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**Thornbury Township MS4
Issued for Public Comment
XXXX XX, 2024**

Pollutant Reduction Plan (PRP)

For

**Thornbury Township, Chester County,
Pennsylvania**

**MS4 Individual Permit Application
May 2024**

**Application Due Date Required: June 1, 2024
MS4 Permit Expiration Date: June 1, 2029**

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**PRP Report and Strategy Plan for Thornbury Township
MS4 Individual Permit Application 2024**

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1. SUMMARY

Thornbury Township is completely in an Urbanized area per the U.S. Census of 2010, and the Urbanized Area consists of two major watershed areas, the Brandywine Creek Watershed, and the Chester Creek Watershed. Per the Environmental Protection Agency (EPA), and the Pennsylvania Department of Environmental Protection (PADEP), the Township is to meet the load reduction requirements for the entirety of each watershed area.

In compliance with the provisions of the Clean Water Act, 33 U.S.C. Section 1251 and the Pennsylvania Clean Streams Law, as amended, 35 P.S. Section 691.1 et seq., Thornbury Township has developed the following Pollutant Reduction Plan to maintain authorization to discharge from a small municipal separate storm sewer system (MS4) to regulated waters of the commonwealth under the National Pollutant Discharge Elimination System (NPDES) Individual Permit.

The requirements call for a reduction in sediment loading within the Township's two watersheds within 5 years of approval. The following table indicates the baseline sediment loading for each watershed and the required reduction of 10% over the five (5) year permit period:

WATERSHED	BASELINE SEDIMENT LOADING (lbs/yr)*	Minimum Required 10% Reduction (lbs/yr)
Brandywine Creek (in Christina Basin)*	162,298	16,230
Chester Creek	249,422	24,942
Total	413,755	41,375

*Accounts for parsed out areas from established sewersheds. See Appendix C & D.

Thornbury Township is proposing three projects, including two stream restorations, one at Chester Creek (A.K.A. Goose Creek), to be designed and implemented by the Pennsylvania Department of Transportation PENNDOT, and one as along a section of Radley Run to be implemented by the Township in the Brandywine Creek Watershed. Additionally, in the Brandywine Creek Watershed a rain garden with a bioswale at South New St. will also be installed. All projects are to address the sediment load reduction within the Township. The proposed projects will be appropriately maintained by either various property owners and the Township in accordance with the guidelines and standard practices provided in the Pennsylvania Stormwater Best Management Practices (BMP) Manual and the Township Stormwater Management Ordinance, and any specific maintenance guidelines developed for the projects.

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2. INTRODUCTION

The 2024 NPDES Individual Permit for small MS4's requires Thornbury Township to implement a Pollutant Reduction Plan (PRP) to address stormwater discharges to impaired waters within the Township. A PRP is a planning document intended to guide the selection and implementation of specific Best Management Practices (BMPs) to reduce pollutant loading to surface waters. The ultimate objective of the PRP is to eventually attain the water quality standards and designated/existing uses in accordance with PA Chapter 93 - Water Quality Standards. According to the Pennsylvania Department of Environmental Protection's (DEP) "Municipal MS4 Requirements Table" last revised November 18, 2019, the Township's streams are impaired for sediment. Therefore, a PRP in accordance with Appendix E of the Individual Permit is required to demonstrate a strategy to achieve a 10% reduction in sediment loading within 5 years of approval in each impaired watershed.

The following Pollutant Loading Analysis and Reduction Plan provides in detail the steps utilized to estimate baseline pollutant loads and develop planned BMPs and pollutant control measures necessary to achieve and exceed the required water quality improvements.

3. Existing Loading Without Accounting for any BMP's

Christina Basin / Brandywine Creek Watershed

Existing sediment loading rate has already been established for Thornbury Township in a report via Christina Basin Land Use Loading Rates Calculation Tool, for Brandywine Creek, 2012, See Appendix A, (and via Appendix A, Table 2-4 of the Christina Basin Nutrient and Bacteria TMDLs 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). The value for the existing loading rate determined by the report(s) for the portion of Thornbury Township in the Christina Basin/Brandywine Watershed is 82.17 tons/yr., or 164,340 lbs./yr., which was approved for use by PADEP. The value has been further reduced by parsing-out PennDOT Route 202 roadway by calculating the existing load rate being a total of 2,042 lbs/yr and deducting them from the 164,340 lbs/yr to derive an adjusted amount of 162,298 lbs/yr. The final minimum loading rate reduction of 10% is 16,230 lbs/yr.

The watershed/basin area within the western part (from approximately Route 202) of the Township is designated warm water fish/migratory fishes (WWF/MF) waterway. The Brandywine Creek contains the impaired stream Radley Run and its various tributaries.

Chester Creek Watershed

Existing sediment loading calculations were determined utilizing DEP's "Simplified Method" as provided in Appendix B. Only MS4 Storm sewersheds were delineated for

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each of the individual outfalls. Some MS4 sewersheds in series to a common final discharge point has been combined as one MS4 sewershed. Where other entities are required to have their own MS4 permit, these areas have been parsed-out. Portions of PennDOT highways were parsed-out when intersecting the MS4 storm sewershed.

Likewise, Cheyney University has been parsed-out in the Chester Creek Watershed. Wikiwatershed online (<https://wikiwatershed.org>) was utilized to determine land cover for each outfall sewershed. Per the PRP: A Methodology and PADEP, the following percentages of impervious coverage were applied to the corresponding land cover for each MS4 watershed:

Developed Open Space - 19% Impervious
Low Intensity Impervious - 49% Impervious
Medium Intensity Impervious - 79% Impervious
High Intensity Impervious - 100% Impervious

Thornbury Township follows the Chester County developed land loading rates set forth in the NPDES Stormwater Discharges from MS4's PRP Instructions (3800-PM-BCW0100k Rev. 3/2017), Attachment A for developed Land Loading Rates for PA Counties were utilized to determine the existing loading rates for sediment (1,504.78 pounds/acre/year for impervious areas and 185.12 pounds/acre/year for pervious areas).

The impairment for each watershed is based on the HUC-12 level of stream classification. HUC- 12 streams within Thornbury Township include Chester Creek, Goose Creek (part of Chester Creek), East and West Branch Chester Creek, Waln Run, and Radley Run. Impaired streams within each of the HUC-12 watersheds are indicated on the Outfall Urbanized Area maps included in Appendix C. DEP has not approved a TMDL for these waters, however the impaired status requires the identification and control of pollutant loadings for sediment.

An analysis of existing land cover within the urbanized area of the Chester Creek watershed is required to estimate impervious and pervious area. Parsed-out areas are included in each MS4 sewershed noted as either PENNDOT or Cheyney University as aforementioned above. See calculations for each MS4 sewershed in Appendix D. After tabulation of all sewersheds, the total existing loading is 249,421.59 lbs/yr, with the required minimum 10% load reduction of 24,942.16 lbs/yr. The total sum of all the MS4 sewersheds is 599.48 acres.

4. BMP Reductions of Existing Loading Rates and Load Reduction Measures

Christina Basin / Brandywine Creek Watershed

Existing Loading

The existing loading has been established for the Christina Basin per the Christina Basin Land Use Loading Rates Calculation Tool, Watershed: Brandywine Creek, in

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2012, last revised May 12, 2017. The determined loading rate used is 82.17 tons/year or 164,340 lbs./yr. Since the loading has been determined for the Christina Basin, parsing out the area PennDOT Road Route 202 directly, the loading rate for that area within watershed SSB11-12 was determined using the Simplified Method, then that area's loading rate of 2,042 lbs./yr. was deducted resulting in 162,298 lbs./yr. or at 10%, 16,230 lbs/yr. minimum load rate reduction required. See Appendix D. The Township proposes the following BMP's in reducing this load rate. Implementing a raingarden and bioswale and stream restoration that will reduce the load by 23,139 lbs./yr. An alternate location for stream restoration along Radley Run would also reduce the load also by 23,139 lbs./yr.

BMP South New Street Raingarden with Bioswale

The Township proposes to construct a raingarden with bioswale adjacent to MS4 Sewershed B3 discharge point as shown on the MS4 Outfall and Urbanized Area Map. The project will be performed on Township owned property, and therefore operation and maintenance will be performed by the Township. The project is pending approval of grant funds to construct the BMP. This BMP would be performed in conjunction with either of the Radley Run stream restoration locations.

BMP Additional Stream Restorations for Radley Run

The Stream Restoration Plan for Radley Run in the Radley Run Watershed was prepared by the Brandywine Valley Association along Radley Run was prepared in 2008, and the project was completed in 2011 with 1,500 linear feet of stream restoration at various locations and additional upgrades to tree and buffer plantings at various points. The project involved additional riparian buffer / stream stabilization / native planting measures along high, and medium Low Priority points as recommended per Action Items listed in Appendix E. In addition to other points and along the unnamed tributary was evaluated to further insure that the Radley Run BMP/control measures are implemented effectively to address the sediment impairment.

Per the Restoration Plan for Radley Run Watershed along Radley Run at Medium Priority Point 51 and High Priority Segment 53 to 54, the existing riparian buffer / stream stabilization already established will be maintained. Thornbury Township provides maintenance at the storm sewer system that drains to the noted stream segments. Thornbury Township also assists with emergency repairs to maintain the stream flow.

As indicated, 1,500 linear feet were completed in 2011. In the "medium priority" stream segment, restoration was done at Point 51 for approximately 150 feet upstream and 50 feet downstream. In the "high priority" segment between High Priority Points 53 to 54, there is available stream length that is approximately 1,258 linear feet between points where stream restoration can be performed. There is also an alternate Radley Run stream restoration location of approximately 400 linear feet that can be performed between points 51 to 53. In either situation, this would reduce the sediment load to the

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minimum 10% in the Brandywine Creek / Christina Basin if a minimum of approximately 400 linear feet of stream is completed.

Operation and maintenance for stream restoration will be by the adjacent HOA development - Brandywine at Thornbury. The bioswale and raingarden would be situated on Township Property and therefore operation and maintenance will be by the Township.

Chester Creek Watershed

Existing Loading

The Chester Creek Watershed existing loading rate has been determined using the Simplified Method. See Appendix B. The existing loading after areas of PennDOT Roads within designated sewersheds have been deducted is 249,422 lbs./yr. The required 10% minimum road reduction is 24,942 lbs./yr. The Township proposes Implementing PennDOT's stream project restoration along Chester Creek that will reduce the load significantly by 166,505 lbs./yr. See Appendix D.

PENNDOT Goose Creek Park: Chester Creek and Tributaries Stream Restoration

The Commonwealth of Pennsylvania, acting through the Pennsylvania Department of Transportation (PennDOT) and Thornbury Township (Thornbury) as required to reduce sediment pollution in the Delaware Watershed as part of the pollution reduction plan obligations in the National Pollution Discharge Elimination System permits for their respective municipal separate storm sewer systems. PennDOT has awarded First Pennsylvania Resource, LLC (FPR) to construct a project within the Goose Creek Watershed of Thornbury Township. The project is anticipated to be totally funded by PennDOT, with no costs to Thornbury Township.

PennDOT provided at this time, "A Goose Creek Park: Chester Creek and Tributaries Concept Design" plan. The plan is to provide stream restoration in accordance with PADEP specifications along the Chester Creek (a.k.a. Goose Creek local vernacular). The restoration in the Township will extend from Street Road (L.R. 0926) to Westtown-Thornton Road (L.R. 2005) for approximately 3246 linear feet, and includes restoration of two unnamed tributaries leading into Chester Creek totaling 620 linear feet, which totals to approximately 3,866 linear feet of restoration. Once this has been installed the sediment load reduction would be reduced to below the 10% required reduction. See Appendix F for PennDOT information and Appendix D for the calculations.

Currently it is our understanding that both operation and maintenance will be shared by PennDOT and the Thornbury Township upon a final written agreement with each party.

5. BMP's Proposed for Load Reduction

The following stormwater BMPs and other pollutant control measures (PCM) are required to reduce sediment loading by 10% within the next five years. The following

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descriptions, considerations, and conceptual designs for stormwater BMPs are provided in Appendices G, and Calculations in Appendix D, and are as follows:

Stream Restoration in Brandywine Creek and Chester Creek Watersheds

An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol. They have a sediment removal effectiveness value of 48.88 lbs./ft./yr.

Bioretention / Raingarden (C/D Soils w/Underdrain) in the Christina Basin / Brandywine Creek Watershed

A shallow basin or depression backfilled with engineered media, topsoil, mulch and vegetation, used to temporarily store and treat stormwater runoff by filtering through plant and soil medias. They have a sediment removal effectiveness value of 55%

Bioswale (to be used with the Bioretention / Raingarden) in the Christina Basin / Brandywine Creek Watershed

For a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area. A bioswale is an excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. They have a sediment removal effectiveness value of 80%

6. Pollutant Load Reduction Summary

Thornbury Township has met the required pollutant load reductions required by providing the above mentioned BMP's for both Christina Basin/Brandywine Creek and Chester Creek Watersheds meeting or exceeding the 10% minimum.

Adjustments have been made in both watershed areas by parsing the PennDOT 's roadways of affected MS4 sewersheds. In order to determine the reduction of the PennDOT roadways in the Christina Basin/Brandywine Creek Watershed, Wikiwatersheds was used to calculate their respective load rates and deduct them from the established value to final resultant. In the Chester Creek Watershed, the areas of PennDOT roads and Cheyney University within the respective MS4 sewersheds have been deducted from each of the watersheds and then Wikiwatershed has been used to determine the load from each sewershed, and totaled. See Appendices C & D.

Christina Basin / Brandywine Creek Watershed

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The minimum 10% Load Reduction Required	= 16,230 lbs./yr.
Bioretention / Raingarden at S. New Street	= 5,187 lbs./yr.
and either Radley Run Stream Restoration location	= 17, 952 lbs./yr.
<u>Total BMP's = 23,139 lbs. / yr.</u>	

BMP's > the minimum 10% Load Reduction Required therefore OK.

Chester Creek Watershed

The minimum 10% Load Reduction Required	= 24,942.16 lbs./yr.
PennDOT Goose Creek Stream Restoration Project	= 166,505 lbs./yr.

This BMP > the minimum 10% Load Reduction Required therefore OK.

7. Order of Magnitude Cost estimate for Proposed BMP's

The order of magnitude of estimated total costs are indicated in Table 1.

The cost estimate is based on the following:

1. BMP cost estimates include installation, equipment, and labor.
2. The cost estimate is based on limited conceptual information and is subject to change based on completed engineering and final bidding.
3. Any repair and/or replacements costs are not included.
4. PennDOT's Goose Creek Stream Restoration Project costs are currently based on available data at this time, and are subject to change, as determined by PennDOT.
5. Engineering sediment analysis may be required by PADEP and are not included.
6. Radley Run O&M will be by the HOA of Brandywine at Thornbury, and will be monitored by Thornbury Township.
7. Goose Creek Stream Restoration Project installation will be by PennDOT. A final O&M agreement will be between PennDOT and Thornbury Township to determine extent of responsibilities.

8. Implementation of BMP's

The estimated implementation of all BMP's will be subject to funding, project bidding and final construction within the 5-year permit period as follows:

Christina Basin / Brandywine Creek Watershed

The estimated process of installation and implementation of Christina Basin/Brandywine Creek Watershed BMP's being Bioswale and Biorientation Raingarden, and Radley Run Stream Restoration by 2026, with completion no late than 2028.

Table 1: Order of Magnitude Cost Estimate for Proposed BMP's

WATERSHED	PROPOSED BMP	Quantity	Unit	Unit Cost ⁽¹⁾	Sub Unit Total Costs
Christina Basin / Brandywine Creek	Option A - South New Street Bioretention / Raingarden w/UD ⁽¹⁾ and Bioswale	1	Complete	\$ 50,000	\$ 50,000
		11.76	AC	\$ 6,000	\$ 70,560
	Township Basin Operation, Inspection and Maintenance Annually 10%	1		\$ 7,056	\$ 7,056
	Christina Basin/Brandywine Creek Watershed Sub Cost Estimate Total			\$	\$ 127,616
	Engineering Cost 15% Construction ⁽⁵⁾	1		\$ 19,142	\$ 19,142
Christina Basin/Brandywine Creek Watershed Cost Estimate Total					\$ 146,758
	Stream Restoration per Linear Foot at Radley Run (Either Location)	400	LF	\$ 600	\$ 240,000
	HOA Stream Res. Operation, Inspection and Maintenance Annually 10%	1		\$ 24,000	\$ 24,000
	Christina Basin/Brandywine Creek Watershed Sub Cost Estimate Total			\$	\$ 264,000
	Engineering Cost 15% Construction ⁽⁵⁾	1		\$ 39,600	\$ 39,600
Christina Basin/Brandywine Creek Watershed Cost Estimate Total					\$ 303,600
Christina Basin/Brandywine Creek Watershed Cost Estimate Final Total					\$ 293,517
Chester Creek	PennDOT Stream Restoration Project per Linear Foot at Goose Creek	3,866.00	LF	\$ 600	\$ 2,319,600
	Township Stream Operation, Inspection and Maintenance Annually 10%	1		\$ 231,960	\$ 231,960
	Chester Creek Watershed Sub Cost Estimate Total			\$	\$ 2,551,560
	Engineering Cost 15% Construction ⁽⁵⁾	1		\$ 382,734	\$ 382,734
Chester Creek Watershed Cost Estimate Total					\$ 2,934,294
Total All Watersheds MS4 BMP's Cost Estimated					\$ 3,384,652
Thornbury Township Total Annual O&M MS4 BMP's Cost Estimated					\$ 239,016
HOA Total Annual O&M MS4 BMP's Cost Estimated Radley Run					\$ 24,000
Total Annual O&M MS4 BMP's Cost Estimated per Option A					\$ 3,647,668

Notes:

- BMP Cost Estimates includes installation (labor, equipment.)
- This Cost Estimate is based on conceptual information and subject to change based on completed engineering and final bidding.
- Repair & Replacement costs not included.
- The PennDOT Stream Restoration Project final costs to be determined by PennDot, and may affect Total Cost Estimate.
- Engineering Sediment Removal Analysis Post-Construction may be required by PADEP and is not included.
- Radley Run O&M will be by the HOA, and monitored by the Thornbury Township.
- Goose Creek Stream Restoration installation by PennDOT, & O&M by PenndDOT to be coordinated with Thornbury Township by agreement.

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Chester Creek Watershed

The estimated process of installation and implementation of the Chester Creek BMP being the PennDOT's Goose Creek Stream Restoration Project by 2027, with completion to be no later than 2028.

9. Final Report Summary

The Thornbury MS4 Pollutant Reduction Plan (PRP) comprising of the Christina Basin / Brandywine Creek Watershed and the Chester Creek Watershed proposes BMP's that will reduce at least or exceed the minimum 10% load rate reduction required by the Pennsylvania Department of Environmental Protection.

For the Christina Basin / Brandywine Creek Watershed, the required 10% load rate reduction is 16,230 lbs./yr. based on the Christina Basin Land Use Loading Rates established as 82.17 tons/yr., or 164,340 lbs./yr or after PennDOT roadways parsing 162,298 at 10% of 16,230 lbs./yr. There are two BMP's: a bioretention raingarden with bioswale on for the Christina Basin / Brandywine Creek Watershed on the Township property to be owned and operated by the Township. This BMP can reduce the loading by 5,187 lbs./yr. Total costs to be estimated at \$146,758.00. An additional 400 linear feet of stream restoration along the Radley Run to further enhance the stream to be owned and operated by the HOA of Brandywine at Thornbury. That can reduce the loading by 17,952 lbs./yr, with a cost o \$303,600.00. Total costs are estimated by order of magnitude at 293,517 that includes operation and maintenance costs.

For the Chester Creek Watershed, the required 10% load rate reduction is 24,942.16 lbs./yr. using the Simplified Method and Wikiwatersheds and after parsing out both PennDOT roadways and Cheyney University property. A PennDOT Goose Creek Park Stream Restoration Project along Chester Creek and tributaries for a total approximate 4,000 linear feet, will reduce the loading rate by 166,505 lbs./yr. By a final agreement, to be established, both the Pennsylvania Department of Transpiration and Thornbury Township will share operation and maintenance of the stream. The stream restoration costs to be estimated by order of magnitude at \$2,934,294.00. Overall order of magnitude estimated costs at \$3,647,668.00 for both watersheds combined, including O&M costs..

The Township intends to meet its long term goal of the TMDL Waste Load Allocation (WLA) over future terms with new Best Management Practices (BMP'S).