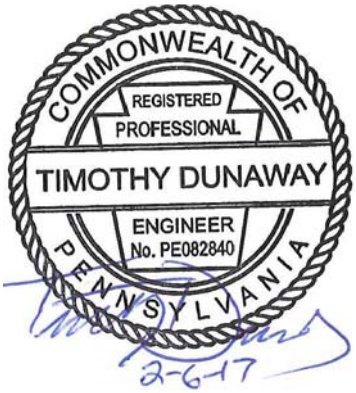
Site Restoration and Post-Construction Stormwater Management Plan

Pennsylvania Pipeline Project
Doylesburg Pump Station Expansion

February 2017



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LIST OF ACRONYMS

ACRONYM	MEANING
AASHTO	American Association of State Highway and Transportation Officials
ABACT	Antidegradation Best Available Combination of Technologies
BMP	Best Management Practice
CCE	Calcium Carbonate Equivalent
CWF	Cold Water Fishery
E&SC	Erosion and Sediment Control
ENV	Effective Neutralizing Value
HDD	Horizontal directional drilling
HDPE	High-density polyethylene
HQ	High Quality
LOD	Limit of Disturbance
NRCS	Natural Resource Conservation Service
NGL	Natural gas liquids
PA	Pennsylvania
PADEP	Pennsylvania Department of Environmental Protection
PASDA	Pennsylvania Spatial Data Access

PCSM	Post-Construction Stormwater Management
ROW	Right of way
SCS	U.S. Soil Conservation Service
SR	Sight Restoration
SPLP	Sunoco Pipeline, L.P.
TSF	Trout stock fisheries
Tt	Tetra Tech, Inc.
UNT	Unnamed tributary
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WWF	Warm water fisheries

1.0 INTRODUCTION

Tetra Tech, Inc. (Tt) has prepared this Site Restoration Plan and Post-Construction Stormwater Management (PCSM) Plan for Sunoco Pipeline, L.P. (SPLP). The Plan addresses restoration and post-construction stormwater management following installation of the Doylesburg Station (Project). The Project is located in Toboyne Township, Perry County, Pennsylvania (PA). A United States Geological Survey (USGS) site location map is provided in Appendix A.

Sunoco Pipeline, L.P. (SPLP) is proposing to expand the SPLP Doylesburg Station (Project) in Toboyne Township, Perry County, PA. The station is located on State Route 274 at latitude 40° 17' 10.67'', longitude -77° 36' 51.48''. The Doylesburg Station will include the expansion of the pump station, installation of above ground pipes and pipe supports, and site restoration. The proposed Doylesburg Station will be improved within a limit of disturbance (LOD) of approximately 1.80 acres.

Section 2.0 discusses the existing site and its characteristics. Section 3.0 discusses the construction sequence, site restoration practices, and the inspection and maintenance procedures. Section 4.0 discusses the proposed BMPs, the design criteria, and design process

2.0 EXISTING SITE DESCRIPTION

Past and present land use of the Project area includes an existing equipment pad and access road surrounded by woodland and grass lot. Future land use will be a maintained expanded gravel pad, access road, and restored areas being returned to meadow in good condition. A site location map is located in Appendix A. The project area drains to Sherman Creek. The current land use within the project area is wooded and industrial. Site soils information was taken from the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Web Soil Survey. A soil map and list of existing soil types is located in Appendix B.

2.1 TOPOGRAPHY

The work zone is located on ground of varying elevations. Site elevations vary from approximately 920 feet (access road entrance) to 948 feet (northwest edge of pad) above mean sea level based on the Pennsylvania Spatial Data Access. The construction plans show the topography of the site and the surrounding area.

2.2 GEOLOGY AND SOILS

The soils and geologic formations surrounding the site are shown on the figures provided in Appendix B. Appendix B also provides soil descriptions and properties of the soils found at the site. In general, the following actions will be taken to counteract soil limitations:

- Pipes installed will be protected from potential corrosive soils. The pipeline(s) being installed will be either high-density polyethylene (HDPE) or coated steel.
- Soils will be evaluated throughout the construction process to determine whether additional measures will need to be taken to make the soil suitable for its intended use on site. Soil amendments will be added to site soils to promote vegetative growth.
- A wetland delineation and stream investigation has been conducted to determine the presence and location of hydric soils.

The site consists of **Albrights (AbB)** silt loam, 3 to 8 percent slopes and **Calvin (CaC)** shaly silt loam, 8 to 15 percent slopes, which are described below.

AbB – Albrights- silt loam, 3 to 8 percent slopes.

This moderately well-draining soil is located on toeslopes and footslopes of ridges at elevations ranging from 500 to 2,800 feet above mean sea-level. It is formed from fine-loamy colluvium derived from sedimentary rock. The typical soil profile is: 0 to 10 inches: silt loam (Hydrological Soil Group A); 10 to 30 inches clay loam (Hydrological Soil Group B); and 30 to 60 inches: silt loam (Hydrological Soil Group C).

The depth to water table is 12 to 28 inches. The restrictive feature, fragipan, is encountered 18 to 32 inches below the surface. There is no frequency of flooding or ponding. Limitations for the Allbrights silt loam are cutbanks cave, corrosivity, droughty, erodibility, seasonal high water table, hydric inclusions, low strength, slow percolation, piping, poor source of topsoil, susceptible to frost action, and wetness.

CaC-Calvin-shaly silt loam, 8 to 15 percent slopes.

This well-draining soil is located on summit hills at elevations ranging from 300 to 1,600 feet above mean sea-level. It is formed from red, residuum weathered from shale and siltstone. The typical soil profile is: 0 to 8 inches: channery silt loam (Hydrological Soil Group A); 8 to 26 inches: very channery silt loam (Hydrological Soil Group B); and 26 to 40 inches: extremely channery silt loam (Hydrological Soil Group C); 40 to 44 inches: bedrock. The depth to water table is more than 80 inches. The restrictive feature, lithic bedrock, is encountered 20 to 40 inches below the surface. There is no frequency of flooding or ponding. Limitations for the Calvin shaly silt loam are cutbanks cave, corrosivity, droughty, erodibility, hydric inclusions, piping, and susceptible to frost action.

2.3 SURFACE WATER HYDROLOGY

The Project area surface water runoff drains offsite to the southeast, approximately 1000 feet downgradient, towards Sherman Creek which is designated as a High Quality Cold Water Fishery (HQ-CWF) under PA Code 25 Chapter 93. These waters are designated as attained, supporting recreation and aquatic life.

ABACT PCSM BMPs are required to maintain the designated use of the receiving waters. The locations of the receiving waters relative to the Project area can be seen on Appendix A, USGS Project Location figure.

3.0 SITE RESTORATION PRACTICES

Grounds disturbed by any of the operations necessary to complete the work for this project are to be permanently seeded, or if specified, sodded, unless occupied by structures, paved, graveled, or designated as a permanent access road. Disturbed areas will be seeded and mulched as soon as practical once final grades are achieved. If seeding cannot be completed within a four (4) day period due to weather conditions, the disturbed area will be mulched with straw at the rate of three (3) tons per acre. This straw will be anchored using a method described in Section 3.4. The subsurface infiltration bed will be installed as post construction stormwater BMP to mitigate the permanent stormwater impacts of construction.

3.1 CONSTRUCTION SEQUENCE

Refer to the PCSM plan drawings for the locations of the proposed stormwater BMPs. A construction sequence is provided below for installing post construction stormwater BMPs. The construction sequence is intended to provide a course of action to conform to the applicable regulatory agency requirements for restoration and post-construction stormwater management of the site. Necessary steps for proper and complete execution of work pertaining to this plan, whether specifically mentioned or not, are to be performed by the contractor. The contractor must comply with all requirements listed in this section. If the contractor needs to alter controls based on the effectiveness of controls or differing conditions encountered in the field, they must first receive the approval of the Perry County Conservation District and Pennsylvania Department of Environmental Protection (PADEP).

A pre-construction meeting is required prior to the start of any construction activity. The PADEP or applicable county conservation district, contractors, the landowner, appropriate municipal officials, and the plan preparer shall be invited to this meeting at least 7 days in advance.

1. Install post construction BMPs after completion and stabilization of the Project to prevent sediment accumulation in the BMPs.

2. A licensed professional shall oversee all installation and testing procedures for the subsurface infiltration bed, level spreader, vegetated channels, and stormwater inlets, piping and outlets.

Minimize Total Disturbed Area

1. All construction shall take place within the designated limits of disturbance as shown on the plans.
2. Maintain soil stockpiles in the areas designated on the plans.
3. The existing compressor station gravel pad shall be used for equipment and material storage to minimize the limits of disturbance and soil compaction.

4. Within the limits of disturbance, contractors are to minimize land disturbance to the maximum extent. Repeated travel is restricted to travel lanes and travel through areas are limited to those necessary to complete the work.

5. Surface roughing is the practice of providing a rough soil surface with horizontal depressions for the purpose of reducing runoff velocity, increasing infiltration, aiding the establishment of vegetation, and reducing erosion. During the preparation for seeding on slopes 3H:1V or steeper, unless a stable rock face is provided, surface roughening is to be conducted by tracking the slopes by running tracked equipment (with blades up) across the surface as to leave grooves parallel to the contour. Any area where stone and/or timber mats are used for temporary stabilization, soil will be decompacted through multiple passes using tracked equipment. The tracking method can be used elsewhere to aid in the decompaction of soils as deemed necessary to facilitate successful restoration. The tracking method can be used on the subsoil before topsoil replacement and/or on the topsoil prior to seeding. In agricultural areas, severely compacted areas are to be plowed with a harrow, paraplow, paratill or other equipment before subsoil replacement. Vehicular traffic is to be restricted from areas that are ready to be seeded. The level of soil compaction will vary greatly across the project and the decompaction measures to be implemented will be considered on case-by-case basis and evaluated through testing (e.g., penetrometer) and discussions between Spread Managers and Environmental Inspectors.

Re-Vegetate Disturbed Areas

1. Apply permanent seeding as described in Section 3.2

Level Spreader Installation

1. Construct earthen level spreaders on zero percent grades to ensure uniform spreading of sediment-free runoff.

2. Minimum width of earthen level spreaders shall be 6 feet.

3. A transition section shall be constructed between the diversion channel and the earthen level spreader if the widths are different.

4. Protect the lip of an earthen level spreader with an erosion-resistant material to prevent erosion and enable vegetation to become established. For the permanent installation, the material shall be a rigid lip of non-erodible material, such as concrete curbing.

5. Provide a smooth transition between the level spreader and the native ground downslope.

6. A rigid level lip shall be entrenched at least 2 inches below the ground surface and securely anchored to prevent displacement. Immediately after the earthen level spreader is constructed, the entire area of the spreader shall be appropriately seeded and mulched.

Subsurface Infiltration Bed Installation

1. Due to the nature of construction sites, Subsurface Infiltration should be installed toward the end of the construction period, if possible. (Infiltration beds may be used as temporary sediment basins or traps as discussed above).
2. Install and maintain adequate Erosion and Sediment Control Measures (as per the Pennsylvania Erosion and Sedimentation Control Program Manual) during construction.
3. The existing subgrade under the bed areas should NOT be compacted or subject to excessive construction equipment traffic prior to geotextile and stone bed placement.
4. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material should be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches with a York rake (or equivalent) and light tractor. All fine grading should be done by hand. All bed bottoms should be at level grade.
5. Earthen berms (if used) between infiltration beds should be left in place during excavation. These berms do not require compaction if proven stable during construction.
6. Install upstream and downstream control structures, cleanouts, perforated piping, and all other necessary stormwater structures.
7. Geotextile and bed aggregate should be placed immediately after approval of subgrade preparation and installation of structures. Geotextile should be placed in accordance with manufacturer's standards and recommendations. Adjacent strips of geotextile should overlap a minimum of 16 inches. It should also be secured at least 4 feet outside of bed in order to prevent any runoff or sediment from entering the storage bed. This edge strip should remain in place until all bare soils contiguous to beds are stabilized and vegetated. As the site is fully stabilized, excess geotextile along bed edges can be cut back to the edge of the bed.
8. Clean-washed, uniformly graded aggregate should be placed in the bed in maximum 8-inch lifts. Each layer should be lightly compacted, with construction equipment kept off the bed bottom as much as possible.
9. Do not remove inlet protection or other Erosion and Sediment Control measures until site is fully stabilized.

Vegetated Channel Installation

1. Fine grade the vegetated channel. Accurate grading is crucial for channels. Even the smallest nonconformities may compromise flow conditions.

2. Seed, vegetate and install protective lining as per approved plans and according to final planting list. Plant the swale at a time of the year when successful establishment without irrigation is most likely. However, temporary irrigation may be needed in periods of little rain or drought. Vegetation should be established as soon as possible to prevent erosion and scour.

3. Once all tributary areas are sufficiently stabilized, remove temporary erosion and sediment controls. It is very important that the swale be stabilized before receiving upland stormwater flow.

Stormwater Inlets, Piping and Outlets

1. Excessive sediment generated during construction can clog the inlets, outlets, and piping and prevent or reduce the anticipated post-construction water quality benefits. Stabilize all contributing areas before runoff enters structures. If inlets require installation prior to site stabilization, the inlet shall be protected with sand bags or other means necessary to prevent sediment laden runoff from entering.

2. Excavate trenches for stormwater inlets, piping, and outlets. Take care to ensure slope stability during excavation in order to avoid slope failure.

3. Place underlying gravel, stone, or clean fill per the construction details provided on the PCSM plan sheets. Lightly compact the underlying media.

4. Place stormwater structure on top of the lightly compacted underlying media.

5. Cover the inlets, outlets, and piping per the construction details provided in the PCSM plan sheets.

3.2 PERMANENT SEEDING

Site preparation and establishment of permanent cover will be conducted according to the following guidelines:

1. Install needed surface water control measures.

2. Hydroseed or follow Steps 3 through 6 below.

3. Perform all cultural operations at right angles to the slope.

4. Determine agricultural lime application rates by field pH testing at a rate of 1 test per acre (min.). In the absence of testing, apply at 6 tons per acre.

5. Apply dry 10-20-20 formulation of fertilizer at the rate of 678 lb. per acre or at a rate determined by field testing.

6. Work in lime and fertilizer to a depth of 4 inches using suitable equipment.

7. Seed Mixture – The seed mixture will be:

SCIENTIFIC NAME	COMMON NAME	REQUIRED VARIETIES	% BY WEIGHT	MINIMUM % PURITY	MINIMUM % GERMINATION	MAX % WEED	SEEDING RATE (LBS/1000 SF)
Festuca Arundinacea	Tall Fesuce	Festuca arundinacea var. Kentucy 31	70	98	85	0.15	7.5
Lotus Corniculatus	Birdsfoot Trefoil Mixture	A combination of varieties (Viking, Empire, Norcen, Dawn, Leo, Bull, Maitland) with no one variety exceeding 50% of the total Trefoil component.	20	98	80(1)	0.1	2
Agrostis Alba	Redtop	Agrostis alba	10	92	80	0.15	1

8. If not hydroseeding, apply mulch.

Notes:

1. *Spread seeds where indicated and at the rates specified in Table 1, or as otherwise indicated.*
2. *Spread seeds within April 1 to June 15 or August 16 to September 15.*
3. *Extend seeding dates where project conditions warrant. Apply full treatment or apply only 50% of the permanent seeding and soil supplements and apply the remaining 50% within the next seeding dates, as directed in writing.*
4. *Use tillage and soil supplements before permanent seeding on topsoiled areas, where temporary seeding or mulching has been applied.*
    a. *On topsoiled areas, 1:3 (3:1) and flatter, loosen the surface to a depth of at least 50 mm (2 inches) by disking, harrowing, or other acceptable methods until the tillage is satisfactory. On untopsoiled areas, 1:3 (3:1) and flatter, till only as directed. Also, till or scarify areas if the surface is glazed or crusted.*
    b. *Correct surface irregularities by filling depressions and leveling rough or uneven areas. Remove metal objects, stones larger than 50 mm (2 inches) in any dimension, and other debris or objects deemed detrimental to maintenance operations.*
5. *Inoculate leguminous seed, such as Crownvetch and Birdsfoot Trefoil, with proper cultures, according to the manufacturer's directions.*
6. *At the rates specified in Table 1, sow seeds uniformly on the prepared areas by the helicopter, hydraulic placement, broadcasting, drilling, or hand seeding methods. Inspect seeding equipment and adjust the*

equipment, if required, to ensure the specified application rates. Periodically perform a check on the rate and uniformity of application, as directed. Prior to seed application of each designated seed formula, thoroughly clean-out seed tank by rinsing with clean water to prevent contamination from one seed formula to the next. Repeat rinsing cycle until tank is clean. Collect all non-applied seed derived from each clean-out event and remove as waste from the project.

7. *After seeding, roll topsoiled areas that are to be mowed. Use a roller with a mass (weight) not more than 100 kg/m (65 pounds per foot). If soil is wet or frozen, roll only when directed.*
8. *Apply herbicides as directed, to areas that are to be mowed and where weed growth is prominent. The Representative will designate existing plants or groups of plants to be saved within these areas before herbicide application. If directed, more than one application may be required to control undesirable growth. Apply material with application personnel certified by the Department of Agriculture and with equipment specified in Section 108.05(c).*
9. *Final acceptance of seeding and soil supplement materials and installation are subject to the results of official sampling and testing as specified before use and installation and the resultant establishment of the specified vegetation. Remove non-approved materials from the project.*
    a. *Reseed rejected areas with additional applications of the specified seed and soil supplement materials. Redress soil surfaces when directed. Perform reapplication of seed and soil supplements within the next applicable seeding date if necessary or as directed. When directed, reseed areas damaged by herbicide applications and mowing operations. NOTE: Reseeded areas will also require the application of appropriate mulch as specified in Section 805.*
    b. *Seeded areas may be rejected based on the lack of actual grass seedling establishment exhibited in the area for the specified seed formula.*
        i. *Table 1 formula seeded areas that exhibit less than 70% surface area coverage with the specified germinated grass seedlings after 90 days of growth may be rejected upon visual inspection. The seed germination and growth period is determined from the date of the seeding operation for the area when these operations are performed within the specified seeding dates.*
        ii. *Special seed formula planted areas (seed mixtures not indicated in Table 1) may be rejected based on the lack of the specified seed germination and growth of less than 11 seedlings/m2 (9 seedlings/square yard) after 120 days of growth determined by visual inspection. The seed germination and growth period is determined from the date of the seeding operation of the area when these operations are performed within the specified seeding dates.*
        iii. *Seeded areas exhibiting soil surface erosion rills or gullies deeper than 250 mm (1-inch) may be rejected upon visual inspection. Redress and reseed designated eroded areas with specified materials and application rates as directed.*

Liming Rates

Minimum 6 tons per acre at 100% effective neutralizing value (% ENV), unless the soil test determines that a lesser amount is needed. To determine the actual amount of regular lime to apply, divide the amount called for by the soil test by the % ENV for the product used. For example, if 6 tons per acre is needed and

the ENV for the lime used is 88%, divide 6 by 0.88 resulting in 6.8 tons needing to be applied. For dolomitic lime, which has a significant amount of magnesium in it, divide the amount called for by the soil test by the % calcium carbonate equivalent (% CCE) listed for the product instead of the % ENV. The % CCE may be above 100% which accounts for the fact that magnesium has a greater effect per pound than the calcium in regular lime. Note: When a soil test requires more than 8,000 pounds of lime per acre, the lime must be mixed into the top 6 inches of soil.

Fertilization Rates

Prepare areas for seeding by uniformly applying supplements. Document bulk delivery. Blend the initial soil supplements into the soil at least 50 mm (2 inches), on topsoiled areas, by raking, disking, harrowing, or other acceptable methods. Blend the supplements into the soil during tillage operations. Apply slow-release nitrogen fertilizer to the surface of Formula W seeded areas before project completion. Apply soil supplements as shown in the following table, unless otherwise indicated:

Permanent Seeding Application Rate				
Soil Amendment	**Per Acre**	**Per 1,000 sq. ft.**	**Per 1,000 sq. yds.**	**Notes**
Agricultural Lime	3872 LBS.	89 LBS.	800 LBS.	or as per soil test; may not be required in agricultural fields
10-20-20 Fertilizer	678 LBS.	16 LBS.	140 LBS.	
38-0-0 Ureaform Fertilizer, OR	242 LBS.	6 LBS.	50 LBS.	
32-0-0 to 38-0-0 Sulfur Coated Urea Fertilizer, OR	286 LBS.	7 LBS.	59 LBS.	
31-0-0 IBDU Fertilizer	295 LBS.	7 LBS.	61 LBS.	

3.3 TEMPORARY SEEDING

Temporary grass cover will be established in the following areas:

- Where vegetative filters must be established below filter bags, a minimum distance of 10 feet will be seeded down slope of the trap outlet. Seed mixture for temporary cover will consist of 100-percent annual ryegrass. Seed will be applied at the rate of 40 lb. per acre or as recommended by a local recognized seed supplier and approved by the owner's representative. Prior to seeding, apply 1 ton of agricultural grade limestone per acre plus 10-10-10 fertilizer at the rate of 500 lb. per acre and work into soil.

- Where soil stockpiles are to be exposed for a period greater than four (4) days, the stockpile shall be seeded.

Temporary Seeding Application Rate				
Soil Amendment	**Per Acre**	**Per 1,000 sq. ft.**	**Per 1,000 sq. yd.**	**Notes**
Agricultural Lime	1 ton	40lb.	410 lb.	Typically not required for topsoil stockpiles
10-10-10 Fertilizer	500lb.	12.5 lb.	100lb.	Typically not required for topsoil stockpiles

3.4 MULCHING

The purpose of mulch is to reduce runoff and erosion, prevent surface compaction or crusting, conserve moisture, aid in establishing plant cover, and control weeds. Mulch will be applied on any area subject to erosion, or which has unfavorable conditions for plant establishment and growth. The practice will be used alone or in conjunction with other structural and vegetative conservation practices, such as waterways, ponds, sedimentation traps or critical area planting. On sediment producing areas where the period of exposure is less than 2 months, mulch materials will be applied according to the following guidelines:

- Apply straw mulch at the rate of 3 tons per acre. Chemically treated or salted straw is not acceptable as mulch.

- Anchor straw mulch immediately after application by at least one of the following methods.

  A. "Crimp" straw mulch into the soil using tractor drawn equipment (straight bladed coulter or similar). This method is limited to slopes no steeper than 3:1. Operate machinery on the contour. Crimping of hay or straw by running it over with tracked machinery is not recommended.

  B. Uniformly apply asphalt, either emulsified or cut-back, containing no solvents or other diluting agents toxic to plant or animal life, at the rate of 31 gallons per 1,000 square feet.

  C. Use synthetic binders (chemical binders) as recommended by the manufacturer to anchor mulch provided sufficient documentation is provided to show that it is non-toxic to native plant and animal species.

  D. Staple lightweight plastic, fiber, or paper nets over the mulch according to the manufacturer's recommendations.

Mulched areas will be checked periodically and after each runoff event (e.g. rain, snowmelt, etc.) for damage until the desired purpose of the mulching is achieved. Damaged portions of the mulch or tie-down material will be repaired upon discovery.

3.5 MATERIAL RECYCLING AND DISPOSAL

The operator will remove from the site, recycle, or dispose of all building materials and wastes in accordance with PADEP's solid waste management regulations at 25 PA Code 260.1 et seq., 271.1 et seq., and 287.1 et seq. The operator will first characterize the waste materials as municipal, residual or hazardous waste. Before the waste material is hauled away, the material will be stored and labeled in accordance with the applicable management procedures, if any, under the Solid Waste Management Act regulations. The operator will then hire a licensed and insured waste hauler to transport the waste material to a properly permitted waste disposal facility. The contractor will not illegally bury, dump, or discharge building material or wastes at the site. Excess material brought into the site areas to facilitate construction access will be completely removed prior to rough grading and final surface stabilization. Expected construction wastes will consist of packaging material and sediment cleaned from BMPs. Sediment removed from BMPs will either be spread in a protected area, within the LOD, to dry and then recycled as fill material or disposed of off-site. Off-site spoil and/or borrow sites greater than one acre must be operated under an E&SC Plan approved by the County Conservation District.

3.6 THERMAL IMPACTS

Potential pollution to surface waters from thermal impacts will be minimized by minimizing clearing and retaining existing vegetation where possible during construction. Following construction, permanent seeding will occur as soon as practicable to facilitate vegetative growth. All post-construction water storage will be underground, thus minimizing the opportunity for increase in water temperature. Additionally, all other proposed BMPs allow for stormwater runoff to flow consistently, thus reducing the opportunity for the temperature to rise in the stormwater.

3.7 RIPARIAN FOREST BUFFERS

Exiting riparian forest buffers do not exist within the Project area.

3.8 INSPECTION AND MAINTENANCE PROCEDURES

Seeded areas will be inspected weekly and after each runoff event for bare spots, washouts, and healthy growth. Necessary repairs will be made immediately. Mulched areas will be checked periodically and after severe storms for damage until the desired purpose of the mulching is achieved. Damaged portions of the mulch or tie-down material will be repaired upon discovery.

All sedimentation control measures will remain in place until the disturbed areas are stabilized and a uniform 70-percent perennial vegetative cover is established. Any area not achieving a 70-percent vegetative cover will be reseeded and mulched within 24 hours of detection. The following inspection and maintenance practices will be used to maintain PCSM BMPs on site during restoration activities:

- PCSM BMPs will be in place and inspected according to the schedule below. PCSM BMPs will also be inspected after each runoff event. The Contractor will immediately repair any deficiencies.

- Maintenance and inspection of PCSM BMPs will conform to PADEP Chapter 102 and 105 rules and regulations.

If BMPs are found to be inoperative or ineffective during an inspection, PADEP should be contacted within 24 hours, followed by submission of a written noncompliance report to PADEP within 5 days of the initial contact.

Long-Term Maintenance

The owner will maintain the stormwater management facilities for this site. Maintenance of the stormwater management facilities includes, but is not limited to, the following:

1. The proposed stormwater detention system, private storm systems, and stormwater BMP's will be inspected and maintained by the property owner in accordance with the approved operation and maintenance program.

2. The stormwater BMP's are fixtures that can be altered or removed only after approval by the Municipality and PA Department of Environmental Protection.

3. Vegetation should be inspected around the site during all regular inspections. Vegetation outside of the fence and equipment pad shall be mowed sparingly to maintain a meadow condition. Bare spots shall be re-seeded and mulched to maintain full vegetated cover. Invasive plants shall be removed manually or by mowing.

4. Level Spreader:

    - Inspect Level Spreaders quarterly for the first two years following installation, and then semiannually thereafter and within 48 hours after every major storm event (> 1 inch rainfall depth). The receiving land area should be immediately restored to design conditions after any disturbance. Vegetated areas should be seeded and blanketed.

    - It is critical that even sheet flow conditions are sustained throughout the life of the level spreader, as their effectiveness can deteriorate due to lack of maintenance, inadequate design/location, and poor vegetative cover.

        - Inspection – the area below a level spreader should be inspected for clogging, density of vegetation, damage by foot or vehicular traffic, excessive accumulations, and channelization. Inspections should be made on a quarterly basis for the first two years

following installation, and then on a semiannual basis thereafter. Inspections should also be made after every storm event greater than 1-inch.

- Removal – sediment and debris should be routinely removed (but never less than semiannually), or upon observation, when buildup occurs. Regrading and reseeding may be necessary in the areas below the level spreader. Regrading may also be required when pools of standing water are observed along the slope. (In no case should standing water be allowed for longer than 72 hours.)

- Vegetation – maintaining a vigorous vegetative cover on the areas below a level spreader is critical for maximizing pollutant removal efficiency and erosion prevention. If vegetative cover is not fully established within the designated time, it may need to be replaced with an alternative species. (It is standard practice to contractually require the contractor to replace dead vegetation.) Unwanted or invasive growth should be removed on an annual basis. Biweekly inspections are recommended for at least the first growing season, or until the vegetation is permanently established. Once the vegetation is established, inspections of health, diversity, and density should be performed at least twice per year, during both the growing and non-growing season. Vegetative cover should be sustained at 85% and replaced if damage greater than 50% is observed.

5. Stormwater Inlets, Piping and Outlets:

   - Stormwater inlets, piping, and outlets shall be checked in accordance with the inspection schedule.
   - Remove sediment or debris that is blocking inlets.
   - Sediment shall be removed from inlet sumps when the sediment depth is greater than 6 inches.
   - Inspect outlet protection for displaced riprap and erosion and repair as necessary.

6. Subsurface Infiltration Bed:

   - Inspect subsurface infiltration bed and associated inlets and piping at least two times per year and within 48 hours after every major storm event (> 1 inch rainfall depth). Inspection considerations include:
     - Inspect cleanouts – any water left in a cleanout after the design drain down time indicates the BMP is not optimally functioning. The drawdown rate should be observed if possible during inspections.
     - Remove trash and debris as necessary.

- Vehicular access on subsurface infiltration bed areas should be prohibited. If access is needed, use of permeable, turf reinforcement should be considered.
- Catch Basins and Inlets should be cleaned of sediment when accumulation is more than 6 inches.
- Scrape gravel with rakes or vacuum to remove silt.
- Replace gravel if scraping/removal has reduced depth of gravel or if dewatering times are inadequate.
- Dispose of gravel in accordance with all state and federal regulations.

7. Vegetated Channel:

- Inspect Vegetated Channel at least four times per year and within 48 hours after every major storm event (> 1 inch rainfall depth).Inspect and correct erosions problems, damage to vegetation, and sediment and debris accumulation (address when > 3 inches at any spot or covering vegetation)
- Inspect vegetation on side slopes for erosion and formation of rills or gullies, correct as needed
- Inspect for pools of standing water, dewater and discharge to an approved location and restore to design grade
- Mow and trim vegetation to ensure safety, aesthetics, proper swale operation, or to suppress weeds and invasive vegetation; dispose of cuttings in a local composting facility; mow only when swale is dry to avoid rutting
- Inspect for litter; remove prior to mowing
- Inspect for uniformity is cross-section and longitudinal slope, correct as needed
- Inspect swale inlet (curb cuts, pipes, etc.) and outlet for signs of erosion or blockage, correct as needed
- Maintenance to be done as needed
    - Plant alternative grass species in the event of unsuccessful establishment
    - Reseed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming
    - Rototill and replant swale if draw down time is more than 48 hours
    - Inspect and correct check dams when signs of altered water flow (channelization, obstructions, erosion, etc.) are identified

- Water during dry periods, fertilize, and apply pesticide only when absolutely necessary

- Additional maintenance necessitated by winter conditions
  - Inspect swale immediately after spring melt, remove residuals (e.g. sand) and replace damaged vegetation without disturbing remaining vegetation
  - If roadside road side or parking lot runoff is directed to the swale, mulching and/or soil aeration/manipulation may be required in the spring to restore structure and moisture capacity and to reduce the impacts of deicing agents
  - Use nontoxic, organic deicing agents, applied either as blended, magnesium chloride-based liquid products or as pretreated salt
  - Use salt-tolerant vegetation in swales

Long-Term Operation and Maintenance Schedule

PCSM BMP	Inspection	Repairs	Reconstruction	BMP Life Expectancy
Subsurface Infiltration Bed	1 hr Quarterly @ $70/hr	Replace 10% of gravel: 1 day / $2,200	4-5 days Cost: $50,000	20-30 years
Level Spreader	1 hr Quarterly @ $70/hr	Repair erosion: 1 day / $700	1-2 days Cost: $2,100	20-30 years
Vegetated Channel	1 hr Annually @ $70/hr	Repair erosion: 1 day / $1,200	1-2 days Cost: $5,900	20-30 years
Stormwater Inlets, Piping, and Outlets	1 hr Annually @ $70/hr	Repair erosion: 1 day / $800	1-2 days Cost: $2,800	20-30 years

3.9 ANTIDEGRADATION REQUIREMENTS

Earth- disturbance activities associated with the Doylesburg Station will be located within a HQ-CWF watershed. Therefore; antidegradation requirements for special protection waters apply. A combination of non-discharge alternatives and the use of PCSM BMPs on site will protect the water quality of the receiving waters.

The post-construction stormwater infiltration volume equals or exceeds the pre-construction stormwater infiltration volume after application of PCSM BMPs as shown in Section 4.0 of this report. In addition, post-construction stormwater discharge is pre-treated and managed so that it will not degrade the

physical, chemical or biological characteristics of the receiving stream for the following reasons:

- The facility is designed for zero discharge of sanitary waste water and grey water.
- The PSCM BMP functions at the surface like a filter, providing treatment of surface runoff.
- The PCSM BMP discharges to a grass channel, then to a level spreader onto a grass slope, providing additional pollutant filtration prior to discharging into existing conveyances offsite.

4.0 POST-CONSTRUCTION STORMWATER MANAGEMENT ANALYSIS

4.1 DESIGN BASIS

This plan has been prepared to comply with the Pennsylvania Stormwater Best Management Practices Manual.

The site's pre-development and post-development drainage characteristics were modeled in accordance with local and state requirements. The hydrology calculations were performed utilizing the U.S. Soil Conservation Service (SCS) TR-55 Urban Hydrology for Small Watersheds. The 2, 5, 10, 25, 50, and 100-year, 24-hour storm events have been analyzed for pre- and post-developed conditions. The rainfall depths for each storm event are 2.9, 3.6, 4.2, 5.1, 5.9, and 6.9 inches respectively, and follow the SCS 24-hour Type II rainfall distribution. Rainfall depths were taken from the NOAA Atlas 14 data, which is provided in Appendix E. Bentley PondPack V8i was used to perform the hydrology analysis. The pre-development watershed maps, including time of concentration (Tc) paths, are located in Appendix C. The controlled post-development Tc is estimated as the minimum (0.083 h), given the short Tc path, initial steep slopes and impervious cover. This is also the most conservative estimate. The post-development watershed maps are located in Appendix D. The PondPack report is located in Appendix E.

Stormwater Best Management Practices (BMPs) have been designed for the pump station to comply with the stormwater quality and quantity management requirements. The watershed network and detention facility routing calculations were performed using Bentley PondPack V8i. The BMPs also have been designed meet state stormwater quality and quantity management requirements. Calculation worksheets from Chapter 8 of the Pennsylvania Stormwater Best Management Practices Manual were used to ensure compliance with state requirements. The completed worksheets are located in Appendix F.

4.2 HYDROLOGY

Pre-development and post-development runoff results were calculated using the previously described design basis. The pre-development and post-development watersheds have the same single point of interest that encompass both developed and undeveloped areas. The point of interest is located just east of the development and encompasses the entire developed area.

The pre-development drainage area contains an impervious area of 0.20 acres. Volume control guideline 1 of the BMP Manual requires that "twenty (20) percent of existing impervious area, when present, shall be considered meadow (good condition) in the model for existing conditions for redevelopment." Therefore, in the pre-development drainage area, the impervious area was reduced to 0.16 acres and 0.04 acres of meadow in good condition was added. Table 1 provides a summary of the pre-development and post-development watersheds and associated peak flow discharge rates.

Table 1: Pre-Development and Post-Development Hydrology

				Peak Flow (cfs)					
DA	**Drainage Area (ac.)**	**Tc (hr)**	**CN**	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
Pre-Development	8.170	0.359	69.03	4.18	7.49	10.86	16.52	21.99	28.59
Post-Development Controlled	0.813	0.083	77.29	1.21	1.83	2.41	3.35	4.25	5.30
Post-Development Uncontrolled	7.358	0.357	69.49	3.97	7.06	10.21	15.43	20.46	26.52

Maps for the pre-development and post-development watersheds are located in Appendix C and Appendix D respectively.

4.3 BMP DESIGN

A single BMP is used to control runoff volume and peak flow rates. The BMP is a subsurface infiltration bed with perforated piping for additional storage. BMP is designed to control both peak runoff and runoff volume in the controlled watershed. The BMP design details are shown in Appendix G.

The subsurface infiltration bed consists of a 5-foot deep flat gravel bed surrounded by filter fabric. A 1 foot high berm is constructed downslope of the subsurface infiltration bed to retain surface runoff. The berm directs runoff into a drop inlet that connects to four, 150-foot long lengths of perforated HDPE pipe that run the length of the subsurface infiltration bed. The opposite side of the drop inlet is connected to a manhole with an interior weir that controls discharge from the subsurface infiltration bed during larger storm events. The PondPack report of the storm routing for the BMP is provided in Appendix E. The cumulative storage volume of the BMP is shown in Table 2. The routing summary for the BMP is shown in Table 3.

Table 2: BMP Cumulative Storage Volume

Elevation of Water in System[1]	Cumulative Pipe Storage[2]	Cumulative Pipe and Gravel Storage[3]	Total System Cumulative Storage[4]	Total System Cumulative Storage
(Feet)	(Cubic Feet / Foot)	(Cubic Feet / Foot)	(Cubic Feet)	(Acre Feet)
0.0	0.00	0.00	0.00	0.000
0.5	0.00	1.00	900.00	0.021
1.0	0.61	2.37	2,131.67	0.049
1.5	1.57	3.94	3,548.23	0.081
2.0	2.53	5.52	4,964.80	0.114
2.5	3.14	6.88	6,196.46	0.142
3.0	3.14	7.88	7,096.46	0.163
3.5	3.14	8.88	7,996.46	0.184
4.0	3.14	9.88	8,896.46	0.204

1. BMP bottom elevation 0.0 corresponds to elevation 925.00 AMSL on the plan.
2. Storage per foot of length of a 24" pipe set at invert elevation 0.5.
3. Storage per foot of length of a 24" pipe set at invert elevation 0.5 plus surrounding gravel set in a 5 foot wide trench with 40% pore space [pipe storage + 40% * ((5ft * depth) – pipe storage)]
4. Total System Cumulative Storage = Cumulative Pipe and Gravel Storage * 900 feet of pipe length.

Table 3: BMP Routing Summary

Storm Event (years)	Peak BMP Inflow (cfs)	Routed Peak BMP Outflow (cfs)	Maximum Storage Volume (ac-ft)	Water Surface Elevation (feet)
2	1.21	0.00	0.048	925.98
5	1.83	0.00	0.081	926.50
10	2.41	0.00	0.112	926.98
25	3.35	0.10	0.122	927.14
50	4.25	0.26	0.135	927.37
100	5.30	0.53	0.158	927.87

4.4 INFILTRATION AREAS

The BMP is designed to provide infiltration for volume control. PondPack allows for infiltration information to be included in the BMP design and it can be used to calculate the volumes removed by the BMPs through infiltration. Infiltration testing was performed according to the Pennsylvania Stormwater Best Management Practices Manual to determine the infiltration rates to use in the calculations. Infiltration test results are located in Appendix B. Infiltration rates were determined as follows:

BMP-1 is located at infiltration test points IT-3 and IT-4. The previous infiltration test results at IT-1 and IT-2 were invalid due to incorrect location and depth. The infiltration rate at IT-3 was measured to be 0.00 in/hr. The infiltration rate at IT-4 was measured to be 0.03 in/hr. The rate at each test location is too low for an infiltration BMP. Given that there is no alternative BMP location available, an underdrain was designed at the base of the BMP to produce a slow release rate similar to soil infiltration. A calculation worksheet is provided in Appendix E that shows the underdrain will dewater the BMP in approximately 46 hours. This falls within the normal range for dewatering of infiltration BMPs in 24 to 72 hours. The volume reduction required for the 2-year storm is contained between the bottom of the BMP and the lowest outlet orifice on the riser as shown in the PondPack report provided in Appendix E.

4.5 STORMWATER MANAGEMENT

Stormwater quality management for the project will comply with Township ordinances and state regulations through the implementation and maintenance of post construction stormwater management (PCSM) controls after construction. Stormwater quality is achieved with the proposed BMP design, which is in accordance with the Pennsylvania Stormwater Best Management Practices Manual. Table 4 shows how the design criterion for peak discharge rate and volume reduction is achieved for this project. The post development peak flow is less than 100% of the pre-development peak flow for each design storm event. For the 2-year storm, the post development hydrograph volume is less than the pre-development hydrograph volume.

Table 4: POI-1 Peak Discharge Rate Reduction Summary

Storm Event (years)	Total Pre-Development Peak Flow (cfs)	Total Post-Development Peak Flow (cfs)[1]	Total Peak Flow Difference Post-Pre (cfs)	Total Pre-Development Hydrograph Volume (ac-ft)	Total Post-Development Hydrograph Volume (ac-ft)	Total Volume Difference Post-Pre (ac-ft)
2	4.18	3.99	-0.19	**0.410**	**0.381**	**-0.029**
5	7.49	7.08	-0.41	0.675	0.624	-0.051
10	10.86	10.23	-0.63	0.940	0.866	-0.074
25	16.52	15.45	-1.07	1.384	1.319	-0.065
50	21.99	20.54	-1.45	1.816	1.761	-0.055
100	28.59	26.98	-1.61	2.344	2.297	-0.047

1. The total post development peak flow is the routed flow of all post-development watersheds to POI-1 plus 0.02 cfs from underdrain flow

5.0 REFERENCES

Erosion and Sediment Pollution Control Program Manual, Commonwealth of Pennsylvania, Department of Environmental Protection, Office of Water Management, March 2012.

Pennsylvania Stormwater Best Management Practices Manual Draft (Document Number 363-0300-002), Pennsylvania Department of Environmental Protection, Bureau of Watershed Management, December 2006.

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