SILVER SPRING TOWNSHIP

Chesapeake Bay Pollutant Reduction Plan

Cumberland County, Pennsylvania

May 2018

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CUMBERLAND COUNTY, PENNSYLVANIA

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INTRODUCTION

Silver Spring Township discharges stormwater to surface waters located within the Chesapeake Bay Watershed and is therefore regulated by a National Pollutant Discharge Elimination System Individual Permit to Discharge Stormwater From Small Municipal Separate Storm Sewer Systems, Appendix D (nutrients and sediment in stormwater discharges to waters in the Chesapeake Bay Watershed). The Township also has two watershed impairments regulated by an Individual Permit, Appendix E (nutrients and/or sediment in stormwater discharges to impaired waterways). This Chesapeake Bay Pollutant Reduction Plan (CBPRP) was developed in accordance with both individual permit requirements and documents how the Township intends to achieve the pollutant reduction requirements listed in the Pennsylvania Department of Environmental Protection (PADEP) Municipal MS4 Requirements Table[1].

This document was prepared following the guidance provided in the PADEP National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges from Small Municipal Separate Storm Sewer Systems Pollutant Reduction Plan (PRP) Instructions[2] .

General Information	
Permittee Name: Silver Spring Township	**NPDES Permit No.:** PAI133514
Mailing Address: 8 Flowers Drive	**Effective Date:** January 1, 2014
City, State Zip: Mechanicsburg, PA 17050	**Expiration Date:** December 31, 2018
MS4 Contact Person: Kelly Kurtas	**Renewal Due Date:** July 4, 2018
Title: MS4 Program Coordinator	**Municipality:** Silver Spring Township
Phone: 717-766-0178 x3510	**County:** Cumberland
Email: kkurtas@sstwp.org	**Consultant Name**: Herbert, Rowland & Grubic, Inc.
Co-Permittees (if applicable): N/A	**Consultant Contact:** Erin Letavic, P.E. 369 East Park Drive Harrisburg, PA 17109 (717) 564-1121 eletavic@hrg-inc.com

Silver Spring Township is a small MS4 Community currently in its third permit term. The Township is approximately 56-percent developed and has 6,326.3 acres of Urbanized Area (UA) according to the United States Census Bureaus' 2010 census.

Silver Spring Township is located in the Simmons Creek, Hogestown Run, Trindle Springs Run and Conodoguinet Creek HUC-12 watersheds. The Hogestown Run and Trindle Springs Run watersheds have been classified as impaired by PADEP. The Pollutant Reduction Plan (PRP) requirements for these impaired watersheds are included within this CBPRP.

[1] PADEP, MS4 Requirements Table (Municipal) (rev. 3/5/2018)
[2] PADE PRP Instructions; Document #3800-PM-BCW0100k (rev. 3/2017)

SECTION A: PUBLIC PARTICIPATION

A complete copy of this CBPRP was made available for the public to review at the Silver Spring Township municipal office from May 17, 2018 to June 15, 2018. The availability of the document was publicized on the Township website for 30 days and published in *The Sentinel on May 17, 2018*. The published public notice contained a brief description of the plan, the dates and locations at which the plan was available for review by the public, and the length of time provided for the receipt of comments. Copies of the public notice as posted on the Township website and published in *The Sentinel* are included in Appendix A.

Written comments were accepted for 30 days following the publication date of the public notice, Public comment documentation will be included in Appendix A.

The information contained in this report was presented to the public during the regularly scheduled Township Board of Supervisor's meeting held on May 23, 2018. Comments and questions regarding the CBPRP were received during the public presentation. A copy of CBPRP presentation and the meeting minutes are included in Appendix A.

SECTION B: MAPPING

The Silver Spring Township CBPRP Planning Area Map depicts the Township's regulated outfalls and it's contributing Municipal Separate Storm Sewer System (MS4) as required under MCM #3, BMPs 2 and 3 of the individual permit. In addition to the MS4 infrastructure (inlets, pipes, outfalls, existing BMPs), the MS4 Map also shows the CBPRP planning areas, UA boundary, impaired streams (color-coded by impairment) watersheds boundaries, and proposed BMP locations.

The Township's Land Use Map was developed using the most recent National Land Cover Database[3]. The majority of the Township is agricultural or undeveloped. The portions of the Township that are developed are generally located along the major transportation thoroughfares. Land cover throughout Silver Spring Township includes a mixture of commercial, residential, industrial, and agricultural. The commercial development is concentrated along S.R. 11 (Carlisle Pike) which runs through the center of the township from northeast to southwest. Residential development is spread throughout the township; however denser residential development is concentrated in the southeast quadrant of the township and is highly focused in the Trindle Springs Run watershed. Industrial and agricultural land are found on the western side of the township however the Pennsy Supply Silver Spring Quarry is located just north of S.R. 11 on the east side of the township.

[3] Multi-Resolution Land Characteristics (MRLC) Consortium, *National Land Cover Database 2011* (NLCD 2011)

SECTION C: POLLUTANTS OF CONCERN

The pollutants of concern for Silver Spring Township were determined by referencing the PADEP MS4 Municipal Requirements Table[4] (Table 1). The applicable section of this table is included for reference in Appendix C.

Table 1. Pollutants of Concern

Planning Area (Watershed)	Impaired Downstream Water	Pollutants of Concern
CBPRP	Chesapeake Bay Nutrients/ Sediment	Appendix D - Nutrients, Siltation (4a)
Hogestown Run	Hogestown Run	Appendix E - Organic Enrichment/Low D.O.; Siltation (4a), Appendix B – Pathogens (5)
Trindle Spring Run	Trindle Springs Run	Appendix E - Siltation (4a), Appendix C – PCB, Priority Organics (5)

[4] PADEP, MS4 Requirements Table (Municipal) (rev. 3/5/2018)

SECTION D: DETERMINE EXISTING LOADING FOR POLLUTANTS OF CONCERN

D.1 Sewershed Planning Areas

Mapping was completed using ESRI's ArcMap Version 10.6. The sewershed planning areas were delineated manually using Lidar generated contours, aerial mapping, located outfalls, pipes, inlets and existing BMPs. Analysis of the drainage features resulted in 113 mapped sewershed planning areas. Each sewershed was delineated to incorporate drainage to each outfall or a group of adjacent outfalls.

Consideration was given to areas outside of the UA when delineating the sewershed planning areas in addition to non-UA areas that drain to and from the UA were included in the sewershed planning areas.

D.2 Parsed Area Calculation

In order to calculate the actual pollutant loads applicable to the Silver Spring Township MS4, the PRP instructions allow areas that do not drain to the MS4 and areas that are already covered by an NPDES permit to be removed from the planning area through the parsing process[5].

Therefore, the following areas were removed from the CBPRP and PRP planning areas:

- **Interstate-81 Corridor & PennDOT Roadways**– The estimated pollutant load from stormwater runoff generated by PennDOT roadways located within the Township was parsed from the existing pollutant base load, as PennDOT maintains their own MS4 permits to account for stormwater runoff generated from their facilities.
- **PAG-03** – Shaffer Trucking is located within the Hogestown Run watershed and holds a PAG-03 permit for Discharge of Stormwater Associated with Industrial Activities (PAR803513). The land area covered by Shaffer Trucking that was parsed out of the planning area is 46.7 acres. Pennsy Supply Silver Spring Quarry located along the eastern end of the township is immediately adjacent to the Conodoguinet Creek. This area and all that drains into the quarry facilities were not included in the planning areas for the PRP.

A summary of parsed area removed from the Township planning areas is shown in Tables 2A – C. Parsed areas are shown on the CBPRP Planning Area Map (Appendix B) and supporting calculations for the pollutant loads associated with each parsed area are included in Appendix D.

Table 2A. Parsed Area Summary – Non-Impaired Planning Area

Planning Area	Urbanized Area (acres)
Non-Impaired Planning Area	1369.08
Parsed Areas (I-81 and PennDOT Roadways)	77.6-
Adjusted Planning Area	**1291.48**

[5] PADEP - PRP Instructions, Attachment A: Parsing Guidelines for MS4s in Pollutant Reduction Plans (rev. 3/2017)

Table 2B. Parsed Area Summary – Hogestown Run Watershed Planning Area

Planning Area	Urbanized Area (acres)
Hogestown Run Planning Area	800.47
Parsed Areas (PennDOT Roadways)	56.5-
Parsed Areas (PAG-03)	46.7-
Adjusted Planning Area	**697.27**

Table 2C. Parsed Area Summary – Trindle Springs Run Watershed Planning Area

Planning Area	Urbanized Area (acres)
Trindle Springs Run Watershed	1,233.67
Parsed Areas (PennDOT Roadways)	9.4-
Adjusted Planning Area	**1,224.27**

D.2 Existing Pollutant Load Calculation

The existing pollutant loadings were calculated using the Simplified Method[6]. In accordance with this method, land use coverage was determined using WikiWatershed to develop a site based pervious/impervious coverage amount in acres. This modeling tool determined the acres of impervious and pervious land within each planning area. The impervious and pervious acreages were then multiplied by the Developed Land Loading Rates for Cumberland County[7] to determine the total existing pollutant load attributed to the Township. The existing pollutant loading was determined for the CBPRP planning area as well as for each non-impaired and impaired watersheds (PRP planning areas).

As stated previously in Section C, the pollutants of concern are TSS, TN, and TP; however, it is presumed that within the overall Bay watershed, the TP and TN goals will be achieved when the permit-required sediment reduction is achieved. Therefore, only the TSS pollutant loading was calculated (Table 3). Detailed pollutant load calculations are provided in Appendix D.

Table 3. Pollutant Loading for Silver Spring Township Planning Areas

Planning Area	UA (acres)	Regulated Pollutant Load TSS (lbs/yr)
Non-Impaired Planning Area	1,291.48	911,665.75
Hogestown Run Watershed PRP	697.27	666,392.27
Trindle Springs Run Watershed PRP	1,224.27	989,651.34
CBPRP Total	**3,213.02**	**2,567,709.40**

[6] PADEP PRP Instructions - Attachment C "Chesapeake Bay PRP Example Using DEP Simplified Method"
[7] PADEP - PRP Instructions, Attachment B: Developed Land Loading Rates for PA Counties (rev. 3/2017)

D.3 Existing Pollutant Loading Adjustment for Previously Implemented BMPs

Silver Spring Township contains various BMPs that have been installed previously and continue to function as designed. These existing BMPs treat over 100 acres of UA and are being claimed as credit towards reducing the existing baseline pollutant loading. The municipally-owned BMPs are maintained by public works staff and the Township MS4 Coordinator and are inspected regularly throughout the year. Privately owned BMPs located within the Township are maintained in accordance with Operation and Maintenance agreements recorded with the land development plan or Stormwater Permit. These BMPs are inspected during and immediately after construction by the Township's engineering consultant and annually thereafter by the property owner and Township MS4 Coordinator as needed.

Where available the land development plans and stormwater management reports were used to determine the pollutant load reduction associated with each existing BMP (Table 4). In the case of older BMPs where land development plans were unavailable, land use data from WikiWatershed[8] and PADEP's standard BMP Effectiveness Values[9] were used to estimate the pollutant load reduction associated with the BMP. Additional information on existing BMPs is provided in Appendix D. The locations of existing BMPs are shown on the CBPRP Planning Area Map (Appendix B).

Table 4: Adjusted Baseline Load Summary

Planning Area	Pollutant Load TSS (lbs/yr)	Installed BMP Reduction TSS (lbs/yr)	Adjusted Pollutant Load TSS (lbs/yr)
Non-Impaired Planning Area	911,665.75	32,052.37	879,613.38
Hogestown Run PRP	666,392.27	17,073.17	649,319.10
Trindle Springs Run PRP	989,651.34	31,768.10	957,883.24
CBPRP Total	**2,567,709.40**	**80,893.64**	**2,486,815.70**

[8] WikiWatershed, Stroud Water Research Center, https://wikiwatershed.org/
[9] PADEP Document 3899-PM-BCW0100M, NPDES Stormwater Discharges from Small MS4s, BMP Effectiveness Values (5/2015)

SECTION E: BMPS TO ACHIEVE THE REQUIRED POLLUTANT LOADING REDUCTIONS

E.1 Required Pollutant Reduction Calculation

Silver Spring Township discharges stormwater to surface water located within the Chesapeake Bay Watershed and is, therefore, regulated by an individual Permit, Appendix D (nutrients and sediment in stormwater discharges to waters in the Chesapeake Bay watershed). The pollutants of concern for Appendix D are TSS, TP, and total nitrogen (TN) with required loading reductions of 10-percent, 5-percent, and 3-percent, respectively. However, as stated previously, it is presumed that within the overall Bay watershed, the TP and TN goals will be achieved when a 10-percent reduction in sediment is achieved[10]. Therefore, only the required 10-percent TSS reduction is calculated herein as a requirement for planning area load reductions (Table 5). The pollutant load reduction requirements listed below take into account adjustments to baseline loading from the parsed areas and existing BMPs discussed in Section D.

Table 5: Required Pollutant Load Reduction Goals – Non-Impaired Planning Area

Planning Area	UA (acres)	Required Load Reduction TSS (lbs/yr)
Non-Impaired Planning Area	1,329.38	87,961.34

In addition to meeting the individual Permit, Appendix D requirements listed in Table 5, two watersheds within Silver Spring Township, Hogestown Run and Trindle Springs Run, have impairments regulated by an individual Permit, Appendix E (nutrients and/or sediment in stormwater discharges to impaired waterways). Appendix E siltation impairments require a minimum 10-percent reduction in sediment load. The pollutant load reduction requirements in pounds per year for Appendix E watersheds are shown in Table 6. The pollutant load reduction requirements listed below take into account adjustments to baseline loading from the parsed areas and existing BMPs discussed in Section D. The planning areas associated with each of these impaired waters are shown on the CBPRP Planning Area Map (Appendix B).

Table 6: Required Pollutant Load Reduction Goals – PRP Planning Areas

Planning Area	UA (acres)	Required Load Reduction TSS (lbs/yr)
Hogestown Run PRP	1,218.06	64,931.91
Trindle Springs Run PRP	1,281.46	95,788.32

As stated previously, the load reduction requirements for each impaired watershed planning areas are included as a portion of the total CBPRP pollutant load reduction. Of the total CBPRP Planning area required sediment load reduction 248,681.57 lbs/yr, at least 26.1-percent (64,931.91 lbs/yr) must be achieved within the Hogestown Run planning area, and 38.5-percent (95,788.32 lb/yr) must be achieved within the Trindle Springs Run planning area. The remaining 35.4 percent (87,961.34 lb/yr) may be achieved anywhere within the CBPRP planning area including both impaired and unimpaired planning areas.

[10] PADEP – PRP Instruction, Document #3800-PM-BCW0100k (rev. 3/2017)

E.2 Proposed BMPs

The following section outlines the BMP implementation strategy developed to achieve the required pollutant load reduction goals stated in Section E.1. The proposed BMPs were determined through discussions with municipal staff, in-field site assessments, and public outreach meetings.

A summary of the type and scale of BMP projects included in the pollutant reduction strategy is listed in Table 7. The pollutant loading reductions for each proposed BMP were calculated in terms of pounds per year using PADEP's standard BMP Effectiveness Values[11]. Complete calculations for the anticipated pollutant load reductions for each BMPs listed below is provided in Appendix E.

Table 7: Silver Spring Township Proposed BMP Summary

Proj Site	BMP ID	BMP Type	Planning Area	Size	Drainage Area (acres)	Load Reduction TSS (lbs/yr)
Cicada Hill Detention Basin	BMP-1	Basin Retrofit	Trindle Springs Run	0.45	6.8	18,824
IronGate Detention Basin	BMP-2	Basin Retrofit	Trindle Springs Run	0.97	113.8	21,997
Hogestown and Rife Detention Basin	BMP-3	Basin Retrofit	Trindle Springs Run	0.26	95.1	10,787
Mulberry Crossing	BMP-4	Basin Retrofit	Trindle Springs Run	1.44	37.6	39,337
Trindle Springs Detention Basin	BMP-5	Basin Retrofit	Trindle Springs Run	3.06	32.6	50,695
Konhaus Estates Royal Palm Drive N Detention Basin	BMP-6	Basin Retrofit	Trindle Springs Run	0.43	113.8	5,736
Konhaus Estates South Detention Basin	BMP-7	Basin Retrofit	Trindle Springs Run	0.32	12.19	10,828
Hogestown Run between S.R. 11 and Confluence with Conodoguinet Creek	BMP-8	Stream Restoration	Hogestown Run	1500 ft.	N/A	67,320
Willow Mill Park	BMP-9	Riparian Buffer	CBPRP	1.12	6.02	24,500
Various Locations	BMP-10	Storm Sewer System Solids Removal	CBPRP/Hogestown Run/Trindle Springs Run	N/A	N/A	24,000
Total						**274,024**

[11] PADEP Document 38-99-PM-BCW0100M, NPDES Stormwater Discharges from Small MS4s, BMP Effectiveness Values (5/2015)

E.3 BMP Project Descriptions

Seven existing Township owned drainage basins were identified within Silver Spring Township and are all located within the Trindle Springs Run Planning Area. The basins each range in size from 0.26 acres to 3.06 acres. Each basin was designed as a dry detention basin and efficiency can be greatly improved by a proposed retrofit to incorporate amended soils and appropriate vegetation to convert to a bioretention facility. Each of the existing basins are currently maintained by the township Public Works Department by mowing regularly and clearing debris from the inlet and outlet structures. No sediment removal or dredging has been conducted in any of the basins. All of the basins were constructed prior to the year 2000. Deeds for each parcel in which the basins are located are on file at the Township office. Descriptions of each Basin retrofit are as follows:

BMP-1 – Cicada Hill Basin Retrofit and Site Upgrade - Stormwater runoff from the residential area located between Monarch Road and Cicada Road in the eastern portion of the Township is conveyed via stormwater pipes and swale to a detention basin along the northeast end of the residential subdivision. This basin covers an area of approximately 0.45-acres and was constructed prior to the year 2000. Due to the age of the basin, it is assumed that it was designed to temporarily fill with runoff after major rain events and control the rate at which stormwater was discharged to Trindle Springs Run.

During a site visit to the basin and discussion with public works staff, it was noted that the basin is being mowed and maintained regularly. There are multiple other aspects of the basin and surrounding property are in need of retrofit and/or repair to maximize the stormwater quality benefit provided by the basin.

The design of the basin includes an outlet structure located at the bottom of the basin that allows the basin to drain completely. This design reduces the pollutant load reductions achieved by the basin by allowing smaller storms with less runoff volume but higher pollutant load concentrations to pass through the basin. As part of the basin retrofit, the outlet structure will be raised so that runoff from even small storms will be retained in the basin and allowed time to infiltrate.

The drainage channel that coveys stormwater from the MS4 to the basin is in need of stabilization. Stormwater from the drainage pipe system collects to one outlet pipe and enters a swale prior to discharging into the basin. Stormwater that enters the basin from this channel has potential to bypass the majority of the basin and therefore does not receive any filtration benefits from the basin. In order to improve the drainage pathways through the basin, the retrofit will expand and regrade a portion of the basin to create a sediment forebay and meandering stream channel to the outlet structure. This will ensure that runoff entering the basin from the channel will be allowed adequate time for the settlement of sediment. Additionally, the soils and vegetation inside the basin will be evaluated and depending on the soil conditions, pockets of amended soil may be added to the basin to promote infiltration. Any invasive species growing inside the basin and swale will be removed. Additional plantings may be added to increase the diversity of species and/or replace any bare spots that may result from the removal of invasive species.

The area outside of the basin is currently maintained by the Township as a mowed lawn. This area will be planted with a meadow mix and no longer mowed. The new vegetation will provide filtration of stormwater runoff from Cicada Hill and serve as a vegetative buffer along the conveyance channels. Educational signage will be added to the site to explain the benefits of the site upgrade. Finally, an operations and maintenance (O&M) plan for the long term maintenance of the site will be developed to ensure that the site will be maintained in such a way as to provide continued stormwater quality benefits.

BMP-2– Irongate Basin Retrofit - Stormwater runoff from the residential area located between Surrey Road and Mayberry Road in the eastern portion of the Township is conveyed via stormwater pipes to a detention basin along the western end of the residential subdivision. This basin covers an area of approximately 0.97-acres and was constructed prior to the year 2000. Due to the age of the basin, it is assumed that it was

designed to temporarily fill with runoff after major rain events and control the rate at which stormwater was discharged to Trindle Springs Run.

During a site visit to the basin and discussion with public works staff, it was noted that the basin is being mowed and maintained regularly. There are multiple other aspects of the basin and surrounding property are in need of retrofit and/or repair to maximize the stormwater quality benefit provided by the basin.

The design of the basin includes an outlet structure located at the bottom of the basin that allows the basin to drain completely. This design reduces the pollutant load reductions achieved by the basin by allowing smaller storms with less runoff volume but higher pollutant load concentrations to pass through the basin. As part of the basin retrofit, the outlet structure will be raised so that runoff from even small storms will be retained in the basin and allowed time to infiltrate.

The retrofit will expand and regrade a portion of the basin to create a sediment forebay and meandering stream channel to the outlet structure. This will ensure that runoff entering the basin from the channel will be allowed adequate time for the settlement of sediment. Additionally, the soils and vegetation inside the basin will be evaluated and depending on the soil conditions, pockets of amended soil may be added to the basin to promote infiltration. Any invasive species growing inside the basin and swale will be removed. Additional plantings may be added to increase the diversity of species and/or replace any bare spots that may result from the removal of invasive species. The new vegetation will provide filtration of stormwater runoff from Irongate Residential developement and serve as a vegetative buffer between the residential development and outfall discharge to Trindle Springs Run. Educational signage will be added to the site to explain the benefits of the site upgrade. Finally, an operations and maintenance (O&M) plan for the long-term maintenance of the site will be developed to ensure that the site will be maintained in such a way as to provide continued stormwater quality benefits.

BMP-3– Hogestown and Rife Basin Retrofit - Stormwater runoff from the residential area located at the intersection of Hogestown Road and Rife Road in the eastern portion of the Township is conveyed via stormwater pipes to a detention basin along the western end of the residential subdivision. This basin covers an area of approximately 0.26-acres and was constructed prior to the year 2000. Due to the age of the basin, it is assumed that it was designed to temporarily fill with runoff after major rain events and control the rate at which stormwater was discharged to the Mulberry Crossing stormwater system and Trindle Springs Run.

During a site visit to the basin and discussion with public works staff, it was noted that the basin is being mowed and maintained regularly. The design of the basin includes an outlet structure located at the bottom of the basin that allows the basin to drain completely. This design reduces the pollutant load reductions achieved by the basin by allowing smaller storms with less runoff volume but higher pollutant load concentrations to pass through the basin. As part of the basin retrofit, the outlet structure will be raised so that runoff from even small storms will be retained in the basin and allowed time to infiltrate.

The retrofit will regrade a portion of the basin to create a meandering stream channel to the outlet structure. This will ensure that runoff entering the basin from the channel will be allowed adequate time for the settlement of sediment. Additionally, the soils and vegetation inside the basin will be evaluated and depending on the soil conditions, pockets of amended soil may be added to the basin to promote infiltration. Any invasive species growing inside the basin and swale will be removed. Additional plantings may be added to increase the diversity of species and/or replace any bare spots that may result from the removal of invasive species. The new vegetation will provide filtration of stormwater runoff from the Hogestown and Rife Residential developement and serve as a vegetative buffer between the residential development and outfall discharge to the Mulberry Crossing stormwater system and Trindle Springs Run. Educational signage will be added to the site to explain the benefits of the site upgrade. Finally, an operations and maintenance (O&M) plan for the long-term maintenance of the site will be developed to ensure that the site will be maintained in such a way as to provide continued stormwater quality benefits.

BMP-4– Mulberry Crossing Basin Retrofit - Stormwater runoff from the residential area located in the Mulberry Crossing Residential development in the eastern portion of the Township is conveyed via stormwater pipes to a detention basin along the western end of the residential subdivision. This basin covers an area of approximately 1.44-acres and was constructed prior to the year 2000. Due to the age of the basin, it is assumed that it was designed to temporarily fill with runoff after major rain events and control the rate at which stormwater was discharged to Trindle Springs Run.

During a site visit to the basin and discussion with public works staff, it was noted that the basin is being mowed and maintained regularly. The design of the basin includes an outlet structure located at the bottom of the basin that allows the basin to drain completely. This design reduces the pollutant load reductions achieved by the basin by allowing smaller storms with less runoff volume but higher pollutant load concentrations to pass through the basin. As part of the basin retrofit, the outlet structure will be raised so that runoff from even small storms will be retained in the basin and allowed time to infiltrate.

The retrofit will regrade a portion of the basin to create a meandering stream channel to the outlet structure. This will ensure that runoff entering the basin from the channel will be allowed adequate time for the settlement of sediment. Additionally, the soils and vegetation inside the basin will be evaluated and depending on the soil conditions, pockets of amended soil may be added to the basin to promote infiltration. Any invasive species growing inside the basin and swale will be removed. Additional plantings may be added to increase the diversity of species and/or replace any bare spots that may result from the removal of invasive species. The new vegetation will provide filtration of stormwater runoff from the Mulberry Crossing Residential developement and serve as a vegetative buffer between the residential development and outfall discharge to Trindle Springs Run. Educational signage will be added to the site to explain the benefits of the site upgrade. Finally, an operations and maintenance (O&M) plan for the long-term maintenance of the site will be developed to ensure that the site will be maintained in such a way as to provide continued stormwater quality benefits.

BMP-5– Trindle Springs Basin Retrofit - Stormwater runoff from the residential area located in the Trindle Springs Residential development in the eastern portion of the Township is conveyed via stormwater pipes to a detention basin along the northern end of the residential subdivision. This basin covers an area of approximately 3.06-acres and was constructed prior to the year 2000. Due to the age of the basin, it is assumed that it was designed to temporarily fill with runoff after major rain events and control the rate at which stormwater was discharged to Trindle Springs Run.

During a site visit to the basin and discussion with public works staff, it was noted that the basin is being mowed and maintained regularly. The design of the basin includes an outlet structure located at the bottom of the basin that allows the basin to drain completely. This design reduces the pollutant load reductions achieved by the basin by allowing smaller storms with less runoff volume but higher pollutant load concentrations to pass through the basin. As part of the basin retrofit, the outlet structure will be raised so that runoff from even small storms will be retained in the basin and allowed time to infiltrate.

The retrofit will regrade a portion of the basin to create a meandering stream channel to the outlet structure. This will ensure that runoff entering the basin from the channel will be allowed adequate time for the settlement of sediment. Additionally, the soils and vegetation inside the basin will be evaluated and depending on the soil conditions, pockets of amended soil may be added to the basin to promote infiltration. Any invasive species growing inside the basin will be removed. Additional plantings may be added to increase the diversity of species and/or replace any bare spots that may result from the removal of invasive species. The new vegetation will provide filtration of stormwater runoff from the Trindle Springs Residential developement and serve as a vegetative buffer between the residential development and outfall discharge to Trindle Springs Run. Educational signage will be added to the site to explain the benefits of the site upgrade. Finally, an operations and maintenance (O&M) plan for the long-term maintenance of the site will

be developed to ensure that the site will be maintained in such a way as to provide continued stormwater quality benefits.

BMP-6– Konhaus Estates North Basin Retrofit - Stormwater runoff from the residential area located in the Konhaus Estates Residential development in the eastern portion of the Township is conveyed via stormwater pipes to a detention basin along the northern end of the residential subdivision. This basin covers an area of approximately 0.43-acres and was constructed prior to the year 2000. Due to the age of the basin, it is assumed that it was designed to temporarily fill with runoff after major rain events and control the rate at which stormwater was discharged to Trindle Springs Run.

During a site visit to the basin and discussion with public works staff, it was noted that the basin is being mowed and maintained regularly. The design of the basin includes an outlet structure located at the bottom of the basin that allows the basin to drain completely. This design reduces the pollutant load reductions achieved by the basin by allowing smaller storms with less runoff volume but higher pollutant load concentrations to pass through the basin. As part of the basin retrofit, the outlet structure will be raised so that runoff from even small storms will be retained in the basin and allowed time to infiltrate.

The retrofit will regrade a portion of the basin to create a meandering stream channel to the outlet structure. This will ensure that runoff entering the basin from the channel will be allowed adequate time for the settlement of sediment. Additionally, the soils and vegetation inside the basin will be evaluated and depending on the soil conditions, pockets of amended soil may be added to the basin to promote infiltration. Any invasive species growing inside the basin will be removed. Additional plantings may be added to increase the diversity of species and/or replace any bare spots that may result from the removal of invasive species. The new vegetation will provide filtration of stormwater runoff from the northern end of the Konhaus Estates Residential developement and serve as a vegetative buffer between the residential development and outfall discharge to Trindle Springs Run. Educational signage will be added to the site to explain the benefits of the site upgrade. Finally, an operations and maintenance (O&M) plan for the long-term maintenance of the site will be developed to ensure that the site will be maintained in such a way as to provide continued stormwater quality benefits.

BMP-6– Konhaus Estates South Basin Retrofit - Stormwater runoff from the residential area located in the Konhaus Estates Residential development in the eastern portion of the Township is conveyed via stormwater pipes to a detention basin along the northern end of the residential subdivision. This basin covers an area of approximately 0.32-acres and was constructed prior to the year 2000. Due to the age of the basin, it is assumed that it was designed to temporarily fill with runoff after major rain events and control the rate at which stormwater was discharged to Trindle Springs Run.

During a site visit to the basin and discussion with public works staff, it was noted that the basin is being mowed and maintained regularly. The design of the basin includes an outlet structure located at the bottom of the basin that allows the basin to drain completely. This design reduces the pollutant load reductions achieved by the basin by allowing smaller storms with less runoff volume but higher pollutant load concentrations to pass through the basin. As part of the basin retrofit, the outlet structure will be raised so that runoff from even small storms will be retained in the basin and allowed time to infiltrate.

The retrofit will regrade a portion of the basin to create a meandering stream channel to the outlet structure. This will ensure that runoff entering the basin from the channel will be allowed adequate time for the settlement of sediment. Additionally, the soils and vegetation inside the basin will be evaluated and depending on the soil conditions, pockets of amended soil may be added to the basin to promote infiltration. Any invasive species growing inside the basin will be removed. Additional plantings may be added to increase the diversity of species and/or replace any bare spots that may result from the removal of invasive species. The new vegetation will provide filtration of stormwater runoff from the southern end of the Konhaus Estates Residential developement and serve as a vegetative buffer between the residential development

and outfall discharge to Trindle Springs Run. Educational signage will be added to the site to explain the benefits of the site upgrade. Finally, an operations and maintenance (O&M) plan for the long-term maintenance of the site will be developed to ensure that the site will be maintained in such a way as to provide continued stormwater quality benefits.

BMP-8– Hogestown Run Stream Restoration - In the Hogestown Run planning area, a stream restoration project was identified along Hogestown Run. Approximately 4000 feet of stream spanning from upstream at S.R. 11 (Carlisle Pike) to the downstream confluence of with the Conodoguinet Creek. This section of Hogestown Run exhibits a straightened channel, streambank erosion, unnatural debris in the channel, lack of riparian buffer and excessive algae growth. It was determined that the reach would benefit from approximately 1500 feet of restoration (900 feet upstream of S.R. 114 and 600 feet downstream of S.R. 114) consisting of construction of cross vanes, J-hook vanes and willow plantings to aid in stabilizing the stream bed and banks and reintroducing a more natural, meandering flow path. Constructed features will aid in slowing stream velocity and sediment transport while incorporation of native vegetation will act to filter out sediment through runoff entering the stream.

BMP-9– Willow Mill Park Riparian Buffer - Within the Non-Impaired planning area, an area was identified that drains a neighboring residential area void of Best Management Practices through Willow Mill Park prior to draining into the Condoguinet Creek. A 35 ft. Riparian Buffer will be incorporated along each side of the 350-ft. drainage swale leading into the creek on township property. Additional trees can be planted along the creek to enhance and strengthen the areas lacking in riparian buffer. A strengthened riparian area at this location in the park will act to reduce the speed of runoff of and sediment into the Conodoguinet Creek.

BMP-10– Storm Sewer System Solids Removal - The township has conducted storm sewer system solids removal in the past as part of its MS4 program. A more detailed program will be developed to track, manage and report storm sewer systems solids removal per DEP specifications and will be conducted on a regular basis within the MS4 Urbanized Areas. This program will serve all planning areas.

Each of the proposed BMP Project descriptions and calculation of load reductions is provided in Appendix E.

Table 8: BMP Implementation Schedule

Proj Site	BMP ID	BMP Type	Permitting & Engineering Design (Permit Year -PY)	Construction/Reporting (Permit Year -PY)
Various Sites	BMP-10	Storm Sewer System Solids Removal	PY 1-5	PY 1-5
Willow Mill Park	BMP-9	Riparian Buffer	PY1	PY1
Cicada Hill	BMP-1	Basin Retrofit	PY1	PY2
Irongate	BMP-2	Basin Retrofit	PY1	PY2
Hogestown/Rife	BMP-3	Basin Retrofit	PY2	PY3
Mullberry Crossing	BMP-4	Basin Retrofit	PY2	PY3
Hogestown Run	BMP-8	Stream Restoration	PY2	PY3
Trindle Springs	BMP-5	Basin Retrofit	PY3	PY4
Konhaus Estates N	BMP-6	Basin Retrofit	PY3	PY4
Konhaus Estates S	BMP7	Basin Retrofit	PY4	PY5

SECTION F: FUNDING MECHANISMS

Funding for the design and construction of the BMPs proposed herein will be funded through a variety of sources including the Township's General Fund, available grants, and public donation of materials and manpower.

The township is currently involved in a stormwater financing study being conducted by the University of Maryland's Environmental Finance Center. This study is funded through grant money provided by the Alliance for the Chesapeake Bay and will conclude at the end of 2018. The study will take into consideration the proposed BMPs outlined in this Chesapeake Bay Pollutant Reduction Plan as well as the Township's current and future MS4 programs needs and goals to aid in determining a variety of methods to obtain finances for future stormwater improvements. Finance solutions may include but are not limited to development of a Stormwater Authority, Stormwater Fee structure, use of Environmental Impact Bonds as well as opportunities for grant funding and state programs such as the state of Pennsylvania's PENNVEST program.

SECTION G: BMP OPERATIONS AND MAINTENANCE (O&M)

Once implemented, the BMPs outlined in this plan will be operated and maintained by Silver Spring Township Staff and inspected regularly by the Township's MS4 Program Coordinator to ensure that they continue to produce the expected pollutant reductions. The Operation and Maintenance activities will be reported in the Annual MS4 Status Reports submitted in accordance with the Individual Permit. In areas in which a project is located within private property, an easement will be obtained if not already existing.

The Operation and Maintenance activities and schedule for each BMP will be developed during the design phase. A general summary of the O&M activities involved with each BMP type and the frequency at which O&M activities will occur are as follows:

Bioretention BMPs and Retrofits

Operation and maintenance requirements for the bioretention projects include:

- Ensure disturbed areas are kept free of foot and/or vehicular traffic until full stabilization has occurred. Properly designed and installed Bioretention areas require some regular maintenance.
- While vegetation is being established, pruning and weeding may be required.
- Detritus may also need to be removed every year. Perennial plantings may be cut down at the end of the growing season.
- Mulch should be re-spread when erosion is evident and be replenished as needed. Once every 2 to 3 years the entire area may require mulch replacement.
- Bioretention areas should be inspected at least two times per year for sediment buildup, erosion, vegetative conditions, etc.
- During periods of extended drought, Bioretention areas may require watering.
- Trees and shrubs should be inspected twice per year to evaluate health.

The contractor shall be responsible for the operation and maintenance of the bioretention basin until all features of the project have been successfully constructed to the specifications and design standards set forth by the Township Engineer. The Contractor should provide a one-year 80% care and replacement warranty for all planting beginning after installation and inspection of all plants.

Once construction of the project(s) is complete, the Township shall be responsible for long term implementation of all Operation and Maintenance procedures to ensure the basin remains operationally functional and physically consistent with the original design.

Stream Restoration BMP

Operation and maintenance requirements for the stream restoration project includes:

- Ensure disturbed areas are kept free of foot and/or vehicular traffic until full stabilization has occurred. Properly designed and installed stream features require some monitoring and regular maintenance.
- Stream Restoration areas should be inspected at least four times per year for sediment buildup, erosion, vegetative conditions, etc.
- Trees and shrubs should be inspected twice per year to evaluate health.

The contractor shall be responsible for the operation and maintenance of the stream restoration area until all features of the project have been successfully constructed to the specifications and design standards set forth by the Township Engineer. The Contractor should provide a one-year 80% care and replacement warranty for all planting beginning after installation and inspection of all plants.

Once construction of the project(s) is complete, the Township shall be responsible for long term implementation of all Operation and Maintenance procedures to ensure the stream channel remains operationally functional and physically consistent with the original design.

Riparian Buffer BMP

Operation and maintenance requirements for the riparian buffer project includes:

- Ensure disturbed areas are kept free of foot and/or vehicular traffic until full stabilization has occurred. Properly planted riparian areas require some monitoring and regular maintenance.
- Trees and shrubs should be inspected twice per year to evaluate health.

If applicable, the contractor shall be responsible for the operation and maintenance of the stream restoration area until all features of the project have been successfully constructed to the specifications and design standards set forth by the Township Engineer. The Contractor should provide a one-year 80% care and replacement warranty for all planting beginning after installation and inspection of all plants.

Once construction of the project(s) is complete, the Township shall be responsible for long term implementation of all Operation and Maintenance procedures to ensure the riparian buffer remains operationally functional and physically consistent with the original design.

APPENDIX A

Public Participation Documentation

Include the following in this section:

- Notice of Public Participation & Public Meeting Notice Published on Township Website
- Notice of Public Participation & Public Meeting Notice
- Public meeting agenda
- Public meeting minutes
- Public Presentation
- Public Comments Received & Record of Consideration

NOTICE OF PUBLIC COMMENT AND PUBLIC MEETING FOR NPDES STORMWATER DISCHARGE POLLUTANT REDUCTION PLAN

Silver Spring Township is hereby giving notice of the 30-day public comment period for its National Pollutant Discharge Elimination (NPDS) Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) Pollutant Reduction Plan (PRP). The Plan proposes best management practices (BMPs) to satisfy the PRP requirements for the Chesapeake Bay and local stream impairments (Trindle Springs Run and Hogestown Run).

The Plan is available for public examination as noted below. The plan is also available on the municipal website (www.sstwp.org) and a hard copy is available at the municipal office. The public is invited to review this document and provide written comments to the individual listed below:

Pollutant Reduction Plan:
Silver Spring Township
8 Flowers Drive
Mechanicsburg, PA 17050
Phone (717) 766-0178 x 3510
Comments to Kelly Kurtas

Visit times are Monday through Friday, between 8:00 a.m. and 4:00 p.m.

The minimum 30-day public comment period will begin May 15, 2018 and ends June 13, 2018.

A public meeting for the Plan will be held on May 23, 2018 during the regularly scheduled Township Board of Supervisors meeting. The meeting is held at 8 Flowers Drive, Mechanicsburg, PA 17050, beginning at 6:30 p.m.

Silver Spring Township

APPENDIX B

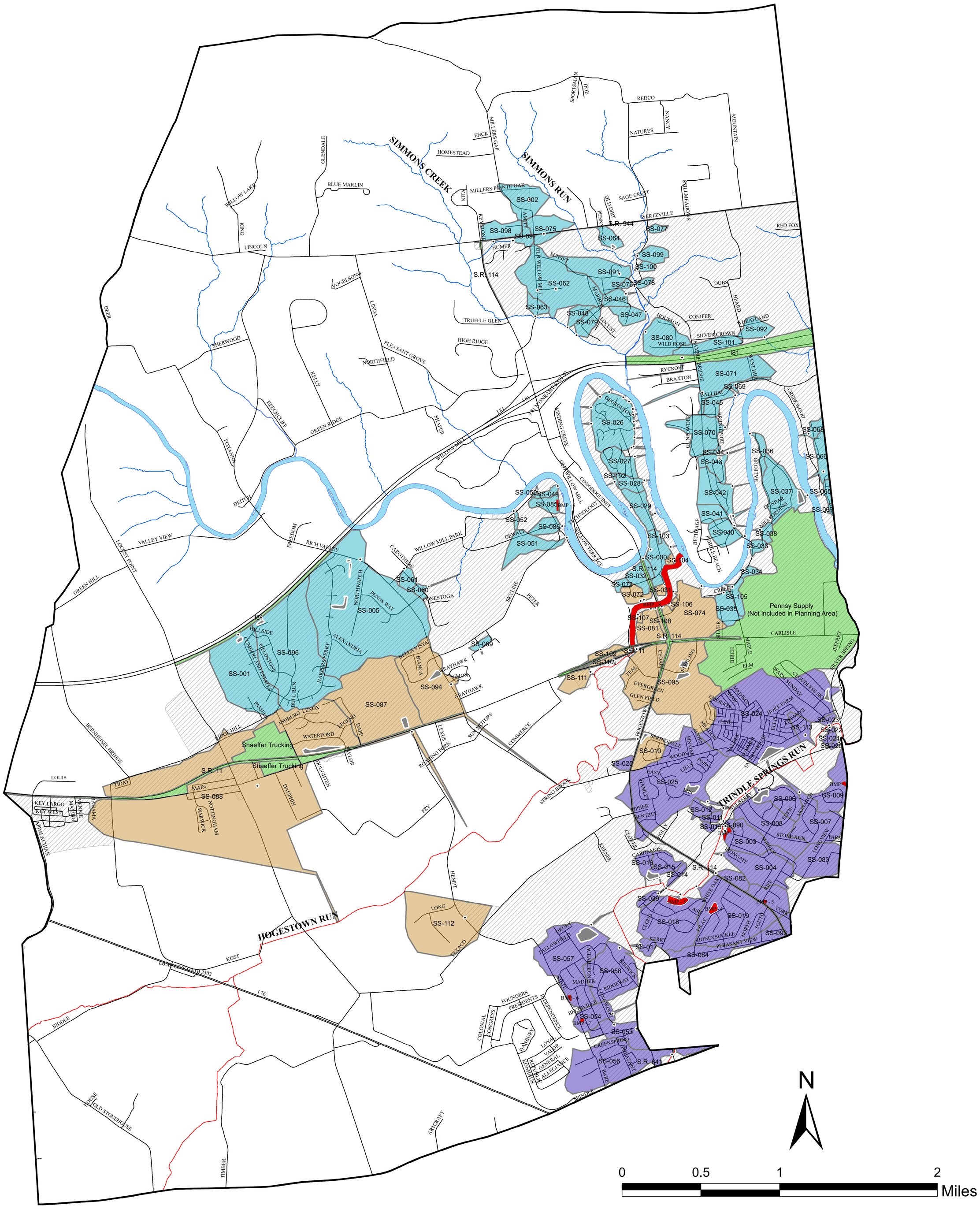
Mapping

Chesapeake Bay Pollutant Reduction Plan
Land Use Map

SILVER SPRING TOWNSHIP

8 Flowers Drive
Mechanicsburg, PA 17050

Chesapeake Bay Pollutant Reduction Plan
Planning Area Map



Legend

- Proposed BMPs
- Existing BMPs
- Urbanized Area (2010)

Sewersheds

- Parsed Lands
- Non-Impaired
- Hogestown Run
- Trindle Springs Run

2019 Outfalls

- Observation Point
- Outfall
- Not Impaired
- Impaired

8 Flowers Drive
Mechanicsburg, PA 17050

APPENDIX C

PADEP Municipal MS4 Requirements Table

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Cumberland County						
MECHANICSBURG BORO	PAG133553	No		Unnamed Tributaries to Cedar Run		Flow Alterations, Other Habitat Alterations (4c)
				Cedar Run	Appendix B-Pathogens (5), Appendix E-Nutrients, Siltation (5)	
				Trindle Spring Run	Appendix E-Siltation (4a), Appendix C-PCB, Priority Organics (5)	Cause Unknown (5)
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
MIDDLESEX TWP		Yes	SP	Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Wertz Run	Appendix E-Siltation (4a)	
MONROE TWP	PAG133573	No		Dogwood Run	Appendix B-Pathogens (5), Appendix E-Organic Enrichment/Low D.O., Suspended Solids (5)	
				Trindle Spring Run	Appendix E-Siltation (4a), Appendix C-PCB, Priority Organics (5)	Cause Unknown (5)
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
NEW CUMBERLAND BORO	PAG133677	No		Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Susquehanna River	Appendix C-PCB (5)	
				Yellow Breeches Creek	Appendix B-Pathogens (5)	
NORTH MIDDLETON TWP		Yes	SP	Alexanders Spring Creek	Appendix E-Siltation (4a)	
				Wertz Run	Appendix E-Siltation (4a)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
SHIREMANSTOWN BORO	PAG133660	No		Yellow Breeches Creek	Appendix B-Pathogens (5)	
				Cedar Run	Appendix B-Pathogens (5), Appendix E-Nutrients, Siltation (5)	
				Unnamed Tributaries to Cedar Run		Flow Alterations, Other Habitat Alterations (4c)
				Susquehanna River	Appendix C-PCB (5)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
SILVER SPRING TWP	PAI133514	Yes	SP, IP	Hogestown Run	Appendix E-Organic Enrichment/Low D.O., Siltation (4a), Appendix B-Pathogens (5)	Cause Unknown (5)
				Trindle Spring Run	Appendix E-Siltation (4a), Appendix C-PCB, Priority Organics (5)	Cause Unknown (5)
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
SOUTH MIDDLETON TWP		Yes	SP	Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	

MS4 Name	Permit Number	HUC 12 Name	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)
Cumberland County				
NEW CUMBERLAND BORO	PAG133677	Lower Yellow Breeches Creek	Chesapeake Bay Nutrients\Sediment, Yellow Breeches Creek	Appendix B-Pathogens, Appendix D-Siltation/Nutrients
		Laurel Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Susquehanna River	Appendix C-PCB, Appendix D-Siltation/Nutrients
NORTH MIDDLETON TWP		Alexanders Spring Creek, Letort Spring Run, Simmons Creek-Conodoguinet Creek, Wertz Run-Conodoguinet Creek	Alexanders Spring Creek, Chesapeake Bay Nutrients\Sediment, Wertz Run	Appendix D-Siltation/Nutrients, Appendix E-Siltation
		Alexanders Spring Creek, Wertz Run-Conodoguinet Creek	Alexanders Spring Creek, Wertz Run	Appendix E-Siltation
SHIREMANSTOWN BORO	PAG133660	Laurel Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Susquehanna River	Appendix C-PCB, Appendix D-Siltation/Nutrients
		Lower Yellow Breeches Creek	Cedar Run, Chesapeake Bay Nutrients\Sediment, Yellow Breeches Creek	Appendix B-Pathogens, Appendix D-Siltation/Nutrients, Appendix E-Nutrients, Siltation
SILVER SPRING TWP	PAI133514	Hogestown Run, Trindle Spring Run	Hogestown Run, Trindle Spring Run	Appendix E-Organic Enrichment/Low D.O., Siltation
		Hogestown Run	Hogestown Run	Appendix B-Pathogens
		Trindle Spring Run	Trindle Spring Run	Appendix C-PCB, Priority Organics
		Conodoguinet Creek-Susquehanna River, Hogestown Run, Simmons Creek-Conodoguinet Creek, Trindle Spring Run	Chesapeake Bay Nutrients\Sediment, Hogestown Run, Trindle Spring Run	Appendix D-Siltation/Nutrients, Appendix E-Organic Enrichment/Low D.O., Siltation
		Laurel Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
SOUTH MIDDLETON TWP		Middle Yellow Breeches Creek	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
		Letort Spring Run, Simmons Creek-Conodoguinet Creek	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
UPPER ALLEN TWP	PAG133708	Lower Yellow Breeches Creek, Middle Yellow Breeches Creek	Cedar Run, Chesapeake Bay Nutrients\Sediment, Unnamed Tributaries to Yellow Breeches Creek	Appendix D-Siltation/Nutrients, Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation
		Trindle Spring Run	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
		Lower Yellow Breeches Creek, Middle Yellow Breeches Creek	Cedar Run, Chesapeake Bay Nutrients\Sediment, Unnamed Tributaries to Yellow Breeches Creek	Appendix D-Siltation/Nutrients, Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation
		Lower Yellow Breeches Creek	Cedar Run, Unnamed Tributaries to Yellow Breeches Creek, Yellow Breeches Creek	Appendix B-Pathogens, Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation
WORMLEYSBURG BORO	PAG133616	Laurel Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Susquehanna River, Unnamed Tributaries to Susquehanna River	Appendix C-PCB, Appendix D-Siltation/Nutrients, Appendix E-Siltation
		Conodoguinet Creek-Susquehanna River	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients

APPENDIX D

Existing Pollutant Load Reduction Calculations

Appendix D – Table 1A: Existing Pollutant Load Calculation Summary, Non-Impaired Planning Area

Sewersheds	Urbanized Area*			Loading Rate TSS** (lb/ac/yr)		Total Load TSS (lb/yr)
	UA (acres)	Imperv. (acres)	Pervious (acres)	Imperv.	Pervious	
SS-001	93.12	11.75	81.37	2,065.10	306.95	49,237.26
SS-002	19.51	4.81	14.70	2,065.10	306.95	14,439.25
SS-005	261.61	46.48	215.13	2,065.10	306.95	162,022.15
SS-026	56.53	29.88	26.66	2,065.10	306.95	69,881.67
SS-027	8.47	6.04	2.43	2,065.10	306.95	13,209.83
SS-028	9.09	4.936	4.16	2,065.10	306.95	11,451.33
SS-029	15.74	9.91	5.83	2,065.10	306.95	22,255.43
SS-030	20.18	11.40	8.78	2,065.10	306.95	26,235.90
SS-032	12.42	3.82	8.59	2,065.10	306.95	10,534.86
SS-033	4.43	0.57	3.86	2,065.10	306.95	2,366.71
SS-034	3.55	0.28	3.27	2,065.10	306.95	1,576.08
SS-035	15.30	5.70	9.60	2,065.10	306.95	14,717.20
SS-036	6.87	0.55	6.33	2,065.10	306.95	3,072.41
SS-037	40.79	10.39	30.40	2,065.10	306.95	30,787.31
SS-038	4.66	0.57	4.08	2,065.10	306.95	2,434.77
SS-040	10.64	0.24	10.41	2,065.10	306.95	3,679.70
SS-041	11.75	0.49	11.26	2,065.10	306.95	4,476.02
SS-042	28.38	5.21	23.17	2,065.10	306.95	17,866.94
SS-043	13.97	3.70	10.26	2,065.10	306.95	10,796.83
SS-044	1.77	0.47	1.30	2,065.10	306.95	1,370.78
SS-045	11.31	3.13	8.17	2,065.10	306.95	8,982.32
SS-046	9.98	2.37	7.60	2,065.10	306.95	7,237.02
SS-047	11.97	0.98	10.99	2,065.10	306.95	5,401.60
SS-048	8.20	2.20	6.00	2,065.10	306.95	6,388.56
SS-049	3.10	0.39	2.72	2,065.10	306.95	1,630.97
SS-050	0.67	0.26	0.41	2,065.10	306.95	660.21
SS-051	23.72	1.71	22.01	2,065.10	306.95	10,290.82
SS-052	2.00	0.15	1.84	2,065.10	306.95	877.53
SS-060	4.43	0.43	4.00	2,065.10	306.95	2,125.04
SS-061	7.54	1.87	5.67	2,065.10	306.95	5,599.74
SS-062	83.58	12.94	70.64	2,065.10	306.95	48,411.71
SS-063	7.54	0.52	7.02	2,065.10	306.95	3,225.57
SS-064	9.09	0.75	8.34	2,065.10	306.95	4,115.43
SS-065	4.43	1.51	2.92	2,065.10	306.95	4,023.33
SS-066	14.85	4.00	10.85	2,065.10	306.95	11,591.36

SS-067	2.00	0.65	1.34	2,065.10	306.95	1,758.46
SS-068	5.54	1.41	4.14	2,065.10	306.95	4,172.59
SS-069	3.10	0.47	2.63	2,065.10	306.95	1,779.09
SS-070	33.92	12.65	21.27	2,065.10	306.95	32,661.33
SS-071	50.77	4.44	46.33	2,065.10	306.95	23,383.74
SS-073	3.33	1.04	2.29	2,065.10	306.95	2,845.02
SS-075	7.54	3.83	3.71	2,065.10	306.95	9,041.56
SS-076	2.44	0.69	1.75	2,065.10	306.95	1,956.93
SS-077	3.33	0.32	3.01	2,065.10	306.95	1,582.08
SS-078	3.10	0.52	2.59	2,065.10	306.95	1,864.84
SS-079	11.97	4.43	7.54	2,065.10	306.95	11,470.65
SS-080	30.82	6.42	24.39	2,065.10	306.95	20,751.53
SS-085	5.99	1.06	4.93	2,065.10	306.95	3,692.83
SS-086	10.64	4.08	6.56	2,065.10	306.95	10,446.49
SS-089	3.99	1.36	2.63	2,065.10	306.95	3,622.17
SS-091	35.25	8.41	26.84	2,065.10	306.95	25,601.18
SS-092	13.30	2.73	10.57	2,065.10	306.95	8,881.47
SS-096	161.62	28.86	132.77	2,065.10	306.95	100,341.95
SS-097	3.33	1.43	1.90	2,065.10	306.95	3,534.93
SS-098	15.52	6.25	9.27	2,065.10	306.95	15,744.06
SS-099	10.20	0.21	9.99	2,065.10	306.95	3,500.71
SS-100	3.77	0.59	3.18	2,065.10	306.95	2,185.94
SS-101	18.40	7.22	11.18	2,065.10	306.95	18,343.84
SS-102	0.89	0.37	0.52	2,065.10	306.95	919.27
SS-103	1.33	0.54	0.79	2,065.10	306.95	1,363.30
SS-105	8.20	2.69	5.51	2,065.10	306.95	7,246.13
Adjusted Baseline Total	**1,291.48**			**-**	**-**	**911,665.75**

* WikiWatershed - Land Cover Estimates

**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 1B: Existing Pollutant Load Calculation Summary, Hogestown Run Watershed PRP Planning Area

Sewersheds	Urbanized Area*			Loading Rate TSS** (lb/ac/yr)		Total Load TSS (lb/yr)
	UA (acres)	Imperv. (acres)	Pervious (acres)	Imperv.	Pervious	
SS-010	21.28	4.69	16.59	2,065.10	306.95	14,777.20
SS-031	2.66	1.37	1.29	2,065.10	306.95	3,225.55
SS-072	5.32	2.92	2.40	2,065.10	306.95	6,770.73
SS-074	19.07	16.11	2.96	2,065.10	306.95	34,170.95
SS-081	18.40	14.34	4.06	2,065.10	306.95	30,856.25
SS-087	128.81	67.99	60.82	2,065.10	306.95	159,080.33
SS-088	228.14	64.84	163.29	2,065.10	306.95	184,033.06
SS-094	79.15	21.96	57.19	2,065.10	306.95	62,903.80
SS-095	148.10	44.19	103.91	2,065.10	306.95	123,156.61
SS-104	2.00	1.84	0.16	2,065.10	306.95	3,839.95
SS-106	1.77	0.87	0.90	2,065.10	306.95	2,072.41
SS-107	1.55	0.96	0.59	2,065.10	306.95	2,164.17
SS-108	2.00	1.44	0.55	2,065.10	306.95	3,150.02
SS-109	8.65	4.88	3.76	2,065.10	306.95	11,237.29
SS-110	2.00	1.42	0.57	2,065.10	306.95	3,114.94
SS-111	13.30	2.64	10.66	2,065.10	306.95	8,725.60
SS-112	15.08	4.83	10.25	2,065.10	306.95	13,113.42
Adjusted Baseline Total	**697.27**			**-**	**-**	**666,392.27**

* WikiWatershed - Land Cover Estimates

**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 1C: Existing Pollutant Load Calculation Summary, Trindle Springs Run Watershed PRP Planning Area

Sewersheds	Urbanized Area*			Loading Rate TSS** (lb/ac/yr)		Total Load TSS (lb/yr)
	UA (acres)	Imperv. (acres)	Pervious (acres)	Imperv.	Pervious	
SS-003	31.93	10.47	21.46	2,065.10	306.95	28,201.78
SS-004	45.01	14.82	30.19	2,065.10	306.95	39872.46
SS-006	25.94	1.43	24.51	2,065.10	306.95	10,476.35
SS-007	42.35	8.76	33.59	2,065.10	306.95	28,398.84
SS-008	51.88	9.51	42.37	2,065.10	306.95	32,638.72
SS-009	30.37	6.80	23.58	2,065.10	306.95	21,270.41
SS-011	3.99	2.02	1.97	2,065.10	306.95	4,779.87
SS-012	8.42	1.23	7.19	2,065.10	306.95	4757.16
SS-013	2.88	0.81	2.07	2,065.10	306.95	2,315.23
SS-014	4.21	1.67	2.55	2,065.10	306.95	4,220.35

SS-015	15.52	6.24	9.28	2,065.10	306.95	15,732.50
SS-016	7.54	2.28	5.27	2,065.10	306.95	6,320.88
SS-017	6.21	1.71	4.49	2,065.10	306.95	4,918.59
SS-018	70.50	24.66	45.84	2,065.10	306.95	64,993.74
SS-019	116.17	49.74	66.43	2,065.10	306.95	123,113.95
SS-020	2.00	0.24	1.76	2,065.10	306.95	1,025.66
SS-021	3.10	0	3.10	2,065.10	306.95	952.74
SS-022	1.11	0.13	0.98	2,065.10	306.95	562.45
SS-023	3.10	1.19	1.92	2,065.10	306.95	3,042.03
SS-024	205.30	32.62	172.68	2,065.10	306.95	120,374.90
SS-025	150.10	31.42	118.67	2,065.10	306.95	101,317.19
SS-039	5.10	2.07	3.03	2,065.10	306.95	5,205.89
SS-053	24.61	8.47	16.14	2,065.10	306.95	22,451.84
SS-054	20.62	9.66	10.95	2,065.10	306.95	23,320.08
SS-055	0.67	0.33	0.34	2,065.10	306.95	777.16
SS-056	84.03	33.59	50.44	2,065.10	306.95	84,846.05
SS-057	94.67	26.46	68.21	2,065.10	306.95	75,584.49
SS-058	57.87	24.95	32.92	2,065.10	306.95	61,621.50
SS-059	6.43	3.08	3.35	2,065.10	306.95	7,395.59
SS-082	9.53	2.54	6.99	2,065.10	306.95	7,397.21
SS-083	34.59	10.93	23.65	2,065.10	306.95	29,840.88
SS-084	26.16	10.79	15.37	2,065.10	306.95	27,005.44
SS-090	1.77	0.74	1.04	2,065.10	306.95	1,838.54
SS-093	19.73	7.79	11.95	2,065.10	306.95	19,746.29
SS-113	10.86	0	10.86	2,065.10	306.95	3,334.59
Adjusted Baseline Total	**1,224.27**			**-**	**-**	**989,651.34**

* WikiWatershed - Land Cover Estimates

**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 2: Baseload Reduction for Previously Installed BMPs

BMP ID	BMP Type	BMP Location	Planning Area	Size (acre) / length (ft)	Drainage Area (acres)	Urbanized Area*		Loading Rate TSS** (lb/ac/yr)		Pollutant Loading TSS (lb/yr)	BMP Efficiency	Load Reduction TSS (lb/yr)
						Imperv. (acres)	Pervious (acres)	Imperv.	Pervious			
Ex-1	Dry Detention Basin	Preserve At Simmons Creek / 2005-23F	CBPRP	0.35	5.76	0.45	5.31	2065.1	306.95	2,559	10%	255.92
Ex-2	Dry Detention Basin	Morgan Tract (West Basin)/ 2006-8	CBPRP	0.6	23.72	4.69	19.04	2065.1	306.95	15,530	10%	1,552.96
Ex-3	Dry Detention Basin	Morgan Tract East Basin)/ 2006-8	CBPRP	0.53	32.37	6.44	25.92	2065.1	306.95	21,255	10%	2,125.54
Ex-4	Dry Detention Basin	Hillside Farms Phase 5 / 2006-18	CBPRP	0.58	23.72	4.61	19.11	2065.1	306.95	15,386	10%	1,538.59
Ex-5	Dry Detention Basin	Hillside Farms Phase 4 / 2000-19	CBPRP	1.94	96.44	14.21	82.23	2065.1	306.95	54,586	10%	5,458.56
Ex-6	Dry Detention Basin	Millfording Preserve Phase 3 (north basin) / 2014-3	CBPRP	0.23	10.64	3.04	7.60	2065.1	306.95	8,611	10%	861.07
Ex-7	Dry Detention Basin	Millfording Preserve Phase 3 (south basin) / 2014-3	CBPRP	0.49	28.38	5.21	23.17	2065.1	306.95	17,871	10%	1,787.12
Ex-8	Wet Pond	Millfording Highlands Phase 1 / 2005-20	CBPRP	1.54	40.79	10.39	30.40	2065.1	306.95	30,788	60%	18,472.60
Ex-9	Dry Detention Basin	Waterford	Hogestown Run Watershed	3.85	42.73	16.90	42.73	2065.1	306.95	48,016	10%	4,801.62
Ex-10	Dry Detention Basin	Cumberland Valley High School / LD98-21F	Hogestown Run Watershed	1.45	25.05	21.92	3.13	2065.1	306.95	46,228	10%	4,622.77
Ex-11	Dry Detention Basin	Bella Vista / 2004-11F	Hogestown Run Watershed	1.5	34.14	7.50	26.65	2065.1	306.95	23,668	10%	2,366.85
Ex-12	Dry Detention Basin	Sheetz / LD2011-5F	Hogestown Run Watershed	0.23	2	1.36	0.64	2065.1	306.95	3,005	10%	300.50
Ex-13	Dry Detention Basin	Carmax / LD2012-1F	Hogestown Run Watershed	1.12	6.65	1.63	5.02	2065.1	306.95	4,907	10%	490.70
Ex-14	Dry Detention Basin	114 Associates / 2011-4	Hogestown Run Watershed	1.47	41.46	11.30	30.16	2065.1	306.95	32,593	10%	3,259.32
Ex-15	Dry Detention Basin	Sterling Glen / 2002-1	Hogestown Run Watershed	0.81	18.18	3.83	14.35	2065.1	306.95	12,314	10%	1,231.41
Ex-16	Dry Detention Basin	Evergreen Phase 2 / 99-7	Trindle Springs Run Watershed	4.92	94.67	26.46	68.21	2065.1	306.95	75,580	10%	7,557.96
Ex-17	Dry Detention Basin	Trindle Springs	Trindle Springs Run Watershed	3.06	27.49	11.78	15.71	2065.1	306.95	29,149	10%	2,914.91
Ex-18	Dry Detention Basin	Mulberry Crossing	Trindle Springs Run Watershed	1.44	53.87	23.74	30.14	2065.1	306.95	58,277	10%	5,827.69
Ex-19	Dry Detention Basin	Ginger Fields	Trindle Springs Run Watershed	1.71	25.5	9.31	16.19	2065.1	306.95	24,196	10%	2,419.56
Ex-20	Dry Detention Basin	Carmella	Trindle Springs Run Watershed	2.01	50.99	9.03	41.97	2065.1	306.95	31,531	10%	3,153.05
Ex-21	Dry Detention Basin	Woodbridge Phase 1 / 2015-2F	Trindle Springs Run Watershed	2.52	29.04	1.17	27.87	2065.1	306.95	10,971	10%	1,097.09
Ex-22	Dry Detention Basin	Walden Phase 1 / 2006-16F	Trindle Springs Run Watershed	3.47	67.62	14.71	52.91	2065.1	306.95	46,618	10%	4,661.83
Ex-23	Dry Detention Basin	Rivendell Phase 2 / 2005-14	Trindle Springs Run Watershed	1.09	49	14.97	34.03	2065.1	306.95	41,360	10%	4,136.01
Total												**80,893.64**

*WikiWatershed - Land Cover Estimates
**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties
***PADEP - BMP Effectiveness Values

APPENDIX E

Proposed BMP Pollutant Load Reduction Calculations

Appendix E – Table 1: Proposed BMPs

BMP ID	BMP Type	Planning Area	Lat	Long	Size (acre) / length (ft)	Drainage Area (acres)	Urbanized Area*		Loading Rate TSS** (lb/ac/yr)		Loading TSS (lb/yr)	BMP Efficiency***	Load Reduction TSS (lb/yr)
							Imperv. (acres)	Pervious (acres)	Imperv.	Pervious			
BMP-1	Basin Retrofit and vegetated swale	Trindle Springs Run	40.232967	-77.007195	0.45	6.8	6.80	0.00	2065.1	306.95	21,270	88.5%	18,824
BMP-2	Basin Retrofit	Trindle Springs Run	40.22852	-77.021328	0.97	113.8	27.31	86.49	2065.1	306.95	28,202	78%	21,997
BMP-3	Basin Retrofit	Trindle Springs Run	40.22222	-77.016831	0.26	95.1	22.82	72.28	2065.1	306.95	15,410	70%	10,787
BMP-4	Basin Retrofit	Trindle Springs Run	40.221608	-77.023017	1.44	37.6	9.02	28.58	2065.1	306.95	52,449	75%	39,337
BMP-5	Basin Retrofit	Trindle Springs Run	40.222345	-77.027384	3.06	32.6	7.82	24.78	2065.1	306.95	64,993	78%	50,695
BMP-6	Basin Retrofit	Trindle Springs Run	40.213543	-77.040338	0.43	113.8	27.31	86.49	2065.1	306.95	7,354	78%	5,736
BMP-7	Basin Retrofit	Trindle Springs Run	40.211449	-77.038885	0.32	12.19	6.31	5.89	2065.1	306.95	14,833	73%	10,828
BMP-8	Stream Restoration	Hogestown Run	40.250239	-77.029715	1500 ft.	N/A	N/A	N/A	N/A	N/A	1,500	44.88	67,320
BMP-9	Riparian Buffer	Non-Impaired	40.258795	-77.041345	1.12	6.02	0.00	0.00	2065.1	306.95	30,000	50%	24,500
BMP-10	Storm Sewer System Solids Removal	CBPRP	N/A	N/A	N/A	N/A	0.00	0.00	2065.1	306.95	30,000	80%	24,000
Total													**264,524**

* WikiWatershed - Land Cover Estimates
**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties
***PADEP - BMP Effectiveness Value

Basin Retrofit Effectiveness Calculations -- The methodology outlined in the Chesapeake Bay Expert Panel Report for Urban Stormwater Retrofit Projects[13] (Expert Panel Report) was used to calculate the anticipated load reduction for each of the basin retrofits. Of the types of retrofit projects outlined in the Expert Panel Report, the proposed upgrades most closely fit into the category of "BMP Enhancement." BMP enhancement projects utilize the original stormwater treatment mechanism, but improve the nutrient and/or sediment removal. The components of the basin retrofits that will improve the pollutant load removal efficiency of the basin include:

- regraded basin with a meandering flow path to prevent short circuiting and increase the hydraulic residence time, and
- internal design features (amended soils, native wetland plantings, raised outfall structure) to enhance the overall nutrient and sediment reduction of the basin.

BMP-1 Cicada Hill Detention Basin and Vegetated Swale - In its current state, the basin covers approximately 0.45 acres and is two feet deep from the bottom of the basin to the emergency spillway. Sizing calculations are based off of aerial mapping and available LIDAR data and may be revised during the project design phase when more detailed survey data becomes available. The current runoff storage volume (RS) is assumed to be negligible. The basin retrofit will regrade the basin add amended soils and vegetation, and modify the outlet structure to increase the hydraulic retention time. The improvements to the basin will increase the runoff storage volume (RS) to approximately 0.9 acre-feet.

The standard retrofit equation from the Expert Panel Report, RS, and impervious drainage area (IA) (calculated above in Table 1) were used to determine the amount of runoff treated by the basin retrofit project.

$$Runoff_{Treated}\ (in) = \frac{(RS)(12)}{IA} = \frac{(0.9)(12)}{6.8} = 1.6$$

Once the amount of runoff captured was determined from this equation. the Retrofit Removal Adjuster Curve for Sediment (Expert Panel Report, Figure 5) was used to determine the pollutant removal rote for the basin retrofit. The BMP that will result from the retrofit project will most closely resembles a constructed wetland, therefore as the Expert Panel report classifies this type of facility as a Stormwater Treatment (ST) BMP, the "ST" curve was used on the Retrofit Removal Adjuster Curve to determine the sediment removal rate.

Using this process, a sediment removal rote of 77% was determined. The removal rate determined from the Retrofit Removal Adjuster Curve was applied to the entire drainage area to the basin, and not just its impervious acres. Applying this sediment removal efficiency to the sediment load coming into the basin resulted in a load reduction of 16,378.22 lbs/yr. However, the runoff will be conveyed to the retrofitted basin by a vegetated swale, therefore the basin will be the second in a series of BMPs. In order to calculate the BMP effectiveness for the BMP series, the following formula from the PA BMP Manual" was used:

$$R = \sum_{i=1}^{n} \begin{pmatrix} R = Removal\ Efficiency\ of\ n\ BMPs\ in\ series \\ ri = Removal\ efficiency\ of\ BMPi \end{pmatrix}$$

The BMP effectiveness value for vegetated swales (C/D soils) is 50%. Using this value, and the BMP effectiveness value calculated above for the basin retrofit, results in a combined sediment removal efficiency (R) of 883 for the BMP series.

R = 1-(1 - 0.77) x (1 - 0.5) = 88.5%

Applying this sediment removal efficiency to the sediment load coming into the basin resulted in a load reduction of 18,824.31 lbs/yr.

BMP-2 Irongate Detention Basin - In its current state, the basin covers approximately 0.97 acres and is two feet deep from the bottom of the basin to the emergency spillway. Sizing calculations are based off of aerial mapping and available LIDAR data and may be revised during the project design phase when more detailed survey data becomes available. The current runoff storage volume (RS) is assumed to be negligible. The basin retrofit will regrade the basin add amended soils and vegetation, and modify the outlet structure to increase the hydraulic retention time. The improvements to the basin will increase the runoff storage volume (RS) to approximately 2.2 acre-feet.

The standard retrofit equation from the Expert Panel Report, RS, and impervious drainage area (IA) (calculated above in Table 1) were used to determine the amount of runoff treated by the basin retrofit project.

$$Runoff_{Treated}\ (in) = \frac{(RS)(12)}{IA} = \frac{(1.94)(12)}{10.47} = 2.2$$

Once the amount of runoff captured was determined from this equation. the Retrofit Removal Adjuster Curve for Sediment (Expert Panel Report, Figure 5) was used to determine the pollutant removal rote for the basin retrofit. The BMP that will result from the retrofit project will most closely resembles a constructed wetland, therefore as the Expert Panel report classifies this type of facility as a Stormwater Treatment (ST) BMP, the "ST" curve was used on the Retrofit Removal Adjuster Curve to determine the sediment removal rate.

Using this process, a sediment removal rote of 78% was determined. The removal rate determined from the Retrofit Removal Adjuster Curve was applied to the entire drainage area to the basin, and not just its impervious acres. Applying this sediment removal efficiency to the sediment load coming into the basin resulted in a load reduction of 21,997.39 lbs/yr.

BMP-3 Hogestown and Rife Detention Basin - In its current state, the basin covers approximately 0.26 acres and is two feet deep from the bottom of the basin to the emergency spillway. Sizing calculations are based off of aerial mapping and available LIDAR data and may be revised during the project design phase when more detailed survey data becomes available. The current runoff storage volume (RS) is assumed to be negligible. The basin retrofit will regrade the basin add amended soils and vegetation, and modify the outlet structure to increase the hydraulic retention time. The improvements to the basin will increase the runoff storage volume (RS) to approximately 0.99 acre-feet.

The standard retrofit equation from the Expert Panel Report, RS, and impervious drainage area (IA) (calculated above in Table 1) were used to determine the amount of runoff treated by the basin retrofit project.

$$Runoff_{Treated}\ (in) = \frac{(RS)(12)}{IA} = \frac{(0.52)(12)}{6.29} = 0.99$$

Once the amount of runoff captured was determined from this equation. the Retrofit Removal Adjuster Curve for Sediment (Expert Panel Report, Figure 5) was used to determine the pollutant removal rote for the basin retrofit. The BMP that will result from the retrofit project will most closely resembles a constructed wetland, therefore as the Expert Panel report classifies this type of facility as a Stormwater Treatment (ST) BMP, the "ST" curve was used on the Retrofit Removal Adjuster Curve to determine the sediment removal rate.

Using this process, a sediment removal rote of 70% was determined. The removal rate determined from the Retrofit Removal Adjuster Curve was applied to the entire drainage area to the basin, and not just its impervious acres. Applying this sediment removal efficiency to the sediment load coming into the basin resulted in a load reduction of 10,786.97 lbs/yr.

BMP-4 Mulberry Crossing Detention Basin - In its current state, the basin covers approximately 1.44 acres and is two feet deep from the bottom of the basin to the emergency spillway. Sizing calculations are based off of aerial mapping and available LIDAR data and may be revised during the project design phase when more detailed survey data becomes available. The current runoff storage volume (RS) is assumed to be negligible. The basin retrofit will regrade the basin add amended soils and vegetation, and modify the outlet structure to increase the hydraulic retention time. The improvements to the basin will increase the runoff storage volume (RS) to approximately 1.45 acre-feet.

The standard retrofit equation from the Expert Panel Report, RS, and impervious drainage area (IA) (calculated above in Table 1) were used to determine the amount of runoff treated by the basin retrofit project.

$$Runoff_{Treated}\ (in) = \frac{(RS)(12)}{IA} = \frac{(2.88)(12)}{23.74} = 1.45$$

Once the amount of runoff captured was determined from this equation. the Retrofit Removal Adjuster Curve for Sediment (Expert Panel Report, Figure 5) was used to determine the pollutant removal rote for the basin retrofit. The BMP that will result from the retrofit project will most closely resembles a constructed wetland, therefore as the Expert Panel report classifies this type of facility as a Stormwater Treatment (ST) BMP, the "ST" curve was used on the Retrofit Removal Adjuster Curve to determine the sediment removal rate.

Using this process, a sediment removal rote of 75% was determined. The removal rate determined from the Retrofit Removal Adjuster Curve was applied to the entire drainage area to the basin, and not just its impervious acres. Applying this sediment removal efficiency to the sediment load coming into the basin resulted in a load reduction of 39,336.98 lbs/yr.

BMP-5 Trindle Springs Detention Basin - In its current state, the basin covers approximately 3.06 acres and is two feet deep from the bottom of the basin to the emergency spillway. Sizing calculations are based off of aerial mapping and available LIDAR data and may be revised during the project design phase when more detailed survey data becomes available. The current runoff storage volume (RS) is assumed to be negligible. The basin retrofit will regrade the basin add amended soils and vegetation, and modify the outlet structure to increase the hydraulic retention time. The improvements to the basin will increase the runoff storage volume (RS) to approximately 2.97 acre-feet.

The standard retrofit equation from the Expert Panel Report, RS, and impervious drainage area (IA) (calculated above in Table 1) were used to determine the amount of runoff treated by the basin retrofit project.

$$Runoff_{Treated}\ (in) = \frac{(RS)(12)}{IA} = \frac{(6.12)(12)}{24.66} = 2.97$$

Once the amount of runoff captured was determined from this equation. the Retrofit Removal Adjuster Curve for Sediment (Expert Panel Report, Figure 5) was used to determine the pollutant removal rote for the basin retrofit. The BMP that will result from the retrofit project will most closely resembles a constructed wetland, therefore as the Expert Panel report classifies this type of facility as a Stormwater Treatment (ST) BMP, the "ST" curve was used on the Retrofit Removal Adjuster Curve to determine the sediment removal rate.

Using this process, a sediment removal rote of 78% was determined. The removal rate determined from the Retrofit Removal Adjuster Curve was applied to the entire drainage area to the basin, and not just its impervious acres. Applying this sediment removal efficiency to the sediment load coming into the basin resulted in a load reduction of 50,694.54 lbs/yr.

BMP-6 Konhaus Estates Royal Palm Drive North Detention Basin - In its current state, the basin covers approximately 0.43 acres and is two feet deep from the bottom of the basin to the emergency spillway. Sizing calculations are based off of aerial mapping and available LIDAR data and may be revised during the project design phase when more detailed survey data becomes available. The current runoff storage volume (RS) is assumed to be negligible. The basin retrofit will regrade the basin add amended soils and vegetation, and modify the outlet structure to increase the hydraulic retention time. The improvements to the basin will increase the runoff storage volume (RS) to approximately 3.5 acre-feet.

The standard retrofit equation from the Expert Panel Report, RS, and impervious drainage area (IA) (calculated above in Table 1) were used to determine the amount of runoff treated by the basin retrofit project.

$$Runoff_{Treated}\ (in) = \frac{(RS)(12)}{IA} = \frac{(0.86)(12)}{2.94} = 3.5$$

Once the amount of runoff captured was determined from this equation. the Retrofit Removal Adjuster Curve for Sediment (Expert Panel Report, Figure 5) was used to determine the pollutant removal rote for the basin retrofit. The BMP that will result from the retrofit project will most closely resembles a constructed wetland, therefore as the Expert Panel report classifies this type of facility as a Stormwater Treatment (ST) BMP, the "ST" curve was used on the Retrofit Removal Adjuster Curve to determine the sediment removal rate.

Using this process, a sediment removal rote of 78% was determined. The removal rate determined from the Retrofit Removal Adjuster Curve was applied to the entire drainage area to the basin, and not just its impervious acres. Applying this sediment removal efficiency to the sediment load coming into the basin resulted in a load reduction of 5,736.25 lbs/yr.

BMP-7 Konhaus Estates South Detention Basin - In its current state, the basin covers approximately 0.32 acres and is two feet deep from the bottom of the basin to the emergency spillway. Sizing calculations are based off of aerial mapping and available LIDAR data and may be revised during the project design phase when more detailed survey data becomes available. The current runoff storage volume (RS) is assumed to be negligible. The basin retrofit will regrade the basin add amended soils and vegetation, and modify the outlet structure to increase the hydraulic retention time. The improvements to the basin will increase the runoff storage volume (RS) to approximately 1.22 acre-feet.

The standard retrofit equation from the Expert Panel Report, RS, and impervious drainage area (IA) (calculated above in Table 1) were used to determine the amount of runoff treated by the basin retrofit project.

$$Runoff_{Treated}\ (in) = \frac{(RS)(12)}{IA} = \frac{(0.64)(12)}{6.31} = 1.22$$

Once the amount of runoff captured was determined from this equation. the Retrofit Removal Adjuster Curve for Sediment (Expert Panel Report, Figure 5) was used to determine the pollutant removal rote for the basin retrofit. The BMP that will result from the retrofit project will most closely resembles a constructed wetland, therefore as the Expert Panel report classifies this type of facility as a Stormwater Treatment (ST) BMP, the "ST" curve was used on the Retrofit Removal Adjuster Curve to determine the sediment removal rate.

Using this process, a sediment removal rote of 73% was determined. The removal rate determined from the Retrofit Removal Adjuster Curve was applied to the entire drainage area to the basin, and not just its impervious acres. Applying this sediment removal efficiency to the sediment load coming into the basin resulted in a load reduction of 10,827.78 lbs/yr.

BMP-8 Stream Restoration Hogestown Run – a stream restoration project was identified along Hogestown Run. Approximately 4000 feet of stream spanning from upstream at S.R. 11 (Carlisle Pike) to the downstream confluence of with the Conodoguinet Creek. This section of Hogestown Run exhibits a straightened channel, streambank erosion, unnatural debris in the channel, lack of riparian buffer and excessive algae growth. It was determined that the reach would benefit from approximately 1500 feet of restoration (900 feet upstream of S.R. 114 and 600 feet downstream of S.R. 114) consisting of construction of cross vanes, J-hook vanes and willow plantings to aid in stabilizing the stream bed and banks and reintroducing a more natural, meandering flow path. The BMP efficiency was obtained by the PADEP BMP Effectiveness Values at 44.88 lbs/ft/yr

Load Reduction = Length of Project x 44.88

67,320 = 1,500 x 44.88

BMP-9 Riparian Buffer Willow Mill Park – A riparian area proposed along drainage leading to the Conodoguinet Creek in Willow Mill Park will cover an area of 70 ft. in width and 350 ft. in length for a total area of 24,500. For the purpose of calculating the load reduction of this BMP, guidance suggests multiplying the area times two. The DEP Effectiveness Value for a Buffer is suggested to be 50%. Based on the guidance, the load reduction was calculated as 24,500 lbs/yr.

BMP-10 Storm Sewer System Solids Removal - As part of on-going MS4 maintenance, the Township public works department removes solids from the MS4s. A program will be developed to track, manage and report storm sewer systems solids removal per DEP specifications. This program will serve all planning areas. In 2018, Public Works has tracked removal of 15 cubic yards of solids from inlets throughout MS4 areas in the township. The weight of solids was estimated conservatively at 2,000 lbs per cubic yard for a total of 30,000 lbs removed from the beginning of 2018 to the date of this report. Sediment effectiveness values are 1 for Sediment and the description lists that DEP will allow up to 50% of total pollutant reduction to be met through this BMP. A removal efficiency of 80% was assumed for this calculation with a resulting estimated load reduction of 24,000 lbs/yr.

Public works employees will be provided training during year one of the permit term to ensure that inlet cleaning is tracked in accordance with DEP requirements. Materials removal during inlet cleaning will be reported to the Township MS4 Coordinator for inclusion in the Annual MS4 Status Reports. The reported reduction will contribute toward meeting the sediment reduction five (5)-year goal.