WEST GOSHEN TOWNSHIP >

Combined Total Maximum Daily Load & Pollutant Reduction Plan

August 2017

HRG Project No. R004194.0430

HRG
Herbert, Rowland & Grubic, Inc.
Engineering & Related Services
AN EMPLOYEE-OWNED COMPANY

Combined Total Maximum Daily Load & Pollutant Reduction Plan For

Christina River Basin
Goose Creek
East Branch Chester Creek
Chester Creek Watersheds

WEST GOSHEN TOWNSHIP

CHESTER COUNTY, PENNSYLVANIA

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INTRODUCTION

The following Combined Total Maximum Daily Load (TMDL) Plan addresses how the Township of West Goshen, Chester County, Pennsylvania intends to meet the pollutant reduction requirements prescribed in the TMDL report dated June 30, 2008 entitled, "Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania," as well as the pollutant reductions prescribed in the TMDL report dated September, 2006 entitled, "Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland" as established by the United States Environmental Protection Agency Region III. The prescribed nutrient pollutant load reductions will be achieved using the "Presumptive Approach," focusing on sediment reduction as a means of measuring the effectiveness of the Best Management Practices (BMPs) proposed herein to reduce nitrogen and phosphorus loads.

This document was prepared following the guidance provided in the Pennsylvania Department of Environmental Protection (PADEP) document 3800-PM-BCW0200d - National Pollutant Discharge Elimination System (NPDES) Individual Permit to Discharge Stormwater from Small Municipal Separate Storm Sewer Systems (Ms4s) TMDL Plan Instructions, revised March of 2017).

GENERAL INFORMATION	
Permittee: West Goshen Township	**NPDES Permit No.:** PAI130532
Mailing Address: 1025 Paoli Pike	**Effective Date:** February 13, 2004
City, State, Zip: West Chester, PA 19380	**Expiration Date:** Administratively Extended
MS4 Contact Person: Rick J. Craig, P.E., CSM	**Renewal Due Date:** September 16, 2017
Title: Township Engineer	**Municipality:** West Goshen Township
Phone: 610-696-5266	**County:** Chester
Email: rcraig@westgoshen.org	**Consultant Name:** Erin Letavic, P.E. Herbert, Rowland & Grubic, Inc. 369 East Park Drive Harrisburg, PA 17111 717-564-1121
Co-Permittees (if applicable): N/A	

Located in eastern Chester County, Pennsylvania; West Goshen Township is an MS4 community (PAI 130532) currently in its second permit term. The entire township is classified as an Urbanized Area (UA) according to the United States Census Bureau's 2010 census. The western portion of the township lies within the Brandywine Creek Watershed and the central and eastern portions comprise parts of the Chester Creek and East Branch Chester Creek Watersheds.

The above mentioned Brandywine Creek Watershed is a sub-watershed of the Christina River Basin, encompassing approximately 2,362 acres in the western region of West Goshen Township. Many of the stream reaches within the Brandywine Creek Watershed have been classified by the Pennsylvania Department of Environmental Protection as impaired, including those located within West Goshen Township.

Goose Creek Watershed, a sub-watershed of the Chester Creek Watershed, encompasses approximately 1,488 acres in the south central region of West Goshen Township. Many of the stream segments within the Goose Creek Watershed have also been classified by the Pennsylvania Department of Environmental Protection as impaired, including those located within West Goshen Township. The EPA's Goose Creek

Watershed TMDL Report establishes a Total Phosphorus (TP) TMDL for the Goose Creek Watershed and provides a total phosphorus Waste Load Allocation (WLA) to each of the MS4s in the watershed.

Further, the Township is required to prepare a pollutant reduction plan for sediment-impaired streams that discharge to the East Branch Chester Creek. Being that all of these surface waters ultimately drain to the Delaware River, and the goals for water quality can be accomplished at the same time, the planning area used to calculate sediment reduction goals and achievements combine the watersheds with TMDL and Appendix E-Siltation requirements.

SECTION A: PUBLIC PARTICIPATION

A complete copy of this Combined TMDL Plan was made available for the public to review at the West Goshen Township Municipal Office from July 26, 2017 to August 25, 2017. The availability of the document was publicized in Daily Local News (August 1, 2017). The published public notice contained a brief description of the plan, the dates and locations at which the plan was available for review by the public, and the length of time provided for the receipt of comments.

A copy of the public notice is included in Appendix A. Public comments were accepted for 30 days following the publication date of the public notice. Thirteen (13) public comments were received. Copies of all public comments and the responses issued to each comment are included in Appendix A.

A public meeting was held on July 26, 2017 at West Goshen Township Municipal Building to present the information contained in this report to the public. Comments and questions regarding the Combined TMDL Plan were received during the public presentation. A copy of the meeting minutes for the meeting at which the Combined TMDL Plan was presented are included in Appendix A.

SECTION B: MAP

The maps located in Appendix B of this report, depicts West Goshen's complete Municipal Separate Storm Sewer System (MS4), as required by the National Pollutant Discharge Elimination System (NPDES) Individual Permit to Discharge Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s) Application Instructions[1]. West Goshen's urbanized area located within the Brandywine and Chester Creek Watersheds is to be considered the planning area for the purpose of this Combined TMDL Plan. The Planning Area encompasses the entire municipality, with the exception of a 715 acre portion of the Valley Creek Watershed (HUC 12 Code 020402050104), located in the northwest corner of the Township. The Valley Creek Watershed has been associated with no PRP or TMDL requirements due to the unknown source of impairment. The Combined TMDL Planning Area encompasses approximately 6,925 acres of land within West Goshen Township. All water courses, inlets, pipes, outfalls, observation points, existing BMPs, and proposed BMP locations within the planning area have been located and identified on the MS4 maps.

A Land Use Map of the Planning Area was developed using the most recent National Land Cover Database[2]. The northern portion of the Township is largely residential with a large pocket of forested land approaching the center of the Township. The majority of Township's higher density mixed-use development is located in the center and western portions of the municipality near its boundary with West Chester Borough. The southeast quadrant of the Township exists as mainly medium density residential development.

[1] PADEP, form 3800-PM-BCW0200a, (rev. 1/2017)

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

SECTION C: POLLUTANTS OF CONCERN

The pollutants of concern for the Planning Area were determined by referencing the PADEP MS4 Municipal Requirements Table[3] (Table 1). The applicable sections of this table are included for reference in Appendix C.

Table 1. Pollutants of Concern by Watershed

Watershed	Pollutants of Concern
Goose Creek	TMDL - Nutrients (TP, TN)
Christina River Basin - TMDL	TMDL - Sediment (TSS)
East Branch Chester Creek	Appendix E - Siltation (TSS)
Chester Creek	Appendix E - Siltation (TSS)

Likely sources of these pollutants in the Planning Area are identified below.

Sediment (TSS):

- Streambank erosion
- Construction / earth moving activities
- Urban runoff
- Lack of adequate stream buffer

Nutrients (TN, TP):

- Lack of adequate stream buffer
- Heavy use of lawn fertilizers
- Agricultural activities
- Urban runoff

Since the Combined TMDL Planning Area includes the East Branch Chester Creek and Chester Creek Watersheds, the 10 % sediment load reductions prescribed by both Appendix E PRPs listed above will be achieved through the implementation of the Short-Term Goals listed in this Combined TMDL Plan. The ability to combine planning requirements is attained by PADEP in the TMDL Plan instructions[4].

[3] PADEP, MS4 Requirements Table (Municipal) (rev. 6/26/2017)
[4] PADEP, TMDL Plan Instructions (rev. 3/2017)

SECTION D: EXISTING LOAD FOR POLLUTANTS OF CONCERN

Baseline Pollutant Load Calculations

Baseline and existing pollutant load calculations were computed for the Planning Area using MapShed modeling software, version 1.5.0. MapShed is a "GIS-based watershed modeling tool that uses hydrology, land cover, soils, topography, weather, pollutant discharges, and other critical environmental data to model sediment and nutrient transport within a watershed."[5] This program calculates the existing pollutant loading in terms of pounds per year and evaluates BMP-based pollutant reductions using the DEP - approved BMP effectiveness values[6]. All GIS data used to create the pollutant baseline loading model was sourced from the MapShed Download web site.[7] The MapShed modeling software was used to calculate the Township's existing pollutant loads discharging to the Upper and Lower East Brandywine Creek watersheds, as well as the Chester and East Branch Chester Creek watersheds. The area contains the impaired reaches of the East Branch Chester Creek and Chester Creek listed in PADEP's MS4 Municipal Requirements Table, which necessitate Appendix E PRPs for siltation. Since both impaired creeks are included in the Combined TMDL Planning Area, the required pollutant load reductions for both impaired watersheds will be achieved through the implementation of the Township's Combined TMDL Plan, as suggested by PADEP's Pollutant Aggregation Table Instructions. A summary of pollutant loading for the Combined TMDL Planning Area is shown in Table 2.

Table 2. Baseline Pollutant Loading for Planning Area

Watershed	Urbanized Area (Acres)	Baseline Pollutant Loading (lbs/yr)		
		TSS	TN	TP
Combined TMDL Planning Area	6,925	3,799,869	29,756	2,053

Parsed Areas

MapShed modeling results for the Township's Baseline and Existing Pollutant Loads are included in Appendix D. Certain properties were parsed from the modeling area due to their individual stormwater quality obligations (Appendix D). A modest assumption that 15% of the existing streams in the Planning Area were adjoined by a forested buffer area, 35 feet in width, was made based on a review of satellite imagery from April 2016 and based upon local knowledge. A stream flow volume adjustment factor of 0.5 was used to calibrate the model and bring baseline sediment loads to a level consistent with those reported in the Christina River Basin TMDL Report. Existing detention basins were not included in the model, as MapShed 1.5 offers no water quality benefit to standard detention basins. A 488 acre forested area northwest of the intersection of West Chester Bypass and Phoenixville Pike, is disconnected from the Township's MS4, and modeled as an area direct drainage. Runoff from the forested area drains directly to either Taylor Run, or an UNT to Taylor Run. Using MapShed's Urbanized Area Viewer tool (UA Viewer), the Baseline Pollutant Loads for the West Goshen Township Combined TMDL Planning Area were determined (Table 3).

5. Evans, B., & Corradini, K. (n.d.). MapShed Overview Page. Retrieved August 18, 2015, from http://www.MapShed.psu.edu/overview.htm
6. PADEP form 3800-PM-BCW0100m, revised 05/2016
7. Evans, B., & Corradini, K. (2015) MapShed Download Page. Retrieved August 15, 2015, from http://www.MapShed.psu.edu/download.htm

Table 3. Baseline **Pollutant Loading by Source**

Source	Baseline Pollutant Load by Source (lbs/yr)		
	TSS	TN	TP
Land-Based Load	750,974	10,099	1,325
In-Stream Load	3,048,895	1607	440
Septic	0	64	0
Total Baseline Loading	3,799,869	11,770	1,765

The Township's baseline pollutant loads are summarized by source in Table 3. The MapShed model results demonstrate that approximately 72% of the Township's sediment load or 1,574,978 pounds of sediment per year is attributed to streambank erosion. Land-based sources and land uses contribute a smaller percentage of the total sediment load, 28% or 601,643 pounds per year, but are greater contributors of nutrient loading.

Existing Pollutant Load Calculations

Table 4: Existing BMP Sediment Load Reductions (Appendix D)

BMP Type	Location (Lat. / Long.)	Map Reference	HUC 12 Watershed	TSS Reduction (lbs/yr)
Bicking Basin Retrofit	39,952347°, -75.570360°	EX-01	Chester Creek	56,800
Total Existing BMP TSS Load Reduction				56,800 lbs/yr

Existing pollutant load modeling calculations include pollutant load reductions from one existing BMP, EX-01 (Table 4). West Goshen Township conducted a detention basin retrofit on a large basin in 2009. The basin, known as the Bicking Basin, serves as the main stormwater management facility for a large residential development in the southeast corner of the Township. The 30,000 square foot basin manages storm runoff from the 128 acre drainage area located to the north and east of the basin. During the retrofit, the entire basin bottom was naturalized with amended soil and wetland plantings which are now mature. The existing corrugated metal riser was replaced with a new 24 inch diameter HDPE riser. The new riser provides extended detention with two one-inch circular orifices located 6 inches above the outlet invert and two additional one-inch orifices for each foot of vertical rise of the riser pipe.

Table 5. Existing Pollutant Loads

Source	Combined TMDL Planning Area Baseline Pollutant Load by Source (lbs/yr)		
	TSS	TN	TP
Baseline Pollutant Loading	3,799,869	11,770	1,764
Existing BMP Load Reductions	56,800	157	24
Existing Pollutant Loading	**3,743,069**	**11,613**	**1,740**

The Combined TMDL Planning Area's existing sediment load was determined to be 3,743,069 pounds per year (Table 5). Existing load calculations are included in Appendix D.

SECTION E: WASTELOAD ALLOCATIONS (WLAs)

West Goshen Township was assigned a Wasteload Allocation for total phosphorous stating that no more than 0.54 pound per day of total phosphorous shall be discharged from the Township's MS4 into the Goose Creek Watershed (Table 6). The WLA is listed on page 3-6 of the June 30, 2008 TMDL report entitled, "Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania."

Table 6. Goose Creek MS4 Waste Load Allocations (WLA) and Required Reduction:

MS4 Permittee	Existing TP Load (lb/day)	TP WLA (lb/day)	Required Reduction
West Goshen Twp.	1.16	0.54	53.9%

*Current TP load as listed in TMDL Report. See Section D for recalculated Baseline Pollutant Loads.

West Goshen Township was also assigned a Wasteload Allocation for sediment stating that the discharge from the Township's MS4 shall contribute no more than 184 tons of sediment to the Christina River Basin Watershed (Table 7). The WLA is listed on page 4-16 of the 2006 TMDL report entitled, "Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland."

Table 7. Christina River Basin MS4 Waste Load Allocations (WLA) and Required Reduction:

MS4 Permittee	Baseline Sediment Load (tons/year)	Sediment WLA (tons/year)	Required Reduction
West Goshen Twp.	470	184	60.87%

*Current sediment load as listed in TMDL Report. See Section D for recalculated Baseline Pollutant Loads.

SECTION F: ANALYSIS OF TMDL OBJECTIVES

Long-Term Reduction

West Goshen Township intends to achieve the required long-term pollutant load reduction goals prescribed by the EPA's Goose Creek Watershed and Christina River Basin TMDL Reports through continued implementation of the pollutant load reducing BMPs and educational activities over several future MS4 Permit terms. The Township will continue to review and revise the approved TMDL Plan and work to identify and develop future projects that will provide water quality benefits to the receiving waters of the MS4. Long-term load reduction requirements for each WLA-associated pollutant have been calculated for each watershed (Table 8).

Table 8: Long-Term Pollutant Load Reduction (Appendix F)

Watershed	Impairment	Existing Pollutant Load*	Percent Reduction Required	Long-Term Pollutant Loading Goal
Christina River Basin	Sediment / Siltation	828,378 lbs/yr	60.87%	324,144 lbs/yr TSS
Goose Creek Watershed	Total Phosphorus	1,078 lbs/yr	53.9%	497 lbs/yr TP

*Based on individual watershed, not Combined TMDL Planning Area

Short-Term Reduction

Utilizing the "Presumptive Approach," as described in PADEP's TMDL Plan Instruction Document 3800-PM-BCW0200d, West Goshen Township intends to achieve the required short-term sediment load reduction goals through construction, operation and maintenance of the five pollutant load reducing BMPs proposed herein. The BMPs have been located throughout the Planning Area to achieve sediment load reductions in both TMDL watersheds, as well as the two impaired Appendix E, PRP watersheds. Short-term sediment load reduction requirements have been quantified for the Combine TMDL Planning Area (Table 9).

Pollutant Reduction Requirements

Table 9: Short-Term Pollutant Load Reduction (Appendix F)

Watershed	Impairment	Existing Pollutant Load**	Percent Reduction Required	Reduction Required (lbs/yr)	Short-Term Pollutant Loading Goal (lbs/yr)
Combined TMDL Planning Area	Sediment / Siltation	3,743,069	10%	374,307	3,368,762

**Based on Combined TMDL Planning Area calculated using MapShed modeling software

SECTION G: SELECT BMPS TO ACHIEVE MINIMUM REQUIRED REDUCTIONS

Short-Term Reductions for Permit Term

The following BMP strategy represents an effective approach to meeting the required reduction goals of the Short-term TMDL requirements for the Goose Creek and Christina River Basin Watersheds, as well as the load reductions required by the Appendix E PRPs for Chester Creek and East Branch Chester Creek Watersheds. The proposed BMPs include streambank stabilization, riparian forest buffer restoration, and detention basin retrofits throughout the Township's urbanized area. The sediment load reductions achieved through the implementation of the proposed BMPs described herein were determined through the use of the same MapShed model used to determine the Township's Baseline and Existing Sediment Loads.

Table 10: Proposed BMPs for Short-term Sediment Load Reduction Strategy (Appendix F)

BMP Type	Location (Lat. / Long.)	Map Reference	Watershed	TSS Reduction (lbs/yr)
Hamilton Drive Detention Basin Retrofit	39.995733° , -75.611727°	BMP-01	Lower East Branch Brandywine	13,800
Farren Drive Detention Basin Retrofit	39.998006° , -75.612304°	BMP-02	Lower East Branch Brandywine	13,200
Hagerty Lane Stream Restoration	39.948947° , -75.581787°	BMP-03	Chester Creek	132,250
Westtown Road Stream Restoration	39.958095°, -75.584041°	BMP-04A	Chester Creek	198,375
Westtown Road Detention Basin Retrofits & Constructed Wetlands	39.958095°, -75.584041°	BMP-04B	Chester Creek	20,600
Basin Road Stream Restoration	39.963242°, -75.567053°	BMP-05A	Chester Creek	49,450
Basin Road Detention Basin Retrofit	39.962703°, -75.566718°	BMP-05B	Chester Creek	84,000
Total Reduction Achieved				**511,675 lbs/yr**
Required Reduction				**374,307 lbs/yr**

BMP Selection Process

The results of the MapShed model demonstrates that the majority of the sediment load generated within the Urbanized Area of West Goshen Township originates from streambank erosion. As such, BMPs including streambank stabilization, floodplain reconnection, and riparian buffer restoration were selected to address the instream erosion issues, in addition to land-based BMPs, such as bio-retention, and constructed wetlands. BMP locations came as a result of a feasibility investigation performed in the spring of 2015 in which representatives of West Goshen Township and HRG identified candidate BMP locations that offered the greatest potential for sediment load reduction in locations that the Township felt property owners would likely be cooperative. BMP location maps are included in Appendix B.

Proposed Streambank Stabilization and Buffer Restoration BMPs

Streambank stabilization prevents further erosion and degradation of disturbed or cut back streambanks, ultimately resulting in lower sediment and nutrient loads being released into the stream. Where practical, the Township will implement vegetative streambank stabilization to promote plant uptake of pollutant laden runoff in order to reduce the amount of nutrients and sediment eventually reaching the local waterways. Vegetative stabilization relies on the root structures of established plantings to stabilize the streambank and provide scour protection. In addition, incised streambanks will be regraded at a lesser slope to prevent further incision by allowing the stream to reconnect to the surrounding floodplain. This method offers a relatively inexpensive means of stabilization and provides a naturalized appearance to the rehabilitated streambank.

Velocity reduction, where practical, will be achieved through the use of rock vanes, wing deflectors, and grade controls in combination with streambank stabilization, riparian buffer projects, and floodplain reconnection. These instream structures will direct stream flow away from eroding or newly stabilized streambanks, as well as create stream meanders that will reduce stream velocity, further preventing streambank erosion and scour. The structures will be constructed of natural materials such as rock, root wads, and logs. The exact number and locations for the proposed instream structures will be determined upon approval of the Combined TMDL Plan during the completion of the engineered design.

West Goshen Township intends to perform riparian buffer restoration on the segments of stream to be stabilized. The goal of the riparian buffer projects is to naturalize the existing floodplain and reestablish buffer areas along the stream segments to a minimum width of 35 feet. The restorations will include the removal and replacement of dead, diseased, and/or invasive vegetation; as well as new plantings in areas where buffers have diminished in size. The riparian buffer restoration projects will be implemented concurrently with the stabilization projects in order to maximize the nutrient load reduction potential of each segment of stream to be enhanced, and will incorporated into the engineered design.

Proposed BMP-03, BMP-04A, and BMP-05A will contribute approximately 3,305 feet of restored stream and enhanced buffer in the Combined TMDL Planning Area, greatly reducing the amount of sedimentation due to instream erosion.

Detention Basin Retrofit

BMP-01, BMP-02, BMP-04B, and BMP-05B are proposed detention basin retrofits. The existing basins serve as the main stormwater management facilities for two adjoining neighborhoods in northcentral portion of the Township. The existing basins offer no water quality benefits, other than minor settling, as they are simply detention, designed for rate control. BMP-04B, adjacent to the West Chester Sports Center, entails a large detention basin retrofit, along with the possibility to incorporate constructed wetlands into a smaller adjoining detention area. The project will be paired with a stream restoration project at the same location.

Detention basins are relatively simple basins designed to receive, temporarily hold, and discharge stormwater at a controlled rate. While they can provide rate and volume mitigation, detention basins offer limited water quality benefit. Detention basin retrofits transform these simple catch, store, and release ponds into BMPs which provide infiltration, bioretention, and improved sediment and nutrient removal capabilities. This is achieved by extending the storage time with structure modifications, improving soil conditions to allow for greater infiltration rates, and naturalizing the basins with native and/or wetland plant species.

West Goshen Township conducted a detention basin retrofit on a large basin in 2009. The basin, known as the Bicking Basin, serves as the main stormwater management facility for a large residential development in

the southeast corner of the Township. Finding that the retrofitted basin produced substantial water quality and aesthetic value, the Township expressed interest in conducting more retrofits in order to achieve the sediment reduction requirements mandated by the TMDLs and PRPs. The Township is proposing to perform two additional detention basin retrofits at locations within the Combined TMDL Planning Area (Table 11). While the extent and nature of the retrofits will rely on the results of future engineering investigations, each basin retrofit will reduce the quantity and increase the quality of the stormwater runoff reaching the impaired streams. For modeling purposes, the fraction of area treated values for each retrofit were taken as a percentage of the basin's respective sewershed. The locations of the proposed detention basin retrofit projects are displayed on the location map in Appendix B.

Short-Term BMP Implementation Schedule

A preliminary implementation schedule has been provided (Table 11); however, construction of the proposed BMPs may rely on the results of the engineering investigation, design, and permitting process. The proposed stream restoration projects will likely require a Joint Permit Application (JPA) and will be subject to PADEP and United States Army Corps of Engineers (USACE) review. The Township recognizes their ability to review and revise their Short-term sediment reduction strategy and may elect to do so in accordance with PADEP regulations. Any revisions to the Combined TMDL Plan will be appropriately reported to all applicable regulatory agencies.

Table 11: Implementation Schedule for Proposed Short-term BMPs

BMP Type	Location (Lat. / Long.)	Map Reference	Permitting & Engineering Design (Permit Year)	Construction (Permit Year)
Basin Road Stream Restoration	39.958095°, -75.584041°	BMP-05A	1	2
Basin Road Detention Basin Retrofits	39.958095°, -75.584041°	BMP-05B	1	2
Hamilton Drive Detention Basin Retrofit	39.995733° , -75.611727°	BMP-01	2	3
Farren Drive Detention Basin Retrofit	39.998006° , -75.612304°	BMP-02	2	3
Hagerty Lane Stream Restoration	39.948947° , -75.581787°	BMP-03	2	3
Westtown Road Stream Restoration	39.958095°, -75.584041°	BMP-04A	3	4-5
Westtown Road Detention Basin Retrofits & Constructed Wetlands	39.958095°, -75.584041°	BMP-04B	3	4-5

Long-Term Reductions to Meet WLA(s):

As previously stated, West Goshen Township intends to achieve the required long-term pollutant load reduction goals prescribed by the WLAs included in the EPA's Goose Creek Watershed and Christina River Basin TMDL Reports through continued implementation of the pollutant load reducing BMPs and educational activities over several future MS4 Permit terms. The Township will continue to implement pollutant reducing BMPs in order to achieve the required pollutant reductions necessary to the WLAs for both the Goose Creek Watershed and the Christina River Basin Watershed. West Goshen Township submitted a MS4 TMDL Strategy for both impaired watersheds in 2015, in which the Township identified numerous potential projects that upon successful construction, could achieve each impaired watershed's respective WLA. The Township will continue to use the original strategies as a source of identifying future project locations, and will recalculate the pollutant load reductions associated with each project based on the latest PADEP-approved pollutant removal efficiencies.

Table 12: Long-Term Pollutant Load Reduction (Appendix F)

Watershed	Impairment	Short-term Load Reduction (lbs/yr)	Short-term Load Reduction (%)	Long-Term Load Reduction Goal (lbs/yr)	Remaining Reduction Required (lbs/yr)
Christina River Basin	TSS	350,818	42%.	504,234	153,416
Goose Creek Watershed	TP	62.8 ***	5%	581.2	518.4

***Based on correlation made under "Presumptive Approach," 10% TSS reduction equivalent to 5% reduction in TP.

Based on the Short-term pollutant loads expected to be achieved during the first permit term (Table 12), a preliminary timeframe of when the Township could likely meet the required long-term pollutant reductions of the TMDLs can be projected. Pending future guidance by PADEP, the Township will continue forward with the goal of achieving pollutant load reductions similar to those proposed for the first permit term as described under the Short-term Pollutant goals. At the continued pace of the Short-term pollutant load reduction goals, the Township will look to achieve the 60.87% sediment load reduction for the Christina River Basin upon completion of the third 5-year permit term. The more difficult to achieve 53.9% reduction of total phosphorus may be achieved by the end of the sixth 5-year permit term.

SECTION H: FUNDING MECHANISMS

The design and construction of the BMPs proposed herein may be funded through a variety of sources including collected stormwater fees, Township general funds, available grants, and public donation of materials and manpower. The proposed forest buffer projects may be constructed, at least in part, by Township staff and/or civic and volunteer groups in order to lessen the overall cost of implementing the Combined TMDL Plan.

SECTION I: OPERATION & MAINTENANCE (O&M)

O&M requirements for the streambank stabilization and buffer restoration projects shall include:

- Ensure disturbed areas are kept free of foot and/or vehicular traffic until full stabilization has occurred – year round
- Regular watering of plantings during first growing season. Planting in the fall may reduce the need for additional watering - seasonally
- Conduct site visits to ensure plantings are healthy and sufficiently watered, weeds are properly managed, sufficient mulch is in place until site is stabilized and planting have become established - monthly
- Conduct site visits to ensure all disturbed earth remains stabilized and erosion or cutting of the streambank has not taken place. Any destabilized earth or active streambank erosion shall be repaired immediately upon discovery - monthly
- Conduct inspections once streambank is stabilized and plants have become established - biannually
- Immediately upon notice; repair any rills, gullies, or streambank cutting that may occur – year round
- Remove weeds and invasive plant species during each growing season. Naturally growing native vegetation should be left intact to promoted stabilization of the streambank and surrounding area - seasonally
- Replace mulch as needed - biannually
- Remove accumulated trash and debris - monthly
- Remove and replace dead and diseased plantings - biannually
- Keep machinery and vehicles away from stabilized areas – year round

O&M requirements for the retrofit bio-retention basins shall continue to include:

- Conduct regular inspections until site is stabilized and plantings are established -monthly
- Immediately upon notice, repair and erosion issues in the basin – year round
- Remove and replace dead of diseased plantings - biannually
- Remove weeds and invasive species from the basin - quarterly
- Remove accumulated sediment and debris - monthly
- Mulch as necessary – biannually
- Use no chemical herbicides or pesticides – year round
- Maintain a "No Mow Zone" around the perimeter of the basin – year round
- Ensure outlet structures remain unobstructed and free of debris - monthly

The contractor shall be responsible for the operation and maintenance of the streambank restoration and buffer project(s) until all features of the project have been successfully constructed to the specifications and design standards set forth by the Township Engineer. The Contractor shall remain responsible for operation and maintenance of the streambank restoration and buffer project(s) until 70% permanent vegetative stabilization has been achieved. Once construction of the project(s) is complete and stabilization has occurred, the Township shall be responsible for implementing all Operation and Maintenance procedures to ensure the streambank stabilization and buffer improvements remained operationally functional and physically consistent with the original design.

APPENDIX A – PUBLIC COMMENT DOCUMENTATION

Public Advertisement

Public Meeting Presentation

Public Comments & Responses

21ST CENTURY media

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AFFIDAVIT OF PUBLICATION

307 Derstine Avenue • Lansdale, PA 19446

WEST GOSHEN TOWNSHIP
1025 PAOLI PIKE
WEST CHESTER, PA 19380
Attention:

STATE OF PENNSYLVANIA,
COUNTY OF MONTGOMERY

The undersigned Kathy Vincent, being duly sworn the he/she is the principal clerk of Daily Local News, Daily Local News Digital, published in the English language for the dissemination of local or transmitted news and intelligence of a general character, which are duly qualified newspapers, and the annexed hereto is a copy of certain order, notice, publication or advertisement of:

WEST GOSHEN TOWNSHIP

Published in the following edition(s):

Daily Local News	07/22/17
Daily Local News Digital	07/22/17

Public Notice

Notice is hereby given that West Goshen Township will hold a public meeting to present and take public comment on the Township's proposed Pollution Reduction Plans (PRPs) for East Branch Chester Creek and Chester Creek and Total Maximum Daily Load Plans (TMDL) for Christina River and Goose Creek at 7:00 p.m. Wednesday, July 26, 2017 at the West Goshen Township Administration Building, 1025 Paoli Pike, West Chester, PA. 19380.

Notice is also hereby given that West Goshen Township will hold a public meeting immediately following the PRP Plans and TMDL Plans meeting to provide a project update for the Township's Basin Road stormwater basin retrofit project. The public is invited to attend to learn more about this project.

Casey LaLonde
Township Manager
dln. 7/22 - 1a.

Sworn to the subscribed before me this 7/24/2017.

Maureen Schmid

Notary Public, State of Pennsylvania
Acting in County of Montgomery

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
MAUREEN SCHMID, Notary Public
Lansdale Boro., Montgomery County
My Commission Expires March 31, 2021

Advertisement Information

Client Id: 884411 **Ad Id:** 1390019 **PO:** Stmwtr PRP/TMDL **Sales Person:** 093304

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[BUILDING RELATIONSHIPS. DESIGNING SOLUTIONS.]

West Goshen Township
Stormwater Quality Plans

July 26, 2017

Herbert, Rowland & Grubic, Inc.

- Headquartered in Harrisburg, PA
- +200 employees
- Municipal services for +50 years

- **Erin Letavic, M.Eng, P.E.,** Project Manager
  - 13 years MS4 experience
  - eletavic@hrg-inc.com

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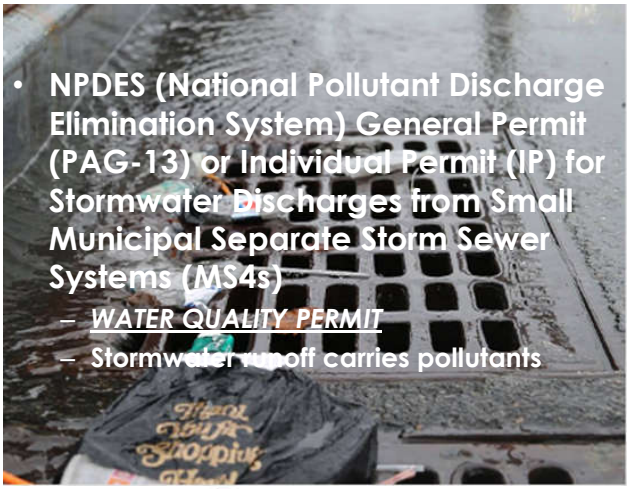
MS4 Permit



- NPDES (National Pollutant Discharge Elimination System) General Permit (PAG-13) or Individual Permit (IP) for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s)
  - ***WATER QUALITY PERMIT***
  - Stormwater runoff carries pollutants

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MS4
(Municipal Separate Storm Sewer System)

The system within the "*Urbanized Area*" that collects, conveys, or manages stormwater

- Pipes
- Inlets
- Swales
- Detention BMPs
- Infiltration BMPs
- Water Quality BMPs
- Outfalls – Goose Creek, Christina River, East Branch Chester Creek, Chester Creek

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Two Stormwater Runoff Problems

- Economic Progress (land development)
  - Problem #1: Increase in **quantity**
  - Problem #2: Decrease in **quality**
- Aging Infrastructure
  - Problem #1: **Funding** challenges
  - Problem #2: What **design** standards?

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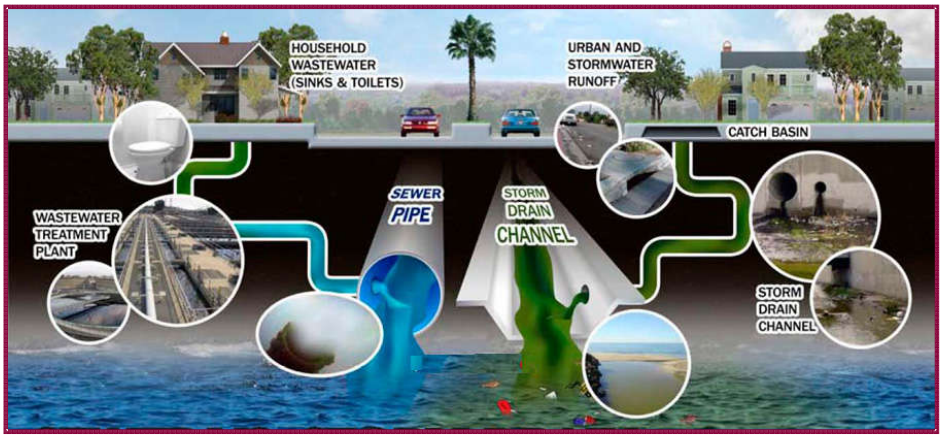
Sanitary Sewer (Treated)

Storm Sewer (Untreated)



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Stormwater Pollutants

- Sediment
- Nutrients (nitrogen & phosphorus)
- Bacteria
- Oxygen Demand
- Oil and Grease
- Metals
- Toxic Chemicals
- Chlorides
- Thermal Impacts
- Pesticides & Herbicides

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Impaired Watersheds

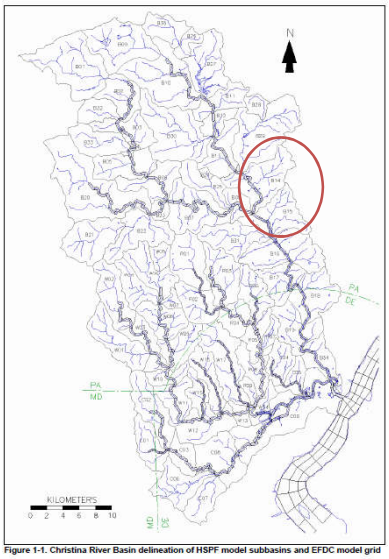

Figure 1-1. Christina River Basin delineation of HSPF model subbasins and EFDC model grid

Christina River & Goose Creek (Total Maximum Daily Loads)

- Sediment
- Nutrients (nitrogen & phosphorus)

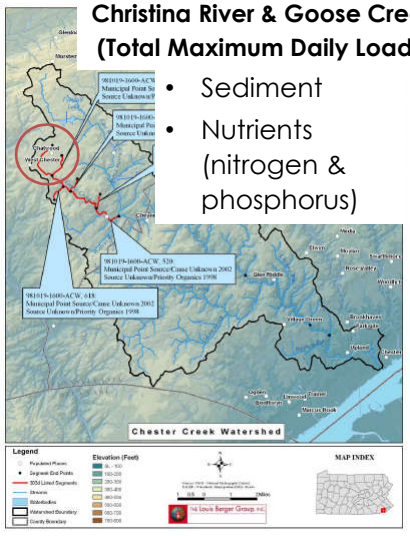

Figure 1-1: Impaired Segments in the Goose Creek Watershed

Pollutant Reduction Requirements

Brandywine Creek/ Christina River TMDL (Total Maximum Daily Load)

Pollutant: Sediment
Required Reduction: 61%

(Restore recreation and protection of aquatic life)

Goose Creek TMDL (Total Maximum Daily Load)

Pollutant: Phosphorus
Required Reduction: 54%

(Protection of aquatic life)

Chester Creek/East Branch Chester Creek PRP (Pollutant Reduction Plan)

Pollutant: Sediment
Required Reduction: 10%

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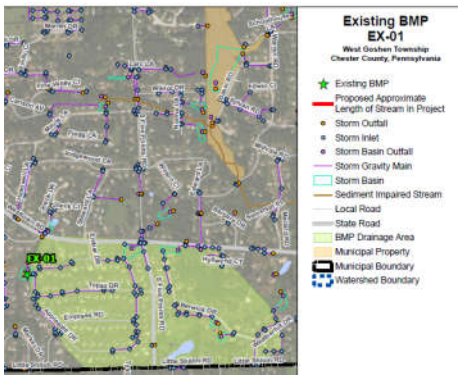
TMDL Plan Development

- Previously developed in 2015
- Updated in 2017
  - New MS4 Requirements
  - East Branch Chester Creek/Chester Creek Impairment
  - Updated stream restoration credit
- Modeling
  - MapShed Software



Bicking Basin Retrofit

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2018 Permit Implementation

- Permittees are **automatically expected to comply** with latest permit terms.
  - ✓ Pollution Control Measures (PCMs)
  - ✓ Updated list of authorized non-stormwater discharges
  - ✓ Increased public involvement
  - ✓ Clearer requirements requiring public access
  - ✓ Updated TMDL and new Pollutant Reduction Plans

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2018 Permit Regulatory Changes
Pollution Reduction Plans (PRPs)

- PRP requirement extended to a wider group of MS4s.
- PRPs required for all waters impaired by nutrient or sediment loadings that do not have a TMDL.
- Just having a plan is not enough; the plan needs to be implemented in a demonstrative way.
- Project implementation in a 5-year period – completion by 2023.

2018 Permit Regulatory Changes
Pollution Reduction Plans (PRPs)

- **PRP Requirement Table** provided in the draft permit identifies specific requirements relating to remediation of impaired waters (pre-TMDL).
- These requirements go **above and beyond** implementation of the MCMs as part of an MS4's stormwater management program.

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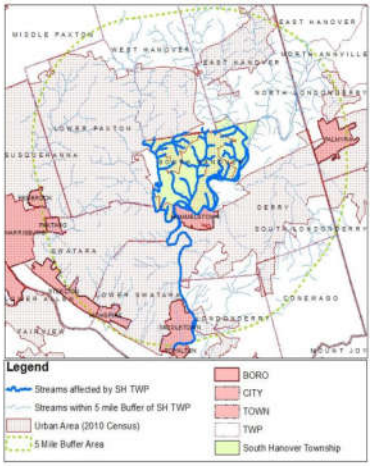
2018 Permit Regulatory Changes
PRP Requirements Table

- Selection of impaired waters included on Table
  - 5-mile buffer drawn around each municipality's urbanized area (UA)
  - Drainage areas delineation within the buffer
  - If stormwater from UA was expected to flow into impaired waters within the buffer, impaired waters were selected for the Table



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2018 Permit Regulatory Changes

TMDL Plans

Current Permit	2018 Permit
➢ Two-part TMDL Plan • TMDL Strategy with NOI/application • TMDL Design details due 1 year after permit issuance ➢ TMDL Plan required for all pollutants with an "applicable WLA" ➢ MS4 eligible to be covered under PAG-13	➢ One TMDL Plan ➢ Nutrients/sediment WLA • TMDL Plan required • Not eligible for PAG-13 permit ➢ WLA for other pollutant (not nutrients/sediment) • TMDL plan not required, PAG-13 remains an option

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TMDL Plan Development

- Modeling
  - MapShed Software
  - Pollutant loading assumptions according to land use & instream erosion
  - BMP benefits
    - Detention basin naturalization
    - Stream buffers

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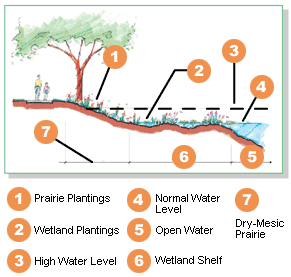
TMDL Plan Development

- **Detention basin naturalization**
- Stream restoration/buffer



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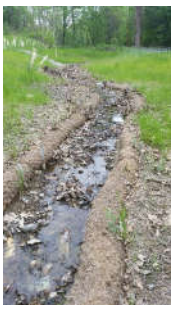
TMDL Plan Development

- Detention basin naturalization
- **Stream restoration/buffer**



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Short-term Sediment Load Reduction

- Combined Planning Area
- Focus projects within TMDL watersheds

Table 10: Short-Term Pollutant Load Reduction (Appendix F)

Watershed	Impairment	Existing Pollutant Load**	Percent Reduction Required	Reduction Required (lbs./yr.)	Short-Term Pollutant Loading Goal (lbs./yr.)
Combined TMDL Planning Area	Sediment / Siltation	3,743,069	10%	374,307	3,368,762

**Based on Combined TMDL Planning Area calculated using Mapshed modeling software

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Short-term Sediment Load Reduction

Table 11: Proposed BMPs for Short-term Sediment Load Reduction Strategy (Appendix F)

BMP Type	Location (Lat. / Long.)	Map Reference	Watershed	TSS Reduction (lbs/yr)
Hamilton Drive Detention Basin Retrofit	39.995733°, -75.611727°	BMP-01	Lower East Branch Brandywine	13,800
Farren Drive Detention Basin Retrofit	39.998006°, -75.612304°	BMP-02	Lower East Branch Brandywine	13,200
Hagerty Lane Stream Restoration	39.948947°, -75.581787°	BMP-03	Chester Creek	132,250
Westtown Road Stream Restoration	39.958095°, -75.584041°	BMP-04	Chester Creek	198,375
Westtown Road Detention Basin Retrofits & Constructed Wetlands	39.958095°, -75.584041°	BMP-05	Chester Creek	20,600
Total Reduction Achieved				**378,225 lbs./yr.**
Required Reduction				**374,307 lbs./yr.**

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Proposed Implementation Schedule

Table 12: Implementation Schedule for Proposed Short-term BMPs

BMP Type	Location (Lat. / Long.)	Map Reference	Permitting & Engineering Design (Permit Year)	Construction (Permit Year)
Hamilton Drive Detention Basin Retrofit	39.995733°, -75.611727°	BMP-01	1	2
Farren Drive Detention Basin Retrofit	39.998006°, -75.612304°	BMP-02	1	2
Hagerty Lane Stream Restoration	39.948947°, -75.581787°	BMP-03	2	3
Westtown Road Stream Restoration	39.958095°, -75.584041°	BMP-04	3	4-5
Westtown Road Detention Basin Retrofits & Constructed Wetlands	39.958095°, -75.584041°	BMP-05	3	4-5

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Long-Term Pollutant Load Reduction

Table 13: Long-Term Pollutant Load Reduction (Appendix F)

Watershed	Impairment	Short-term Load Reduction (lbs./yr.)	Short-term Load Reduction (%)	Long-Term Load Reduction Goal	Remaining Reduction Required (lbs./yr.)
Christina River Basin	TSS	217,368	26%.	504,233.5	286,865.9
Goose Creek Watershed	TP	62.8 ***	5%	581.2 lbs./yr.	518.4

***Based on correlation made under "Presumptive Approach," 10% TSS reduction equivalent to 5% reduction in TP.

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Next Steps

- Public comment period closes — August 25, 2017
- Revise report — September 2017
- Submit report — September 15, 2017

- Implementation – upon Individual Permit Approval

Questions?

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WEST GOSHEN TOWNSHIP
Combined TMDL Plan
Public Comments – Margie Swart
August 25, 2017

Section A: Public Participation

Comment 1. Unable to confirm referenced Daily Local News (August 1, 2017) public notice.

Response: *Proof of Publication is included in Appendix A of the TMDL Plan.*

Comment 2. Public notice dated 7/22/17 does not reference a 30 day written comment period, brief description of plan, or the dates and locations at which the plan was made available for review by the public.

Comment 3. At the July 26, 2017 meeting, the PRP/TMDL plans were not presented. Instead, "an overview of storm water issues generally, including land development issues and aging infrastructure…details on the various reduction percentages required by EPA / DEP for the pollutants" were presented.

Response: *The Public Presentation held on July 26, 2017 and the information provided meets the requirements of PADEP's TMDL Plan Instructions (PADEP form 3800-PM-BCW0200d, rev. 3/2017).*

Comment 4. The required comment period at a public meeting or hearing has not been met. Public could not comment on the plan at the July 26, 2017 meeting because the plan was not presented.

Response: *The Public Presentation held on July 26, 2017 and the information provided meets the requirements of PADEP's TMDL Plan Instructions (PADEP form 3800-PM-BCW0200d, rev. 3/2017).*

Comment 5. Meeting minutes need amending based off audio and/or video supported evidence.

(a) Paragraph two should be deleted in entirety, (proposed plans were NOT presented)

(b) Paragraph four should read, *One resident asked if the pollutant levels increased lately or have the requirements changed? Ms. Letavic responded that the requirements changed.*

(C) Valerie Wagner, Basin Rd. resident, inquired about an update on the grant for the Basin Road storm water project. Mr. LaLonde explained that a separate presentation

with a separate set of engineers will follow current meeting. (exchange needs to be inserted in minutes)

(d) Ray Federici, Stoney Brook Lane resident, wanted to know what he could expect to be done during the Basin Rd. stormwater project about the retaining wall and drain that sometimes clogs next to his property. He was told that information would be covered in the next meeting immediately following. (exchange needs to be inserted in minutes)

(e) Add, *Margie Swart asked why the township has two engineering firms for storm water projects?*

(f) Correct Margie Swart's question to read, *Is the Basin Rd. retrofit calculated into this plan? Ms. Letavic – No, because the schedule can be fluid and the plan can be revised whenever the township wants.*

(g) Add, *Margie Swart asked if the two engineering firms consulted one another on the pollution reduction plans. Ms. Letavic - No*

(h) Correct Ms. Letavic's response to Margie Swart's question about cost of projects to read, "*It's not final yet."* (delete *$7 per pound or about $2.1M* as that figure is not in the plan and that figure was what it has cost her other clients)

Section D: Existing Load for Pollutants of Concern

Table 3. Baseline Pollutant Loading for Planning Area

Comment 6. A modest assumption that 15% of the existing streams in the Planning Area…" *Too low of an assumption percentage in my opinion.

Response: *Comment noted. Explanation of assumption was included in the TMDL Plan made available for public comment on July 26, 2017.*

Comment 7. "Existing detention basins were not included in the model…."
The township has over 200 privately owned detention basins. Just because Mapshed 1.5 offers no water quality benefit to standard detention basins, should not preclude the township from receiving credit for the many detention basins in its boundary. (Use a different model)

Response: *Standard detention-only basins are not recognized as water quality BMPs according to PADEP's BMP Effectiveness Value Table (PADEP form 3800-PM-BCW0100m, rev. 5/2016) and were therefore not included in the Existing Pollutant Load calculations. The MapShed modeling software was updated in 2016 to reflect current PADEP approved BMP pollutant load removal efficiencies. The MapShed modeling software is a PADEP-approved means of calculating pollutant loads and BMP pollutant load reduction values.*

Table 4. Baseline Pollutant Loading by Source

Comment 8. It seems as though the Map Shed model results don't accurately reflect the source of sediment load. The model predicts 72% from stream bank erosion. Most of the township's streams are low flow, intermittent, bank less streams.

Response: *The MapShed modeling software determines stream bank erosion based on a variety of factors, including length of stream, flow, weather data, land cover, and topography. The model uses empirical data collected from representative watersheds that is applied to the Planning Area being modeled. Again, the MapShed modeling software is a PADEP-approved means of calculating pollutant loads and BMP pollutant load reduction values.*

Section E: Waste load Allocations (WLAs)

Comment 9. The township is undertaking a 27 million dollar sewer plant upgrade, in part, to reduce the total phosphorous discharged into the Goose Creek Watershed from West Goshen Township Sewer Plant. Credit should be given to the WLAs for these efforts.

Response: *Sanitary Sewer Treatment Facilities are considered point source dischargers and were prescribed Wasteload Allocations in EPA's 2008 report, "Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania" independent to those assigned to non-point source MS4 dischargers.*

Section G: Select BMPs to Achieve Minimum Required Reductions

Table 11: Proposed BMPs

Comment 10. The Township is spending approximately $800,000, inclusive of a PA Growing Greener Grant totaling $296,400, on the Basin Rd retrofit project with the stated goals: "enhance storm water basin performance, trap and treat pollutants; repair and stabilize the damaged stream banks, enhance wetlands, riparian, and upland habitat; and provide passive recreation and education opportunities." *This project is nowhere to be found in this TMDL/PRP plan submission.* WHY?

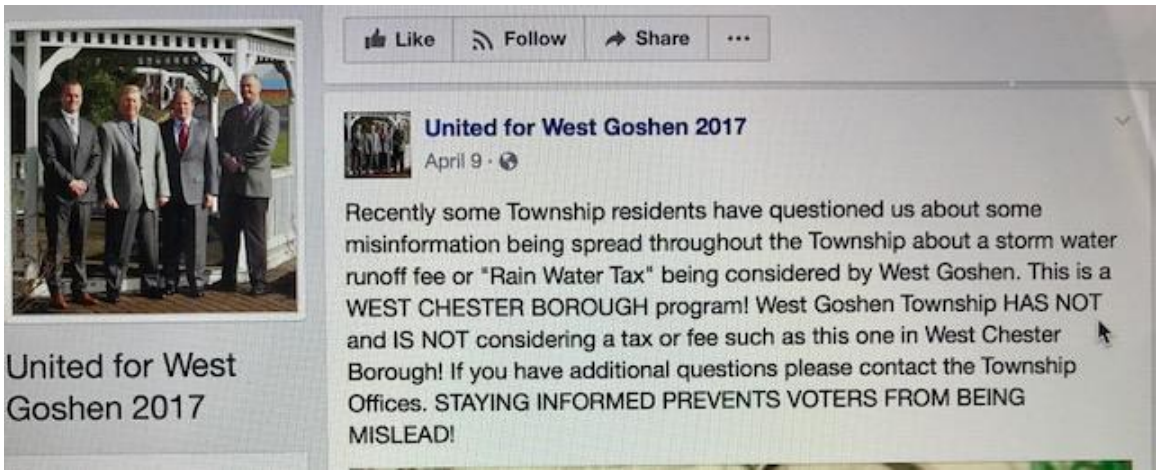
Response: *The Basin Road stream restoration and detention basin retrofit projects have been included in the TMDL Plan as BMP-05A and BMP-05B, respectively.*

Section H: Funding Mechanisms

Comment 11. Remove the "collected stormwater fees" as a funding source.

*** Township Supervisors have been adamant, overzealous, and definitive in their public statements about opposition to accessing a storm water fee:

April 9, 2017, long term Supervisor/Public Works Director and Incumbent Supervisor candidate, Ray Halvorsen, approved the following statement posted on his campaign Facebook page: West Goshen Township HAS NOT and IS NOT considering a tax or fee….If you have additional questions please contact the Township Offices. STAYING INFORMED PREVENTS VOTERS FROM BEING MISLEAD!



April 12, 2017, Board of Supervisor's meeting - Chairman Meakim read a statement that was approved by the entire Board and made public comments refuting any plans for a storm water fee.

April 22, 2017, Vice Chairman of the Board of Supervisors, Hugh Purnell, made the following public statements:

"As a supervisor, I have not heard of tax/fee for storm water control….but there is NO consideration in the works."

"…that does not mean we are considering a tax because we aren't."

"Can I be any more plane-we are not considering a tax unless the state or feds mandate it. We have not discussed it."

Comment 12. Cost estimates have not been provided. A breakdown cost per project, with an estimated total cost over the 5 yr. permit term, needs to be calculated and included in the plan.

Comment 13. The township mislead the public into believing that the presentation given at the July 26, 2017 meeting was the actual "Storm water Quality Plan" (see

first slide in Power Point presentation) In addition, the Township Manager opened the meeting by stating "We have E*** L*** here from ***, she'll be presenting all four plans tonight."

Happy the Township confirmed General Fund revenues would be the stated funding mechanism submitted in the application, I left the meeting satisfied.

I asked good questions and trusted each one would be documented in the minutes so I didn't plan on submitting additional written comments. However, on August 19, 2017, I thought I should check the township website to confirm a *bait and switch* tactic wasn't in play regarding the funding mechanism. Unfortunately, the Township's word cannot always be trusted so I was searching for written confirmation. After considerable time digging through the Township website, I located a draft Combined Total Maximum Daily Load & Pollution Reduction Plan.

My intuition proved accurate – misrepresentation comes naturally from some Township officials.

In conclusion, the DEP should reject the application of West Goshen Township based on the many deficiencies stated here in. I would like to have the opportunity to comment on the newly discovered cumbersome document but have run out of time to do so.

Submitted by:

Margie Swart
1519 Links Dr.
West Chester, PA 19380

WEST GOSHEN TOWNSHIP
Combined TMDL Plan
ADDENDUM #1
Public Comments – Margie Swart
August 30, 2017

Comment 14. BMP 04, Stream Restoration project, *Westtown Road Stream restoration*.

The 2015 plan included a *Westtown Road Stream Enhancement Project* immediately upstream from the current plan. (Public property on the Chester County Government Services site)

Why did the township eliminate that project and replace it with the current proposed stream restoration that is located on private property?

The private property has its own storm water requirements to meet under PAG – 03 PAR800164 & PAR030034. (Appendix D of proposed plan)

In addition, the township chose to parse this property, along with all other PAG-03 industrial acreage, out of the base load calculations. Accordingly, the township cannot take credit for a BMP located on property that has been parsed out of the *Planning Area.*

The township must have consent of the property owner before it can proceed with a DEP approved plan. The current BMP 04 is estimated to cost more than $1.3 million. Did the township notify the property owner that it is including this project in their MS4 application? If not, why?

Response: *Due to the new BMP efficiency credits allotted to streambank restoration, the length of required stream work was reduced and therefore reconsidered. The referenced stream reach was selected based on the current condition of the stream, surrounding vegetation, and proximity to the proposed upstream land-based BMPs, as well as new streambank restoration criteria released by PADEP in June of 2017. Working with private landowners is often required when implementing any type of plan and is an issue that will be addressed during the design and permitting phase. Parsing of adjoining properties does not affect the proposed pollutant load reductions forecasted for the referenced stream restoration project, as the pollutant load reductions are calculated based linear feet of stream, not the drainage area treated. Streambank erosion from the stream reach was not parsed from the Existing Load calculation.*

APPENDIX B – MAPPING

Township Storm Sewer Map

Proposed BMP Location Maps

Township Land Use Map

Municipal Separate Storm Sewer System (MS4)

West Goshen Township
Chester County, Pennsylvania

850 0 850 Feet

Mapping derived from data provided by West Goshen Township, Chester County, US Census, and USGS.

8/31/2017	PM: EGL	GIS: BLS	QA: MDW	R004194.0430

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- Storm Outfall (Township Owned)
- Storm Outfall
- Storm Inlet
- Storm Manhole
- Storm Pipe
- Storm Sewer Shed
- Storm Basin
- Infiltration Bed
- Road
- Integrated List Non-Attaining
- Integrated List Attaining
- Integrated List Attaining - Lakes
- Water
- Parcel
- Municipal Boundary
- Urbanized Area (2010)

BMP-04 RETROFIT

BMP-04 CONSTRUCTED WETLAND

BMP-04 STREAM RESTORATION

Broad Run
John Smedley Run
Sharpless Lake
Taylor Run
Fernhill Lake
East Branch Chester Creek
Goose Creek
Plum Run
Blackhorse Run
Westtown Lake

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Combined TMDL Planning Area

West Goshen Township
Chester County, Pennsylvania

BMP-01
BMP-02
BMP-03
BMP-04A
BMP-04B
BMP-04B RETROFIT
BMP-04A STREAM RESTORATION
BMP-04B CONSTRUCTED WETLAND
BMP-05A
BMP-05B
EX-01

Broad Run
John Smedley Run
Valley Creek Watershed
Taylor Run
Lower East Branch Brandywine Creek Watershed
Direct Discharge
Ridley Creek Watershed
Ridley Creek WATERSHED
East Branch Chester Creek
East Branch Chester Creek Watershed
Chester Creek Watershed
Upper Brandywine Creek Watershed
Goose Creek
Blackhorse Run
Plum Run
Downingtown PK
Copeland School RD
Grove RD
E Boot RD
Shin RD
Boot RD
Greenhill RD
Fernhill RD
Goshen RD
Lincoln AV
E Marshall ST
N High ST
S High ST
E Chestnut ST
E Gay ST
E Market ST
N Mattack ST
Price ST
Lenape RD
S Bradford AV
Oakbourne RD
S Concord RD
Wilmington PK
Westtown RD
S Five Points RD
Little Shiloh RD
E Strasburg RD
West Chester PK
Paoli PK
Pottstown PK
Phoenixville PK
RT 100
RT 202
RT 322
Safety Kleen West Chester Facility
Eldredge Inc.
Trans Materials Inc.
Hain Celestial
Schramm Inc.
Metallurgical Prod Co.
Rusmar Inc.
ConWay Freight
Pottscap West Chester Pit
A Duie Pyle West Chester Facility
A Duie Pyle Bolmar Street Facility

Mapping derived from data provided by West Goshen Township, Chester County, PennDOT, US Census, and USGS.

850 0 850 Feet

8/30/2017	PM: EGL	GIS: BLS	QA: EGL	R004194.0430

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- Existing BMP
- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Proposed Approximate Length of Stream In Project
- Sediment Impaired Stream
- Impaired Water Body
- Non-Impaired Stream
- Non-Impaired Water Body
- State Road
- Local Road
- Parsed Areas
- BMP Drainage Area
- Combined TMDL Planning Area
- Municipal Property
- Municipal Boundary
- Urbanized Area (2010)
- Watershed Boundary

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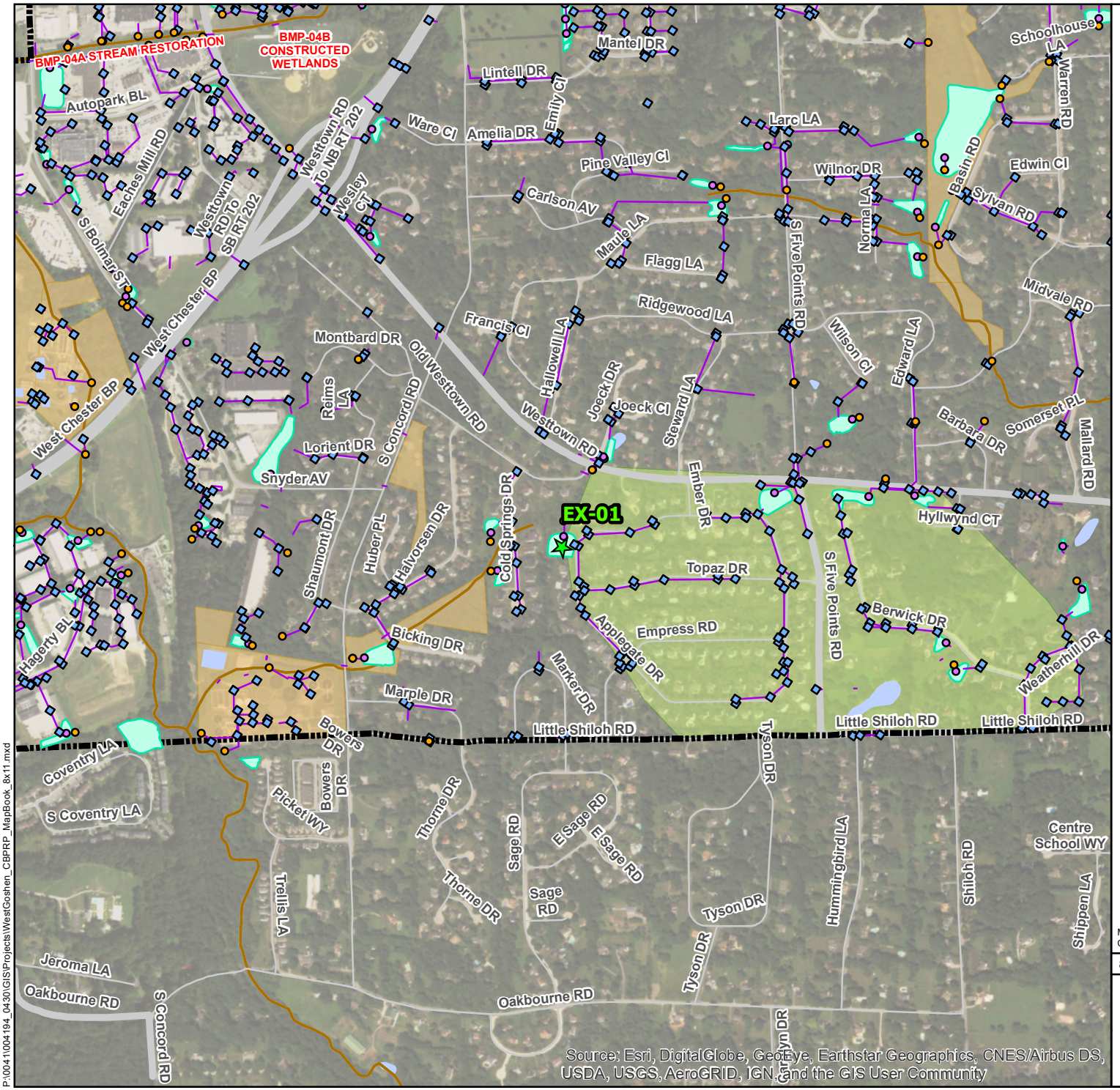

Existing BMP EX-01

West Goshen Township
Chester County, Pennsylvania

- Existing BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Sediment Impaired Stream
- Local Road
- State Road
- BMP Drainage Area
- Municipal Property
- Municipal Boundary
- Watershed Boundary

0 1,000 Feet

Mapping derived from data provided by West Goshen Township, Chester County, USGS, US Census, and ESRI.

8/30/2017	PM: EGL	GIS: BLS	QA: EGL	R004194.0431

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Engineering & Related Services
An Employee-Owned Company

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717.564.1158 [fax]
www.hrg-inc.com

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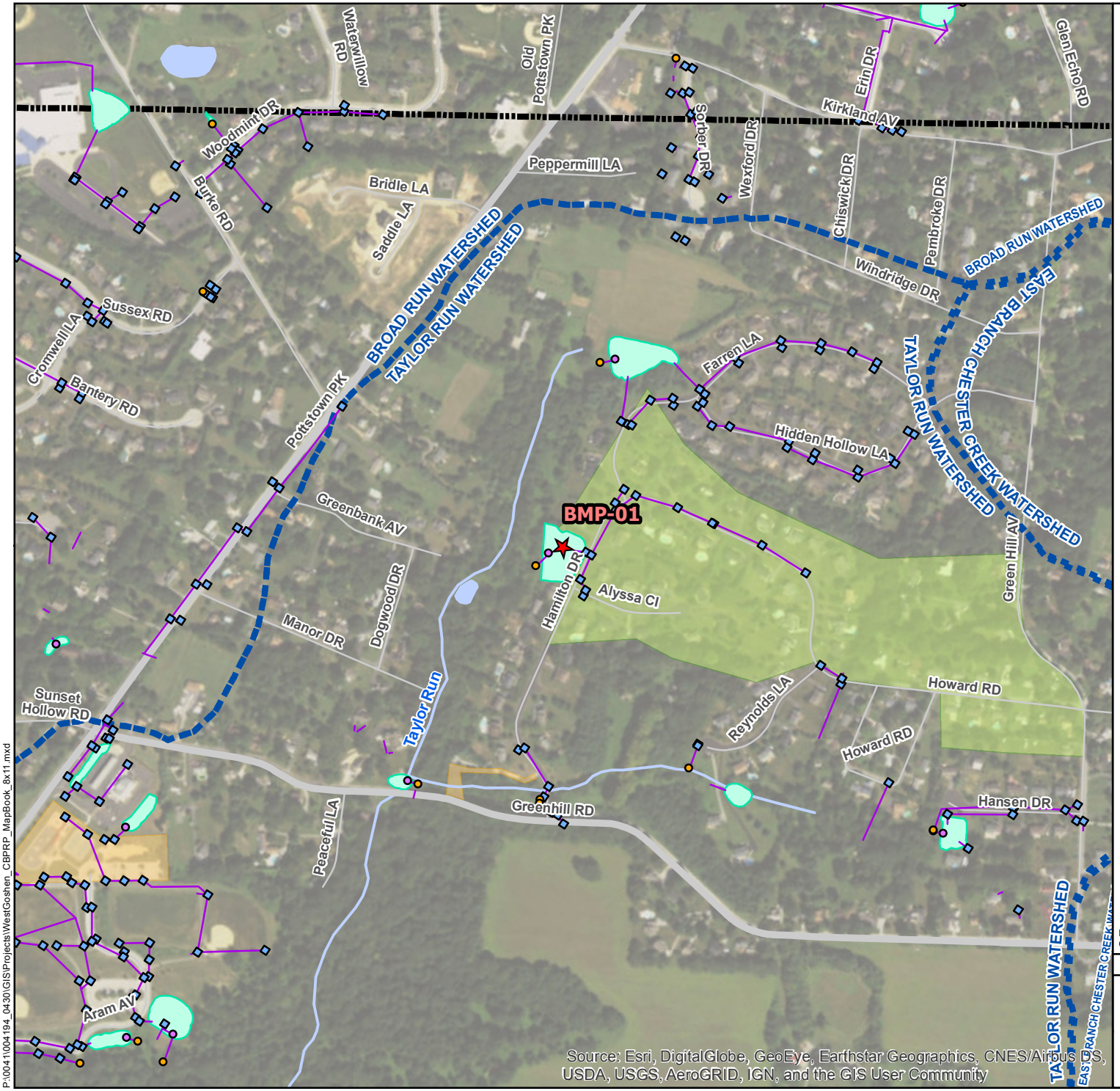

Proposed BMP
BMP-01

West Goshen Township
Chester County, Pennsylvania

- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Local Road
- State Road
- BMP Drainage Area
- Municipal Property
- Municipal Boundary
- Watershed Boundary

0 600 Feet

Mapping derived from data provided by West Goshen Township, Chester County, USGS, US Census, and ESRI.

8/30/2017	PM: EGL	GIS: BLS	QA: EGL	R004194.0431

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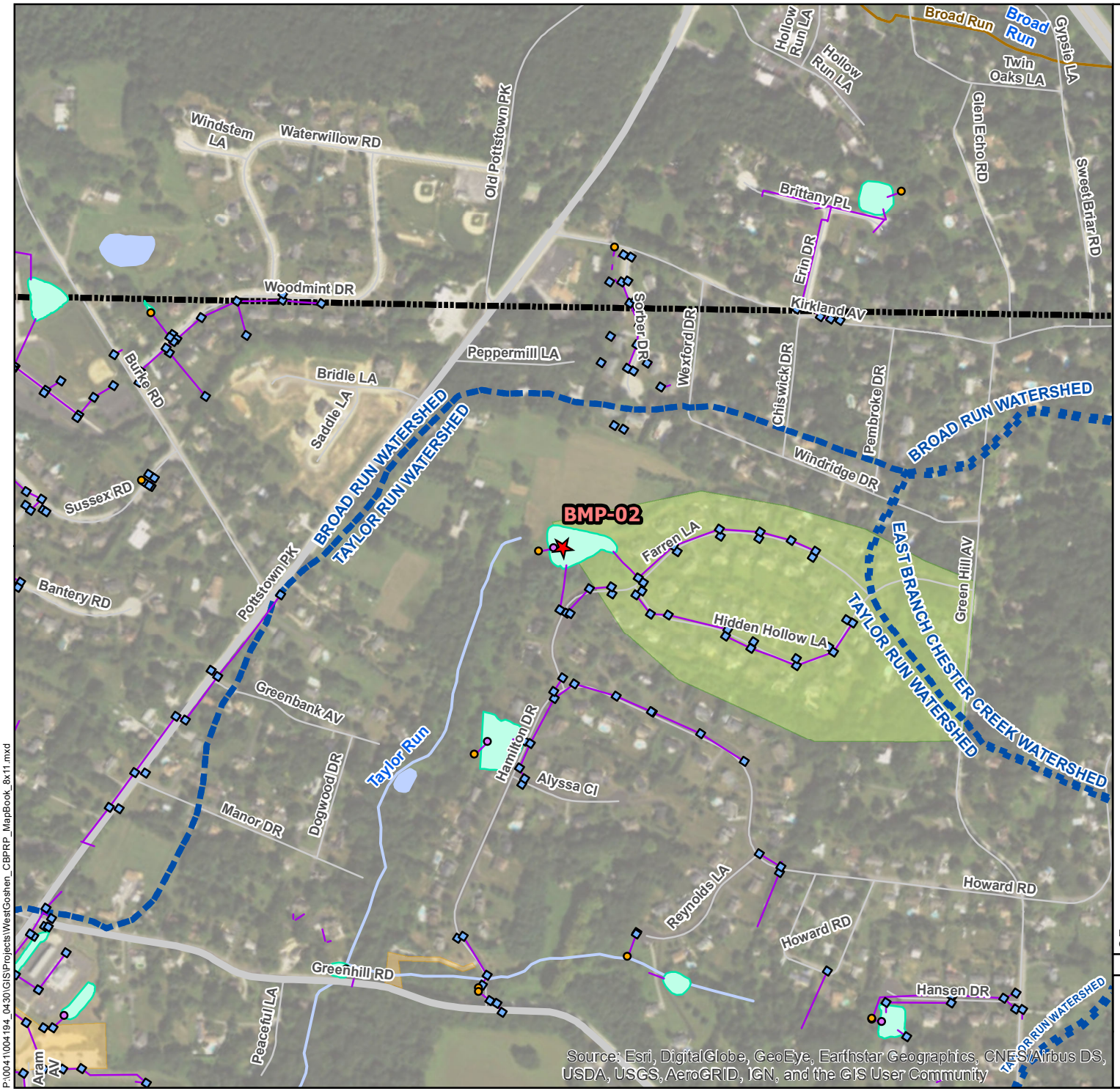

Proposed BMP
BMP-02

West Goshen Township
Chester County, Pennsylvania

- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Sediment Impaired Stream
- Local Road
- State Road
- BMP Drainage Area
- Municipal Property
- Municipal Boundary
- Watershed Boundary

0 600 Feet

Mapping derived from data provided by West Goshen Township, Chester County, USGS, US Census, and ESRI.

8/30/2017	PM: EGL	GIS: BLS	QA: EGL	R004194.0431

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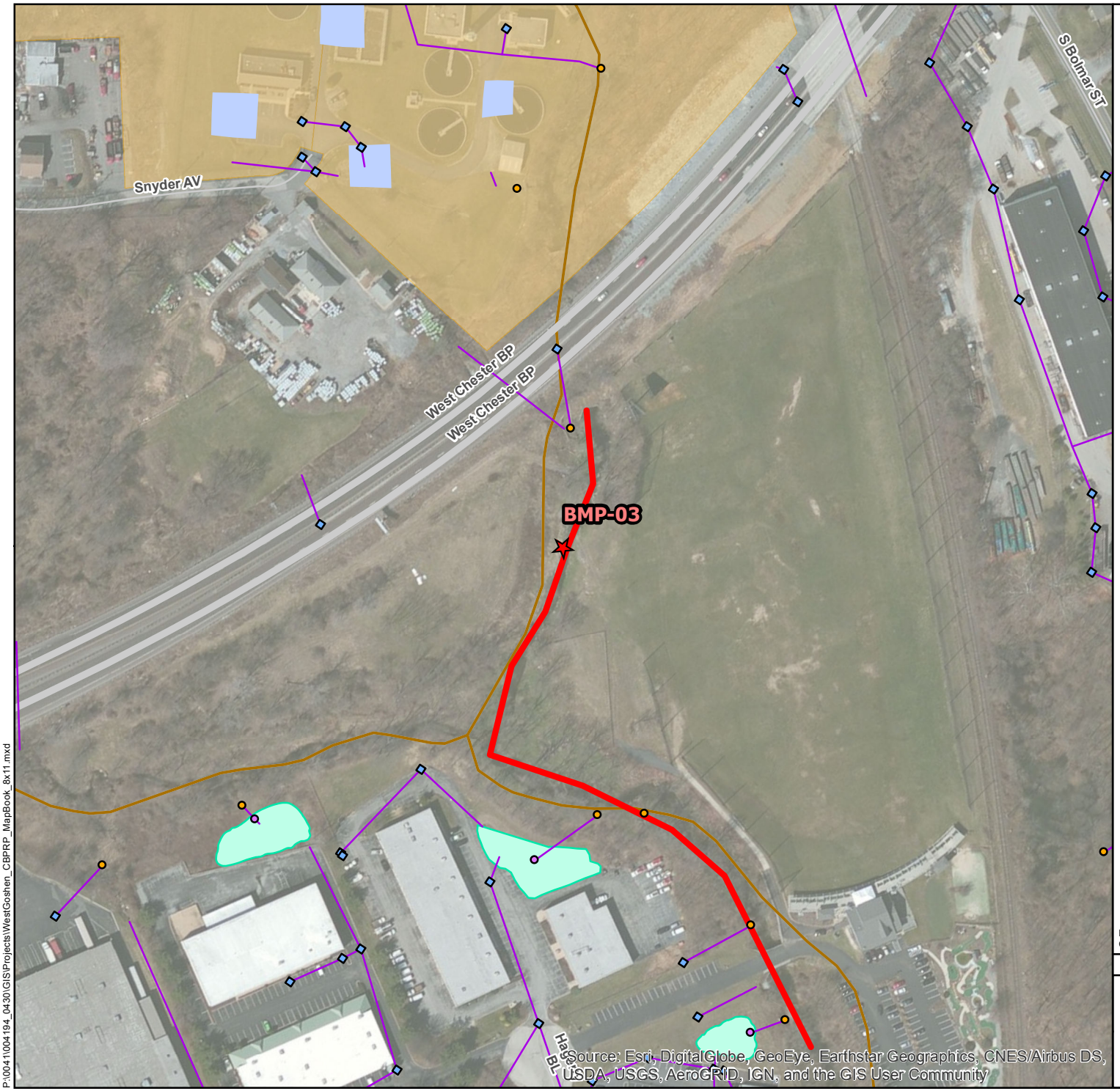

Proposed BMP
BMP-03

West Goshen Township
Chester County, Pennsylvania

- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Proposed Approximate Length of Stream In Project
- Sediment Impaired Stream
- Local Road
- State Road
- Municipal Property
- Municipal Boundary
- Watershed Boundary

0 200 Feet

Mapping derived from data provided by West Goshen Township, Chester County, USGS, US Census, and ESRI.

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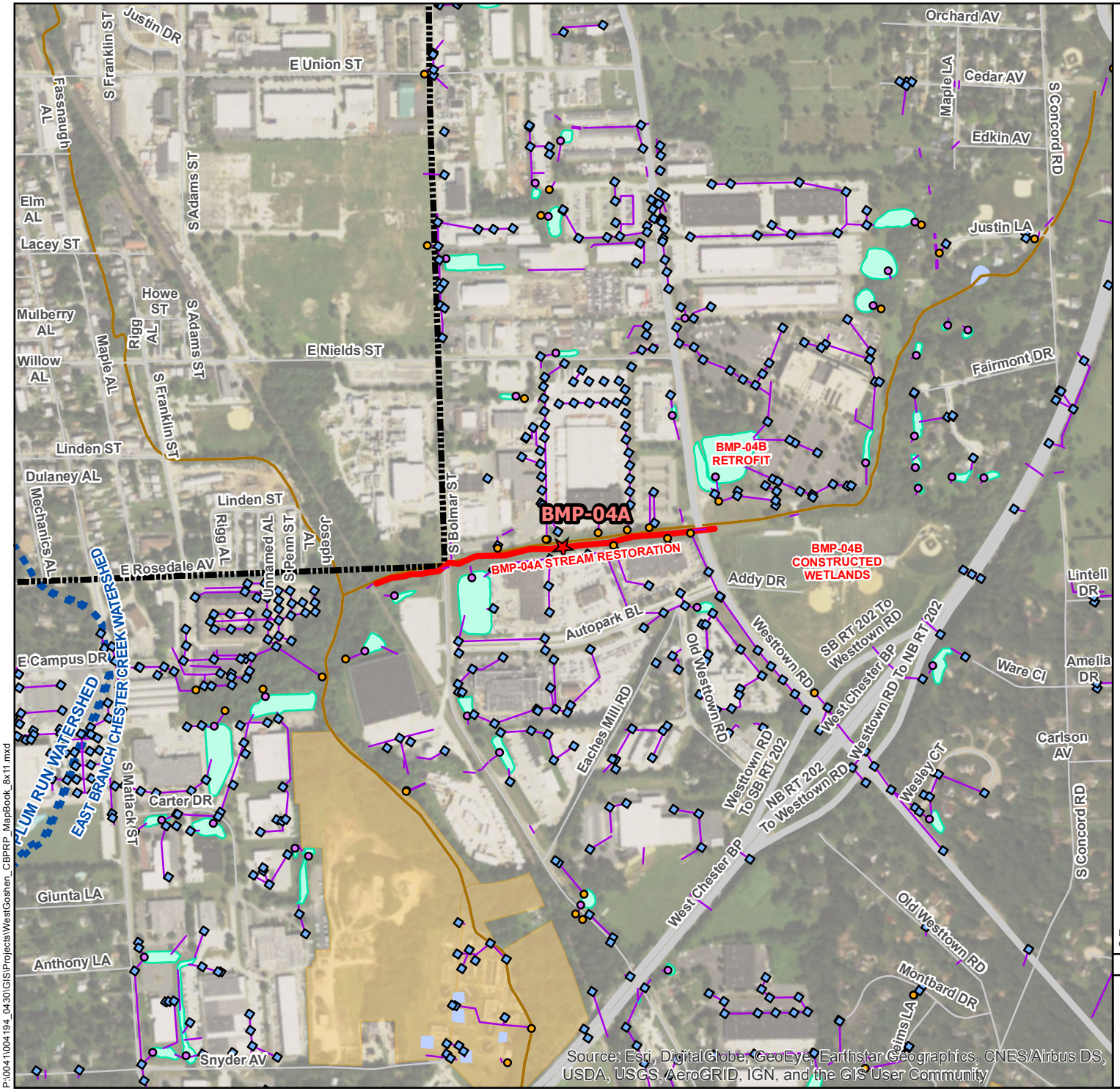

Proposed BMP
BMP-04A

West Goshen Township
Chester County, Pennsylvania

- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Proposed Approximate Length of Stream In Project
- Sediment Impaired Stream
- Local Road
- State Road
- Municipal Property
- Municipal Boundary
- Watershed Boundary

0 700 Feet

Mapping derived from data provided by West Goshen Township, Chester County, USGS, US Census, and ESRI.

8/30/2017	PM: EGL	GIS: BLS	QA: EGL	R004194.0431

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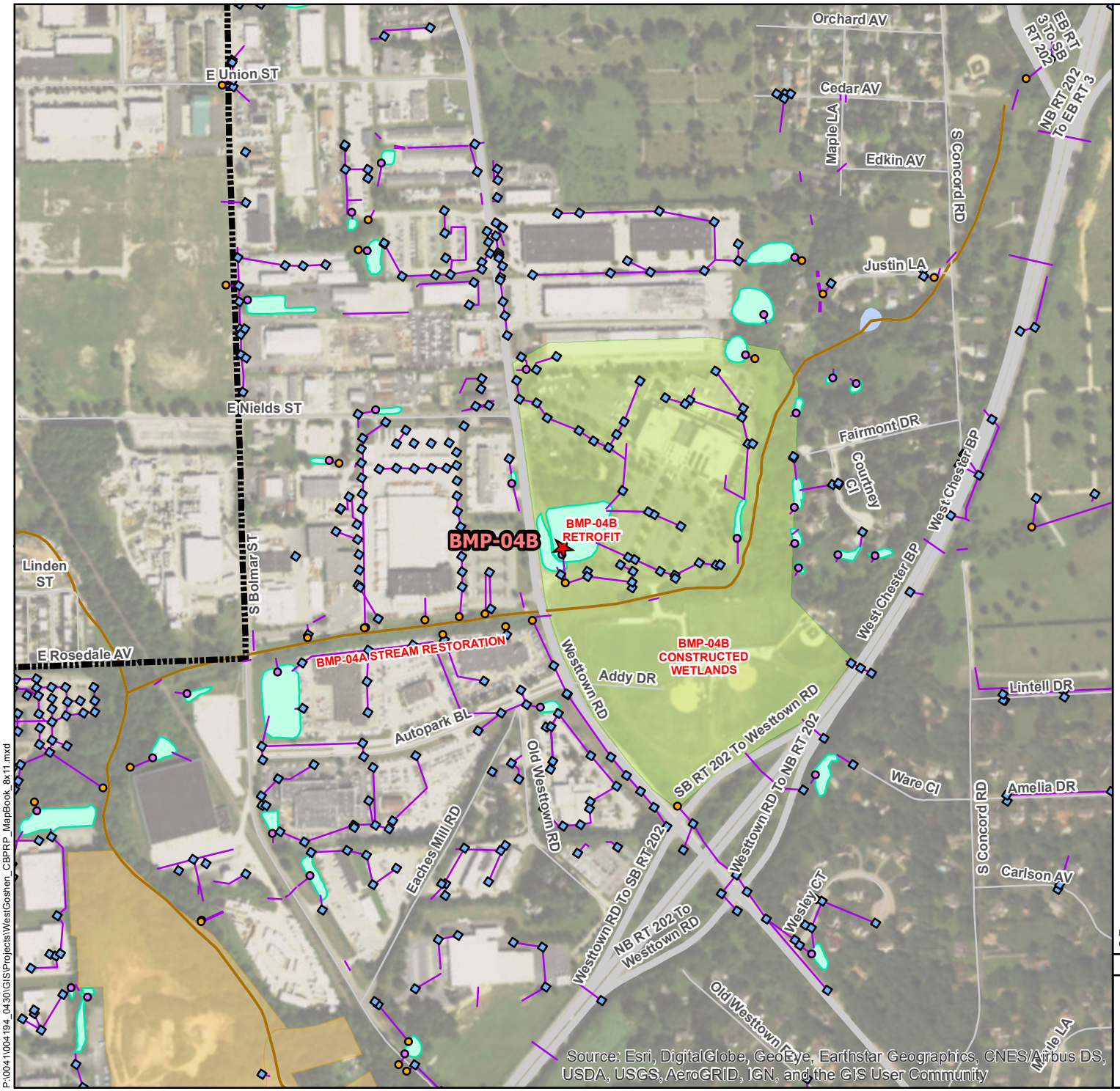

Proposed BMP
BMP-04B

West Goshen Township
Chester County, Pennsylvania

- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Sediment Impaired Stream
- Local Road
- State Road
- BMP Drainage Area
- Municipal Property
- Municipal Boundary
- Watershed Boundary

0 600 Feet

Mapping derived from data provided by West Goshen Township, Chester County, USGS, US Census, and ESRI.

8/30/2017	PM: EGL	GIS: BLS	QA: EGL	R004194.0431

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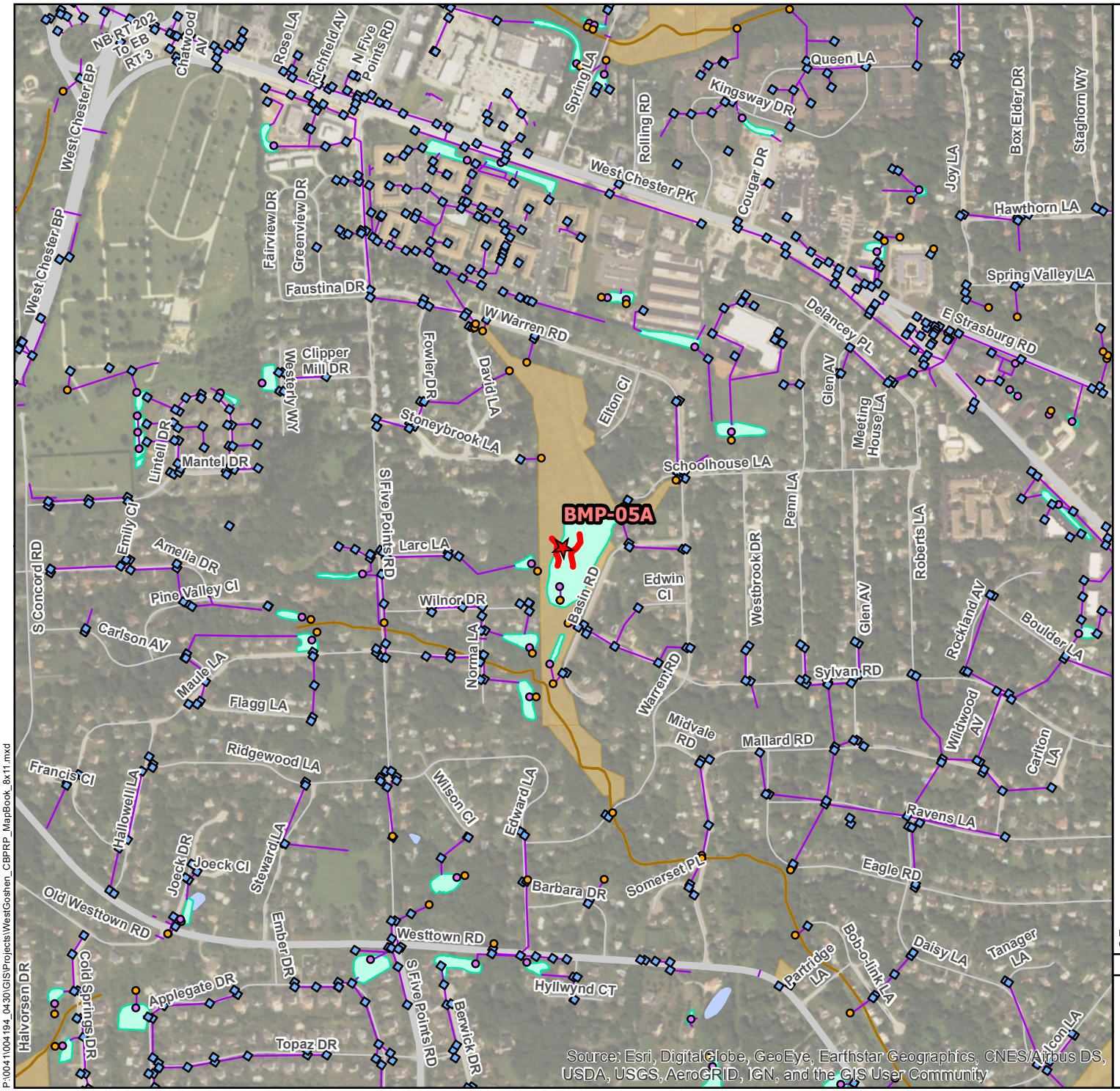

Proposed BMP
BMP-05A

West Goshen Township
Chester County, Pennsylvania

- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Proposed Approximate Length of Stream In Project
- Sediment Impaired Stream
- Local Road
- State Road
- Municipal Property
- Municipal Boundary
- Watershed Boundary

0 900 Feet

Mapping derived from data provided by West Goshen Township, Chester County, USGS, US Census, and ESRI.

8/30/2017	PM: EGL	GIS: BLS	QA: EGL	R004194.0431

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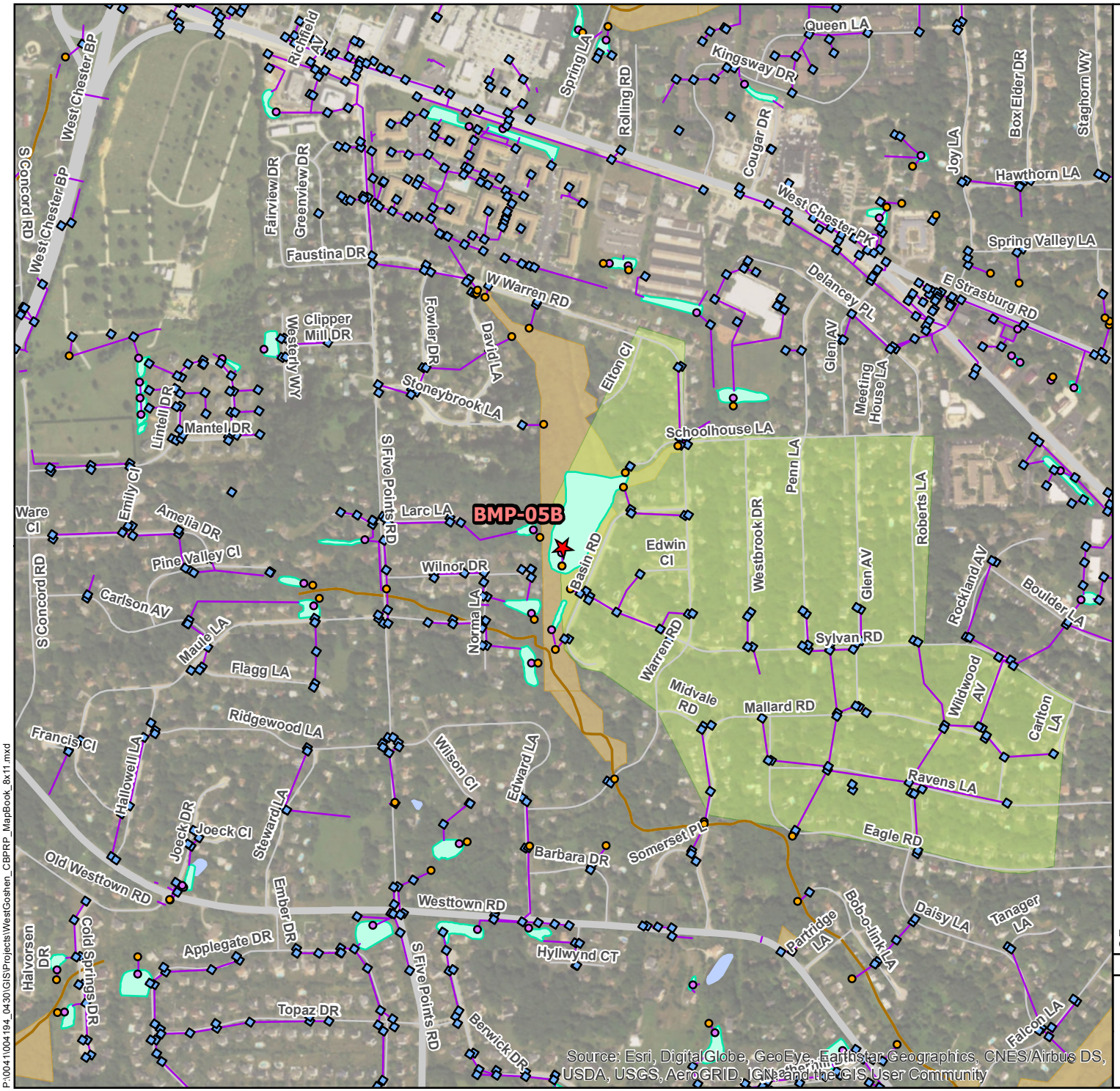

Proposed BMP
BMP-05B

West Goshen Township
Chester County, Pennsylvania

- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Basin Outfall
- Storm Gravity Main
- Storm Basin
- Sediment Impaired Stream
- Local Road
- State Road
- BMP Drainage Area
- Municipal Property
- Municipal Boundary
- Watershed Boundary

0 900 Feet

Mapping derived from data provided by West Goshen Township, Chester County, USGS, US Census, and ESRI.

8/30/2017	PM: EGL	GIS: BLS	QA: EGL	R004194.0431

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APPENDIX C – PADEP MUNICIPAL MS4 REQUIREMENTS TABLE

Municipal Requirements Table

Pollutant Aggregation Table

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Chester County						
WEST BRANDYWINE TWP	PAI130544	Yes	TMDL Plan, SP, IP	West Branch Brandywine Creek	Appendix C-PCB (4a), Appendix E-Siltation (4a)	Water/Flow Variability (4c)
				Beaver Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
				Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O. (4a)	
				Culbertson Run	Appendix E-Siltation (4a)	Other Habitat Alterations (4c)
				Unnamed Tributaries to West Branch Brandywine Creek		Cause Unknown (4a)
				East Branch Brandywine Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
WEST CALN TWP	PAG130145	Yes	TMDL Plan, SP	Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O. (4a)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	
				Indian Spring Run	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				Pequea Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				West Branch Brandywine Creek	Appendix C-PCB (4a)	Water/Flow Variability (4c)
WEST CHESTER BORO	PAG130002	Yes	TMDL Plan	Taylor Run	Appendix E-Siltation (4a)	Cause Unknown (4a), Other Habitat Alterations (4c)
				Plum Run	Appendix E-Siltation (4a)	Water/Flow Variability (4c)
				Goose Creek TMDL	TMDL Plan-Nutrients (4a)	Cause Unknown (4a)
				Chester Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)	Cause Unknown (5), Flow Alterations, Water/Flow Variability (4c)
				Brandywine Creek	Appendix E-Siltation (4a)	
				Blackhorse Run	Appendix E-Siltation (4a)	Other Habitat Alterations, Water/Flow Variability (4c)
WEST GOSHEN TWP	PAI130532	Yes	TMDL Plan, SP, IP	East Branch Chester Creek	Appendix E-Siltation (5)	Cause Unknown (5), Other Habitat Alterations, Water/Flow Variability (4c)
				Broad Run		Water/Flow Variability (4c)
				Chester Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)	Cause Unknown (5), Flow Alterations, Water/Flow Variability (4c)
				East Branch Brandywine Creek		Cause Unknown (4a), Water/Flow Variability (4c)
				Goose Creek TMDL	TMDL Plan-Nutrients (4a)	Cause Unknown (4a)
				John Smedley Run		Water/Flow Variability (4c)
				Plum Run		Water/Flow Variability (4c)
				Taylor Run		Cause Unknown (4a), Other Habitat Alterations (4c)
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	

MS4 Name	Permit Number	HUC 12 Name	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)
Chester County				
WEST BRADFORD TWP	PAI130511	Lower West Branch Brandywine Creek, Upper West Branch Brandywine Creek	Christina River Basin Nutrients, Christina River Basin Sediment	TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids
		Upper West Branch Brandywine Creek	West Branch Brandywine Creek	Appendix C-PCB
		Beaver Creek, Lower East Branch Brandywine Creek	Christina River Basin Nutrients, Christina River Basin Sediment	TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids
		Upper Brandywine Creek	Christina River Basin Nutrients, Christina River Basin Sediment	TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids
WEST BRANDYWINE TWP	PAI130544	Upper West Branch Brandywine Creek	Christina River Basin Nutrients, West Branch Brandywine Creek	Appendix C-PCB, Appendix E-Siltation, TMDL Plan-Nutrients, Organic Enrichment/Low D.O.
		Upper East Branch Brandywine Creek	Culbertson Run	Appendix E-Siltation
		Beaver Creek, Lower East Branch Brandywine Creek, Upper East Branch Brandywine Creek	Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O.
WEST CALN TWP	PAG130145	Upper West Branch Brandywine Creek	Christina River Basin Nutrients, Christina River Basin Sediment, West Branch Brandywine Creek	Appendix C-PCB, TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids
		Headwaters Pequea Creek	Chesapeake Bay Nutrients\Sediment, Indian Spring Run, Pequea Creek	Appendix D-Siltation/Nutrients, Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation
WEST CHESTER BORO	PAG130002	Lower East Branch Brandywine Creek	Blackhorse Run, Taylor Run	Appendix E-Siltation
		Upper Brandywine Creek	Brandywine Creek, Plum Run	Appendix E-Siltation
		Chester Creek	Chester Creek, Goose Creek TMDL	Appendix B-Pathogens, Appendix E-Siltation, TMDL Plan-Nutrients
WEST GOSHEN TWP	PAI130532	Middle Brandywine Creek, Upper Brandywine Creek	Christina River Basin Sediment	TMDL Plan-Nutrients, Siltation, Suspended Solids
		Chester Creek	Chester Creek, Goose Creek TMDL	Appendix B-Pathogens, TMDL Plan-Nutrients, Siltation, Suspended Solids
		Lower East Branch Brandywine Creek, Valley Creek	Christina River Basin Sediment	TMDL Plan-Nutrients, Siltation, Suspended Solids
		Chester Creek, East Branch Chester Creek	Chester Creek, East Branch Chester Creek	Appendix E-Siltation
WEST GROVE BORO	PAG130144	East Branch White Clay Creek, Middle Branch White Clay Creek, Upper White Clay Creek	Christina River Basin Nutrients, Christina River Basin Sediment, East Branch White Clay Creek, Middle Branch White Clay Creek	Appendix B-Pathogens, TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids
WEST NOTTINGHAM TWP		North East Creek	Chesapeake Bay Nutrients\Sediment, North East Creek	Appendix D-Siltation/Nutrients, Appendix E-Siltation
		Basin Run-Octoraro Creek, Tweed Creek-Octoraro Creek	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
WEST PIKELAND TWP	PAI130531	Pickering Creek	Pickering Creek	Appendix B-Pathogens
WEST SADSBURY TWP	PAG130170	Muddy Run-East Branch Octoraro Creek, Pine Creek, Valley Creek-East Branch Octoraro Creek	Chesapeake Bay Nutrients\Sediment, East Branch Octoraro Creek, Pine Creek, Unnamed Tributaries to East Branch Octoraro Creek, Valley Creek	Appendix D-Siltation/Nutrients, Appendix E-Nutrients, Siltation

APPENDIX D – EXISTING POLLUTANT LOAD CALCULATIONS

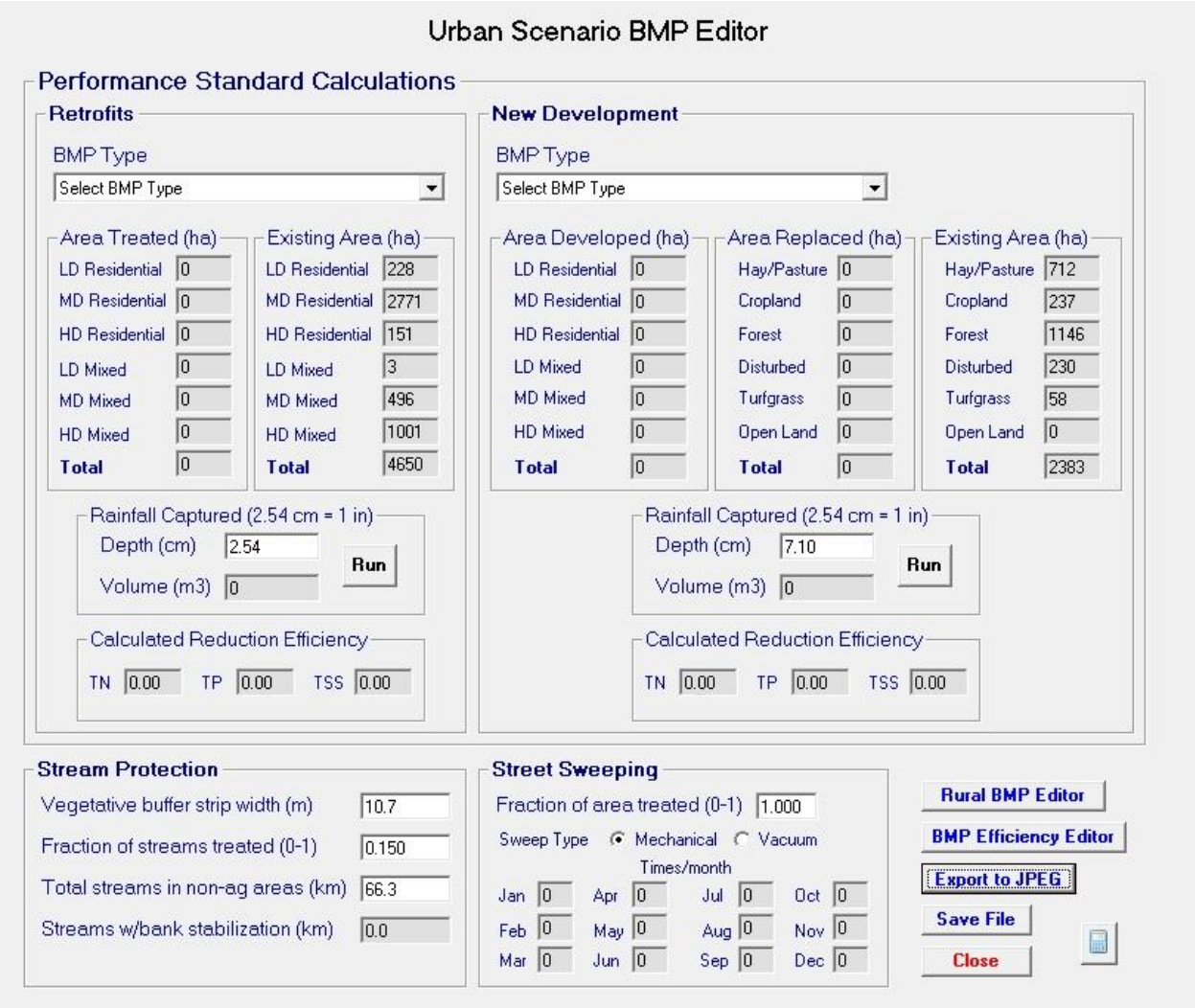
Parsing Calculations

Baseline Load Calculations (MapShed Exhibits)

Existing Load Calculations (MapShed Exhibits)

Existing BMP Information

Baseline Pollutant Load – MapShed Baseline Load Input Exhibit



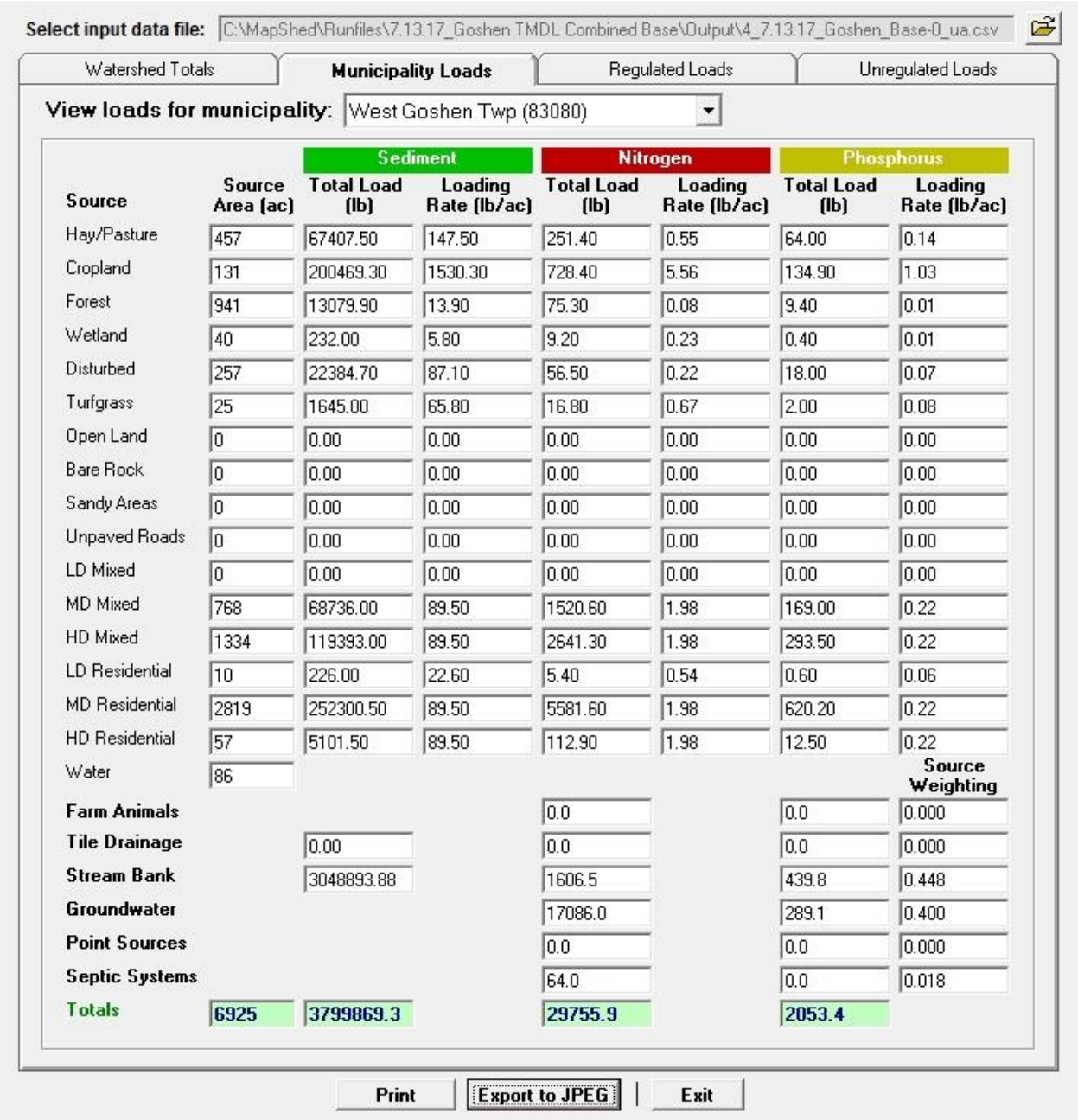
Baseline Modeled Area Pollutant Load – MapShed Baseline Pollutant Loads by Source for Entire Modeled Area

GWLF Total Loads for file: 4_7.13.17_Goshen_Base-0 **Period of analysis:** 17 years from 1975 to 1991

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	1759	1.4	1094.2	129.8	428.4	975.2	103.5	253.2
Cropland	586	3.6	3780.9	448.4	1367.5	3257.0	85.5	602.6
Forest	2832	1.1	165.8	19.7	136.4	219.3	7.1	29.8
Wetland	210	5.2	5.1	0.6	46.4	48.9	2.4	3.1
Disturbed	568	7.6	208.6	24.7	19.3	123.6	9.5	38.1
Turfgrass	143	0.9	39.7	4.7	76.5	96.4	5.5	11.0
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD Mixed	7	4.3	0.0	0.1	1.1	4.0	0.2	0.4
MD Mixed	1226	11.9	0.0	54.8	740.1	2429.3	104.9	273.6
HD Mixed	2474	16.9	0.0	110.7	1493.7	4902.7	211.8	552.2
LD Residential	563	4.3	0.0	6.3	85.0	303.0	12.0	32.3
MD Residential	6847	7.2	0.0	306.4	4134.9	13571.9	586.3	1528.6
HD Residential	373	10.0	0.0	16.7	225.3	739.6	31.9	83.3
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				3698.8		3897.8		1067.0
Groundwater					42715.0	42715.0	722.8	722.8
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					3557.8	3557.8	0.0	0.0
Totals	17588.9	7.10	5294.3	4821.7	55027.5	76841.5	1883.4	5198.0

Go Back | Pathogen Loads | Export to JPEG | Print | Close

Baseline Combined TMDL Planning Area Pollutant Load - MapShed Baseline Load Calculation Results for Planning Area



Select input data file: C:\MapShed\Runfiles\7.13.17_Goshen TMDL Combined Base\Output\4_7.13.17_Goshen_Base-0_ua.csv

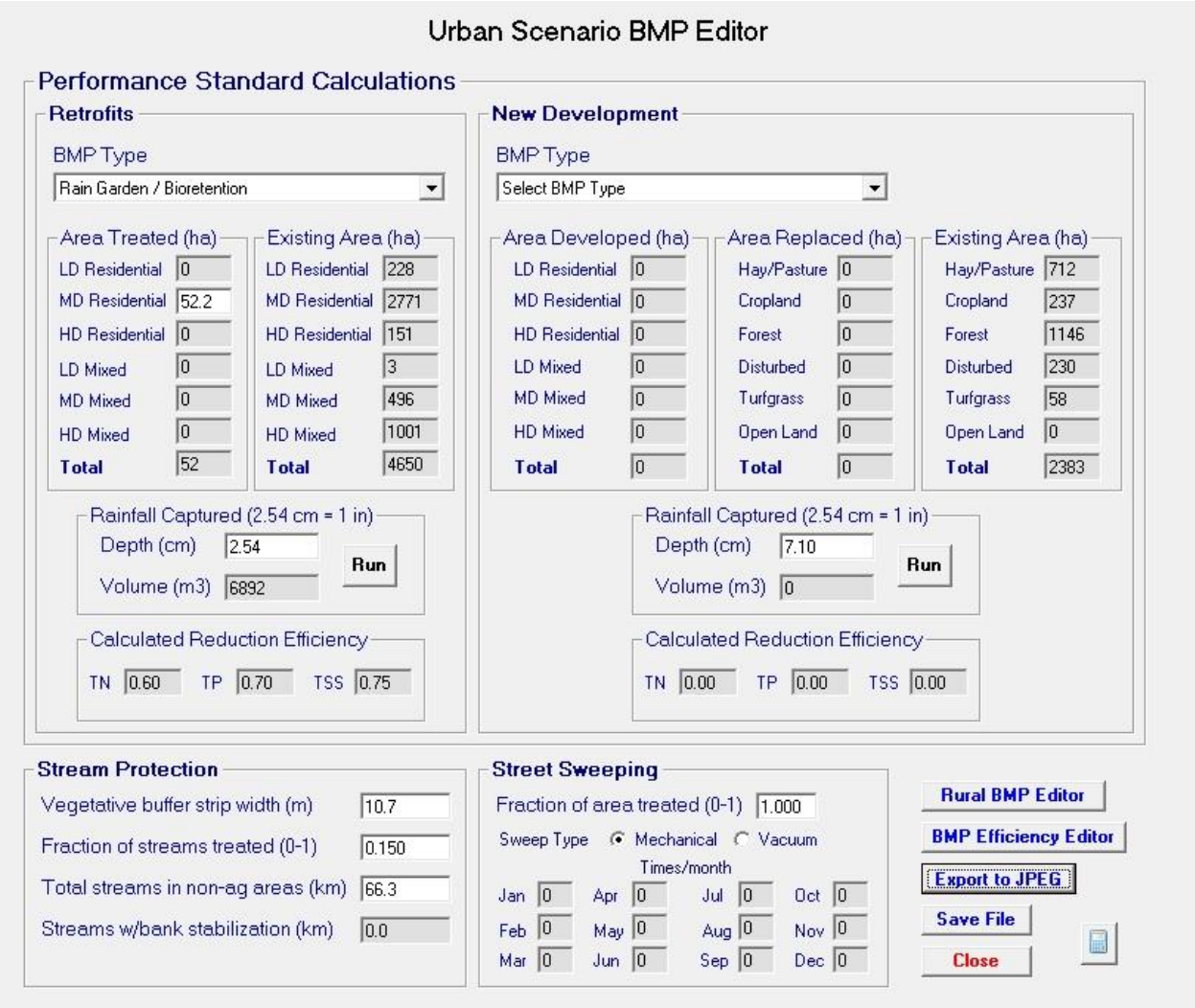
Watershed Totals | **Municipality Loads** | Regulated Loads | Unregulated Loads

View loads for municipality: West Goshen Twp (83080)

		Sediment		Nitrogen		Phosphorus	
Source	**Source Area (ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**
Hay/Pasture	457	67407.50	147.50	251.40	0.55	64.00	0.14
Cropland	131	200469.30	1530.30	728.40	5.56	134.90	1.03
Forest	941	13079.90	13.90	75.30	0.08	9.40	0.01
Wetland	40	232.00	5.80	9.20	0.23	0.40	0.01
Disturbed	257	22384.70	87.10	56.50	0.22	18.00	0.07
Turfgrass	25	1645.00	65.80	16.80	0.67	2.00	0.08
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	768	68736.00	89.50	1520.60	1.98	169.00	0.22
HD Mixed	1334	119393.00	89.50	2641.30	1.98	293.50	0.22
LD Residential	10	226.00	22.60	5.40	0.54	0.60	0.06
MD Residential	2819	252300.50	89.50	5581.60	1.98	620.20	0.22
HD Residential	57	5101.50	89.50	112.90	1.98	12.50	0.22
Water	86						**Source Weighting**
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		3048893.88		1606.5		439.8	0.448
Groundwater				17086.0		289.1	0.400
Point Sources				0.0		0.0	0.000
Septic Systems				64.0		0.0	0.018
Totals	**6925**	**3799869.3**		**29755.9**		**2053.4**	

Print | Export to JPEG | Exit

Combined TMDL Planning Area Baseline Sediment Load = 3,799,869.3 pounds per year


Urban Scenario BMP Editor
Performance Standard Calculations
Retrofits
BMP Type
Rain Garden / Bioretention
Area Treated (ha)
LD Residential 0
MD Residential 52.2
HD Residential 0
LD Mixed 0
MD Mixed 0
HD Mixed 0
Total 52
Existing Area (ha)
LD Residential 228
MD Residential 2771
HD Residential 151
LD Mixed 3
MD Mixed 496
HD Mixed 1001
Total 4650
Rainfall Captured (2.54 cm = 1 in)
Depth (cm) 2.54
Volume (m3) 6892
Run
Calculated Reduction Efficiency
TN 0.60 TP 0.70 TSS 0.75
New Development
BMP Type
Select BMP Type
Area Developed (ha)
LD Residential 0
MD Residential 0
HD Residential 0
LD Mixed 0
MD Mixed 0
HD Mixed 0
Total 0
Area Replaced (ha)
Hay/Pasture 0
Cropland 0
Forest 0
Disturbed 0
Turfgrass 0
Open Land 0
Total 0
Existing Area (ha)
Hay/Pasture 712
Cropland 237
Forest 1146
Disturbed 230
Turfgrass 58
Open Land 0
Total 2383
Rainfall Captured (2.54 cm = 1 in)
Depth (cm) 7.10
Volume (m3) 0
Run
Calculated Reduction Efficiency
TN 0.00 TP 0.00 TSS 0.00
Stream Protection
Vegetative buffer strip width (m) 10.7
Fraction of streams treated (0-1) 0.150
Total streams in non-ag areas (km) 66.3
Streams w/bank stabilization (km) 0.0
Street Sweeping
Fraction of area treated (0-1) 1.000
Sweep Type Mechanical Vacuum
Times/month
Jan 0 Apr 0 Jul 0 Oct 0
Feb 0 May 0 Aug 0 Nov 0
Mar 0 Jun 0 Sep 0 Dec 0
Rural BMP Editor
BMP Efficiency Editor
Export to JPEG
Save File
Close

EX-01 Pollutant Reduction – MapShed Pollutant Loads by Source for Entire Modeled Area w/ EX-01

GWLF Total Loads for file: 5_7.13.17_Goshen_Base-0 **Period of analysis:** 17 years from 1975 to 1991

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	1759	1.4	1094.2	129.8	428.4	975.2	103.5	253.2
Cropland	586	3.6	3780.9	448.4	1367.5	3257.0	85.5	602.6
Forest	2832	1.1	165.8	19.7	136.4	219.3	7.1	29.8
Wetland	210	5.2	5.1	0.6	46.4	48.9	2.4	3.1
Disturbed	568	7.6	208.6	24.7	19.3	123.6	9.5	38.1
Turfgrass	143	0.9	39.7	4.7	76.5	96.4	5.5	11.0
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD Mixed	7	4.3	0.0	0.1	1.1	4.0	0.2	0.4
MD Mixed	1226	11.9	0.0	54.4	735.7	2414.9	104.2	271.7
HD Mixed	2474	16.9	0.0	109.9	1484.8	4873.6	210.3	548.4
LD Residential	563	4.3	0.0	6.3	84.5	301.2	11.9	32.1
MD Residential	6847	7.2	0.0	304.1	4110.2	13491.1	582.2	1518.0
HD Residential	373	10.0	0.0	16.6	224.0	735.2	31.7	82.7
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				3674.1		3871.3		1060.4
Groundwater					42715.0	42715.0	722.8	722.8
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					3557.8	3557.8	0.0	0.0
Totals	17588.9	7.10	5294.3	4793.3	54987.7	76684.4	1876.9	5174.2

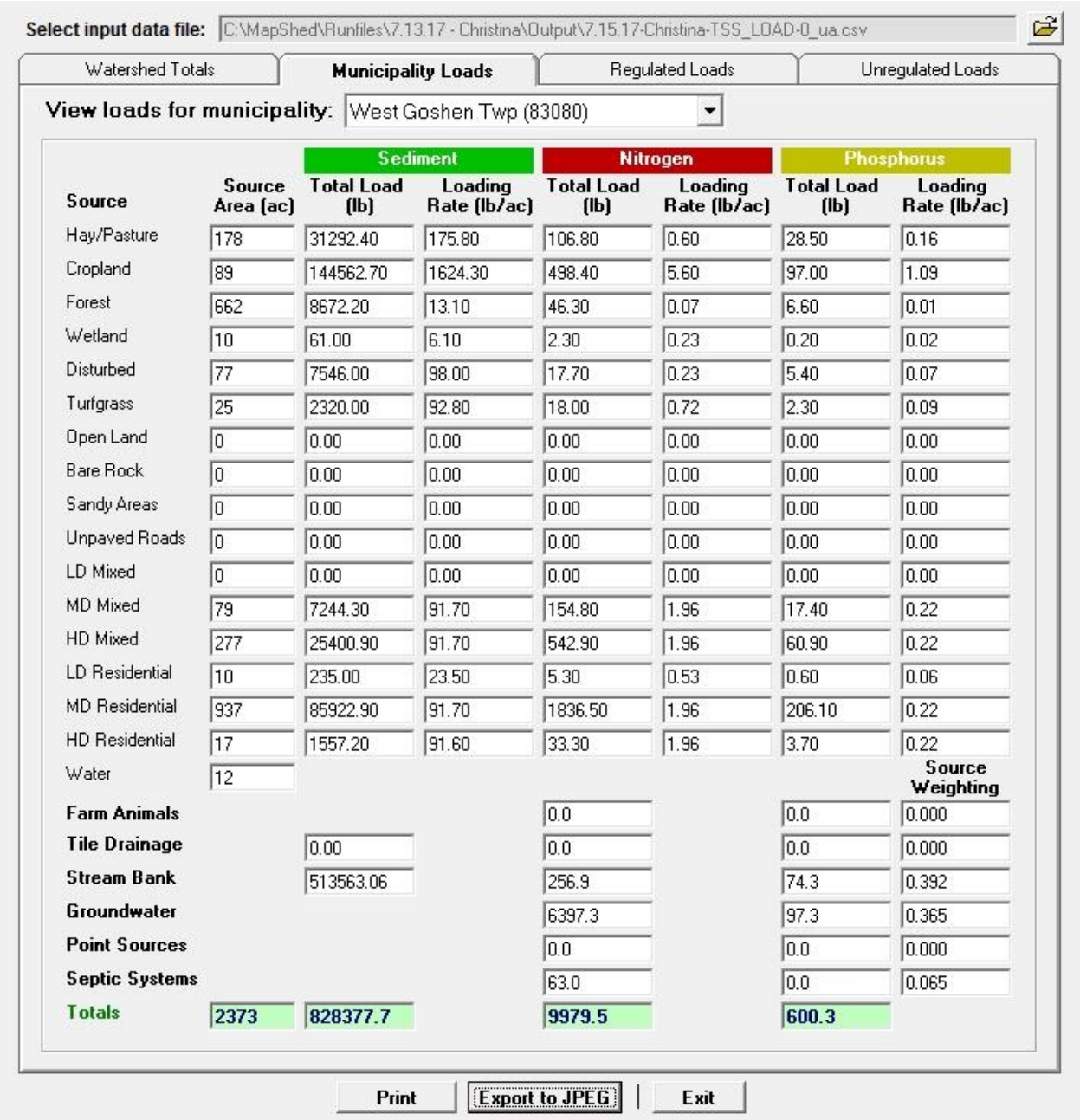
Go Back | Pathogen Loads | Export to JPEG | Print | Close

EX-01 Sediment Load Reduction = 4821.7 tons – 4793.3 tons = 28.4 tons = 56,800 lbs

Total Existing BMP Sediment Load Reduction = 56,800 lbs/yr

Combined TMDL Planning Area Sediment Load = 3,799,969.3 lbs – 56,800 lbs = 3,743,069.3 lbs

Existing Pollutant Load for Christina River Basin – Used to calculate remaining Long-term sediment load reductions.



Select input data file: C:\MapShed\Runfiles\7.13.17 - Christina\Output\7.15.17-Christina-TSS_LOAD-0_ua.csv

Watershed Totals | **Municipality Loads** | Regulated Loads | Unregulated Loads

View loads for municipality: West Goshen Twp (83080)

		Sediment		Nitrogen		Phosphorus	
Source	**Source Area (ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**
Hay/Pasture	178	31292.40	175.80	106.80	0.60	28.50	0.16
Cropland	89	144562.70	1624.30	498.40	5.60	97.00	1.09
Forest	662	8672.20	13.10	46.30	0.07	6.60	0.01
Wetland	10	61.00	6.10	2.30	0.23	0.20	0.02
Disturbed	77	7546.00	98.00	17.70	0.23	5.40	0.07
Turfgrass	25	2320.00	92.80	18.00	0.72	2.30	0.09
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	79	7244.30	91.70	154.80	1.96	17.40	0.22
HD Mixed	277	25400.90	91.70	542.90	1.96	60.90	0.22
LD Residential	10	235.00	23.50	5.30	0.53	0.60	0.06
MD Residential	937	85922.90	91.70	1836.50	1.96	206.10	0.22
HD Residential	17	1557.20	91.60	33.30	1.96	3.70	0.22
Water	12						
							Source Weighting
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		513563.06		256.9		74.3	0.392
Groundwater				6397.3		97.3	0.365
Point Sources				0.0		0.0	0.000
Septic Systems				63.0		0.0	0.065
Totals	**2373**	**828377.7**		**9979.5**		**600.3**	

Print | Export to JPEG | Exit

Existing Pollutant Load for Goose Creek Watershed – Used to calculate remaining Long-term total phosphorus load reductions.

Select input data file: C:\MapShed\Runfiles\7.13.17 Goose\Output\7.15.17-Goose-TP_LOAD-3_ua.csv

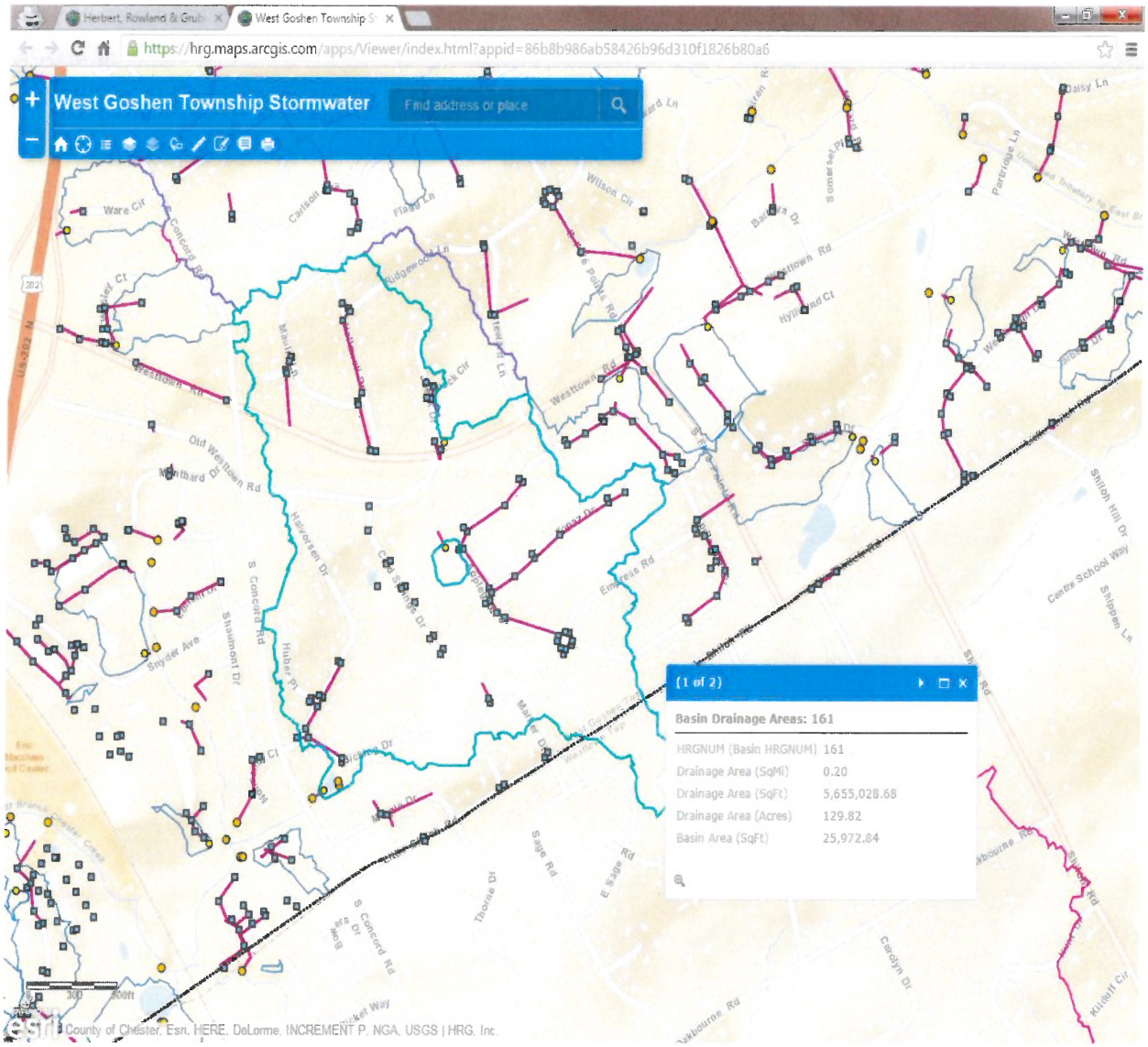
Watershed Totals | **Municipality Loads** | Regulated Loads | Unregulated Loads

View loads for municipality: West Goshen Twp (83080)

		Sediment		Nitrogen		Phosphorus	
Source	**Source Area (ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**	**Total Load (lb)**	**Loading Rate (lb/ac)**
Hay/Pasture	279	30606.30	109.70	147.90	0.53	36.30	0.13
Cropland	42	58254.00	1387.00	249.50	5.94	44.90	1.07
Forest	279	2734.20	9.80	19.50	0.07	2.80	0.01
Wetland	30	132.00	4.40	6.60	0.22	0.30	0.01
Disturbed	183	10833.60	59.20	34.80	0.19	11.00	0.06
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	689	47472.10	68.90	1336.70	1.94	144.70	0.21
HD Mixed	1058	73002.00	69.00	2052.50	1.94	222.20	0.21
LD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Residential	1883	129738.70	68.90	3653.00	1.94	395.40	0.21
HD Residential	40	2760.00	69.00	77.60	1.94	8.40	0.21
Water	77						
							Source Weighting
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		1253041.36		832.6		212.3	0.472
Groundwater				10240.8		177.3	0.415
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	**4560**	**1608574.3**		**18651.5**		**1255.6**	

Print | Export to JPEG | Exit

EXISTING BMP EX-01 DETAILS


West Goshen Township Stormwater
Find address or place
https://hrg.maps.arcgis.com/apps/Viewer/index.html?appid=86b8b986ab58426b96d310f1826b80a6
(1 of 2)
Basin Drainage Areas: 161
HRGNUM (Basin HRGNUM) 161
Drainage Area (SqMi) 0.20
Drainage Area (SqFt) 5,655,028.68
Drainage Area (Acres) 129.82
Basin Area (SqFt) 25,972.84
County of Chester, Esri, HERE, DeLorme, INCREMENT P, NGA, USGS | HRG, Inc.

Aquascapes Unlimited
P.O. Box 364
Pipersville, PA 18947 *Attn: Kent Wise
(215) 766-8151 *Re: Bicking Basin

Acknowledgement

Ship Date	Order Num...
7/14/2009	661

Bill To

Township of Goshen
1025 Paoli Pike
West Chester, PA 19380
ATTN: Kent Wise
RE: Bicking basin

P.O. No.	Terms	Ship Via
	Net 30	UPS

	Description	Qty	Rate	Total
+	Eleocharis palustris PL/72	72	[redacted]	[redacted]
−	Mimulus ringens (Monkey Flower) PL/72	72		
+	Carex sp. PL/72	288		
−	Lobelia cardinalis (Cardinal Flower) PL/72	72		
−	Eupatorium perfoliatum (Boneset) PL/72	72		
−	Juncus effusus e plus <	72		
−	Hibiscus moscheutos (Swamp Rose Mallow) PL/72	72		
+	Acorus americana (Sweet Flag) PL/72	72		
−	Verbena hastata (Blue Vervain) PL/72	72		
	Box/Packing Fee	4		
	Shipping/ Handling Fee (TBD based on UPS Charges)			

Notes:

① I need a tax exempt form faxed to me in order to avoid the 6%.

② We can ship Next week with a P.O.

③ Please fax back w/ signature. & P.O.

Subtotal	[redacted]
Sales Tax	[redacted]
Total	[redacted]

If your order is correct, please sign and date below and return by FAX 215-766-8986.
Thank you

_____

0

G & A CLANTON, INC.

350 LAKE ROAD
AVONDALE, PA 19311

RAY, THIS IS A COPY WOODY

Invoice

Date	Invoice #
10/16/2008	11180

Bill To	Ship To
WEST GOSHEN TOWNSHIP 1025 PAOLI PIKE WEST CHESTER, PA 19380	

P.O. Numb...	Terms	Rep	Ship	Via	F.O.B.	Project
	UPON RECEIPT		10/16/2008			

Quantity	Item Code	Description	Price Each	Amount
15.95	SCREENED TOP SOIL	BY THE TON ON 10/7/08--TICKET #81726	[redacted]	[redacted]
6.37	SCREENED TOP SOIL	BY THE TON ON 10/7/08--TICKET #81736		

Req. #
P.O. #
Account #
Amount
Authorized

Thank you for your business.

1 1/2 % INTEREST AFTER 30 DAYS

Total [redacted]

Phone #	Fax #	E-mail
610-869-8971	610-869-2485	CLANTONTOPSOIL@AOL.COM

Pipe Xpress, Inc.
821 East Washington Street
West Chester, PA 19380
610-918-7120
FAX 610-918-1328

Copy

Invoice

Date	Invoice #
10/10/2008	39168

Bill To	Ship To
WEST GOSHEN TOWNSHIP BOARD OF SUPERVISORS 1025 PAOLI PIKE WEST CHESTER, PA 19380	ROAD DEPT

P.O. No.	Terms	Due Date	Rep	Ship Via	Ordered
VERBAL	2% 10 Net 30	11/9/2008		PICK UP	MARK

Item	Description	Ordered	Rate	Amount
MG24	24 STD METAL GRATE	1	[redacted]	[redacted]

Reg. #
P.O. #
Account #
Amount
Authorized

Thank you for your business.

Subtotal	[redacted]
Sales Tax 0	[redacted]
Total	[redacted]

Pipe Xpress, Inc.

821 East Washington Street
West Chester, PA 19380
610-918-7120
FAX 610-918-1328

Invoice

Date	Invoice #
9/17/2008	38737

Bill To
WEST GOSHEN TOWNSHIP BOARD OF SUPERVISORS 1025 PAOLI PIKE WEST CHESTER, PA 19380

Ship To
CUSTOMER PICK UP

P.O. No.	Terms	Due Date	Rep	Ship Via	Ordered
VERBAL	2% 10 Net 30	10/17/2008		PICK UP	MARK

Item	Description	Ordered	Rate	Amount
T2415	24 X 15 PE DBL WALL CORR TEE PE X PE X PE	1	[redacted]	[redacted]
MMCPL18	18 MARMAC POLYSEAL COUPLER	1	[redacted]	[redacted]
Freight	FRT-IN SHIPPING CHARGE	1	[redacted]	[redacted]

Reg. #
P.O. #
Account #
Amount
Authorized

Thank you for your business.

Subtotal	[redacted]
Sales Tax 0	[redacted]
Total	[redacted]

Bill To:
West Goshen Township
1025 Paoli Pike
West Chester, PA 19380-4699
Phone: (610) 696-5266

Purchase Order #
00001533-00 FY 2008
Page Number: 1

NOTICE TO VENDOR

Purchase order number must appear on all packing slips and invoices in order for invoices to be processed for payment.

Vendor
URS CORPORATION 1200 PHILADELPHIA PIKE WILMINGTON, DE 19809

Ship To:
WEST GOSHEN TOWNSHIP ATTN: ADMINISTRATION DEPT 1025 PAOLI PIKE WEST CHESTER, PA 19380-4699

Requisition
00001619

Date Ordered	Vendor Number	Date Required	Freight Method/Terms	Department/Location
10/21/08	003728			ADMINISTRATION

LN	Description/Part Number	QTY	Cost Each	Ext. Price
001	Design of plant selections and locations for vegetating the rehabilitated Bicking Drive stormwater basin. 01446-30270	1.0 Each	PO Total	

APPROVED FOR PURCHASE — DATE
Richard J. Craig — 10/27/08
APPROVED FOR PAYMENT — DATE

PAID BY CHECK # — DATE

APPENDIX E – WASTELOAD ALLOCATIONS

Christina River Basin WLAs

Goose Creek Watershed WLAs

Sediment Wasteload Allocation for West Goshen Township

US EPA (2006). "Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland"(pg. 4-16)

Table 4-8. Average annual sediment allocations for towns in Brandywine Creek Watershed

Township	Baseline (ton/yr)	TMDL (ton/yr)	Percent Reduction
BIRMINGHAM TWP	310.81	130.35	58.06%
COATESVILLE CITY	231.29	79.76	65.52%
EAST BRADFORD TWP	1185.00	467.17	60.58%
EAST FALLOWFIELD TWP	803.23	426.42	46.91%
EAST MARLBOROUGH TWP	366.70	139.44	61.98%
HIGHLAND TWP	384.80	238.86	37.93%
HONEY BROOK BORO	20.58	13.23	35.70%
HONEY BROOK TWP	813.84	558.76	31.34%
MODENA BORO	27.96	12.46	55.43%
NEWLIN TWP	144.18	59.59	58.67%
PARKESBURG BORO	52.11	32.35	37.93%
PENNSBURY TWP	113.98	43.48	61.85%
POCOPSON TWP	821.21	320.79	60.94%
SADSBURY TWP	289.73	172.13	40.59%
THORNBURY TWP	82.17	34.46	58.06%
VALLEY TWP	485.14	164.64	66.06%
WALLACE TWP	21.74	17.41	19.92%
WEST BRADFORD TWP	283.22	121.60	57.07%
WEST CALN TWP	68.28	43.07	36.92%
WEST GOSHEN TWP	461.32	180.51	60.87%

Total phosphorus Wasteload Allocation for West Goshen Township

US EPA (2008). "Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania,"(pg. 3-6)

Table 3-3: Land Based Non-Point TP Load in the Goose Creek Watershed by MS4 Area

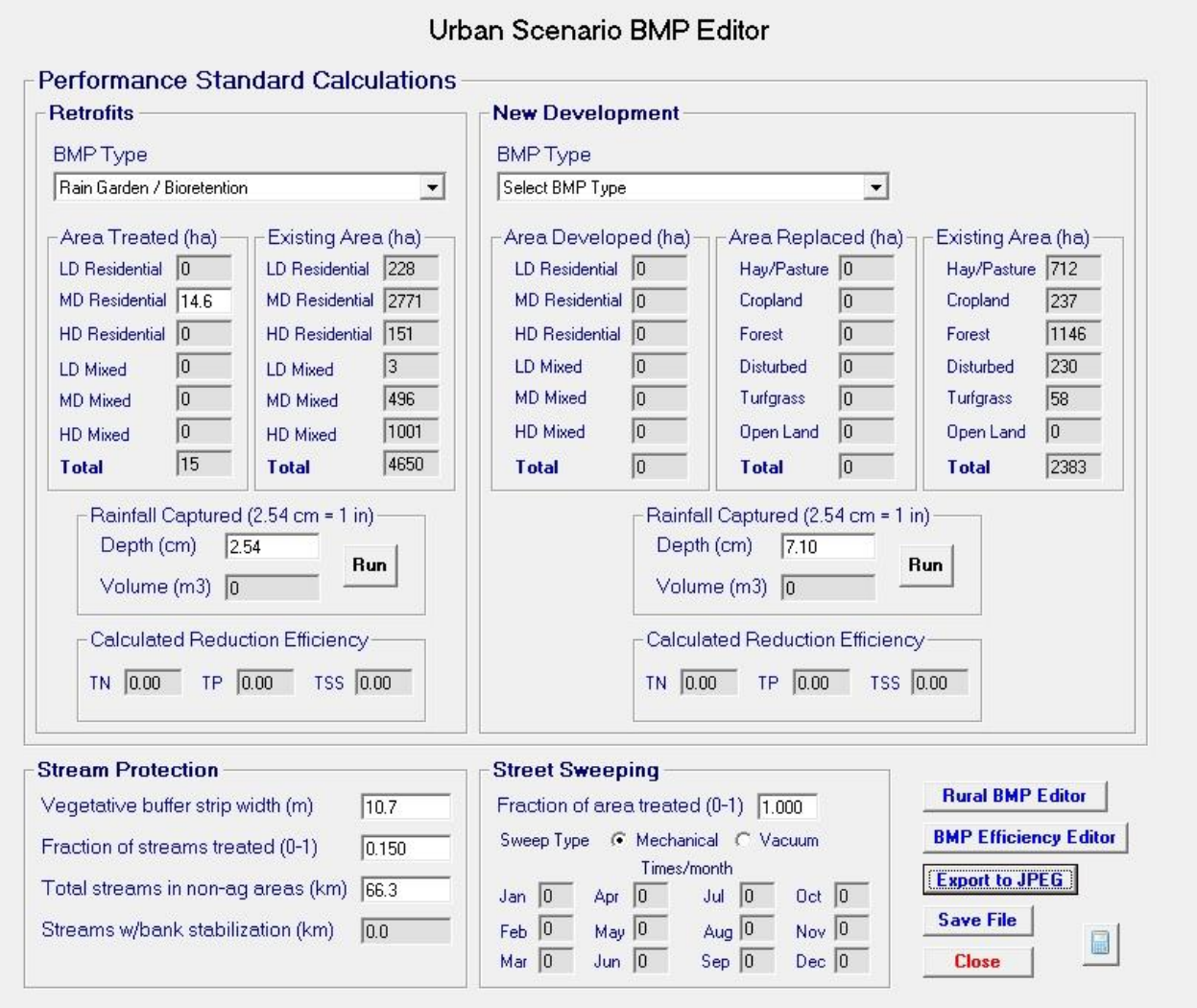
MS4 Permit Holder	Area by MS4	Existing TP Load	Allocated TP Load	Required Reduction
	acres	lb/day	lb/day	
West Goshen Township	1,488	1.16	0.54	53.9%
West Chester Borough	310	0.24	0.11	53.9%
Westtown Township	1,791	1.40	0.64	53.9%
Thornbury Township (Chester County)	772	0.60	0.28	53.9%
Thornbury Township (Delaware County)	113	0.09	0.04	53.9%
Total	**4,474**	**3.49**	**1.61**	**53.9%**

APPENDIX F – PROPOSED BMPS

Pollutant Load Calculations (MapShed Exhibits)

Long-term Pollutant Goal Calculations

Proposed BMP-01 Pollutant Load Reduction - MapShed BMP-01 Input Exhibit



Proposed BMP - 01 Pollutant Reduction - MapShed Pollutant Loads by Source for Entire Modeled Area w/ BMP-01

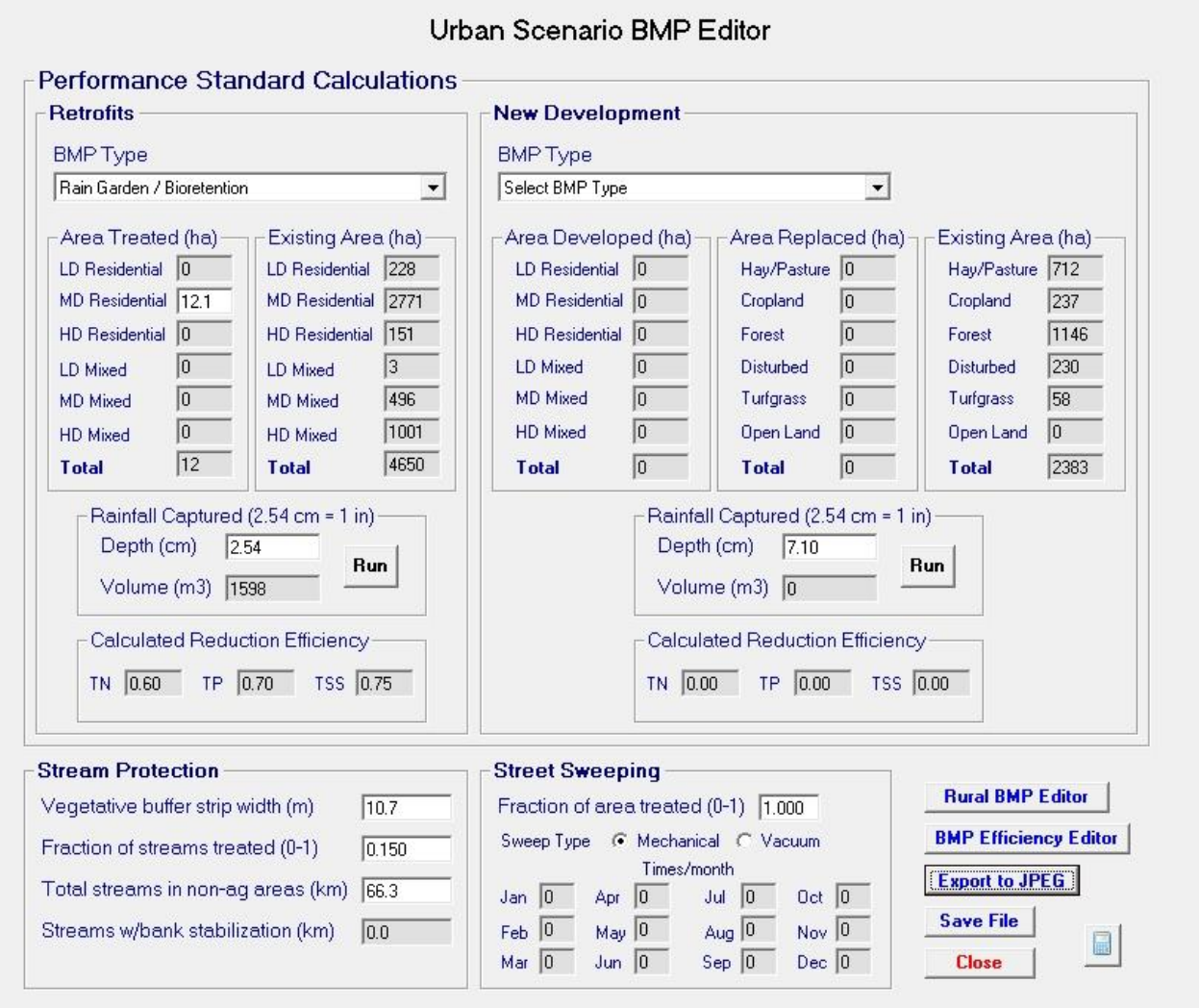
GWLF Total Loads for file: 6_7.13.17_Goshen_Base-0 **Period of analysis:** 17 years from 1975 to 1991

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	1759	1.4	1094.2	129.8	428.4	975.2	103.5	253.2
Cropland	586	3.6	3780.9	448.4	1367.5	3257.0	85.5	602.6
Forest	2832	1.1	165.8	19.7	136.4	219.3	7.1	29.8
Wetland	210	5.2	5.1	0.6	46.4	48.9	2.4	3.1
Disturbed	568	7.6	208.6	24.7	19.3	123.6	9.5	38.1
Turfgrass	143	0.9	39.7	4.7	76.5	96.4	5.5	11.0
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD Mixed	7	4.3	0.0	0.1	1.1	4.0	0.2	0.4
MD Mixed	1226	11.9	0.0	54.8	740.1	2429.3	104.9	273.6
HD Mixed	2474	16.9	0.0	110.7	1493.7	4902.7	211.8	552.2
LD Residential	563	4.3	0.0	6.3	85.0	303.0	12.0	32.3
MD Residential	6847	7.2	0.0	306.4	4134.9	13571.9	586.3	1528.6
HD Residential	373	10.0	0.0	16.7	225.3	739.6	31.9	83.3
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				3691.9		3888.9		1064.8
Groundwater					42715.0	42715.0	722.8	722.8
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					3557.8	3557.8	0.0	0.0
Totals	17588.9	7.10	5294.3	4814.8	55027.5	76832.7	1883.4	5195.8

Go Back | Pathogen Loads | Export to JPEG | Print | Close

BMP-01 Sediment Load Reduction = 4821.7 tons – 4814.8 tons = 6.9 tons = 13,800 lbs

Proposed BMP-02 Pollutant Load Reduction - MapShed BMP-02 Input Exhibit



Proposed BMP - 02 Pollutant Reduction - MapShed Pollutant Loads by Source for Entire Modeled Area w/ BMP-02

GWLF Total Loads for file: 7_7.13.17_Goshen_Base-0 **Period of analysis:** 17 years from 1975 to 1991

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	1759	1.4	1094.2	129.8	428.4	975.2	103.5	253.2
Cropland	586	3.6	3780.9	448.4	1367.5	3257.0	85.5	602.6
Forest	2832	1.1	165.8	19.7	136.4	219.3	7.1	29.8
Wetland	210	5.2	5.1	0.6	46.4	48.9	2.4	3.1
Disturbed	568	7.6	208.6	24.7	19.3	123.6	9.5	38.1
Turfgrass	143	0.9	39.7	4.7	76.5	96.4	5.5	11.0
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD Mixed	7	4.3	0.0	0.1	1.1	4.0	0.2	0.4
MD Mixed	1226	11.9	0.0	54.8	739.1	2426.0	104.8	273.2
HD Mixed	2474	16.9	0.0	110.5	1491.6	4896.0	211.4	551.3
LD Residential	563	4.3	0.0	6.3	84.9	302.6	11.9	32.3
MD Residential	6847	7.2	0.0	305.9	4129.1	13553.2	585.3	1526.2
HD Residential	373	10.0	0.0	16.7	225.0	738.5	31.9	83.2
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				3693.0		3891.2		1064.8
Groundwater					42715.0	42715.0	722.8	722.8
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					3557.8	3557.8	0.0	0.0
Totals	17588.9	7.10	5294.3	4815.1	55018.3	76804.6	1881.9	5191.8

Go Back | Pathogen Loads | Export to JPEG | Print | Close

BMP-02 Sediment Load Reduction = 4821.7 tons – 4815.1tons = 6.6 tons = 13,200 lbs

BMP-03 Stream Restoration Sediment Load Reduction Calculation

1,150 ft. x 115 lbs/ft. = 132,250 lbs sediment reduction

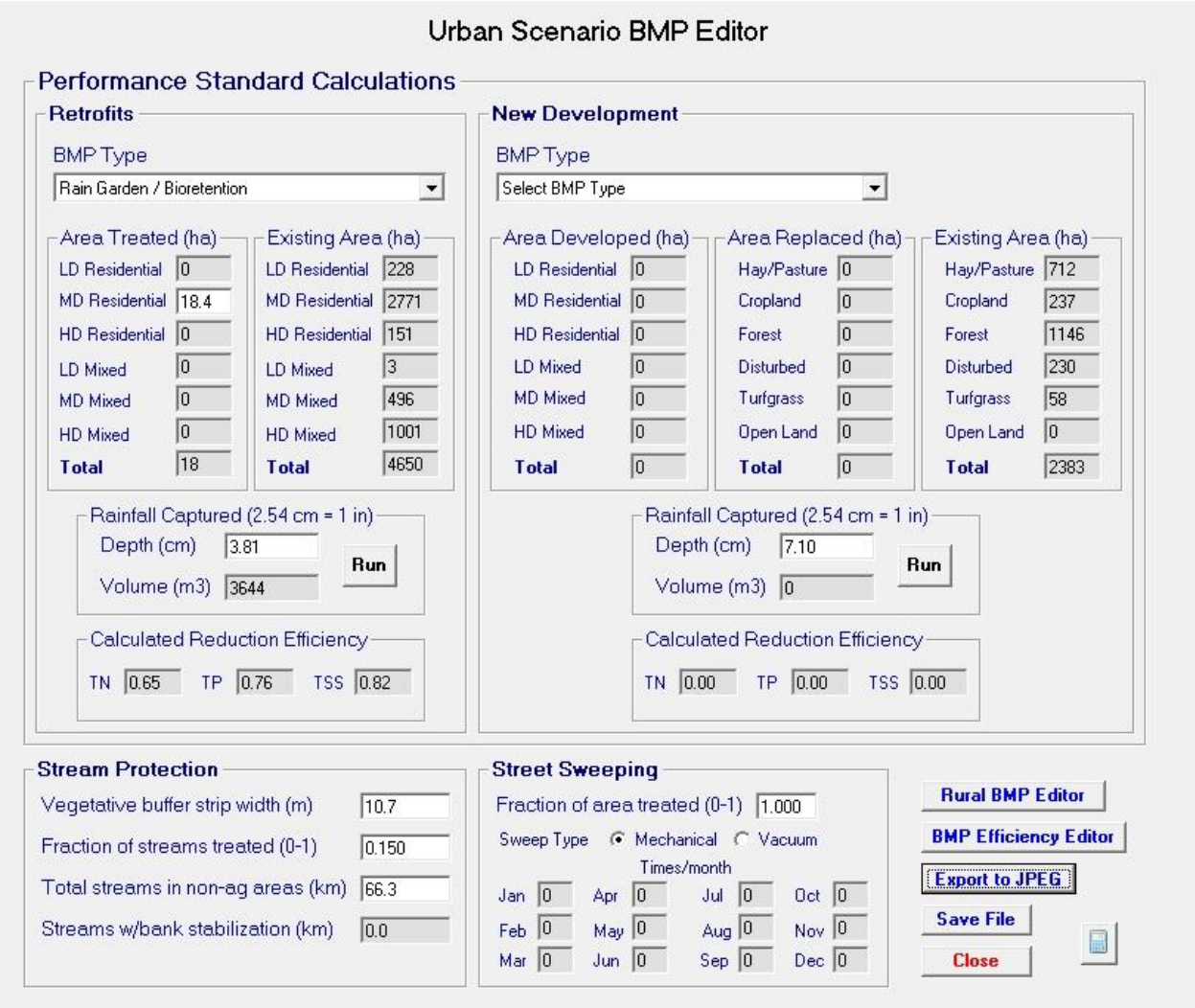
BMP-04A Stream Restoration Sediment Load Reduction Calculation

1,725 ft. x 115 lbs/ft. = 198,375 lbs sediment reduction

BMP-05A Stream Restoration Sediment Load Reduction Calculation

430 ft. x 115 lbs/ft. = 49,450 lbs sediment reduction

Proposed BMP-04B Pollutant Load Reduction - MapShed BMP-04B Input Exhibit for bioretention only



Proposed BMP – 04B Pollutant Reduction - MapShed Pollutant Loads by Source for Entire Modeled Area w/ BMP-04B bioretention only

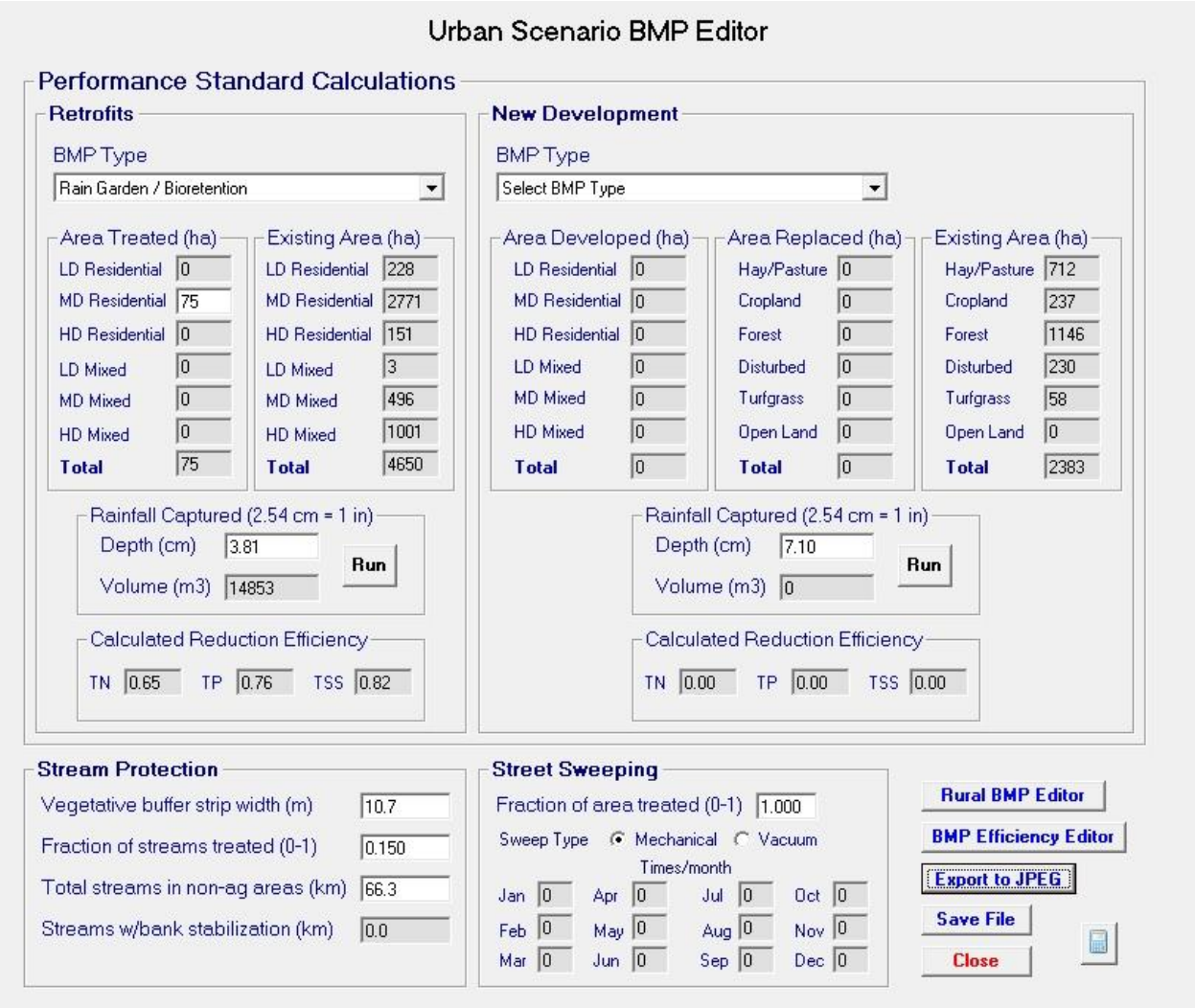
GWLF Total Loads for file: 8_7.13.17_Goshen_Base-0 **Period of analysis:** 17 years from 1975 to 1991

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	1759	1.4	1094.2	129.8	428.4	975.2	103.5	253.2
Cropland	586	3.6	3780.9	448.4	1367.5	3257.0	85.5	602.6
Forest	2832	1.1	165.8	19.7	136.4	219.3	7.1	29.8
Wetland	210	5.2	5.1	0.6	46.4	48.9	2.4	3.1
Disturbed	568	7.6	208.6	24.7	19.3	123.6	9.5	38.1
Turfgrass	143	0.9	39.7	4.7	76.5	96.4	5.5	11.0
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD Mixed	7	4.3	0.0	0.1	1.1	4.0	0.2	0.4
MD Mixed	1226	11.9	0.0	54.7	738.4	2423.8	104.7	272.9
HD Mixed	2474	16.9	0.0	110.4	1490.3	4891.6	211.2	550.7
LD Residential	563	4.3	0.0	6.3	84.8	302.3	11.9	32.2
MD Residential	6847	7.2	0.0	305.5	4125.5	13541.1	584.7	1524.6
HD Residential	373	10.0	0.0	16.6	224.8	737.9	31.9	83.1
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				3689.9		3886.7		1064.8
Groundwater					42715.0	42715.0	722.8	722.8
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					3557.8	3557.8	0.0	0.0
Totals	17588.9	7.10	5294.3	4811.4	55012.3	76780.6	1880.9	5189.2

Go Back | Pathogen Loads | Export to JPEG | Print | Close

BMP-04B Bioretention Sediment Load Reduction = 4821.7 tons – 4811.4 tons = 10.3 tons = 20,600 lbs

Proposed BMP-05B Pollutant Load Reduction - MapShed BMP-05B Input Exhibit for bioretention only



Proposed BMP – 05B Pollutant Reduction - MapShed Pollutant Loads by Source for Entire Modeled Area w/ BMP-05B bioretention only

GWLF Total Loads for file: 9_BMP#5_08.29.2017-0 **Period of analysis:** 17 years from 1975 to 1991

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	1759	1.4	1094.2	129.8	428.4	975.2	103.5	253.2
Cropland	586	3.6	3780.9	448.4	1367.5	3257.0	85.5	602.6
Forest	2832	1.1	165.8	19.7	136.4	219.3	7.1	29.8
Wetland	210	5.2	5.1	0.6	46.4	48.9	2.4	3.1
Disturbed	568	7.6	208.6	24.7	19.3	123.6	9.5	38.1
Turfgrass	143	0.9	39.7	4.7	76.5	96.4	5.5	11.0
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD Mixed	7	4.3	0.0	0.1	1.1	3.9	0.2	0.4
MD Mixed	1226	11.9	0.0	54.2	733.3	2406.8	103.8	270.7
HD Mixed	2474	16.9	0.0	109.4	1479.8	4857.3	209.5	546.2
LD Residential	563	4.3	0.0	6.3	84.2	300.2	11.8	32.0
MD Residential	6847	7.2	0.0	302.8	4096.5	13446.2	579.9	1512.1
HD Residential	373	10.0	0.0	16.5	223.2	732.7	31.6	82.4
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				3662.6		3858.1		1056.0
Groundwater					42715.0	42715.0	722.8	722.8
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					3557.8	3557.8	0.0	0.0
Totals	17588.9	7.10	5294.3	4779.7	54965.5	76598.4	1873.2	5160.2

Go Back | Pathogen Loads | Export to JPEG | Print | Close

BMP-05B Bioretention Sediment Load Reduction = 4821.7 tons – 4779.7 tons = 42.0 tons = 84,000 lbs

Total Short-term sediment load reduction = 511,675 lbs/yr

Long-term Pollutant Goal Calculations

Total Short-term sediment load reduction

- 511,675 lbs/yr

Goose Creek 5% TP reduction equals 10% TSS reduction

- Goose Creek sediment load = 1,608,574.3 lbs
- 10% TSS reduction = 1,608,574.3 lbs x 0.1 = 160,857.4 lbs
- 5% TP reduction achieved = 1,255.6 lbs x 0.05 = 62.8 lbs

Remaining sediment load reduction

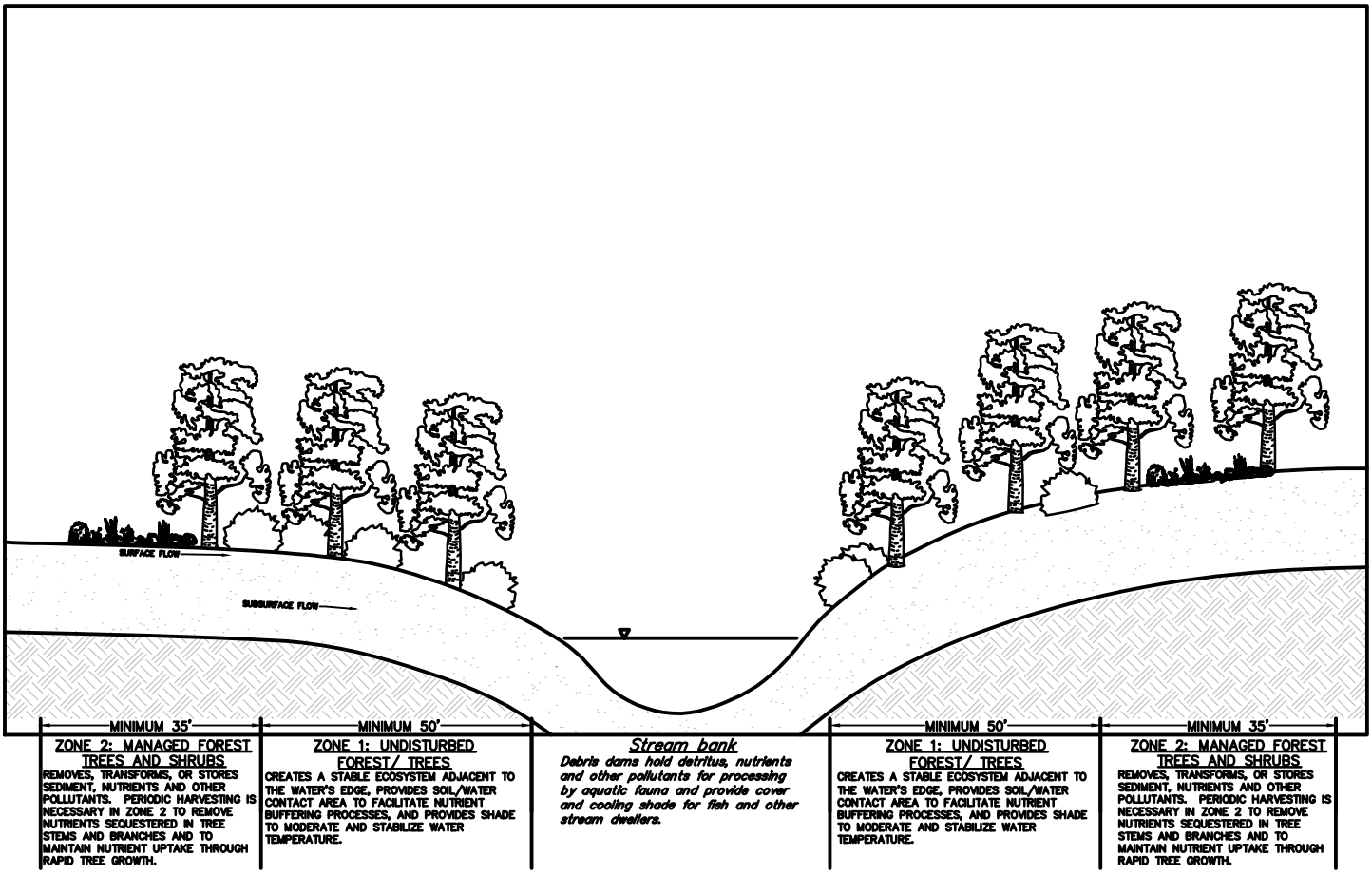
- 511,675 lbs – 160,857.4 lbs = 350,817.6 lbs

Christina River Basin sediment reduction from Short-term BMPs

- 350,817.6 lbs ÷ 828,377.7 lbs = 0.42 x 100 = 42%

APPENDIX G – TYPICAL BMP DESIGN DETAILS

Typical BMP Design Details



TYPICAL RIPARIAN BUFFER DETAIL

NOT TO SCALE

NOTES:

1. THE AVERAGE MINIMUM RIPERIAN FOREST BUFFER WIDTH RECOMMENDED BY PADEP IS TO BE 100 FEET (50 FEET ZONE 1 AND 50 FEET ZONE 2). ACCORDING TO THE MOST RECENT CHESAPEAKE BAY EXPERT REVIEW PANEL (RECOMMENDATION OF THE EXPERT PANEL TO REASSESS REMOVAL RATES FOR RIPARIAN FOREST AND GRASS BUFFER BET MANAGEMENT PRACTICES, OCTOBER 2014), THE BUFFER WIDTH REQUIRED TO RECEIVE CREDIT IS 35 FEET.
2. THE RIPERIAN FOREST BUFFER MANAGEMENT PLAN SHALL CONSIST OF THE FOLLOWING:
   - 2.A. A PLANTING PLAN FOR CONVERTED OR NEWLY ESTABLISHED RIPARIAN FOREST BUFFERS THAT IDENTIFIES THE NUMBER, DENSITY AND SPECIES OF NATIVE TREES AND SHRUBS APPROPRIATE TO A GEOGRAPHIC LOCATION THAT WILL ACHIEVE 60% UNIFORM CANOPY COVER.
   - 2.B. A MAINTENANCE SCHEDULE AND MEASURES FOR CONVERTED OR NEWLY ESTABLISHED RIPARIAN FOREST BUFFERS TO ENSURE SURVIVAL AND GROWTH OF PLANTINGS AND PROTECTION FROM COMPETING PLANTS AND ANIMALS INCLUDING NOXIOUS WEEDS AND INVASIVE SPECIES OVER A FIVE YEAR ESTABLISHMENT PERIOD INCLUDING ACTIVITIES OR PRACTICES USED TO MAINTAIN THE RIPARIAN FOREST BUFFER INCLUDING THE DISTURBANCE OF EXISTING VEGETATION, TREE REMOVAL, SHRUB REMOVAL, CLEARING, MOWING, BURNING OR SPRAYING IN ACCORDANCE WITH LONG TERM OPERATION AND MAINTENANCE.
   - 2.C. AN INSPECTION SCHEDULE AND MEASURES TO ENSURE LONG TERM MAINTENANCE AND PROPER FUNCTIONING OF RIPARIAN FOREST BUFFERS INCLUDING MEASURES TO REPAIR DAMAGE TO THE BUFFER FROM STORM EVENTS GREATER THAN THE 2 YEAR/ 24 HOUR STORM.

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RIPARIAN BUFFER DETAIL FOR

COST ESTIMATION

XX TOWNSHIP XX COUNTY PENNSYLVANIA

PROJ. MGR. – ***	DRAWING NO. DT
DESIGN– ***	
CADD– ***	
CHECKED– ***	SHEET NO. 1 OF 1
SCALE– NOT TO SCALE	
DATE– XX–XX–2017	PROJECT ***

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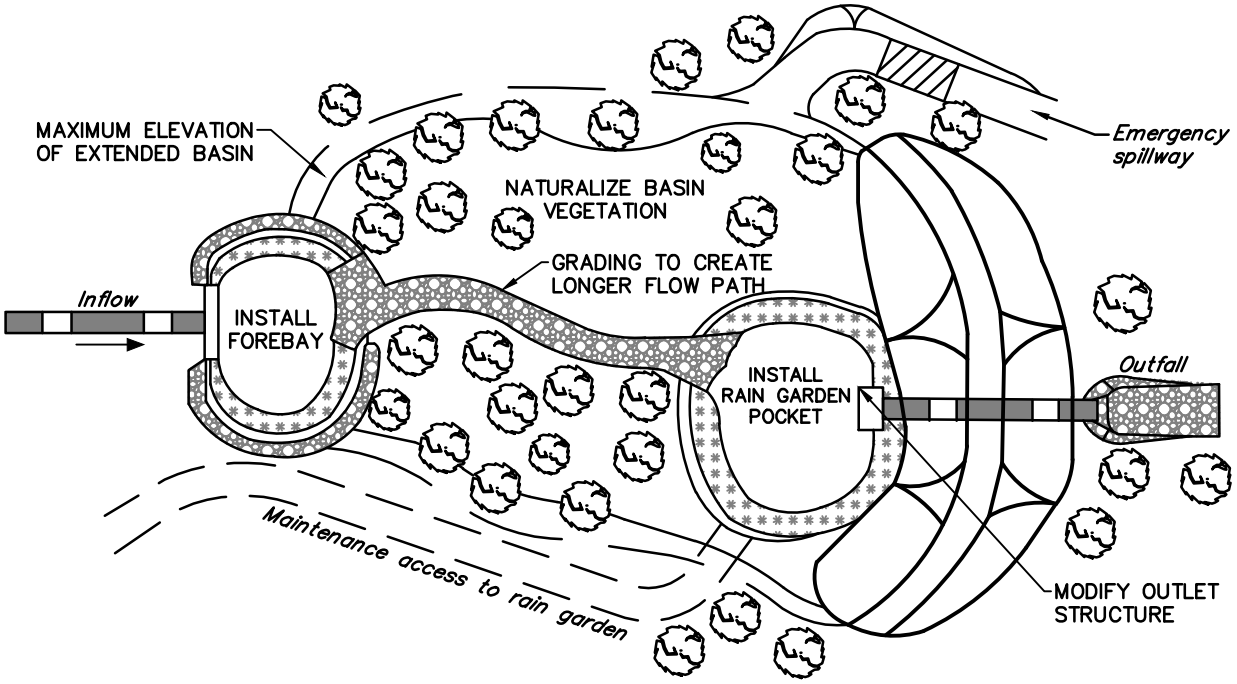
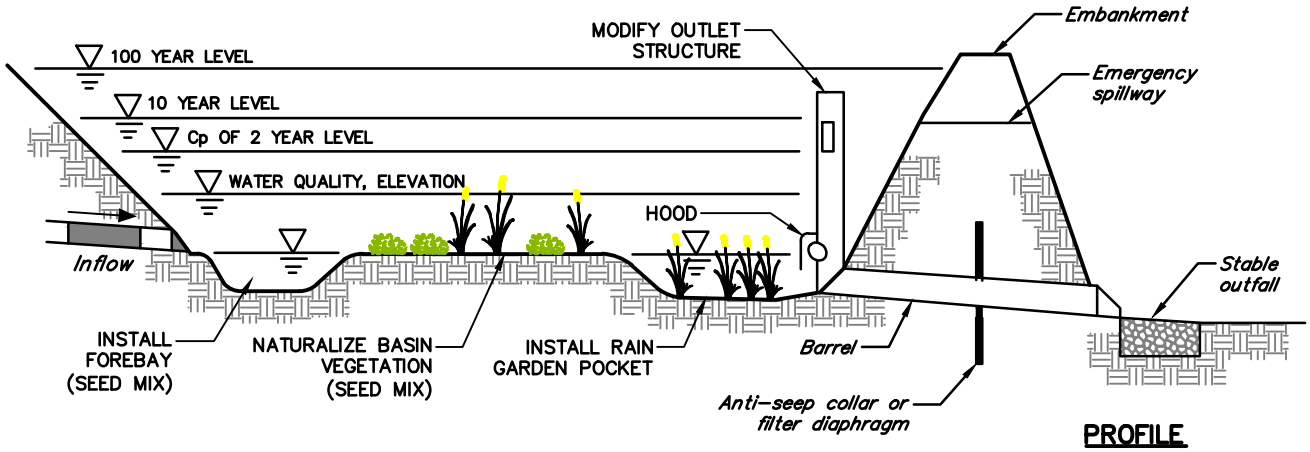


PLAN VIEW



PROFILE

TYPICAL BASIN RETROFIT DETAIL

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BASIN RETROFIT DETAIL
FOR

COST ESTIMATION

XX TOWNSHIP XX COUNTY PENNSYLVANIA

PROJ. MGR. – ***	
DESIGN– ***	
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CHECKED– ***	
SCALE– NOT TO SCALE	
DATE– XX–XX–2017	

DRAWING NO. DT

SHEET NO. 1 OF 1

PROJECT ***

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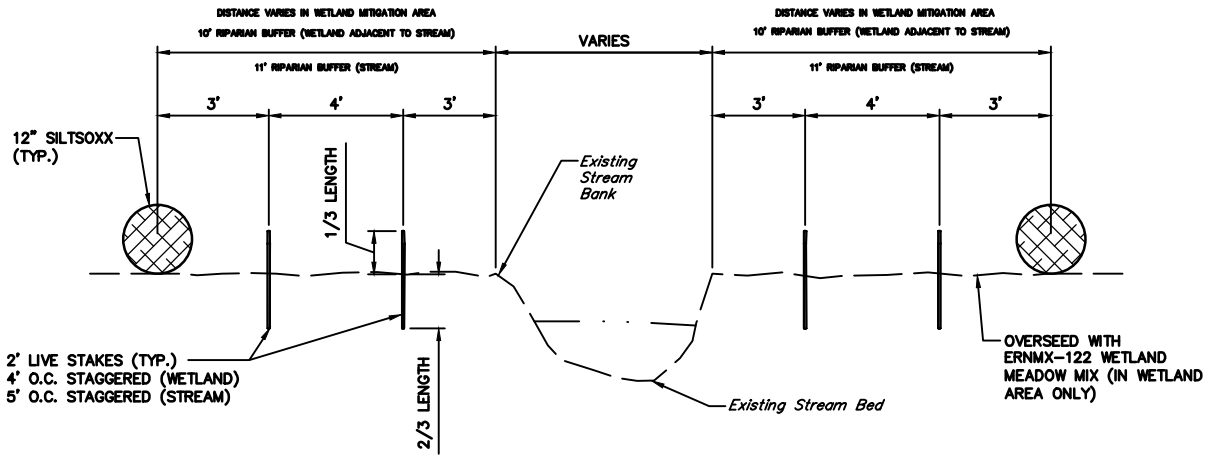

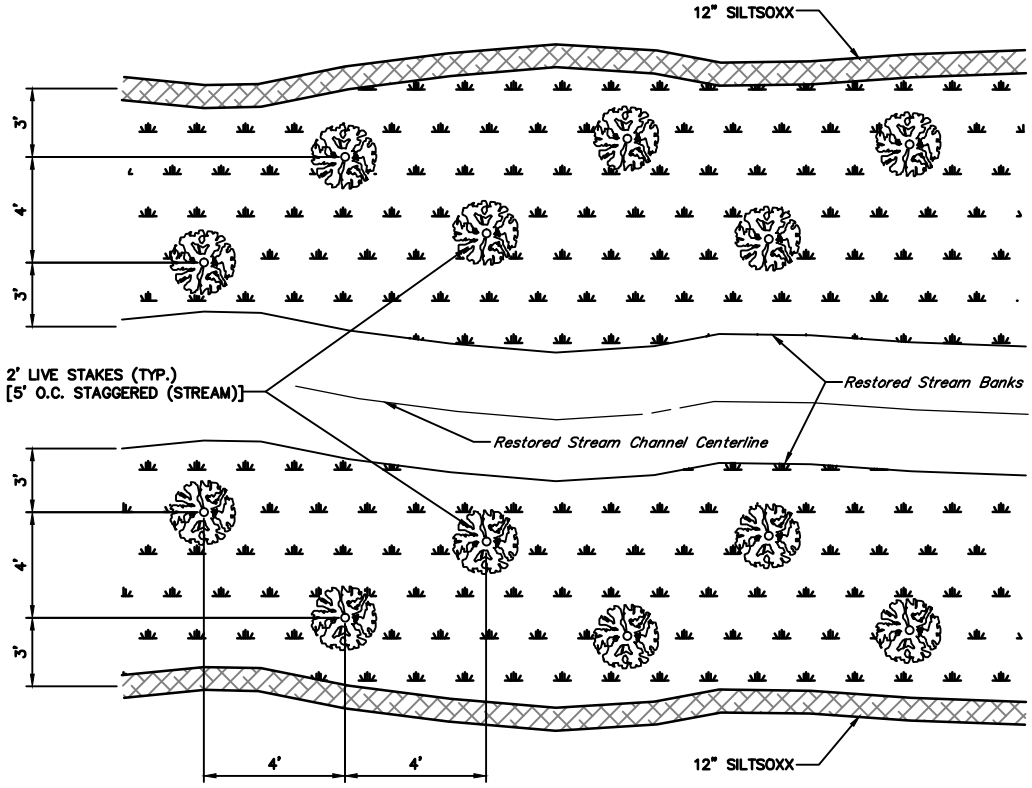

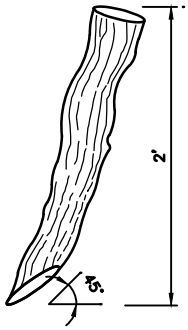

WETLAND AND STREAM LIVE STAKE SIZE AND SHAPE

TYPICAL STREAMSIDE WETLAND RESTORATION

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WETLAND RESTORATION DETAIL FOR

COST ESTIMATION

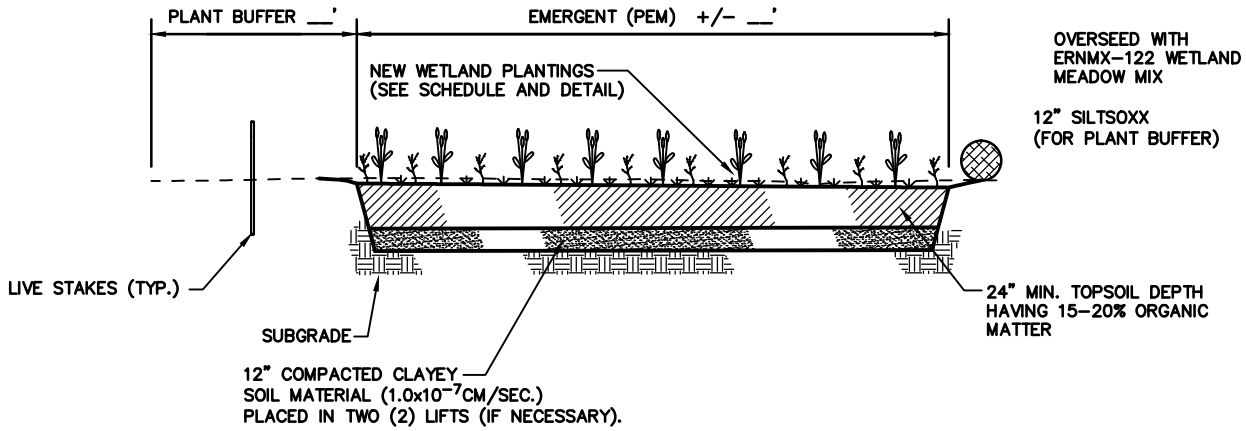
XX TOWNSHIP XX COUNTY PENNSYLVANIA

PROJ. MGR. – ***	DRAWING NO. DT-1
DESIGN– ***	
CADD– ***	
CHECKED– ***	SHEET NO. 1 OF 2
SCALE– NOT TO SCALE	
DATE– XX-XX-2017	PROJECT ***

SHRUBS					
QTY. (WETLAND)	QTY. (STREAM)	BOTANICAL NAME	COMMON NAME	PLANTING INTERVAL (WETLAND)	PLANTING INTERVAL (STREAM)
XX	XX	Cephalanthus occidentalis	BUTTONBUSH	4 FT. O/C, STAGGERED	5 FT. O/C, STAGGERED
XX	XX	Cornus stolonifera	RED OSIER DOGWOOD	4 FT. O/C, STAGGERED	5 FT. O/C, STAGGERED
XX	XX	Viburnum dentatum	ARROW-WOOD	4 FT. O/C, STAGGERED	5 FT. O/C, STAGGERED
XX	XX	Sambucus canadensis	ELDERBERRY	4 FT. O/C, STAGGERED	5 FT. O/C, STAGGERED
XX	XX	Cornus amomum	SILKY DOGWOOD	4 FT. O/C, STAGGERED	5 FT. O/C, STAGGERED
XX	XX	Salix purpurea	STREAMCO WILLOW	4 FT. O/C, STAGGERED	5 FT. O/C, STAGGERED
TOTAL=XXX	TOTAL=XXX	*SCHEDULE DOES NOT INCLUDE LIVE STAKES FOR COIR ROLL			

WETLAND AND STREAM SHRUB PLANTING SCHEDULE FOR LIVE STAKES*

FACW WETLAND MEADOW MIX (ERNMX-122)		
20.00%	Carex vulpinoidea	Fox Sedge
20.00%	Elymus virginicus	Virginia Wild Rye
6.00%	Verbena hastata	Blue Vervain
5.00%	Carex lurida	Lurid (Shallow) Sedge
5.00%	Carex scoparia	Blunt Broom Sedge
5.00%	Scirpus atrovirens	Green Bulrush
4.00%	Heliopsis helianthoides	Ox Eye Sunflower/False
3.00%	Eupatorium fistulosum	Joe Pye Weed
3.00%	Eupatorium perfoliatum	Boneset
3.00%	Glyceria grandis	American Mannagrass
3.00%	Juncus effusus	Soft Rush
3.00%	Onoclea sensibilis	Sensitive Fern
2.00%	Carex comosa	Cosmos (Bristly) Sedge
2.00%	Carex lupulina	Hop Sedge
2.00%	Eupatorium maculatum	Spotted Joe Pye Weed
2.00%	Juncus tenuis, PA Ecotype	Path Rush, PA Ecotype
2.00%	Mimulus ringens	Square Stemmed Monkey Flower
2.00%	Scirpus polyphyllus	Many Leaved Bulrush
2.00%	Vernonia gigantea	Giant Ironweed
1.00%	Carex stipata	Awl Sedge
1.00%	Carex tribuloides	Bristlebract Sedge
1.00%	Euthamia graminifolia	Grass Leaved Goldenrod
1.00%	Geum laciniatum	Rough Avens
1.00%	Glyceria canadensis	Rattlesnake Grass
1.00%	Ludwigia alternifolia	Seedbox
SEEDING RATE: 15 LB PER ACRE, OR 1/3 - 1/2 LB PER 1,000 SQ. FT.		



TYPICAL WETLAND CROSS SECTION

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WETLAND RESTORATION DETAIL
FOR

COST ESTIMATION

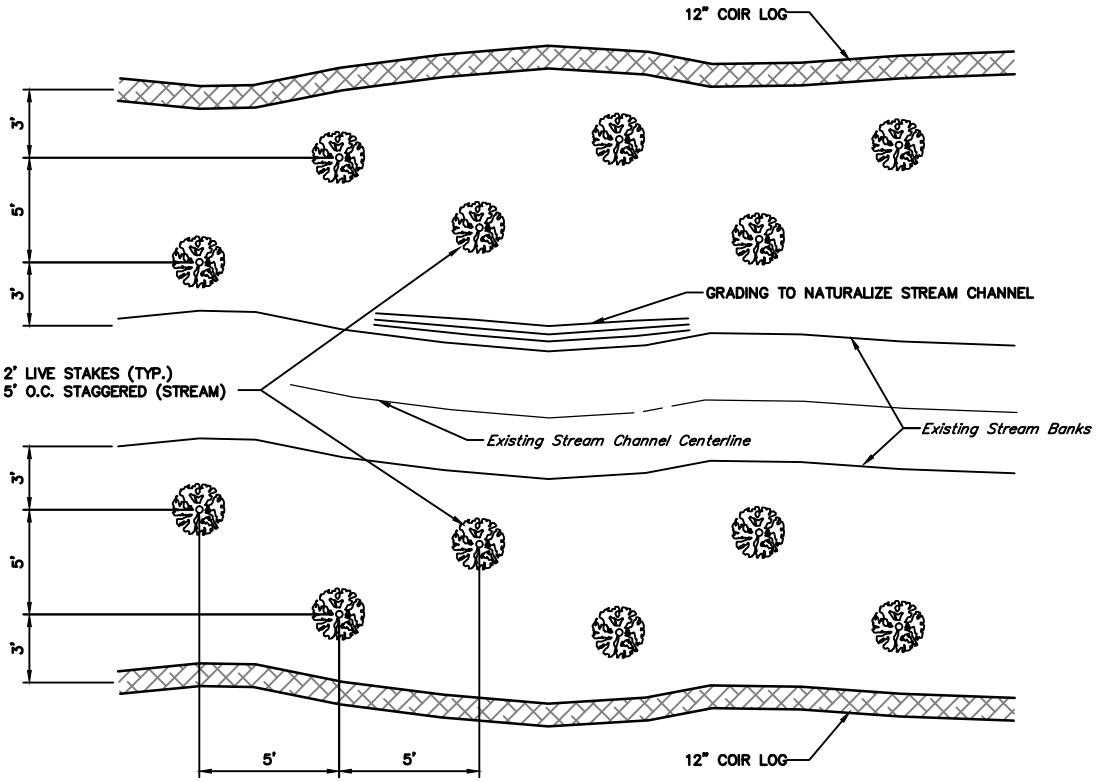
XX TOWNSHIP XX COUNTY PENNSYLVANIA

PROJ. MGR. - ***	
DESIGN- ***	
CADD- ***	
CHECKED- ***	
SCALE- NOT TO SCALE	
DATE- XX-XX-2017	

DRAWING NO. DT-2

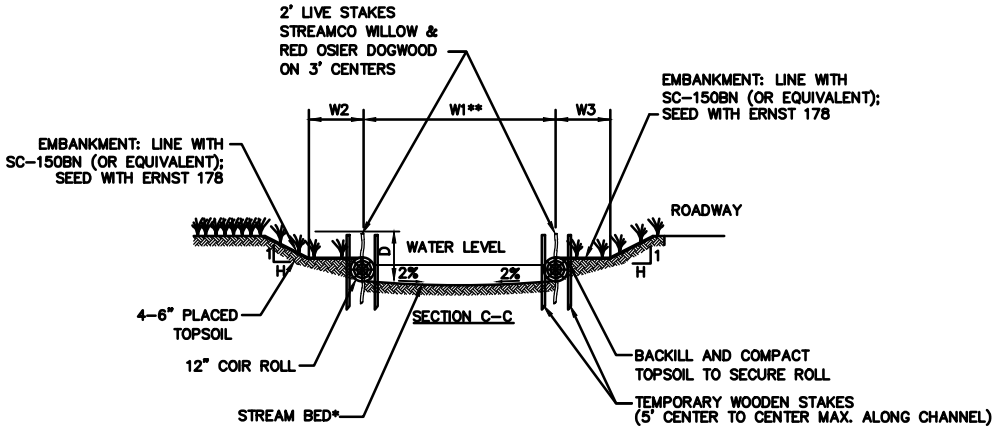
SHEET NO. 2 OF 2

PROJECT ***



TYPICAL STREAM RESTORATION CONFIGURATION DETAIL

NOT TO SCALE



SWALE NO.	WIDTH W1**	WIDTH W2	WIDTH W3	DEPTH D	LONGITUDINAL SLOPE (%)	SIDE SLOPE H
STREAM	5	3	4	VARIES	VARIES (SEE DR-03)	VARIES (SEE DR-04)

*STREAM BED TO BE EXCAVATED TO PROPOSED GRADE. DO NOT OVER EXCAVATE. IF ANY GRADE ADJUSTMENT IS NEEDED, USE ONLY NATIVE TOPSOIL AND R-4 EQUIVALENT NATIVE COBBLES) MIXTURE.

**INSTALL COIR ROLL AT 5' WIDTH CENTER TO CENTER, RESULTING IN AN APPROXIMATE 4' NORMAL WIDTH CHANNEL

TYPICAL STREAM SECTION (LOOKING DOWNSTREAM)

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STREAM RESTORATION DETAIL
FOR

COST ESTIMATION

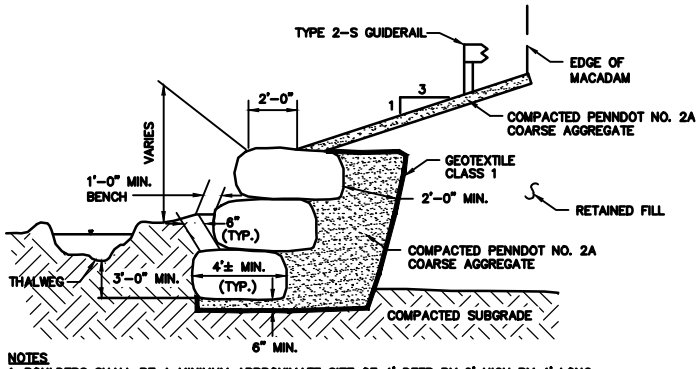
XX TOWNSHIP XX COUNTY PENNSYLVANIA

PROJ. MGR. – ***	
DESIGN– ***	
CADD– ***	
CHECKED– ***	
SCALE– NOT TO SCALE	
DATE– XX-XX-2017	

DRAWING NO.
DT

SHEET NO.
1 OF 1

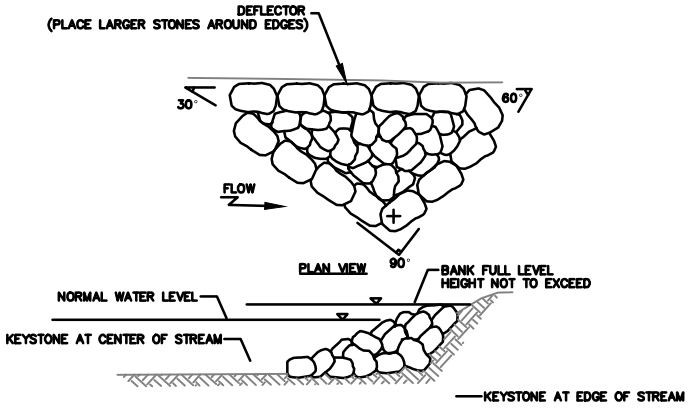
PROJECT ***



NOTES
1. BOULDERS SHALL BE A MINIMUM APPROXIMATE SIZE OF 4' DEEP BY 2' HIGH BY 4' LONG.
2. STAGGER JOINTS BETWEEN BOULDERS IN SUCCESSIVE ROWS.
3. GEOTEXTILE SHALL CONFORM TO PENNDOT PUB. 408, SECTIONS 212 AND 735.
4. WALL FACE BATTER SLOPE SHOULD BE A MAXIMUM OF 1H:4V, HOWEVER IF FIELD CONDITIONS DO NOT ALLOW FOR MINIMUM SPACING REQUIREMENTS FOR TYPE 2-S GUIDERAIL AND EDGE OF MACADAM PER PENNDOT AND BETWEEN EDGE OF STREAM AND WALL BENCH, SLOPES CAN BE MODIFIED AT THE DISCRETION OF THE ENGINEER.

TYPICAL SECTION ROCK WALL

NOT TO SCALE

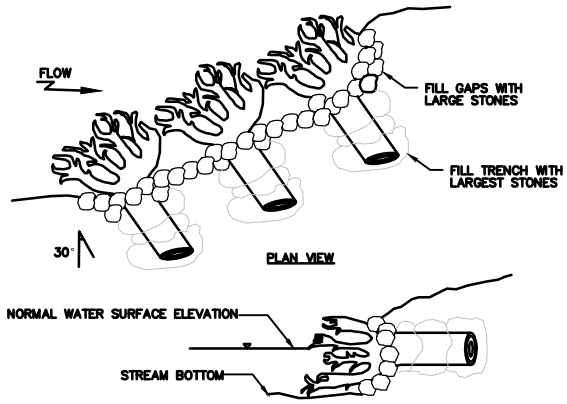


SECTION VIEW

NOTES:
1. SUBMERGE KEYSTONES (R-4) IN CENTER OF STREAM, LEAVING APPROXIMATELY 6" EXPOSED. USE LARGER STONES AS KEYSTONES.
2. SUBMERGE KETSTONES AT EDGE OF STREAM, LEAVING APPROXIMATELY 10" EXPOSED. USE LARGER STONES AS KEYSTONES.
3. DEFLECTORS SHALL BE CONSTRUCTED DURING NORMAL LOW FLOW CONDITIONS TYPICALLY ENCOUNTERED IN EARLY SUMMER THROUGH MID-FALL.
4. THE DISTANCE FROM THE STREAM BANK TO THE TIP OF THE STRUCTURE SHOULD TYPICALLY EQUAL A THIRD OF THE CHANNEL WIDTH AND NEVER EXCEED HALF THE CHANNEL WIDTH.
5. ONLY CLEAN STONE SHALL BE USED TO CONSTRUCT DEFLECTORS.
6. " + " DENOTES STATION LOCATION OF DEFLECTOR;
7. SEE "STREAM FEATURE LOCATIONS" TABLE FOR STATIONING.

STONE DEFLECTORS DETAIL

NOT TO SCALE



SECTION VIEW

NOTES:
1. ROOT WADS CAN BE PLACED AS A SINGLE DEFLECTOR OR OVERLAPPING AS SHOWN.
2. TREE STEM SHOULD BE A MINIMUM OF 8' IN LENGTH AND A MINIMUM OF 6" DIAMETER WITH THE ROOT BALL STILL ATTACHED AND TRENCHED INTO THE BANK A MINIMUM OF 4 FEET.
3. TO INSTALL DEFLECTOR, DIG A TRENCH UPSTREAM AT A 30 DEGREE ANGLE THEN PLACE THE ROOT WAD INTO THE TRENCH WITH THE ROOT BALL EXTENDING INTO THE CHANNEL BEFORE BACKFILLING THE TRENCH AND AREA BETWEEN THE ROOT BALL AND STREAM BANK WITH LARGE STONES.
4. WHEN LAID IN THE TRENCH, THE ROOT BALL SHOULD REST ON THE STREAM BOTTOM OR IT SHOULD BE ONE-THIRD TO ONE-HALF SUBMERGED IN DEEPER WATER. THE UPSTREAM SIDE OF THE ROOT BALL SHOULD BE TIGHT AGAINST THE TRENCH.
5. DEFLECTORS SHOULD BE CONSTRUCTED DURING NORMAL LOW-FLOW CONDITIONS, TYPICALLY ENCOUNTERED IN EARLY SUMMER THROUGH MID-FALL.
6. SEE "STREAM FEATURE LOCATIONS" TABLE FOR STATIONING.

ROOT WAD DEFLECTORS DETAIL

NOT TO SCALE

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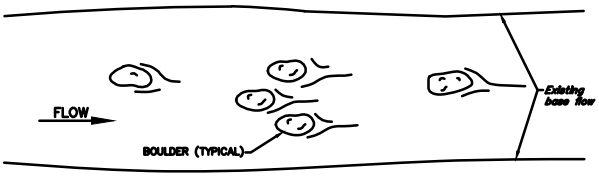
IN-STREAM RESTORATION DETAIL FOR

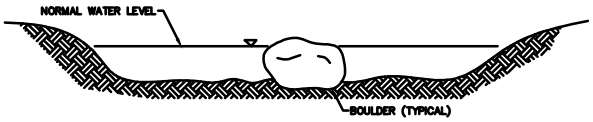
COST ESTIMATION

XX TOWNSHIP XX COUNTY PENNSYLVANIA

PROJ. MGR. – ***	DRAWING NO. DT-1
DESIGN– ***	
CADD– ***	
CHECKED– ***	SHEET NO. 1 OF 2
SCALE– NOT TO SCALE	
DATE– XX-XX-2017	PROJECT ***



PLAN VIEW

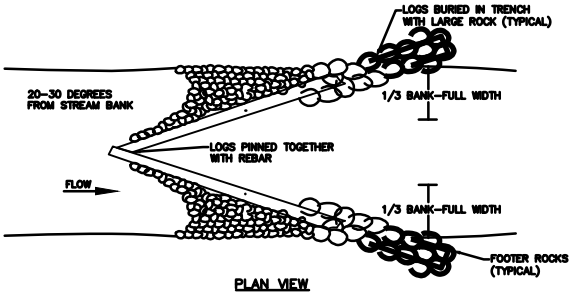


SECTION VIEW

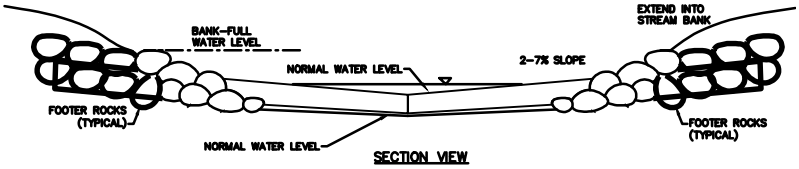
NOTES:
1. PLACE BOULDERS IN THE MIDDLE THIRD OF THE WETTED WIDTH OF THE STREAM TO PREVENT FLOW DEFLECTION INTO THE STREAM BANKS.
2. BOULDER SHOULD BE LARGE ENOUGH NOT TO BE DISPLACED DURING HIGH FLOW PERIODS.
3. DRAWING IN REFERENCE TO PA FISH AND BOAT COMMISSION STANDARD DRAWINGS OF HABITAT STRUCTURES.

RANDOM BOULDER PLACEMENT DETAIL

NOT TO SCALE



PLAN VIEW

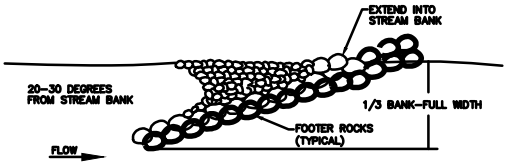


SECTION VIEW

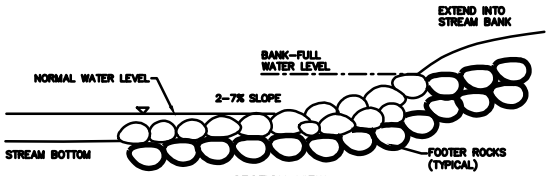
NOTES:
1. DRAWING IN REFERENCE TO PA FISH AND BOAT COMMISSION STANDARD DRAWINGS OF HABITAT STRUCTURES.

LOG CROSS VANE DETAIL

NOT TO SCALE



PLAN VIEW

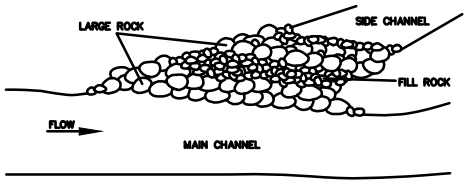


SECTION VIEW

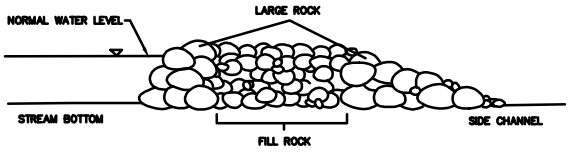
NOTES:
1. DRAWING IN REFERENCE TO PA FISH AND BOAT COMMISSION STANDARD DRAWINGS OF HABITAT STRUCTURES.

ROCK VANE DEFLECTOR DETAIL

NOT TO SCALE



PLAN VIEW



SECTION VIEW

NOTES:
1. CHANNEL BLOCK BUILT LOWER THAN SURROUNDING STREAM BANKS.
2. DRAWING IN REFERENCE TO PA FISH AND BOAT COMMISSION STANDARD DRAWINGS OF HABITAT STRUCTURES.

STONE CHANNEL BLOCK DETAIL

NOT TO SCALE

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IN-STREAM RESTORATION DETAIL FOR

COST ESTIMATION

XX TOWNSHIP XX COUNTY PENNSYLVANIA

PROJ. MGR. – ***	DRAWING NO. DT-2
DESIGN– ***	
CADD– ***	
CHECKED– ***	SHEET NO. 2 OF 2
SCALE– NOT TO SCALE	
DATE– XX-XX-2017	PROJECT ***