MS4 Pollution Reduction Plan (PRP)

Terre Hill Borough

August 2023

MS4 Pollution Reduction Plan (PRP)

Prepared for: Terre Hill Borough
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August 2023

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GENERAL DESCRIPTION

Terre Hill Borough (the MS4) is located in Lancaster County, Pennsylvania. The Borough is primarily residential with few commercial and manufacturing land uses. The Urbanized Area (UA) from the 2010 census covers the entire Borough. The extents of the UA are shown on Map #1. All maps associated with this document may be found in Attachment D.

Terre Hill Borough is located in eastern Lancaster County. The Borough is surrounded by East Earl Township. The Borough is roughly 0.5 square miles in area. The population is approximately 1,300 people. There is currently 3.89 miles of roadway in addition to the storm water system maintained by the Borough, and public water and sewer systems maintained by Weaverland Valley Authority.

SECTION A – PUBLIC PARTICIPATION

The Pollution Reduction Plan (PRP) was made available for public review and comment from _____ until _____. A hard copy of the PRP was available at the Borough building and an electronic version was available on the Borough's website. Comments on the PRP were solicited at the _____ and the _____, 2023 Borough Council meeting.

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SECTION B – MAPS

We have set up the map in ArcGIS.

The actual maps immediately follow this section:

Two maps are provided that show the entire Borough. The Urbanized Area includes the entire Borough. The primary difference between the two maps is that Map 2 includes aerial background and contours at 2' intervals.

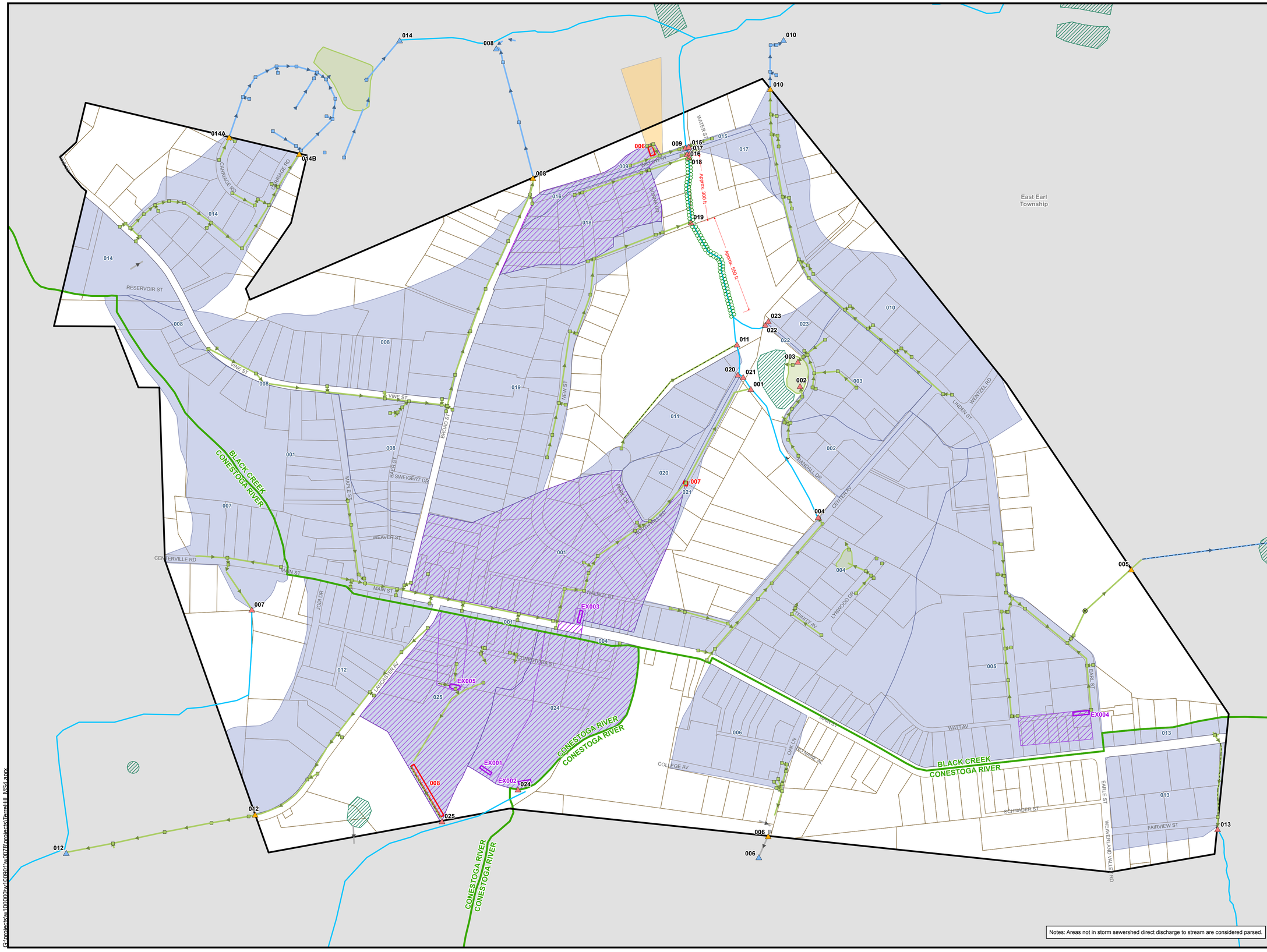
SECTION C – POLLUTANTS OF CONCERN

There are two primary watersheds within the Borough; Black Creek to the north and Conestoga River to the south. The Conestoga River is identified by the Pennsylvania Department of Environmental Resources (PaDEP) in the Requirements Table as impaired. Both watersheds are within the Chesapeake Bay watershed and therefore subject to Appendix D.

Impaired Downstream Waters Name	Impairment	Appendix as Identified in the Permit
Conestoga River	Nutrition / Siltation	E
Chesapeake Bay	Nutrition / Siltation	D

PaDEP requires that the MS4 address each impairment in accordance with the appendix noted. For those impairments that require the Borough to address impairments of Sediment (Siltation), the MS4 is required to prepare a Pollution Reduction Plan (PRP) that demonstrates that the pollutant reduction(s) (lbs/year) proposed in the PRP have been achieved within 5 years following the PaDEP's approval of coverage under the Permit. Sediments shall be reduced by 10%. The following pollution reduction plan demonstrates that Terre Hill Borough will reduce sediments by 10% in accordance with the Permit requirements.

Terre Hill Borough MS4 Map Lancaster County, PA Map 1



Data Sources:
Outfalls, SSM, 2019
Inlets, SSM, 2018
Manholes, SSM, 2018
Pipes & Swales, SSM, 2018
BMPs, SSM, 2018
Storm Sewersheds, SSM, 2018
Boundaries, PENNDOT, 2014
Wetlands, NWI, 2018
Contours, LIDAR, 2014

Notes: Areas not in storm sewershed direct discharge to stream are considered parsed.

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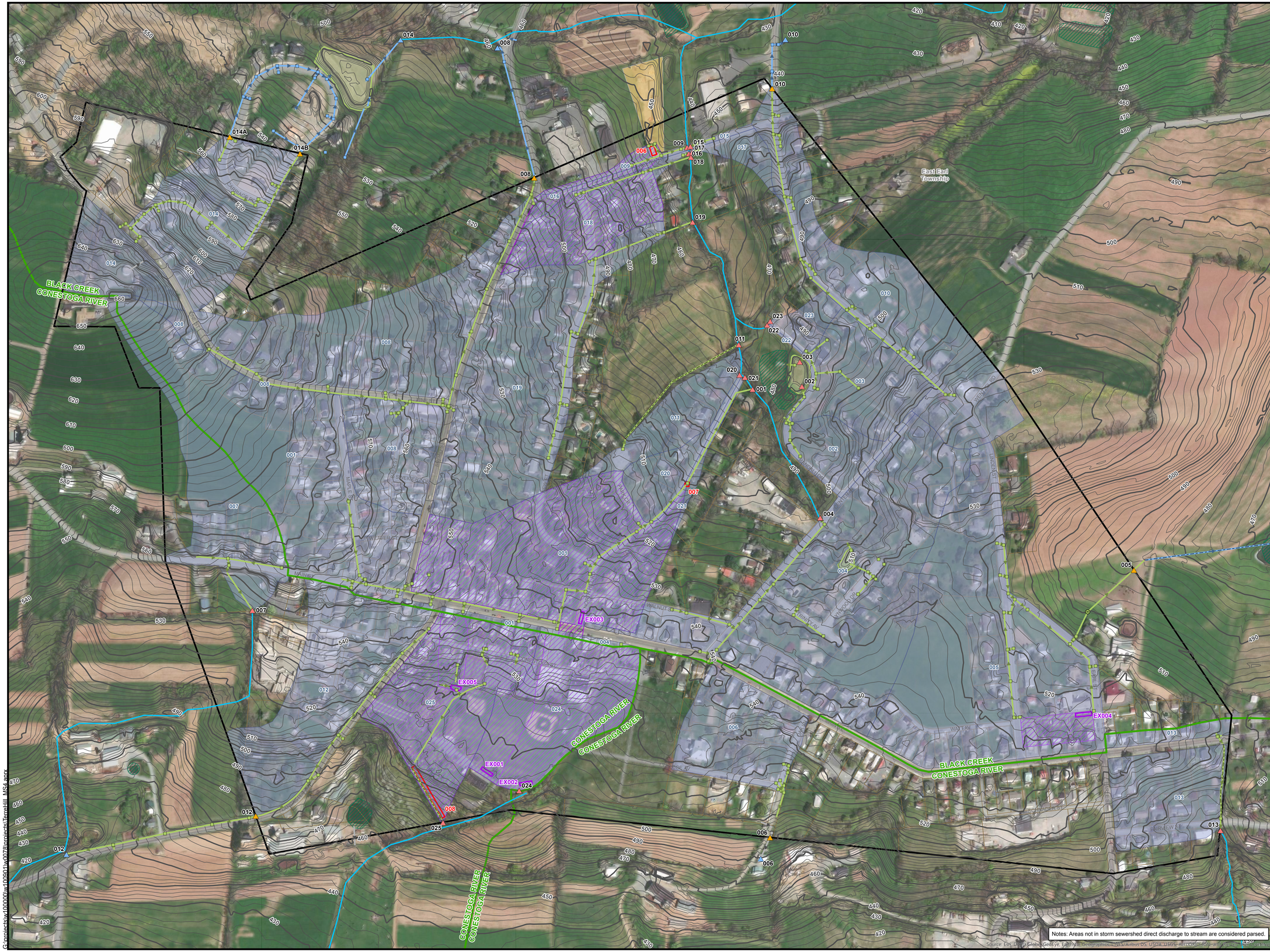
Terre Hill Borough
MS4 Map
Lancaster County, PA



- Terre Hill Boro Outfall
- East Earl Twp Outfall
- Observation Point
- Borough Owned Inlet
- Privately Owned Inlet
- Township Owned Inlet
- Manhole
- Stream
- Borough Owned Pipe
- Privately Owned Pipe
- Township Owned Pipe
- Borough Owned Swale
- Township Owned Swale
- 10ft Interval Contour
- Wetland
- Existing BMP
- Proposed BMP
- Urbanized Area
- Terre Hill Borough Boundary / Urbanized Area
- Watersheds
- Detention Basin
- Storm Sewershed
- BMP Drainage Area
- Borough Owned Property
- Parcel Boundary
- Municipal Boundary

N

0 300 600 Feet

1:2,400

Data Sources:
Outfalls, SSM, 2019
Inlets, SSM, 2018
Manholes, SSM, 2018
Pipes & Swales, SSM, 2018
BMPs, SSM, 2018
Storm Sewersheds, SSM, 2018
Boundaries, PENNDOT, 2014
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MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Lancaster County						
SALISBURY TWP	PAG133619*	Yes	SP	Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Pequea Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
STRASBURG BORO	PAG133715	No		Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Little Beaver Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				Pequea Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				Walnut Run	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
STRASBURG TWP	PAG133694*	No		Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Little Beaver Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				Pequea Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				Calamus Run	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
TERRE HILL BORO	PAI133523	Yes	IP	Conestoga River	Appendix E-Nutrients, Siltation (5)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
UPPER LEACOCK TWP	PAG133681	Yes	TMDL Plan	Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Conestoga River	Appendix B-Pathogens (5), Appendix E-Organic Enrichment/Low D.O., Siltation (5)	
				Mill Creek	Appendix E-Nutrients, Siltation (5)	
				Unt Mill Creek TMDL	TMDL Plan-Nutrients, Siltation, Suspended Solids (4a)	
				Unnamed Tributaries to Conestoga River	Appendix E-Nutrients (5)	
WARWICK TWP	PAG133565	Yes	TMDL Plan	Lititz Run	Appendix B-Pathogens (5)	
				Little Conestoga Creek	Appendix B-Pathogens (5), Appendix E-Nutrients, Siltation (5)	Cause Unknown (5)
				New Haven Run	Appendix B-Pathogens (5), Appendix E-Nutrients (5)	
				Lititz Run TMDL	TMDL Plan-Siltation, Suspended Solids, Turbidity (4a)	
				Hammer Creek	Appendix E-Nutrients, Siltation (5)	
				Cocalico Creek	Appendix E-Nutrients, Siltation (5)	Cause Unknown (5)
				Bachman Run	Appendix B-Pathogens (5)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Conestoga River	Appendix B-Pathogens (5), Appendix E-Organic Enrichment/Low D.O., Siltation (5)	

SECTION D – DETERMINE EXISTING LOADING FOR POLLUTANTS OF CONCERN

Sewershed Mapping

Terre Hill Borough has mapped their entire storm sewer system. In order to meet the requirements of the permit renewal for load reductions, efficiently map sewersheds, and provide a PRP that identifies Best Management Practices (BMPs) that can meet the required 10% sediment reductions, the Borough has taken a very systematic approach to delineating storm sewersheds.

The overall storm sewersheds were delineated first, parsing out areas not within the UA as well as areas not within the impaired watershed and only upstream of the lowest outfall area. These maps were not finalized nor were existing loading calculations finalized until the Borough, along with its engineer, identified potential areas for BMPs. One of the most efficient and cost effective means to address sediment reduction is through the conversion of conventional detention basins to extended detention wet basins or naturalized basins that more efficiently remove pollutants. Unfortunately, there are no Borough owned detention basins that could serve this purpose and privately owned would require the Township to spend funds on basins that would provide little benefit in load reduction. In addition, there are very few open spaces in which a "naturalized" facility could be located. The Borough also sought to partner with adjoining Townships to collectively address pollutant reduction requirements. Unfortunately the Townships apparently did not feel that there would be a benefit to them.

Existing Loading and Reduction Calculations

The Borough Engineer chose to use the simplified method (excel spreadsheet) for the calculations. The data source for the impervious and pervious areas was developed from the 2011 National Land Cover Database (NLCD 2011).

The Borough is located within two different HUC-12 watersheds. Therefore, any excess load reduction within each watershed should not be carried over to the other. Unfortunately, the borough has little space to construct BMPs and it has been impossible to find locations for proposed BMPs.

The BMP effectiveness values utilized in this analysis are taken from the PaDEP BMP Effectiveness Values Table document 3800-PM-BCW0100m. When the Borough first started the development of this PRP, the means to determine the effectiveness was thought to be this table alone. Subsequently, the Department has

noted that if the design meets the design requirements of the Pennsylvania Stormwater BMP Manual or the volume captured is verified by use of the Chesapeake Bay Program “Expert Panel Report.”

The Borough owns two parcels in each watershed. “The Garage” at the north end of the Borough (just north of Willow St.) and shown on Map 1 in yellow. This is within the Black Creek watershed. The second is the Terre Hill Community Memorial Borough Park.

During the design engineer’s original development of the PRP, a bio-swale was considered at the south end of the Borough and within the Borough Park. This is shown on Map 1 as BMP 008 and immediately upstream of outfall 025. This bio swale was originally considered in the early development of this PRP and utilized the 80% load reduction as outlined in PaDEP's "BMP Effectiveness Value" chart published in 2018. Since then, the DEP has noted that the removal rate noted can only be used as long as the BMP design accounts for the loading ratio recommendations in the Pennsylvania Stormwater BMP Manual or similar resource. Or one could also use the Expert Panel Report. Loading ratios are applicable to BMPs that utilize infiltration and we're not confident that this is feasible. Checking the use of this bio swale via the "Expert Panel Report" suggests that minimal volume is obtained and thus the runoff captured in inches is minimal. Ultimately suggesting that this bio swale will not provide the load reduction of 80% suggested by the BMP Effectiveness Value chart and therefore is not suggested as a prime alternative as a BMP for load reduction as part of this Pollution Reduction Plan.

Map 1 also shows existing BMPs implemented by the Borough Public Works. These are identified as EX001 through EX005 in a purple font. EX001 through EX004 are infiltration trenches / beds and unfortunately were not developed in accordance with the design methods / protocols of the Pennsylvania Stormwater BMP Manual. In addition, the inlets that lead to these beds are clogged and therefore we cannot confirm that they are functioning as intended. Therefore, these are not considered in the development of this PRP. EX005 is a raingarden that has been functioning well and has been used by the Borough for educational purposes of the public.

		Existing Sediment Loading					Existing BMPs					Proposed BMPs			
		Impervious		Pervious		Total									
Outfall	Watershed	Area (acres)	Load (lbs/yr)	Area (acres)	Load (lbs/yr)	Load (lbs/yr)	BMP Load (lbs/yr)	BMP Type	BMP Efficiency (%)	Load Reduction (lbs/yr)	Adjusted Load (lbs/yr)	BMP Load (lbs/yr)	BMP Type	BMP Efficiency (%)	Load Reduction (lbs/yr)
001	Black Creek	10.82	16018.25	17.60	3360.37	19378.62					19378.62				
BMP 007		5.31	7861.08	7.56	1443.43							9304.51	Hydrodynamic Seperator	0	0.00
002	Black Creek	1.07	1584.06	1.35	257.76	1841.82					1841.82				
003	Black Creek	1.09	1613.67	3.69	704.53	2318.20					2318.20				
004	Black Creek	8.08	11961.87	12.75	2434.36	14396.23					14396.23				
005	Black Creek	6.43	9519.16	12.75	2434.36	11953.52					11953.52				
008	Black Creek	6.21	9193.47	10.67	2037.22	11230.69					11230.69				
009	Black Creek	0.32	473.74	0.21	40.10	513.84					513.84				
BMP 006		2.40	3553.03	2.67	509.78							4062.81	Rain Garden	80	3250.25
010	Black Creek	3.87	5729.26	7.24	1382.33	7111.59					7111.59				
011	Black Creek	0.19	281.28	0.14	26.73	308.01					308.01				
014	Black Creek	3.53	5225.92	7.29	1391.88	6617.80					6617.80				
015	Black Creek	0.15	222.06	0.01	1.91	223.97					223.97				
016	Black Creek	0.46	681.00	0.21	40.10	721.10					721.10				
017	Black Creek	0.25	370.11	0.66	126.01	496.12					496.12				
018	Black Creek	1.79	2649.97	2.32	442.96	3092.93					3092.93				
019	Black Creek	3.83	5670.05	9.48	1810.02	7480.07					7480.07				
020	Black Creek	0.57	843.85	1.30	248.21	1092.06					1092.06				
021	Black Creek	0.28	414.52	0.15	28.64	443.16					443.16				
022	Black Creek	0.05	74.02	0.00	0.00	74.02					74.02				
023	Black Creek	0.25	370.11	0.77	147.02	517.13					517.13				

Black Creek Total Sediment (lbs /yr:	94,651.87	**Existing Reduction (lbs/yr):**	0.00	94651.87	**Black Creek Proposed Reduction (lbs /yr):** 3250.25
Imp (lbs/ac/yr)	Perv (lbs/ac/yr)		**Reqd 10% Reduction (lbs/yr):**	9465.19	
1,480.43	190.93				**BC Shortfall =** (6,214.94)

		Existing Sediment Loading						Existing BMPs					Proposed BMPs		
		Impervious		Pervious		Total									
Outfall	Watershed	Area (acres)	Load (lbs/yr)	Area (acres)	Load (lbs/yr)	Load (lbs/yr)	BMP Load (lbs/yr)	BMP Type	BMP Efficiency (%)	Load Reduction (lbs/yr)	Adjusted Load (lbs/yr)	BMP Load (lbs/yr)	BMP Type	BMP Efficiency (%)	Load Reduction (lbs/yr)
006	Conestoga River	1.97	2916.45	0.39	74.46	2990.91					2990.91				
007	Conestoga River	1.23	1820.93	4.02	767.54	2588.47					2588.47				
012	Conestoga River	3.25	4811.40	5.77	1101.67	5913.07					5913.07				
013	Conestoga River	2.46	3641.86	3.76	717.90	4359.76					4359.76				
24	Conestoga River	2.64	3908.34	4.78	912.65	4820.99					4820.99	4820.99	Rain Gardens	80	3856.79
	EX001	0.34	503.35	1.44	274.94	778.29									
	EX002	2.30	3404.99	3.34	637.71	4042.70									
025	Conestoga River	3.01	4456.09	5.45	1040.57	5496.66					5120.30				
BMP EX 005	Conestoga River	0.39	577.37	0.56	106.92	684.29		Rain Garden	55	376.36	307.93				
BMP 008	Conestoga River	2.55	3775.10	4.89	933.65							4708.75	Bioswale	80	3767 *
			Conestoga River Total Sediment (lbs /yr:)			31,675.14		**Existing Reduction (lbs/yr):**		376.36	26101.43		**Conestoga River Proposed Reduction (lbs /yr):**		3856.79
			Imp (lbs/ac/yr)		Perv (lbs/ac/yr)				**Reqd 10% Reduction (lbs/yr):**		2610.14				
			1,480.43		190.93										
									Total reqd 10% Reduction (lbs/yr):		12075.33			**Total Reduction (lbs/yr):**	7107.04
														Total Shortfall =	4968.29

Length of stream restoration required = 4968.29/44.88 = 110.70 LF **

Length of stream restoration required just for Black Creek = 9465.19/44.88 = 210.90 LF

Length of stream restoration for both watersheds = 12,075.33/44.88 = 269.07 LF

** Typical cost benefits are not realized for any stream restoration less than 200'

* This bio swale was originally considered in the early development of this PRP and utilized the 80% load reduction as outlined in PaDEP's "BMP Effectiveness Value" chart published in 2018. Since then, the DEP has noted that the removal rate noted can only be used as long as the BMP design accounts for the loading ratio recommendations in the Stormwater BMP Manual or similar resource. Or one could also use the Expert Panel Report.Loading ratio's are applicable to BMPs that utilize infiltration and we're not confident that this is feasible. Checking the use of this bio swale via the "Expert Panel Report" suggests that minimal volume is obtained and thus the runoff captured in inches is minimal. Ultimately suggesting that this bio swale will not provide the load reduction of 80% suggested by the BMP Effectiveness Value chart and therefore is not suggested as a prime alternative as a BMP for load reduction as part of this Pollution Reduction Plan.

SECTION E – SELECT BMPS TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADIN

As demonstrated in the spreadsheets on the previous pages the required 10% sediment reduction will be achieved. Locations of proposed BMPs are identified on the maps.

Based on the above, SSM is suggesting the following for the Borough of Terre Hill PRP:
There are two types of BMPs that can be proposed at 4 or 5 locations within the Borough. The types of BMPs are Rain Gardens (Bio – retention) and Stream Restoration.

- Conestoga River Watershed – Rain Gardens at or near the existing infiltration beds EX001 and EX002 will provide sufficient load reduction for the Conestoga River watershed. This may require the removal of some trees along the drive through Memorial Park.
- Black Creek Watershed – A rain garden on the Garage property (proposed BMP 006) would not be sufficient enough to provide the complete load reduction required for the watershed. A second BMP would need to be implemented to make up the shortfall. The only other feasible BMP is stream restoration located south (upstream) of Willow St. across the street from the Borough Garage. In order to make up this shortfall, approximately 110 LF of stream restoration would be needed to make up the load reduction within this watershed. Typical cost benefits are not realized for stream restoration less than 200 LF and therefore it is recommended that the rain garden on the garage property not be proposed but rather stream restoration should be investigated. The total stream restoration required for Black Creek alone is just over 210 LF and would require easement agreements from five property owners.

  During the development of this PRP, SSM discussed with PaDEP the potential of making up the shortfall in Black Creek by implementing additional BMPs within the Conestoga River watershed. PaDEP indicated that they would consider it. If feasible, stream restoration alone (270 LF) could provide the total load reduction for the entire Borough and therefore may be the most cost effective overall.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORMWATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS BMP EFFECTIVENESS VALUES

This table of BMP effectiveness values (i.e., pollutant removal efficiencies) is intended for use by MS4s that are developing and implementing Pollutant Reduction Plans and TMDL Plans to comply with NPDES permit requirements. The values used in this table generally consider pollutant reductions from both overland flow and reduced downstream erosion, and are based primarily on average values within the Chesapeake Assessment Scenario Tool (CAST) (www.casttool.org). Design considerations, operation and maintenance, and construction sequences should be as outlined in the Pennsylvania Stormwater BMP Manual, Chesapeake Bay Program guidance, or other technical sources. The Department of Environmental Protection (DEP) will update the information contained in this table as new information becomes available. Interested parties may submit information to DEP for consideration in updating this table to DEP's MS4 resource account, RA-EPPAMS4@pa.gov. Where an MS4 proposes a BMP not identified in this document or in Chesapeake Bay Program expert panel reports, other technical resources may be consulted for BMP effectiveness values. Note – TN = Total Nitrogen and TP = Total Phosphorus.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Wet Ponds and Wetlands	20%	45%	60%	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
Dry Extended Detention Basins	20%	20%	60%	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Infiltration Practices w/ Sand, Veg.	85%	85%	95%	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil, they are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approval to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.
Filtering Practices	40%	60%	80%	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
Filter Strip Runoff Reduction	20%	54%	56%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips.
Filter Strip Stormwater Treatment	0%	0%	22%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips.
Bioretention – Raingarden (C/D soils w/ underdrain)	25%	45%	55%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.
Bioretention / Raingarden (A/B soils w/ underdrain)	70%	75%	80%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Bioretention / Raingarden (A/B soils w/o underdrain)	80%	85%	90%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.
Vegetated Open Channels (C/D Soils)	10%	10%	50%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.
Vegetated Open Channels (A/B Soils)	45%	45%	70%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.
Bioswale	70%	75%	80%	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	10%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/ underdrain)	45%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/o underdrain)	75%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (A/B Soils w/ underdrain)	50%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Permeable Pavement w/ Sand or Veg. (A/B Soils w/o underdrain)	80%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (C/D Soils w/ underdrain)	20%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.
Stream Restoration	0.075 lbs/ft/yr	0.068 lbs/ft/yr	44.88 lbs/ft/yr	An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol.
Forest Buffers	25%	50%	50%	An area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. Effectiveness credit for TN is for 4 upslope acres for each acre of buffer (4:1), and 2 upslope acres for TP and sediment (2:1). Additional credit is gained by converting land use from current use to forest. (Note – the values represent pollutant load reductions from stormwater draining through buffers).
Tree Planting	10%	15%	20%	The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given.
Street Sweeping	3%	3%	9%	Street sweeping must be conducted 25 times annually. Only count those streets that have been swept at least 25 times in a year. The acres associated with all streets that have been swept at least 25 times in a year would be eligible for pollutant reductions consistent with the given BMP effectiveness values.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1 – TN and TP concentrations	This BMP (also referred to as “Storm Drain Cleaning”) involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. To determine pollutant reductions for this BMP, these steps must be taken: 1) Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected. 2) Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter). 3) Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the sediment removal efficiency specified by the manufacturer may be assumed, but no higher than 80%.

SECTION F – IDENTIFY FUNDING MECHANISM(S)

Background

Terre Hill Borough realizes the importance to establish a designed infrastructure to reduce pollution being transmitted to our waterways and, even more importantly, properly plan for the installation of such facilities, including how to finance the costs of these installations. A proper sequencing plan of installations and a pro-active financing plan increase the potential for success to accomplish our goals of reducing our waterway pollution.

As noted by the above calculations, Terre Hill Borough has identified that by installing rain gardens and stream restoration or if DEP allows, stream restoration only. During the first year of the permit, the Borough will explore the feasibility of stream restoration and then refine the design by surveying the areas of facility placement and finalizing design. The construction will follow in an order that allows the Borough to install the BMPs in a financially responsible order (i.e. least expensive first) so that funds may be accumulated accordingly.

If the Borough cannot obtain grants or other financial assistance, the Borough's anticipated cost to install the facilities may be as much as $450,000 assuming that substantial utility relocation and restoration is not warranted. The Borough will own and maintain the BMPs in accordance with proper BMP maintenance protocols. The estimated annual maintenance cost is approximately $7,000.

Goal

The goal of the Terre Hill Borough BMP Installation and Financing Plan is to lay out a specific set of criteria to install and finance our Best Management Practice sites to achieve measurable milestones and goals. This set of specific criteria shall be kept simple for continuity purposes with any staff changes, yet detailed enough to provide accountability by the Borough. The program shall be arranged to allow some flexibility in the event of extenuating circumstances taking place outside of the Terre Hill Borough Pollution Reduction Plan that may conflict with or impact the ability to implement this plan. Once the BMPs are completed, routine maintenance will likely be completed by Borough staff. However, should any maintenance or repairs extend beyond their capabilities, the Borough will hire a contractor that is capable of providing the appropriate services.

Strategies to Achieve Measurable Goals

The Permit period covers five years. This allows time for the Borough to plan, prepare, and arrange financing to complete the required BMP facility within the five year period.

Timing of Projects

No BMP facilities will be installed in the first, maybe even the second year of the permit cycle. This will allow the Borough to properly prepare for the projects, complete topographical surveys, avoid utility conflicts and adjust for any design modifications. This one year period will also allow the Borough to reinforce the financial planning of these projects.

Financing

All material, labor and equipment costs associated with the installation of these facilities will be paid for from the Capital Improvement General Fund. The Capital Improvement General Fund is funded by the General Fund through annual transfers. Presently, Terre Hill Borough has not created a Storm Sewer User Fee. If it is determined that the funding source must be altered, that determination will be made depending upon the most prudent course of action in implementing the PRP. Also, if grants or other funding sources are found, the Borough may seek such assistance to fund the project.

SECTION G – IDENTIFY RESPONSIBLE PARTIES FOR OPERATION AND MAINTENANCE (O&M) OF BMPS

Once the BMPs are completed, routine maintenance might be completed by Borough staff and/or volunteers. However, should any maintenance or repairs extend beyond their capabilities or capacity, the Borough will hire a contractor that is capable of providing the appropriate services. It is also possible that some of the BMPs may be maintained by agreement with private entities.

SPECIFIC O&M REQUIREMENTS

Rain Gardens (Bio-retention)

- Properly designed and installed Bioretention areas require some regular maintenance.
- While vegetation is being established, pruning and weeding may be required.
- Detritus may also need to be removed and perennial plantings may be cut down at the end of the growing season.
- Mulch shall be re-spread when erosion is evident and be replenished as needed. Once every 2 to 3 years the entire mulch may require replacement.
- Bio-retention areas shall be inspected at least two times per year for sediment buildup, erosion, vegetative conditions, etc.
- During periods of extended drought, Bioretention areas may require watering.
- Trees and shrubs shall be inspected twice per year to evaluate health.

Stream Restoration

The Borough recognizes the importance of maintenance and this is especially important during the first five years after construction, particularly years 1-3. The following are estimated maintenance costs:

- Year 1 & 2 – estimate $17,500 per year – This could come down based on the final restoration footprint. Assumes 2 engineering inspections to assess restoration function and site stability (focus on sewer cover), and includes preparation and filling of annual reports with regulatory agencies. Also assumes 6 maintenance visits to ID & address problematic species, including spraying, pruning and potentially meadow mowing/trimming as necessary. It may also require to include a contingency for reseeding & matting/planting replacements as necessary.
- Year 3 – estimate $7,500 – Typically only require 1 engineering inspection. Assume 2 to 4 maintenance visits.
- Years 4 & 5 – estimate $3,000 to $5,000 as necessary, 2 -4 maintenance visits

- After year 5, any maintenance should be infrequent and minimal and any routine maintenance will be completed by the Township. However, should any maintenance or repairs extend beyond their capabilities, the Township will hire a contractor that is capable of providing the appropriate services.

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