Dewberry

ARCHITECTS ENGINEERS CONSULTANTS

Chesapeake Bay Pollutant Reduction Plan for Individual MS4 Permit

Antrim Township, Franklin County, PA

September 2017

SUBMITTED BY:

Dewberry Engineers Inc.

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SUBMITTED TO:

PA Department of Environmental Protection

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Appendices

Introduction

This report is prepared on behalf of Antrim Township, Franklin County, PA. Antrim Township is located entirely within the Chesapeake Bay watershed, draining to the Bay via tributaries to the Potomac River. Antrim Township occupies 70.3 square miles (approximately 45,000 acres) and had a population of approximately 15,000 in the 2010 census. About 10% of the Township (4,348 Acres) is located within urbanized area (UA) #36190 for Hagerstown MD, which also includes portions of WV, and PA. Of the UA, approximately 16% (678 acres) is impervious.

Project Location

Antrim Township is located along Pennsylvania's southern border with the state of Maryland in south-central Franklin County. The Township completely surrounds the Borough of Greencastle and is bordered by Montgomery, Peters, St. Thomas, Hamilton, Guilford, Quincy, and Washington Townships. Interstate 81 runs north to south through the Township between exits 10 and 1.

Plan Preparer's Qualifications

Name of Plan Preparer:

J. Michael Hess, P.E.
Dewberry Engineers Inc.
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Formal Education:

Pennsylvania State University
B.S. – Environmental Systems Engineering

Relevant Experience:

Prepared MS4 permit applications and annual updates for:

- Windsor Township, York County
- Fairview Township, York County

- Upper Allen Township, Cumberland County
- Lemoyne Borough, Cumberland County

Prepared regional watershed studies for:

- Fishing Creek in Red Lion Borough, Windsor Borough, and Windsor Township, York County.
- Bumble Bee Hollow Creek in Upper Allen Township, Cumberland County
- Regional Flooding Analysis for storm sewer system in Lower Paxton Township, Dauphin County.

Prepared Stormwater Management Plans and Calculations for:

- Defense Logistics Agency Susquehanna, Fairview Township, York County
- Cobbs Creek Parkway Green Stormwater Infrastructure, City of Philadelphia
- Multiple PennDOT roadway improvements projects.
- Multiple institutional, commercial, and residential land development projects.

Stream Classification and Description

The western portion of the Township drains to the Conococheague Creek either directly or via a number of small tributary streams. Muddy Run is the largest such tributary, running northeast to southwest in the northern portion of the Township. Southeastern portions of the Township flow to Marsh Run. The Conococheague Creek discharges to the Potomac River near Williamsport, MD. Marsh Run discharges to the Antietam Creek near Hagerstown, MD and Antietam Creek discharges to the Potomac in Antietam, MD. The classification of each receiving stream within the Township is as follows:

- <u>Muddy Run</u>
  - Existing Use: None
  - Designated Use: High Quality – Cold Water Fishery
  - Impairment status: Tentative for Pathogens - source unknown. Several tributaries to Muddy Run have an impairment status of “Approved” for pathogens – source unknown.
  - TMDL Status: No TMDL

- Conococheague Creek
  - Existing Use: None
  - Designated Use: Warm Water Fishery
  - Impairments: None, however several unnamed tributaries to the Conococheague Creek have an impairment status of "Approved" for pathogens – source unknown.
  - TMDL Status: No TMDL

- Marsh Run
  - Existing Use: None
  - Designated Use: Warm Water Fishery
  - Impairments: Impairment status approved for pathogens – source unknown
  - TMDL Status: No TMDL

It should be noted that none of the receiving streams have been assigned a TMDL. In addition, the stream impairments within the Township are not due to sedimentation or nutrient pollution. The PRP instructions* indicate that "*A PRP is also not required to be attached to the NOI or individual permit application if the applicant is not eligible for a waiver but has completed its mapping of all stormwater outfalls and can demonstrate the following: There are no stormwater discharges to local surface waters impaired for nutrients or sediment."* Because none of the identified impairments in Antrim Township's streams are due to nutrients or sediment, no PRP for impaired waterways is included with this application.

* Document titled "National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges from Small Municipal Separate Storm Sewer Systems Pollutant Reduction Plan (PRP) Instructions," document number 3800-PM-BCW0100k.

Methodology

The methodology employed in the PRP analysis is as follows:

1. Determination of the PRP Planning Area: The note under section II.B of the PRP instructions states, "*In addition, a municipality entirely within the Chesapeake Bay Watershed with no local surface water impairments may elect to consider the entire urbanized area within its municipality as the PRP Planning Area, and calculate the existing loading using that area."* The PRP Planning area has therefore been identified as the entire UA within the Township boundary.

2. Mapping of impervious surfaces: Within the UA, roadway areas were mapped using LiDAR breaklines. Building and parking areas were delineated by hand using aerial photography. The roadway and building/parking area values were summed to determine the total impervious area within the UA.

3. Calculation of the sediment load via the Simplified Method: Per section I.B of the PRP instructions, "*…it is expected that, overall within the Bay watershed, the TP (5%) and TN (3%) goals will be achieved when a 10% reduction in sediment is achieved."* Accordingly, the pollutant loads and pollutant reductions were based solely on the TSS parameter. To do so, the sediment loading rates for Franklin County's pervious and impervious areas were determined from Attachment B of the PRP instructions and multiplied by the corresponding area values.

4. Calculation of the required pollutant load reduction: The required pollutant reduction was determined by multiplying the calculated sediment load by 10 percent.

5. Selection and preliminary sizing of BMPs needed to achieve the load reduction: Seven BMP types were selected for possible implementation based upon their construction and operation and maintenance (O&M) requirements. For each of the 7 BMP types, the impervious area and pervious area necessary to generate the required pollutant load was calculated, and the size of the BMP footprint was approximated. For infiltration-based BMP's, the footprint size was based upon a 3:1 loading ratio for impervious areas or 8:1 for all areas due to Antrim Township's karst geology. For stream restoration, the BMP size was based upon a rate of 44.88 lbs/ft/year as prescribed by the simplified method.

6. Conduct a field investigation of potential BMP implementation sites: The plan preparer and Township staff conducted a desktop analysis, plan review, and field investigation of potential BMP implementation sites. Several potential sites were ruled out due to concerns over loading rates or site access. Of the remaining sites, several potential sites emerged as candidates for future BMP implementation.

Findings

The steps described above calculated the following pollutant load values:

Parameter	Value
Urbanized Area (UA)	4,348 Ac
Impervious UA	678 Ac
Impervious Loading Rate*	1,944.85
Pervious UA	3,670 Ac
Pervious Loading Rate*	308.31
TSS Pollutant Load	2,450,107 lb/yr
Required TSS Reduction	245,011 lb/yr

*Values provided in the PRP instructions for simplified method

A map is provided in Appendix A to detail the sediment load analysis.

Recommendations

In order to maintain compliance with the PRP requirements as cost effectively as possible, we recommend that the Township adopt a strategy of additional analysis and BMP implementation. This strategy should be enacted over the course of the 5-year permit. The following sections discuss the additional analysis, BMP implementation, and phased approach.

Additional Analysis:

The calculations employed in this analysis rely upon PADEP's simplified method. It is likely that this methodology is conservative and that a detailed analysis using the SWMM or CAST modeling tools would decrease the calculated sediment load, increase the BMP pollutant removal efficiencies, or both. It is recommended that the Township perform a detailed analysis in the first year of the permit term. Doing so could significantly decrease the extent of BMP's necessary to achieve the required pollutant load reduction, thereby decreasing costs. The BMP Implementation section that follows provides sizing data based upon the findings of the simplified method and therefore represents a "worst case" scenario.

BMP Implementation

Several methods were employed to identify potential BMP implementation sites and then narrow the field down to the most favorable locations. These methods include desktop analysis of available mapping, review of construction plans, and a field view with Township staff. The following table details these efforts:

Site	Review Methods	Findings
Truck Stop Facility on John Wayne Drive	Mapping, Aerial Photo, Plans	Unfavorable due to lined basin and history of spills on the site
Kauffman Development	Aerial Photo, Plans, Site Visit	Unfavorable due to lack of existing conveyance facilities and space to implement BMP
Sherwood Development	Aerial Photo, Plans, Site Visit	Unfavorable due to lack of existing conveyance facilities and space to implement BMP
Kauffman Community Center	Aerial Photo, Plans, Site Visit	Favorable. Perform additional analysis
Township Building Property	Aerial Photo, Mapping, Site Visit	Favorable. Perform additional analysis
Stream Restoration Sites A, B, and C	Aerial Photo, Mapping	Favorable. Perform additional analysis

Additional analysis was then performed to determine the cost effectiveness of BMP implementation on each of the favorable sites. For the Kauffman Community Center and Township Building Sites, a conceptual BMP design was prepared, the potential pollutant removal was calculated, and a construction cost was estimated. For the stream restoration sites, a cost per linear foot value was applied based upon construction cost data on similar projects. It was determined that stream restoration is the most cost effective option by a wide margin. It was also determined that the total length of stream available on the stream restoration sites is sufficient to achieve the required pollutant reduction.

A discussion of each analyzed alternative is provided below. It should be noted that the costs provided herein are expected construction costs, but do not include the cost of design, permitting, or easement or real estate acquisition. Property owner negotiations will be undertaken in permit years 1 and 2, and the selection of sites and project lengths within each site will be determined on the basis of cost effectiveness once property acquisition costs are determined. Design, permitting, and inspection costs will vary depending upon the restoration sites selected, and whether or not a detailed pollutant loading analysis is undertaken to decrease the magnitude of restoration efforts required. However, additional costs in the range of 10-20% of the construction cost are standard in the industry for design, permitting, and inspection, and the values reported here should be escalated accordingly. Values reported here are in 2017 dollars, and inflation between now and the date construction contract(s) are awarded will also escalate costs somewhat.

- Stream Restoration: *Recommended Alternative*

  The analysis determined that the entire sediment reduction requirement of 245,011 lbs/year can be addressed through stream restoration. Using the rate of 44.88 lbs/yr specified in the PRP instructions for the simplified method, a total of 5,460 LF of stream restoration is required. Three stream restoration sites have been identified which meet the requirements of the "Considerations of Stream Restoration Projects in Pennsylvania for Eligibility as an MS4 Best Management Practice" document dated June 22, 2017. The potential stream restoration areas at those sites have lengths of 3,657 LF at Site A, 6,086 LF at Site B, and 634 LF at Site C for a total of 10,377 LF of stream restoration opportunity. This value is nearly double the 5,460 LF of stream restoration required, so the Township has flexibility in selecting stream restoration sites depending upon each property owner's degree of cooperation, as long as the minimum length is achieved. The Township will enter into negotiations with the Site A, B, and C property owners in an attempt to secure conservation easements for the stream restoration project(s) of sufficient length. If no such agreement can be reached, additional sites will be pursued and detailed in future annual updates to the MS4 permit.

Stream Restoration Cost Effectiveness	
Estimated Construction Cost	$1,540,000.00
Estimated Pollutant Removal (lb/yr)	245,011
Cost Effectiveness ($ per lb of sediment per year)	$6.28

- Infiltration Basin: *Not recommended at this time due to cost*

  While infiltration facilities have a high sediment removal efficiency, the ability to implement them in Antrim Township is limited due to the underlying Karst Geology and the corresponding low loading rates that must be observed to minimize the potential for sinkhole formation. However, one site, the Kauffman Community Center, was identified for a potential infiltration BMP due to the area available relative to the tributary drainage area. The Kauffman Community Center infiltration basin is estimated to have a 2,390 lbs/yr sediment removal potential. However this option is not recommended because it carries a significantly higher unit cost per pound of sediment removal than stream restoration does.

Infiltration Basin Cost Effectiveness	
Estimated Construction Cost	$279,000.00
Estimated Pollutant Removal (lb/yr)	2,390
Cost Effectiveness ($ per lb of sediment per year)	$116.73

- Bioretention: *Not recommended at this time due to cost*

  A bioretention facility was analyzed for the Township building site to treat runoff from the adjacent parking and storage areas. This area presents an opportunity to capture significant sediment loadings in a limited amount of space due to the tributary area characteristics. Immediately north of the BMP site is a gravel “anti-skid” stockpile area which is anticipated to generate significant stone dust fines in the runoff stream. Farther north is a parking and building area which is almost entirely impervious. South of the BMP site is a recycling drop-off area which is surfaced with compacted gravel and may generate additional pollutants. A bioretention facility in this area would not be designed to infiltrate but would be equipped with an underdrain, and discharge to an existing culvert under Interstate 81. While it is anticipated that the facility in this area would require regular maintenance due to its pollutant loading, it is located on Township property and in an area where both workers and equipment are readily available. The Township building bioretention basin is estimated to have a 3,480 lbs/yr sediment removal potential. However this option is not recommended because it

carries a significantly higher unit cost for sediment removal than stream restoration does.

Bioretention Cost Effectiveness	
Estimated Construction Cost	$268,000.00
Estimated Pollutant Removal (lb/yr)	3,480
Cost Effectiveness ($ per lb of sediment per year)	$77.01

Phased Schedule of Implementation

The following schedule of implementation is recommended:

- Year 2017
  - Complete Public Participation task and file a permit amendment. (Please refer to the following section titled “Public Participation”)

- Year 2018:
  - Revise the PRP if necessary as a result of the public participation task and include this revision in the first annual update.
  - Complete detailed pollutant loading analysis and revise PRP if necessary for the first annual update. Determine revised stream restoration area as a result of the detailed analysis. This step is optional but recommended due to its potential to decrease construction costs.
  - Begin easement negotiations with stream restoration site owners.

- Year 2019:
  - Conclude easement negotiations with stream restoration site owners.
  - Complete preliminary engineering design for stream restoration sites. Begin permitting for stream restoration sites.

- Year 2020:
  - Complete permitting for stream restoration sites. Complete final engineering design and construction documents.
  - Construct roughly one third of the required stream restoration

- Year 2021:
  - Construct roughly one third of the required stream restoration

- Year 2022:
  - Construct the remainder of the required stream restoration

Public Participation

Due to scheduling constraints, public participation tasks were not completed prior to submission of the MS4 permit application. Antrim Township proposes to perform these tasks after the permit submission and file a follow-up permit amendment. The amendment will describe the public involvement efforts undertaken, the comments and responses received from stakeholders, and any modifications to the PRP that have been implemented in response to the comments. A schedule of the tasks to be performed is as follows:

- Week of 9/25/2017 to 9/29/2017: Run newspaper advertisement at least two times to inform the public that the PRP is available for review.

- 10/24/2017: Discuss the PRP at a regular meeting of the Antrim Township Board of Supervisors.

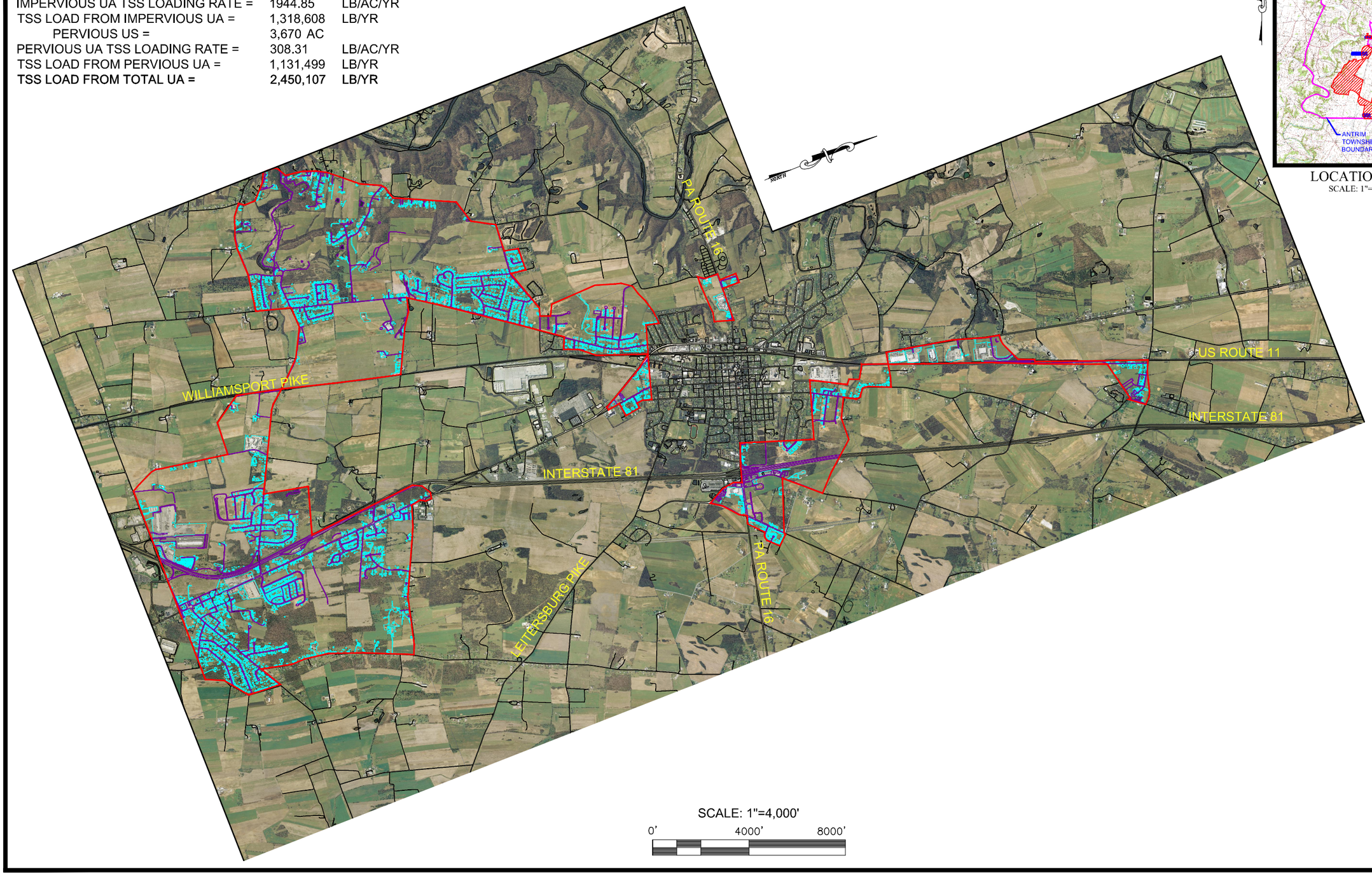
- 10/31/2017: Close of public comment period

- 11/1/2017 to 11/15/2017: Document comments and draft responses. Prepare a list of recommended PRP changes for the first annual update if necessary.

- 11/17/2017: Submit Permit Amendment to PADEP.

Appendix A: Impacts Exhibit

TOWNSHIP AREA =	45,000	AC
URBANIZED AREA (UA) =	4,348	AC
IMPERVIOUS AREA =	678	AC
IMPERVIOUS UA TSS LOADING RATE =	1944.85	LB/AC/YR
TSS LOAD FROM IMPERVIOUS UA =	1,318,608	LB/YR
PERVIOUS US =	3,670 AC	
PERVIOUS UA TSS LOADING RATE =	308.31	LB/AC/YR
TSS LOAD FROM PERVIOUS UA =	1,131,499	LB/YR
TSS LOAD FROM TOTAL UA =	**2,450,107**	**LB/YR**



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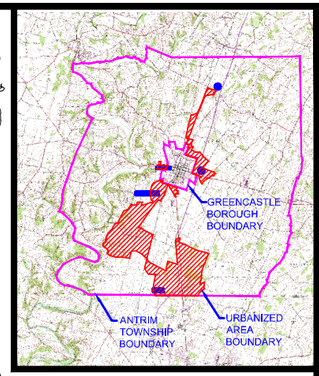

LOCATION MAP
SCALE: 1"= 30,000 '

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LEGEND
URBANIZED AREA BOUNDARY LINE
IMPERVIOUS ROADWAY AREA BOUNDARY LINE
IMPERVIOUS BUILDING AREA BOUNDARY LINE

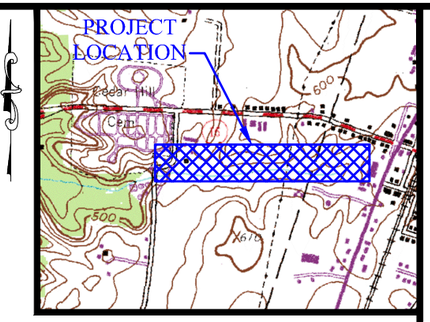
ANTRIM TOWNSHIP MS4 CHESAPEAKE BAY POLLUTANT REDUCTION PLAN IMPACTS EXHIBIT

ANTRIM TOWNSHIP

PENNSYLVANIA

Drawn by:	SWK
Designed by:	MRM
Checked by:	JMH
Date: 09/08/17	Sheet: 1 of 1
Scale: AS SHOWN	File number: 50070110

Appendix B: Mitigation BMP Exhibits



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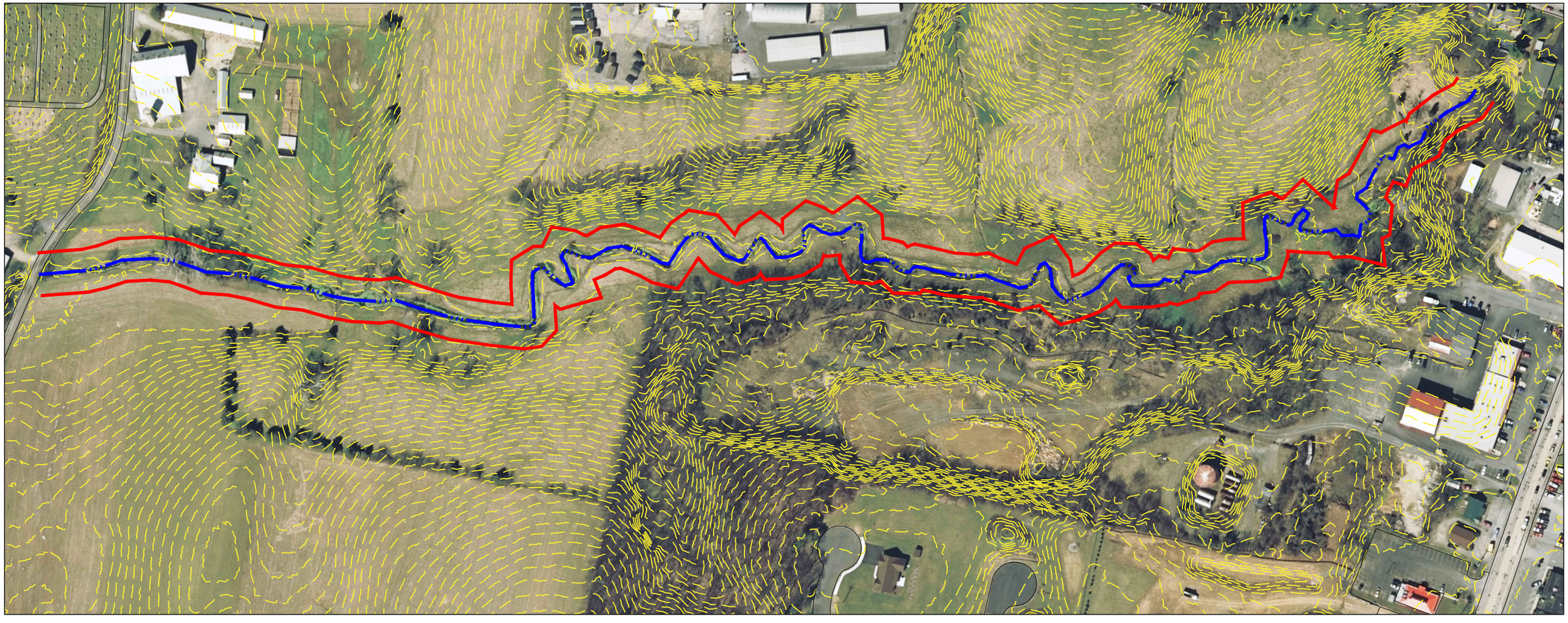

SCALE: 1"=200'
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MAX LENGTH OF STREAM RESTORATION =	3,657	FT
SEDIMENT REDUCTION RATE =	44.88	LB/FT/YR
MAX SEDIMENT REDUCTION =	164,126	LB/YR

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LEGEND
LIMITS OF STREAM RESTORATION
LIMITS OF RIPARIAN BUFFER RESTORATION

ANTRIM TOWNSHIP MS4 CHESAPEAKE BAY POLLUTANT REDUCTION PLAN
STREAM MITIGATION SITE A EXHIBIT

ANTRIM TOWNSHIP
PENNSYLVANIA

Drawn by:	SWK
Designed by:	MRM
Checked by:	JMH
Date: 09/08/17	Sheet: 3 of 5
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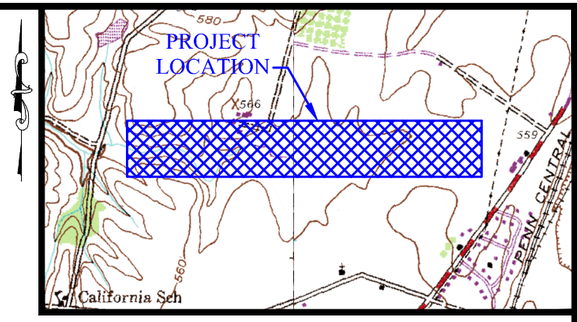

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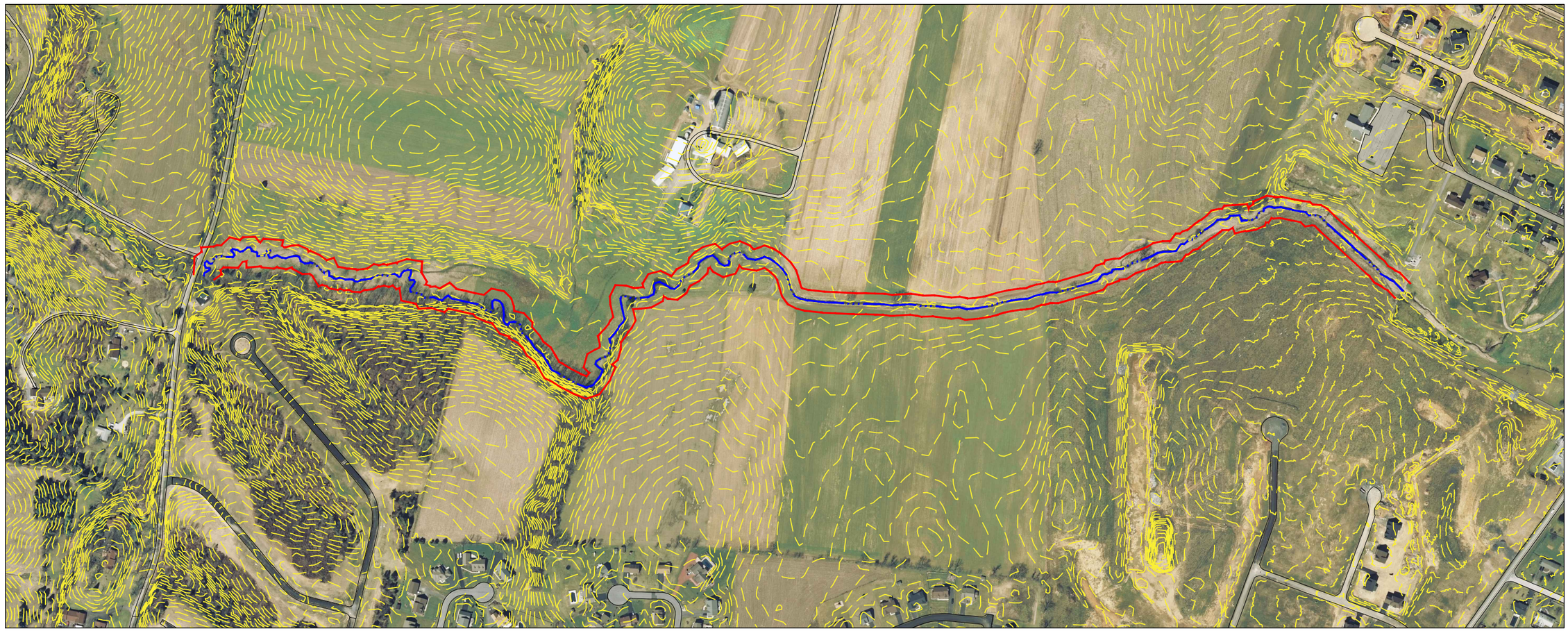

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MAX LENGTH OF STREAM RESTORATION =	6,086	FT
SEDIMENT REDUCTION RATE =	44.88	LB/FT/YR
MAX SEDIMENT REDUCTION =	273,140	LB/YR

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LEGEND
LIMITS OF STREAM RESTORATION
LIMITS OF RIPARIAN BUFFER RESTORATION

ANTRIM TOWNSHIP MS4 CHESAPEAKE BAY
POLLUTANT REDUCTION PLAN
STREAM MITIGATION SITE B EXHIBIT
PENNSYLVANIA
ANTRIM TOWNSHIP

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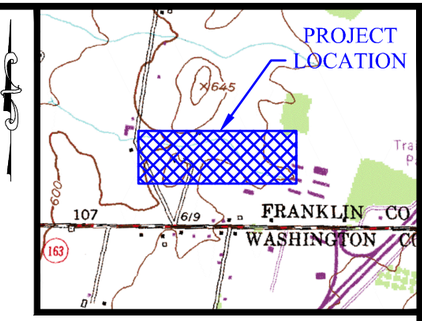

LOCATION MAP
SCALE: 1"= 2000 '

SCALE: 1"=100'
0' 100' 200'

MAX LENGTH OF STREAM RESTORATION =	634	FT
SEDIMENT REDUCTION RATE =	44.88	LB/FT/YR
MAX SEDIMENT REDUCTION =	28,454	LB/YR

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LEGEND
LIMITS OF STREAM RESTORATION
LIMITS OF RIPARIAN BUFFER RESTORATION

ANTRIM TOWNSHIP MS4 CHESAPEAKE BAY
POLLUTANT REDUCTION PLAN
STREAM MITIGATION SITE C EXHIBIT
ANTRIM TOWNSHIP PENNSYLVANIA

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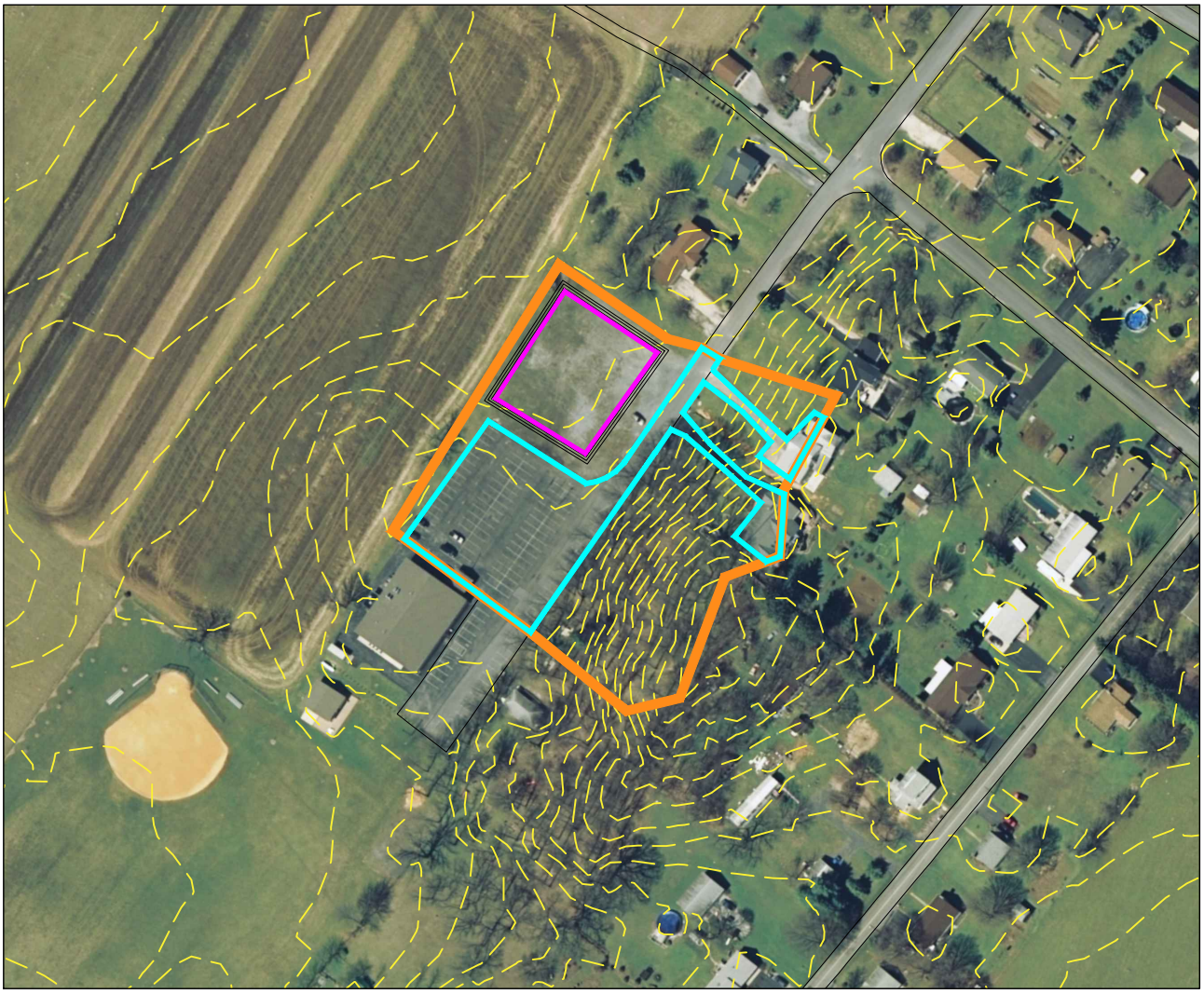

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LOCATION MAP

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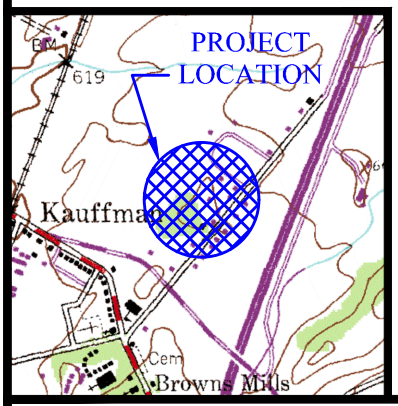

TOTAL DRAINAGE AREA TO BMP =	3.05	AC
IMPERVIOUS DRAINAGE AREA TO BMP =	0.96	AC
IMPERVIOUS TSS LOADING RATE =	1,944.85	LB/AC/YR
TSS LOAD FROM IMPERVIOUS DA =	1,867	LB/YR
PERVIOUS DRAINAGE AREA TO BMP =	2.09	AC
PERVIOUS TSS LOADING RATE =	308.31	LB/AC/YR
TSS LOAD FROM PERVIOUS DA =	646	LB/YR
TOTAL TSS LOAD TO BMP =	2,512	LB/YR
BMP REMOVAL EFFICIENCY =	95%	LB/YR
TSS REMOVAL =	**2,387**	**LB/YR**

LEGEND

OVERALL DRAINAGE AREA

IMPERVIOUS DRAINAGE AREA

BMP FOOTPRINT

ANTRIM TOWNSHIP MS4 CHESAPEAKE BAY POLLUTANT REDUCTION PLAN
KAUFFMAN COMMUNITY CENTER BMP SITE EXHIBIT
(NOT RECOMMENDED)

ANTRIM TOWNSHIP PENNSYLVANIA

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Drawn by:	SWK
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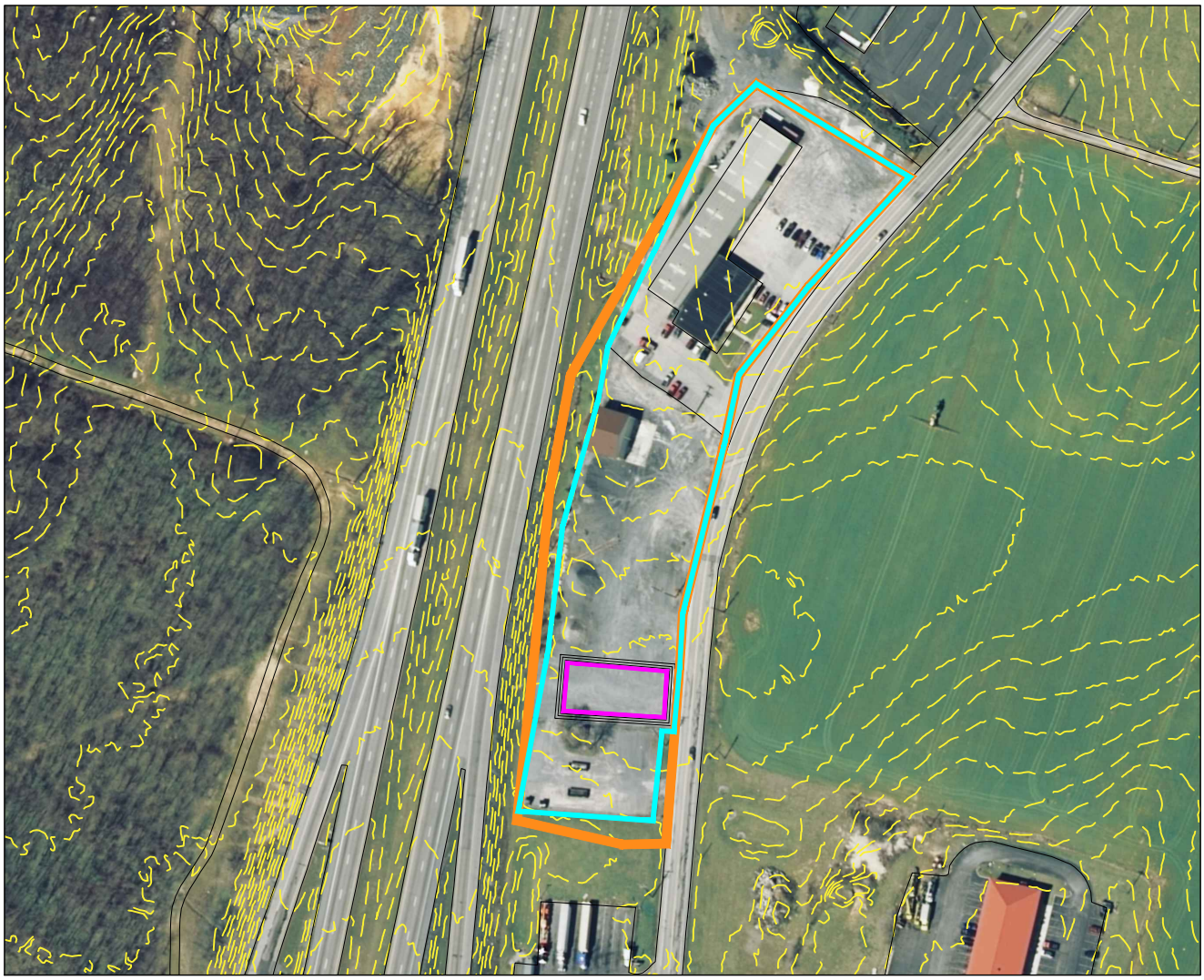

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LOCATION MAP

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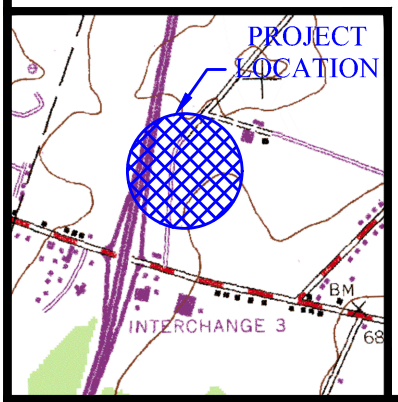

TOTAL DRAINAGE AREA TO BMP =	3.62	AC
IMPERVIOUS DRAINAGE AREA TO BMP =	3.19	AC
IMPERVIOUS TSS LOADING RATE =	1,944.85	LB/AC/YR
TSS LOAD FROM IMPERVIOUS DA =	6,197	LB/YR
PERVIOUS DRAINAGE AREA TO BMP =	0.43	AC
PERVIOUS TSS LOADING RATE =	308.31	LB/AC/YR
TSS LOAD FROM PERVIOUS DA =	133	LB/YR
TOTAL TSS LOAD TO BMP =	6,329	LB/YR
BMP REMOVAL EFFICIENCY =	55%	LB/YR
TSS REMOVAL =	**3,481**	**LB/YR**

LEGEND

- OVERALL DRAINAGE AREA
- IMPERVIOUS DRAINAGE AREA
- BMP FOOTPRINT

ANTRIM TOWNSHIP MS4 CHESAPEAKE BAY POLLUTANT REDUCTION PLAN TOWNSHIP BUILDING BMP SITE EXHIBIT (NOT RECOMMENDED)

ANTRIM TOWNSHIP PENNSYLVANIA

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Designed by:	MRM
Checked by:	JMH
Date:	09/08/17
Sheet:	2 of 5
Scale:	AS SHOWN
File number:	50070110

Appendix C: Calculations

Tile	Non-Road Impervious Area (sf)	Non-Road Impervious Area (acre)
15001960	477444	11
15001970	8887433	205
15001980	58329	2
16001960	4110044	95
16001970	807133	19
16001980		0
17001960	34312	1
17001970	2301151	53
17001980	300978	7
18001970	1947365	45
18001980		0
19001970		0
19001980	259104	6
	Total	444

Road Impervious Area (sf)	Road Impervious Area (acre)
10183388	234

Project total	**678**

Township Area	
Total Area (sf)	189,399,066
Total Area (ac)	4,348
Impervious Area (ac)	678
Pervious Area (ac)	3,670

	Pollutants Present	
	Impervious	Pervious
Area (ac)	678	3,670
TN (lb/ac/yr)	31.6	24.37
TN (lb)	21,425	89,438
TP (lb/ac/yr)	2.72	0.76
TP (lb)	1,844	2,789
TSS (lb/ac/yr)	1944.85	308.31
TSS (lb)	1,318,608	1,131,499

Pollutant Reduction	
TSS Total (lb/yr) =	2,450,107
10% TSS Pervious (lb/yr) =	113,150
10% TSS Impervious (lb/yr) =	131,861

Reduction TSS Required: 245,011 lb/yr

		Basin Township	Basin Kauffman	Stream Length	Unit Price	Total Price (Township)	Total Price (Kauffman)	Total Price (Stream Restoration)
Excavation Class 1 (basins)	CY	869.0	2154.4		$20.00	$17,380.00	$43,088.89	
Excavation Class 4 (pipes)	CY	2250.0	1250.0		$27.00	$60,750.00	$33,750.00	
Pipes (18")	LF	100	50		$116.00	$11,600.00	$5,800.00	
Inlets (Type M)	EA	4	0		$2,000.00	$8,000.00	$0.00	
Outlet	EA	1	1		$900.00	$900.00	$900.00	
Amended Soils	CY	458.44	1253.78		$65.00	$29,798.89	$81,495.56	
No. 8 Aggregate	CY	90	90		$46.00	$4,140.00	$4,140.00	
8" Underdrain	LF	40	40		$17.00	$680.00	$680.00	
Seeding	lbs/SY	44.56	102.43		$25.00	$1,114.05	$2,560.83	
Plantings	SF	6189.0	16926.0		$3.00	$18,567.00	$50,778.00	
Swales Upgrade	LF	515			$120.00	$61,800.00	$0.00	
Stream Restoration	LF			5460	$225.00			$1,228,500.00

Total	$214,729.94	$223,193.28	$1,228,500.00
Total (with 25% Contingency)	$268,412.42	$278,991.60	$1,535,625.00

BMP	Sediment Removed	Total price for BMP	Price per lb of Sediment Removal
	lb	$	$/lb
Bioretention	3,481.18	$268,412.42	$77.10
Infiltration	2,386.81	$278,991.60	$116.89
Stream Restoration	239,210.40	$1,535,625.00	$6.42