Site Restoration and Post-Construction Stormwater Management Plan

Ebensburg Pump Station

PADEP Southwest Region Submission

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Prepared for:

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LIST OF ACRONYMS

ACRONYM	MEANING
ABACT	Antidegradation Best Available Combination of Technologies
BMP	Best Management Practice
CWF	Cold water fisheries
E&SC	Erosion and Sediment Control
HDPE	High-density polyethylene
HQ	High quality
NGL	Natural gas liquids
PADEP	Pennsylvania Department of Environmental Protection
PASDA	Pennsylvania Spatial Data Access
PCSM	Post-Construction Stormwater Management
ROW	Right of way
SR	Site Restoration
Tt	Tetra Tech, Inc.
UNT	Unnamed tributary
WWF	Warm water fisheries

1.0 INTRODUCTION

Tetra Tech, Inc. (Tt) has prepared this Site Restoration Plan and Post-Construction Stormwater Management Plan for Sunoco Pipeline, L.P. (SPLP) – Pennsylvania Pipeline Project (PPP) Ebensburg Pump Station. The Plan addresses restoration and post-construction stormwater management following installation of the proposed Ebensburg Pump Station (Project). The Project is located in Cambria Township, Cambria County, Pennsylvania. A USGS site location map is provided in Appendix A.

2.0 SITE DESCRIPTION

SPLP is proposing to construct the Project in Cambria Township, Cambria County, PA. The Ebensburg Pump Station, which will be connected to the PPP twenty-inch diameter transmission pipeline, will be located on Wilmore Road, Ebensburg, PA at latitude 40.449°, longitude -78.714°. The Project will include the construction of an access road, pump station installation, and site restoration. Pump station installation will include a bypass inlet, meter, the pump, strainers, and a flame. The proposed Project will be constructed within an LOD of approximately 4.44 acres in Cambria County.

Past and present land use of the Project area and surrounding area is meadowland and woodland. Future land use will be a maintained gravel pad which the pump station will sit on. Relevant topographic features, including streams, streets, pipelines, structures, utility lines, fences, paving, and other significant items along the pump station LOD, are indicated on the plans, where applicable. The PCSM BMPs at the site include underground storage pipes, infiltration filters, and berms.

2.1 TOPOGRAPHY

The work zone is located on ground of varying elevations steeply sloping toward the confluence of Sanders Run and Howells Run. Site elevations vary from approximately 1880 feet (northwest corner of pad area) to 1800 feet (southeast corner of pad area) 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

Soil and geologic formations surrounding the site are shown on the figures provided in Appendix B. The site consists of Blairton-Berks channery silt loam (BpC), 8 to 15 percent slopes, Cookport and Ernest very stony soils (CvD), 8 to 25 percent slopes, and Laidig soils, 25 to 70 percent slopes (LDF), which are described below.

BpC – Blairton-Berks channery silt loam, 8 to 15 percent slopes.

Description of Blairton – This moderately well-draining soil is located on concave and concave hills at elevations ranging from 300 to 1,500 feet above mean sea-level. It is formed from local silty colluvium derived from shale and siltstone over acid and silty residuum weathered from shale and siltstone; colluvium derived from shale and siltstone. The typical soil profile is: 0 to 9 inches: channery silt loam **(Hydrological Soil Group B)**; 9 to 30 inches: channery silt clay loam **(Hydrological Soil Group D)**; and 30 to 38 inches: channery silt loam **(Hydrological Soil Group B)**; 38 to 42 inches: bedrock. The depth to water table is 12 to 24 inches. The restrictive feature, lithic bedrock, is encountered 20 to 40 inches below the surface. There is no frequency of flooding or ponding.

Description of Berks – This well-draining soil is located on convex and convex hillslopes at elevations ranging from 300 to 1,500 feet above mean sea-level. It is formed from local silty colluvium derived from shale and siltstone over acid and silty residuum weathered from shale and siltstone; colluvium derived from shale and siltstone. The typical soil profile is: 0 to 8 inches: channery silt loam **(Hydrological Soil Group B)**; 8 to 26 inches: very channery silt loam **(Hydrological Soil Group B)**; and 26 to 30 inches: very channery loam **(Hydrological Soil Group B)**; 30 to 34 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 – A high groundwater table is shown to exist within the Blairton soil group located on site which is a limiting condition and may require special construction considerations.

In the event that a high groundwater table is encountered during construction, water will be drained away from disturbed areas to a well vegetated area or alternatively to a placed compost filter sock (CFS) prior to being discharged off the site. Proper construction and placement of the CFS is described in Section 3.3 discussing the construction of BMP E&S controls.

In addition, high volumes of water encountered during construction activities will be pumped through a pumped water filter bag to a well vegetated upland area. Lastly, all Saturated soils encountered during construction will be dried prior to being used on-site. Drying of the soils is expected to be rapid due to the generally well-draining characteristics of the encountered soil morphologies.

CvD – Cookport and Ernest very stony soils, 8 to 25 percent slopes.

Description of Cookport – This moderately well-draining soil is located on concave and concave mountains at elevations ranging from 480 to 3,000 feet above mean sea-level. It is formed from colluvium derived from sandstone and siltstone. The typical soil profile is: 0 to 10 inches: channery loam **(Hydrological Soil Group A)**; and 10 to 26 inches: channery loam **(Hydrological Soil Group A)**; 26 to 40 inches: channery loam **(Hydrological Soil Group A)**; 40 to 60 inches: channery sandy loam **(Hydrological Soil Group A)**; 60 to 62 inches: bedrock. The depth to water table is 0 to 6 inches below the surface. The restrictive feature is encountered about 26 inches (fragipan) and 40 to 72 inches (lithic bedrock) below the surface. There is no frequency of flooding or ponding.

Description of Ernest – This moderately well-draining soil is located on concave and concave hills at elevations ranging from 480 to 3,000 feet above mean sea-level. It is formed from colluvium derived from shale and siltstone. The typical soil profile is: 0 to 8 inches: channery silt loam **(Hydrological Soil Group B**); and 8 to 26 inches: silty clay loam **(Hydrological Soil Group C);** 26 to 41 inches: channery silt loam **(Hydrological Soil Group B)**; 41 to 61 inches: channery silt loam **(Hydrological Soil Group B)**. The depth to water table is about 4 to 20 inches below the surface. The restrictive feature, fragipan, is encountered 17 to 36 inches below the surface. There is no frequency of flooding or ponding.

Limitations – A high groundwater table is shown to exist within the Cookport soil group located on site which is a limiting condition and may require special construction considerations.

In the event that a high groundwater table is encountered during construction, water will be drained away from disturbed areas to a well vegetated area or alternatively to a placed compost filter sock (CFS) prior to being discharged off the site. Proper construction and placement of the CFS is described in Section 3.3 discussing the construction of BMP E&S controls.

In addition, high volumes of water encountered during construction activities will be pumped through a pumped water filter bag to a well vegetated upland area. Lastly, all Saturated soils encountered during construction will be dried prior to being used on-site. Drying of the soils is expected to be rapid due to the generally well-draining characteristics of the encountered soil morphologies.

LDF – Laidig soils, 25 to 70 percent slopes. This well-draining soil is located on concave and concave mountains at elevations ranging from 400 to 3,800 feet above mean sea-level. It is formed from mountain-slope fine loamy colluvium derived from interbedded sedimentary rock. The typical profile is 0 to 7 inches: channery loam **(Hydrological Soil Group A)**; 7 to 36 inches: channery loam **(Hydrological Soil Group A)**; 36 to 50 inches: channery sandy loam **(Hydrological Soil Group A)**; 50 to 65 inches: channery sandy loam **(Hydrological Soil Group A)**. The depth to water table is approximately 28 to 36-inches. The restrictive feature, fragipan, is encountered 30 to 50 inches below the surface. There is no frequency of ponding or flooding.
Limitations – A high groundwater table is shown to exist within the Laidig soil group located on site which is a limiting condition and may require special construction considerations.

In the event that a high groundwater table is encountered during construction, water will be drained away from disturbed areas to a well vegetated area or alternatively to a placed compost filter sock (CFS) prior to being discharged off the site. Proper construction and placement of the CFS is described in Section 3.3 discussing the construction of BMP E&S controls.

In addition, high volumes of water encountered during construction activities will be pumped through a pumped water filter bag to a well vegetated upland area. Lastly, all Saturated soils encountered during construction will be dried prior to being used on-site. Drying of the soils is expected to be rapid due to the generally well-draining characteristics of the encountered soil morphologies.

2.3 SURFACE WATER HYDROLOGY

The Project area surface water runoff drains to Sanders Run to Howells Run which is designated as cold water fisheries (CWF) under PA Code 25 Chapter 93.

This E&SCP contains BMPs 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. A constructed infiltration filter and underground storage will be installed as post construction stormwater BMPs to mitigate the permanent stormwater impacts of construction.

3.1 CONSTRUCTION SEQUENCE

A generalized construction sequence is provided below for installing post construction stormwater BMPs. The construction sequence is intended to provide a general 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 will comply with all requirements listed in this section and the Pennsylvania Stormwater Best Management Practices Manual. The contractor may be required to alter controls based on the effectiveness of controls or differing conditions encountered in the field. If the contractor plans on deviating from the methods and controls in this PCSM Plan, they must get approval from the county conservation district and DEP before any actions commence.

A pre-construction meeting is required prior to the start of any construction activity. The Pennsylvania Department of Environmental Protection (PADEP) or applicable county conservation district, contractors, the landowner, appropriate municipal officials, and the plan preparer must be invited to this meeting at least 7 days prior to construction commencement. All construction activities shall be discussed in this meeting including, but not limited to, the PCSM features and any deviations the contractor has planned.

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

2) **Infiltration Filter Installation**
   a) Permanent Filters should not be installed until the site is stabilized. Excessive sediment generated during construction can clog the Filter and prevent or reduce the anticipated post-construction water quality benefits. Stabilize all contributing areas before runoff enters filters.
   b) Structures such as inlet boxes, reinforced concrete boxes, etc. should be installed in accordance with the manufacturers' or design engineers guidance.
   c) Structures may be set on a layer of clean, lightly compacted gravel (such as AASHTO #57).
   d) Lay filter bed material. Do not compact subgrade.

e) The filter bed material should be underlain by a layer of permeable non-woven-geotextile.

f) Place underlying gravel/stone in minimum 6 inch lifts. Place pipes in gravel during placement.

g) Wrap and secure in nonwoven geotextile to prevent gravel/stone from clogging with sediments.

h) Gravel should be free of fine sands, silts and clays within and above the underground storage system to the ground surface to allow infiltration.

3) **Underground Storage Pipe Installation**

a) Structures such as inlet boxes, reinforced concrete boxes, etc. should be installed in accordance with the manufacturers' or design engineers guidance.

b) Structures may be set on a layer of clean, lightly compacted gravel (such as AASHTO #57).

c) The underground storage system should be underlain by a layer of permeable non-woven-geotextile.

d) Place underlying gravel/stone in minimum 6 inch lifts and lightly compact. Place pipes in gravel during placement.

e) Wrap and secure nonwoven geotextile to prevent gravel/stone from clogging with sediments.

f) Gravel should be free of fine sands, silts and clays within and above the underground storage system to the ground surface to allow infiltration into the pipes.

4) Berm

a) Lightly scarify the soil in the area of the proposed berm before delivering soil to site.

b) Bring in fill material to make up the majority of the berm. Soil shall be added and compacted according to design specifications. The slope and shape of the berm shall be graded out as soil is added.

c) Complete final grading of berm after the top layer of soil is added. Tamp soil down lightly and smooths sides of the berm.

d) Plant berm with permanent grass seed mix.

e) Mulch planted and disturbed areas with compost mulch to prevent erosion while plants become established.

5) Level Spreader

a) The uphill development shall be stabilized before diverting runoff to any dispersing flow techniques.

b) All contributing stormwater elements (infiltration berms, inlets, outlet control structures, pipes, etc.) shall be installed prior to installation of the level spreader.

c) HDPE pipe shall be installed along a contour uphill of the level spreader, with care taken to construct a slightly sloped bottom.

d) If necessary, install erosion control matting along the length of the level spreader and to a distance downhill, as specified by the manufacturer/supplier.

e) A berm shall be installed along the outlet of the HDPE pipe to ensure stormwater runoff is routed to the level spreader.

6) Vegetated Channel

a) Begin vegetated channel construction only when the upgradient temporary erosion and sediment control measures are in place. Vegetated channels shall be constructed and stabilized before mass earthwork and paving increase the rate and volume of runoff.

b) Rough grade the vegetated channel. Equipment shall avoid excessive compaction and/or land disturbance. Excavating equipment shall operate from the side of the channel and never on the bottom. If excavation leads to substantial compaction of the subgrade (where a vegetated channel is not proposed), 18 inches shall be removed and replaced with a blend of topsoil and sand to promote infiltration and biological growth. Following this, the area shall be disked prior to final grading of topsoil.

c) Fine grade the vegetated channel. Accurate grading is crucial for channels. Even the smallest non-conformities may compromise flow conditions.

d) Seed, vegetate, and install protective lining as per approved plans according to final planting list. Plant the swale at a time of the year when successful establishment without irrigation is most likely. Temporary irrigation may be needed in periods of little rain or drought. Vegetation shall be established within 24 hours after construction to prevent erosion and scour.

e) Once all tributary area are sufficiently stabilized, remove temporary erosion and sediment controls. It is very important that the channel is stabilized before receiving upland stormwater flow.

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.	
10-20-20 Fertilizer	678 LBS.	16 LBS.	140 LBS.	
38-0-0 Ureaform Fertilizer, OR	242 LBS.	6 LBS.	50 LBS.	or as per soil test; may not be required in agricultural fields
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 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. Packaging from the materials brought on-site will be disposed of by a licensed hauler. 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. In cases where disposal is necessary, waste materials are to be disposed of at an approved, permitted PADEP waste disposal facility. 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.

3.7 RIPARIAN FOREST BUFFERS

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

3.8 INSPECTION AND MAINTENANCE PROCEDURES

The following inspection and maintenance practices will be used to maintain E&SCs on site during restoration activities:

- PCSM BMPs will be in place and inspected as seen in the schedule below. The Contractor will immediately repair any deficiencies.
- 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.
- A licensed professional shall oversee all installation and testing procedures for the infiltration filters, underground storage pipes, level spreader, berm, and vegetated channels.

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.
3. Infiltration Filter:
    - Inspect Infiltration Filters and associated inlets and piping at least four 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 surface filter after the design drain down time indicates the filter is not optimally functioning.

- Film or discoloration of any surface filter material – this indicates organics or debris have clogged the filter surface.

- Remove trash and debris as necessary.
- Scrape silt with rakes.
- Till and aerate filter area.
- Replace filtering medium if scraping/removal has reduced depth of filtering media.
- Dispose of filter media in accordance with all state and federal regulations.

4. Underground Storage Pipes:
   - Inspect Underground Storage Pipes at least four times per year and within 48 hours after every major storm event (> 1 inch rainfall depth).
   - The gravel surrounding underground pipes should be free of fine sands, sits and clays to provide proper storage and drainage.
   - Catch Basins and Inlets should be cleaned of sediment when accumulation is more than 6 inches.
   - Remove trash and debris as necessary from collection inlets, pipes and from the surface above the storage area. Rake or vacuum fine materials as necessary from the gravel.
   - Replace gravel if raking/vacuuming has reduced depth of gravel.
5. Level Spreader:
   - Inspections to be done annually and within 48 hours after every major storm event (> 1 inch rainfall depth)
   - The receiving land are shall be immediately restored to design conditions after any disturbance. Vegetated areas shall 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 vegetation cover.
     - Inspection – The area below the level spreader shall be inspected for clogging, density of vegetation, damage by foot or vehicular traffic, excessive accumulations, and channelization. Inspections shall be made on a quarterly basis for the first two years following installation, and then on a semiannual basis thereafter. Inspections shall also be made after every storm event greater than 1-inch.
     - Removal – Sediment and debris shall be routinely removed (but never less than semiannually), or upon observation, when buildup occurs in the clean outs. 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 the 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 shall 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 shall be performed at least twice a year, during both the growing and non-growing season. Vegetative cover shall be sustained at 85% and replaced if damage greater than 50% is observed.

6. Vegetated Channel:

- Inspections to be done annually 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

7. Berm

- Inspections to be done annually and within 48 hours after every major storm event (> 1 inch rainfall depth)
- Maintain turf grass and other vegetation by mowing and re-mulching
- The crest of the berm may be used as access for heavy equipment when necessary to limit disturbance.
- Routinely remove accumulated trash and debris.
- Remove invasive plants as needed.
- Inspect for signs of flow channelization; restore level gradient immediately after deficiencies are observed.

Long-Term Operation and Maintenance Schedule

PCSM BMP	Inspection	Repairs	Reconstruction	BMP Life Expectancy
Infiltration Filter	1 hr Quarterly @ $70/hr	Replace 10% of filter media: $2,200	1-2 weeks Cost: $100,000	20-30 years
Underground Storage Pipes	1 hr Quarterly @ $70/hr	Replace 10% of gravel: $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
Berm	1 hr Annually @ $70/hr	Repair erosion: 1 day / $800	1-2 days Cost: $2,800	20-30 years

1. *Sunoco Pipeline L.P. is the owner/operator of the Ebensburg Pump Station and is responsible for the long term maintenance of the site PCSM BMPs. SPLP can be contacted at: 610-670-3200*

3.9 ANTIDEGRADATION REQUIREMENTS

PCSM BMPs associated with the Ebensburg Pump Station project will be located within a CWF watershed. A combination of non-discharge alternatives and the use of BMPs on site will protect the water quality of the receiving waters.

Non-discharge alternatives were evaluated to minimize accelerated E&S and achieve zero net charge in runoff between the pre and post-construction conditions. The extent of the disturbed area will be minimized, and the duration of disturbance will be minimized by stabilizing disturbed areas as soon as practicable. BMPs will be used onsite to protect and maintain the existing water quality of receiving waters.

4.0 POST-CONSTRUCTION STORMWATER MANAGEMENT ANALYSIS

4.1 DESIGN BASIS

This plan has been prepared to comply with the Cambria Township Subdivision and Land Development Ordinance, and the Cambria County Act 167 County-Wide Stormwater Management Plan.

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 1, 2, 5, 10, 25, and 100-year storm events have been analyzed for pre- and post-developed conditions. The rainfall depths for each storm event are 2.4, 2.8, 3.4, 4.2, 4.8, and 5.7 inches respectively, and follow the SCS 24-hour Type II rainfall distribution. Bentley PondPack V8i was used to perform the hydrology analysis. The pre-development watershed maps are located in Appendix C. The post-development watershed maps are located in Appendix D. The PondPack report is located in Appendix E.

Stormwater 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.

Ditches and stormwater pipes will be provided to convey runoff on the site. Ditches and stormwater pipes are designed to convey the 50-year storm event peak flow. Bentley FlowMaster Vi8 is used to perform flow calculations for ditches and culverts.

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 a point of interest that encompass both developed and undeveloped areas. The point of interest is located southeast of the development along Howell's Run and encompasses the full developed area. Table 1 provides a summary of the pre-development and post-development hydrology and associated peak flow discharge rates without BMP controls and post-development hydrology and associated peak flow discharge rates with BMP controls.

Table 1: Pre-Development and Post-Development Hydrology

				Peak Flow (cfs)					
DA	**Drainage Area (ac.)**	**Tc (hr)**	**CN**	**1-yr**	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**100-yr**
Pre-Development	43.97	0.410	68.47	10.36	17.92	31.92	53.57	71.32	99.67
Post-Development Controlled	2.15	0.083	87.22	4.01	5.13	6.85	9.17	10.92	13.55
Post-Development Uncontrolled	41.82	0.410	68.20	9.51	16.62	29.71	50.17	66.97	93.84

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

4.3 BMP DESIGN

Four BMPs are used to control runoff volume and peak flow rates. BMP-1 is an underground pipe storage system that discharges to BMP-2. BMP-2 is an infiltration filter that discharges to BMP-3. BMP-3 is an infiltration filter that discharges to BMP-4. BMP-4 is an infiltration filter that discharges offsite. Multiple infiltration berms/filters in series were used instead of an infiltration basin due to shallow bedrock in the area. The BMP design details are shown in Appendix G.

The BMP-1 underground pipe storage system consists of an array of perforated pipes, surrounded by gravel and wrapped in filter fabric and geomembrane. BMP-1 does not infiltrate and provides peak rate control only. The BMP-2, BMP-3 and BMP-4 infiltration filters consists of an array of perforated pipes, surrounded by gravel and wrapped in filter fabric. BMP-2, BMP-3 and BMP-4 infiltrate stormwater into the ground and provide both volume control and peak rate control. The PondPack report of the storm routing for all BMPs is provided in Appendix E. The cumulative storage volume of each BMP is shown in Table 2 through Table 5. The routing summary for each BMP is summarized in Table 6 through Table 9.

Table 2: BMP-1 Cumulative Storage Volume

Depth of Water in System	Cumulative Pipe Storage	Cumulative Pipe + Gravel Storage	Total System Cumulative Storage	Total System Cumulative Storage
(Feet)	(Cubic Feet)	(Cubic Feet)	(Cubic Feet)	(Acre Feet)
4.0	3.14	9.88	5041.30	0.116
3.5	3.14	8.88	4531.30	0.104
3.0	3.14	7.88	4021.30	0.092
2.5	3.14	6.88	3511.30	0.081
2.0	3.14	5.88	3001.30	0.069
1.5	1.57	3.94	2010.65	0.046
1.0	0.61	2.37	1208.03	0.028
0.5	0.00	1.00	510.00	0.012
0.0	0.00	0.00	0.00	0.000

Table 3: BMP-2 Cumulative Storage Volume

Depth of Water in System	Cumulative Pipe Storage	Cumulative Pipe + Gravel Storage	Total System Cumulative Storage	Total System Cumulative Storage
(Feet)	(Cubic Feet)	(Cubic Feet)	(Cubic Feet)	(Acre Feet)
4.0	3.14	12.88	7344.39	0.169
3.5	3.14	10.38	5919.39	0.136
3.0	3.14	7.88	4494.39	0.103
2.5	3.14	6.88	3924.39	0.090
2.0	3.14	5.88	3354.39	0.077
1.5	1.57	3.94	2247.20	0.052
1.0	0.61	2.37	1350.15	0.031
0.5	0.00	1.00	570.00	0.013
0.0	0.00	0.00	0.00	0.000

Table 4: BMP-3 Cumulative Storage Volume

Depth of Water in System	Cumulative Pipe Storage	Cumulative Pipe + Gravel Storage	Total System Cumulative Storage	Total System Cumulative Storage
(Feet)	(Cubic Feet)	(Cubic Feet)	(Cubic Feet)	(Acre Feet)
4.0	3.14	12.88	3478.92	0.080
3.5	3.14	10.38	2803.92	0.064
3.0	3.14	7.88	2128.92	0.049
2.5	3.14	6.88	1858.92	0.043
2.0	3.14	5.88	1588.92	0.036
1.5	1.57	3.94	1064.46	0.024
1.0	0.61	2.37	639.55	0.015
0.5	0.00	1.00	270.00	0.006
0.0	0.00	0.00	0.00	0.000

Table 5: BMP-4 Cumulative Storage Volume

Depth of Water in System	Cumulative Pipe Storage	Cumulative Pipe + Gravel Storage	Total System Cumulative Storage	Total System Cumulative Storage
(Feet)	(Cubic Feet)	(Cubic Feet)	(Cubic Feet)	(Acre Feet)
4.0	3.14	12.88	3285.65	0.075
3.5	3.14	10.38	2648.15	0.061
3.0	3.14	7.88	2010.65	0.046
2.5	3.14	6.88	1755.65	0.040
2.0	3.14	5.88	1500.65	0.034
1.5	1.57	3.94	1005.32	0.023
1.0	0.61	2.37	604.02	0.014
0.5	0.00	1.00	255.00	0.006
0.0	0.00	0.00	0.00	0.000

Table 6: BMP-1 Routing Summary

Storm Event (years)	Peak BMP Inflow (cfs)	Routed Peak BMP Outflow (cfs)	Maximum Storage Volume (ac-ft)	Water Surface Elevation (feet)
1	4.01	3.41	0.030	1843.06
2	5.13	4.34	0.037	1843.25
5	6.85	5.65	0.048	1843.54
10	9.17	6.85	0.068	1843.97
25	10.92	8.07	0.083	1844.60
100	13.55	9.66	0.107	1845.64

Table 7: BMP-2 Routing Summary

Storm Event (years)	Peak BMP Inflow (cfs)	Routed Peak BMP Outflow (cfs)	Maximum Storage Volume (ac-ft)	Water Surface Elevation (feet)
1	3.41	1.29	0.068	1831.82
2	4.34	1.65	0.089	1832.44
5	5.65	2.84	0.114	1833.17
10	6.85	4.74	0.137	1833.51
25	8.07	6.22	0.147	1833.67
100	9.66	8.12	0.161	1833.88

Table 8: BMP-3 Routing Summary

Storm Event (years)	Peak BMP Inflow (cfs)	Routed Peak BMP Outflow (cfs)	Maximum Storage Volume (ac-ft)	Water Surface Elevation (feet)
1	1.29	0.95	0.031	1828.77
2	1.65	1.17	0.040	1829.30
5	2.84	1.90	0.052	1830.09
10	4.74	4.02	0.063	1830.48
25	6.22	5.72	0.070	1830.68
100	8.12	7.67	0.077	1830.90

Table 9: BMP-4 Routing Summary

Storm Event (years)	Peak BMP Inflow (cfs)	Routed Peak BMP Outflow (cfs)	Maximum Storage Volume (ac-ft)	Water Surface Elevation (feet)
1	0.95	0.73	0.046	1827.01
2	1.17	1.01	0.048	1827.05
5	1.90	1.56	0.050	1827.13
10	4.02	3.46	0.058	1827.40
25	5.72	4.91	0.064	1827.62
100	7.67	7.09	0.074	1827.96

4.4 INFILTRATION AREAS

BMP-2, BMP-3 and BMP-4 are 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-2 is located at infiltration test points IT-1 and IT-2. The infiltration rate at IT-1 was measured to be 1.03 in/hr. The infiltration rate at IT-2 was measured to be 0.75 in/hr. The average of IT-1 and IT-2 is

0.89 in/hr (0.074 ft/hr). The method for entering the infiltration of BMP-2 into PondPack must account for the BMP area. Therefore the infiltration rate was determined as follows:

Surface area of BMP-2 = 2,850 ft^2 – (40 ft * 4 ft) = 2,690 ft^2

2,690 ft^2 * 0.074 ft/hr * 0.0166 hr/min * 0.0166 min/s = 0.06 ft^3/s

BMP-3 is located at infiltration test points IT-1 and IT-2. The infiltration rate at IT-1 was measured to be 1.03 in/hr. The infiltration rate at IT-2 was measured to be 0.75 in/hr. The average of IT-1 and IT-2 is 0.89 in/hr (0.074 ft/hr). The method for entering the infiltration of BMP-3 into PondPack must account for the BMP area. Therefore the infiltration rate was determined as follows:

Surface area of BMP-3 = 1,350 ft^2 – (32 ft * 4 ft) = 1,222 ft^2

1,222 ft^2 * 0.074 ft/hr * 0.0166 hr/min * 0.0166 min/s = 0.03 ft^3/s

BMP-4 is located at infiltration test point IT-3. The infiltration rate at IT-3 was measured to be 4.69 in/hr (0.391 ft/hr). The method for entering the infiltration of BMP-4 into PondPack must account for the BMP area. Therefore the infiltration rate was determined as follows:

Surface area of BMP-4 = 1,275 ft^2

1,275 ft^2 * 0.391 ft/hr * 0.0166 hr/min * 0.0166 min/s = 0.14 ft^3/s

4.5 STORMWATER MANAGEMENT

Stormwater quality management for the project will comply with Township ordinances and state regulations through the implementation of erosion and sediment controls during construction and implementation and maintenance of post construction stormwater management (PCSM) controls after construction. Erosion and sediment control details are included in the land development plans for the project and are designed to be in compliance with state regulations. Stormwater quality is achieved with the proposed BMP design, which is in accordance with the Pennsylvania Stormwater Best Management Practices Manual. Table 10 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 10: POI-1 Peak Discharge Rate Reduction Summary

Storm Event (years)	Total Pre-Development Peak Flow (cfs)	Total Post-Development Peak Flow (cfs)	Total Peak Flow Rate Difference (cfs)	Total Pre-Development Hydrograph Volume (ac-ft)	Total Post-Development Hydrograph Volume (ac-ft)	Total Hydrograph Volume Difference (ac-ft)
1	10.36	9.51	-0.85	1.317	1.268	-0.049
2	17.92	16.62	-1.30	1.994	1.947	-0.047
5	31.92	29.71	-2.21	3.176	3.129	-0.047
10	53.57	50.17	-3.40	4.993	4.942	-0.051
25	71.32	68.26	-3.06	6.493	6.438	-0.055
100	99.67	99.63	-0.04	8.910	8.848	-0.062

1. The total post development peak flow is the routed flow of all post-development watersheds to POI-1

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, Pennsylvania Department of Environmental Protection, Bureau of Watershed Management, October, 2009.

Ebensburg Quadrangle, Pennsylvania – Cambria County, Geological Survey, United States Department of Interior.

Web Soil Survey of Cambria County, Pennsylvania, United States Department of Agriculture, Soil Conservation Service.

Cambria County Act 167 Plan.

APPENDIX A – SITE LOCATION MAP

Legend

- Access Road
- Alignment Centerline
- Limit of Disturbance
- Pump Station

Sheet Identifier

Feet
0 1,000 2,000

Meters
0 300 600

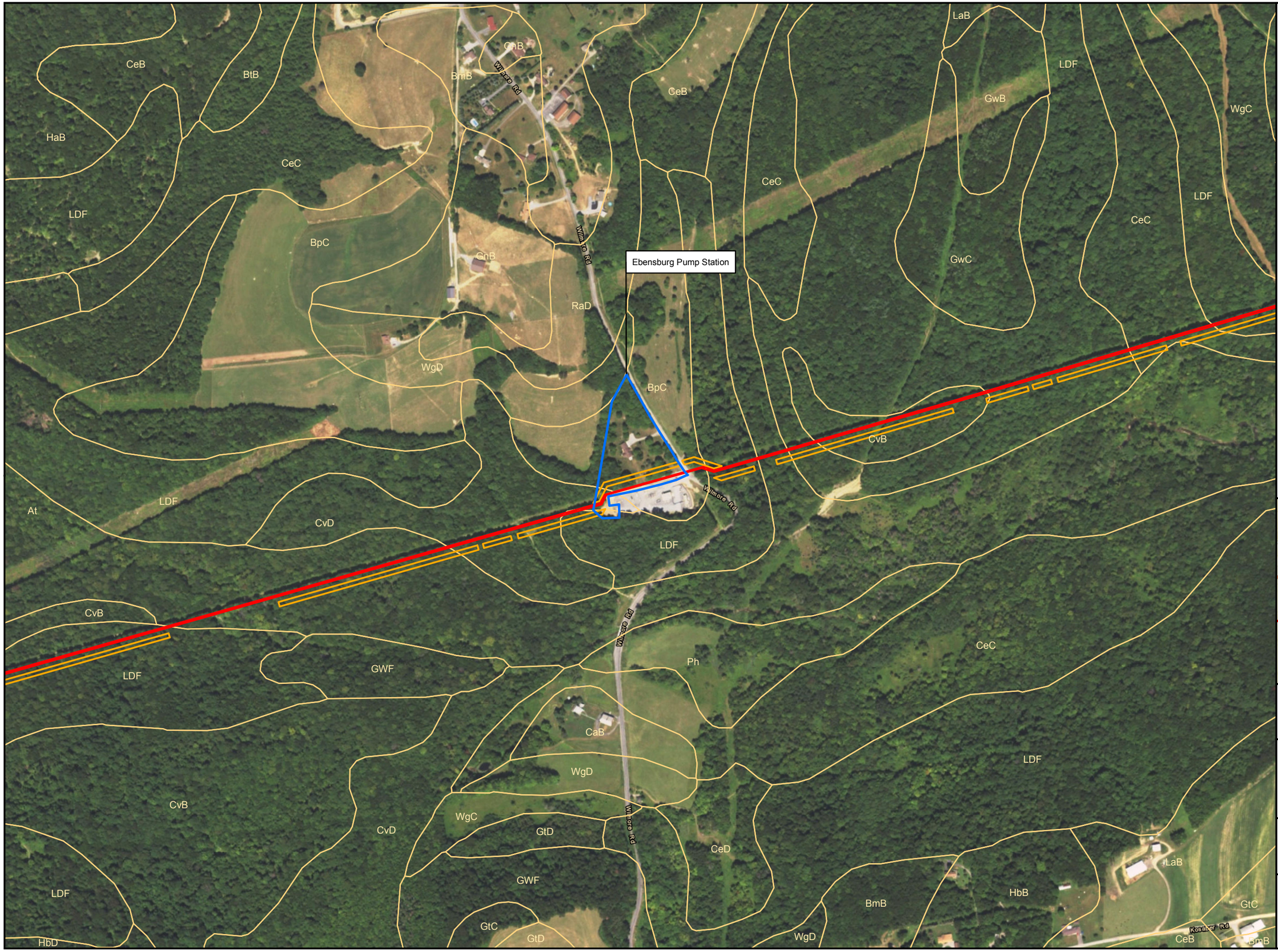
PROJECT LOCATION MAP
ATTACHMENT 1
PENNSYLVANIA PIPELINE PROJECT
AUGUST 2, 2015 ALIGNMENT
SUNOCO LOGISTICS, L.P.
CAMBRIA COUNTY, PA

TETRA TECH

Notes:
1) Topographic map provided by ESRI's ArcGIS Online USA Topo Maps map service (© 2013 National Geographic Society, i-cubed).
2) Quadrangles being displayed are Ebensburg

P:\GIS\SUNOCO\MARINER EAST 2\MXD\PPP ES\CP\PUMP STATIONS\PENNPIPELINE_PUMPSTATIONS_USGS_ES_CP.MXD 11/03/15 JN

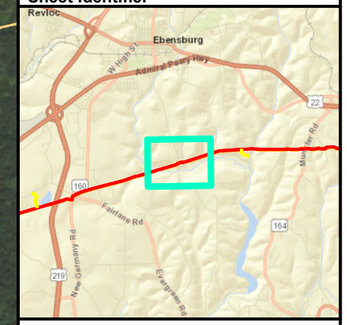
APPENDIX B – SOILS LOCATION MAP AND INFILTRATION TEST RESULTS



Legend

- Access Road
- Alignment Centerline
- Limit of Disturbance
- NRCS Soils and Codes
- Pump Station

Sheet Identifier



N

0 250 500 Feet

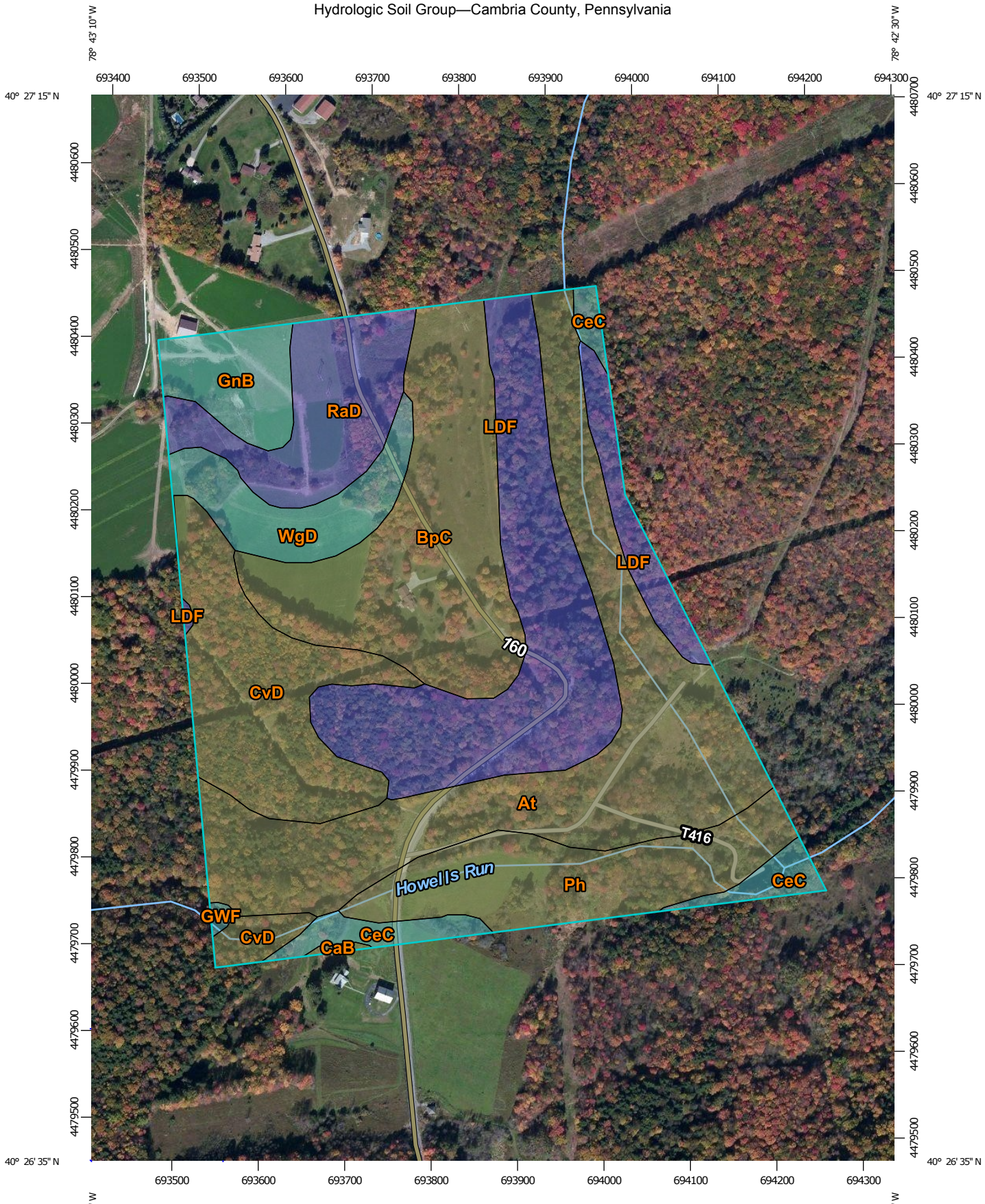
0 76.2 152.4 Meters

NRCS SOILS MAP
ATTACHMENT 2
PENNSYLVANIA PIPELINE PROJECT
OCTOBER 3, 2016 ALIGNMENT
SUNOCO LOGISTICS, L.P.
CAMBRIA COUNTY, PA

TETRA TECH

Notes:
Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2015 ESRI and its data suppliers)

PGH P:\GIS\SUNOCO\MARINER EAST 2\MXD\PPP ESC\PPPUMP STATIONS\PENNPIPELINE_PUMPSTATIONS_SOILS_ESC0P.MXD 10/14/16 SP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78° 42' 30" W
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RaD
LDF
CeC
WgD
BpC
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CeC
CaB
Map Scale: 1:5,990 if printed on A portrait (8.5" x 11") sheet.
N
Meters
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Feet
0 250 500 1000 1500
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cambria County, Pennsylvania
Survey Area Data: Version 7, Sep 15, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 6, 2011—Oct 17, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Cambria County, Pennsylvania (PA021)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
At	Atkins silt loam, 0 to 3 percent slopes, frequently flooded	C/D	23.9	22.8%
BpC	Blairton-Berks channery silt loams, 8 to 15 percent slopes	C/D	17.3	16.5%
CaB	Cavode silt loam, 3 to 8 percent slopes	C/D	0.1	0.1%
CeC	Cookport and Ernest soils, 8 to 15 percent slopes	C	3.4	3.3%
CvD	Cookport and Ernest very stony soils, 8 to 25 percent slopes	C/D	12.9	12.3%
GnB	Gilpin silt loam, 3 to 8 percent slopes	C	4.0	3.8%
GWF	Gilpin-Weikert channery silt loams, 25 to 70 percent slopes	C	0.2	0.2%
LDF	Laidig soils, 25 to 70 percent slopes	B	19.8	18.9%
Ph	Philo silt loam, 0 to 3 percent slopes, occasionally flooded	C/D	10.1	9.7%
RaD	Rayne silt loam, 15 to 25 percent slopes	B	8.0	7.6%
WgD	Wharton-Gilpin silt loams, 15 to 25 percent slopes	C	5.1	4.8%
Totals for Area of Interest			**104.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TRIP REPORT

Date: October 27, 2015

To: Megan Carson

From: Tim Evans, PG

Subject: Summary of Soil Infiltration Tests
Ebensburg Station
Sunoco PPP
Cambria Township, Cambria County, Pennsylvania

This trip report provides results of soil infiltration tests that were completed as part of the Pennsylvania Pipeline Project (PPP) for Sunoco Pipeline, LP, in Cambria Township, Cambria County, Pennsylvania.

1.0 PURPOSE

This report presents the field data and results of double-ring soil infiltration tests conducted to support the design of stormwater management systems at several locations in Cambria Township, Cambria County, Pennsylvania. Three shallow tests (IT-1, IT-2, and IT-3) were performed at the property. Test locations are listed by coordinates (latitude and longitude) in Table 1 and shown on the attached figures.

2.0 FIELD ACTIVITIES

The infiltration tests were conducted by Mark Mengel and Scott Anderson of Tetra Tech, Inc., on October 13, 2015. The test locations were positioned in the field using a handheld, WAAS-enabled GPS unit and reference to google earth map. Table 1 provides the coordinates of the test locations. IT-1, IT-2 and IT-3 were located in a farm field in a gently sloping area. Photographs of testing locations are attached to this report.

The infiltration tests were performed in accordance with the procedure specified in the 2006 Pennsylvania Stormwater Best Management Practices (BMP) Manual. Double ring tests were performed. The double rig test locations were prepared for test locations with the assistance of a mini-excavator, with care taken to minimize disturbance of the soil surface to be tested. The double-ring infiltrometers that were used for testing consisted of 10-inch and 6-inch diameter sections of steel casing. After digging to the target depth, the test surface was leveled, and any loose soil or fallen vegetation was removed. The rings were driven a minimum of 2 inches into the soil. Infiltration test depths are provided on Table 1.

Test locations were pre-soaked for 1 hour. The tests were then conducted with measurements at 10 or 30-minute intervals, based on the observed water level drops during the pre-soak period.

Pre-soak and test information was recorded on infiltration test sheets; copies of the test sheets are attached to this report.

During the testing, the weather was overcast and cool, approximately 60 degrees Fahrenheit, and no precipitation was observed during the tests.

In addition, a test pit was machine-excavated at a location equidistant between the infiltration test pits, to characterize the soil, determine the depth to bedrock, if encountered, and inspect for evidence of the seasonal high water table. The test pit was completed to two feet below the target infiltration test depth or refusal, whichever was encountered first. A description of lithology for each infiltration test pit was also recorded.

Descriptions of the soil were recorded on field logs, which were based on the form example in the BMP manual. Copies of the field soil logs are attached to this report.

3.0 RESULTS

3.1 SOILS DESCRIPTION

Soils encountered consisted of up to 10 inches dark brown/black topsoil/surface soil silt layer, underlain by silty clay loam to silty clay. Thin grass roots and leaves were encountered in the topsoil/surface soils with few roots being observed in the underlying soil horizons. Table 1 summarizes the depths of the infiltration tests (test pits completed approximately 2 feet deeper than infiltration test depths).

The soils were noted to be dry to moist during the excavation activities. No mottling of soils or groundwater was observed in the test pits.

According to United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey[1] data, the soil types for the test locations are mapped as follows:

- IT-1, IT-2 and IT-3 – Blairton-Berks channery silt loam (BpC soil symbol), 8 to 15 percent slopes

3.2 INFILTRATION TEST RESULTS

Table 1 summarizes the infiltration rates (inches per hour) calculated from the test data. Infiltration rates presented in Table 1 were calculated from the average water level drop of the last four readings measured in the inner ring.

[1] http://websoilsurvey.nrcs.usda.gov/. Accessed October 21, 2015.

Two tests exhibited a slow rate of infiltration (IT-1 and IT-2), requiring a 30-minute test cycle. Location IT-3 exhibited moderate infiltration rates, requiring 10-minute test cycle.

Table 1
Summary of Infiltration Test Results
Ebensburg Station
Cambria Township, Cambria County, PA
Sunoco PPP

Test Location (IT-)	Location Data		Test Depth (inches)	Infiltration Test Result (inches/hour)
	LATITUDE	LONGITUDE		
IT-1	40.44875	-78.714561	48	1.03
IT-2	40.448911	-78.714467	48	0.75
IT-3	40.448753	-78.714261	48	4.69

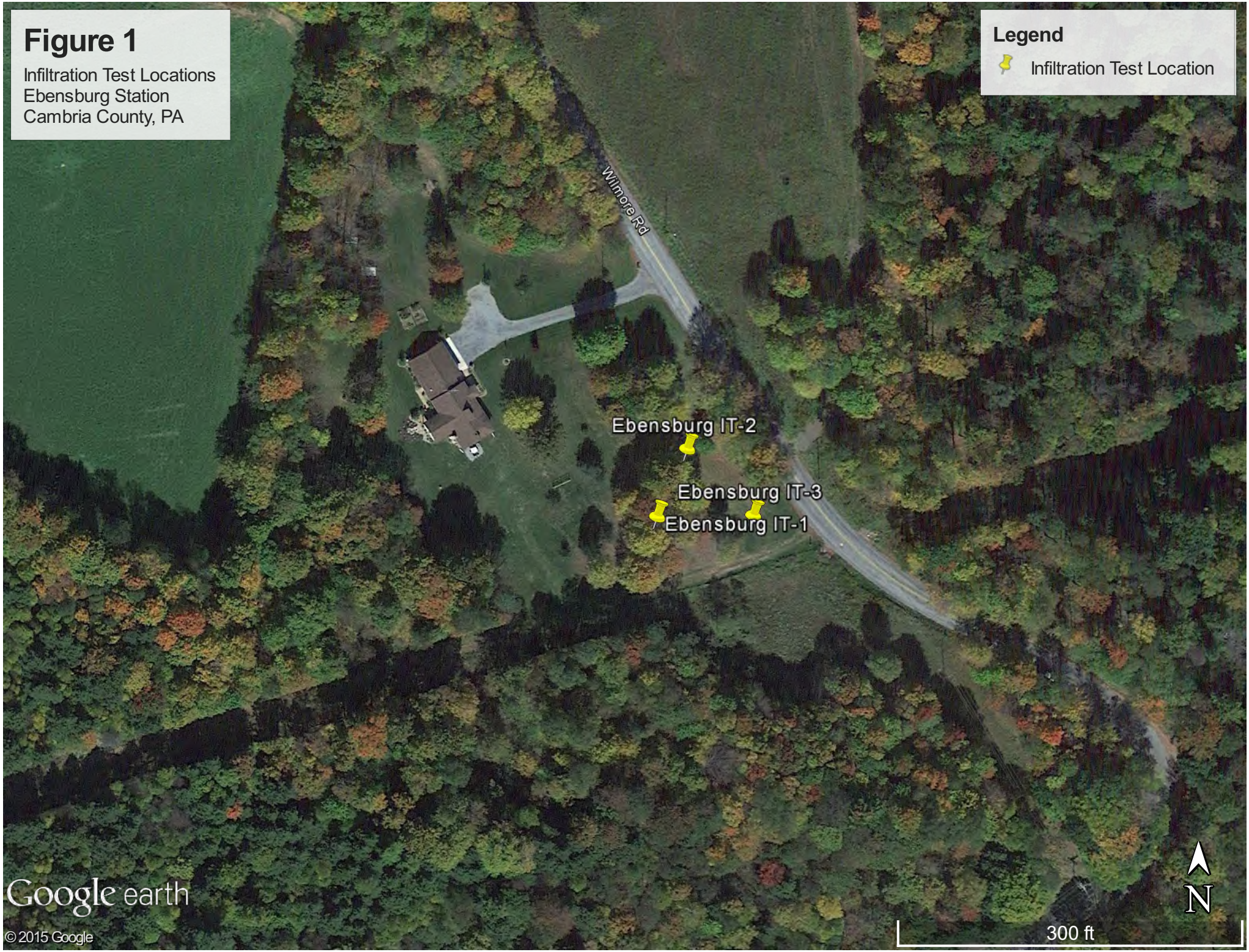


Figure 1
Infiltration Test Locations
Ebensburg Station
Cambria County, PA
Legend
Infiltration Test Location
Wilmore Rd
Ebensburg IT-2
Ebensburg IT-3
Ebensburg IT-1
Google earth
© 2015 Google
N
300 ft

ATTACHMENTS

SOIL LOGS

TETRA TECH **Soil Log**

Tested By: Scott Anderson **Project:** Sunoco Stations **Project No.:** 112IC07771

Test Pit: Ebensburg IT-1 **Date:** 10/13/15 **Elevation:** _____ **Equipment Used** Mini Excavator

Geology: _____ **Soil Type:** _____ **Land Use:** _____ **Weather:** 60°F, overcast

Additional Comments _____

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	9"	Silt to Silt Loam	Silt w/ trace to minor clay. Leaves	Dark Brown	Uniform	Numerous pores & roots	>4'	—	1" Black organic over 8" Brown
A	9"	16"	silty clay loam	clayey silt to silty clay w fine c sands	Tan to orange	Variable	few pores & roots	>4'	—	Sandstone >1" now base
B	16"	48"	silty clay & clay	silty clay to clay with rocks, gravel	Gray/brown to tan	—	few roots	>4'	—	+ Hard, Dense clay from ~3" to 6" when dug - Iron, Black Staining

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification Classification as Follows: Abrupt	
A	Dark colored, mixed mineral organic matter			
B	Maximum accumulation of silicate clay minerals		(Clear)	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH **Soil Log**

Tested By: Scott Anderson
Test Pit: Ebensburg IT-2
Geology:
Date: 10/13/15
Soil Type:
Project: Sunoco Stations
Elevation:
Land Use:
Project No.: 119IC07771
Equipment Used: Mini Excavator
Weather: 60°F, overcast

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	9"	silt to silt loam	silt with trace clay to minor clay. rocks	Dark Brown	Uniform	numerous pores, roots	>4'	—	large rocks to ~1'
A	9"	24"	silty clay loam	clayey silt to silty clay w sands and rock	Tan to orange	Variable	minor roots, pores	>4'	—	numerous rocks (sandstone), <1' (3"-6")
B	24"	48"	silty clay	silty clay w/some clay	Grey/Brown clay to orange	—	few roots	>4'	—	numerous rocks (sandstone) ~3" to >1' (Iron stain/Black on rocks)

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

Tested By: Scott Anderson
Test Pit: Ebensburg ET-3
Date: 10/13/15
Geology:
Soil Type:
Project: Sunoco Stations
Elevation:
Land Use:
Project No.: 112IC07771
Equipment Used Mini Excavator
Weather: 60°F, overcast

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	9"	Silt to silt loam	silt w/ trace to minor clay, rocks	Dark Brown	Uniform	Numerous pores & roots	>4'	—	Thinner in areas
A	9"	18"	Silty clay loam	clayey silt to silty clay w/ sands, gravel	Tan to orange	Unmottled	Minor pores, roots	>4'	—	-Some rocks @ Base
B	18"	48"	Silty clay	silty clay w/ gravel & rock	Orange to Gray	Variable	few roots	>4'	—	-rocks and gravel are rare to absent

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	-less rocks and clayey areas compared to other locations
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH **Soil Log**

Tested By: Scott Anderson **Project:** Sunoco Stations **Project No.:** 112IC07771

Test Pit: Ebensburg Center Pit **Date:** 10/13/15 **Elevation:** _____ **Equipment Used** M.n. Excavator

Geology: _____ **Soil Type:** _____ **Land Use:** _____ **Weather:** 60°F, Overcast

Additional Comments Approximate center of Three IT locations

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	10"	silt to silt loam	silt with trace clay to minor clay	Dark Brown	Uniform	Numerous roots & pores	>6'	—	Topsoils
A/SA	10"	23"	silty clay loam	Clayey silt to silty clay w trace f-c scnds	Tan to orange	Variable	few pores, few roots	>6'	—	- iron staining
B	23"	72"	silty clay & clay	silty clay w/ clayey areas and gravels	Gray/orange clay / orange sc	—	mini fine roots, no pores?	>6'	—	- Hard, Dense clayey areas with iron, Mn staining

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	B zone is intermixed silty clay with tan clay zones (>1') - clay is dry, dense w/ iron staining & dark blebs (Mn??) - Darker in color and possibly damp @ ~70"
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		(Clear)	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

- roots observed to >5' deep (NG')

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

INFILTRATION TEST DATA SHEETS

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Sunoco Stations
PROJECT NUMBER: 112C07771
TEST AREA ID: Ebensburg IT-1
PERSONNEL: Mark Mergel, Scott Anderson

TEST METHOD: (Double Ring Infiltrometer) Percolation
Single Ring Infiltrometer

Location Coordinates or Description:
Lat 40.44875
Long -78.714561

INNER RING INSIDE DIAMETER/HEIGHT: 6"x10"
OUTER RING INSIDE DIAMETER/HEIGHT: 10"x10"

PERCOLATION HOLE DIAMETER: — (If performing an open hole perc test)

DATE(s): 10/13/15

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches): ~7.5"

MEASURING POINT: (Ring Rim) Indicator Mark

DEPTH OF TEST: 4'

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
PRESOAK DATA				
1152	0	----------	~9.5L	Start Test
1222	30	1 1/16	0.6 L	
1252	60	10/16	0.40L	
TEST DATA				
1252	0	----------		[redacted]
1322	30	9/16	0.20	
1352	60	8/16	0.20	
1422	90	8/16	0.20	
1452	120	8/16	—	

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Sunoco Stetsons
PROJECT NUMBER: 112C07771
TEST AREA ID: Edinsburg IT-2
PERSONNEL: SA MM

TEST METHOD: ~~Double Ring Infiltrometer~~ ~~Percolation~~ Single Ring Infiltrometer

Location Coordinates or Description:
Lat 40.448911
Long -78.714467

INNER RING INSIDE DIAMETER/HEIGHT: 6"x10"
OUTER RING INSIDE DIAMETER/HEIGHT: 10"x10"

PERCOLATION HOLE DIAMETER: — (If performing an open hole perc test)

DATE(s): 10/13/15

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches): ~7.5"

MEASURING POINT: Ring Rim Indicator Mark

DEPTH OF TEST: 4'

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
PRESOAK DATA				
1225	0	----------	9.5	Start Test (~4L Initial)
1255	30	1"	0.55L	[illegible]
1325	60	9/16	0.30L	
TEST DATA				
1325	0	----------		
1355	30	6/16	0.350L	
1425	60	6/16	0.350L	
1455	90	6/16	0.350L	
1525	120	6/16	—	

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Sunoco Stations
PROJECT NUMBER: 112C07771
TEST AREA ID: Ebensburg IT-3
PERSONNEL: MM, SA

TEST METHOD: (Double Ring Infiltrometer) Percolation
Single Ring Infiltrometer

Location Coordinates or Description:
Lat 40.448753
Long -78.714261

INNER RING INSIDE DIAMETER/HEIGHT: 6"x10"
OUTER RING INSIDE DIAMETER/HEIGHT: 10"x10"

PERCOLATION HOLE DIAMETER: — (If performing an open hole perc test)

DATE(s): 10/13/15

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches): ~7"

MEASURING POINT: (Ring Rim) Indicator Mark

DEPTH OF TEST: 4'

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
PRESOAK DATA				
1245	0	----------	~4L	~9.5L Full, start Test
1315	30	1 6/16	0.6L	(1305) Down 4". Added 2.2L
1345	60	4 4/16	2.30L	
TEST DATA				
1345	0	----------		
1355 ~~1445~~	10	1 2/16	0.65L	
1405 ~~1445~~	20	15/16	0.60	
1415 ~~1515~~	30	1 2/16	0.65	
1425 ~~1545~~	40	1 2/16	—	

PHOTOGRAPHS

SITE PHOTOGRAPHIC LOG

Date:	View:	Photographer:
10/13/15		S. Anderson

IT-1 Infiltration Test.

Date:	View:	Photographer:
10/13/15		S. Anderson

IT-2 Infiltration Test.

Date:	View:	Photographer:
10/13/15		S. Anderson

IT-3 Infiltration Test.

Date:	View:	Photographer:
10/13/15		S. Anderson

Test pit for lithology only.

TRIP REPORT
EBENSBRUG STATION

1.0 PURPOSE

This Trip Report presents the field data and results of test pitting conducted to support the design of a stormwater management system at the Ebensburg Station site located in Cambria Township, Cambria County, Pennsylvania, as part of the Pennsylvania Pipeline Project (PPP) for Sunoco Pipeline, LP. Three test pits (IT-1 through IT-3) were excavated using a backhoe at the site to obtain Munsell color designations of the subsurface soils. The test locations are listed by coordinates (latitude and longitude) in Table 1 and shown on the attached figure.

2.0 FIELD ACTIVITIES

The test pit field observations were made by Daniel Fenstermacher and Duane Traux of RETTEW, Inc., on September 27, 2016. The test pit locations were positioned in the field using a handheld, WAAS-enabled GPS unit. The test pits were located in a slightly wooded, gently sloping area.

A mini-excavator (backhoe) was utilized to expose the subsurface lithologies and to obtain Munsell color designations applicable to test pits previously excavated in October 2015. Test pits were dug within five feet of the previous test pit location and to the same depths. Munsell color designations were documented on previously completed field logs, which were based on the example form in the Pennsylvania Stormwater Best Management Practices Manual (December 30, 2006). Copies of the soil logs are attached to this report.

3.0 RESULTS

3.1 Soil Description

Soils encountered consisted of up to 10 inches dark brown/black (10YR 3/3, 10YR **3/2,** 10YR 4/3) topsoil/surface soil silt layer, underlain by silty clay loam to silty clay (tan to orange, 10YR 6/4, 10YR 4/4, and 10YR 5/4). Thin grass roots and leaves were encountered in the topsoil/surface soils with few roots being observed in the underlying soil horizons. Table 1 summarizes the depths of the test pits.

The soils were noted to be dry to moist during the excavation activities. No mottling of soils or groundwater was observed in the test pits.

According to United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey data, the soil types for the test locations are mapped as follows:

- IT-1, IT-2 and IT-3 – Blairton-Berks channery silt loam (BpC soil symbol) with 8 to 15 percent slopes with very high runoff and moderately well drained.

Table 1
Summary of Infiltration Test Results
Ebensburg Station
Cambria Township, Cambria County, PA
Sunoco PPP

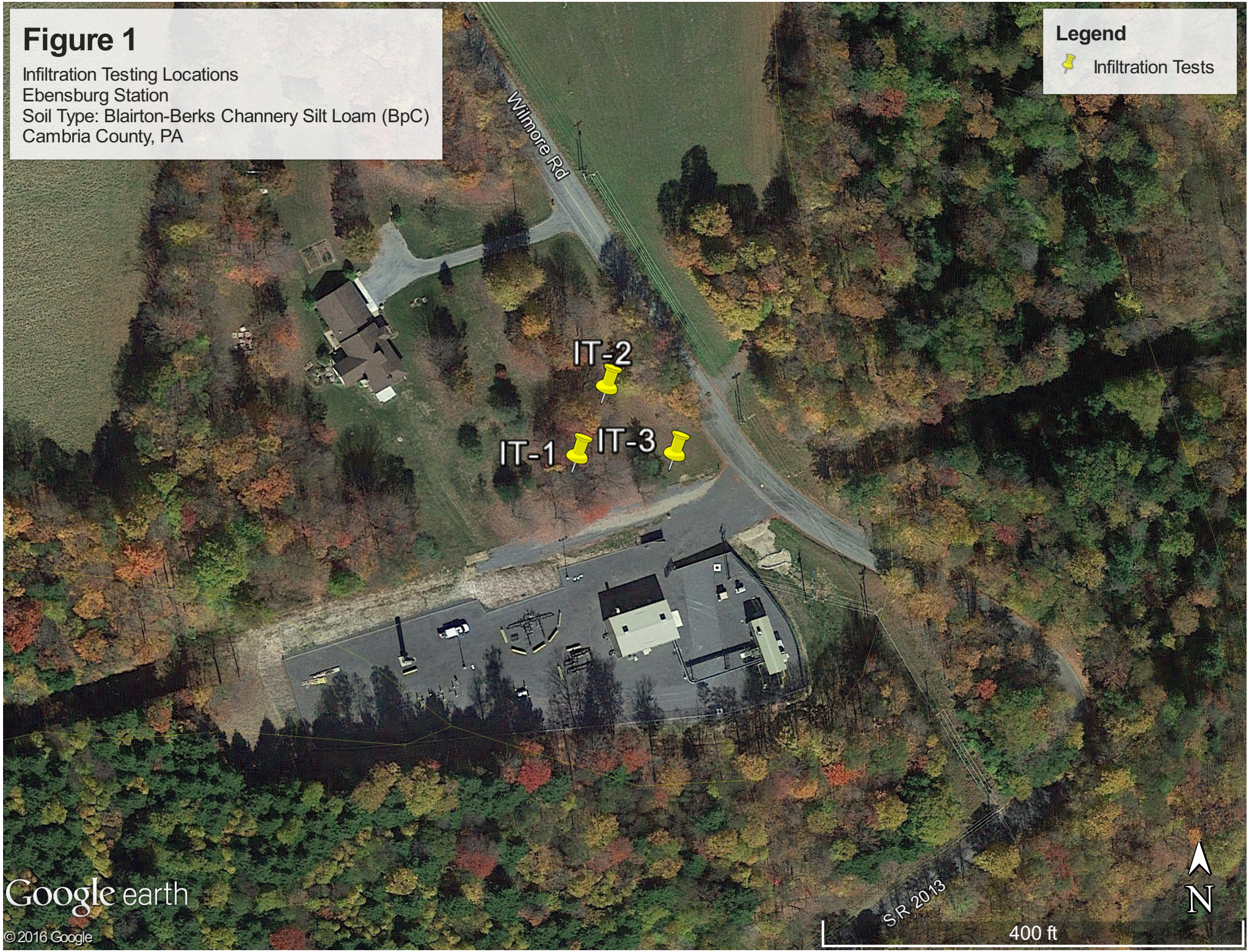
Test Location (IT-)	Location Data		Test Pit Depth (feet bgs)
	LATITUDE	LONGITUDE	
IT-1	40.448750	-78.714561	4
IT-2	40.448911	-78.714467	4
IT-3	40.448753	-78.714261	4

Note -

A central Test Pit was dug to 6 feet bgs in 2015 to inspect for depth to bedrock surface and seasonal high groundwater, if present

Figure 1

Infiltration Testing Locations
Ebensburg Station
Soil Type: Blairton-Berks Channery Silt Loam (BpC)
Cambria County, PA



ATTACHMENTS

SOIL LOGS

D. Fenstermacher 9/27/16
(Reflew)

TETRA TECH **Soil Log**

Tested By: Scott Anderson
Test Pit: Elverson IT-1
Geology: Glenshaw
Date: 10/13/15
Soil Type: Blairton-Berks
Project: Sunoco Stations
Elevation:
Land Use: cornfield
Project No.: 112C07771
Equipment Used: Mini Excavator
Weather: 60°F, overcast

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
10YR3/3 A	0"	9"	Silt to silt loam	Silt w/ trace to minor clay. Leaves	Dark Brown	Uniform	Numerous pores & roots	>4'	—	1" Black organic over 8" Brown
10YR6/4 AB	9"	16"	silty clay loam	clayey silt to silty clay w fine c sands	Tan to orange	Variable	few pores & roots	>4'	—	Sandstone >1" now base
10YR5/6 silty clay loam B	16"	~~Hard~~ 34	~~silty clay~~ clay loam	silty clay to clay with rocks, gravel	Gray/orange to tan	—	few roots	>4'	16" - SMWT	- Hard, Dense clay from ~31" to 6" when dug - Iron, Black staining
~~Bt1~~	~~34~~	~~48+~~	~~clay~~	~~NO CoF~~	~~10YR5/6~~	2.5Y6/2	Depletions Prominent			~~Fragic~~
Btx	34 -	48+	clay	NO CoF	10YR5/6	2.5Y6/1	Depletions Prominent in Boreline			very firm fragic Bx/t.s Difficulty excavating

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

D. Fenstermacher 9/27/16
(Return)

TETRA TECH **Soil Log**

Tested By: Scott Anderson
Test Pit: Ebensburg IT-2
Geology: Glenshaw
Date: 10/13/15
Soil Type: Blairton - Berks
Project: Susco Stations
Elevation:
Land Use: Forest
Project No.: 111C07771
Equipment Used: Mini Excavator
Weather: 60°F, overcast

Additional Comments: No Redox in any horizon

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
~~A~~	0"	9"	silt to silt loam	silt with trace clay to minor clay. rocks	Dark Brown	Solid Uniform	numerous pores, roots	>4'	—	large rocks to ~1'
~~B~~ 10YR4/4	9"	24"	silty clay loam	clayey silt to silty clay w sands and rock	Tan to orange	Solid Variable	minor roots, pores	>4'	—	numerous rocks (sandstone), <1' (3"-6")
B 10YR6/4	24"	48"	silty clay	silty clay w/some clay very cobbly channery	Grey/orange clay to orange	Solid	few roots	>4'	—	numerous rocks (sandstone) ~3" to >1' (Iron stony/Block on rocks)

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification Classification as Follows: Abrupt	
A	Dark colored, mixed mineral organic matter			
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

D. Fenstermacher (Retired) 9/27/16

TETRA TECH **Soil Log**

Tested By: Scott Anderson
Test Pit: Ebensburg ET-3
Geology: Gatenshaw
Date: 10/13/15
Soil Type: Blairton-Berks
Project: Sunoco Stations
Elevation:
Land Use: forest
Project No.: 112IC07771
Equipment Used: Mini Excavator
Weather: 60°F, overcast

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
A	0"	9"	Silt to silt loam	silt w/ trace to minor clay, rocks	Dark Brown	Uniform	Numerous pores & roots	>4'	—	Thicker in areas
AB	9"	18"	Silty clay loam	clayey silt to silty clay w/ cobbles, gravel	Tan to orange	~~Variable~~ Uniform	Minor pores, roots	>4'	—	- Some rocks @ Base
B	18"	48"	Silty clay	silty clay w/ gravel & rock	Orange to Gray	~~Variable~~ Uniform	few roots	>4'	—	- rocks and gravel are rare to absent

10YR4/3

10YR5/4

10YR5/3

No Redox in any horizon

Horizon:	USDA Definition
O	Organic debris
A	Dark colored, mixed mineral organic matter
B	Maximum accumulation of silicate clay minerals
C	Weathered parent material
R	Layer of consolidated rock beneath the soil

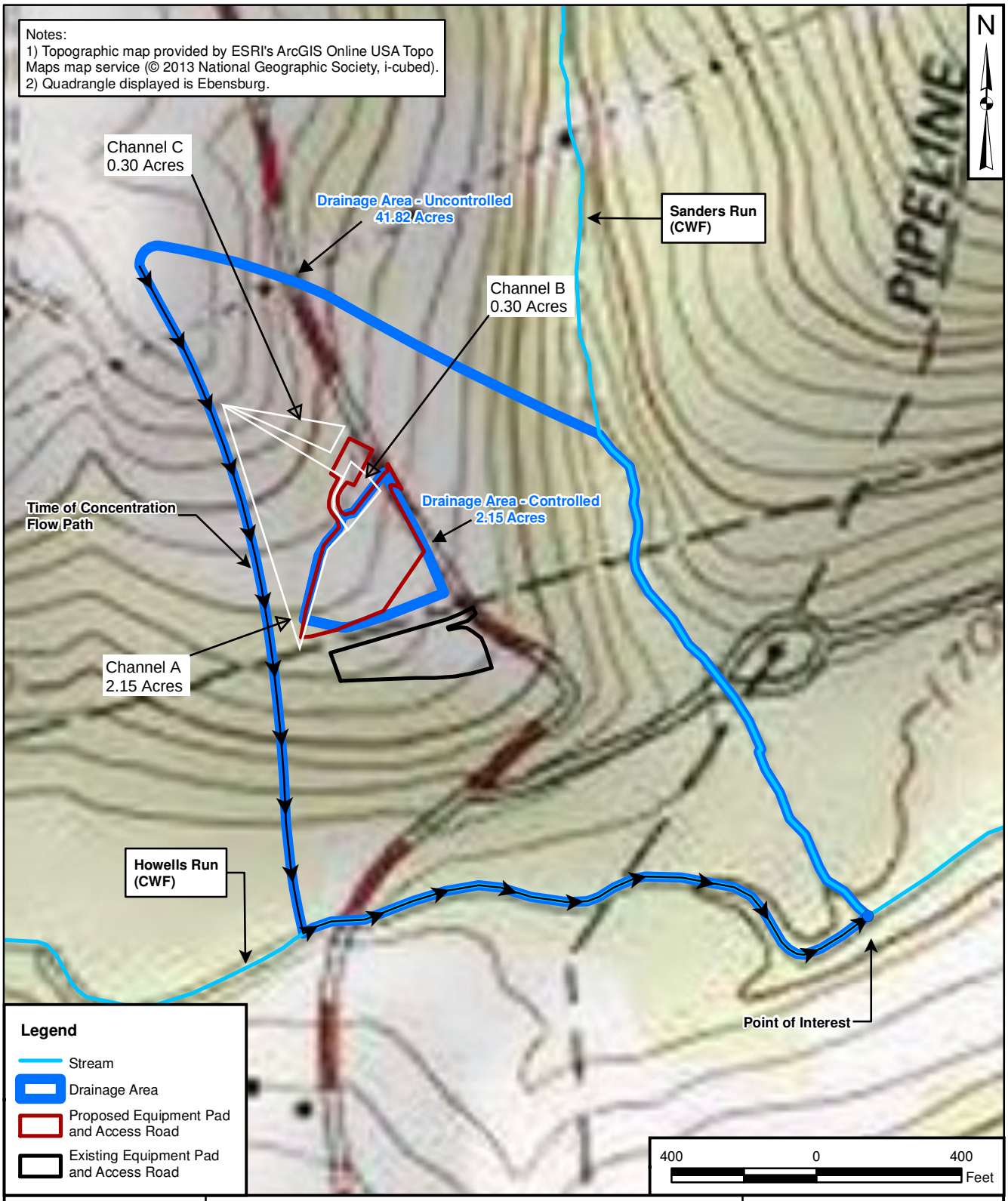
Soil Textural Class	Boundary
Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification
	Classification as Follows:
	Abrupt
	(Clear)
	Gradual
	Diffuse

Notes:
- less rocks and clayey areas compared to other locations

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

APPENDIX C – PRE-DEVELOPED RUNOFF MAP

PGH P:\GIS\SUNOCO\MAPDOCS\ME1_EBENSBURG_PUMP_STATION_PCSM_USGS_2015.MXD 10/16/15 SP



TETRA TECH

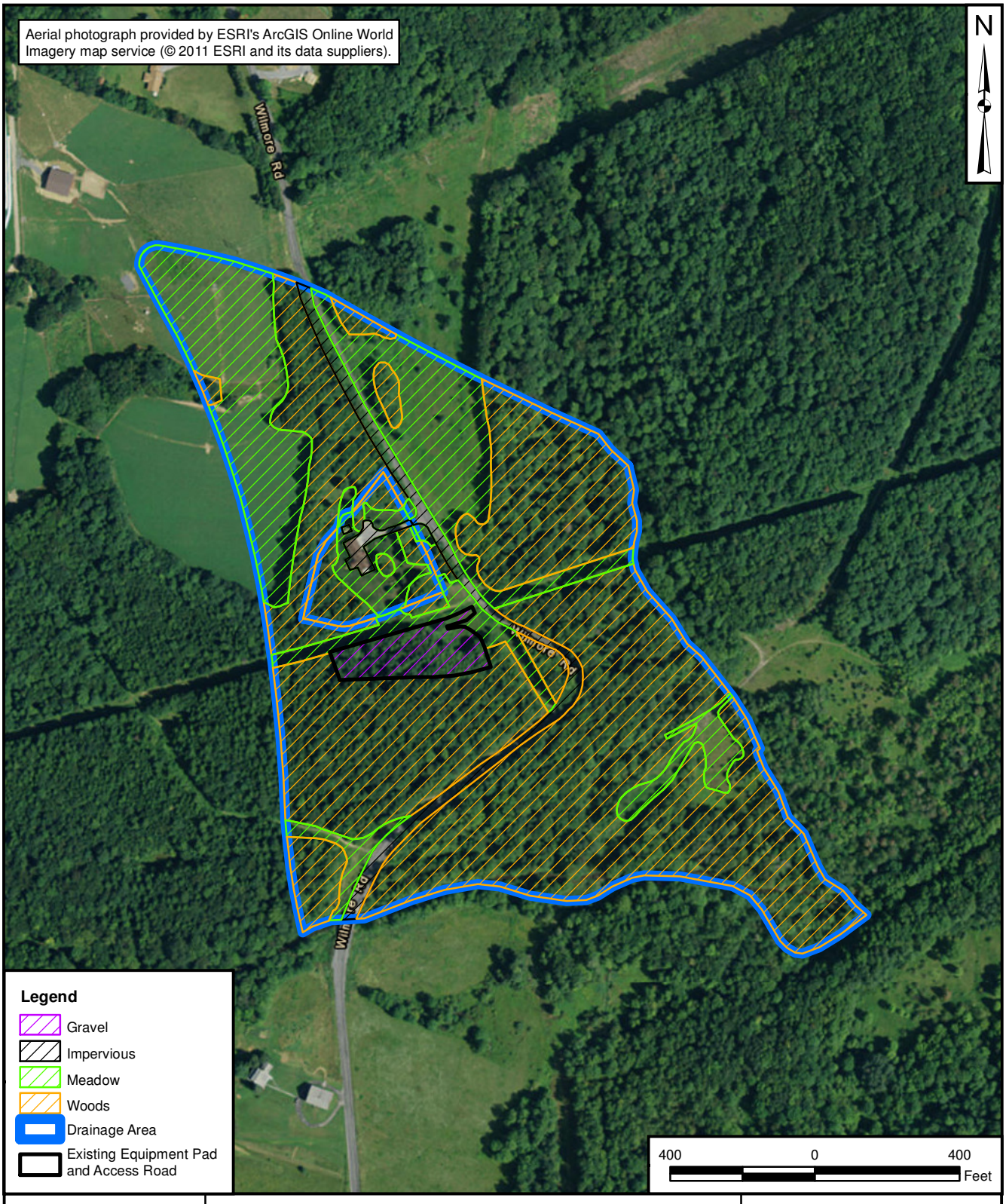
STORMWATER DRAINAGE AREA MAP
EBENSBURG PUMP STATION
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
CAMBRIA COUNTY, PENNSYLVANIA

DRAWN BY: S. PAXTON 10/15/15
CHECKED BY: T. DUNAWAY 10/16/15
APPROVED BY:

CONTRACT NUMBER: 112IC05370

FIGURE NUMBER	REV
1	0

PGH P:\GIS\SUNOCO\MAPDOCS\ME1_EBENSBURG_PUMP_STATION_PCSM_PRE-CONSTRUCTION_2015.MXD 10/16/15 SP



TETRA TECH

PRE-CONSTRUCTION DRAINAGE AREA MAP

EBENSBURG PUMP STATION

MARINER EAST

SUNOCO LOGISTICS, L.P.

CAMBRIA COUNTY, PENNSYLVANIA

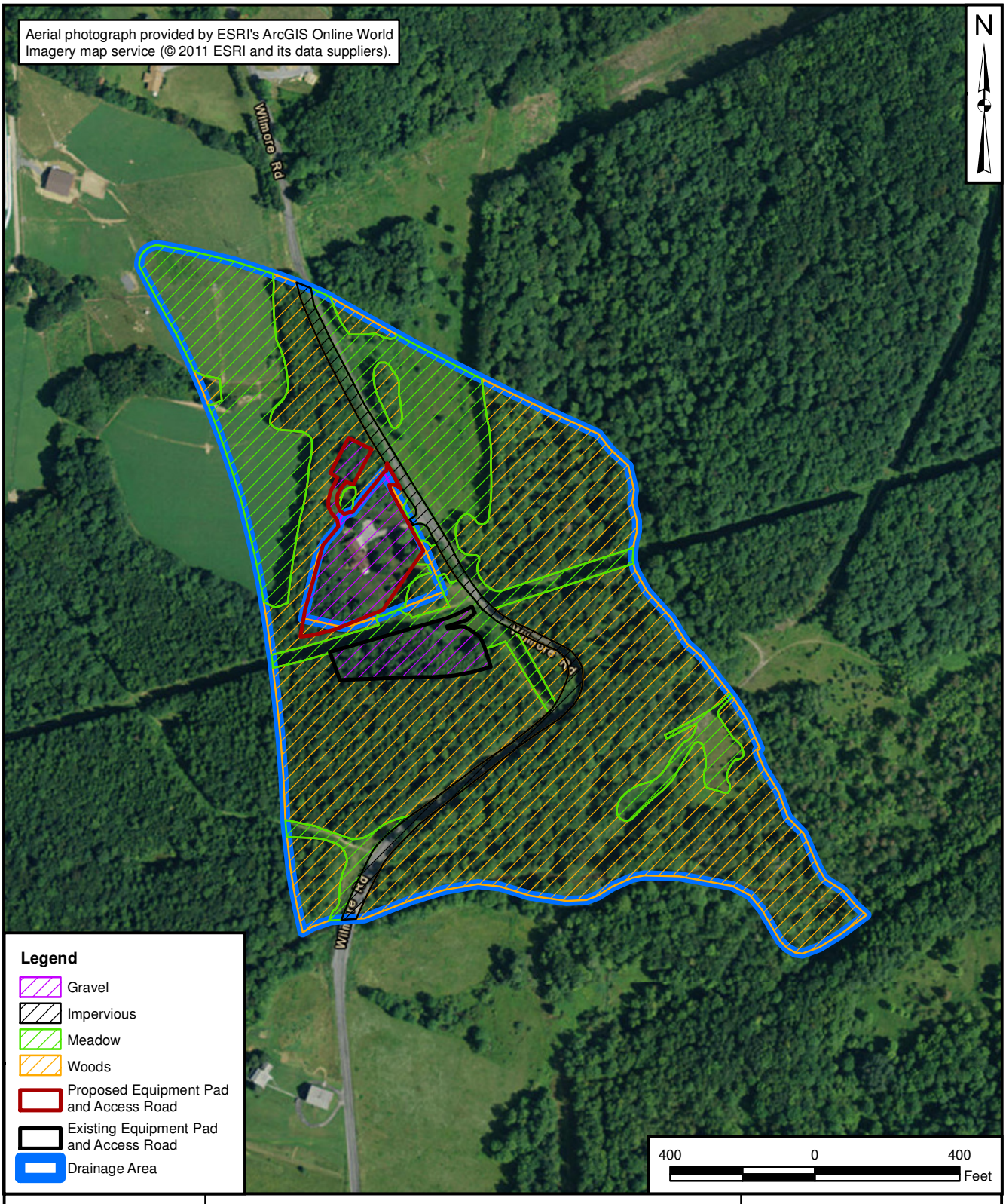
DRAWN BY: S. PAXTON 10/15/15
CHECKED BY: T. DUNAWAY 10/16/15
APPROVED BY:

CONTRACT NUMBER: 112IC05370

FIGURE NUMBER	REV
1	0

APPENDIX D – POST-DEVELOPED RUNOFF MAP

PGH P:\GIS\SUNOCO\MAPDOCS\ME1_EBENSBURG_PUMP_STATION_PCSM_POST-CONSTRUCTION_2015.MXD 10/16/15 SP



TETRA TECH

POST-CONSTRUCTION DRAINAGE AREA MAP
EBENSBURG PUMP STATION
MARINER EAST
SUNOCO LOGISTICS, L.P.
CAMBRIA COUNTY, PENNSYLVANIA

DRAWN BY: S. PAXTON 10/15/15
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FIGURE NUMBER	REV
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APPENDIX E – PONDPACK AND FLOWMASTER CALCULATIONS

Table of Contents

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Pre-Development	1-year	1	1.317	12.200	10.36
Pre-Development	2-year	2	1.994	12.200	17.92
Pre-Development	5-year	5	3.176	12.150	31.92
Pre-Development	10-year	10	4.993	12.150	53.57
Pre-Development	25-year	25	6.493	12.150	71.32
Pre-Development	100-year	100	8.910	12.150	99.67
Post-Controlled	1-year	1	0.222	11.900	4.01
Post-Controlled	2-year	2	0.283	11.900	5.13
Post-Controlled	5-year	5	0.377	11.900	6.85
Post-Controlled	10-year	10	0.508	11.900	9.17
Post-Controlled	25-year	25	0.608	11.900	10.92
Post-Controlled	100-year	100	0.761	11.900	13.55
Post-Uncontrolled	1-year	1	1.224	12.200	9.51
Post-Uncontrolled	2-year	2	1.861	12.200	16.62
Post-Uncontrolled	5-year	5	2.975	12.150	29.71
Post-Uncontrolled	10-year	10	4.690	12.150	50.17
Post-Uncontrolled	25-year	25	6.108	12.150	66.97
Post-Uncontrolled	100-year	100	8.396	12.150	93.84

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Pre Outfall	1-year	1	1.317	12.200	10.36
Pre Outfall	2-year	2	1.994	12.200	17.92
Pre Outfall	5-year	5	3.176	12.150	31.92
Pre Outfall	10-year	10	4.993	12.150	53.57
Pre Outfall	25-year	25	6.493	12.150	71.32
Pre Outfall	100-year	100	8.910	12.150	99.67
Post Outfall	1-year	1	1.268	12.200	9.51
Post Outfall	2-year	2	1.947	12.200	16.62
Post Outfall	5-year	5	3.129	12.150	29.71
Post Outfall	10-year	10	4.942	12.150	50.17
Post Outfall	25-year	25	6.438	12.150	68.26
Post Outfall	100-year	100	8.848	12.150	99.63

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
BMP-2 (IN)	1-year	1	0.222	12.000	3.41	(N/A)	(N/A)

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
BMP-2 (OUT)	1-year	1	0.147	12.200	1.29	1,831.82	0.068
BMP-2 (IN)	2-year	2	0.283	12.000	4.34	(N/A)	(N/A)
BMP-2 (OUT)	2-year	2	0.203	12.200	1.65	1,832.44	0.089
BMP-2 (IN)	5-year	5	0.377	12.000	5.65	(N/A)	(N/A)
BMP-2 (OUT)	5-year	5	0.293	12.150	2.84	1,833.17	0.114
BMP-2 (IN)	10-year	10	0.508	12.000	6.85	(N/A)	(N/A)
BMP-2 (OUT)	10-year	10	0.419	12.150	4.74	1,833.51	0.137
BMP-2 (IN)	25-year	25	0.608	12.000	8.07	(N/A)	(N/A)
BMP-2 (OUT)	25-year	25	0.515	12.150	6.22	1,833.67	0.147
BMP-2 (IN)	100-year	100	0.761	12.000	9.66	(N/A)	(N/A)
BMP-2 (OUT)	100-year	100	0.663	12.100	8.12	1,833.88	0.161
BMP-3 (IN)	1-year	1	0.147	12.200	1.29	(N/A)	(N/A)
BMP-3 (OUT)	1-year	1	0.125	12.650	0.95	1,828.77	0.031
BMP-3 (IN)	2-year	2	0.203	12.200	1.65	(N/A)	(N/A)
BMP-3 (OUT)	2-year	2	0.177	12.700	1.17	1,829.30	0.040
BMP-3 (IN)	5-year	5	0.293	12.150	2.84	(N/A)	(N/A)
BMP-3 (OUT)	5-year	5	0.260	12.350	1.90	1,830.09	0.052
BMP-3 (IN)	10-year	10	0.419	12.150	4.74	(N/A)	(N/A)
BMP-3 (OUT)	10-year	10	0.382	12.250	4.02	1,830.48	0.063
BMP-3 (IN)	25-year	25	0.515	12.150	6.22	(N/A)	(N/A)
BMP-3 (OUT)	25-year	25	0.477	12.200	5.72	1,830.68	0.070
BMP-3 (IN)	100-year	100	0.663	12.100	8.12	(N/A)	(N/A)
BMP-3 (OUT)	100-year	100	0.622	12.150	7.67	1,830.90	0.077
BMP-4 (IN)	1-year	1	0.125	12.650	0.95	(N/A)	(N/A)
BMP-4 (OUT)	1-year	1	0.044	13.000	0.73	1,827.01	0.046
BMP-4 (IN)	2-year	2	0.177	12.700	1.17	(N/A)	(N/A)
BMP-4 (OUT)	2-year	2	0.086	12.850	1.01	1,827.05	0.048
BMP-4 (IN)	5-year	5	0.260	12.350	1.90	(N/A)	(N/A)
BMP-4 (OUT)	5-year	5	0.154	12.550	1.56	1,827.13	0.050
BMP-4 (IN)	10-year	10	0.382	12.250	4.02	(N/A)	(N/A)

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
BMP-4 (OUT)	10-year	10	0.252	12.350	3.46	1,827.40	0.058
BMP-4 (IN)	25-year	25	0.477	12.200	5.72	(N/A)	(N/A)
BMP-4 (OUT)	25-year	25	0.329	12.300	4.91	1,827.62	0.064
BMP-4 (IN)	100-year	100	0.622	12.150	7.67	(N/A)	(N/A)
BMP-4 (OUT)	100-year	100	0.451	12.250	7.09	1,827.96	0.074
BMP-1 (IN)	1-year	1	0.222	11.900	4.01	(N/A)	(N/A)
BMP-1 (OUT)	1-year	1	0.222	12.000	3.41	1,843.06	0.030
BMP-1 (IN)	2-year	2	0.283	11.900	5.13	(N/A)	(N/A)
BMP-1 (OUT)	2-year	2	0.283	12.000	4.34	1,843.25	0.037
BMP-1 (IN)	5-year	5	0.377	11.900	6.85	(N/A)	(N/A)
BMP-1 (OUT)	5-year	5	0.377	12.000	5.65	1,843.54	0.048
BMP-1 (IN)	10-year	10	0.508	11.900	9.17	(N/A)	(N/A)
BMP-1 (OUT)	10-year	10	0.508	12.000	6.85	1,843.97	0.068
BMP-1 (IN)	25-year	25	0.608	11.900	10.92	(N/A)	(N/A)
BMP-1 (OUT)	25-year	25	0.608	12.000	8.07	1,844.60	0.083
BMP-1 (IN)	100-year	100	0.761	11.900	13.55	(N/A)	(N/A)
BMP-1 (OUT)	100-year	100	0.761	12.000	9.66	1,845.64	0.107

Time of Concentration Results

Segment #1: TR-55 Sheet Flow	
Hydraulic Length	100.00 ft
Manning's n	0.150
Slope	0.020 ft/ft
2 Year 24 Hour Depth	2.8 in
Average Velocity	0.16 ft/s
Segment Time of Concentration	0.175 hours

Segment #2: TR-55 Shallow Concentrated Flow	
Hydraulic Length	1,840.00 ft
Is Paved?	False
Slope	0.144 ft/ft
Average Velocity	6.12 ft/s
Segment Time of Concentration	0.083 hours

Segment #3: TR-55 Channel Flow	
Flow Area	20.0 ft²
Hydraulic Length	1,695.00 ft
Manning's n	0.045
Slope	0.010 ft/ft
Wetted Perimeter	22.00 ft
Average Velocity	3.11 ft/s
Segment Time of Concentration	0.152 hours

Time of Concentration (Composite)	
Time of Concentration (Composite)	0.410 hours

==== SCS Channel Flow

Tc =

R = Qa / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

(Lf / V) / 3600

Where:

R= Hydraulic radius
Aq= Flow area, square feet
Wp= Wetted perimeter, feet
V= Velocity, ft/sec
Sf= Slope, ft/ft
n= Manning's n
Tc= Time of concentration, hours
Lf= Flow length, feet

==== SCS TR-55 Shallow Concentration Flow

Tc =

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved Surface:
V = 20.3282 * (Sf**0.5)

(Lf / V) / 3600

Where:

V= Velocity, ft/sec
Sf= Slope, ft/ft
Tc= Time of concentration, hours
Lf= Flow length, feet

==== SCS TR-55 Sheet Flow

Tc = (0.007 * ((n * Lf)**0.8)) / ((P**0.5) * (Sf**0.4))

Where:

Tc= Time of concentration, hours
n= Manning's n
Lf= Flow length, feet
P= 2yr, 24hr Rain depth, inches
Sf= Slope, %

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ac-ft)
1,842.00	0.000
1,842.50	0.012
1,843.00	0.028
1,843.50	0.046
1,844.00	0.069
1,844.50	0.081
1,845.00	0.092
1,845.50	0.104
1,846.00	0.116

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ac-ft)
1,830.00	0.000
1,830.50	0.013
1,831.00	0.031
1,831.50	0.052
1,832.00	0.077
1,832.50	0.090
1,833.00	0.103
1,833.50	0.136
1,834.00	0.169

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ac-ft)
1,827.00	0.000
1,827.50	0.006
1,828.00	0.015
1,828.50	0.024
1,829.00	0.036
1,829.50	0.043
1,830.00	0.049
1,830.50	0.064
1,831.00	0.080

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ac-ft)
1,824.00	0.000
1,824.50	0.006
1,825.00	0.014
1,825.50	0.023
1,826.00	0.034
1,826.50	0.040
1,827.00	0.046
1,827.50	0.061
1,828.00	0.075

Requested Pond Water Surface Elevations	
Minimum (Headwater)	1,842.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	1,846.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Stand Pipe	Riser - 1	Forward	Culvert - 1	1,846.00	1,846.00
Orifice-Circular	Orifice - 1	Forward	Culvert - 1	1,842.00	1,846.00
Culvert-Circular	Culvert - 1	Forward	TW	1,841.00	1,846.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	18.0 in
Length	40.00 ft
Length (Computed Barrel)	41.11 ft
Slope (Computed)	0.238 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.018
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	0.977
T2 ratio (HW/D)	1.078
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	1,842.46 ft	T1 Flow	7.58 ft³/s
T2 Elevation	1,842.62 ft	T2 Flow	8.66 ft³/s

Structure ID: Riser - 1 Structure Type: Stand Pipe	
Number of Openings	1
Elevation	1,846.00 ft
Diameter	30.0 in
Orifice Area	4.9 ft²
Orifice Coefficient	0.600
Weir Length	7.85 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	1,842.00 ft
Orifice Diameter	15.0 in
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Requested Pond Water Surface Elevations	
Minimum (Headwater)	1,830.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	1,834.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1	Forward	Culvert - 1	1,833.00	1,834.00
Stand Pipe	Riser - 1	Forward	Culvert - 1	1,834.00	1,834.00
Orifice-Circular	Orifice - 1	Forward	Culvert - 1	1,830.50	1,834.00
Culvert-Circular	Culvert - 1	Forward	TW	1,827.50	1,834.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.0 in
Length	20.00 ft
Length (Computed Barrel)	20.00 ft
Slope (Computed)	0.000 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.012
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.095
T2 ratio (HW/D)	1.197
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	1,829.69 ft	T1 Flow	15.55 ft³/s
T2 Elevation	1,829.89 ft	T2 Flow	17.77 ft³/s

Structure ID: Riser - 1 Structure Type: Stand Pipe	
Number of Openings	1
Elevation	1,834.00 ft
Diameter	30.0 in
Orifice Area	4.9 ft²
Orifice Coefficient	0.600
Weir Length	7.85 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	1,833.00 ft
Weir Length	2.50 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	1,830.50 ft
Orifice Diameter	7.0 in
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Convergence Tolerances

Requested Pond Water Surface Elevations	
Minimum (Headwater)	1,827.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	1,831.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1	Forward	Culvert - 1	1,830.00	1,831.00
Stand Pipe	Riser - 1	Forward	Culvert - 1	1,831.00	1,831.00
Orifice-Circular	Orifice - 1	Forward	Culvert - 1	1,827.50	1,831.00
Culvert-Circular	Culvert - 1	Forward	TW	1,824.50	1,831.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.0 in
Length	20.00 ft
Length (Computed Barrel)	20.00 ft
Slope (Computed)	0.000 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.012
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.095
T2 ratio (HW/D)	1.197
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	1,826.69 ft	T1 Flow	15.55 ft³/s
T2 Elevation	1,826.89 ft	T2 Flow	17.77 ft³/s

Structure ID: Riser - 1 Structure Type: Stand Pipe	
Number of Openings	1
Elevation	1,831.00 ft
Diameter	30.0 in
Orifice Area	4.9 ft²
Orifice Coefficient	0.600
Weir Length	7.85 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	1,830.00 ft
Weir Length	2.50 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	1,827.50 ft
Orifice Diameter	6.0 in
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Convergence Tolerances

Requested Pond Water Surface Elevations	
Minimum (Headwater)	1,824.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	1,828.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Stand Pipe	Riser - 1	Forward	Culvert - 1	1,828.00	1,828.00
Rectangular Weir	Weir - 1	Forward	Culvert - 1	1,826.80	1,828.00
Culvert-Circular	Culvert - 1	Forward	TW	1,824.00	1,828.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	12.0 in
Length	20.00 ft
Length (Computed Barrel)	20.02 ft
Slope (Computed)	0.050 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.031
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.070
T2 ratio (HW/D)	1.172
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	1,825.07 ft	T1 Flow	2.75 ft³/s
T2 Elevation	1,825.17 ft	T2 Flow	3.14 ft³/s

Structure ID: Riser - 1 Structure Type: Stand Pipe	
Number of Openings	1
Elevation	1,828.00 ft
Diameter	30.0 in
Orifice Area	4.9 ft²
Orifice Coefficient	0.600
Weir Length	7.85 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	1,826.80 ft
Weir Length	2.50 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

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CN Area Collection - Pre-Development (Catchment)

Description	CN	Area (acres)	Percent Connected Impervious Area (%)	Percent Unconnected Impervious Area (%)
Impervious Areas - Gravel (w/ right-of-way) - Soil C/D	90.000	1.182	0.0	0.0
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil C	98.000	1.894	0.0	0.0
Meadow - cont. grass (non grazed) - ---- - Soil B	58.000	2.650	0.0	0.0
Meadow - cont. grass (non grazed) - ---- - Soil C/D	74.000	6.836	0.0	0.0
Meadow - cont. grass (non grazed) - ---- - Soil C	71.000	1.939	0.0	0.0
Woods - good - Soil B	55.000	12.627	0.0	0.0
Woods - good - Soil C/D	73.000	15.947	0.0	0.0
Woods - good - Soil C	70.000	0.877	0.0	0.0
Impervious Areas - Gravel (w/ right-of-way) - Soil B	85.000	0.014	0.0	0.0

CN Area Collection - Post-Controlled (Catchment)

Description	CN	Area (acres)	Percent Connected Impervious Area (%)	Percent Unconnected Impervious Area (%)
Impervious Areas - Gravel (w/ right-of-way) - Soil C/D	90.000	1.780	0.0	0.0
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil C	98.000	0.004	0.0	0.0
Meadow - cont. grass (non grazed) - ---- - Soil C/D	74.000	0.147	0.0	0.0
Woods - good - Soil C/D	73.000	0.215	0.0	0.0

CN Area Collection - Post-Uncontrolled (Catchment)

Description	CN	Area (acres)	Percent Connected Impervious Area (%)	Percent Unconnected Impervious Area (%)
Impervious Areas - Gravel (w/ right-of-way) - Soil B	85.000	0.014	0.0	0.0
Impervious Areas - Gravel (w/ right-of-way) - Soil C/D	90.000	1.457	0.0	0.0
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil C	98.000	1.669	0.0	0.0
Meadow - cont. grass (non grazed) - ---- - Soil B	58.000	2.650	0.0	0.0
Meadow - cont. grass (non grazed) - ---- - Soil C	71.000	1.939	0.0	0.0
Meadow - cont. grass (non grazed) - ---- - Soil C/D	74.000	5.976	0.0	0.0
Woods - good - Soil B	55.000	12.627	0.0	0.0
Woods - good - Soil C	70.000	0.877	0.0	0.0
Woods - good - Soil C/D	73.000	14.611	0.0	0.0

APPENDIX F – CALCULATION WORKSHEETS

WORKSHEET 1. GENERAL SITE INFORMATION

Date: May 27, 2016

Project Name: Sunoco - Ebensburg Pump Station

Municipality: Cambria Township

County: Cambria

Total Area (acres): 4.44

Major River Basin: Ohio River

Watershed: Little Conemaugh River

Sub Basin: Little Conemaugh River

Nearest Surface Water to Receive Runoff: Sanders Run/Howells Run

Chapter 93 - Designated Water Use: CWF

Impaired according to Chapter 303(d) list?	YES	
List Causes of Impairment:	NO	x

Is Project Subject to, or Part of:

Municipal Separate Storm Sewer System (MS4) Requirements	YES	
	NO	X
Existing or Planned drinking water supply?	YES	
	NO	X
If yes, distance from proposed discharge (miles):		
Approved Act 167 Plan?	YES	X
	NO	
Existing River Conservation Plan?	YES	
	NO	X

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS:

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	n/a	0	0
Floodplains	n/a	0	0
Riparian Areas	n/a	0	0
Wetlands	n/a	0	0
Woodlands	yes	0	0
Natural Drainage Ways	no	0	0
Steep Slopes, 15% - 25%	no	0	0
Steep Slopes, over 25%	no	0	0
Other:	n/a	0	0
Other:	n/a	0	0
TOTAL EXISTING:		0	0

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) 0 **Ac.**

1.2 Area of Riparian Forest Buffer Protection 0 **Ac.**

3.1 Area of Minimum Disturbance/Reduced Grading 0 **Ac.**

TOTAL 0 **Ac.**

Site Area	*minus*	Protected Area	=	Stormwater Management Area
4.44	-	0	=	4.44

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn _____ ft^2 x 1/4" x 1/12 = 0 ft^3

Meadow _____ ft^2 x 1/3" x 1/12 = 0 ft^3

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

Tree Canopy _____ ft^2 x 1/2" x 1/12 = 0 ft^3

_____ 0

5.1 Disconnect Roof Leaders to Vegetated Areas

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area _____ ft^2 x 1/3" x 1/12 = 0 ft^3

For all other disconnected roof areas

Roof Area _____ ft^2 x 1/4" x 1/12 = 0 ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area _____ ft^2 x 1/3" x 1/12 = 0 ft^3

For all other disconnected roof areas

Impervious Area _____ ft^2 x 1/4" x 1/12 = 0 ft^3

0

** For use on Worksheet 5*

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

Project:	Sunoco - Ebensburg Pump Station	
Drainage Area:	43.97	
2-Year Rainfall:	2.8	
Total Site Area (ac.):	4.44	
Protected Site Area:	0.00	acres
Managed Site Area:	4.44	acres

Existing Conditions								
Cover Type/Condition	**Soil Type**	**Area (sf)**	**Area (ac)**	**CN**	**S**	**Ia**	**Q**	**Runoff Volume (cf)**
TOTAL:		**1,821,679**	**41.820**	**From PondPack**				**86858.00**
Developed Conditions								
Cover Type/Condition	**Soil Type**	**Area (sf)**		**CN**	**S**	**Ia**	**Q**	**Runoff Volume (cf)**
TOTAL:		**1,821,679**	**41.820**	**From PondPack**				**93393.00**

2-Year Volume Increase (ft3):	**6535.000**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = Q = (P - 0.2S)2 / (P+ 0.8S) where
   P = 2-Year Rainfall (in)
   S = (1000/CN)-10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft.)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

Worksheet 5. Structural BMP Volume Credits

PROJECT: Sunoco - Ebensburg Pump Station
SUB-BASIN: Little Conemaugh River

Required Control Volume (ft3) - *from Worksheet 4:* 6,535

Non-structural Volume Credit (ft3) - *from Worksheet 3:* 0

Structural Volume Reqmt (ft3) 6,535
(Required Control Volume minus Non-structural Credit)

Proposed BMP		Area (ft2)	Storage Volume (ft3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well/Seepage Pit		
6.4.7	Constructed Filter		8,581
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-Use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond/Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration/Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other:			

Total Structural Volume Provided (ft3): **8,581**

Structural Volume Requirement (ft3): **6,535**

DIFFERENCE: **-2,046**

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		X
NS BMP 5.5.4 - Cluster Uses at Each Site		X
NS BMP 5.6.1 - Minimize Total Disturbed Area	X	
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native Species)		X
NS BMP 5.9.1 - Street Sweeping / Vacuuming		X
Structural BMP 6.7.1 - Riparian Buffer Restoration		X
Structural BMP 6.7.2 - Landscape Restoration	X	

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features		X
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features	X	
NS BMP 5.6.2 - Minimize Soil Compaction		X
Structural BMP 6.4.5 - Rain Garden / Bioretention		X
Structural BMP 6.4.8 - Vegetated Swale		X
Structural BMP 6.4.9 - Vegetated Filter Strip		X
Structural BMP 6.6.1 - Constructed Wetland		X
Structural BMP 6.7.1 - Riparian Buffer Restoration		X
Structural BMP 6.7.2 - Landscape Restoration	X	
Structural BMP 6.7.3 - Soils Amendment/Restoration		X

Stormwater BMP Information Chart 5.B revised March 15, 2016

	Infiltration Information					Drainage Information						BMP Information					
Proposed Infiltration BMP(s) (site specific)	Measured Infiltration Rate[9]	Factor of Safety	Design Infiltration Rate	Dewatering Time[1]	Elevation of Limiting Zone - Water Table, Bedrock, etc.[2]	Total Drainage Area to BMP	Total Impervious Drainage Area to BMP	Infiltration BMP Surface Area	Total Drainage Area Loading Ratio[6]	Impervious Area Loading Ratio[7]	Volume of Runoff Tributary to BMP During the 2yr/24hr Design Storm[5]	Calculated Infiltration Volume (from storms up to and including 2yr/24hr)	Calculated Managed Volume (from storms up to and including 2yr/24hr)[8]	Maximum water surface elevation in BMP from 2yr storm[3]	Infiltration Elevation Bottom of Bed/ Basin[3]	Elevation of Infiltration Test[4]	Elevation of E&S Sediment Basin Bottom (if applies)
	in./hr.	*Min. of 2*	*in./hr.*	*hrs.*		*sq. ft*	*sq. ft.*	*sq. ft.*			*cf*	*cf*	*cf*				
BMP 6.4.1 **Pervious Pvmnt w. Infilt. Bed**																	
BMP 6.4.2 **Infiltration Basin**																	
BMP 6.4.3 **Subsurface Infiltration Bed**																	
BMP 6.4.4 **Infiltration Trench**																	
BMP 6.4.5 **Rain Garden/Bioretention**																	
BMP 6.4.6 **Dry Well / Seepage Pit**																	
Other **Constructed Filter BMP-2**	0.89	2	0.89	29.7	~1827	93,654	77,711	2,850	33*	27*	12,327.0	3,485	0	1,832.2	1830*	1,830	N/A
Constructed Filter BMP-3	N/A	0*	0.89	36.4	~1824	93,654	77,711	1,350	69*	58*	12,327.0	1,133	0	1,829.7	1827*	1,830	N/A
BMP 6.4.7 **Constructed Filter BMP-4**	4.69	1*	4.69	6.4	~1821	93,654	77,711	1,275	73*	61*	12,327.0	3,964	0	1,826.5	1824*	1,823	N/A
BMP 6.4.8 **Vegetated Swale**																	
BMP 6.4.9 **Vegetated Filter Strip**																	
BMP 6.4.10 **Infilt. Berm & Ret. Grading**																	

All information to be based on the 2-year/24-hour storm

Provide page numbers from the stormwater narrative identifying the location of the above information.

[1] Can include active infiltration time - dewatering time should not exceed 72 hours after the 2-year/24-hour storm

[2] Depth to limiting zone is recommended to be at least 2 ft below infiltration testing elevation/proposed infiltration elevation.

[3] A maximum of 2 feet of Hydraulic head is recommended.

[4] Provide supporting field notes/documenation from soil evaluation.

[5] This value should be greater than or equal to the Volume to be Infiltrated or Managed by the BMP.

[6] A maximum of 8:1 is recommended.

[7] A maximum of 5:1 is recommended; however, in carbonate geology areas, a maximum of 3:1 is recommended.

[8] Calculated runoff volume that is managed in ways other than infiltration to address 25 PA Code Ch 102.8(g)(2)

[9] The infiltration testing information should be located on the plan view of the PCSM Plan and should include infiltration test elevation and rate.

Any deviations from the recommendations above should be adequately justified by a qualified professional and included with the application.

NOTE: This chart is for summary purposes only and should be consistent with all design calculations and worksheets.

* Notes:

1. BMP-2, BMP 3 and BMP-4 are configured adjacent to each other and in series. BMP-3 is between BMP-2 and BMP-4. A test was not done directly in BMP-3, so the lowest infiltration rate of BMP-2 and BMP-4 was used as the rate for BMP-3. BMP-4 has a very small surface area and only one test was deemed necessary there.
2. The total area and impervious area loading ratios are higher than recommended. A maintenance agreement will be established to ensure proper BMP repairs in the event of sedimentation.
3. The hydraulic head is 0.2-0.7 feet over the recommended value. This is not a significant deviation and is not expected to affect BMP performance.

APPENDIX G – STORMWATER MANAGEMENT PLANS

SEE FULL SIZE DRAWINGS