POLLUTANT REDUCTION PLAN
FOR IMPAIRED WATERS OF THE COMMONWEALTH AND THE CHESAPEAKE BAY
RAPHO TOWNSHIP, LANCASTER COUNTY, PA

Rapho Township
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NPDES MS4 Permit PAG 133564
March 25, 2019
Revised April xx, 2022

Impaired Waters
Chiques Creek
Little Chiques Creek
Rife Run
Chesapeake Bay

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SUMMARY

Note: All revisions made on April xx, 2022 are shown in blue text.

Rapho Township 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). As an MS4 community with locally impaired streams, Rapho Township must comply with Appendix D and Appendix E of the PAG-13 General Permit and must attach this PRP to the Notice of Intent (NOI) for General Permit Coverage. Rapho Township has invited public participation in the planning process by making this PRP 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 urbanized area which drains to an MS4 outfall location, 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 Rapho Township 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.

To improve water quality and meet the required pollutant reductions, Rapho Township will retro-fit one municipal owned dry detention basin into a dry extended detention basin, construct a water quality forebay/bioretention basin, and partner with Penn Township and a private landowner to stabilize approximately 1,800 feet of the Chiques Creek. The proposed dry extended detention basin and forebay/bioretention basin temporarily stores stormwater runoff 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 planned streambank stabilization project includes regrading the streambank, installing in-stream stabilization and fish-habitat structures, and planting a riparian buffer.

Over the course of the 2018-2023 MS4 Permit term, Rapho Township 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.

Rapho Township
Pollutant Reduction Plan
March 25, 2019 (Revised April xx, 2022)

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SECTION A - PUBLIC PARTICIPATION

Rapho Township has promoted public participation and involvement in water quality decisions by making the Pollutant Reduction Plan (PRP) available for public review and comment as required. A complete copy of the PRP was made available for public review on May 16, 2022. 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 LNP 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 June 17, 2022, at least 30 days after the public notice was posted.

Rapho Township did/did not receive any written or verbal comments during the 30-day public review and comment period, and no changes were made to the Plan.

Attachment
A1: A copy of the public notice
A2: A copy of the June 2, 2022 Board of Supervisors Meeting Agenda and Meeting Minutes

SECTION B - MAPS

Rapho Township 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, the location of existing BMPs that provide pollutant reductions, the parsed Penn DOT ROW areas, 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
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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:

- Chiques Creek (Appendix E): Nutrients and Siltation
- Little Chiques Creek (Appendix E): Nutrients and Siltation
- Rife Run (Appendix E): Siltation
- Chesapeake Bay (Appendix D): Nutrients and Siltation

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% TP 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.

Rapho Township must achieve the required pollutant reductions over the 5-year period following PA DEP's approval of coverage.

Attachment
C1: MS4 Requirements Table for Lancaster County Municipalities

SECTION D - DETERMINE EXISTING LOADING FOR POLLUTANTS OF CONCERN

A. Base Pollutant Load Calculation

Rapho Township 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. Analyze existing topographic and contour information on a GIS map to delineate the drainage area/sewershed to each regulated MS4 outfall.
2. Use the Stroud Water Research Center Wiki Watershed Tool (https://wikiwatershed.org) to digitize the sewershed area; the Wiki tool identifies the land use category breakdown within each storm sewershed.
3. Remove any non-Urban Area that is located downstream of the Urban Area and/or does not flow into the Urban Area of the sewershed area.
4. Remove any area located outside of the municipal boundary.
5. 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
6. Add the total impervious and pervious areas within each sewershed. 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 Lancaster County loading rates for sediment, phosphorus, and nitrogen are as follows:
    a. Developed impervious
        i. Sediment: 1,480.43 lbs/year
        ii. Phosphorus: 1.55 lbs/year
        iii. Nitrogen: 38.53 lbs/year
    b. Developed pervious
        i. Sediment: 190.93 lbs/year
        ii. Phosphorus: 0.36 lbs/year
        iii. Nitrogen: 22.24 lbs/year
7. If applicable, reduce the existing baseline pollutant loads by assigning credit for structural BMPs in each sewershed area implemented prior to development of this PRP. The procedure for this task is described below.
8. 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, and any other parcel owned/operated by another MS4 permittee. The procedure for this task is described below.
9. Add the sediment, phosphorus, and nitrogen pollutant loads for each sewershed area by watershed area. Combine the total pollutant loads for each watershed to identify the total municipal baseline pollutant load.

B. Structural BMP Reduction Credits

Reduce the existing baseline pollutant loads by assigning credit for structural BMPs in each sewershed area implemented prior to development of this PRP. Each BMP identified in Attachment D7 includes the following information if applicable:

- Description of the BMP
- Latitude and longitude
- Location on the map
- The permit number, if any, that authorized installation of the BMP
- Calculations demonstrating the pollutant reductions achieved by the BMP (See Attachment D4-D6 for calculations)
- The date the BMP was installed and a statement that the BMP continues to serve the function it was designed for
- The O&M activities and frequencies associated with the BMP

1. Analyze existing topographic and contour information on a GIS map to identify existing structural BMPs within each regulated MS4 outfall sewershed area. Delineate the drainage area to each existing structural BMP.
2. Use the Stroud Water Research Center Wiki Watershed Tool (https://wikiwatershed.org) to digitize the drainage area; the Wiki tool identifies the land use category breakdown within each structural BMP drainage area.
3. 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), and as identified above (Part A.5).
4. 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).
5. Identify the percentage of pollutant reductions for each structural BMP by using PA DEP's BMP Effectiveness Values Table. Use the approved final subdivision, land development, and/or Post Construction Stormwater Management Plans to verify what type of stormwater BMP has been constructed. If no plans can be located, then existing detention basins are assumed to be dry detention basins. Multiply the BMP Effectiveness Value associated with the BMP by the calculated pollutant load for the same BMP to determine the appropriate pollutant reduction credit. Subtract the credit from the BMP pollutant load to determine the final pollutant load.
6. When one or more structural BMP(s) are located within the drainage area of another (sub-drainage area), the pollutant loads are calculated as follows: Subtract the impervious and pervious areas of the sub-drainage area from the overall drainage area. Determine the pollutant load that bypasses the sub-drainage area by multiplying the resultant impervious and pervious areas by the County loading rates as identified above (Part A.6). Add the calculated bypass pollutant loading to the calculated upstream BMP(s) pollutant loading. Multiply the BMP Effectiveness Value associated with the BMP by the calculated pollutant load for the same BMP to determine the appropriate pollutant reduction credit. Subtract the credit from the BMP pollutant load to determine the final pollutant load.

C. 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 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 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 high-density impervious area rate of 100% 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, Rapho Township identified the baseline pollutant loads for each watershed as follows:

Watershed	Sediment (lbs/year)	Phosphorus (lbs/year)	Nitrogen (lbs/year)
Chiques Creek	251,498	346	16,132
Little Chiques Creek	306,575	461	22,131
Rife Run	9,347	12	588
Total*	**567,420**	**819**	**38,851**
**The totals have been rounded to the nearest whole number*			

Attachments

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

Rapho Township identified the minimum required reductions in pollutant loading for each watershed:

Watershed	Required 10% Sediment Reduction (lbs/year)	Required 5% Phosphorus Reduction (lbs/year)	Required 3% Nitrogen Reduction (lbs/year)
Chiques Creek	25,150	17	484
Little Chiques Creek	30,658	23	664
Rife Run	935	1	18
Total	**56,742**	**41**	**1,166**

Rapho Township has identified the stormwater BMPs described below that will provide the required pollutant reductions when implemented over the next 5-year permit term.

BMP Option 1:
The Township owns and maintains an existing detention basin in Green Park which was constructed prior to 2003 and provides stormwater management control for a large residential development in the Little Chiques Creek Watershed. This basin is in the storm sewershed of Outfall R868 which has a contributing drainage area of 59.2 acres. Approximately 27.9 acres of this area is developed impervious and approximately 31.3 acres is developed pervious. Rapho Township plans to retro-fit this dry detention basin into a dry extended detention basin. The calculated pollutant load reductions for this BMP are as follows:

Sediment: 25,537 lbs/year
Phosphorus: 10 lbs/year
Nitrogen: 336 lbs/year

BMP Option 2:
Rapho Township will work with Penn Township and a private landowner to stabilize approximately 1,800 LF of streambanks along the Chiques Creek (Reach Code 02050306000208). This section of the creek flows along the municipal boundary between Rapho Township and Penn Township. Stream restoration improves water quality by minimizing the amount of sediment and attached nutrients delivered downstream by unstable and actively eroding streambanks. The estimated pollutant reductions are calculated by multiplying the total distance of stabilized streambanks by the loading rates identified in the BMP Effectiveness Table (Attachment D8).

Sediment: 44.88 lbs/ft/yr
Phosphorus: 0.068 lbs/ft/yr
Nitrogen: 0.075 lbs/ft/yr

Proposed BMP	Watershed	Calculated Sediment Reduction (lbs/year)	Calculated Phosphorus Reduction (lbs/year)	Calculated Nitrogen Reduction (lbs/year)
1,800 LF Urban Stream Restoration - Chiques Creek	Chiques Creek	80,784	122	135

Rapho Township and Penn Township have developed a Memorandum of Understanding (MOU) that outlines the shared pollutant reductions as follows:

- Rapho Township will receive sediment reductions of at least 31,205 lbs/year and will pay the proportionate implementation costs.
- Penn Township will receive the remaining sediment reductions of 49,579 lbs/year and pay the remaining implementation costs.

BMP Option 3:

The Township will construct a water quality forebay/bioretention basin to treat stormwater runoff. This facility is in the storm sewershed of Outfall 22 which has a contributing drainage area of 22.4 acres. Approximately 2.14 acres of this area is developed impervious and approximately 20.28 acres is developed pervious. The calculated pollutant load reductions for this BMP are as follows:

Sediment:	6,330 lbs/year
Phosphorus:	9 lbs/year
Nitrogen:	426 lbs/year

In summary, Rapho Township will implement the following BMPs to meet the required pollutant load reductions for the PAG General Permit:

Proposed BMP	Watershed	Calculated Sediment Reduction (lbs/year)	Calculated Phosphorus Reduction (lbs/year)	Presumptive Nitrogen Reduction (lbs/year)
BMP Option 1: Dry Extended Detention Basin	Little Chiques Creek	25,537	10	336
BMP Option 2: Streambank Stabilization - Chiques Creek	Chiques Creek	31,205	122	135
BMP Option 3: Water Quality Forebay/Bioretention	Little Chiques Creek	6,330	9	426
	Total	**63,072**	**141**	**897***

*Rapho Township is using the presumptive approach to estimate the total amount of nitrogen reductions as allowed by PA DEP.

Once the stormwater BMPs are implemented, the achieved sediment load reduction of 63,072 lbs/year exceeds the required 56,742 lbs/year by 6,330 lbs/year.

Because the land area of Rapho Township is located entirely within the Chesapeake Bay Watershed, the calculated reductions shown above will meet the pollutant reduction requirements of the Chesapeake Bay PRP.

Attachments

E1: BMP Option 1 Calculations
E1a: BMP Option 3 Calculations
E2: BMP 6.6.3 Dry Extended Detention Basin
E2a: BMP 6.4.5 Rain Garden/Bioretention Basin
E3: Expert Panel - Stream Restoration
E4: Urban Stream Restoration Fact Sheet

SECTION F - IDENTIFY FUNDING MECHANISM

Rapho Township plans to consider many sources of funding to implement the proposed stormwater BMPs identified in this Plan. The anticipated funding source to implement the stormwater BMPs may include any of the following:

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. The Township has an outstanding application for this grant to fund implementation of BMP Option 1 - Dry Extended Detention Basin. These grants vary in availability and total funding dollars.

Rapho Township General Fund: The Township 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.

National Fish & Wildlife Foundation (NFWF) Grants: NFWF provides federal funding for a wide range of environmental projects.

Collaboration: Rapho Township will continue to look for other funding opportunities to implement stormwater BMPs by collaborating with municipalities and other environmental organizations including, but not limited to: the Chiques Creek Watershed Alliance, Lancaster County Clean Water Consortium, and the Lancaster 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: Rapho Township currently owns and maintains the existing detention basin located in Green Park and the water quality forebay/bioretention basin and will continue to do so after the proposed dry extended detention basin is completed. The Township will also work with the developer of the land adjacent to the proposed streambank stabilization project to develop a mutually agreed upon Operation & Maintenance Agreement to ensure that project continues to function as designed.

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.

Streambank stabilization: Once the streambanks of the Chiques Creek have been stabilized, regular inspection and maintenance activities will occur as follows:

- Since vegetation establishment is a critical component of the long-term stability of the streambank, monthly inspections should occur for the first year after the project is complete. A minimum 85% plant survival rate should be achieved and documented.
- Weeds and invasive plants threaten the survival of native plants, and should be aggressively controlled by herbicides, mowing, and/or weed mats for the first four years after implementation.
    - Applying herbicides for the first two to three years may be necessary to control weeds. This activity is regulated by the PA Department of Agriculture and proper care should be taken in a streamside setting.
    - Mowing grasses should occur twice each growing season with a mower height set to eight to twelve inches.
    - Weed mats suppress weed growth around newly planted vegetation and should be removed once trees have developed a canopy sufficient to shade out the weeds.
- Once the vegetation has been established, regular maintenance should be minimal.

Bioretention Basins: 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 bio-diversity. 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.