Township of New Garden

MS4 Program

Updated Total Maximum Daily Load Plan (TMDL Plan)

For

Christina River Basin Sediment

&

Christina River Basin Nutrients

2018 – 2023 MS4 Permit

September 2020

ARRO Project No. 10843.75

ARRO Consulting, Inc.
108 West Airport Road
Lititz, PA 17543
717-569-7021

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1. INTRODUCTION

New Garden Township (Township), Chester County was classified as an urbanized area per the 2010 U.S. Census. The Pennsylvania Department of Environmental Protection (PA DEP) has notified the Township that they are required to renew the National Pollutant Discharge Elimination System (NPDES) Small Municipal Separate Storm Sewer Systems (MS4) permit. The requirements for New Garden Township are defined by the PA DEP MS4 requirements as:

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Chester County						
NEW GARDEN TWP	PAI130516	Yes	TMDL Plan, SP, IP	Bucktoe Creek	Appendix C-PCB (4a)	
				West Branch Red Clay Creek	Appendix C-PCB (4a)	
				Walnut Run	Appendix B-Pathogens (5)	Water/Flow Variability (4c)
				Unnamed Tributaries to East BranchWhite Clay Creek		Other Habitat Alterations (4c)
				Trout Run	Appendix C-Pesticides (4a)	
				Red Clay Creek	Appendix C-PCB (4a)	
				Egypt Run	Appendix B-Pathogens (5)	
				White Clay Creek	Appendix B-Pathogens (5)	
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	
				Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O. (4a)	
				East Branch White Clay Creek	Appendix B-Pathogens (5)	
				Broad Run	Appendix B-Pathogens (5)Water/Flow Variability (4c)	Water/Flow Variability (4c)

PA DEP has published the pollutant Aggregation suggestions for MS4 municipal requirements table; per the aggregation instructions, the aggregate total required reduction may be analyzed and BMP's may be implemented in the identified watersheds, tributary to the same HUC 12 watershed. The aggregated requirements for New Garden Township are:

MS4 Name	Permit Number	HUC 12 Name	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)
Chester County				
NEW GARDEN TWP	PAI130516	East Branch White Clay Creek, Red Clay Creek, West Branch Red Clay Creek	Bucktoe Creek, Red Clay Creek, Trout Run, West Branch Red Clay Creek	Appendix C-PCB, Pesticides
		East Branch White Clay Creek, Upper White Clay Creek	Broad Run, East Branch White Clay Creek, Egypt Run, Walnut Run, White Clay Creek	Appendix B-Pathogens
		East Branch White Clay Creek, Lower White Clay Creek, Red Clay Creek, Upper White Clay Creek, West Branch Red Clay Creek	Christina River Basin Nutrients, Christina River Basin Sediment	TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids

This Total Maximum Daily Load Plan (TMDL Plan) has been developed to satisfy the aggregate requirements of Pennsylvania Department of Environmental Protection's TMDL Plan Requirements.

2. TOTAL MAXIMUM DAILY LOAD PLAN (TMDL PLAN)

A. Public Participation

New Garden Township encouraged a plan that included public participation and buy in. The Township publicly advertised notice of public review, 30 day comment period and public meeting in the local paper on XXXXX; a copy of the advertisement is located in Appendix A.

The Township posted a copy of the complete draft Total Maximum Daily Load Plan on the Township Website prior to the public notice. A hard copy was also made available at the Township office during normal business hours.

The Township received written comment from XXXXX to XXXXX; a copy of all written comments is provided in Appendix B. A public meeting was held on XXXXX at XXXXX a summary of comments received is provided in Attachment C.

The Township would like to acknowledge the valuable input received from the public and Township staff in the development of the TMDL Plan. The Township's record of consideration for all timely comments received is provided in Attachment D. This TMDL Plan reflects careful planning of New Garden Township with respect to the impaired waters of the Commonwealth, local flooding, erosion problems, and the financial impact to the residents.

B. Updated Mapping

The New Garden MS4 TMDL Conveyance System map includes updated regulated Storm Sewer Sheds, Non-Regulated Storm Sewer Sheds, MS4 Conveyance System, Urbanized Area, and explanations for Parsing. New Storm Sewer Sheds were delineated for Illicit Discharge Detection and Elimination (IDD&E) Purposed. Mapping can be found in Attachment E

C. Analysis of TMDL Objectives

C.1 Long-Term Reduction

Long-Term Reduction necessitates that a plan is created that will lower the pollutant loading to the established Wasteload Allocations (WLAs) for the identified impaired waterways and the specific pollutants. New Garden Township's long-term reduction is detailed in the tables in the following sections. The Potential BMP's identified indicate that the Borough will be able to achieve the long-term reduction in future permit years.

C.2 Short-Term Reduction

Short-Term Reduction necessitates that a plan is established for achieving a pollutant load reduction of at least 10% for sediment, 5% for phosphorus, and 3% for nitrogen within the 5-year permit term. The TMDL Plan for New Garden Township is based upon the short-term reduction objective. The short-term reduction goal is summarized in the tables in the following sections.

D. Pollutants of Concern

New Garden Township, in accordance with the PA DEP Municipal requirements table and the impaired waters mapping provided herein, is subject to the following of the MS4 permit for the Brandywine-Christina Watershed. Two Environmental Protection Agency (EPA) documents were used for reference when determining TMDLs. These documents are *Revisions to Total Maximum Daily Loads for Nutrient and Low Dissolved Oxygen Under High-Flow Conditions Christina River Basin, Pennsylvania, Delaware, and Maryland* and *Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland*. The TMDLs are summarized below and in Attachment F. These TMDLs are currently the long term goals that New Garden plans to achieve in future permit cycles.

Average Annual Sediment Allocations						
Watershed	**Township**	**Baseline(ton/yr)**	**Baseline (lbs/year)**	**TMDL (ton/year)**	**TMDL(lb/year)**	**Percent Reduction**
Red Clay Creek Watershed	New Garden	4,709.65	9,419,300.00	2,118.72	4,237,440.00	55.01%
White Clay Creek Watershed	New Garden	6,746.50	13,493,000.00	2,986.66	5,973,320.00	55.73%
			22,912,300.00		10,210,760.00	

Average Annual Nitrogen Allocations						
Watershed	**Township**	**Baseline(kg/day)**	**Baseline (lbs/day)**	**Pennsylvania Allocation(kg/day**	**Pennslyvania Allocation (lbs/day)**	**Percent Reduction**
Red Clay Creek Watershed	New Garden	466.70	1,028.90	320.40	706.36	31.30%
White Clay Creek Watershed	New Garden	956.20	2,108.06	685.00	1,510.16	28.40%
			3,136.95		2,216.52	

Average Annual Phosphorus Allocations						
Watershed	**Township**	**Baseline(kg/day)**	**Baseline (lbs/day)**	**Pennsylvania Allocation**	**TMDL(lb/year)**	**Percent Reduction**
Red Clay Creek Watershed	New Garden	62.80	138.45	17.20	37.92	72.60%
White Clay Creek Watershed	New Garden	110.60	243.83	65.90	145.28	40.40%
			382.28		183.20	

E. Existing Loading for Pollutants of Concern

PA DEP's comment letter stated that the loading calculation may be conducted using the simplified method. Loading calculations were conducted for the entire urbanized area using PA DEP's *Statewide MS4 Land Cover Estimates* document. The Urbanized Area was calculated using The U.S. Census Bureau's 2010 Urbanized Area Geodatabase. The percentages of the Red Clay Creek Watershed and White Clay Creek Watershed within the urbanized area were calculated and aggregated per the aggregation instructions. The information is summarized below and in Attachment G:

New Garden Township

Base Pollutant Loading No Existing BMPs Summary:

New Garden Township Urbanized Area			Chester County Loading Rates			Pollutants of Concern lbs/year		
Total Area (ac)	**9,049.70**	**Acres**	**TSS**	**TP**	**TN**	**TSS**	**TP**	**TN**
% Pervious	0.86	7,802.08	185.12	0.36	14.09	1,444,320.20	2,808.75	109,931.24
% Impervious	0.14	1,247.63	1504.78	1.46	21.15	1,877,405.52	1,821.54	26,387.33
						3,321,725.72	**4,630.28**	**136,318.57**
						0.10	**0.05**	**0.03**
						332,172.57	**231.51**	**4,089.56**

F. Selected BMP's

New Garden Township identified proposed BMPs to reduce the loading within the TMDL watersheds. The proposed BMPs are detailed in Attachment H. The associated pollutant loading reductions for each proposed BMP were calculated and are provided in Attachment H; a summary description of the potential future BMPs evaluated is also provided in Attachment H. The percent of pollutant reductions for each potential future BMP were determined based upon the PA DEP BMP Effectiveness Value. New Garden Township evaluated the following factors in selection of the BMPs to be implemented achieve the required pollutant load reduction. These factors included:

- Return-on-investment for dollar per pound of pollutant removed
- Overall BMP cost
- Availability of land to implement BMPs
- Local flooding and erosion problems
- Drainage areas associated with identified waterways

New Garden Township

Proposed BMP Structures

				Required Reduction		
				332,172.57	*231.51*	*4,089.56*
BMP ID	**Watershed**	**BMP Type**	**Status**	**TSS (lbs/yr)**	**TP (lbs/yr)**	**TN (lbs/yr)**
COF001-BS1	Red Clay Creek	Bioswale	Proposed	52,902.20	51.39	845.00
COF002-BS1	White Clay Creek	Bioswale	Proposed	57,483.18	62.39	1,307.47
COF002-BS2	White Clay Creek	Bioswale	Proposed	28,013.21	30.25	628.06
COF003-BS1	White Clay Creek	Bioswale	Proposed	19,439.08	21.05	439.08
OF080-BS1	White Clay Creek	Bioswale	Proposed	16,630.60	22.19	624.35
OF092-BS1	White Clay Creek	Bioswale	Proposed	6,915.84	9.24	260.15
OF099-BS1	White Clay Creek	Bioswale	Proposed	12,598.72	14.64	343.98
OF040-BS1	Red Clay Creek	Bioswale	Proposed	23,396.95	27.07	631.55
OF058-BS1	White Clay Creek	Bioswale	Proposed	8,558.75	11.23	310.08
OF059-BS1	White Clay Creek	Bioswale	Proposed	28,954.86	36.92	985.22
OF110-BS1	White Clay Creek	Bioswale	Proposed	29,555.16	32.59	702.61
BS6	White Clay Creek	Bioswale	Proposed	8,150.91	9.99	253.54
OF053-BS1	White Clay Creek	Bioswale	Proposed	11,019.07	13.63	349.63
OF060-BS1	White Clay Creek	Bioswale	Proposed	5,704.64	6.30	136.38
OF025-BS1	White Clay Creek	Bioswale	Proposed	3,413.42	3.71	78.12
OF014-BS1	Red Clay Creek	Bioswale	Proposed	10,234.43	14.01	405.50
OF015-BS1	Red Clay Creek	Bioswale	Proposed	9,824.53	12.82	351.86
				332,795.55	***379.42***	***8,652.59***
				Reduction Met With Proposed BMPs		

G. Funding Mechanism

Proposed BMP construction will be funded through the Township's budget, as established through the General Fund. The General Fund revenues are based upon the Township's tax base, as regulated under the Township Code. Planning Estimates of Opinion of Probable Construction Cost information can be found in Attachment J and Return on Investment (ROI) information can be found in Attachment K.

New Garden Township
Proposed BMP Structures

BMP ID	Watershed	BMP Type	Status	Estimated Cost	$ per lb TSS	$ per lb TP	$ per lb TN
COF001-BS1	Red Clay Creek	Bioswale	Proposed	$60,099.00	1.14	1,169.46	71.12
COF002-BS1	White Clay Creek	Bioswale	Proposed	$22,694.10	0.39	363.75	17.36
COF002-BS2	White Clay Creek	Bioswale	Proposed	$32,381.70	1.16	1,070.43	51.56
COF003-BS1	White Clay Creek	Bioswale	Proposed	$32,381.70	1.67	1,538.55	73.75
OF080-BS1	White Clay Creek	Bioswale	Proposed	$23,860.20	1.43	1,075.26	38.22
OF092-BS1	White Clay Creek	Bioswale	Proposed	$22,694.10	3.28	2,457.00	87.23
OF099-BS1	White Clay Creek	Bioswale	Proposed	$28,201.68	2.24	1,926.32	81.99
OF040-BS1	Red Clay Creek	Bioswale	Proposed	$39,109.20	1.67	1,444.95	61.93
OF058-BS1	White Clay Creek	Bioswale	Proposed	$25,788.75	3.01	2,296.23	83.17
OF059-BS1	White Clay Creek	Bioswale	Proposed	$69,382.95	2.40	1,879.19	70.42
OF110-BS1	White Clay Creek	Bioswale	Proposed	$34,220.55	1.16	1,050.07	48.70
BS6	White Clay Creek	Bioswale	Proposed	$50,007.75	6.14	5,004.25	197.24
OF053-BS1	White Clay Creek	Bioswale	Proposed	$59,919.60	5.44	4,397.69	171.38
OF060-BS1	White Clay Creek	Bioswale	Proposed	$44,150.34	7.74	7,004.66	323.74
OF025-BS1	White Clay Creek	Bioswale	Proposed	$34,713.90	10.17	9,349.46	444.35
OF014-BS1	Red Clay Creek	Bioswale	Proposed	$66,826.50	6.53	4,768.66	164.80
OF015-BS1	Red Clay Creek	Bioswale	Proposed	$61,265.10	6.24	4,777.65	174.12
				$707,697.12	***Estimated Cost of Proposed BMPs***		

H. Responsible Parties for Operation and Maintenance (O&M) of BMPs

New Garden Township will own and operate any proposed BMPs for stormwater management and treatment. O&M requirements for future BMP's that may be required will be established at that time.

BMP COF001-BS1: Bioswale:

Location:	Existing swale on private property, parallel to the railroad North of 285 Scarlet Road discharging to the Observation point before COF001.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP COF002-BS1: Bioswale:

Location:	Existing swale on public property, South of 23 Firehouse Way.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP COF002-BS2: Bioswale:

Location:	Existing swale on private property, North East of 8821 Gap Newport Pike.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP COF003-BS1: Bioswale:

Location:	Existing swale on private property, North East of 323 Ellicot Road.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF040-BS1: Bioswale:

Location:	Existing swale on private property, east of 320 Buck Toe Road and terminating near OF040.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF058-BS1: Bioswale:

Location:	Existing swale on private property, west of 107 Heatherly Lane and terminating at approximately the tree line.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF059-BS1: Bioswale:

Location:	Existing swale on private property, south of 722 Penn Green Road.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF080-BS1: Bioswale:

Location:	Existing swale East of Barley Ct., and West of Penn Greed Rd, in the woods discharging to OF080.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF092-BS1: Bioswale:

Location:	Existing swale on private property East of Chaingate Cir., and West of Reynolds Road discharging to OF092.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF099-BS1: Bioswale:

Location:	Existing swale on private property Southwest of Chaingate Cir., discharging to OF099.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF110-BS1: Bioswale:

Location:	Existing swale on private property, East of 850 Southwood Road and starting at Southwood Road.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP BS6: Bioswale:

Location:	Existing swale on private property, north east 107 Cezanne Court.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF053-BS1: Bioswale:

Location:	Existing swale on private property, south of 540 Church Rd.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF060-BS1: Bioswale:

Location:	Existing swale on private property, east of Lavender Hill Lane.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF025-BS1: Bioswale:

Location:	Existing swale on private property, north of 307 Carlisle Dr.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF014-BS1: Bioswale:

Location:	Existing swale on private property, north east of 309 Pemberton Road.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

BMP OF015-BS1: Bioswale:

Location:	Existing swale on private property, north east of 263 S Thistle Down.
Responsible Party:	New Garden Township
O&M Activities:	Monitor storm sewer discharge areas and swale banks for scouring and erosion, immediately stabilize any areas of erosion. Maintain vegetation in natural state, where appropriate. Remove any invasive species that may develop.
Frequency of O&M Activities:	Complete inspection of the restored corridor a minimum of once a year. Complete restoration and/or selective vegetation management as needed based upon inspections.

I. TMDL Plan Implementation Schedule

Task	Implementation Date
MS4 Permit Authorization	
BMP COF001-BS1	March 2021
BMP COF002-BS1	March 2021
BMP COF002-BS2	March 2021
BMP COF003-BS1	March 2021
BMP OF040-BS1	March 2021
BMP OF058-BS1	March 2021
BMP OF059-BS1	March 2022
BMP OF080-BS1	March 2022
BMP OF092-BS1	March 2022
BMP OF099-BS1	March 2022
BMP OF110-BS1	March 2022
BMP BS6	March 2022
BMP OF053-BS1	March 2023
BMP OF060-BS1	March 2023
BMP OF025-BS1	March 2023
BMP OF014-BS1	March 2023
BMP OF015-BS1	March 2023
MS4 Permit Expiration	March 2023

ATTACHMENT A

PUBLIC NOTICE

ATTACHMENT B

WRITTEN PUBLIC COMMENTS

ATTACHMENT C

PUBLIC MEETING COMMENTS

ATTACHMENT D

RECORD OF CONSIDERATION OF ALL TIMELY COMMENTS RECEIVED

ATTACHMENT E

MAPPING OF NEW GARDEN

New Garden Township
MS4 TMDL Conveyance System

BMP ID	Status	Watershed	BMP Type	Latitude	Longitude	Estimated Cost
BS6	Proposed	White Clay Creek	Bioswale	39.7935	-75.7397	$50,007.75
COF001-BS1	Proposed	Red Clay Creek	Bioswale	39.7920	-75.7254	$60,099.00
COF002-BS1	Proposed	White Clay Creek	Bioswale	39.7945	-75.7740	$22,694.10
COF002-BS2	Proposed	White Clay Creek	Bioswale	39.8351	-75.7637	$32,381.70
COF003-BS1	Proposed	White Clay Creek	Bioswale	39.7828	-75.7298	$32,381.70
OF014-BS1	Proposed	Red Clay Creek	Bioswale	39.8478	-75.7377	$66,826.50
OF015-BS1	Proposed	Red Clay Creek	Bioswale	39.8498	-75.7331	$61,265.10
OF025-BS1	Proposed	White Clay Creek	Bioswale	39.8072	-75.7456	$34,713.90
OF040-BS1	Proposed	Red Clay Creek	Bioswale	39.8395	-75.7270	$39,109.20
OF053-BS1	Proposed	White Clay Creek	Bioswale	39.8392	-75.7807	$59,919.60
OF058-BS1	Proposed	White Clay Creek	Bioswale	39.8207	-75.7756	$25,788.75
OF059-BS1	Proposed	White Clay Creek	Bioswale	39.8427	-75.7269	$69,382.95
OF060-BS1	Proposed	White Clay Creek	Bioswale	39.7954	-75.7762	$44,150.34
OF080-BS1	Proposed	White Clay Creek	Bioswale	39.8195	-75.7710	$23,860.20
OF092-BS1	Proposed	White Clay Creek	Bioswale	39.8167	-75.7801	$22,694.10
OF099-BS1	Proposed	White Clay Creek	Bioswale	39.8164	-75.7300	$28,201.68
OF110-BS1	Proposed	White Clay Creek	Bioswale	39.8175	-75.7643	$34,220.55
BS5	Alternative	White Clay Creek	Bioswale	39.7883	-75.7727	$44,042.70
BS7	Alternative	White Clay Creek	Bioswale	39.7920	-75.7413	$67,544.10
OF010-BS1	Alternative	Red Clay Creek	Bioswale	39.8462	-75.7443	$23,860.20
OF013-BS1	Alternative	Red Clay Creek	Bioswale	39.8473	-75.7421	$23,860.20
OF029-BS1	Alternative	Red Clay Creek	Bioswale	39.8084	-75.7400	$23,860.20
OF056-BS1	Alternative	White Clay Creek	Bioswale	39.8199	-75.7579	$26,860.20
OP003-BS1	Alternative	Red Clay Creek	Bioswale	39.8053	-75.7694	$117,237.90

Notes:
- 2010 urbanized area and land cover raster were used to calculate the existing loading.
- Existing BMPs were not used to reduce the existing loading.

Data Credits:
- 2010 urbanized area: eMapPA
- Land cover raster: Chesapeake Conservancy Land Cover Data Project 2013/2014
- Streams and water bodies: National Hydrography Dataset
- Wetlands: National Wetlands Inventory
- Aerial imagery: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Projection: NAD 1983 State Plane Pennsylvania South
Coordinate System: GCS North American 1983

Last Updated: September 9, 2020

Legend

- Municipal Inlet
- County Inlet
- Private Inlet
- State Inlet
- Municipal Manhole
- County Manhole
- Private Manhole
- State Manhole
- Pipe Outlet
- Pipe Inlet
- Headwall
- Endwall
- Outlet
- Municipal Outfall
- County Outfall
- Private Outfall
- State Outfall
- Observation Point
- Sample Point
- Municipal Road
- State Road
- Municipal Storm Pipe
- County Storm Pipe
- Private Storm Pipe
- State Storm Pipe
- Swale
- NHD Stream
- Urbanized Area 2010
- Non-Urbanized Area
- Basin
- Proposed BMP
- Alternative BMP
- Proposed BMP Drainage Area
- Alternative BMP Drainage Area
- MS3 Drainage Area
- Non-Regulated MS3 Drainage Area
- NHD Water Body
- NWI Wetland
- Municipal Boundary

0 500 1,000 2,000 Feet

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ATTACHMENT F

RED CLAY CREEK AND WHITE CLAY CREEK TMDL

1. Average Annual Sediment Allocation
2. Average Annual Nitrogen Allocation
3. Average Annual Phosphorus Allocation

ATTACHMENT F

RED CLAY AND WHITE CLAY CREEK TMDL

1. Average Annual Sediment Load Allocation

New Garden Township
TMDL Plan
ARRO No.: 10843.75
TMDL Baselines and Reductions as per the EPA Documention

Average Annual Sediment Allocations						
Watershed	**Township**	**Baseline(ton/yr)**	**Baseline (lbs/year)**	**TMDL (ton/year)**	**TMDL(lb/year)**	**Percent Reduction**
Red Clay Creek Watershed	New Garden	4,709.65	9,419,300.00	2,118.72	4,237,440.00	55.01%
White Clay Creek Watershed	New Garden	6,746.50	13,493,000.00	2,986.66	5,973,320.00	55.73%
			22,912,300.00		10,210,760.00	

ATTACHMENT F

RED CLAY AND WHITE CLAY CREEK TMDL

2. Average Annual Nitrogen Allocation

New Garden Township
TMDL Plan
ARRO No.: 10843.75
TMDL Baselines and Reductions as per the EPA Documention

Average Annual Nitrogen Allocations						
Watershed	**Township**	**Baseline(kg/day)**	**Baseline (lbs/day)**	**Pennsylvania Allocation(kg/day)**	**Pennslyvania Allocation (lbs/day)**	**Percent Reduction**
Red Clay Creek Watershed	New Garden	466.70	1,028.90	320.40	706.36	31.30%
White Clay Creek Watershed	New Garden	956.20	2,108.06	685.00	1,510.16	28.40%
			3,136.95		2,216.52	

ATTACHMENT F

RED CLAY AND WHITE CLAY CREEK TMDL

3. Average Annual Phosphorus Allocation

New Garden Township
TMDL Plan
ARRO No.: 10843.75
TMDL Baselines and Reductions as per the EPA Documention

Average Annual Phosphorus Allocations						
Watershed	**Township**	**Baseline(kg/day)**	**Baseline (lbs/day)**	**Pennsylvania Allocation**	**TMDL(lb/year)**	**Percent Reduction**
Red Clay Creek Watershed	New Garden	62.80	138.45	17.20	37.92	72.60%
White Clay Creek Watershed	New Garden	110.60	243.83	65.90	145.28	40.40%
			382.28		183.20	

ATTACHMENT G

EXISTING LOADING FOR POLLUTANTS OF CONCERN

New Garden Township Urbanized Area

New Garden Township

Base Pollutant Loading No Existing BMPs Summary:

Calculated using PA DEP's *Statewide ms4 Land Cover Estimates* Document

New Garden Township Urbanized Area			Chester County Loading Rates			Pollutants of Concern lbs/year			
Total Area (ac)	**9,049.70**	**Acres**	**TSS**	**TP**	**TN**	**TSS**	**TP**	**TN**	
% Pervious	0.86	7,802.08	185.12	0.36	14.09	1,444,320.20	2,808.75	109,931.24	
% Impervious	0.14	1,247.63	1504.78	1.46	21.15	1,877,405.52	1,821.54	26,387.33	
						3,321,725.72	**4,630.28**	**136,318.57**	Total lb/yr
						0.10	**0.05**	**0.03**	Reduction Rate
						332,172.57	**231.51**	**4,089.56**	Required Reduction

ATTACHMENT H

PROPOSED BMP POLLUTANT LOADING REDUCTION

1. Proposed BMP Description
2. Proposed BMP Calculations

PROPOSED BMP POLLUTANT LOADING REDUCTION

Proposed BMP Description

BMP COF001- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, parallel to the railroad North of 285 Scarlet Road. Limits are from Scarlet Road to the observation point before COF001. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP COF002- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on public property, South of 23 Firehouse Way. Limits are from Firehouse Way to the observation point. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP COF002- BS2: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, North-East of 8821 Gap Newport Pike. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP COF003- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, North-East of 323 Ellicot Road. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF040- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, east of 320 Buck Toe Road and terminating near OF040. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF058- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, west of 107 Heatherly Lane and terminating approximately at the tree line. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF059- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, south of 722 Penn Green Road. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF080- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property east of Barley Ct., and west of Penn Greed Rd. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF092- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be located approximately east of Chaingate Cir., and west of Reynolds Rd., discharging to OF092. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF099- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be located south west of Chaingate Cir., discharging to OF099. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF110- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, east of 850 Southwood Road and starting at Southwood Road. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP BS6: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, north east of 107 Cezanne Court. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF053- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, south of 540 Church Road. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF060- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, east of Lavender Hill Lane. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF025- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, north of 307 Carlisle Dr. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF014- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, north east of 309 Pemberton Road. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF015- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, north east of 263 S Thistle Down.. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

ATTACHMENT H

PROPOSED BMP POLLUTANT LOADING REDUCTION

2. Proposed BMP Calculations

New Garden Township
TMDL Plan
ARRO No.: 10843.75
Potential BMPs

Worksheet 4:
Drainage Area: Urbanized MS4 Regulated Area
2-year Rainfall: 3.26 in

Potential BMP Calculations:

Cover/Type/Condition	Soil Type	Area (SF)	Area (Ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (CF)	Acre-Ft
BMP COF001-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	2,837,672	65.144	71	4.08	0.82	0.91	216,226.57	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		2,837,672	65.144					216,226.57	4.96
Post-Development									
Pervious	C	1,052,959	24.173	77	2.99	0.60	1.25	110,108.95	
Impervious	C	1,784,713	40.971	98	0.20	0.04	3.03	450,233.92	
		2,837,672	65.144					560,342.87	12.86
						Net Increase:		344,116.30	7.90
BMP COF002-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	4,932,762	113.241	71	4.08	0.82	0.91	375,869.42	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		4,932,762	113.241					375,869.42	8.63
Post-Development									
Pervious	C	3,252,931	74.677	77	2.99	0.60	1.25	340,162.22	
Impervious	C	1,679,831	38.564	98	0.20	0.04	3.03	423,775.05	
		4,932,762	113.241					763,937.27	17.54
						Net Increase:		388,067.85	8.91
BMP COF002-BS2	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	2,360,614	54.192	71	4.08	0.82	0.91	179,875.42	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		2,360,614	54.192					179,875.42	4.13
Post-Development									
Pervious	C	1,535,915	35.260	77	2.99	0.60	1.25	160,612.16	
Impervious	C	824,699	18.932	98	0.20	0.04	3.03	208,048.81	
		2,360,614	54.192					368,660.97	8.46
						Net Increase:		188,785.55	4.33

BMP COF003-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,653,556	37.960	71	4.08	0.82	0.91	125,998.59	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,653,556	37.960					125,998.59	2.89
Post-Development									
Pervious	C	1,083,445	24.872	77	2.99	0.60	1.25	113,296.97	
Impervious	C	570,110	13.088	98	0.20	0.04	3.03	143,823.10	
		1,653,556	37.960					257,120.07	5.90
						Net Increase:		131,121.48	3.01
BMP OF080-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	2,596,073	59.598	71	4.08	0.82	0.91	197,817.08	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		2,596,073	59.598					197,817.08	4.54
Post-Development									
Pervious	C	2,274,058	52.205	77	2.99	0.60	1.25	237,800.50	
Impervious	C	322,015	7.392	98	0.20	0.04	3.03	81,235.60	
		2,596,073	59.598					319,036.11	7.32
						Net Increase:		121,219.03	2.78
BMP OF092-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,082,048	24.840	71	4.08	0.82	0.91	82,450.52	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,082,048	24.840					82,450.52	1.89
Post-Development									
Pervious	C	948,484	21.774	77	2.99	0.60	1.25	99,183.96	
Impervious	C	133,564	3.066	98	0.20	0.04	3.03	33,694.43	
		1,082,048	24.840					132,878.39	3.05
						Net Increase:		50,427.87	1.16

BMP OF099-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,353,901	31.081	71	4.08	0.82	0.91	103,165.36	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,353,901	31.081					103,165.36	2.37
Post-Development									
Pervious	C	1,023,994	23.508	77	2.99	0.60	1.25	107,080.07	
Impervious	C	329,908	7.574	98	0.20	0.04	3.03	83,226.57	
		1,353,901	31.081					190,306.64	4.37
						Net Increase:		87,141.28	2.00
BMP OF040-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	2,479,842	56.929	71	4.08	0.82	0.91	188,960.39	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		2,479,842	56.929					188,960.39	4.34
Post-Development									
Pervious	C	1,862,337	42.753	77	2.99	0.60	1.25	194,746.48	
Impervious	C	617,504	14.176	98	0.20	0.04	3.03	155,779.27	
		2,479,842	56.929					350,525.75	8.05
						Net Increase:		161,565.36	3.71
BMP OF058-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,282,671	29.446	71	4.08	0.82	0.91	97,737.73	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,282,671	29.446					97,737.73	2.24
Post-Development									
Pervious	C	1,109,463	25.470	77	2.99	0.60	1.25	116,017.69	
Impervious	C	173,208	3.976	98	0.20	0.04	3.03	43,695.61	
		1,282,671	29.446					159,713.30	3.67
						Net Increase:		61,975.57	1.42

BMP OF059-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	4,036,331	92.661	71	4.08	0.82	0.91	307,562.63	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		4,036,331	92.661					307,562.63	7.06
Post-Development									
Pervious	C	3,407,846	78.233	77	2.99	0.60	1.25	356,361.83	
Impervious	C	628,485	14.428	98	0.20	0.04	3.03	158,549.42	
		4,036,331	92.661					514,911.25	11.82
						Net Increase:		207,348.61	4.76
BMP OF110-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	2,680,476	61.535	71	4.08	0.82	0.91	204,248.44	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		2,680,476	61.535					204,248.44	4.69
Post-Development									
Pervious	C	1,837,025	42.172	77	2.99	0.60	1.25	192,099.51	
Impervious	C	843,451	19.363	98	0.20	0.04	3.03	212,779.47	
		2,680,476	61.535					404,878.98	9.29
						Net Increase:		200,630.54	4.61
BS6	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,023,142	23.488	71	4.08	0.82	0.91	77,961.98	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,023,142	23.488					77,961.98	1.79
Post-Development									
Pervious	C	830,355	19.062	77	2.99	0.60	1.25	86,831.10	
Impervious	C	192,787	4.426	98	0.20	0.04	3.03	48,634.78	
		1,023,142	23.488					135,465.88	3.11
						Net Increase:		57,503.91	1.32

OF053-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,415,869	32.504	71	4.08	0.82	0.91	107,887.17	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,415,869	32.504					107,887.17	2.48
Post-Development									
Pervious	C	1,159,831	26.626	77	2.99	0.60	1.25	121,284.69	
Impervious	C	256,038	5.878	98	0.20	0.04	3.03	64,591.22	
		1,415,869	32.504					185,875.91	4.27
						Net Increase:		77,988.74	1.79
OF060-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	520,985	11.960	71	4.08	0.82	0.91	39,698.34	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		520,985	11.960					39,698.34	0.91
Post-Development									
Pervious	C	358,691	8.234	77	2.99	0.60	1.25	37,508.71	
Impervious	C	162,294	3.726	98	0.20	0.04	3.03	40,942.30	
		520,985	11.960					78,451.02	1.80
						Net Increase:		38,752.67	0.89
OF025-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	295,211	6.777	71	4.08	0.82	0.91	22,494.67	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		295,211	6.777					22,494.67	0.52
Post-Development									
Pervious	C	195,783	4.495	77	2.99	0.60	1.25	20,473.23	
Impervious	C	99,428	2.283	98	0.20	0.04	3.03	25,082.98	
		295,211	6.777					45,556.20	1.05
						Net Increase:		23,061.53	0.53

OF014-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,698,685	38.996	71	4.08	0.82	0.91	129,437.38	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,698,685	38.996					129,437.38	2.97
Post-Development									
Pervious	C	1,514,695	34.773	77	2.99	0.60	1.25	158,393.18	
Impervious	C	183,990	4.224	98	0.20	0.04	3.03	46,415.60	
		1,698,685	38.996					204,808.78	4.70
						Net Increase:		75,371.40	1.73
OF015-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,453,000	33.356	71	4.08	0.82	0.91	110,716.49	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,453,000	33.356					110,716.49	2.54
Post-Development									
Pervious	C	1,251,458	28.730	77	2.99	0.60	1.25	130,866.23	
Impervious	C	201,541	4.627	98	0.20	0.04	3.03	50,843.33	
		1,453,000	33.356					181,709.56	4.17
						Net Increase:		70,993.07	1.63

New Garden Township
TMDL Plan
ARRO No.: 10843.75

Expert Panel Pollutant Reduction Efficiency Calculations:

x = (12 x Ep)/IA
Ep = Post - Predevelopment volume increase
IA = Impervious Area (Ac)

					PA DEP BMP Effectiveness Values Pollutant % Removal			Existing BMP Efficiency Pollutant % Removal			Adjusted BMP Effectiveness Values Pollutant % Removal		
BMP ID	**BMP Description**	**EP**	**IA**	**x**	**TN**	**TP**	**TSS**	**TN**	**TP**	**TSS**	**TN**	**TP**	**TSS**
BMP COF001-BS1	Bioswale	7.90	40.971	2.31	70%	75%	80%				70%	75%	80%
BMP COF002-BS1	Bioswale	8.91	38.564	2.77	70%	75%	80%				70%	75%	80%
BMP COF002-BS2	Bioswale	4.33	18.932	2.75	70%	75%	80%				70%	75%	80%
BMP COF003-BS1	Bioswale	3.01	13.088	2.76	70%	75%	80%				70%	75%	80%
BMP OF080-BS1	Bioswale	2.78	7.392	4.52	70%	75%	80%				70%	75%	80%
BMP OF092-BS1	Bioswale	1.16	3.066	4.53	70%	75%	80%				70%	75%	80%
BMP OF099-BS1	Bioswale	2.00	7.574	3.17	70%	75%	80%				70%	75%	80%
BMP OF040-BS1	Bioswale	3.71	14.176	3.14	70%	75%	80%				70%	75%	80%
BMP OF058-BS1	Bioswale	1.42	3.976	4.29	70%	75%	80%				70%	75%	80%
BMP OF059-BS1	Bioswale	4.76	14.428	3.96	70%	75%	80%				70%	75%	80%
BMP OF110-BS1	Bioswale	4.61	19.363	2.85	70%	75%	80%				70%	75%	80%
BS6	Bioswale	1.32	4.426	3.58	70%	75%	80%				70%	75%	80%
OF053-BS1	Bioswale	1.79	5.878	3.66	70%	75%	80%				70%	75%	80%
OF060-BS1	Bioswale	0.89	3.726	2.87	70%	75%	80%				70%	75%	80%
OF025-BS1	Bioswale	0.53	2.283	2.78	70%	75%	80%				70%	75%	80%
OF014-BS1	Bioswale	1.73	4.224	4.92	70%	75%	80%				70%	75%	80%
OF015-BS1	Bioswale	1.63	4.627	4.23	70%	75%	80%				70%	75%	80%

New Garden Township
TMDL Plan
ARRO No.: 10843.75
Potential BMP Pollutant Reduction

PA DEP Land Loading:		TN (lbs/acre/year)	TP (lbs/acre/year)	TSS (lbs/acre/year)
Chester	Impervious	21.15	1.46	1504.78
	Pervious	14.09	0.36	185.12
	Undeveloped	10	0.33	234.6

COF-001
Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP COF001-BS1	1,784,713	1,052,959	2,837,672	41.0	24.2	65.1	866.54	340.59	**1,207.14**	59.82	8.70	**68.52**	61,652.9	4,474.8	**66,127.8**
BMP Effectiveness Value (3800-PM-BCW0100m) & Manufacture Literature									70%			75%			80%
Pollutant Reduction									**845.00**			**51.39**			**52,902.20**

COF-002
Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP COF002-BS1	1,679,831	3,252,931	4,932,762	38.6	74.7	113.2	815.62	1,052.20	**1,867.82**	56.30	26.88	**83.19**	58,029.8	13,824.2	**71,854.0**
BMP Effectiveness Value (3800-PM-BCW0100m) & Manufacture Literature									70%			75%			80%
Pollutant Reduction									**1,307.47**			**62.39**			**57,483.18**

COF-002
Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP COF002-BS2	824,699	1,535,915	2,360,614	18.9	35.3	54.2	400.42	496.81	**897.23**	27.64	12.69	**40.33**	28,489.2	6,527.3	**35,016.5**
BMP Effectiveness Value (3800-PM-BCW0100m) & Manufacture Literature									70%			75%			80%
Pollutant Reduction									**628.06**			**30.25**			**28,013.21**

COF-003

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP COF003-BS1	570,110	1,083,445	1,653,556	13.1	24.9	38.0	276.81	350.45	**627.26**	19.11	8.95	**28.06**	19,694.5	4,604.4	**24,298.9**
BMP Effectiveness Value (3800-PM-BCW0100m) & Manufacture Literature									70%			75%			80%
Pollutant Reduction									**439.08**			**21.05**			**19,439.08**

OF-080

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP OF080-BS1	322,015	2,274,058	2,596,073	7.4	52.2	59.6	156.35	735.57	**891.92**	10.79	18.79	**29.59**	11,124.0	9,664.2	**20,788.2**
BMP Effectiveness Value (3800-PM-BCW0100m) & Manufacture Literature									70%			75%			80%
Pollutant Reduction									**624.35**			**22.19**			**16,630.60**

OF-092

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP OF092-BS1	133,564	948,484	1,082,048	3.1	21.8	24.8	64.85	306.80	**371.65**	4.48	7.84	**12.32**	4,614.0	4,030.8	**8,644.8**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**260.15**			**9.24**			**6,915.84**

OF-099
Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP OF099-BS1	329,908	1,023,994	1,353,901	7.6	23.5	31.1	160.18	331.22	**491.41**	11.06	8.46	**19.52**	11,396.7	4,351.7	**15,748.4**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**343.98**			**14.64**			**12,598.72**

OF-040
Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP OF040-BS1	617,504	1,862,337	2,479,842	14.2	42.8	56.9	299.82	602.40	**902.22**	20.70	15.39	**36.09**	21,331.7	7,914.5	**29,246.2**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**631.55**			**27.07**			**23,396.95**

OF-058
Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP OF058-BS1	173,208	1,109,463	1,282,671	4.0	25.5	29.4	84.10	358.87	**442.97**	5.81	9.17	**14.97**	5,983.5	4,715.0	**10,698.4**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**310.08**			**11.23**			**8,558.75**

OF-059

Bioswale

BMP ID	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
	Impervious	Pervious	Total	Impervious	Pervious	Total	TN - Impervious Area (lbs/year)	TN - Pervious Area (lbs/year)	TN (lbs/year)	TP - Impervious Area (lbs/year)	TP - Pervious Area (lbs/year)	TP (lbs/year)	TSS - Impervious Area (lbs/year)	TSS - Pervious Area (lbs/year)	TSS (lbs/year)
BMP OF059-BS1	628,485	3,407,846	4,036,331	14.4	78.2	92.7	305.15	1,102.31	**1,407.46**	21.06	28.16	**49.23**	21,711.0	14,482.6	**36,193.6**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**985.22**			**36.92**			**28,954.86**

OF-110

Bioswale

BMP ID	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
	Impervious	Pervious	Total	Impervious	Pervious	Total	TN - Impervious Area (lbs/year)	TN - Pervious Area (lbs/year)	TN (lbs/year)	TP - Impervious Area (lbs/year)	TP - Pervious Area (lbs/year)	TP (lbs/year)	TSS - Impervious Area (lbs/year)	TSS - Pervious Area (lbs/year)	TSS (lbs/year)
BMP OF110-BS1	843,451	1,837,025	2,680,476	19.4	42.2	61.5	409.53	594.21	**1,003.73**	28.27	15.18	**43.45**	29,137.0	7,806.9	**36,944.0**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**702.61**			**32.59**			**29,555.16**

Non-MS3

Bioswale

BMP ID	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
	Impervious	Pervious	Total	Impervious	Pervious	Total	TN - Impervious Area (lbs/year)	TN - Pervious Area (lbs/year)	TN (lbs/year)	TP - Impervious Area (lbs/year)	TP - Pervious Area (lbs/year)	TP (lbs/year)	TSS - Impervious Area (lbs/year)	TSS - Pervious Area (lbs/year)	TSS (lbs/year)
BS6	192,787	830,355	1,023,142	4.4	19.1	23.5	93.61	268.59	**362.19**	6.46	6.86	**13.32**	6,659.8	3,528.8	**10,188.6**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**253.54**			**9.99**			**8,150.91**

OF053

Bioswale

BMP ID	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
	Impervious	Pervious	Total	Impervious	Pervious	Total	TN - Impervious Area (lbs/year)	TN - Pervious Area (lbs/year)	TN (lbs/year)	TP - Impervious Area (lbs/year)	TP - Pervious Area (lbs/year)	TP (lbs/year)	TSS - Impervious Area (lbs/year)	TSS - Pervious Area (lbs/year)	TSS (lbs/year)
OF053-BS1	256,038	1,159,831	1,415,869	5.9	26.6	32.5	124.32	375.16	**499.48**	8.58	9.59	**18.17**	8,844.8	4,929.0	**13,773.8**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**349.63**			**13.63**			**11,019.07**

OF060

Bioswale

BMP ID	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
	Impervious	Pervious	Total	Impervious	Pervious	Total	TN - Impervious Area (lbs/year)	TN - Pervious Area (lbs/year)	TN (lbs/year)	TP - Impervious Area (lbs/year)	TP - Pervious Area (lbs/year)	TP (lbs/year)	TSS - Impervious Area (lbs/year)	TSS - Pervious Area (lbs/year)	TSS (lbs/year)
OF060-BS1	162,294	358,691	520,985	3.7	8.2	12.0	78.80	116.02	**194.82**	5.44	2.96	**8.40**	5,606.4	1,524.4	**7,130.8**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**136.38**			**6.30**			**5,704.64**

OF025

Bioswale

BMP ID	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
	Impervious	Pervious	Total	Impervious	Pervious	Total	TN - Impervious Area (lbs/year)	TN - Pervious Area (lbs/year)	TN (lbs/year)	TP - Impervious Area (lbs/year)	TP - Pervious Area (lbs/year)	TP (lbs/year)	TSS - Impervious Area (lbs/year)	TSS - Pervious Area (lbs/year)	TSS (lbs/year)
OF025-BS1	99,428	195,783	295,211	2.3	4.5	6.8	48.28	63.33	**111.60**	3.33	1.62	**4.95**	3,434.7	832.0	**4,266.8**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**78.12**			**3.71**			**3,413.42**

OF014

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
OF014-BS1	183,990	1,514,695	1,698,685	4.2	34.8	39.0	89.33	489.95	**579.28**	6.17	12.52	**18.68**	6,355.9	6,437.1	**12,793.0**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**405.50**			**14.01**			**10,234.43**

OF015

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
OF015-BS1	201,541	1,251,458	1,453,000	4.6	28.7	33.4	97.86	404.80	**502.65**	6.76	10.34	**17.10**	6,962.2	5,318.4	**12,280.7**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**351.86**			**12.82**			**9,824.53**

ATTACHMENT I

ALTERNATIVE BMP POLLUTANT LOADING REDUCTION

1. Alternative BMP Description
2. Alternative BMP Calculations

ALTERNATIVE BMP POLLUTANT LOADING REDUCTION

Alternative BMP Description

BMP OP003- BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, South of 735 West Cypress Street and terminating at OP003 before COF003. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP BS5: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, between 6715 Limestone Road and 109 Old Limestone Road. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP BS7: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property of the New Garden Airport, limits are from the southernmost outlet in the Airport area to the private outfall in the south of the property. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF056-BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, south of 75 Daniel Dr. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF029-BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, north of 351 Carlisle Dr. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF010-BS1: Bioswale
The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, south of 23 Firehouse Way. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

BMP OF013-BS1: Bioswale

The analysis evaluated the modification of an existing swale into a bioswale. The BMP would be on private property, south of Pemberton Rd. Construction activities include: Re-grading/expanding channel; installing ballast and amended soils; bioswale plantings; and stabilization of existing storm outlets.

ATTACHMENT I

ALTERNATIVE BMP POLLUTANT LOADING REDUCTION

2. Alternative BMP Calculations

New Garden Township
TMDL Plan
ARRO No.: 10843.75
Alternative BMPs

Worksheet 4:
Drainage Area: Urbanized MS4 Regulated Area
2-year Rainfall: 3.26 in

Potential BMP Calculations:

Cover/Type/Condition	Soil Type	Area (SF)	Area (Ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (CF)	Acre-Ft

BMP OP003-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,310,066	30.075	71	4.08	0.82	0.91	99,825.15	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,310,066	30.075					99,825.15	2.29
Post-Development									
Pervious	C	952,093	21.857	77	2.99	0.60	1.25	99,561.31	
Impervious	C	357,973	8.218	98	0.20	0.04	3.03	90,306.67	
		1,310,066	30.075					189,867.98	4.36
						Net Increase:		90,042.84	2.07
BS5	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	700,155	16.073	71	4.08	0.82	0.91	53,350.83	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		700,155	16.073					53,350.83	1.22
Post-Development									
Pervious	C	503,323	11.555	77	2.99	0.60	1.25	52,633.02	
Impervious	C	196,832	4.519	98	0.20	0.04	3.03	49,655.26	
		700,155	16.073					102,288.27	2.35
						Net Increase:		48,937.45	1.12
BS7	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	279,771	6.423	71	4.08	0.82	0.91	21,318.18	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		279,771	6.423					21,318.18	0.49
Post-Development									
Pervious	C	254,672	5.846	77	2.99	0.60	1.25	26,631.31	
Impervious	C	25,099	0.576	98	0.20	0.04	3.03	6,331.87	
		279,771	6.423					32,963.18	0.76
						Net Increase:		11,645.00	0.27
OF056-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	2,244,701	51.531	71	4.08	0.82	0.91	171,043.03	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		2,244,701	51.531					171,043.03	3.93
Post-Development									
Pervious	C	1,922,453	44.133	77	2.99	0.60	1.25	201,032.80	
Impervious	C	322,249	7.398	98	0.20	0.04	3.03	81,294.42	
		2,244,701	51.531					282,327.23	6.48
						Net Increase:		111,284.19	2.55

OF029-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,048,874	24.079	71	4.08	0.82	0.91	79,922.67	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,048,874	24.079					79,922.67	1.83
Post-Development									
Pervious	C	513,717	11.793	77	2.99	0.60	1.25	53,719.92	
Impervious	C	535,156	12.286	98	0.20	0.04	3.03	135,005.18	
		1,048,874	24.079					188,725.11	4.33
						Net Increase:		108,802.43	2.50
OF010-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,148,178	26.359	71	4.08	0.82	0.91	87,489.54	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,148,178	26.359					87,489.54	2.01
Post-Development									
Pervious	C	961,116	22.064	77	2.99	0.60	1.25	100,504.88	
Impervious	C	187,062	4.294	98	0.20	0.04	3.03	47,190.60	
		1,148,178	26.359					147,695.48	3.39
						Net Increase:		60,205.94	1.38
OF013-BS1	**Bioswale**								
Pre-Development									
Pervious	C	0	0.000	77	2.99	0.60	1.25	0.00	
Meadow	C	1,515,164	34.783	71	4.08	0.82	0.91	115,453.35	
Impervious	C	0	0.000	98	0.20	0.04	3.03	0.00	
		1,515,164	34.783					115,453.35	2.65
Post-Development									
Pervious	C	1,466,283	33.661	77	2.99	0.60	1.25	153,330.70	
Impervious	C	48,881	1.122	98	0.20	0.04	3.03	12,331.33	
		1,515,164	34.783					165,662.03	3.80
						Net Increase:		50,208.68	1.15

New Garden Township
TMDL Plan
ARRO No.: 10843.75

Expert Panel Pollutant Reduction Efficiency Calculations:

x = (12 x Ep)/IA
Ep = Post - Predevelopment volume increase
IA = Impervious Area (Ac)

					PA DEP BMP Effectiveness Values Pollutant % Removal			Existing BMP Efficiency Pollutant % Removal			Adjusted BMP Effectiveness Values Pollutant % Removal		
BMP ID	**BMP Description**	**EP**	**IA**	**x**	**TN**	**TP**	**TSS**	**TN**	**TP**	**TSS**	**TN**	**TP**	**TSS**
BMP OP003-BS1	Bioswale	2.07	8.218	3.02	70%	75%	80%				70%	75%	80%
BS5	Bioswale	1.12	4.519	2.98	70%	75%	80%				70%	75%	80%
BS7	Bioswale	0.27	0.576	5.57	70%	75%	80%				70%	75%	80%
OF056-BS1	Bioswale	2.55	7.398	4.14	70%	75%	80%				70%	75%	80%
OF029-BS1	Bioswale	2.50	12.286	2.44	70%	75%	80%				70%	75%	80%
OF010-BS1	Bioswale	1.38	4.294	3.86	70%	75%	80%				70%	75%	80%
OF013-BS1	Bioswale	1.15	1.122	12.33	70%	75%	80%				70%	75%	80%

New Garden Township
TMDL Plan
ARRO No.: 10843.75
Alternative BMP Pollutant Reduction

PA DEP Land Loading:		TN (lbs/acre/year)	TP (lbs/acre/year)	TSS (lbs/acre/year)
Chester	Impervious	21.15	1.46	1504.78
	Pervious	14.09	0.36	185.12
	Undeveloped	10	0.33	234.6

OP-003

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BMP OP003-BS1	357,973	952,093	1,310,066	8.2	21.9	30.1	173.81	307.97	**481.77**	12.00	7.87	**19.87**	12,366.2	4,046.2	**16,412.3**
BMP Effectiveness Value (3800-PM-BCW0100m) & Manufacture Literature									70%			75%			80%
Pollutant Reduction									**337.24**			**14.90**			**13,129.88**

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BS5	196,832	503,323	700,155	4.5	11.6	16.1	95.57	162.81	**258.38**	6.60	4.16	**10.76**	6,799.6	2,139.0	**8,938.6**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**180.86**			**8.07**			**7,150.85**

Non-MS3

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
BS7	25,099	254,672	279,771	0.6	5.8	6.4	12.19	82.38	**94.56**	0.84	2.10	**2.95**	867.1	1,082.3	**1,949.4**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**66.19**			**2.21**			**1,559.48**

OF056

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**1,922,453**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
OF056-BS1	322,249	1,922,453	2,244,701	7.4	44.1	51.5	156.46	621.84	**778.30**	10.80	15.89	**26.69**	11,132.1	8,170.0	**19,302.1**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**544.81**			**20.02**			**15,441.65**

OF029

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
OF029-BS1	535,156	513,717	1,048,874	12.3	11.8	24.1	259.84	166.17	**426.01**	17.94	4.25	**22.18**	18,487.0	2,183.2	**20,670.2**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**298.20**			**16.64**			**16,536.13**

OF010

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious**	**TN - Pervious Area**	**TN (lbs/year)**	**TP - Impervious**	**TP - Pervious Area**	**TP (lbs/year)**	**TSS - Impervious**	**TSS - Pervious**	**TSS (lbs/year)**
OF010-BS1	187,062	961,116	1,148,178	4.3	22.1	26.4	90.83	310.88	**401.71**	6.27	7.94	**14.21**	6,462.1	4,084.5	**10,546.6**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**281.20**			**10.66**			**8,437.27**

OF013

Bioswale

	Drainage Area (SF)			Drainage Area (Ac)			PA DEP Land Loading								
BMP ID	**Impervious**	**Pervious**	**Total**	**Impervious**	**Pervious**	**Total**	**TN - Impervious Area (lbs/year)**	**TN - Pervious Area (lbs/year)**	**TN (lbs/year)**	**TP - Impervious Area (lbs/year)**	**TP - Pervious Area (lbs/year)**	**TP (lbs/year)**	**TSS - Impervious Area (lbs/year)**	**TSS - Pervious Area (lbs/year)**	**TSS (lbs/year)**
OF013-BS1	48,881	1,466,283	1,515,164	1.1	33.7	34.8	23.73	474.29	**498.02**	1.64	12.12	**13.76**	1,688.6	6,231.4	**7,920.0**
BMP Effectiveness Value (3800-PM-BCW0100m)									70%			75%			80%
Pollutant Reduction									**348.61**			**10.32**			**6,335.97**

ATTACHMENT J

PLANNING ESTIMATES OF OPINION OF PROBABLE COST

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020 CRF
Project Number: 10843.75 Checked By:
Project Name: TMDL Plan

BMPCOF001-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	535	CY	$20.00	$10,700.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	640	SY	$10.00	$6,400.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	195	Ton	$20.00	$3,900.00
8	6" Amended soils	100	Ton	$25.00	$2,500.00
9	Plantings	100	Ea	$25.00	$2,500.00
	Subtotal				$33,500.00
	Contingency (30%)				$10,050.00
	Construction Sub-Total				$43,550.00
	Engineering (30%)				$13,065.00
	Right-of-Way (5%)				$2,177.50
	Legal (3%)				$1,306.50
					.
	TOTAL				**$60,099.00**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020 CRF
Project Number: 10843.75 Checked By:
Project Name: TMDL Plan

BMPCOF002-BS2: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	210	CY	$20.00	$4,200.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	250	SY	$10.00	$2,500.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	80	Ton	$20.00	$1,600.00
8	6" Amended soils	40	Ton	$25.00	$1,000.00
9	Plantings	50	Ea	$25.00	$1,250.00
	Subtotal				$18,050.00
	Contingency (30%)				$5,415.00
	Construction Sub-Total				$23,465.00
	Engineering (30%)				$7,039.50
	Right-of-Way (5%)				$1,173.25
	Legal (3%)				$703.95
					.
	TOTAL				**$32,381.70**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020
Project Number: 10843.75
Project Name: TMDL Plan
Checked By: CRF

BMPCOF003-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	210	CY	$20.00	$4,200.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	250	SY	$10.00	$2,500.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	80	Ton	$20.00	$1,600.00
8	6" Amended soils	40	Ton	$25.00	$1,000.00
9	Plantings	50	Ea	$25.00	$1,250.00
	Subtotal				$18,050.00
	Contingency (30%)				$5,415.00
	Construction Sub-Total				$23,465.00
	Engineering (30%)				$7,039.50
	Right-of-Way (5%)				$1,173.25
	Legal (3%)				$703.95
					.
	TOTAL				**$32,381.70**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 9/4/2020 AT
Project Number: 10843.08 Checked By:
Project Name: TMDL Plan

BMPOF014-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	650	CY	$20.00	$13,000.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	700	SY	$10.00	$7,000.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	200	Ton	$20.00	$4,000.00
8	6" Amended soils	115	Ton	$25.00	$2,875.00
9	Plantings	115	Ea	$25.00	$2,875.00
	Subtotal				$37,250.00
	Contingency (30%)				$11,175.00
	Construction Sub-Total				$48,425.00
	Engineering (30%)				$14,527.50
	Right-of-Way (5%)				$2,421.25
	Legal (3%)				$1,452.75
					.
	TOTAL				**$66,826.50**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 9/4/2020 AT
Project Number: 10843.08 Checked By:
Project Name: TMDL Plan

BMPOF015-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	545	CY	$20.00	$10,900.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	650	SY	$10.00	$6,500.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	200	Ton	$20.00	$4,000.00
8	6" Amended soils	105	Ton	$25.00	$2,625.00
9	Plantings	105	Ea	$25.00	$2,625.00
	Subtotal				$34,150.00
	Contingency (30%)				$10,245.00
	Construction Sub-Total				$44,395.00
	Engineering (30%)				$13,318.50
	Right-of-Way (5%)				$2,219.75
	Legal (3%)				$1,331.85
					.
	TOTAL				**$61,265.10**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 9/4/2020 AT
Project Number: 10843.08 Checked By:
Project Name: TMDL Plan

BMPOF025-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	200	CY	$20.00	$4,000.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	255	SY	$10.00	$2,550.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	95	Ton	$20.00	$1,900.00
8	6" Amended soils	68	Ton	$25.00	$1,700.00
9	Plantings	68	Ea	$25.00	$1,700.00
	Subtotal				$19,350.00
	Contingency (30%)				$5,805.00
	Construction Sub-Total				$25,155.00
	Engineering (30%)				$7,546.50
	Right-of-Way (5%)				$1,257.75
	Legal (3%)				$754.65
					.
	TOTAL				**$34,713.90**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020 CRF
Project Number: 10843.75 Checked By:
Project Name: TMDL Plan

BMP OF040-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	280	CY	$20.00	$5,600.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	335	SY	$10.00	$3,350.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	105	Ton	$20.00	$2,100.00
8	6" Amended soils	55	Ton	$25.00	$1,375.00
9	Plantings	75	Ea	$25.00	$1,875.00
	Subtotal				$21,800.00
	Contingency (30%)				$6,540.00
	Construction Sub-Total				$28,340.00
	Engineering (30%)				$8,502.00
	Right-of-Way (5%)				$1,417.00
	Legal (3%)				$850.20
					.
	TOTAL				**$39,109.20**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 9/4/2020 AT
Project Number: 10843.08 Checked By:
Project Name: TMDL Plan

BMPOF053-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	530	CY	$20.00	$10,600.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	640	SY	$10.00	$6,400.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	195	Ton	$20.00	$3,900.00
8	6" Amended soils	100	Ton	$25.00	$2,500.00
9	Plantings	100	Ea	$25.00	$2,500.00
	Subtotal				$33,400.00
	Contingency (30%)				$10,020.00
	Construction Sub-Total				$43,420.00
	Engineering (30%)				$13,026.00
	Right-of-Way (5%)				$2,171.00
	Legal (3%)				$1,302.60
					.
	TOTAL				**$59,919.60**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020
Project Number: 10843.75
Project Name: TMDL Plan
Checked By: CRF

BMP OF058-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	125	CY	$20.00	$2,500.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	150	SY	$10.00	$1,500.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	50	Ton	$20.00	$1,000.00
8	6" Amended soils	25	Ton	$25.00	$625.00
9	Plantings	50	Ea	$25.00	$1,250.00
	Subtotal				$14,375.00
	Contingency (30%)				$4,312.50
	Construction Sub-Total				$18,687.50
	Engineering (30%)				$5,606.25
	Right-of-Way (5%)				$934.38
	Legal (3%)				$560.63
					.
	TOTAL				**$25,788.75**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/30/2020 CRF
Project Number: 10843.75 Checked By:
Project Name: TMDL Plan

BMP OF059-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	635	CY	$20.00	$12,700.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	765	SY	$10.00	$7,650.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	235	Ton	$20.00	$4,700.00
8	6" Amended soils	120	Ton	$25.00	$3,000.00
9	Plantings	125	Ea	$25.00	$3,125.00
	Subtotal				$38,675.00
	Contingency (30%)				$11,602.50
	Construction Sub-Total				$50,277.50
	Engineering (30%)				$15,083.25
	Right-of-Way (5%)				$2,513.88
	Legal (3%)				$1,508.33
					.
	TOTAL				**$69,382.95**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 9/4/2020 AT
Project Number: 10843.08 Checked By:
Project Name: TMDL Plan

BMPOF060-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	400	CY	$20.00	$8,000.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	556	SY	$10.00	$5,560.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	90	Ton	$20.00	$1,800.00
8	6" Amended soils	35	Ton	$25.00	$875.00
9	Plantings	35	Ea	$25.00	$875.00
	Subtotal				$24,610.00
	Contingency (30%)				$7,383.00
	Construction Sub-Total				$31,993.00
	Engineering (30%)				$9,597.90
	Right-of-Way (5%)				$1,599.65
	Legal (3%)				$959.79
					.
	TOTAL				**$44,150.34**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020
Project Number: 10843.75
Project Name: TMDL Plan
Checked By: CRF

BMPOF080-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	95	CY	$20.00	$1,900.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	110	SY	$10.00	$1,100.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	40	Ton	$20.00	$800.00
8	6" Amended soils	25	Ton	$25.00	$625.00
9	Plantings	55	Ea	$25.00	$1,375.00
	Subtotal				$13,300.00
	Contingency (30%)				$3,990.00
	Construction Sub-Total				$17,290.00
	Engineering (30%)				$5,187.00
	Right-of-Way (5%)				$864.50
	Legal (3%)				$518.70
					.
	TOTAL				**$23,860.20**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 9/31/20 CRF
Project Number: 10843.75 Checked By:
Project Name: TMDL Plan

BMPOF092-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	85	CY	$20.00	$1,700.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	100	SY	$10.00	$1,000.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	35	Ton	$20.00	$700.00
8	6" Amended soils	20	Ton	$25.00	$500.00
9	Plantings	50	Ea	$25.00	$1,250.00
	Subtotal				$12,650.00
	Contingency (30%)				$3,795.00
	Construction Sub-Total				$16,445.00
	Engineering (30%)				$4,933.50
	Right-of-Way (5%)				$822.25
	Legal (3%)				$493.35
					.
	TOTAL				**$22,694.10**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020 CRF
Project Number: 10843.75 Checked By:
Project Name: TMDL Plan

BMPOF099-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	135	CY	$20.00	$2,700.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	160	SY	$10.00	$1,600.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	56	Ton	$20.00	$1,120.00
8	6" Amended soils	32	Ton	$25.00	$800.00
9	Plantings	80	Ea	$25.00	$2,000.00
	Subtotal				$15,720.00
	Contingency (30%)				$4,716.00
	Construction Sub-Total				$20,436.00
	Engineering (30%)				$6,130.80
	Right-of-Way (5%)				$1,021.80
	Legal (3%)				$613.08
					.
	TOTAL				**$28,201.68**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020 CRF
Project Number: 10843.75 Checked By:
Project Name: TMDL Plan

BMP OF110-BS1: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	235	CY	$20.00	$4,700.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	280	SY	$10.00	$2,800.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	85	Ton	$20.00	$1,700.00
8	6" Amended soils	45	Ton	$25.00	$1,125.00
9	Plantings	50	Ea	$25.00	$1,250.00
	Subtotal				$19,075.00
	Contingency (30%)				$5,722.50
	Construction Sub-Total				$24,797.50
	Engineering (30%)				$7,439.25
	Right-of-Way (5%)				$1,239.88
	Legal (3%)				$743.93
					.
	TOTAL				**$34,220.55**

The ARRO Group, Inc.
108 West Airport Road
Lititz, PA 17543

OPINION OF PROBABLE CONSTRUCTION COST

Date: 8/31/2020
Project Number: 10843.75
Project Name: TMDL Plan
Checked By: CRF

BMP BS6: Bioswale

Item No.	Description	Qty.	Unit	Unit Price	Total Cost
	Miscellaneous/Site Work Payment Items				
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Channel Excavation - Swale	0	CY	$20.00	$0.00
3	Channel Excavation - Bioswale	420	CY	$20.00	$8,400.00
4	Erosion control matting	0	SY	$15.00	$0.00
5	Finish grading and seeding - Bioswale	500	SY	$10.00	$5,000.00
6	Finish grading and seeding - Swale	0	SY	$6.00	$0.00
7	12" Gravel	155	Ton	$20.00	$3,100.00
8	6" Amended soils	80	Ton	$25.00	$2,000.00
9	Plantings	75	Ea	$25.00	$1,875.00
	Subtotal				$27,875.00
	Contingency (30%)				$8,362.50
	Construction Sub-Total				$36,237.50
	Engineering (30%)				$10,871.25
	Right-of-Way (5%)				$1,811.88
	Legal (3%)				$1,087.13
					.
	TOTAL				**$50,007.75**

ATTACHMENT K

RETURN ON INVESTMENT ANALYSIS

New Garden Township

Return on Investment Analysis

Proposed and Alternative BMP Structures

				Required Reduction						
				332,172.57	*231.51*	*4,089.56*				
BMP ID	**Watershed**	**BMP Type**	**Status**	**TSS (lbs/yr)**	**TP (lbs/yr)**	**TN (lbs/yr)**	**Estimated Cost**	**$ per lb TSS**	**$ per lb TP**	**$ per lb TN**
COF001-BS1	Red Clay Creek	Bioswale	Proposed	52,902.20	51.39	845.00	$60,099.00	1.14	1,169.46	71.12
COF002-BS1	White Clay Creek	Bioswale	Proposed	57,483.18	62.39	1,307.47	$22,694.10	0.39	363.75	17.36
COF002-BS2	White Clay Creek	Bioswale	Proposed	28,013.21	30.25	628.06	$32,381.70	1.16	1,070.43	51.56
COF003-BS1	White Clay Creek	Bioswale	Proposed	19,439.08	21.05	439.08	$32,381.70	1.67	1,538.55	73.75
OP003-BS1	Red Clay Creek	Bioswale	Alternative	13,129.88	14.90	337.24	$117,237.90	8.93	7,868.30	347.64
OF080-BS1	White Clay Creek	Bioswale	Proposed	16,630.60	22.19	624.35	$23,860.20	1.43	1,075.26	38.22
OF092-BS1	White Clay Creek	Bioswale	Proposed	6,915.84	9.24	260.15	$22,694.10	3.28	2,457.00	87.23
OF099-BS1	White Clay Creek	Bioswale	Proposed	12,598.72	14.64	343.98	$28,201.68	2.24	1,926.32	81.99
OF040-BS1	Red Clay Creek	Bioswale	Proposed	23,396.95	27.07	631.55	$39,109.20	1.67	1,444.95	61.93
OF058-BS1	White Clay Creek	Bioswale	Proposed	8,558.75	11.23	310.08	$25,788.75	3.01	2,296.23	83.17
OF059-BS1	White Clay Creek	Bioswale	Proposed	28,954.86	36.92	985.22	$69,382.95	2.40	1,879.19	70.42
OF110-BS1	White Clay Creek	Bioswale	Proposed	29,555.16	32.59	702.61	$34,220.55	1.16	1,050.07	48.70
BS5	White Clay Creek	Bioswale	Alternative	7,150.85	8.07	180.86	$44,042.70	6.16	5,459.15	243.51
BS6	White Clay Creek	Bioswale	Proposed	8,150.91	9.99	253.54	$50,007.75	6.14	5,004.25	197.24
BS7	White Clay Creek	Bioswale	Alternative	1,559.48	2.21	66.19	$67,544.10	43.31	30,570.04	1,020.39
OF056-BS1	White Clay Creek	Bioswale	Alternative	15,441.65	20.02	544.81	$23,860.20	1.55	1,192.02	43.80
OF053-BS1	White Clay Creek	Bioswale	Proposed	11,019.07	13.63	349.63	$59,919.60	5.44	4,397.69	171.38
OF060-BS1	White Clay Creek	Bioswale	Proposed	5,704.64	6.30	136.38	$44,150.34	7.74	7,004.66	323.74
OF029-BS1	Red Clay Creek	Bioswale	Alternative	16,536.13	16.64	298.20	$23,860.20	1.44	1,434.18	80.01
OF025-BS1	White Clay Creek	Bioswale	Proposed	3,413.42	3.71	78.12	$34,713.90	10.17	9,349.46	444.35
OF010-BS1	Red Clay Creek	Bioswale	Alternative	8,437.27	10.66	281.20	$23,860.20	2.83	2,238.37	84.85
OF013-BS1	Red Clay Creek	Bioswale	Alternative	6,335.97	10.32	348.61	$23,860.20	3.77	2,312.64	68.44
OF014-BS1	Red Clay Creek	Bioswale	Proposed	10,234.43	14.01	405.50	$66,826.50	6.53	4,768.66	164.80
OF015-BS1	Red Clay Creek	Bioswale	Proposed	9,824.53	12.82	351.86	$61,265.10	6.24	4,777.65	174.12
				332,795.55	***379.42***	***8,652.59***	***$707,697.12***	***Estimated Cost of Proposed BMPs***		
				Reduction Met Using Proposed BMPs						