</b>		<b>5</b>	<b>283.6</b>	<b>1.2</b>	<b>0.2</b>

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**APPENDIX E -  
EXISTING BMPs FOR  
POLLUTANT LOAD REDUCTION CREDIT**

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**EXISTING BMPs FOR POLLUTANT LOAD REDUCTION CREDIT  
LETORT SPRING RUN WATERSHED**

BMP ID	Latitude	Longitude	Permit Number (if Applicable)	Year Constructed	Facility Type	Planning Area Treated (Ac)	Sediment Reduction (lb/year)	Phosphorus Load Reduction (lb/year)	Nitrogen Load Reduction (lb/year)	Serves Designed Function	O&M Activities	O&M Frequency
Pine Hill Sports Center	N40° 13' 26"	W77° 09' 48"	Unknown	1996(1)	Dry Detention Basin	8.1	337.63	0.32	2.51	Yes	Per Storm Agreement	Annually @ Min.
Pine Hill Industrial Park Lot 1	N40° 13' 26"	W77° 09' 48"	Unknown	1991(2)	Dry Detention Basin	20.7	862.82	0.81	6.41	Yes	Per Storm Agreement	Annually @ Min.
Sheetz (1098 Harrisburg Pk)	N40° 13' 20"	W77° 09' 46"	Unknown	1991(2)	Dry Detention Basin	21.8	908.67	0.85	6.75	Yes	Per Storm Agreement	Annually @ Min.
Harmony Hall Court	N40° 13' 13"	W77° 09' 36"	Unknown	1995(1)	Dry Detention Basin	7.5	312.62	0.29	2.32	Yes		
Former Turkey Hill	N40° 13' 16"	W77° 09' 44"	Unknown	<2003(3)	Dry Detention Basin	4.6	191.74	0.18	1.42	Yes	Per Storm Agreement	Annually @ Min.
Best Western	N40° 13' 36"	W77° 09' 01"	PAR803674 (PAG-03)	2005(3)	Dry Detention Basin	4.8	200.07	0.19	1.49	Yes		
Flying J	N40° 14' 10"	W77° 07' 30"	PAR803674 (PAG-03)	1993(3)	Extended Detention	63.1	15,780.85	4.91	78.12	Yes	Per Storm Agreement	Annually @ Min.
Old Dominion	N40° 14' 25"	W77° 07' 08"	PAR803562 (PAG-03)	<1994(3)	Wet Pond	11.9	2,976.10	2.08	14.73	Yes	Per PAG-03	Semi-Annual @ Min.
Old Dominion	N40° 14' 31"	W77° 06' 70"	PAR803562 (PAG-03)	<1994(3)	Extended Detention	193.3	48,342.92	15.04	239.30	Yes	Per PAG-03	Semi-Annual @ Min.
ABF Freight	N40° 14' 21"	W77° 06' 36"	PAR803562 (PAG-03)	1996(2)	Dry Detention Basin	20	833.64	0.78	6.19	Yes	Per PAG-03	Semi-Annual @ Min.
ABF Freight	N40° 14' 16"	W77° 06' 41"	Unknown	1996(2)	Dry Detention Basin	15.5	646.07	0.60	4.80	Yes	Per PAG-03	Semi-Annual @ Min.
ABF Freight	N40° 14' 15"	W77° 06' 31"	Unknown	1996(2)	Dry Detention Basin	33.4	1,392.18	1.30	10.34	Yes	Per PAG-03	Semi-Annual @ Min.
PA Keenland	N40° 14' 16"	W77° 06' 48"	Unknown	<1994(3)	Dry Detention Basin	39.9	1,663.12	1.55	12.35	Yes		
PA Keenland	N40° 14' 06"	W77° 06' 51"	PAR803610 (PAG-03)	<1994(3)	Dry Detention Basin	11.6	483.51	0.45	3.59	Yes	Per PAG-03	Semi-Annual @ Min.
Heartland Equipment	N40° 14' 20"	W77° 06' 57"	PAR803610 (PAG-03)	<1999(3)	Dry Detention Basin	6.1	254.26	0.24	1.89	Yes	Per PAG-03	Semi-Annual @ Min.
Yellow Freight-Roadway	N40° 13' 44"	W77° 07' 48"	PAR803610 (PAG-03)	Between 1982-1993(3)	Extended Detention	122.9	30,736.40	9.56	152.15	Yes	Per PAG-03	Semi-Annual @ Min.
Yellow Freight-Roadway	N40° 13' 43"	W77° 06' 60"	PAR803610 (PAG-03)	Between 1982-1993(3)	Dry Detention Basins	5	208.41	0.19	1.55	Yes	Per PAG-03	Semi-Annual @ Min.
Roadway Drive Lots #5&6	N40° 13' 46"	W77° 06' 43"	Unknown	<1995(3)	Dry Detention Basin	27.1	1,129.59	1.05	8.39	Yes	Per PAG-03	Semi-Annual @ Min.
<b>TOTAL</b>						<b>617.3</b>	<b>107,260.60</b>	<b>40.40</b>	<b>554.27</b>			



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**APPENDIX F -  
BMP COST AND REDUCTION ANALYSIS  
SPREADSHEETS**

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## **BMP COST AND REDUCTION ANALYSIS SPREADSHEET DESCRIPTION**

### **User Input**

User input in the Spread Sheet includes the following data fields

- Watershed Name
- HUC 12 Code
- MS4 Area (refers to the planning area within the watershed)
- BMP ID
- BMP Latitude
- BMP Longitude
- Map Page
- Anticipated Construction Year
- BMP Options (from a pull down menu matching the list of BMPs on PA DEP 3800-PM-BCW0100m) date 5/2016)
- Quantity (Linear feet for stream Restoration Treated Acres for all others)

### **Pollutant Reduction Calculations**

The spread sheet produces the pollutant loading rates under the heading “Load Rate (lbs/ac/yr)” using the MapShed-generated pollutant load for the regulated planning area as reported on the Urban Tool summary sheets. MapShed has already calculated pollutant load generation proportioned to the regulated planning area land uses. For sediment loading, MapShed includes the sediment load from streambank erosion as well.

MapShed’s composite sediment loading rate is applied to the BMPs contributory drainage area to generate sediment load flowing into the proposed BMP and sediment reduction efficiencies are subsequently applied to generate achieved load reductions. The consistent use of MapShed generated loading rates ensures that pollutant load computations for existing condition and treated-acre loads are consistent and spread sheet results remain analogous to MapShed.

### **Cost Estimation**

Estimates were derived from the referenced Pennsylvania unit prices in the BayFAST web-based pollutant reduction model and adjusted from 2010 to 2017 values using the US Inflation Calculator ([www.usinflationcalculator.com](http://www.usinflationcalculator.com)).

The following paragraph from the BayFAST Help for “Costs” provides the program’s base assumptions.

“All default costs are in 2010 dollars. Capital and opportunity costs are amortized and added to annual operations and maintenance (O&M) costs for a total annualized cost. Interest rate for capital and opportunity cost is 5%. Costs are those incurred by both public and private entities. Costs are not accumulated over time, but are a single year of cost.”

BayFAST Unit prices are offered in terms of linear feet for Stream Restoration and in treated acres for all other BMPs, so application of the pricing was straightforward multiplication for the various price categories.

Modifications to the BayFAST spread sheet include the following:

- BMP Names used in BayFAST were cross-walked to match the list of BMPs on PA DEP 3800-PM-BCW0100m) date 5/2016
- Unit price for infiltration BMPs with underdrain that BayFAST identified as the same price as the same BMPs without underdrain were increased to include the cost of underdrain installation
- A factor of 111.7% was applied per the US Inflation Calculator ([www.usinflationcalculator.com](http://www.usinflationcalculator.com)) to increase the 2010 prices to 2017 values.

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## **F1 - Chesapeake Bay Basin Summary**

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## CHESAPEAKE BAY BASIN BMP COST AND REDUCTION ANALYSIS SUMMARY

**BMP Reduction Analysis Table**

Current Condition Baseline		PTC MS4 Area (ac.)	Min. Req'd Loading Reduction (%)	Minimum Req'd Loading Reduction (lbs/yr)	Proposed BMP Reductions	
Pollutant	Lbs.				BMP Load Reduction (lbs/yr)	Reduction remaining (-) Over reduction (+)
Sediment	1,056,497	2,801	10%	105,650	106,215	+565
Phosphorus	996		5%	50		
Nitrogen	17,287		3%	519		

**BMP Cost Analysis Table**

Total Capital Cost	Annual Capital Cost Budget/ Year for 5 years	Total O&M Cost	Total Opportunity Cost	Total Annualized Cost
\$1,165,117.68	\$233,023.54	\$35,836.59	\$48,344.76	\$119,265.04

**Proposed BMPs Table**

BMP Options	Number of Treated Acres
Bioretention / Raingarden (A/B soils w/ underdrain)	1.6
Vegetated Open Channels (C/D Soils)	62.9
Vegetated Open Channels (A/B Soils)	19.9
Stream Restoration	760.0



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## **F2 - Watershed Summary**

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**MIDDLESEX TOWNSHIP  
BMP COST AND REDUCTION ANALYSIS WATERSHED SUMMARY**

Watershed	MS4 Area (Acres)	Current Condition Baseline		Minimum Required Loading Reduction (%)	Minimum Required Loading Reduction (lbs/yr)	Proposed BMP Reductions		Total Capital Cost	Total O&M Cost	Total Opportunity Cost	Annualized Cost on Life of BMP Basis (\$/Yr)
		Pollutant	Lbs.			BMP Sediment Load Reduction (lbs/yr)	Reduction remaining (-) Over reduction (+)				
Wertz Run-Conodoguinet Creek	439	Sediment	181,026.4	10%	18,102.64	18,280	+177	\$577,242.25	\$27,493.28	\$45,792.09	\$70,385.75
		Phosphorus	118.9	5%	5.95						
		Nitrogen	3,250.8	3%	97.52						
Letort Spring Run	2357	Sediment	875,187.0	10%	87,518.70	87,875	+357	\$573,583.07	\$7,627.88	\$1,361.06	\$47,097.87
		Phosphorus	876.7	5%	43.84						
		Nitrogen	14,035.3	3%	421.06						
Hogestown Run	5	Sediment	283.6	10%	28.36	60	+31	\$14,292.35	\$715.44	\$1,191.62	\$1,781.42
		Phosphorus	0.2	5%	0.01						
		Nitrogen	1.2	3%	0.04						





**F3 - Wertz Run-Conodoguinet  
Watershed Spreadsheet**

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**BMP COST AND REDUCTION ANALYSIS**  
Wertz Run-Conodoguinet Creek

HUC 12 Code: 20503050403

Middlesex MS4 Area (ac.): 439

Current Condition Baseline		Min. Req'd Loading Reduction (%)	Min. Req'd Loading Reduction (lbs/yr)	Load Rate (lbs/ac/yr)	Proposed BMP Reductions		Total Capital Cost	Total O&M Cost	Total Opportunity Cost	Total Annualized Cost
Pollutant	Lbs.				BMP Sediment Load Reduction (lbs/yr)	Reduction remaining (-) Over reduction (+)				
Sediment	181,026.4	10%	18,102.64	412.36	18,279.96	+177	\$577,242.25	\$27,493.28	\$45,792.09	\$70,385.75
Phosphorus	118.9	5%	5.95	0.27						
Nitrogen	3,250.8	3%	97.52	7.41						

BMP ID	BMP Latitude	BMP Longitude	Map Page	Anticipated Construction Year	BMP Options	Quantity	Units	Existing Sediment Load to BMP	Sediment Reduction (lb/year)	Capital Cost	O&M Cost	Opportunity (Lost Revenue)	Total Annualized Cost
1	N40° 15' 47"	W77° 10' 31"		2018	Vegetated Open Channels (A/B Soils)	1.7	Treated Acres	701	490.7	\$ 13,962.61	\$ 579.16	\$ 964.64	\$ 1,606.82
2	N40° 15' 49"	W77° 10' 20"		2018	Vegetated Open Channels (A/B Soils)	6.4	Treated Acres	2,639	1,847.4	\$ 52,565.13	\$ 2,180.38	\$ 3,631.59	\$ 6,049.22
3	N40° 15' 20"	W77° 09' 57"		2019	Vegetated Open Channels (A/B Soils)	11.8	Treated Acres	4,866	3,406.1	\$ 96,916.95	\$ 4,020.08	\$ 6,695.74	\$ 11,153.24
4	N40° 14' 56"	W77° 09' 51"		2019	Vegetated Open Channels (C/D Soils)	21.1	Treated Acres	8,701	4,350.4	\$ 143,604.09	\$ 7,188.45	\$ 11,972.90	\$ 17,899.07
5	N40° 14' 06"	W77° 09' 52"		2021	Vegetated Open Channels (C/D Soils)	15.4	Treated Acres	6,350	3,175.2	\$ 104,810.57	\$ 5,246.55	\$ 8,738.51	\$ 13,063.78
6	N40° 13' 48"	W77° 09' 52"		2021	Vegetated Open Channels (C/D Soils)	24.3	Treated Acres	10,020	5,010.2	\$ 165,382.91	\$ 8,278.65	\$ 13,788.69	\$ 20,613.62
<b>TOTALS</b>								<b>0 (Linear Feet)</b>	<b>18,280.0</b>	<b>\$ 577,242.25</b>	<b>\$ 27,493.28</b>	<b>\$ 45,792.09</b>	<b>\$ 70,385.75</b>
								<b>80.7 (Treated Acres)</b>					





**F4 - Letort Spring Run  
Watershed Spreadsheet**

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**BMP COST AND REDUCTION ANALYSIS**  
Letort Spring Run

HUC 12 Code: 20503050404

Middlesex MS4 Area (ac.): 2357

Current Condition Baseline		Min. Req'd Loading Reduction (%)	Min. Req'd Loading Reduction (lbs/yr)	Load Rate (lbs/ac/yr)	Proposed BMP Reductions		Total Capital Cost	Total O&M Cost	Total Opportunity Cost	Total Annualized Cost
Pollutant	Lbs.				BMP Sediment Load Reduction (lbs/yr)	Reduction remaining (-) Over reduction (+)				
Sediment	875,187.00	10%	87,518.70	371.31	87,875.28	+357	\$573,583.07	\$7,627.88	\$1,361.06	\$47,097.87
Phosphorus	876.70	5%	43.84	0.37						
Nitrogen	14,035.30	3%	421.06	5.95						

BMP ID	BMP Latitude	BMP Longitude	Map Page	Anticipated Construction Year	BMP Options	Quantity	Units	Existing Sediment Load to BMP	Sediment Reduction (lb/year)	Capital Cost	O&M Cost	Opportunity (Lost Revenue)	Total Annualized Cost
7	N40° 13' 35"	W77° 09' 36"	Anderson Park	2020	Bioretention / Raingarden (A/B soils w/ underdrain)	1.6	Treated Acres	594	475.3	\$ 26,029.67	\$ 327.16	\$ 1,361.06	\$ 2,101.13
8	N40° 13' 57"	W77° 08' 12"	Letort Spring Run	2022	Stream Restoration	760	Linear Feet	282,199	87,400.0	\$ 547,553.40	\$ 7,300.71	\$ -	\$ 44,996.74
<b>TOTALS</b>						760	(Linear Feet)	282,793	87,875.3	\$ 573,583.07	\$ 7,627.88	\$ 1,361.06	\$ 47,097.87
						1.6	(Treated Acres)						





**F5 - Hogestown Run  
Watershed Spreadsheet**

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**BMP COST AND REDUCTION ANALYSIS**  
Hogestown Run

HUC 12 Code: 20503050405

Middlesex MS4 Area (ac.): 5

Current Condition Baseline		Min. Req'd Loading Reduction (%)	Min. Req'd Loading Reduction (lbs/yr)	Load Rate (lbs/ac/yr)	Proposed BMP Reductions		Total Capital Cost	Total O&M Cost	Total Opportunity Cost	Total Annualized Cost
Pollutant	Lbs.				BMP Sediment Load Reduction (lbs/yr)	Reduction remaining (-) Over reduction (+)				
Sediment	283.6	10%	28.36	56.72	59.56	+31	\$14,292.35	\$715.44	\$1,191.62	\$1,781.42
Phosphorus	0.2	5%	0.01	0.04						
Nitrogen	1.2	3%	0.04	0.24						

BMP ID	BMP Latitude	BMP Longitude	Map Page	Anticipated Construction Year	BMP Options	Quantity	Units	Existing Sediment Load to BMP	Sediment Reduction (lb/year)	Capital Cost	O&M Cost	Opportunity (Lost Revenue)	Total Annualized Cost	
9	N40° 13' 13"	W77° 06' 12"		2019	Vegetated Open Channels (C/D Soils)	2.1	Treated Acres	119	59.6	\$ 14,292.35	\$ 715.44	\$ 1,191.62	\$ 1,781.42	
<b>TOTALS</b>								0 (Linear Feet)						
								2.1 (Treated Acres)	119	59.6	\$ 14,292.35	\$ 715.44	\$ 1,191.62	\$ 1,781.42





## **F6 - PA DEP Effectiveness Values**

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**PA DEP EFFECTIVENESS VALUES**

per  
3800-PM-BCW0100m dated 5/2016

BMP NAME	BMP EFFECTIVENESS VALUES		
	TN	TP	SEDIMENT
Wet Ponds and Wetlands	20%	45%	60%
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%
Dry Extended Detention Basins	20%	20%	60%
Infiltration Practices with Sand, Vegetation	85%	85%	95%
Filtering Practices	40%	60%	80%
Filter Strip Runoff Reduction	20%	54%	56%
Filter Strip Stormwater Treatment	0%	0%	22%
Bioretention – Raingarden (C/D soils with underdrain)	25%	45%	55%
Bioretention/Raingarden (A/B soils with underdrain)	70%	75%	80%
Bioretention/Raingarden (A/B soils without underdrain)	80%	85%	90%
Vegetated Open Channels (C/D Soils)	10%	10%	50%
Vegetated Open Channels (A/B Soils)	45%	45%	70%
Bioswale	70%	75%	80%
Permeable Pavement without Sand or Vegetation (C/D Soils with underdrain)	10%	20%	55%
Permeable Pavement without Sand or Vegetation (A/B Soils with underdrain)	45%	50%	70%
Permeable Pavement without Sand or Vegetation (A/B Soils without underdrain)	75%	80%	85%
Permeable Pavement with Sand or Vegetation (A/B Soils with underdrain)	50%	50%	70%
Permeable Pavement with Sand or Vegetation (A/B Soils without underdrain)	80%	80%	85%
Permeable Pavement with Sand or Vegetation (C/D Soils with underdrain)	20%	20%	55%
Stream Restoration (If using the PA DEP Simplified Method)	0.075 lb/ft/yr	0.068 lb/ft/yr	44.88 lb/ft/yr
Stream Restoration (If modeled at a local watershed scale) <sup>1</sup>			115 lb/ft/yr
Forest Buffers	25%	25%	50%
Tree Planting	10%	15%	20%
Street Sweeping	3%	3%	9%
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1-TN and TP concentrations

1. The proposed stream restoration was modeled at the local watershed scale



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**APPENDIX G -  
PUBLIC REVIEW COMMENTS  
AND CONSIDERATIONS**

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Public Comment Log  
for Middlesex Township'Combined PRP  
August 21, 2017



Receipt Date	Format of Comment	From	Correspondence Date	Comment	Consideration	Revision to the PRP
8/14/2017	Letter	PennFuture	8/9/2017	1. The Draft PRP improperly parses from the Planning Area 278.7 acres on properties covered by Chapter 102 NPDES Permits for discharges of stormwater associated with construction activity	<p><b>PA DEP PRP Instructions (3800-PM-BCW0100k) Rev.3/2017</b></p> <p><b>Page 5: B. Map.</b>, Figure 1, Line 11, "...except that in the Farm Creek storm sewershed one area has been parsed because this site already has NPDES permit coverage for stormwater...." (Note that the exhibit shows a small single lot in the central part of the municipality's urbanized area, not near or adjacent to an outfall, that is excluded from the planning area within sewershed B. It is surrounded on all sides by MS4 planning area.)</p> <p><b>Page10:Attachment A, Parsing Guidelines, Parsing for PRPs</b>, (1st sentence under the heading) "...and areas that are already covered by an NPDES permit."</p> <p><b>PRP Development Process Summary</b>, June 9,2017 <b>Item 7</b>, (1st sentence) "Consider parsing out areas as described in the PRP instructions, including areas which contribute flow into the system but have their own NPDES Stormwater Permit."</p>	No change
				2. The final PRP should include a BMP implementation schedule	Implementation schedule is included in Appendix F on the BMP Cost and Reduction Analysis Tables (Appendix F3, F4, and F5)	No change
				3. It would be prudent to develop alternatives to the Letort Spring Run stream restoration project	Concern is noted	No change



**PennFuture**

August 9, 2017

Eileen Gault, Manager and Secretary  
Middlesex Township  
350 North Middlesex Road  
Carlisle, PA 17013

**Re: Draft Middlesex Township Combined Pollutant Reduction Plan for the Chesapeake Bay Basin, Wertz Run and Hogestown Run, Middlesex Township, Cumberland County, Pennsylvania**

**Comments of Citizens for Pennsylvania's Future (PennFuture)**

Dear Ms. Gault:

On behalf of Citizens for Pennsylvania's Future (PennFuture) and its members, I submit these comments on Middlesex Township's Draft Combined Pollutant Reduction Plan for the Chesapeake Bay Basin, Wertz Run and Hogestown Run dated July 5, 2017 (Draft PRP).

PennFuture is a public interest membership organization dedicated to leading the transition to a clean energy economy in Pennsylvania and beyond. PennFuture strives to protect our air, water and land, and to empower citizens to build sustainable communities for future generations. One focus of PennFuture's work is to improve and protect water resources and water quality across Pennsylvania through public outreach and education, advocacy, and litigation. Middlesex Township's Draft PRP touches on two areas that have been at the heart of PennFuture's water resource protection work: the Chesapeake Bay Total Maximum Daily Load (TMDL) and its implementation; and stormwater management, including the regulation of discharges from MS4s.

PennFuture thanks Middlesex Township for making its full Draft PRP, including all of the appendices and the "MS4 Maps Binder," available on the Township's web page, which greatly facilitates public review of the plan. Although our first comment below points out what we believe to be a significant error that will require revisions to the Draft PRP, we also commend the Township and its consultants for the overall quality of the Draft PRP in both substance and presentation.

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## Comments

### **1. The Draft PRP improperly parses from the Planning Area 278.7 acres on properties covered by Chapter 102 NPDES permits for discharges of stormwater associated with construction activities.**

The Draft PRP addresses an overall (Chesapeake Bay) Planning Area of 2,800.5 acres, comprised of 4.5 acres in the Hogestown Run watershed, 2,357 acres in the Letort Springs Run watershed, and 439 acres in the Wertz Run-Conodoguinet Creek watershed. (Draft PRP, Table 9, p. 20). To determine that Planning Area, the Township began with a larger area, the “MS4 Regulated Area,” which “consists of the urbanized area [as defined in the 2010 U.S. Census] and the contributory region upgradient of the urbanized area flowing to and through the Township’s storm sewer system.” (Draft PRP, p. 4). It then deleted, or “parsed,”<sup>1</sup> at least 313.6 acres<sup>2</sup> from the MS4 Regulated Area to arrive at the 2,880.5 acres of the Planning Area. (Draft PRP, pp. 26, 30-31 & Table 15).

As listed in Table 15 on page 31 of the Draft PRP, the 313.6 acres parsed from the Planning Area fall into two categories: 1) “NPDES Permitted Sites;” and 2) “Private Developments.” The former consists of 278.7 acres at eleven facilities listed in Table 15 that are covered (or formerly were covered)<sup>3</sup> by individual NPDES permits authorizing the discharge of stormwater associated with construction activities (Chapter 102 NPDES Permits). These eleven facilities were selected from a larger set of properties covered by Chapter 102 NPDES Permits listed in Appendix C of the Draft PRP. The Draft PRP explains that the eleven sites “possess their own NPDES permit with Post-Construction Stormwater Management (PCSM) obligations and were determined to have limited potential for additional pollutant removal from the MS4-regulated area.” (Draft PRP, p. 30; *see also id.*, p. 26). The remaining 34.9 acres parsed from the Planning Area are in two “Private Developments” listed in Table 15 of the Draft PRP, which do not “contribute runoff to or through the municipal stormwater sewer collection/conveyance system.” (Draft PRP, p. 30).

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<sup>1</sup> In this context, “parsing is defined as a process in which land area is removed from a Planning Area in order to calculate the actual or target pollutant loads that are applicable to an MS4.” (PADEP, Pollutant Reduction Plan (PRP) Instructions,” 3800-PM-BCW0100k Rev. 3/2017 (PRP Instructions), Attachment A, p. 10).

<sup>2</sup> We say “at least 313.6 acres” because while Table 15, titled “Parsed Properties Excluded from Middlesex Township MS4 Planning Area,” lists a total of 313.6 acres of parsed properties, the description of the parsed properties in the text preceding Table 15 includes several varieties that are not found in the table. (Draft PRP, pp. 30-31). None of those additional varieties appears to be problematic, however, because, like the “Private Developments” discussed in the text of this comment, they are all part of a larger group of properties “entirely under private ownership that did not contribute runoff to or through the municipal stormwater sewer collection/conveyance system.” (Draft PRP, p. 30). Any property that contributes no runoff to the MS4 may be parsed from the Planning Area.

<sup>3</sup> It is unclear whether any of the Chapter 102 NPDES Permits for the eleven areas parsed from the Planning Area have been terminated. Five of those permits were issued more than five years ago, with the oldest having been issued on July 31, 2008. (Draft PRP, Appendix C).

If the 34.9 acres in the two Private Developments listed in Table 15 of the Draft PRP contribute no runoff to the Township's MS4, as the Draft PRP indicates, PennFuture agrees that they were properly parsed from the Planning Area. In contrast, it was incorrect to parse the 278.7 acres at the eleven NPDES Permitted Sites listed in Table 15.

Although they expressly mention other varieties of NPDES permits, neither the Parsing Guidelines in Attachment A of PADEP's PRP Instructions nor the discussions of parsing in the May 2016 Comment-Response Document for General NPDES Permit PAG-13 contain any reference to Chapter 102 NPDES Permits, including General NPDES Permit PAG-02. Given the pervasiveness of Chapter 102 NPDES Permits, the absence of any such reference strongly suggests that PADEP did not intend to allow coverage under Chapter 102 NPDES Permits to qualify an area for parsing.

PennFuture has confirmed with PADEP that areas covered by Chapter 102 NPDES Permits may be parsed from the Planning Area only if the stormwater from them does not enter the MS4 (in which case they are eligible for parsing regardless of their Chapter 102 NPDES Permit status).<sup>4</sup> Otherwise, such sites should be included in the Planning Area that is modeled to determine the existing pollutant load, and any *existing* stormwater BMPs at them should be accounted for in determining the existing pollutant load by calculating pollutant load reductions using the drainage area and load reduction efficiency for each BMP,<sup>5</sup> as the Draft PRP does in Section II.D.2.b. (For *proposed* BMPs, any load reductions used to satisfy the pollutant load reduction target must be discounted by the portion of the reduction required by Chapter 102.<sup>6</sup>)

The Draft PRP's parsing of the 278.7 acres at the eleven "NPDES Permitted Sites" listed in Table 15 was improper. That acreage must be included in the Planning Area and the sediment load attributable to it must be included in the existing pollutant loads (Table 16), with any sediment load reductions provided by existing BMPs at those sites accounted for by deducting them from the revised existing loads. Correcting this error will expand the 2,800.5-acre Planning Area by roughly 10% (278.7 acres), to 3,079.2 acres. The amount of the associated increase in the existing sediment loads, and thus the 10% load reduction targets, will depend on the specific HUC 12 watersheds in which the properties are located, and on any potential sediment load reduction credits available from any existing stormwater BMPs at the eleven sites.

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<sup>4</sup> PennFuture believes this same rule should apply generally: an area – whether covered by an NPDES permit or not – should be eligible for parsing from the Planning Area if and only if it does not contribute stormwater to the MS4.

<sup>5</sup> Parsing from the Planning Area acreage that drains to the MS4 has the same effect on the determination of the existing pollutant load as not parsing that acreage and assuming that all of it drains to a BMP(s) with a pollutant load reduction efficiency of 100%. Such an assumption generally would be unfounded, and so is parsing the acreage on the basis that the area is covered by a Chapter 102 NPDES Permit.

<sup>6</sup> In the context of discussing the BMPs selected to meet the MS4's pollutant load reduction target(s), the PRP Instructions state: "[A] BMP that was installed to meet Chapter 102 NPDES permit requirements for stormwater associated with construction activities may not be used to meet permit term minimum pollutant reductions unless the MS4 can demonstrate that the BMP exceeded regulatory requirements; if this is done, the MS4 may take credit for only those reductions that will occur as a result of exceeding regulatory requirements." (PRP Instructions, p. 4).



**2. The final PRP should include a BMP implementation schedule.**

Both Appendix D and Appendix E to General NPDES Permit PAG-13 provide that “[t]he BMPs proposed in the PRP<sup>7</sup> for the term of General Permit coverage shall be implemented in accordance with the schedule in the PRP.” (PAG-13, pp. 29, 30) The Draft PRP contains no schedule for completing the nine proposed projects listed in Table 19 as the sediment load reduction BMPs. The final PRP should include such an implementation schedule.

**3. It would be prudent to develop alternatives to the Letort Spring Run stream restoration project.**

The Draft PRP puts a lot of eggs in one basket, namely proposed BMP Project Number 8, a stream restoration project in the main stem of the Letort Spring Run adjacent to the Miracle Mile.<sup>8</sup> (Draft PRP, p. 39). By itself, that proposed project accounts for nearly all (99.5%) of Middlesex Township’s sediment load reductions in the Letort Spring Run watershed, and more than 82% of its MS4-wide sediment load reduction to the Chesapeake Bay. (Draft PRP, Table 19, p. 37)

PADEP recently released a set of “Considerations of Stream Restoration Projects in Pennsylvania for Eligibility as an MS4 Best Management Practice” (June 22, 2017). Based on the brief description in the Draft PRP, the proposed stream restoration project for the Letort appears to satisfy several of PADEP’s eligibility criteria, and the fact that the proposed project would essentially complete the last segment of a larger, three-segment project weighs heavily in its favor. Nevertheless, where a single project that may run into any number of roadblocks accounts for such a large share of the necessary pollutant load reductions, it is advisable to have a back-up plan. Even if alternate BMP projects cannot be identified in the final PRP submitted with the Township’s forthcoming Notice of Intent for Coverage under PAG-13, the Township should develop a list of alternate BMP projects<sup>9</sup> and add it to the PRP before the latest renewal of PAG-13 takes effect on March 16, 2018.

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<sup>7</sup> Here Appendix D uses “CBPRP” for “Chesapeake Bay Pollutant Reduction Plan.”

<sup>8</sup> The “Existing Sediment Load to BMP” for Project No. 8 is listed as 720,349 lbs/yr in Table 19 on page 37 of the Draft PRP, but is just 282,199 lbs/yr in the spreadsheet on page F-4 in Appendix F to the Draft PRP. This discrepancy does not affect the calculated sediment load reduction of 87,400 lbs/yr attributed to Project No. 8, which is identical in Table 19 and the Appendix F spreadsheet. Nevertheless, in the final PRP, either the existing sediment load figures in Table 19 and the Appendix F spreadsheet should match, or the PRP should explain why they do not.

<sup>9</sup> The draft “York County Regional Chesapeake Bay Pollutant Reduction Plan (2018-2023),” for example, includes, in its Appendix VIII, a “Shortlist” of replacement projects that would be implemented if unforeseen circumstances prevent the implementation of one or more of the selected BMP projects. That draft plan is available at: <http://www.ycpc.org/public-participation-opportunities.html>.

Thank you for your consideration of these comments. Please feel free to contact me at 717-214-7925 if you have any questions.

Sincerely,



Kurt J. Weist  
Senior Attorney

cc: Lee A. McDonnell, P.E., Director, Bureau of Clean Water, PADEP