

**POLLUTANT REDUCTION PLAN
FOR IMPAIRED WATERS OF THE COMMONWEALTH
AND THE CHESAPEAKE BAY,
AND
TMDL PLAN TO PAXTON CREEK
PENBROOK BOROUGH, DAUPHIN COUNTY, PA**

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NPDES MS4 Permit PAG133544
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SUMMARY

Penbrook Borough has prepared this Pollutant Reduction Plan (PRP) for stormwater discharges of nutrients and sediment to surface waters in the Chesapeake Bay Watershed and to local surface waters impaired for nutrients and/or sediment to meet the requirements set forth by Pennsylvania's Department of Environmental Protection (PA DEP). This document also includes a Total Maximum Daily Load Plan (TMDL) to Paxton Creek that receives stormwater discharges from Penbrook Borough's MS4 area. The EPA-approved TMDL report was prepared by the PA DEP in July, 2008, and has identified specific waste-load allocations (WLAs) for sediment and phosphorus. As an MS4 community with locally impaired streams, Penbrook Borough must comply with Appendix D and Appendix E of the PAG-13 Individual Permit and must attach this PRP and TMDL to the Notice of Intent (NOI) for Individual Permit Coverage. Penbrook Borough has invited public participation in the planning process by making this PRP and TMDL plan available for a 30-day public review and comment period. A copy of all written comments received and the record of consideration of each one is included in Section A of this document.

This PRP calculates the existing loading of stormwater pollutants within the portion of the urban area which drains to an MS4 outfall location in the Spring Creek Watershed, in lbs/year; calculates the minimum required reduction in loading, in lbs/year; selects best management practices (BMPs) to reduce the loading rates; and demonstrates that the selected BMPs will achieve the minimum reductions. The pollutants of concern and associated required reductions for the Chesapeake Bay and locally impaired streams in Penbrook Borough are sediment (10%), phosphorus (5%), and nitrogen (3%). PA DEP allows using a presumptive approach in which it is assumed that a 10% reduction in sediment will accomplish a 5% reduction in phosphorus and a 3% reduction in nitrogen.

This Paxton Creek TMDL plan identifies the established WLA for sediment, in lbs/year, identifies the required reduction in loading to meet water quality goals, in lbs/year; calculates the minimum 10% reduction required to satisfy short-term objectives, in lbs/year; selects BMPs to reduce the loading rates; and demonstrates that the selected BMPs will achieve the minimum reductions.

To improve water quality and meet the required pollutant reductions for both the Spring Creek and Paxton Creek Watersheds, Penbrook Borough proposes to construct a rain garden, a dry extended detention basin, an infiltration bed, and retro-fit a grass swale into a bioswale/vegetated swale. The proposed dry extended detention basin temporarily stores stormwater runoff from upland developed areas for up to three days and minimizes sediment pollution by allowing ample time for suspended solids to settle out in the basin rather than being discharged downstream. The proposed rain garden and bioswale will be planted with native vegetation to promote groundwater infiltration and filter stormwater discharge. The infiltration trench will also promote groundwater infiltration and remove stormwater volume discharge to surface streams. These BMPs will improve water quality by reducing stormwater volumes, increasing groundwater supplies, and filtering stormwater pollutants.

Penbrook Borough will prepare and submit updates on the progress of implementing this PRP with the MS4 Annual Report due each year to PA DEP by September 30th.

TABLE OF CONTENTS

SECTION A - PUBLIC PARTICIPATION

Attachments

- A1: A copy of the public notice
- A2: The record of all written and verbal comments
- A3: Written consideration of all timely comments
- A4: Description of changes made to the PRP

SECTION B - MAPS

Attachments

- B1: Hydrology Map
- B2: Stormwater System Map
- B3: Proposed Stormwater BMP Map

SECTION C - POLLUTANTS OF CONCERN

Attachments

- C1: MS4 Requirements Table for Dauphin County Municipalities
- C2: 2008 Total Maximum Daily Load (TMDL) Paxton Creek
- C3: Paxton Creek TMDL Nutrient Withdrawal Decision Rationale
- C4: Paxton Creek Sediment TMDL Errata

SECTION D - DETERMINE EXISTING LOADING FOR POLLUTANTS OF CONCERN

Attachments

- D1: Attachment B - Developed Land Loading Rates for PA Counties
- D2: Penbrook Watershed Pollutant Load Summary
- D3: Final Land Use by Watershed Spreadsheet
- D4: Pollutant Load Calculations: Spring Creek
- D5: Pollutant Load Calculations: Paxton Creek

SECTION E - WASTELOAD ALLOCATIONS

SECTION F - ANALYSIS OF TMDL OBJECTIVES

SECTION G - SELECT BMPs TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING

Attachments

- G1: BMP Option 1 Calculations
- G2: BMP Option 2 Calculations
- G3: BMP Option 3 Calculations
- G4: BMP Option 4 Calculations
- G5: PA BMP Effectiveness Values
- G6: BMP 6.6.3 Dry Extended Basin
- G7: BMP 6.4.8 Vegetated Swale
- G8: BMP 6.4.5 Rain Garden/Bioretenion
- G9: BMP 6.4.3 Subsurface Infiltration Bed

SECTION H - IDENTIFY FUNDING MECHANISM

SECTION I - IDENTIFY RESPONSIBLE PARTIES FOR OPERATION AND MAINTENANCE (O&M) OF BMPs

SECTION A - PUBLIC PARTICIPATION

Penbrook Borough has promoted public participation and involvement in water quality decisions by making the PRP and TMDL available for public review and comment as required. A complete copy of the PRP was made available for public review on July 21, 2017, 57 days prior to the submission deadline on September 16, 2017. This meets the PA DEP requirement that the PRP be published at least 45 days prior to the submission deadline. A public notice was posted in a Newspaper of General Circulation containing a description of the plan, where it may be reviewed by the public, and the length of time made available for the receipt of comments. The municipality accepted both written and verbal comments from the public until this Date, 30 days after the public notice was posted.

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SECTION B - MAPS

Penbrook Borough has completed a series of maps that show the location of the municipal boundary, impaired and non-impaired streams, the 2010 urbanized area, stormwater system facilities, aerial imagery to identify land use and associated impervious and pervious areas, the storm sewershed area associated with each regulated MS4 outfall, and the location of proposed structural BMPs that will be implemented to achieve the required pollutant load reductions. Please note that some streams identified on the maps as impaired, may be impaired for reasons that do not need to be addressed by this PRP. This PRP addresses only those impairments that require Appendix D and/or Appendix E (See Section C for specific information on applicable impairments).

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B1: Hydrology Map

B2: Stormwater System Map

B3: Proposed Stormwater BMP Map

SECTION C - POLLUTANTS OF CONCERN

The following pollutants of concern for each impaired stream are based on the impairment listing provided in the MS4 Requirements Table provided by PA DEP:

- Chesapeake Bay (Appendix D): Nutrients and Siltation
- Paxton Creek (TMDL): Siltation, Suspended Solids
- UNT Spring Creek (Appendix E): Siltation

For the PRPs, if the impairment listed above is based on siltation only, a minimum 10% sediment reduction is required. If the impairment is based on nutrients (including Excessive Algal Growth and Organic Enrichment/Low D.O.), a minimum 5% Total Phosphorus (TP) reduction is required. If the impairment is due to both siltation and nutrients, both a 10% sediment reduction and 5% phosphorus reduction is required. PA DEP allows using a presumptive approach in which it is assumed that a 10% reduction in sediment will accomplish a 5% reduction in phosphorus and a 3% reduction in nitrogen. Penbrook Borough must achieve the required pollutant reductions identified in the PRP over the 5-year period following PA DEP's approval of coverage.

The PA DEP TMDL report for Paxton Creek dated June 30, 2008, identified phosphorus and total suspended solids as the pollutants causing stream impairment of Paxton Creek. In a letter dated August 15, 2013, the United States Environmental Protection Agency (EPA) issued a Withdrawal Decision Rationale which withdrew the existing nutrient TMDL for Paxton Creek Watershed. The Withdrawal Decision Rationale, Attachment C3, did not withdraw the sediment TMDLs established for Paxton Creek.

As identified in the TMDL report, the current loading rate for sediment is 48,800 lbs/year. The MS4 designated area within the Paxton Creek Watershed has a WLA for sediment as 31,600 lbs/year. This represents a required 35% sediment reduction to attain minimum water quality standards. In the short-term, the Borough must achieve a minimum 10% sediment reduction over the 5-year period following PA DEP's approval of coverage.

Please note that the pollutant load units in Table 7-4 of the TMDL Errata (Attachment C4) are identified as tons/day. Based on current standards and the reference to tons/year identified in the Paxton Creek Watershed TMDL Strategy, we are assuming the correct units in the TMDL Errata are tons/year. It should be noted that although the allocations in Table 7-4 are labeled as tons per day, they should be labeled as tons per year as shown in Table 7-3.

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SECTION D - DETERMINE EXISTING LOADING FOR POLLUTANTS OF CONCERN

A. PRP Base Pollutant Load Calculation

Penbrook Borough calculated the existing pollutant loading rates (lbs/year) for sediment, phosphorus, and nitrogen generated within their regulated/planning area in the Spring of 2017. The process used to perform this task is as follows:

1. Use the Stroud Water Research Center Wiki Watershed Tool (<https://wikiwatershed.org>) to digitize each watershed located in the municipality; the Wiki tool identifies the land use category breakdown within each watershed.
2. Calculate the impervious and pervious areas within each land use category by using data provided by the National Land Cover Database 2011 (www.mrlc.gov). This data identifies the percentage of impervious coverage in four land use categories as follows:
 - a. Developed Open Space: 19% impervious
 - b. Developed Low Intensity: 49% impervious
 - c. Developed Medium Intensity: 79% impervious
 - d. Developed High Intensity: 100% impervious
3. Add the total impervious and pervious areas within each watershed. Multiply the total impervious and pervious areas by the applicable loading rate as identified in the Chesapeake Bay Derived Developed Land Loading Rates for PA Counties. The Dauphin County loading rates for sediment, phosphorus, and nitrogen are as follows:
 - a. Developed impervious
 - i. Sediment: 1,999.14 lbs/year
 - ii. Phosphorus: 1.07 lbs/year
 - iii. Nitrogen: 28.59 lbs/year
 - b. Developed pervious
 - i. Sediment: 299.62 lbs/year
 - ii. Phosphorus: 0.34 lbs/year
 - iii. Nitrogen: 21.24 lbs/year
4. Reduce the existing baseline pollutant loads by removing pollutant loads from parcels with NPDES MS4 permits and Rights-of-Way (R-O-W) areas of State Roads, Railroads, PA Turnpike, airports, and any other parcel owned/operated by another MS4 permittee. The procedure for this task is described below.
5. Combine the total pollutant loads for each watershed to identify the total municipal baseline pollutant load.

B. Private MS4s/Right-of-Way (R-O-W) Reduction Credits

Reduce the existing baseline pollutant loads by removing pollutant loads from parcels with NPDES MS4 permits and Rights-of-Way (R-O-W) areas of State Roads, Railroads, PA Turnpike, airports, and any other parcel owned/operated by another MS4 permittee.

1. Analyze parcel information on a GIS map to identify any State Right-of-Way, Railroad Right-of-Way, or private MS4s. Mark the area within each sewershed area that falls under those categories. Calculate the area in each sewershed using GIS.
2. Calculate the impervious and pervious areas within each R-O-W. For this PRP, we have applied the medium density impervious area rate of 49% to these areas.
3. Multiply the total impervious and pervious areas by the Chesapeake Bay Derived Developed Land Loading Rates for PA Counties, as identified above (Part A.6).
4. Subtract the calculated Right-of-Way/private MS4 pollutant loads from the applicable sewershed area pollutant load.

Using the method described above, Penbrook Borough has identified the baseline pollutant loads for the Spring Creek and Paxton Creek Watersheds as shown in the chart below. We have also identified the current sediment load for the Paxton Creek Watershed as identified in the TMDL report which was calculated using the AVGWLF model. A summary of this model and hydrologic calibration is found in Section 4.0 of the TMDL report.

Watershed	Existing Sediment Load (lbs/year)	Existing Phosphorus Load (lbs/year)	Existing Nitrogen Load (lbs/year)
UNT to Spring Creek (Stroud Research Tool)	158,938	92	2,916
Paxton Creek (TMDL)	48,800	-	-

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SECTION E - WASTELOAD ALLOCATIONS

Table 7-4 of the Paxton Creek TMDL Errata document dated August 28, 2013, identifies the existing sediment loading, in tons/year, for Penbrook Borough as 24.4 tons/year or 48,800 lbs/year. The identified allocated load is 15.8 tons/year or 31,600 lbs/year. Thus, to achieve water quality standards Penbrook Borough must reduce the sediment load by 17,200 lbs/year (35%).

SECTION F - ANALYSIS OF TMDL OBJECTIVES

As indicated above the MS4 designated area within the Paxton Creek has a WLA for sediment of 48,800 lbs/year. To achieve these reductions and meet water quality goals, Penbrook Borough must implement stormwater BMPs that will reduce sediment by 17,200 lbs/year (35%). The Borough is using the option of reducing the baseline sediment load by 10% in the short-term over the next 5-year permit term and then reducing the remaining load in the long-term during future permit terms.

SECTION G - SELECT BMPs TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING

Penbrook Borough has identified the minimum required reductions in pollutant loading for each watershed identified below:

Watershed	Required 10% Sediment Reduction (lbs/year)	Required 5% Phosphorus Reduction (lbs/year)	Required 3% Nitrogen Reduction (lbs/year)
UNT to Spring Creek	15,894	5	87
Paxton Creek TMDL	4,880		
Total	20,774	5	87

Penbrook Borough has identified four potential stormwater BMPs that will achieve the required pollutant load reductions when implemented over the next 5-year permit term.

BMP Option 1: Dry Extended Detention Basin

Penbrook Borough may construct a dry extended detention basin on the north side of the East Harrisburg Cemetery in the Paxton Creek Watershed. The drainage area to this basin is 96.9 acres with 61.71 acres of impervious surface and 35.18 acres of pervious surface. The calculated pollutant loads for this BMP are as follows:

Sediment: 80,345 lbs/year
 Phosphorus: 16 lbs/year
 Nitrogen: 502 lbs/year

BMP Option 2: Bioswale

Penbrook Borough may retro-fit an existing grass swale to a bioswale along Parkway Boulevard between South 27th Street and South 28th Street in the Spring Creek Watershed. The drainage area to this swale is 2.9 acres with 1.48 acres of impervious surface and 1.40 acres of pervious surface. The calculated pollutant loads for this BMP are as follows:

Sediment: 2,701 lbs/year
 Phosphorus: 2 lbs/year
 Nitrogen: 50 lbs/year

BMP Option 3: Rain Garden/Bioretenion

Penbrook Borough may construct a rain garden at the corner of Market Street and South 30th Street in the Spring Creek Watershed. The drainage area to this BMP is 0.9 acres with 0.43 acres of impervious surface and 0.45 acres of pervious surface. The calculated pollutant loads for this BMP are as follows:

Sediment: 904 lbs/year
 Phosphorus: 1 lbs/year
 Nitrogen: 18 lbs/year

BMP Option 4: Subsurface Infiltration Bed

Penbrook Borough will construct infiltration beds below South 31th Street near the corner of Charles Street. The drainage area to this infiltration area is 2.8 acres with 1.0 acre of impervious surface and 1.8 acres of pervious surface. The calculated pollutant loads for this BMP are as follows:

Sediment: 2,411 lbs/year
 Phosphorus: 1 lbs/year
 Nitrogen: 57 lbs/year

In summary, Penbrook Borough has identified the following four stormwater BMPs that when implemented will meet the required pollutant load reductions for the PAG Individual Permit:

Proposed BMPs	Watershed	Calculated Sediment Reduction (lbs/year)	Calculated Phosphorus Reduction (lbs/year)	Calculated Nitrogen Reduction (lbs/year)
BMP Option 1: Dry Extended Detention Basin	Paxton Creek	80,345	16	502
BMP Option 2: Bioswale	UNT Spring Creek	2,701	2	50
BMP Option 3: Rain Garden/Bioretenion	UNT Spring Creek	904	1	18
BMP Option 4: Subsurface Infiltration Bed	UNT Spring Creek	2,412	1	57

The estimated sediment reductions in the Paxton Creek Watershed total 80,345 lbs/year which exceeds the total 35% sediment reduction required in the TMDL report for Paxton Creek by 63,145 lbs/year. If implemented, Penbrook Borough could achieve the long-term sediment reduction goals identified in the TMDL report over the next 5-year permit term.

The estimated sediment reductions in the Spring Creek Watershed total 6,017 lbs/year which is less than the minimum required reduction of 15,894 lbs/year by 9,877 lbs/year. However, the total estimated sediment reduction for both watersheds of 86,362 lbs/year exceeds the total required minimum reduction of 20,774 lbs/year by 65,588 lbs/year. The Borough plans to work with individual property owners over the next five-year permit term to implement only those stormwater BMPs that will achieve the minimum required pollutant reductions.

Because Penbrook Borough is located entirely within the Chesapeake Bay Watershed, the calculated reductions shown above will meet the pollutant reduction requirements of the Chesapeake Bay PRP.

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- G4: BMP Option 4 Calculations
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- G7: BMP 6.4.8 Vegetated Swale
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SECTION F - IDENTIFY FUNDING MECHANISM

Penbrook Borough plans to consider many sources of funding to implement the proposed stormwater BMP identified in this plan.

Penbrook Borough General Fund: The Borough may plan to budget sufficient funds each year of the five-year permit term (2018-2023) to fully fund the implementation of all stormwater BMPs to meet the required pollutant reductions.

PENNVEST: The Pennsylvania Infrastructure Investment Authority (PENNVEST) provides funding for urban stormwater and agricultural BMPs.

Growing Greener Grants: Growing Greener provides state funds to address environmental concerns, including the negative effects of stormwater pollution on water quality. These grants vary in availability and total funding dollars.

PA DEP's Urban Stormwater BMP Grants: As part of the Local Stormwater BMP Implementation Program, PA DEP has provided grants to communities located in the Chesapeake Bay Watershed to reduce stormwater runoff to local waterways. These grants vary in availability and total funding dollars.

Collaboration: Penbrook Borough will continue to look for other funding opportunities to implement stormwater BMPs by collaborating with other environmental organizations including, but not limited to: the Paxton Creek Preservation Association, the Dauphin County Clean Water Consortium, and the Dauphin County Conservation District.

SECTION G - IDENTIFY RESPONSIBLE PARTIES FOR OPERATION AND MAINTENANCE (O&M) OF BMPs

All the identified stormwater BMPs must be maintained on a regular basis, after fully implemented, to ensure they continue to provide water quality benefits as designed.

Parties Responsible for ongoing O&M: Penbrook Borough will work with property owners to develop a mutually agreed upon Operation & Maintenance Agreement to ensure that the implemented BMPs function as designed to minimize the sediment and nutrient loading rates to local surface streams.

Activity involved with O&M for each BMP and the frequency at which O&M activities occur:

Dry Extended Detention Basin: A dry extended detention basin provides temporary storage of stormwater runoff so that suspended solids have time to settle out into the basin instead of being carried downstream. To ensure this stormwater BMP continues to function as designed, regular O&M activities must occur as follows:

- All basin structures should be inspected at least four times per year and after all storm events greater than 1 inch. Structures may include basin bottoms, trash racks, outlet structures, riprap or gabion structures, and inlets. Check for clogging, excessive debris and sediment accumulation.
- Remove accumulated sediment as needed when the basin is completely dry and dispose of properly. Seed and stabilize the disturbed areas immediately.
- Mow and trim all vegetation as needed. Remove all plant detritus and dispose of properly.
- Inspect vegetated areas as follows:
 - Inspect annually for erosion.
 - Inspect annually for unwanted growth of exotic/invasive species.
 - Maintain vegetative cover at 95% minimum cover. If bare spots exist, replant or seed and stabilize as needed.

Vegetated Swales: A vegetated swale is a shallow channel, densely planted with a variety of trees, shrubs, and/or grasses. This BMP functions to filter stormwater pollutants and infiltrate runoff volumes. Additional benefits include reducing the rate of stormwater conveyance, providing habitat, and increasing bio-diversity and visual aesthetics. However, to ensure the vegetated swale continues to function as designed, regular O&M activities must occur as described below and as identified in the PA DEP BMP Manual.

O&M activities to be performed annually, and within 48 hours of a rain event >1 inch/24 hours:

- Inspect and correct erosion problems, damage to vegetation, and sediment and debris accumulation. Remove sediment when >3 inches accumulates at any spot or is covering the vegetation.
- Inspect vegetation on side slopes for erosion and formation of rill or gullies, correct as needed.
- Inspect for pools of standing water; dewater and discharge to an approved location and restore to design grade.
- Mow and trim vegetation to ensure safety, aesthetics, proper swale operation, or to suppress weeds and invasive vegetation; dispose of cuttings properly. If vegetation requires mowing, mow only when the swale is dry to prevent rutting.

- Inspect for uniformity in cross-section and longitudinal slope; correct as needed.
- Inspect associated stormwater facilities such as inlets, pipes, and curb cuts, for signs of erosion or blockage; correct as needed.

O&M activities to be performed as needed:

- Plant alternative grass species in the event of unsuccessful establishment.
- Reseed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Rototill and replant swale if draw down time is more than 48 hours.
- Inspect and correct check dams, if applicable, when signs of altered water flow are identified.
- Water during dry periods, fertilize, and apply pesticide only when necessary.

Rain Garden/Bioretenion: A bioretention basin is an excavated shallow surface depression planted with native vegetation to treat and capture stormwater runoff. This BMP functions to reduce stormwater volumes and stormwater pollutants that may otherwise discharge to local surface waters. Additional benefits of constructing a bioretention basin include recharging groundwater supplies, reducing stormwater temperature impacts, enhancing evapotranspiration, providing habitat, and expanding biodiversity. However, to ensure that bioretention basins continue to function as designed, regular O&M activities must occur as follows:

- Bioretention basins should be inspected at least two times per year and after significant storm events for sediment buildup, surface erosion, vegetative conditions, and debris/trash collection.
- To ensure native vegetation successfully establishes and to minimize competition for sunlight, water, and nutrients, all invasive and unwanted weeds should be removed. Growing trees and shrubs should be pruned as needed to remove dead branches. All vegetation should be inspected twice per year to evaluate health.
- Trash and other detritus should be removed annually or as needed.
- Perennial plantings may be cut down at the end of the growing season. All plant debris should be removed to prevent accumulation.
- The ground surface should always be covered by vegetation and/or mulch. Any bare areas should be planted and/or mulched to minimize erosion and sedimentation.

Subsurface Infiltration Bed: Subsurface infiltration facilities, usually filled with stone, provide temporary storage of stormwater runoff by directing stormwater volumes underground where it can slowly infiltrate into subsurface areas. However, to ensure continued function of this BMP, the following minimum O&M activities must occur:

- All catch basins and inlets should be inspected and cleaned at least 2 times per year.
- The overlying vegetation should be maintained in good condition. Bare spots should be revegetated as soon as possible.
- Vehicular access should be prohibited and care should be taken to avoid excessive compaction. If access is needed, then consider using permeable turf reinforcement structures.