BETHEL TOWNSHIP

MS4

POLLUTANT REDUCTION PLAN

Revised August 31, 2021

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BACKGROUND

The stormwater requirements of the Federal Clean Water Act are administered under the **Pennsylvania Department of Environmental Protection**'s Municipal Separate Storm Sewer (MS4) Program. Polluted storm water run-off is often transported to municipal separate storm sewer systems (MS-4's) and ultimately discharged into local rivers and streams without treatment. In 1990, the Environmental Protection Agency (EPA) promulgated rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) stormwater program. The Phase I program for MS4's requires operators of "medium" and "large" MS4s (those MS4s that generally serve populations of 100,000 or greater), to implement a stormwater management program as a means to control polluted discharges from these MS4s. The Stormwater Phase II Rule extends coverage of the NPDES stormwater program to certain "small" MS4s but takes a slightly different approach to how the stormwater management program is developed and implemented.

The EPA's Stormwater Phase II Rule establishes an MS4 stormwater management program that is intended to improve the Nation's waterways by reducing the quantity of pollutants that stormwater picks up and carries into storm sewers during storm events. Common pollutants include oil and grease from roadways, pesticides from lawns, sediment from construction sites, carelessly discarded trash, and other illicit discharges. When deposited into nearby waterways through MS4 discharges, these pollutants can impair waterways, thereby discouraging recreational use of the resource, contaminating drinking water supplies, and interfering with the habitat for fish, other aquatic organisms, and wildlife.

In December 2002, DEP issued a General Permit for use by MS4s that fall under the National Pollutant Discharge Elimination System (NPDES) Phase II program, requiring the implementation of a stormwater management program for minimizing the impacts from runoff. Under the MS4 Program, permittees (including Bethel Township), are required to incorporate the following six elements (known as minimum control measures, or MCMs) into their stormwater management programs:

- Public education and outreach
    - Develop, implement and maintain a written Public Education and Outreach Program
    - Develop and maintain lists of target audience groups
    - Annually publish at least one educational item on the SWM Program
    - Distribute Stormwater Educational Materials to the Target Audiences
- Public involvement and participation

- Develop, Implement and maintain a Written Public Involvement and Participation Plan (PIPP)
- Public comment on any ordinance changes
- Regularly solicit public involvement and participation from the Target audience groups

- Illicit discharge detection and elimination

  - Develop and maintain a written program for the detection, elimination, and prevention of illicit discharges
  - Develop and maintain a map of the regulated MS4 area.
  - Up-date map to show roads, inlets, storm sewers, basins, etc
  - Outfall Screening
  - Enact SWM Ordinance
  - Provide Educational Outreach to Public Employees, Business Owners and Employees, Property Owners, the general public, and elected officials about the program to detect and eliminate illicit discharges

- Construction site runoff control

  - Develop program for construction storm water permitting, construction inspections, and enforcement of installation and maintenance of the necessary E/S controls
  - Enact, implement, and enforce an Ordinance for E/S implementation.
  - Implement requirements to control waste at construction sites
  - Implement Procedures for receipt and consideration of public inquiries and concerns.

- Post-construction stormwater management in new development and redevelopment

  - Develop written procedures for storm water BMP's
  - Select BMP's that minimize water quality impacts
  - Insure BMP installation
  - Post-Construction SWM requirements
  - Low Impact Design
  - Operation and Maintenance issues

- Pollution prevention and good housekeeping for municipal operations and maintenance

- Inventory facilities and activities
- Develop, implement, and maintain O&M program for Municipal Operations and Facilities
- Employee Training Program

Each MCM has a series of suggested best management practices (BMPs) associated with it to guide permit holders in program development, tracking, and reporting. Pennsylvania has close to 1,000 jurisdictions that are considered small municipal separate stormwater systems (MS4s).

During the next five-year permitting period starting in March 2018, if there are impaired streams in a Municipality, the Municipality must reduce sediment pollution loads by 10% over a five year period. In order to achieve this goal the Municipality must develop a Pollutant Reduction Program (PRP). The PRP Program is to be developed by the Municipality and approved by PaDEP. The PRP must include the following information:

- Accurate Map of the municipality's Storm Sewer Shed
- Determine the area and land use types in the Storm Sewer Shed
- Determine the sediment loading in the Storm Sewer Shed
- Establish the 10% reduction value of the sediment loading
- Develop and fund a program to meet the 10% reduction
- Physical work will need to be accomplished – stream bank stabilization, retro-fit SWM Basins, installation of the SWM Facilities, Tree planting, etc.

More specifically, the PRP shall contain the following:

A. Public Participation

1. The PRP shall be made available for public review.

2. A Public Notice shall be published in a newspaper of general circulation concerning the PRP – where it can be viewed, comment period, etc.

3. Public comments concerning the PRP shall be received by the municipality

B. Map

1. A Map that identifies land uses and/or impervious/pervious surfaces and the storm sewer shed boundary associated with each MS4 that discharges to an impaired waterway.

C. Pollutants of Concern

1. The pollutants of concern for each storm sewershed or the overall PRP Planning Area shall be identified.

D. Determine Existing Loading for Pollutants of Concern

1. Calculations are to be provided to determine the existing loading, in lbs per year, for the pollutant(s) of concern in the PRP Planning Area.

E. BMPs to Achieve the Minimum Required Reductions in Pollutant Loading

1. The municipality must propose the implementation of BMP(s) or land use changes within the PRP Planning Area that will result in meeting the minimum required reductions in pollutant loading within the planning area.

F. Identify the Funding Mechanism

G. Identify Responsible Parties for the Operation and Maintenance (O&M) of the BMPs

The requirements of the MS4 program including the Pollution Reduction program is an unfunded mandate meaning the municipality must fund the expenses related to the MS4 program

A. PUBLIC PARTICIPATION

Copies of the Bethel Township Pollution Reduction Plan (PRP) are available at the Bethel Municipal Office located at 1092 Bethel Road, Garnet Valley, PA. A public notice containing a statement describing the PRP was published in the Delaware County Times on 11 August, 2017. A copy of the proof of publication is attached in Appendix 'A'. Comments concerning the PRP were accepted for a period of 30 days from the date of the public notice. Copies of written comments are included in Appendix 'B' of this report. Bethel Township record of consideration is included in Appendix 'C' of this report.

B. PRP MAP

A Storm Sewershed map for Bethel Township is included in Appendix 'G' of this report. The Storm Sewershed Map illustrates the existing road system within the Township and also the

residential and commercial developments within the Township. The storm sewershed drainage areas to all Township Roads and Drainage Facilities have been delineated on the Storm Sewershed Map.

Bethel Township is primarily a residential community. The predominant land uses are either low density residential (minimum lot areas of 30,000 sf) in the R-1 District, or medium density residential (minimum lot areas of 10,000 sf) in the R-3 District. The commercial areas are relatively small and are generally located at the intersections of the major streets that traverse through the Township. There is also a mixed use commercial development on Garnet Mine Road east of Foulk Road.

There are two relatively large active adult communities located within the Township – Belmont and Foxfield. These are private communities with private roads; therefore, theses communities are not part of the Township's MS4.

The following is a list of the State Highways that traverse through the Township:

- Foulk Road
- Garnet Mine Road
- Pyle Road
- Concord Road
- Chichester Avenue
- Chelsea Road
- Conchester Highway (Route 322)
- Bethel Road
- Naamans Creek Road
- Valleybrook Road

The drainage areas to the State Highways are not part of the Township's MS4.

Hicks Lane is a private lane and is also not part of the MS4.

There are three major watersheds located within Bethel Township: Naamans Creek Watershed; West Branch of the Chester Creek Watershed; and the Brandywine Creek Watershed.

There is an un-named tributary to Beaver Creek which is part of the Brandywine Creek Watershed located at the far southwest portion of Bethel Township. The major developments in that portion of the Township include Trotters Lea; Chartwell, and the westerly half of Belmont. The un-named tributary to Beaver Creek is not listed as impaired and therefore a Pollution reduction Plan for this storm sewershed is not required.

The Naamans Creek Watershed covers approximately 70% of the Township. All of the easterly portion and most of the southerly portion of the Township is located in the Naamans Creek Watershed. The Naamans Creek Watershed is subdivided into the following storm sewersheds:

- West Branch Naamans Creek
- South Branch Naamans Creek
- Naamans Creek (main branch)
- Spring Run
- East Branch Naamans Creek

All branches of the Naamans Creek Watershed are listed as impaired.

The West Branch Chester Creek covers approximately 25% of the Township. The West Branch Chester Creek Watershed is located in the westerly portion of the Township. The West Branch Chester Creek is subdivided into the two following storm sewer sheds:

- Webb Creek (aka Concord Creek)
- Green Creek

The two branches of the West Branch Chester Creek Watershed are listed as impaired.

C. POLLUTANTS OF CONCERN

The identified pollutants of concern for both the Naamans Creek Watershed and the West Branch of the Chester Creek Watershed are 1) Urban Run-off, and 2) Siltation.

D. EXISTING LOADING OF POLLUTANTS OF CONCERN

A table for the determination of the Sediment Loading (lbs/yr) has been included in Appendix 'D'. The Sediment Loading was determined by the following method:

1. Determine the storm sewershed for each Township Road and Township Drainage Facility.
2. The Drainage Area is shown on the Township Storm Sewershed Map that contains LIDAR Topographic Information.
3. The Area of each storm sewershed is calculated and included on the Bethel Township PRP Sediment Loading Table.

4. The impervious cover in each storm sewershed is established by determining the 1) length and width of road surfaces in the storm sewershed; 2) the number of buildings and approximate building footprint in the storm sewershed; 3) measuring the length of driveways or private lanes in the storm sewershed; and 4) providing an allowance for miscellaneous impervious surface.

5. The sediment loading values for Delaware County provided by PaDEP were used – 1,839 lbs/acre/year for impervious surfaces and 265 lbs/acre/year for pervious surfaces.

6. The loading for the storm sewersheds for each Development/Township Road was determined by taking the drainage area and then multiplying by the percent impervious cover x 1839 lbs/year/ac and also the percent pervious cover x 265 lbs/year/acre. The loading for the individual development/road storm sewersheds were then summed to provide the sediment loading for each of the major storm sewersheds in the Township.

7. The sediment loading is included on the Bethel Township PRP Work Sheet included in Appendix 'D'

E. BMPs for REQUIRED REDUCTIONS IN POLLUTANT LOADING

All of the BMPs listed within the BMP Effectiveness Values Table (3800-PM-BCW0100m) were considered for the required Pollution Reduction Plan (PRP). A copy of the PaDEP BMP Effectiveness Table is included in Appendix E. The Township contains a significant amount of wetland area especially along the headwaters of the Naamans Creek. There is little interest to create additional wetlands or wet ponds for the PRP. Generally, the Township owned land is limited to several active recreation parks. The park lands were negotiated with developers to provide amenities to Township Residents. The Township would not want to sacrifice the active recreation areas in order to install wetlands or wet ponds.

The large majority of the developments constructed in Bethel Township were built in the 1980's, 1990's and early 2000's. The developments all included storm water detention basins for storm water rate control. The large majority of township roads drain into a dry storm water detention basin. A logical and efficient BMP measure would be the conversion of SWM rate control basins into Dry Extended Detention Basins. The net effectiveness of this measure is the difference between the effectiveness value of a dry extended detention basin and a dry detention basin (60%-10%=50%). If some filtration of the storm water can be accomplished while the extended duration basins are draining, the effectiveness of sediment removal can be increased to 60%.

Infiltration Practices are not considered an effective BMP within Bethel Township because the Township Soils are generally poorly draining. Filtering practices whereby stormwater run-off is captured and passed through a filter bed of sand or organic matter would be a possible BMP especially if the filtering is performed with a SWM basin conversion.

A significant number of developments in the Township have Homeowner Association owned open space. The open spaces are generally located near environmentally sensitive areas such as streams and wetlands. Therefore, the Township has an appreciable amount of existing filter strips, but little opportunity to create new filter strips for the PRP due to the lack of available land.

Bioretention (raingardens) can be effective BMP for the PRP. The application of bioretention within Bethel Township would be limited to smaller scale applications due to poorly draining soils. Since rain gardens are shallow basins, significant land area would be required for rain gardens to be a major component of the PRP. The Township does not have access to land area necessary for this BMP.

The majority of developments within Bethel Township rely on storm sewers for the conveyance of storm water run-off rather than vegetated open channels. Those open channels in existence are few and have small flow lengths (less than 100 feet). Converting storm sewers into Vegetated Open Channels would be costly, and more importantly would have to be performed on private property. Resident "buy-in" to creating a swale in a rear yard rather than through a not visible storm sewer is doubtful.

Replacing standard parking lots with permeable paving is not economically practical. Since the Township is primarily residential there are not large areas of gently sloping paved expanses typical with retail and other commercial uses (other than the Booth Corner Farmers Market).

There are a number of streams located within the Township and stream bank stabilization projects are certainly a viable BMP for the PRP.

As previously mentioned, there are significant existing forested buffers within the Township, but little land opportunity to create new forested buffers for the PRP. Similarly, the amount of meadow land available for tree planting is limited. The land use in the Township is primarily either lawn area of small to medium size lots or existing woodlands.

Street sweeping was not considered as a significant alternative for the PRP plan since most township roads drain to SWM basins where the sediment can be trapped. Street Sweeping may be used for select collector roads that have been in existence prior to 1960 and whereby these collector roads do not drain into SWM facilities.

West Branch Naamans Creek

A total sediment reduction of approximately 10,283 lbs/yr is required to meet the 10% sediment reduction standard in the West Branch Naamans Creek Storm Sewershed.

The major residential developments located in the West Branch Naamans Creek Storm Sewershed within Bethel Township include Woods at Naamans, Rock Creek, Greenbrier, Donald Drive, and the Link Subdivision. Small sections of the collector roads, Zebley Road and Marsh Road, also exist in the West Branch Naamans Creek Storm Sewershed. The developments were all approved prior to 2003. Except for the Link Subdivision, Storm Water Management Basins were provided in all the Developments for storm water rate control. The basins are available for retrofit from a dry detention basin to a dry extended basin for a net BMP Effectiveness ratio benefit of 50% (60% with some filtering of Storm Water). Portions of the storm water management basins in the Greenbrier and Donald Drive Developments are located on individual lots. The Township would be required to seek permission from the Property Owners in order to retro-fit these basins. The SWM basins in the Woods at Naamans and Rock Creek Development are located on community open space. The Homeowners Association would need to grant permission to retrofit the existing SWM basin.

The SWM Basins in the Woods at Naamans Development are all located within Community Open Space. The rear SWM Basin is accessible from Ryans Run and receives enough tributary drainage area to meet the require 10% sediment reduction.

As an alternate, a stream bank stabilization project for approximately 240 feet of stream would provide the necessary sediment pollution reduction. Streams are available in this storm sewershed for stream bank stabilization project.

The Pollutant Reduction Calculations are included in Appendix 'F' of this report. The proposed method of sediment pollution reduction is the retrofit of the rate control storm water management basin in the Woods at Naamans Development. The alternate method is stream bank stabilization within an eroded section of the West Branch of the Naamans Creek.

South Branch Naamans Creek

A total sediment reduction of approximately 12,813 lbs/yr is required to meet the 10% sediment reduction standard in the South Branch Naamans Creek Storm Sewershed.

The major residential developments located in the South Branch Naamans Creek Storm Sewershed within Bethel Township include The Meadows, Brookcroft, Sharon, Sweetbrier, Clayton Meadows, Webster Farm, Calais Woods, Taylor Run, Weller Glen, Linton Farm, a portion of Woodland Acres, and Beau Tree Subdivisions. Portions of the collector road, Zebley Road, also exist in the South Branch Naamans Creek Storm Sewershed. The developments were all approved prior to 2003 with the exception of Webster Farm. Storm Water Management Basins were provided in all the Developments for storm water rate control. The basins are available for retrofit from a dry detention basin to a dry extended basin for a net BMP Effectiveness ratio benefit of 50% (60% with some filtering of Storm Water) . Portions of the storm water management basins in The Meadows, Sweetbrier, Clayton Meadows, Calais Wood, Taylor Run, Weller Glen, Linton Farm, and Woodland Acres Developments are located on individual lots.

The SWM Basin in the Sharon Development is owned by Bethel Township. It is also one of the oldest SWM Basins. The SWM Basin at the Sharon Development is proposed for retrofitting because the basin already needs some maintenance work, and the Basin is owned by the Township thus eliminating issues concerning rights of entry. The available sediment reduction for the retrofit of the Sharon Basin is slightly less than the required for that Storm Sewer Shed (12,813 lbs required versus 9,741 lbs available); however, other storm Sewer Sheds of the Naamans Creek can make up the difference.

As an alternate, a stream bank stabilization project for approximately 285 feet of stream would provide the necessary sediment pollution reduction. Streams are available in this storm sewershed for stream bank stabilization project.

The Pollutant Reduction Calculations are included in Appendix 'F' of this report. The proposed method of sediment pollution reduction is the retrofit of the rate control storm water management basin in the Sharon Development. The alternate method is stream bank stabilization within an eroded section of the South Branch of the Naamans Creek.

Main Branch Naamans Creek

A total sediment reduction of approximately 12,335 lbs/yr is required to meet the 10% sediment reduction standard in the Main Branch Naamans Creek Storm Sewershed.

The major residential developments located in the Main Branch Naamans Creek Storm Sewershed within Bethel Township include Hidden Creek, Creekside Run, Hills at Bethel, Sarum Farm, Goodley Manor, Winding Brook, Brookside, Hidden Valley I, Hidden Valley II, Garnet Woods, and Kirkwood Close Subdivisions. Portions of the collector road, Goodley Road, also exist in the Main Branch Naamans Creek Storm Sewershed. The developments were all approved prior to 2003. Storm Water Management Basins were provided in all the Developments for storm water rate control except for the Garnet Woods Development which was constructed in the late 1960s. The basins are available for retrofit from a dry detention basin to a dry extended basin for a net BMP Effectiveness ratio benefit of 50% (60% with some filtering of Storm Water). Portions of the storm water management basins in Hidden Creek, Creekside Run, Sarum Farm, Goodley Manor, Winding Brook, Brookside, Hidden Valley I, Hidden Valley II, Garnet Woods, and Kirkwood Close Developments are located on individual lots. The Township would be required to seek permission from the Property Owners in order to retro-fit these basins. The SWM basins in the Hills at Bethel Development are located on community open space. The Homeowners Association would need to grant permission to retrofit the existing SWM basins.

The SWM Basin in the Hills at Bethel Development is located within Community Open Space. The SWM Basin is accessible from Naamans Creek Road and receives enough tributary drainage area to meet the require 10% sediment reduction.

As an alternate, a stream bank stabilization project for approximately 274 feet of stream would provide the necessary sediment pollution reduction. Streams are available in this storm sewershed for stream bank stabilization project.

The Pollutant Reduction Calculations are included in Appendix 'F' of this report. The proposed method of sediment pollution reduction is the retrofit of the rate control storm water management basin in the Hills at Bethel Development. The alternate method is stream bank stabilization within an eroded section of the Main Branch of the Naamans Creek.

Spring Run

A total sediment reduction of approximately 5,798 lbs/yr is required to meet the 10% sediment reduction standard in the Spring Run Storm Sewershed.

The major residential developments located in the Spring Run Storm Sewershed within Bethel Township include Garnet Ridge, Garnet Hills, Spring Meadow, Fortress Laughead, Foulk Run, Bethel Woods, and the southerly portions the Greystone and Longmeadow Subdivisions. The developments were all approved prior to 2003. Storm Water Management Basins were provided in all the Developments for storm water rate control except for the Foulk Run and Bethel Woods Developments which was constructed in the late 1960s. The basins are available for retro-fit from a dry detention basin to a dry extended basin for a net BMP Effectiveness ratio benefit of 50%. Portions of the storm water management basins in Spring Meadow, Fortress Laughead, Greystone and Longmeadow Developments are located on individual lots. The Township would be required to seek permission from the Property Owners in order to retro-fit these basins. The SWM basins in the Garnet Hills and Garnet Ridge Developments are located on community open space. The Homeowners Association would need to grant permission to retrofit the existing SWM basins.

The SWM Basin in the Garnet Hills Development is located within Community Open Space. The SWM Basin is accessible from William Road and receives enough tributary drainage area to meet the require 10% sediment reduction.

As an alternate, a stream bank stabilization project for approximately 130 feet of stream would provide the necessary sediment pollution reduction. Streams are available in this storm sewershed for stream bank stabilization project.

The Pollutant Reduction Calculations are included in Appendix 'F' of this report. The proposed method of sediment pollution reduction is the retrofit of the rate control storm water management basin in the Garnet Hills at Bethel Development. The alternate method is stream bank stabilization within an eroded section of Spring Run.

East Branch Naamans Creek

A total sediment reduction of approximately 5,116 lbs/yr is required to meet the 10% sediment reduction standard in the East Branch Naamans Creek Storm Sewershed.

The major residential developments located in the East Branch Naamans Creek Storm Sewershed within Bethel Township include the Scots Glen, Garnet Oaks, Woodmere, and the southeasterly portion of the Longmeadow Subdivisions. The developments were all approved prior to 2003. Storm Water Management Basins were provided in all the Developments for storm water rate control. The basins are available for retrofit from a dry detention basin to a dry extended basin for a net BMP Effectiveness ratio benefit of 50% (60% with some filtering of storm water run-off). Portions of the storm water management basins in Scots Glen, and Woodmere Developments are located on individual lots. The Township would be required to seek permission from the Property Owners in order to retro-fit these basins. The SWM basins in the Garnet Oaks and Longmeadow Developments are located on community open space. The Homeowners Association would need to grant permission to retrofit the existing SWM basins.

The SWM Basin in the Scotts Glen Development is located on private property, but is readily available from the public roads. The SWM Basin receives enough tributary drainage area to meet the require 10% sediment reduction for this Storm Sewer Shed. The Township will need to negotiate with the property owner for access rights to the basin and to perform the necessary retrofit work. If unsurmountable opposition from the property owner is received, then the alternate SWM Basin retro fit would be within the Longmeadow Development.

As an alternate, a stream bank stabilization project for approximately 114 feet of stream would provide the necessary sediment pollution reduction. Streams are available in this storm sewershed for stream bank stabilization project.

The Pollutant Reduction Calculations are included in Appendix 'F' of this report. The proposed method of sediment pollution reduction is the retrofit of the rate control storm water management basin in the Scotts Glen Development. The alternate SWM Basin retrofit is the rear basin in the Longmeadow Development. The alternate method is stream bank stabilization within an eroded section of the East Branch of the Naamans Creek.

Webb Creek

A total sediment reduction of approximately 1,993 lbs/yr is required to meet the 10% sediment reduction standard in the Webb Creek Storm Sewershed.

The major residential developments located in the Webb Creek Storm Sewershed within Bethel Township include the Scalones Landing Development, the northeasterly portion of the Chartwell Development, and the westerly portion of the Woodland Acres Development. The developments were all approved prior to 2003. Storm Water Management Basins were provided in all the Developments for storm water rate control. The basins are available for retro-fit from a dry detention basin to a dry extended basin for a net BMP Effectiveness ratio benefit of 50%. Portions of the storm water management basins in Scalones Landing, and Woodland Acres Developments are located on individual lots. The Township would be required to seek permission from the Property Owners in order to retro-fit the basins. The SWM basins in the Chartwell Development are located on community open space. The Homeowners Association would need to grant permission to retrofit the existing SWM basins.

The SWM Basin in the Woodland Acres is located within Community Open Space. The SWM Basin is accessible from Marian Drive and receives enough tributary drainage area to meet the require 10% sediment reduction.

As an alternate, a stream bank stabilization project for approximately 44 feet of stream would provide the necessary sediment pollution reduction. The minimum length of stream bank stabilization is 100 feet, so excess stream bank stabilization is required. Streams are available in this storm sewershed for stream bank stabilization project.

The Pollutant Reduction Calculations are included in Appendix 'F' of this report. The proposed method of sediment pollution reduction is the retrofit of the rate control storm water management basin in the Woodland Acres Development. The alternate method is stream bank stabilization within an eroded section of the Webb Creek.

Green Creek

A total sediment reduction of approximately 13,233 lbs/yr is required to meet the 10% sediment reduction standard in the Green Creek Storm Sewershed.

The major residential developments located in the Green Creek Storm Sewershed within Bethel Township include the Chelsea Downs, Green Glen, Northbrook, Longmeadow (westerly portion), Pondview I & II, Summitt Lane, Greystone, Waiting Rock, Marthas Way, Tall Trees, and Indian Rock Subdivisions. The developments were all approved prior to 2003. Storm Water Management Basins were provided in all the Developments for storm water rate control. The basins are available for retro-fit from a dry detention basin to a dry extended basin for a net BMP Effectiveness ratio benefit of 50%. Portions of the storm water management basins in the Chelsea Downs, Green Glen, Longmeadow, Pondview, Summitt Lane, Greystone, Waiting Rock, Marthas Way, Tall Trees and Indian Rock are located on individual lots. The Township would be required to seek permission from the Property Owners in order to retro-fit these basins. The SWM basins in the Northbrook Development are located on community open space. The Homeowners Association would need to grant permission to retrofit the existing SWM basins.

The SWM Basin in the Northbrook Development is located within Community Open Space. The SWM Basin is accessible from Garnet Mine Road and receives enough tributary drainage area to meet the require 10% sediment reduction.

As an alternate, a stream bank stabilization project for approximately 294 feet of stream would provide the necessary sediment pollution reduction. Streams are available in this storm sewershed for stream bank stabilization project.

The Pollutant Reduction Calculations are included in Appendix 'F' of this report. The proposed method of sediment pollution reduction is the retrofit of the rate control storm water management basin in the Northbrook Development. The alternate method is stream bank stabilization within an eroded section of the Tributaries to Green Creek.

F. FUNDING MECHANISM

The efforts to achieve the 10% reduction in sediment loading will be funded by the General Funds of Bethel Township. A Preliminary Cost Estimate for the proposed BMPs is included in Appendix 'G' of this report.

G. BMP OPERATION and MAINTENANCE RESPONSIBILITIES

The operation and maintenance responsibilities of the proposed BMP's will be established as follows:

1. Retro-fit SWM Basins

The day-day maintenance of the SWM Basins will continue to that of the owner of the Basin – whether a Homeowners Association or an individual Lot owner. The Township will maintain any facility that is to be newly installed to achieve the extended duration feature of the basin. Retro-fitted SWM basins will be inspected at least once a year by an authorized agent of the Township (typically the Township Engineer).

2. Stream Bank Stabilization

It will be the Borough's responsibility to oversee and maintain the stream bank stabilization projects. The treated stream banks will be inspected yearly and after rain events producing more than 4 inches of rain in a 24 hour period.

APPENDIX 'D'

SEDIMENT LOADING TABLE

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading	
WEST BRANCH NAAMANS CREEK								
Garnet Woods	Princess Ann	0.96	R-1	100	20	557	56	
Goodley Road	Goodely Road	1.32	R-1	100	20	765	77	
John Adkinson Park	Naamans Creek Rd	5.542	OS	100	5	1,905	190	
Woods at Naamans	Ryans Run Drew Lane Todd Lane Pennford Place	37.52	R-3 OS	80 20	40 5	26,852 2,579	2,685 258	
Rock Creek	Highland Drive Marsh Road Manor Court Larkin Road	37	R-3 OS	95 5	40 5	31,445 636	3,145 64	
Donald Drive	Donald Drive	5.73	R-1	100	20	3,322	332	
Greenbrier	Powell Circle Stephen James Poole Circle Link Drive Walter Harvey Circle Trimble Road	53.07	R-1 OS	90 10	20 5	27,693 1,824	2,769 182	
Marsh Road	Marsh Road	3.72	Special	100	40	3,328	333	
Zebley Rd South	Zebley Road	9.4	R-1A	100	18	5,154	515	
	Sub-Total	154.262				102,834		10,283

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading
SOUTH BRANCH NAAMANS CREEK							
Sharon	Sharon Drive Atlee Circle Elizabeth Drive	28.09	R-1	100	20	16,287	1,629
The Meadows	Luhman Circle	11.72	R-1 OS	85 15	20 5	5,776 604	578 60
Brookcroft	Brookcroft Lane Brookcroft Place	25.82	R-1 OS	90 10	20 5	13,473 887	1,347 89
Webster Farm	Briggs Way Webster Drive	15.83	R-1 OS	90 10	20 5	8,260 544	826 54
Taylor Run	Taylor Drive	3.71	R-1	100	20	2,151	215
Weller Glen	Weller Drive	3.96	R-1	100	20	2,296	230
Linton Farm	Linton Farm Drive	4.69	R-1 OS	90 10	20 5	2,447 161	245 16
Woodland Acres	Marion Drive	10.27	R-1	100	20	5,955	595
Calais Woods Tall Trees	Red Oak Lane Belvedere Drive	24.46	R-1	100	20	14,182	1,418
Sweetbrier	Split Rail Driive Old Post Circle Zebley Road	41.805	R-1 OS	85 15	20 5	20,603 2,155	2,060 216
Zebley Road - Mid	Zebley Road	13.79	R-1	100	20	7,995	800
Zebley Road - West	Zebley Road	14.13	R-1 OS	90 10	20 5	7,373 486	737 49
Kirk Road - Mid	Kirk Road	6.83	R-1	100	20	3,960	396

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading	
Ebright Road	Ebright Road	21.62	R-1	100	20	12,535	1,254	
	Sub-Total	226.725				128,132		12,813

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading
MAIN BRANCH NAAMANS CREEK							
Hidden Creek	Charles Griffin Drive	37.38	R-1	85	20	18,422	1,842
	Oday Lane		OS	15	5	1,927	193
Creekside Run	Essex Way	3.28	R-1	100	20	1,902	190
Hills at Bethel	Overlook Circle Meadow View Lane Forrest Hill Drive	27.8	R-3	100	40	24,870	2,487
Goodley Manor	Wendy Way Nicole Drive	19.17	R-1	100	15	9,606	961
Winding Brook	Winding Brook Lane	10.98	R-1	80	20	5,093	509
	Fox Run		OS	20	5	755	75
Hidden Valley II	Spring Meadow Lane	6.93	R-1	85	20	3,415	342
			OS	15	5	357	36
Garnet Woods	Princess Anne	27.08	R-1	85	20	13,346	1,335
	Robins Road		OS	15	5	1,396	140
Brookside	Dorothy Drive Spring Meadow Lane						
Grams Way	Grams Way	7.28	R-1	100	20	4,221	422
Hidden Valley	Deer Meadow Lane	7.03	R-1	85	20	3,465	346
			OS	15	5	362	36
Kirkwood Close	Kirkwood Close	2.58	R-1	100	20	1,496	150
Goodley Road	Goodley Road	24.81	R-1	100	20	14,385	1,438
Kirk Road	Kirk Road East	18.1	R-1	50	20	5,247	525
	Booths Corner		Special	50	75	13,082	1,308

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading	
	Sub-Total	192.42				123,347		12,335

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading	
SPRING RUN								
Garnet Ridge	Maher Boulevard	10.79	R-3	90	40	8,687	869	
	Edward Circle		OS	10	5	371	37	
Garnet Hills	William Road	30.59	R-4	33	52	10,937	1,094	
			OS	67	5	7,044	704	
Spring Meadow	Stillwood Lane	10.78	R-1	85	20	5,313	531	
			OS	15	5	556	56	
Laughead Fortress	Great Oak Drive	5.69	R-1	100	20	3,299	330	
Laughead Twp	Laughead Lane	5.22	R-1A	100	16	2,698	270	
Foulk Run	Booth Drive	7.38	R-1	100	20	4,279	428	
	Green Street							
	Warner Place							
Bethel Woods	Arbor Drive	11.13	R-1	85	20	5,485	549	
	Booth Drive		OS	15	5	574	57	
Longmeadow	Longmeadow Road	8.54	R-1	100	20	4,951	495	
	Farmhouse Lane							
Pond View	Darzcuk Drive	2.13	R-1	100	20	1,235	123	
Greystone	Hedgerow Circle	4.69	R-1	85	20	2,311	231	
				15	5	242	24	
	Sub-Total	96.94				57,983		5,798

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading	
EAST BRANCH NAAMANS CREEK								
Woodmere	Booth Drive	3.58	R-1	100	20	2,076	208	
Longmeadow	Farmhouse Drive	3.57	R-1	100	20	2,070	207	
Garnet Oaks	Colonial Drive	38.16	R-3	80	40	27,310	2,731	
	Springhouse Hollow		OS	20	5	2,623	262	
	Woodsview drive							
	Shadyside Lane							
	Sunnyside Lane							
Scots Glen	Eleanor Circle	23.47	R-1	100	20	13,608	1,361	
	Robert Burns Drive							
Tall Trees	David Drive	2.28	R-1	100	20	1,322	132	
Indian Rock	Venuti Drive	3.71	R-1	100	20	2,151	215	
	Sub-Total	74.77				51,160		5,116

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading	
WEBB CREEK								
Scalones Landing	Scalones Landing	3.02	R-1	100	20	1,751	175	
Woodland Acres	Marian Drive	14.79	R-1	80	20	6,860	686	
			OS	20	5	1,017	102	
Chartwell	Weathering Lane	12.72	R-3	80	42	9,424	942	
	Knole Lane		OS	20	5	874	87	
	Heathfield Close							
	Sub-Total	30.53				19,926		1,993

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading
GREEN CREEK/WEST BRANCH CHESTER CREEK							
Foulk Manor	Manor Drive	9.32	R-1	100	20	5,404	540
Chelsea Downs	Loraine Drive	4.47			0.31	1,206	121
Green Glen	Green Glen Drive	5.9			0.35	1,596	160
Northbrook Phase I	Brookstone Drive	23.05	R-1 R-4 OS	60 30 10	20 52 5	8,019 7,492 792	802 749 79
Northbrook Phases II-IV	Woods Edge Drive McLaughlin Court Fieldstone Court Tall Trees Circle	28.83	R-4 OS	85 15	52 5	26,551 1,486	2,655 149
Longmeadow	Longmeadow Road Farmhouse Lane	15.2	R-1	100	20	8,813	881
Pondview	Darzcuk Drive Hammond Drive	20.03	R-1 OS	95 5	20 5	11,033 344	1,103 34
Summit	Summit Lane	3.48	R-1	100	20	2,018	202
Greystone	Logan Lane Hamilton Lane Beverly Drive Hedgerow Circle	20.28	R-1 OS	85 15	20 5	9,995 1,046	999 105
Waiting Rock	Griggs Drive Baldwin Drive Carpenter Court High Meadow	54.26	R-1	100	20	31,460	3,146
Marthas Way	Marthas Way	3	R-1	100	20	1,739	174

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD		STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading	
Municipal Complex	Bethel Road		3.189	Special	100	80	4,861	486	
Kirk Road -West	Kirk Road		9	Special	100	18	4,935	493	
Indian Rock	Venuti Drive		2.132	R-1	100	20	1,236	124	
Tall Trees	David Drive		3.976	R-1	100	20	2,305	231	
		Sub-Total	119.347				132,331		13,233
Grand Total			**894.994**				**615,712**		**61,571**

BETHEL TOWNSHIP
PRP WORK SHEET
July 30, 2017

DEVELOPMENT	ROAD	STORM SEWER SHED AREA (acres)	IMPERV COVER TYPE	PERCENTAGE OF LAND IN COVER TYPE	IMPERV COVER (%)	SEDIMENT LOADING (lbs)	10% of SEDIMENT Loading	
BRANDYWINE CREEK (UN-NAMED TRIBUTARY)								
Trotters Lea	Trotters Lea Lane	18.06	R-4	90	52	17,611	1,761	
	Sulky Way		OS	10	5	621	62	
Chartwell	Mayfield Lane	99.3	R-3	60	40	53,300	5,330	
	Rotherfield Lane		OS	40	30	29,282	2,928	
	Heathfield Close							
	Knole Lane							
	Heaver Close							
	Knole Lane East							
	Hawkhurst Close							
	Lamberhurst Close							
	Sub-Total	117.36				100,813		10,081

APPENDIX 'A'

PROOF OF PUBLICATION

APPENDIX 'B'

PUBLIC COMMENTS

APPENDIX 'C'

TOWNSHIP CONSIDERATION

OF

PUBLIC COMMENTS

APPENDIX 'E'

PaDEP

BMP EFFECTIVENESS VALUES

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%.

APPENDIX 'F'

PROPOSED BMP

ALTERNATIVES

PROPOSED SEDIMENT REDUCTION PROJECTS

STORM SEWER SHED: WEST BRANCH NAAMANS CREEK

Required Sediment Reduction	10,283	lbs
SWM Basin to Retrofit	Ryan Run Rear Basin	
Drainage Area to Basin	27	ac
Percentage Impervious Cover	33	%
Sediment Load to Basin	21,179	lbs
Effective Sediment Reduction	12,708	lbs

ALTERNATE PRP - Stream Bank Stabilization

Length of Stream Bank Required= 229 ft

STORM SEWER SHED: SOUTH BRANCH NAAMANS CREEK

Required Sediment Reduction	12,813	lbs
SWM Basin to Retrofit	Sharon Development	
Drainage Area to Basin	28	ac
Percentage Impervious Cover	20	%
Sediment Load to Basin	16,234	lbs
Effective Sediment Reduction	9,741	lbs

ALTERNATE PRP - Stream Bank Stabilization

Length of Stream Bank Required= 285 ft

STORM SEWER SHED: MAIN BRANCH NAAMANS CREEK

Required Sediment Reduction	12,335	lbs
SWM Basin to Retrofit	Overlook Circle	
Drainage Area to Basin	28	ac
Percentage Impervious Cover	40	%
Sediment Load to Basin	25,049	lbs
Effective Sediment Reduction	15,029	lbs

ALTERNATE PRP - Stream Bank Stabilization

Length of Stream Bank Required= 274 ft

STORM SEWER SHED: **SPRING RUN**

Required Sediment Reduction	5,798	lbs
SWM Basin to Retrofit	Garnet Hills	
Drainage Area to Basin	28	ac
Percentage Impervious Cover	20	%
Sediment Load to Basin	16,234	lbs
Effective Sediment Reduction	9,741	lbs

ALTERNATE PRP - Stream Bank Stabilization
Length of Stream Bank Required= 129 ft

STORM SEWER SHED: **EAST BRANCH NAAMANS CREEK**

Required Sediment Reduction	5,116	lbs
SWM Basin to Retrofit	Scotts Glen	
Drainage Area to Basin	12	ac
Percentage Impervious Cover	20	%
Sediment Load to Basin	6,958	lbs
Effective Sediment Reduction	4,175	lbs

ALTERNATE PRP - Stream Bank Stabilization
Length of Stream Bank Required= 114 ft

STORM SEWER SHED: **GREEN CREEK**

Required Sediment Reduction	13,233	lbs
SWM Basin to Retrofit	Northbrook	
Drainage Area to Basin	28	ac
Percentage Impervious Cover	45	%
Sediment Load to Basin	27,252	lbs
Effective Sediment Reduction	16,351	lbs

ALTERNATE PRP - Stream Bank Stabilization
Length of Stream Bank Required= 294 ft

STORM SEWER SHED: **WEBB CREEK**

Required Sediment Reduction	1,993	lbs
SWM Basin to Retrofit	Woodland Acres	
Drainage Area to Basin	14.8	ac
Percentage Impervious Cover	20	%
Sediment Load to Basin	8,581	lbs
Effective Sediment Reduction	5,149	lbs

ALTERNATE PRP - Stream Bank Stabilization

Length of Stream Bank Required= 44 ft

BETHEL TOWNSHIP PRP
INITIAL 10% SEDIMENT LOAD REDUCTION
SWM BASIN RETROFITS

WATERSHED	REQUIRED SEDIMENT REDUCTION	SEDIMENT REDUCTION PROVIDED	SWM BASIN TO BE RETROFITTED
WEST BRANCH NAAMANS CREEK	10283	12708	Ryan Run
SOUTH BRANCH NAAMANS CREEK	12813	9741	Sharon
MAIN BRANCH NAAMANS CREEK	12335	15029	Overlook
SPRING RUN	5798	9741	Garnet Hills
EAST BRANCH NAAMANS CREEK	5116	4175	Scotts Glen
WEBB CREEK	1993	5149	Woodland Acre
GREEN CREEK/WEST BRANCH CHESTERCREEK	13233	16351	Northbrook
TOTALS	**61571**	**72894**	

APPENDIX 'G'

PRELIMINARY COST ESTIMATE

ESTIMATED BMP COST
FOR
BETHEL TOWNSHIP
POLLUTANT REDUCTION PLAN

BASIN RETROFIT

1	Mobilization	1 EA	$ 3,000.00	$ 3,000.00
2	Track Hoe	5 Day	$ 2,000.00	$ 10,000.00
3	Dump Truck	3 Day	$ 1,100.00	$ 3,300.00
4	Foreman	5 Day	$ 750.00	$ 3,750.00
5	Laborers	10 Day	$ 500.00	$ 5,000.00
6	Stone	100 TN	$ 20.00	$ 2,000.00
7	Stabilization	1 LS	$ 2,000.00	$ 2,000.00
8	E/S Matting	550 YD	$ 5.00	$ 2,750.00
9	Riser Modification	1 EA	$ 4,000.00	$ 4,000.00
10	Underdrain Piping	75 FT	$ 40.00	$ 3,000.00
	Sub-Total			$ 38,800.00
11	Engineering (10%)			$ 3,880.00
	TOTAL			**$ 42,680.00** per Basin

NOTE: Bethel Township Road Crew may be able to perform select basin retro-fits

STREAM BANK STABILIZATION - PER 100 feet

1	Stream Bank Stabil	100 FT	$170.00	$17,000.00
2	Engineering (10%)			$ 1,700.00
	TOTAL			**$ 18,700.00**

APPENDIX 'H'

BOROUGH STORM SEWERSHED MAP