

## APPLICATION FOR NPDES MS4 INDIVIDUAL PERMIT (IP) FOR STORMWATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s)

- (1) Please read the attached instructions carefully before completing this application.
- (2) If any of your regulated small MS4s discharge into "special protection waters" you must use this Individual NPDES MS4 Permit application.
- (3) Check the appropriate box if you are submitting this application for a RENEWAL of your current permit, or if this application is for a NEW permit:

**Renewal Permit**     (for renewal, please provide Permit Number) PAI-130539  
 OR  
**New Permit**       

A. Multi-Municipal Joint Application									
1.	Is this application being made jointly with other municipalities? <span style="float: right;"><input type="checkbox"/> Yes    <input checked="" type="checkbox"/> No</span> If "Yes", please complete the information below								
2.	Attach a completed and signed "Applicant Information for a Joint NPDES MS4 Authorization" for each joint permittee. Enter the total number of joint permittees: _____ A completed "Applicant Information for a Joint NPDES MS4 Authorization" is attached for each joint permittee. <span style="float: right;"><input type="checkbox"/> Yes    <input type="checkbox"/> No</span>								
3.	Attach to this application a map (or maps) to show the locations of the regulated small MS4s, the urbanized area boundaries, and the municipal boundaries of each of the joint permittees. Are the required maps attached to this application? <span style="float: right;"><input type="checkbox"/> Yes    <input type="checkbox"/> No</span>								
B. MS4 Operator Information									
1.	Name of MS4 Operator: Penn Township								
2.	Contact Person: Karen Versukh								
3.	Title/Role: Director of Operations								
4.	Division: _____ Department: _____								
5.	Phone Number: 610-869-9620 Fax: 610-869-9194								
6.	E-mail: kversuk@penntownship.us								
7.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; vertical-align: top;">Mailing Address:</td> <td style="padding: 2px;">Address Line 1: 260 Lewis Road</td> </tr> <tr> <td></td> <td style="padding: 2px;">Address Line 2:</td> </tr> <tr> <td></td> <td style="padding: 2px;">City: West Grove, PA</td> </tr> <tr> <td></td> <td style="padding: 2px;">Zip Code: 19390</td> </tr> </table>	Mailing Address:	Address Line 1: 260 Lewis Road		Address Line 2:		City: West Grove, PA		Zip Code: 19390
Mailing Address:	Address Line 1: 260 Lewis Road								
	Address Line 2:								
	City: West Grove, PA								
	Zip Code: 19390								
8.	<input checked="" type="checkbox"/> Place a check mark in the box to indicate that all of the following map requirements are met: USGS Topographical, or equivalent, maps that show municipal boundaries for all permittees listed in Sections A or B above are enclosed; and the maps marked to show the location of regulated MS4 outfalls; and the maps are marked to show and identify all named Waters of the Commonwealth that receive discharges from each regulated MS4 outfalls.								

<b>C. Urbanized Area (UA) Information</b>	
Urbanized Area Name(s): Philadelphia, PA, NJ, DE, MD Southwest Portion	UA #(s): 15



**D. Description of Receiving Waters (refer to the Instructions for more information).**

List water bodies into which the regulated small MS4(s) discharge, their classification(s), uses, impairments, TMDL status, and location of the most downstream outfall.

	1. Name of Waterbody	2.i. Designated Uses	2.ii. Existing Uses	3. 303(d) or 305(b) Listed? (Y/N)	4. TMDL ? (Y/N)	5. TMDL Parameter(s) List the Wasteload Allocation (WLA) and Load Allocation (LA) if applicable.	6. ID of most Downstream Outfall - 3-digit number.	7. Latitude (° , ' , ")	8. Longitude (° , ' , ")
a.	West Branch WWC W01	TSF & MF	Same	Yes	Yes	N-13.12 kg/dy P-.144 kg/dy S-486.20 t/yr			
b.	UNT to Middle Branch WCC W02	TSF & MF	Same	Yes	Yes	N-20.24 kg/dy P-.215 kg/dy S-924.00 t/yr			
c.	East Branch Big Elk Creek	HQ-TSF-MF	Same			Chesapeake Bay Basin			
d.									
e.									
f.									
g.									
h.									
i.									
j.									
k.									
l.									

9. Do any of the waterbodies that receive discharges from your regulated small MS4 qualify as either "High Quality" or "Exceptional Value" under 25 Pa. Code Chapter 93 of DEP's regulations?  Yes  No

Londonderry Township

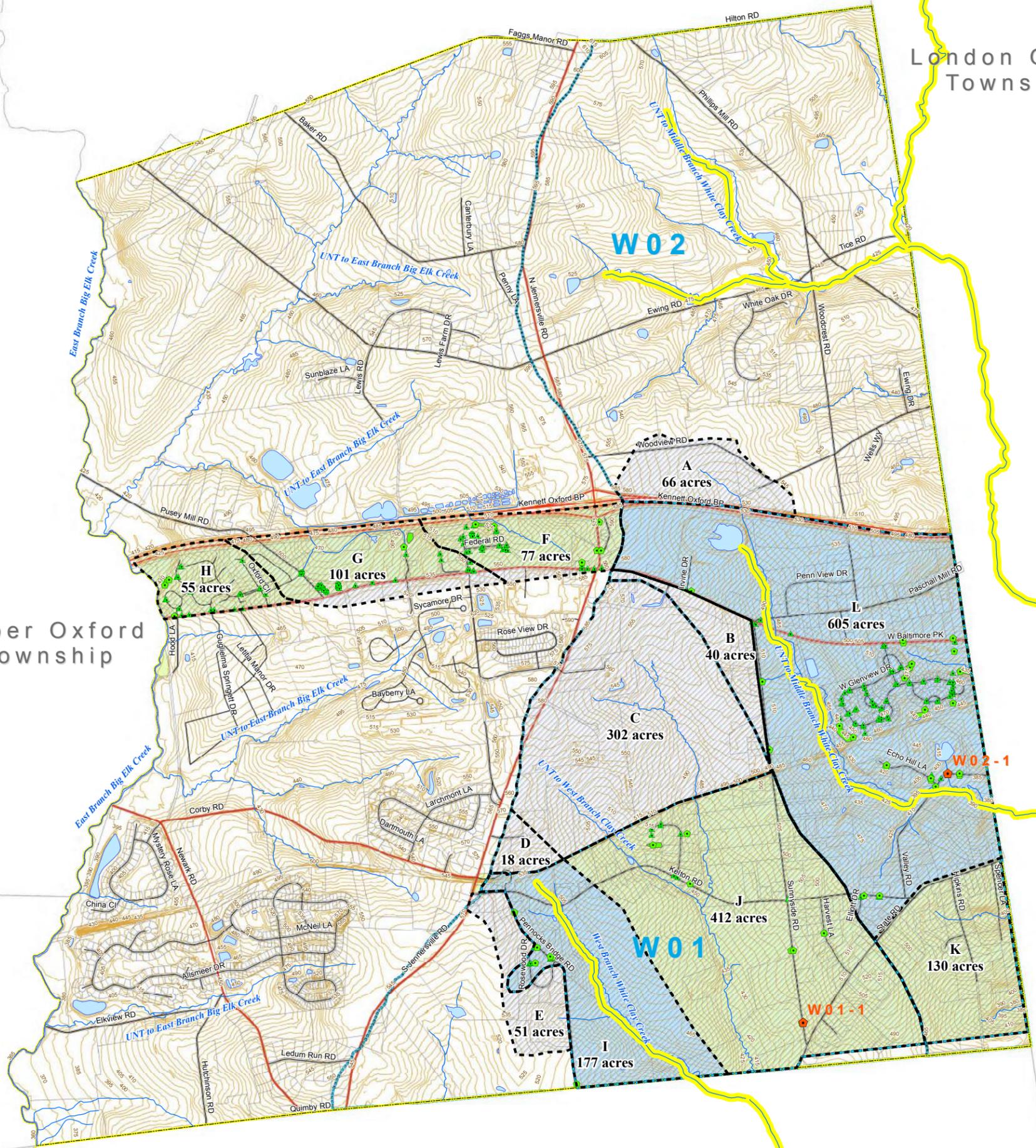
London Grove Township

Upper Oxford Township

Lower Oxford Township

East Nottingham Township

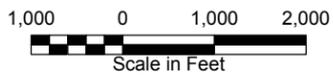
New London Township



Outfall_ID	Lon	Lat
W01-1	75° 51' 27.87" W	39° 48' 7.59" N
W02-1	75° 50' 55.19" W	39° 48' 50.07" N

**LEGEND**

- Regulated Outfalls
- MS4 Outfalls
- Culverts
- ▲ Inlets
- Manholes
- Basins
- Lakes and Ponds
- Christina TMDL Subbasins
- Rivers and Streams
- Impaired Streams
- Township Boundary
- Local Roads
- State Roads
- Tax Parcels
- Topography (5-ft.)
- 2000 Urbanized Area
- Impaired Subbasins
- Drainage Areas



*Penn Township,  
Chester County, Pennsylvania*

**MS4 STORM SEWER SYSTEM  
AND OUTFALL LOCATION MAP**

Note: Impaired streams are from Chester County Water Resources Authority, 2015, Christina Basin TMDL: Nutrient or Sediment Impairments from 1996 or 1998

<b>E. Stormwater Management Program (SWMP)</b>		
<p>MS4 operators must implement a written SWMP with BMPs to meet six (6) Minimum Control Measures (MCMs), including measurable goals and a schedule, as part of the application. The SWMP in Appendix A of the Authorization to Discharge meets this requirement.</p>		
<p>Check the boxes next to each Minimum Control Measure in the following table to confirm that the Stormwater Management Program contained in Appendix A will be followed. <b>For any MCM in which the Program in DEP's version of Appendix A will not be followed, you must revise Appendix A to provide an alternative program that achieves equal or better protection of water quality.</b> In the right-hand column, provide the names of the person(s) responsible for implementing the program for each Minimum Control Measure.</p>		
<b>Minimum Control Measures</b>	Check to indicate that the MS4 Permittee will implement the MCM as provided in DEP's <b>SWMP (i.e. DEP's Version of Appendix A)</b>	<b>Name and telephone number of the principal person responsible for implementation.</b>
<p>The permittee will implement the SWMP in Appendix A of the Authorization to Discharge. You must check the box in the center column, and provide the information in the right-hand column.</p>	<input checked="" type="checkbox"/>	KAREN VERSUK 610-869-9620
(1) Public Education and Outreach	<input checked="" type="checkbox"/>	SAME
(2) Public Participation and Involvement	<input checked="" type="checkbox"/>	SAME
(3) Illicit Discharge Detection and Elimination	<input checked="" type="checkbox"/>	SAME
<p>(4) Construction Site Stormwater Runoff Control, and            (5) BMPs #1, #2, and #3 of the MCM for Post-Construction Stormwater Management in New Development and Redevelopment</p> <p><b>You must check one (1) of the two (2) boxes in the column to the right and fill-in the blanks as indicated.</b></p> <p>Check the following box if you will implement these MCMs as provided in DEP's <b>SWMP (i.e. DEP's Version of Appendix A)</b> <input checked="" type="checkbox"/></p>	<input checked="" type="checkbox"/>	<p>MCM #4.A: The permittee will rely on DEP's statewide program for issuing National Pollutant Discharge Elimination System (NPDES) Permits for Stormwater Discharges Associated with Construction Activities to satisfy all requirements under this MCM #4 and all requirements described under BMPs #1 through #3 of MCM #5 in DEP's version of Appendix A. In this case, the permittee is not required as a condition of this permit to implement any of the BMPs listed under MCM #4 nor any of the requirements described in first three (3) BMPs listed under MCM #5 in DEP's version of Appendix A of the Authorization to Discharge.</p> <p>Note: The permittee may not issue any final approvals for development or redevelopment projects that require NPDES permits for discharges of stormwater from construction sites until after DEP or a delegated County Conservation District issues the NPDES Permit for Stormwater Discharges Associated with Construction Activities.</p>

	<input type="checkbox"/> MCM #4.B: The permittee is not relying on DEP's program for issuing NPDES Permits for Stormwater Discharges Associated with Construction Activities; therefore, the permittee must satisfy all of the requirements described in all of the BMPs listed under MCM #4 and all of the requirements in the BMPs #1, #2, and #3 under MCM #5 in DEP's version of Appendix A of the Authorization to Discharge.	Name of person responsible: _____ Telephone number: _____
(5)BMPs #4, #5, and #6 of the MDM for Post Construction Stormwater Management in New Development and Redevelopment	<input checked="" type="checkbox"/>	JAMES W. MACCOMBIE, P.E, P.L.S TOWNSHIP ENGINEER 610-356-9550
(6) Pollution Prevention and Good Housekeeping for Municipal Operations and Maintenance	<input checked="" type="checkbox"/>	TREVER ELVIN 610-869-9620

**F. MS4 TMDL Plan for Discharges to Impaired Waters with a TMDL**

**Additional Requirement to have a written MS4 TMDL Plan for Impaired Waters with a TMDL:** If any outfalls of your regulated small MS4 discharges stormwater into any portion of a receiving water with applicable wasteload allocations in an approved TMDL, you must develop, submit to DEP for approval, and ensure implementation of a written MS4 TMDL Plan that achieves pollutant reductions consistent with the assumptions and requirements of the wasteload allocations in applicable TMDLs. Refer to Section 2, Part C, of the Authorization to Discharge for the list of ten (10) components that shall be addressed in the MS4 TMDL Strategy component of the MS4 TMDL Plan, **which shall be submitted as a written attachment to this application.**

**Is any of your regulated small MS4 discharging stormwater to any portion of receiving waters with applicable WLAs in an approved TMDL?**  Yes  No

If you answered yes above, then you must complete the remainder of this section.

**Name and telephone number** of the principal person responsible for preparation and implementation of the MS4 TMDL Plan.

Name: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Preparation: James W. MacCombie, P.E., P.L.S. 610-356-9550  
 Implementation: Karen Versuk & James MacCombie, P.E 610-869-9620

**Check one (1) of the following boxes to indicate how your MS4 TMDL Plan was developed:**

- Your MS4 TMDL Plan implements and enforces the TMDL control measures from a watershed or regional TMDL Plan; or
- You will develop, submit to DEP for approval, and ensure implementation of your own TMDL control measures for your MS4 TMDL Plan according to the guidance in Section II.F of the Instructions.

**Signature and Seal by Professional Engineer (PE) for MS4 TMDL Plans**

If an MS4 TMDL Plan is required, do the components submitted with this application include the signature and seal of a professional engineer with a valid license in good standing from the Pennsylvania Department of State as required?  Yes  No

**G. Discharges to the Chesapeake Bay**

**Are any of your regulated small MS4s located in or discharging to any receiving watersheds that drain to the Chesapeake Bay?**  Yes  No

If you answered yes above, then within twelve (12) months of the effective date of your Approval of Individual Permit Coverage, you must develop and submit to DEP for approval a Chesapeake Bay Pollutant Reduction Plan;

Your Chesapeake Bay Pollutant Reduction Plan may incorporate portions of MS4 TMDL Plans that address applicable waste load allocations (WLAs) for sediment, nitrogen, or phosphorus associated with existing stormwater discharges to watersheds that drain to the Chesapeake Bay as described in Part C(1) of the Authorization to Discharge. Will your Chesapeake Bay Pollutant Reduction Plan incorporate portions of any MS4 TMDL Plans?  Yes  No

**Signature and Seal by Professional Engineer (PE) for Chesapeake Bay Pollutant Reduction Plan**

Indicate by checking the following box that your Chesapeake Bay Pollutant Reduction Plan will include the signature and seal of a professional engineer with a valid license in good standing from the Pennsylvania Department of State as required?  Yes

#### H. Discharges to Impaired Waters without a TMDL

For each regulated small MS4 that discharges stormwater into any portion of a receiving water that is impaired, but does not have an approved TMDL, permittees shall ensure that new discharges from the permittee's regulated small MS4s do not cause or contribute to exceedances of water quality standards. Permittees must:

- a. identify outfalls that discharge to impaired waters;
- b. identify additional or modified BMPs in the SWMP to ensure that discharges do not cause or contribute to the impairment; and
- c. implement such BMPs and report on the status of each.

**For each outfall that discharges to impaired waters, list the outfall, the impairment, and the BMPs that will be added or modified to the SWMP to ensure that new discharges from your regulated small MS4 will not cause or contribute to the identified impairments. For outfalls that discharge stormwater that reasonably cannot be a cause or contributor to the impairment of the receiving water, provide an explanation.**

**I. Stormwater Management Ordinance**

Indicate by checking one (1) of the boxes below whether you have an existing ordinance from an Act 167 Plan approved by DEP in 2005 or later; or you plan to adopt an MS4 Stormwater Management Ordinance that corresponds to the checked box in E(4)-(5); or you have completed and attached an MS4 Stormwater Management Ordinance Checklist that corresponds to the checked box in E(4)-(5).

The applicant will satisfy one (1) of the following (Check one and fill-in blanks where indicated.):

<p style="text-align: center;">F.1.</p> <p><input type="checkbox"/> <u>By the end of the first year of coverage under this permit</u>, you will enact and implement either: a) the MS4 Stormwater Management Ordinance corresponding to the checked box in E(4)-(5); or, b) an ordinance from an Act 167 Plan approved in 2005 or later; or, c) an ordinance that satisfies all applicable requirements on a completed and signed MS4 Stormwater Management Ordinance Checklist corresponding to the checked box in E(4)-(5).</p>	<b>OR</b>	<p style="text-align: center;">F.2.</p> <p><input checked="" type="checkbox"/> Already have enacted and implemented an Act 167 Stormwater Management Ordinance from an Act 167 Plan approved in 2005 or later. Provide the enactment date and number of your stormwater management ordinance.</p> <p>Number: <u>03-2013</u></p> <p>Date: <u>Adopted December 16, 2013 in accordance with the Chester County, County-wide Act 167 Plan.</u></p>	<b>OR</b>	<p style="text-align: center;">F.3.</p> <p><input type="checkbox"/> In relation to the box checked in E(4)-(5), the corresponding MS4 Stormwater Management Ordinance Checklist is completed, signed, and attached, and all applicable requirements are satisfied. If your ordinance already is enacted, provide the enactment date and number of your stormwater management ordinance.</p> <p>Number: _____</p> <p>Date: _____</p>
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Fill in the Name and Telephone number of the principal person responsible.

Karen Versuk, Director of Operations  
 Name

610-869-9620  
 Telephone number

**J. Compliance History Review**

Has the applicant been in violation during the past five (5) years of any permits issued by DEP, or any orders, regulations, or schedules of compliance?

Yes       No

If yes, list each permit, order, regulation, or schedule that is/was in violation and provide compliance status of the permitted activity (use additional sheets to provide information on all permits).

Brief Description of Non-Compliance:

- \*MS-4 Program deficiencies - Yrs. 5 & 6
- \*Wastewater Treatment Plant - Act 537 Compliance April 2009

Steps Taken to Return to Compliance and Dates Compliance Achieved:

- \*Deficiencies corrected - Program in compliance Yrs. 7, 8 & 9.
- \*Materials provided to achieve Act 537 Plan compliance - May 2009

**K. Certification:**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowledge of violations."

Name and official title: (Please Print or Type name and title. Use corporate or professional seal as appropriate)

\_\_\_\_\_

Signature: \_\_\_\_\_ Date Signed: \_\_\_\_\_

# Penn Township Christina Basin MS4 TMDL Plan Part 1 – MS4 TMDL Strategy

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Submitted By: *Penn Township*

Date: *September 14, 2014*  
*Revised November 20, 2015(Public Notice Draft)*

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## **C-TIP MS4 TMDL STRATEGY OUTLINE**

### **Section A- Introduction**

### **Section B - Key Definitions**

- I. Definitions from PAG-13 (3/2012), “Authorization to Discharge”**
- II. Definitions Used in this MS4 TMDL Strategy**

### **Section C - Required Information (as required in the NOI instructions)**

- I. Title of TMDL(s) that affect Penn Township**
- II. Watershed Name(s) and Hydrologic Unit Code (HUC)**
  - **Figure 1.** Christina Basin and its TMDL Watersheds, TMDL Subbasins and Municipalities
- III. List of Pollutants and Waste Load Allocations (WLAs) Assigned to Each MS4 Covered by the NOI**
  - a. Pollutants Assigned
    - **Table 1.** Brandywine-Christina Watershed (HUC # 02040205)EPA TMDL MS4 Baseline Pollutant Loadings, MS4 Allocations, and Reductions
  - b. Pollutants Not Applicable
- IV. List of Municipalities Subject to the Same TMDL Pollutants (within HUC Watershed 02040205)**
- V. List of Counties Subject to the TMDL (within HUC Watershed 02040205)**
- VI. Allocated Pollutant Loadings Established in Each Applicable TMDL**
- VII. Reduction in Pollutant Loads Necessary to Meet Each Applicable TMDL or WLA**
  - a. EPA Pollutant Load Reductions
    - i. Sediment Reductions:
    - ii. Nitrogen and Phosphorus Reductions:
  - b. Adjusted MS4 Allocations and Required Load Reductions
    - i. Justification for Adjusting MS4 Baseline, MS4 Allocations, and Reductions
    - ii. Adjustment Approach
      1. Adjustment Process
      2. Delineation of TMDL Storm Sewershed
    - iii. Recalculation of Required Load Reduction (Adjustment Equations)
    - iv. New Municipal Load Allocation (LA)

- **Table 2.** Adjusted MS4 Baselines, MS4 Allocations Required Load Reductions and New LA for Penn Township

**VIII. Control Measures and BMPs Implemented to Meet the TMDL(s)**

- MS4 TMDL Implementation Area
- Priorities for Implementation
- Inventory of Previously Installed Pollutant Reduction Control Measures (March 10, 2003– [date of submission])
  - **Table 3.** Previously Installed BMPs/Control Measures and Pollutant Reductions
  - **Figure 2.** Locations of Previously Installed and Candidate BMPs/Control Measures
- Municipal Stormwater Ordinance Control Measure
- Proposed Control Measures to be Implemented
  - **Table 4.** List of Candidate Control Measures (BMPs)

**IX. Analysis of Consistency of this Implementation Plan with WLAs and TMDLs**

- Analysis of Consistency
- Timeline and Milestones
  - **Table 5.** Timeline and Milestones for attaining TMDL Pollutant Load Reductions
- Implementation Tracking
  - **Table 6.** TMDL Implementation and Attainment Log
- Process for Evaluating and Updating MS4 TMDL Plan
- BMP/Control measures Performance Evaluation and Reporting

**X. Additional Information: (See Appendices)**

**Section D - References**

**Appendix A - List of Municipalities in C-TIP Partnership**

**Appendix B – PADEP letter dated March 21, 2012**

**Appendix C - Worksheets for adjusting TMDL MS4 Allocations**

**Appendix D - BMP/control measure documentation and calculation**

## **SECTION A - INTRODUCTION**

This MS4 TMDL Strategy is Part 1 of Penn Township’s MS4 TMDL Plan. This MS4 TMDL Strategy is submitted in accordance with the requirements of *Individual Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s)*. This MS4 TMDL Strategy has been prepared and will be implemented as part of the Christina Basin TMDL Implementation Plan (C-TIP), and addresses all requirements of the Christina Basin stormwater TMDLs (as listed in Subsection C.I), applicable to Penn Township. Penn Township is a participating member of the C-TIP Partnership as indicated in Appendix A.

This MS4 TMDL Strategy (Part I) for Penn Township is based on, and consistent with all applicable Christina Basin TMDLs. This MS4 TMDL Strategy is organized to follow and respond to the instructions presented in the *Individual Permit* instruction packages. Part II, MS4 TMDL Design Details, will be developed by Penn Township, and will be submitted to DEP within one year of the date of the approval of coverage under the Municipality’s new MS4 permit.

This MS4 TMDL Strategy has been developed after significant coordination with both EPA and PADEP over more than a three year period. A letter from PADEP, included for reference as Appendix B, provides support for the approach taken in this MS4 TMDL Strategy, and more specifically, offers concurrence with the general concept for revising the Christina Basin TMDL MS4 Allocations. This MS4 TMDL Strategy is based on several analyses of the data and results published in the Christina Basin stormwater TMDL Reports and current conditions that have been previously reviewed by PADEP.

This MS4 TMDL Strategy includes the following:

- Section A .....Introduction**
- Section B .....Key Definitions**
- Section C.....Required Information (as required in the NOI instructions)**
- Section D .....References**
- Appendix A .....List of Municipalities in C-TIP partnership**
- Appendix B .....PADEP letter dated March 21, 2012**
- Appendix C .....Worksheets for adjusting TMDL MS4 Allocations**
- Appendix D .....BMP/control measure documentation and calculations**

## SECTION B - KEY DEFINITIONS

### I. Definitions from PAG-13 (3/2012), “Authorization to Discharge” (pages 6, 7, 8):

**Municipal Separate Storm Sewer:** A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains), which is all of the following:

- Owned or operated by a state, city, town, borough, township, county, district, association or other public body (created under state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater or other wastes,
- Designed or used for collecting or conveying stormwater,
- Not a combined sewer, and
- Not part of a Publicly Owned Treatment Works as defined at 40 CFR § 122.2.

**Outfall:** A “Point Source” as defined by 40 CFR § 122.2 is the point where an MS4 discharges stormwater to other surface waters of this Commonwealth. This does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream and are used to convey waters of the Commonwealth (40 CFR § 122.26(b)(9)).

**Regulated Small MS4:** Any small MS4 that is covered by the federal Phase II stormwater program, either through automatic nationwide designation under 40 CFR § 122.32(a)(1) (via the Urbanized Area criteria) or by designation on a case-by-case basis by DEP pursuant to 40 CFR § 122.32(a)(2). “Regulated small MS4s” are a subset of “small MS4s”.

**Storm Sewershed:** The catchment area that drains into the storm sewer system based on the surface topography in the area served by the storm sewer.

**Urbanized Area (UA):** Land area comprising one or more places (central place(s)) and the adjacent densely settled surrounding area (urban fringe) that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile, as defined by the United States Bureau of the Census and as determined by the latest available decennial census. The UA outlines the extent of automatically regulated areas.

## II. Definitions Used in this MS4 TMDL Strategy:

(The terms listed below are capitalized throughout the text.)

**Adjusted TMDL Allocations:** MS4 Baseline Loads, MS4 Allocations (Waste Load Allocations), or Load Reductions that have been recalculated to more accurately represent the pollutant loads received and discharged by the regulated MS4, and covered by the MS4 permit, as recommended in the TMDL Reports. Adjustment methods are described in Subsection C.VII.b.

**Load Reduction:** The required pollutant load reduction; difference between the TMDL MS4 Baseline Load and the MS4 Allocation (Waste Load Allocation).

**MS4 Allocation:** Used herein to refer to EPA’s “MS4 Allocation, EPA’s “MS4 Load Allocation”, as used in the TMDL Reports, and which appear to be used by EPA as synonyms for “Waste Load Allocation” (WLA).

**MS4 TMDL Implementation Area:** All areas that are within the Municipality’s boundaries and within a TMDL Watershed that are:

- a. Located where the target pollutant load reductions are quantifiable at the impaired stream segment that receives stormwater discharges from the Municipality’s regulated small MS4; and
- b. Within the Urbanized Area; or
- c. Outside the Urbanized Area and in accordance with PADEP’s forthcoming credit, trading, and offset policies.

This is the maximum geographic area within which the MS4 Municipality can install new TMDL control measures or can identify previously installed control measures (2003-2012) that can be counted toward achieving the Municipality’s required pollutant Load Reduction.

**Regulated Storm Sewershed:** All land area that drains to the Regulated Small MS4 that is both within the Urbanized Area and within the Municipal boundary.

**TMDL Storm Sewershed:** All Regulated Storm Sewershed areas and portions of the Regulated Small MS4 that are within a TMDL Subbasin. This represents the land area that generates the pollutant load received and discharged by the Regulated Small MS4 and which can be used to “adjust” EPA’s MS4 Baseline Loads, MS4 Allocations, and required pollutant Load Reductions.

**TMDL Subbasin:** Any “subbasin” delineated in either EPA Christina Basin TMDL Report and for which either TMDL Report lists WLAs for TSS, TN and/or TP.

**TMDL Watershed:** The watershed in which the TMDL Subbasin is located; Either Brandywine Creek, Red Clay Creek, or White Clay Creek watershed.

## SECTION C - REQUIRED INFORMATION

### I. Title of TMDL(s) that affect Penn Township:

The following TMDLs have been established for various portions of the watersheds in the Christina Basin, PA. Those that are and are not applicable to Penn Township are indicated below:

- a. *Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland.* September 2006. U.S. Environmental Protection Agency, Philadelphia, PA (herein referred to as Bacteria/Sediment TMDL Report). This TMDL Report presents TMDLs for sediment and bacteria.
- Applicable, Penn Township is listed with a WLA in the above Report
  - Not Applicable, Penn Township is **NOT** listed with a WLA in the above Report.
- b. *Revisions to Total Maximum Daily Loads for Nutrient and Low Dissolved Oxygen Under High-Flow Conditions, Christina River Basin, Pennsylvania, Delaware, and Maryland.* September 2006. U.S. Environmental Protection Agency, Philadelphia, PA (herein referred to as the Nutrient/Low DO TMDL Report). This TMDL Report presents TMDLs for Total Nitrogen and Total Phosphorus.
- Applicable, Penn Township is listed with a WLA in the above Report
  - Not Applicable, Penn Township is **NOT** listed with a WLA in the above Report.
- c. *Total Maximum Daily Loads, Polychlorinated Biphenyls (PCBs) and Chlordane, West Branch Brandywine Creek, Chester County, Pennsylvania.* March 9, 2001. Pennsylvania Department of Environmental Protection, Harrisburg, PA (herein referred to as the Brandywine Creek PCB/Chlordane TMDL Report). This TMDL Report presents a TMDL only for PCB.
- Not Applicable, Penn Township is **NOT** listed with a WLA in the above Report.
- d. *Total Maximum Daily Load for the Red Clay Creek Basin Chester County, Pennsylvania.* April 7, 2007. U.S. Environmental Protection Agency, Philadelphia, PA (herein referred to as the Red Clay Creek PCB TMDL Report). This TMDL Report presents TMDLs for PCB.
- Not Applicable, Penn Township is **NOT** listed with a WLA in the above Report.

Further details about the applicability of the above TMDLs are provided in Subsection C.III.

## II. Watershed Name(s) and Hydrologic Unit Code (HUC):

Following are the list of watershed names and the eight-digit HUC for the areas that are addressed in the Christina Basin TMDL Reports. Only watersheds that are checked below discharge through the Penn Township Regulated Small MS4 to water bodies with TMDLs:

Brandywine-Christina Watershed, HUC #02040205, including:

- Brandywine Creek Watershed (PA)
- Red Clay Creek Watershed (PA)
- White Clay Creek Watershed (PA)

These watersheds are referred to herein as the TMDL Watersheds (see “Key Definitions”, above). Figure 1 presents the Christina Basin, the TMDL Watersheds and the subbasins used in the TMDL Reports (herein referred to as the TMDL Subbasins - see “Key Definitions”), as well as municipal boundaries, streams and Urbanized Area boundaries.

**Figure 1. Christina Basin and its TMDL Watersheds, TMDL Subbasins and Municipalities**

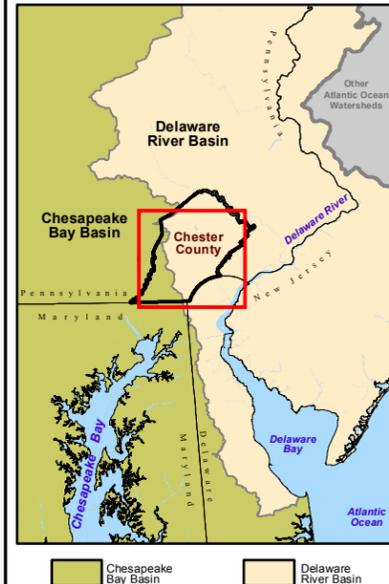
# Figure 1. Christina Basin and its TMDL Watersheds, TMDL Subbasins and Municipalities

September 26, 2012 (Revised)

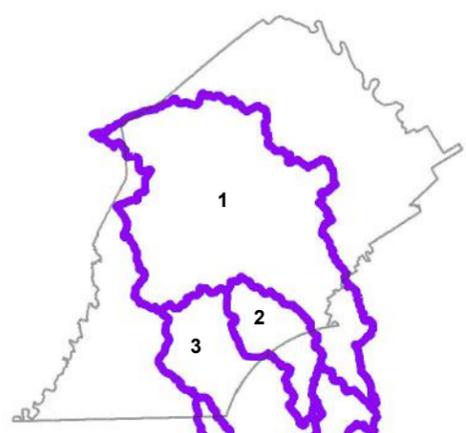
Chester County Water Resources Authority

-  Christina Basin Watersheds
-  Christina Basin HSPF Subbasins (As presented in the Christina Basin EPA TMDL Reports)
-  TMDL Subbasins (Listed with at least 1 WLA)
-  Urbanized Area (Christina Basin)- 2000 Census
-  Chester County Boundary
-  Municipalities
-  Water Bodies
-  Streams

### Map Location and Major Drainages



### Christina Basin TMDL Watersheds



1. Brandywine Creek watershed
2. Red Clay Creek watershed
3. White Clay Creek watershed

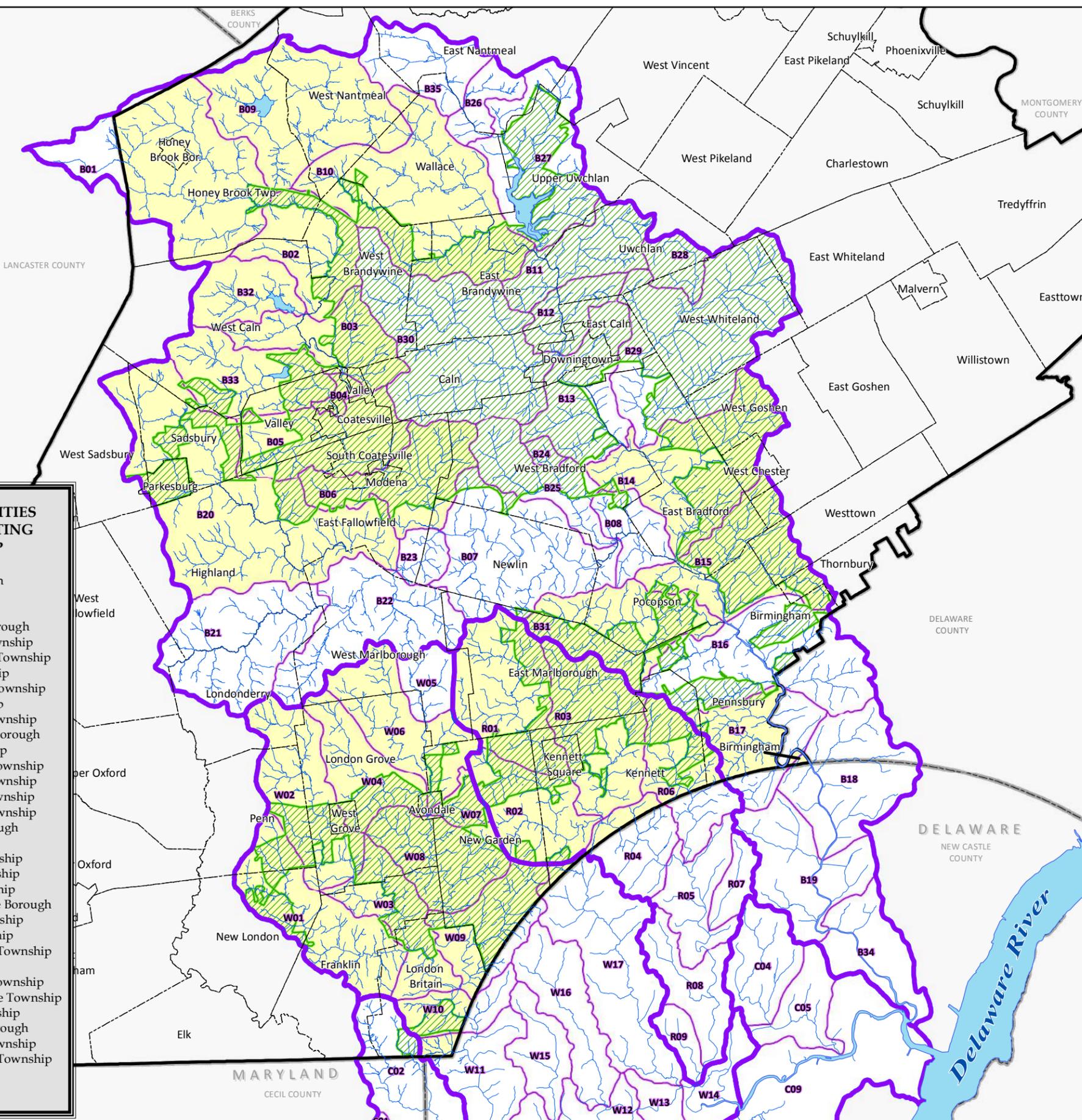


**DATA SOURCES:**  
 Administrative Boundaries, Watersheds, Streams - Chester County  
 Census 2000 Urbanized Areas (UA) subset of "Urban Areas 2000" - U.S. Department of Commerce; Bureau of the Census; Geography Division.  
 HSPF Subbasin Delineation - GIS files provided by USGS Exton, PA Office - June, 2009.

**DISCLAIMER:**  
 This map was generated using the best information available at the time of publication. This map should not be relied upon as the sole basis of determination of regulatory requirements or responsibilities. The relevant PADEP reports and other documents should be consulted for official designations and associated regulatory information. Should any conflicts exist between this map and the PADEP reports and regulations, the latter supersede this map.

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- ### MUNICIPALITIES PARTICIPATING IN C-TIP
1. Avondale Borough
  2. Caln Township
  3. City of Coatesville
  4. Downingtown Borough
  5. East Bradford Township
  6. East Brandywine Township
  7. East Caln Township
  8. East Fallowfield Township
  9. Franklin Township
  10. Honey Brook Township
  11. Kennett Square Borough
  12. Kennett Township
  13. London Grove Township
  14. Londonderry Township
  15. New Garden Township
  16. New London Township
  17. Parkesburg Borough
  18. Penn Township
  19. Pennsbury Township
  20. Pocopson Township
  21. Sadsbury Township
  22. South Coatesville Borough
  23. Thornbury Township
  24. Uwchlan Township
  25. Upper Uwchlan Township
  26. Valley Township
  27. West Bradford Township
  28. West Brandywine Township
  29. West Caln Township
  30. West Chester Borough
  31. West Goshen Township
  32. West Whiteland Township



### III. List of Pollutants and Waste Load Allocations (WLAs) Assigned to Each MS4 Covered by the NOI:

This NOI is for Penn Township.

#### a. Pollutants Assigned:

The following TMDL pollutants (as presented in the applicable TMDL Reports listed in Subsection C.I.) **are** applicable to Penn Township because a Waste Load Allocation has been listed for Penn Township, and *their* implementation is addressed in this Penn Township MS4 TMDL Strategy:

- Total Suspended Solids (Sediment)
- Total Nitrogen
- Total Phosphorus

Table 1 lists the pollutants (total suspended solids, total nitrogen and total phosphorous) and WLAs presented in the Bacteria/Sediment TMDL Report and the Nutrient/Low DO TMDL Report for Penn Township and for all other municipalities listed in the TMDL Report(s). The TMDL Report(s) present these WLAs as “MS4 Load Allocation” (for Total Suspended Solids (TSS) referred to in the TMDL Report and herein as sediment), and “MS4 Allocation” (for total nitrogen (TN), and total phosphorus (TP), referred to herein as nitrogen and phosphorus, respectively), and these terms and numbers are presented in Table 1 exactly as presented in the TMDL Reports.

**Table 1. Brandywine-Christina Watershed (HUC # 02040205)  
EPA TMDL MS4 Baseline Pollutant Loadings, MS4 Allocations, and Reductions**

**Table 1. Brandywine-Christina Watershed (HUC # 02040205)  
EPA TMDL MS4 Baseline Pollutant Loadings, MS4 Allocations, and Reductions**

MUNICIPALITIES LISTED IN TMDL REPORTS Brandywine Creek Watershed	Sediment (tons/year)				Total Nitrogen (kg/day)				Total Phosphorus (kg/day)			
	Baseline MS4 Load <sup>1b</sup>	MS4 Load Allocation <sup>1b</sup>	MS4 Load Reduction <sup>1e</sup>	% Reduction <sup>1b</sup>	MS4 Baseline Load <sup>2g</sup>	MS4 Allocation <sup>2a</sup>	MS4 Load Reduction <sup>2m</sup>	% Reduction <sup>2m</sup>	MS4 Baseline Load <sup>2j</sup>	MS4 Allocation <sup>2d</sup>	MS4 Load Reduction <sup>2m</sup>	% Reduction <sup>2m</sup>
BIRMINGHAM TWP	310.81	130.35	180.46	58.06%								
COATESVILLE CITY	231.29	79.76	151.53	65.52%	16.08	10.86	5.22	32.46%	3.015	2.031	0.984	32.64%
EAST BRADFORD TWP	1185.00	467.17	717.83	60.58%								
EAST BRANDYWINE TWP					54.19	44.44	9.75	17.99%	0.826	0.677	0.149	18.04%
EAST FALLOWFIELD TWP	803.23	426.42	376.81	46.91%	110.54	75.74	34.80	31.48%	22.365	15.348	7.017	31.37%
EAST MARLBOROUGH TWP	366.70	139.44	227.26	61.98%								
HIGHLAND TWP	384.80	238.86	145.94	37.93%								
HONEY BROOK BORO	20.58	13.29	7.35	35.70%	9.61	5.76	3.85	40.06%	0.184	0.11	0.074	40.22%
HONEY BROOK TWP	813.84	558.76	255.08	31.34%	421.64	279.02	142.62	33.83%	7.599	4.956	2.643	34.78%
KENNETT TWP			0.00		2.38	2.22	0.16	6.72%	0.213	0.198	0.015	7.04%
MODENA BORO	27.96	12.46	15.50	55.43%	4.80	3.25	1.55	32.29%	0.966	0.656	0.31	32.09%
NEWLIN TWP	144.18	59.59	84.59	58.67%	6.53	4.57	1.96	30.02%	1.337	0.936	0.401	29.99%
PARKESBURG BORO	52.11	32.35	19.76	37.93%								
PENNSBURY TWP	113.98	43.48	70.50	61.85%	47.00	43.71	3.29	7.00%	4.206	3.911	0.295	7.01%
POCOPSON TWP	821.21	320.79	500.42	60.94%								
SADSBURY TWP	289.73	172.13	117.60	40.59%	3.05	2.26	0.79	25.90%	0.329	0.205	0.124	37.69%
THORNBURY TWP	82.17	34.46	47.71	58.06%								
UPPER UWCHLAN TWP			0.00		10.92	8.96	1.96	17.95%	0.166	0.137	0.029	17.47%
VALLEY TWP	485.14	164.64	320.50	66.06%	57.57	43.75	13.82	24.01%	6.941	4.726	2.215	31.91%
WALLACE TWP	21.74	17.41	4.33	19.92%	126.53	103.76	22.77	18.00%	1.929	1.582	0.347	17.99%
WEST BRADFORD TWP	283.22	121.6	161.62	57.07%	17.25	12.08	5.17	29.97%	3.532	2.473	1.059	29.98%
WEST BRANDYWINE TWP			0.00		136.01	104.78	31.23	22.96%	9.63	8.344	1.286	13.35%
WEST CALN TWP	68.28	43.07	25.21	36.92%	183.72	149.26	34.46	18.76%	9.95	8.649	1.301	13.08%
WEST GOSHEN TWP	461.32	180.51	280.81	60.87%								

Red Clay Creek Watershed	Sediment (tons/year)				Total Nitrogen (kg/day)				Total Phosphorus (kg/day)			
	Baseline MS4 Load <sup>1c</sup>	MS4 Load Allocation <sup>1c</sup>	MS4 Load Reduction <sup>1e</sup>	% Reduction <sup>1c</sup>	MS4 Baseline Load <sup>2h</sup>	MS4 Allocation <sup>2b</sup>	MS4 Load Reduction <sup>2m</sup>	% Reduction <sup>2m</sup>	MS4 Baseline Load <sup>2k</sup>	MS4 Allocation <sup>2e</sup>	MS4 Load Reduction <sup>2m</sup>	% Reduction <sup>2m</sup>
EAST MARLBOROUGH TWP	8791.41	4,193.24	4598.17	52.30%	137.13	68.56	68.57	50.00%	2.742	1.372	1.37	49.96%
KENNETT SQUARE BORO	840.10	405.41	434.69	51.74%	13.26	6.63	6.63	50.00%	0.452	0.151	0.301	66.59%
KENNETT TWP	6751.63	3,312.06	3439.57	50.94%	157.97	97.83	60.14	38.07%	21.517	3.731	17.786	82.66%
NEW GARDEN TWP	4709.65	2,118.72	2590.93	55.01%	77.03	38.52	38.51	49.99%	27.708	2.87	24.838	89.64%
PENNSBURY TWP					4.32	4.32	0.00	0.00%	0.082	0.082	0.00	0.00%

White Clay Creek Watershed	Sediment (tons/year)				Total Nitrogen (kg/day)				Total Phosphorus (kg/day)			
	Baseline MS4 Load <sup>1d</sup>	MS4 Load Allocation <sup>1d</sup>	MS4 Load Reduction <sup>1e</sup>	% Reduction <sup>1d</sup>	MS4 Baseline Load <sup>2i</sup>	MS4 Allocation <sup>2c</sup>	MS4 Load Reduction <sup>2m</sup>	% Reduction <sup>2m</sup>	MS4 Baseline Load <sup>2l</sup>	MS4 Allocation <sup>2f</sup>	MS4 Load Reduction <sup>2m</sup>	% Reduction <sup>2m</sup>
AVONDALE BORO	463.65	140.02	323.63	69.80%	9.16	4.58	4.58	50.00%	0.322	0.135	0.187	58.07%
FRANKLIN TWP	4220.43	2,305.87	1914.56	45.36%	122.01	61.01	61	50.00%	15.219	5.557	9.662	63.49%
KENNETT TWP					2.17	2.17	0.00	0.00%	0.055	0.055	0	0.00%
LONDON BRITAIN TWP	2634.66	1,620.44	1014.22	38.50%	96.47	49.9	46.57	48.27%	15.732	7.333	8.399	53.39%
LONDON GROVE TWP	13616.33	4,842.81	8773.52	64.43%	262.76	128.47	134.29	51.11%	25.875	7.965	17.91	69.22%
NEW GARDEN TWP	6746.50	2,986.66	3759.84	55.73%	167.06	83.83	83.23	49.82%	41.916	13.374	28.542	68.09%
NEW LONDON TWP	1913.97	1,008.60	905.37	47.30%	53.56	26.61	26.95	50.32%	0.65	0.292	0.358	55.08%
PENN TWP	3584.76	1,410.29	2174.47	60.66%	71.23	33.36	37.87	53.17%	0.798	0.359	0.439	55.01%
WEST GROVE BORO	562.29	192.63	369.66	65.74%	9.24	4.36	4.88	52.81%	0.112	0.05	0.062	55.36%

(1) U.S. EPA Region III, 8 April 2005. Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin Watershed Pennsylvania, Delaware, and Maryland. Philadelphia, PA.

(2) U.S. EPA Region III, 26 September 2006. Revisions to Total Maximum Daily Loads for Nutrient and Low Dissolved Oxygen under High-flow Conditions: Christina River Basin Watershed, Pennsylvania, Delaware, and Maryland. Philadelphia, PA.

a. Table 4.2 Fecal coliform TMDL allocations for MS4 municipalities. p 4-5  
b. Table 4.8 Sediment allocations for towns in Brandywine Creek Watershed. p 4-16  
c. Table 4.9 Sediment allocations for towns in Red Clay Creek Watershed. p 4-16  
d. Table 4.10 Preliminary sediment allocations for towns in White Clay Creek Watershed. p 4-16  
e. Calculated by COWRA using Tables listed in 1a.-1d. listed above. MS4 Reduction = (Baseline MS4 Load) - (MS4 Load Allocation)  
 Municipalities that are not currently regulated under the NPDES MS4 program, and thus not required to implement TMDLs

a. Appendix C - Table C-5b. Total nitrogen MS4 allocations for Brandywine Creek watershed (kg/day) p. C-6  
b. Appendix C. Table C-7b. Total nitrogen MS4 allocations for Red Clay Creek watershed (kg/day) p. C-9  
c. Appendix C. Table C-9b. Total nitrogen MS4 allocations for White Clay Creek watershed (kg/day) p. C-11  
d. Appendix C. Table C-6b. Total phosphorus MS4 allocations for Brandywine Creek watershed (kg/day) p.C-8  
e. Appendix C. Table C-8b. Total phosphorus MS4 allocations for Red Clay Creek watershed (kg/day) p. C-10  
f. Appendix C. Table C-10b. Total phosphorus MS4 allocations for White Clay Creek watershed (kg/day) p. C-13  
g. Appendix C - Table C-5a. Total nitrogen MS4 baseline loads for Brandywine Creek watershed (kg/day) p. C-5

h. Appendix C. Table C-7a. Total nitrogen MS4 baseline loads for Red Clay Creek watershed (kg/day) p. C-8  
i. Appendix C. Table C-9a. Total nitrogen MS4 baseline loads for White Clay Creek watershed (kg/day) p. C-10  
j. Appendix C. Table C-6a. Total phosphorus MS4 baseline loads for Brandywine Creek watershed (kg/day) p.C-7  
k. Appendix C. Table C-8a. Total phosphorus MS4 baseline loads for Red Clay Creek watershed (kg/day) p. C-9  
l. Appendix C. Table C-10a. Total phosphorus MS4 baseline loads for White Clay Creek watershed (kg/day) p. C-12  
m. Calculated by COWRA using Tables listed in 2a.-2l. listed above. MS4 Reduction = (MS4 Baseline Load) - (MS4 Allocation); %Reduction = (MS4 Load Reduction) / (MS4 Baseline Load)

**b. Pollutants Not Applicable:**

The following TMDL pollutants (as listed in the TMDL Reports listed in Subsection C.I.) are **NOT** applicable to Penn Township, as indicated and explained below:

- Sediment (Total Suspended Solids)** – There is NO WLA listed for Penn Township. Therefore, implementation of the Sediment TMDL is not addressed in this Penn Township MS4 TMDL Strategy
- Total Nitrogen** - There is NO WLA listed for Penn Township. Therefore, implementation of the Total Nitrogen TMDL is not addressed in this Penn Township MS4 TMDL Strategy.
- Total Phosphorus** - There is NO WLA listed for Penn Township. Therefore, implementation of the Total Phosphorus TMDL is not addressed in this Penn Township MS4 TMDL Strategy.

**Bacteria** – Penn Township is:

- a)** not listed with a WLA for bacteria. Therefore, implementation of the Bacteria TMDL is not addressed in this Penn Township MS4 TMDL Strategy.
- b)** is listed with a WLA for bacteria, however, based on the PADEP letter dated March 21, 2012 (Appendix B) and best information available<sup>1</sup> at the time of preparation of this MS4 TMDL Strategy there are no streams designated as impaired by bacteria attributed to stormwater runoff located within or downstream of Penn Township, or within the Christina Basin, PA. Therefore, implementation of the Bacteria TMDL is not addressed in this Penn Township MS4 TMDL Strategy.

**PCB/Chlordane (Brandywine Creek)** –

- a)** There are no Municipal WLAs listed in the Brandywine Creek PCB/Chlordane TMDL Report. This TMDL applies only to 5.6 miles of the West Branch Brandywine Creek in East Fallowfield, West Bradford, and Newlin Townships, the City of Coatesville, and Modena Borough. As quoted in the TMDL Report: “*Pennsylvania found no permitted point sources contributing to the load of either chlordane or PCBs to the West Branch Brandywine Creek*” and “*...the WLA was assigned a value of 0*”. Therefore, implementation of the Brandywine Creek PCB/Chlordane TMDL is not addressed in this Penn Township MS4 TMDL Strategy.

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<sup>1</sup> 2010 Pennsylvania Integrated Water Quality Monitoring and Assessment Report.”Undated, Pennsylvania Department of Environmental Protection. Office of Water Management, Bureau of Water Supply & Wastewater Management, Water Quality Assessment and Standards Division.

- b) Penn Township has no land area in the Brandywine Creek Watershed. Therefore, implementation of the Brandywine Creek PCB/Chlordane TMDL is not addressed in this Penn Township MS4 TMDL Strategy.

**PCB (Red Clay Creek)**

- a) There are no Municipal WLAs listed in the Red Clay Creek PCB TMDL Report. As quoted in the TMDL Report: “According to PADEP, there are no known point sources of PCB to Red Clay and the East and West Branches of Red Clay Creek at this time” and “...the WLA was set to zero.” Therefore, implementation of the Red Clay Creek PCB TMDL is not addressed in this Penn Township MS4 TMDL Strategy.
- b) Penn Township has no land area in the Red Clay Creek Watershed. Therefore, implementation of the Red Clay Creek PCB TMDL is not addressed in this Penn Township MS4 TMDL Strategy.

**IV. List of Municipalities Subject to the Same TMDL Pollutants (within HUC Watershed 02040205):**

Table 1, presented in Subsection C.III, lists all Pennsylvania municipalities in the HUC 02040205 that are subject to the sediment, nitrogen and phosphorus TMDLs.

**V. List of Counties Subject to the TMDL (within HUC Watershed 02040205):**

There are no counties listed or referenced in any of the above referenced TMDL Reports and therefore there are no counties subject to any of the Christina TMDLs.

**VI. Allocated Pollutant Loadings Established in Each Applicable TMDL:**

Table 1, as presented in Subsection C.III, lists the EPA allocated pollutant loadings for Penn Township for each applicable TMDL pollutant addressed by the Christina Basin Bacteria/Sediment and Low DO/Nutrient TMDL Reports. The allocated pollutant loadings are presented within these TMDL Reports as “MS4 Load Allocation” or “MS4 Allocation”, and Table 1 presents the pollutant loadings and terminology exactly as presented in the TMDL Reports.

**VII. Reduction in Pollutant Loads Necessary to Meet Each Applicable TMDL or WLA:**

**a. EPA Pollutant Load Reductions:**

Table 1, as presented in Section C.III, lists the applicable pollutant Load Reductions required by the TMDL Reports. Penn Township is located within the White Clay Watershed. Table 1 indicates that pollutant Load Reductions are required by Penn Township for Sediment, Total Nitrogen, and Total Phosphorus.

- i. Sediment Reductions:** The pollutant Load Reductions for sediment (TSS) are presented within the Bacteria/Sediment TMDL Report as “Percent Reduction” and are presented in Table 1 exactly as presented in the Bacteria/Sediment TMDL Report. Table 1 also includes Municipal sediment “MS4 Load Reductions” in tons per year, which were calculated for the C-TIP based on the following equation:

$$(MS4\ Load\ Reduction) = (Baseline\ MS4\ Load) - (MS4\ Load\ Allocation)$$

where “Baseline MS4 Load” and “MS4 Load Allocation” are taken from tables presented in the Sediment TMDL Report.

- ii. Nitrogen and Phosphorus Reductions:** The Nutrient/Low DO TMDL Report does not present pollutant Load Reductions by Municipality; they are presented only by Subbasin and only by “percent”. Table 1 presents TN (nitrogen) and TP (phosphorus) Load Reductions by Municipality and percent reductions that were calculated using the following equations:

$$(MS4\ Load\ Reduction) = (MS4\ Baseline\ Load) - (MS4\ Allocation)$$
$$(Percent\ Reduction) = (MS4\ Load\ Reduction) / (MS4\ Baseline\ Load)$$

where “MS4 Baseline Load” and “MS4 Load Allocation” are taken from tables presented in the Nutrient/Low DO TMDL Report.

**b. Adjusted MS4 Allocations and Required Load Reductions:**

Penn Township

- has adjusted their MS4 Allocation(s) and Load Reduction(s). See below.
- has NOT adjusted their MS4 Allocation(s) and Load Reduction(s) at this time and will adhere to Table 1 Load Reductions (Skip below and go to Part VIII).

- i. Justification for Adjusting MS4 Baseline, MS4 Allocations, and Reductions:**

The TMDL Reports explain that the EPA MS4 Allocation and required Load Reductions were calculated assuming the entire land area within the TMDL

Subbasin in the Municipality drains to the MS4. However because the Urbanized Area boundary bisects many municipalities in the Christina Basin, and because most Regulated MS4s cover only a portion of the Municipality, EPA acknowledges that the municipal allocations should be recalculated when MS4 mapping is available. This involves recalculating MS4 Baselines, MS4 Allocations, and pollutant Load Reductions.

The Bacteria /Sediment TMDL Report States:

*“5.0 REASONABLE ASSURANCE AND IMPLEMENTATION*

*For purposes of this TMDL, WLAs were developed for each municipality holding MS4 permits. Distribution of loads was estimated using land use data within municipal boundaries and application of unit area loadings (lbs/acre/year) determined for subbasins defined in the HSPF model and used for TMDL development. As additional data are collected by PADEP regarding drainage areas of each storm sewer system in the basin, these WLAs can be refined to more detailed representation of WLAs for each stormwater permit and LAs for areas not bound by such permits. To do this, the drainage area of each storm sewer should be delineated so that the area and distributions of land use can be determined. The land use areas within the stormwater drainage areas can be multiplied by the unit area loadings reported herein to determine the WLA for each MS4 permit and to calculate the load reduction necessary to meet the TMDL. The remaining load in each respective township can then be assigned to LAs. Until such storm water drainage area data are available, the WLAs and required load reductions reported herein are applicable.”*

**(Excerpt from *Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin Watershed Pennsylvania, Delaware, and Maryland. Philadelphia, PA. April, 2005 (pg. 5-2).*)**

The Nutrient/Low DO TMDL Report States:

*“5.0 REASONABLE ASSURANCE AND IMPLEMENTATION*

*For purposes of this TMDL, WLAs were developed for each municipality holding MS4 permits. Distribution of loads was estimated using land use data within municipal boundaries and application of unit area loadings (lbs/acre/year) determined for subbasins defined in the HSPF model and used for TMDL development. As additional data are collected by PADEP regarding drainage areas of each storm sewer system in the basin, these WLAs can be refined to more detailed representation of WLAs for each stormwater permit and LAs for areas not bound by such permits. To do this, the drainage area of each storm sewer should be delineated so that the area and distributions of land use can be determined. The remaining load in each respective township can then be assigned to LAs. Until such storm water*

*drainage area data are available, the WLAs and required load reductions reported herein are applicable.”*

**(Excerpt from *Revisions to Total Maximum Daily Loads for Nutrient and Low Dissolved Oxygen Under High-Flow Conditions: Christina River Basin Watershed, Pennsylvania, Delaware, and Maryland. Philadelphia, PA. September, 2006 (pg. 5-2).*)**

After extensive coordination with PADEP and analyses of available TMDL and GIS data, an approach was selected for adjusting MS4 Baselines, MS4 Allocations and required Load Reductions for the MS4 TMDL Strategy that reflects the actual extent of Regulated MS4s, and their contributing drainage areas, as described in the following section.

## **ii. Adjustment Approach:**

### **1. Adjustment Process:**

The MS4 Baselines, MS4 Allocations and Load Reductions were adjusted using the following approach:

- 1) The TMDL Storm Sewershed or Urbanized Area was delineated for each TMDL Subbasin based on mapping of the MS4 system and topography, excluding any portions that are discharging to streams that are not currently listed by PADEP for stormwater related impairments; and
- 2) The delineated TMDL Storm Sewershed or Urbanized Area land area was then used to pro-rate the MS4 Baselines, MS4 Allocations, and Load Reduction requirements.

Methods used for adjusting MS4 Baselines, MS4 Allocations and Load Reductions are described in the following subsection. The overall process included the following steps:

- A base map for Penn Township was prepared using best available geographic data to include: political boundaries, streams and surface water bodies, TMDL Subbasin boundaries, TMDL Watershed boundaries, and the Urbanized Area.
- The Penn Township Regulated Small MS4 (as defined in “Key Definitions”) was mapped.
- The Regulated Storm Sewershed (as defined in “Key Definitions”) was delineated using best available topographic data (2-foot LiDAR contours).
- The TMDL Storm Sewershed area (as defined in “Key Definitions”) was delineated for each TMDL subbasin that is applicable to Penn Township.
  - The portions of the TMDL Storm Sewershed that do not drain to a stream currently listed as impaired by PADEP for stormwater related causes are subtracted from the TMDL Storm Sewershed area for each TMDL subbasin.
  - The portions of the Urbanized Area that do not drain to a stream currently listed as impaired by PADEP for stormwater related

causes are subtracted from the Urbanized Area land area for each TMDL subbasin.

- Adjusted MS4 Baselines, MS4 Allocations, and Load Reductions for each applicable TMDL pollutant were calculated by TMDL Subbasin using the methods and equations as presented below.

## 2. Delineation of TMDL Storm Sewershed:

The following method was used by Penn Township to delineate the TMDL Storm Sewershed. This methodology is consistent with the recommended approach described by EPA in the TMDL Reports and has been conditionally approved by PADEP in its letter dated March 21, 2012 (Appendix B):

- Land Use Area Method** – Within each applicable TMDL subbasin, the TMDL Storm Sewershed area is delineated based on 2008 LiDAR topography (2-foot contours), and the individual land use areas are determined using 2010 land use data. The Adjustment Equations are then applied to each land use type to recalculate the MS4 Baselines, MS4 Allocations and required Load Reductions for each category of land use within each TMDL Subbasin, for each applicable pollutant. The individual land use Baselines, MS4 Allocations and required Load Reductions are then summed by TMDL Subbasin, and then by TMDL Watershed. The TMDL Watershed totals become the adjusted MS4 Baseline, Allocation and required Load Reductions for each applicable pollutant.
- Total Land Area Method** – Within each applicable TMDL subbasin, the TMDL Storm Sewershed area is delineated based on 2008 LiDAR topography (2-foot contours). The Adjustment Equations are then applied to the total TMDL Storm Sewershed area for each TMDL Subbasin to recalculate the MS4 Baselines, MS4 Allocations, and Load Reductions for each applicable pollutant. The TMDL Subbasin totals are then summed by TMDL Watershed. The TMDL Watershed totals become the adjusted MS4 Baseline, Allocation and required Load Reductions for each applicable pollutant.
- Urbanized Area Method** – Within each applicable TMDL subbasin, the total land area within the Urbanized Area is determined using the Urbanized Areas currently depicted on the PADEP Stormwater webpage (2000 Census). The Adjustment Equations are then applied to the total land area within the Urbanized Area for each TMDL Subbasin to recalculate the MS4 Baselines, MS4 Allocations, and Load Reductions for each applicable pollutant. The TMDL Subbasin totals are then summed by TMDL Watershed. The TMDL Watershed totals become the adjusted MS4 Baseline, MS4 Allocation and required Load Reductions for each applicable pollutant.

**Other Method –**

**iii. Recalculation of Required Load Reduction (Adjustment Equations):**

Each method above results in a delineation of the land area(s) to be used to calculate the Adjusted MS4 Baselines, MS4 Allocations, and required Load Reductions (See “Key Definitions”) using the following Adjustment Equations:

$$\text{Adjustment Ratio} = \frac{\left( \text{Actual Contributing land area (acres)} \right)}{\left( \text{Land area (acres) used by EPA to calculate the EPA MS4 Allocation} \right)}$$

Adjusted MS4 Baseline = Adjustment Ratio x (EPA MS4 Baseline)  
Adjusted MS4 Allocation = Adjustment Ratio x (EPA MS4 Allocation)  
Adjusted MS4 Load Reduction = (Adjusted MS4 Baseline) – (Adjusted MS4 Allocation)

The adjustment calculations are provided in Appendix C:

- Appendix C.1 – MS4 Worksheet for Calculating Adjusted MS4 Baseline Loads, MS4 Allocations, required Load Reductions and new Municipal LAs - Land Use Area method.
- Appendix C.2 – MS4 Worksheet for Calculating Adjusted MS4 Baseline Loads, MS4 Allocations, required Load Reductions and new Municipal LAs - Total Land Area method.

**iv. New Municipal Load Allocation (LA):**

The portion of the EPA MS4 Allocation that was removed by the adjustment is now assigned as the Load Allocation (LA) for Penn Township. The total TMDL Allocation for Penn Township remains unchanged by the adjusted MS4 Allocation, and becomes: MS4 Allocation (WLA) + Municipal LA +MOS.

Table 2 presents the Adjusted MS4 Baselines, MS4 Allocations and adjusted Load Reductions for Penn Township. The new LA for Penn Township is also shown for each TMDL Watershed.

**Table 2. Adjusted MS4 Baselines, MS4 Allocations Required Load Reductions and New LA for Penn Township**

APPENDIX C.2 - MS4 WORKSHEET FOR CALCULATING ADJUSTED MS4 BASELINE LOADS, ADJUSTED MS4 ALLOCATIONS AND ADJUSTED MS4 LOAD REDUCTIONS - TOTAL LAND AREA METHOD			
MUNICIPALITY NAME: <input type="text" value="Penn Township"/> , CHESTER COUNTY, PA			
DATE OF TMDL PLAN SUBMISSION: <input type="text" value="30-Dec-15"/>			
LIST APPLICABLE TMDL WATERSHED(S):	LIST ONLY THE TMDL SUBBASINS WITHIN EACH TMDL WATERSHED:		
1) <input type="text" value="White Clay"/>	<input type="text" value="W01 W02"/>		
2) <input type="text"/>			
FOR ALL LISTED TMDL SUBBASINS FILL IN SECTIONS 1, 2 and 4 WITH THE VALUES REFERENCED FROM THE APPLICABLE TMDL REPORT ALL OTHER VALUES ARE CALCULATED AS DESCRIBED. CALCULATIONS MUST BE APPLIED TO ALL NEW ROWS ADDED.			
<b>1 LAND USE AREAS (ACRES):</b>			
Copied from Tables C-1, - C-4, in Appendix C of TMDL Report; Total (Watershed) is the sum of all acres for all land uses in each TMDL Watershed			
	TMDL subbasin	MS4 Total	Total (Watershed)
	W01 - West Branch of the White Clay Creek	1092.29	3140.32
	W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	2048.03	
			0.00
<b>2 TMDL STORM SEWERSHED AREA (ACRES):</b> To be calculated by Municipality and inserted below			
The following method, as described in Subsection VII.B, was used to assign these TMDL Storm Sewershed areas:			
	Total Land Area <input type="text"/>		
	TMDL subbasin	MS4 Total	Total (Watershed)
	W01 - West Branch of the White Clay Creek	177.00	782.00
	W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	605.00	
			0.00
<b>3 LAND USE ADJUSTMENT RATIOS:</b>			
Divide the TMDL Storm Sewershed area from Section 2 by the corresponding land use area from Section 1			
	TMDL subbasin	MS4 Total	Total (Watershed)
	W01 - West Branch of the White Clay Creek	0.16	0.25
	W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	0.30	
			0.00

<b>4 MS4 BASELINE LOADS AND MS4 ALLOCATIONS:</b>			
<b>Total nitrogen MS4 baseline loads (kg/day):</b>			
Copied from TMDL Report Appendix C, Table(s): <b>C-9a</b>			
<b>TMDL Subbasin</b>	<b>Subtotal</b>	<b>Total (Watershed)</b>	
W01 - West Branch of the White Clay Creek	26.24	71.23	
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	44.99		
		0.00	
<b>Total nitrogen MS4 allocations (kg/day):</b>			
Copied from TMDL Report Appendix C, Table(s): <b>C-9b</b>			
<b>TMDL Subbasin</b>	<b>Subtotal</b>	<b>Total (Watershed)</b>	
W01 - West Branch of the White Clay Creek	13.12	33.36	
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	20.24		
		0.00	
<b>Total phosphorus MS4 baseline loads (kg/day):</b>			
Copied from TMDL Report Appendix C, Table(s): <b>C-10a</b>			
<b>TMDL Subbasin</b>	<b>Subtotal</b>	<b>Total (Watershed)</b>	
W01 - West Branch of the White Clay Creek	0.32	0.80	
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	0.48		
		0.00	
<b>Total phosphorus MS4 allocations (kg/day):</b>			
Copied from TMDL Report Appendix C, Table(s): <b>C-10b</b>			
<b>TMDL Subbasin</b>	<b>Subtotal</b>	<b>Total (Watershed)</b>	
W01 - West Branch of the White Clay Creek	0.14	0.36	
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	0.22		
		0.00	
<b>Sediment baseline MS4 loads (tons/year):</b>			
Copied from TMDL Report Appendix C, Table(s): <b>C-7b</b>			
<b>TMDL Subbasin</b>	<b>Subtotal</b>	<b>Total (Watershed)</b>	
W01 - West Branch of the White Clay Creek	1236.08	3584.76	
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	2348.68		
		0.00	
<b>Sediment MS4 WLAs (tons/year):</b>			
Copied from TMDL Report Appendix C, Table(s): <b>C-7a</b>			
<b>TMDL Subbasin</b>	<b>Subtotal</b>	<b>Total (Watershed)</b>	
W01 - West Branch of the White Clay Creek	486.29	1410.29	
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	924.00		
		0.00	

5 ADJUSTED MS4 BASELINE LOADS AND MS4 ALLOCATIONS		
<b>Adjusted nitrogen MS4 baseline loads (kg/day):</b>		
Multiply the MS4 Baseline Loads from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	4.25	17.54
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	13.29	
	0.00	0.00
	0.00	
<b>Adjusted nitrogen MS4 allocations (kg/day):</b>		
Multiply the MS4 Allocations (WLA) from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	2.13	8.11
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	5.98	
	0.00	0.00
	0.00	
<b>Adjusted phosphorus MS4 baseline loads (kg/day):</b>		
Multiply the MS4 Baseline Loads from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	0.05	0.19
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	0.14	
	0.00	0.00
	0.00	
<b>Adjusted phosphorus MS4 allocations (kg/day):</b>		
Multiply the MS4 Allocations (WLA) from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	0.02	0.09
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	0.06	
	0.00	0.00
	0.00	
<b>Adjusted Sediment baseline MS4 loads (tons/year):</b>		
Multiply the MS4 Baseline Loads from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Sub-Total	Total (Watershed)
List all TMDL subbasins from Watershed 1 above	200.30	894.11
(Add or delete rows as needed)	693.81	
	0.00	0.00
	0.00	
<b>Adjusted Sediment MS4 WLAs (tons/year):</b>		
Multiply the MS4 Allocations (WLA) from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Sub-Total	Total (Watershed)
W01 - West Branch of the White Clay Creek	78.80	351.76
W02 - Unnamed Tributary to the Middle Branch of the White Clay Creek	272.95	
	0.00	0.00
	0.00	

<b>6 MUNICIPAL TMDL SUMMARY (BY WATERSHED)</b>			
<b>Note: All values are calculated in this section from the Watershed Totals in Appendix C.2, column E</b>		<b>TMDL Watershed 1</b>	<b>TMDL Watershed 1</b>
<b>NITROGEN</b> -	Applicable <input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/>	<b>W01</b>	<b>W02</b>
Total Nitrogen MS4 baseline Load (kg/day):		26.24	44.99
Total Nitrogen MS4 Allocation (kg/day):		13.12	20.24
Nitrogen Reduction (kg/day):		13.12	24.75
TMDL Percent Reduction:		50.0%	55.0%
Adjusted Total Nitrogen MS4 baseline Load (kg/day):		4.25	13.29
Adjusted Total Nitrogen MS4 Allocation (kg/day):		2.13	5.98
Adjusted Nitrogen Reduction (kg/day)		2.13	7.31
Adjusted Nitrogen Percent Reduction		50.0%	55.0%
New Nitrogen Municipal Load Allocation (kg/day):*		10.99	14.26
<b>PHOSPHORUS</b> -	Applicable <input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/>		
Total Phosphorus MS4 baseline Load (kg/day):		0.32	0.48
Total Phosphorus MS4 Allocation (kg/day):		0.14	0.22
Phosphorus Reduction (kg/day):		0.18	0.26
TMDL Percent Reduction:		56.3%	54.2%
Adjusted Total Phosphorus MS4 baseline Load (kg/day):		0.05	0.14
Adjusted Total Phosphorus MS4 Allocation (kg/day):		0.02	0.06
Adjusted Phosphorus Reduction (kg/day):		0.03	0.08
Adjusted Phosphorus Percent Reduction:		56.3%	54.2%
New Phosphorus Municipal Load Allocation (kg/day):*		0.12	0.16
<b>SEDIMENT</b> -	Applicable <input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/>		
Total Sediment baseline MS4 Load (tons/year):		1236.08	2348.68
Total Sediment MS4 Allocation (tons/year):		486.29	924.00
Sediment Reduction (tons/year):		749.79	1424.68
TMDL Percent Reduction:		60.7%	61%
Adjusted Total Sediment MS4 baseline Load (tons/year):		200.30	693.81
Adjusted Total Sediment MS4 Allocation (tons/year):		78.80	272.95
Adjusted Sediment Reduction (tons/year):		121.50	420.86
Adjusted Sediment Percent Reduction:		60.7%	60.7%
New Sediment Municipal Load Allocation (tons/year)*		407.49	651.05
* The new Municipal Load Allocations are not addressed by this MS4 TMDL Strategy			
** Refer to Appendix D			

## VIII. Control Measures and BMPs Implemented to Meet the TMDL(s):

### a. MS4 TMDL Implementation Area:

The TMDL Implementation Area for placing TMDL BMPs/control measures consists of any location within a TMDL Subbasin that drains to a stream with a stormwater-related impairment, and within the Urbanized Area. Once PADEP credit, trading, and offset policies are in place, BMPs/control measures may be located outside the Urbanized Area, subject to those policies. The MS4 TMDL Implementation Area for Penn Township is based on the information above and the definition presented in “Key Definitions”.

### b. Priorities for Implementation:

Based on PADEP feedback from the letter dated March 21, 2012 (Appendix B), BMP/control measure selection has been prioritized within the Implementation Area in the following order:

- First on properties owned by the Municipality that will minimize the volume and rate of stormwater flow discharging from the Regulated Small MS4 and are within the TMDL watershed and the Urbanized Area;
- Second, on non-Municipal properties that will minimize the volume and rate of stormwater flow discharging from the Regulated Small MS4 and are within the TMDL watershed and Urbanized Area;
- Third, on non-Municipal properties within the Urbanized Area that are a source of sediment or nutrients; and
- Fourth, on any sources outside the Urbanized Area located within the TMDL watershed and targeted to maximize pollutant load reductions, and in accordance with DEP’s forthcoming applicable credit, trading, and offset policies.

Penn Township will formally establish its responsibilities associated with protecting the permanence of each BMP/control measure implemented for achieving the TMDL Load Reductions presented in this MS4 TMDL Strategy, in order to sustain those water quality improvements into the long-term future. This includes establishing the necessary legal and administrative arrangements and instruments to insure that Penn Township can fulfill its responsibilities for access, and inspection, maintenance, and operation (O, M & I) of any constructed TMDL BMP/control measure, and protect each measure against future disturbance except as authorized by Penn Township. These responsibilities will be established and implemented for each BMP/control measure installation or retrofit for which a Load Reduction is counted by Penn Township toward its incremental and total TMDL targets.

c. **Inventory of Previously Installed Pollutant Reduction Control Measures (March 10, 2003–December 31, 2015)**

Penn Township:

- has previously installed pollutant reduction control measures to claim (2003-2012). See below.
- has NO previously installed pollutant reduction control measures to claim at this time (2003-2015). (Skip below and go to Subsection VIII.d).

The Township will as part of its strategy develop an inventory of previously installed BMP and determine if the BMP provide pollution reduction measure to incorporate into future updates of the TMDL Strategy.

**Table 3. Previously Installed BMPs/Control Measures and Pollutant Reductions  
For Penn Township in [Name of TMDL Watershed]  
[to be completed by municipalities]  
[If Municipality has two TMDL Watersheds duplicate Table 3 and renumber the Tables 3.a and 3.b.]**

BMP/ control measure #	Date Installed	Description	BMP Category *	TMDL Subbasin	In Urbanized Area?	Pollutant(s) Treated	Removal Efficiency (for each)**	Estimated Pollutant Load Reduction**	Date of Last Inspection	Condition/ Performance of BMP at inspection
1		Add a new record for each BMP	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Nitrogen <input type="checkbox"/> Phosphorus <input type="checkbox"/> Sediment	X% X% X%	N (kg/day) P (kg/day) S (tons/year)		
			1 and 2	<b>Total Installed BMP/control measure Reduction</b> (sum of BMP/control measures categories 1 +2**)→				N (kg/day) P (kg/day) S (tons/year)		
			3	<b>Reductions achieved through Municipal Stormwater Ordinance Control Measure</b> (Sum of BMP/control measures category 3**)→				N (kg/day) P (kg/day) S (tons/year)		
				<b>Total Gross Reduction →</b> (BMP/control measures + Stormwater Ordinance)				N (kg/day) P (kg/day) S (tons/year)		
		<i>No Credits Are Being Claimed at this Time</i>		Increased Pollutant loadings due to development, additional impervious surfaces, or other sources between March 10, 2003 and <i>December 31, 2015</i> <b>Total Increase →</b>				N (kg/day) P (kg/day) S (tons/year)		
				<b><u>TOTAL NET REDUCTION →</u></b> (Total Gross – Increase) Counted towards meeting the TMDL				N (kg/day) P (kg/day) S (tons/year)		

\*BMP/control measure Categories:

- 1) Voluntary retrofits/control measures – non-structural or structural.
- 2) Voluntary increased control measures above the NPDES requirements installed as part of land development project.
- 3) Non-voluntary increased control measures required by the Municipal Stormwater Management Ordinance, which exceed NPDES requirements.

\*\*All calculations and supporting documentation are provided in Appendix D.



**Figure 2. Penn Township Locations of Previously Installed and Candidate  
BMPs/Control Measures**

Londonderry Township

London Grove Township

Upper Oxford Township

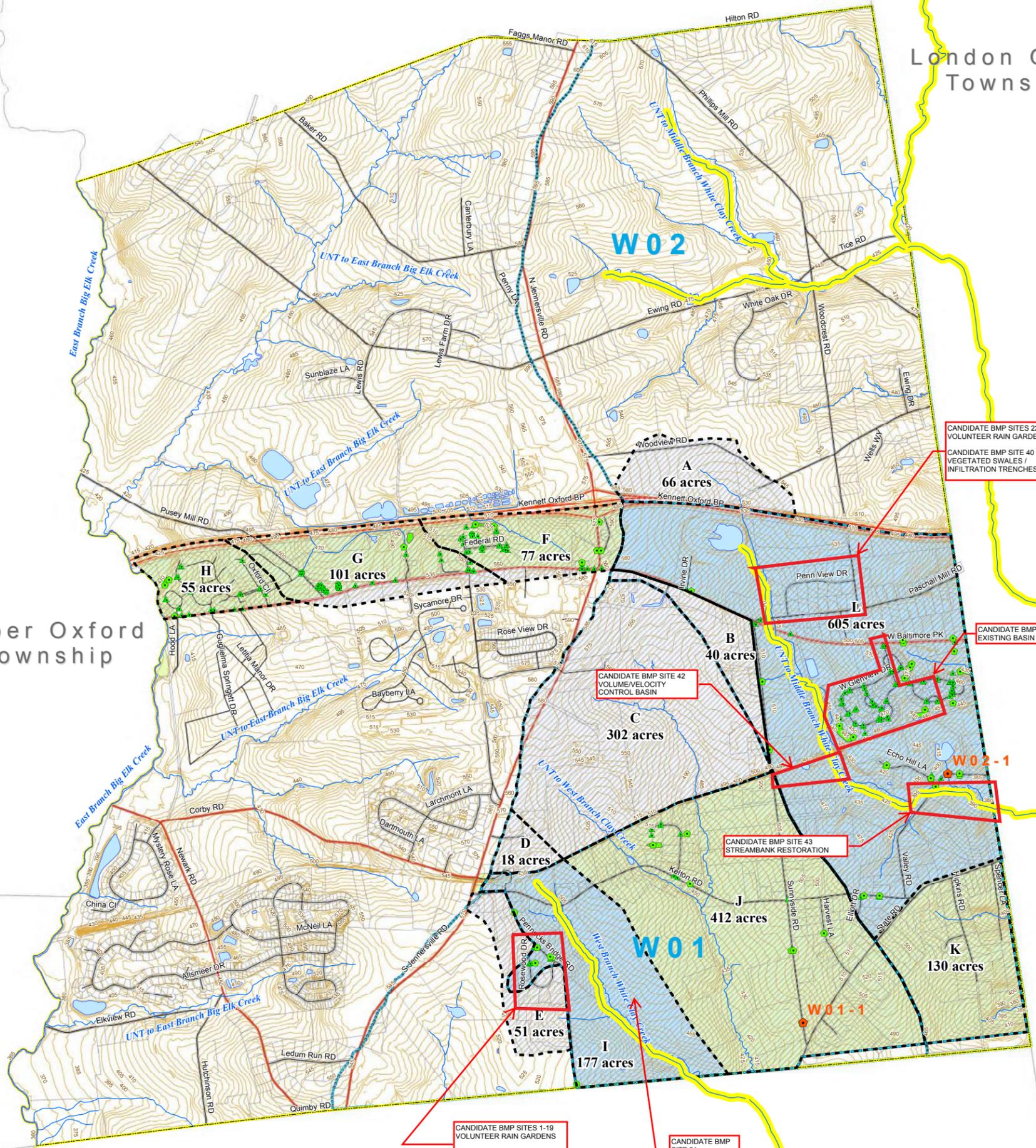
Lower Oxford Township

East Nottingham Township

New London Township

Penn Township,  
Chester County, Pennsylvania

**MS4 STORM SEWER SYSTEM  
AND OUTFALL LOCATION MAP**

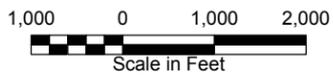


Outfall_ID	Lon	Lat
W01-1	75° 51' 27.87" W	39° 48' 7.59" N
W02-1	75° 50' 55.19" W	39° 48' 50.07" N

**LEGEND**

- ◆ Regulated Outfalls
- ◆ MS4 Outfalls
- Culverts
- ▲ Inlets
- Manholes
- Basins
- Lakes and Ponds
- Christina TMDL Subbasins
- Rivers and Streams
- Impaired Streams
- Township Boundary
- Local Roads
- State Roads
- Tax Parcels
- Topography (5-ft.)
- 2000 Urbanized Area
- Impaired Subbasins
- Drainage Areas

- CANDIDATE BMP SITES 1-19  
VOLUNTEER RAIN GARDENS
- CANDIDATE BMP SITE 20  
STREET SWEEPING
- CANDIDATE BMP SITE 21  
AGRICULTURAL CONSERVATION PLAN
- CANDIDATE BMP SITE 42  
VOLUME/VELOCITY CONTROL BASIN
- CANDIDATE BMP SITE 43  
STREAMBANK RESTORATION
- CANDIDATE BMP SITE 41  
EXISTING BASIN RETRO-FIT
- CANDIDATE BMP SITES 22-39  
VOLUNTEER RAIN GARDENS
- CANDIDATE BMP SITE 40  
VEGETATED SWALES / INFILTRATION TRENCHES



Note: Impaired streams are from Chester County Water Resources Authority, 2015, Christina Basin TMDL: Nutrient or Sediment Impairments from 1996 or 1998

The PADEP letter further states that “...any municipality that seeks to count pollutant load reductions made in the past can do so only if they satisfy all of the above factors to DEP’s satisfaction.”

As noted above, there are projects within Penn Township that were previously implemented. However, the projects are not all currently within a TMDL Watershed. Penn Township will continue to work to properly inventory previously implemented BMPs and determine if pollutant reduction credits can be justified if and when it is determined they are located within a TMDL Watershed.

**d. Municipal Stormwater Ordinance Control Measure:**

The stormwater ordinance adopted by Penn Township in *January 2014* meets or exceeds the minimum standards required in the “County-wide Act 167 Plan for Chester County.” Penn Township’s stormwater ordinance exceeds the minimum PADEP NPDES permit requirements for new construction for the following components related to water quality protection:

- Infiltration;
- Volume control;
- Minimum area of proposed impervious surface or proposed or earth disturbance to which ordinance standards apply;
- Peak Rate Reductions for New Development of 2-yr Post to 1-yr Pre, 5-yr Post to 2-yr Pre, 10-yr Post to 2-yr Pre, 25-yr Post to 10-yr Pre, and 50-yr Post to 25-yr (24-Hour Duration Storm Events)

Penn Township may document all future BMPs/control measures installed as part of new construction or redevelopment projects that meet the requirements of its Ordinance and achieve pollutant load reductions that exceed the minimum requirements of a PADEP NPDES permit for new construction. Only the portion of pollutant load removal that is above and beyond the PADEP NPDES permit requirement is counted towards the required TMDL pollutant Load Reductions and will be counted toward the TMDL implementation timeline and milestones for Penn Township(see Subsection 3.IX).

**e. Proposed Control Measures to be Implemented:**

Table 4 and Figure 2 present the candidate BMPs/control measures to be implemented by Penn Township during this 5-year permit cycle. Penn Township is reviewing the opportunities to implement these or other BMP/control measures at locations where the water quality benefits will be maximized.

For each BMP/control measure listed in Table 4, justification for load reduction performance, including calculations and a brief analysis to explain and justify the selection of BMP/control measures proposed, have been provided in Appendix D.

In subsequent permit cycles all BMPs/control measures implemented from Table 4 will be moved to Table 3, and counted towards the MS4 TMDL milestones.

The final list of selected BMP/control measures with the specific location and MS4 TMDL design details will be submitted to PADEP as Penn Township's MS4 TMDL Plan – Part II, no later than one year from the effective date of authorization of Penn Township's MS4 permit renewal. All constructed or retrofitted BMP/control measures will be accompanied by the necessary legal and/or administrative arrangements and instruments to establish long term access and inspection, operation and maintenance responsibilities by Penn Township and permanent protection from disturbance or modification except as authorized by Penn Township.



**Table 4a. List of Candidate BMPs/Control Measures**  
**W01 – West Branch of the White Clay Creek – Penn Township**

BMP/ control measure #	Description of BMP/Control Measure	BMP Category *	TMDL Subbasin	In Urbanized Area?	Pollutant(s) Treated	Removal Efficiency (for each)**	Estimated Pollutant Load Reduction*
1-19	Rosewood Drive Subdivision BMP 6.4.5 – Voluntary Rain Garden Implementation and/or Township Rain Garden Program for Existing Single-Family Residential properties.	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	W01	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Nitrogen <input checked="" type="checkbox"/> Phosphorus <input checked="" type="checkbox"/> Sediment	30% 85% 85%	0.0205 (kg/day) 0.0007 (kg/day) 2.7413 (tns/yr)
20	Rosewood Drive Subdivision BMP 5.9.1 Street Sweeping: Bi-weekly Sweeping Program Seek Partnership with adjacent Municipalities for equipment sharing to minimize cost.	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	W01	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Nitrogen <input checked="" type="checkbox"/> Phosphorus <input checked="" type="checkbox"/> Sediment	20% 10% 20%	0.0551 (kg/day) 0.0003 (kg/day) 2.5982 (tns/yr)
21	Agricultural Conservation Plan Preventive Plan for Nitrogen, Phosphorus, and Sediment Work with Agricultural Community to update practiced to reduce runoff to the West Branch of the White Clay Creek	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	W01	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Nitrogen <input checked="" type="checkbox"/> Phosphorus <input checked="" type="checkbox"/> Sediment	20% 20% 50%	0.7808 (kg/day) 0.0098 (kg/day) 92.039 (tns/yr)
<b><i>TOTAL ESTIMATED REDUCTION →</i></b> Counted towards meeting the TMDL							<b>0.856 (kg/day)</b> <b>0.011 (kg/day)</b> <b>99.68 (tns/yr)</b>

\*BMP Categories:

- 1) Retrofits/control measures – non-structural or structural.
- 2) Increased control measures above the NPDES requirements installed as part of land development project.
- 3) Increased control measures required by the Municipal Stormwater Management Ordinance, which exceed NPDES requirements.

\*\*All calculations and supporting documentation are provided in Appendix D.

**Table 4b. List of Candidate BMPs/Control Measures**  
**W02 – Unnamed Tributary to the Middle Branch of the White Clay Creek – Penn Township**

BMP/ control measure #	Description of BMP/Control Measure	BMP Category *	TMDL Subbasin	In Urbanized Area?	Pollutant(s) Treated	Removal Efficiency (for each)**	Estimated Pollutant Load Reduction*
22-39	Penn View Dr / Paschal Mill Rd BMP 6.4.5 – Voluntary Rain Garden Implementation and/or Township Rain Garden Program for Existing Single-Family Residential properties.	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	W02	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Nitrogen <input checked="" type="checkbox"/> Phosphorus <input checked="" type="checkbox"/> Sediment	30% 85% 85%	0.0178 (kg/day) 0.0005 (kg/day) 2.6319 (tns/yr)
40	Penn View Drive / Paschal Mill Road BMP 6.4.8 - Vegetated Swales: Attenuate and provide some infiltration from adjacent impervious surfaces, settling of pollutants	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	W02	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Nitrogen <input checked="" type="checkbox"/> Phosphorus <input checked="" type="checkbox"/> Sediment	20% 50% 50%	0.0212 (kg/day) 0.0005 (kg/day) 2.7644 (tns/yr)
41	Penn Ridge Development BMP 6.6.2 – Retrofit existing Basins for Retention and add Forebays and a permanent pool.	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	W02	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Nitrogen <input checked="" type="checkbox"/> Phosphorus <input checked="" type="checkbox"/> Sediment	30% 60% 70%	0.2750 (kg/day) 0.0050 (kg/day) 33.451 (tns/yr)
42	Sunnyside Road Nursery – UPI 58-4-105.2A BMP 6.6.2 – Install new Wet Pond Basin for Retention and water Quality	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	W02	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Nitrogen <input checked="" type="checkbox"/> Phosphorus <input checked="" type="checkbox"/> Sediment	30% 60% 70%	0.0690 (kg/day) 0.0013 (kg/day) 8.3888 (tns/yr)
43	Streambank Restoration Improvements to reduce streambank erosion	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	W02	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Nitrogen <input checked="" type="checkbox"/> Phosphorus <input checked="" type="checkbox"/> Sediment	1% 3% 95%	0.0076 (kg/day) 0.0002 (kg/day) 37.52 (tns/yr)
						<b><i>TOTAL ESTIMATED REDUCTION →</i></b> Counted towards meeting the TMDL	<b>0.391 (kg/day)</b> <b>0.007 (kg/day)</b> <b>84.75 (tns/yr)</b>

\*BMP Categories:

- 1) Retrofits/control measures – non-structural or structural.
- 2) Increased control measures above the NPDES requirements installed as part of land development project.
- 3) Increased control measures required by the Municipal Stormwater Management Ordinance, which exceed NPDES requirements.

\*\*All calculations and supporting documentation are provided in Appendix D.



## **IX. Analysis of Consistency of this Implementation Plan with WLAs and TMDLs:**

### **a. Analysis of Consistency:**

As shown in Tables 1, 2, 3, 4, and 5 (presented below), Figures 1 and 2, and as described in the “Key Definitions” and Subsections C.I through C.VIII of this MS4 TMDL Strategy, the implementation actions listed in Subsection C.VIII and this MS4 TMDL Strategy are consistent with the requirements and assumptions of the applicable TMDL Reports listed in Subsection C.I.

### **b. Timeline and Milestones:**

Table 5 presents the TMDL implementation timeline and milestones for *Penn Township*. In accordance with the expectations set forth in the PADEP letter dated March 21, 2012 (Appendix B), *Penn Township* will attain its full required pollutant Load Reduction(s) within the following timeline:

- *Regulated small MS4s with applicable WLAs requiring reductions of up to 50% should have a timeline no longer than 10 years;*
- *Where reductions of 50-85% are required in the WLA, the timeline should be no longer than 15 years; and*
- *Regulated small MS4s subject to WLAs requiring reductions 85% or greater, should have a timeline no greater than 20 years.*

The PADEP letter further states: “Operators of regulated small MS4s can seek a longer timeframe if they are able to provide a compelling justification in their MS4 TMDL Plan submittal, to DEPs satisfaction, demonstrating why a longer timeframe is necessary.”

**Table 5. Timeline and Milestones for Attaining TMDL Pollutant Load Reductions  
Penn Township - 2013 -2018**

TMDL WATERSHED	Pollutant	Load Reduction Required	Percent Load Reduction Required	PADEP Required Timeframe for Attaining Reduction*		Cumulative Percent of Required Pollutant Load Reduction Attained by end of Permit Cycle**			
				Total years	Calendar Year	(1) 2018	(2) 2023	(3) 2028	(4) 2033
W01 West Branch of the White Clay Creek	Nitrogen	2.13 (kg/day)	50%	10	2026	2.74%	39.70%	39.95%	40.21%
	Phosphorus	0.03 (kg/day)	56%	10	2026	1.53%	34.83%	36.36%	37.00%
	Sediment	121.50 (tons/year)	61%	10	2026	2.49%	78.96%	81.45%	82.05%
W02 UNT to the Middle Branch of the White Clay Creek	Nitrogen	7.31 (kg/day)	55%	10	2026	0.33%	4.17%	4.35%	5.34%
	Phosphorus	0.08 (kg/day)	54%	10	2026	0.70%	7.14%	7.56%	9.25%
	Sediment	420.86 (tons/year)	61%	10	2026	0.76%	8.92%	18.01%	20.14%

Notes:

\*Per PADEP letter dated March 21, 2012 (Appendix B), "Regulated small MS4s with applicable WLAs requiring reductions up to 50% should have a timeline no longer than 10 years. Where reductions of 50 - 85% are required in the WLA, the timeline should be no longer than 15 years. Regulated small MS4s subject to WLSs requiring reductions of 85% or greater should have a timeline no greater than 20 years."

\*\* Per PADEP letter dated March 21, 2012 (Appendix B), "...at least 10-15% of the pollutant load reductions are targeted to be achieved by the end of the first MS4 TMDL permit cycle unless a municipality provides compelling justification in its MS4 TMDL Plan, to DEP's satisfaction, demonstrating the rationale for why alternate load reduction percentages may be merited in the first and other permit terms."

As shown, the following milestones will be achieved by Penn Township:

- One year from authorization of permit renewal: Proposed BMP/control measure design details will be submitted to PADEP as the Penn Township MS4 TMDL Plan, Part II, for PADEP approval.
- Proposed control measures will be installed on-the-ground in time for their successful operation to be documented in the periodic report or progress report submitted at the end of the third year of coverage under this permit.
- Prior to next permit cycle, the Penn Township's timeline and milestones will be reviewed and, if necessary, revised based on progress achieved and experience gained in this 5-year permit cycle.

**c. Implementation Tracking:**

Penn Township will maintain a TMDL Implementation and Attainment Log (Table 6) that will be an official tally of progress toward the incremental (by permit cycle) and total (cumulative) TMDL targets presented in this MS4 TMDL Strategy. This log will document pollutant Load Reductions achieved from previously installed control measures (2003 – 2012) (Subsection C.VIII.c -Table 3), reductions achieved as new control measures are installed or retrofitted during each permit cycle, and reductions achieved through implementation of the Penn Township stormwater ordinance (Subsection C.VIII.d). The TMDL Implementation and Attainment Log will be included in each periodic municipal MS4 permit report to PADEP.

All pollutant reduction actions taken by the Municipality that satisfy the requirements specified in this MS4 TMDL Strategy and by PADEP will be quantified and recorded in the TMDL Implementation and Attainment Log (Table 6), and applied towards the Adjusted required pollutant Load Reductions (Table 2) (or EPA original MS4 reduction (Table 1), if no adjustment was made). Progress will be reported both numerically (mass/time) and as a percentage of the overall MS4 required Load Reduction.



**Table 6. TMDL Implementation and Attainment Log  
Penn Township - TMDL Watershed W01, 2013 -2018**

Line	TMDL WATERSHED 1: [Insert Name of TMDL Watershed*]	Nitrogen (kg/day)	Phosphorus (kg/day)	Sediment (tons/year)	Source or Calculation
	<b>REQUIRED POLLUTANT LOAD REDUCTIONS:</b>	Check if NOT Applicable <input type="checkbox"/>	Check if NOT Applicable <input type="checkbox"/>	Check if NOT Applicable <input type="checkbox"/>	
1	Total MS4 Load Reduction Required	<b>2.13</b>	<b>0.03</b>	<b>121.5</b>	Table 2 / Appendix C
	<b>POLLUTANT LOAD REDUCTIONS ACHIEVED:</b>				
2	Total Net Reductions achieved 2003 - 2015	0	0	0	Table 3, Total Net Reduction
3	Reductions estimated through proposed control measures (Permit cycle 1)	0.0242	0.0006	3.203	Table 4, Total Estimated Reduction
4	<b>Total Pollutant Reduction estimated by end of MS4 Permit Cycle</b>	<b>0.0242</b>	<b>0.0006</b>	<b>3.203</b>	Line 2 + Line 3
	<b>TMDL IMPLEMENTATION PROGRESS:</b>				
5	Percentage of Total TMDL Reduction Achieved during this MS4 Permit Cycle (incremental)	1.14%	2.00%	2.64%	(Line 4 / line 1) x 100
6	Percentage of Total TMDL Reduction Achieved by end of this MS4 Permit Cycle (cumulative)	1.14%	2.00%	2.64%	Same as line 5 (for this permit cycle only)
7	Implementation Milestone (target) for current MS4 Permit Cycle (Percent of Required Pollutant Load Reduction Attained by end of Permit Cycle )	10.00%	10.00%	10.00%	Table 5
8	Percentage of Remaining Pollutant Load Reduction to be achieved in future MS4 Permit Cycles	98.86%	98.00%	97.36%	100% - Line 6

**Table 6. TMDL Implementation and Attainment Log  
Penn Township - TMDL Watershed W02, 2013 -2018**

Line	TMDL WATERSHED 1: [Insert Name of TMDL Watershed*]	Nitrogen (kg/day)	Phosphorus (kg/day)	Sediment (tons/year)	Source or Calculation
	<b>REQUIRED POLLUTANT LOAD REDUCTIONS:</b>	Check if NOT Applicable <input type="checkbox"/>	Check if NOT Applicable <input type="checkbox"/>	Check if NOT Applicable <input type="checkbox"/>	
1	Total MS4 Load Reduction Required	<b>7.31</b>	<b>0.08</b>	<b>420.86</b>	Table 2 / Appendix C
	<b>POLLUTANT LOAD REDUCTIONS ACHIEVED:</b>				
2	Total Net Reductions achieved 2003 - 2015	0	0	0	Table 3, Total Net Reduction
3	Reductions estimated through proposed control measures (Permit cycle 1)	0.0242	0.0006	3.203	Table 4, Total Estimated Reduction
4	Total Pollutant Reduction estimated by end of MS4 Permit Cycle	<b>0.0242</b>	<b>0.0006</b>	<b>3.203</b>	Line 2 + Line 3
	<b>TMDL IMPLEMENTATION PROGRESS:</b>				
5	Percentage of Total TMDL Reduction Achieved during this MS4 Permit Cycle (incremental)	0.33%	0.75%	0.76%	(Line 4 / line 1) x 100
6	Percentage of Total TMDL Reduction Achieved by end of this MS4 Permit Cycle (cumulative)	0.33%	0.75%	0.76%	Same as line 5 (for this permit cycle only)
7	Implementation Milestone (target) for current MS4 Permit Cycle (Percent of Required Pollutant Load Reduction Attained by end of Permit Cycle )	10.00%	10.00%	10.00%	Table 5
8	Percentage of Remaining Pollutant Load Reduction to be achieved in future MS4 Permit Cycles	99.67%	99.25%	99.24%	100% - Line 6

**d. Process for Evaluating and Updating MS4 TMDL Plan:**

Penn Township will review its progress on meeting milestones on a periodic basis, maintain inspections and records to evaluate control measures and will periodically evaluate this MS4 TMDL Strategy for necessary modifications. Any modifications will be coordinated with PADEP prior to implementation. Penn Township will also continue participation in the C-TIP Partnership and work with the group to evaluate, and, as needed, revise the overall C-TIP approach to ensure timely progress toward the TMDL Watershed implementation targets.

**e. BMP/Control measures Performance Evaluation and Reporting:**

BMP/control measures performance evaluation will consist of inspections conducted by Penn Township (or its designee) to ensure that the BMP/control measures constructed or retrofitted to meet the TMDL requirements continue to be maintained as designed. The Municipality will insure that an appropriate technical expert will inspect the facility during construction and annually, and will report observations made. Any needs will be identified and reported, and will be scheduled for implementation. Inspection information will be maintained on file and summarized in municipal periodic MS4 permit reports.

**X. Additional Information: (See Appendices)**

## SECTION D – References

*2010 Pennsylvania Integrated Water Quality Monitoring and Assessment Report.* Undated. Pennsylvania Department of Environmental Protection. Office of Water Management, Bureau of Water Supply & Wastewater Management, Water Quality Assessment and Standards Division, Harrisburg, PA.

*Furlan, Ronald C. – PADEP.* Letter dated March 21, 2012, re: Christina Basin Total Maximum Daily Load Implementation Plan (C-TIP) (2/13/2012).

*Revisions to Total Maximum Daily Loads for Nutrient and Low Dissolved Oxygen Under High-Flow Conditions, Christina River Basin, Pennsylvania, Delaware, and Maryland.* September 2006. U.S. Environmental Protection Agency, Philadelphia, PA.

*Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland.* September 2006. U.S. Environmental Protection Agency, Philadelphia, PA

*Total Maximum Daily Load for the Red Clay Creek Basin Chester County, Pennsylvania.* April 7, 2007. U.S. Environmental Protection Agency, Philadelphia, PA.

*Total Maximum Daily Loads, Polychlorinated Biphenyls (PCBs) and Chlordane, West Branch Brandywine Creek, Chester County, Pennsylvania.* March 9, 2001. Pennsylvania Department of Environmental Protection, Harrisburg, PA,

### **SIGNATURE AND SEAL BY PROFESSIONAL ENGINEER**

\_\_\_\_\_  
Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
PA License Number

\_\_\_\_\_  
Date

**APPENDIX A –  
MUNICIPALITIES PARTICIPATING IN C-TIP PARTNERSHIP**

## APPENDIX A



# Brandywine Valley Association

This is a list of the Municipalities that are members of the CTIP partnership.

1. Avondale Borough
2. Caln Township
3. Coatesville
4. Downingtown Borough
5. East Bradford Township
6. East Brandywine Township
7. East Caln Township
8. East Fallowfield Township
9. Franklin Township
10. Honey Brook Township
11. Kennett Borough
12. Kennett Township
13. London Grove Township
14. Londonderry Township
15. New Garden Township
16. New London Township
17. Parkesburg Borough
18. Penn Township
19. Pennsbury Township
20. Pocopson Township
21. Sadsbury Township
22. South Coatesville
23. Thornbury Township
24. Upper Uwchlan Township
25. Uwchlan Township
26. Valley Township
27. West Bradford Township
28. West Brandywine Township
29. West Caln Township
30. West Chester Borough
31. West Goshen Township
32. West Whiteland Township

**1760 Unionville-Wawaset Road, West Chester, PA 19382-6751**

**T: 610-793-1090 F: 610- 793-2813 E: [water@bva-rcva.org](mailto:water@bva-rcva.org)**

**Web: [www.brandywinewatershed.org](http://www.brandywinewatershed.org)**

**APPENDIX B –  
PADEP LETTER DATED MARCH 21, 2012**



# pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

March 21, 2012

Ms. Jan Bowers  
Chester County Water Resources Authority  
601 Westtown Rd., Suite 270  
West Chester, PA 19380-0990

**Re: Christina River Total Maximum Daily Load Implementation Plan (C-TIP)(02/13/2012)**

Dear Ms. Bowers:

This letter constitutes the Department of Environmental Protection's (DEP) response to the Chester County Water Resource Authority's (CCWRA) submittal of the February 13, 2012, C-TIP proposal and discussions held in Harrisburg on that date. DEP would like to thank you, along with other CCWRA staff, the CCWRA, the Chester County Board of Commissioners, the Chester County Conservation District, the Brandywine Valley Association, and others who have taken the time and initiative to develop the approach and vet it with the many Christina Basin municipalities in Chester County. This coordinated effort is critical to the preparation and implementation of measures to meaningfully address the complex and geographically large Christina Basin TMDLs for Sediment and Nutrients. We are also appreciative of the efforts expended to revise earlier versions of C-TIP in response to concerns raised in several discussions with our agency.

In sum, DEP generally concurs with your approach, in concept, as a viable way for Christina municipalities to make substantial progress in addressing applicable MS4 TMDL WLAs under PAG-13 or an MS4 Individual NPDES permit to improve this Commonwealth's waters. We believe that your conceptual approach is generally sound, and parts of it, such as the approach to the parsing of WLA load in a municipality, mimic ongoing efforts we have engaged in. Also, we concur with your analysis regarding the non-applicability of bacteria TMDLs to the municipalities due to the absence of bacteria § 303(d) listings in the Christina Basin. In addition, your implementation approach appears sound, as well, though we have specific concerns below that will need to be addressed.

Although we generally concur with your proposal, our concurrence is conditioned on CCWRA and the implementing municipalities addressing our comments on how C-TIP can and should be improved, and some caveats, as set forth in the following paragraphs.

DEP's general conceptual approval of the February 13, 2012, C-TIP approach is subject to these caveats:

1. ***Concurrence in Concept Only*** - The conceptual approval from DEP of the February 13, 2012, C-TIP proposal is expressly limited to only the concept that has been brought before DEP, not any particulars or specifics in the proposal, except as expressly noted in this letter.
2. ***Right to Change Position*** - DEP reserves the right to change its position regarding the C-TIP proposal should further information or analysis reveal technical or legal flaws in the concept, as proposed or implemented, or should other circumstances or factors arise meriting a change in position.
3. ***No Pre-Approval of Municipal MS4 TMDL Plans*** - DEP's conceptual approval of the February 13, 2012, C-TIP proposal does not constitute pre-approval of any municipal MS4 TMDL Plan. The MS4 TMDL Strategy portion of each Plan that each municipality must develop under PAG-13 must be submitted to DEP by September 14, 2012, and will be evaluated on its own merits. Similarly, the MS4 TMDL Design Details part of the Plan that each municipality must develop must be submitted to DEP within one year of approval of coverage by DEP. DEP will not approve a MS4 TMDL Plan for a municipality unless the agency conducts an evaluation of the proposed Plan and then makes a finding that the Plan satisfies all applicable conditions of the permit and federal, state and local law, including a timeline with milestones outlining what will be accomplished, both in the first permit term and ultimately, along with the ten elements required for a Plan on pages 16-17 of Part C of the PAG-13 Authorization to Discharge.

DEP's approval is further conditioned on CCWRA and the implementing municipalities addressing the following concerns to the satisfaction of DEP.

1. ***Timeline for Attaining Pollutant Reduction Goals*** -- The C-TIP proposes a 25 year timeline to meet pollutant reduction targets. While this timeline is markedly better than the 40 year timeline set forth in the prior C-TIP proposal that was presented to DEP, it still falls short of the 15 year timeline recommended by EPA. As a condition of concurring with the C-TIP proposal, the timelines in the C-TIP need to be modified and implemented as follows.

DEP expects timeframes for pollutant reductions to be based on the pollutant load percentage reduction required for each regulated small MS4. Regulated small MS4s with applicable WLAs requiring reductions up to 50% should have a timeline no longer than 10 years. Where reductions of 50-85% are required in the WLA, the timeline should be no longer than 15 years. Regulated small MS4s subject to WLAs requiring reductions of 85% or greater should have a timeline no greater than 20 years. Operators of regulated small MS4s can seek a longer timeframe if they are able to provide a compelling justification in their MS4 TMDL Plan submittal, to DEP's satisfaction, demonstrating why a longer timeframe is necessary. Each MS4 TMDL Plan, including a request for an alternate timeline, will be evaluated on its merits.

2. ***Priorities for Municipal Pollutant Load Reductions*** -- On page 4 of the C-TIP narrative, the C-TIP gives first priority to implementing measures on "municipal owned/operated pollutant sources." DEP supports the focus on these areas as a way to harvest "low-hanging fruit" pollutant

load reductions in the first permit term and thereafter. Moreover, DEP expects that C-TIP municipalities will prioritize the installation and implementation of BMPs on municipal owned sources and other sources claimed by the municipality to minimize the volume and rate of stormwater flow discharging from the regulated small MS4 to surface waters. DEP also expects that BMPs will be installed and implemented at locations on municipal owned sources within the watershed that are targeted to maximize pollutant load reductions. It is important that pollutant reduction opportunities be undertaken in an efficient manner given the challenges of eliminating impairments and the costs of installing and implementing measures to address these impairments.

As a condition of DEP's concurrence with C-TIP, DEP expects that the C-TIP be amended and implemented to reflect the above-stated priorities, unless the municipality is able to provide a compelling justification, to DEP's satisfaction, demonstrating why a different approach is preferable.

**3. First Term Permit Reductions** - The C-TIP proposal specifies a 5% reduction in pollutant load in the first MS4 TMDL permit cycle (ie, the cycle running from approximately 2013-2018), along with 20-25% reductions listed in the C-TIP for subsequent permit cycles. While we acknowledge that there will be startup issues in obtaining such reductions, 5% seems like a low reduction target for the first permit term. Municipalities should, as specified in the C-TIP, be tackling their "low hanging fruit" in the first permit cycle, such as runoff from municipal owned and operated facilities. DEP questions whether it is reasonable to "backload" reductions to later permit cycles when the low hanging fruit is targeted as a priority in the first permit term. Accordingly, DEP's concurrence in the C-TIP proposal is conditioned on the C-TIP indicating that an effort will be made so that at least 10-15% of pollutant load reductions are targeted to be achieved by the end of the first MS4 TMDL permit cycle unless a municipality provides compelling justification in its MS4 TMDL Plan, to DEP's satisfaction, demonstrating the rationale for why alternate load reduction percentages may be merited in the first and other permit terms. Such demonstration needs to be consistent with any demonstration made for an alternate timeline as set forth above.

**4. Cause or Contribute Terminology** -- Throughout the C-TIP proposal there are references to the term "cause or contribute," or various iterations thereof. As we understand your use of the term, it is meant to address situations where the TMDL erroneously assigns a WLA to a municipality, such as the situation where a regulated small MS4 does not discharge stormwater from its outfalls (assuming they have been correctly identified) into the subbasin subject to the WLA. It could also apply to situations where an operator of a regulated small MS4 is not required under law to submit a MS4 TMDL Plan. We think your use of the term "cause or contribute" is better expressed in the phrase "the operator of the regulated small MS4 is not required to submit an MS4 TMDL Plan because the WLA is not applicable." The term "cause or contribute" is a term of art under the federal Clean Water Act that carries with it many permitting and water-quality based effluent limitations; implications that we believe unduly complicate what you are trying to do. If you choose to continue using the term "cause or contribute" you will need to provide a definition, together with an explanation and requisite justification explaining how, as the term is used in your proposal, a municipality would demonstrate that it does not "cause or contribute" to an existing impairment, including the justifications they would need to provide. This is a critical issue since the C-TIP proposal contains numerous "outs" excusing operators of

regulated small MS4s from preparing and executing MS4 TMDL Plans if they do not “cause or contribute.”

In sum, DEP’s concurrence is conditioned on the C-TIP proposal being amended in either of two ways. First, the proposal can be amended to delete any references to the term “cause or contribute” and replace them with terminology such as “the permittee is not required to submit an MS4 TMDL Plan because the WLA is not applicable,” or some similar language, along with conforming revisions. A second alternative is to provide an explanation with requisite definitions and justifications explaining how, as the term is used in your proposal, a permittee would demonstrate that it does not “cause or contribute” to an existing impairment, including the justifications they would need to provide.

**5. *Eligible Past Pollutant Reductions*** – A question arises whether a municipality participating in the C-TIP will be able to count pollutant reductions the permittee made at some time after the assessment that resulted in the impairment listing for which a TMDL (and WLA) was prepared. In prior C-TIP correspondence between DEP and CCWRA (July 15, 2011), DEP set out the following prerequisites for a municipality seeking to count pollutant load reductions from past actions. Any pollutant reductions claimed by a municipality for past BMP implementations will be analyzed under these factors: (1) the municipality must demonstrate that the subject BMPs satisfy all applicable legal requirements; (2) the municipal actions must have occurred after the more recent of: (a) March 10, 2003, (the date PCSM began to be implemented statewide) or (b) the completion date of the stream assessment for the applicable TMDL; (3) the municipality must demonstrate that any actions taken by the municipality to reduce pollutant loads were voluntary and not required by any permit, order, or other enforceable mechanism, or by any state, federal or local law; (4) the municipality must demonstrate that any actions taken reduced pollutant loads from the *status quo ante* prior to the action; (5) pollutant load reductions may not be claimed for open space or agricultural preservation; to count an action to reduce pollutant loads must be restorative not preservative; (6) net pollutant loading reductions must be calculated by netting the demonstrated pollutant load reductions of the applicable restoration BMPs installed after the applicable eligibility date against the increased pollutant loadings, if any, due to the addition of impervious surface and other development in and otherwise impacting the municipality during the timeframe in which credit for an applicable pollutant load reduction is sought; and (7) pollutant load reductions may be counted upon DEP’s determination that all applicable legal requirements have been satisfied and there is a demonstrated quantifiable net decrease in applicable pollutant loadings in the municipality for the identified timeframe.

DEP’s concurrence in the C-TIP concept is conditioned such that any municipality that seeks to count pollutant load reductions made in the past can do so only if they satisfy all of the above factors to DEP’s satisfaction.

**6. *Eligibility of Reductions Outside the Urbanized Area (UA)*** – A question arises whether pollutant reductions undertaken outside the UA by any entity can be counted by a municipality toward meeting a permittee’s MS4’s TMDL WLA obligations. In prior C-TIP correspondence between DEP and CCWRA (July 15, 2011), DEP set out the following prerequisites that a municipality must demonstrate, to DEP’s satisfaction, to count reductions undertaken outside of

the UA toward meeting a permittee's MS4's TMDL WLA obligation: (1) the municipality must demonstrate that it satisfies all applicable legal requirements; (2) any load reductions outside the UA can only be counted if they are consistent with DEP's forthcoming applicable credit, trading and offset policies; (3) the performance of any BMPs must be substantiated to the satisfaction of DEP with appropriate analyses to satisfy the claimed pollutant load reduction; (4) the permittee must establish suitable authority (e.g. ownership and control) over the BMP facilities; (5) the facilities and BMPs cannot also be counted toward meeting some other party's TMDL obligations; and (6) the target pollutant load reductions must be quantifiable at the impaired stream segment that receives stormwater discharges from the municipality's regulated small MS4.

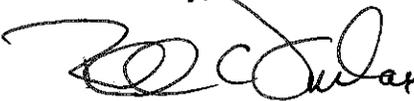
DEP's concurrence in the C-TIP concept is conditioned such that any municipality that seeks credits for pollutant load reductions undertaken outside the UA may do so only if they satisfy all of the above factors to DEP's satisfaction.

**7. Offsets, Trading and Credits in MS4 TMDL Plans** – As referenced above, any offset or credit sought by a municipality must be in accordance with DEP's applicable credit, trading and offset policies. As you are aware, DEP currently has an ongoing stakeholder group (in which you are a participant) that is discussing how offsets, trading and credits would be applied in a stormwater context. As such, municipalities that seek to include offsets and/or credits for pollutant load reductions in an MS4 TMDL Plan will need to ensure that such proposals conform with DEP's applicable credit, trading and offset policies as they evolve and are finalized and implemented.

**8. Adjustment of Allocations After First Permit Cycle** – The C-TIP proposal provides no explanation of how load reductions will be allocated by a municipality after the first MS4 TMDL permit cycle. DEP's concurrence in the C-TIP approach is conditioned on CCWRA providing language to DEP detailing how such load reductions will be re-allocated after the first MS4 TMDL permit cycle.

In closing, DEP thanks you again for your contributions toward planning, coordinating and implementing a program that has the tremendous potential to improve and protect Pennsylvania's water resources. We look forward to a continuing dialogue as PAG-13 implementation dates approach. If you have any questions about this letter, please contact me by e-mail at [rfurlan@pa.gov](mailto:rfurlan@pa.gov) or by telephone at 717.787.8184.

Sincerely,



Ronald C. Furlan, PE, Division Manager  
Division of Planning and Permitting

**APPENDIX C –**

**MS4 WORKSHEET FOR CALCULATING ADJUSTED MS4 BASELINE  
LOADS, ADJUSTED MS4 ALLOCATIONS, AND ADJUSTED MS4 LOAD  
REDUCTIONS**

**APPENDIX C.2 - MS4 WORKSHEET FOR CALCULATING ADJUSTED MS4 BASELINE LOADS,  
ADJUSTED MS4 ALLOCATIONS AND ADJUSTED MS4 LOAD REDUCTIONS -  
TOTAL LAND AREA METHOD**

MUNICIPALITY NAME:  , CHESTER COUNTY, PA

DATE OF TMDL PLAN SUBMISSION:

LIST APPLICABLE TMDL WATERSHED(S):

LIST ONLY THE TMDL SUBBASINS WITHIN EACH TMDL  
WATERSHED:

- 1) *White Clay Creek*
- 2)

*W01 and W02*

**FOR ALL LISTED TMDL SUBBASINS FILL IN SECTIONS 1, 2 and 4 WITH THE VALUES REFERENCED FROM THE APPLICABLE TMDL REPORT  
ALL OTHER VALUES ARE CALCULATED AS DESCRIBED. CALCULATIONS MUST BE APPLIED TO ALL NEW ROWS ADDED.**

**1 LAND USE AREAS (ACRES):**

*Copied from Tables C-1. - C-4. in Appendix C of TMDL Report; Total (Watershed) is the sum of all acres for all land uses in each TMDL Watershed*

TMDL subbasin	MS4 Total	Total (Watershed)
W01 - West Branch of the White Clay Creek	1092.29	3140.32
W02 - UNT to the Middle Branch of the White Clay Creek	2048.03	

**2 TMDL STORM SEWERSHED AREA (ACRES):** To be calculated by Municipality and inserted below

The following method, as described in Subsection VII.B, was used to assign these TMDL Storm Sewershed areas:

Total Land Area  ▼

TMDL subbasin	MS4 Total	Total (Watershed)
W01 - West Branch of the White Clay Creek	<b>177.00</b>	782.00
W02 - UNT to the Middle Branch of the White Clay Creek	<b>605.00</b>	

**3 LAND USE ADJUSTMENT RATIOS:**

Divide the TMDL Storm Sewershed area from Section 2 by the corresponding land use area from Section 1

TMDL subbasin	MS4 Total	Total (Watershed)
W01 - West Branch of the White Clay Creek	0.16	0.25
W02 - UNT to the Middle Branch of the White Clay Creek	0.30	

4 MS4 BASELINE LOADS AND MS4 ALLOCATIONS:		
<b>Total nitrogen MS4 baseline loads (kg/day):</b> Copied from TMDL Report Appendix C, Table(s): <u>C-9a</u>		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	26.24	71.23
W02 - UNT to the Middle Branch of the White Clay Creek	44.99	
<b>Total nitrogen MS4 allocations (kg/day):</b> Copied from TMDL Report Appendix C, Table(s): <u>C-9b</u>		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	13.12	33.36
W02 - UNT to the Middle Branch of the White Clay Creek	20.24	
<b>Total phosphorus MS4 baseline loads (kg/day):</b> Copied from TMDL Report Appendix C, Table(s): <u>C-10a</u>		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	0.320	0.800
W02 - UNT to the Middle Branch of the White Clay Creek	0.480	
<b>Total phosphorus MS4 allocations (kg/day):</b> Copied from TMDL Report Appendix C, Table(s): <u>C-10b</u>		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	0.140	0.360
W02 - UNT to the Middle Branch of the White Clay Creek	0.220	
<b>Sediment baseline MS4 loads (tons/year):</b> Copied from TMDL Report Appendix C, Table(s): <u>C-7b</u>		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	1236.08	3584.76
W02 - UNT to the Middle Branch of the White Clay Creek	2348.68	
<b>Sediment MS4 WLAs (tons/year):</b> Copied from TMDL Report Appendix C, Table(s): <u>C-7a</u>		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	486.29	1410.29
W02 - UNT to the Middle Branch of the White Clay Creek	924.00	

5 ADJUSTED MS4 BASELINE LOADS AND MS4 ALLOCATIONS		
<b>Adjusted nitrogen MS4 baseline loads (kg/day):</b>		
Multiply the MS4 Baseline Loads from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	4.25	17.54
W02 - UNT to the Middle Branch of the White Clay Creek	13.29	
<b>Adjusted nitrogen MS4 allocations (kg/day):</b>		
Multiply the MS4 Allocations (WLA) from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	2.13	8.11
W02 - UNT to the Middle Branch of the White Clay Creek	5.98	
<b>Adjusted phosphorus MS4 baseline loads (kg/day):</b>		
Multiply the MS4 Baseline Loads from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	0.05	0.19
W02 - UNT to the Middle Branch of the White Clay Creek	0.14	
<b>Adjusted phosphorus MS4 allocations (kg/day):</b>		
Multiply the MS4 Allocations (WLA) from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Subtotal	Total (Watershed)
W01 - West Branch of the White Clay Creek	0.02	0.09
W02 - UNT to the Middle Branch of the White Clay Creek	0.06	
<b>Adjusted Sediment baseline MS4 loads (tons/year):</b>		
Multiply the MS4 Baseline Loads from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Sub-Total	Total (Watershed)
W01 - West Branch of the White Clay Creek	200.30	894.11
W02 - UNT to the Middle Branch of the White Clay Creek	693.81	
<b>Adjusted Sediment MS4 WLAs (tons/year):</b>		
Multiply the MS4 Allocations (WLA) from section 4 by the corresponding Land Use Adjustment Ratio from section 3		
TMDL Subbasin	Sub-Total	Total (Watershed)
W01 - West Branch of the White Clay Creek	78.80	351.76
W02 - UNT to the Middle Branch of the White Clay Creek	272.95	

<b>6 MUNICIPAL TMDL SUMMARY (BY WATERSHED)</b>				
Note: All values are calculated in this section from the Watershed Totals in Appendix C.2, column E			TMDL Watershed 1	TMDL Watershed 1
NITROGEN -	Applicable <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>	W01	W02
Total Nitrogen MS4 baseline Load (kg/day):			26.24	44.99
Total Nitrogen MS4 Allocation (kg/day):			13.12	20.24
Nitrogen Reduction (kg/day):			13.12	24.75
TMDL Percent Reduction:			50.0%	55.0%
Adjusted Total Nitrogen MS4 baseline Load (kg/day):			4.25	13.29
Adjusted Total Nitrogen MS4 Allocation (kg/day):			2.13	5.98
Adjusted Nitrogen Reduction (kg/day)			<b>2.13</b>	<b>7.31</b>
Adjusted Nitrogen Percent Reduction			50.0%	55.0%
New Nitrogen Municipal Load Allocation (kg/day):*			10.99	14.26
PHOSPHORUS -	Applicable <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>		
Total Phosphorus MS4 baseline Load (kg/day):			0.32	0.48
Total Phosphorus MS4 Allocation (kg/day):			0.14	0.22
Phosphorus Reduction (kg/day):			0.18	0.26
TMDL Percent Reduction:			56.3%	54.2%
Adjusted Total Phosphorus MS4 baseline Load (kg/day):			0.05	0.14
Adjusted Total Phosphorus MS4 Allocation (kg/day):			0.02	0.06
Adjusted Phosphorus Reduction (kg/day):			<b>0.03</b>	<b>0.08</b>
Adjusted Phosphorus Percent Reduction:			56.3%	54.2%
New Phosphorus Municipal Load Allocation (kg/day):*			0.12	0.16
SEDIMENT -	Applicable <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>		
Total Sediment baseline MS4 Load (tons/year):			1236.08	2348.68
Total Sediment MS4 Allocation (tons/year):			486.29	924.00
Sediment Reduction (tons/year):			749.79	1424.68
TMDL Percent Reduction:			60.7%	61%
Adjusted Total Sediment MS4 baseline Load (tons/year):			200.30	693.81
Adjusted Total Sediment MS4 Allocation (tons/year):			78.80	272.95
Adjusted Sediment Reduction (tons/year):			<b>121.50</b>	<b>420.86</b>
Adjusted Sediment Percent Reduction:			60.7%	60.7%
New Sediment Municipal Load Allocation (tons/year)*			407.49	651.05

\* The new Municipal Load Allocations are not addressed by this MS4 TMDL Strategy

\*\* Refer to Appendix D

**APPENDIX D –  
BMP/CONTROL MEASURE DOCUMENTATION AND CALCULATIONS**

**PENN TOWNSHIP**  
**Strategy to Address TMDLs in the Christina Watershed**

**APPENDIX D**

**VOLUNTEER RAIN GARDEN IMPLEMENTATION/TOWNSHIP RAIN GARDEN PROGRAM**

Penn Township should reach out to property owners as part of the Public Outreach and Education to promote water quality improvement BMPs that individual private property owners could implement, such as Rain Gardens. The outreach and education should include information relating to grant opportunities. The Township should also consider implementing a Rain Garden program, which could be partially or fully funded by the MS4 Program stormwater fees, or other method selected by the Township to fund the MS4 Program. The Township could also pursue credits or reductions to stormwater fees if Rain Gardens are implemented on a voluntary basis by private property owners, or the Township could seek grant funding in order to implement a certain number of Rain Gardens per year through funding by grants.

**STREET SWEEPING PROGRAM**

Table A-4 in the PA BMP Manual lists the pollutant removal efficiency for street sweeping as 50% for Nitrogen, 85% for Phosphorus, and 85% for Total Suspended Solids. Appendix A also provides a tabular breakdown of the results of various studies, which compared sweeping frequency, type of equipment, and the associated pollutant removal efficiencies. Biweekly sweeping is listed with removal efficiencies for TP (20-40%) and TSS (40-60%) with no removal efficiency listed for TN. The table does not indicate what type of machine was used. Vacuum-assisted sweeper efficiencies are listed for TN (77%), TP (74%), and TSS (42%) but the table does not indicate the frequency that the sweeping occurred. A tabular summary is also provided with a range of pollutant removal efficiencies: TN (42–70%), TP (20–74%), and TSS (40–70%). The pollutant removal efficiencies used in this Strategy are taken from the low end of the ranges listed in the tabular summary and further reduced by half as a factor of safety to be conservative: TN 20%, TP, 10%, and TSS 20%.

The drainage area to the Rosewood Drive subdivision was analyzed by taking the area draining to the cartway of the roadway to determine the loading and pollutant reductions for street sweeping. There are approximately 10.5 acres that would drain to Rosewood Drive from the existing residential properties. Until a street sweeping program is implemented and quantifiable data is gained, a conservative approach is presented in this Strategy. If the projected loading is attained the program can be expanded to other areas of the MS4.

## AGRICULTURAL CONSERVATION PLANNING

The purpose of this strategy is to address the large area of agricultural land which drain to the West Branch of the White Clay Creek in the W01 watershed. The Township will work with the land owners and contract operators to develop a plan to reduce pollutants. In 2005, the PA DEP Chesapeake Bay Program shifted its program emphasis to support management type best management practices (BMPs), such as no-till, cover crop, and precision farming. While these practices are the focus of the PA Chesapeake Bay Tributary Strategies and have scientifically demonstrated the greatest reduction in soil and nutrient loss, these BMPs have also proved the greatest return in financial investment for the individual farmer/operator. The Penn Township Strategy for the West Branch of the White Clay Creek would follow the Chesapeake Bay Program and encourage farmers to cooperate with the Chester County Conservation District to develop and maintain a plan to reduce sediment and nutrient loss. The alternative would be to parse out the rather extensive drainage area. This would result in an opportunity to provide substantial sediment reduction in the stream. The Township will be proactive in monitoring the program to determine is measurable results can be attained. For the purposes of determining sediment and nutrient removal several BMPs were considered and conservative removal numbers were assumed.

## VEGETATED SWALES/INFILTRATION TRENCHES

The Township proposes to construct and maintain linear swales along the streets within the Penn View Drive Subdivision Area. Vegetated swales combined with infiltration trenches provide a broad shallow channel densely planted to attenuate and provide infiltration from the adjacent streets and a small portion of the adjoining properties. The channels allow some of the sediment to settle out while other pollutant laden runoff is infiltrated. The Swales will be constructed within existing rights of way of Township roads. In addition, the Township will provide an educational component to the strategy to educate residents of the importance of the swales and how they should be maintained since many of the areas adjacent to the roadways are maintained by the adjoining properties.

## RETRO-FIT EXISTING BASINS

This strategy would include the design and construction of retro-fit outs of the existing stormwater management basins at the Penn Ridge Residential Development. The existing basin were designed as detention basins, detaining additional runoff and control discharge of increased peak rates as a result of the development. The basin retro-fits would include forebays for sediment control and removal, a robust and diverse vegetative wet pond, and dewatering watering mechanism to extend detention time. The basins would be designed to provide a natural landscape connection to the adjoining riparian corridor to which the basin current drain. Tree planting from the point of discharge to the stream would provide added benefits. The basins currently receive runoff from approximately 41.7 acres of residential development captured in a storm sewer system.

## VOLUME / VELOCITY CONTROL BASIN

Penn Township will work with the property owners of an existing nursery site on the easterly side of Sunnyside Road to install a basin to provide volume and velocity controls for approximately 10.4 acres of land currently used for a nursery. The intense use as a nursery is currently draining to a portion of the unnamed tributary to the Middle Branch of the White Clay Creek. The strategy is to target intense uses that contribute high amounts of pollutants directly to the stream corridor. The Township proposes to work with the Conservation District as well as nursery associations to develop a model program that can be used at other nurseries throughout the Township and area.

## STREAMBANK RESTORATION

The Township Strategy includes a project to stabilize approximately 1,000 L.F. of stream bank of the UNT to the Middle Branch of the White Clay Creek in the southeastern portion of the Township adjoin London Grove Township. The project would use natural stabilization techniques to restore a permanent vegetative cover to the streambanks to reduce sediment from being carried by the stream during periods of high flows. In order to determine the sediment and nutrient removal from this strategy the Township considered an approximately 1,700 l.f. bank stabilization project was completed along an approximately 13.5 acre EPA capped property along the northerly bank of the West Branch Brandywine Creek. The property is part of the former Luria Brothers owned properties, in East Fallowfield Township and Modena Borough. The property was a former scrap metal yard and is presently capped. The estimated pollutant load reduction was calculated using the *Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual*, Revised June 1999, prepared by the Michigan Department of Environmental Quality, Water Division, Nonpoint Source Unit along with an Excel Workbook, which utilizes the same training manual. A conservative assumption was made with regard to the estimated amount of bank erosion per year (lateral recession rate). The amount of nutrients reduction is based on the tons of soil (sediment) kept in place by the stabilization. Default values for Nitrogen and Phosphorus were used, which are based on the soil type selected (silt loam in this case). Based on the model the resultant pollutant reduction was 0.0224 kg/day (2 %) for TN, 0.0112 kg/day (6%) for TP, and 9.03 tons/yr (161%) for TSS. Using a conservative modeling approach the pollutant load reduction as part of that project is estimated to achieve reductions of 0.0132 kg/day (1 %) for TN, 0.0066 kg/day (3%) for TP, and 5.31 tons/yr (95%) for TSS using the same model for calculations. It is estimated approximately 34.4 acres drain to this portion of the stream.

## SUMMARY

It is noted that while the PaDEP would like a 10% reduction in the first permit cycle the Township believes this is not possible due to the limited time remaining in the first cycle (2013-2018). In addition, the majority of the project will require funding through cooperation with property owners, conservation organizations and state and federal grant sources. It is estimated that it could take three to five years to develop the financial program necessary to begin the TMDL program.

D.A. in Basin	W01 BASIN - UNIT POLLUTANT LOADING		
	W01	TN	TP
Ac	kg/Ac/day	kg/Ac/day	tons/Ac/yr
53.0	0.0240	0.0003	1.1316

W01 BASIN - POLLUTANT REDUCTION TARGET		
TN	TP	TSS
kg/day	kg/day	tons/yr
2.13	0.03	121.50

			BMP POLLUTANT LOADING				BMP WQ FUNCTION (% REMOVAL)			BMP POLLUTANT REMOVAL			CUMULATIVE POLLUTANT REMOVAL		
			D.A to BMP	TN	TP	TSS	TN	TP	TSS	TN	TP	TSS	TN	TP	TSS
			Ac.	kg/day	kg/day	tons/yr	%	%	%	kg/day	kg/day	tons/yr	kg/day	kg/day	tons/yr
<b>Voluntary Rain Gardens/Rain Garden Program</b>															
1	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
2	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
3	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
4	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
5	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
6	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
7	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
8	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
9	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
10	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
11	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
12	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
13	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
14	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
15	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
16	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
17	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
18	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
19	6.4.5	Rain Garden/Bioretenion	0.150	0.0036	0.0000	0.1697	30%	85%	85%	0.0011	0.0000	0.1443			
TOTALS:			2.850	0.0684	0.0009	3.2251				0.0205	0.0007	2.7413	0.0205	0.0007	2.7413
PERCENTAGES:										0.96%	2.42%	2.26%	0.96%	2.42%	2.26%
<b>Rosewood Drive Subdivision</b>															
20	5.9.1	Streetsweeping	11.480	0.2755	0.0034	12.9908	20%	10%	20%	0.0551	0.0003	2.5982			
TOTALS:			11.480	0.2755	0.0034	12.9908				0.0551	0.0003	2.5982	0.0756	0.0011	5.3395
PERCENTAGES:										2.59%	1.15%	2.14%	3.55%	3.57%	4.39%
<b>Agricultural Conservation Planning</b>															
21	6.4.4	Infiltration Trench	162.670	3.9041	0.0488	184.0774	20%	20%	50%	0.7808	0.0098	92.0387			
TOTALS:			162.670	3.9041	0.0488	184.0774				0.7808	0.0098	92.0387	0.8564	0.0108	97.3781
PERCENTAGES:										36.66%	32.53%	75.75%	40.21%	36.10%	80.15%

**By End of Permit Cycle 1 (2018)**

BMP	TN	TP	TSS
20	0.0551	0.0003	2.5982
1	0.0011	0.0000	0.1443
2	0.0011	0.0000	0.1443
3	0.0011	0.0000	0.1443
<b>Permit Cycle 1 Total =</b>	<b>0.0583</b>	<b>0.0005</b>	<b>3.0310</b>
<b>Permit Cycle 1 % Removed =</b>	<b>2.74%</b>	<b>1.53%</b>	<b>2.49%</b>

**By End of Permit Cycle 2 (2023)**

BMP	TN	TP	TSS
21	0.7808	0.0098	92.0387
4	0.0011	0.0000	0.1443
5	0.0011	0.0000	0.1443
6	0.0011	0.0000	0.1443
7	0.0011	0.0000	0.1443
8	0.0011	0.0000	0.1443
9	0.0011	0.0000	0.1443
<b>Permit Cycle 2 Total =</b>	<b>0.7873</b>	<b>0.0100</b>	<b>92.9044</b>
<b>Permit Cycle 2 % Removed =</b>	<b>36.96%</b>	<b>33.30%</b>	<b>76.46%</b>
<b>Cumulative Total =</b>	<b>0.8456</b>	<b>0.0104</b>	<b>95.9354</b>
<b>Cumulative % Removed =</b>	<b>39.70%</b>	<b>34.83%</b>	<b>78.96%</b>

**By End of Permit Cycle 3 (2028)**

BMP	TN	TP	TSS
10	0.0011	0.0003	2.5982
11	0.0011	0.0000	0.0000
12	0.0011	0.0000	0.1443
13	0.0011	0.0000	0.1443
14	0.0011	0.0000	0.1443
<b>Permit Cycle 3 Total =</b>	<b>0.0054</b>	<b>0.0005</b>	<b>3.0310</b>
<b>Permit Cycle 3 % Removed =</b>	<b>0.25%</b>	<b>1.53%</b>	<b>2.49%</b>
<b>Cumulative Total =</b>	<b>0.8510</b>	<b>0.0109</b>	<b>98.9663</b>
<b>Cumulative % Removed =</b>	<b>39.95%</b>	<b>36.36%</b>	<b>81.45%</b>

**By End of Permit Cycle 4 (2033)**

BMP	TN	TP	TSS
15	0.0011	0.0000	0.1443
16	0.0011	0.0000	0.1443
17	0.0011	0.0000	0.1443
18	0.0011	0.0000	0.1443
19	0.0011	0.0000	0.1443
<b>Permit Cycle 2 Total =</b>	<b>0.0054</b>	<b>0.0002</b>	<b>0.7214</b>
<b>Permit Cycle 2 % Removed =</b>	<b>0.25%</b>	<b>0.64%</b>	<b>0.59%</b>
<b>Cumulative Total =</b>	<b>0.8564</b>	<b>0.0111</b>	<b>99.6877</b>
<b>Cumulative % Removed =</b>	<b>40.21%</b>	<b>37.00%</b>	<b>82.05%</b>

D.A. in Basin	W01 BASIN - UNIT POLLUTANT LOADING		
	W01	TN	TP
Ac	kg/Ac/day	kg/Ac/day	tons/Ac/yr
605.0	0.0220	0.0002	1.1468

W01 BASIN - POLLUTANT REDUCTION TARGET		
TN	TP	TSS
kg/day	kg/day	tons/yr
7.31	0.08	420.86

			BMP POLLUTANT LOADING				BMP WQ FUNCTION (% REMOVAL)			BMP POLLUTANT REMOVAL			CUMULATIVE POLLUTANT REMOVAL		
			D.A. to BMP	TN	TP	TSS	TN	TP	TSS	TN	TP	TSS	TN	TP	TSS
			Ac.	kg/day	kg/day	tons/yr	%	%	%	kg/day	kg/day	tons/yr	kg/day	kg/day	tons/yr
<b>Voluntary Rain Gardens/Rain Garden Program</b>															
22	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
23	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
24	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
25	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
26	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
27	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
28	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
29	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
30	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
31	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
32	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
33	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
34	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
35	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
36	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
37	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
38	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
39	6.4.5	Rain Garden/Bioretenion	0.150	0.0033	0.0000	0.1720	30%	85%	85%	0.0010	0.0000	0.1462			
TOTALS:			2.700	0.0594	0.0005	3.0964				0.0178	0.0005	2.6319	0.0178	0.0005	2.6319
PERCENTAGES:										0.24%	0.57%	0.63%	0.24%	0.57%	0.63%
<b>Penn View Drive / Paschal Mill Road Vegetated Swales</b>															
40	6.4.8	Vegetated Swales	4.821	0.1061	0.0010	5.5287	20%	50%	50%	0.0212	0.0005	2.7644			
TOTALS:			4.821	0.1061	0.0010	5.5287				0.0212	0.0005	2.7644	0.0390	0.0009	5.3963
PERCENTAGES:										0.29%	0.60%	0.66%	0.53%	1.18%	1.28%
<b>Agricultural Conservation Planning</b>															
41	6.6.2	Retrofit Existing Basins	41.670	0.9167	0.0083	47.7872	30%	60%	70%	0.2750	0.0050	33.4510			
TOTALS:			41.670	0.9167	0.0083	47.7872				0.2750	0.0050	33.4510	0.3141	0.0059	38.8473
PERCENTAGES:										3.76%	6.25%	7.95%	4.30%	7.43%	9.23%
42	6.6.2	Wet Pond w/ Forebay	10.450	0.2299	0.0021	11.9841	30%	60%	70%	0.0690	0.0013	8.3888			
TOTALS:			10.450	0.2299	0.0021	11.9841				0.0690	0.0013	8.3888	0.3830	0.0072	47.2361
PERCENTAGES:										0.94%	1.57%	1.99%	5.24%	8.99%	11.22%
43	6.6.2	Streambank Restoration	34.435	0.7576	0.0069	39.4901	1%	3%	95%	0.0076	0.0002	37.5156			
TOTALS:			34.435	0.7576	0.0069	39.4901				0.0076	0.0002	37.5156	0.0076	0.0002	37.5156
PERCENTAGES:										0.10%	0.26%	8.91%	0.10%	0.26%	8.91%

**By End of Permit Cycle 1 (2018)**

BMP	TN	TP	TSS
40	0.0212	0.0005	2.7644
22	0.0010	0.0000	0.1462
23	0.0010	0.0000	0.1462
24	0.0010	0.0000	0.1462
<b>Permit Cycle 1 Total =</b>	<b>0.0242</b>	<b>0.0006</b>	<b>3.2030</b>
<b>Permit Cycle 1 % Removed =</b>	<b>0.33%</b>	<b>0.70%</b>	<b>0.76%</b>

**By End of Permit Cycle 2 (2023)**

BMP	TN	TP	TSS
41	0.2750	0.0050	33.4510
25	0.0010	0.0000	0.1462
26	0.0010	0.0000	0.1462
27	0.0010	0.0000	0.1462
28	0.0010	0.0000	0.1462
29	0.0010	0.0000	0.1462
30	0.0010	0.0000	0.1462
<b>Permit Cycle 2 Total =</b>	<b>0.2810</b>	<b>0.0052</b>	<b>34.3283</b>
<b>Permit Cycle 2 % Removed =</b>	<b>3.84%</b>	<b>6.44%</b>	<b>8.16%</b>
<b>Cumulative Total =</b>	<b>0.3051</b>	<b>0.0057</b>	<b>37.5313</b>
<b>Cumulative % Removed =</b>	<b>4.17%</b>	<b>7.14%</b>	<b>8.92%</b>

**By End of Permit Cycle 3 (2028)**

BMP	TN	TP	TSS
43	0.0076	0.0002	37.5156
31	0.0010	0.0000	0.1462
32	0.0010	0.0000	0.1462
33	0.0010	0.0000	0.1462
34	0.0010	0.0000	0.1462
35	0.0010	0.0000	0.1462
<b>Permit Cycle 3 Total =</b>	<b>0.0125</b>	<b>0.0003</b>	<b>38.2466</b>
<b>Permit Cycle 3 % Removed =</b>	<b>0.17%</b>	<b>0.42%</b>	<b>9.09%</b>
<b>Cumulative Total =</b>	<b>0.3177</b>	<b>0.0060</b>	<b>75.7780</b>
<b>Cumulative % Removed =</b>	<b>4.35%</b>	<b>7.56%</b>	<b>18.01%</b>

**By End of Permit Cycle 4 (2033)**

BMP	TN	TP	TSS
42	0.0690	0.0013	8.3888
36	0.0010	0.0000	0.1462
37	0.0010	0.0000	0.1462
38	0.0010	0.0000	0.1462
39	0.0010	0.0000	0.1462
<b>Permit Cycle 2 Total =</b>	<b>0.0729</b>	<b>0.0014</b>	<b>8.9737</b>
<b>Permit Cycle 2 % Removed =</b>	<b>1.00%</b>	<b>1.70%</b>	<b>2.13%</b>
<b>Cumulative Total =</b>	<b>0.3906</b>	<b>0.0074</b>	<b>84.7517</b>
<b>Cumulative % Removed =</b>	<b>5.34%</b>	<b>9.25%</b>	<b>20.14%</b>

## BMP 5.9.1: Streetsweeping

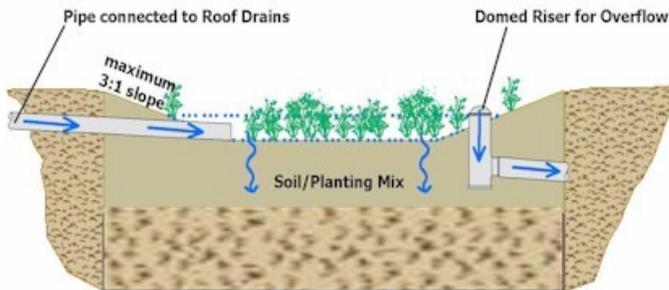


Use of one of several modes of sweeping equipment (e.g., mechanical, regenerative air, or vacuum filter sweepers) on a programmed basis to remove larger debris material and smaller particulate pollutants, preventing this material from clogging the stormwater management system and washing into receiving waterways/waterbodies.

<p style="text-align: center;"><b><u>Key Design Elements</u></b></p> <ul style="list-style-type: none"> <li>▪ Use proper equipment; dry vacuum filters demonstrate optimal results, significantly better than mechanical and regenerative air sweeping, though move slowly and are most costly</li> <li>▪ Develop a proper program; vary sweeping frequency by street pollutant load (a function of road type, traffic, adjacent land uses, other factors); sweep roads with curbs/gutters</li> <li>▪ Develop a proper program; restrict parking when sweeping to improve removal.</li> <li>▪ Develop a proper program; seasonal variation for winter applications as necessary.</li> </ul>	<p style="text-align: center;"><b><u>Potential Applications</u></b></p> <p>Residential: Yes  Commercial: Yes  Ultra Urban: Yes  Industrial: Yes  Retrofit: Yes  Highway/Road: Yes</p>
<p style="text-align: center;"><b><u>Stormwater Functions</u></b></p> <p>Volume Reduction: Low/None  Recharge: Low/None  Peak Rate Control: Low/None  Water Quality: High</p>	<p style="text-align: center;"><b><u>Stormwater Functions</u></b></p> <p>TSS: 85%  TP: 85%  NO3: 50%</p>

## BMP 6.4.5: Rain Garden/Bioretention

### RECHARGE GARDEN / BIORETENTION BED



A Rain Garden (also called Bioretention) is an excavated shallow surface depression planted with specially selected native vegetation to treat and capture runoff.

<p style="text-align: center;"><b><u>Key Design Elements</u></b></p> <ul style="list-style-type: none"> <li>▪ Maintain a minimum 2-foot separation to bedrock and seasonally high water table, provide distributed infiltration area (5:1 impervious area to infiltration area - maximum), site on natural, uncompacted soils with acceptable infiltration capacity, and follow other guidelines described in Protocol 2: Infiltration Systems Guidelines</li> <li>▪ Flexible in terms of size and infiltration</li> <li>▪ Ponding depths generally limited to 6 inches or less for aesthetics, safety, and rapid draw down. Certain situations may allow deeper ponding depths.</li> <li>▪ Deep rooted perennials and trees encouraged</li> <li>▪ Native vegetation that is tolerant of hydrologic variability, salts and environmental stress</li> <li>▪ Modify soil with compost.</li> <li>▪ Stable inflow/outflow conditions</li> <li>▪ Provide positive overflow</li> <li>▪ Maintenance to ensure long-term functionality</li> </ul>	<p style="text-align: center;"><b><u>Potential Applications</u></b></p> <p>Residential: Yes Yes                  Commercial: Ultra Yes                  Urban: Industrial: Yes Yes                  Retrofit: Yes                  Highway/Road: Yes</p> <hr/> <p style="text-align: center;"><b><u>Stormwater Functions</u></b></p> <p>Volume Reduction: Medium                  Recharge: Med./High                  Peak Rate Control: Low/Med.                  Water Quality: Med./High</p> <hr/> <p style="text-align: center;"><b><u>Stormwater Functions</u></b></p> <p>TSS: TP: 85% 85%                  NO3: 30%</p>
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### Other Considerations

- **Protocol 1. Site Evaluation and Soil Infiltration Testing** and **Protocol 2. Infiltration Systems Guidelines** should be followed, see Appendix C

## BMP 6.4.8: Vegetated Swale



A Vegetated Swale is a broad, shallow, trapezoidal or parabolic channel, densely planted with a variety of trees, shrubs, and/or grasses. It is designed to attenuate and in some cases infiltrate runoff volume from adjacent impervious surfaces, allowing some pollutants to settle out in the process. In steeper slope situations, check dams may be used to further enhance attenuation and infiltration opportunities.

<p style="text-align: center;"><b><u>Key Design Elements</u></b></p> <ul style="list-style-type: none"> <li>▪ Plant dense, low-growing native vegetation that is water-resistant, drought and salt tolerant, providing substantial pollutant removal capabilities</li> <li>▪ Longitudinal slopes range from 1 to 6%</li> <li>▪ Side slopes range from 3:1 to 5:1</li> <li>▪ Bottom width of 2 to 8 feet</li> <li>▪ Check-dams can provide limited detention storage, as well as enhanced volume control through infiltration. Care must be taken to prevent erosion around the dam</li> <li>▪ Convey the 10-year storm event with a minimum of 6 inches of freeboard</li> <li>▪ Designed for non-erosive velocities up to the 10-year storm event</li> <li>▪ Design to aesthetically fit into the landscape, where possible</li> <li>▪ Significantly slow the rate of runoff conveyance compared to pipes</li> </ul>	<p style="text-align: center;"><b><u>Potential Applications</u></b></p> <p>Residential: Yes Yes                  Commercial: Limited                  Ultra Urban: Yes                  Industrial: Yes*                  Retrofit: Yes                  Highway/Road: Yes</p> <hr/> <p style="text-align: center;"><b><u>Stormwater Functions</u></b></p> <p>Volume Reduction: Low/Med.                  Recharge: Low/Med.                  Peak Rate Control: Med./High                  Water Quality: Med./High</p> <hr/> <p style="text-align: center;"><b><u>Stormwater Functions</u></b></p> <p>TSS: 50%                  TP: 50%                  NO3: 20%</p>
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### **Other Considerations**

- **Protocol 1. Site Evaluation and Soil Infiltration Testing** and **Protocol 2. Infiltration Systems Guidelines** should be followed whenever infiltration of runoff is desired, see Appendix C

## BMP 6.6.2: Wet Pond/Retention Basin



Wet Ponds/Retention Basins are stormwater basins that include a substantial permanent pool for water quality treatment and additional capacity above the permanent pool for temporary runoff storage.

<p style="text-align: center;"><b><u>Key Design Elements</u></b></p> <ul style="list-style-type: none"> <li>▪ Adequate drainage area (usually 5 to 10 acres minimum)</li> <li>▪ Natural high groundwater table</li> <li>▪ Maintenance of permanent water surface</li> <li>▪ Should have at least 2 to 1 length to width ratio</li> <li>▪ Robust and diverse vegetation surrounding wet pond</li> <li>▪ Relatively impermeable soils</li> <li>▪ Forebay for sediment collection and removal</li> <li>▪ Dewatering mechanism</li> </ul>	<p style="text-align: center;"><b><u>Potential Applications</u></b></p> <p>Residential: Yes                  Commercial: Yes                  Ultra Urban: Yes                  Industrial: Yes                  Retrofit: Yes                  Highway/Road: Yes</p>
	<p style="text-align: center;"><b><u>Stormwater Functions</u></b></p> <p>Volume Reduction: Low                  Recharge: Low                  Peak Rate Control: High                  Water Quality: Limited</p>
	<p style="text-align: center;"><b><u>Stormwater Functions</u></b></p> <p>TSS: 70%                  TP: 60%                  NO3: 30%</p>