

Combined Total Maximum Daily Load & Pollutant Reduction Plan

September 2017

HRG Project No. R004194.0430



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.			
Co-Permittees (if applicable): N/A	369 East Park Drive Harrisburg, PA 17111 717-564-1121			

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 Instructions¹. 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 Database². 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 Table³ (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 instructions⁴.

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." 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. All GIS data used to create the pollutant baseline loading model was sourced from the MapShed Download web site. 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	Baseline Pollutant Loading (lbs/yr)		
Watershed	(Acres)	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)

ВМР Туре	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 Loc	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)		
			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	Existing TP Load	TP WLA	Required	
Permittee	(lb/day)	(lb/day)	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)

ВМР Туре	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.

<u>Detention Basin Retrofit</u>

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

<u>Long-Term Reductions to Meet WLA(s):</u>

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 areaseasonally
- 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

<u>Public Meeting Presentation</u>

Public Comments & Responses





PHILADELPHIA GROUP

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 🥒 , 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 Daily Local News Digital 07/22/17 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 im-mediately 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 in-vited to attend to learn more about this project.

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

Sworn to the subscribed before me this

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

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BUILDING RELATIONSHIPS.
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West Goshen Township

Stormwater Quality Plans

July 26, 2017

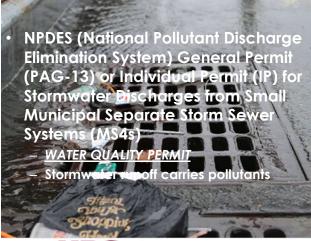


Herbert, Rowland & Grubic, Inc.

- 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



MS4 Permit





BUILDING RELATIONSHIPS.
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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



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?





Stormwater Pollutants

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





BUILDING RELATIONSHIPS.
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Impaired Watersheds Christina River & Goose Creek (Total Maximum Daily Loads) Sediment Nutrients (nitrogen & phosphorus) Figure 1-1. Christina River Balin defineation of HEFF model sudbasians and EFFC model grid

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

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



BUILDING RELATIONSHIPS.
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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.

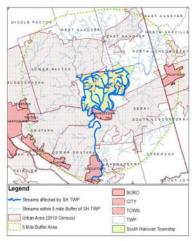




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2018 Permit Regulatory Changes PRP Requirements Table

- 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





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

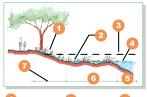
- Modeling
 - MapShed Software
 - Pollutant loading assumptions according to land use & instream erosion
 - BMP benefits
 - Detention basin naturalization
 - · Stream buffers

Detention Basins		Constructed Wetlands
Detention basin volume (m³)	41276	Total area urban land (Ha) [2444
Basin dead storage (m ³)	Ó	Fraction of erea treated (0-1) 0 000
Basin surface area (m²)	41,276	100000000000000000000000000000000000000
Basin days to drain	3	Street Sweeping
Basin cleaning month	(a	January 0 July 1
Stream Protection		Februsey 0 August 1
Vegetative buffer strip width (m)	[11	Merch 0 September 1 April 1 October 1
Fraction of streams treated (0-1)	[0	May 1 November 0
Total streams in norrag areas	62.2	June 1 December (0)
Streams w/bank stabilization (kr	r) [0	Impervious Surface Reduction
Infiltration/Bioretestion		X Red X Assa X Red X Assa LD Moved 0 0 LD Residential 0 0
Amount of runoff retention (cm)	[0	MD Mixed 0 0 MD Residential 0 0
Fraction of area treated (8-1)	0	HD Mixed 0 0 HD Residential 0 0
CSN Tool Data		7
		Load Reduced Development Type*
Storm Event Simulated (cm) (0	TN (kg)	
Area Simulated (Ha) 0	TP kgl	
Selected Dev Type Area (He) 🛭	TP Mai	"Fro residential area, use "Mosel" lane



TMDL Plan Development

- Detention basin naturalization
- Stream restoration/buffer















BUILDING RELATIONSHIPS.
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TMDL Plan Development

- Detention basin naturalization
- Stream restoration/buffer









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)

ВМР Туре	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.



Proposed Implementation Schedule

Table 12: Implementation Schedule for Proposed Short-term BMPs

ВМР Туре	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.



Next Steps

• Public comment period closes August 25, 2017

• Revise report September 2017

• Submit report September 15, 2017

• Implementation – upon Individual Permit Approval

Questions?



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 <u>not</u> 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, <u>Margie Swart asked why the township has two engineering firms for storm</u> water projects?
 - (f) Correct Margie Swart's question to read, <u>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.</u>
 - (g) Add, <u>Margie Swart asked if the two engineering firms consulted one another on the pollution reduction plans.</u> <u>Ms. Letavic No</u>
 - (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.

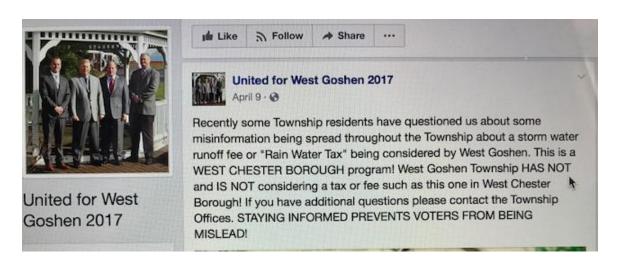
Section H: Funding Mechanisms

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

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?

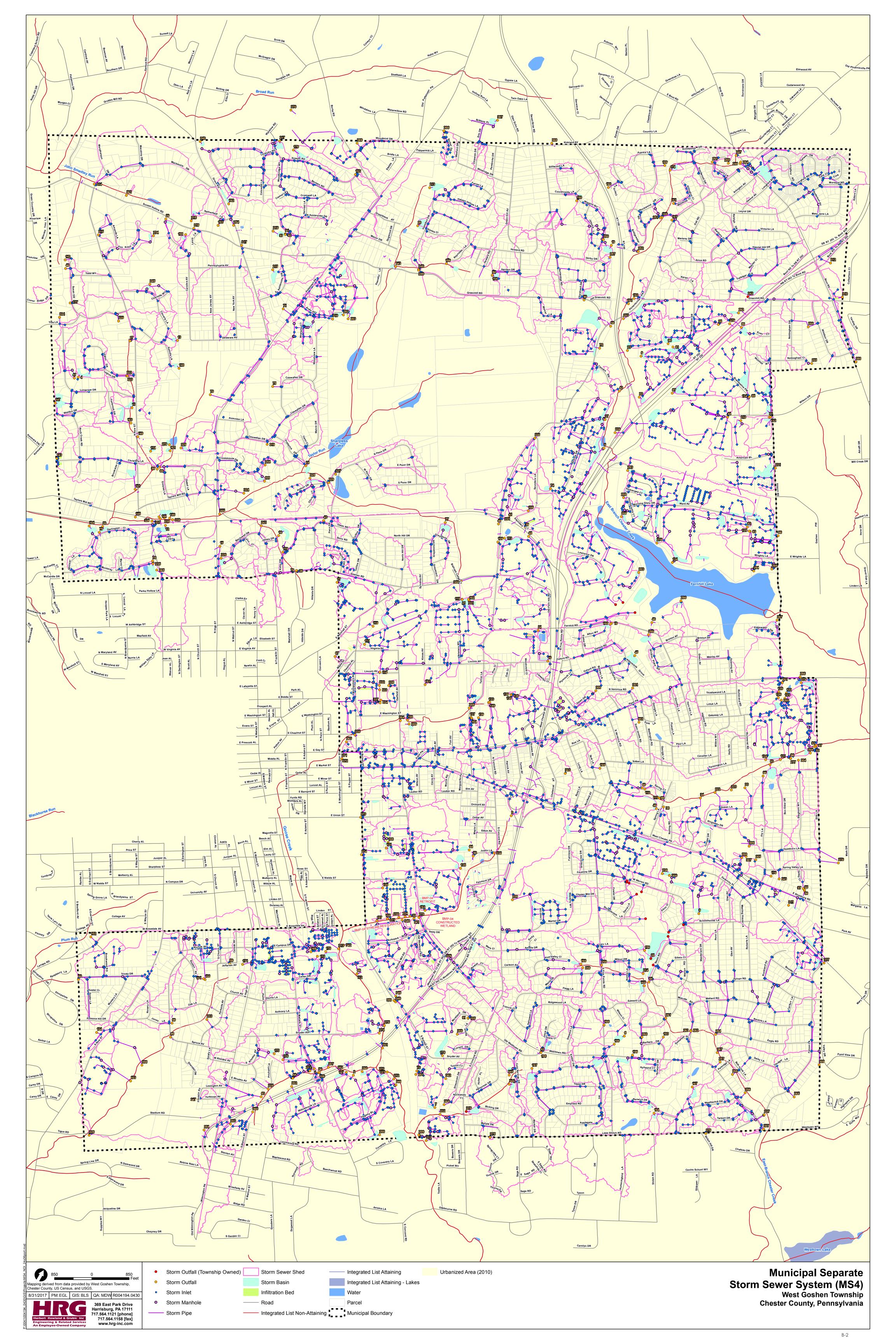
Response: Due to the new BMP efficiency credits allotted to streambank restoration, the length of required stream work was reduced and therefore reconsidered. The referenced stream reach was selected based on the current condition of the stream, surrounding vegetation, and proximity to the proposed upstream 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.

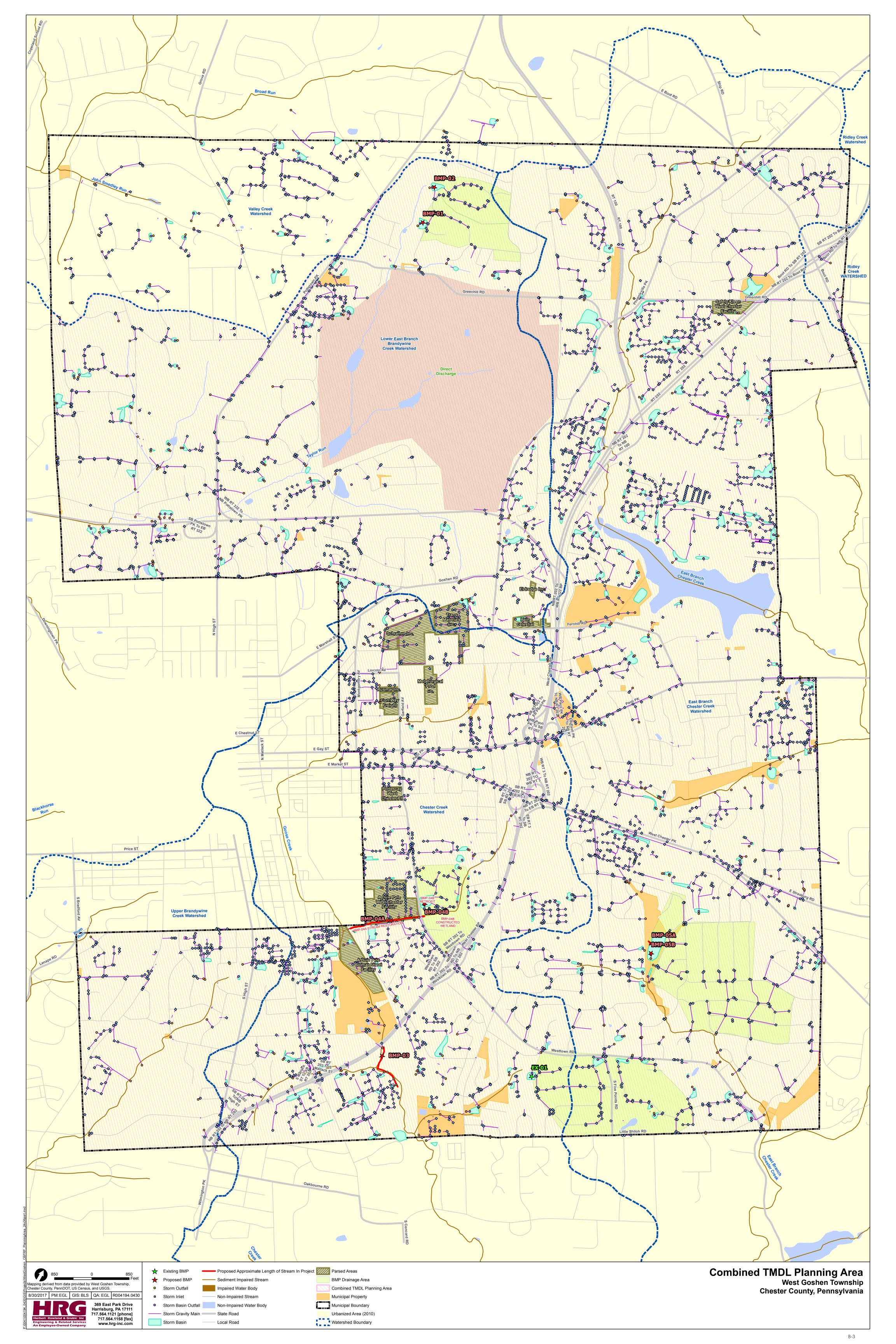
APPENDIX B - MAPPING

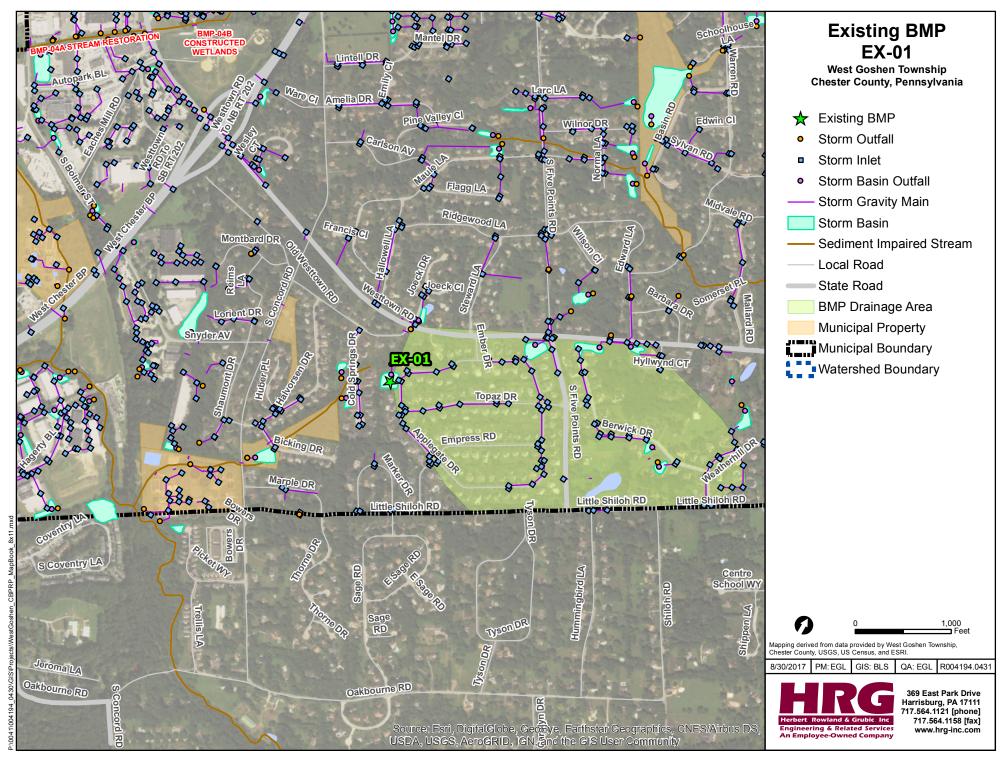
Township Storm Sewer Map

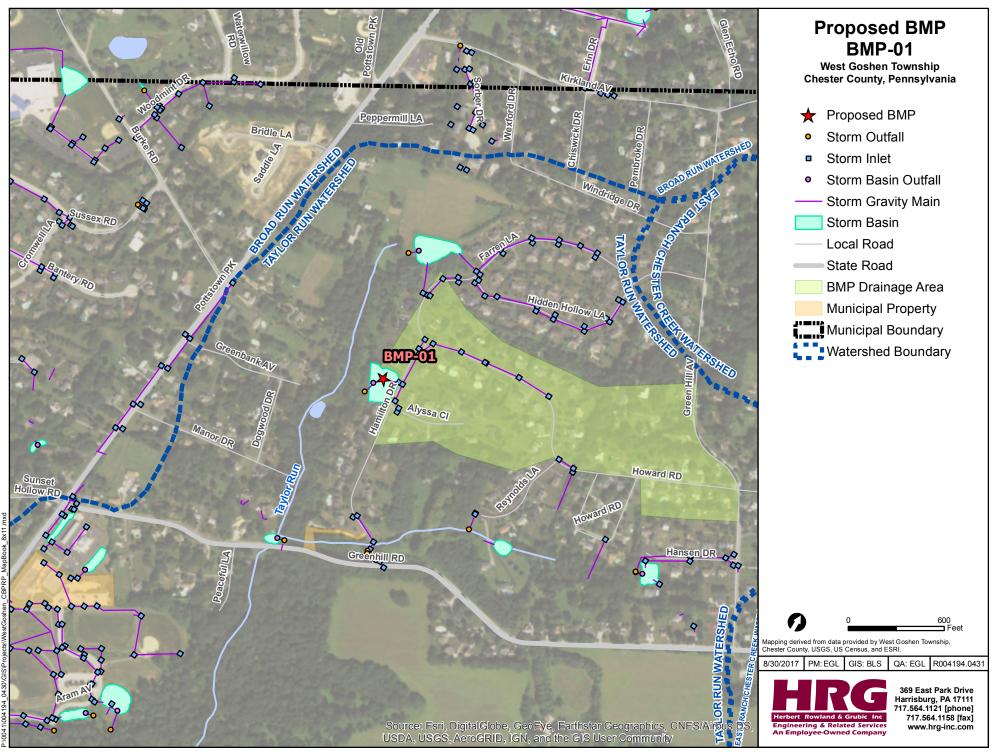
Proposed BMP Location Maps

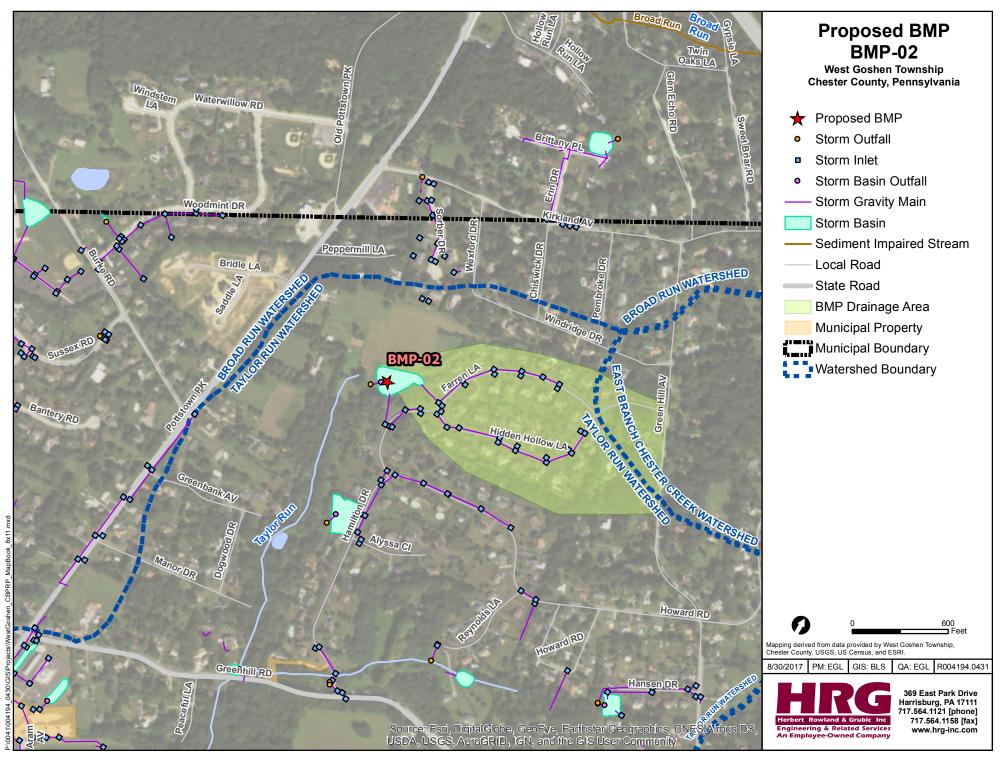
Township Land Use Map

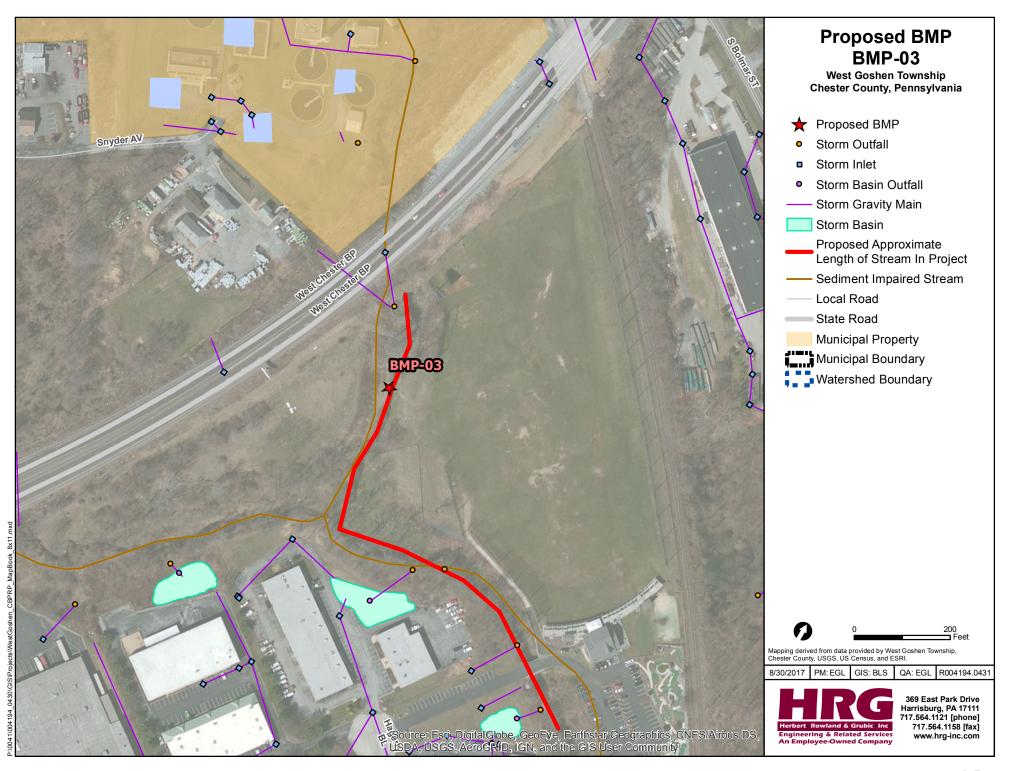


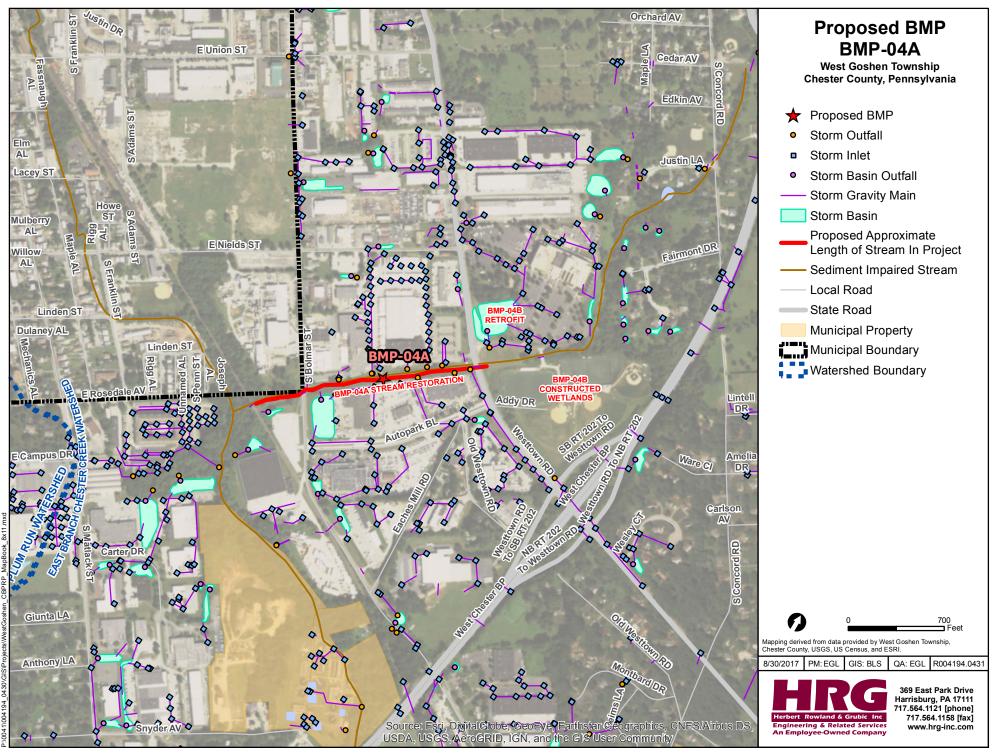


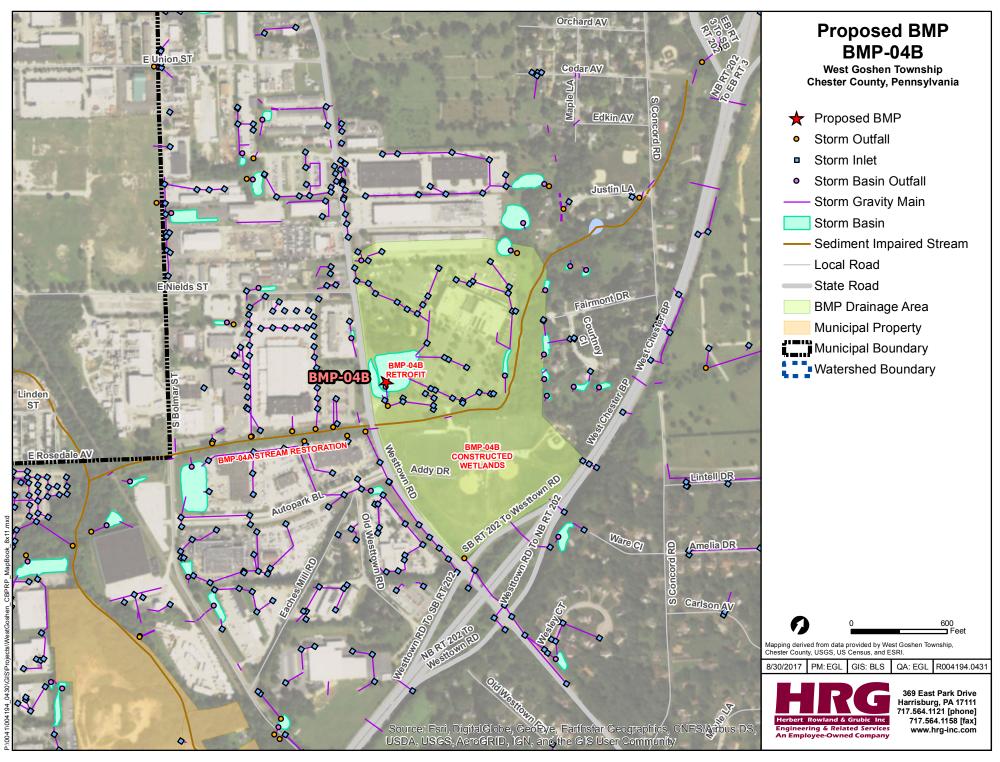


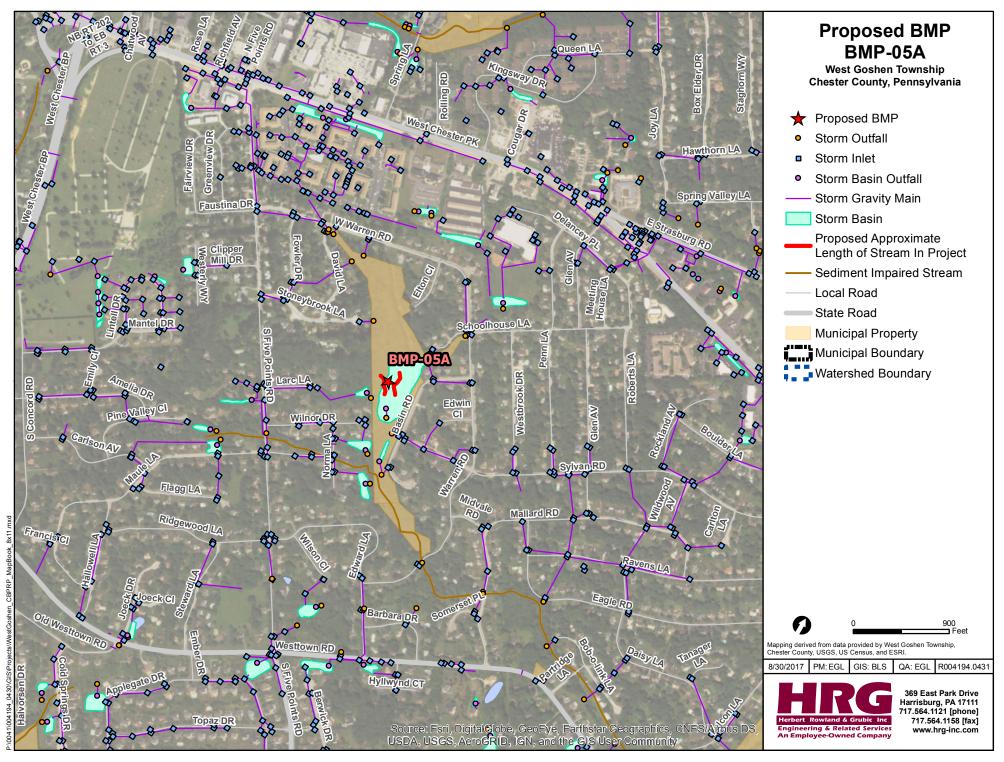


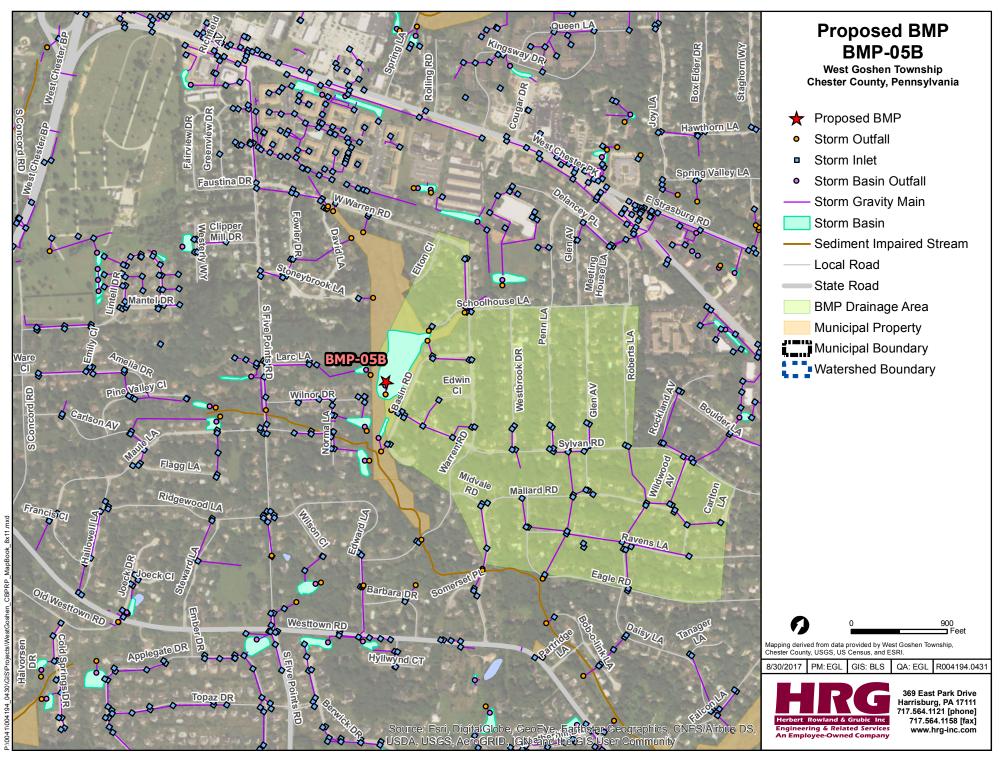












APPENDIX C - PADEP MUNICIPAL MS4 REQUIREMENTS TABLE

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 Variabilit (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)	

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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	Chacanaska Ray Nutriants\Sodimont North East Crook	Appendix D. Ciltation/Nutrianta Appendix C. Cillation
		Basin Run-Octoraro Creek, Tweed Creek-Octoraro Creek	Chesapeake Bay Nutrients\Sediment, North East Creek Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients, Appendix E-Siltation Appendix D-Siltation/Nutrients
WEST PIKELAND TWP	PAI130531	Sasiff fail Octobal Octobs, 1 Week Octobs Octobs	опозировко вау нашення пен	Аррения о-ощацинуминенто
		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

Page 43 of 112 Revised 6/26/2017

APPENDIX D - EXISTING POLLUTANT LOAD CALCULATIONS

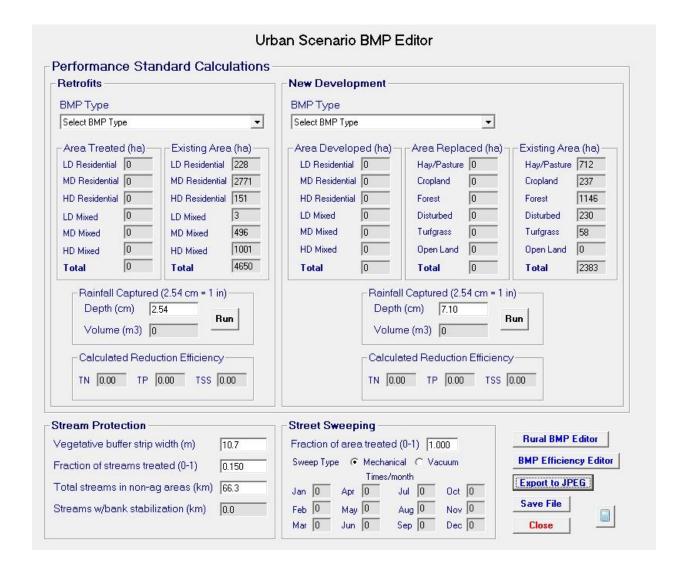
Parsing Calculations

Baseline Load Calculations (MapShed Exhibits)

Existing Load Calculations (MapShed Exhibits)

Existing BMP Information

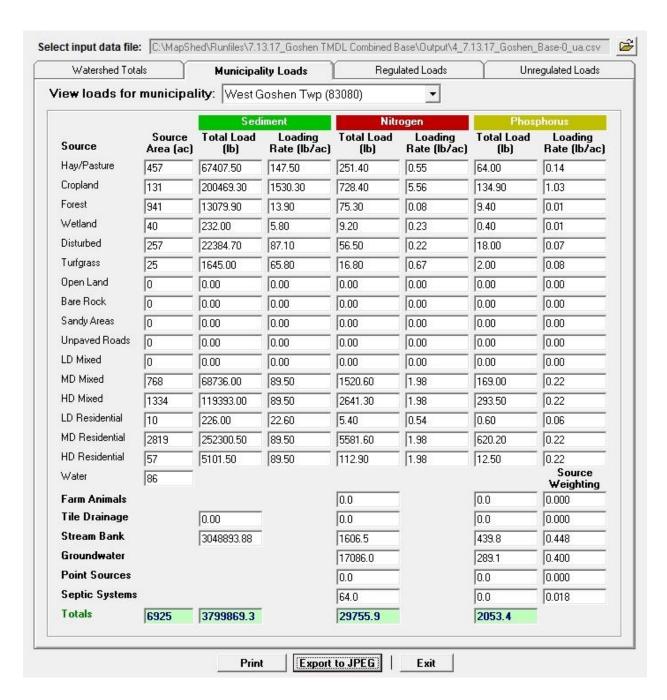
Baseline Pollutant Load - MapShed Baseline Load Input Exhibit



<u>Baseline Modeled Area Pollutant Load</u> – MapShed Baseline Pollutant Loads by Source for Entire Modeled Area

Area	Runoff	Tons		Total Loads (Pounds)			
(Acres)	(in)	Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
1759	1.4	1094.2	129.8	428.4	975.2	103.5	253.2
586	3.6	3780.9	448.4	1367.5	3257.0	85.5	602.6
2832	1.1	165.8	19.7	136.4	219.3	7.1	29.8
210	5.2	5.1	0.6	46.4	48.9	2.4	3.1
568	7.6	208.6	24.7	19.3	123.6	9.5	38.1
143	0.9	39.7	4.7	76.5	96.4	5.5	11.0
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	4.3	0.0	0.1	1.1	4.0	0.2	0.4
1226	11.9	0.0	54.8	740.1	2429.3	104.9	273.6
2474	16.9	0.0	110.7	1493.7	4902.7	211.8	552.2
563	4.3	0.0	6.3	85.0	303.0	12.0	32.3
6847	7.2	0.0	306.4	4134.9	13571.9	586.3	1528.6
373	10.0	0.0	16.7	225.3	739.6	31.9	83.3
					0.0		0.0
			0.0		0.0		0.0
			3698.8		3897.8		1067.0
				42715.0	42715.0	722.8	722.8
				0.0	0.0	0.0	0.0
				3557.8	3557.8	0.0	0.0
17588.9	7.10	5294.3	4821.7	55027.5	76841.5	1883.4	5198.0
	1759 586 2832 210 568 143 0 0 0 0 7 1226 2474 563 6847 373	fAcres finl 1759 1.4 586 3.6 2832 1.1 210 5.2 568 7.6 143 0.9 0 0.0 0 0.0 0 0.0 0 0.0 7 4.3 1226 11.9 2474 16.9 563 4.3 6847 7.2 373 10.0	Area (Acres) Hunoli (in) Erosion 1759 1.4 1094.2 586 3.6 3780.9 2832 1.1 165.8 210 5.2 5.1 568 7.6 208.6 143 0.9 39.7 0 0.0 0.0 0 0.0 0.0 0 0.0 0.0 0 0.0 0.0 7 4.3 0.0 1226 11.9 0.0 2474 16.9 0.0 563 4.3 0.0 6847 7.2 0.0 373 10.0 0.0	Area (Acres) Funds (in) Erosion Sediment 1759 1.4 1094.2 129.8 586 3.6 3780.9 448.4 2832 1.1 165.8 19.7 210 5.2 5.1 0.6 568 7.6 208.6 24.7 143 0.9 39.7 4.7 0 0.0 0.0 0.0 0 0.0 0.0 0.0 0 0.0 0.0 0.0 0 0.0 0.0 0.0 0 0.0 0.0 0.0 7 4.3 0.0 0.1 1226 11.9 0.0 54.8 2474 16.9 0.0 110.7 563 4.3 0.0 6.3 6847 7.2 0.0 306.4 373 10.0 0.0 16.7	Fund Fund Frosion Sediment Dissolved N	Frosion Sediment Dissolved N Total N 1759	Parison Pari

<u>Baseline Combined TMDL Planning Area Pollutant Load</u> - MapShed Baseline Load Calculation Results for Planning Area



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

Existing BMP, EX - 01 Pollutant Reduction - MapShed EX-01 BMP Input Exhibit

etrofits			New Develop	ment —				
MP Type			BMPType					
Rain Garden / Bioretentio	on	<u>+</u>	Select BMP Type			_		
Area Treated (ha) —	_ Existing Area	a (ha) —	⊢Area Develop	ed (ha)	Area Repla	ced (ha)	Existing Area	a (ha)
D Residential 0	LD Residential	228	LD Residential	0	Hay/Pasture	0	Hay/Pasture	712
MD Residential 52.2	MD Residential	2771	MD Residential	0	Cropland	0	Cropland	237
ID Residential 0	HD Residential	151	HD Residential	0	Forest	0	Forest	1146
D Mixed 0	LD Mixed	3	LD Mixed	0	Disturbed	0	Disturbed	230
MD Mixed 0	MD Mixed	496	MD Mixed	0	Turfgrass	0	Turfgrass	58
HD Mixed 0	HD Mixed	1001	HD Mixed	0	Open Land	0	Open Land	0
			The state of the s	12	III and the second			_
Rainfall Captured Depth (cm)	2.54	1	Total		Total II Captured (2.5 h (cm) 7.10			2383
Rainfall Captured Depth (cm) 2 Volume (m3) 6	d (2.54 cm = 1 in) 2.54 Ru	in]	Total	Rainfe Depti	III Captured (2.5 h (cm) 7.10 ne (m3) 0 ated Reduction	4 cm = 1	in) Run	2383
Rainfall Captured Depth (cm) 2 Volume (m3) 6	d (2.54 cm = 1 in) 2.54 Ru 8892 action Efficiency 0.70 TSS 0.	in]	Total Street Sweep Fraction of area	Rainfa Deptl Volur Calcul TN 0.0	Il Captured (2.5 h (cm) 7.10 ne (m3) 0 ated Reduction	4 cm = 1	in) Run	
Rainfall Captured Depth (cm) 2 Volume (m3) 6 Calculated Redu TN 0.60 TP	d (2.54 cm = 1 in) 2.54 Ru 8992 action Efficiency 0.70 TSS 0. width (m) 1 ated (0-1) 0	in 75	-Street Sweep	Rainfa Deptl Volur Calcul TN 0.0	Ill Captured (2.5 h (cm) 7.10 me (m3) 0 ated Reduction TP 0.00 (0-1) 1.000 cal C Vacuum	4 cm = 1	Run 27	Editor cy Editor

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

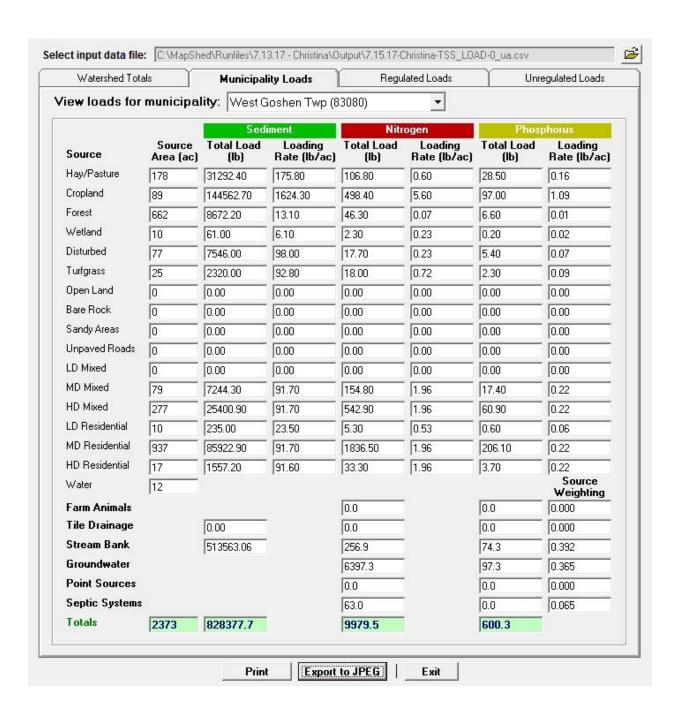
	Area	Runoff	Tons		Total Loads (Pounds)			
Source	(Acres)	(in)	Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	1759	1.4	1094.2	129.8	428.4	975.2	103.5	253.2
Cropland	586	3.6	3780.9	448.4	1367.5	3257.0	85.5	602.6
Forest	2832	1.1	165.8	19.7	136.4	219.3	7.1	29.8
Wetland	210	5.2	5.1	0.6	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
Jnpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
_D 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

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

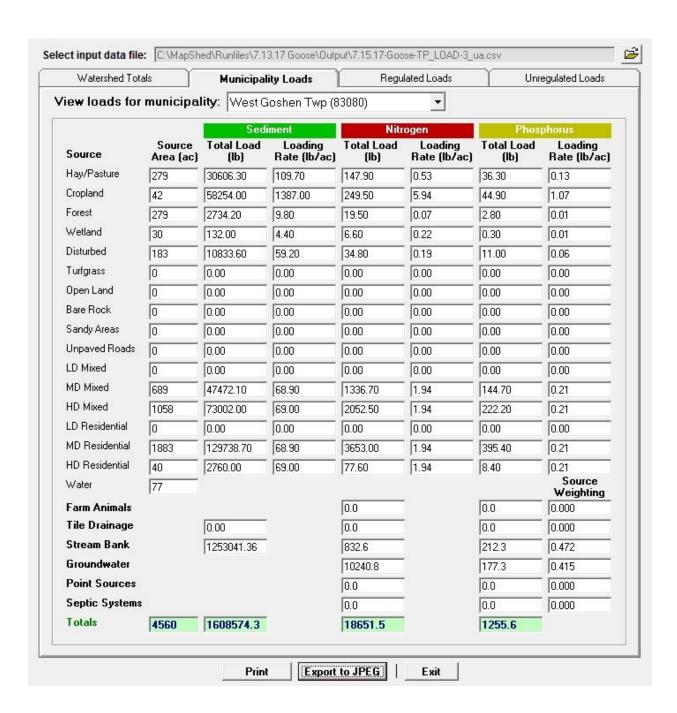
Total Existing BMP Sediment Load Reduction = 56,800 lbs/yr

Combined TMDL Planning Area Sediment Load = 3,799,969.3 lbs - 56,800 lbs = <u>3,743,069.3 lbs</u>

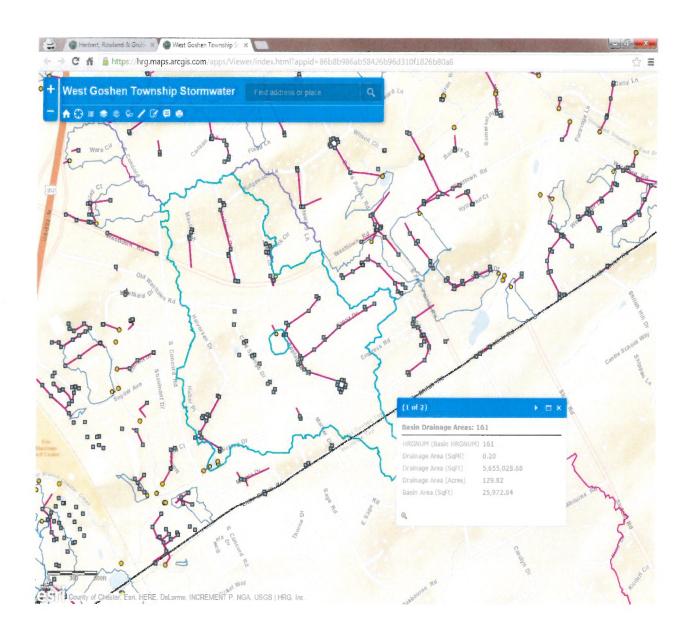
<u>Existing Pollutant Load for Christina River Basin</u> – Used to calculate remaining Long-term sediment load reductions.



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



EXISTING BMP EX-01 DETAILS	





Aquascapes Unlimited

Acknowledgement

P.O. Box 364

Township of Goshen 1025 Paoli Pike West Chester, PA 19380

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

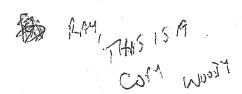
Ship Date	Order Num
7/14/2009	661

	ATTN: Kent Wise RE: Bicking basin				
		P.O. No.	Terms	Ship Via	· -]
			Net 30	UPS	
	Description	Qty	Rate	Total	۲.
フーナーニーナー	Eleocharis palustris PL/72 Mirmulus ringens (Monkey Flower) PL/72 Carex sp. PL/72 Lobelia cardinalis (Cardinal Flower) PL/72 Eupatorium perfoliatum (Boneset) PL/72 Juncus Affusus PNUS Hibiscus moscheutos (Swamp Rose Mallow) PL/72 Acorus americana (Sweet Flag) PL/72 Verbena hastata (Blue Vervain) PL/72 Box/Packing Fee Shipping/ Handling Fee (TBD based on UPS Charges) Notes: (I I med a tax exempt for world the 6%.	k with a	P.O.	50.40 201.60 50.40 50.40 50.40 50.40 4000	
	(3) Hove fax back w/ s	ignature. et	PA-	C. C	
				while the search of the search	
	If your and the same of the sa	S	Subtotal	8648.40	
	If your order is correct, please sign and date below and return by FAX 215-766-8986. Thank you	S	Sales Tax		
			Total	2501810	



G & A CLANTON, INC.

350 LAKE ROAD AVONDALE, PA 19311



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		Descrip	tion	Price Each	Amount
15.95 6.37	SCREENED TOP SOIL SCREENED TOP SOIL		ON ON 10/7/08 ON ON 10/7/08			75
	**	10				
	•	. 0				,
				į.		
	·			reg.#		-
				P.O.# Account#		
				Amount		-
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		granders of the grand of the control of the grander than			. car urr m more in	
hank you for ye	our business.	1 1/2 % IN	TEREST AFTER 3	30 DAYS		
	9 (90) 1900 (90 (1900) 1900 (Total	\$123,65

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



Invoice

Date	Invoice#
10/10/2008	39168

Bill To

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

Ship To	
ROAD DEPT	

P.O. No.	Terms	Due Date	Rep)	Ship Via	Ordered
VERBAL	2% 10 Net 30	11/9/2008			PICK UP	MARK
Item	Desc	ription	C	Ordered	Rate	Amount
MG24	24 STD METAL GRA	Reg. # P.O. # Account # Amount Authorized		1		
Thank you for y	our business.			Sı	ıbtotal	\$149.38
	¥			Sa	ales Tax ()	60.00
				T	otal	\$149.33

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	F	Rep	Ship Via	Ordered
VERBAL	2% 10 Net 30	10/17/2008			PICK UP	MARK
Item	Descr	ription		Ordered	Rate	Amount
T2415	24 X 15 PE DBL WAI PE X PE	LL CORR TEE P	EX	1	25	4000
MMCPL18	18 MARMAC POLYS	SEAL COUPLER		1	86.	
Freight	FRT-IN SHIPPING CI	HARGE		1		
	Reg.# P.O.# Account# Amount Authorized					
			eratuma puri melartia serian			
Thank you for yo	ur business.			Sı	ubtotal	
•					ales Tax ()	30.00
				Te	otal	6441.08



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

O	Date Vendor Number 0/21/08 003728	Date Required	Freight Method/	Terms		ent/Location
LN		ption/Part Numl	per	QTY	ADMINISTRATI Cost Each	Ext. Price
	Design of plant locations for verehabilitated Bi stormwater basin 01446-30270	egetating th cking Drive	and ne	1.0 Each		
The Company of						
	PPROVED FOR PURCHASE California J. (PPROVED FOR PAYMENT	ing	DATE 10/27/08		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

<u>Proposed BMP Project Sheets</u>

Pollutant Load Reduction Calculations (MapShed Exhibits)

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

Retrofits		New Development		
ВМР Туре		BMP Type		
Rain Garden / Bioretentio	n 🔻	Select BMP Type		
Area Treated (ha) —	Existing Area (ha)	- Area Developed (ha) -	Area Replaced (ha)	Existing Area (ha) Hay/Pasture 712
MD Residential 14.6	MD Residential 2771	MD Residential 0	Cropland 0	Cropland 237
HD Residential 0	HD Residential 151	HD Residential 0	Forest 0	Forest 1146
LD Mixed 0	LD Mixed 3	LD Mixed 0	Disturbed 0	Disturbed 230
MD Mixed 0	MD Mixed 496	MD Mixed 0	Turfgrass 0	Turfgrass 58
HD Mixed 0	HD Mixed 1001	HD Mixed 0	Open Land 0	Open Land 0
Total 15	Total 4650	Total 0	Total 0	Total 2383
Depth (cm) 2		Volu	th (cm) 7.10 me (m3) 0 - lated Reduction Efficien	Run
- Calculated Redu	0.00 TSS 0.00	TN O.	00 TP 0.00 TSS	0.00
Calculated Redu TN 0.00 TP	0.00 TSS 0.00	Street Sweeping		0.00 Rural BMP Editor
Calculated Redu TN 0.00 TP tream Protection egetative buffer strip	0.00 TSS 0.00 width (m) 10.7	Street Sweeping Fraction of area treated	1 (0-1) 1.000	Rural BMP Editor
Calculated Redu TN 0.00 TP tream Protection – egetative buffer strip	0.00 TSS 0.00 width (m) 10.7	Street Sweeping	I (0-1) 1.000 cal C Vacuum	Rural BMP Editor BMP Efficiency Editor
Calculated Redu TN 0.00 TP tream Protection— egetative buffer strip raction of streams tre	width (m) 10.7	Street Sweeping Fraction of area treated Sweep Type • Mechani	I (0-1) 1.000 cal C Vacuum	Rural BMP Editor
- Calculated Redu	width (m) 10.7 ated (0-1) 0.150 g areas (km) 66.3	Street Sweeping Fraction of area treated Sweep Type • Mechani Times/m Jan 0 Apr 0	I (0-1) 1.000 cal C Vacuum	Rural BMP Editor BMP Efficiency Editor

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

	Area	Runoff		Tons		Total Lo	ads (Pounds)	
Source	(Acres)	(in)	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
Jnpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
_D 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
_D 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

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

LD Residential 0 MD Residential 12.1 HD Residential 0 LD Mixed 0	Existing Area (ha) LD Residential 228 MD Residential 2771 HD Residential 151	BMP Type Select BMP Type Area Developed LD Residential MD Residential	(ha) — Area Replac		ing Area (ha) —
Area Treated (ha) LD Residential 0 MD Residential 12.1 HD Residential 0 LD Mixed 0	Existing Area (ha) LD Residential 228 MD Residential 2771	Area Developed		ced (ha) Existi	ng Area (ha) —
LD Residential 0 MD Residential 12.1 HD Residential 0 LD Mixed 0	LD Residential 228 MD Residential 2771	LD Residential 0			ng Area (ha) —
MD Residential 12.1 HD Residential 0 LD Mixed 0	MD Residential 2771		Hay/Pasture	n u.s/	
HD Residential 0		MD Residential 0		nay/	Pasture 712
_D Mixed 0	HD Residential 151		Cropland	0 Cropl	land 237
- Inmod		HD Residential 0	Forest	0 Fores	st 1146
MD Mived D	LD Mixed 3	LD Mixed 0	Disturbed	0 Distu	irbed 230
ino ilinoa	MD Mixed 496	MD Mixed 0	Turfgrass	0 Turfg	grass 58
HD Mixed 0	HD Mixed 1001	HD Mixed 0	Open Land	0 Oper	Land 0
Total 12	Total 4650	Total 0	Total	0 Tota	2383
Volume (m3) 1598 Calculated Reduction TN 0.60 TP 0.70	n Efficiency		Volume (m3) 0 Calculated Reduction N 0.00 TP 0.00	Efficiency TSS 0.00	
ream Protection	th (m) 10.7	Street Sweeping Fraction of area tre		Rura	I BMP Editor

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

	Area	Runoff	Tons			Total Lo	ads (Pounds)	
Source	(Acres)	(in)	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
Jnpaved 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

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

BMP-03 Stre	am 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

<u>Proposed BMP-04B Pollutant Load Reduction</u> - MapShed BMP-04B Input Exhibit for bioretention only

Retrofits		New Development				
ВМР Туре		BMP Type				
Rain Garden / Bioretenti	on 🔻	Select BMP Type		•		
Area Treated (ha)	Existing Area (ha)	-Area Developed (ha)	Area Replac	ed (ha) 🔠	Existing Are	a (ha) —
LD Residential 0	LD Residential 228	LD Residential 0	Hay/Pasture	0	Hay/Pasture	712
MD Residential 18.4	MD Residential 2771	MD Residential 0	Cropland	0	Cropland	237
HD Residential 0	HD Residential 151	HD Residential 0	Forest	0	Forest	1146
LD Mixed 0	LD Mixed 3	LD Mixed 0	Disturbed	0	Disturbed	230
MD Mixed 0	MD Mixed 496	MD Mixed 0	Turfgrass	0	Turfgrass	58
HD Mixed 0	HD Mixed 1001	HD Mixed 0	Open Land	0	Open Land	0
Total 18	Total 4650	Total 0	Total	0	Total	2383
	d (2.54 cm = 1 in)		all Captured (2.54 th (cm) 7.10			
Depth (cm) Volume (m3) Calculated Red	3.81 Run	Dep Volu	th (cm) 7.10 ume (m3) 0 ulated Reduction I	Ro	un	
Depth (cm) Volume (m3) Calculated Red	3.81 Run 3644 Run	Dep Volu	th (cm) 7.10 ume (m3) 0 ulated Reduction I	Ru	un	
Depth (cm) Volume (m3) Calculated Redu TN 0.65 TP	3.81 Run 3644 Pun 364	Dep Volu Calcu TN [0	th (cm) 7.10 ume (m3) 0 ulated Reduction 0 .00 TP 0.00	Ru	un	Editor
Depth (cm) Volume (m3) Calculated Redu TN 0.65 TP	3.81 Run 3644 Pun 364	Calcu TN C Street Sweeping Fraction of area treater Sweep Type Mechan	th (cm) 7.10 ume (m3) 0 ulated Reduction I 00	Ru	.00 Rural BMP BMP Efficien	cy Editor
Depth (cm) Volume (m3) Calculated Redu TN 0.65 TP tream Protection -	3.81 Run 3644 Pun 364	Calcu TN C Street Sweeping Fraction of area treate	th (cm) 7.10 ume (m3) 0 ulated Reduction I 00	Efficiency TSS 0	00 Rural BMP	cy Editor
Depth (cm) Volume (m3) Calculated Redu TN 0.65 TP tream Protection - egetative buffer strip raction of streams tre	3.81 Run 3644 uction Efficiency 0.76 TSS 0.82 width (m) 10.7 eated (0-1) 0.150 ag areas (km) 66.3	Calcu TN C Street Sweeping Fraction of area treater Sweep Type • Mechar Times/	th (cm) 7.10 ume (m3) 0 ulated Reduction I 0.00 TP 0.00 d (0-1) 1.000 ical C Vacuum month	Efficiency TSS 0	.00 Rural BMP BMP Efficien	cy Editor

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

	Area	Runoff	Tons			Total Loads (Pounds)		
Source	(Acres)	(in)	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

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

<u>Proposed BMP-05B Pollutant Load Reduction</u> - MapShed BMP-05B Input Exhibit for bioretention only

Retrofits		New Development			
ВМР Туре		BMP Type			
Rain Garden / Bioretentic	on 🔻	Select BMP Type		•	
Area Treated (ha) —	Existing Area (ha)	Area Developed (ha)	Area Replaced	d (ha) – Existing Are	ea (ha) —
LD Residential 0	LD Residential 228	LD Residential 0	Hay/Pasture 0	Hay/Pasture	712
MD Residential 75	MD Residential 2771	MD Residential 0	Cropland 0	Cropland	237
HD Residential 0	HD Residential 151	HD Residential 0	Forest 0	Forest	1146
LD Mixed 0	LD Mixed 3	LD Mixed 0	Disturbed 0	Disturbed	230
MD Mixed 0	MD Mixed 496	MD Mixed 0	Turfgrass 0	Turfgrass	58
HD Mixed 0	HD Mixed 1001	HD Mixed 0	Open Land 0	Open Land	0
Total 75	Total 4650	Total 0	Total 0	Total	2383
	d (2.54 cm = 1 in)		all Captured (2.54 c th (cm) 7.10		
Depth (cm) 3 Volume (m3) 1 Calculated Redu	8.81 Run 4853	Dep Volu	th (cm) 7.10 Ime (m3) 0	Run	
Depth (cm) 3 Volume (m3) 1 Calculated Redu	A853 Run detion Efficiency	Dep Volu Calcu	th (cm) 7.10 Ime (m3) 0	Run ficiency TSS 0.00	
Depth (cm) 3 Volume (m3) 1 Calculated Redu TN 0.65 TP	Run 4853 Auction Efficiency 0.76 TSS 0.82	Dep Volu - Calcu TN 0	th (cm) 7.10 the (m3) 0 thated Reduction Eff	Run	Editor
Depth (cm) 3 Volume (m3) 1 Calculated Redu TN 0.65 TP	9.81 Run 4853 Run 0.76 TSS 0.82 width (m) 10.7	Calcu TN 0 Street Sweeping Fraction of area treated Sweep Type	th (cm) 7.10 th (cm) 7.10 tme (m3) 0 tlated Reduction Eff 00 TP 0.00 d (0-1) 1.000 ical C Vacuum	Run ficiency TSS 0.00 Rural BMP BMP Efficier	ncy Editor
Depth (cm) 3 Volume (m3) 1 Calculated Redu TN 0.65 TP tream Protection egetative buffer strip	8.81 Run 4853 action Efficiency 0.76 TSS 0.82 width (m) 10.7 ated (0-1) 0.150	Calcu TN 0 Street Sweeping Fraction of area treated	th (cm) 7.10 th (cm) 7.10 tme (m3) 0 tlated Reduction Eff 00 TP 0.00 d (0-1) 1.000 ical C Vacuum	Run ficiency TSS 0.00	ncy Editor
Depth (cm) 3 Volume (m3) 1 Calculated Redu TN 0.65 TP tream Protection egetative buffer strip raction of streams tre	9.81 Run 4853 Run 4853 Run 9.76 TSS 0.82 Run 9.76 TSS 0.82 Run 9.76 Run 9.7	Street Sweeping Fraction of area treated Sweep Type	th (cm) 7.10 th (cm) 7.10 tme (m3) 0 tlated Reduction Eff .00 TP 0.00 d (0-1) 1.000 ical © Vacuum	Run ficiency TSS 0.00 Rural BMP BMP Efficier	ncy Editor

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

	Area	Runoff		Tons		Total Lo	ads (Pounds)	
Source	(Acres)	(in)	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

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<u>lbs/yr</u>

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 = $0.42 \times 100 = 42\%$

BMP-01 Hamilton Drive Detention Basin Retrofit

West Goshen Township, Chester County

General Information

Ownership: Private
Impacted Properties: 1
Watershed: Lower East Branch Brandywine

Location

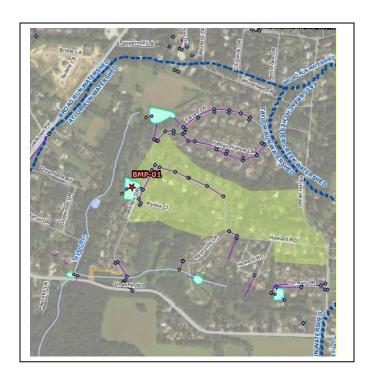
Latitude: 39.995733 Longitude: -75.611727

Pollutant Load Reduction

Sediment Reduction (lbs/yr): 13,800 Cost (\$/lb) 10.86

Secondary Benefits

Protects private property: Yes
Protects infrastructure: Yes
Publically accessible: Yes



- Over-excavate basin floor, install modified soils
- Vegetate basin w/ wetland species
- Vegetate surrounding area w/ native trees & shrubs
- Conduct stabilization of basin berm and adjacent streambank

BMP-02 Farren Drive Detention Basin Retrofit

West Goshen Township, Chester County

General Information

Ownership: Private
Impacted Properties: 1
Watershed: Lower East Branch Brandywine

Location

Latitude: 39.998006 Longitude: -75.612304

Pollutant Load Reduction

Sediment Reduction (lbs/yr): 13,200 Cost (\$/lb) 10.86

Secondary Benefits

Protects private property: Yes
Protects infrastructure: Yes
Publically accessible: Yes



- Modify existing outfall structure
- Over-excavate basin floor, install modified soils
- Vegetate basin w/ wetland species
- Vegetate surrounding area w/ native trees & shrubs
- Conduct stabilization of basin berm and adjacent streambank

BMP-03 Hagerty Lane Stream Restoration

West Goshen Township, Chester County

General Information

Ownership: Private
Impacted Properties: 2
Watershed: Chester Creek
Stream Restoration Length (ft): 1,150

Location

Latitude: 39.948947 Longitude: -75.581787

Pollutant Load Reduction

Stream Restoration TSS

(lbs/yr): 132,250 Cost (\$/lb) 4.14

Secondary Benefits

Protects private property: Yes
Publically accessible: Yes

- Existing outfalls to be evaluated
- Existing culvert crossings to be evaluated
- Erosion and sediment deposits to be addressed
- Extend riparian buffer



BMP-04A Westtown Road Stream Restoration

West Goshen Township, Chester County

General Information

Ownership: Private
Impacted Properties: 2
Watershed: Chester Creek
Stream Restoration Length (ft): 1,725

Location

Latitude: 39.958095 Longitude: -75.584041

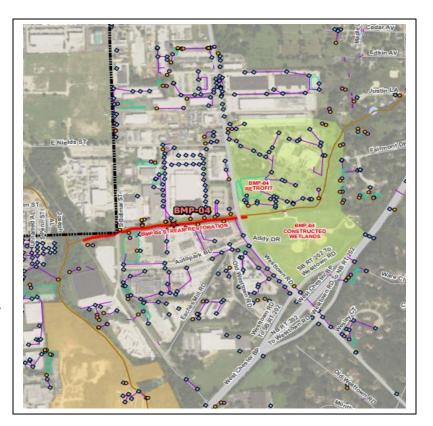
Pollutant Load Reduction

Stream Restoration TSS

(lbs/yr): 198,375 Cost (\$/lb) 4.14

Secondary Benefits

Protects private property: Yes
Protects infrastructure: Yes
Publically accessible: Yes



- Existing outfalls to be evaluated
- Existing culvert crossings to be evaluated
- Erosion and sediment deposits to be addressed
- Extend riparian buffer

BMP-04B Westtown Road Retrofits

West Goshen Township, Chester County

General Information

Ownership: Private
Impacted Properties: 2
Watershed: Chester Creek
Stream Restoration Length (ft): 1,725

Location

Latitude: 39.958200 Longitude: -75.584607

Pollutant Load Reduction

Sediment Reduction (lbs/yr): 20,600 Cost (\$/lb) 10.86

Secondary Benefits

Protects private property: Yes
Protects infrastructure: Yes
Publically accessible: Yes

ENICIDEST ENICIPIES ENICIPIES

- Existing outfalls to be evaluated
- Existing culvert crossings to be evaluated
- Streambank cutting and erosion to be address
- Extend riparian buffer and/or wetland plantings
- Over-excavate existing basin floor, install modified soils
- Revegetate existing basin w/ wetland species
- Install native trees and shrubs

BMP-05A Basin Road Stream Restoration

West Goshen Township, Chester County

General Information

Ownership: Public
Impacted Properties: 1
Watershed: Chester Creek
Stream Restoration Length (ft): 430

Location

Latitude: 39.963242 Longitude: -75.567053

Pollutant Load Reduction

Stream Restoration TSS (lbs/yr): 49,450 Cost (\$/lb) 2.47

Secondary Benefits

Protects private property: Yes
Protects infrastructure: Yes
Publically accessible: Yes

Construction of Annual Construction of Annual

- Address severe streambank erosion upstream of basin
- Install vegetative streambank stabilization
- Conduct minor regrading of streambanks
- Erosion and sediment deposits to be addressed

BMP-05B Basin Road Detention Basin Retrofit

West Goshen Township, Chester County

General Information

Ownership: Public
Impacted Properties: 1
Watershed: Chester Creek

Location

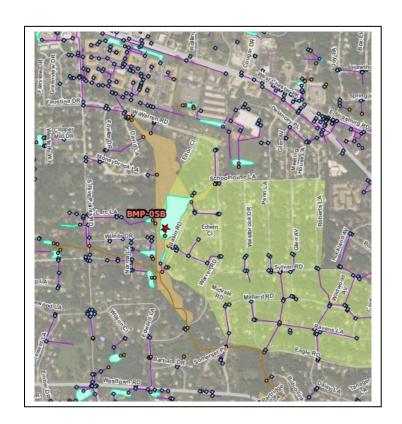
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Pollutant Load Reduction

Sediment Reduction (lbs/yr): 84,000 Cost (\$/lb) 4.98

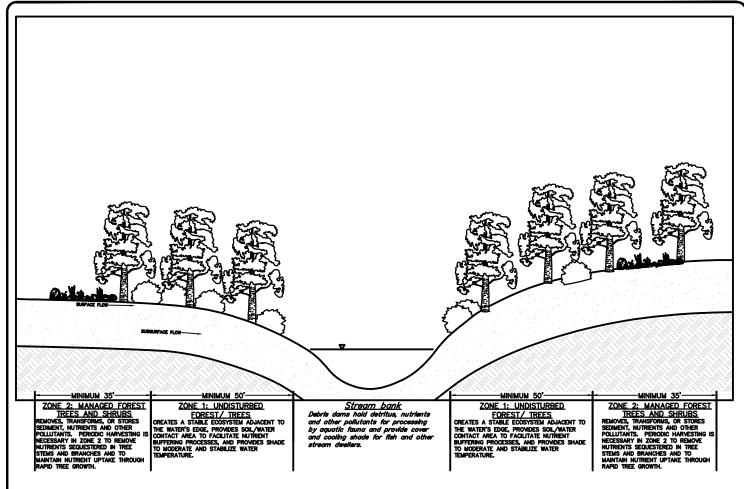
Secondary Benefits

Protects private property: Yes
Protects infrastructure: Yes
Publically accessible: Yes



- Modify/replace existing outlet control structures
- Install sediment forebay upstream of basin
- Over-excavate existing basin floor, install modified soils
- Revegetate basin w/ wetland species
- Install native trees and shrubs
- Install meadow filter strip

<u>sign Details</u>		



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.
- THE RIPERIAN FOREST BUFFER MANAGEMENT PLAN SHALL CONSIST OF THE FOLLOWING:

XX TOWNSHIP

- 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.



369 East Park Drive Harrisburg, PA 17111 (717) 564-1121 Fax (717) 564-1158 ing@ing-inc.com www.hrg-inc.com

RIPARIAN BUFFER DETAIL FOR

COST ESTIMATION

XX COUNTY

PENNSYLVANIA

PROJ. MGR. - ***

DESIGN- ***

CADD- ***

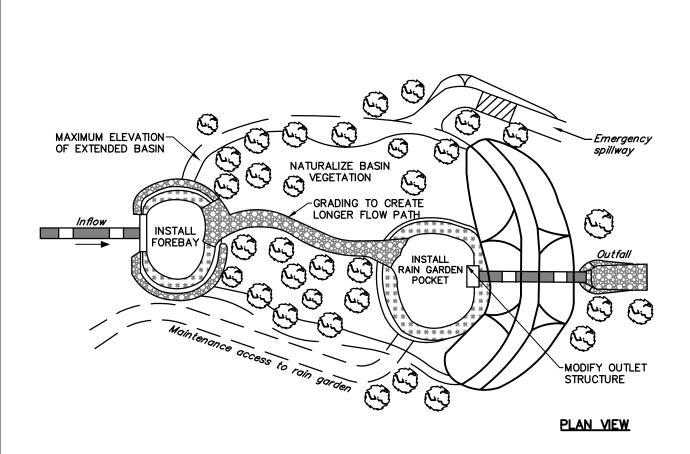
CHECKED- ***

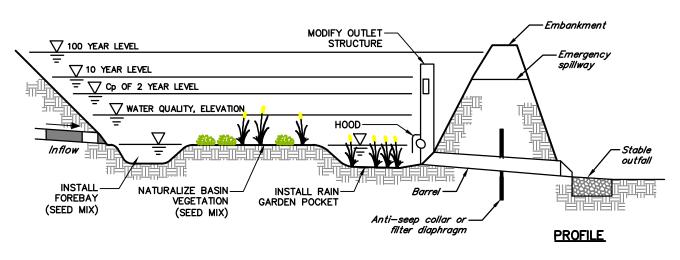
SCALE- NOT TO SCALE

DATE- XX-XX-2017

PROJECT ***

The server S. Vittel McA. Duth Coat E-though into Darton Buffers American Buffers American Man 20 1012 41450mm manner





TYPICAL BASIN RETROFIT DETAIL

NOT TO SCALE

XX TOWNSHIP



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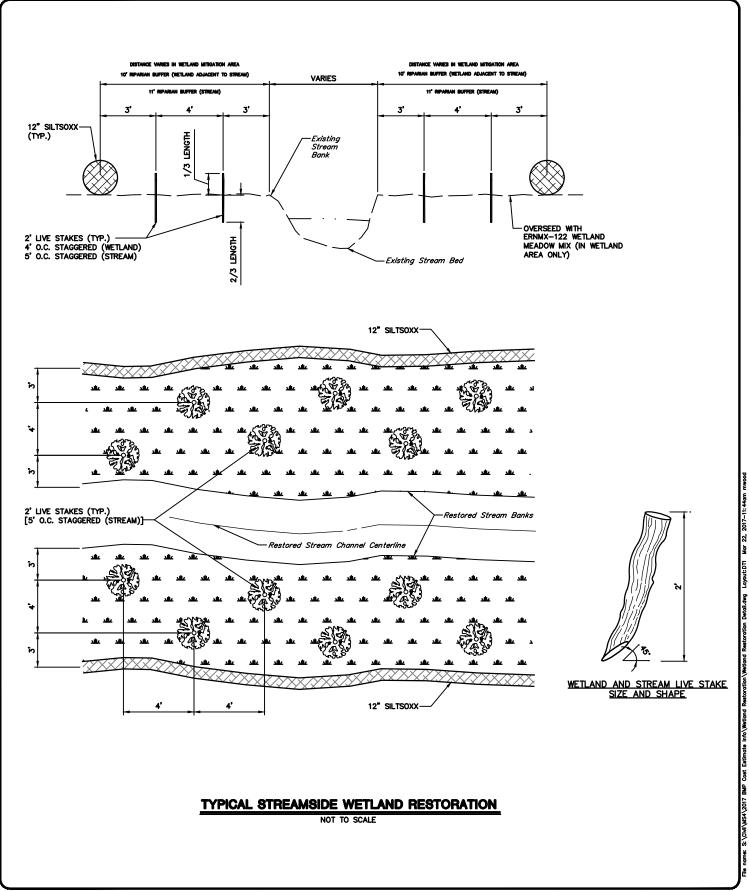
BASIN RETROFIT DETAIL FOR

COST ESTIMATION XX COUNTY

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PENNSYLVANIA

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XX TOWNSHIP

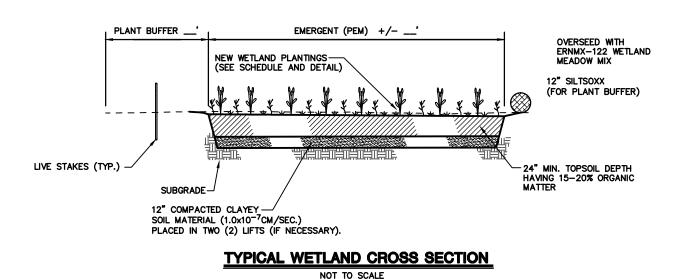
WETLAND RESTORATION DETAIL FOR

COSTESTIMATION	
XX COUNTY	PENNSYLVANIA

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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 F	RATE: 15 LB PER ACRE, OR 1/3	- 1/2 LB PER 1,000 SQ. FT.



Higher E. Rowland & Grahad Inc.
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WETLAND RESTORATION DETAIL FOR

COST ESTIMATION

XX TOWNSHIP XX COUNTY

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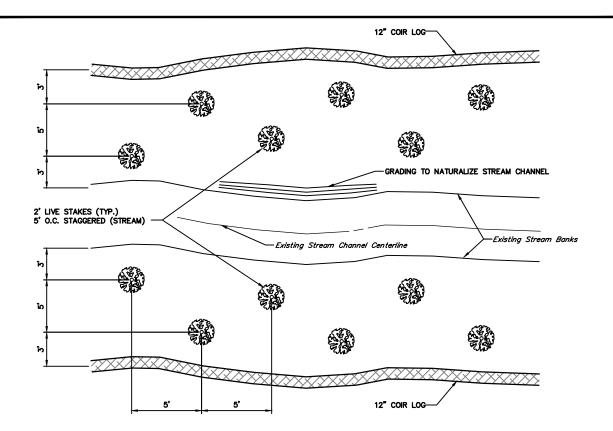
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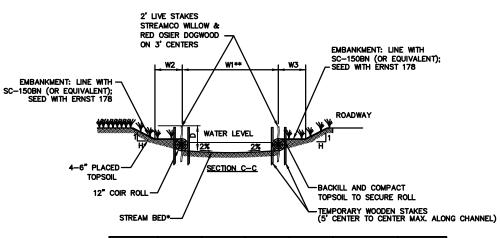
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TYPICAL STREAM RESTORATION CONFIGURATION DETAIL

NOT TO SCALE



SWALE NO.	WIDTH	WIDTH	WIDTH	DEPTH	LONGITUDINAL	SIDE SLOPE
	W1**	W2	W3	D	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

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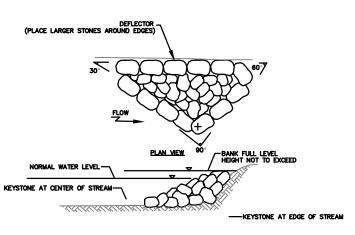
1. BOULDERS SHALL BE A MINIMUM APPROXIMATE SIZE OF 4' DEEP BY 2' HIGH BY 4' LONG.

2. STAGGER JOINTS BETWEEN BOULDERS IN SUCCESSIVE ROWS.

3. GEOTEXTILE SHALL CONFORM TO PENINDOT PUB. 408, SECTIONS 212 AND 735.

4. WALL FACE BATTER SLOPE SHOULD BE A MAXIMUM OF 114-4V, HOWEVER IF FIELD CONDITIONS DO NOT ALLOW FOR MINIMUM SPACING REQUIREMENTS FOR TYPE 2-S GUIDERAIL AND EDGE OF MACADAM PER PENINDOT 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



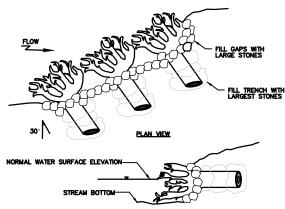
SECTION VIEW

- 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 6" IN LEWGTH 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 SHOULD REST ON THE STREAM BOTTOM OR IT SHOULD BE ONE-THEN 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

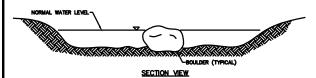
COST ESTIMATION

XX TOWNSHIP XX COUNTY PENNSYLVANIA

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PLAN VIEW



- NOTES:

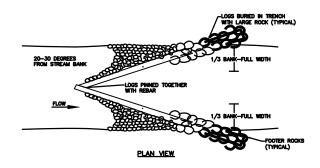
 1. PLACE BOULDERS IN THE MIDDLE THIRD OF THE WETTED WIDTH OF THE STREAM TO PREVENT FLOW DEFLECTION INTO THE STREAM BANKS.

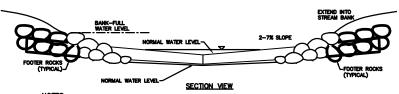
 2. BOULDER SHOULD BE LARGE ENOUGH NOT TO BE DISPLACED DURING HIGH FLOW PERIODS.

 3. DRAWING IN REFERENCE TO PA FISH AND BOAT COMMISSION STANDARD DRAWINGS OF HABITAT STRUCTURES.

RANDOM BOULDER PLACEMENT DETAIL

NOT TO SCALE

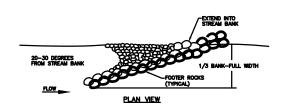


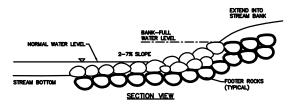


NOTES:
1. DRAWING IN REFERENCE TO PA FISH AND BOAT COMMISSION STANDARD DRAWINGS OF HABITAT STRUCTURES.

LOG CROSS VANE DETAIL

NOT TO SCALE

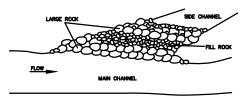




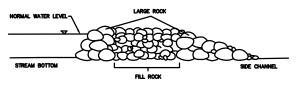
NOTES:
1. DRAWING IN REFERENCE TO PA FISH AND BOAT COMMISSION STANDARD DRAWINGS OF HABITAT STRUCTURES.

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

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IN-STREAM RESTORATION DETAIL FOR

COST ESTIMATION

XX TOWNSHIP

XX COUNTY

PENNSYLVANIA

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