ARM Group LLC

Engineers and Scientists

January 22, 2020

ORIGINAL

PA Department of Environmental Protection
Bureau of Oil & Gas Management
Northcentral Regional Office
208 W 3rd Street, Suite 101
Williamsport, PA 17701

Re: Joint Permit Application
Loyalsock / Shawnee Freshwater System
Pennsylvania General Energy
Company, L.L.C.
Plunketts Creek and Gamble Townships,
Lycoming County, Pennsylvania
ARM Project 190736

To Whom It May Concern:

On behalf of Pennsylvania General Energy Company, L.L.C. (PGE), ARM Group LLC (ARM) is hereby submitting the enclosed application for registration of a Joint Permit Application for Pennsylvania Water Obstruction and Encroachment Permit & U.S. Army Corps of Engineers Section 404 Permit under the Pennsylvania Department of Environmental Protection (PADEP). The proposed project is located in Plunketts Creek and Gamble Townships, Lycoming County, Pennsylvania. A pre-application meeting was held on November 25, 2019 at the PADEP Northcentral Regional Office with Representatives from the PADEP, PGE and ARM.

PGE is proposing to develop the Loyalsock / Shawnee Freshwater System. The purpose of the project is to support PGE's natural gas operations from the Marcellus shale formation, which will provide a key source of energy for the United States. The overall project includes a freshwater intake and withdrawal system, a booster pump station pad & access road, and a 0.3-mile permanent underground utility corridor that crosses Loyalsock Creek. The project area consists of approximately 9.5-acres of disturbed land that is owned by PGE for the proposed development activities.

The buried freshwater intake will be installed at 41.355167°, -76.888760° and a gravel maintenance drive will be utilized to allow permanent access to this location. The intake will connect to a wet well, valve vault, and a 12-inch buried freshwater pipeline to transfer water from Loyalsock Creek to the booster pump station building at approximately 41.353950°, -76.886704°. A 6-inch underground electric conduit, a 2-inch communications conduit, and a 2-inch compressed air line will be installed in the same trench as the freshwater pipeline in order to supply electricity and controls to the intake pumps and compressed air to the self-cleaning intake

2548 Park Center Boulevard • State College, PA 16801
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strainers. From the booster pump station building, a temporary aboveground freshwater pipeline will extend east to a future impoundment location (permitted separately).

The permanent underground utility corridor will include a 12-inch natural gas pipeline, two (2) 12-inch freshwater pipelines, a 12-inch electrical conduit, and a 2-inch communications conduit. This utility corridor will be constructed between the booster pump station pad and a future tie-in location approximately 350-feet west of Loyalsock Creek at 41.356123°, -76.890221° where each utility will be terminated at the ends for future connections.

Although all resource crossings were not avoidable, the selected alignment was chosen to minimize impacts to streams and avoid impacts to wetlands and other sensitive areas. As a result of the proposed construction, the project will encroach on three (3) separate waterbody locations, which are listed below and shown on the attached Figure 1.

- Loyalsock Creek: Intake Structure & Utility Line(s) Stream Crossing
- Loyalsock Creek Side Channel: Utility Line(s) Stream Crossing
- Loyalsock Creek Side Channel: Temporary Bridge Stream Crossing

The freshwater intake structure will be buried in Loyalsock Creek using an in-stream cofferdam diversion. The permanent underground utility corridor will be trenched across Loyalsock Creek using a two-phased open-cut restore method with coffer dams. The permanent underground utility corridor will also be trenched across the Loyalsock Creek Side Channel using a temporary cofferdam and pump bypass. A temporary bridge stream crossing will be utilized to cross the Loyalsock Creek Side Channel during construction on the western side of the Loyalsock Creek. These impacts are depicted in the site-specific standard drawings. Work requiring stream diversion shall be conducted during low-flow, dry weather conditions to the extent practical. No wetlands, including no exceptional value wetlands, will be impacted during the proposed project. Consequently, this application is being submitted for a Joint Permit Application for Pennsylvania Water Obstruction and Encroachment Permit & U.S. Army Corps of Engineers Section 404 Permit for this proposed construction.

On behalf of PGE, and in accordance with requirements of the PADEP and conditions of the Joint Permit Application, ARM is hereby submitting one (1) original and two (2) copies of the required documents for your review and approval. PGE is requesting waivers for the sections identified below:

Requirement

A. General Information Form & Joint Permit Application
B. Chapter 105 - Fee(s) Calculation Worksheet
C. Act 14 Municipal Notifications
D. Pennsylvania Historical & Museum Commission (PHMC) Documentation
E. PASPGP-5 – Cumulative Impact Project Screening Form
~~F. Bog Turtle Habitat Screening~~ ***N/A***
G. Pennsylvania Natural Diversity Inventory (PNDI) Documentation
H. Site Plans
I. Site Location Map

J. Project Narrative
K. Encroachment Color Photographs
L. Environmental Assessment Form
M. Erosion and Sediment (E&S) Control Plan
N. Hydrologic and Hydraulic Analysis
~~O. Stormwater Management Analysis~~ ***Waiver Request***
~~P. Floodplain Management Analysis~~ ***Waiver Request***
~~Q. Risk Assessment~~ ***Waiver Request***
R. Professional Engineer's Seal and Certification
S. Alternative Analysis
~~T. Mitigation Plan~~ ***Waiver Request***

Attachment
1.0 PADEP Aquatic Resources Impact Table

A check in the amount of $5,350 is enclosed to satisfy the Joint Permit Application fee. Your timely review and consideration of this submittal will be appreciated, and we look forward to an expedited approval. If you have any questions or comments, or require any additional information to support, simplify, or expedite your review, please do not hesitate to contact me at 814-272-0455 Ext. 2214.

Respectfully submitted,
ARM Group LLC

Michael D. Race, P.E., CPESC
Project Manager

Brian C. Bonner, P.E.
Senior Engineer

Attachments

cc: Pennsylvania General Energy Company, L.L.C.

JOINT APPLICATION FOR
PENNSYLVANIA WATER OBSTRUCTION AND ENCROACHMENT PERMIT
&
U.S. ARMY CORPS OF ENGINEERS SECTION 404 PERMIT

LOYALSOCK / SHAWNEE FRESHWATER SYSTEM

ARM Project No. 190736

Gamble and Plunketts Creek Townships,
Lycoming County, Pennsylvania

Submitted to:

Department of Environmental Protection
Bureau of Oil and Gas Management
Northcentral Regional Office
208 W 3rd Street, Suite 101
Williamsport, PA 17701

Prepared for:

PENNSYLVANIA GENERAL ENERGY

Prepared by:

ARM Group LLC
Engineers and Scientists

January 2020

JOINT APPLICATION FOR
PENNSYLVANIA WATER OBSTRUCTION AND ENCROACHMENT PERMIT
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Northcentral Regional Office
208 W 3rd Street, Suite 101
Williamsport, PA 17701

Prepared for:

Pennsylvania General Energy Company, L.L.C.
120 Market Street
Warren, PA 16365

Prepared by:

ARM Group LLC
2548 Park Center Boulevard
State College, PA 16801

January 2020

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A. GENERAL INFORMATION FORM & JOINT PERMIT APPLICATION

B. CHAPTER 105 - FEE(S) CALCULATION WORKSHEET

C. ACT 14 MUNICIPAL NOTIFICATIONS

D. PENNSYLVANIA HISTORICAL & MUSEUM COMMISSION (PHMC) DOCUMENTATION

E. PASPGP-5 – CUMULATIVE IMPACT PROJECT SCREENING FORM

~~F. BOG TURTLE HABITAT SCREENING~~ ***N/A***

G. PENNSYLVANIA NATURAL DIVERSITY INVENTORY (PNDI) DOCUMENTATION

H. SITE PLANS

I. SITE LOCATION MAP

J. PROJECT NARRATIVE

K. ENCROACHMENT COLOR PHOTOGRAPHS

L. ENVIRONMENTAL ASSESSMENT FORM

- A. AQUATIC RESOURCE INVESTIGATION MEMORANDUM
- B. PROJECT LOCATION MAP
- C. ANTIDEGRADATION ANALYSIS

M. EROSION AND SEDIMENT (E&S) CONTROL PLAN

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~~O. STORMWATER MANAGEMENT ANALYSIS~~ ***WAIVER REQUEST***

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~~Q. RISK ASSESSMENT~~ ***WAIVER REQUEST***

R. PROFESSIONAL ENGINEER'S SEAL AND CERTIFICATION

S. ALTERNATIVE ANALYSIS

~~T. MITIGATION PLAN~~ ***WAIVER REQUEST***

ATTACHMENT

1.0 PADEP AQUATIC RESOURCES IMPACT TABLE

REQUIREMENT A

General Information Form & Joint Permit Application

A R M G r o u p L L C

0210-PM-PIO0001 4/2018
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

GENERAL INFORMATION FORM – AUTHORIZATION APPLICATION

Before completing this General Information Form (GIF), read the step-by-step instructions provided in this application package. This version of the General Information Form (GIF) must be completed and returned with any program-specific application being submitted to the Department.

Related ID#s (If Known)				DEP USE ONLY
Client ID#	213205	**APS ID#**		Date Received & General Notes
Site ID#		**Auth ID#**		
Facility ID#				

CLIENT INFORMATION

DEP Client ID#	**Client Type / Code**			
213205				
Organization Name or Registered Fictitious Name		**Employer ID#** (EIN)	**Dun & Bradstreet ID#**	
Pennsylvania General Energy Company, L.L.C.		432002031	964794478	
Individual Last Name	**First Name**	**MI**	**Suffix**	**SSN**
Additional Individual Last Name	**First Name**	**MI**	**Suffix**	**SSN**
Mailing Address Line 1		**Mailing Address Line 2**		
120 Market Street				
Address Last Line – City	**State**	**ZIP+4**	**Country**	
Warren	PA	16365	USA	
Client Contact Last Name	**First Name**	**MI**	**Suffix**	
Harris	Nathan			
Client Contact Title		**Phone**	**Ext**	
Vice President of Health, Safety and Environment		814-723-3230		
Email Address		**FAX**		
nathanharris@penngeneralenergy.com				

SITE INFORMATION

DEP Site ID#	**Site Name**				
	Loyalsock / Shawnee Freshwater System				
EPA ID#	**Estimated Number of Employees to be Present at Site**	0 (Fully Automated)			
Description of Site					
The overall project includes a freshwater intake and withdrawal system, a booster pump station pad & access road, and a separate 0.3-mile permanent underground utility corridor to support PGE's natural gas development operations.					
County Name	**Municipality**	**City**	**Boro**	**Twp**	**State**
Lycoming	Plunketts Creek	☐	☐	☒	
County Name	**Municipality**	**City**	**Boro**	**Twp**	**State**
Lycoming	Gamble	☐	☐	☒	
Site Location Line 1		**Site Location Line 2**			
8012 Rt 87 HWY					
Site Location Last Line – City	**State**	**ZIP+4**			
Williamsport	PA	17701			
Detailed Written Directions to Site					
From the intersection of I-180 and PA-87. Take exit 21 for PA-87 N and travel for 8.4 miles. The proposed pump station site entrance will be located on your right, while the proposed intake site entrance will be located on your left.					
Site Contact Last Name	**First Name**	**MI**	**Suffix**		
Harris	Nathan				
Site Contact Title		**Site Contact Firm**			
Vice President of Health, Safety and Environment		Pennsylvania General Energy Company, L.L.C.			
Mailing Address Line 1		**Mailing Address Line 2**			
120 Market Street					

Mailing Address Last Line – City	State	ZIP+4
Warren	PA	16365

Phone	Ext	FAX	Email Address
814-723-3230			nathanharris@penngeneralenergy.com

NAICS Codes (Two- & Three-Digit Codes – List All That Apply)	6-Digit Code (Optional)
211	211110

Client to Site Relationship
OWNOP

FACILITY INFORMATION

Modification of Existing Facility	Yes	No
1. Will this project modify an existing facility, system, or activity?	☐	☒
2. Will this project involve an addition to an existing facility, system, or activity?	☐	☒

If "Yes", check all relevant facility types and provide DEP facility identification numbers below.

	Facility Type	DEP Fac ID#		Facility Type	DEP Fac ID#
☐	Air Emission Plant		☐	Industrial Minerals Mining Operation	
☐	Beneficial Use (water)		☐	Laboratory Location	
☐	Blasting Operation		☐	Land Recycling Cleanup Location	
☐	Captive Hazardous Waste Operation		☐	Mine DrainageTrmt/LandRecyProjLocation	
☐	Coal Ash Beneficial Use Operation		☐	Municipal Waste Operation	
☐	Coal Mining Operation		☐	Oil & Gas Encroachment Location	
☐	Coal Pillar Location		☐	Oil & Gas Location	
☐	Commercial Hazardous Waste Operation		☐	Oil & Gas Water Poll Control Facility	
☐	Dam Location		☐	Oil & Gas Wastewater Storage Impoundment	
☐	Deep Mine Safety Operation -Anthracite		☐	Public Water Supply System	
☐	Deep Mine Safety Operation -Bituminous		☐	Radiation Facility	
☐	Deep Mine Safety Operation -Ind Minerals		☐	Residual Waste Operation	
☐	Encroachment Location (water, wetland)		☐	Storage Tank Location	
☐	Erosion & Sediment Control Facility		☐	Water Pollution Control Facility	
☐	Explosive Storage Location		☐	Water Resource	
			☐	Other:	

Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Buried Freshwater Intake	41	21	19.12	-76	53	20.10
Booster Pump Station	41	21	14.21	-76	53	12.13
Buried Waterline and Gas Pipeline Future Tie-In	41	21	22.04	-76	53	24.80

Horizontal Accuracy Measure Feet --or-- Meters

Horizontal Reference Datum Code
- ☐ North American Datum of 1927
- ☒ North American Datum of 1983
- ☐ World Geodetic System of 1984

Horizontal Collection Method Code Surveyed

Reference Point Code N/A

Altitude Feet +/- 640' --or-- Meters

Altitude Datum Name
- ☐ The National Geodetic Vertical Datum of 1929
- ☒ The North American Vertical Datum of 1988 (NAVD88)

Altitude (Vertical) Location Datum Collection Method Code N/A

Geometric Type Code

Data Collection Date

Source Map Scale Number Inch(es) = Feet
--or-- Centimeter(s) = Meters

PROJECT INFORMATION

Project Name
Loyalsock / Shawnee Freshwater System

Project Description
Water Obstruction Encroachment Permit for surface water withdrawal from Loyalsock Creek and utility line crossings

of Loyalsock Creek and associated Side Channel.

Project Consultant Last Name	First Name	MI	Suffix
Race	Michael	D	P.E., CPESC

Project Consultant Title	Consulting Firm
Project Manager	ARM Group LLC

Mailing Address Line 1	Mailing Address Line 2
2548 Park Center Boulevard	

Address Last Line – City	State	ZIP+4
State College	PA	16801

Phone	Ext	FAX	Email Address
814-272-0455	2214	814-272-0467	mrace@armgroup.net

Time Schedules	Project Milestone (Optional)

1.	**Have you informed the surrounding community and addressed any concerns prior to submitting the application to the Department?**	☒ Yes	☐ No
2.	**Is your project funded by state or federal grants?**	☐ Yes	☒ No

Note: If "Yes", specify what aspect of the project is related to the grant and provide the grant source, contact person and grant expiration date.
Aspect of Project Related to Grant
Grant Source: _____
Grant Contact Person: _____
Grant Expiration Date: _____

3.	**Is this application for an authorization on Appendix A of the Land Use Policy? (For referenced list, see Appendix A of the Land Use Policy attached to GIF instructions)**	☒ Yes	☐ No

Note: If "No" to Question 3, the application is not subject to the Land Use Policy.
If "Yes" to Question 3, the application is subject to this policy and the Applicant should answer the additional questions in the **Land Use Information** section.

LAND USE INFORMATION

Note: Applicants are encouraged to submit copies of local land use approvals or other evidence of compliance with local comprehensive plans and zoning ordinances.

1.	**Is there an adopted county or multi-county comprehensive plan?**	☒ Yes	☐ No
2.	**Is there an adopted municipal or multi-municipal comprehensive plan?**	☐ Yes	☒ No
3.	**Is there an adopted county-wide zoning ordinance, municipal zoning ordinance or joint municipal zoning ordinance?**	☒ Yes	☐ No

Note: If the Applicant answers "No" to either Questions 1, 2 or 3, the provisions of the PA MPC are not applicable and the Applicant does not need to respond to questions 4 and 5 below.
If the Applicant answers "Yes" to questions 1, 2 and 3, the Applicant should respond to questions 4 and 5 below.

4.	**Does the proposed project meet the provisions of the zoning ordinance or does the proposed project have zoning approval?** If zoning approval has been received, attach documentation.	☒ Yes	☐ No
5.	**Have you attached Municipal and County Land Use Letters for the project?**	☐ Yes	☒ No

COORDINATION INFORMATION

Note: The PA Historical and Museum Commission must be notified of proposed projects in accordance with DEP Technical Guidance Document 012-0700-001 and the accompanying Cultural Resource Notice Form.

If the activity will be a mining project (i.e., mining of coal or industrial minerals, coal refuse disposal and/or the operation of a coal or industrial minerals preparation/processing facility), respond to questions 1.0 through 2.5 below.

If the activity will not be a mining project, skip questions 1.0 through 2.5 and begin with question 3.0.

1.0	**Is this a coal mining project?** If "Yes", respond to 1.1-1.6. If "No", skip to Question 2.0.	☐	Yes	☒	No
1.1	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be equal to or greater than 200 tons/day?**	☐	Yes	☐	No
1.2	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be greater than 50,000 tons/year?**	☐	Yes	☐	No
1.3	**Will this coal mining project involve coal preparation/ processing activities in which thermal coal dryers or pneumatic coal cleaners will be used?**	☐	Yes	☐	No
1.4	**For this coal mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
1.5	**Will this coal mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No
1.6	**Will this coal mining project involve underground coal mining to be conducted within 500 feet of an oil or gas well?**	☐	Yes	☐	No
2.0	**Is this a non-coal (industrial minerals) mining project?** If "Yes", respond to 2.1-2.6. If "No", skip to Question 3.0.	☐	Yes	☒	No
2.1	**Will this non-coal (industrial minerals) mining project involve the crushing and screening of non-coal minerals other than sand and gravel?**	☐	Yes	☐	No
2.2	**Will this non-coal (industrial minerals) mining project involve the crushing and/or screening of sand and gravel with the exception of wet sand and gravel operations (screening only) and dry sand and gravel operations with a capacity of less than 150 tons/hour of unconsolidated materials?**	☐	Yes	☐	No
2.3	**Will this non-coal (industrial minerals) mining project involve the construction, operation and/or modification of a portable non-metallic (i.e., non-coal) minerals processing plant under the authority of the General Permit for Portable Non-metallic Mineral Processing Plants (i.e., BAQ-PGPA/GP-3)?**	☐	Yes	☐	No
2.4	**For this non-coal (industrial minerals) mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
2.5	**Will this non-coal (industrial minerals) mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No

3.0	**Will your project, activity, or authorization have anything to do with a well related to oil or gas production, have construction within 200 feet of, affect an oil or gas well, involve the waste from such a well, or string power lines above an oil or gas well?** If "Yes", respond to 3.1-3.3. If "No", skip to Question 4.0.	☒	Yes	☐	No
3.1	**Does the oil- or gas-related project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water (including wetlands)?**	☒	Yes	☐	No
3.2	**Will the oil- or gas-related project involve discharge of industrial wastewater or stormwater to a dry swale, surface water, ground water or an existing sanitary sewer system or storm water system?** If "Yes", discuss in *Project Description*.	☐	Yes	☒	No
3.3	**Will the oil- or gas-related project involve the construction and operation of industrial waste treatment facilities?**	☐	Yes	☒	No
4.0	**Will the project involve a construction activity that results in earth disturbance?** If "Yes", specify the total disturbed acreage. **4.0.1 Total Disturbed Acreage** 9.5	☒	Yes	☐	No
5.0	**Does the project involve any of the following?** If "Yes", respond to 5.1-5.3. If "No", skip to Question 6.0.	☒	Yes	☐	No
5.1	**Water Obstruction and Encroachment Projects – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water?**	☒	Yes	☐	No
5.2	**Wetland Impacts – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a wetland?**	☐	Yes	☒	No
5.3	**Floodplain Projects by the commonwealth, a Political Subdivision of the commonwealth or a Public Utility – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a floodplain?**	☒	Yes	☐	No
6.0	**Will the project involve discharge of stormwater or wastewater from an industrial activity to a dry swale, surface water, ground water or an existing sanitary sewer system or separate storm water system?**	☐	Yes	☒	No
7.0	**Will the project involve the construction and operation of industrial waste treatment facilities?**	☐	Yes	☒	No
8.0	**Will the project involve construction of sewage treatment facilities, sanitary sewers, or sewage pumping stations?** If "Yes", indicate estimated proposed flow (gal/day). Also, discuss the sanitary sewer pipe sizes and the number of pumping stations/treatment facilities/name of downstream sewage facilities in the *Project Description*, where applicable. **8.0.1 Estimated Proposed Flow (gal/day)**	☐	Yes	☒	No
9.0	**Will the project involve the subdivision of land, or the generation of 800 gpd or more of sewage on an existing parcel of land or the generation of an additional 400 gpd of sewage on an already-developed parcel, or the generation of 800 gpd or more of industrial wastewater that would be discharged to an existing sanitary sewer system?**	☐	Yes	☒	No
	9.0.1 Was Act 537 sewage facilities planning submitted and approved by DEP? If "Yes" attach the approval letter. Approval required prior to 105/NPDES approval.	☐	Yes	☐	No
10.0	**Is this project for the beneficial use of biosolids for land application within Pennsylvania?** If "Yes" indicate how much (i.e. gallons or dry tons per year). **10.0.1 Gallons Per Year (residential septage)** _____ **10.0.2 Dry Tons Per Year (biosolids)**	☐	Yes	☒	No

11.0	**Does the project involve construction, modification or removal of a dam?** If "Yes", identify the dam. **11.0.1 Dam Name**	☐	Yes	☒	No
12.0	**Will the project interfere with the flow from, or otherwise impact, a dam?** If "Yes", identify the dam. **12.0.1 Dam Name**	☐	Yes	☒	No
13.0	**Will the project involve operations (excluding during the construction period) that produce air emissions (i.e., NOX, VOC, etc.)?** If "Yes", identify each type of emission followed by the amount of that emission. **13.0.1 Enter all types & amounts of emissions; separate each set with semicolons.**	☐	Yes	☒	No
14.0	**Does the project include the construction or modification of a drinking water supply to serve 15 or more connections or 25 or more people, at least 60 days out of the year?** If "Yes", check all proposed sub-facilities.	☐	Yes	☒	No
	14.0.1 Number of Persons Served _____				
	14.0.2 Number of Employee/Guests _____				
	14.0.3 Number of Connections _____				
	14.0.4 Sub-Fac: Distribution System	☐	Yes	☐	No
	14.0.5 Sub-Fac: Water Treatment Plant	☐	Yes	☐	No
	14.0.6 Sub-Fac: Source	☐	Yes	☐	No
	14.0.7 Sub-Fac: Pump Station	☐	Yes	☐	No
	14.0.8 Sub Fac: Transmission Main	☐	Yes	☐	No
	14.0.9 Sub-Fac: Storage Facility	☐	Yes	☐	No
15.0	**Will your project include infiltration of storm water or waste water to ground water within one-half mile of a public water supply well, spring or infiltration gallery?**	☐	Yes	☒	No
16.0	**Is your project to be served by an existing public water supply?** If "Yes", indicate name of supplier and attach letter from supplier stating that it will serve the project. **16.0.1 Supplier's Name** _____	☐	Yes	☒	No
	16.0.2 Letter of Approval from Supplier is Attached	☐	Yes	☐	No
17.0	**Will this project involve a new or increased drinking water withdrawal from a stream or other water body?** If "Yes", should reference both Water Supply and Watershed Management. **17.0.1 Stream Name**	☐	Yes	☒	No
18.0	**Will the construction or operation of this project involve treatment, storage, reuse, or disposal of waste?** If "Yes", indicate what type (i.e., hazardous, municipal (including infectious & chemotherapeutic), residual) and the amount to be treated, stored, re-used or disposed. **18.0.1 Type & Amount**	☐	Yes	☒	No
19.0	**Will your project involve the removal of coal, minerals, etc. as part of any earth disturbance activities?**	☐	Yes	☒	No
20.0	**Does your project involve installation of a field constructed underground storage tank?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **20.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
21.0	**Does your project involve installation of an aboveground storage tank greater than 21,000 gallons capacity at an existing facility?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **21.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No

22.0	**Does your project involve installation of a tank greater than 1,100 gallons which will contain a highly hazardous substance as defined in DEP's Regulated Substances List, 2570-BK-DEP2724?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **22.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
23.0	**Does your project involve installation of a storage tank at a new facility with a total AST capacity greater than 21,000 gallons?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **23.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
24.0	**Will the intended activity involve the use of a radiation source?**	☐	Yes	☒	No

CERTIFICATION

I certify that I have the authority to submit this application on behalf of the applicant named herein and that the information provided in this application is true and correct to the best of my knowledge and information.

Type or Print Name Michael D. Race, P.E., CPESC

	Project Manager	2020-01-07
Signature	**Title**	**Date**

3150-PM-BWEW0036A Rev. 8/2016

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
and
DEPARTMENT OF ARMY CORPS OF ENGINEERS
(Baltimore, Philadelphia, and Pittsburgh Districts)

JOINT APPLICATION FOR PENNSYLVANIA CHAPTER 105 WATER OBSTRUCTION AND ENCROACHMENT PERMIT AND U.S. ARMY CORPS OF ENGINEERS SECTION 404 PERMIT

Before completing this form, please read the step-by-step instructions and Section F Application Completeness Checklist provided with this Joint Permit package.

AGENCY USE ONLY

Application ID# (Assigned by DEP) _____ RECEIVED DATE _____ CHECK NO. _____

Program Application No. _____ REQUIRED APP. FEE _____ AMOUNT $_____

SECTION A. APPLICATION TYPE

STANDARD ☒ SMALL PROJECTS ☐

SECTION B. APPLICANT IDENTIFIER

Applicant Name: Pennsylvania General Energy Company, L.L.C.
Employer ID# (EIN): 432002031

Consulting Firm: ARM Group LLC
Employer ID# (EIN): 84-3909305

SECTION C. PROJECT LOCATION DATA AND STATUS

Name of stream and/or body of water and Chapter 93 designation.

Loyalsock Creek - TSF, MF

Corps District where project will occur.

☐ Pittsburgh (Ohio River Basin) ☒ Baltimore (Susquehanna River Basin) ☐ Philadelphia (Delaware River Basin)

Name of the U.S.G.S. 7 1/2 Minute Quadrangle Map where project is located: Huntersville, Photo Revised 1986, and Montoursville North 1999.

Indicate location of project:

Latitude (DD) 41.355167° Longitude (DD) -76.888760° - Buried Freshwater Intake

Latitude (DD) 41.353950° Longitude (DD) -76.886704° - Booster Pump Station

Latitude (DD) 41.356123° Longitude (DD) -76.890221° - Buried Waterline and Gas Pipeline Future Tie-In

Project type, purpose and need: Water Obstruction Encroachment Permit for a surface water withdrawal from Loyalsock Creek and utility line crossings of Loyalsock Creek and associated Side Channel. Refer to Project Narrative for additional information.

HAS ANY PORTION OF PROPOSED PROJECT BEEN AUTHORIZED? ☐ yes ☒ no _____ date authorized

If yes, attach description of those portions of the project that have been authorized and identify dates of authorization.

SECTION D. AQUATIC RESOURCE IMPACT TABLE

HAS ALL INFORMATION INCLUDED ON THE IMPACT TABLE BEEN PROVIDED? ☒ yes ☐ no

If NO, indicate the information not included and the reason. Also attach a completed Aquatic Resource Impact Table (3150-PM-BWEW0557) worksheet or equivalent.

- Project Information: _____
- Corps / 404: _____
- DEP / 105: _____

SECTION E. COMPLIANCE REVIEW

Yes	No	
☐	☒	Is the applicant (owner and/or operator) currently in violation of any permits issued by the Department? If yes, please provide:

1. Permit Number: _____
2. Nature of the violation (if any): _____
3. Status of violation (i.e., schedule for compliance, etc.): _____

SECTION F. APPLICATION COMPLETENESS CHECKLIST

Applicant must place an entry - Y = Yes, N = No, N/A = Not Applicable - in each left side column space. See Section 105.13 for additional details. If you are applying under the Small Projects Application format, place an entry in only those comments prefixed by an asterisk (*).

REQUIREMENT	Applicant Entry	DEP Use Only
a. GIF and permit application properly signed, sealed and witnessed	*Y	
b. Application Fee & Worksheet enclosed (see Section G.)	*Y	
c. Copies and proof of receipt - Act 14 notification - Acts 67/68/127	*Y	
d. Cultural Resource Notice (Notice, return receipt and PHMC review letter, as appropriate)	*Y	
e. PASPGP-5 Reporting Criteria Checklist	*Y	
f. Bog Turtle Habitat Screening (copy of "No Effect" determination from the Army Corps of Engineers OR copy of documented clearance from the US Fish and Wildlife Service)	*N/A	
g. Pennsylvania Natural Diversity Inventory (signed PNDI Receipt showing Avoidance Measures or Potential Impacts and proof of delivery to the appropriate jurisdictional agency(ies) where further coordination is required, as appropriate)	*Y	
h. Plans (site plan including cross sections and profiles for Subsections 151, 191, 231, 261)	*Y	
i. Location map	Y	
j. Project description narrative including PNDI avoidance measures (if applicable) AND Aquatic Resource Impact Table	*Y *Y	
k. Color photographs with map showing location taken	*Y	
l. Environmental Assessment form	*Y	
m. Erosion and Sediment Control Plan and approval letter	Y	
n. Hydrologic and hydraulic analysis	Y	
o. Stormwater Management Analysis with consistency letter	Waiver Request	
p. Floodplain Management Analysis with consistency letter	Waiver Request	
q. Risk Assessment	Waiver Request	
r. Professional engineer's seal and certification	Y	
s. Alternative analysis	Y	
t. Mitigation plan	Waiver Request	

SECTION G. DETERMINATION OF APPLICATION FEES (DEP FEES ONLY)

The fee required for a project authorized under this permit shall be consistent with 25 PA Code §105.13 (relating to regulated activities – information and fees). To determine the application fee, please complete the Chapter 105 Fee(s) Calculation Worksheet (3150-PM-BWEW0553). Please provide the completed worksheet and a check for the applicable fee(s) made payable to the "Commonwealth of Pennsylvania Clean Water Fund."

SECTION H. ADJOINING PROPERTY OWNERS

Please list the name and address of all property owners whose land adjoins the project property.

NAME	ADDRESS
LYNCH, KEVIN L & KELLY S	8027 RT 87 HWY, WILLIAMSPORT, PA 17701
PLANKENHORN, KAREN L	7965 RT 87 HWY, WILLIAMSPORT, PA 17701
MATHIAS, SCOTT A & JESSICA K	7944 RT 87 HWY, WILLIAMSPORT, PA 17701
WALTERS, SCOTT	7926 STATE ROUTE 87, WILLIAMSPORT, PA 17701
PENNSYLVANIA GENERAL ENERGY COMPANY LLC	120 MARKET ST, WARREN, PA 16365
JARMOSKA, BARBARA L	766 BUTTERNUT GROVE RD, MONTOURSVILLE, PA 17754

SECTION I. CERTIFICATION AND SIGNATURE (see Instructions for clarification of signature requirements)

I certify under penalty of law that the information provided in this permit registration is true and correct to the best of my knowledge and information and that I possess the authority to undertake the proposed action. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. (If any of the information and/or plans is found to be in error, falsified, and/or incomplete, this authorization/verification may be subject to modification, suspension, or revocation in accordance with applicable regulations.)

I certify that the project proposed in this application complies with and will be conducted in a manner that is consistent with the approved Coastal Zone Management program of the Commonwealth of Pennsylvania. (Only portions of Erie, Bucks, Philadelphia and Delaware Counties are in the Coastal Zone).

I grant permission to the agencies responsible for authorization of this work, or their duly authorized representative, to enter the project site for inspection purposes during working hours. I will abide by the conditions of the permit or license if issued and will not begin work without the appropriate authorization.

Nathan Harris — 12/20/2019

Signature of Applicant/Owner — Date

Nathan Harris, Vice President of Health, Safety and Environment

Typed / Printed Name & Title of Applicant/Owner

Signature of Witness

Ashley Hordusky-Fiske Notary Public

Typed / Printed Name & Title of Witness

SEAL

Commonwealth of Pennsylvania - Notary Seal
Ashley Hordusky-Fiske, Notary Public
Warren County
My commission expires September 7, 2022
Commission number 1227282
Member, Pennsylvania Association of Notaries

PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

DELEGATION OF AUTHORITY POLICY

Approved by the Managing Member on 1/11/19

1. PURPOSE AND SCOPE

This Delegation of Authority Policy ("Policy") is established to define the limits of authority designated to specified positions of responsibility within Pennsylvania General Energy Company, L.L.C. ("Company") and to establish the types and maximum amount of obligations that may be approved by individuals or groups of individuals holding such positions. The approval of commitments and transactions outlined in this Policy must always be made by the parties that have been designated the responsibility for final approval.

This Policy contains a listing of the most common types of transactions, commitments, agreements and expenditures by the Company, with the appropriate signature level required. The officer positions referred to are officers of the Company. For the avoidance of doubt, and notwithstanding anything to the contrary contained herein, all delegations of authority made pursuant to this Policy shall at all times be subject to the terms of the Company's Amended and Restated Limited Liability Company Agreement, dated as of October 7, 2014 (as amended, modified or supplemented from time to time, the "PGE LLCA") and the Second Amended and Restated Limited Liability Company Agreement of Kinzua Energy Company, LLC (the "Managing Member"), dated as of April 18, 2016 (as amended, modified or supplemented from time to time, the "Kinzua LLCA"), including, but not limited to, Section 3.9(g) and Section 6.3(b) of the Kinzua LLCA. Furthermore, nothing in this Policy shall limit or otherwise reduce the authority, powers and responsibilities for the Board of Managers of the Managing Member, and all such authority, power and responsibilities are expressly reserved.

Conduct that violates this Policy is always considered outside the scope of employment of any employee acting on behalf of the Company. Employees who have other employees or representatives of the Company reporting to them should take all necessary steps to ensure their direct reports know and follow this Policy. In this regard, all managers should periodically consult with their direct reports to determine that appropriate procedures for implementation of the policy have been developed and are being followed. Except as otherwise stated herein, this Policy may not be modified except by the Company's Managing Member.

2. MANAGEMENT AUTHORITY OF COMPANY

The PGE LLCA establishes the management authority of the Company as follows:

> 10. Management Authority. The entire business and affairs of the Company shall be managed by or under the direction of its sole member, Kinzua General (sic) Energy Company, LLC (the "Managing Member"). The Managing Member shall have the sole right to manage the business of the Company and

shall have all powers and rights necessary, appropriate or advisable to effectuate and carry out the purposes and business of the Company. All matters of the Company shall be determined by the Managing Member. Any action required or permitted to be taken by the Managing Member at a meeting may be taken without a meeting in a writing executed by the Managing Member. The Managing Member may adopt such other procedures governing the conduct of business as it shall deem appropriate.

11. Officers. The officers of the Company (the "Officers"), if any, shall be appointed by the Managing Member in its sole discretion, and the Managing Member may assign such officers titles including, but not limited to, "chief executive officer," "president," "vice president," "treasurer," "secretary," "assistant secretary" and "chief financial officer." Any officers so appointed will have such authority and perform such duties as the Member may, from time to time, delegate to them....

3. DELEGATION AND RESERVATION OF AUTHORITY

By virtue of this Policy, and subject to the terms and conditions of the PGE LLCA and the Kinzua LLCA, the Managing Member delegates certain powers to the Officers and Department Heads as specifically set forth herein. The Managing Member reserves all decision-making authority to itself except to the extent that such power has been delegated herein. This includes control at all times over the Managing Member's statutory obligations and key strategic directions and control and monitoring of all issues that may significantly impact the Company.

The intention of this Policy is to ensure that the correct balance of responsibilities is struck between the Managing Member and the Officers and Department Heads in the best interests of the stakeholders. It is specifically acknowledged that the President/CEO is empowered to manage and lead the business on a day-to-day basis based upon the Managing Member-endorsed strategic, policy, risk, people, and financial framework. The President/CEO shall be responsible for attracting, motivating, and retaining a qualified team of managers and staff, as approved by the Managing Member; providing reports, analysis, and recommendations to the Managing Member as required; and implementing Managing Member decisions.

It is essential that the Managing Member receives adequate and timely reporting of the use of delegated authority by the President/CEO (particularly any unbudgeted or discretionary authority) so that the Managing Member can be fully informed at all times.

All decisions made by the Officers and/or the Department Heads in accordance with this Policy shall at all times be subject to the terms of the then-in-effect Budget (as defined in the Kinzua LLCA); *provided, however* that such Officers and/or Department Heads shall

have the authority to expend amounts (including, without limitation, entering into agreements or other arrangements and taking any other normal and customary action otherwise permitted by this Policy) that, when taken together with all other expenditures in a fiscal year, would not cause the Company to spend and/or incur more than an amount equal to 115% of the budgeted expenditures set forth in the Budget in effect for the applicable fiscal year.

8. CONTRACTS

8.1. *Contracts, Agreements and Legal Documents*. General Counsel must approve in writing the final version of any agreement or other legal document, including contract renewal, amendment, modification, restatement or waiver before it is executed on behalf of the Company. The officer in charge of Risk Management, must approve coverage of insurance required for each contract. Form or template contracts or legal documents that have been approved by the Legal Department prior to use and have not been altered need only be submitted to and approved by the Legal Department and the officer in charge of Risk Management to verify compliance of the contracting party with Company requirements and the appropriate insurance coverage. For purposes of clarity, this paragraph pertains to, but is not limited to, Master Services Agreements, Master Purchase Agreements,

Confidentiality or Nondisclosure Agreements, Land or Data Swap Agreements, Licenses, Leases, Geophysical Agreements, Employment Agreements, Independent Contractor Agreements, Joint Venture Agreements, Non-Derivative Swap Agreements, and all other legal documents that may bind the Company. Any contract or agreement that would reasonably be expected to require the Company to spend more than $3,000,000 shall require approval of the Managing Member. In addition, approval of the Managing Member shall be required for the Company to enter into or replace or amend, modify, restate or supplement, or waive or fail to enforce any material rights of the Company under, any participation, joint venture, area of mutual interest or other similar agreement to which the Company is a party or which affect any of the Company's assets, in each case, that has a material and adverse effect on the Company or the Series B Member (as defined in the Kinzua LLCA).

8.4. *Authority to Execute.* The Department Head for the applicable Department has authority to execute and bind the Company to a contract or other legal agreement requested by that Department once the same has been reviewed and approved as set forth in this Section 8 and in compliance with Schedule A.

REQUIREMENT B

Chapter 105 – Fee(s) Calculation Worksheet

A R M G r o u p L L C

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATERWAYS ENGINEERING AND WETLANDS

CHAPTER 105 FEE(S) CALCULATION WORKSHEET

Additional information can be found at 25 PA Code §105.13 (relating to regulated activities – information and fees), the General Permit Registration (3150-PM-BWEW0500), the Joint Permit Application (3150-PM-BWEW0036) and the Dam Permit Application (3140-PM-BWEW0001)

Federal, State, county or municipal agencies or municipal authorities: ☐ **EXEMPT from fees**

These entities are exempt from these fees. If the applicant falls into one of these categories, please check the box above and provide only the first page of this worksheet with the project application or registration.

ALL OTHERS:

1. Please place an "X" in the box next to all authorizations that apply to the project and complete the fee information below those authorization(s). Projects may require multiple authorizations and fees, further clarification and examples are included below and at the end of this document.
2. Total each authorization, Section, and Part. Part One is for Water Obstructions and Encroachment authorizations, Part Two is for Dam Safety authorizations.
3. Please provide this completed worksheet (page 1 and page 2 and/or page 3, as is appropriate to the project) and a check for the applicable fee(s) with the project application or registration. The check should be made payable to the "**Commonwealth of Pennsylvania Clean Water Fund**" OR "**_____ Conservation District Clean Water Fund**", whichever is the reviewing entity.

NOTES:

Per *25 PA Code §105.13(c)(2)(iii)* Disturbance review fees are calculated by individually adding all of the permanent and temporary impacts to waterways, floodways, floodplains and bodies of water including wetlands to the next highest tenth acre and multiplying the permanent and temporary impacts by the respective fees and then these amounts are added to the other applicable fees.

Entities proposing structures or activities to occupy a Submerged Lands of the Commonwealth must obtain a Submerged Lands License Agreement (SLLA) and pay the appropriate annual charge. The applicant will be contacted if this charge applies to the project.

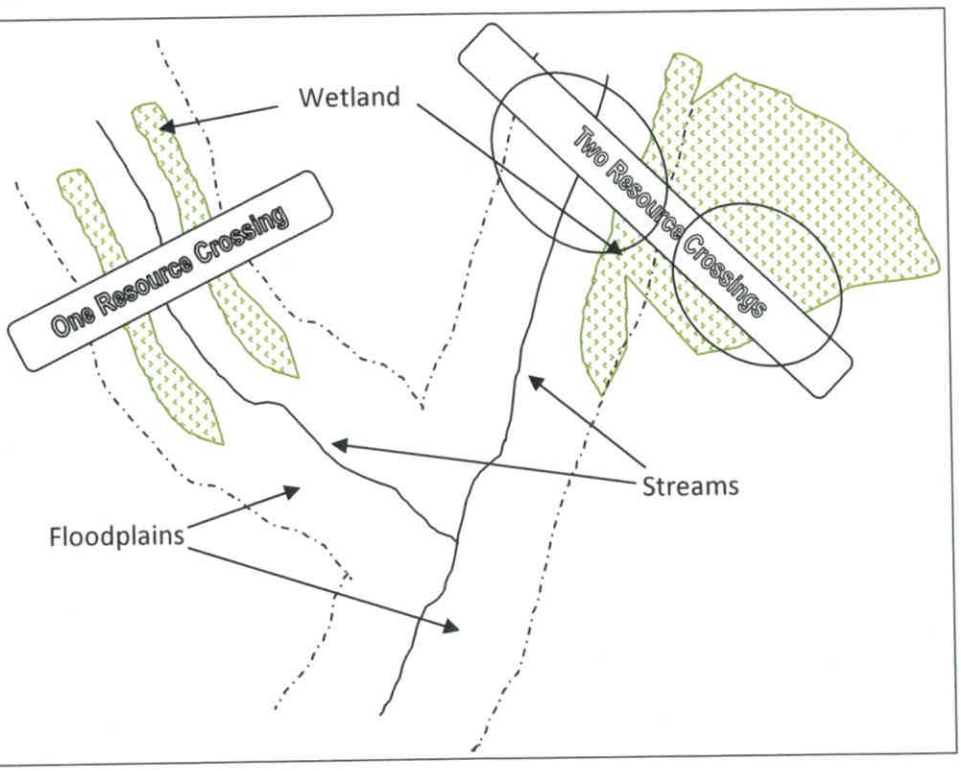
Floodway – The channel of the watercourse and portions of the adjoining floodplains which are reasonably required to carry and discharge the 100-year frequency flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by FEMA. In an area where no FEMA maps or studies have defined the boundary of the 100-year frequency floodway, it is assumed, absent evidence to the contrary, that the floodway extends from the stream to 50 feet from the top of the bank of the stream.

Wetland and Stream Clarification:

[1] In many instances, wetlands are located within the floodplain of a stream. These resources for the purposes of calculating disturbance fees are considered co-located or overlapping and the area of disturbance would only be used once.

[2] In the case of GP-5, GP-7 and GP-8 fees are charged per structure per resource crossing and the following also applies to the disturbance fees:

- A crossing of the stream and the floodplain with wetlands present within the floodplain is considered one resource crossing.
- When the crossing traverses a stream and the floodplain and a wetland that is located outside of the floodplain or a wetland that extends out beyond the floodplain, it is considered two resource crossings.



PART ONE: WATER OBSTRUCTIONS AND ENCROACHMENTS

SECTION A. APPLICATION FEES

☒ **WATER OBSTRUCTION AND ENCROACHMENT PERMIT** (Joint Permit Application)

Some activities or structures within a project may also qualify for an accumulation of General Permit fees, please mark the box above indicating an Individual Water Obstruction and Encroachment Permit AND the corresponding fee(s) in the General Permit section below those. Activities or structures not qualifying for a General Permit fee must include a disturbance fee.

☒ Administrative Filing Fee[1]		$ 1,750	+	
☒ Temporary Disturbance ($400/0.1ac)	0.7 acres x $4,000 =	$ 2,800	+	
☒ Permanent Disturbance ($800/0.1ac)	0.1 acres x $8,000 =	$ 800		= $ 5,350
		WO&E FEE subtotal (a)		$ 5,350

☐ **GENERAL PERMIT(S)** (select activity/structure(s) below, see page 4 for "#" explanation)

Some activities or structures within a project requiring an Individual Water Obstruction and Encroachment Permit may qualify for an accumulation of General Permit fees, please mark the corresponding fee(s) below but not the box above indicating a General Permit.

☐ GP-1 Fish Habitat Enhancement Structures		$ 50		= $ ____
☐ GP-2 Small Docks and Boat Launching Ramps	____ (#) x	$ 175		= $ ____
☐ GP-3 Bank Rehabilitation, Bank Protection and Gravel Bar Removal	____ (#) x	$ 250		= $ ____
☐ GP-4 Intake and Outfall Structures	____ (#) x	$ 200		= $ ____
☐ GP-5 Utility Line Stream Crossings[2]	____ (#) x ____ (#) x	$ 250		= $ ____
☐ GP-6 Agricultural Crossings and Ramps	____ (#) x	$ 50		= $ ____
☐ GP-7 Minor Road Crossings[2]	____ (#) x	$ 350		= $ ____
☐ GP-8 Temporary Road Crossings[2]	____ (#) x	$ 175		= $ ____
☐ GP-9 Agricultural Activities		$ 50		= $ ____
☐ GP-10 Abandoned Mine Reclamation		$ 500		= $ ____
☐ GP-11 Maintenance, Testing, Repair, Rehabilitation, or Replacement of Water Obstructions and Encroachments[1]		$ 750	+	
☐ Temporary Disturbance ($400/0.1ac)	____.____ acres x $4,000 =	$ ____	+	
☐ Permanent Disturbance ($800/0.1ac)	____.____ acres x $8,000 =	$ ____		= $ ____
☐ GP-15 Private Residential Construction in Wetlands[1]		$ 750	+	
☐ Temporary Disturbance ($400/0.1ac)	____.____ acres x $4,000 =	$ ____	+	
☐ Permanent Disturbance ($800/0.1ac)	____.____ acres x $8,000 =	$ ____		= $ ____
		GP(s) FEE subtotal (b)		$ ____

PART ONE: SECTION A. APPLICATION FEE(S) subtotal (a+b=c) $ ____

SECTION B. OTHER FEES

☐ Environmental Assessment for Waived Activities (§105.13(c)(2)(iv))		$ 500		$ ____
☐ Amendment to Water Obstruction and Encroachment Permit				
☐ Major Amendment[1]		$ 500	+	
☐ Temporary Disturbance	____.____ acres x $4,000 =	$ ____	+	$ ____
☐ Permanent Disturbance	____.____ acres x $8,000 =	$ ____		= $ ____
☐ Minor Amendment		$ 250		$ ____

Transfer of Water Obstruction and Encroachment Permit *does not require submission of this form; see Application for Transfer of Permit / Submerged Lands License Agreement (3150-PM-BWEW-0016)*

PART ONE: SECTION B. OTHER FEE(S) subtotal (d) $ ____

PART ONE: FEE(S) TOTAL (c+d=e) $ 5,350

DEP USE ONLY			
FEE TOTAL:	____	Permit / Authorization Number (s):	____
Correct Amount:	____	Check #: ____	____
Check Amount:	____	Payable to: ____	____

ARM GROUP INC.

74480

DATE	INVOICE NO.	COMMENT	AMOUNT	NET AMOUNT
12/23/2019	Permit Fee	Joint Permit Application		5,350.00
DATE 12/23/19		**VENDOR** Commonwealth of PA Clean Water Fund	**TOTAL**	5,350.00

ARM GROUP INC.
1129 W. GOVERNOR ROAD
P.O. BOX 797
HERSHEY, PA 17033-0797

PNC BANK, N.A.
SOUTHCENTRAL PA 040

60-1273
313

74480

Five Thousand Three Hundred Fifty and no/100

DATE		AMOUNT
12/23/19	74480	$5,350.00

PAY TO THE ORDER OF **COMMONWEALTH OF PA CLEAN WATER FUND**

VOID AFTER 90 DAYS

⑈074480⑈ ⑆031312738⑆ 5005126174⑈

REQUIREMENT C

Act 14 Municipal Notifications

A R M G r o u p L L C

ARM Group Inc.

Engineers and Scientists

December 20, 2019

CERTIFIED MAIL ARTICLE NO: 7017 0530 0000 7339 5510

Gamble Township Supervisors
17 Beech Valley Rd
Trout Run, PA 17771

Re: Act 14 Notification
ESCGP-3 & Joint Permit Applications
Loyalsock / Shawnee Freshwater System
Pennsylvania General Energy
Company, L.L.C.
Plunketts Creek and Gamble Townships,
Lycoming County, Pennsylvania
ARM Project 190736

Dear Supervisors:

This municipal notification, under the requirements of Act 14, is to inform you that ARM Group Inc., acting on behalf of Pennsylvania General Energy Company, L.L.C. (PGE), is applying for coverage under the "Erosion and Sediment Control General Permit (ESCGP-3) for Earth Disturbance Associated with Oil and Gas Exploration, Production, Processing, or Treatment Operations or Transmission Facilities" as well as a "Joint Application for Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit" for a utility line stream crossing from the Pennsylvania Department of Environmental Protection (PADEP) Northcentral Regional Office.

Applicant Contact: Michael Race, P.E., CPESC
ARM Group Inc.
2548 Park Center Blvd.
State College, PA 16803
(814) 272-0455 x 2214

Project Location: Refer to attached Figure 1.

Project Description: PGE is proposing to develop the Loyalsock / Shawnee Freshwater System in Plunketts Creek and Gamble Townships, Lycoming County, Pennsylvania. The purpose of the project is to support PGE's natural gas operations from the Marcellus shale formation, which will provide a key source of energy for the United States. The overall project includes a freshwater intake and withdrawal system, a booster pump station pad and associated access road, and

a 0.3-mile permanent underground utility corridor that crosses Loyalsock Creek. The project area consists of approximately 9.5-acres of disturbed land that is owned by PGE.

The buried freshwater intake will be installed at 41.355167°, -76.888760° and a gravel maintenance drive will be utilized to allow permanent access to this location. The intake will connect to a wet well, valve vault, and a 12-inch buried freshwater pipeline to transfer water from Loyalsock Creek to the booster pump station building at approximately 41.353950°, -76.886704°. From the booster pump station building, an aboveground freshwater pipeline will extend east to a future impoundment location (permitted separately).

The permanent underground utility corridor will include natural gas, freshwater, and utility conduits. This utility corridor will be constructed between the booster pump station pad and a future tie-in location approximately 350-feet west of Loyalsock Creek where each utility will be terminated at the ends for future connections.

Pursuant to Act 14, P.L. 384, and Acts 67, 68 and 127, notice is hereby given that the applicant is submitting the above referenced applications. Acts 67, 68 and 127, which amended the Municipalities Planning Code (MPC), direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Sections 619.2 and 1105 of the Municipalities Planning Code.

Please submit any comments concerning this project within 30 days from date of receipt of this letter to the PADEP District Oil & Gas Operations Office at:

Pennsylvania Department of Environmental Protection
Northcentral District Oil & Gas Operations Office
208 W 3rd Street, Suite 101
Williamsport, PA 17701

Respectfully submitted,
ARM Group Inc.

Michael Race, P.E., CPESC
Project Manager

Attachments:

- Figure 1 – Site Location Map
- Sheet 2 – Total Project Area Plan
- Notice of Intent (NOI) for Coverage Under the ESCGP-3
- Joint Application for Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit

cc: Pennsylvania General Energy Company, L.L.C.

7017 0530 0000 7339 5510

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

For delivery information, visit our website at www.usps.com®.

OFFICIAL USE

Certified Mail Fee
$

Extra Services & Fees (check box, add fee as appropriate)
- [x] Return Receipt (hardcopy) $ 2.80
- [ ] Return Receipt (electronic) $
- [x] Certified Mail Restricted Delivery $ ~~0.00~~ 3.50
- [ ] Adult Signature Required $
- [ ] Adult Signature Restricted Delivery $

Postage
$ 1.90

Total Postage and Fees
$ 8.20

Postmark Here
STATE COLLEGE PA 16803
DEC 2 2019

190734

Sent To
Gamble Township Supervisors

Street and Apt. No., or PO Box No.
17 Beech Valley Rd

City, State, ZIP+4®
Trout Run, PA, 17771

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

---

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Gamble Township Supervisors
17 Beech Valley Rd
Trout Run, PA 17771

9590 9402 3070 7124 0419 00

2. Article Number (Transfer from service label)
7017 0530 0000 7339 5510

PS Form 3811, July 2015 PSN 7530-02-000-9053

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Anita McFadden
- [ ] Agent
- [ ] Addressee

B. Received by (Printed Name) Anita McFadden
C. Date of Delivery

D. Is delivery address different from item 1? If YES, enter delivery address below:
- [ ] Yes
- [ ] No

3. Service Type
- [ ] Adult Signature
- [ ] Adult Signature Restricted Delivery
- [x] Certified Mail®
- [ ] Certified Mail Restricted Delivery
- [ ] Collect on Delivery
- [ ] Collect on Delivery Restricted Delivery
- [ ] Insured Mail
- [ ] Insured Mail Restricted Delivery (over $500)
- [ ] Priority Mail Express®
- [ ] Registered Mail™
- [ ] Registered Mail Restricted Delivery
- [ ] Return Receipt for Merchandise
- [ ] Signature Confirmation™
- [ ] Signature Confirmation Restricted Delivery

190736 MDR

Domestic Return Receipt

ARM Group Inc.

Engineers and Scientists

December 20, 2019

CERTIFIED MAIL ARTICLE NO: 7017 0530 0000 0981 3637

Mr. Ray Lewis
Plunketts Creek Township Chair-Supervisor
10751 State Route 87 Hwy
Williamsport, PA 17701

Re: Act 14 Notification
ESCGP-3 & Joint Permit Applications
Loyalsock / Shawnee Freshwater System
Pennsylvania General Energy
Company, L.L.C.
Plunketts Creek and Gamble Townships,
Lycoming County, Pennsylvania
ARM Project 190736

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Applicant Contact: Michael Race, P.E., CPESC
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Project Description: PGE is proposing to develop the Loyalsock / Shawnee Freshwater System in Plunketts Creek and Gamble Townships, Lycoming County, Pennsylvania. The purpose of the project is to support PGE's natural gas operations from the Marcellus shale formation, which will provide a key source of energy for the United States. The overall project includes a freshwater intake and withdrawal

system, a booster pump station pad and associated access road, and a 0.3-mile permanent underground utility corridor that crosses Loyalsock Creek. The project area consists of approximately 9.5-acres of disturbed land that is owned by PGE.

The buried freshwater intake will be installed at 41.355167°, -76.888760° and a gravel maintenance drive will be utilized to allow permanent access to this location. The intake will connect to a wet well, valve vault, and a 12-inch buried freshwater pipeline to transfer water from Loyalsock Creek to the booster pump station building at approximately 41.353950°, -76.886704°. From the booster pump station building, an aboveground freshwater pipeline will extend east to a future impoundment location (permitted separately).

The permanent underground utility corridor will include natural gas, freshwater, and utility conduits. This utility corridor will be constructed between the booster pump station pad and a future tie-in location approximately 350-feet west of Loyalsock Creek where each utility will be terminated at the ends for future connections.

Pursuant to Act 14, P.L. 384, and Acts 67, 68 and 127, notice is hereby given that the applicant is submitting the above referenced applications. Acts 67, 68 and 127, which amended the Municipalities Planning Code (MPC), direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Sections 619.2 and 1105 of the Municipalities Planning Code.

Please submit any comments concerning this project within 30 days from date of receipt of this letter to the PADEP District Oil & Gas Operations Office at:

Pennsylvania Department of Environmental Protection
Northcentral District Oil & Gas Operations Office
208 W 3rd Street, Suite 101
Williamsport, PA 17701

Respectfully submitted,
ARM Group Inc.

Michael Race, P.E., CPESC
Project Manager

Attachments:

- Figure 1 – Site Location Map
- Sheet 2 – Total Project Area Plan
- Notice of Intent (NOI) for Coverage Under the ESCGP-3
- Joint Application for Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit

cc: Pennsylvania General Energy Company, L.L.C.

7017 0530 0000 0981 3637

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- ☐ Adult Signature Restricted Delivery $

Postage $ 1.90

Total Postage and Fees $ 8.20

Postmark Here

190736

Sent To Mr. Ray Lewis

Street and Apt. No., or PO Box No. 10751 State Route 87 Hwy

City, State, ZIP+4® Williamsport, PA 17701

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

---

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
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1. Article Addressed to:

Mr. Ray Lewis
Plunketts Creek Township Chair-Supervisor
10751 State Route 87 Hwy
Williamsport, PA 17701

9590 9402 3070 7124 0418 87

2. Article Number (Transfer from service label)
017 0530 0000 0981 3637

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Debra B. Lewis ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery 11/3/23

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
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- ☐ Collect on Delivery
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- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 190736 MDR Domestic Return Receipt

ARM Group Inc.

Engineers and Scientists

December 20, 2019

CERTIFIED MAIL ARTICLE NO: 7017 0530 0000 7339 5503

Lycoming County Commissioners
Lycoming County Courthouse
48 West Third Street
Williamsport, PA 17701

Re: Act 14 Notification
ESCGP-3 & Joint Permit Applications
Loyalsock / Shawnee Freshwater System
Pennsylvania General Energy
Company, L.L.C.
Plunketts Creek and Gamble Townships,
Lycoming County, Pennsylvania
ARM Project 190736

Dear Commissioners:

This municipal notification, under the requirements of Act 14, is to inform you that ARM Group Inc., acting on behalf of Pennsylvania General Energy Company, L.L.C. (PGE), is applying for coverage under the "Erosion and Sediment Control General Permit (ESCGP-3) for Earth Disturbance Associated with Oil and Gas Exploration, Production, Processing, or Treatment Operations or Transmission Facilities" as well as a "Joint Application for Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit" for a utility line stream crossing from the Pennsylvania Department of Environmental Protection (PADEP) Northcentral Regional Office.

Applicant Contact: Michael Race, P.E., CPESC
ARM Group Inc.
2548 Park Center Blvd.
State College, PA 16803
(814) 272-0455 x 2214

Project Location: Refer to attached Figure 1.

Project Description: PGE is proposing to develop the Loyalsock / Shawnee Freshwater System in Plunketts Creek and Gamble Townships, Lycoming County, Pennsylvania. The purpose of the project is to support PGE's natural gas operations from the Marcellus shale formation, which will provide a key source of energy for the United States. The overall project includes a freshwater intake and withdrawal

system, a booster pump station pad and associated access road, and a 0.3-mile permanent underground utility corridor that crosses Loyalsock Creek. The project area consists of approximately 9.5-acres of disturbed land that is owned by PGE.

The buried freshwater intake will be installed at 41.355167°, -76.888760° and a gravel maintenance drive will be utilized to allow permanent access to this location. The intake will connect to a wet well, valve vault, and a 12-inch buried freshwater pipeline to transfer water from Loyalsock Creek to the booster pump station building at approximately 41.353950°, -76.886704°. From the booster pump station building, an aboveground freshwater pipeline will extend east to a future impoundment location (permitted separately).

The permanent underground utility corridor will include natural gas, freshwater, and utility conduits. This utility corridor will be constructed between the booster pump station pad and a future tie-in location approximately 350-feet west of Loyalsock Creek where each utility will be terminated at the ends for future connections.

Pursuant to Act 14, P.L. 384, and Acts 67, 68 and 127, notice is hereby given that the applicant is submitting the above referenced applications. Acts 67, 68 and 127, which amended the Municipalities Planning Code (MPC), direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Sections 619.2 and 1105 of the Municipalities Planning Code.

Please submit any comments concerning this project within 30 days from date of receipt of this letter to the PADEP District Oil & Gas Operations Office at:

Pennsylvania Department of Environmental Protection
Northcentral District Oil & Gas Operations Office
208 W 3rd Street, Suite 101
Williamsport, PA 17701

Respectfully submitted,
ARM Group Inc.

Michael Race, P.E., CPESC
Project Manager

Attachments:

- Figure 1 – Site Location Map
- Sheet 2 – Total Project Area Plan
- Notice of Intent (NOI) for Coverage Under the ESCGP-3
- Joint Application for Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit

cc: Pennsylvania General Energy Company, L.L.C.

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- [ ] Adult Signature Required $
- [ ] Adult Signature Restricted Delivery $

Postage $ 1.90

Total Postage and Fees $ 8.20

Postmark Here

190736

Sent To: Lycoming County Commissioners
Street and Apt. No., or PO Box No.: 48 West Third Street
City, State, ZIP+4®: Williamsport, PA, 17701

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:
Lycoming County Commissioners
Lycoming County Courthouse
48 West Third Street
Williamsport, PA 17701

9590 9402 3070 7124 0418 94

2. Article Number (Transfer from service label)
7017 0530 0000 7339 5503

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X
- [ ] Agent
- [ ] Addressee

B. Received by (Printed Name): Courtney English
C. Date of Delivery: 12/23/19

D. Is delivery address different from item 1? - [ ] Yes
If YES, enter delivery address below: - [ ] No

3. Service Type
- [ ] Adult Signature
- [ ] Adult Signature Restricted Delivery
- [x] Certified Mail®
- [ ] Certified Mail Restricted Delivery
- [ ] Collect on Delivery
- [ ] Collect on Delivery Restricted Delivery
- [ ] Insured Mail
- [ ] Insured Mail Restricted Delivery (over $500)
- [ ] Priority Mail Express®
- [ ] Registered Mail™
- [ ] Registered Mail Restricted Delivery
- [ ] Return Receipt for Merchandise
- [ ] Signature Confirmation™
- [ ] Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 190736 MDR Domestic Return Receipt

REQUIREMENT D

Pennsylvania Historical & Museum Commission (PHMC) Documentation

A R M G r o u p L L C

Pennsylvania State Historic Preservation Office
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION

January 7, 2020

David J. Rue
Rue Environmental LLC
811 Cricklewood Drive #3
State College, PA 16803

Re: File No. ER 2020-0561-081-A
COE ESCGP-3 & Chapter 105/Section 404 Permits: Loyalsock/Shawnee Freshwater System Development Project, Plunketts Creek Twp., Lycoming Co.

Dear Mr. Rue:

Thank you for submitting information concerning the above referenced project. The Pennsylvania State Historic Preservation Office (PA SHPO) reviews projects in accordance with state and federal laws. Section 106 of the National Historic Preservation Act of 1966, and the implementing regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation, is the primary federal legislation. The Environmental Rights amendment, Article 1, Section 27 of the Pennsylvania Constitution and the Pennsylvania History Code, 37 Pa. Cons. Stat. Section 500 et seq. (1988) is the primary state legislation. These laws include consideration of the project's potential effects on both historic and archaeological resources.

Archaeological Resources

Based on an evaluation by our staff, including a review of the Statewide Pre-Contact Predictive Model, there is a high probability that National Register significant archaeological sites are present within this project area. These resources could be adversely affected by project activities. Our review considers the locations of known archaeological resources, soil type, topographic setting, slope direction and distance to water, among other regionally specific predictive factors for archaeological site locations. It is our opinion that a Phase I archaeological survey should be conducted to locate potentially significant resources. Guidelines and instructions for conducting all phases of archaeological survey in Pennsylvania are available on our website http://www.phmc.pa.gov/Preservation/About/Documents/SHPO-Guidelines-Archaeological-Investigation.pdf.

The PASHPO will keep the information you provided for this submission and any subsequent submission on file. Please provide a copy of this letter and any other project-related correspondence to your state or federal permitting or funding agency.

Above Ground Resources

Based on our files and the information provided, it is our opinion that there are no above ground historic properties present. Should new information be brought to your attention regarding historic properties located within the project area of potential effect, please notify the PA SHPO at (717) 783-8947 for reconsideration of the project.

If you need further information in this matter, please consult Casey Hanson at chanson@pa.gov. or (717) 772-0923.

Sincerely,

Douglas C. McLearen, Chief
Division of Environmental Review

DCM/tmw

RUE ENVIRONMENTAL LLC

~

811 Cricklewood Dr., #3
State College, PA 16803
814-237-1076

~

rueenv@rueenv.com

December 16, 2019

Douglas C. McLearen
Division of Archaeology and Protection
Pennsylvania Historical and Museum Commission
State Historic Preservation Office
Commonwealth Keystone Building
400 North Street, 2nd Floor
Harrisburg, PA 17120-0093

RE: Review Request Form, Loyalsock/Shawnee Freshwater System Project, Lycoming County, Pennsylvania

Dear Mr. McLearen:

Enclosed please find a completed Review Request Form for the referenced project. If you have any questions or require additional information, please let me know. My email address is davidrue@rueenv.com.

Sincerely,

David J. Rue, Ph.D.
Project Manager Cultural Resources

Encl.
Cc: Brian Bonner, ARM Group

RE737

Pennsylvania Historical & Museum Commission

PROJECT REVIEW FORM

Request to Initiate SHPO Consultation on State and Federal Undertakings

SHPO USE ONLY	Reviewers: ___/___
DATE RECEIVED:	DATE DUE:
ER NUMBER:	HRSF: _____

REV: 06/2018

SECTION A: PROJECT NAME & LOCATION

Is this a new submittal? (•) YES ( ) NO OR ( ) This is additional information for ER Number:

Project Name: Loyalsock / Shawnee Freshwater System
County: Lycoming
Municipality: Plunketts Creek Twp.
Project Address: 41.3550, -76.8883
City/State/ Zip:

SECTION B: CONTACT INFORMATION & MAILING ADDRESS

Name: David J. Rue
Company: Rue Environmental LLC
Street/PO Box: 811 Cricklewood Dr., #3
City/State/Zip: State College, PA 16803
Phone: (814) 237-1076
Fax: (814) 237-1076
Email: davidrue@rueenv.com

SECTION C: PROJECT DESCRIPTION

This project is located on: (check all that apply) ☐ Federal property ☐ State property ☐ Municipal property ☑ Private property

List all federal and state agencies and programs providing funds, permits, licenses.

Agency Type	Agency/Program/Permit Name	Project/Permit/Tracking Number (if applicable)
State & Federal	USACOE/PADEP/JP	

Proposed Work – Attach project description, scope of work, site plans, and/or drawings

Project includes (check all that apply): ☑ Construction ☐ Demolition ☐ Rehabilitation ☐ Disposition

Total acres of project area: 9.5 Total acres of earth disturbance: 9.5

Are there any buildings or structures within the project area? (•) Yes ( ) No Approximate age of buildings: 45 yrs

Does this project involve properties listed in or eligible for the National Register of Historic Places, or designated as historic by a local government?	Yes	No	Unsure	Name of historic property or historic districts
	( )	(•)	( )	

Please print and mail completed form and all attachments to:

PHMC
State Historic Preservation Office
400 North St.
Commonwealth Keystone Building, 2nd Floor
Harrisburg, PA 17120-0093

Attachments – Please include the following information with this form

- ☑ **Map** – 7.5' USGS quad showing project boundary and Area of Potential Effect
- ☑ **Description/Scope** – Describe the project, including any ground disturbance and previous land use
- ☑ **Site Plans/Drawings** – Indicate past and present land use, location and dates of buildings, and proposed improvements
- ☑ **Photographs** – Attach prints or digital photographs showing the project site, including images of all buildings and structures keyed to a site plan

SHPO DETERMINATION (SHPO USE ONLY)

- ☐ There are **NO HISTORIC PROPERTIES** in the Area of Potential Effect
- ☐ The project will have **NO EFFECT** on historic properties
- ☐ The project will have **NO ADVERSE EFFECTS** on historic properties:
- ☐ The project will have **NO ADVERSE EFFECTS WITH CONDITIONS** (see attached)
- ☐ **SHPO REQUESTS ADDITIONAL INFORMATION** (see attached)

SHPO REVIEWER: _____ **DATE:** _____

Narrative

Loyalsock Shawnee Freshwater System, Lycoming County, PA

Pennsylvania General Energy (PGE) is proposing to develop the Loyalsock/Shawnee Freshwater System in Gamble and Plunketts Creek Townships, Lycoming County, Pennsylvania. The project area is on the Montoursville North USGS 7.5' Quadrangles east of the populated place called Butternut Grove (Figure 1, attached). The project area is shown on an attached aerial base map (Figure 2, attached). The purpose of the project is to support PGE's natural gas operations from the Marcellus shale formation, which will provide a key source of energy for the United States. The overall project includes a freshwater intake and withdrawal system, a booster pump station pad and associated 0.1-mile long, 15-foot wide access road, and a separate 0.3-mile permanent underground utility corridor that crosses Loyalsock Creek. The permanent underground utility corridor includes natural gas, freshwater, and utility conduits. The proposed project design plan is included on Sheet 4 (attached).

The buried freshwater intake will be installed within the Loyalsock Creek and a gravel maintenance drive will be utilized to allow permanent access to this location. The intake will connect to a wet well, valve vault, and a 12-inch buried freshwater pipeline to transfer water from Loyalsock Creek to the booster pump station building. A 6-inch underground electric conduit, a 2-inch communications conduit, and a 2-inch compressed air line will be installed in the same trench as the freshwater pipeline in order to supply electricity and controls to the intake pumps and compressed air to the self-cleaning intake strainers. The freshwater intake and withdrawal system will cross a portion of the Loyalsock Creek and Federal Emergency Management Agency (FEMA) 100-year floodplain.

The permanent underground utility corridor will include a 24-inch natural gas pipeline, a 12-inch freshwater pipeline, and a 12-inch utility conduit. This utility trench will be constructed between the booster pump station pad and a future tie-in location approximately 350-feet west of Loyalsock Creek at 41.356123°, -76.890221° where each utility will be terminated at the ends for future connections. The utility corridor will cross the Loyalsock Creek, Loyalsock Creek Side Channel, and FEMA 100-year floodplain.

The review is requested for compliance with the State History Code, since the project will require authorizations for a Pennsylvania Department of Environmental Protection (PADEP) Erosion and Sediment Control General Permit-3 (ESCGP-3) and a Chapter 105/Section 404 permit through submittal of a *Joint Permit Application for a Pennsylvania Water Obstruction and Encroachment Application and United States Army Corps of Engineers Section 404 Permit Application*. Wetlands are avoided and will not be impacted by the project. As mentioned, the intake system and utility corridor will cross either the Loyalsock Creek and/or Loyalsock Creek Side Channel, and FEMA 100-year floodplain. The waterway crossings will be constructed using an open-cut / restore trench method. A minimum of 3 feet of cover will be maintained above the top of all pipelines.

The *Project Review Form to Request to Initiate SHPO Consultation on State and Federal Undertakings* is enclosed. The limit of disturbance (LOD) encompasses approximately 9.5 acres

that is owned by PGE for the proposed development activities. The area of potential effect (APE) for above ground historic resources and archaeological resources is defined as the LOD.

Portions of the project are situated on the alluvium of Loyalsock Creek. Photos 1-2 portray the landscape. One residence is located in the vicinity, a mid-twentieth century ranch style house on the west side of the road (Photo 3) north of the LOD. Review of the Cultural Resource Geographic Information System (CRGIS) indicated that no previously recorded archaeological sites are located in or near the LOD. The Statewide Probability Model for Prehistoric Resources, shown on the CRGIS, indicated that the LOD has a low probability.

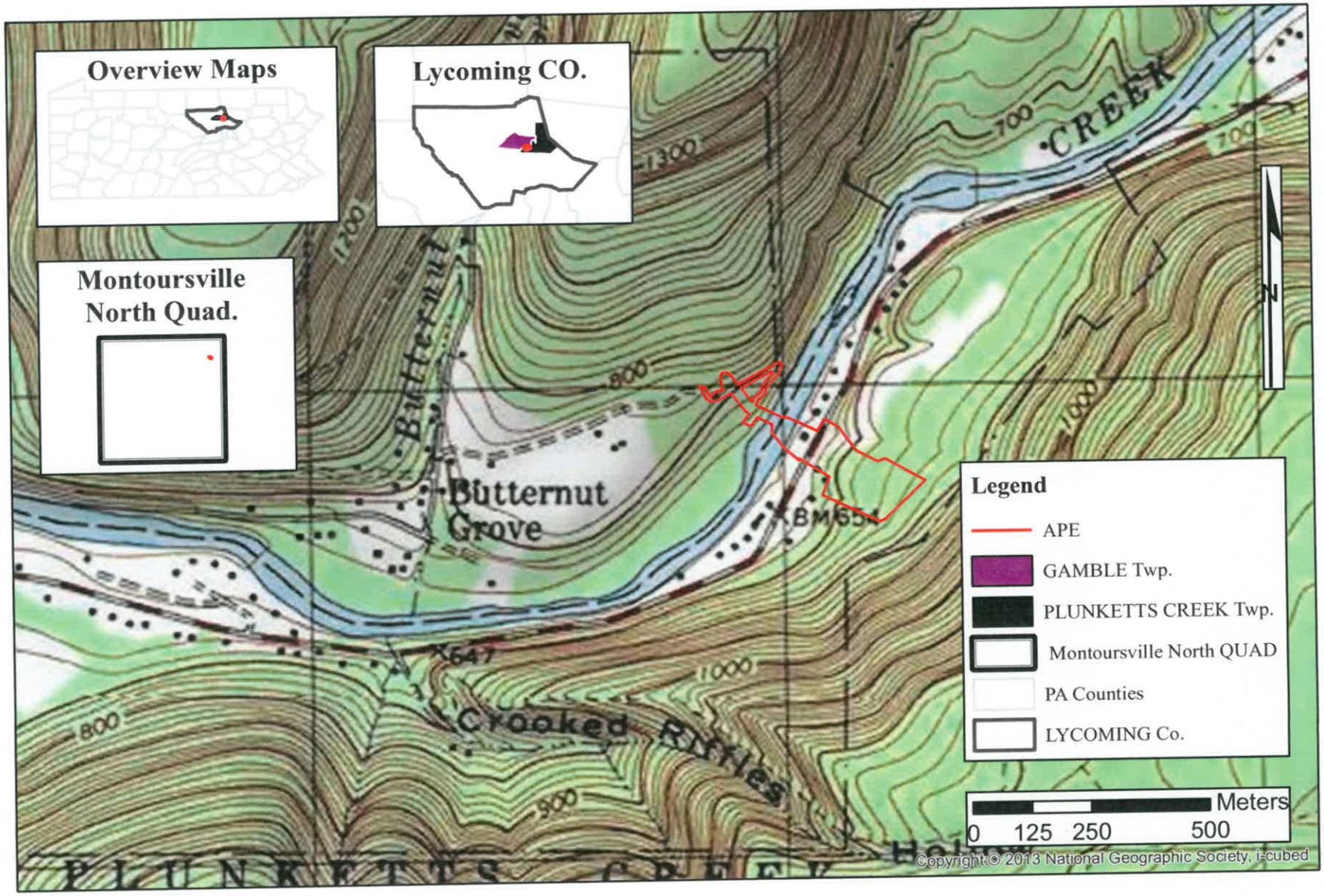


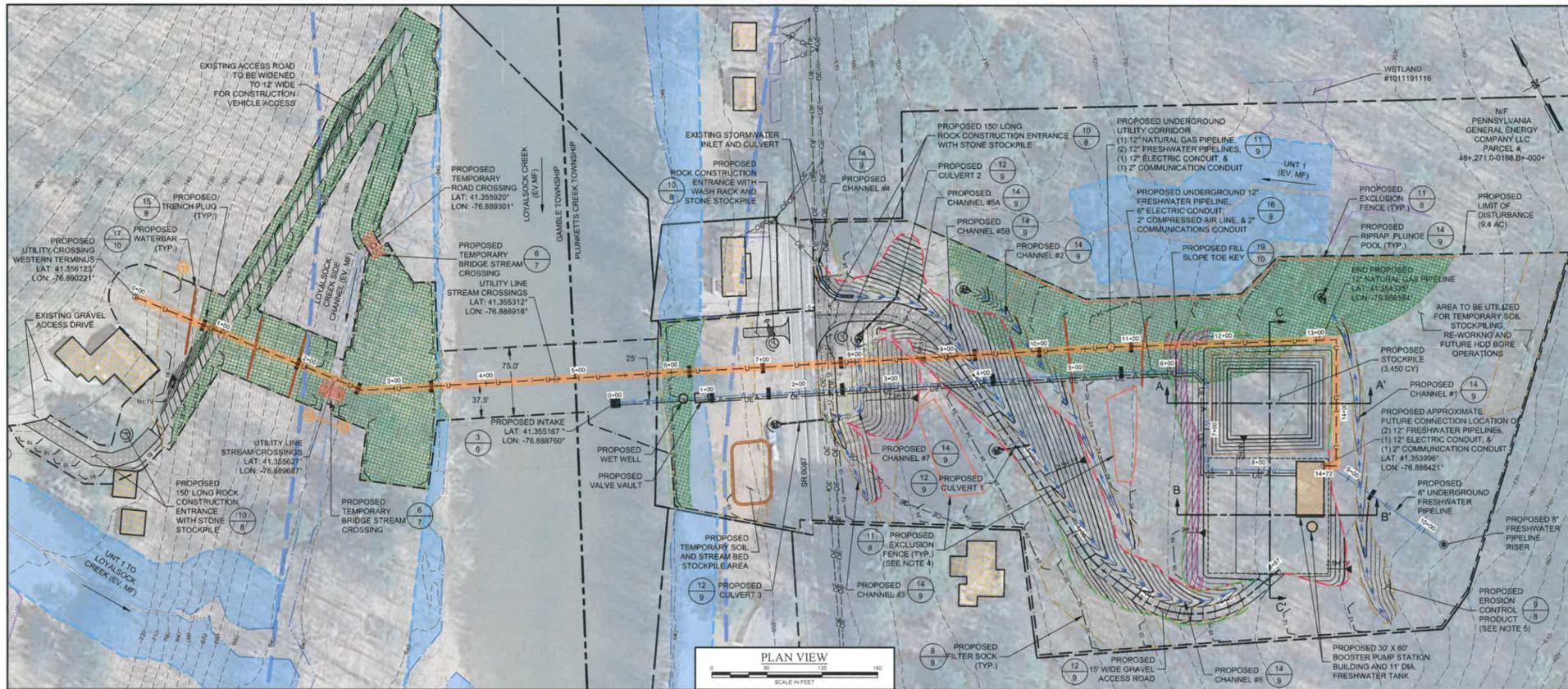
Figure 1. Topographic Map with APE and LOD.

Figure 2. Aerial Photograph with APE and LOD.

Photo 1. Conditions on terrace east of Loyalsock Creek.

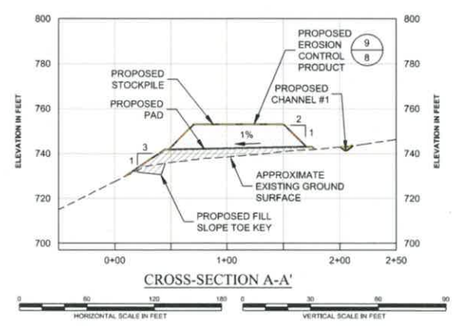
Photo 2. Conditions on the footslope west of Loyalsock Creek.

Photo 3. Residence north of LOD, west of Route 82.

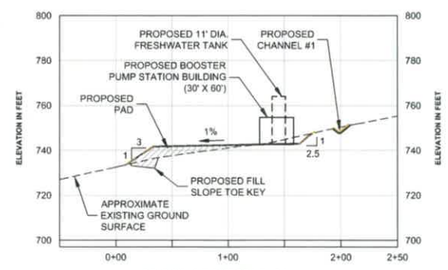


VOLUME REPORT[1]	
WELL PAD	
TOPSOIL - STOCKPILE (CY)[2]	1,118
SUBSOIL CUT (CY)[3]	292
TOTAL AVAILABLE STRUCTURAL FILL (CY)[4]	263
REQUIRED STRUCTURAL FILL (CY)[5]	5,190
NET AVAILABLE FILL (CY)[6]	(4,927)
ACCESS ROAD	
TOPSOIL - STOCKPILE (CY)[2]	980
SUBSOIL CUT (CY)[3]	5,389
TOTAL AVAILABLE STRUCTURAL FILL (CY)[4]	4,850
REQUIRED STRUCTURAL FILL (CY)[5]	162
NET AVAILABLE FILL (CY)[6]	4,688
PIPELINE PAD	
TOPSOIL - STOCKPILE (CY)[2]	276
SUBSOIL CUT (CY)[3]	1,207
TOTAL AVAILABLE STRUCTURAL FILL (CY)[4]	1,086
REQUIRED STRUCTURAL FILL (CY)[5]	51
NET AVAILABLE FILL (CY)[6]	1,035
TOTAL TOPSOIL - STOCKPILE (CY)	**2,373**
TOTAL EXCESS MATERIAL (CY)	**796**

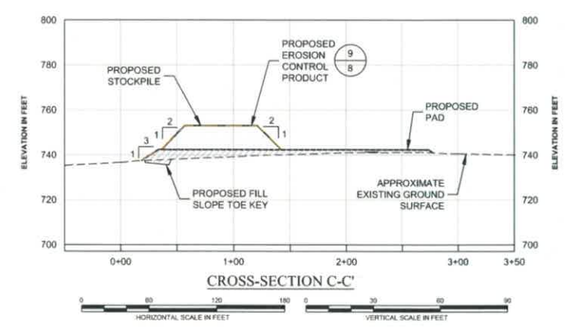
1. VOLUMES ARE BASED ON APPROXIMATE EXISTING GROUND SURFACE. EXISTING GROUND SURFACES ARE BASED ON LIDAR AND SHALL BE FIELD VERIFIED TO CONFIRM EXISTING CONDITIONS.
2. TOP SOIL VOLUME IS BASED ON IN-PLACE CUBIC YARDS; NO SWELL FACTOR APPLIED.
3. SUBSOIL VOLUME IS BASED ON IN-PLACE CUBIC YARDS; NO SWELL FACTOR APPLIED.
4. TOTAL AVAILABLE STRUCTURAL FILL AFTER APPLYING A 10 PERCENT SHRINKAGE FACTOR TO SUBSOIL CUT TO ACCOUNT FOR COMPACTED DENSITY.
5. REQUIRED STRUCTURAL FILL VOLUME BASED ON IN-PLACE (I.E. COMPACTED) CUBIC YARDS.
6. NET AVAILABLE FILL AFTER SUBTRACTING REQUIRED STRUCTURAL FILL FROM TOTAL AVAILABLE STRUCTURAL FILL.



CROSS-SECTION A-A'



CROSS-SECTION B-B'



CROSS-SECTION C-C'

NOTES:

1. THE BASE MAP HAS BEEN CREATED USING AVAILABLE AERIAL PHOTOGRAPHY PROVIDED BY PAMAP TILES 4300220OPAN, 4300210PAN, 4400220OPAN AND 4400210PAN. EXISTING TOPOGRAPHY HAS BEEN CREATED USING LIDAR CONTOURS PROVIDED BY PAMAP TILES 4300220OPAN, 4300210PAN, 4400220OPAN AND 4400210PAN AND TOPOGRAPHIC SURVEY BY HAWBAKER ENGINEERING, NOVEMBER 2019.
2. PROPERTY LINES AND OWNER INFORMATION ARE TAKEN FROM LYCOMING COUNTY TAX ASSESSMENT MAPS AND RECORDS. SURVEYED PROPERTY LINES PROVIDED BY HAWBAKER ENGINEERING, NOVEMBER 2019.
3. THIS PLAN IS IN THE PENNSYLVANIA STATE PLANE NORTH, NORTH AMERICAN DATUM 1983 (NAD 83) COORDINATE SYSTEM.
4. EVERY EFFORT MUST BE TAKEN TO AVOID EARTH DISTURBANCE AND EQUIPMENT TRACKING WITHIN THE PROPOSED INFILTRATION BERM AREAS, AND THE PROPOSED PONDING AREAS IMMEDIATELY UPGRADIENT OF THE INFILTRATION BERMS. THIS INSTALLATION MUST BE ACCOMPLISHED WITH CARE. EXCLUSION FENCE SHALL BE PLACED AROUND THESE AREAS PRIOR TO THE START OF EARTHWORK.
5. PROPOSED EROSION CONTROL PRODUCT OR EQUIVALENT SHALL BE PLACED ON ALL DISTURBED SLOPES >3H:1V AND WITHIN 100' OF STREAMS AND WETLAND CROSSINGS.

LEGEND

NOTE: LEGEND IS TYPICAL, NOT ALL OBJECTS IN LEGEND APPEAR IN PLAN.

- 1550 — EXISTING CONTOURS
- EXISTING WETLANDS
- EXISTING RIPARIAN FOREST BUFFER
- EXISTING STRUCTURE
- EXISTING PROPERTY LINE
- EXISTING PROPERTY LINE (SURVEYED)
- OE — EXISTING OVERHEAD ELECTRIC LINE
- UE — EXISTING UNDERGROUND ELECTRIC LINE
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- EXISTING TREELINE
- EXISTING MAPPED WATERCOURSE
- EXISTING FIELD VERIFIED STREAM
- EXISTING FLOODWAY
- EXISTING FEMA 100YR FLOODPLAIN
- EXISTING FENCE
- EXISTING CULVERT
- 1490 — PROPOSED CONTOURS
- PROPOSED GRAVEL ROAD AND PAD SURFACE
- W — PROPOSED UNDERGROUND FRESHWATER PIPELINE
- U — PROPOSED UNDERGROUND UTILITY CORRIDOR
- UE — PROPOSED UNDERGROUND ELECTRIC
- A — PROPOSED UNDERGROUND AIR LINE
- 12 — PROPOSED 12" FILTER SOCK
- 18 — PROPOSED 18" FILTER SOCK
- 24 — PROPOSED 24" FILTER SOCK
- 32 — PROPOSED 32" FILTER SOCK
- PROPOSED FILTER SOCK SIZE DESCRIPTOR (INCH)
- PROPOSED WATERBAR
- PROPOSED TRENCH PLUG
- PROPOSED EROSION CONTROL PRODUCT
- PROPOSED STOCKPILE BOUNDARY
- PROPOSED CHANNEL
- PROPOSED FILL SLOPE TOE KEY
- PROPOSED EXCLUSION FENCE (CONSTRUCTION FENCE)
- PROPOSED ESCGP-3 PERMIT BOUNDARY / LIMIT OF DISTURBANCE
- PROPOSED 150' LONG ROCK CONSTRUCTION ENTRANCE
- PROPOSED ROCK CONSTRUCTION ENTRANCE WITH WASH RACK
- PROPOSED CULVERT WITH PLUNGE POOL
- 2H:1V — PROPOSED SLOPE
- WeB — EXISTING SOIL BOUNDARY AND DESCRIPTOR
- PORPOSED STRUCTURE

DRAFT

This drawing, its contents, and each component of this drawing are the property of and proprietary to ARM Group Inc. and shall not be reproduced or used in any manner except for the purpose identified on the Title Block, and only by or on behalf of this client for the identified project unless otherwise authorized by the express, written consent of ARM Group Inc.

ARM Group Inc.
Engineers and Scientists
www.armgroup.net

No.	Revision	Date	By

scale	AS NOTED
date	12/13/2019
project no.	190736
designed	ALG
drawn	MDR
checked	JAW

SITE PLAN AND CROSS-SECTIONS
EROSION AND SEDIMENT CONTROL PLAN

GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

prepared for: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

drawing title

Sheet 4

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FAQs

REQUIREMENT E

PASPGP-5 Cumulative Impact Project Screening Form

A R M G r o u p L L C

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATERWAYS ENGINEERING AND WETLANDS

PASPGP-5 REVIEW CHECKLIST

NOTE: This checklist and instructions can be used as a tool to assist permit applicants to determine if a proposed project will be either a U.S. Army Corp of Engineer's Reporting or Non-Reporting action. It is not required to be submitted for a Chapter 105 permit review but, if provided, it may provide clarity to DEP during the permit review.

Applicant / Project Name: Pennsylvania General Energy Company, L.L.C. / Loyalsock / Shawnee Freshwater System	County(ies): Lycoming

YES ☐ NO ☒ 1. Is any of the proposed work located waterward of the ordinary high water mark (OHWM) of any of the ineligible waterbodies identified in the instructions?

YES ☐ NO ☒ 2. Does the proposed work result in the diversion of more than 10,000 gallons per day of surface water or groundwater into or out of the Great Lakes Basin (Lake Erie Watershed)?

*****

YES ☐ NO ☒ 3. Does the application/registration include any Single and Complete Projects that propose the permanent conversion of greater than 0.10 acre of forested and/or shrub-scrub wetlands in association with a regulated activity?

YES ☐ NO ☒ 4. Is the application/registration associated with a Single and Complete Project whereby a previous Department of the Army authorization has been issued through an Individual Permit, a Nationwide Permit, or a PASPGP processed by the Corps as a Category III/Reporting Activity? **If YES, please complete the following table.**

Authorization Type	Authorization Number	Date (mm/dd/yyyy)	Federal Permitted Impacts	
			Wetlands	Waters

YES ☐ NO ☒ 5. Does the proposed project require the preparation of an Environmental Impact Statement?

YES ☐ NO ☒ 6. Does the proposed regulated activity or area of indirect impact (secondary impact) extend across state boundaries (i.e., the work in not wholly located within the Commonwealth of Pennsylvania)?

YES ☐ NO ☒ 7. Does the Single and Complete Project involve the construction or expansion of a residential, commercial or institutional subdivision or development?

YES ☐ NO ☒ 8. Does greater than 0.25 acre of wetland(s) exist within the property boundary that are not proposed to be directly impacted as part of this application/registration? **If YES, provide wetland acreage: _____ acres.**

YES ☐ NO ☒ 9. Are you proposing to protect the wetland area(s) through a deed restriction or conservation easement that follows the Corps' Model Protective Covenant?

YES ☐ NO ☒ 10. Does the proposed work temporarily impact waters and/or wetlands that will remain in place for more than 1 year?

YES ☐ NO ☒ 11. Are you proposing to do work in the Delaware River (upstream from the U.S. Route 202 Bridge in New Hope, Pennsylvania.) and/or the Lehigh River (from the mouth to Francis E. Walter Dam, located in Carbon and Luzerne County, Pennsylvania between March 15 and June 30?

YES ☐ NO ☒ 12. Does the proposed work occur in any of the waters listed in the instructions?

YES ☒ NO ☐ 13. Will you comply with all of the identified conservation measures?

YES ☒ NO ☐ 14. Is there any other pending applications/registrations with the DEP or Corps that are necessary for this total proposed project to function and meet its intended purpose? **If YES, provide following information.**

Application / Registration Number / Type	Project Name	Date of Submittal to DEP (mm/dd/yyyy)	DEP / CCD Reviewing Office	Corps Reviewing Office
ESCGP-3	Loyalsock / Shawnee Freshwater System	01/22/2020	NCRO	N/A

REQUIREMENT G

Pennsylvania Natural Diversity Inventory (PNDI) Documentation

A R M G r o u p L L C

1. PROJECT INFORMATION

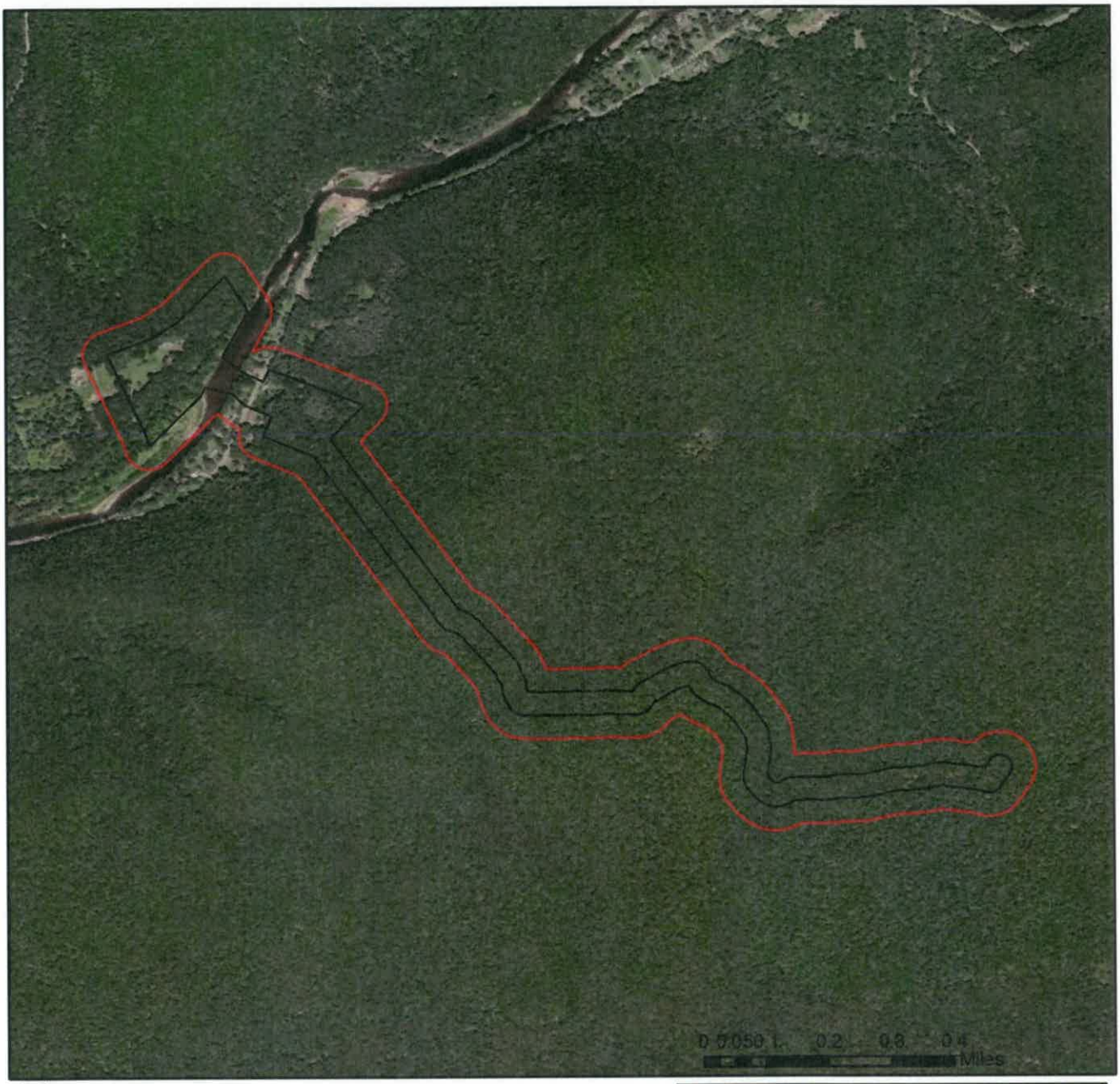
Project Name: **Loyalsock/Shawnee Freshwater System**
Date of Review: **11/11/2019 03:52:44 PM**
Project Category: **Water extraction/transfer, Other**
Project Area: **63.70 acres**
County(s): **Lycoming**
Township/Municipality(s): **GAMBLE; PLUNKETTS CREEK**
ZIP Code: **17754**
Quadrangle Name(s): **HUNTERSVILLE; MONTOURSVILLE NORTH**
Watersheds HUC 8: **Lower West Branch Susquehanna**
Watersheds HUC 12: **Little Bear Creek-Loyalsock Creek**
Decimal Degrees: **41.353149, -76.885726**
Degrees Minutes Seconds: **41° 21' 11.3347" N, 76° 53' 8.6133" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	**Conservation Measure**	**No Further Review Required, See Agency Comments**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

Pennsylvania Natural Diversity Inventory (PNDI) records indicate that while threatened and endangered and/or special concern species and resources are in the project vicinity and that recommended Conservation Measures should be implemented in their entirety to avoid and minimize impacts to these species, no further coordination is required with the jurisdictional agencies. If a DEP permit is required for this project, DEP has the discretion to incorporate one or more Conservation Measures into its permit. This response does not reflect potential agency concerns regarding potential impacts to other ecological resources, such as wetlands.

Loyalsock/Shawnee Freshwater System



Project Boundary

Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
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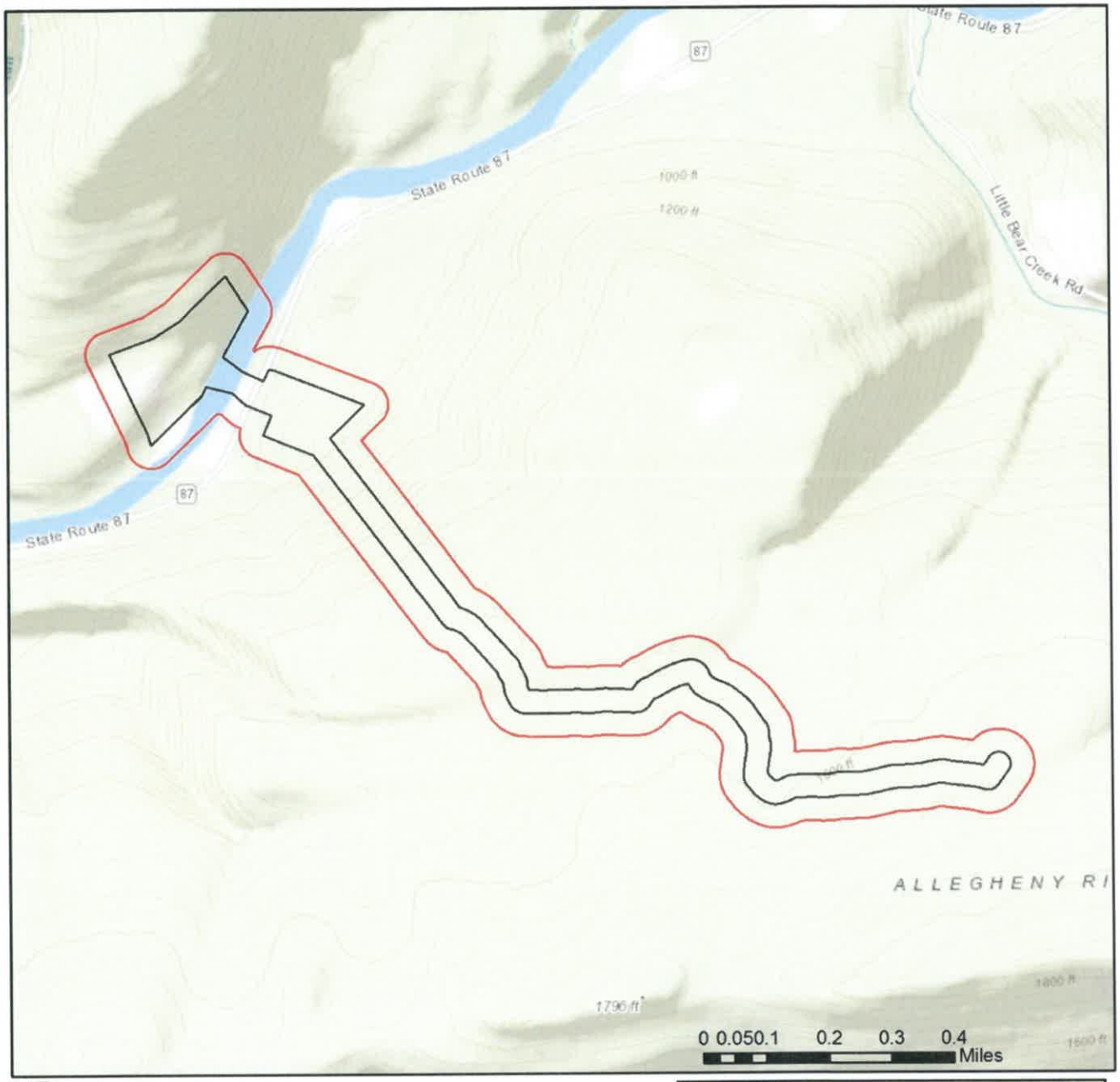
Loyalsock/Shawnee Freshwater System



Project Boundary

Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission
RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources
RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission
RESPONSE:

Conservation Measure: Projects conducted in the occupied range of the timber rattlesnake (*Crotalus horridus*) have a high risk of encountering this species during construction.
1) Workers responsible for implementing this project should be advised that timber rattlesnakes may be encountered and that avoidance is the best means of minimizing risks to personal safety. It is suggested that safety protocols be implemented for timber rattlesnake encounters and workers should be advised that the timber rattlesnake is a state protected species and is not to be harmed. Killing of timber rattlesnakes is prohibited by the Commission pursuant to 58 Pa. Code Section 79.6.
2) We recommend that a timber rattlesnake habitat assessment be conducted in the project area by a qualified timber rattlesnake surveyor in order to assist project planners in avoiding disturbance of critical habitat. A list of qualified surveyors and habitat assessment protocol can be found here.
• See http://www.fishandboat.com/Resource/AmphibiansandReptiles/Pages/TimberRattlesnakeConservation.aspx for a list of Qualified Timber Rattlesnake Surveyors
• See http://www.fishandboat.com/Resource/AmphibiansandReptiles/Pages/TimberRattlesnakeConservation.aspx for the Timber Rattlesnake Habitat Protocol
3) If potential den (over-wintering) habitat is located during the habitat assessment, we recommend that the project be modified to avoid direct impacts to this irreplaceable habitat, or a Timber Rattlesnake Presence-Absence Survey of potential den (over-wintering) habitat be conducted in the habitats that are currently slated for direct disturbance to determine the presence or absence of rattlesnake hibernacula in the project area. Survey reports should be sent to PFBC for review and consultation. This information is necessary to allow PFBC to formulate recommendations to avoid adverse impacts to this species of special concern.
• See http://www.fishandboat.com/Resource/AmphibiansandReptiles/Pages/TimberRattlesnakeConservation.aspx for the Timber Rattlesnake Presence-Absence Survey Protocol
4) If potential or occupied gestation habitat is located during the habitat assessment and cannot be avoided by the proposed development, we recommend that this habitat be replaced using our habitat creation guidelines.
• See http://www.fishandboat.com/Resource/AmphibiansandReptiles/Pages/TimberRattlesnakeConservation.aspx for the PFBC Gestation Habitat Creation Guidelines
5) Tree clearing and timbering within potential timber rattlesnake critical habitats (135°-275° aspect, >10% slope) should be conducted from October 16 to April 14 in order to avoid encounters with timber rattlesnakes.
6) For the safety of workers and snakes, the Commission recommends that a PFBC permitted timber rattlesnake biologist who has the proper skills to handle this venomous species be on-site prior to and during construction, between April 15 and October 15, to inspect and clear the area (including staging areas and access roads) of timber rattlesnakes and to capture and remove any rattlesnakes that may interfere with work activities.
See http://www.fishandboat.com/Resource/AmphibiansandReptiles/Pages/TimberRattlesnakeConservation.aspx for the Monitoring Guidelines
7) If concerns arise during construction over high numbers of snake encounters or habitat alteration, please contact the PFBC at 814-359-5237 for consultation with our biologists.

PFBC Species: (Note: The Pennsylvania Conservation Explorer tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)

Scientific Name	Common Name	Current Status
Sensitive Species**		Special Concern Species*

U.S. Fish and Wildlife Service
RESPONSE:

No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq. is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictional agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. Two review options are available to permit applicants for handling PNDI coordination in conjunction with DEP's permit review process involving either T&E Species or species of special concern. Under sequential review, the permit applicant performs a PNDI screening and completes all coordination with the appropriate jurisdictional agencies prior to submitting the permit application. The applicant will include with its application, both a PNDI receipt and/or a clearance letter from the jurisdictional agency if the PNDI Receipt shows a Potential Impact to a species or the applicant chooses to obtain letters directly from the jurisdictional agencies. Under concurrent review, DEP, where feasible, will allow technical review of the permit to occur concurrently with the T&E species consultation with the jurisdictional agency. The applicant must still supply a copy of the PNDI Receipt with its permit application. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. The applicant and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at https://conservationexplorer.dcnr.pa.gov/content/resources.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a preliminary screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552
Email: RA-HeritageReview@pa.gov

U.S. Fish and Wildlife Service
Pennsylvania Field Office
Endangered Species Section
110 Radnor Rd; Suite 101
State College, PA 16801
NO Faxes Please

PA Fish and Boat Commission
Division of Environmental Services
595 E. Rolling Ridge Dr., Bellefonte, PA 16823
Email: RA-FBPACENOTIFY@pa.gov

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA 17110-9797
Email: RA-PGC_PNDI@pa.gov
NO Faxes Please

7. PROJECT CONTACT INFORMATION

Name: Ricky Ristau II
Company/Business Name: Pennsylvania General Energy Company, L.L.C.
Address: 120 Market Street
City, State, Zip: Warren, PA 16365
Phone: (814) 723-3230 Fax: (814) 723-3502
Email: rickyristau@penngeneralenergy.com

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

Ricky J. Ristau II 11-14-19

applicant/project proponent signature date

REQUIREMENT H

Site Plans

A R M G r o u p L L C

NOTES:

1. THE BASE MAP HAS BEEN CREATED USING AVAILABLE AERIAL PHOTOGRAPHY PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN. EXISTING TOPOGRAPHY HAS BEEN CREATED USING LIDAR CONTOURS PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN AND TOPOGRAPHIC SURVEY BY HAWBAKER ENGINEERING, NOVEMBER 2019.
2. PROPERTY LINES AND OWNER INFORMATION ARE TAKEN FROM LYCOMING COUNTY TAX ASSESSMENT MAPS AND RECORDS. SURVEYED PROPERTY LINES PROVIDED BY HAWBAKER ENGINEERING, NOVEMBER 2019.
3. THIS PLAN IS IN THE PENNSYLVANIA STATE PLANE NORTH, NORTH AMERICAN DATUM 1983 (NAD 83) COORDINATE SYSTEM.
4. EVERY EFFORT MUST BE TAKEN TO AVOID EARTH DISTURBANCE AND EQUIPMENT TRACKING WITHIN THE PROPOSED INFILTRATION BERM AREAS, AND THE PROPOSED PONDING AREAS IMMEDIATELY UPGRADIENT OF THE INFILTRATION BERMS. THIS INSTALLATION MUST BE ACCOMPLISHED WITH CARE. EXCLUSION FENCE SHALL BE PLACED AROUND THESE AREAS PRIOR TO THE START OF EARTHWORK.
5. PROPOSED EROSION CONTROL PRODUCT OR EQUIVALENT SHALL BE PLACED ON ALL DISTURBED SLOPES >3H:1V AND WITHIN 100' OF STREAMS AND WETLAND CROSSINGS.
6. CHANNEL MUST BE RESTORED TO PREVIOUS CONDITIONS WITHIN 24 HOURS OF PIPELINE INSTALLATION.
7. PGE INTENDS TO MAKE GRAVEL SURFACE IMPROVEMENTS TO THE EXISTING GRAVEL ACCESS DRIVE IN ACCORDANCE WITH A SEPARATE ROAD MAINTENANCE PLAN. THE LIMITS OF THE EXISTING ROADWAY WILL NOT BE EXPANDED OR WIDENED.

LEGEND

NOTE: LEGEND IS TYPICAL, NOT ALL OBJECTS IN LEGEND APPEAR IN PLAN.

- 1550 — EXISTING CONTOURS
- EXISTING WETLANDS
- EXISTING RIPARIAN FOREST BUFFER
- EXISTING STRUCTURE
- EXISTING PROPERTY LINE
- EXISTING PROPERTY LINE (SURVEYED)
- OE — EXISTING OVERHEAD ELECTRIC LINE
- UE — EXISTING UNDERGROUND ELECTRIC LINE
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- EXISTING TREELINE
- EXISTING MAPPED WATERCOURSE
- EXISTING FIELD VERIFIED STREAM
- EXISTING FLOODWAY
- EXISTING FEMA 100YR FLOODPLAIN
- X — EXISTING FENCE
- EXISTING CULVERT
- 1490 — PROPOSED CONTOURS
- PROPOSED GRAVEL ROAD AND PAD SURFACE
- W — PROPOSED UNDERGROUND FRESHWATER PIPELINE
- U — PROPOSED UNDERGROUND UTILITY CORRIDOR
- UE — PROPOSED UNDERGROUND ELECTRIC
- A — PROPOSED UNDERGROUND AIR LINE
- 18 — PROPOSED 18" FILTER SOCK
- 24 — PROPOSED 24" FILTER SOCK
- 32 — PROPOSED 32" FILTER SOCK
- 18 24 — PROPOSED FILTER SOCK SIZE DESCRIPTOR (INCH)
- PROPOSED WATERBAR
- PROPOSED TRENCH PLUG
- PROPOSED EROSION CONTROL PRODUCT
- PROPOSED STOCKPILE BOUNDARY
- PROPOSED CHANNEL
- PROPOSED FILL SLOPE TOE KEY
- PROPOSED EXCLUSION FENCE (CONSTRUCTION FENCE)
- PROPOSED ESCGP-3 PERMIT BOUNDARY / LIMIT OF DISTURBANCE
- PROPOSED 150' LONG ROCK CONSTRUCTION ENTRANCE
- PROPOSED ROCK CONSTRUCTION ENTRANCE WITH WASH RACK
- PROPOSED CULVERT WITH PLUNGE POOL
- 2H:1V — PROPOSED SLOPE
- WeB — EXISTING SOIL BOUNDARY AND DESCRIPTOR
- PROPOSED STRUCTURE

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL DEAN RACE
ENGINEER
NO. PE083105

This Drawing shall not be used for tender or construction unless sealed.

I do hereby certify to the best of my knowledge, information, and belief, that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 78a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

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No.	Revision	Date	By

scale 1" = 200'
date 01/17/2020
project no. 190736
SCALE IN FEET 0 200 400 800

designed ALG
checked MDR
drawn JAW

drawing title
TOTAL PROJECT AREA PLAN
EROSION AND SEDIMENT CONTROL PLAN

GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

project title
LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

Sheet 2

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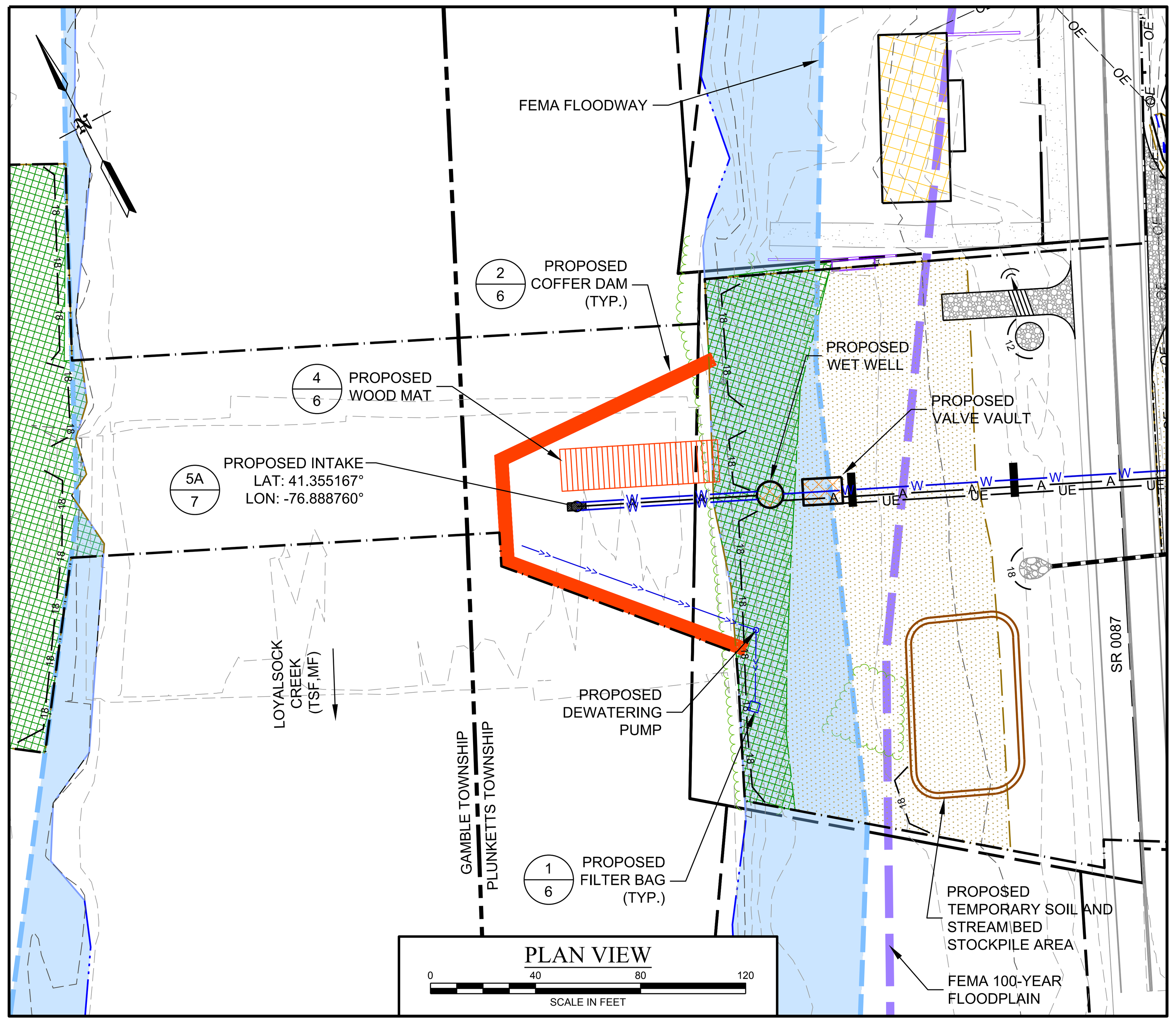
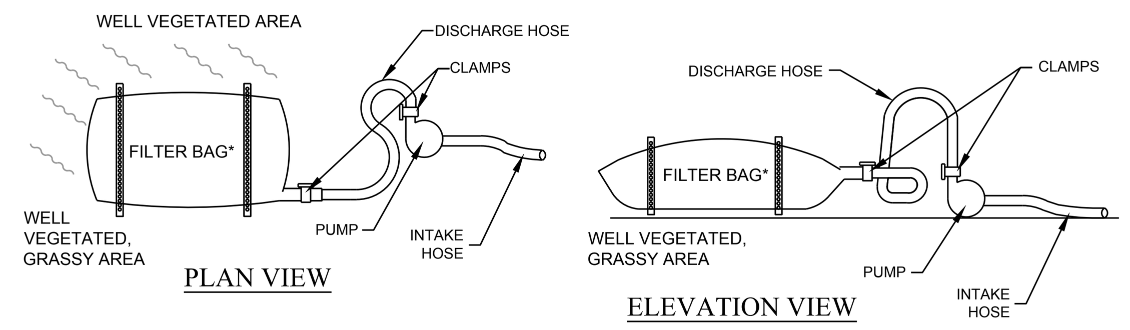


PLAN VIEW

0 40 80 120
SCALE IN FEET



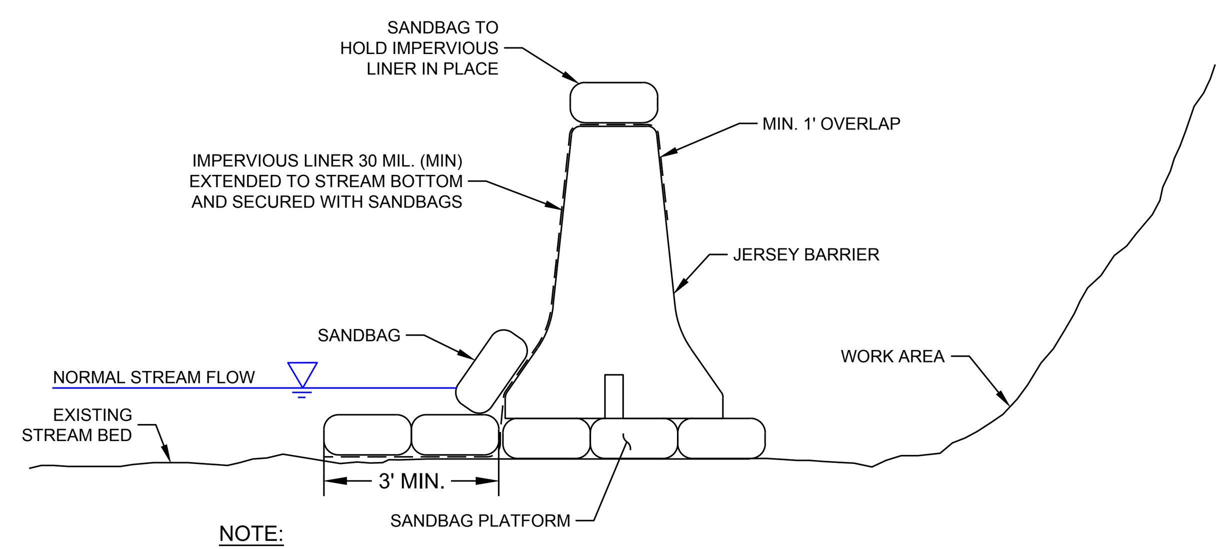
PLAN VIEW

ELEVATION VIEW

NOTES:

1. FILTER BAGS SHALL BE MADE FROM NON-WOVEN GEOTEXTILE MATERIAL SEWN WITH HIGH STRENGTH, DOUBLE STITCHED "J" TYPE SEAMS. THEY SHALL BE CAPABLE OF TRAPPING PARTICLES LARGER THAN 150 MICRONS.
2. A SUITABLE MEANS OF ACCESSING THE BAG WITH MACHINERY REQUIRED FOR DISPOSAL PURPOSES MUST BE PROVIDED. FILTER BAGS SHALL BE REPLACED WHEN THEY BECOME ½ FULL. SPARE BAGS SHALL BE KEPT AVAILABLE FOR REPLACEMENT OF THOSE THAT HAVE FAILED OR ARE FILLED.
3. BAGS SHALL BE LOCATED IN WELL-VEGETATED (GRASSY) AREAS, AND DISCHARGE ONTO STABLE, EROSION RESISTANT AREAS. WHERE THIS IS NOT POSSIBLE, A GEOTEXTILE FLOW PATH SHALL BE PROVIDED. BAGS SHALL NOT BE PLACED ON SLOPES GREATER THAN 5%.
4. THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED.
5. THE PUMPING RATE SHALL BE NO GREATER THAN 750 GPM OR ½ THE MAXIMUM SPECIFIED BY THE MANUFACTURER, WHICHEVER IS LESS. PUMP INTAKES SHOULD BE FLOATING AND SCREENED.
6. FILTER BAGS SHALL BE INSPECTED DAILY. IF ANY PROBLEM IS DETECTED, PUMPING SHALL CEASE IMMEDIATELY AND NOT RESUME UNTIL THE PROBLEM IS CORRECTED.

1 STANDARD CONSTRUCTION DETAIL #3-16
TYPICAL PUMPED WATER FILTER BAG
NOT TO SCALE



NOTE:
SAND BAGS BENEATH PLASTIC CAN BE SUBSTITUTED FOR CONCRETE DEAD MEN OR BARRIERS. CLEAR STREAM BED OF SIGNIFICANT ROCKS. PLACE LAYER OF SAND BAGS AS A FOUNDATION LAYER AND PLACE CONCRETE DEAD MEN OR BARRIERS ON TOP. DRAPE PLASTIC OVER CONCRETE AND ANCHOR.

2 DETAIL
TEMPORARY COFFER DAM DETAIL
NOT TO SCALE

UTILITY STREAM CROSSING NOTES

1. ALL UTILITY LINES UNDER STREAMBEDS SHALL BE LOCATED SUCH THAT THERE WILL BE A MINIMUM OF FOUR (4) FEET OF COVER BETWEEN THE TOP OF THE UTILITY LINE OR ENCASEMENT AND THE LOWEST POINT IN THE NATURAL CONTOUR OF THE STREAMBED, UNLESS THE UTILITY LINE IS IN ROCK, WHERE A MINIMUM COVER OF ONE (1) FOOT SHALL BE PROVIDED.
2. TRENCHES EXCAVATED FOR THE INSTALLATION OF UTILITY LINES SHALL BE THE MINIMUM WIDTH NECESSARY. AS SOON AS THE UTILITY LINE IS INTALLED AND TESTED TO ASCERTAIN NO LEAKAGE, APPROPRIATE NEW OR PREVIOUSLY EXCAVATED BACKFILL MATERIAL SHALL BE PLACED IN THE TRENCH AND THE AREA RESTORED TO ITS ORIGINAL CONDITION AND ELEVATION AND STABILIZED. BACKFILL MATERIAL STORED IN CONNECTION WITH THE INSTALLATION MUST BE PROPERLY RETAINED OUT OF THE FLOODWAY SO AS TO PREVENT ITS DISCHARGE, WASHINGS, OR RUNOFF FROM ENTERING THE WATERWAY PRIOR TO ITS PLACEMNET AS BACKFILL.
3. ADEQUATE MEASURES SHALL BE USED TO PREVENT SEDIMENTATION FROM THE TRENCH FROM ENTERING THE STREAM.
4. THE BACKFILLING OF THE TRENCH IN WHICH THE PIPE WILL BE LAID SHALL BE DONE SO AS TO ELIMINATE THE FORMATION OF A PERMANENT RIDGE IN THE STREAMBED.
5. ARCHEAOLOGICAL ARTIFACTS DISCOVERED DURING THE PERFORMANCE OF WORK AUTHORIZED UNDER THIS GENERAL PERMIT MUST BE ADEQUATELY PROTECTED AND THEIR DISCOVERY PROMPTLY REPORTED TO THE BUREAU OF HISTORIC PRESERVATION, HISTORICAL AND MUSEUM COMMISSION, 400 NORTH STREET, SECOND FLOOR, HARRISBURG, PA 17120-0093, TELEPHONE (717) 783-8946.
6. WHENEVER POSSIBLE, IN ACCORDANCE WITH BEST CONSTRUCTION METHODS, UTILITY LINE CORSSINGS ARE TO BE MADE "IN THE DRY" BY INSTALLING SANDBAG AND PLASTIC DAMS AND PIPING STREAM FLOW THROUGH THE AFFECTED AREA.
7. PRIOR TO THE USE OF EXPLOSIVES IN A WATERCOURSE OR BODY OF WATER THE PERMITTEE SHALL SECURE A WRITTEN PERMIT FROM THE FISH AND BOAT COMMISSION, UNDER THE PENNSYLVANIA FISH AND BOAT CODE 30 Pa. C.S. §2906 (RELATING TO PERMITS FOR USE OF EXPLOSIVES). REQUESTS SHOULD BE DIRECTED TO THE FISH AND BOAT COMMISSION, DIVISION OF ENVIRONMENTAL SERVICES (SEE "EXHIBIT A").

GENERAL PIPELINE AND UTILITY LINE NOTES

1. TRENCHES EXCAVATED FOR THE INSTALLATION OF UTILITY LINES SHALL BE THE MINIMUM WIDTH NECESSARY. AS SOON AS THE UTILITY LINE IS INSTALLED AND TESTED TO ASCERTAIN NO LEAKAGE, APPROPRIATE NEW OR PREVIOUSLY EXCAVATED BACKFILL MATERIAL SHALL BE PLACED IN THE TRENCH AND THE AREA RESTORED TO ITS ORIGINAL CONDITION AND ELEVATION AND STABILIZED. BACKFILL MATERIAL STORED IN CONNECTION WITH THE INSTALLATION MUST BE PROPERLY RETAINED OUT OF THE FLOODWAY SO AS TO PREVENT ITS DISCHARGE, WASHINGS, OR RUNOFF FROM ENTERING THE WATERWAY PRIOR TO ITS PLACEMENT AS BACKFILL.
2. SOIL SUPPLEMENTS, SEED AND MULCH SHOULD BE APPLIED WITHIN FOUR DAYS OR IMMEDIATELY AFTER THE PIPELINE/UTILITY LINE IS INSTALLED. NOTE: TEMPORARY STABILIZATION IS REQUIRED WITHIN FOUR DAYS IF THERE IS TEMPORARY CESSATION OF AN EARTH DISTURBANCE ACTIVITY. MEANWHILE, PERMANENT STABILIZATION IS REQUIRED IMMEDIATELY UPON FINAL COMPLETION OF AN EARTH DISTURBANCE ACTIVITY OR ANY STAGE OR PHASE OF AN ACTIVITY.
3. LIMIT CLEARING AND GRUBBING TO CUTTING EXISTING VEGETATION RATHER THAN BULLDOZING THE VEGETATION. LIMIT TRENCH WIDTH TO WHAT IS NECESSARY TO INSTALL THE PIPE.
4. LIMIT DAILY TRENCH EXCAVATION TO THE LENGTH OF PIPE TO BE INSTALLED EACH DAY.
5. THE TRENCH IS TO BE BACKFILLED THE SAME DAY THE TRENCH IS DUG AND PIPE IS LAID.
6. FOR STEEL PIPELINES WITH WELDED JOINTS, THE LENGTH OF TIME REQUIRED FOR OPEN TRENCH OPERATIONS AT ANY STATION ALONG THE RIGHT-OF-WAY SHOULD NOT EXCEED 30 CALENDAR DAYS PER THE REQUIREMENTS ON PAGE 283 OF THE PADEP EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL, MARCH 2012.

EROSION AND SEDIMENT CONTROL FOR IN-CHANNEL WORK

1. WHENEVER POSSIBLE, WORK SHOULD BE SCHEDULED FOR LOW FLOW SEASONS. NORMAL FLOW SHOULD BE CONVEYED PAST THE WORK AREA BY MEANS OF A BYPASS CHANNEL, PIPE, PUMP, OR COFFERDAM. ALL SUCH BYPASSES SHOULD BE COMPLETED AND STABILIZED PRIOR TO DIVERTING FLOW.
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3. ALL EXCAVATED CHANNEL MATERIALS THAT WILL BE SUBSEQUENTLY USED AS BACKFILL SHOULD BE PLACED IN A TEMPORARY STOCKPILE LOCATED OUTSIDE THE CHANNEL. A SEDIMENT BARRIER SHOULD BE INSTALLED BETWEEN THE STORAGE PILE AND THE STREAM CHANNEL.
4. ALL EXCAVATED MATERIALS THAT WILL NOT BE USED ON SITE MUST BE IMMEDIATELY REMOVED TO A DISPOSAL SITE HAVING AN APPROVED EROSION AND SEDIMENT POLLUTION CONTROL PLAN.
5. ANY PUMPED WATER FROM EXCAVATED AREAS MUST BE FILTERED PRIOR TO DISCHARGING INTO WATERS OF THE COMMONWEALTH. THE USE OF FILTER BAGS IS ANOTHER ACCEPTABLE METHOD IF LOCATED ON A RELATIVELY FLAT (<5% SLOPE), WELL-VEGETATED AREA. THE BAG SHOULD BE DESIGNED TO TRAP PARTICLES LARGER THAN 150 MICRONS. THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED. WHEN THE BAG HAS BEEN FILLED TO 1/2 ITS TOTAL CAPACITY, IT SHOULD BE REPLACED WITH A NEW BAG AND PROPERLY DISPOSED. WHEREVER WELL-VEGETATED AREAS ARE NOT AVAILABLE, A GEOTEXTILE UNDERLAYMENT SHOULD BE USED. CONSIDERATION SHOULD BE GIVEN TO HOW THE BAG WILL BE ACCESSED AND REMOVED ONCE IT HAS BEEN 1/2 FILLED WITH SEDIMENT.
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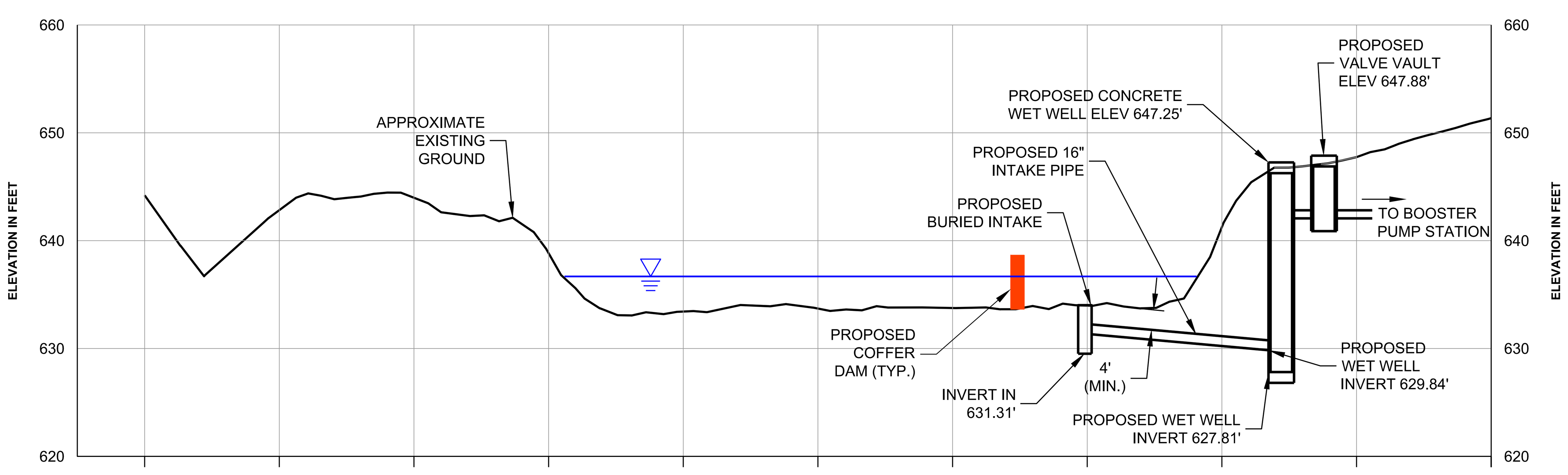
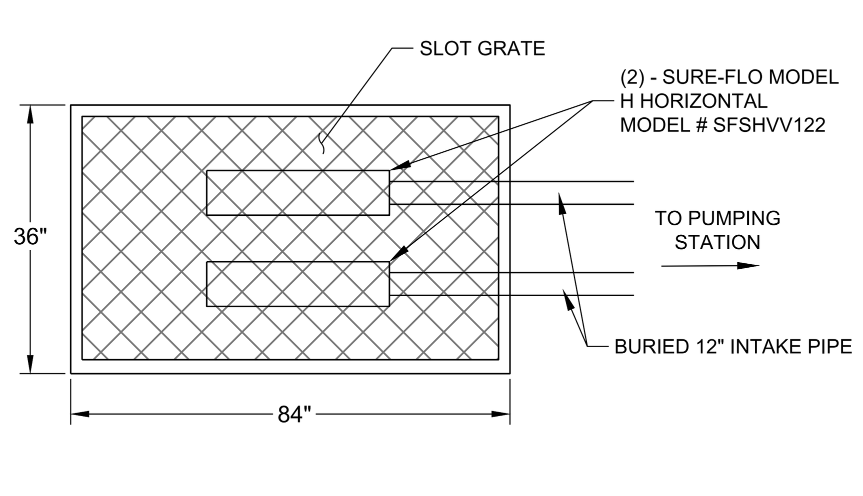
7. EXISTING STREAM BED MATERIALS WITHIN DISTURBED STREAM BED SHALL BE STOCKPILED AND PLACED BACK TO ORIGINAL CONDITIONS.
8. STREAM EMBANKMENTS SHALL BE LINED WITH EROSION CONTROL MATTING NAG BIONET S150BN OR EQUIVALENT AS SHOWN.
9. RIPARIAN RE-VEGETATION SHALL BE PLACED 50' FROM TOP OF STREAM BANK.



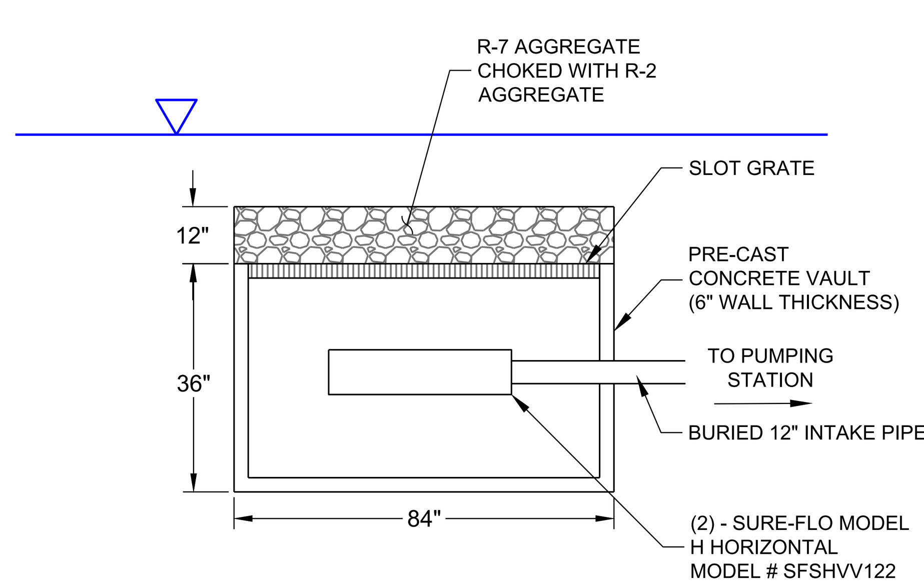
0 40 80 120
HORIZONTAL SCALE IN FEET

SUBMERGED INTAKE STRAINER CROSS SECTION

0 10 20 30
VERTICAL SCALE IN FEET

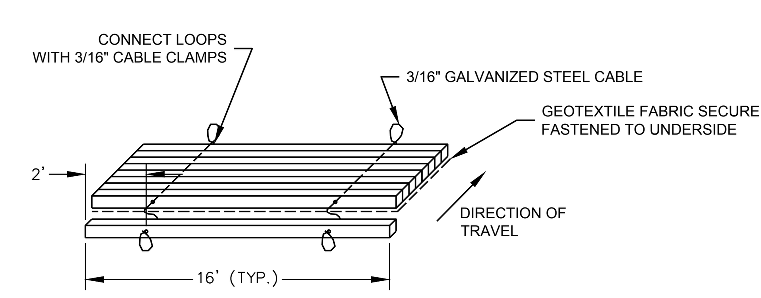


CONCRETE VAULT PLAN VIEW
NOT TO SCALE



CONCRETE VAULT SECTION VIEW
NOT TO SCALE

3 DETAIL
BURIED INTAKE STRAINER
NOT TO SCALE



NOTES:

1. IF TEMPORARY TRENCH DEWATERING IS NECESSARY, ALL PUMPED WATER MUST PASS THROUGH A FILTER BAG. THE FILTER BAG MUST BE SURROUNDED BY A FILTER SOCK AND PUMPED WATER SHOULD NOT DRAIN AWAY FROM THE WETLAND.
2. WOOD MAT WIDTH MAY BE INCREASED IF WIDER EQUIPMENT IS USED.

4 DETAIL
TYPICAL WOOD MAT FOR IN-STREAM WORK
NOT TO SCALE

NOTES:

1. THE BASE MAP HAS BEEN CREATED USING AVAILABLE AERIAL PHOTOGRAPHY PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN. EXISTING TOPOGRAPHY HAS BEEN CREATED USING LIDAR CONTOURS PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN AND TOPOGRAPHIC SURVEY BY HAWBAKER ENGINEERING, NOVEMBER 2019.
2. PROPERTY LINES AND OWNER INFORMATION ARE TAKEN FROM LYCOMING COUNTY TAX ASSESSMENT MAPS AND RECORDS. SURVEYED PROPERTY LINES PROVIDED BY HAWBAKER ENGINEERING, NOVEMBER 2019.
3. THIS PLAN IS IN THE PENNSYLVANIA STATE PLANE NORTH, NORTH AMERICAN DATUM 1983 (NAD 83) COORDINATE SYSTEM.
4. EVERY EFFORT MUST BE TAKEN TO AVOID EARTH DISTURBANCE AND EQUIPMENT TRACKING WITHIN THE PROPOSED INFILTRATION BERM AREAS, AND THE PROPOSED PONDING AREAS IMMEDIATELY UPGRADIENT OF THE INFILTRATION BERMS. THIS INSTALLATION MUST BE ACCOMPLISHED WITH CARE. EXCLUSION FENCE SHALL BE PLACED AROUND THESE AREAS PRIOR TO THE START OF EARTHWORK.
5. PROPOSED EROSION CONTROL PRODUCT OR EQUIVALENT SHALL BE PLACED ON ALL DISTURBED SLOPES >3H:1V AND WITHIN 100' OF STREAMS AND WETLAND CROSSINGS.
6. CHANNEL MUST BE RESTORED TO PREVIOUS CONDITIONS WITHIN 24 HOURS OF PIPELINE INSTALLATION.
7. PGE INTENDS TO MAKE GRAVEL SURFACE IMPROVEMENTS TO THE EXISTING GRAVEL ACCESS DRIVE IN ACCORDANCE WITH A SEPARATE ROAD MAINTENANCE PLAN. THE LIMITS OF THE EXISTING ROADWAY WILL NOT BE EXPANDED OR WIDENED.

LEGEND

NOTE: LEGEND IS TYPICAL, NOT ALL OBJECTS IN LEGEND APPEAR IN PLAN.

- 1550 — EXISTING CONTOURS
- EXISTING WETLANDS
- EXISTING RIPARIAN FOREST BUFFER
- EXISTING STRUCTURE
- EXISTING PROPERTY LINE
- EXISTING PROPERTY LINE (SURVEYED)
- OE — EXISTING OVERHEAD ELECTRIC LINE
- UE — EXISTING UNDERGROUND ELECTRIC LINE
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- EXISTING TREELINE
- EXISTING MAPPED WATERCOURSE
- EXISTING FIELD VERIFIED STREAM
- EXISTING FLOODWAY
- EXISTING FEMA 100YR FLOODPLAIN
- EXISTING FENCE
- EXISTING CULVERT
- 1490 — PROPOSED CONTOURS
- PROPOSED GRAVEL ROAD AND PAD SURFACE
- W — PROPOSED UNDERGROUND FRESHWATER PIPELINE
- U — PROPOSED UNDERGROUND UTILITY CORRIDOR
- UE — PROPOSED UNDERGROUND ELECTRIC
- A — PROPOSED UNDERGROUND AIR LINE
- 18 — PROPOSED 18" FILTER SOCK
- 24 — PROPOSED 24" FILTER SOCK
- 32 — PROPOSED 32" FILTER SOCK
- 18 24 — PROPOSED FILTER SOCK SIZE DESCRIPTOR (INCH)
- PROPOSED WATERBAR
- PROPOSED TRENCH PLUG
- PROPOSED EROSION CONTROL PRODUCT
- PROPOSED STOCKPILE BOUNDARY
- PROPOSED CHANNEL
- PROPOSED FILL SLOPE TOE KEY
- PROPOSED EXCLUSION FENCE (CONSTRUCTION FENCE)
- PROPOSED ESCGP-3 PERMIT BOUNDARY / LIMIT OF DISTURBANCE
- PROPOSED 150' LONG ROCK CONSTRUCTION ENTRANCE
- PROPOSED ROCK CONSTRUCTION ENTRANCE WITH WASH RACK
- PROPOSED CULVERT WITH PLUNGE POOL
- 2H:1V — PROPOSED SLOPE
- WeB — EXISTING SOIL BOUNDARY AND DESCRIPTOR
- PROPOSED STRUCTURE

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL DEAN RACE
ENGINEER
NO. PE083105

This Drawing shall not be used for tender or construction unless sealed.

I do hereby certify to the best of my knowledge, information, and belief, that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 78a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

This drawing, its contents, and each component of this drawing are the property of and proprietary to ARM Group LLC and shall not be reproduced or used in any manner except for the purpose identified on the Title Block, and only by or on behalf of this client for the identified project unless otherwise authorized by the express, written consent of ARM Group LLC.

ARM Group LLC
Engineers and Scientists
www.armgroup.net

No. | Revision | Date | By

designed ALG | checked MDR | drawn JAW | graphic scale
scale AS NOTED | date 01/17/2020 | project no. 190736

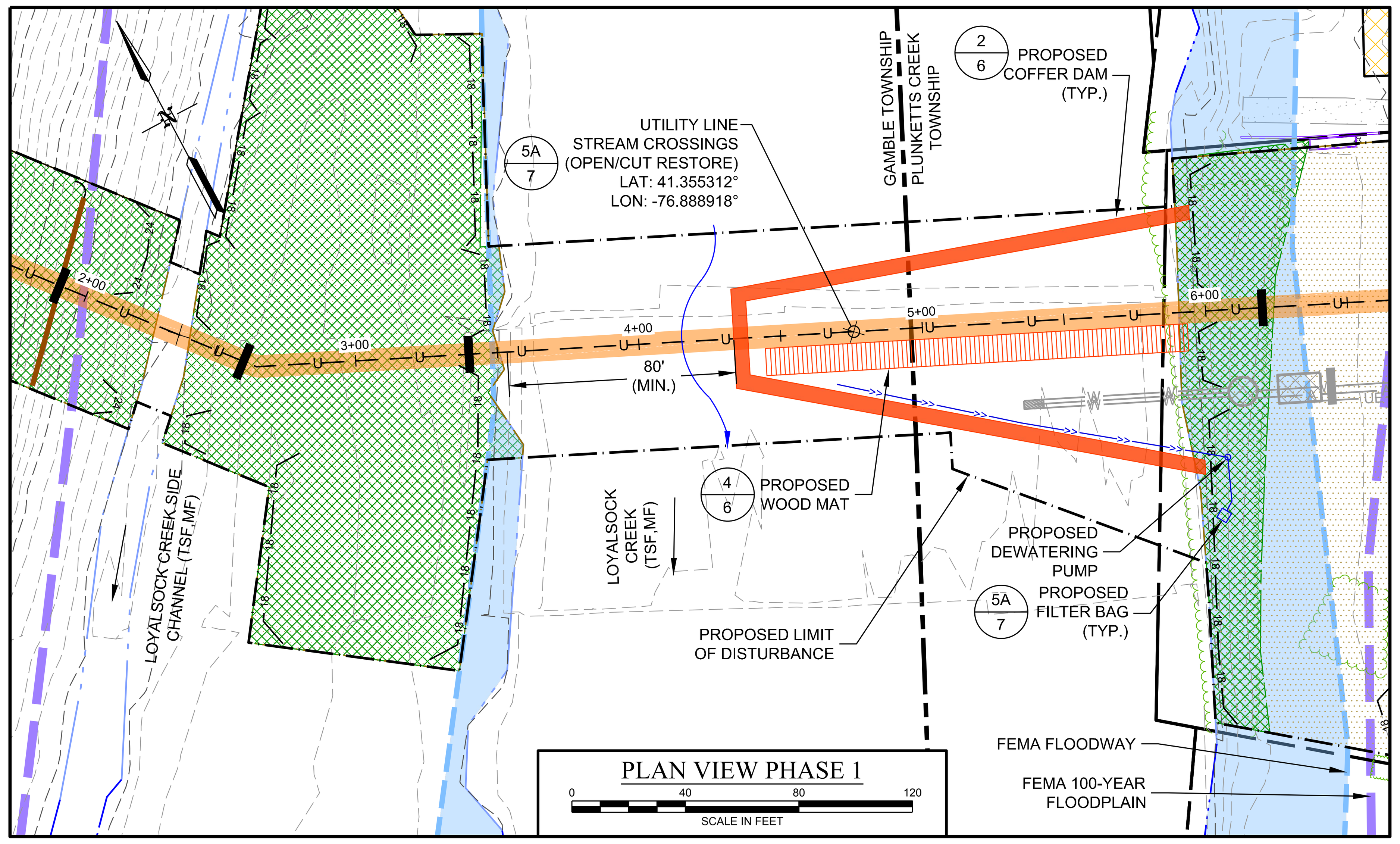
drawing title: FRESHWATER INTAKE DETAILS
EROSION AND SEDIMENT CONTROL PLAN

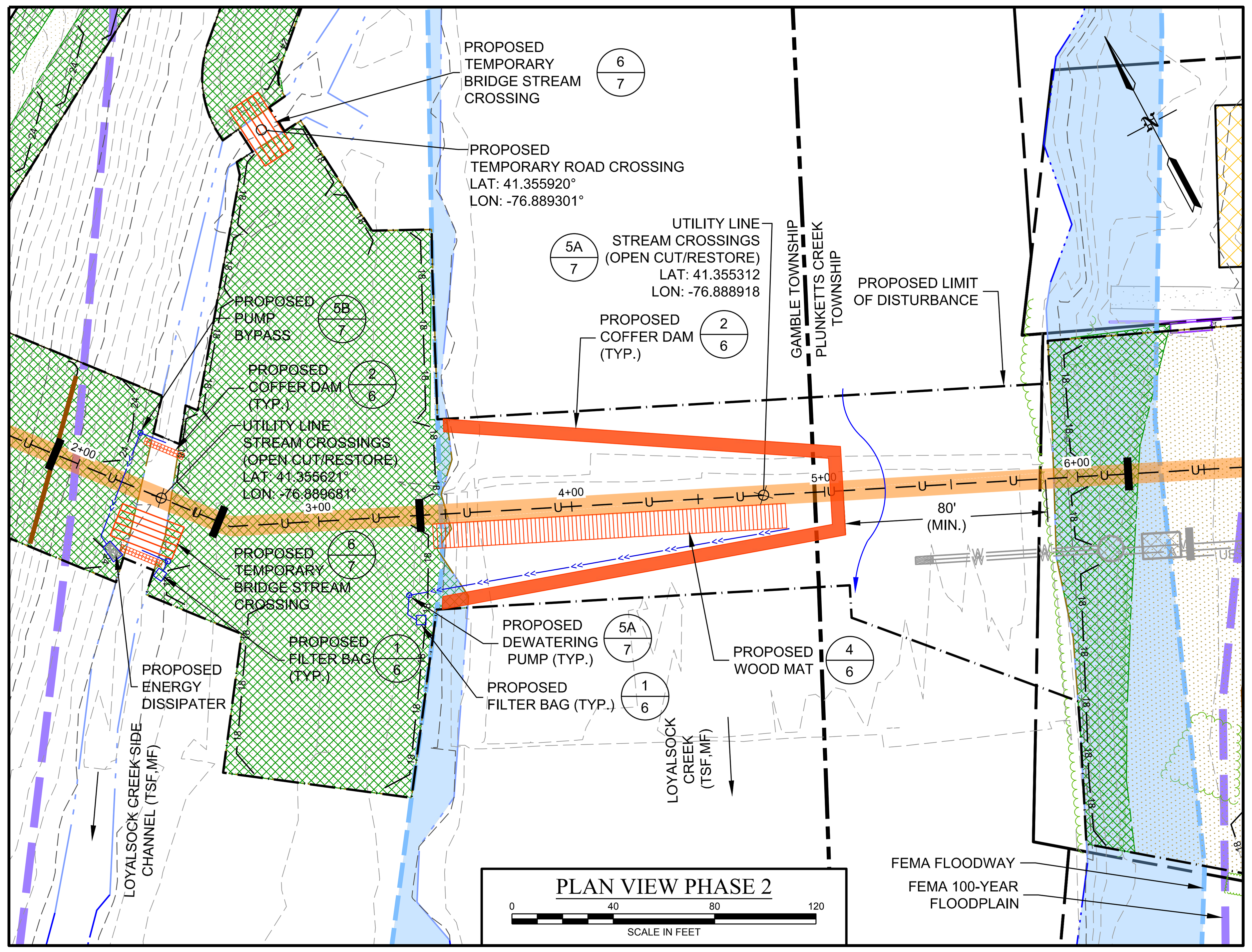
project title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

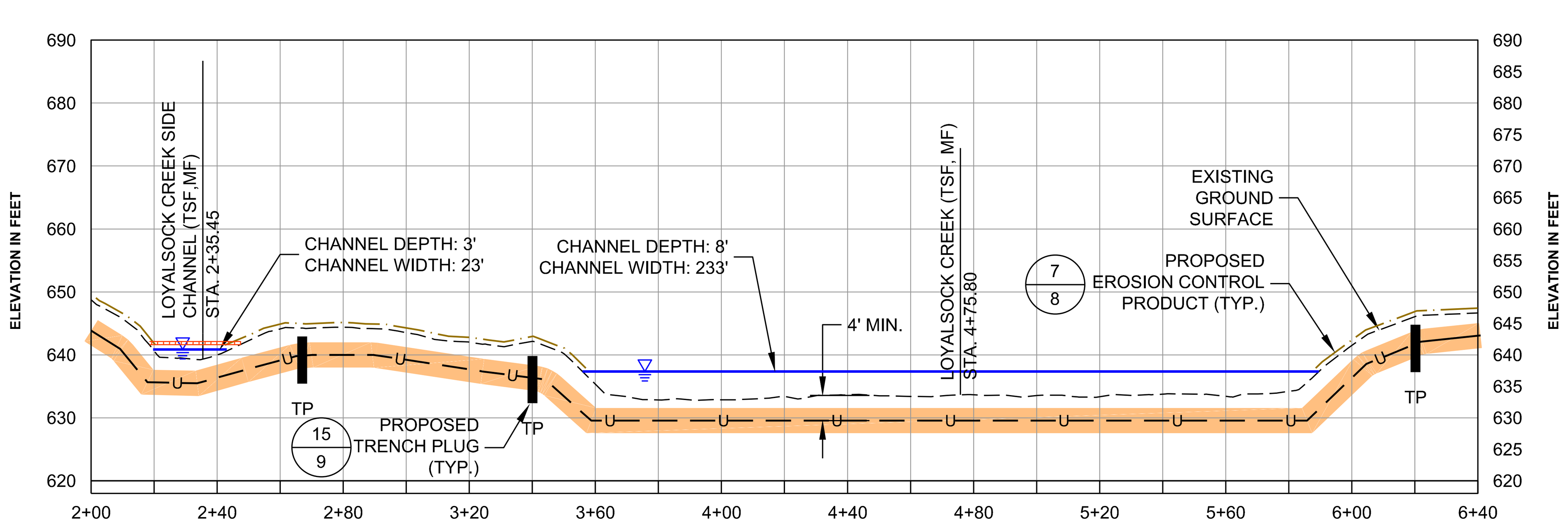
GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

Sheet 6

P:\PGE\190736 Loyalsock-Shawnee Freshwater System\Drwg\Production\E&S (24x36)\190736-ES-C-106_Intake Details.dwg Plotted: January 15, 2020

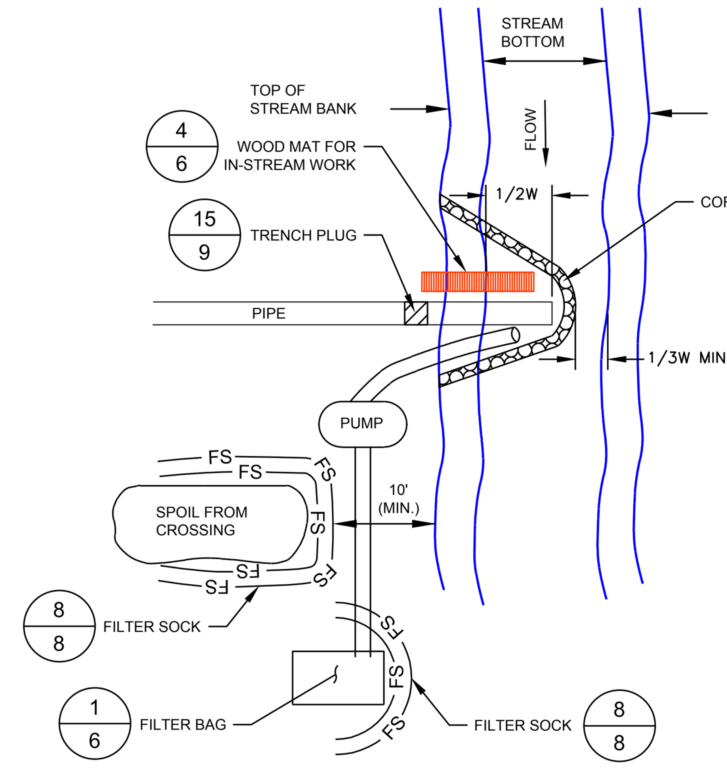






LOYALSOCK CREEK (TSF, MF) STREAM CROSSING

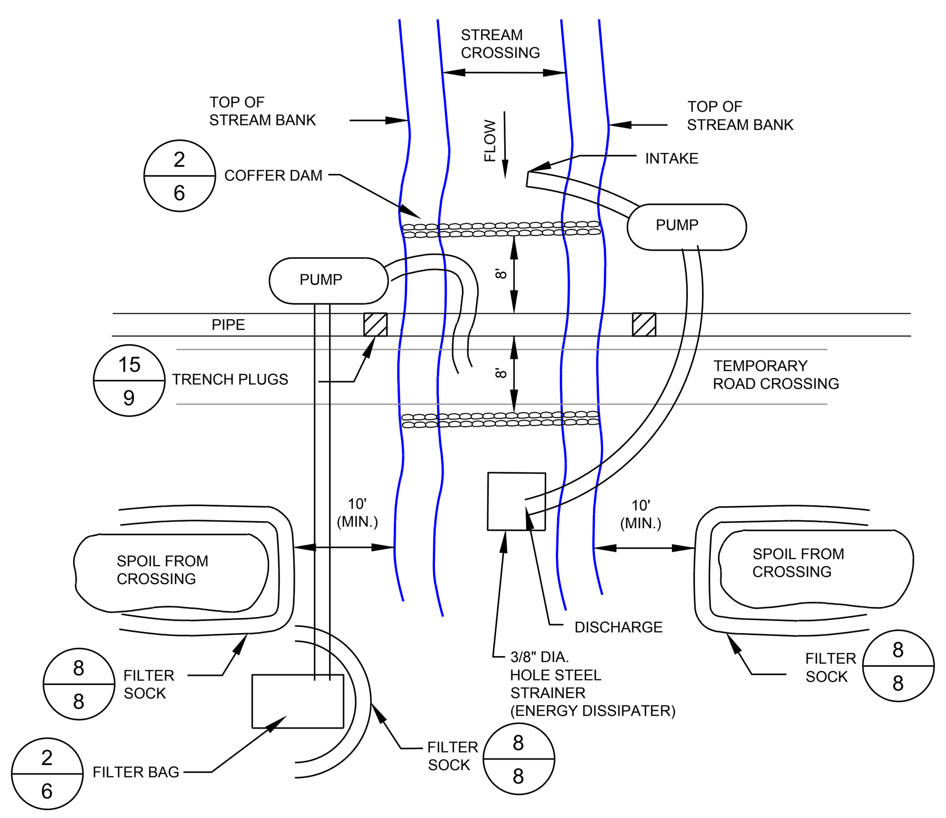
HORIZONTAL SCALE IN FEET — VERTICAL SCALE IN FEET



NOTES:

1. WORK REQUIRING STREAM DIVERSION SHALL BE CONDUCTED DURING LOW-FLOW, DRY WEATHER CONDITIONS TO THE EXTENT PRACTICAL.
2. DEWATERING WILL REQUIRE THE USE OF AN APPROVED FILTER BAG, AS SHOWN IN THE DETAILS, TO BE INCORPORATED WITH ALL DEWATERING AND DISCHARGE OPERATIONS.
4. WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO AN APPROVED SEDIMENT BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY RECEIVING WATER SURFACE WATER.
5. ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA.
6. ALL DISTURBED AREAS WITHIN 50 FEET OF TOP-OF-BANK SHALL BE BLANKETED OR MATTED WITHIN 72 HOURS OF INITIAL DISTURBANCE UNLESS OTHERWISE AUTHORIZED. APPROPRIATE STREAMBANK PROTECTION SHALL BE PROVIDED WITHIN THE CHANNEL.

5A STANDARD CONSTRUCTION DETAIL #13-3
TWO-PHASED UTILITY LINE STREAM CROSSING WITH COFFER DAM
NOT TO SCALE



NOTES:

1. WORK REQUIRING STREAM DIVERSION SHALL BE CONDUCTED DURING LOW-FLOW, DRY WEATHER CONDITIONS TO THE EXTENT PRACTICAL., IF THIS CHANNEL IS DRY DURING CONSTRUCTION, THE PUMP BYPASS SYSTEM WILL NOT BE USED AND THE STREAM BED WILL BE RESTORED IMMEDIATELY AFTER PIPELINE INSTALLATION.
2. PUMPED BYPASS SHALL BE CAPABLE OF HANDLING THE CAPACITY OF THE FLOW TO BE BYPASSED.
3. PUMPED BYPASS WILL REQUIRE THE USE OF AN APPROVED FILTER BAG, AS SHOWN IN THE DETAILS, TO BE INCORPORATED WITH ALL DEWATERING AND DISCHARGE OPERATIONS.
4. WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO AN APPROVED SEDIMENT BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY RECEIVING WATER SURFACE WATER.
5. ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA.
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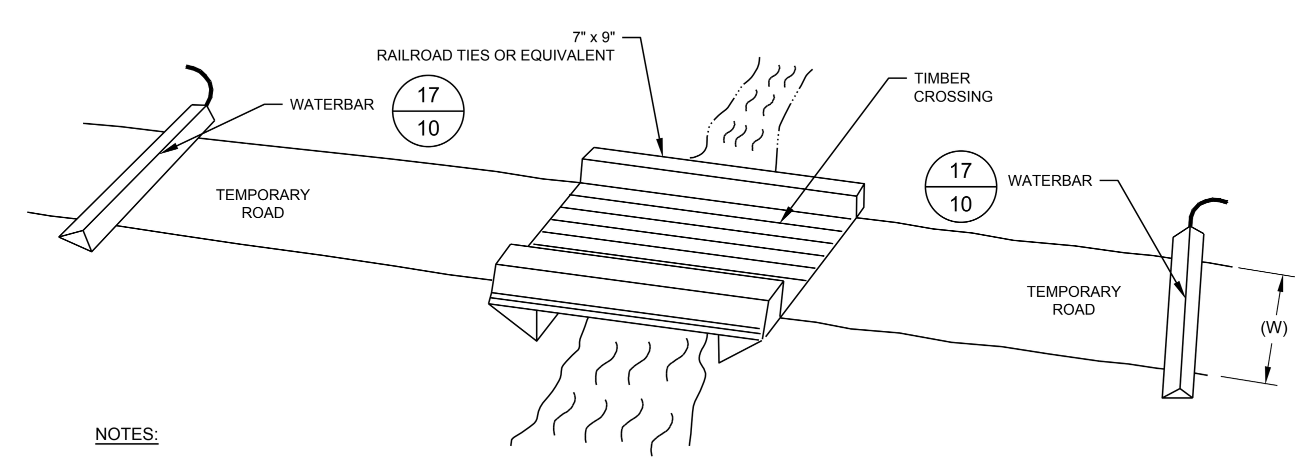
5B STANDARD CONSTRUCTION DETAIL #13-2
UTILITY LINE STREAM CROSSING WITH PUMP BYPASS
NOT TO SCALE



NOTES:

1. WIDTH (W) OF TEMPORARY ROAD AND TIMBER CROSSING TO BE THE SAME.
2. WIDTH (W) TO BE DETERMINED BY EQUIPMENT USED FOR CONSTRUCTION.
3. SURFACE FLOW DIVERTED BY WATERBAR TO SEDIMENT REMOVAL FACILITIES/BMPS.
4. TEMPORARY WATERBARS ARE REQUIRED AT ALL STREAM, RIVER, AND OTHER WATERBODY CROSSINGS.
5. PERMANENT WATERBARS SHALL NOT REMAIN IN PLACE WITHIN FLOODWAY (50 FEET FROM STREAM BANK).

6 DETAIL
TYPICAL TEMPORARY BRIDGE STREAM CROSSING
NOT TO SCALE

STREAM WORK CONSTRUCTION SEQUENCE

TWO PHASE CROSSING

1. INSTALL TEMPORARY EROSION & SEDIMENT CONTROL DEVICES.
2. CLEAR AND GRUB EASEMENT AREA FOR PIPELINE CONSTRUCTION. INSTALL FILTER SOCK TOE PROTECTION.
3. PREPARE FOR TEMPORARY PHASE 1 COFFER DAM FOUNDATION BY REMOVING STREAM BED MATERIAL. STORE MATERIAL FOR REPLACEMENT.
4. PLACE PLASTIC AND SAND BAGS AS COFFER DAM FOUNDATION.
5. CHECK COFFER DAM FOR LEAKS AND FIX IMMEDIATELY. IF INSIGNIFICANT LEAKS PERSIST DOWNSTREAM OF COFFER DAM AND/OR IN EXCAVATION TRENCH, PROVIDE SUMP/TRASH PUMP TO REMOVE WATER. PUMP WATER INTO FILTER BAG.
6. PREPARE STREAM BED FOR TRENCH EXCAVATION BY REMOVING STREAM BEDDING FOR LATER PLACEMENT. EXCAVATE TRENCH FOR PIPELINE IN THE DRY.
7. INSTALL PIPELINE.
8. STABILIZE STREAM BANKS BY SEEDING AND PLACING MATTING (50' MINIMUM FROM TOP OF BANK).
9. REMOVE TEMPORARY PHASE 1 COFFER DAM AND REPLACE STREAM BEDDING MATERIAL.
10. REPEAT STEPS 3 THROUGH 9 FOR PHASE 2 OF CROSSING.
11. STABILIZE REMAINING AREA BY SEEDING AND MATTING AS SPECIFIED.
12. ONCE STABILIZED, REMOVE TEMPORARY EROSION CONTROL DEVICES.

UTILITY STREAM CROSSING NOTES

1. ALL UTILITY LINES UNDER STREAMBEDS SHALL BE LOCATED SUCH THAT THERE WILL BE A MINIMUM OF FOUR (4) FEET OF COVER BETWEEN THE TOP OF THE UTILITY LINE OR ENCASEMENT AND THE LOWEST POINT IN THE NATURAL CONTOUR OF THE STREAMBED, UNLESS THE UTILITY LINE IS IN ROCK, WHERE A MINIMUM COVER OF ONE (1) FOOT SHALL BE PROVIDED.
2. TRENCHES EXCAVATED FOR THE INSTALLATION OF UTILITY LINES SHALL BE THE MINIMUM WIDTH NECESSARY. AS SOON AS THE UTILITY LINE IS INTALLED AND TESTED TO ASCERTAIN NO LEAKAGE, APPROPRIATE NEW OR PREVIOUSLY EXCAVATED BACKFILL MATERIAL SHALL BE PLACED IN THE TRENCH AND THE AREA RESTORED TO ITS ORIGINAL CONDITION AND ELEVATION AND STABILIZED. BACKFILL MATERIAL STORED IN CONNECTION WITH THE INSTALLATION MUST BE PROPERLY RETAINED OUT OF THE FLOODWAY SO AS TO PREVENT ITS DISCHARGE, WASHINGS, OR RUNOFF FROM ENTERING THE WATERWAY PRIOR TO ITS PLACEMNET AS BACKFILL.
3. ADEQUATE MEASURES SHALL BE USED TO PREVENT SEDIMENTATION FROM THE TRENCH FROM ENTERING THE STREAM.
4. THE BACKFILLING OF THE TRENCH IN WHICH THE PIPE WILL BE LAID SHALL BE DONE SO AS TO ELIMINATE THE FORMATION OF A PERMANENT RIDGE IN THE STREAMBED.
5. ARCHEAOLOGICAL ARTIFACTS DISCOVERED DURING THE PERFORMANCE OF WORK AUTHORIZED UNDER THIS GENERAL PERMIT MUST BE ADEQUATELY PROTECTED AND THEIR DISCOVERY PROMPTLY REPORTED TO THE BUREAU OF HISTORIC PRESERVATION, HISTORICAL AND MUSEUM COMMISSION, 400 NORTH STREET, SECOND FLOOR, HARRISBURG, PA 17120-0093, TELEPHONE (717) 783-8946.
6. WHENEVER POSSIBLE, IN ACCORDANCE WITH BEST CONSTRUCTION METHODS, UTILITY LINE CORSSINGS ARE TO BE MADE “IN THE DRY” BY INSTALLING SANDBAG AND PLASTIC DAMS AND PIPING STREAM FLOW THROUGH THE AFFECTED AREA.
7. PRIOR TO THE USE OF EXPLOSIVES IN A WATERCOURSE OR BODY OF WATER THE PERMITTEE SHALL SECURE A WRITTEN PERMIT FROM THE FISH AND BOAT COMMISSION, UNDER THE PENNSYLVANIA FISH AND BOAT CODE 30 Pa. C.S. §2906 (RELATING TO PERMITS FOR USE OF EXPLOSIVES). REQUESTS SHOULD BE DIRECTED TO THE FISH AND BOAT COMMISSION, DIVISION OF ENVIRONMENTAL SERVICES (SEE “EXHIBIT A”).

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3. LIMIT CLEARING AND GRUBBING TO CUTTING EXISTING VEGETATION RATHER THAN BULLDOZING THE VEGETATION. LIMIT TRENCH WIDTH TO WHAT IS NECESSARY TO INSTALL THE PIPE.
4. LIMIT DAILY TRENCH EXCAVATION TO THE LENGTH OF PIPE TO BE INSTALLED EACH DAY.
5. THE TRENCH IS TO BE BACKFILLED THE SAME DAY THE TRENCH IS DUG AND PIPE IS LAID.
6. FOR STEEL PIPELINES WITH WELDED JOINTS, THE LENGTH OF TIME REQUIRED FOR OPEN TRENCH OPERATIONS AT ANY STATION ALONG THE RIGHT-OF-WAY SHOULD NOT EXCEED 30 CALENDAR DAYS PER THE REQUIREMENTS ON PAGE 283 OF THE PADEP EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL, MARCH 2012.

EROSION AND SEDIMENT CONTROL FOR IN-CHANNEL WORK

1. WHENEVER POSSIBLE, WORK SHOULD BE SCHEDULED FOR LOW FLOW SEASONS. NORMAL FLOW SHOULD BE CONVEYED PAST THE WORK AREA BY MEANS OF A BYPASS CHANNEL, PIPE, PUMP, OR COFFERDAM. ALL SUCH BYPASSES SHOULD BE COMPLETED AND STABILIZED PRIOR TO DIVERTING FLOW.
2. ANY IN-CHANNEL EXCAVATIONS SHOULD BE DONE FROM THE TOP OF BANKS WHEREVER POSSIBLE. WHERE THIS IS NOT POSSIBLE, A TEMPORARY STREAM ACCESS SHOULD BE PROVIDED FOR ANY EQUIPMENT WORKING FROM WITHIN THE CHANNEL. UPON COMPLETION, ALL CHANNEL ENTRANCES SHOULD BE RESTORED TO PRE-CONSTRUCTION CONFIGURATIONS, AS MUCH AS POSSIBLE, AND STABILIZED.
3. ALL EXCAVATED CHANNEL MATERIALS THAT WILL BE SUBSEQUENTLY USED AS BACKFILL SHOULD BE PLACED IN A TEMPORARY STOCKPILE LOCATED OUTSIDE THE CHANNEL. A SEDIMENT BARRIER SHOULD BE INSTALLED BETWEEN THE STORAGE PILE AND THE STREAM CHANNEL.
4. ALL EXCAVATED MATERIALS THAT WILL NOT BE USED ON SITE MUST BE IMMEDIATELY REMOVED TO A DISPOSAL SITE HAVING AN APPROVED EROSION AND SEDIMENT POLLUTION CONTROL PLAN.
5. ANY PUMPED WATER FROM EXCAVATED AREAS MUST BE FILTERED PRIOR TO DISCHARGING INTO WATERS OF THE COMMONWEALTH. THE USE OF FILTER BAGS IS ANOTHER ACCEPTABLE METHOD IF LOCATED ON A RELATIVELY FLAT (<5% SLOPE), WELL-VEGETATED AREA. THE BAG SHOULD BE DESIGNED TO TRAP PARTICLES LARGER THAN 150 MICRONS. THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED. WHEN THE BAG HAS BEEN FILLED TO 1/2 ITS TOTAL CAPACITY, IT SHOULD BE REPLACED WITH A NEW BAG AND PROPERLY DISPOSED. WHEREVER WELL-VEGETATED AREAS ARE NOT AVAILABLE, A GEOTEXTILE UNDERLAYMENT SHOULD BE USED. CONSIDERATION SHOULD BE GIVEN TO HOW THE BAG WILL BE ACCESSED AND REMOVED ONCE IT HAS BEEN 1/2 FILLED WITH SEDIMENT.
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7. EXISTING STREAM BED MATERIALS WITHIN DISTURBED STREAM BED SHALL BE STOCKPILED AND PLACED BACK TO ORIGINAL CONDITIONS.
8. STREAM EMBANKMENTS SHALL BE LINED WITH EROSION CONTROL MATTING NAG BIONET S150BN OR EQUIVALENT AS SHOWN.
9. RIPARIAN RE-VEGETATION SHALL BE PLACED 50' FROM TOP OF STREAM BANK.

NOTES:

1. THE BASE MAP HAS BEEN CREATED USING AVAILABLE AERIAL PHOTOGRAPHY PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN. EXISTING TOPOGRAPHY HAS BEEN CREATED USING LIDAR CONTOURS PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN AND TOPOGRAPHIC SURVEY BY HAWBAKER ENGINEERING, NOVEMBER 2019.
2. PROPERTY LINES AND OWNER INFORMATION ARE TAKEN FROM LYCOMING COUNTY TAX ASSESSMENT MAPS AND RECORDS. SURVEYED PROPERTY LINES PROVIDED BY HAWBAKER ENGINEERING, NOVEMBER 2019.
3. THIS PLAN IS IN THE PENNSYLVANIA STATE PLANE NORTH, NORTH AMERICAN DATUM 1983 (NAD 83) COORDINATE SYSTEM.
4. EVERY EFFORT MUST BE TAKEN TO AVOID EARTH DISTURBANCE AND EQUIPMENT TRACKING WITHIN THE PROPOSED INFILTRATION BERM AREAS, AND THE PROPOSED PONDING AREAS IMMEDIATELY UPGRADIENT OF THE INFILTRATION BERMS. THIS INSTALLATION MUST BE ACCOMPLISHED WITH CARE. EXCLUSION FENCE SHALL BE PLACED AROUND THESE AREAS PRIOR TO THE START OF EARTHWORK.
5. PROPOSED EROSION CONTROL PRODUCT OR EQUIVALENT SHALL BE PLACED ON ALL DISTURBED SLOPES >3H:1V AND WITHIN 100' OF STREAMS AND WETLAND CROSSINGS.
6. CHANNEL MUST BE RESTORED TO PREVIOUS CONDITIONS WITHIN 24 HOURS OF PIPELINE INSTALLATION.
7. PGE INTENDS TO MAKE GRAVEL SURFACE IMPROVEMENTS TO THE EXISTING GRAVEL ACCESS DRIVE IN ACCORDANCE WITH A SEPARATE ROAD MAINTENANCE PLAN. THE LIMITS OF THE EXISTING ROADWAY WILL NOT BE EXPANDED OR WIDENED.

LEGEND

NOTE: LEGEND IS TYPICAL, NOT ALL OBJECTS IN LEGEND APPEAR IN PLAN.

Symbol	Description
1550	EXISTING CONTOURS
	EXISTING WETLANDS
	EXISTING RIPARIAN FOREST BUFFER
	EXISTING STRUCTURE
	EXISTING PROPERTY LINE
	EXISTING PROPERTY LINE (SURVEYED)
OE	EXISTING OVERHEAD ELECTRIC LINE
UE	EXISTING UNDERGROUND ELECTRIC LINE
G	EXISTING GAS LINE
W	EXISTING WATER LINE
	EXISTING TREELINE
	EXISTING MAPPED WATERCOURSE
	EXISTING FIELD VERIFIED STREAM
	EXISTING FLOODWAY
	EXISTING FEMA 100YR FLOODPLAIN
x	EXISTING FENCE
	EXISTING CULVERT
1490	PROPOSED CONTOURS
	PROPOSED GRAVEL ROAD AND PAD SURFACE
W	PROPOSED UNDERGROUND FRESHWATER PIPELINE
U	PROPOSED UNDERGROUND UTILITY CORRIDOR
UE	PROPOSED UNDERGROUND ELECTRIC
A	PROPOSED UNDERGROUND AIR LINE
18	PROPOSED 18" FILTER SOCK
24	PROPOSED 24" FILTER SOCK
32	PROPOSED 32" FILTER SOCK
18 24	PROPOSED FILTER SOCK SIZE DESCRIPTOR (INCH)
	PROPOSED WATERBAR
	PROPOSED TRENCH PLUG
	PROPOSED EROSION CONTROL PRODUCT
	PROPOSED STOCKPILE BOUNDARY
	PROPOSED CHANNEL
	PROPOSED FILL SLOPE TOE KEY
	PROPOSED EXCLUSION FENCE (CONSTRUCTION FENCE)
	PROPOSED ESCGP-3 PERMIT BOUNDARY / LIMIT OF DISTURBANCE
	PROPOSED 150' LONG ROCK CONSTRUCTION ENTRANCE
	PROPOSED ROCK CONSTRUCTION ENTRANCE WITH WASH RACK
	PROPOSED CULVERT WITH PLUNGE POOL
2H:1V	PROPOSED SLOPE
WeB	EXISTING SOIL BOUNDARY AND DESCRIPTOR
	PROPOSED STRUCTURE

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER MICHAEL DEAN RACE NO. PE083105

This Drawing shall not be used for tender or construction unless sealed.

I do hereby certify to the best of my knowledge, information, and belief, that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 78a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

This drawing, its contents, and each component of this drawing are the property of and proprietary to ARM Group LLC and shall not be reproduced or used in any manner except for the purpose identified on the Title Block, and only by or on behalf of this client for the identified project unless otherwise authorized by the express, written consent of ARM Group LLC.

ARM Group LLC
Engineers and Scientists
www.armgroup.net

No.	Revision	Date	By

designed ALG — checked MDR — drawn JAW — graphic scale
scale AS NOTED — date 01/17/2020 — project no. 190736

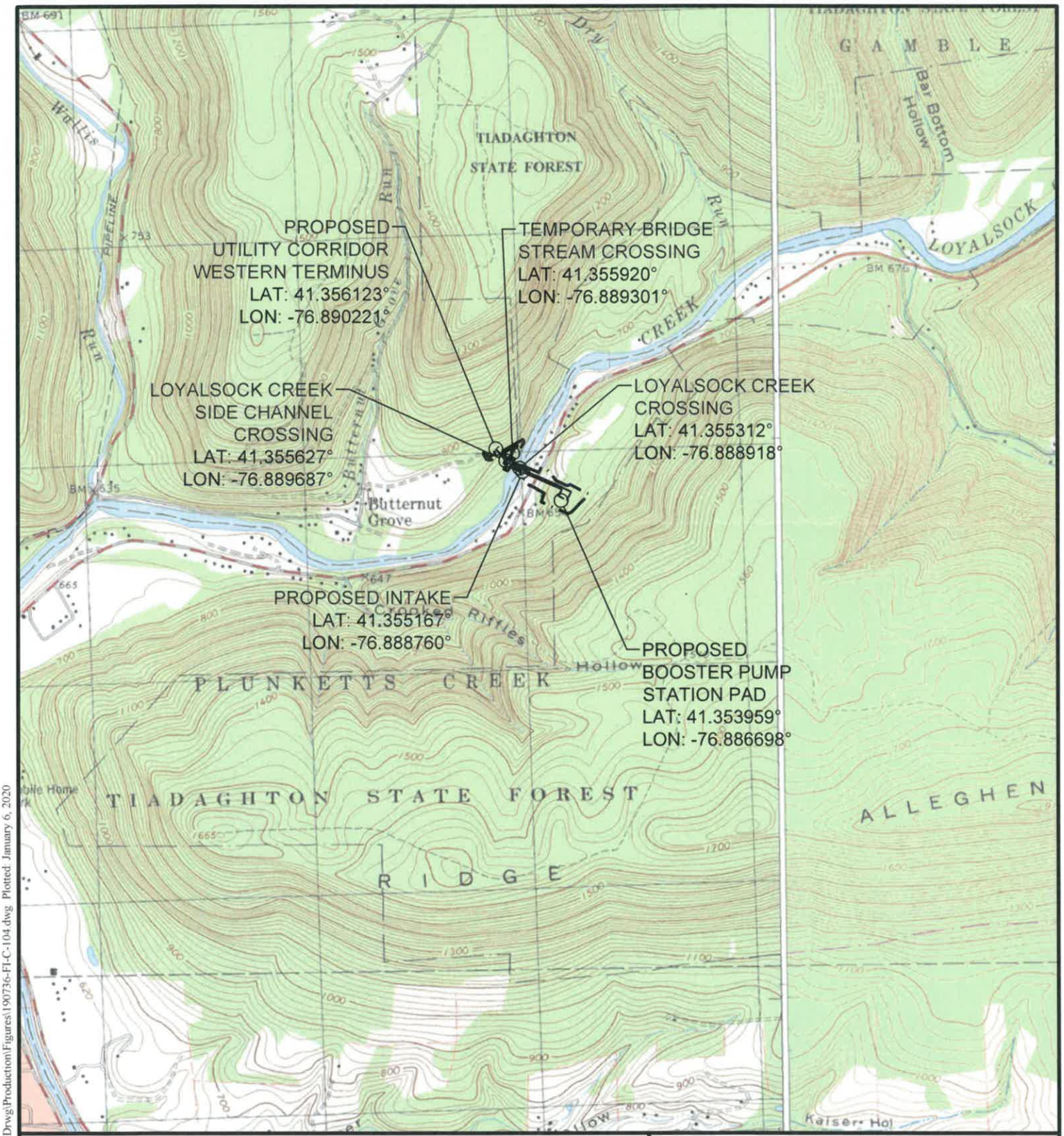
project title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.
GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

drawing title: LOYALSOCK CREEK CROSSING DETAILS
EROSION AND SEDIMENT CONTROL PLAN

Sheet 7

REQUIREMENT I

Site Location Map



Base map from USGS 7½ minute quadrangles Huntersville, Photo Revised 1986, and Montoursville North 1999.

LEGEND

PROPOSED LIMIT OF DISTURBANCE

0 2000 4000 6000

SCALE IN FEET

N

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SITE LOCATION MAP

LOYALSOCK/SHAWNEE FRESHWATER SYSTEM
PENNSYLVANIA GENERAL ENERGY COMPANY, L.C.C.
GAMBLE & PLUNKETTS CREEK TOWNSHIP,
LYCOMING COUNTY, PENNSYLVANIA

January 2020	Scale: 1" = 2000'	190736

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Figure 1

P:\PGE\190736 Loyalsock-Shawnee Freshwater System\Drwg\Production\Figures\190736-FI-C-104.dwg Plotted: January 6, 2020

REQUIREMENT J

Project Narrative

A R M G r o u p L L C

PROJECT NARRATIVE

Pennsylvania General Energy Company, L.L.C. (PGE) is proposing to develop the Loyalsock / Shawnee Freshwater System in Plunketts Creek and Gamble Townships, Lycoming County, Pennsylvania. The purpose of the project is to support PGE's natural gas operations from the Marcellus shale formation, which will provide a key source of energy for the United States. The overall project includes a freshwater intake and withdrawal system, a 130' x 130' booster pump station pad and associated 0.1-mile long, 15-foot wide access road, and a 0.3-mile permanent underground utility corridor. The project area consists of approximately 9.5-acres of disturbed land that is owned by PGE for the proposed development activities.

The buried freshwater intake will be installed at 41.355167°, -76.888760° and a gravel maintenance drive will be utilized to allow permanent access to this location. The intake will connect to a wet well, valve vault, and a 12-inch buried freshwater pipeline to transfer water from Loyalsock Creek to the booster pump station building at approximately 41.353950°, -76.886704°. A 6-inch underground electric conduit, a 2-inch communications conduit, and a 2-inch compressed air line will be installed in the same trench as the freshwater pipeline in order to supply electricity and controls to the intake pumps and compressed air to the self-cleaning intake strainers. From the booster pump station building, a temporary aboveground freshwater pipeline will extend east to a future impoundment location (permitted separately).

The permanent underground utility corridor will include a 12-inch natural gas pipeline, two (2) 12-inch freshwater pipelines, a 12-inch electrical conduit, and a 2-inch communications conduit. This utility corridor will be constructed between the booster pump station pad and a future tie-in location approximately 350-feet west of Loyalsock Creek at 41.356123°, -76.890221° where each utility will be terminated at the ends for future connections.

Although all resource crossings were not avoidable, the selected alignment was chosen to minimize impacts to streams and avoid impacts to wetlands and other sensitive areas. As a result of the proposed construction, the project will encroach on three (3) separate waterbody locations, which are listed below and shown on the attached Figure 1.

- Loyalsock Creek: Intake Structure & Utility Line(s) Stream Crossing
- Loyalsock Creek Side Channel: Utility Line(s) Stream Crossing
- Loyalsock Creek Side Channel: Temporary Bridge Stream Crossing

The freshwater intake structure will be buried in Loyalsock Creek using an in-stream cofferdam diversion. The permanent underground utility corridor will be trenched across Loyalsock Creek using a two-phased open-cut restore method with coffer dams. The permanent underground utility corridor will also be trenched across the Loyalsock Creek Side Channel using a temporary cofferdam and pump bypass. A temporary bridge stream crossing will be utilized to cross the Loyalsock Creek Side Channel during construction on the western side of the Loyalsock Creek. These impacts are depicted in the site-specific standard drawings. Work requiring stream diversion will be conducted during low-flow, dry weather conditions to the extent practical. No wetlands, including no exceptional value wetlands, will be impacted during the proposed project.

Consequently, this application is being submitted for a Joint Permit Application for Pennsylvania Water Obstruction and Encroachment Permit & U.S. Army Corps of Engineers Section 404 Permit for this proposed construction.

The project is located within the Loyalsock Creek watershed. Loyalsock Creek is a tributary to the West Branch Susquehanna River (Hydrologic Unit Codes (HUC) Lower West Branch Susquehanna HUC 02050206 United States Environmental Protection Agency). According to PA Code, Title 25, Chapter 93.9w, Drainage List L, Water Quality Standards, Loyalsock Creek has a designation of Trout Stocking Fishes, Migratory Fishes (TSF, MF) and unnamed tributaries to this segment of Loyalsock Creek, have a designation of a High Quality-Cold Water Fishes, Migratory Fishes (HQ-CWF, MF). No receiving waters of the AOI have been designated as siltation-impaired streams (eMapPA, October 2019). According to the PA Department of Environmental Protection's (PADEP's) Statewide Existing Use Classifications list for Lycoming County (October 8, 2019), Loyalsock Creek has an existing use classification Exceptional Value, Migratory Fishes (EV, MF). The Pennsylvania Fish and Boat Commission (PFBC) lists Loyalsock Creek as a trout stocked stream but not as a Wild Trout stream (PFBC October 2019).

Site specific drawings associated with the stream/floodway crossings are presented in Section H of this application. Construction activities will include work in Plunketts Creek and Gamble Townships, Lycoming County, Pennsylvania. The township and county governments were notified of the project. Copies of those notifications are included in Section C of this submission.

A signed receipt for the Pennsylvania Natural Diversity Inventory (PNDI) search indicating a PA Fish and Boat Commission "Conservation Measure" along with the agency coordination documentation, are included in Section G of this submission. An Aquatic Resource Investigation Memorandum for the project is included in Requirement L, Enclosure A.

Coffer Dam(s) Description:

Work requiring coffer dams and stream diversion and/or pump bypass will be conducted during low-flow, dry weather conditions to the extent practical.

- Loyalsock Creek – The freshwater intake structure will be buried in Loyalsock Creek using an in-stream cofferdam diversion. The permanent underground utility corridor will be trenched across Loyalsock Creek using a two-phased in-stream cofferdam diversion. PGE intends to deploy a temporary 7-foot cofferdam structure to protect the in-stream work areas and divert flows around the work site during construction. A HEC-RAS model was generated at this location to provide an understanding of how the proposed cofferdam will perform during the anticipated seasonal stream flows. Refer to the Hydrologic and Hydraulic (H&H) Analysis (Requirement No. 9 of the Joint Permit Application package) for more detailed information. Note: If conditions are favorable at the time of construction, PGE may elect to install the freshwater intake structure and the eastern portion of the utility corridor at the same time, all within the footprint of one cofferdam system. This would result in a one-time disturbance to the eastern portion of Loyalsock Creek, and ultimately less in-stream impacts.

- Loyalsock Creek Side Channel – The permanent underground utility corridor will be trenched across the Loyalsock Creek Side Channel using a temporary cofferdam and pump bypass system; however, PGE intends to construct this crossing in the dry. Flows can be highly variable within this stream segment and are dictated by the main channel of Loyalsock Creek. The Loyalsock Creek Side Channel is dry during normal flow conditions and only carries flows from Loyalsock Creek during high-flow (flooding) conditions. If this channel is dry during construction and the forecasted weather is dry, the coffer dam and pump bypass system will not be used, and the streambed will be restored immediately after pipeline installation.

Freshwater Intake & Withdrawal System Infrastructure and Site Layout Description:

The freshwater intake and withdrawal system are depicted on the site-specific drawing plans presented in Requirement H of this application. Please note a Metering Plan was submitted in the Surface Water Withdrawal Application package to SRBC and describes the site layout in greater detail. As described within the Metering Plan and as shown on the plans, the Loyalsock / Shawnee Freshwater System includes the following proposed features:

- Buried intake screen strainer, comprised of two (2) Sure-Flo Model H Horizontal Model# SFSHVV12 Screens with the following dimensions: diameter of 22 inches and length of 36 inches (each), that will be installed in the stream;

- The screen assembly will be located in a 36" x 36" x 84" pre-cast concrete vault. A 12" x 36" x 84" aggregate filter (with 40% open area void space) will be placed flush with the existing stream bed and above the concrete vault slot grate, to deflect debris away from the intake screens. An air-burst assembly will also be incorporated into the screen assembly to provide a means of cleaning the intakes;

- The intake screen strainer incorporates an air burst system that will be used to regularly clean the screens using an airline connection;

- Since the screen will be placed within a concrete vault covered by aggregate and the pump will be placed within a wet well, this will further decrease the velocity of flowing water as it enters the intake structure and the potential for direct impingement and/or entrainment is further minimized;

- The intake screens will provide water via gravity flow to a wet well equipped with two Gorman-Rupp submersible pumps (Model SF6B);

- The wet well will be located approximately 45 ft east of the intake location. The well will consist of an approximately 18 ft deep, 8-ft diameter concrete wet well, within which the submersible pumps will be installed;

- A 6-inch diameter Siemens SITRANS F M MAG 5100W equipped with a MAG 5000 Insert Transmitter will be used to meter the amount of water withdrawn from the intake location;

- Due to the 24-hour and automated nature of operations at the proposed facility, automated meter readings will be recorded from the flow meter and programmed into the SCADA system design planned for the booster pump station. Associated data, such as destination drilling pad sites receiving withdrawn water, will be maintained by PGE water management personnel during pumping operations. All recorded daily withdrawal volumes from the Loyalsock Creek withdrawal site will be electronically submitted to SRBC on a quarterly basis in accordance with SRBC Regulation 806.30(b)(1). In addition, all daily consumptive use of the withdrawn water will be accounted for on a drilling pad basis per each well pad's "Approval by Rule" permit;

- Gate valves that normally remain open but may be closed periodically to isolate and maintain or calibrate the flowmeters; and,

- A 12-inch diameter, buried high-density polyethylene (HDPE) freshwater pipeline routed from the intake to the booster pump station pad, located on the east side of State Route 0087.

The Metering Plan provides detailed specifications for the intake screen strainer, withdrawal pump, and digital flowmeter.

When the Loyalsock / Shawnee Freshwater System is being operated, water will be withdrawn from the creek and pumped to the booster pump station and stored in an aboveground storage tank. From the booster pump station building, a single, temporary, aboveground freshwater pipeline consisting partially of 8-inch high pressure piping and 12-inch low pressure HDPE, will extend east to a future impoundment.

Proposed Withdrawal Rates:

The intake screen strainer, pump, flowmeter, and associated appurtenances were specified based on a maximum daily withdrawal of 2.0 MGD and a maximum withdrawal rate of 1,500 gpm (3.34 cfs) as approved by the SRBC under Docket #2019-0908.

Utility Corridor Alternatives Analysis: Open Cut Trench vs. HDD Bore:

PGE considered both trenching and horizontal directional drill (HDD) techniques as installation methods for the utility corridor crossing of Loyalsock Creek. In order to successfully complete an HDD bore, both Loyalsock Creek and SR 0087 would have to be bored in a single pull. This is due to the entry and exit geometry required to allow the pipes to be installed without damage. This necessitates the bore entry location being on the northwest side of Loyalsock Creek in the vicinity of the existing house. The bore exit would be midway between SR 0087 and the proposed pump station pad. Approximately 1100' of clearing from the bore exit up the hillside would be needed as workspace to layout and weld the pipe(s) for pullback. This, in turn, creates additional disturbance. The small width of the valley bottom combined with the steep sloping valley walls and a minimal disturbance requirement makes HDD boring of Loyalsock Creek virtually impossible. The difference in elevation between the bore entrance and the bottom of

Loyalsock Creek is approximately 150'. This elevation difference creates a larger than normal head pressure resulting in a significant risk of inadvertent returns in the creek bed while boring beneath it. As the project calls for 5 pipelines crossing the creek, this process would have to be completed up to 5 times as opposed to laying all the lines in a single trench across the creek. The increased disturbance and multiple risks for inadvertent returns during boring operations has resulted in PGE proposing to cross the Loyalsock Creek via the two-phase open cut/restore trenching method and not HDD boring.

Impacts to the Riparian Buffer:

Portions of the project site are located within 150-feet of special protection (EV) waters. Approximately 3.2-acres of existing riparian buffer is present within the LOD and consists of residential lawns (maintained and overgrown), forestland, vegetated alluvium, and transportation right-of-way. Approximately 2.4-acres of riparian forest buffer will be impacted as part of this project. Due to the location of the project site, impacts to riparian buffers were unavoidable; however, measures were taken throughout the design phase to avoid and minimize impacts upon streams, wetlands, and riparian buffers where practical and feasible. Due to the location of the starting and ending points of the Loyalsock / Shawnee Freshwater System, there are no alternate routes that would avoid all riparian buffer impacts. In accordance with Title 25 Pa. Code §102.14(d)(2), a written waiver request was submitted with the ESCGP-3 application for this project.

Sampling Procedures for Adjacent Landowner's Groundwater Supply Wells:

The majority of homes in the immediate vicinity of the project area rely on a groundwater well for their primary water source. PGE intends to contact the five (5) landowners that have a house located within 500 feet of the intake location for groundwater well testing before any earthwork commences. This will allow PGE to collect baseline data in order to determine if the construction activities have or have not affected the groundwater supply should a problem arise. All samples will be collected and analyzed by a PA DEP accredited lab with proper chain of custody procedures.

PGE will test for the following parameters: *Hardness, Metals (Ar, Ba, Ca, Fe, K, Mg, Mn, Na, Pb, Sr), VOCs (Benzene, Toluene, Ethylbenzene, Xylenes (total), MTBE), Total Alkalinity, Bromide, Chloride, Turbidity, Specific Conductance (EC), Methylene Blue active substances, Nitrate as N, Oil & Grease, pH @ 14.2 *C, TDS, TSS, Sulfate as SO4, Sulfide, Ammonia as N, E Coli, Total Coliforms, Specific Conductance (field), pH (field), Temperature (field), Methane, Ethane, Ethene, & Propane.*

Pipeline Abandonment Plan:

In the event that PGE discontinues use of the pipeline(s) underneath the Loyalsock Creek and there is no longer a suitable need to keep the piping in operation, the pipe will be abandoned in place. Attempts will be made in order to remove all internal components within the piping, if any exist. Once removed, the pipeline will be purged and flowable fill will be used to fill all voids within the piping.

Loyalsock Creek Side Channel – FEMA Floodway Description

Refer to the written description that is included as an appendix to this Project Narrative.

Application Completeness Checklist:

Requirements associated with the proposed construction are listed with their respective location in the Joint Permit package in the table below, Section F. Application Completeness Checklist.

Requirement	Included in Joint Permit Application
a. GIF and permit application properly signed, sealed and witnessed	**Requirement A**
b. Application Fee & Worksheet enclosed (see Section G.)	**Requirement B**
c. Copies and proof of receipt - Act 14 notification - Acts 67/68/127	**Requirement C**
d. Cultural Resource Notice (Notice, return receipt and PHMC review letter, as appropriate)	**Requirement D**
e. PASPGP-5 Cumulative Impact Project Screening Form	**Requirement E**
f. Bog Turtle Habitat Screening (copy of "No Effect" determination from the Army Corps of Engineers OR copy of documented clearance from the US Fish and Wildlife Service)	*N/A*
g. Pennsylvania Natural Diversity Inventory (PNDI Project Environmental Review Search Receipt including Avoidance Measures and documentation of agency coordination, as appropriate)	**Requirement G**
h. Plans (site plan including cross sections and profiles for Subsections 151, 191, 231, 261)	**Requirement H**
i. Location map	**Requirement I**
j. Project description narrative	**Requirement J**
k. Color photographs with map showing location taken	**Requirement K**
l. Environmental Assessment form	**Requirement L**
m. Erosion and Sediment Control Plan and approval letter	**Requirement M**
n. Hydrologic and hydraulic analysis	**Requirement N**
o. Stormwater Management Analysis with consistency letter	*Waiver Request*
p. Floodplain Management Analysis with consistency letter	*Waiver Request*
q. Risk Assessment	*Waiver Request*
r. Professional engineer's seal and certification	**All plans, specifications, and reports.**
s. Alternative analysis	**Requirement S**
t. Mitigation plan	*Waiver Request*

APPENDIX

Loyalsock Creek Side Channel
FEMA Floodway Description Narrative

Loyalsock Creek Side Channel – FEMA Floodway Description Narrative

The proposed project site includes a short reach of the Loyalsock Creek in the area immediately upstream of Butternut Grove, Gamble Township, Lycoming County, Pennsylvania. The site is upstream of the confluence with Wallis Run, and downstream of the confluence with Dry Run. Loyalsock Creek represents the municipal boundary of Gamble Township (to the north-northwest, or right overbank area) and Plunkett's Creek Township (to the south-southeast, or left overbank area). Coordinates of the proposed work site are approximately 41.35516° (latitude), -76.88876° (longitude).

The proposed construction consists of: 1) the installation of a freshwater intake system (i.e., proposed Loyalsock/Shawnee Freshwater System in Plunkett's Creek Township, Lycoming County) utilizing a temporary coffer dam; and 2) a two-phased utility line stream crossing corridor (i.e., open-cut/restore installation method) utilizing phased coffer dams extending from each stream bank (i.e., Gamble Township bank and Plunkett's Creek Township bank).

During the pre-application meeting held at the PADEP Northcentral Regional Office on 11/25/2019, the PADEP indicted that, unless a written justification was included with the application, the existing side channel should be considered a separate stream from the main stem of the Loyalsock Creek. If that were the case, a 50-foot floodway boundary extending from the top of each streambank would need to be incorporated into this channel, and the encroachment into this floodway would require additional impact calculations for permitting purposes. This written narrative serves as justification to prove that Loyalsock Creek (main stem) and the Loyalsock Creek Side Channel were modeled as one stream segment in FEMA's flood insurance study (FIS). Therefore, the Loyalsock Creek Side Channel is not shown with a separate 50-foot floodway boundary associated with it.

In order to prove this, and ultimately reduce the overall floodway impacts to the project, ARM engineers requested information through AECOM[1] and their floodplain managers for information related to the FEMA Flood Information Study (FIS), in particular the HEC-RAS base modeling prepared for the FIS developed for Loyalsock Creek. ARM received copies of the models for both the Upper and Lower Loyalsock FIS Restudy from AECOM which were developed in 2004. The hydraulic models were performed by AECOM, for FEMA, using HEC-RAS 3.0.

Upon review of the FIS models developed for Loyalsock Creek, it was determined that the Loyalsock Creek Side Channel was included as part of the Loyalsock Restudy and was included in the FIS. Screenshots from the HEC-RAS model for the Upper Loyalsock Creek (included herein) reflect cross section 'BN', which is 58,080-feet above the confluence of the West Branch Susquehanna River, and immediately coincident with the project area.

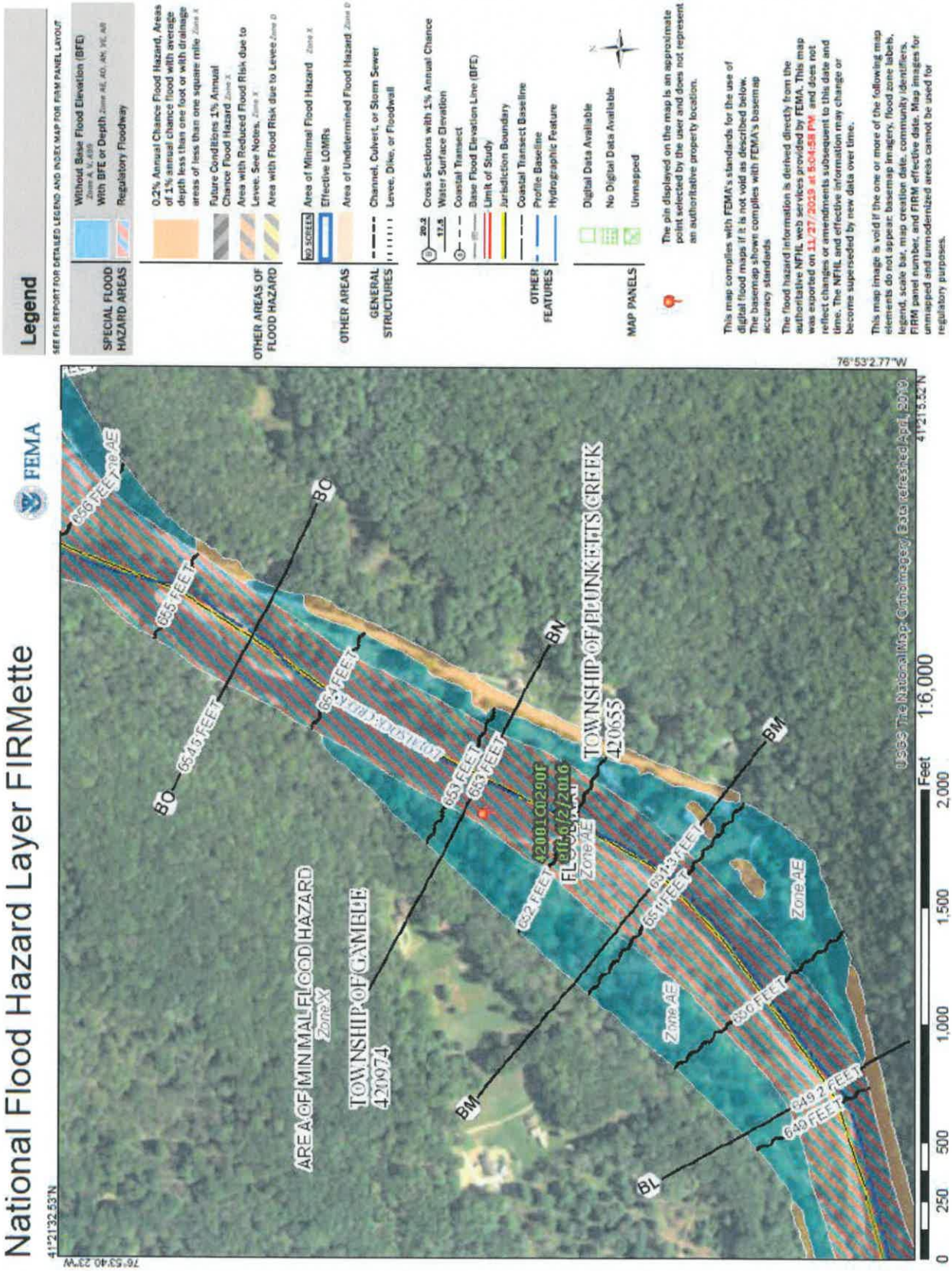
Based upon the information presented in this narrative, it is ARM's conclusion that the Loyalsock Creek Side Channel is part of Loyalsock Creek and is located outside of the FEMA floodway which was determined through the detailed study.

[1] ARM Group received information from AECOM engineers William Jiang, P.E.,CFM, Water Resources Engineer II and Jeff Smith, P.E., PMP, CFM, Program Manager.

Desktop Review References

ARM compiled and reviewed available published documents, including the following:

- USGS StreamStats Report (Clicked Point: 41.35523, -76.88891), United States Geologic Survey (USGS), StreamStats (v. 4.3.11) Web-based Geographic Information Systems (GIS) application (https://streamstats.usgs.gove/ss/), accessed December 10, 2019.
- USGS 01552000 Loyalsock Creek at Loyalsockville, PA, United States Geologic Survey (USGS), National Water Information System: Web Interface (https://waterdata.usgs.gove/usa/nwis/uv?01552000), accessed December 2019.
- Flood Insurance Study (FIS), Lycoming County, Pennsylvania (All Jurisdictions), Federal Emergency Management Agency (FEMA), FIS No. 42081CV001C, revised June 2, 2016.
- Flood Insurance Rate Map, Lycoming County, Pennsylvania (All Jurisdictions), Federal Emergency Management Agency (FEMA), Panel 0290F, Map No. 42081C0290F, revised June 2, 2016.
- PAMAP Program Topographic Contours (2-ft Interval) of Pennsylvania and PAMAP Program 3.2 ft Digital Elevation Model of Pennsylvania, PA Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey; constructed from PAMAP LiDAR (Light Detection and Ranging) elevation points; collected between March 21 and May 2, 2006, published December 13, 2006
- FEMA HEC-RAS v. 3.0 model for Upper Loyalsock Creek in Lycoming County, PA, completed as part of a 2003-2004 restudy of Loyalsock Creek, furnished to ARM by AECOM on December 19, 2019.
- Recent and historic aerial imagery available through the Pennsylvania Spatial Data Access (PASDA) PA Imagery Navigator (maps.psiee.psu.edu/imagery/Navigator/), accessed December 2019.
- Available Google Maps and Google Earth Imagery (1993 – 2019), accessed December 2019.


National Flood Hazard Layer FIRMette
FEMA
Legend
SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT
SPECIAL FLOOD HAZARD AREAS
Without Base Flood Elevation (BFE) Zone A, V, A99
With BFE or Depth Zone AE, AO, AH, VE, AR
Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD
0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
Future Conditions 1% Annual Chance Flood Hazard Zone X
Area with Reduced Flood Risk due to Levee. See Notes. Zone X
Area with Flood Risk due to Levee Zone D
OTHER AREAS
NO SCREEN Area of Minimal Flood Hazard Zone X
Effective LOMRs
Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES
Channel, Culvert, or Storm Sewer
Levee, Dike, or Floodwall
OTHER FEATURES
Cross Sections with 1% Annual Chance Water Surface Elevation
Coastal Transect
Base Flood Elevation Line (BFE)
Limit of Study
Jurisdiction Boundary
Coastal Transect Baseline
Profile Baseline
Hydrographic Feature
MAP PANELS
Digital Data Available
No Digital Data Available
Unmapped
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.
This map complies with FEMA's standards for the use of digital flood maps if it is not voided as described below. The basemap shown complies with FEMA's basemap accuracy standards
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/27/2019 at 5:04:58 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.
This map image is valid if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.
41°21'32.53"N
76°53'40.23"W
76°53'2.77"W
41°21'3.32"N
0.56 FEET
655 FEET
654.5 FEET
654 FEET
653 FEET
652 FEET
651.3 FEET
651 FEET
650 FEET
649.2 FEET
649 FEET
BO
BM
BL
ARE A OF MINIMAL FLOOD HAZARD
Zone X
TOWNSHIP OF CAMBLE
420074
TOWNSHIP OF PLUNKETTS CREEK
420055
Zone AE
0 250 500 1,000 1,500 2,000 Feet
1:6,000
USGS The National Map Orthoimagery. Data refreshed April, 2019

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Loyalsock Creek (continued)								
AY	45,590	215	4,745	11.2	620.4	620.4	620.9	0.5
AZ	47,200	377	4,871	10.9	625.8	625.8	626.0	0.2
BA	47,940	368[2]	6,055	8.8	628.4	628.4	628.6	0.2
BB	48,680	291	5,013	10.6	629.4	629.4	629.8	0.4
BC	49,620	309	4,968	10.7	631.3	631.3	631.7	0.4
BD	50,070	230	4,152	12.8	631.7	631.7	632.5	0.8
BE	50,910	366[2]	5,976	8.3	635.1	635.1	635.8	0.7
BF	51,370	369	5,633	8.7	635.9	635.9	636.4	0.5
BG	52,180	365	5,016	9.8	637.7	637.7	638.2	0.5
BH	53,410	370	5,433	9.0	642.0	642.0	642.2	0.2
BI	53,920	578[2]	6,678	7.4	643.3	643.3	643.7	0.4
BJ	54,700	434	5,632	8.7	644.6	644.6	645.0	0.4
BK	55,440	200	3,934	12.5	646.1	646.1	646.4	0.3
BL	56,540	283	5,027	9.8	649.8	649.8	650.2	0.4
BM	57,400	346	5,392	9.1	651.9	651.9	652.3	0.4
BN	58,080	268	4,936	9.9	653.6	653.6	654.2	0.6
BO	58,940	251	4,826	10.2	655.1	655.1	655.9	0.8
BP	60,300	311[2]	5,282	9.3	657.9	657.9	658.6	0.7
BQ	60,740	213[2]	4,153	11.8	658.2	658.2	658.9	0.7
BR	61,830	258	5,198	9.4	661.6	661.6	662.3	0.7
BS	62,840	269[2]	5,000	9.8	663.6	663.6	664.3	0.7
BT	63,900	340	5,783	8.5	665.8	665.8	666.6	0.8
BU	64,510	272[2]	5,201	9.4	666.8	666.8	667.5	0.7
BV	66,180	272	4,405	10.9	670.2	670.2	671.0	0.8
BW	68,200	477	6,160	7.7	675.8	675.8	676.0	0.2

[1]Feet above confluence with West Branch Susquehanna River
[2]The floodway shown on the FIRM has been widened beyond this value for administrative purposes

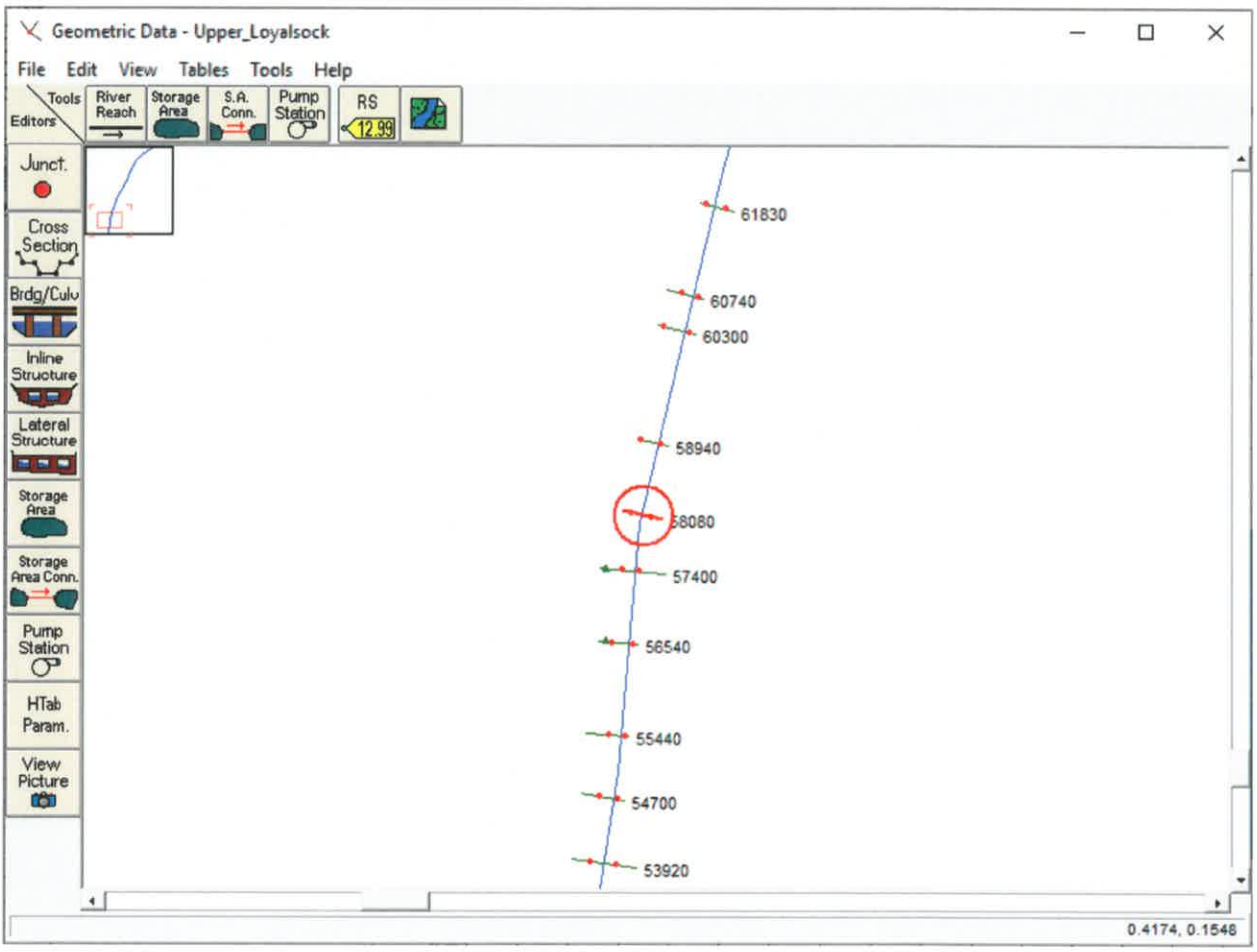
TABLE 7

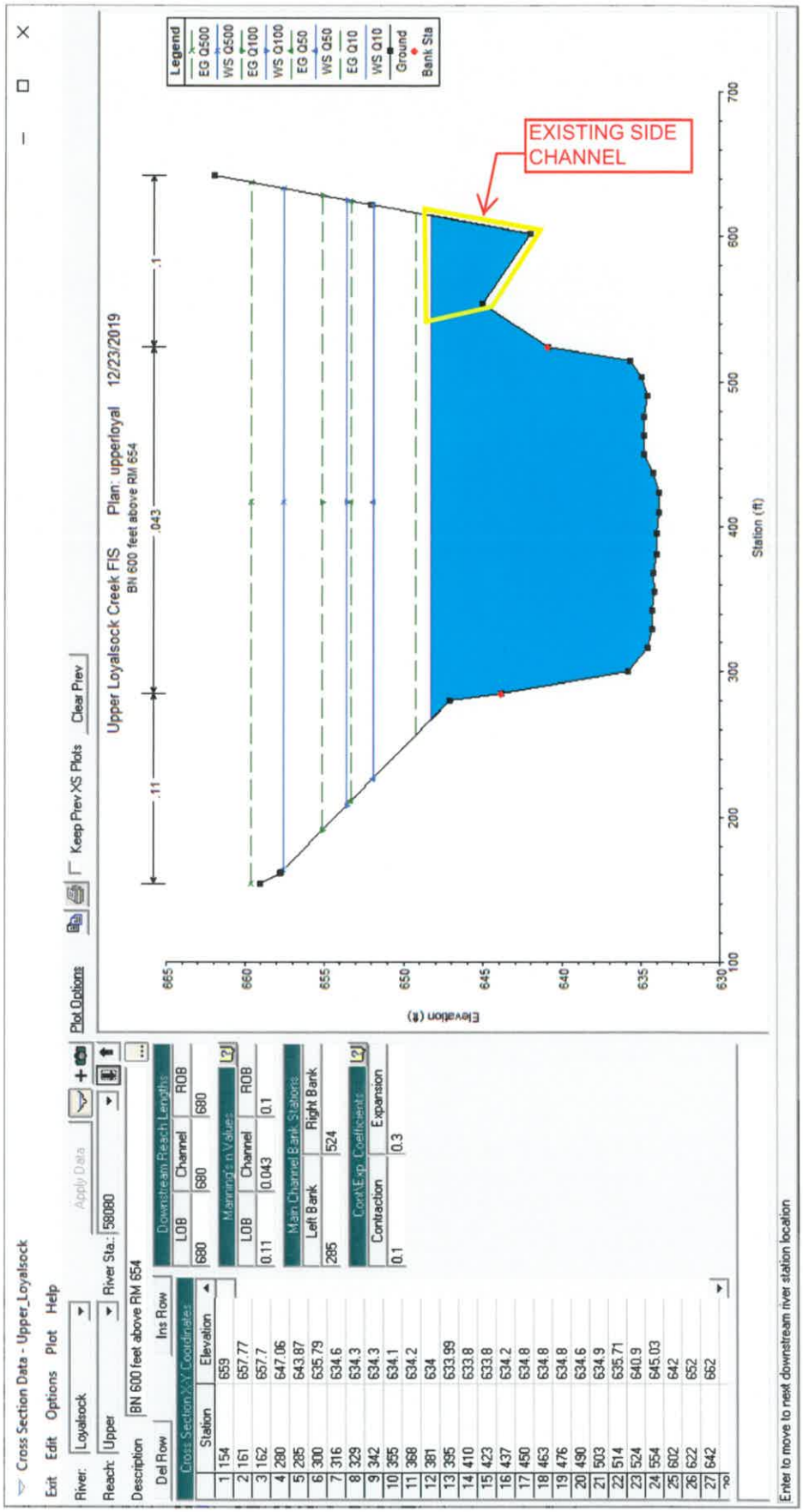
FEDERAL EMERGENCY MANAGEMENT AGENCY

LYCOMING COUNTY, PA
(ALL JURISDICTIONS)

FLOODWAY DATA

LOYALSOCK CREEK


Geometric Data - Upper_Loyalsock
File Edit View Tables Tools Help
Tools
Editors
River Reach
Storage Area
S.A. Conn.
Pump Station
RS
12.99
Junct.
Cross Section
Brdg/Culv
Inline Structure
Lateral Structure
Storage Area
Storage Area Conn.
Pump Station
HTab Param.
View Picture
61830
60740
60300
58940
58080
57400
56540
55440
54700
53920
0.4174, 0.1548


Cross Section Data - Upper_Loyalsock
Exit Edit Options Plot Help
River: Loyalsock
Reach: Upper
River Sta.: 58080
Description BN 600 feet above RM 654
Apply Data
Plot Options
Keep Prev XS Plots
Clear Prev
Del Row
Ins Row
Cross Section X-Y Coordinates
Station Elevation
1 154 659
2 161 657.77
3 162 657.7
4 280 647.06
5 285 643.87
6 300 635.79
7 316 634.6
8 329 634.3
9 342 634.3
10 355 634.1
11 368 634.2
12 381 634
13 395 633.99
14 410 633.8
15 423 633.8
16 437 634.2
17 450 634.8
18 463 634.8
19 476 634.8
20 490 634.6
21 503 634.9
22 514 635.71
23 524 640.9
24 554 645.03
25 602 642
26 622 652
27 642 662
Downstream Reach Lengths
LOB Channel ROB
680 680 680
Mannings n Values
LOB Channel ROB
0.11 0.043 0.1
Main Channel Bank Stations
Left Bank Right Bank
285 524
Cont/Exp Coefficients
Contraction Expansion
0.1 0.3
Upper Loyalsock Creek FIS Plan: upperloyal 12/23/2019
BN 600 feet above RM 654
.11 .043 .1
Elevation (ft)
Station (ft)
Legend
EG Q500
WS Q500
EG Q100
WS Q100
EG Q50
WS Q50
EG Q10
WS Q10
Ground
Bank Sta
EXISTING SIDE CHANNEL
Enter to move to next downstream river station location

Requirement K

Encroachment Color Photographs

Refer to the Photograph Log included in Aquatic Resource Investigation Memorandum

A R M G r o u p L L C

REQUIREMENT L

Environmental Assessment Form

A R M G r o u p L L C

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATERWAYS ENGINEERING AND WETLANDS

CHAPTER 105 ENVIRONMENTAL ASSESSMENT FORM

			Included	Item Location
Note: The Department may waive a specific information requirement in writing, at the request of the Applicant, during the pre-application review process if the Department determines the information is not necessary to complete the review.				
Module S1: Project Summary				
This module is intended to organize information in order to present an overall summary of the project scope, certain key information requirements and when applicable, a comprehensive view of the overall project and related projects.				
A. Provide an overall project description and If the answer to the question below is **YES**, address CEA requirements; otherwise proceed to **S1.B** Comprehensive Environmental Assessment (CEA) when applicable. Answer the following question:			☒	REQ: J
Does the "overall" project require more than one Ch. 105 permit in more than one county or will the project be completed in more than one phase?	☒ Yes	☐ No		
B. Provide information related to the project purpose, need, water dependency and summarize the amount and type of resources present and the temporary and permanent impacts proposed to those resources.			☒	REQ: J
Module S2: Resource Identification and Characterization				
This module is intended to organize information related to the identification of the resources present on the project site and to characterize those resources that may be affected by the proposed project.				
A. Provide the standard resource identification information, location map, wetland determination or delineation reports; watercourse reports; identification and qualifications of preparers; location map, and answer the related questions.			☒	REQ: L ENCL. A
Is the site located within or adjacent to any of the following; or within 100 feet of items vii or viii?				
i. National, state or local park, forest or recreation area	☒ Yes	☐ No		
ii. National natural landmark	☐ Yes	☒ No		
iii. National wildlife refuge, or Federal, state, local or private wildlife or plant sanctuaries	☐ Yes	☒ No		
iv. State Game Lands	☐ Yes	☒ No		
v. Areas identified as prime farmland	☐ Yes	☒ No		
vi. Source for a public water supply	☐ Yes	☒ No		
vii. A National Wild or Scenic River or the Commonwealth's Scenic Rivers System	☐ Yes	☒ No		
viii. Designated Federal wilderness area	☐ Yes	☒ No		
B. Identify all aquatic resources present on the project site and provide an identifier, the resource type; size of the resource(s); fishery designations, Ch. 93 uses and special protection status; and Exceptional Value (EV) wetland analysis.			☒	REQ: L ENCL. A
C. Provide the following information related to habitat for Federal threatened and endangered (T&E) plant and animal species or State T&E species or species of special concern - copies of search forms or search receipts; identification of avoidance and minimization efforts taken to resolve identified conflicts.			☒	REQ. G
Did the PNDI search or agency coordination identify any potential conflicts?	☒ Yes	☐ No		
If the above is answered **YES**; answer the following two questions related to PNDI Coordination:				
a. *Is the applicant utilizing a sequential review of the PNDI coordination?*	☐ Yes	☒ No		
b. *Is the applicant utilizing a concurrent review of the PNDI coordination?*	☐ Yes	☒ No		
D. Characterize the aquatic resources: riverine, wetland and lacustrine present on the project site that are proposed to be directly or indirectly affected by the project. Including but not limited to the following, resource classification information, Level 2 rapid condition assessment results, discussion of resource functions, characterization of riparian properties and any other relevant information or studies conducted.			☐	
Module S3: Identification and Description of Potential Project Impacts				
*This module is intended to organize and present information concerning the potential impacts or effects of the proposed project **in this** application. Impacts related to the "over all" project that are proposed under related but separate application(s) should be addressed as part of the CEA Policy response under **S1.A**.*				
A. Provide a summary table of the proposed temporary and permanent direct and indirect impacts for each effected resource category (e.g. riverine, wetlands and lacustrine resources).			☒	ATT: 1.0
B. If any questions from **S2.A** Standard Information Response questions were answered YES, discuss in detail any potential impacts to those resource(s).			☒	*S2A.i: No Impacts to adjacent Loyalsock State Forest*
IMPORTANT NOTE: If either item vii or viii from S2.A is answered YES, the project is not eligible as a "Small Project Application" type. Complete all applicable sections of the EA form for the standard application type unless an item was otherwise waived by the Department in writing (see previous Note on waiving of information requirements).				

	Included	Item Location
C. Provide a table(s) of all proposed water obstruction(s), encroachment activities and dams (e.g. subfacility codes) and provide an identifier, the subfacility code and description, resource identifier from **S2.B**, latitude and longitude, the proposed temporary and permanent direct and indirect impacts and subfacility details.	☒	ATT: 1.0
D. Provide a discussion of how the proposed subfacility(ies) individually and in combination directly and/or indirectly impact the identified resource(s) and the effects on the applicable resource functions: hydrologic, biogeochemical, habitat, recreation, any other environmental impacts and the effects on the property or riparian rights of owners upstream, downstream or adjacent to the project.	☐	
E. **Antidegradation Analysis** - The applicant should demonstrate consistency with State antidegradation requirements as described in the Water Quality Antidegradation Implementation Guidance Policy Document Number 391-0300-002. Project application information provided below in **S3.F, G and H** may be cross-referenced.	☒	REQ: L ENCL. C
F. **Alternatives Analysis** - The scope and extent of this analysis should be commensurate with the size and scope of the proposed project impacts *in this* application, information provided in **S4.A** below, related to avoidance and minimization efforts, may be cross-referenced.	☒	REQ. S
G. **Potential Secondary Impact Evaluation** - Identify and describe environmental impacts on adjacent land and water resources associated with but not that direct result of the project.	☐	
H. Identify and evaluate the potential cumulative environmental impacts of this project and other potential or existing projects like it, and the impacts that may result through numerous piecemeal changes to the wetland resource.	☐	
Module S4: Mitigation Plan		
*This module is intended to organize and present information concerning actions undertaken in accordance with the definition of **Mitigation** in Title 25 Pa. Code Chapter 105 - §105.1, 105.16, 105.18a(a)(3), 105.18a(b)(7), 105.20a, and 105.21 as related to the potential impacts or effects of the proposed project **in this** application.*		
A. Identify and discuss any measures taken that resulted in avoiding or minimizing unavoidable resource impacts, provide detailed responses for individual proposed impact area(s) **and** the project as a whole.	☐	
B. Identify and discuss any repair, rehabilitation or restorative actions taken to rectify an impacted resource, provide detailed responses for individual proposed impact area(s) and the project as a whole. Identify and discuss any proposed preservation and maintenance operations that will be taken to reduce or eliminate an impact during the life of the project.	☐	
C. Identify and discuss any actions undertaken to provide compensatory mitigation including the purchase of credits from an approved provider, a detailed discussion of proposed compensation actions and how they will offset the lost resource functions. Provide detailed plans including performance standards and success criteria.	☐	
Answer the following question. If the answer to the question is **YES**, provide the information regarding the mitigation credit provider; otherwise provide a detailed mitigation plan. If the application proposes to utilize both mitigation bank credits and conduct permittee responsible mitigation; both the credit provider and mitigation plan information shall be submitted.	☐	
Does the applicant propose to utilize an approved mitigation bank to provide all or a portion of the compensation? ☐ Yes ☐ No		
D. When applicable, provide a plan to monitor the identified actions proposed in **S4.B** and/or **S4.C** compensatory mitigation area. Applicants should utilize the Department's Design Criteria and the USACE's RGL 08-03 -(http://www.usace.army.mil/Portals/2/docs/civilworks/RGLS/rgl08_03.pdf) to develop monitoring plans for compensatory mitigation proposals. The plan should include performance standards/success criteria, duration and timeframes of monitoring, monitoring report template, and template remedial action or adaptive management plan.	☐	
Note: All or portions of this Module may apply to "Small Project" type applications under case specific circumstances and should be discussed during any pre-application meetings or prior to application submittal.		
CERTIFICATION		
I certify that the above statements, attachments including those labeled and identified as Enclosures, and all conclusions are true, correct, and based upon current environmental principles and science, to the best of my knowledge and belief.		
Signature: [signature]	Date: 2020-01-07	

ENCLOSURE A

Aquatic Resource Investigation Memorandum

A R M G r o u p L L C

ARM GROUP INC.
MEMO

To: **Michael D. Race, P.E., CPESC, Project Manager**

From: **Matthew Bixler, PWS, Project Manager**
Scott L. Martin, PWS, Senior Scientist

Subject: **Pennsylvania General Energy Company, L.L.C.**
Aquatic Resource Investigation
Loyalsock / Shawnee Freshwater System
Gamble and Plunketts Creek Townships, Lycoming County
Pennsylvania (PA)
ARM Project 180681

Reviewed by: Michelle Cohen, Vice President Natural Resources / Senior Scientist

Date: **December 18, 2019**

Introduction

The purpose of this memorandum is to describe the findings of an aquatic resource (i.e. streams and wetlands) investigation for Pennsylvania General Energy Company L.L.C.'s (PGE's) proposed Loyalsock / Shawnee Freshwater System project located in Gamble and Plunketts Creek Townships, Lycoming County, PA. The temporary waterline will extend from proposed pump stations on both sides of Loyalsock Creek to the proposed impoundment site within Loyalsock State Forest. The investigation is necessary because streams and wetlands are protected by regulations at the state and federal level and unavoidable impacts to these aquatic resources require a permit. This memorandum serves as technical documentation during the permitting process and includes supporting documentation such as project mapping, qualifications (resumes) of individuals conducting the wetland investigation, photographs, and data forms.

The project is approximately 3.25 miles northeast of Warrensville, PA. The **Site Location Map, Figure 1, Attachment A** (United States Geological Survey [USGS] 7.5-minute quadrangle maps) illustrates the project site location. The center of the proposed temporary waterline is located at Latitude 41.349046° / Longitude -76.881483° (North American Datum [NAD] 83). The area of investigation (AOI) for the proposed Loyalsock / Shawnee Freshwater System project is approximately 39.4 acres (including pump station pads and access on both sides of the Loyalsock Creek). The AOI discussed in this memorandum and depicted on the **Aquatic Resource Identification Map (Sheet 1, Attachment A)** represents the area that is the most relevant to the proposed project at the time of this memorandum.

Methodology

The AOI was examined for wetlands and other surface waters by ARM scientists Matthew Bixler and Scott L. Martin on October 11, 2019, Scott L. Martin on November 1, 2019, and Matthew Bixler on December 18, 2019 (**Qualifications**, **Attachment B**). Precipitation over the seven days prior to the October 11, 2019 field work was approximately 1.0 to 1.75 inches of precipitation, precipitation over the previous 30 days was 25 to 75 percent of normal, and over the previous 365 days was 110 to 150 percent of normal. For the November 1, 2019 field work, precipitation in October was 150 to 200 percent of normal; Year-to-date 125 to 150 percent of normal. Approximately 0.25 and 0.75 inches of rain on October 31st caused flooding on Loyalsock Creek. A light rain fell during the December 2019 field investigation and 0.75 to 1.25 inches fell during the seven days preceding the field investigation (National Oceanic and Atmospheric Administration, NOAA, November 2019).

The aquatic resource investigation entailed a combination of reviewing existing information and conducting on-site investigations. An aerial imagery-based geographic information system (GIS)-generated map was created to illustrate the natural resource features for the AOI to facilitate the review of existing information. Existing information was obtained from various sources of data including, but not limited to, past wetland/stream data (wetland and stream locations), potential hydric soils lists and mapping, National Wetland Inventory (NWI) mapping, mapped streams, 100-year Federal Emergency Management Agency (FEMA) floodplains, USGS mapping, previous wetland delineations, and watershed mapping. This map was used as the foundation of the Aquatic Resource Identification Map (**Sheet 1, Attachment A**).

The AOI is within the Northcentral and Northeast Region of United States Department of Agriculture (USDA) Land Resource Region (LRR) R. Therefore, wetland habitats were identified in accordance with the methodology outlined in the United States Army Corps of Engineers Corps of Engineers Wetlands Delineation Manual (1987) and a *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)* (January 2012). Vegetation, soil, and hydrology data were recorded for the wetland and upland habitats at representative data points throughout the AOI. Data points were identified as an Upland Data Point (UDP) or a Wetland Data Point (WDP), as appropriate, and information was recorded on Wetland Determination Data Forms.

The boundaries of aquatic resources, if encountered within the AOI, were delineated with pink "Wetland Delineation" flagging for wetlands and blue flagging for streams and immediately surveyed using a Trimble GeoXH handheld global positioning system (GPS) device. The locations of representative data points were surveyed with the same device. Representative data points were assigned a numeric code for identification purposes and incorporated onto the Aquatic Resource Identification Map (**Sheet 1, Attachment A**), which also shows the location and orientation of representative photographs taken to document site conditions within the AOI.

The wetland indicator status of each plant species was assigned according to the United States Army Corps of Engineers' *National Wetland Plant List* (Lichvar *et al.*, 2016). Under normal conditions, hydrophytic vegetation was determined to be present where more than 50 percent of the dominant species in all vegetation stratums were classified as facultative, FAC (equally

likely to occur in wetlands as they are in non-wetlands and are adapted for moderate exposure to either condition); facultative wetland, FACW (most often occur in wetlands conditions, but sometimes occur in uplands); or obligate, OBL (almost always occur in wetlands). Wetland and waters were classified according to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et. al., 1979) and the Pennsylvania Code, Title 25 Chapter 105.17(1) *Exceptional Value Wetlands*.

Results

Background Review

Review of the background information revealed three soil types (Barbour fine sandy loam-Ba; Nolo very stony loam-NoB; and Cookport channery loam-CxB) that may contain inclusions of hydric components within the AOI. Hydric soil types were not present within the AOI. Soil types mapped within the AOI and vicinity are shown on **Sheet 1, Attachment A**.

A review of historical aerial photography revealed that a majority of the AOI has continuously been forested for at least the past 100 years. A majority of the AOI follows an existing forest access road, which appears to have been constructed and maintained since at least 1938 (PennPilot 9-24-1938). One mapped stream, Loyalsock Creek, with a mapped FEMA 100-floodplain was identified in the AOI and the Creek is mapped as an NWI riverine unknown perennial unconsolidated bottom permanently flooded (R5UBH).

The AOI is located within the Loyalsock Creek watershed. Loyalsock Creek is a tributary to the West Branch Susquehanna River (Hydrologic Unit Codes (HUC) Lower West Branch Susquehanna HUC 02050206 United States Environmental Protection Agency). According to PA Code, Title 25, Chapter 93.9w, *Drainage List L*, Water Quality Standards, Loyalsock Creek has a designation of Trout Stocking Fishes, Migratory Fishes (TSF-MF), and unnamed tributaries to this segment of Loyalsock Creek, have a designation as a High Quality-Cold Water Fishes, Migratory Fishes (HQ-CWF, MF) stream. No receiving waters of the AOI have been designated as siltation-impaired streams (eMapPA, October 2019). According to the PA Department of Environmental Protection's (PADEP's) Statewide *Existing Use Classifications* list for Lycoming County (October 8, 2019), Loyalsock Creek has an existing use classification Exceptional Value, Migratory Fishes (EV, MF). The Pennsylvania Fish and Boat Commission (PFBC) lists Loyalsock Creek as a trout stocked stream but not as a Wild Trout stream (PFBC October 2019).

On-site Investigation

The predominant land use of the AOI is forest (**Sheet 1, Attachment A**). Photographs documenting site conditions are contained in **Attachment C**. Vegetation, soils, and hydrology data collected are recorded on the data forms (**Attachment D**). The photograph locations and locations of the data points (WDP and UDP) are shown on **Sheet 1, Attachment A**.

Wetlands and Streams

The four wetlands and six streams, identified and delineated within the AOI during the field investigations, are illustrated on **Sheet 1, Attachment A**. The aquatic resources are described from west to east. The wetlands are summarized in terms of classification, size and connectivity in **Table 1.** The streams are summarized in **Table 2** with respect to water quality designation, PFBC trout classification, stream classification, navigability and type. UNT 1 is an isolated stream segment which began within Wetland 1011191116 and dissipated on the slope 60 feet higher than and 450 feet upslope of Loyalsock Creek (**Photograph 20 and 21**).

Table 1 Wetland Summary

Wetland Name	Cowardin Classification / Exceptional Value	Size (ac) Within the AOI	Isolated Wetland	Open-Ended Wetland
Wetland 1101190909	PEM1 / EV	0.28	N	N
Wetland 1101190835	PEM1 / EV	0.01	N	N
Wetland 1011191116	PFO1E / EV	0.17	Y	Y
Wetland 1011190854	PFO1E / EV	0.03	Y	N

Note: PEM1-palustrine, emergent, persistent
PFO1E- palustrine, forested, broad-leaved deciduous, seasonally flooded/saturated

Table 2 Stream Summary

Stream Name	Chapter 93 Classification / PFBC Designation / Navigable Status	Stream Type *	FEMA 100-year Floodplain
UNT 1 to Loyalsock Creek	HQ-CWF MF / TS / NA	R4SB3	No
Loyalsock Creek (side channel)	TSF, MF/ TS / NA	R4SB3/5	Yes
Loyalsock Creek	TSF, MF / TS / PA Public Highway (1811)	R3UB1	Yes
UNT 1	HQ-CWF, MF / NA / NA	R4SB3/5	No
UNT 2 of Little Bear Creek	HQ-CWF, MF / Natural Trout Reproduction /	R4SB3	No
UNT 1 of Little Bear Creek	HQ-CWF, MF / Natural Trout Reproduction /	R4SB5	No

Notes: Title 25 Chapter 93 Water Quality designation: CWF – Cold Water Fishes, EV – Exceptional Value, MF – Migratory Fish, TS – Trout Stocked stream
UNT – Unnamed Tributary
R-Riverine, 3-Upper Perennial, 4-Intermittent, UB-Unconsolidated Bottom (1-Cobble-Gravel), SB-Streambed (3-Cobble-Gravel, 5-Mud)
Navigation Status includes state and federal status.
*Stream Type based upon observations during October and November 2019 field investigations

Uplands

The uplands were characterized by a total of six upland data points **(Attachment D)**. These data points were collected to characterize the upland areas. The forest was dominated by upland species such as sugar maple (*Acer saccharum*, FACU), Eastern hemlock (*Tsuga canadensis*, FACU), chestnut oak (*Quercus montana*, UPL), mountain laurel (*Kalmia latifolia*, FACU), white pine (*Pinus strobus*, FACU), and New York fern (*Thelypteris noveboracensis*, FAC).

Summary

This memorandum documents the findings of a field investigation conducted for the approximate 37.3-acre AOI on October 11, November 1, and December 18, 2019 for the proposed Loyalsock / Shawnee Freshwater System project. Four wetlands and six streams were identified within the AOI. The AOI is within the Loyalsock Creek watershed, which eventually flows to the Susquehanna River. All four of the wetlands are exceptional value.

Any change to the proposed project that may exceed the limits of the AOI as depicted on the Aquatic Resource Identification Map **(Sheet 1, Attachment A)** will require additional wetland review. An approved erosion and sedimentation control plan will be required for protection of downstream waters and wetlands.

References

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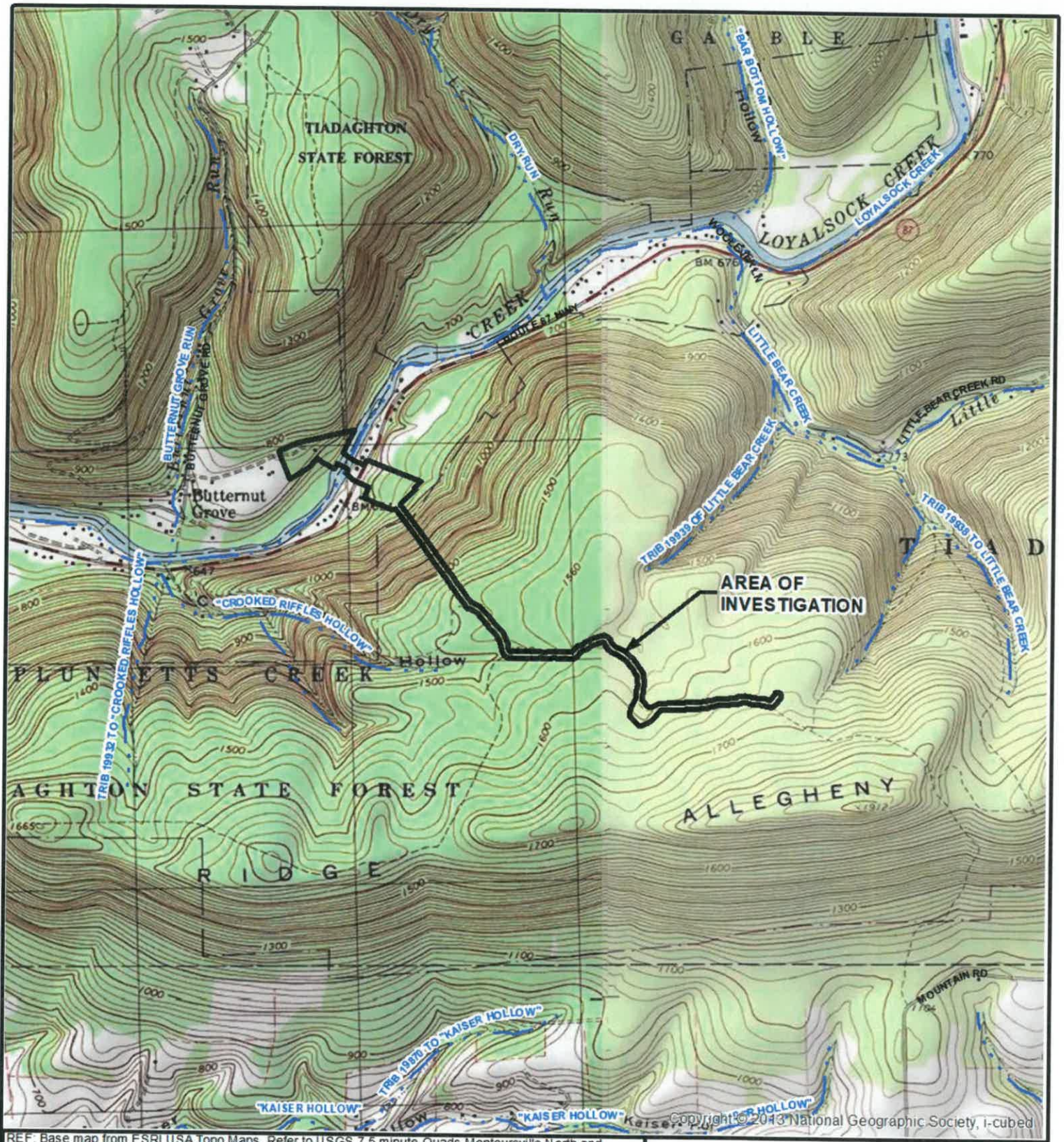
United States Department of Agriculture (USDA), Natural Resource Conservation Service [NRCS] Web Soil Survey. https://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

United States Fish and Wildlife Service (USFWS), National Wetlands Inventory, Geospatial Wetlands Digital Data, Wetlands Mapper. https://www.fws.gov/wetlands/

United States Geologic Survey (USGS). 7.5-minute quadrangle Huntersville and Montoursville North, PA.

ATTACHMENT A

Figure and Sheet



REF: Base map from ESRI USA Topo Maps. Refer to USGS 7.5 minute Quads Montoursville North and Huntersville, PA.

LEGEND

AREA OF INVESTIGATION

STREAM

0 2,000 4,000 6,000

SCALE IN FEET

N

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Site Location Map

Loyalsock / Shawnee Freshwater System
Pennsylvania General Electric
Gamble & Plunketts Creek Townships,
Lycoming County, Pennsylvania

December, 2019	Scale: 1" = 2,000'	180681

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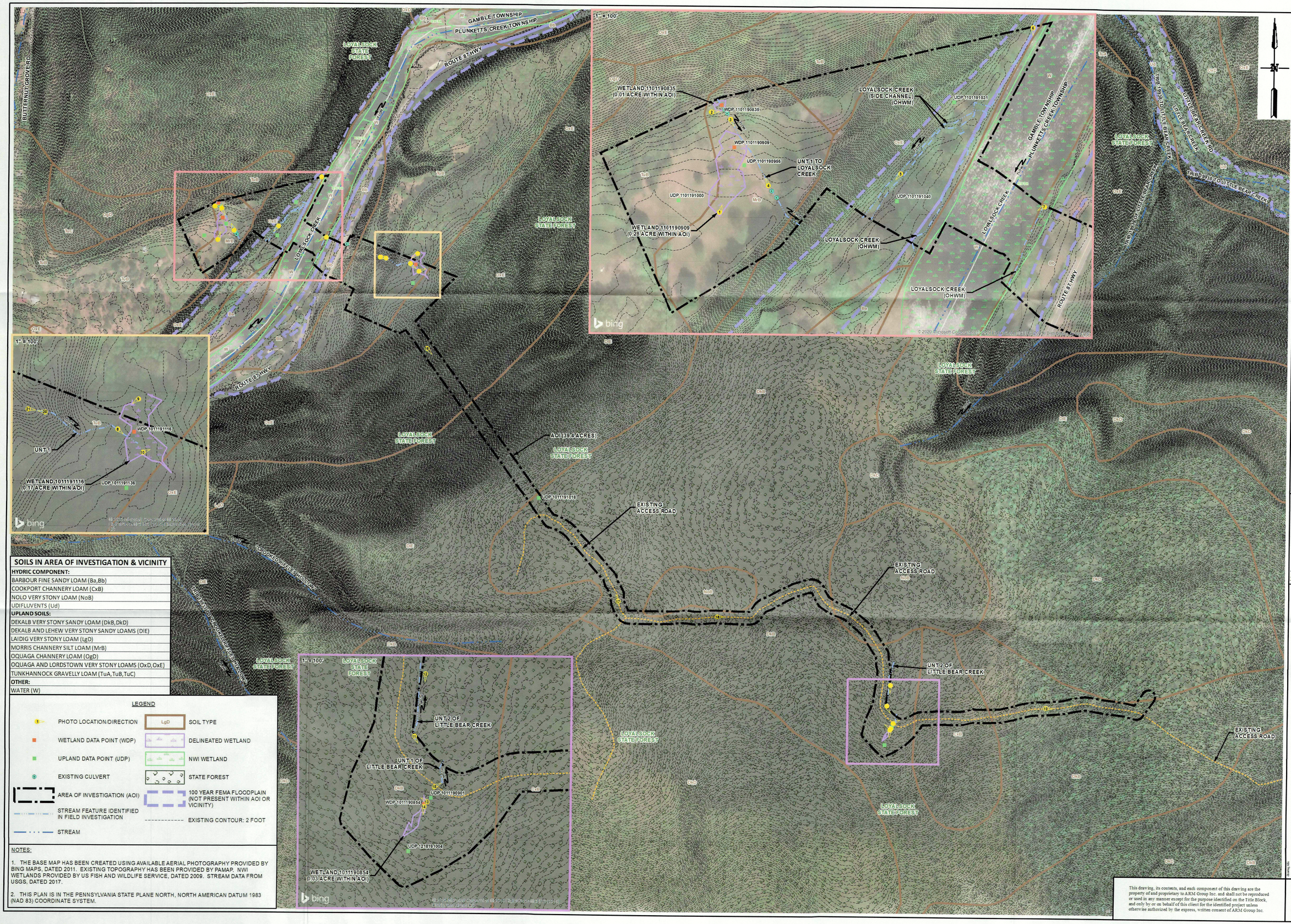
Figure 1

P:\PGE\180681.3 General Site Layout\GIS\Figure 1_Site Location Map_PGE_Loyalsock_Aquatic_20191218.mxd



SOILS IN AREA OF INVESTIGATION & VICINITY

HYDRIC COMPONENT:
BARBOUR FINE SANDY LOAM (Ba,Bb)
COOKPORT CHANNERY LOAM (CxB)
NOLO VERY STONY LOAM (NoB)
UDIFLUVENTS (Ud)
UPLAND SOILS:
DEKALB VERY STONY SANDY LOAM (DkB,DkD)
DEKALB AND LEHEW VERY STONY SANDY LOAMS (DIE)
LAIDIG VERY STONY LOAM (LgD)
MORRIS CHANNERY SILT LOAM (MrB)
OQUAGA CHANNERY LOAM (OgD)
OQUAGA AND LORDSTOWN VERY STONY LOAMS (OxD,OxE)
TUNKHANNOCK GRAVELLY LOAM (TuA,TuB,TuC)
OTHER:
WATER (W)

LEGEND

- PHOTO LOCATION/DIRECTION
- WETLAND DATA POINT (WDP)
- UPLAND DATA POINT (UDP)
- EXISTING CULVERT
- AREA OF INVESTIGATION (AOI)
- STREAM FEATURE IDENTIFIED IN FIELD INVESTIGATION
- STREAM
- SOIL TYPE (LgD)
- DELINEATED WETLAND
- NWI WETLAND
- STATE FOREST
- 100 YEAR FEMA FLOODPLAIN (NOT PRESENT WITHIN AOI OR VICINITY)
- EXISTING CONTOUR: 2 FOOT

NOTES:

1. THE BASE MAP HAS BEEN CREATED USING AVAILABLE AERIAL PHOTOGRAPHY PROVIDED BY BING MAPS, DATED 2011. EXISTING TOPOGRAPHY HAS BEEN PROVIDED BY PAMAP. NWI WETLANDS PROVIDED BY US FISH AND WILDLIFE SERVICE, DATED 2009. STREAM DATA FROM USGS, DATED 2017.

2. THIS PLAN IS IN THE PENNSYLVANIA STATE PLANE NORTH, NORTH AMERICAN DATUM 1983 (NAD 83) COORDINATE SYSTEM.

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No.	Revision	Date	By

Designed	ARM	date
Checked	MSC	date
Drawn	ARL	project no.
graphic scale		

SCALE IN FEET: 0 300 600 900

AQUATIC RESOURCE IDENTIFICATION MAP

project title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM

GAMBLE & PLUNKETTS CREEK TOWNSHIPS, LYCOMING COUNTY, PENNSYLVANIA

drawing title

Sheet 1

© 2018 ARM Group Inc. Unauthorized use prohibited. C:\Aquatic Resources\Shawnee\Shawnee Map_FOR_Exploration_20190218.dwg

ATTACHMENT B

Qualifications

Matt A. Bixler, PWS

PROJECT MANAGER

SUMMARY OF QUALIFICATIONS

Mr. Bixler has more than 18 years of experience in the natural resources field. Mr. Bixler's responsibilities entail conducting natural resource technical investigations and reporting for resources such as streams, wetlands and threatened and endangered species in Pennsylvania and surrounding states. He is experienced in wetland delineations and has conducted global positioning system (GPS) surveys and ecological assessments for rare, threatened and endangered species. Mr. Bixler also possesses strong communication skills related to consultation with state and federal resource agency representatives and clients. Mr. Bixler has experience in conducting environmental assessments and preparing appropriate documentation in accordance with National Environmental Policy Act (NEPA) requirements. Mr. Bixler also has extensive experience with project management and administration and client coordination.

PROJECT EXPERIENCE

Wetland Investigations, Delineations, and Assessments

Wetland Identification and Delineation, Whiteford Maryland Project at Former Miller Chemical Site, Harford County, MD. Identification and delineation of aquatic resources (wetlands and streams) within the approximate 48-acre investigation area. Wetlands and streams were identified and surveyed to determine permitting and site construction restraints. Historical soil contamination by arsenic during past industrial use at the site required special handling of soils during the wetland investigation. Wetland delineation field verified by U.S. Army Corps of Engineers.

Wetland Investigations, Multiple Well Pad Sites, EM Energy Ohio, LLC, Washington County, OH. Conducted wetland investigations and delineations for potential natural gas well pad sites in Washington County, OH. Wetlands and streams were identified and surveyed to determine permitting and site construction restraints that could inhibit future development of natural gas projects within the site. Potential avoidance and minimization strategies were evaluated on-site with input from the engineer and property owner constraints.

Wetland Investigation – Lake Ontelaunee Maintenance Dredging, Reading Area Water Authority, Berks County, PA (past relevant experience). Worked with a team of biologists to conduct on-site investigation of a 30+ acre site to be used for the construction of dredge dewatering basins. Review of the Pennsylvania Natural Diversity Inventory (PNDI) indicated potential presence of redbelly turtle habitat. Coordination with a qualified redbelly turtle surveyor, the PFBC and the client was managed. PNDI and consultation with the UUSFWS indicated the potential presence of bog turtles within the project area. Coordination with the U.S. Army Corps was completed, and the site was cleared of any potential bog turtle impacts.

EMPLOYEE HIGHLIGHTS

EDUCATION

Bachelor of Arts in Environmental Studies, Minor in Biology,
Washington College

Master of Science in Energy and Environmental Policy,
University of Delaware

CERTIFICATIONS/TRAINING

PAFBC Scientific Collectors' Permit #529

PADEP, Division of Water Quality Standards, Benthic Macroinvertebrate Field Sampling Quality Assurance Audit, November 7, 2017

State of Ohio Level 2 QHEI Qualified Data Collector

Wetland Delineation Course in accordance with US Army Corps of Engineers 1978 Wetlands Delineation Manual, Richard Chinn Environmental Training, Inc.

Ohio Rapid Assessment Method (ORAM) for Wetland v. 5.0, Ohio Environmental Protection Agency, 2013

Stream Assessments and Monitoring

Stream Monitoring and Benthic Macroinvertebrate Sampling, Advanced Disposal, Cumberland County Landfill, Cumberland County, PA. Lead biologist in managing and conducting an on-going annual stream assessment to evaluate water quality within tributaries of Conodoguinet Creek both down- and upstream from the Cumberland County Landfill in compliance with landfill permit conditions. The assessment involves a benthic macroinvertebrate community survey in accordance with the Pennsylvania Department of Environmental Protection's protocols outlined in An Index of biotic Integrity of Benthic Macroinvertebrate Communities in Pennsylvania's Wadeable, Freestrone, Riffle-Run Streams (2015). As part of the assessment, in-situ water chemistry data and qualitative habitat assessment data is collected and recorded for seven sites. The assessment is also conducted in accordance with the PFBC's Scientific Collectors permit. The technical findings are submitted for review to the Pennsylvania Department of Environmental Protection and macroinvertebrate data is uploaded to the PFBC's database.

Water Quality Sampling

Pre-Drill Baseline Survey and Sampling, Southwestern Energy, Susquehanna County, PA. Responsible for the management of the baseline sampling program for private potable water sources, including drilled wells, dug wells, springs/seeps, and ponds within a designated radius from natural gas well pad and water impoundment locations. The sampling requires close communication with the client due to the sensitive nature of the resource. Tasks include project coordination, landowner, laboratory and client scheduling and management of results. Emergency sampling is required in addition to baseline sampling. Emergency sampling tasks require prompt responsiveness to the client and expedited turnaround times. Sample collection and reporting are completed in compliance with regulatory requirements.

Environmental Due Diligence

Environmental Due Diligence Report, EM Energy Ohio, LLC, Various parcels, Monroe County, OH. – Conducted desktop studies and regulatory review to document potential environmental and engineering constraints that may limit or prohibit natural gas development of identified parcels. Assessments included the following: locations of existing wells; coal mining features; wetland identification; cultural resource evaluation; threatened and endangered species; groundwater contamination complaints; FEMA floodplain mapping; navigable waterways, mapped streams, and use designations; and public lands. The final report summarized potential constraints to assist the client in their investment decision.

Threatened and Endangered Species Assessments

Phase I Bog Turtle (*Glyptemys muhlenbergii*) Investigations, Christman Dam, Monroe County, PA. Completed a Phase I bog turtle survey prior to the remediation of the Christman Dam in Monroe County, PA using the guidelines presented in the USFWS's *Guidelines for Bog Turtle Surveys* (April 2006). Completed a report documented the findings of the surveys for submittal to the United States Fish and Wildlife Service (USFWS). Findings of the survey were confirmed by the USFWS.

EMPLOYEE HIGHLIGHTS

CERTIFICATIONS/TRAINING CONT.

Interagency Consultation for Endangered Species (U.S. Fish and Wildlife Service, National Conservation Training Center)

Bog Turtle Habitat and Surveying Training

Permit-Required Confined Space Entry Training

MSHA 24-Hour Mine Safety Training

SafeLandUSA Safety Training

First Aid/AED/CPR Certified

PUBLICATIONS AND PRESENTATIONS

"Mutual Benefits: Linking Source Water Protection and TMDLs." Presentation for the 61st Annual Conference of the American Water Works Association – Pennsylvania Section (May 2009)

"Achieving Watershed Improvement through Source Water Protection" Presentation for Delaware Estuary Science & Environmental Summit (Feb 2011)

ARM Group Inc.
Engineers and Scientists

Scott L. Martin, PWS

SENIOR SCIENTIST

SUMMARY OF QUALIFICATIONS

Mr. Martin has over 16 years of experience in natural resource consulting and 12 years of project administration, client coordination, cost management and staff supervision. Mr. Martin's responsibilities entail conducting natural resource technical investigations and reporting for resources such as streams, wetlands and threatened and endangered species. He is experienced in freshwater benthic macroinvertebrate, wetland delineations, wetland mitigation plan development, construction and post-construction wetland monitoring, global positioning system (GPS) survey, and ecological assessments for rare, threatened and endangered species. Experience conducting environmental assessments in Alabama, Connecticut, Illinois, Maryland, Massachusetts, Missouri, New York, North Carolina, New Jersey, Ohio, Pennsylvania, Puerto Rico, Virginia, West Virginia, and military installations.

PROJECT EXPERIENCE

Botanical Investigation for Federally Endangered Running Buffalo Clover (*Trifolium stoloniferum*), Mountaineer Pipelines, Brooke and Ohio counties, WV. The botanical survey of the 12.5-mile pipeline project included a total investigation area of approximately 494 acres. Documented a de novo population of this federally endangered species in Brooke County which was observed to extend east into Washington County, PA and a population in Ohio County, WV both these populations were new county records. According to historical aerial photographs of these new populations, the habitat has been continuously forested for over 100 years. Selective logging and the construction and irregular use of logging access roads appears to maintain the habitat necessary for this species. The observation information was submitted to the USFWS, PA DCNR, and WV DNR.

Annual Rooted-Crown Count for Federally Endangered Running Buffalo Clover (*Trifolium stoloniferum*), Fernow Experimental Forest, West Virginia Department of Natural Resources (WVDNR), Parsons County, WV. Worked with the state botanist and WVDNR personnel to conduct the annual crown-count of this species in the US Forest Service's Experimental Forest near Parsons, WV to track population changes over the study years.

Annual Rooted-Crown Count for Federally Endangered Running Buffalo Clover (*Trifolium stoloniferum*), Boch Hollow Nature Preserve, Ohio Department of Natural Resources (ODNR), Hocking County, Ohio. Worked with the state botanist and Preserve and USFWS Ohio Field Office personnel to conduct the annual crown-count to track population changes over the study years. More than 6,000 individual plants were counted, making this the largest running buffalo clover population in Ohio.

Aquatic Resource and Botanical Investigations – Point Marion to Knight Well Pad, Keystone Clearwater, LLC, Fayette County, PA. Developed a temporary freshwater pipeline alignment while identifying and minimizing/avoiding impacts on aquatic resources and species of concern. Made changes in the field to improve constructability and avoid resources and forest impacts for a 2.5-mile pipeline. Work included on-site

EMPLOYEE HIGHLIGHTS

EDUCATION

Bachelor of Science in Environmental Biology,
Millersville University

PROFESSIONAL LICENSING / CERTIFICATIONS

Professional Wetland Scientist No. 2820

USFWS, PA Field Office and Pennsylvania Fish & Boat Commission Bog Turtle Qualified Surveyor

Maryland Department of Natural Resources Recognized Qualified Bog Turtle Surveyor

USFWS, Ohio Field Office, Approved Surveyor List for: Running Buffalo Clover (*Trifolium stoloniferum)*

USFWS, West Virginia Field Office, Qualified Running Buffalo Clover Surveyor

USFWS, PA Field Office, Qualified Northeastern Bulrush Surveyor

USFWS, Virginia Field Office, Approved Surveyors in Virginia for: Northeastern bulrush (*Scirpus ancistrochaetus*) and Harperella (*Ptilimnium nodosum*)

USFWS, Chesapeake Bay Field Office, Qualified Surveyor for Northeastern bulrush (*Scirpus ancistrochaetus*) and Harperella (*Ptilimnium nodosum*)

Wild Plant Management Permit 19-062

PA Fish & Boat Commission Approved Timber Rattlesnake Monitor

meetings with engineers, gas and pipeline company representatives, the pipeline contractor, and property owners to develop an acceptable alignment. Identified the extent of populations of wild-oat (*Chasmanthium latifolium*), sourwood (*Oxydendrum arboreum*), roundleaf thoroughwort (*Eupatorium rotundifolium*), netted chainfern (*Woodwardia areolata*), and red mulberry (*Morus rubra*) observed within and in the vicinity of the project. The nearest existing population of *W. areolata* was 90 miles east of this observation, and a first for Fayette County. Avoidance and minimization efforts to protect these species of concern enabled the project to receive DCNR clearance.

Botanical Survey for Pennsylvania Listed *Platanthera ciliaris* (yellow-fringed orchid) in the Quehanna Powerline BDA in Moshannon State Forest, Clearfield, PA. Investigated a known *P. ciliaris* population in the summer of 2012 in a remote area of Moshannon State Forest. At least 132 *P. ciliaris* plants were observed in bloom during the botanical survey, the population extended along 1,300 feet of a powerline clearing (approximately 1.5 acres). The limits of the BDA, identified on the PNDI database, were corrected to more accurately represent the limits of the population. Spicebush swallowtail butterflies were observed actively feeding on several plants. The results of the botanical survey were submitted to the DCNR.

Botanical Survey for *Eleocharis compressa* (flat-stemmed spikerush), Pennsylvania Endangered, in the Conewago Falls Natural Heritage Area, Dauphin and Lancaster Counties, PA. Surveyed a documented population of *E. compressa* in the Conewago Falls area along the eastern shore of the Susquehanna River. This species has been observed in this area four times since 1988; the habitat appears to have been maintained by natural flooding/scour since at least 1938 (historical aerial photographs). Four population groups, including 1,000s of plants, were identified on boulder/bedrock outcrops within the River. The findings were submitted to the DCNR.

Pennsylvania Biological Survey, Proposed Status Changes at the 2014 Rare Plant Forum Presentation, Penn State University, April 2014. Presented the findings of two years of field investigations on *Aplectrum hyemale* (puttyroot), *Stenanthium gramineum* (eastern featherbells), and *Tipularia discolor* (cranefly orchid). The findings that these species exceeded the Pennsylvania Rare (PR) listing limits for the number of sites, number of individual plants, and population trend - the species did not appear to be declining as a result of habitat loss, disturbance, disease/predation, and/or invasive plant competition in Pennsylvania. In fact, their numbers appear to be increasing. The Vascular Plants Technical Committee concurred with the delisting of *A. hyemale* and *S. gramineum* in November 2014 but requested additional occurrence information on *T. discolor* for southwestern PA.

Botanical Survey for the 43-mile Fort Beeler Pipeline Project, Ohio Valley Midstream LLC, Washington County, PA. Conducted a survey of the 31.3-mile Pennsylvania portion (1,692 acres) of a gas pipeline project for seven plant species. Species included: *Antennaria solitaria, Arnoglossum reniforme, Diarrhena amerciana, Passiflora lutea, Polymnia uvedalia, Stachys nuttalia,* and *Woodwardia areolata.* A team of two botanists searched the 300-foot wide pipeline corridor and approximately thirty-eight access roads. All potentially suitable habitats were investigated, similar species were photodocumented, and observed species of concern were GPS surveyed and detailed habitat and species data collected, and the findings were submitted to the DCNR. *P. lutea* (yellow passionflower) were documented in Washington County – a first for this County.

EMPLOYEE HIGHLIGHTS

PROFESSIONAL LICENSING / CERTIFICATIONS CONT.

Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (9 hrs)

Federal Manual for Identifying and Delineating Wetlands

Society of Wetland Scientists, Member

PADEP, Division of Water Quality Standards, Benthic Macroinvertebrate Field Sampling QA Audit-Verified

Standard First Aid and Adult CPR/AED

MSHA 24-Hour Mine Safety Training

SafelandUSA Trained

PA Fish & Boat Commission, Boating Safety Education Certified No. W0085680

Carnegie Museum of Natural History, Pennsylvania Botanist List

Pennsylvania Amphibian and Reptile Survey Atlas Project (PARS), Lancaster County Coordinator

The Biota of North America Program (BONAP), North American Vascular Flora, Field Botanist and Photographic Contributor

The James C. Parks Herbarium (MVSC), Millersville University, Pennsylvania Herbarium Associate

Botanical Society of Western Pennsylvania, Member

Muhlenberg Botanical Society, Member

Experience conducting botanical surveys for the following PA species of special concern (SOSC) and federally listed species:

- *Acontium uncinatum* (PT) – Blue Monkshood; Westmoreland County, PA
- *Andropogon glomeratus* (PR) – Bushy bluestem, Berks, Chester, and Lancaster counties, PA
- *Andropogon gyrans* (PR) – Elliott's Beardgrass; Greene County, PA
- *Antennaria solitaria* (PE) – Solitary Pussy-toes; Greene County, PA; Doddridge and Richie counties, WV
- *Arnoglossum reniforme* (PE) – Great Indian Plantain; Greene County, PA
- *Aletris farinosa* (PE) - Colicroot; Lancaster County, PA
- *Asplenium bradleyi* (PE) – Bradley's Spleenwort; Lancaster County, PA
- *Baptisia australis* (PT) – Blue Wild Indigo; Butler County, PA
- *Boltonia asteroides* (PE) – Aster-like Boltonia; Dauphin, Lancaster, and York counties, PA
- *Castilleja coccinea* (PT) – Scarlet Indian-Paintbrush; Lebanon County, PA
- *Chasmanthium latifolium* (PE) – Wild-oat; Greene, Fayette, Lancaster, and Washington counties, PA
- *Chasmanthium laxum* (PE) – Slender woodoats; Shelby County, AL
- *Chrysognonum virginianum* (PE) – Green and Gold, Pleasants and Richie counties, WV
- *Diarrhena americana* (PE) – American Beakgrain; Greene and Washington counties, PA
- *Dodecatheon radicatum* (PT) – Jeweled Shooting-star; Lancaster County, PA
- *Eleocharis compressa* (PE) – Flat-stemmed spike-rush, Dauphin and Lancaster counties, PA
- *Ellisia nyctelea* (PT) – Ellisia; Lancaster County, PA
- *Erigenia bulbosa* (PR) – Harbinger-of-spring; Greene and Lancaster counties, PA
- *Eupatorium godfreyanum* (PT) - Geodfrey's thoroughwort; Dauphin and Lancaster counties, PA
- *Erythronium albidum* (PR) – White Trout-lily; Greene and Lancaster Counties, PA
- *Gaylussacia brachycera* (PE) – Box Huckleberry; Perry County, PA
- *Hypericum stragulum* (PT) – St. Andrew's Cross; Greene, Lancaster, and Lebanon counties, PA
- *Juncus biflora* (PT); Grass-leaved Rush; Berks and Dauphin counties, PA
- *Lathyrus ochroleucus* (PT) – Cream-colored Vetchling; Centre County, PA
- *Lycopodiella appressa* (PT) – Southern Bog Clubmoss; Cumberland County, PA
- *Lycopus rubellus* (PE) – Gypsy-wort; Berks County, PA
- *Magnolia virginiana* (PT) – Sweetbay Magnolia; Lebanon County, PA
- *Magnolia tripetala* (PR) – Umbrella Magnolia; Chester and Lancaster counties, PA
- *Opuntia humifusa* (PR) – Prickly-pear Cactus; Cumberland County, PA
- *Passiflora lutea* (PT) – Yellow Passionflower; Fayette, Greene, and Washington counties, PA and Richie County, WV
- *Platanthera ciliaris* (PT) – Yellow Fringed Orchid; Clearfield and Dauphin counties, PA
- *Poa paludigena* (PT) – Bog bluegrass; Lawrence County, PA
- *Polymnia uvedalia* (PR) – Yellow Leaf-cup; Greene and Lancaster counties, PA
- *Prenanthes serpentaria* (PT) – Lion's-foot rattlesnake-root; Lancaster County, PA
- *Pyrularia pubera* (PR) - Buffalo nut; Westmoreland County, PA
- *Ratibida pinnata* (PE) – Gray-headed Prairie Coneflower, Washington County, PA
- *Rotala ramosior* (PR) – Toothcup; Dauphin County, PA
- *Rubus cuneifolius* (PE) – Sand Blackberry; Dauphin County, PA
- *Rudbeckia fulgida* (PT) – Eastern Coneflower; Dauphin and Lebanon counties, PA
- *Scirpus ancistrochaetus* (PT, FE) – Northeastern Bulrush; Centre, Franklin, Huntingdon, and Mifflin counties, PA
- *Senna marilandica* (PR) – Maryland Senna; Marshall County, WV
- *Stachy cordata* (PE) – Nuttall's Hedge-nettle; Greene County, PA and Richie County, WV
- *Spiraea betulifolia var. corymbosa* (PE) – Dwarf spiraea; Fulton County, PA
- *Spiraea virginiana* (FE) – Virginia Spiraea; Raleigh County, WV
- *Trifolium stoloniferum* (FE, OE, PE) – Running Buffalo Clover; Washington County, PA; Brooke, Ohio, and Randolph Counties, WV; Hocking and Jackson Counties, OH
- *Trillium cernuum* (PT) – Nodding Trillium; Berks, Chester, Lancaster, and Lebanon counties, PA; Tyler County, WV
- *Trollius laxus (PE)* – American globeflower; Lawrence County, PA
- *Veratrum virginicum* (PE) – Virginia Bunchflower; Lawrence, Lebanon counties, PA
- *Xyris torta* (PT) – Slender Yellow-eyed Grass; Lancaster County, PA

ATTACHMENT C

Photograph Log

PHOTOGRAPH LOG
LOYALSOCK / SHAWNEE FRESHWATER SYSTEM

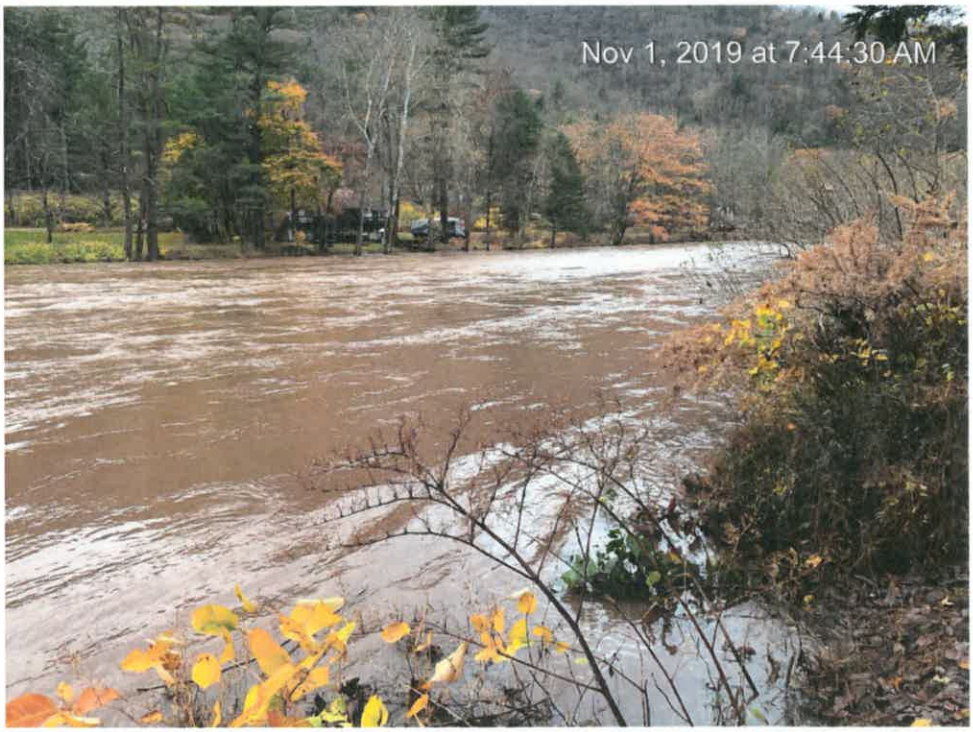
Photograph 1 illustrates Wetland 1101190909 near the western AOI limits. The view is facing northeast.

Photograph 2 illustrates Wetland 1101190835 near the western AOI limits along an existing residential driveway. The view is facing east.

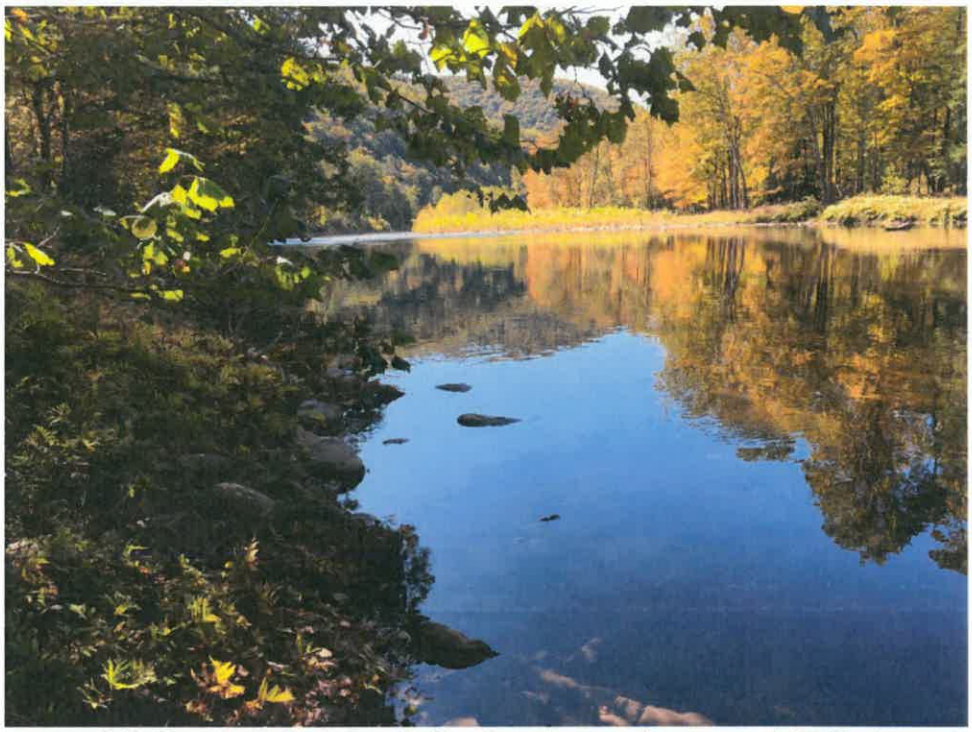
Photograph 3 illustrates UNT 1 to Loyalsock Creek northeast of Wetland 1101190909 and south of the residential driveway culvert. The view is facing southeast.

Photograph 4 illustrates UNT 1 to Loyalsock Creek downgradient of Wetland 1101190909. The view is facing northwest.

Photograph 5 illustrates the Loyalsock Creek side channel within the high floodplain during flooding conditions. The view is facing southwest.



Photograph 6 illustrates Loyalsock Creek during flooding conditions. The view is facing south.



Photograph 7 illustrates Loyalsock Creek at the northwestern AOI limits under normal conditions. The view is facing downstream (southwest) on the left bank.

Photograph 8 illustrates the isolated intermittent stream UNT 1 within Wetland 1011191116. The view is facing upstream (east).

Photograph 9 illustrates the forested Wetland 1011191116. The view is facing southwest.

Photograph 10 illustrates the forested Wetland 1011191116. The view is facing east.

Photograph 11 illustrates the upper intermittent limits of UNT 2 to Little Bear Creek. The view is facing upstream.

Photograph 12 illustrates UNT 2 to Little Bear Creek where groundwater appears to create perennial conditions. The view is facing upstream.

Photograph 13 illustrates the isolated Wetland 1011190854 upgradient from an existing forest access road and the proposed TWL. The view is facing west.

Photograph 14 illustrates the isolated Wetland 1011190854 south beyond the AOI limits. The view is facing south.

Photograph 15 illustrates the intermittent UNT 1 to Little Bear Creek downgradient of the existing forest access road and temporary waterline (TWL). The view is facing downstream.

Photograph 16 illustrates the AOI on the northwest facing slope east of Loyalsock Creek. The view is facing upslope.

Photograph 17 illustrates an existing forest access road and TWL alignment. The view is facing northwest.

Photograph 18 illustrates the existing forest access road and TWL alignment. The view is facing east.

Photograph 19 illustrates the existing forest access road and TWL alignment. The view is facing east.

Photograph 20 illustrates the end of UNT 1 where the intermittent stream channel dissipates on the slope and the defined bed is lost. The view is facing east (upslope).

Photograph 21 illustrates the end of UNT 1 where the intermittent stream channel dissipates on the slope and the defined bed is lost. The view is facing west (downslope).

ATTACHMENT D

Data Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 11/1/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: WDP 1101190909
Investigator(s): S. Martin Section, Township, Range: Gamble Township
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): slight slope
Subregion (LRR or MLRA): LRR R Lat: 41.355778 Long: -76.89129 Datum: NAD83
Soil Map Unit Name: Morris channery silt loam, 0 to 8 percent slopes, extremely stony - MrB NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐	**Is the Sampled Area within a Wetland?** Yes ☑ No ☐
Hydric Soil Present?	Yes ☑	No ☐	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☑	No ☐	

Remarks:

Cowardin classification: PEM1. Wetland 1101190909 is located on a level area at the toe of slope (ancient floodplain). The wetland hydrology is provided by a high water table and surface water runoff from the adjacent landscape. All three wetland parameters were present at the data point. Adjacent upland habitat was characterized by UDP1101190956 as well as UDP 1101191000. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal. Approximately 0.25 and 0.75 inches of rain day prior caused flooding on Loyalsock Creek.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): surface

Wetland Hydrology Present? Yes ☑ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Wetland hydrology indicators A3 (Saturation), and C3 (Oxidized Rhizospheres on Living Roots) were observed. Hydrology is provided by a high water table and supplemented by surfce water runoff from the adjacent uplands. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal. The nearby channelized stream may have reduced the hydroperiod of the wetland.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Rhynchospora capitellata	80	Y	OBL
2. Aster sp.*	40	Y	FAC
3. Euthamia graminifolia	25	N	FAC
4. Pycnanthemum verticillatum	25	N	FAC
5. Carex sp.*	25	N	FAC-OBL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	195	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- [x] 1 – Rapid Test for Hydrophytic Vegetation
- [ ] 2 – Dominance Test is >50%
- [ ] 3 – Prevalence Index is ≤3.0[1]
- [ ] 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes [x] No [ ]

Remarks: (Include photo numbers here or on a separate sheet.)
Vegetation meets the Dominance Test for hydrophytic vegetation.
*Carex sp. and Aster sp. could not be identified to the species; they were an indicator status of FAC-OBL based on professional experience and co-dominants.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR3/2	95	10YR3/4	5	M	C	silt loam	
2-18	10YR6/2	75	10YR5/8	25	M	C		clayey sandy loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

Hydric soil indicator F3 (Depleted Matrix) was observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 11/1/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: WDP 1101190835
Investigator(s): S. Martin Section, Township, Range: Gamble Township
Landform (hillslope, terrace, etc.): slope Local relief (concave, convex, none): concave
Subregion (LRR or MLRA): LRR R Lat: 41.356108 Long: -76.891414 Datum: NAD83
Soil Map Unit Name: Morris channery silt loam, 0 to 8 percent slopes, extremely stony - MrB NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑	No ☐	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☑	No ☐	

Remarks:

Cowardin classification: PEM1. Wetland 1101190835 is located upgradient of the house driveway. The wetland hydrology is provided by a high water table and an intermittent stream channel. All three wetland parameters were present at the data point. Adjacent upland habitat was characterized at UDP 1101191000. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal. Approximately 0.25 and 0.75 inches of rain day prior caused flooding on Loyalsock Creek.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☑	No ☐	Depth (inches): surface
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): surface

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Wetland hydrology indicators A3 (Saturation), A2 (High Water Table), and D2 (Geomorphic Position) were observed. Hydrology is provided by a high water table and supplemented by surface water runoff from UNT 1 to Loyalsock Creek. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Microstegium vimineum	50	Y	FAC
2. Persicaria pensylvanica	30	Y	FACW
3. Carex sp.	20	Y	FAC-OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species _____ x 1 = _____

FACW species _____ x 2 = _____

FAC species _____ x 3 = _____

FACU species _____ x 4 = _____

UPL species _____ x 5 = _____

Column Totals: _____ (A) _____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☑ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)
Vegetation meets the Dominance Test for hydrophytic vegetation.
*Carex sp. could not be identified to the species. It was given an indicator status of FAC-OBL based on professional experience.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR3/2	95	10YR3/6	5	M	C	sandy loam	
10								rock

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 10

Hydric Soil Present? Yes ☑ No ☐

Remarks:

Hydric soil indicator F3 (Depleted Matrix) was observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 10/11/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: WDP 1011191116
Investigator(s): M. Bixler, S. Martin Section, Township, Range: Plunketts Creek Township
Landform (hillslope, terrace, etc.): level area Local relief (concave, convex, none): concave
Subregion (LRR or MLRA): LRR R Lat: 41.354775 Long: -76.885926 Datum: NAD83
Soil Map Unit Name: Tunkhannock gravelly loam, 3 to 8 percent slopes (TuB) NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑	No ☐	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☑	No ☐	

Remarks:
Cowardin classification: PFO1E. Wetland 1011191116 is located on a level area at the base of a hillslope. The wetland hydrology is provided by a high water table and surface water runoff from the adjacent hilllope. All three wetland parameters were present at the data point. An isolated stream segment begins within the wetland and ends west of the wetland, within the AOI. Adjacent upland habitat was characterized at UDP 1011191136.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland hydrology indicators B9 (Water-Stained Leaves), B10 (Drainage Patterns), and C3 (Oxidized Rhizospheres on Living Roots) were observed. Hydrology is provided by a high water table and supplemented by surfce water runoff from the adjacent uplands.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1. Quercus alba	60	Y	FACU
2. Acer rubrum	20	Y	FAC
3. Pinus strobus	10	N	FACU
4.			
5.			
6.			
7.			
	90	=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Hamamelis virginiana	20	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	20	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Microstegium vimineum	70	Y	FAC
2. *Carex sp.	20	Y	FACW
3. Polystichum acrostichoides	10	N	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 60% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species _____ x 1 = _____

FACW species _____ x 2 = _____

FAC species _____ x 3 = _____

FACU species _____ x 4 = _____

UPL species _____ x 5 = _____

Column Totals: _____ (A) _____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☑ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)
Vegetation meets the Dominance Test for hydrophytic vegetation.
*Carex sp. could not be identified to the species. It was given an indicator status of FACW based on professional experience.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR3/2	100					loam	
3-10	10YR4/2	60	10YR5/6	10	D	PL/M	silt loam	
	10YR5/2	30						
10-12	10YR5/3	60					silt loam	
	10YR5/4	40						
12								refusal

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 12

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

Hydric soil indicator F3 (Depleted Matrix) was observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 10/11/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: WDP 1011190854
Investigator(s): M. Bixler, S. Martin Section, Township, Range: Plunketts Creek Township
Landform (hillslope, terrace, etc.): hilltop Local relief (concave, convex, none): concave
Subregion (LRR or MLRA): LRR R Lat: 41.345066 Long: -76.872726 Datum: NAD83
Soil Map Unit Name: Dekalb very stony sandy loam, 0 to 8 percent slopes (DkB) NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑	No ☐	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☑	No ☐	

Remarks:
Cowardin classification: PFO1E. Wetland 1011190854 is located on a level area on a plateau. The wetland hydrology is provided by a high water table and surface water runoff from the adjacent landscape. All three wetland parameters were present at the data point. Adjacent upland habitat was characterized at UDP 1011190901.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☑ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland hydrology indicators B8 (Sparsely Vegetated Concave Surface), B9 (Water-Stained Leaves), and D2 (Geomorphic Position) were observed. Hydrology is provided by a high water table and supplemented by surfce water runoff from the adjacent uplands. Shallow tree roots were observed within the wetland and caused a tree throw (uprooted tree with due to shallow roots).

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1. Acer rubrum	75	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	75	=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Hamamelis virginiana	20	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	20	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Osmundastrum cinnamomeum	5	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 67% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species _____ x 1 = _____

FACW species _____ x 2 = _____

FAC species _____ x 3 = _____

FACU species _____ x 4 = _____

UPL species _____ x 5 = _____

Column Totals: _____ (A) _____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☑ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

Vegetation meets the Dominance Test for hydrophytic vegetation.

*Carex sp. could not be identified to the species. It was given an indicator status of FACW based on professional experience.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR4/2	100					silt loam	
4-12	10YR2/2	50	10YR4/3	30			silt loam	
			10YR4/6	20				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 12

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

Hydric soil indicator F3 (Depleted Matrix) was observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 10/11/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: UDP 1011190901
Investigator(s): M. Bixler, S. Martin Section, Township, Range: Plunketts Creek Township
Landform (hillslope, terrace, etc.): level area Local relief (concave, convex, none): none
Subregion (LRR or MLRA): LRR R Lat: 41.345104 Long: -76.872675 Datum: NAD83
Soil Map Unit Name: Dekalb very stony sandy loam, 0 to 8 percent slopes (DkB) NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	**Is the Sampled Area within a Wetland?** Yes ☐ No ☑
Hydric Soil Present?	Yes ☐	No ☑	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☐	No ☑	

Remarks:
UDP 1011190901 is located within a forested area, adjacent to an access road. The data is located between isolated Wetland 1011190854 and the headwaters of a stream. The data point is representative of the upland conditions in the forested area along the access road. No indicators of wetland hydrology, hydrophytic vegetation or hydric soils were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology were observed.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1. Acer saccharum	50	Y	FACU
2. Tsuga canadensis	25	Y	FACU
3. Pinus strobus	10	N	FACU
4.			
5.			
6.			
7.			
	85	=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Kalmia latifolia	25	Y	FACU
2. Tsuga canadensis	15	Y	FACU
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Thelypteris noveboracensis	75	Y	FAC
2. Viola sororia	20	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species _____ x 1 = _____

FACW species _____ x 2 = _____

FAC species _____ x 3 = _____

FACU species _____ x 4 = _____

UPL species _____ x 5 = _____

Column Totals: _____ (A) _____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)
No indicators of hydrophytic vegetation.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR3/2	100					silt loam	gravely
4								refusal

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 4

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

No hydric soil indicators were observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 10/11/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: UDP 1011191018
Investigator(s): M. Bixler, S. Martin Section, Township, Range: Plunketts Creek Township
Landform (hillslope, terrace, etc.): level area Local relief (concave, convex, none): none
Subregion (LRR or MLRA): LRR R Lat: 41.349897 Long: -76.882514 Datum: NAD83
Soil Map Unit Name: Dekalb very stony sandy loam, 0 to 8 percent slopes (DkB) NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	**Is the Sampled Area within a Wetland?** Yes ☐ No ☑
Hydric Soil Present?	Yes ☐	No ☑	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☐	No ☑	

Remarks:
UDP 1011191018 is located on a level area, at the top of a forested hillslope within Loyalsock State Forest. The data point is representative of the upland conditions along the forested ridgetop. No indicators of wetland hydrology, hydrophytic vegetation or hydric soils were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology were observed.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1. Tsuga canadensis	50	Y	FACU
2. Pinus strobus	25	Y	FACU
3. Quercus montana	25	Y	UPL
4. Acer rubrum	10	N	FAC
5.			
6.			
7.			
	110	=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Kalmia latifolia	30	Y	FACU
2. Vaccinium angustifolium	10	Y	FACU
3.			
4.			
5.			
6.			
7.			
	40	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species _____ x 1 = _____

FACW species _____ x 2 = _____

FAC species _____ x 3 = _____

FACU species _____ x 4 = _____

UPL species _____ x 5 = _____

Column Totals: _____ (A) _____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)
No indicators of hydrophytic vegetation.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR2/2	100					organic	
4								refusal

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 4

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

No hydric soil indicators were observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 10/11/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: UDP 1011191136
Investigator(s): M. Bixler, S. Martin Section, Township, Range: Plunketts Creek Township
Landform (hillslope, terrace, etc.): level area Local relief (concave, convex, none): none
Subregion (LRR or MLRA): LRR R Lat: 41.354394 Long: -76.885985 Datum: NAD83
Soil Map Unit Name: Tunkhannock gravelly loam, 3 to 8 percent slopes (TuB) NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	**Is the Sampled Area within a Wetland?** Yes ☐ No ☑
Hydric Soil Present?	Yes ☐	No ☑	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☐	No ☑	

Remarks:
UDP 1011191136 is located along a level area at the base of a forested hillslope, adjacent to Wetland 1011191116. The data point is representative of the upland conditions adjacent to the wetland. No indicators of wetland hydrology, hydrophytic vegetation or hydric soils were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology were observed.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1. Pinus strobus	75	Y	FACU
2. Fagus grandifolia	25	Y	FACU
3.			
4.			
5.			
6.			
7.			
	100	=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Berberis thunbergii	20	Y	FACU
2. Pinus strobus	15	Y	FACU
3.			
4.			
5.			
6.			
7.			
	35	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Thelypteris noveboracensis	50	Y	FAC
2. Polystichum acrostichoides	10	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 20% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)
No indicators of hydrophytic vegetation.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR3/3	100					loam	
8-12	10YR3/4	100					loam	gravely
12								refusal

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 12

Hydric Soil Present? Yes ☐ No ☑

Remarks:

No hydric soil indicators were observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 11/1/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: UDP 1101190956
Investigator(s): S. Martin Section, Township, Range: Gamble Township
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): slight slope
Subregion (LRR or MLRA): LRR R Lat: 41.355659 Long: -76.891208 Datum: NAD83
Soil Map Unit Name: Morris channery silt loam, 0 to 8 percent slopes, extremely stony - MrB NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☑ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	**Is the Sampled Area within a Wetland?** Yes ☐ No ☑
Hydric Soil Present?	Yes ☐	No ☑	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☐	No ☑	

Remarks:
UDP 1101190956 is located between Wetland 1101190909 and the excavated intermittent stream channel. No indicators of wetland hydrology or hydric soils were observed. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal. Approximately 0.25 and 0.75 inches of rain day prior caused flooding on Loyalsock Creek.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology were observed. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Microstegium vimineum	100	Y	FAC
2. Asclepias syriaca	75	Y	UPL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	175	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species _____ x 1 = _____

FACW species _____ x 2 = _____

FAC species _____ x 3 = _____

FACU species _____ x 4 = _____

UPL species _____ x 5 = _____

Column Totals: _____ (A) _____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)
No indicators of hydrophytic vegetation.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR4/3	97	10YR4/4	3			silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

No hydric soil indicators were observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 11/1/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: UDP 1101191000
Investigator(s): S. Martin Section, Township, Range: Gamble Township
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): slight slope
Subregion (LRR or MLRA): LRR R Lat: 41.355413 Long: -76.891809 Datum: NAD83
Soil Map Unit Name: Tunkhannock gravelly loam, 3 to 8 percent slopes - TuB NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	**Is the Sampled Area within a Wetland?** Yes ☐ No ☑
Hydric Soil Present?	Yes ☐	No ☑	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☐	No ☑	

Remarks:
UDP 1101191000 is located along a level area at the base of a forested hillslope west of Wetland 1101190909. The data point is representative of the upland conditions adjacent to the wetland. No indicators of wetland hydrology, hydrophytic vegetation or hydric soils were observed. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal. Approximately 0.25 and 0.75 inches of rain day prior caused flooding on Loyalsock Creek.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology were observed. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Elaeagnus umbellata*	2	N	UPL
2.			
3.			
4.			
5.			
6.			
7.			
	2	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Microstegium vimineum	80	Y	FAC
2. Cirsium vulgare	60	Y	FACU
3. Achillea millefolium	25	N	FACU
4. Pycnanthemum verticillatum	25	N	FAC
5. Lotus corniculatus	10	N	FACU
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	200	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)
No indicators of hydrophytic vegetation. *indicator status based on professional experience.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR3/4	100					silt loam	
8-18	10YR5/6	90	10YR2/1	10	M	D		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☐ No ☑

Remarks:

No hydric soil indicators were observed.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 11/1/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: UDP 1101191031
Investigator(s): S. Martin Section, Township, Range: Gamble Township
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): convex
Subregion (LRR or MLRA): LRR R Lat: 41.356038 Long: -76.8892429 Datum: NAD83
Soil Map Unit Name: Oquaga and Lordstown very stony loams, 25 to 70 percent slopes - OxE NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	**Is the Sampled Area within a Wetland?** Yes ☐ No ☑
Hydric Soil Present?	Yes ☐	No ☑	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☐	No ☑	

Remarks:
UDP 1101191031 is located in the FEMA 100-year floodplain of Loyalsock Creek. The data point is representative of the upland conditions of the floodplain. No indicators of wetland hydrology, hydrophytic vegetation or hydric soils were observed. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal. Approximately 0.25 and 0.75 inches of rain day prior caused flooding on Loyalsock Creek.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology were observed. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal. Flooding was approimately three feet lower in elevation.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1. Acer rubrum	15	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	15	=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Berberis thunbergii	70	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	70	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Reynoutria japonica	20	Y	FACU
2. Persicaria pensylvanica	20	Y	FACW
3. Dichanthelium clandestinum	10	N	FACW
4. Microstegium vimineum	10	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)

No indicators of hydrophytic vegetation. Invasive species of floodplains often have a wide range of suitable habitat conditions.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-24	10YR3/4	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☐ No ☑

Remarks:

No hydric soil indicators were observed. Well-drained floodplain soils. Should be mapped Barbour fine sandy loam (Ba).

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 11/1/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: UDP 1101191040
Investigator(s): S. Martin Section, Township, Range: Gamble Township
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): convex
Subregion (LRR or MLRA): LRR R Lat: 41.355337 Long: -76.889794 Datum: NAD83
Soil Map Unit Name: Oquaga and Lordstown very stony loams, 25 to 70 percent slopes - OxE NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☐ No ☑ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	**Is the Sampled Area within a Wetland?** Yes ☐ No ☑
Hydric Soil Present?	Yes ☐	No ☑	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☐	No ☑	

Remarks:
UDP 1101191040 is located in the FEMA 100-year floodplain of Loyalsock Creek between the Creek and an high-water side channel. The data point is representative of the upland conditions. No indicators of wetland hydrology, hydrophytic vegetation or hydric soils were observed. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal. Approximately 0.25 and 0.75 inches of rain day prior caused flooding on Loyalsock Creek.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology were observed. Precipitation in October was 150-200 percent of normal; Year-to-date 125 to 150 percent of normal.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
		=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Berberis thunbergii	80	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	80	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Microstegium vimineum	70	Y	FAC
2. Dichanthelium clandestinum	5	N	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	75	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)
No indicators of hydrophytic vegetation.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-24	10YR3/4	100					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☐ No ☑

Remarks:

No hydric soil indicators were observed. Should be mapped Barbour fine sandy loam (Ba).

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Loyalsock / Shawnee Freshwater System City/County: Lycoming County Sampling Date: 12/18/19
Applicant/Owner: Pennsylvania General Energy Company, L.L.C. State: PA Sampling Point: UDP 1218191004
Investigator(s): M. Bixler Section, Township, Range: Plunketts Creek Township
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none
Subregion (LRR or MLRA): LRR R Lat: 41.344738 -77 Datum: NAD83
Soil Map Unit Name: Dekalb very stony sandy loam, 0 to 8 percent slopes (DkB) NWI classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ ignificantly disturbed? Are "Normal Circumstances present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ aturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	**Is the Sampled Area within a Wetland?** **Yes** ☐ **No** ☑
Hydric Soil Present?	Yes ☐	No ☑	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ☐	No ☑	

Remarks:
UDP 1218191004 is located along a hillslope, adjacent to Wetland 1011190854 and an existing access road/trail. The data point is representative of the upland conditions adjacent to the wetland and along the access road/trail. No indicators of wetland hydrology, hydrophytic vegetation or hydric soils were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat of Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☐	No ☑	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):

Wetland Hydrology Present? **Yes** ☐ **No** ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology were observed.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot Size: 30-foot radius)			
1. Pinus strobus	25	Y	FACU
2. Quercus alba	25	Y	FACU
3. Acer rubrum	20	Y	FAC
4. Tsuga canadensis	10	N	FACU
5.			
6.			
7.			
	80	=Total Cover	
Sapling/Shrub Stratum (Plot Size: 15-foot radius)			
1. Pinus strobus	10	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Herb Stratum (Plot Size: 5-foot radius)			
1. Kalmia latifolia	50	Y	FACU
2. Vaccinium angustifolium	20	Y	FACU
3. Hamamelis virginiana	10	N	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80	=Total Cover	
Woody Vine Stratum (Plot Size: 30-foot radius)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species that Are OBL, FACW, or FAC: 17% (A/B)

Prevalence Index worksheet:

Total % Cover of:

OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☐ 2 – Dominance Test is >50%
- ☐ 3 – Prevalence Index is ≤3.0[1]
- ☐ 4 – Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)
No indicators of hydrophytic vegetation.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR2/2	100					loam	
2-4	10YR4/2	100					loam	gravely
4-10	10YR5/6	100					loam	gravely
10								refusal

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR R, MLRA**
- ☐ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ☐ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ☐ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Much (A10) **(LRR K, L, MLRA 149B)**
- ☐ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ☐ Dark Surface (S7) **(LRR K, L)**
- ☐ Polyvalue Below Surface (S8) **(LRR K, L)**
- ☐ Thin Dark Surface (S9) **(LRR K, L)**
- ☐ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ☐ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 10

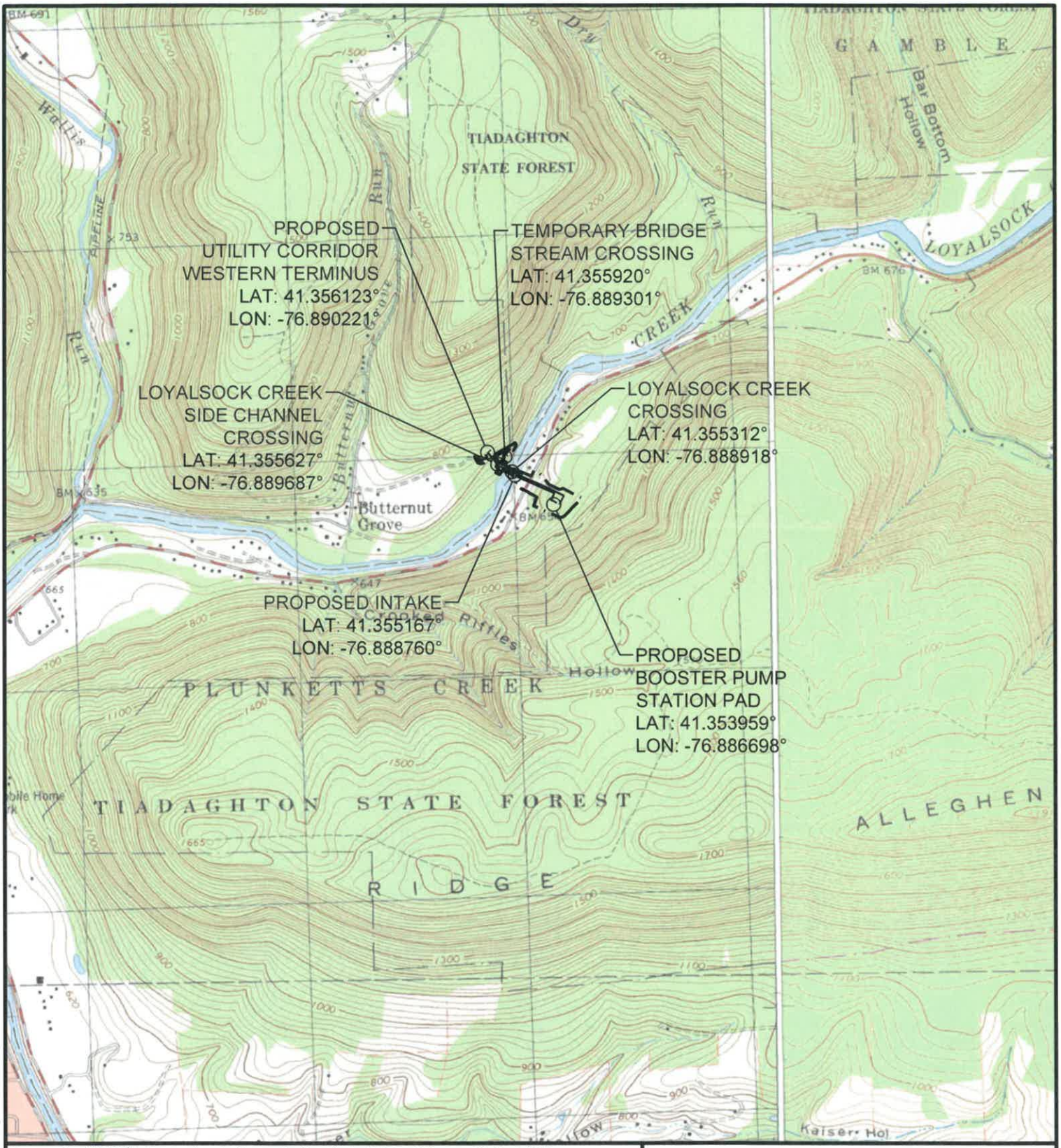
Hydric Soil Present? Yes ☐ No ☑

Remarks:

No hydric soil indicators were observed.

ENCLOSURE B

Project Location Map



Base map from USGS 7½ minute quadrangles Huntersville, Photo Revised 1986, and Montoursville North 1999.

LEGEND

PROPOSED LIMIT OF DISTURBANCE

0 2000 4000 6000

SCALE IN FEET

N

This drawing, its contents, and each component of this drawing are the property of and proprietary to ARM Group LLC and shall not be reproduced or used in any manner except for the purpose identified on the Title Block, and only by or on behalf of this client for the identified project unless otherwise authorized by the express, written consent of ARM Group LLC.

SITE LOCATION MAP

LOYALSOCK/SHAWNEE FRESHWATER SYSTEM
PENNSYLVANIA GENERAL ENERGY COMPANY, L.C.C.
GAMBLE & PLUNKETTS CREEK TOWNSHIP,
LYCOMING COUNTY, PENNSYLVANIA

January 2020	Scale: 1" = 2000'	190736

ARM Group LLC
Engineers and Scientists
www.armgroup.net

Figure 1

P:\PGE\190736 Loyalsock-Shawnee Freshwater System\Drwg\Production\Figures\190736-FI-C-104.dwg Plotted January 6, 2020

ENCLOSURE C

Antidegradation Analysis

A R M G r o u p L L C

ANTIDEGRADATION ANALYSIS

E & S Plan:

Nondischarge BMPs

☒ Alternative Siting

☒ Alternative location – The pump station site and underground utility corridor alignments, including their associated entrances and staging areas, were carefully selected and were determined to be in the most optimal location for the project during the design/permitting phase. The project site was carefully selected by owner, land agents, engineers, and biologists to minimize impacts to natural resources and to provide a cost-effective design for constructability purposes.

☒ Alternative configuration – When designing the project, Low Impact Development (LID) techniques were used. The site was laid out to minimize disturbance, located to minimize impacts to streams and avoid impacts to wetlands. The pipeline corridors and other areas of the site will be reclaimed to meadow or pre-construction conditions.

☒ Alternative location of discharge – The entire project area will drain to High Quality / Exceptional Value, Migratory Fishes (HQ / EV, MF) waters. Alternate locations for this project site were evaluated; however, impacts to Special Protection waters were unavoidable.

☒ Limited Disturbed Area – Earth disturbance activities will be kept to a minimum during the construction/reclamation phases, while maintaining a safe and efficient work process.

☒ Limiting Extent & Duration of Disturbance (Phasing, Sequencing) – Earth disturbance will be staged so that not all areas of the project site are disturbed at once. Temporary and permanent seeding requirements will be followed throughout the earth disturbance activities.

☒ Riparian Buffers (150 ft. min.) – In accordance with PA Code Section 102.14(d)(2), a riparian forest buffer waiver request has been submitted for this project. Avoidance and minimization techniques were implemented to riparian forest buffers throughout the design of the pipeline project. All disturbed riparian forest buffers will be restored to meadow conditions.

☐ Riparian Forest Buffer (150 ft. min.) – Riparian forest buffers were not used in the siting of this project. Refer to Waiver Request (Section 102.14(d)(2)(2).

☒ Other – ABACT BMPs, waterbars, trench plugs, infiltration berms, vegetative filter strips, rock construction entrances (150-foot long or with wash racks), compost filter socks, permanent revegetation, maintaining vegetated areas throughout the site, and restoring all non-gravel areas to meadow conditions, or better will be used in conjunction to eliminate the net change in stormwater volume, rate and water quality at the site.

PCSM/Site Restoration Plan

Nondischarge BMPs

☒ Alternative Siting

☒ Alternative location - The pump station site and underground utility corridor alignments, including their associated entrances and staging areas, were carefully selected and were determined to be in the most optimal location for the project during the design/permitting phase. The project site was carefully selected by owner, land agents, engineers, and biologists to minimize impacts to natural resources and to provide a cost-effective design for constructability purposes.

ANTIDEGRADATION ANALYSIS

☒ Alternative configuration - When designing the project, Low Impact Development (LID) techniques were used. The site was laid out to minimize disturbance, located to minimize impacts to streams and avoid impacts to wetlands. The pipeline corridors and other areas of the site will be reclaimed to pre-construction conditions.

☒ Alternative location of discharge - The entire project area will drain to High Quality / Exceptional Value, Migratory Fishes (HQ / EV, MF) waters. Alternate locations for this project site were evaluated; however, impacts to Special Protection waters were unavoidable.

☒ Low Impact Development (LID / BSD) – Low Impact Development / Better Site Design was implemented during the design phase of this project. The site was designed and constructed with these techniques in mind.

☒ Riparian Buffers (150 ft. min.) - In accordance with PA Code Section 102.14(d)(2), a riparian forest buffer waiver request has been submitted for this project. Avoidance and minimization techniques were implemented to riparian forest buffers throughout the design of the pipeline project. All disturbed riparian forest buffers will be restored to meadow conditions.

☐ Riparian Forest Buffer (150 ft. min.) - Riparian forest buffers were not used in the siting of this project.

☒ Infiltration – Infiltration berms and vegetative filter strips will be implemented to help minimize accelerated erosion and promote the infiltration of water before leaving the project site. In addition, although not an accepted 'infiltration' PCSM BMP, waterbars will provide a similar benefit. Reclaiming the pipeline corridors and all non-gravel areas to original conditions will also encourage infiltration throughout the site.

☐ Water Reuse – N/A

☒ Other - ABACT BMPs, waterbars, trench plugs, infiltration berms, vegetative filter strips, compost filter socks, permanent revegetation, maintaining vegetated areas throughout the site, and restoring all non-gravel areas to meadow conditions, or better will be used in conjunction to eliminate the net change in stormwater volume, rate and water quality at the site.

REQUIREMENT M

Erosion and Sediment (E&S) Control Plan

A R M G r o u p L L C

EROSION AND SEDIMENT CONTROL PLAN

LOYALSOCK / SHAWNEE FRESHWATER SYSTEM

ARM Project No. 190736

Gamble and Plunketts Creek Townships,
Lycoming County, Pennsylvania

Submitted to:

Department of Environmental Protection
Bureau of Oil and Gas Management
Northcentral Regional Office
208 W 3rd Street, Suite 101
Williamsport, PA 17701

Prepared for:

Pennsylvania General Energy Company, L.L.C.
120 Market Street
Warren, PA 16365

Prepared by:

ARM Group LLC
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State College, PA 16801

January 2020

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FIGURES

Figure 1 Site Location Map ..... Following Narrative

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Appendix D Geohazards Desktop Analysis ..... Following Text

1.0 INTRODUCTION

This Erosion and Sediment Control Plan (ESCP) provides for the control of soil erosion and sedimentation that may result from the proposed site construction activities. This plan, and the associated drawings and details, were developed in accordance with the Pennsylvania Department of Environmental Protection (PADEP) Erosion Control Regulations (Pa Code Title 25, Chapter 102) and the PADEP Erosion and Sediment Pollution Control Manual (March 2012). This written narrative, in combination with the Erosion and Sediment Control Drawings, comprise the Erosion and Sediment Control Plan for this project. The ESCP has been planned, designed, and is to be implemented to be consistent with the accompanying Post Construction Stormwater Management (PCSM) Plan for this site.

1.1 Project Description

Pennsylvania General Energy Company, L.L.C. (PGE) is proposing to develop the Loyalsock / Shawnee Freshwater System in Gamble and Plunketts Creek Townships, Lycoming County, Pennsylvania. The purpose of the project is to support PGE's natural gas operations from the Marcellus shale formation, which will provide a key source of energy for the United States. The overall project includes a freshwater intake and withdrawal system, a 130' x 130' booster pump station pad and associated 0.1-mile long, 15-foot wide access road, and a 0.3-mile permanent underground utility corridor. The project area consists of approximately 9.5-acres of disturbed land that is owned by PGE for the proposed development activities.

The buried freshwater intake will be installed at 41.355167°, -76.888760° and a gravel maintenance drive will be utilized to allow permanent access to this location. The intake will connect to a wet well, valve vault, and a 12-inch buried freshwater pipeline to transfer water from Loyalsock Creek to the booster pump station building at approximately 41.353950°, -76.886704°. A 6-inch underground electric conduit, a 2-inch communications conduit, and a 2-inch compressed air line will be installed in the same trench as the freshwater pipeline in order to supply electricity and controls to the intake pumps and compressed air to the self-cleaning intake strainers. From the booster pump station building, a temporary aboveground freshwater pipeline will extend east to a future impoundment location (permitted separately).

The permanent underground utility corridor will include a 12-inch natural gas pipeline, two (2) 12-inch freshwater pipelines, a 12-inch electrical conduit, and a 2-inch communications conduit. This utility corridor will be constructed between the booster pump station pad and a future tie-in location approximately 350-feet west of Loyalsock Creek at 41.356123°, -76.890221° where each utility will be terminated at the ends for future connections.

Erosion and Sediment (E&S) controls for the project area are outlined in this application for use of the ESCGP-3. PGE intends to begin project construction as soon as possible, once all necessary approvals are granted. The construction duration is estimated to be two to four months. All non-gravel surfaces will be stabilized after construction and runoff will be controlled with

stormwater BMPs as described in this ESCP and the PCSM/SR Plan.

1.2 Location

The project area is located in Gamble and Plunketts Creek Townships, Lycoming County, Pennsylvania. The location of the proposed project site is illustrated on Figure 1, Site Location Map (United States Geological Survey [USGS] 7.5 minute quadrangle maps, Huntersville, Photo Revised 1986, and Montoursville North 1999). A centrally located point along the pipeline corridor is located at the State Route 0087 crossing at approximately 41.354997°, -76.888032°.

1.3 Existing Features

The land use within the project site is predominantly forestland with residential buildings, open lawns, and waterways consisting of portions of the project site. The project was designed in a manner to minimize encroachments on streams and wetlands. Based on natural resource field surveys performed by ARM Group Inc. in October, November, and December 2019, waterways and wetlands were observed within the project area. The complete results of the investigation are included in Aquatic Resource Investigation Memorandum.

Proper soil erosion and sediment controls will be implemented and maintained prior to, during, and after project construction to minimize erosion and sediment pollution to waters of the Commonwealth near the project location. All disturbed areas will be properly stabilized following construction.

1.4 Soils Information

The United States Department of Agriculture, Natural Resources Conservation Service's (NRCS) Web Soil Survey was used to identify soils that will be disturbed during construction.

According to the Soil Survey dated September 2019, the following soil phases and series will be encountered:

Barbour fine sandy loam (Bb) / Morris channery silt loam (MrB) / Oquaga and Lordstown very stony loams (OxE) / Tunkhannock gravelly loam (TuB) / Water (W)

A Soil Resource Report from the NRCS Web Soil Survey for the soils listed above is included as Appendix C of this ESCP. The locations of each soil type in relation to the proposed site construction are shown in the attached drawings.

The limiting characteristics and hazards of the project soils are expected to have little to no impact in this particular construction project. Large fragments will be segregated during earthwork construction. Low strength soils will be stabilized and top dressed with shale for durability. Seasonal water table impacts and frost action will be field verified and stabilized by

standard construction and engineering practices, if encountered. A proactive approach to erosion control will limit the impact of the erosion hazard.

1.5 Off-site Discharge

Discharge from the site maintains the approximate existing drainage patterns. All discharge is spread out which reduces discharge velocity and maintains flow depths corresponding to sheet and shallow flow and is dispersed into vegetated areas before reaching the surface waters located adjacent to the site. Discharges are dispersed via plunge pools or berms. Natural drainage patterns are maintained to the extent practicable and discharges should not be a source of erosion, damage, or nuisance to off-site properties or surface waters.

2.0 PROPOSED EARTH DISTURBANCE ACTIVITIES

This project was designed to limit the amount of disturbed area by utilizing existing access roads, areas with less dense vegetative/tree cover, and avoiding any physical or chemical impact to wetlands whenever possible. The proposed disturbance areas within the project area are shown on the drawings. The main earth disturbance will occur during the construction of the pump station pad, intake, pipelines, and associated access roads. Earth disturbance activities will be minimized and Best Management Practices (BMPs) will be utilized. The project limits of disturbance were sited to have a minimal impact while providing sufficient room for operations and safety requirements.

2.1 Hydrology

Site drainage consists of surface water runoff within the Loyalsock watershed, which drains to the West Branch Susquehanna River (Hydrologic Unit Codes (HUC) Lower West Branch Susquehanna HUC 02050206 United States Environmental Protection Agency).

No increase in runoff volume or peak rate from the site is expected. Infiltration berms will be utilized to manage runoff from the disturbed portions of the site. The BMP discharge locations were selected to discharge to vegetated areas and mimic natural drainage patterns. The utilization of additional BMPs (described below) will further eliminate the risk of detrimental stormwater runoff to waters of the Commonwealth and wetlands, as well as the regional watershed.

2.2 Water Quality

Pennsylvania streams are classified based on their designated and existing water uses and water quality criteria. The location of waters which may receive runoff from the project site and their classification is pursuant to Title 25 Pa. Code Chapter 93-Water Quality Standards. The project is located within the Loyalsock Creek watershed. Loyalsock Creek is a tributary to the West Branch Susquehanna River (Hydrologic Unit Codes (HUC) Lower West Branch Susquehanna HUC 02050206 United States Environmental Protection Agency). According to PA Code, Title 25, Chapter 93.9w, Drainage List L, Water Quality Standards, Loyalsock Creek has a designation of Trout Stocking Fishes, Migratory Fishes (TSF, MF) and unnamed tributaries to this segment of Loyalsock Creek, have a designation of a High Quality-Cold Water Fishes, Migratory Fishes (HQ-CWF, MF). No receiving waters of the AOI have been designated as siltation-impaired streams (eMapPA, October 2019). According to the PA Department of Environmental Protection's (PADEP's) Statewide Existing Use Classifications list for Lycoming County (October 8, 2019), Loyalsock Creek has an existing use classification Exceptional Value, Migratory Fishes (EV, MF). The Pennsylvania Fish and Boat Commission (PFBC) lists Loyalsock Creek as a trout stocked stream but not as a Wild Trout stream (PFBC October 2019).

The proposed E&S controls were designed to manage surface runoff such that discharges from the site will not degrade the physical, chemical, biological, or thermal characteristics of the

surface waters. The disturbed area will be limited during construction to minimize the footprint of all earth disturbance activities for safe and efficient completion of the project. Adverse physical, chemical, and thermal impacts to the existing streams and local/regional watershed are not anticipated from this project.

The site has been located to minimize impacts to, and therefore protect, sensitive and special value features such as floodplains, wetlands, riparian areas, drainageways, etc. BMPs were designed to decrease the volume and rate of surface runoff through infiltration, detention, and evapotranspiration to therefore avoid potential physical, chemical, biological and thermal impacts to surface waters and the surrounding watershed. The site footprint during construction will be minimized and the flow from potentially warm runoff gravel areas will not drain directly to surface waters. Potential thermal impacts will be mitigated by utilizing BMPs that infiltrate, evapotranspirate, and promote sheet flow from the site to well vegetated areas, which disconnects ditches and streams and helps to return any thermally impacted stormwater runoff back to ground water temperature before reaching surface waters. Any stormwater runoff that may see thermal increase from gravel areas within the site will not be discharged near surface waters.

Runoff from the site has the potential to drain to special protection waters based on the most recent data provided by the PADEP (eMapPA) and PA Department of Environmental Protection's (PADEP's) Statewide Existing Use Classifications list for Lycoming County (October 8, 2019). This includes runoff draining toward Loyalsock Creek and its tributaries. Antidegradation implementation for the special protection waters includes several nondischarge Best Management Practices (BMPs) at the site. These nondischarge BMPs will minimize accelerated erosion and sedimentation during the earth disturbance activity and will be implemented to achieve no net change from pre-development to post-development volume, rate, and concentration of pollutants in water quality. Further explanation of how the nondischarge BMPs will be utilized are provided as an attachment to this E&S plan.

3.0 EROSION AND SEDIMENT CONTROL MEASURES

Construction will be conducted in a manner that minimizes the potential for uncontrolled erosion and sediment migration. The primary earth disturbance activities will be associated with the construction of the pump pad, intake, pipelines, and associated access roads. All erosion and sediment control measures were designed in accordance with the PADEP Erosion and Sediment Control Manual to restrict erosion and sediment migration. Erosion and sediment control measures will be in place prior to upslope earth disturbance. Additional details and notes regarding the erosion and sediment control measures are presented on the attached ESCP Drawings.

Temporary and permanent erosion and sediment control measures will be required during the construction and post-construction phases of the project. These measures are described below and illustrated on the drawings. All BMPs shall be maintained as described in this plan.

3.1 Temporary Erosion and Sediment Control Measures

Temporary controls include various control structures and work practices that can be installed and implemented temporarily during construction. The following temporary controls will be utilized for the project.

3.1.1 Filter Socks

Filter socks are a best management practice that can be used in lieu of filter fence. A filter sock is a tubular sediment control device filled with well-decomposed organic material (typically composted wood mulch). The filter sock traps sediment by filtering water that passes through the sock netting and filler material. The sock slows the flow of stormwater runoff, which causes the water to pond allowing solids and pollutants to settle.

Filter socks work well on slopes and give sprouting seeds ample time to develop an intricate root system that will continue the task of stabilization after the filter socks decompose. Filter sock sizing calculations are provided in Appendix A. Details showing proper installation and maintenance are included on the drawings.

3.1.2 Erosion Control Product

Erosion control product, as specified in this ESCP and on the drawings, may be either erosion control blankets or hydraulically applied erosion control product.

Erosion Control Blankets

Erosion control blankets will be 100-percent biodegradable mats with an agricultural straw fiber matrix design for a typical functional longevity of approximately 12 months. The blanket will be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket will be covered on the top and bottom sides with 100-percent biodegradable woven natural fiber netting. The top netting will consist of machine directional strands formed from two intertwined yarns with cross-directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form a mesh. The blanket will be sewn with biodegradable thread.

Installation staking patterns will be clearly marked on the erosion control blanket with environmentally safe paint. The blanket will be manufactured with a colored line or thread stitched along both outer edges to ensure proper material overlapping. The seed bed (including lime, fertilizer, and seed) will be prepared prior to the installation of the blankets. The areas to be blanketed should be smooth and uniform to ensure continuous contact between the blanket and the underlying soil. Blankets will be secured by biodegradable wooden stakes or staples and will be utilized along slopes (3H:1V and steeper).

Hydraulically Applied Erosion Control Product (HECP)

HECP is a hydraulically applied, 100% biodegradable, high performance – flexible growth medium (HP-FGM) composed of 100% recycled thermally refined wood fibers, crimped interlocking man-made biodegradable fibers, micro-pore granules, naturally derived cross-linked biopolymers and water absorbents. The HP-FGM is phytosanitized, free from plastic netting, requires no curing period, and upon application forms an intimate bond with the soil surface to create a continuous, porous, absorbent, and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.

Approved hydro-spraying machines with fan-type nozzles (50-degree tip) will be used for installation. To achieve optimum soil surface coverage, the HP-FGM will be applied from opposing directions. Slope interruption devices or water diversion techniques will be used when slope lengths exceed 100 feet on 3H:1V slope. For steeper slopes, shorter slope interruption lengths will be used. The application area will be measured and staked prior to installation to ensure proper application rates. To ensure maximum performance, the HP-FGM will be applied in two steps. First, the fertilizer will be applied with the specified prescriptive agronomic formulation and 50% of seed with a small amount of HP-FGM for visual metering. The balance of seed will then be mixed and the HP-FGM will be applied at a rate of 50 lbs per 125 gallons of water over freshly seeded surfaces. The loading rates will be confirmed with the equipment manufacturer.

Flexterra® HECP or an equivalent product will be used on this site.

3.1.3 Trench Plugs

Trench plugs will be installed at the recommended spacing to limit erosion while the trench is being constructed. Trench plugs will also be used for stream crossings.

3.1.4 Rock Construction Entrances (150-Foot Long or with Wash Racks)

Construction entrances minimize the amount of sediment leaving the site. Temporary rock construction entrances that are either 150-feet long by 20-feet wide or 50-feet long by 20-feet wide (with a wash rack) will be maintained anywhere the pipeline corridor will be accessed off of existing paved or gravel roads. These ABACT rock construction entrances are utilized because the stormwater runoff has the potential to discharge to special protection (EV) waters. These structures will be designed and constructed to accommodate anticipated construction vehicle traffic, and have a water supply available to wash the wheels of vehicles leaving the site. See the ESCP drawings for RCE type and locations. Any sediment deposited on pavement adjacent to the construction areas will be removed at the end of each construction day.

Culverts may be used to convey stormwater under rock construction entrances. Culverts will be installed a minimum of one foot below the RCE surface at a minimum of 2 percent slope to prevent sediment accumulation. Culverts will extend beyond the fill slope and discharge into a suitable outlet protection device to dissipate the energy at the outlet.

3.2 Permanent Erosion and Sediment Control Measures

Permanent erosion and sediment control measures proposed for this project include those specified below.

3.2.1 Native Revegetation

This BMP utilizes vegetation (i.e., native species) that does not require significant chemical maintenance. Native species have the greatest tolerances, resist pests, and require less fertilization. Native revegetation assists in runoff volume reduction and water quality improvement. As species grow and mature, the volume of runoff would be expected to be lower compared to conventional permanent seeding. Water quality is improved by reducing the chemicals associated with fertilization.

3.2.2 Permanent Seeding

Disturbed areas will be stabilized with an erosion resistant grass cover. Seeding will be established in general accordance with the seeding specifications illustrated on the drawings. Upland and riparian areas may be held to different vegetative requirements, as noted on the drawings.

3.2.3 Grass-Lined Channels

Channels will be used to convey stormwater throughout the site. To minimize erosion and enable vegetation, the channels will be lined with the materials shown on the drawings. The grass-lined conveyance channels at the site were designed to convey the expected peak flow rates and meet freeboard requirements. Appropriate outlet protection will be installed at discharge points to prevent scour. Design calculations are located in Appendix A and details can be found in the ESCP drawings.

3.2.4 Culverts

Culverts will be used to convey stormwater under road crossings. Culverts were designed using the Federal Highway Administration's HY-8 Culvert Hydraulic Analysis software package. Culverts will be installed a minimum of one foot below the road surface at a 2 to 4 percent slope, where possible, to prevent sediment accumulation. Culverts will extend beyond the fill slope and discharge into riprap plunge pools, or similar outlet protection, to dissipate the energy.

3.2.5 Riprap Aprons & Plunge Pools

Riprap aprons & plunge pools are used to prevent scour at channel and culvert outfalls and release concentrated flows off the site as sheet flow. The design includes the use of a compost filter sock at the outlet of the plunge pools as a temporary additional protection measure during construction to trap/filter sediment and further reduce velocities. Each channel or culvert shall outlet at least one foot above the maximum pool water elevation. Pool dimensions and details showing proper plunge pool construction are provided in the drawings.

3.2.6 Waterbars

Waterbars will be constructed along newly graded pipeline to direct runoff to well-vegetated areas or sediment removal facilities. They should discharge to the downslope side of the right-of-way so that runoff will flow away from, not back onto the site. A 2% maximum gradient is recommended to ensure proper discharge of water entering the waterbar. The waterbar will remain in place once construction is complete, as shown on the drawings.

4.0 CONSTRUCTION SEQUENCE

All earth disturbance activities will proceed in accordance with the following sequence. Deviation from the ESCP must be approved in writing from the engineer.

1. An on-site preconstruction meeting shall take place before starting any earth disturbance activities (including clearing and grubbing), and the owner and/or operator shall invite all contractors involved in those activities, the landowner, and the engineer. PADEP shall be notified of the preconstruction meeting at least seven (7) days before the meeting occurs.

2. At least seven (7) days before starting any earth disturbance activities, the engineer shall notify all appropriate municipal officials, PADEP, and the Pennsylvania Fish and Boat Commission (if required by permit), of the intent to begin construction.

3. At least three (3) days before starting any earth disturbance activities, all contractors involved in those activities shall notify the Pennsylvania One Call System, Inc. at 1-800-242-1776 to locate existing underground utilities.

4. At least three (3) days prior to commencing bulk earth disturbance (after placing the access road perimeter BMPs), all contractors involved in those activities will notify PADEP.

5. Mark the project limits of disturbance for the project site.

6. Install orange exclusion fencing around adjacent streams, wetlands, proposed infiltration BMP ponding areas, and other sensitive areas for protection.

7. Install the rock construction entrances (west of SR 0087) and all compost filter socks as shown on the drawings.

   Note: A temporary access route may be utilized on approximate existing grade within the wooded area (east of SR0087) to provide adequate equipment access during the installation of perimeter erosion and sediment controls and Channels 1 - 3. Tree clearing may occur, as needed, to provide equipment access; however, grubbing shall occur at a later stage, as outlined in this construction sequence.

8. Install Channels 1-3 with associated riprap plunge pools.

9. In accordance with PennDOT's requirements, perform the bank removal excavation and install the site entrance (Sta. 0+00 to ~3+50) along with the 150-foot long rock construction entrance (east of SR 0087). This includes the construction of Channel 4, Channel 5A, Channel 7, and a portion of Channel 5B. This also includes the construction of Culvert 2 and Culvert 3 with associated riprap plunge pools.

Note:

a. This entrance and associated site features must be installed initially to provide site access.

Site work is broken into four sub-sequences below that are independent of one another but may be completed concurrently. These sub-sequences will be completed in an order dictated by weather and other factors at the time of construction.

Booster Pump Station Pad and Access Road (East of SR 0087)

1. Clear and grub within disturbance limits (east of SR 0087). Strip topsoil and stockpile as clearing progresses.

   Note: Temporary stabilization measures are to be implemented whenever earthwork activities at a particular location cease for more than 4 days.

2. Construct the remainder of the access road and associated site features east of SR 0087 from the site entrance to the booster pump station pad (including the channels, culverts, and riprap plunge pools, where indicated). Strip the topsoil as construction progresses.

   Note: The area east of the booster pump station pad shall be utilized for temporary soil stockpiling, and re-working (as needed).

3. Construct the booster pump station pad and permanent stockpile.

4. Upon reaching finished grades, seed and mulch as specified on the drawings and apply erosion control product as shown on the plans.

   Notes:

   a. Every effort must be taken to avoid earth disturbance and equipment tracking within the proposed infiltration berm areas, and the proposed ponding areas immediately upgradient of these BMPs. These installations must be accomplished with care. All soils within the BMP ponding areas shall remain uncompacted to maintain the desired infiltration within the BMPs. A licensed professional or designee shall monitor the installation of these BMP facilities.

   b. Culverts shall be extended or temporarily diverted away from the BMP facilities until the drainage areas upgradient are stabilized. Sediment accumulation shall be avoided in these areas. Additional filter sock may be installed to accomplish this.

Freshwater Intake & Withdrawal System (West of SR 0087)

1. Clear and grub within disturbance limits (west of SR 0087). Strip topsoil and stockpile as clearing progresses.

Note: Temporary stabilization measures are to be implemented whenever earthwork activities at a particular location cease for more than 4 days.

2. Construct the freshwater intake and withdrawal system (including the wet well and valve vault). Strip the topsoil as construction progresses. (See note b. below).

3. Upon reaching finished grades, seed and mulch as specified on the drawings and apply erosion control product as shown on the plans and anywhere grade is equal to or greater than 3:1 and all disturbed areas to be revegetated within 50 feet of surface waters.

Notes:

b. Refer to the drawing details for specific BMP installation instructions.

c. Excess material shall be stockpiled at the locations shown on the drawings.

Permanent Underground Utility Corridor

1. Construct the underground utility corridor (including the buried waterline, natural gas pipeline, and utility conduit) from the booster pump station to the proposed future tie-in / western terminus. Regrade and revegetate pipeline corridor with permanent vegetation as construction progresses.

Note: Exclusion fence shall be installed around adjacent streams for protection. Care must be taken to ensure that no vehicles or construction equipment enter the streams adjacent to the project area. Refer to the drawings for exclusion fence locations.

Underground Freshwater Withdrawal System Pipeline

1. Construct the underground freshwater withdrawal system pipeline (including the buried waterline, electrical utility line and compressed air line) from the intake to the booster pump station. Regrade and revegetate pipeline corridor with permanent vegetation as construction progresses.

Site Stabilization

Temporary Stabilization - Upon temporary cessation of an earth disturbance activity or any stage or phase of an activity where a cessation of earth disturbance activities will exceed 4 days, the site will be immediately seeded, mulched, or otherwise protected from accelerated erosion and

sedimentation pending future earth disturbance activities.

Permanent Stabilization - Upon final completion of an earth disturbance activity or any stage or phase of an activity, the site will immediately have topsoil restored, replaced, or amended, seeded, mulched, or otherwise permanently stabilized and protected from accelerated erosion and sedimentation.

1. Stabilize with erosion control matting on steep slopes where specified on the drawings and details, and provide revegetation of permanent, native areas as specified in the drawings and listed in Section 3.2. Note: All non-gravel areas will be reclaimed to meadow conditions, or better, and will be seeded and mulched to help stabilize the disturbed areas.

2. Clean up site to satisfaction of owner or their representative.

3. Remove temporary erosion measures when permanent stabilization is achieved. Permanent stabilization is defined as a minimum uniform 70% perennial vegetative cover, with a density capable of resisting accelerated erosion.

4. Upon completion of earth disturbance activities and installation of permanent best management practices, a notice of termination will be submitted to the PADEP.

Notes:

All disturbed areas will be stabilized immediately with rock and/or seeding and mulching.

Only clean, non-polluting materials will be used as fill. Minimum stone size should be R-4, as rated by the National Stone Association.

All earthmoving activities must incorporate measures to minimize accelerated erosion. The ESCP must be at the site of activity at all times and available for inspection by a representative of PADEP.

All earth disturbance activities will proceed in accordance with the sequence provided in the plan drawings. Deviation from the sequence must be redlined and initialed. PADEP will be notified seven (7) days prior to the start of the project construction and prior to any plan changes.

5.0 MAINTENANCE PROGRAM

Erosion and sediment control measures will be maintained according to the applicable PADEP requirements and standard best management practices. In general, maintenance will include inspections on a weekly basis and after each stormwater event, and periodic removal of any sediment accumulated. Complete details regarding maintenance of erosion and sediment control measures are presented on the ESCP drawings.

The following maintenance program will be followed until the site is completely stabilized after construction. During construction, the contractor will be responsible for inspection and maintenance of all E&S features.

1. All temporary E&S control measures will be inspected weekly AND after each runoff event. All defective erosion control measures will be repaired immediately.

   a) *Filter Socks:* Split, torn, unraveling or slumping filter socks will be repaired or replaced. Sediment will be removed when accumulations reach 1/2 the diameter of the filter sock.

   b) *Erosion Control Product*: Erosion control product damaged before sufficient stabilization of up-gradient vegetation will be immediately replaced.

   c) *Rock Construction Entrances (150-Foot Long <u>or</u> with Wash Racks)*: Construction entrance thickness shall be constantly maintained to the specified dimensions by adding rock. A stockpile shall be maintained on site for this purpose. Drain space under wash rack shall be kept open at all times. Damage to the wash rack shall be repaired prior to further use of the rack. At the end of each construction day, all sediment deposited on paved roadways shall be removed and returned to the construction site. Culverts should be kept free of obstructions, including but not limited to fill, rocks, leaves, woody debris, accumulated sediment, excess vegetation, and construction material/wastes.

2. All permanent E&S control measures shall be inspected weekly AND after each runoff event until final stabilization is achieved and the Notice of Termination (NOT) for the permit is approved. All defective erosion control measures will be repaired immediately.

   a) *Permanent Seeding*: Seeding will be applied in the locations and rates specified on the drawings. Seeded areas will be inspected once stabilized, prior to leaving the site, at six month intervals for one year, then yearly for each subsequent year. Vegetation cover and signs of erosion will also be checked and re-seeded and fertilized, as necessary.

   Observation of the growth of desired species and weed competition is essential to

making maintenance decisions. Adhere to supplier's maintenance directions for each seed mix.

b) *Channels and Culverts:* The dimensions of these structures will be maintained. Sediment deposits will be removed. Damaged linings will be repaired or replaced. All channels and culverts should be kept free of obstructions, including but not limited to fill, rocks, leaves, woody debris, accumulated sediment, excess vegetation, and construction material/wastes. All channels and culverts will be inspected on a weekly basis and after each runoff event.

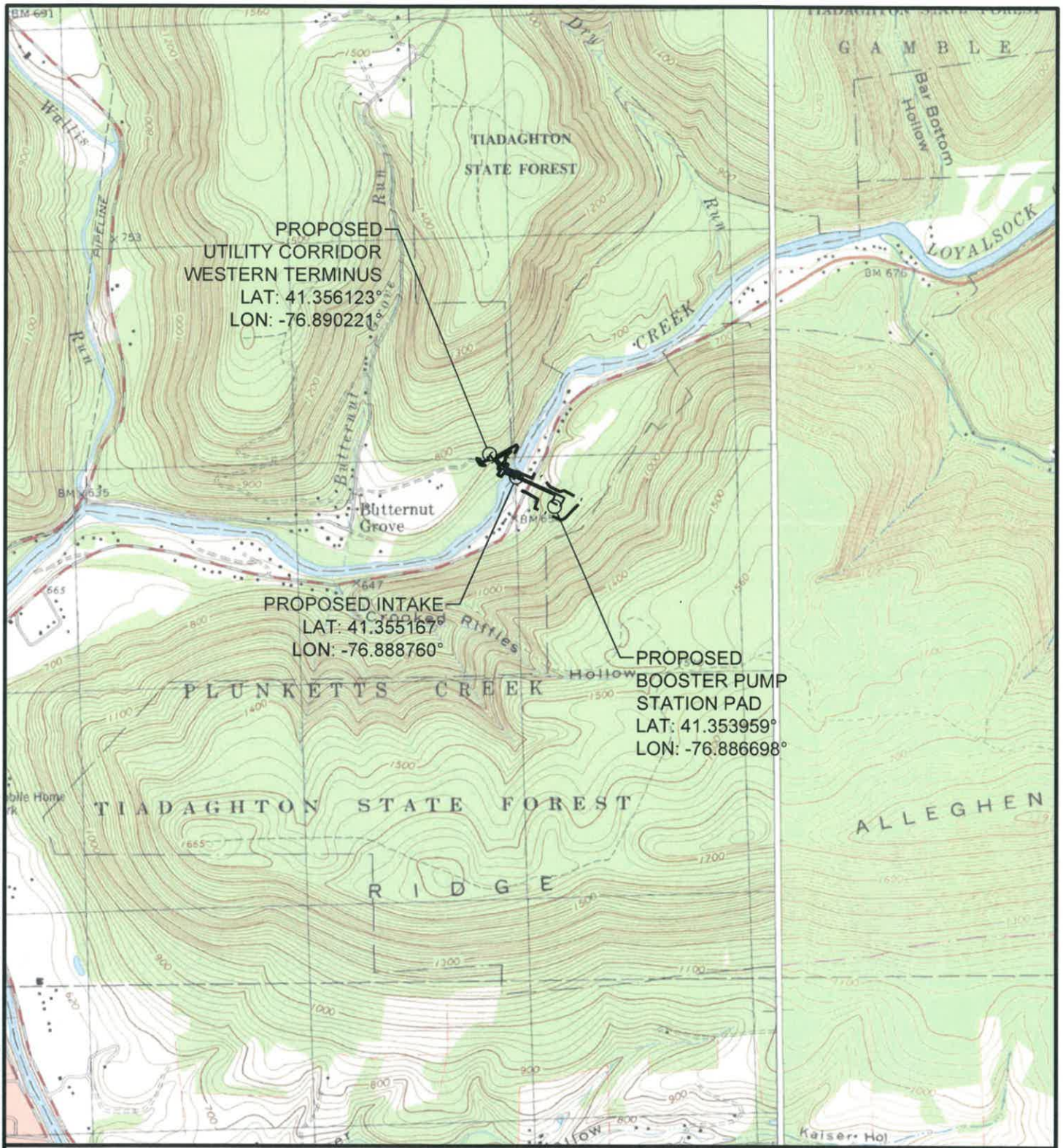
c) *Riprap Aprons & Plunge Pools:* Displaced riprap in the aprons & plunge pools shall be replaced immediately. The minimum pool depth specified in the drawings should be maintained. Any accumulated sediment buildup should be removed. All aprons & plunge pools shall be inspected on at least a weekly basis and after each runoff event.

d) *Waterbars*: Sediment must be removed when accumulations reach 1/3 the height of the waterbar fill berm. Maintenance of waterbars and the surrounding areas stabilized with vegetation shall be provided until the right-of-way has achieved permanent stabilization. Waterbars on right-of-way shall be left in place after permanent stabilization has been achieved, unless in an agricultural field or yard.

Maintenance for both the temporary and permanent E&S control BMPs will include proper removal and disposal of materials in the project area. Accumulated sediment will be spread within the easement areas and prepared for permanent erosion control measures. No sediment will be placed within 100 feet of streams, lakes, ponds, and wetlands.

Construction wastes, such as building materials, concrete wash water, sanitary wastes, etc., shall be removed from the site and recycled or disposed of in accordance with the PADEP's Solid Waste Management Regulations at 25 Pa. Code 260.1 et seq., 271.1, and 287.1 et seq. No building materials or wastes or unused building materials shall be burned, buried, dumped, or discharged at the site. These materials should be recycled where feasible and is preferred versus disposal. Waste materials could adversely impact the water quality of the streams, lakes, ponds, and wetlands. If these materials cannot be recycled, they must be transferred to an offsite facility, and disposed of in accordance with PADEP regulations.

Figure



Base map from USGS 7½ minute quadrangles Huntersville, Photo Revised 1986, and Montoursville North 1999.

LEGEND

PROPOSED LIMIT OF DISTURBANCE

0 2000 4000 6000

SCALE IN FEET

N

This drawing, its contents, and each component of this drawing are the property of and proprietary to ARM Group LLC and shall not be reproduced or used in any manner except for the purpose identified on the Title Block, and only by or on behalf of this client for the identified project unless otherwise authorized by the express, written consent of ARM Group LLC.

SITE LOCATION MAP

LOYALSOCK/SHAWNEE FRESHWATER SYSTEM
PENNSYLVANIA GENERAL ENERGY COMPANY, L.C.C.
GAMBLE & PLUNKETTS CREEK TOWNSHIP,
LYCOMING COUNTY, PENNSYLVANIA

January 2020	Scale: 1" = 2000'	190736

ARM Group LLC
Engineers and Scientists
www.armgroup.net

Figure 1

P:\PGE\190736 Loyalsock-Shawnee Freshwater System\Drwg\Production\Figures\190736-FI-C-105.dwg Plotted: January 6, 2020

APPENDIX A

Calculations

FILTER SOCKS

DESCRIPTION

Evaluate the necessary filter sock size that will satisfy the maximum flow length and slope as outlined in *Reference 1*.

REFERENCES

1. Erosion and Sediment Pollution Control Program Manual, PADEP, March 2012

DEFINITION OF VARIABLES

L = slope length (ft)

s = surface slope (ft/ft)

CALCULATIONS

1. Define the slope of the existing ground surface and maximum slope length.

   - Details of the slope and maximum slope length are presented on the attached Figure 4.2 – Maximum Permissible Slope Lengths Above Compost Filter Socks. Various sections of the project limit of disturbance were analyzed to determine the applicable filter sock size for the given region.

2. Plot the slope and maximum slope length on Figure 4.2 and determine the required filter sock size.

   - In some cases, where filter socks have long upslope drainage lengths that extend outside of the LOD (i.e. filter sock positioned at the base of a mountain), Figure 4.2 may not be applicable. In these cases, the designer shall evaluate the upslope length of disturbed land, the land use and slope of the resulting drainage area, and any nearby features that may warrant additional coverage.

3. Per Figure 4.2 and the designer's assessment of the site, the project will require the filter sock sizes as labeled.

CONCLUSION

Sizes of filter socks are shown on the Drawings based on Figure 4.2 and the designer's assessment of the project site. All filter socks utilized shall be the size and location that is presented on the Drawings. See attachments for preferred Filtrexx filter sock specifications.

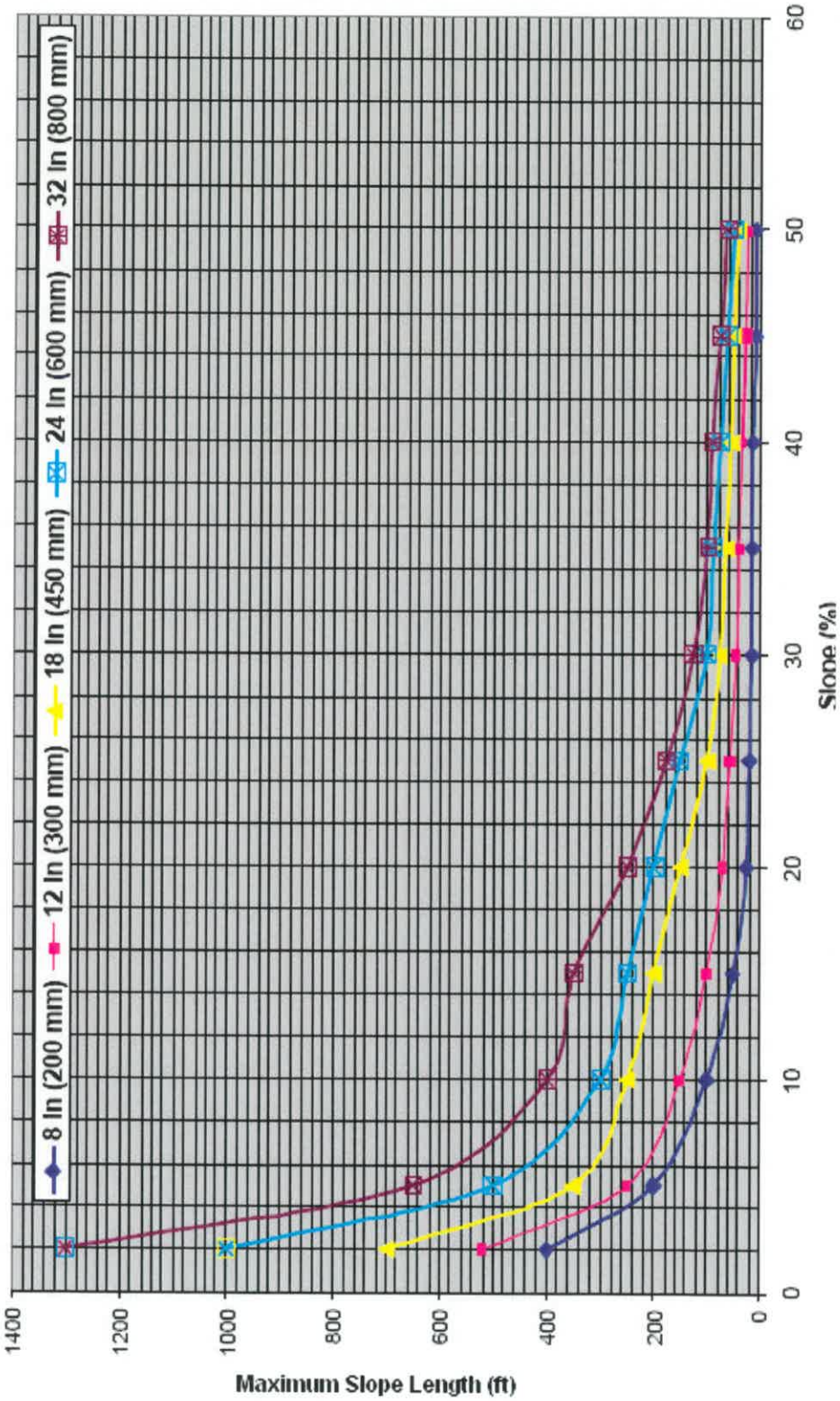
Compost Filter Sock Sizing Worksheet

Project Name: Loyalsock/Shawnee Freshwater System
Location: Gamble & Plunketts Creek Townships, Lycoming County
Prepared By: MDR **Date:** 1/8/2020
Checked By: KGJ **Date:** 1/14/2020

Sock Region	Diameter (in)	Location	Slope %	Slope Length Above Barrier
		WEST of Loyalsock Creek		
1	18	Downgradient of 150' Rock Construction Entrance and Lawn Areas Near House	9	160
2	24	Downgradient of Temporary Access Road (Southwest of Utility ROW)	40	80
3	24	Downgradient of Temporary Access Road (Northeast of Utility ROW)	45	50
4	24	Flat Access Immediatey West of Loyalsock Creek and Loyalsock Creek Side Channel	27	110
5	18	Flat Access and Work Area Between Loyalsock Creek and Loyalsock CreekSide Channel	7	75
		EAST of Loyalsock Creek (West of SR 0087)		
6	18	Adjacent to Loyalsock Creek Bank	14	140
		EAST of Loyalsock Creek (East of SR 0087)		
7	24	Adjacent to SR 0087 (North of Proposed Access Road)	30	100
8*	32	North of Proposed Underground Utility Corridor (~Sta. 10+00)	11	375
9*	24	North of Proposed Underground Utility Corridor (Sta. 10+50 ~ Sta. 11+25)	10	300
10*	18	North of Proposed Underground Utility Corridor (Sta. 11+75 ~ Sta. 12+75)	7	195
11*	18	Adjacent to SR 0087 (South of Proposed Access Road & Downgradient of Channels 3 & 7)	20	25
12*	24	West of Access Road (Sta. 2+00 ~ Sta. 4+00)	17	195
13*	24	East of Access Road Cut Slope (Sta. 2+50 ~ Sta. 4+25) & Immediately Upgradient of Channel 2	10	280
14*	32	West and South of Access Road (Sta. 4+00 ~ Sta. 5+25)	17	310
15*	18	North of Access Road (~Sta. 5+45 at Base of Fill Slope) and South of Access Road (~Sta. 5+75)	10	205
16*	18	South of Access Road (~Sta. 6+67) and Booster Pump Station Pad	13	100

* Channels 1, 2 and 3 will be installed prior to the commencement of bulk earth disturbance activities (including grubbing). The filter socks downgradient of these channels are sized accordingly. Refer to the Sequence of Construction.

FIGURE 4.2
MAXIMUM PERMISSIBLE SLOPE LENGTHS ABOVE COMPOST FILTER SOCKS



NOTE: 8" diameter socks should only be used to control small (≤ ¼ acre) disturbed areas on individual house lots).

SWPPP Cut Sheet:

Filtrexx® Sediment Control

Sediment & Perimeter Control Technology

PURPOSE & DESCRIPTION

Filtrexx® Sediment control is a three-dimensional tubular sediment control and storm water runoff filtration device typically used for **perimeter control** of sediment and other soluble pollutants (such as phosphorus and petroleum hydrocarbons), on and around construction activities.

APPLICATION

Filtrexx® Sediment control is to be installed down slope of any disturbed area requiring erosion and sediment control and filtration of soluble pollutants from runoff. Sediment control is effective when installed perpendicular to sheet or low concentrated flow. Acceptable applications include:

- Site perimeters
- Above and below disturbed areas subject to sheet runoff, interrill and rill erosion
- Above and below exposed and erodable slopes
- Around area drains or inlets located in a 'sump'
- On compacted soils where trenching of silt fence is difficult or impossible
- Around sensitive trees where trenching of silt fence is not beneficial for tree survival or may unnecessarily disturb established vegetation.
- On frozen ground where trenching of silt fence is impossible.
- On paved surfaces where trenching of silt fence is impossible.

INSTALLATION

1. Sediment control used for perimeter control of sediment and soluble pollutants in storm runoff shall meet Filtrexx® Soxx™ Material Specifications and use Certified Filtrexx® FilterMedia™.
2. Contractor is required to be Filtrexx® Certified™ as determined by Filtrexx® International, LLC (440-926-2607 or visit website at www.filtrexx.com). Certification shall be considered current if appropriate identification is shown during time of bid or at time of application (current listing can be found at www.filtrexx.com). Look for the Filtrexx® Certified™ Seal.
3. Sediment control will be placed at locations indicated on plans as directed by the Engineer.
4. Sediment control should be installed parallel to the base of the slope or other disturbed area. In extreme conditions (i.e., 2:1 slopes), a second Sediment control shall be constructed at the top of the slope.
5. Effective Soxx™ height in the field should be as follows: 8" Diameter Sediment control = 6.5" high, 12" Diameter Sediment control = 9.5" high, 18" Diameter SiltSoxx™ = 14.5" high, 24" Diameter Sediment control = 19" high.
6. Stakes shall be installed through the middle of the Sediment control on 10 ft (3m) centers, using 2 in (50mm) by 2 in (50mm) by 3 ft (1m) hard wood stakes. In the event staking is not possible, i.e., when Sediment control is used on pavement, heavy concrete blocks shall be used behind the Sediment control to help stabilize during rainfall/runoff events.
7. Staking depth for sand and silt loam soils shall be 12 in (300mm), and 8 in (200mm) for clay soils.
8. Loose compost may be backfilled along the upslope side of the Sediment control, filling the seam between the soil surface and the device, improving filtration and sediment retention.
9. If the Sediment control is to be left as a permanent filter or part of the natural landscape, it may be seeded at time of installation for establishment of permanent vegetation. The Engineer will specify seed requirements.

10. Filtrexx® Sediment control is not to be used in perennial, ephemeral, or intermittent streams.

See design drawing schematic for correct Filtrexx® Sediment control installation (Figure 1.1).

INSPECTION AND MAINTENANCE

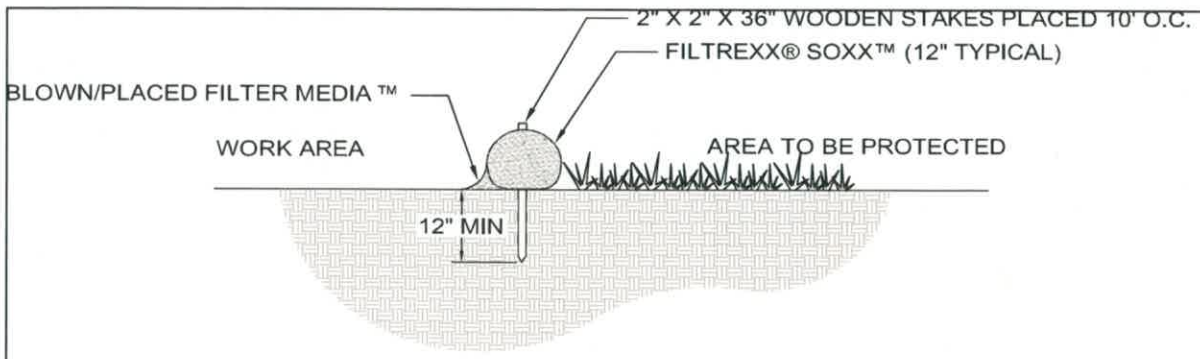
Routine inspection should be conducted within 24 hrs of a runoff event or as designated by the regulating authority. Sediment control should be regularly inspected to make sure they maintain their shape and are producing adequate hydraulic flow-through. If ponding becomes excessive, additional Sediment control may be required to reduce effective slope length or sediment removal may be necessary. Sediment control shall be inspected until area above has been permanently stabilized and construction activity has ceased

1. The Contractor shall maintain the Sediment control in a functional condition at all times and it shall be routinely inspected.
2. If the Sediment control has been damaged, it shall be repaired, or replaced if beyond repair.
3. The Contractor shall remove sediment at the base of the upslope side of the Sediment control when accumulation has reached 1/2 of the effective height of the Sediment control, or as directed by the Engineer. Alternatively, a new Sediment control can be placed on top of and slightly behind the original one creating more sediment storage capacity without soil disturbance.
4. Sediment control shall be maintained until disturbed area above the device has been permanently stabilized and construction activity has ceased.
5. The FilterMedia™ will be dispersed on site once disturbed area has been permanently stabilized, construction activity has ceased, or as determined by the Engineer.
6. For long-term sediment and pollution control applications, Sediment control can be seeded at the time of installation to create a vegetative filtering system for prolonged and increased filtration of sediment and soluble pollutants (contained vegetative filter strip). The appropriate seed mix shall be determined by the Engineer.

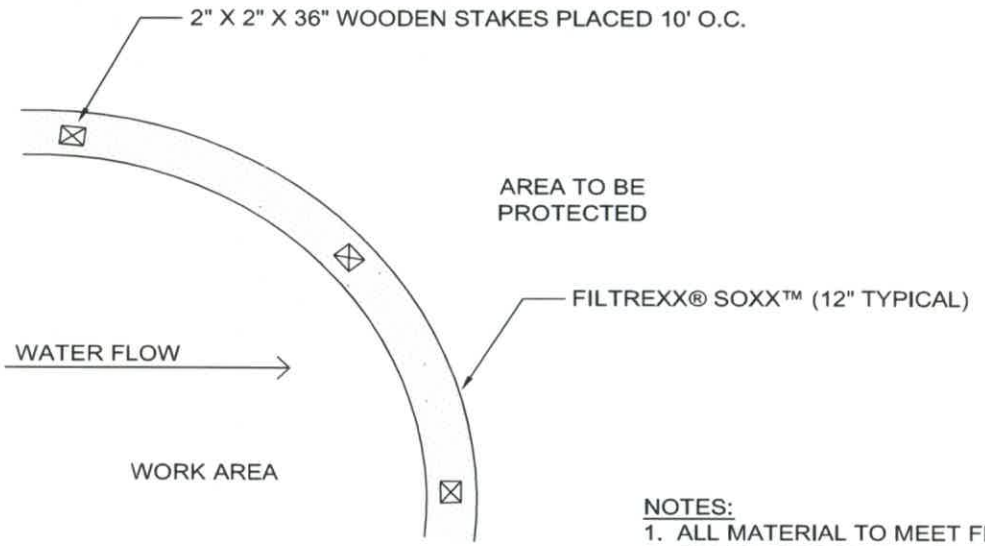
Slope Percent	Maximum Slope Length Above Sediment Control in Feet (meters)*				
	8 in (200 mm) Sediment control	12 in (300 mm) Sediment control	18 in (450 mm) Sediment control	24 in (600mm) Sediment control	32 in (800mm) Sediment control
	6.5 in (160 mm)**	9.5 in (240 mm) **	14.5 in (360 mm) **	19 in (480 mm) **	26 in (650 mm) **
2 (or less)	600 (180)	750 (225)	1000 (300)	1300 (400)	1650 (500)
5	400 (120)	500 (150)	550 (165)	650 (200)	750 (225)
10	200 (60)	250 (75)	300 (90)	400 (120)	500 (150)
15	140 (40)	170 (50)	200 (60)	325 (100)	450 (140)
20	100 (30)	125 (38)	140 (42)	260 (80)	400 (120)
25	80 (24)	100 (30)	110 (33)	200 (60)	275 (85)
30	60 (18)	75 (23)	90 (27)	130 (40)	200 (60)
35	60 (18)	75 (23)	80 (24)	115 (35)	150 (45)
40	60 (18)	75 (23)	80 (24)	100 (30)	125 (38)
45	40 (12)	50 (15)	60 (18)	80 (24)	100 (30)
50	40 (12)	50 (15)	55 (17)	65 (20)	75 (23)

* Based on a failure point of 36 in (0.9 m) super silt fence (wire reinforced) at 1000 ft (303 m) of slope, watershed width equivalent to receiving length of sediment control device, 1 in/ 24 hr (25 mm/24 hr) rain event.

** Effective height of Sediment control after installation and with constant head from runoff as determined by Ohio State University.



SECTION NTS



PLAN NTS

NOTES:
1. ALL MATERIAL TO MEET FILTREXX® SPECIFICATIONS.
2. FILTER MEDIA™ FILL TO MEET APPLICATION REQUIREMENTS.
3. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY ENGINEER.

FILTREXX® SEDIMENT CONTROL

NTS

CHANNELS

DESCRIPTION

Evaluate the necessary channel dimensions and linings to effectively manage and transport the anticipated stormwater runoff for the 10-year / 24-hour storm event. The procedures outlined in *Reference 1* will be followed.

REFERENCES

1. Erosion and Sediment Pollution Control Program Manual, PADEP, March 2012

DEFINITION OF VARIABLES

A = drainage area (acres)
A_c = cross-sectional area of the channel (ft^2)
a = flow area (ft^2)
C = runoff coefficient
D_m = mean depth of flow (ft)
d = flow depth (ft)
F = freeboard (ft)
I = expected rainfall intensity (in/hr)
n = Manning's roughness coefficient
p = wetted perimeter (ft)
Q = design flow rate (cfs)
r = hydraulic radius (ft)
S_c = critical slope (ft/ft)
s = surface slope (ft/ft)
T = top of channel width at the water surface (ft)
τ_d = design shear stress
V = channel velocity (fps)

CALCULATIONS

1. Calculate the peak flow rate (Q) for each channel. The channels were designed to handle the 10-year storm event per the recommendations in *Reference 1* for permanent channel design.

2. Calculate the required channel dimensions using Manning's Equation.

$$Q = Va$$

$$V = \frac{1.486}{n} r^{2/3} s^{1/2}$$

Determine a, r, s, and n for each channel or channel segment. Refer to Table 6.1 – Geometric Elements of Channel Sections within *Reference 1* for computing Area (a) and Hydraulic Radius (r) for different channel sections.

Manning's roughness coefficient (n) is determined based on the proposed channel lining. Manufacturer's design specifications are used for channels with manufactured linings. For vegetated channels with C Retardance, Manning's roughness coefficient (n) is calculated using the following equation.

Manning's roughness coefficient (for Retardance Class C channels only):

$$n = 0.047\,(62.4 \times r \times s)^{-0.4}$$

Based on iterative trial and error, the design dimensions and flow depth are determined. Refer to the calculation sheets following the narrative for channel design calculations.

3. Determine design shear stress (τ_d) and check acceptability of channel lining material.

$$\tau_d = 62.4ds$$

Check that the design shear stress and design velocity meet the maximum permissible shear stress and velocity requirements for each channel with the specified lining materials.

- Maximum permissible shear stress and velocity for channel lining materials are presented with the Manufacturer's design specifications. For vegetated channels with C Retardance, Tables 6.2 and 6.4 within *Reference 1* present the maximum permissible shear stress and velocity.

4. Calculate the Required Freeboard.

Compute the channel's critical slope.

$$S_c = \frac{14.56n^2 D_m}{r^{4/3}}$$

$$D_m = \frac{A_c}{T}$$

Using the critical slope of the channel, determine whether stable or unstable flow conditions exist. Unstable conditions occur when uniform flow is at or near its critical depth and waves form at the water's surface. Sufficient freeboard should be provided to prevent the waves from overtopping the channel. Unstable flow conditions occur when $0.7S_c \leq s \leq 1.3S_c$.

If unstable flow conditions exist, the minimum required freeboard is computed as follows:

$$F = 0.075\,V\,d$$

For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.

CONCLUSIONS

Each channel shall be constructed to match the designed dimensions and with the channel lining material installed per the details and manufacturer's specifications.

Refer to the calculation sheets following this narrative or the channel schedule on the E&S Plans for channel dimensions and linings.

Channel Schedule								
Channel ID	Design Flow (cfs)	Length (ft)	Bottom Width B (ft)	Side Slopes (Z:1)	Channel Slope (%)	Channel Depth (ft)	Top Width T (ft)	Lining*
Channel 1	7.0	368	2.0	2.5	4.9	1.25	8.3	NAG P300
Channel 2	0.05	338	2.0	2.5	10.7	1.0	7.0	NAG S150
Channel 3	0.03	102	2.0	2.5	9.8	1.0	7.0	NAG S150
Channel 4	0.1	103	2.0	2.5	5.8	1.0	7.0	NAG S150
Channel 5A	17.8	36	4.0	2.5	14.0	1.0	9.0	R-4 Riprap
Channel 5B	0.01	196	2.0	2.5	12.2	1.0	7.0	NAG S150
Channel 6	0.1	295	2.0	2.5	13.6	1.0	7.0	NAG S150
Channel 7	19.2	120	2.0	2.5	3.3	1.5	9.5	NAG P300
Channel 8 (PCSM)	0.8	111	2.0	2.5	7.2	1.0	7.0	NAG S150
Channel D1 PCSM)	0.8	95	0.0	2.5	1.0	1.25	6.25	NAG S150
*NAG – North American Green								

NOTES:

1. THE BASE MAP HAS BEEN CREATED USING AVAILABLE AERIAL PHOTOGRAPHY PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN. EXISTING TOPOGRAPHY HAS BEEN CREATED USING LIDAR CONTOURS PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN AND TOPOGRAPHIC SURVEY BY HAWBAKER ENGINEERING, NOVEMBER 2019.
2. PROPERTY LINES AND OWNER INFORMATION ARE TAKEN FROM LYCOMING COUNTY TAX ASSESSMENT MAPS AND RECORDS. SURVEYED PROPERTY LINES PROVIDED BY HAWBAKER ENGINEERING, NOVEMBER 2019.
3. THIS PLAN IS IN THE PENNSYLVANIA STATE PLANE NORTH, NORTH AMERICAN DATUM 1983 (NAD 83) COORDINATE SYSTEM.
4. EVERY EFFORT MUST BE TAKEN TO AVOID EARTH DISTURBANCE AND EQUIPMENT TRACKING WITHIN THE PROPOSED INFILTRATION BERM AREAS, AND THE PROPOSED PONDING AREAS IMMEDIATELY UPGRADIENT OF THE INFILTRATION BERMS. THIS INSTALLATION MUST BE ACCOMPUSHED WITH CARE. EXCLUSION FENCE SHALL BE PLACED AROUND THESE AREAS PRIOR TO THE START OF EARTHWORK.
5. PROPOSED EROSION CONTROL PRODUCT OR EQUIVALENT SHALL BE PLACED ON ALL DISTURBED SLOPES >3H:1V AND WITHIN 100' OF STREAMS AND WETLAND CROSSINGS.

LEGEND

NOTE: LEGEND IS TYPICAL, NOT ALL OBJECTS IN LEGEND APPEAR IN PLAN.

- 1550 — EXISTING CONTOURS
- EXISTING WETLANDS
- EXISTING STRUCTURE
- EXISTING PROPERTY LINE
- EXISTING PROPERTY LINE (SURVEYED)
- OE — EXISTING OVERHEAD ELECTRIC LINE
- UE — EXISTING UNDERGROUND ELECTRIC LINE
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- EXISTING TREELINE
- EXISTING MAPPED WATERCOURSE
- EXISTING FIELD VERIFIED STREAM
- EXISTING FLOODWAY
- EXISTING FEMA 100YR FLOODPLAIN
- EXISTING FENCE
- EXISTING CULVERT
- PROPOSED CHANNEL
- PROPOSED ESCGP-3 PERMIT BOUNDARY / LIMIT OF DISTURBANCE
- WeB — EXISTING SOIL BOUNDARY AND DESCRIPTOR
- DRAINAGE AREA (DA1)
- DRAINAGE AREA (DA2)
- DRAINAGE AREA (DA3)
- DRAINAGE AREA (DA4)
- DRAINAGE AREA (DA5A)
- DRAINAGE AREA (DA5B)
- DRAINAGE AREA (DA6)
- DRAINAGE AREA (DA7)
- DRAINAGE AREA (DA8)
- DRAINAGE AREA (DA-DB1)
- POI

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Engineers and Scientists
www.armgroup.net

No.	Revision	Date	By

designed	ALG	scale	1" = 150'
checked	MDR	date	01/07/2020
drawn	JAW	project no.	190736

graphic scale: 0 150 300 450 SCALE IN FEET

Drawing Title: PRE & POST DEVELOPMENT WATERSHED AND SOILS MAP-CHANNEL EROSION AND SEDIMENT CONTROL PLAN

Project Title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

Sheet WS-3

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Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge [8] cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft) Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel 1 - Initial	7.0	0.049	NAG P300 Unveg.	0.034	2.0	2.5	0.474	1.510	4.55	0.332	4.64	9.00	1.45	3.00	7.0	0.025	Stable	0.97	2.0	1.00	2.5	7.0	36.27
Channel 1 - Vegetated	7.0	0.049	NAG P300 Veg.	0.045	2.0	2.5	0.546	1.837	4.94	0.372	3.81	16.00	1.67	8.00	7.0	0.042	Unstable	1.05	2.0	1.25	2.5	8.3	51.29

Notes:

1 Lining: Appropriate channel lining is chosen based on velocity and shear stress considerations.
2 Manning's roughness coefficient (n-value) for channel linings are based on the PA DEP Erosion and Sediment Pollution Control Manual, March 31, 2012, and Manufacturers specifications.
3 Design criteria is based on tables within the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012, and Manufacturers specifications.
4 Critical slope is calculated to determine the stability of each channel following the procedures on Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012.

Critical slope = $S_c = 14.56\, n^2 D_m / R^{4/3}$

where: n = Manning's n
D_m = mean depth of flow (ft)
R = hydraulic radius (ft)

5 Channels are checked for stable vs. unstable conditions in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. Unstable flow occurs when $0.7S_c \leq$ Channel Slope $\leq 1.3S_c$.
6 Minimum channel depth is the sum of the flow depth and the minimum required freeboard. The minimum required freeboard is calculated in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. The required freeboard calculation is based on the stability of the channel.

For unstable flow conditions:

F = (0.025*V)*(3*D)

where: F = minimum freeboard (ft)
V = velocity (fps)
D = flow depth (ft)

For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.
7 Channel depths are rounded up to the nearest 0.25 foot increment for construction purposes.
8 Peak discharge for the 10-year storm event is calculated using the HydroCAD SCS unit hydrograph procedure. The HydroCAD report is included with the channel design calculations.

Sources for Design Inputs			
Lining	**Max Velocity**	**Max Shear Stress**	**Mannings n**
Vegitation	Table 6.4	Table 6.2	Equation on pg. 129
Riprap	Table 6.6	Table 6.2	Figure 6.2
Gabion	Table 6.10	Table 6.10	Table 6.10
ECM	Manufacturer's Specifications	Manufacturer's Specifications	Manufacturer's Specifications

Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge [8] cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft): Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel 2 - Initial (E&S)	0.05	0.107	NAG S150	0.055	2.0	2.5	0.030	0.061	2.16	0.028	0.82	6.00	0.20	1.75	0.1	0.145	Unstable	0.53	2.0	1.00	2.5	7.0	36.00
Channel 2 - Vegetated (E&S)	0.05	0.107	Vegitative, C Retardence	0.083	2.0	2.5	0.038	0.079	2.20	0.036	0.63	4.00	0.25	1.00	0.0	0.310	Stable	0.54	2.0	1.00	2.5	7.0	58.64

Notes:

1 Lining: Appropriate channel lining is chosen based on velocity and shear stress considerations.
2 Manning's roughness coefficient (n-value) for channel linings are based on the PA DEP Erosion and Sediment Pollution Control Manual, March 31, 2012, and Manufacturers specifications.
3 Design criteria is based on tables within the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012, and Manufacturers specifications.
4 Critical slope is calculated to determine the stability of each channel following the procedures on Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012.

Critical slope = $S_c = 14.56\ n^2 D_m / R^{4/3}$

where: n = Manning's n
D_m = mean depth of flow (ft)
R = hydraulic radius (ft)

5 Channels are checked for stable vs. unstable conditions in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. Unstable flow occurs when $0.7S_c \leq$ Channel Slope $\leq 1.3S_c$.
6 Minimum channel depth is the sum of the flow depth and the minimum required freeboard. The minimum required freeboard is calculated in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. The required freeboard calculation is based on the stability of the channel.

For unstable flow conditions:

F = (0.025*V)*(3*D)

where: F = minimum freeboard (ft)
V = velocity (fps)
D = flow depth (ft)

For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.
7 Channel depths are rounded up to the nearest 0.25 foot increment for construction purposes.
8 Peak discharge for the 10-year storm event is calculated using the HydroCAD SCS unit hydrograph procedure. The HydroCAD report is included with the channel design calculations.

Sources for Design Inputs			
Lining	**Max Velocity**	**Max Shear Stress**	**Mannings n**
Vegitation	Table 6.4	Table 6.2	Equation on pg. 129
Riprap	Table 6.6	Table 6.2	Figure 6.2
Gabion	Table 6.10	Table 6.10	Table 6.10
ECM	Manufacturer's Specifications	Manufacturer's Specifications	Manufacturer's Specifications

Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge [8] cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft) Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel 3 - Initial (E&S)	0.030	0.098	NAG S150	0.055	2.0	2.5	0.022	0.046	2.12	0.022	0.66	6.00	0.14	1.75	0.0	0.158	Stable	0.52	2.0	1.00	2.5	7.0	34.46
Channel 3 - Vegetated (E&S)	0.030	0.098	Vegitative, C Retardence	0.093	2.0	2.5	0.031	0.064	2.17	0.030	0.48	4.00	0.19	1.00	0.0	0.411	Stable	0.53	2.0	1.00	2.5	7.0	54.18

Notes:

1 Lining: Appropriate channel lining is chosen based on velocity and shear stress considerations.
2 Manning's roughness coefficient (n-value) for channel linings are based on the PA DEP Erosion and Sediment Pollution Control Manual, March 31, 2012, and Manufacturers specifications.
3 Design criteria is based on tables within the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012, and Manufacturers specifications.
4 Critical slope is calculated to determine the stability of each channel following the procedures on Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012.

Critical slope = $S_c = 14.56\ n^2 D_m / R^{4/3}$

where: n = Manning's n
D_m = mean depth of flow (ft)
R = hydraulic radius (ft)

5 Channels are checked for stable vs. unstable conditions in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. Unstable flow occurs when $0.7S_c \leq$ Channel Slope $\leq 1.3S_c$.
6 Minimum channel depth is the sum of the flow depth and the minimum required freeboard. The minimum required freeboard is calculated in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. The required freeboard calculation is based on the stability of the channel.

For unstable flow conditions:

F = (0.025*V)*(3*D)

where: F = minimum freeboard (ft)
V = velocity (fps)
D = flow depth (ft)

For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.
7 Channel depths are rounded up to the nearest 0.25 foot increment for construction purposes.
8 Peak discharge for the 10-year storm event is calculated using the HydroCAD SCS unit hydrograph procedure. The HydroCAD report is included with the channel design calculations.

Sources for Design Inputs			
Lining	**Max Velocity**	**Max Shear Stress**	**Mannings n**
Vegitation	Table 6.4	Table 6.2	Equation on pg. 129
Riprap	Table 6.6	Table 6.2	Figure 6.2
Gabion	Table 6.10	Table 6.10	Table 6.10
ECM	Manufacturer's Specifications	Manufacturer's Specifications	Manufacturer's Specifications

Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft): Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel 4 - Initial (E&S)	0.1	0.058	NAG S150	0.055	2.0	2.5	0.053	0.114	2.29	0.050	0.88	6.00	0.19	1.75	0.1	0.121	Stable	0.55	2.0	1.00	2.5	7.0	26.51
Channel 4 - Vegetated (E&S)	0.1	0.058	Vegitative, C Retardence	0.085	2.0	2.5	0.069	0.149	2.37	0.063	0.67	4.00	0.25	1.00	0.1	0.267	Stable	0.57	2.0	1.00	2.5	7.0	33.79

Notes:

1 Lining: Appropriate channel lining is chosen based on velocity and shear stress considerations.
2 Manning's roughness coefficient (n-value) for channel linings are based on the PA DEP Erosion and Sediment Pollution Control Manual, March 31, 2012, and Manufacturers specifications.
3 Design criteria is based on tables within the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012, and Manufacturers specifications.
4 Critical slope is calculated to determine the stability of each channel following the procedures on Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012.

Critical slope = $S_c = 14.56\, n^2 D_m / R^{4/3}$

where: n = Manning's n
D_m = mean depth of flow (ft)
R = hydraulic radius (ft)

5 Channels are checked for stable vs. unstable conditions in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. Unstable flow occurs when $0.7S_c \leq$ Channel Slope $\leq 1.3S_c$.
6 Minimum channel depth is the sum of the flow depth and the minimum required freeboard. The minimum required freeboard is calculated in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. The required freeboard calculation is based on the stability of the channel.

For unstable flow conditions:

F = (0.025*V)*(3*D)

where: F = minimum freeboard (ft)
V = velocity (fps)
D = flow depth (ft)

For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.
7 Channel depths are rounded up to the nearest 0.25 foot increment for construction purposes.
8 Peak discharge for the 10-year storm event is calculated using the HydroCAD SCS unit hydrograph procedure. The HydroCAD report is included with the channel design calculations.

Sources for Design Inputs			
Lining	**Max Velocity**	**Max Shear Stress**	**Mannings n**
Vegitation	Table 6.4	Table 6.2	Equation on pg. 129
Riprap	Table 6.6	Table 6.2	Figure 6.2
Gabion	Table 6.10	Table 6.10	Table 6.10
ECM	Manufacturer's Specifications	Manufacturer's Specifications	Manufacturer's Specifications

Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft): Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel 5A	17.8	0.140	R-4 riprap	0.059	4.0	2.5	0.588	3.219	7.17	0.449	5.53	9.00	5.14	2.00	17.8	0.068	Stable	1.09	4.0	1.25	2.5	10.3	89.66
Voids	17.8	0.140	R-4 riprap	0.064	4.0	2.5	0.184	0.819	4.99	0.164	2.62	9.00	1.60	2.00	2.1	0.109	Unstable	0.68	4.0	1.00	2.5	9.0	58.00
Channel 5B - Initial (E&S)	0.01	0.122	NAG S150	0.055	2.0	2.5	0.011	0.023	2.06	0.011	0.47	6.00	0.09	1.75	0.0	0.197	Stable	0.51	2.0	1.00	2.5	7.0	38.44
Channel 5B - Vegetated (E&S)	0.01	0.122	Vegitative, C Retardence	0.111	2.0	2.5	0.016	0.032	2.08	0.015	0.29	4.00	0.12	1.00	0.0	0.722	Stable	0.52	2.0	1.00	2.5	7.0	65.98

Channel Void Space Calculation [8]

Channel I.D.	Peak Discharge cfs	Void Space %	Lining Type	Nominal Thickness ft	Base Width ft	Total Stone Area ft²	Void Space ft²	Excess Flow Area ft²
Channel 5A	17.8	0.40	R-4 riprap	1.5	4.0	6	2.40	0.819

Notes:

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3 Design criteria is based on tables within the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012, and Manufacturers specifications.
4 Critical slope is calculated to determine the stability of each channel following the procedures on Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012.
Critical slope = $S_c = 14.56\ n^2 D_m / R^{4/3}$
where: n = Manning's n
D_m = mean depth of flow (ft)
R = hydraulic radius (ft)
5 Channels are checked for stable vs. unstable conditions in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. Unstable flow occurs when $0.7S_c \leq$ Channel Slope $\leq 1.3S_c$.
6 Minimum channel depth is the sum of the flow depth and the minimum required freeboard. The minimum required freeboard is calculated in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. The required freeboard calculation is based on the stability of the channel.
For unstable flow conditions:
F = (0.025*V)*(3*D)
where: F = minimum freeboard (ft)
V = velocity (fps)
D = flow depth (ft)
For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.
7 Channel depths are rounded up to the nearest 0.25 foot increment for construction purposes.
8 The void space in the channel bottom can be accounted for per recommendations in the Pennsylvania Erosion and Sediment Pollution Control Program Manual to reduce the calculated shear stress for the channel.
The separate Channels Void Space Calculation, determines the void space for of the stone on the channels bottom. The sides of the channel are ignored and only the base width is used in determining this area.
The nominal thickness is adjusted based of the type of rock or the thickness of the gabion or reno mattress. The void space area is found by multiplying the total stone area by the void space, assuming 33% void space for slopes< 10 % and 40% for slopes ≥ 10%.
The excess flow area is the void space area subtracted from the channels cross sectional flow area found initially for the full depth needed to handle the required peak discharge. (If this would result in a flow area less than 0.1 ft2, 0.1 ft2 is assumed.)
On the line labeled **"With Void"**, the new reduced excess flow area is used to determine the new depth of flow over the top of the stone. From the reduced depth the channels final velocity, shear stress and channel dimensions are determined.
9 Peak discharge for the 10-year storm event is calculated using the HydroCAD SCS unit hydrograph procedure. The HydroCAD report is included with the channel design calculations.

Sources for Design Inputs

Lining	Max Velocity	Max Shear Stress	Mannings n
Vegitation	Table 6.4	Table 6.2	Equation on pg. 129
Riprap	Table 6.6	Table 6.2	Figure 6.2
Gabion	Table 6.10	Table 6.10	Table 6.10
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Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft) Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel 6 - Initial (E&S)	0.1	0.136	NAG S150	0.055	2.0	2.5	0.039	0.082	2.21	0.037	1.11	6.00	0.33	1.75	0.1	0.133	Unstable	0.54	2.0	1.00	2.5	7.0	40.59
Channel 6 - Vegetated (E&S)	0.1	0.136	Vegitative, C Retardence	0.071	2.0	2.5	0.045	0.095	2.24	0.042	0.94	4.00	0.38	1.00	0.1	0.211	Stable	0.54	2.0	1.00	2.5	7.0	72.76

Notes:

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Sources for Design Inputs			
Lining	**Max Velocity**	**Max Shear Stress**	**Mannings n**
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Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft) Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel 7 - Initial (E&S)	19.2	0.033	NAG P300 Unveg.	0.031	2.0	2.5	0.831	3.387	6.47	0.523	5.67	9.00	1.71	3.00	19.2	0.018	Stable	1.33	2.0	1.50	2.5	9.5	85.09
Channel 7 - Vegetated (E&S)	19.2	0.033	NAG P300 Veg.	0.043	2.0	2.5	0.977	4.337	7.26	0.598	4.43	16.00	2.01	8.00	19.2	0.034	Unstable	1.48	2.0	1.50	2.5	9.5	59.05

Notes:

1 Lining: Appropriate channel lining is chosen based on velocity and shear stress considerations.
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Critical slope = $S_c = 14.56\ n^2 D_m / R^{4/3}$

where: n = Manning's n
D_m = mean depth of flow (ft)
R = hydraulic radius (ft)

5 Channels are checked for stable vs. unstable conditions in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. Unstable flow occurs when $0.7S_c \leq$ Channel Slope $\leq 1.3S_c$.
6 Minimum channel depth is the sum of the flow depth and the minimum required freeboard. The minimum required freeboard is calculated in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. The required freeboard calculation is based on the stability of the channel.

For unstable flow conditions:

F = (0.025*V)*(3*D)

where: F = minimum freeboard (ft)
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D = flow depth (ft)

For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.
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8 Peak discharge for the 10-year storm event is calculated using the HydroCAD SCS unit hydrograph procedure. The HydroCAD report is included with the channel design calculations.

Sources for Design Inputs			
Lining	**Max Velocity**	**Max Shear Stress**	**Mannings n**
Vegitation	Table 6.4	Table 6.2	Equation on pg. 129
Riprap	Table 6.6	Table 6.2	Figure 6.2
Gabion	Table 6.10	Table 6.10	Table 6.10
ECM	Manufacturer's Specifications	Manufacturer's Specifications	Manufacturer's Specifications

Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft): Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel 8 - Initial (PCSM)	0.8	0.072	NAG S150	0.055	2.0	2.5	0.173	0.422	2.93	0.144	1.99	6.00	0.78	1.75	0.8	0.086	Unstable	0.67	2.0	1.00	2.5	7.0	29.53
Channel 8 - Vegetated (PCSM)	0.8	0.072	Vegitative, C Retardence	0.053	2.0	2.5	0.209	0.527	3.12	0.169	2.32	4.00	0.94	1.00	1.2	0.075	Unstable	0.71	2.0	1.00	2.5	7.0	41.05

Notes:

1 Lining: Appropriate channel lining is chosen based on velocity and shear stress considerations.
2 Manning's roughness coefficient (n-value) for channel linings are based on the PA DEP Erosion and Sediment Pollution Control Manual, March 31, 2012, and Manufacturers specifications.
3 Design criteria is based on tables within the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012, and Manufacturers specifications.
4 Critical slope is calculated to determine the stability of each channel following the procedures on Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012.

Critical slope = $S_c = 14.56\, n^2 D_m / R^{4/3}$

where: n = Manning's n
D_m = mean depth of flow (ft)
R = hydraulic radius (ft)

5 Channels are checked for stable vs. unstable conditions in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. Unstable flow occurs when $0.7S_c \leq$ Channel Slope $\leq 1.3S_c$.
6 Minimum channel depth is the sum of the flow depth and the minimum required freeboard. The minimum required freeboard is calculated in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. The required freeboard calculation is based on the stability of the channel.

For unstable flow conditions:

F = (0.025*V)*(3*D)

where: F = minimum freeboard (ft)
V = velocity (fps)
D = flow depth (ft)

For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.
7 Channel depths are rounded up to the nearest 0.25 foot increment for construction purposes.
8 Peak discharge for the 10-year storm event is calculated using the HydroCAD SCS unit hydrograph procedure. The HydroCAD report is included with the channel design calculations.

Sources for Design Inputs			
Lining	**Max Velocity**	**Max Shear Stress**	**Mannings n**
Vegitation	Table 6.4	Table 6.2	Equation on pg. 129
Riprap	Table 6.6	Table 6.2	Figure 6.2
Gabion	Table 6.10	Table 6.10	Table 6.10
ECM	Manufacturer's Specifications	Manufacturer's Specifications	Manufacturer's Specifications

Pennsylvania General Energy Company, L.L.C.: Loyalsock / Shawnee Freshwater System
CHANNEL DESIGN CALCULATIONS

Channel I.D.	Peak Discharge cfs	Channel Slope ft/ft	Lining Type [1]	Manning's "n" [2]	Base Width ft.	Side Slope x:1	Flow Depth ft.	Flow Area sq. ft.	Wetted Perim. ft.	Hydraul. Radius ft.	Vel. fps	Allow. Vel. [3] fps	Shear Stress <lb/ft²	Allow. Shear [3] Stress	Avail. Flow cfs	Critical Slope [4] ft/ft	Flow Type [5]	Min. Depth [6] ft	Minimum Channel Dimensions (ft) Bottom Width	Depth [7]	Side Slopes	Top Width	Total Q Avail. (cfs)
Channel D1 - Initial (E&S)	0.8	0.010	NAG S150	0.054	0.0	2.5	0.539	0.725	2.90	0.250	1.09	6.00	0.34	1.75	0.8	0.073	Stable	1.04	0.0	1.25	2.5	6.25	10.63
Channel D1 - Vegetated (E&S)	0.8	0.010	Vegitative, C Retardence	0.091	0.0	2.5	0.655	1.073	3.53	0.304	0.74	4.00	0.41	1.00	0.8	0.195	Stable	1.16	0.0	1.25	2.5	6.25	5.72

Notes:

1 Lining: Appropriate channel lining is chosen based on velocity and shear stress considerations.
2 Manning's roughness coefficient (n-value) for channel linings are based on the PA DEP Erosion and Sediment Pollution Control Manual, March 31, 2012, and Manufacturers specifications.
3 Design criteria is based on tables within the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012, and Manufacturers specifications.
4 Critical slope is calculated to determine the stability of each channel following the procedures on Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012.

Critical slope = $S_c = 14.56\ n^2 D_m / R^{4/3}$

where: n = Manning's n
D_m = mean depth of flow (ft)
R = hydraulic radius (ft)

5 Channels are checked for stable vs. unstable conditions in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. Unstable flow occurs when $0.7S_c \leq$ Channel Slope $\leq 1.3S_c$.
6 Minimum channel depth is the sum of the flow depth and the minimum required freeboard. The minimum required freeboard is calculated in accordance with Page 139 of the PA DEP Erosion and Sediment Pollution Control Program Manual, March 31, 2012. The required freeboard calculation is based on the stability of the channel.

For unstable flow conditions:

F = (0.025*V)*(3*D)

where: F = minimum freeboard (ft)
V = velocity (fps)
D = flow depth (ft)

For stable flow conditions, the minimum freeboard should be 25% of the flow depth or a minimum of 6 inches, whichever is greater.
7 Channel depths are rounded up to the nearest 0.25 foot increment for construction purposes.
8 Peak discharge based on 2.75 cfs/acre for permanent channel design per DEP guidence.

Sources for Design Inputs			
Lining	**Max Velocity**	**Max Shear Stress**	**Mannings n**
Vegitation	Table 6.4	Table 6.2	Equation on pg. 129
Riprap	Table 6.6	Table 6.2	Figure 6.2
Gabion	Table 6.10	Table 6.10	Table 6.10
ECM	Manufacturer's Specifications	Manufacturer's Specifications	Manufacturer's Specifications

Time span=0.00-32.00 hrs, dt=0.05 hrs, 641 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment CH1-PRE: Channel 1 Runoff Area=12.981 ac 0.00% Impervious Runoff Depth=1.36"
Flow Length=2,642' Tc=80.7 min CN=70 Runoff=6.97 cfs 1.467 af

Subcatchment CH2-E&S: Channel 2 Runoff Area=1.417 ac 21.88% Impervious Runoff Depth=0.18"
Flow Length=585' Tc=22.1 min CN=45 Runoff=0.05 cfs 0.022 af

Subcatchment CH2-PRE: Channel 2 DA-PRE Runoff Area=1.445 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=582' Tc=22.5 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment CH3-E&S: Channel 3 Runoff Area=0.751 ac 20.51% Impervious Runoff Depth=0.18"
Flow Length=705' Tc=10.6 min CN=45 Runoff=0.03 cfs 0.012 af

Subcatchment CH3-PRE: Channel 3 DA-PRE Runoff Area=0.471 ac 0.00% Impervious Runoff Depth=0.02"
Flow Length=334' Tc=30.9 min CN=37 Runoff=0.00 cfs 0.001 af

Subcatchment CH4-E&S: Channel 4 Runoff Area=0.199 ac 18.59% Impervious Runoff Depth=0.46"
Flow Length=261' Tc=7.6 min CN=53 Runoff=0.10 cfs 0.008 af

Subcatchment CH5A-E&S: Channel 5A Runoff Area=36.512 ac 0.85% Impervious Runoff Depth=0.99"
Flow Length=3,058' Tc=53.1 min CN=64 Runoff=17.78 cfs 3.027 af

Subcatchment CH5B-E&S: Channel 5B Runoff Area=0.338 ac 20.71% Impervious Runoff Depth=0.16"
Flow Length=228' Tc=6.0 min CN=44 Runoff=0.01 cfs 0.004 af

Subcatchment CH6-E&S: Channel 6 Runoff Area=0.581 ac 26.51% Impervious Runoff Depth=0.28"
Flow Length=448' Tc=9.0 min CN=48 Runoff=0.09 cfs 0.013 af

Subcatchment CH7-E&S: Channel 7 Runoff Area=36.735 ac 0.84% Impervious Runoff Depth=1.05"
Flow Length=3,232' Tc=53.5 min CN=65 Runoff=19.21 cfs 3.220 af

Subcatchment CH8-PCSM: Channel 8 Runoff Area=0.589 ac 47.20% Impervious Runoff Depth=0.89"
Flow Length=309' Tc=6.2 min CN=62 Runoff=0.84 cfs 0.043 af

Total Runoff Area = 92.019 ac Runoff Volume = 7.818 af Average Runoff Depth = 1.02"
98.24% Pervious = 90.398 ac 1.76% Impervious = 1.621 ac

Summary for Subcatchment CH1-PRE: Channel 1 DA-PRE

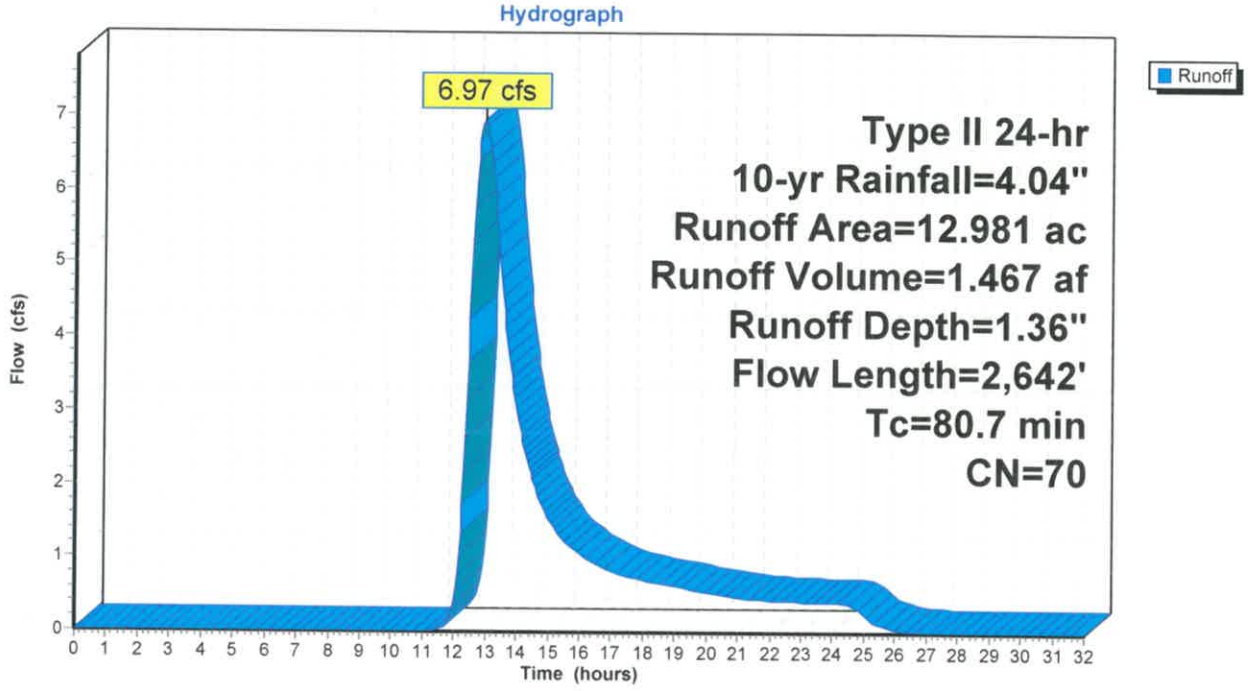
Runoff = 6.97 cfs @ 12.98 hrs, Volume= 1.467 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
0.061	30	Woods, Good, HSG A
12.920	70	Woods, Good, HSG C
12.981	70	Weighted Average
12.981		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
42.5	100	0.0200	0.04		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.48"
18.1	469	0.0300	0.43		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	246	0.1220	0.87		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
14.0	1,465	0.4900	1.75		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.4	362	0.0490	4.27	9.63	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.63' Z= 2.5 '/' Top.W=5.15' n= 0.043
80.7	2,642	Total			

Subcatchment CH1-PRE: Channel 1 DA-PRE



Summary for Subcatchment CH2-E&S: Channel 2 DA-E&S

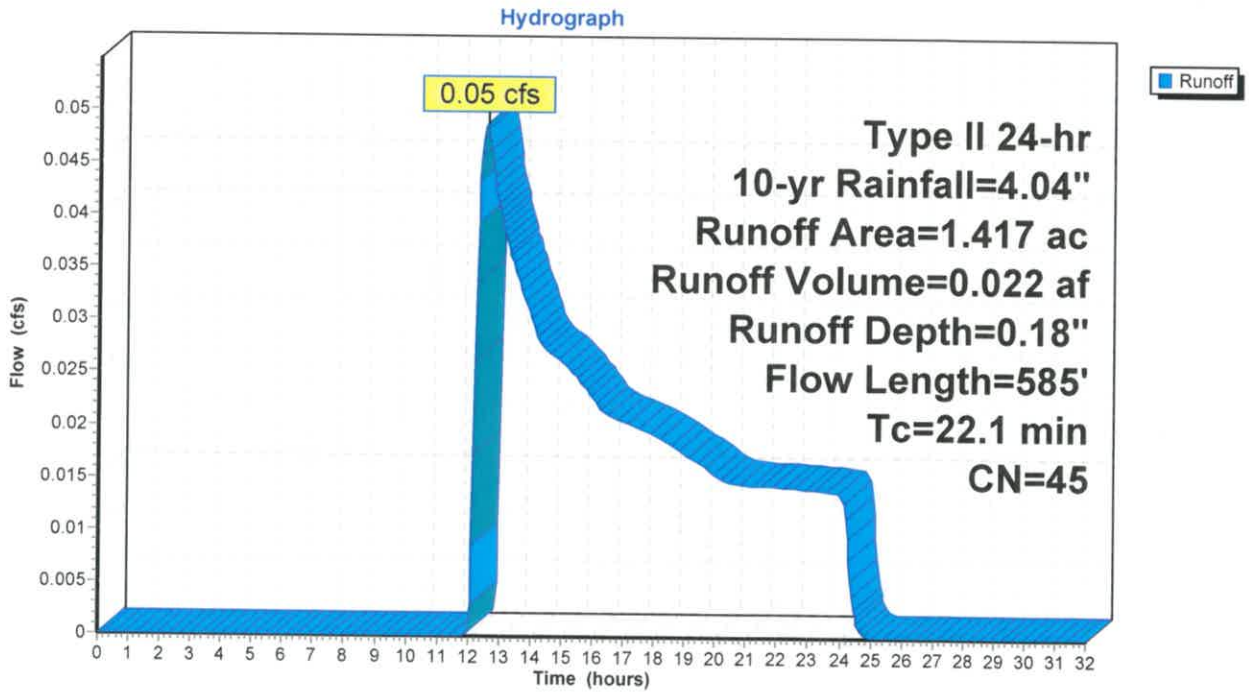
Runoff = 0.05 cfs @ 12.55 hrs, Volume= 0.022 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
1.107	30	Meadow, non-grazed, HSG A
0.310	98	Paved parking, HSG A
1.417	45	Weighted Average
1.107		78.12% Pervious Area
0.310		21.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	36	0.2800	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.48"
1.2	120	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	97	0.2060	3.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.9	332	0.1080	0.31	0.01	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.02' Z= 2.5 '/' Top.W=2.10' n= 0.114
22.1	585	Total			

Subcatchment CH2-E&S: Channel 2 DA-E&S



Summary for Subcatchment CH2-PRE: Channel 2 DA-PRE

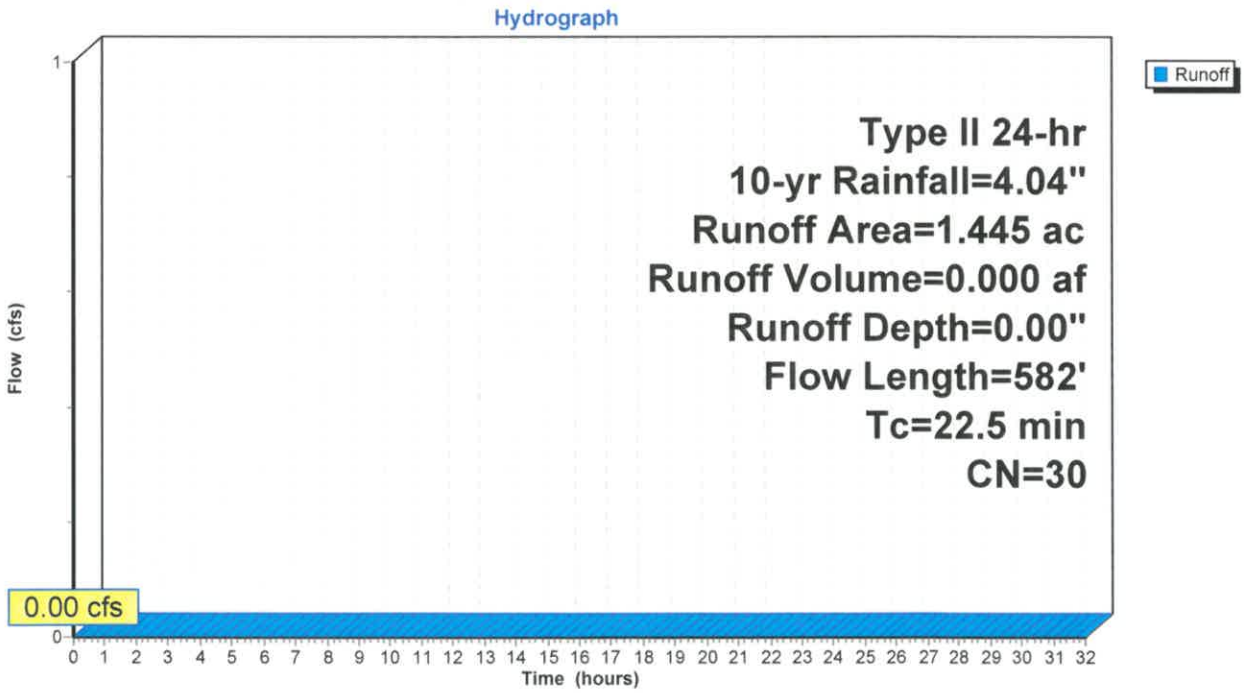
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
1.445	30	Woods, Good, HSG A
1.445		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.5	100	0.1600	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.48"
2.8	150	0.1300	0.90		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.2	332	0.1080	4.56	3.76	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.30' Z= 2.5 '/' Top.W=3.50' n= 0.040
22.5	582	Total			

Subcatchment CH2-PRE: Channel 2 DA-PRE



Summary for Subcatchment CH3-E&S: Channel 3 DA-E&S

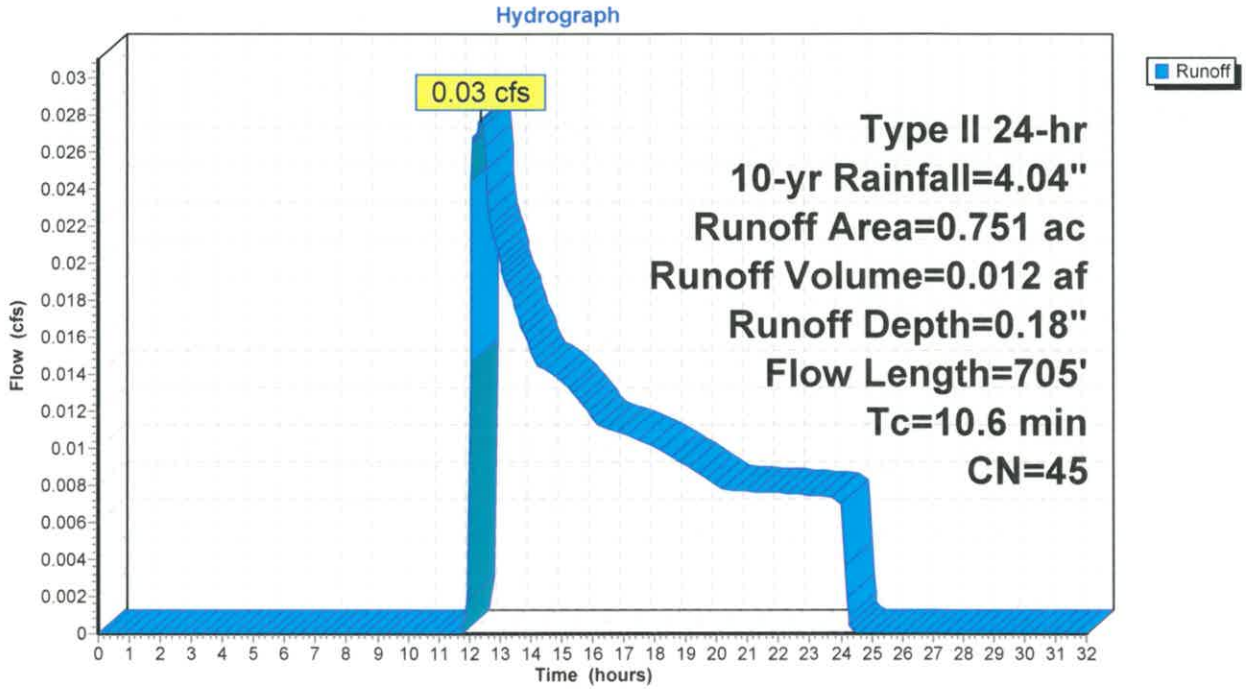
Runoff = 0.03 cfs @ 12.37 hrs, Volume= 0.012 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
0.427	30	Meadow, non-grazed, HSG A
0.154	98	Paved parking, HSG A
0.131	30	Meadow, non-grazed, HSG A
0.039	58	Meadow, non-grazed, HSG B
0.751	45	Weighted Average
0.597		79.49% Pervious Area
0.154		20.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	35	0.3500	0.26		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.48"
1.3	130	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	75	0.2900	3.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	208	0.1360	1.03	0.11	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.05' Z= 2.5 '/' Top.W=2.25' n= 0.069
0.1	42	0.0400	11.89	21.01	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.8	146	0.1980	3.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.5	69	0.0980	0.46	0.03	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.03' Z= 2.5 '/' Top.W=2.15' n= 0.094
10.6	705	Total			

Subcatchment CH3-E&S: Channel 3 DA-E&S



Summary for Subcatchment CH3-PRE: Channel 3 DA-PRE

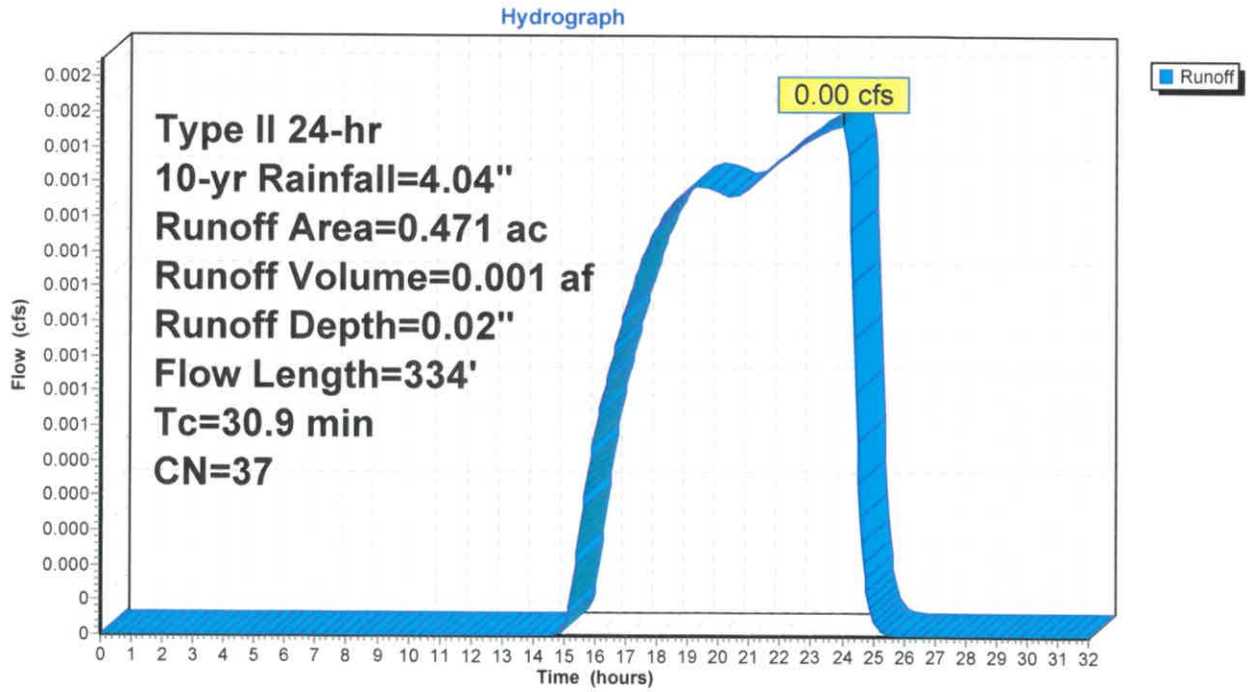
Runoff = 0.00 cfs @ 24.02 hrs, Volume= 0.001 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
0.343	30	Woods, Good, HSG A
0.128	55	Woods, Good, HSG B
0.471	37	Weighted Average
0.471		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	100	0.2100	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.48"
2.2	145	0.2000	1.12		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
12.1	89	0.0980	0.12	0.00	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.01' Z= 2.5 '/' Top.W=2.05' n= 0.174
30.9	334	Total			

Subcatchment CH3-PRE: Channel 3 DA-PRE



Summary for Subcatchment CH4-E&S: Channel 4 DA-E&S

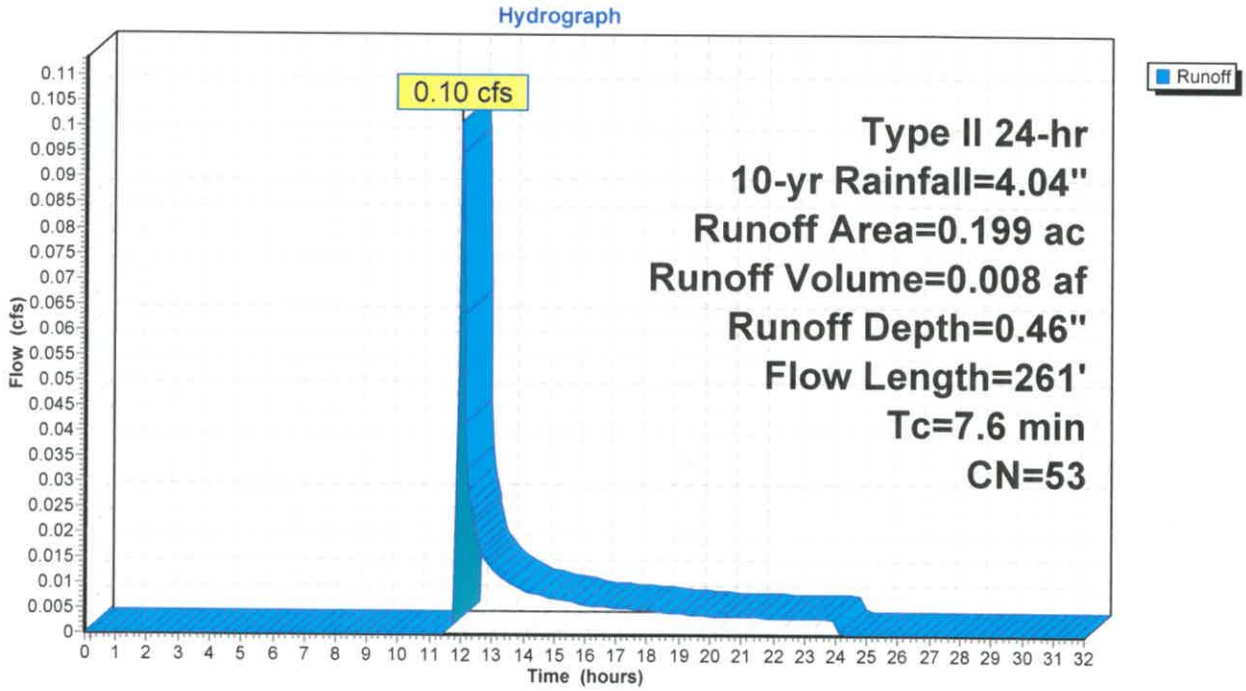
Runoff = 0.10 cfs @ 12.02 hrs, Volume= 0.008 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
0.091	30	Meadow, non-grazed, HSG A
0.037	98	Paved parking, HSG A
0.071	58	Meadow, non-grazed, HSG B
0.199	53	Weighted Average
0.162		81.41% Pervious Area
0.037		18.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0600	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.48"
0.5	117	0.2990	3.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	94	0.0580	1.49	0.57	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.16' Z= 2.5 '/' Top.W=2.80' n= 0.063
7.6	261	Total			

Subcatchment CH4-E&S: Channel 4 DA-E&S



Summary for Subcatchment CH5A-E&S: Channel 5A DA-E&S

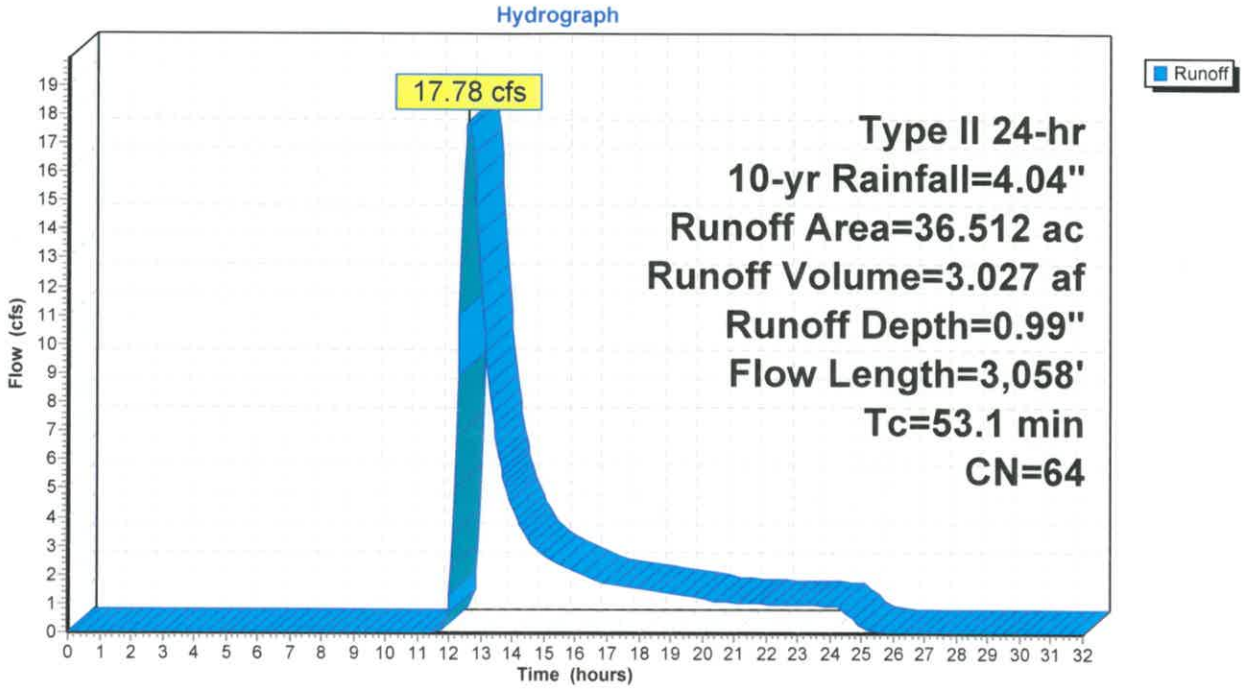
Runoff = 17.78 cfs @ 12.60 hrs, Volume= 3.027 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
3.526	30	Woods, Good, HSG A
0.886	30	Meadow, non-grazed, HSG A
17.364	70	Woods, Good, HSG C
0.268	30	Meadow, non-grazed, HSG A
0.070	98	Paved parking, HSG A
0.239	98	Paved parking, HSG A
1.178	30	Meadow, non-grazed, HSG A
0.061	30	Woods, Good, HSG A
12.920	70	Woods, Good, HSG C
36.512	64	Weighted Average
36.203		99.15% Pervious Area
0.309		0.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	100	0.0600	0.16		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.48"
19.6	589	0.0400	0.50		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.2	190	0.1570	0.99		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
13.9	1,463	0.4900	1.75		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	13	0.3800	4.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.6	264	0.0570	1.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	322	0.1550	1.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	91	0.1980	3.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	26	0.1400	7.20	17.40	**Trap/Vee/Rect Channel Flow,** Bot.W=6.50' D=0.33' Z= 2.5 '/' Top.W=8.15' n= 0.034
53.1	3,058	Total			

Subcatchment CH5A-E&S: Channel 5A DA-E&S



Summary for Subcatchment CH5B-E&S: Channel 5B DA-E&S

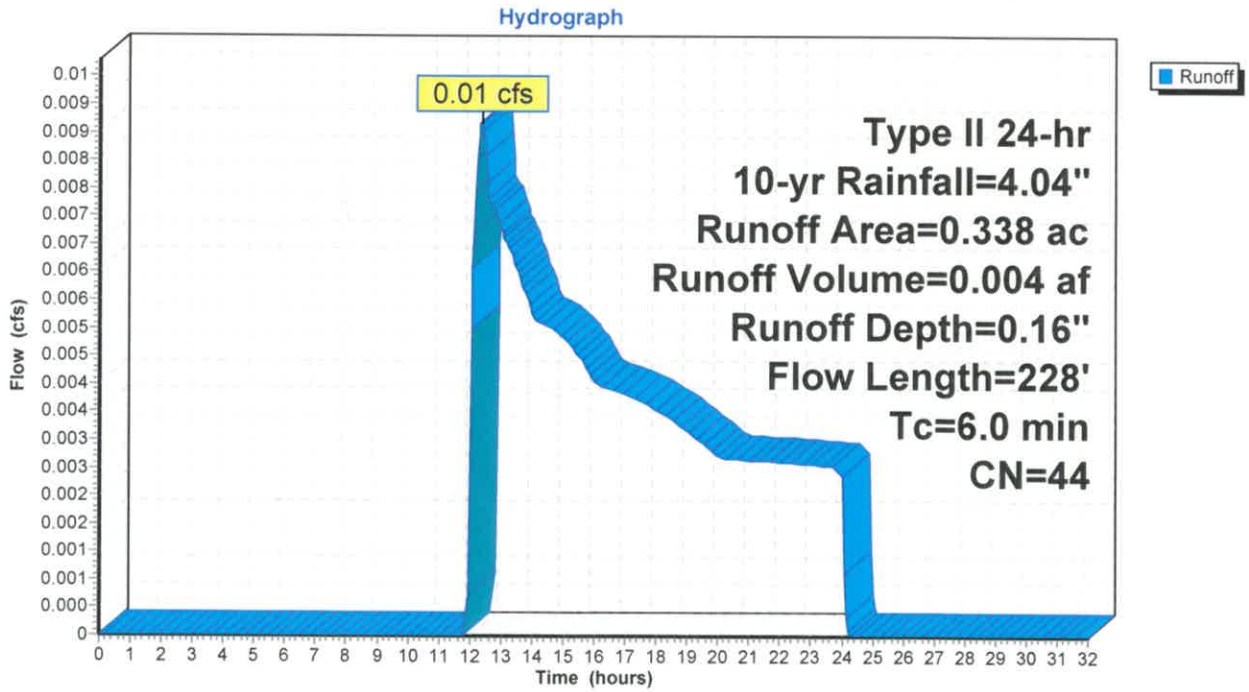
Runoff = 0.01 cfs @ 12.37 hrs, Volume= 0.004 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
0.268	30	Meadow, non-grazed, HSG A
0.070	98	Paved parking, HSG A
0.338	44	Weighted Average
0.268		79.29% Pervious Area
0.070		20.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.4000	0.30		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.48"
0.0	4	0.4000	4.43		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	174	0.1220	2.79	0.99	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.15' Z= 2.5 '/' Top.W=2.75' n= 0.047
3.8	228	Total, Increased to minimum Tc = 6.0 min			

Subcatchment CH5B-E&S: Channel 5B DA-E&S



Summary for Subcatchment CH6-E&S: Channel 6 DA-E&S

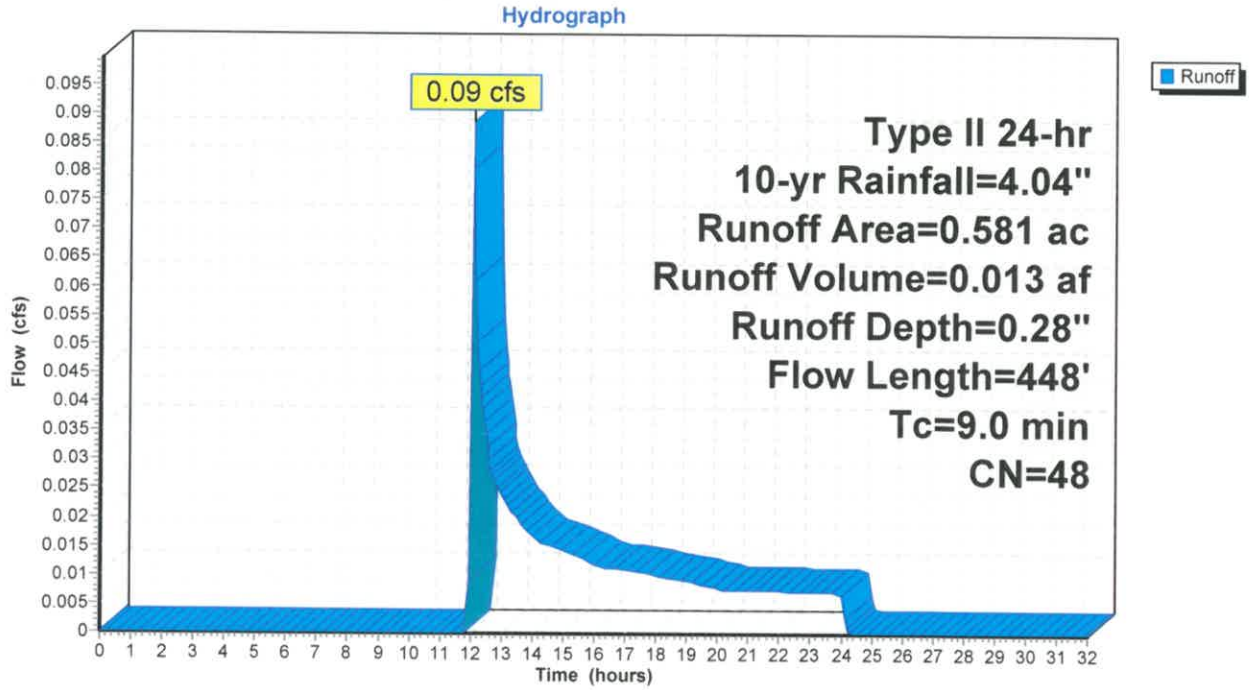
Runoff = 0.09 cfs @ 12.07 hrs, Volume= 0.013 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
0.427	30	Meadow, non-grazed, HSG A
0.154	98	Paved parking, HSG A
0.581	48	Weighted Average
0.427		73.49% Pervious Area
0.154		26.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.1800	0.22		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.48"
0.7	28	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	31	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	131	0.1830	2.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	208	0.1360	1.03	0.11	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.05' Z= 2.5 '/' Top.W=2.25' n= 0.069
9.0	448	Total			

Subcatchment CH6-E&S: Channel 6 DA-E&S



Summary for Subcatchment CH7-E&S: Channel 7 DA-E&S

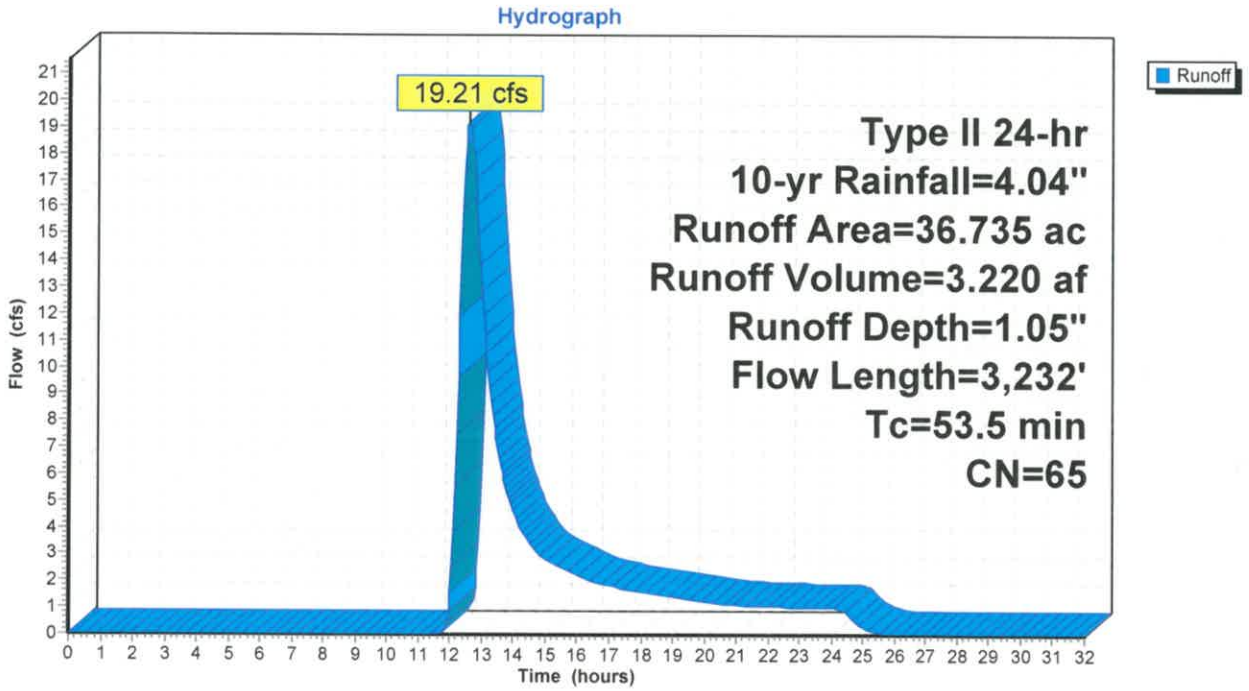
Runoff = 19.21 cfs @ 12.61 hrs, Volume= 3.220 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
3.526	30	Woods, Good, HSG A
0.886	30	Meadow, non-grazed, HSG A
17.364	72	Woods/grass comb., Good, HSG C
0.268	30	Meadow, non-grazed, HSG A
0.070	98	Paved parking, HSG A
0.239	98	Paved parking, HSG A
1.178	30	Meadow, non-grazed, HSG A
0.061	30	Woods, Good, HSG A
12.920	70	Woods, Good, HSG C
0.098	30	Meadow, non-grazed, HSG A
0.125	58	Meadow, non-grazed, HSG B
36.735	65	Weighted Average
36.426		99.16% Pervious Area
0.309		0.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	100	0.0600	0.16		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.48"
19.6	589	0.0400	0.50		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.2	190	0.1570	0.99		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
13.9	1,463	0.4900	1.75		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	13	0.3800	4.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.6	264	0.0570	1.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.7	322	0.1550	1.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	91	0.1980	3.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	26	0.1400	11.92	79.83	**Trap/Vee/Rect Channel Flow,** Bot.W=6.50' D=0.79' Z= 2.5 '/' Top.W=10.45' n= 0.034
0.1	54	0.0400	11.89	21.01	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	120	0.0330	4.54	20.73	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.01' Z= 2.5 '/' Top.W=7.05' n= 0.043
53.5	3,232	Total			

Subcatchment CH7-E&S: Channel 7 DA-E&S



Summary for Subcatchment CH8-PCSM: Channel 8 DA-PCSM

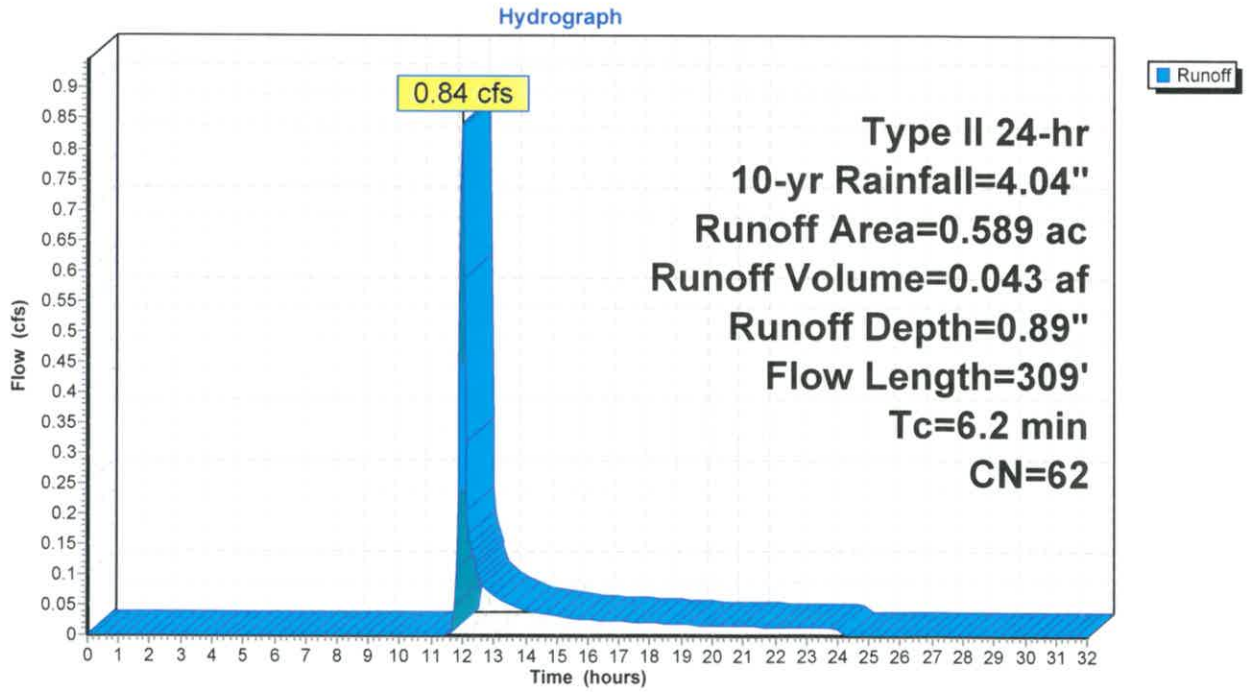
Runoff = 0.84 cfs @ 11.99 hrs, Volume= 0.043 af, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-32.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.04"

Area (ac)	CN	Description
0.311	30	Meadow, non-grazed, HSG A
0.278	98	Paved parking, HSG A
0.589	62	Weighted Average
0.311		52.80% Pervious Area
0.278		47.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1600	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.48"
1.1	106	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	67	0.2060	3.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	86	0.0720	2.30	1.22	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.21' Z= 2.5 '/' Top.W=3.05' n= 0.053
6.2	309	Total			

Subcatchment CH8-PCSM: Channel 8 DA-PCSM



CULVERTS

DESCRIPTION

Design the proposed culverts to convey the required flow rates at the site.

REFERENCES

1. Erosion and Sediment Pollution Control Program Manual, PADEP, March 2012.
2. U.S. Department of Transportation Federal Highway Administration Program HY-8 v. 7.2.
3. Hydrologic Analysis and Design, 3rd Edition, Richard McCuen, 2005

DEFINITION OF VARIABLES

A = drainage area (acres)
C = runoff coefficient
D = culvert diameter (ft)
DI = diversion channel downstream invert (ft)
g = gravity (ft/s2)
L = length (ft)
n = Manning's roughness coefficient
Q = culvert discharge (cfs)
Qt = total discharge (cfs)
S = culvert slope (ft/ft)
s = surface slope (ft/ft)
Tc = time of concentration (min)
UI = diversion channel upstream invert (ft)

DESIGN VARIABLES

Design Variables									
Culvert No.	Upstream Invert, UI (ft)	Downstream Invert, DI (ft)	Crest Elevation (ft)	Length of Culvert, L (ft)	Pipe Slope, S (ft/ft)	Culvert Diameter, D (in)	Number of Barrels	Culvert Barrel Material	Barrel Manning's n
1	692.0	690.75	694.0	55.0	0.023	12	1	HDPE*	0.012
2	663.5	663.0	667.0	55.0	0.009	24	1	HDPE*	0.012
3	652.0	651.25	657.0	65.0	0.012	24	1	HDPE*	0.012

*Corrugated

CALCULATIONS

1. Calculate the required flow rate.

   - Obtain the peak runoff rate (Q) for a 10-year/24 hr storm from the channel flowing to the culvert as outlined in *Reference 1.* Peak discharge for the 10-year storm event is calculated using the HydroCAD SCS unit hydrograph procedure. The HydroCAD report is included with the channel design calculations.

Calculated Design Flow		
Culvert No.	Receiving Channel	Design Flow, Q (cfs)
1	Channel 6	0.1
2	Channel 5A	17.8
3	Channel 7	19.2

CULVERT DESIGN

The culverts were designed using HY8 to evaluate their hydraulic capacity. See the culvert summary sheets following this narrative for HY8 culvert design details.

Culvert Summary Table											
Culvert No.	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1	0.1	0.1	692.18	0.18	0.00	0.09	0.13	0.09	0.04	3.29	1.26
2	17.8	17.8	666.11	2.61	2.29	1.27	1.52	1.33	0.64	7.79	3.43
3	19.2	19.2	654.82	2.82	2.31	1.24	1.58	1.31	0.97	8.60	4.45

Check overtopping and inlet control:

As demonstrated by the table below and attached figures, flow at the proposed culverts will not overtop the proposed road under the design flow rates. The provided freeboard is greater than the required freeboard of 0.50 feet (per *Reference 1*).

Check			
Culvert No.	Headwater Elevation (ft)	Crest Elevation (ft)	Check
1	692.18	694.0	OK
2	666.11	667.0	OK
3	654.82	657.0	OK

CONCLUSIONS

The worst-case scenario for the culverts conveying the 10-year storm event meets all of the necessary design criteria. The following table summarizes the results for the culverts to be utilized at the site.

Culvert Summary Table				
Culvert No.	Pipe Diameter (in.)	Material	Length (ft.)	Slope (%)
1	12	Corrugated HDPE	55.0	2.3
2	24	Corrugated HDPE	55.0	0.9
3	24	Corrugated HDPE	65.0	1.2

HY-8 Culvert Analysis Report

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.05	0.05	718.65	26.649	0.202	7-M2c	0.063	0.048	0.048	0.025	3.584	0.972
0.07	0.07	692.16	0.156	0.0*	1-S2n	0.072	0.098	0.072	0.029	-5.217	1.068
0.08	0.08	692.16	0.160	0.0*	1-S2n	0.079	0.111	0.079	0.033	2.958	1.156
0.10	0.10	692.18	0.177	0.0*	1-S2n	0.086	0.122	0.086	0.037	3.218	1.237
0.10	0.10	692.18	0.182	0.0*	1-S2n	0.088	0.125	0.088	0.038	3.295	1.263
0.13	0.13	692.20	0.198	0.0*	1-S2n	0.098	0.141	0.098	0.043	3.625	1.372
0.14	0.14	692.21	0.211	0.0*	1-S2n	0.104	0.150	0.104	0.046	3.286	1.434
0.16	0.16	692.22	0.218	0.0*	1-S2n	0.109	0.159	0.109	0.049	3.442	1.487
0.17	0.17	692.23	0.229	0.0*	1-S2n	0.114	0.162	0.114	0.052	3.582	1.540
0.19	0.19	692.24	0.240	0.0*	1-S2n	0.118	0.170	0.118	0.055	3.708	1.587
0.20	0.20	692.25	0.251	0.0*	1-S2n	0.123	0.178	0.123	0.057	3.823	1.636

Table 1 - Culvert Summary Table: Culvert 1

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 692.00 ft, Outlet Elevation (invert): 690.75 ft

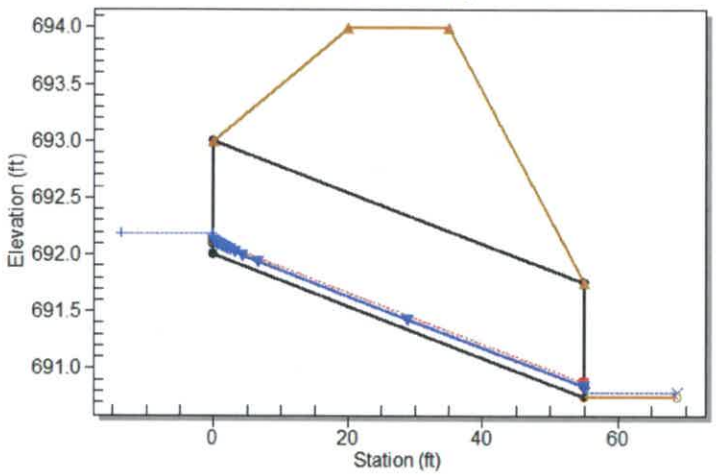
Culvert Length: 55.01 ft, Culvert Slope: 0.0227

****

Water Surface Profile Plot for Culvert: Culvert 1

Crossing - Crossing 1, Design Discharge - 0.1 cfs

Culvert - Culvert 1, Culvert Discharge - 0.1 cfs



Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

HY-8 Culvert Analysis Report

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
16.50	16.50	665.94	2.436	1.850	5-S2n	1.207	1.459	1.265	0.614	7.640	3.348
16.70	16.70	665.96	2.462	1.884	5-S2n	1.217	1.471	1.275	0.618	7.663	3.361
16.90	16.90	665.99	2.488	1.914	5-S2n	1.226	1.480	1.285	0.622	7.689	3.374
17.10	17.10	666.01	2.515	1.945	5-S2n	1.236	1.489	1.295	0.626	7.711	3.387
17.30	17.30	666.04	2.542	1.976	5-S2n	1.246	1.497	1.305	0.630	7.733	3.399
17.50	17.50	666.07	2.569	2.254	5-S2n	1.256	1.506	1.315	0.634	7.755	3.412
17.70	17.70	666.10	2.596	2.282	5-S2n	1.266	1.514	1.325	0.638	7.777	3.424
17.78	17.78	666.11	2.607	2.293	5-S2n	1.270	1.517	1.329	0.640	7.785	3.430
18.10	18.10	666.15	2.652	2.337	5-S2n	1.286	1.530	1.345	0.647	7.824	3.449
18.30	18.30	666.18	2.680	2.365	5-S2n	1.297	1.539	1.355	0.651	7.843	3.461
18.50	18.50	666.21	2.709	2.393	5-S2n	1.307	1.547	1.366	0.655	7.863	3.474

Table 1 - Culvert Summary Table: Culvert 2

****

Straight Culvert

Inlet Elevation (invert): 663.50 ft, Outlet Elevation (invert): 663.00 ft

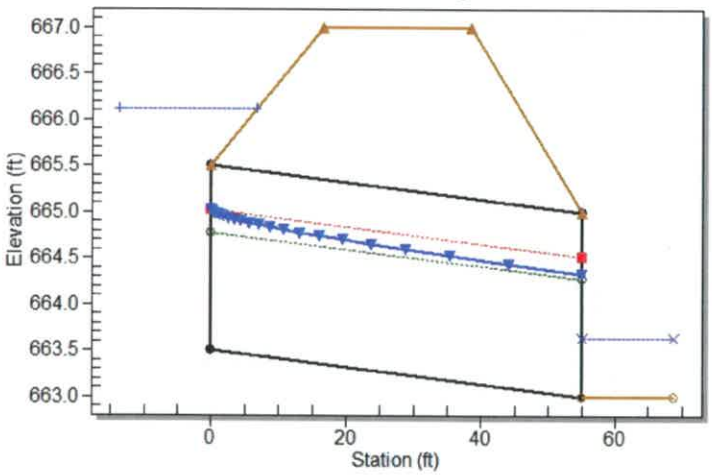
Culvert Length: 55.00 ft, Culvert Slope: 0.0091

****

Water Surface Profile Plot for Culvert: Culvert 2

Crossing - Crossing 2, Design Discharge - 17.8 cfs

Culvert - Culvert 2, Culvert Discharge - 17.8 cfs



Culvert Data Summary - Culvert 2

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

HY-8 Culvert Analysis Report

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
18.50	18.50	654.71	2.707	0.207	5-S2n	1.203	1.547	1.272	0.957	8.510	4.403
18.65	18.65	654.73	2.728	2.221	5-S2n	1.209	1.553	1.279	0.960	8.526	4.412
18.80	18.80	654.75	2.750	2.244	5-S2n	1.216	1.559	1.286	0.964	8.548	4.422
18.95	18.95	654.77	2.772	2.266	5-S2n	1.223	1.564	1.293	0.968	8.564	4.431
19.10	19.10	654.79	2.795	2.289	5-S2n	1.229	1.570	1.299	0.971	8.581	4.441
19.24	19.24	654.82	2.816	2.310	5-S2n	1.235	1.576	1.306	0.975	8.596	4.449
19.40	19.40	654.84	2.840	2.334	5-S2n	1.242	1.582	1.313	0.979	8.612	4.458
19.55	19.55	654.86	2.862	2.357	5-S2n	1.249	1.587	1.320	0.982	8.628	4.468
19.70	19.70	654.89	2.885	2.380	5-S2n	1.256	1.593	1.327	0.986	8.643	4.476
19.85	19.85	654.91	2.909	2.403	5-S2n	1.262	1.599	1.333	0.989	8.666	4.486
20.00	20.00	654.93	2.932	2.427	5-S2n	1.269	1.604	1.340	0.993	8.681	4.495

Table 1 - Culvert Summary Table: Culvert 3

****

Straight Culvert

Inlet Elevation (invert): 652.00 ft, Outlet Elevation (invert): 651.25 ft

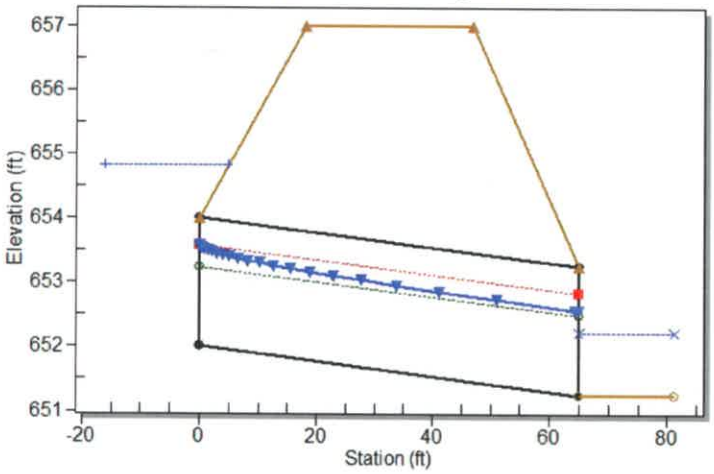
Culvert Length: 65.00 ft, Culvert Slope: 0.0115

****

Water Surface Profile Plot for Culvert: Culvert 3

Crossing - Crossing 3, Design Discharge - 19.2 cfs

Culvert - Culvert 3, Culvert Discharge - 19.2 cfs



Culvert Data Summary - Culvert 3

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

RIPRAP SIZE CHECK

DESCRIPTION

Evaluate the necessary riprap size for outlet protection to effectively manage the anticipated stormwater runoff for the 10-year storm event. For relatively horizontal discharge pipes, riprap placed in the bottom of the plunge pool and downchute should be sized according to maximum anticipated inflow velocities.

REFERENCES

1. Erosion and Sediment Pollution Control Program Manual, PADEP, March 2012.

CALCULATIONS

1. Obtain the outlet velocity and tailwater velocity from the channel/culvert hydraulic calculations.

2. Determine riprap size based on calculated maximum velocity and the allowable velocity as defined in Table 6.6 in *Reference 1* (shown below).

TABLE 6.6
Riprap Gradation, Filter Blanket Requirements, Maximum Velocities

Class, Size NO. / Rock Size (Inches)	R-8	R-7	R-6	R-5	R-4	R-3
	Percent Passing (Square Openings)					
42	100					
30		100				
24	15-50		100			
18		15-50		100		
15	0-15					
12		0-15	15-50		100	
9				15-50		
6			0-15		15-50	100
4				0-15		
3					0-15	15-50
2						0-15
Nominal Placement Thickness (inches)	63	45	36	27	18	9
Filter Stone[1]	AASHTO #1	AASHTO #1	AASHTO #1	AASHTO #3	AASHTO #3	AASHTO #57
V_{max} (ft/sec)	17.0	14.5	13.0	11.5	9.0	6.5

Adapted from PennDOT Pub. 408, Section 703.2(c), Table C

CONCLUSIONS

The following table summarizes the riprap size for each outlet protection method at the site. This table shows that the riprap size is sufficient for each outlet.

Outlet Protection – Riprap Size						
Source of Discharge	**Outlet Protection Method**	**Outlet Velocity (ft/s)**	**Tailwater Velocity (ft/s)**	**Riprap Size**	**V_{max} for chosen Riprap Size (ft/s)**	**Check Maximum Velocity < V_{max}**
Channel 1	Plunge Pool	4.64	N/A	R-3	6.5	Yes
Channel 2	Plunge Pool	0.82	N/A	R-3	6.5	Yes
Channel 3 / Channel 7	Riprap Apron	5.67	N/A	R-3	6.5	Yes
Channel 4	Plunge Pool	0.88	N/A	R-3	6.5	Yes
Channel 8	Riprap Apron	2.32	N/A	R-3	6.5	Yes
Div. Berm D1	Plunge Pool	0.74	N/A	R-3	6.5	Yes
Culvert 1	Plunge Pool	3.29	1.26	R-3	6.5	Yes
Culvert 2	Riprap Apron	7.79	3.43	R-4	9.0	Yes
Culvert 3	Plunge Pool	8.60	4.45	R-4	9.0	Yes

APPENDIX B

Drawings

DRAWINGS FOR EROSION AND SEDIMENT CONTROL PLAN

LOYALSOCK / SHAWNEE FRESHWATER SYSTEM

GAMBLE & PLUNKETTS CREEK TOWNSHIPS, LYCOMING COUNTY, PENNSYLVANIA

JANUARY 2020

LIST OF SHEETS

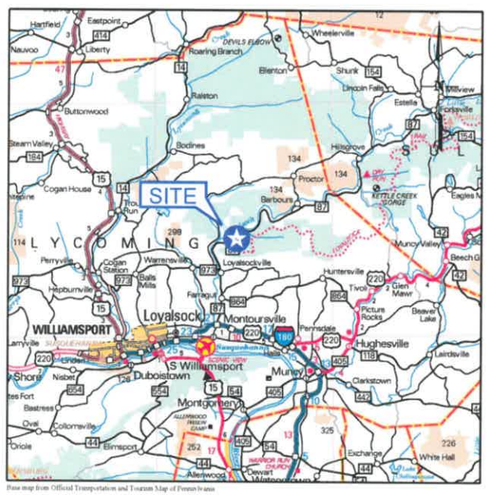
SHEET NO.	DESCRIPTION
1	COVER SHEET
2	TOTAL PROJECT AREA PLAN
3	SOILS AND GEOLOGIC HAZARDS PLAN
4	SITE PLAN AND CROSS-SECTIONS
5	PIPELINE AND ACCESS ROAD PROFILES
6	FRESHWATER INTAKE DETAILS
7	LOYALSOCK CREEK CROSSING DETAILS
8	E&S DETAILS (SHEET 1 OF 4)
9	E&S DETAILS (SHEET 2 OF 4)
10	E&S DETAILS (SHEET 3 OF 4)
11	E&S DETAILS (SHEET 4 OF 4)

DISTURBANCE SUMMARY

ESCGP-3 BOUNDARY / LIMIT OF DISTURBANCE	9.5 ACRES
GRAVEL PAD & ACCESS ROAD FOOTPRINT	0.54 ACRES

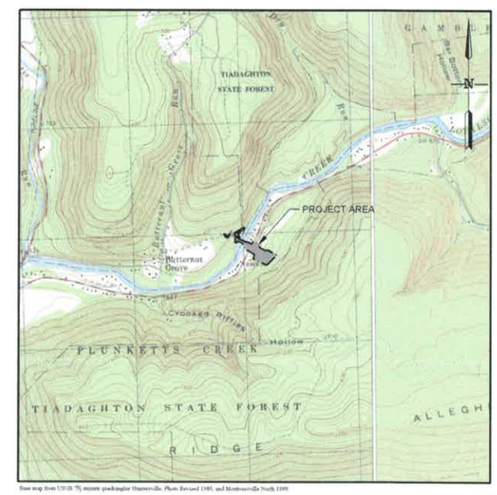
DRIVING DIRECTIONS

TRAVELING EASTBOUND ON I-180 FROM WILLIAMSPORT, PA.TAKE EXIT 21 AND TRAVEL ON PA-87N FOR 8.4 MILES. THE PROPOSED PUMP STATION SITE ENTRANCE WILL BE LOCATED ON RIGHT, & THE PROPOSED INTAKE SITE ENTRANCE WILL BE LOCATED ON THE LEFT.



VICINITY MAP

SCALE: 1" = 5 Miles



LOCATION MAP

SCALE: 1" = 2000'

PENNSYLVANIA ONE CALL SYSTEM

PA. ACT 287 OF 1974 AS AMENDED BY ACT 121 OF 2008
REQUIRES THREE WORKING DAYS NOTICE

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL DEAN RACE
ENGINEER
NO. PE083105

This Drawing shall not be used for tender or construction unless sealed.

I do hereby certify to the best of my knowledge, information, and belief, that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 78a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

PREPARED FOR:

PENNSYLVANIA GENERAL ENERGY

PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.
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HEADQUARTERS:

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ARM Group LLC
Engineers and Scientists
www.armgroup.net

No.	Revision	Date	By

designed ALG
drawn MDR
checked JAW
scale AS NOTED
date 01/17/2020
project no. 190736

drawing title: COVER SHEET
EROSION AND SEDIMENT CONTROL PLAN

project title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

Sheet 1

NOTES:

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LEGEND

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- EXISTING WETLANDS
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- EXISTING STRUCTURE
- EXISTING PROPERTY LINE
- EXISTING PROPERTY LINE (SURVEYED)
- OE — EXISTING OVERHEAD ELECTRIC LINE
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- WeB — EXISTING SOIL BOUNDARY AND DESCRIPTOR
- PROPOSED STRUCTURE

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL DEAN RACE
ENGINEER
NO. PE063105

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MICHAEL DEAN RACE, PE - 063105

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No.	Revision	Date	By

scale	1" = 200'
date	01/17/2020
project no.	190736
drawn	ALG
checked	MDR
approved	JAW

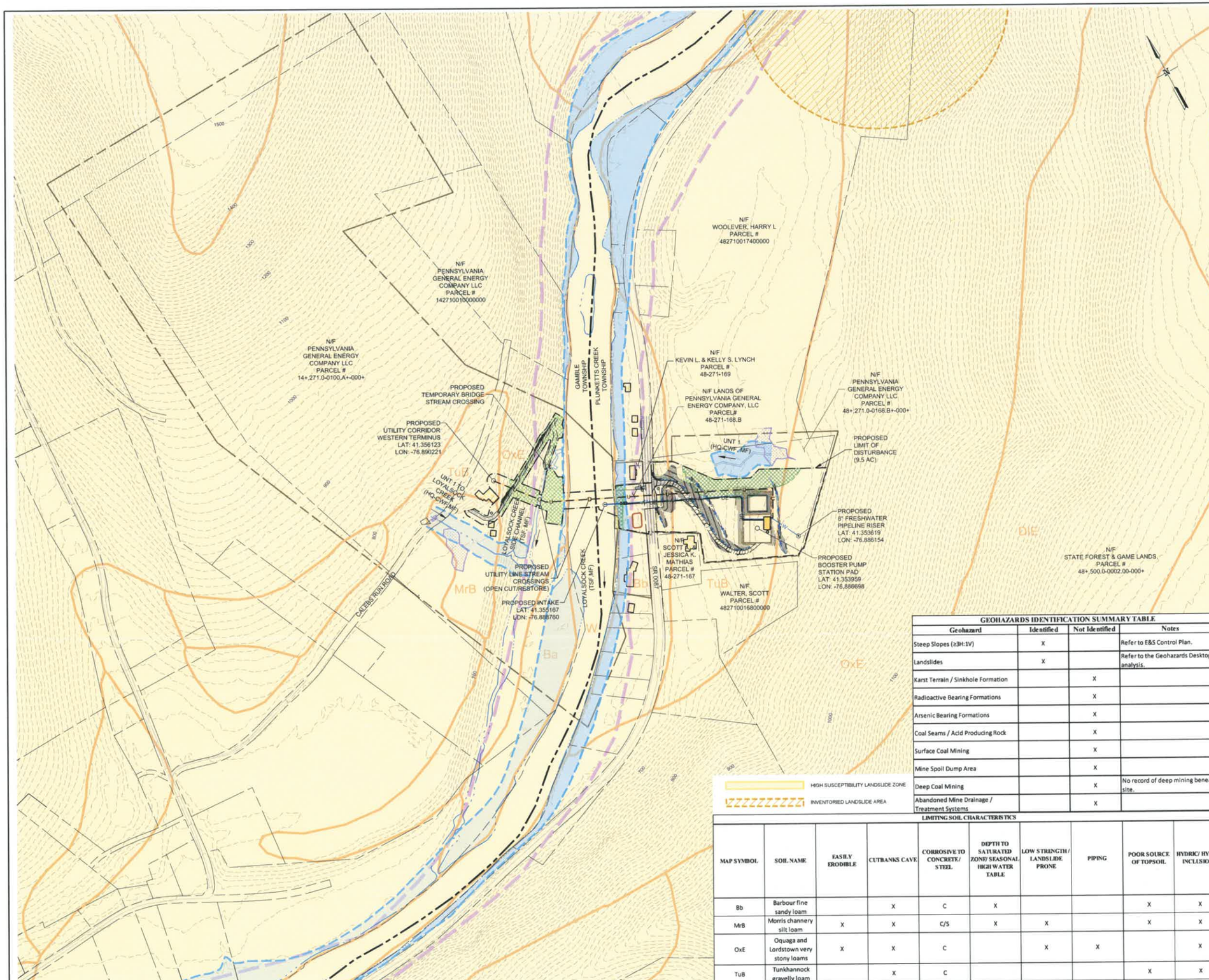
SCALE IN FEET: 0 200 400 600

Drawing title: TOTAL PROJECT AREA PLAN
EROSION AND SEDIMENT CONTROL PLAN

GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

Project title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

Sheet 2



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GEOHAZARDS IDENTIFICATION SUMMARY TABLE

Geohazard	Identified	Not Identified	Notes
Steep Slopes (≥3H:1V)	X		Refer to E&S Control Plan.
Landslides	X		Refer to the Geohazards Desktop analysis.
Karst Terrain / Sinkhole Formation		X	
Radioactive Bearing Formations		X	
Arsenic Bearing Formations		X	
Coal Seams / Acid Producing Rock		X	
Surface Coal Mining		X	
Mine Spoil Dump Area		X	
Deep Coal Mining		X	No record of deep mining beneath site.
Abandoned Mine Drainage / Treatment Systems		X	

LIMITING SOIL CHARACTERISTICS

MAP SYMBOL	SOIL NAME	EASILY ERODIBLE	CUTBANKS CAVE	CORROSIVE TO CONCRETE/ STEEL	DEPTH TO SATURATED ZONE/ SEASONAL HIGH WATER TABLE	LOW STRENGTH / LANDSLIDE PRONE	PIPING	POOR SOURCE OF TOPSOIL	HYDRIC/ HYDRIC INCLUSIONS
Bb	Barbour fine sandy loam		X	C	X			X	X
MrB	Morris channery silt loam	X	X	C/S	X	X		X	X
OxE	Oquaga and Lordstown very stony loams	X	X	C		X	X		X
TuB	Tunkhannock gravelly loam		X	C				X	X
W	Water	-	-	-	-	-	-	-	-

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No.	Revision	Date	By

ALG	scale 1" = 200'	
MDR	date 01/17/2020	
JAW	project no. 190736	

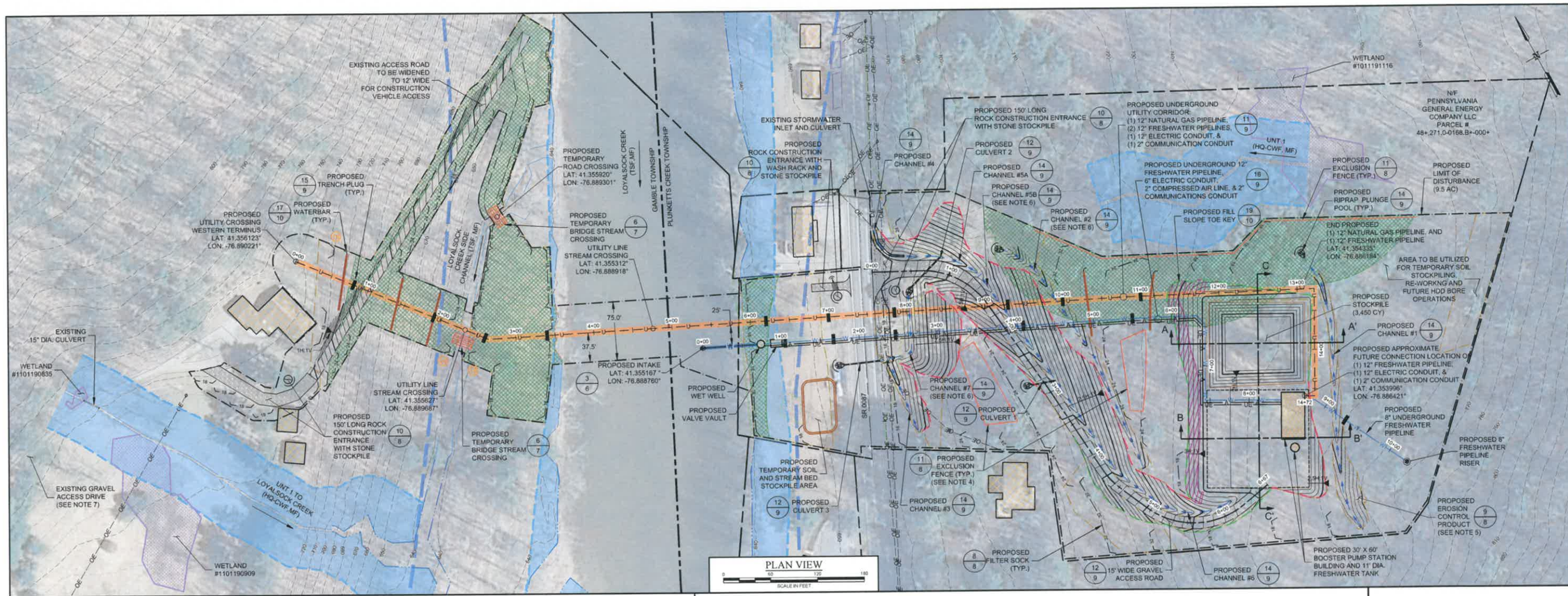
SCALE IN FEET 0 100 200 400 600

drawing title
SOILS AND GEOLOGIC HAZARDS PLAN
EROSION AND SEDIMENT CONTROL PLAN

project title
LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

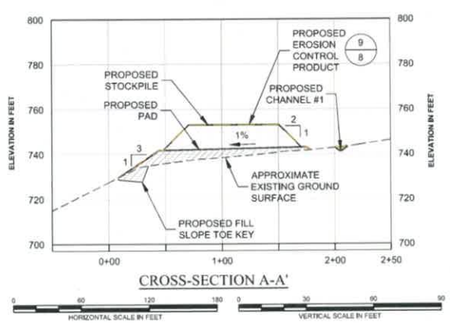
GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

Sheet 3

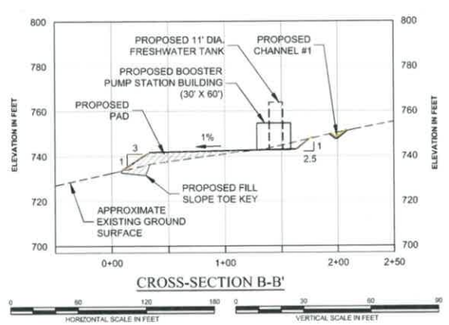


VOLUME REPORT[1]	
BOOSTER PUMP STATION PAD	
TOPSOIL - STOCKPILE (CY) [2]	1,118
SUBSOIL CUT (CY) [3]	292
TOTAL AVAILABLE STRUCTURAL FILL (CY) [4]	263
REQUIRED STRUCTURAL FILL (CY) [5]	5,190
NET AVAILABLE FILL (CY) [6]	(4,927)
ACCESS ROAD	
TOPSOIL - STOCKPILE (CY) [2]	980
SUBSOIL CUT (CY) [3]	5,389
TOTAL AVAILABLE STRUCTURAL FILL (CY) [4]	4,850
REQUIRED STRUCTURAL FILL (CY) [5]	162
NET AVAILABLE FILL (CY) [6]	4,688
SR 0087 BANK REMOVAL	
TOPSOIL - STOCKPILE (CY) [2]	276
SUBSOIL CUT (CY) [3]	1,207
TOTAL AVAILABLE STRUCTURAL FILL (CY) [4]	1,086
REQUIRED STRUCTURAL FILL (CY) [5]	51
NET AVAILABLE FILL (CY) [6]	1,035
TOTAL TOPSOIL - STOCKPILE (CY)	**2,373**
TOTAL EXCESS MATERIAL (CY)	**796**

1. VOLUMES ARE BASED ON APPROXIMATE EXISTING GROUND SURFACE. EXISTING GROUND SURFACES ARE BASED ON LIDAR AND SHALL BE FIELD VERIFIED TO CONFIRM EXISTING CONDITIONS
2. TOP SOIL VOLUME IS BASED ON IN-PLACE CUBIC YARDS; NO SWELL FACTOR APPLIED.
3. SUBSOIL VOLUME IS BASED ON IN-PLACE CUBIC YARDS; NO SWELL FACTOR APPLIED.
4. TOTAL AVAILABLE STRUCTURAL FILL AFTER APPLYING A 10 PERCENT SHRINKAGE FACTOR TO SUBSOIL CUT TO ACCOUNT FOR COMPACTED DENSITY.
5. REQUIRED STRUCTURAL FILL VOLUME BASED ON IN-PLACE (I.E. COMPACTED) CUBIC YARDS.
6. NET AVAILABLE FILL AFTER SUBTRACTING REQUIRED STRUCTURAL FILL FROM TOTAL AVAILABLE STRUCTURAL FILL.



CROSS-SECTION A-A'



CROSS-SECTION B-B'

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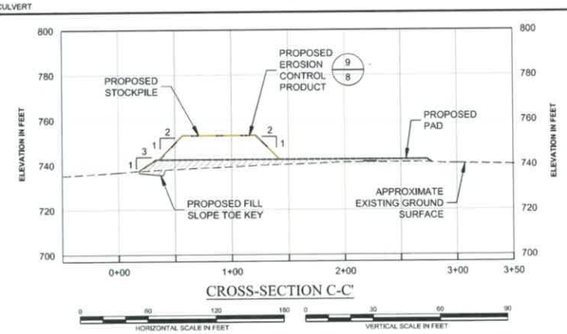

CROSS-SECTION C-C'

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No.	Revision	Date	By

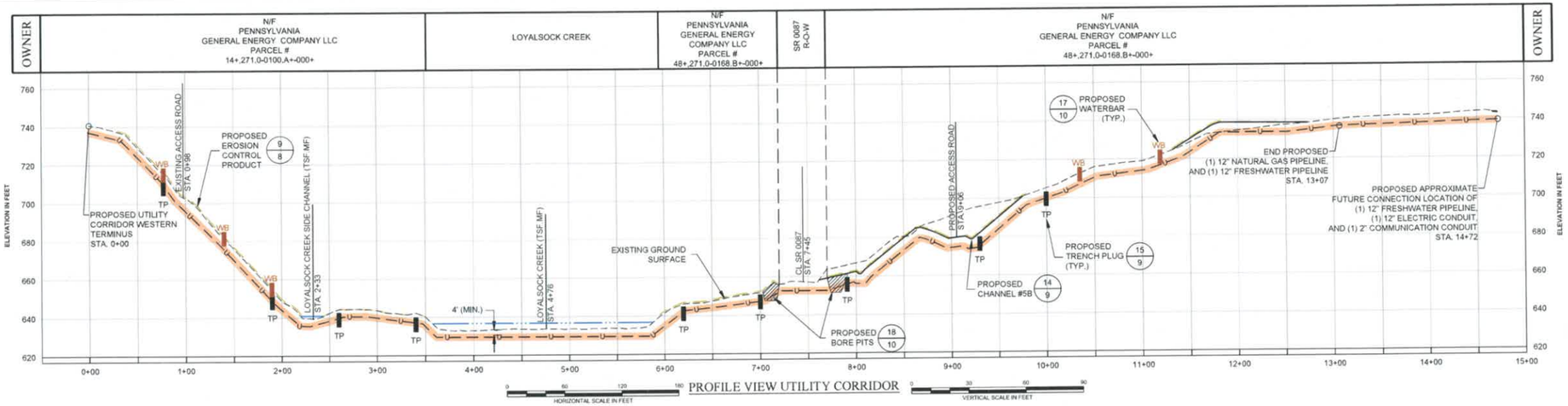
scale	AS NOTED
date	01/17/2020
project no.	190736
designed	ALG
drawn	MDR
checked	JAW

Drawing title: SITE PLAN AND CROSS-SECTIONS EROSION AND SEDIMENT CONTROL PLAN

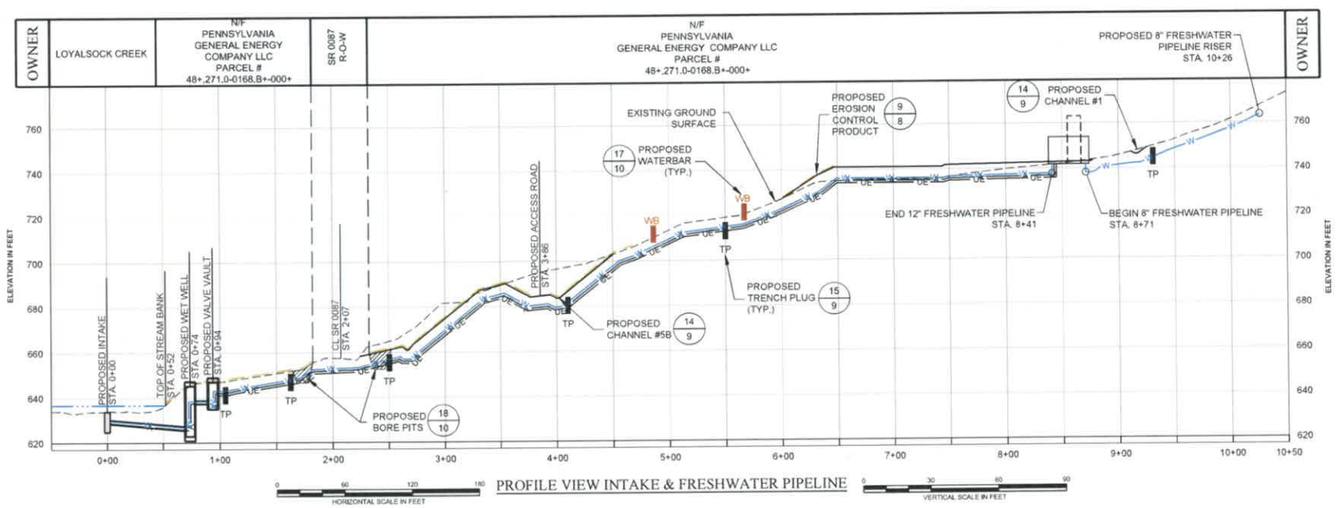
Project title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

GAMBLE & PLUNKETTS CREEK TOWNSHIPS LYCOMING COUNTY, PENNSYLVANIA

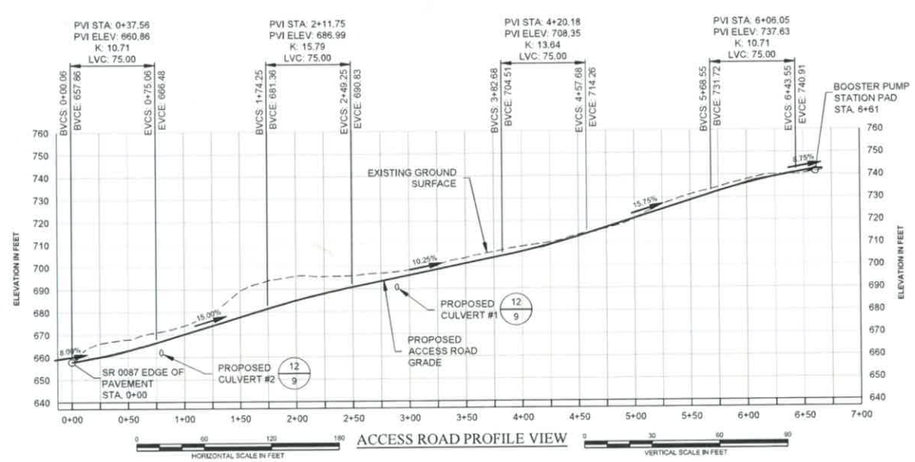
Sheet 4



PROFILE VIEW UTILITY CORRIDOR



PROFILE VIEW INTAKE & FRESHWATER PIPELINE



ACCESS ROAD PROFILE VIEW

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COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER MICHAEL DEAN RACE NO. PE083105

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I do hereby certify to the best of my knowledge, information, and belief, that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 79a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

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No.	Revision	Date	By

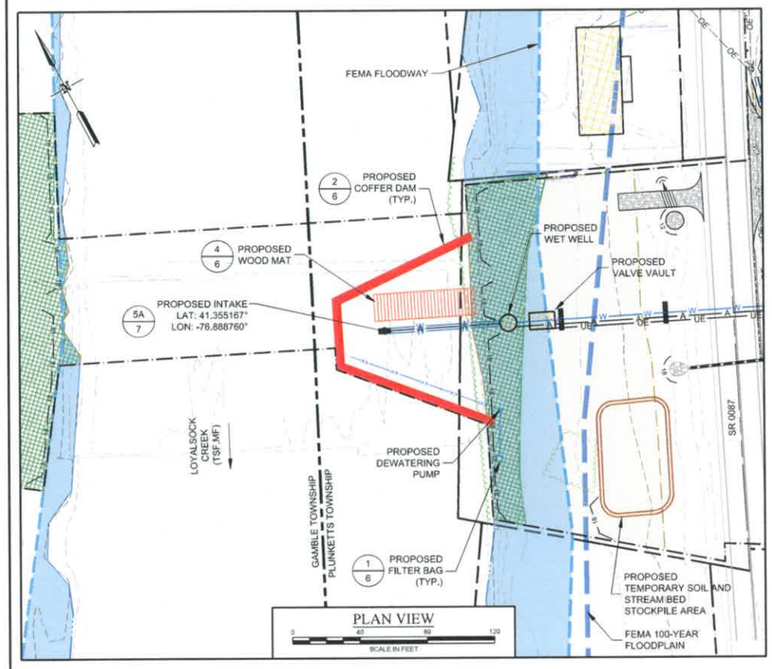
scale	AS NOTED
date	01/07/2020
project no.	190736
designed	ALG
drawn	MDR
checked	JAW

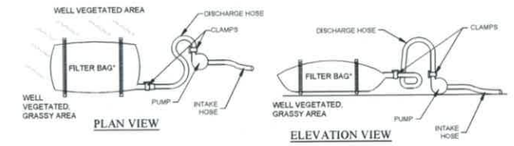
drawing title: PIPELINE AND ACCESS ROAD PROFILES EROSION AND SEDIMENT CONTROL PLAN

project title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, LLC

GAMBLE & PLUNKETTS CREEK TOWNSHIPS LYCOMING COUNTY, PENNSYLVANIA

Sheet 5

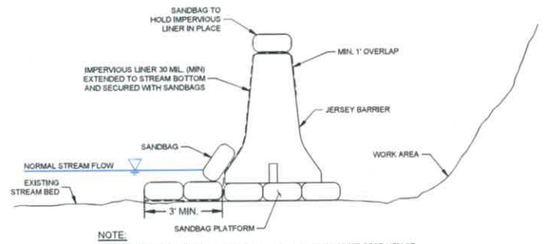




NOTES:

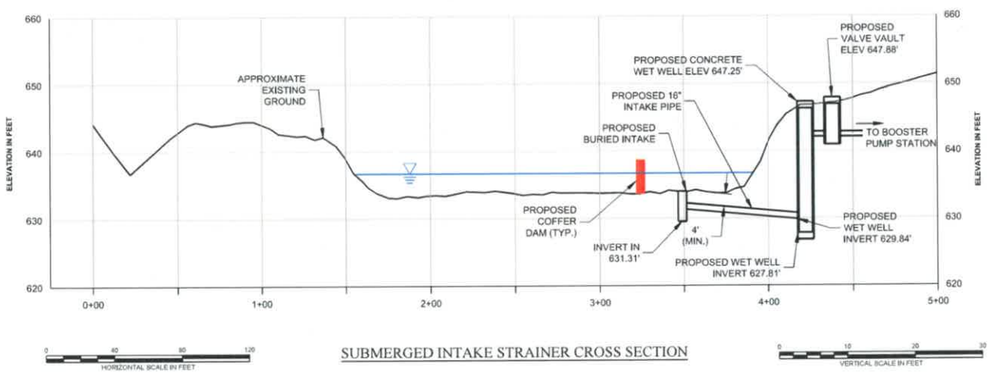
1. FILTER BAGS SHALL BE MADE FROM NON-WOVEN GEOTEXTILE MATERIAL SEWN WITH HIGH STRENGTH, DOUBLE STITCHED "J" TYPE SEAMS. THEY SHALL BE CAPABLE OF TRAPPING PARTICLES LARGER THAN 150 MICRONS.
2. A SUITABLE MEANS OF ACCESSING THE BAG WITH MACHINERY REQUIRED FOR DISPOSAL PURPOSES MUST BE PROVIDED. FILTER BAGS SHALL BE REPLACED WHEN THEY BECOME ½ FULL. SPARE BAGS SHALL BE KEPT AVAILABLE FOR REPLACEMENT OF THOSE THAT HAVE FAILED OR ARE FILLED.
3. BAGS SHALL BE LOCATED IN WELL-VEGETATED (GRASSY) AREAS, AND DISCHARGE ONTO STABLE, EROSION RESISTANT AREAS. WHERE THIS IS NOT POSSIBLE, A GEOTEXTILE FLOW PATH SHALL BE PROVIDED. BAGS SHALL NOT BE PLACED ON SLOPES GREATER THAN 5%.
4. THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED.
5. THE PUMPING RATE SHALL BE NO GREATER THAN 750 GPM OR ¼ THE MAXIMUM SPECIFIED BY THE MANUFACTURER, WHICHEVER IS LESS. PUMP INTAKES SHOULD BE FLOATING AND SCREENED.
6. FILTER BAGS SHALL BE INSPECTED DAILY. IF ANY PROBLEM IS DETECTED, PUMPING SHALL CEASE IMMEDIATELY AND NOT RESUME UNTIL THE PROBLEM IS CORRECTED.

1 STANDARD CONSTRUCTION DETAIL #3-16
TYPICAL PUMPED WATER FILTER BAG
NOT TO SCALE

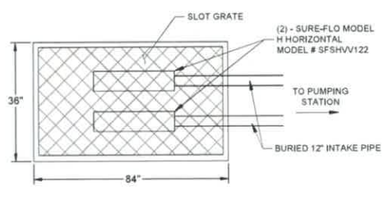


NOTE:
SAND BAGS BENEATH PLASTIC CAN BE SUBSTITUTED FOR CONCRETE DEAD MEN OR BARRIERS. CLEAR STREAM BED OF SIGNIFICANT ROCKS. PLACE LAYER OF SAND BAGS AS A FOUNDATION LAYER AND PLACE CONCRETE DEAD MEN OR BARRIERS ON TOP. DRAPE PLASTIC OVER CONCRETE AND ANCHOR.

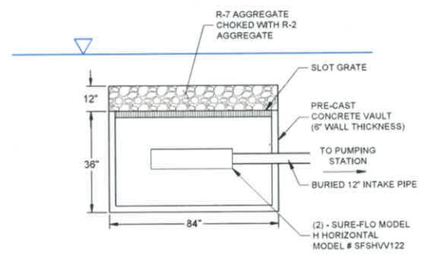
2 DETAIL
TEMPORARY COFFER DAM DETAIL
NOT TO SCALE



SUBMERGED INTAKE STRAINER CROSS SECTION



CONCRETE VAULT PLAN VIEW
NOT TO SCALE



CONCRETE VAULT SECTION VIEW
NOT TO SCALE

3 DETAIL
BURIED INTAKE STRAINER
NOT TO SCALE

UTILITY STREAM CROSSING NOTES

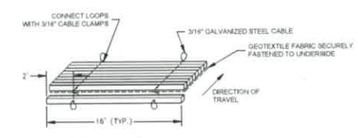
1. ALL UTILITY LINES UNDER STREAMBEDS SHALL BE LOCATED SUCH THAT THERE WILL BE A MINIMUM OF FOUR (4) FEET OF COVER BETWEEN THE TOP OF THE UTILITY LINE OR ENCASEMENT AND THE LOWEST POINT IN THE NATURAL CONTOUR OF THE STREAMBED, UNLESS THE UTILITY LINE IS IN ROCK, WHERE A MINIMUM COVER OF ONE (1) FOOT SHALL BE PROVIDED.
2. TRENCHES EXCAVATED FOR THE INSTALLATION OF UTILITY LINES SHALL BE THE MINIMUM WIDTH NECESSARY. AS SOON AS THE UTILITY LINE IS INTALLED AND TESTED TO ASCERTAIN NO LEAKAGE, APPROPRIATE NEW OR PREVIOUSLY EXCAVATED BACKFILL MATERIAL SHALL BE PLACED IN THE TRENCH AND THE AREA RESTORED TO ITS ORIGINAL CONDITION AND ELEVATION AND STABILIZED. BACKFILL MATERIAL STORED IN CONNECTION WITH THE INSTALLATION MUST BE PROPERLY RETAINED OUT OF THE FLOODWAY SO AS TO PREVENT ITS DISCHARGE, WASHINGS, OR RUNOFF FROM ENTERING THE WATERWAY PRIOR TO ITS PLACEMNET AS BACKFILL.
3. ADEQUATE MEASURES SHALL BE USED TO PREVENT SEDIMENTATION FROM THE TRENCH FROM ENTERING THE STREAM.
4. THE BACKFILLING OF THE TRENCH IN WHICH THE PIPE WILL BE LAID SHALL BE DONE SO AS TO ELIMINATE THE FORMATION OF A PERMANENT RIDGE IN THE STREAMBED.
5. ARCHEAOLOGICAL ARTIFACTS DISCOVERED DURING THE PERFORMANCE OF WORK AUTHORIZED UNDER THIS GENERAL PERMIT MUST BE ADEQUATELY PROTECTED AND THEIR DISCOVERY PROMPTLY REPORTED TO THE BUREAU OF HISTORIC PRESERVATION, HISTORICAL AND MUSEUM COMMISSION, 400 NORTH STREET, SECOND FLOOR, HARRISBURG, PA 17120-0093, TELEPHONE (717) 783-8946.
6. WHENEVER POSSIBLE, IN ACCORDANCE WITH BEST CONSTRUCTION METHODS, UTILITY LINE CORSSINGS ARE TO BE MADE "IN THE DRY" BY INSTALLING SANDBAG AND PLASTIC DAMS AND PIPING STREAM FLOW THROUGH THE AFFECTED AREA.
7. PRIOR TO THE USE OF EXPLOSIVES IN A WATERCOURSE OR BODY OF WATER THE PERMITTEE SHALL SECURE A WRITTEN PERMIT FROM THE FISH AND BOAT COMMISSION. UNDER THE PENNSYLVANIA FISH AND BOAT CODE 30 Pa. C.S. §2906 (RELATING TO PERMITS FOR USE OF EXPLOSIVES). REQUESTS SHOULD BE DIRECTED TO THE FISH AND BOAT COMMISSION, DIVISION OF ENVIRONMENTAL SERVICES (SEE "EXHIBIT A").

GENERAL PIPELINE AND UTILITY LINE NOTES

1. TRENCHES EXCAVATED FOR THE INSTALLATION OF UTILITY LINES SHALL BE THE MINIMUM WIDTH NECESSARY. AS SOON AS THE UTILITY LINE IS INSTALLED AND TESTED TO ASCERTAIN NO LEAKAGE, APPROPRIATE NEW OR PREVIOUSLY EXCAVATED BACKFILL MATERIAL SHALL BE PLACED IN THE TRENCH AND THE AREA RESTORED TO ITS ORIGINAL CONDITION AND ELEVATION AND STABILIZED. BACKFILL MATERIAL STORED IN CONNECTION WITH THE INSTALLATION MUST BE PROPERLY RETAINED OUT OF THE FLOODWAY SO AS TO PREVENT ITS DISCHARGE, WASHINGS, OR RUNOFF FROM ENTERING THE WATERWAY PRIOR TO ITS PLACEMENT AS BACKFILL.
2. SOIL SUPPLEMENTS, SEED AND MULCH SHOULD BE APPLIED WITHIN FOUR DAYS OR IMMEDIATELY AFTER THE PIPELINE/UTILITY LINE IS INSTALLED. NOTE: TEMPORARY STABILIZATION IS REQUIRED WITHIN FOUR DAYS IF THERE IS TEMPORARY CESSATION OF AN EARTH DISTURBANCE ACTIVITY. MEANWHILE, PERMANENT STABILIZATION IS REQUIRED IMMEDIATELY UPON FINAL COMPLETION OF AN EARTH DISTURBANCE ACTIVITY OR ANY STAGE OR PHASE OF AN ACTIVITY.
3. LIMIT CLEARING AND GRUBBING TO CUTTING EXISTING VEGETATION RATHER THAN BULLDOZING THE VEGETATION. LIMIT TRENCH WIDTH TO WHAT IS NECESSARY TO INSTALL THE PIPE.
4. LIMIT DAILY TRENCH EXCAVATION TO THE LENGTH OF PIPE TO BE INSTALLED EACH DAY.
5. THE TRENCH IS TO BE BACKFILLED THE SAME DAY THE TRENCH IS DUG AND PIPE IS LAID.
6. FOR STEEL PIPELINES WITH WELDED JOINTS, THE LENGTH OF TIME REQUIRED FOR OPEN TRENCH OPERATIONS AT ANY STATION ALONG THE RIGHT-OF-WAY SHOULD NOT EXCEED 30 CALENDAR DAYS PER THE REQUIREMENTS ON PAGE 283 OF THE PADEP EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL, MARCH 2012.

EROSION AND SEDIMENT CONTROL FOR IN-CHANNEL WORK

1. WHENEVER POSSIBLE, WORK SHOULD BE SCHEDULED FOR LOW FLOW SEASONS. NORMAL FLOW SHOULD BE CONVEYED PAST THE WORK AREA BY MEANS OF A BYPASS CHANNEL, PIPE, PUMP, OR COFFERDAM. ALL SUCH BYPASSES SHOULD BE COMPLETED AND STABILIZED PRIOR TO DIVERTING FLOW.
2. ANY IN-CHANNEL EXCAVATIONS SHOULD BE DONE FROM THE TOP OF BANKS WHEREVER POSSIBLE. WHERE THIS IS NOT POSSIBLE, A TEMPORARY STREAM ACCESS SHOULD BE PROVIDED FOR ANY EQUIPMENT WORKING FROM WITHIN THE CHANNEL. UPON COMPLETION, ALL CHANNEL ENTRANCES SHOULD BE RESTORED TO PRE-CONSTRUCTION CONFIGURATIONS, AS MUCH AS POSSIBLE, AND STABILIZED.
3. ALL EXCAVATED CHANNEL MATERIALS THAT WILL BE SUBSEQUENTLY USED AS BACKFILL SHOULD BE PLACED IN A TEMPORARY STOCKPILE LOCATED OUTSIDE THE CHANNEL. A SEDIMENT BARRIER SHOULD BE INSTALLED BETWEEN THE STORAGE PILE AND THE STREAM CHANNEL.
4. ALL EXCAVATED MATERIALS THAT WILL NOT BE USED ON SITE MUST BE IMMEDIATELY REMOVED TO A DISPOSAL SITE HAVING AN APPROVED EROSION AND SEDIMENT POLLUTION CONTROL PLAN.
5. ANY PUMPED WATER FROM EXCAVATED AREAS MUST BE FILTERED PRIOR TO DISCHARGING INTO WATERS OF THE COMMONWEALTH. THE USE OF FILTER BAGS IS ANOTHER ACCEPTABLE METHOD IF LOCATED ON A RELATIVELY FLAT (<5% SLOPE), WELL-VEGETATED AREA. THE BAG SHOULD BE DESIGNED TO TRAP PARTICLES LARGER THAN 150 MICRONS. THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED. WHEN THE BAG HAS BEEN FILLED TO 1/2 ITS TOTAL CAPACITY, IT SHOULD BE REPLACED WITH A NEW BAG AND PROPERLY DISPOSED. WHEREVER WELL-VEGETATED AREAS ARE NOT AVAILABLE, A GEOTEXTILE UNDERLAYMENT SHOULD BE USED. CONSIDERATION SHOULD BE GIVEN TO HOW THE BAG WILL BE ACCESSED AND REMOVED ONCE IT HAS BEEN 1/2 FILLED WITH SEDIMENT.
6. ALL DISTURBED AREAS WITHIN THE EXISTING CHANNEL SHOULD BE COMPLETED AND STABILIZED BEFORE FLOW IS REDIRECTED TO IT. SUITABLE PROTECTION SHOULD BE PROVIDED FOR THE STREAM CHANNEL FROM ANY DISTURBED AREAS THAT HAVE NOT YET ACHIEVED STABILIZATION.
7. EXISTING STREAM BED MATERIALS WITHIN DISTURBED STREAM BED SHALL BE STOCKPILED AND PLACED BACK TO ORIGINAL CONDITIONS.
8. STREAM EMBANKMENTS SHALL BE LINED WITH EROSION CONTROL MATTING NAG BIONET S150BN OR EQUIVALENT AS SHOWN.
9. RIPARIAN RE-VEGETATION SHALL BE PLACED 50' FROM TOP OF STREAM BANK.



NOTES:

1. IF TEMPORARY TRENCH DEWATERING IS NECESSARY, ALL PUMPED WATER MUST PASS THROUGH A FILTER BAG. THE FILTER BAG MUST BE SURROUNDED BY A FILTER SOCK AND PUMPED WATER SHOULD NOT DRAIN AWAY FROM THE WETLAND.
2. WOOD MAT WIDTH MAY BE INCREASED IF WIDER EQUIPMENT IS USED.

4 DETAIL
TYPICAL WOOD MAT FOR IN-STREAM WORK
NOT TO SCALE

NOTES:

1. THE BASE MAP HAS BEEN CREATED USING AVAILABLE AERIAL PHOTOGRAPHY PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN. EXISTING TOPOGRAPHY HAS BEEN CREATED USING LIDAR CONTOURS PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN AND TOPOGRAPHIC SURVEY BY HAWBAKER ENGINEERING, NOVEMBER 2019.
2. PROPERTY LINES AND OWNER INFORMATION ARE TAKEN FROM LYCOMING COUNTY TAX ASSESSMENT MAPS AND RECORDS. SURVEYED PROPERTY LINES PROVIDED BY HAWBAKER ENGINEERING, NOVEMBER 2019.
3. THIS PLAN IS IN THE PENNSYLVANIA STATE PLANE NORTH, NORTH AMERICAN DATUM 1983 (NAD 83) COORDINATE SYSTEM.
4. EVERY EFFORT MUST BE TAKEN TO AVOID EARTH DISTURBANCE AND EQUIPMENT TRACKING WITHIN THE PROPOSED INFILTRATION BERM AREAS, AND THE PROPOSED PONDING AREAS IMMEDIATELY UPGRADIENT OF THE INFILTRATION BERMS. THIS INSTALLATION MUST BE ACCOMPLISHED WITH CARE. EXCLUSION FENCE SHALL BE PLACED AROUND THESE AREAS PRIOR TO THE START OF EARTHWORK.
5. PROPOSED EROSION CONTROL PRODUCT OR EQUIVALENT SHALL BE PLACED ON ALL DISTURBED SLOPES >3H:1V AND WITHIN 100' OF STREAMS AND WETLAND CROSSINGS.
6. CHANNEL MUST BE RESTORED TO PREVIOUS CONDITIONS WITHIN 24 HOURS OF PIPELINE INSTALLATION.
7. PGE INTENDS TO MAKE GRAVEL SURFACE IMPROVEMENTS TO THE EXISTING GRAVEL ACCESS DRIVE IN ACCORDANCE WITH A SEPARATE ROAD MAINTENANCE PLAN. THE LIMITS OF THE EXISTING ROADWAY WILL NOT BE EXPANDED OR WIDENED.

LEGEND

NOTE: LEGEND IS TYPICAL, NOT ALL OBJECTS IN LEGEND APPEAR IN PLAN.

- 1550 — EXISTING CONTOURS
- EXISTING WETLANDS
- EXISTING RIPARIAN FOREST BUFFER
- EXISTING STRUCTURE
- EXISTING PROPERTY LINE
- EXISTING PROPERTY LINE (SURVEYED)
- OE — EXISTING OVERHEAD ELECTRIC LINE
- UE — EXISTING UNDERGROUND ELECTRIC LINE
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- EXISTING TREELINE
- EXISTING MAPPED WATERCOURSE
- EXISTING FIELD VERIFIED STREAM
- EXISTING FLOODWAY
- EXISTING FEMA 100YR FLOODPLAIN
- EXISTING FENCE
- EXISTING CULVERT
- 1490 — PROPOSED CONTOURS
- PROPOSED GRAVEL ROAD AND PAD SURFACE
- W — PROPOSED UNDERGROUND FRESHWATER PIPELINE
- U — PROPOSED UNDERGROUND UTILITY CORRIDOR
- UE — PROPOSED UNDERGROUND ELECTRIC
- A — PROPOSED UNDERGROUND AIR LINE
- 18 — PROPOSED 18" FILTER SOCK
- 24 — PROPOSED 24" FILTER SOCK
- 32 — PROPOSED 32" FILTER SOCK
- 18 24 — PROPOSED FILTER SOCK SIZE DESCRIPTOR (INCH)
- PROPOSED WATERBAR
- PROPOSED TRENCH PLUG
- PROPOSED EROSION CONTROL PRODUCT
- PROPOSED STOCKPILE BOUNDARY
- PROPOSED CHANNEL
- PROPOSED FILL SLOPE TOE KEY
- PROPOSED EXCLUSION FENCE (CONSTRUCTION FENCE)
- PROPOSED ESCGP-3 PERMIT BOUNDARY / LIMIT OF DISTURBANCE
- PROPOSED 150' LONG ROCK CONSTRUCTION ENTRANCE
- PROPOSED ROCK CONSTRUCTION ENTRANCE WITH WASH RACK
- PROPOSED CULVERT WITH PLUNGE POOL
- 2H:1V — PROPOSED SLOPE
- WeB — EXISTING SOIL BOUNDARY AND DESCRIPTOR
- PROPOSED STRUCTURE

COMMONWEALTH OF PENNSYLVANIA
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No.	Revision	Date	By

scale: AS NOTED
date: 01/17/2020
project no: 190736
designed: ALG
checked: MDR
drawn: JAW
graphic scale:

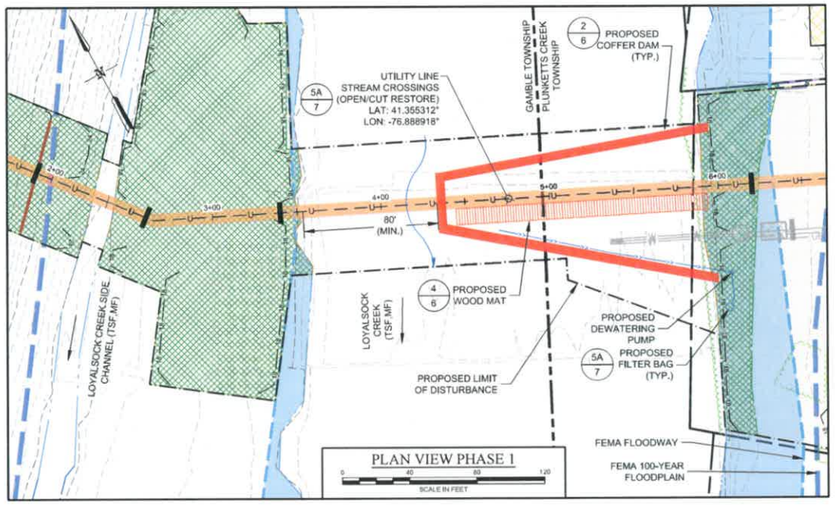
FRESHWATER INTAKE DETAILS
EROSION AND SEDIMENT CONTROL PLAN

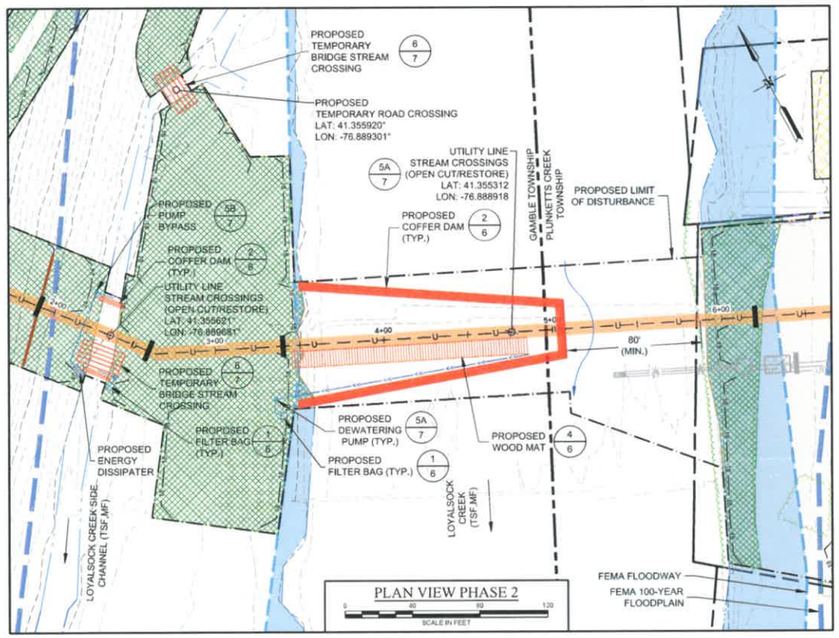
GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

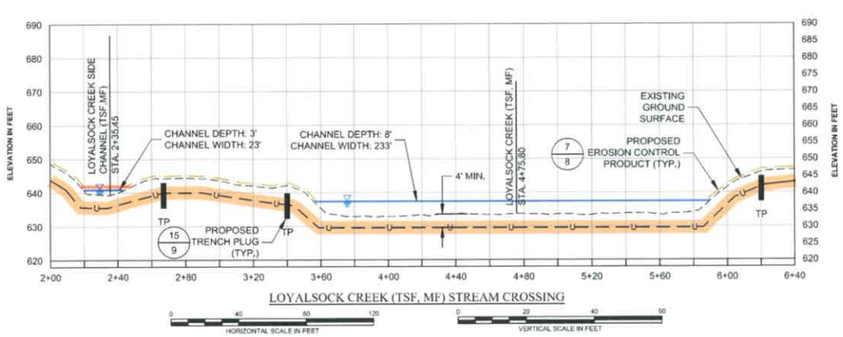
project title: LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

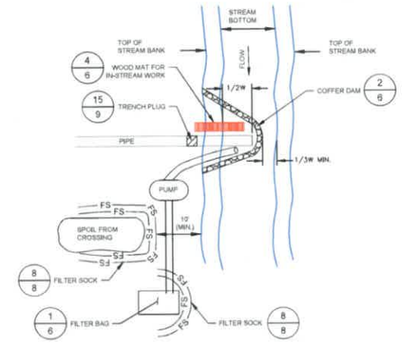
drawing title:

Sheet 6





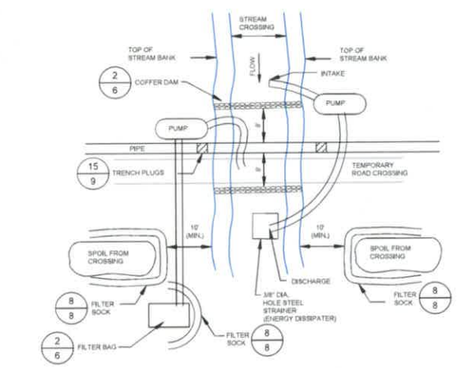




NOTES:

1. WORK REQUIRING STREAM DIVERSION SHALL BE CONDUCTED DURING LOW-FLOW, DRY WEATHER CONDITIONS TO THE EXTENT PRACTICAL.
2. DEWATERING WILL REQUIRE THE USE OF AN APPROVED FILTER BAG, AS SHOWN IN THE DETAILS. TO BE INCORPORATED WITH ALL DEWATERING AND DISCHARGE OPERATIONS.
4. WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO AN APPROVED SEDIMENT BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY RECEIVING WATER SURFACE WATER.
5. ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA.
6. ALL DISTURBED AREAS WITHIN 50 FEET OF TOP-OF-BANK SHALL BE BLANKETED OR MATTED WITHIN 72 HOURS OF INITIAL DISTURBANCE UNLESS OTHERWISE AUTHORIZED. APPROPRIATE STREAMBANK PROTECTION SHALL BE PROVIDED WITHIN THE CHANNEL.

5A STANDARD CONSTRUCTION DETAIL #13-3
TWO-PHASED UTILITY LINE STREAM CROSSING WITH COFFER DAM
NOT TO SCALE



NOTES:

1. WORK REQUIRING STREAM DIVERSION SHALL BE CONDUCTED DURING LOW-FLOW, DRY WEATHER CONDITIONS TO THE EXTENT PRACTICAL. IF THIS CHANNEL IS DRY DURING CONSTRUCTION, THE PUMP BYPASS SYSTEM WILL NOT BE USED AND THE STREAM BED WILL BE RESTORED IMMEDIATELY AFTER PIPELINE INSTALLATION.
2. PUMPED BYPASS SHALL BE CAPABLE OF HANDLING THE CAPACITY OF THE FLOW TO BE BYPASSED.
3. PUMPED BYPASS WILL REQUIRE THE USE OF AN APPROVED FILTER BAG, AS SHOWN IN THE DETAILS. TO BE INCORPORATED WITH ALL DEWATERING AND DISCHARGE OPERATIONS.
4. WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO AN APPROVED SEDIMENT BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY RECEIVING WATER SURFACE WATER.
5. ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA.
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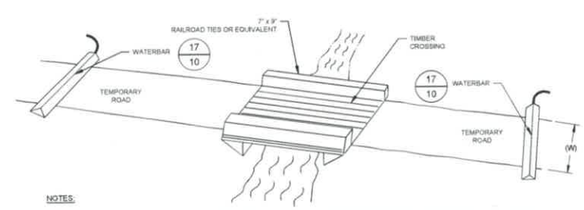
5B STANDARD CONSTRUCTION DETAIL #13-2
UTILITY LINE STREAM CROSSING WITH PUMP BYPASS
NOT TO SCALE



NOTES:

1. WIDTH (W) OF TEMPORARY ROAD AND TIMBER CROSSING TO BE THE SAME.
2. WIDTH (W) TO BE DETERMINED BY EQUIPMENT USED FOR CONSTRUCTION.
3. SURFACE FLOW DIVERTED BY WATERBAR TO SEDIMENT REMOVAL FACILITIES/BMPS.
4. TEMPORARY WATERBARS ARE REQUIRED AT ALL STREAM, RIVER, AND OTHER WATERBODY CROSSINGS.
5. PERMANENT WATERBARS SHALL NOT REMAIN IN PLACE WITHIN FLOODWAY (50 FEET FROM STREAM BANK).

6 DETAIL
TYPICAL TEMPORARY BRIDGE STREAM CROSSING
NOT TO SCALE

STREAM WORK CONSTRUCTION SEQUENCE

TWO PHASE CROSSING

1. INSTALL TEMPORARY EROSION & SEDIMENT CONTROL DEVICES.
2. CLEAR AND GRUB EASEMENT AREA FOR PIPELINE CONSTRUCTION. INSTALL FILTER SOCK TOE PROTECTION.
3. PREPARE FOR TEMPORARY PHASE 1 COFFER DAM FOUNDATION BY REMOVING STREAM BED MATERIAL. STORE MATERIAL FOR REPLACEMENT.
4. PLACE PLASTIC AND SAND BAGS AS COFFER DAM FOUNDATION.
5. CHECK COFFER DAM FOR LEAKS AND FIX IMMEDIATELY. IF INSIGNIFICANT LEAKS PERSIST DOWNSTREAM OF COFFER DAM AND/OR IN EXCAVATION TRENCH, PROVIDE SUMP/TRASH PUMP TO REMOVE WATER. PUMP WATER INTO FILTER BAG.
6. PREPARE STREAM BED FOR TRENCH EXCAVATION BY REMOVING STREAM BEDDING FOR LATER PLACEMENT. EXCAVATE TRENCH FOR PIPELINE IN THE DRY.
7. INSTALL PIPELINE.
8. STABILIZE STREAM BANKS BY SEEDING AND PLACING MATTING (50' MINIMUM FROM TOP OF BANK).
9. REMOVE TEMPORARY PHASE 1 COFFER DAM AND REPLACE STREAM BEDDING MATERIAL.
10. REPEAT STEPS 3 THROUGH 9 FOR PHASE 2 OF CROSSING.
11. STABILIZE REMAINING AREA BY SEEDING AND MATTING AS SPECIFIED.
12. ONCE STABILIZED, REMOVE TEMPORARY EROSION CONTROL DEVICES.

UTILITY STREAM CROSSING NOTES

1. ALL UTILITY LINES UNDER STREAMBEDS SHALL BE LOCATED SUCH THAT THERE WILL BE A MINIMUM OF FOUR (4) FEET OF COVER BETWEEN THE TOP OF THE UTILITY LINE OR ENCASEMENT AND THE LOWEST POINT IN THE NATURAL CONTOUR OF THE STREAMBED. UNLESS THE UTILITY LINE IS IN ROCK, WHERE A MINIMUM COVER OF ONE (1) FOOT SHALL BE PROVIDED.
2. TRENCHES EXCAVATED FOR THE INSTALLATION OF UTILITY LINES SHALL BE THE MINIMUM WIDTH NECESSARY. AS SOON AS THE UTILITY LINE IS INTALLED AND TESTED TO ASCERTAIN NO LEAKAGE, APPROPRIATE NEW OR PREVIOUSLY EXCAVATED BACKFILL MATERIAL SHALL BE PLACED IN THE TRENCH AND THE AREA RESTORED TO ITS ORIGINAL CONDITION AND ELEVATION AND STABILIZED. BACKFILL MATERIAL STORED IN CONNECTION WITH THE INSTALLATION MUST BE PROPERLY RETAINED OUT OF THE FLOODWAY SO AS TO PREVENT ITS DISCHARGE, WASHINGS, OR RUNOFF FROM ENTERING THE WATERWAY PRIOR TO ITS PLACEMINET AS BACKFILL.
3. ADEQUATE MEASURES SHALL BE USED TO PREVENT SEDIMENTATION FROM THE TRENCH FROM ENTERING THE STREAM.
4. THE BACKFILLING OF THE TRENCH IN WHICH THE PIPE WILL BE LAID SHALL BE DONE SO AS TO ELIMINATE THE FORMATION OF A PERMANENT RIDGE IN THE STREAMBED.
5. ARCHEAOLOGICAL ARTIFACTS DISCOVERED DURING THE PERFORMANCE OF WORK AUTHORIZED UNDER THIS GENERAL PERMIT MUST BE ADEQUATELY PROTECTED AND THEIR DISCOVERY PROMPTLY REPORTED TO THE BUREAU OF HISTORIC PRESERVATION, HISTORICAL AND MUSEUM COMMISSION, 400 NORTH STREET, SECOND FLOOR, HARRISBURG, PA 17120-0093, TELEPHONE (717) 783-8946.
6. WHENEVER POSSIBLE, IN ACCORDANCE WITH BEST CONSTRUCTION METHODS, UTILITY LINE CORSSINGS ARE TO BE MADE "IN THE DRY" BY INSTALLING SANDBAG AND PLASTIC DAMS AND PIPING STREAM FLOW THROUGH THE AFFECTED AREA.
7. PRIOR TO THE USE OF EXPLOSIVES IN A WATERCOURSE OR BODY OF WATER THE PERMITTEE SHALL SECURE A WRITTEN PERMIT FROM THE FISH AND BOAT COMMISSION, UNDER THE PENNSYLVANIA FISH AND BOAT CODE 30 Pa. C.S. §2906 (RELATING TO PERMITS FOR USE OF EXPLOSIVES). REQUESTS SHOULD BE DIRECTED TO THE FISH AND BOAT COMMISSION, DIVISION OF ENVIRONMENTAL SERVICES (SEE "EXHIBIT A").

GENERAL PIPELINE AND UTILITY LINE NOTES

1. TRENCHES EXCAVATED FOR THE INSTALLATION OF UTILITY LINES SHALL BE THE MINIMUM WIDTH NECESSARY. AS SOON AS THE UTILITY LINE IS INSTALLED AND TESTED TO ASCERTAIN NO LEAKAGE, APPROPRIATE NEW OR PREVIOUSLY EXCAVATED BACKFILL MATERIAL SHALL BE PLACED IN THE TRENCH AND THE AREA RESTORED TO ITS ORIGINAL CONDITION AND ELEVATION AND STABILIZED. BACKFILL MATERIAL STORED IN CONNECTION WITH THE INSTALLATION MUST BE PROPERLY RETAINED OUT OF THE FLOODWAY SO AS TO PREVENT ITS DISCHARGE, WASHINGS, OR RUNOFF FROM ENTERING THE WATERWAY PRIOR TO ITS PLACEMENT AS BACKFILL.
2. SOIL SUPPLEMENTS, SEED AND MULCH SHOULD BE APPLIED WITHIN FOUR DAYS OR IMMEDIATELY AFTER THE PIPELINE/UTILITY LINE IS INSTALLED. NOTE: TEMPORARY STABILIZATION IS REQUIRED WITHIN FOUR DAYS IF THERE IS TEMPORARY CESSATION OF AN EARTH DISTURBANCE ACTIVITY. MEANWHILE, PERMANENT STABILIZATION IS REQUIRED IMMEDIATELY UPON FINAL COMPLETION OF AN EARTH DISTURBANCE ACTIVITY OR ANY STAGE OR PHASE OF AN ACTIVITY.
3. LIMIT CLEARING AND GRUBBING TO CUTTING EXISTING VEGETATION RATHER THAN BULLDOZING THE VEGETATION. LIMIT TRENCH WIDTH TO WHAT IS NECESSARY TO INSTALL THE PIPE.
4. LIMIT DAILY TRENCH EXCAVATION TO THE LENGTH OF PIPE TO BE INSTALLED EACH DAY.
5. THE TRENCH IS TO BE BACKFILLED THE SAME DAY THE TRENCH IS DUG AND PIPE IS LAID.
6. FOR STEEL PIPELINES WITH WELDED JOINTS, THE LENGTH OF TIME REQUIRED FOR OPEN TRENCH OPERATIONS AT ANY STATION ALONG THE RIGHT-OF-WAY SHOULD NOT EXCEED 30 CALENDAR DAYS PER THE REQUIREMENTS ON PAGE 283 OF THE PADEP EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL, MARCH 2012.

EROSION AND SEDIMENT CONTROL FOR IN-CHANNEL WORK

1. WHENEVER POSSIBLE, WORK SHOULD BE SCHEDULED FOR LOW FLOW SEASONS. NORMAL FLOW SHOULD BE CONVEYED PAST THE WORK AREA BY MEANS OF A BYPASS CHANNEL, PIPE, PUMP, OR COFFERDAM. ALL SUCH BYPASSES SHOULD BE COMPLETED AND STABILIZED PRIOR TO DIVERTING FLOW.
2. ANY IN-CHANNEL EXCAVATIONS SHOULD BE DONE FROM THE TOP OF BANKS WHEREVER POSSIBLE. WHERE THIS IS NOT POSSIBLE, A TEMPORARY STREAM ACCESS SHOULD BE PROVIDED FOR ANY EQUIPMENT WORKING FROM WITHIN THE CHANNEL. UPON COMPLETION, ALL CHANNEL ENTRANCES SHOULD BE RESTORED TO PRE-CONSTRUCTION CONFIGURATIONS, AS MUCH AS POSSIBLE, AND STABILIZED.
3. ALL EXCAVATED CHANNEL MATERIALS THAT WILL BE SUBSEQUENTLY USED AS BACKFILL SHOULD BE PLACED IN A TEMPORARY STOCKPILE LOCATED OUTSIDE THE CHANNEL. A SEDIMENT BARRIER SHOULD BE INSTALLED BETWEEN THE STORAGE PILE AND THE STREAM CHANNEL.
4. ALL EXCAVATED MATERIALS THAT WILL NOT BE USED ON SITE MUST BE IMMEDIATELY REMOVED TO A DISPOSAL SITE HAVING AN APPROVED EROSION AND SEDIMENT POLLUTION CONTROL PLAN.
5. ANY PUMPED WATER FROM EXCAVATED AREAS MUST BE FILTERED PRIOR TO DISCHARGING INTO WATERS OF THE COMMONWEALTH. THE USE OF FILTER BAGS IS ANOTHER ACCEPTABLE METHOD IF LOCATED ON A RELATIVELY FLAT (<5% SLOPE), WELL-VEGETATED AREA. THE BAG SHOULD BE DESIGNED TO TRAP PARTICLES LARGER THAN 150 MICRONS. THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED. WHEN THE BAG HAS BEEN FILLED TO 1/2 ITS TOTAL CAPACITY, IT SHOULD BE REPLACED WITH A NEW BAG AND PROPERLY DISPOSED. WHEREVER WELL-VEGETATED AREAS ARE NOT AVAILABLE, A GEOTEXTILE UNDERLAYMENT SHOULD BE USED. CONSIDERATION SHOULD BE GIVEN TO HOW THE BAG WILL BE ACCESSED AND REMOVED ONCE IT HAS BEEN 1/2 FILLED WITH SEDIMENT.
6. ALL DISTURBED AREAS WITHIN THE EXISTING CHANNEL SHOULD BE COMPLETED AND STABILIZED BEFORE FLOW IS REDIRECTED TO IT. SUITABLE PROTECTION SHOULD BE PROVIDED FOR THE STREAM CHANNEL FROM ANY DISTURBED AREAS THAT HAVE NOT YET ACHIEVED STABILIZATION.
7. EXISTING STREAM BED MATERIALS WITHIN DISTURBED STREAM BED SHALL BE STOCKPILED AND PLACED BACK TO ORIGINAL CONDITIONS.
8. STREAM EMBANKMENTS SHALL BE LINED WITH EROSION CONTROL MATTING NAG BIONET S150BN OR EQUIVALENT AS SHOWN.
9. RIPARIAN RE-VEGETATION SHALL BE PLACED 50' FROM TOP OF STREAM BANK.

NOTES:

1. THE BASE MAP HAS BEEN CREATED USING AVAILABLE AERIAL PHOTOGRAPHY PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN. EXISTING TOPOGRAPHY HAS BEEN CREATED USING LIDAR CONTOURS PROVIDED BY PAMAP TILES 43002200PAN, 43002210PAN, 44002200PAN AND 44002210PAN AND TOPOGRAPHIC SURVEY BY HAWBAKER ENGINEERING, NOVEMBER 2019.
2. PROPERTY LINES AND OWNER INFORMATION ARE TAKEN FROM LYCOMING COUNTY TAX ASSESSMENT MAPS AND RECORDS. SURVEYED PROPERTY LINES PROVIDED BY HAWBAKER ENGINEERING, NOVEMBER 2019.
3. THIS PLAN IS IN THE PENNSYLVANIA STATE PLANE NORTH, NORTH AMERICAN DATUM 1983 (NAD 83) COORDINATE SYSTEM.
4. EVERY EFFORT MUST BE TAKEN TO AVOID EARTH DISTURBANCE AND EQUIPMENT TRACKING WITHIN THE PROPOSED INFILTRATION BERM AREAS, AND THE PROPOSED PONDING AREAS IMMEDIATELY UPGRADIENT OF THE INFILTRATION BERMS. THIS INSTALLATION MUST BE ACCOMPLISHED WITH CARE. EXCLUSION FENCE SHALL BE PLACED AROUND THESE AREAS PRIOR TO THE START OF EARTHWORK.
5. PROPOSED EROSION CONTROL PRODUCT OR EQUIVALENT SHALL BE PLACED ON ALL DISTURBED SLOPES >3H:1V AND WITHIN 100' OF STREAMS AND WETLAND CROSSINGS.
6. CHANNEL MUST BE RESTORED TO PREVIOUS CONDITIONS WITHIN 24 HOURS OF PIPELINE INSTALLATION.
7. PGE INTENDS TO MAKE GRAVEL SURFACE IMPROVEMENTS TO THE EXISTING GRAVEL ACCESS DRIVE IN ACCORDANCE WITH A SEPARATE ROAD MAINTENANCE PLAN. THE LIMITS OF THE EXISTING ROADWAY WILL NOT BE EXPANDED OR WIDENED.

LEGEND

NOTE: LEGEND IS TYPICAL, NOT ALL OBJECTS IN LEGEND APPEAR IN PLAN.

- 1550 — EXISTING CONTOURS
- EXISTING WETLANDS
- EXISTING RIPARIAN FOREST BUFFER
- EXISTING STRUCTURE
- EXISTING PROPERTY LINE
- EXISTING PROPERTY LINE (SURVEYED)
- OE — EXISTING OVERHEAD ELECTRIC LINE
- UE — EXISTING UNDERGROUND ELECTRIC LINE
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- EXISTING TREELINE
- EXISTING MAPPED WATERCOURSE
- EXISTING FIELD VERIFIED STREAM
- EXISTING FLOODWAY
- EXISTING FEMA 100YR FLOODPLAIN
- EXISTING FENCE
- EXISTING CULVERT
- 1490 — PROPOSED CONTOURS
- PROPOSED GRAVEL ROAD AND PAD SURFACE
- W — PROPOSED UNDERGROUND FRESHWATER PIPELINE
- PROPOSED UNDERGROUND UTILITY CORRIDOR
- UE — PROPOSED UNDERGROUND ELECTRIC
- A — PROPOSED UNDERGROUND AIR LINE
- 18 — PROPOSED 18" FILTER SOCK
- 24 — PROPOSED 24" FILTER SOCK
- 32 — PROPOSED 32" FILTER SOCK
- 15 24 — PROPOSED FILTER SOCK SIZE DESCRIPTOR (INCH)
- PROPOSED WATERBAR
- PROPOSED TRENCH PLUG
- PROPOSED EROSION CONTROL PRODUCT
- PROPOSED STOCKPILE BOUNDARY
- PROPOSED CHANNEL
- PROPOSED FILL SLOPE TOE KEY
- PROPOSED EXCLUSION FENCE (CONSTRUCTION FENCE)
- PROPOSED ESCGP-3 PERMIT BOUNDARY / LIMIT OF DISTURBANCE
- PROPOSED 150' LONG ROCK CONSTRUCTION ENTRANCE
- PROPOSED ROCK CONSTRUCTION ENTRANCE WITH WASH RACK
- 48 — PROPOSED CULVERT WITH PLUNGE POOL
- 2H:1V — PROPOSED SLOPE
- WeB — EXISTING SOIL BOUNDARY AND DESCRIPTOR
- PROPOSED STRUCTURE

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER MICHAEL DEAN RACE

This Drawing shall not be used for tender or construction unless sealed.

I do hereby certify to the best of my knowledge, information, and belief, that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 79a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

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Engineers and Scientists
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By	Date	Revision

scale	AS NOTED
date	01/17/2020
project no.	190736
designed	ALG
drawn	MDR
checked	JAW

drawing title: LOYALSOCK CREEK CROSSING DETAILS EROSION AND SEDIMENT CONTROL PLAN

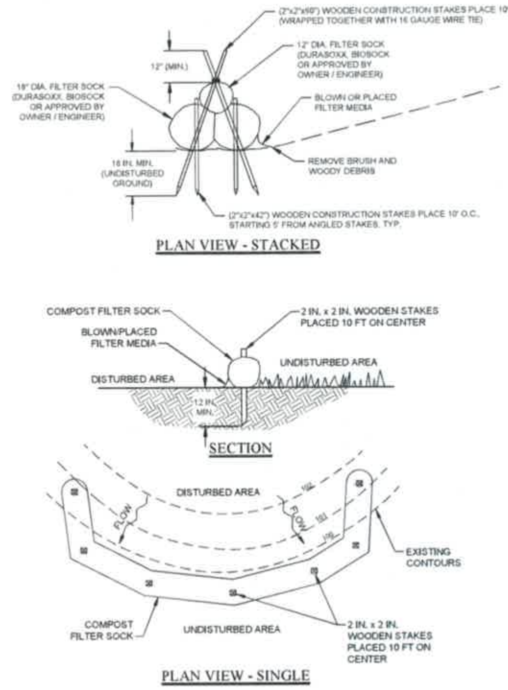
project title: LOYALSOCK, SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

Sheet 7

NOTE:
TRACKING SLOPES IS DONE BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR. IF A BULLDOZER IS USED, THE BLADE SHOULD BE UP.

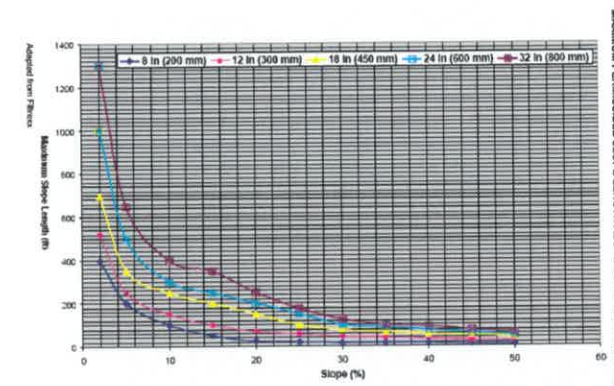
(7) DETAIL
TYPICAL TRACKING FILL AND CUT SLOPES
NOT TO SCALE



(8) STANDARD CONSTRUCTION DETAIL #4-1
TYPICAL COMPOST FILTER SOCK
NOT TO SCALE

NOTES:

1. FILTER SOCKS SHALL BE PLACED PARALLEL TO CONTOURS WITH BOTH ENDS OF THE SOCK EXTENDED UPSLOPE AT A 45 DEGREE ANGLE TO THE REST OF THE SOCK FOR A MINIMUM OF 8 FEET TO PREVENT END-AROUNDS. STAKES SHOULD BE PLACED THROUGH THE CENTER OF THE SOCK AT INTERVALS RECOMMENDED BY THE MANUFACTURER. WHERE SOCKS ARE PLACED ON PAVED SURFACES, CONCRETE BLOCKS SHOULD BE USED IMMEDIATELY DOWNSLOPE OF THE SOCKS TO HELP HOLD THE SOCK IN PLACE.
2. PROPER SITE PREPARATION IS ESSENTIAL TO ENSURE COMPLETE CONTACT OF THE FILTER SOCK WITH THE SOIL.
3. FILTER SOCKS SHALL BE FILLED WITH WELL-DECOMPOSED ORGANIC MATERIAL (TYPICALLY COMPOSTED WOOD MULCH) IN ACCORDANCE WITH THE COMPOST STANDARDS LISTED ABOVE.
4. REMOVE ALL ROCKS, CLODS, VEGETATION, OR OTHER OBSTRUCTIONS SO THAT THE INSTALLED FILTER SOCK WILL HAVE DIRECT CONTACT WITH THE SOIL.
5. THE ENDS OF ADJACENT FILTER SOCK SHOULD BE TIGHTLY ABUTTED SO THAT NO OPENING EXISTS FOR WATER OR SEDIMENT TO PASS THROUGH. ALTERNATELY, FILTER SOCK MAY BE OVERLAPPED 6" MINIMUM TO PREVENT SEDIMENT PASSING THROUGH THE FIELD JOINT.
6. WOODEN STAKES SHOULD BE USED TO SECURE THE FILTER SOCK TO THE SOIL AS ILLUSTRATED. WOODEN STAKES SHOULD BE PLACED 6" FROM THE FILTER SOCK END.
7. CARE SHALL BE TAKEN DURING INSTALLATION SO AS TO AVOID DAMAGE OCCURRING TO THE FILTER SOCK AS A RESULT OF THE INSTALLATION PROCESS. SHOULD THE FILTER SOCK BE DAMAGED DURING INSTALLATION, A WOODEN STAKE SHALL BE PLACED ON EITHER SIDE OF THE DAMAGED AREA TERMINATING THE LOG SEGMENT.
8. FIELD MONITORING SHALL BE PERIODICALLY PERFORMED BY THE ENGINEER TO VERIFY THAT THE PLACEMENT DOES NOT DAMAGE THE FILTER SOCK. ANY FILTER SOCK DAMAGED DURING PLACEMENT SHALL BE REPLACED AS DIRECTED BY THE ENGINEER AT THE CONTRACTOR'S EXPENSE.
9. THE ANTICIPATED FUNCTIONAL LIFE OF A BIODEGRADABLE FILTER SOCK SHOULD BE 6 MONTHS; FOR PHOTODEGRADABLE SOCKS 1 YEAR. POLYPROPYLENE SOCKS SHALL BE REPLACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. PROJECTS WITH DISTURBANCES ANTICIPATED TO LAST LONGER THAN THE FUNCTIONAL LIFE OF A SOCK SHOULD PLAN TO REPLACE THE SOCKS PERIODICALLY OR USE ANOTHER TYPE OF BMP.
10. TRAFFIC SHALL NOT BE PERMITTED TO CROSS FILTER SOCKS.
11. ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES HALF THE ABOVE GROUND HEIGHT OF THE SOCK AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN.
12. SOCKS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED SOCKS SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.
13. UPON STABILIZATION OF THE AREA TRIBUTARY TO THE SOCK, STAKES SHALL BE REMOVED. THE SOCK MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH SHALL BE CUT OPEN AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.
14. WHERE THE LIMIT OF CLEARING / CONSTRUCTION AND FILTER SOCK ARE ADJACENT, PLACE THE SOCK ON THE EDGE OF LIMIT OF CLEARING / CONSTRUCTION.



NOTE: 8" diameter socks should only be used to control small (≤ ¼ acre) disturbed areas on individual house lots).

FLEXTERRA® HP-FGM HYDRAULICALLY APPLIED EROSION CONTROL PRODUCT (HECP)

SPECIFICATION: 31 25 14.13 - HIGH PERFORMANCE-FLEXIBLE GROWTH MEDIUM

THIS SECTION SPECIFIES A HYDRAULICALLY-APPLIED, 100% BIODEGRADABLE, HIGH PERFORMANCE-FLEXIBLE GROWTH MEDIUM (HP-FGM) THAT IS MANUFACTURED IN THE UNITED STATES AND IS COMPOSED OF 100% RECYCLED THERMALLY REFINED (WITHIN A PRESSURE VESSEL) WOOD FIBERS, CRIMPED INTERLOCKING MAN-MADE BIODEGRADABLE FIBERS, MICRO-PORE GRANULES, NATURALLY DERIVED CROSSLINKED BIOPOLYMERS AND WATER ABSORBENTS. THE HP-FGM IS PHYTOSANITIZED, FREE FROM PLASTIC NETTING, REQUIRES NO CURING PERIOD AND UPON APPLICATION FORMS AN INTIMATE BOND WITH THE SOIL SURFACE TO CREATE A CONTINUOUS, POROUS, ABSORBENT AND FLEXIBLE EROSION RESISTANT BLANKET THAT ALLOWS FOR RAPID GERMINATION AND ACCELERATED PLANT GROWTH. ALL COMPONENTS OF THE FGM SHALL BE PRE-PACKAGED BY THE MANUFACTURER TO ASSURE BOTH MATERIAL PERFORMANCE AND COMPLIANCE WITH THE FOLLOWING VALUES. NO CHEMICAL ADDITIVES WITH THE EXCEPTION OF FERTILIZER, LIMING AND BIOSTIMULANT MATERIALS SHOULD BE ADDED TO THIS PRODUCT.

1. THERMALLY PROCESSED (WITHIN A PRESSURE VESSEL) WOOD FIBER - 80% ±3% - HEATED TO A TEMPERATURE GREATER THAN 380 DEGREES FAHRENHEIT (193 DEGREES CELSIUS) FOR 5 MINUTES AT A PRESSURE GREATER THAN 50 PSI (345 KPA) CROSSLINKED BIOPOLYMERS AND WATER ABSORBENTS - 10% ±1% CRIMPED, MAN-MADE BIODEGRADABLE INTERLOCKING FIBERS - 5% ±1% MICRO-PORE GRANULES - 5% ±1%

INSTALLATION

STRICTLY COMPLY WITH EQUIPMENT MANUFACTURER'S INSTALLATION INSTRUCTIONS AND RECOMMENDATIONS. USE APPROVED HYDRO-SPRAYING MACHINES WITH FAN-TYPE NOZZLE (50-DEGREE TIP). TO ACHIEVE OPTIMUM SOIL SURFACE COVERAGE, APPLY HP-FGM FROM OPPOSING DIRECTIONS TO SOIL SURFACE. ROUGH SURFACES (ROCKY TERRAIN,CAT TRACKS AND RIPPED SOILS) MAY REQUIRE HIGHER APPLICATION RATES TO ACHIEVE 100% COVER. SLOPE INTERRUPTION DEVICES OR WATER DIVERSION TECHNIQUES ARE RECOMMENDED WHEN SLOPE LENGTHS EXCEED 100 FEET (30 M). MAXIMUM SLOPE LENGTH IS FOR PRODUCT APPLICATIONS ON A 3H:1V SLOPE FOR APPLICATION ON STEEPER SLOPES, SLOPE INTERRUPTION LENGTHS MAY NEED TO BE DECREASED BASED ON ACTUAL SITE CONDITIONS. NOT RECOMMENDED FOR CHANNELS OR AREAS WITH CONCENTRATED WATER FLOW. NO CHEMICAL ADDITIVES WITH THE EXCEPTION OF FERTILIZER, LIMING AND BIOSTIMULANT MATERIALS SHOULD BE ADDED TO THIS PRODUCT. TO ENSURE PROPER APPLICATION RATES, MEASURE AND STAKE AREA. FOR MAXIMUM PERFORMANCE, APPLY HP-FGM IN A TWO-STEP PROCESS AS FOLLOWS:

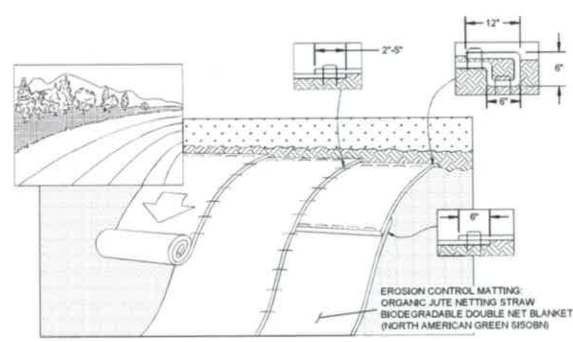
1. STEP ONE: APPLY FERTILIZER WITH SPECIFIED PRESCRIPTIVE AGRONOMIC FORMULATIONS AND 50% OF SEED WITH A SMALL AMOUNT OF HP-FGM FOR VISUAL METERING.
2. STEP TWO: MIX BALANCE OF SEED AND APPLY HP-FGM AT A RATE OF 50 LB PER 125 GALLONS (23 KG/475 LITERS) OF WATER OVER FRESHLY SEEDED SURFACES. CONFIRM LOADING RATES WITH EQUIPMENT MANUFACTURER. DO NOT LEAVE SEEDED SURFACES UNPROTECTED, ESPECIALLY IF PRECIPITATION IS IMMINENT.

APPLICATION RATES

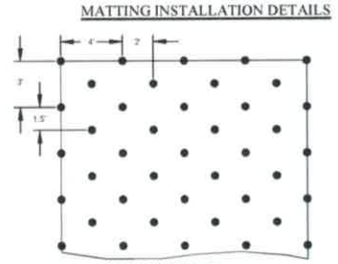
THESE APPLICATION RATES ARE FOR STANDARD CONDITIONS. DESIGNERS MAY WISH TO REDUCE RATES TO ENCOURAGE FASTER VEGETATION ESTABLISHMENT OR MAY NEED TO INCREASE APPLICATION RATES ON ROUGH SURFACES. CONSULT APPLICATION AND LOADING CHARTS TO DETERMINE NUMBER OF BAGS TO BE ADDED FOR DESIRED ARES AND APPLICATION RATE.

SLOPE GRADIENT / CONDITION	ENGLISH	SI
≤ 4H TO 1V	2,500 LB/AC	2,800 KG/HA
> 4H TO 1V AND ≤ 3H TO 1V	3,000 LB/AC	3,400 KG/HA
≥ 3H TO 1V AND ≤ 2H TO 1V	3,500 LB/AC	3,900 KG/HA
> 2H TO 1V AND ≤ 1H TO 1V	4,000 LB/AC	4,500 KG/HA
> 1H TO 1V	4,500 LB/AC	5,100 KG/HA
BELOW ECB OR TRM	1,500 LB/AC	1,700 KG/HA
AS INFILL FOR TRM	3,500 LB/AC	3,900 KG/HA

(9A) DETAIL
FLEXTERRA HP-FGM EROSION CONTROL PRODUCT
NOT TO SCALE



MATTING INSTALLATION DETAILS



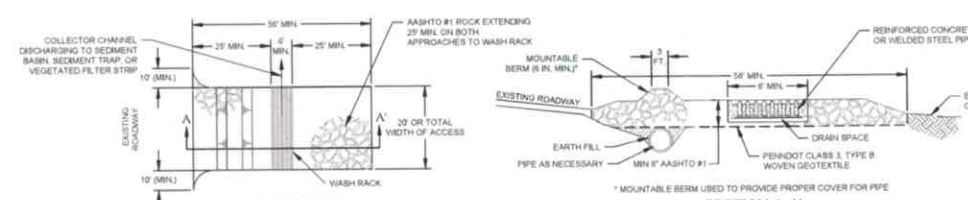
0.7 STAPLES PER SQ. YD.

STAPLE PATTERN FOR 16' WIDE ROLLS

NOTES:

1. MATTING SHALL BE PLACED ON SLOPES 3H:1V OR STEEPER.
2. MATTING SHALL BE PLACED ALONG STREAM EMBANKMENTS AND SLOPES.
3. PREPARE SOIL BEFORE INSTALLING INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
4. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE MATTING IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF MATTING EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE MATTING WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF MATTING BACK OVER SEED AND COMPACTED SOIL. SECURE MATTING OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE MATTING.
5. ROLL MATTING DOWN THE SLOPE. MATTING MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE ABOVE STAPLE PATTERN.
6. THE EDGES OF PARALLEL ROLLS MUST BE STAPLED WITH APPROXIMATELY 2" - 5" OVERLAP. CONSECUTIVE ROLLS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE - WITH UPSLOPE MAT OVERLYING DOWNSLOPE MAT) WITH AN APPROXIMATE 6" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE WIDTH. NOTE: IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE MATTING.
7. AS AN ALTERNATIVE TO ECM, A FLEXIBLE GROWTH MEDIUM (FGM) SHALL BE USED UNLESS SPECIFIED BY THE OWNER OR ENGINEER.

(9B) DETAIL
EROSION CONTROL MATTING
NOT TO SCALE



REMOVE TOPSOIL PRIOR TO INSTALLATION OF ROCK CONSTRUCTION ENTRANCE. EXTEND ROCK OVER FULL WIDTH OF ENTRANCE.

RUNOFF SHALL BE DIVERTED FROM ROADWAY TO A SUITABLE REMOVAL BMP PRIOR TO ENTERING ROCK CONSTRUCTION ENTRANCE.

MOUNTABLE BERM SHALL BE INSTALLED WHEREVER OPTIONAL CULVERT PIPE IS USED AND PROPER PIPE COVER AS SPECIFIED BY MANUFACTURER IS NOT OTHERWISE PROVIDED. PIPE SHALL BE SIZED APPROPRIATELY FOR SIZE OF DITCH BEING CROSSED.

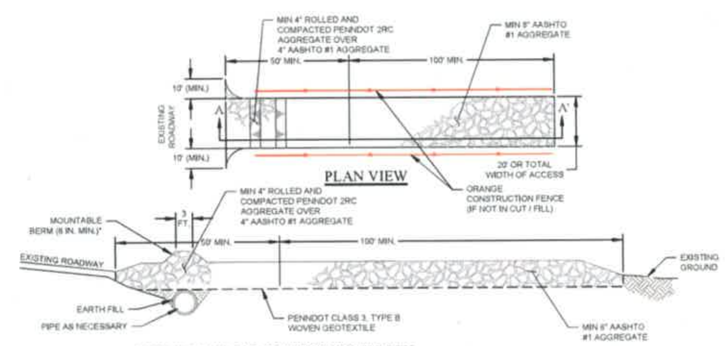
WASH RACK - SHALL BE 20 FEET WIDE MINIMUM, DESIGNED AND CONSTRUCTED TO ACCOMMODATE ANTICIPATED CONSTRUCTION VEHICLE TRAFFIC, AND HAVE A WATER SUPPLY AVAILABLE TO WASH THE WHEELS OF VEHICLES LEAVING THE SITE.

PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

MAINTENANCE: ROCK CONSTRUCTION ENTRANCE THICKNESS SHALL BE CONSTANTLY MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK. A STOCKPILE SHALL BE MAINTAINED ON SITE FOR THIS PURPOSE. DRAIN SPACE UNDER WASH RACK SHALL BE KEPT OPEN AT ALL TIMES. DAMAGE TO THE WASH RACK SHALL BE REPAIRED PRIOR TO FURTHER USE OF THE RACK ALL SEDIMENT DEPOSITS ON PAVED ROADWAYS SHALL BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE IMMEDIATELY. WASHING THE ROADWAY OR SWEEPING THE DEPOSITS INTO ROADWAY DITCHES, SEWERS, CULVERTS, OR OTHER COURSES IN NOT ACCEPTABLE.

WASHING - WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

(10A) STANDARD CONSTRUCTION DETAIL #3-1 & #3-2
TYPICAL ROCK CONSTRUCTION ENTRANCE WITH WASH RACK
NOT TO SCALE



REMOVE TOPSOIL PRIOR TO INSTALLATION OF ROCK CONSTRUCTION ENTRANCE. EXTEND ROCK OVER FULL WIDTH OF ENTRANCE.

RUNOFF SHALL BE DIVERTED FROM ROADWAY TO A SUITABLE REMOVAL BMP PRIOR TO ENTERING ROCK CONSTRUCTION ENTRANCE.

MOUNTABLE BERM SHALL BE INSTALLED WHEREVER OPTIONAL CULVERT PIPE IS USED AND PROPER PIPE COVER AS SPECIFIED BY MANUFACTURER IS NOT OTHERWISE PROVIDED. PIPE SHALL BE SIZED APPROPRIATELY FOR SIZE OF DITCH BEING CROSSED.

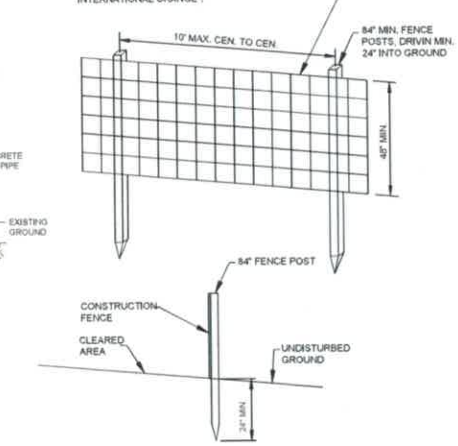
PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

MAINTENANCE: ROCK CONSTRUCTION ENTRANCE THICKNESS SHALL BE CONSTANTLY MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK. A STOCKPILE SHALL BE MAINTAINED ON SITE FOR THIS PURPOSE. DRAIN SPACE UNDER WASH RACK SHALL BE KEPT OPEN AT ALL TIMES. DAMAGE TO THE WASH RACK SHALL BE REPAIRED PRIOR TO FURTHER USE OF THE RACK ALL SEDIMENT DEPOSITS ON PAVED ROADWAYS SHALL BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE IMMEDIATELY. WASHING THE ROADWAY OR SWEEPING THE DEPOSITS INTO ROADWAY DITCHES, SEWERS, CULVERTS, OR OTHER COURSES IN NOT ACCEPTABLE.

WASHING - WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

(10B) DETAIL
TYPICAL 150' LONG ROCK CONSTRUCTION ENTRANCE
NOT TO SCALE

CONSTRUCTION FENCE SHALL BE MANUFACTURED OF POLYETHYLENE OR POLYPROPYLENE WITH A NOMINAL RECTANGULAR MESH OPENING OF NO GREATER THAN 1"X2". FENCE SHALL BE 48" HIGH AND SUPPLIED IN ROLLS OF AT LEAST 50' IN LENGTH. COLOR SHALL BE "INTERNATIONAL ORANGE".



THE CONTRACTOR SHALL INSTALL THE CONSTRUCTION FENCE IN LOCATIONS AS REQUIRED BY THE DRAWINGS AND SPECIFICATIONS.

FENCE DESIRABLE WOODED AREAS, INDIVIDUAL TREES, AND SHRUBS DESIGNATED FOR PROTECTION, BEFORE BEGINNING OTHER GENERAL PROJECT WORK. WHERE DIRECTED, FENCE OTHER AREAS TO BE PROTECTED. DO NOT STOCKPILE MATERIALS UNDER, OR WITHIN, PROTECTED VEGETATION AREAS. PROHIBIT CONSTRUCTION TRAFFIC WITHIN PROTECTED AREAS. PLACE THE FENCE AT THE DRIPLINE OF TREES OR PLANTS, BUT AVOID CAUSING ROOT DAMAGE WHEN DRIVING POSTS. REPLACE DAMAGED FENCE IN KIND WITHIN 24 HOURS OF DAMAGE, AS DIRECTED. REMOVE TEMPORARY PROTECTION, WHEN DIRECTED.

(11) DETAIL
EXCLUSION FENCE
NOT TO SCALE

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Scale	AS NOTED
Date	01/17/2020
Project No.	190736
Designed	ALG
Checked	MDR
Drawn	JAW

E&S DETAILS (SHEET 1 OF 4)
EROSION AND SEDIMENT CONTROL PLAN

LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.
GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

MICHAEL DEAN RACE
PROFESSIONAL ENGINEER

MICHAEL DEAN RACE, PE - 083105

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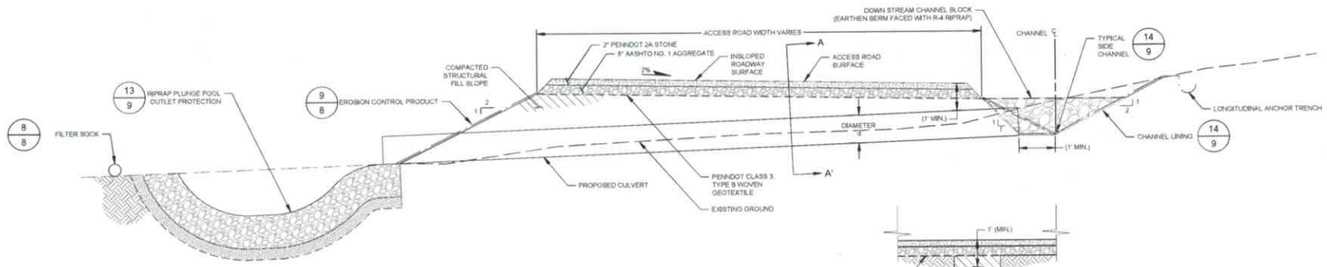
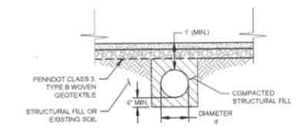
Sheet 8





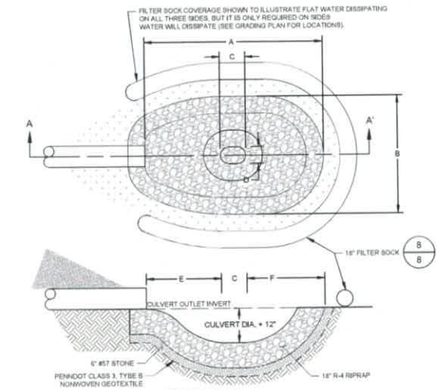
SECTION A-A'

NOTES:

1. REFER TO CULVERT SCHEDULE FOR MINIMUM PIPE SLOPES. CULVERTS SHALL EXTEND BEYOND THE FILL SLOPE.
2. TRANSITION CHANNEL DIMENSIONS TO CULVERT INLETS. INSTALL MATTING WITHIN CHANNEL AND AT CULVERT TRANSITION AREAS INCLUDING CHANNEL BLOCK.
3. STABILIZE IMMEDIATELY AFTER CONSTRUCTION.

CULVERT SCHEDULE						
CULVERT I.D.	DESIGN FLOW (cfs)	CULVERT SIZE AND TYPE (d)	LENGTH (ft)	INLET ELEVATION (ft)	OUTLET ELEVATION (ft)	MIN. SLOPE (%)
CULVERT 1	0.1	12" DIA. HDPE	55	692.0	690.8	2.3
CULVERT 2	17.8	24" DIA. HDPE	55	663.5	663.0	0.9
CULVERT 3	19.2	24" DIA. HDPE	65	652.0	651.3	1.2

12 DETAIL
TYPICAL ACCESS ROAD - CROSS SECTION W/ CULVERT
NOT TO SCALE



SECTION A-A'

PIPE SIZE	A	B	C	D	E	F	WT. RIPRAP IN TONS
15"	10'	7'	1 1/2'	1'	4 1/2'	3'	6
18"	12'	8'	2'	1'	5'	4'	6
21"	15'	9'	2 1/2'	1 1/2'	7'	4 1/2'	12
24"	17'	10'	2 1/2'	1 1/2'	8'	5 1/2'	15
30"	20'	13'	3'	2'	9'	6'	22
36"	24'	16'	3 1/2'	2'	9 1/2'	7'	33

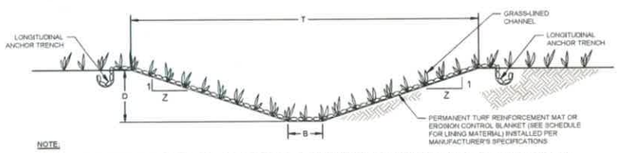
NOTE:

1. WELL PAD DISCHARGE PIPING AND BENCH OUTLET PLUNGE POOLS SHALL USE 15" DIA. CULVERT DIMENSIONS FOR INSTALLING DEVICE.
2. DETAIL DERIVED FROM MECKLENBURG COUNTY LAND DEVELOPMENT STANDARDS MANUAL, REVISED JULY 1, 2010.

Source of Discharge	Outlet Protection Method	Outlet Velocity	Tailwater Velocity	Riprap Size	V_{max} for
Channel 1	Plunge Pool	4.64	N/A	R-3	6.5
Channel 2	Plunge Pool	0.82	N/A	R-3	6.5
Channel 3 / Channel 7	Riprap Apron	5.67	N/A	R-3	6.5
Channel 4	Plunge Pool	0.88	N/A	R-3	6.5
Channel 8	Riprap Apron	2.32	N/A	R-3	6.5
Diversion Berm D1 (PCSM)	Plunge Pool	0.74	N/A	R-3	6.5
Culvert 1	Plunge Pool	3.29	1.26	R-3	6.5
Culvert 2	Riprap Apron	7.79	3.43	R-4	9.0
Culvert 3	Plunge Pool	8.60	4.45	R-4	9.0

*FROM CULVERT HYDRAULIC CALCULATIONS.
**FROM TABLE 6.5 IN PA DEP E&S MANUAL, MARCH 2012.

13 DETAIL
TYPICAL RIPRAP PLUNGE POOL
NOT TO SCALE

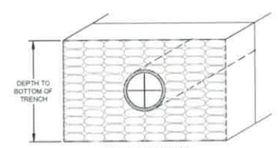


NOTE:

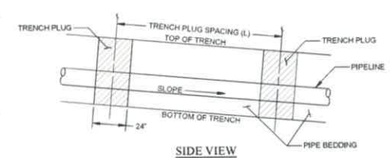
1. ANCHOR TRENCHES SHALL BE INSTALLED AT BEGINNING AND END OF CHANNEL IN THE SAME MANNER AS LONGITUDINAL ANCHOR TRENCHES.

Channel ID	Design Flow (cfs)	Length (ft)	Bottom Width B (ft)	Side Slopes (Z:1)	Channel Slope (%)	Channel Depth (ft)	Top Width T (ft)	Lining*
Channel 3	1.3	102	2	2.5	9.8	1	7	NAG P300
Channel 4	0.6	103	2	2.5	5.8	1	7	NAG S150
Channel 5A	42.4	35.7	4	2.5	14	1	9	R-4
Channel 5B	1	196	2	2.5	12.2	1	7	NAG P300
Channel 6	1.5	295	2	2.5	13.6	1	7	NAG P300
Channel 7	0.6	120	2	2.5	3.3	1	7	NAG S150
Channel 8 (PCSM)	1.6	111	2	2.5	7.2	1	7	NAG S150

14 DETAIL
TYPICAL GRASS-LINED CHANNEL
NOT TO SCALE



CROSS SECTION



SIDE VIEW

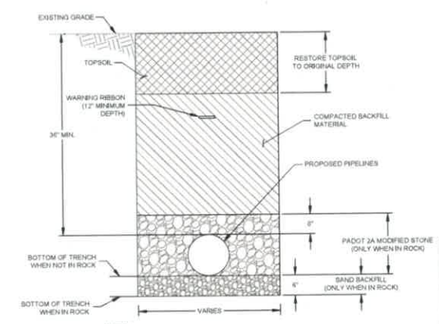
TRENCH BREAKERS/TRENCH PLUGS SHOULD BE INSTALLED IN ALL UTILITY LINE TRENCHES AS PER THE TABLE BELOW. THE TABLE INDICATES THE REQUIRED SPACING AND MATERIALS FOR THE TRENCH BREAKERS/TRENCH PLUGS.

REQUIRED SPACING AND MATERIALS FOR TRENCH BREAKERS/ TRENCH PLUGS		
TRENCH SLOPE	SPACING (L) IN FEET	PLUG MATERAL
0-5%	1000	CLAY, BENTONITE, OR CONCRETE FILLED SACKS
5-15%	500	CLAY, BENTONITE, OR CONCRETE FILLED SACKS
15-25%	300	CLAY, BENTONITE, OR CONCRETE FILLED SACKS
25-35%	200	CLAY, BENTONITE, OR CONCRETE FILLED SACKS
35-100%	100	CLAY, BENTONITE, OR CONCRETE FILLED SACKS
OVER 100%	50	CEMENT FILLED BAGS (WETTED) OR MORTARED STONE

NOTES:

1. TRENCH BREAKERS/TRENCH PLUGS ARE REQUIRED AT ALL STREAM/RIVER/WATERBODY AND WETLAND CROSSINGS REGARDLESS OF TRENCH SLOPE.
2. TO ENSURE PROPER TOPSOIL CONSERVATION, TOPSOIL SHOULD NOT BE USED IN EARTH FILLED SACKS.

15 STANDARD CONSTRUCTION DETAIL #13-4
TYPICAL TRENCH PLUG
NOT TO SCALE



NOTES:

1. PIPE BEDDING WILL BE PLACED BENEATH THE PIPELINE A MINIMUM OF 6" THICK IN AREAS OF EXPOSED STONE.
2. PIPELINE WILL BE PLACED IN THE TRENCH AND BACKFILLED USING EXISTING MATERIALS.
3. WARNING RIBBON WILL BE PLACED A MINIMUM OF 12" BELOW THE EXISTING SURFACE GRADE.

16 DETAIL
TYPICAL TRENCH SECTION
NOT TO SCALE

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL DEAN RACE
ENGINEER
NO. PE083105

This Drawing shall not be used for tender or construction unless sealed.

I do hereby certify to the best of my knowledge, information, and belief, that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 79a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

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Engineers and Scientists
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Revision	Date	By

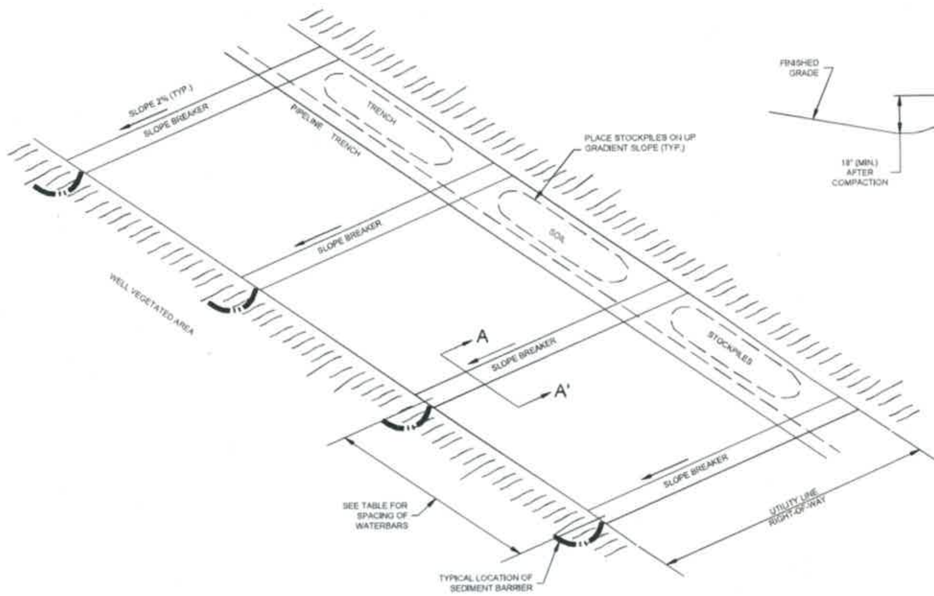
scale AS NOTED
date 01/17/2020
project no. 190736
drawn ALG
reviewed MDR
approved JAW

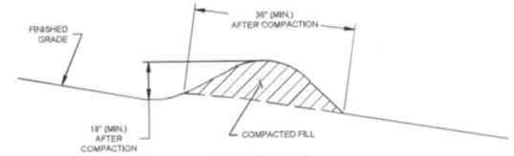
E&S DETAILS (SHEET 2 OF 4)
EROSION AND SEDIMENT CONTROL PLAN

GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

Sheet 9





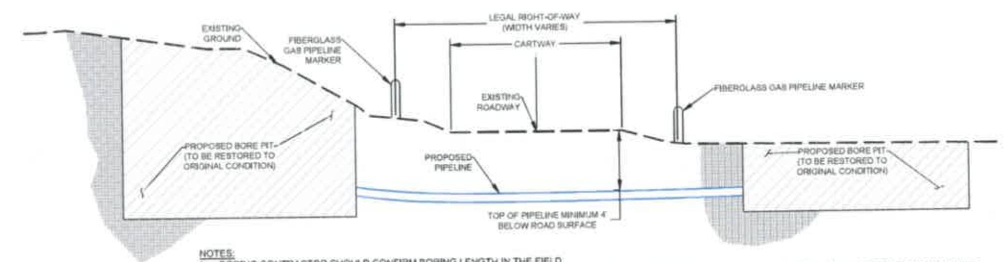
SECTION A-A'

SPACE BETWEEN WATERBARS	
PERCENT SLOPE	SPACING (FT.)
< 5%	250
5 - 15%	150
15 - 30%	100
> 30%	50

NOTES:

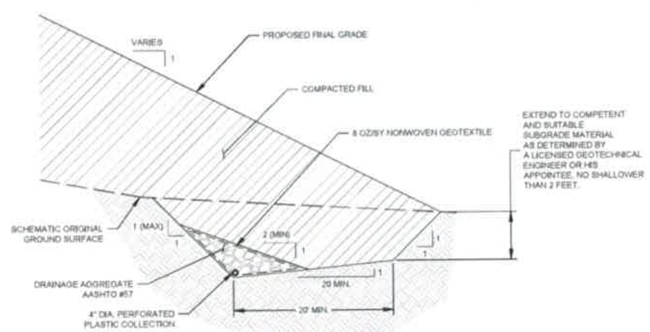
1. WATERBARS SHOULD BE CONSTRUCTED AT A SLOPE OF 2% AND DISCHARGE TO A STABLE AND WELL-VEGETATED AREA.
2. WATERBARS SHOULD NOT DISCHARGE TO THE OPEN TRENCH AND SHOULD BE ALIGNED SO THAT DISCHARGES DO NOT FLOW BACK ONTO THE RIGHT-OF-WAY. RUNOFF SHOULD BE DIRECTED TO THE DOWNSLOPE SIDE OF THE DISTURBED AREA.
3. WATERBARS MUST BE INSTALLED AT ALL STREAM AND WETLAND CROSSINGS AND UPSLOPE FORM PUBLIC ROADWAY AND RAILROAD CUT SLOPES. GENERALLY, ONE WATERBAR IS PLACED AT THE TOP OF THE STREAM BANK AND ANOTHER ONE ABOUT 50 FEET UPSLOPE.
4. A SEDIMENT BARRIER (12" COMPOST FILTER SOCK) SHALL BE PROVIDED AT THE POINT OF DISCHARGE.

(17) DETAIL
TYPICAL WATERBAR (RIGHT-OF-WAY)
NOT TO SCALE



NOTES:
1. BORING CONTRACTOR SHOULD CONFIRM BORING LENGTH IN THE FIELD.
2. THE BORE PROFILE IS BASED ON EXISTING AVAILABLE LIDAR DATA AT 2-FOOT CONTOUR INTERVALS. ACTUAL FIELD CONDITIONS MAY DIFFER FROM AVAILABLE LIDAR.
3. NO GEOTECHNICAL EVALUATIONS WERE COMPLETED FOR THE BORE LOCATION.
4. CONTRACTOR MAY ADJUST THE SIZE OF THE PROPOSED BORE PITS TO BETTER SUIT FIELD CONDITIONS PROVIDED THE LIMITS OF THE BORE PIT(S) REMAIN WITHIN THE PROPOSED PROJECT LIMIT OF DISTURBANCE AND OUTSIDE OF THE PADOT RIGHT-OF-WAY.

(18) DETAIL
PROFILE OF TYPICAL ROAD PIPELINE BORE
NOT TO SCALE



NOTES:

1. DRAIN MAY BE OMITTED AT THE DIRECTION OF A LICENSED GEOTECHNICAL ENGINEER OR HIS APPOINTEE.
2. INSTALL FILL SLOPE TOE KEY WHERE DESIGNATED ON THE DRAWINGS, OR WHERE DIRECTED DURING CONSTRUCTION AS FIELD CONDITIONS DICTATE.
3. DRAIN AGGREGATE TO MEET GRADATION REQUIREMENTS FOR PENNDOT NO. 2B/AASHTO NO. 57 AGGREGATE AND TO BE PRODUCED FROM A TYPE A SOURCE STONE.
4. COLLECTION PIPE TO BE PERFORATED OR SLOTTED SCHEDULE 40 PVC OR HDPE PIPE. PERFORATIONS TO BE 0.25-INCHES IN DIAMETER; MINIMUM OF 8 PER LINEAL FOOT OF PIPE; ARRANGED IN GROUPS OF 2 TO 4 PERFORATIONS LOCATED SYMMETRICALLY AROUND THE LOWER HALF OF THE PIPE CIRCUMFERENCE. SLOTS TO BE 0.05 TO 0.15-INCHES IN WIDTH; MINIMUM OF 4 SLOTS PER LINEAL FOOT OF PIPE; EACH SLOT EXTENDING ACROSS THE LOWER THIRD OF THE PIPE CIRCUMFERENCE.
5. INSTALL COLLECTION PIPE SO THAT PERFORATIONS OR SLOTS ARE ON THE BOTTOM OF THE PIPE.
6. MAINTAIN A SLOPE OF AT LEAST 1.0% IN COLLECTION PIPES. PROVIDE OUTLETS FOR COLLECTION PIPES AT INTERVALS OF NO MORE THAN 200 FEET. OUTLETS TO CONSIST OF NON-PERFORATED OR NON-SLOTTED LONGITUDINAL EXTENSIONS OUTLETTING ON THE GROUND SURFACE ADJACENT TO THE FILL SLOPE, OR, TRANSVERSE LATERALS OUTLETTING THROUGH THE COMPLETED FILL SLOPE. IN EITHER CASE, PROVIDE EROSION PROTECTION MEASURES AT DISCHARGE POINTS IN ACCORDANCE WITH THE EROSION AND SEDIMENTATION CONTROL PLAN.
7. MAINTAIN OVERLAPS AT LEAST 18 INCHES IN WIDTH WHERE GEOTEXTILE PANELS MEET. WRAP ADDITIONAL GEOTEXTILE AROUND PENETRATIONS (SUCH AS AT COLLECTION PIPE OUTLETS) AND SECURE WITH APPROVED MEASURES IN ORDER TO MAINTAIN FILTER PROTECTION AROUND THE DRAINAGE AGGREGATE AND COLLECTION PIPE.

(19) DETAIL
TYPICAL FILL SLOPE TOE KEY
NOT TO SCALE

STRUCTURAL FILL

A. DEEP STRUCTURAL FILL IS DEFINED AS THE STRUCTURAL FILL THAT WILL BE PLACED DEEPER THAN 3 FEET FROM THE SUBGRADE SURFACE (I.E., DEEPER THAN 3 FEET BELOW THE BOTTOM OF THE AGGREGATE LAYER).

1. DEEP STRUCTURAL FILL SHALL CONSIST OF RELATIVELY HOMOGENEOUS, NATURAL SOILS THAT ARE FREE OF DEBRIS, FOREIGN OBJECTS, EXCESS SILT, ROOTS, AND ORGANICS. STRUCTURAL FILL SHALL BE CLASSIFIED ACCORDING TO ASTM D 2487 AS CL, ML, SC, SM, SW, GC, GM, OR GW. STRUCTURAL FILL SHALL BE OBTAINED FROM ON-SITE EXCAVATION OPERATIONS.
2. STRUCTURAL FILL WITH PARTICLE SIZE 6 INCHES IN LARGEST DIMENSION MAY BE USED AS DAM EMBANKMENT FILL FOR THE WET POND.

B. SHALLOW STRUCTURAL FILL IS DEFINED AS THE STRUCTURAL FILL THAT WILL BE PLACED WITHIN 3 FEET OF THE SUBGRADE SURFACE (I.E. WITHIN 3 FEET OF THE BOTTOM OF THE AGGREGATE LAYER).

1. SHALLOW STRUCTURAL FILL SHALL CONSIST OF RELATIVELY HOMOGENEOUS, NATURAL SOILS THAT ARE FREE OF DEBRIS, FOREIGN OBJECTS, EXCESS SILT, ROOTS, AND ORGANICS. SHALLOW STRUCTURAL FILL SHALL BE CLASSIFIED ACCORDING TO ASTM D 2487 AS SM, SW, GM, GW, OR SHALL CONSIST OF A MIXTURE OF WEATHERED ROCK FRAGMENTS APPROVED BY THE OWNER'S REPRESENTATIVE. SHALLOW STRUCTURAL FILL SHALL BE OBTAINED FROM ON-SITE EXCAVATION OPERATIONS. IF MATERIALS MEETING THIS SPECIFICATION ARE NOT AVAILABLE ON SITE, OWNER'S REPRESENTATIVE MAY APPROVE ALTERNATE MATERIALS.
2. SHALLOW STRUCTURAL FILL SHALL CONSIST OF PARTICLE SIZES LESS THAN 6 INCHES IN LARGEST DIMENSION.

STRUCTURAL FILL PLACEMENT AND COMPACTION

A. ALL EARTHWORK PERFORMED SHALL BE CONSTRUCTED TO THE LINES AND GRADES SHOWN ON THE DRAWINGS.

B. STRUCTURAL FILL SHALL BE PLACED IN A LOOSE LIFT THAT RESULTS IN AN AVERAGE COMPACTED LIFT THICKNESS OF NOT MORE THAN 6 INCHES AND A MAXIMUM THICKNESS OF NOT MORE THAN 9 INCHES.

C. PRIOR TO STRUCTURAL FILL PLACEMENT, EXISTING NATIVE OR NON-NATIVE SUBGRADE SHALL BE COMPACTED AND PROOF-ROLLED. PROOF-ROLLING SHOULD BE PERFORMED WITH A LOADED TRI-AXLE DUMP TRUCK TO DISCLOSE ANY AREAS WHERE THE SUBGRADE IS POTENTIALLY UNSUITABLE. IF RUTS IN EXCESS OF 3 INCHES DEVELOP DURING PROOF-ROLLING, OR IF THE MATERIAL EXHIBITS EVIDENCE OF PUMPING DUE TO ELEVATED MOISTURE CONDITIONS, AT THE SOLE DISCRETION OF THE OWNER'S REPRESENTATIVE, THIS MATERIAL SHOULD BE OVER-EXCAVATED AND REPLACED WITH SUITABLE MATERIAL, PREFERABLY CONSISTING OF COARSER-GRAINED SOIL.

D. THE IN-SITU DENSITY AND IN-SITU MOISTURE CONTENT OF THE STRUCTURAL FILL SHALL BE TESTED USING A NUCLEAR DENSOMETER IN ACCORDANCE WITH ASTM D2922/ASTM D3017. THE TESTING FREQUENCY SHALL BE ONE (1) TEST PER 2,500 SF PER LIFT OF PLACED FILL. BASED ON THE CONSISTENCY OF THE TEST RESULTS, AND AT THE SOLE DISCRETION OF THE OWNER'S REPRESENTATIVE, THE TESTING FREQUENCY MAY BE REDUCED TO ONE (1) TEST PER 10,000 SF PER LIFT.

E. COMPACTION SHALL BE ACCOMPLISHED BY A MINIMUM OF TWO PASSES (ONE PASS EQUALS UP AND BACK) BY THE APPROPRIATE COMPACTION EQUIPMENT AS SPECIFIED. SUCH EQUIPMENT SHALL BE OPERATED AT A SPEED WITHIN THE RECOMMENDED RANGES ACCORDING TO THE EQUIPMENT MANUFACTURER BUT IN NO CASE SHALL THE SPEED OF A VIBRATORY SMOOTH-DRUM ROLLER EXCEED THREE MILES PER HOUR (3 MPH).

F. COMPACT EACH LIFT OF STRUCTURAL FILL TO AT LEAST 95% OF MODIFIED PROCTOR DENSITY AS DETERMINED PER ASTM D1557 METHOD C PROCEDURES. IN THE EVENT THAT THE COMPOSITION OF THE STRUCTURAL FILL IS NOT AMENABLE TO MOISTURE-DENSITY READINGS BY NUCLEAR DENSITY GAUGE, THE CONTRACTOR SHALL MAKE THREE PASSES (EACH PASS COMPRISED OF TRAVELING THE LENGTH OF THE LIFT AND BACK) IN ONE DIRECTION, FOLLOWED BY TWO PASSES IN THE ORTHOGONAL DIRECTION. AT THAT POINT THE OWNER'S REPRESENTATIVE MAY APPROVE THE LIFT ON THE BASIS OF NON-MOVEMENT UNDER COMPACTION EQUIPMENT. IF AT THAT POINT THE LIFT STILL EXHIBITS MOVEMENT, CONTINUE COMPACTION UNTIL NO FURTHER MOVEMENT IS OBSERVED OR UNTIL THE OWNER'S REPRESENTATIVE APPROVES THE LIFT OR DIRECTS ITS REMOVAL.

G. STRUCTURAL FILL SHALL BE COMPACTED AT A MOISTURE CONTENT WITHIN PLUS OR MINUS 3 PERCENT OF THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D 1557.

H. IF THE MOISTURE CONTENT OF THE STRUCTURAL FILL IS OUTSIDE OF THE ACCEPTABLE RANGE, AND THE SPECIFIED DENSITY CANNOT BE ACHIEVED, THE SOIL SHALL BE WETTED OR DRIED AS APPROPRIATE. WETTING SHALL BE ACCOMPLISHED USING A WATER TRUCK AND SPRAY NOZZLE, UNLESS THE OWNER'S REPRESENTATIVE APPROVES AN ALTERNATIVE METHOD. DURING WETTING OR DRYING, THE SOIL SHALL BE REGULARLY DISKED OR OTHERWISE MIXED SO THAT UNIFORM MOISTURE CONDITIONS ARE OBTAINED.

I. CONTRACTOR SHALL MOISTURE-CONDITION STRUCTURAL FILL IN EITHER THE STOCKPILE AREA OR WORK AREA. ANY DELAYS IN PROGRESS DUE TO MOISTURE CONDITIONING (WETTING OR DRYING) OF SOIL, HOWEVER, ARE THE RESPONSIBILITY OF CONTRACTOR.

J. SHOULD THE TESTS INDICATE THAT THE DRY DENSITY OF ANY LAYER OF FILL, OR PORTION THEREOF IS BELOW THE MINIMUM ACCEPTABLE VALUE, THE PARTICULAR LAYER, OR PORTION THEREOF, SHALL BE REWORKED AND RECOMPACTED AT NO COST TO OWNER.

K. CONTRACTOR SHALL NOT PLACE FROZEN STRUCTURAL FILL, NOR SHALL CONTRACTOR PLACE STRUCTURAL FILL ON FROZEN GROUND.

L. CONTRACTOR SHALL ANTICIPATE WORKING IN SUB-FREEZING TEMPERATURES AND SHALL PROTECT THE WORK FROM DAMAGE DUE TO WEATHER-RELATED EFFECTS. FROZEN SOIL SHALL NOT BE PLACED AS FILL. FILL SHALL NOT BE PLACED ON FROZEN SOIL EVEN IF THE FROZEN SOIL WAS PREVIOUSLY COMPACTED AND TESTED IN ACCORDANCE WITH THESE SPECIFICATIONS. CONTRACTOR SHALL ANTICIPATE FREEZING TEMPERATURES, AND SHALL DETERMINE MEANS AND METHODS TO AVOID OR MINIMIZE THE DEPTH/PENETRATION OF FROST INTO THE PLACED FILL (E.G., SACRIFICIAL FILL PLACEMENT TO PROTECT FINISHED FILL DURING OVERNIGHT SUB-FREEZING TEMPERATURES). ANY SACRIFICIAL FILL PLACED SHALL BE REMOVED PRIOR TO ENSUING LIFTS OF COMPACTED FILL. ALL SUCH MEASURES SHALL BE INCIDENTAL TO THE WORK AND SHALL NOT CONSTITUTE "EXTRA WORK" OR CLAIM BY CONTRACTOR.

PRODUCT PROTECTION

A. CONTRACTOR SHALL USE ALL MEANS NECESSARY TO PROTECT ALL PRIOR WORK, INCLUDING ALL MATERIALS AND COMPLETED WORK OF OTHER SECTIONS.

B. IN ANTICIPATION OF LIKELY RAINFALL EVENTS, AND WITHIN AREAS WHERE TRAFFIC AND EQUIPMENT WILL BE EXPECTED IN THE CONSTRUCTED CONDITION, CONTRACTOR SHALL GRADE EXPOSED AREAS TO ENSURE POSITIVE DRAINAGE AND SEAL WITH A SMOOTH-DRUM VIBRATORY ROLLER.

C. IN THE EVENT OF DAMAGE, CONTRACTOR SHALL IMMEDIATELY MAKE ALL REPAIRS AND REPLACEMENTS NECESSARY, WITH THE APPROVAL OF THE OWNER'S REPRESENTATIVE AND AT NO ADDITIONAL COST TO OWNER.

AGGREGATE MATERIALS

A. AGGREGATE SHALL CONSIST OF HARD, STRONG, DURABLE PARTICLES THAT ARE FREE OF ANY METAL, ROOTS, CONCRETE, DEBRIS, ORGANICS, AND OTHER DELETERIOUS MATERIALS AND COATINGS. AGGREGATES SHALL BE USED FOR THE FOLLOWING COMPONENTS:

- SEDIMENT TRAPS AND OUTLET STRUCTURES (WHERE APPLICABLE); AND

B. AGGREGATE SHALL MEET THE PADOT OR AASHTO GRADATION REQUIREMENTS SHOWN ON THE CONTRACT DOCUMENTS WHEN TESTED IN ACCORDANCE WITH ASTM C 136.

C. AGGREGATES USED FOR ROAD OR WELL PAD SURFACING MATERIALS SHALL BE COMPRISED OF AGGREGATE MEETING SPECIFICATIONS FOR PADOT ITEM 703 AGGREGATE OF SIZE AND TYPE AS SPECIFIED IN THE CONTRACT DOCUMENTS IN ACCORDANCE WITH THE PADOT CONSTRUCTION AND MATERIAL SPECIFICATIONS.

D. AGGREGATE SHALL UNDERGO LOS ANGELES ABRASION TESTING IN ACCORDANCE WITH ASTM C 131 OR ASTM C 535 (DEPENDING ON AGGREGATE GRADATION) AND DEMONSTRATE THAT THE MAXIMUM WEAR ON THE AGGREGATE IS LESS THAN 50 PERCENT. QUARRY QUALITY CONTROL RESULTS/REPORTS SHALL SATISFY THESE TESTING REQUIREMENTS.

E. AGGREGATE SHALL UNDERGO SODIUM SULFATE SOUNDNESS TESTING IN ACCORDANCE WITH AASHTO T 104 AND DEMONSTRATE THAT THE MAXIMUM LOSS IS LESS THAN 15 PERCENT. QUARRY QUALITY CONTROL RESULTS/REPORTS SHALL SATISFY THESE TESTING REQUIREMENTS.

F. CRUSHER RUN SHALL CONSIST OF A WELL-GRADED MIXTURE OF PARTICLES 6 INCHES IN MAXIMUM DIMENSION AND SMALLER, WITH NO MORE THAN 10% SILT AND CLAY CONTENT. CRUSHER RUN SHALL BE PROCESSED FROM A DURABLE SOURCE ROCK, MEETING THE DURABILITY REQUIREMENTS OF PENNDOT TYPE C OR BETTER PER SECTION 703 OF PUBLICATION 408.

CONSTRUCTION NOTES

1. PRESENCE OF OWNER'S DESIGNATED CONSTRUCTION INSPECTORS. THE CONTRACTOR SHALL NOT PROCEED WITH FILL OPERATIONS, GEOSYNTHETIC PLACEMENT, OR AGGREGATE PLACEMENT WITHOUT THE PRESENCE AND ACTIVE PARTICIPATION OF THE OWNER'S REPRESENTATIVE UNLESS THE CONTRACTOR OBTAINS PERMISSION FROM THE OWNER. SUCH PERMISSION WILL BE FOR A TIME PERIOD DESIGNATED BY THE OWNER.
2. GROUNDWATER. IF SEEPS, SPRINGS, OR OTHER FORMS OF GROUNDWATER ARE ENCOUNTERED, THE CONTRACTOR SHALL NOTIFY THE OWNER IMMEDIATELY. THE ENGINEER WILL BE CONSULTED FOR RECOMMENDATIONS REGARDING THE DESIGN AND INSTALLATION OF DRAINS TO CONTROL THE EFFECTS OF GROUNDWATER ON THE EARTHWORK ACTIVITIES.
3. ROCK REMOVAL. IF BLASTING IS NECESSARY, ANY LOOSE, OVERSHOT ROCK SHOULD BE REMOVED AND REPLACED WITH PROPERLY COMPACTED MATERIAL PRIOR TO PLACING THE AGGREGATE SECTION.
4. IF CONDITIONS ARE SUCH THAT THE FINE-GRAINED SOIL COMPRISES A LARGE FRACTION OF THE UPPER SUBGRADE, IT MAY BE NECESSARY TO INCREASE THE STONE THICKNESS. THIS WILL BE A FIELD DECISION BASED ON THE OBSERVATIONS OF THE OWNER'S REPRESENTATIVE.
5. COMPACTED FILLS SHALL BE ARRANGED TO ENABLE THE UPPER 3 FEET OF MATERIAL TO BE COMPRISED OF COARSE AGGREGATE AND/OR WELL-GRADED MIXTURES OF WEATHERED ROCK FRAGMENTS, SAND, AND SILT SOILS.
6. THE SURFACE OF THE FINE-GRAINED MATERIAL (I.E., THE SUBGRADE UNDER THE COARSER SUBBASE (THE MATERIAL DIRECTLY UNDERLYING THE PROCESSED AGGREGATE)) SHOULD BE SLOPED AT A MINIMUM ONE (1) PERCENT TO ENSURE PROPER DRAINAGE AND TO MINIMIZE THE POTENTIAL FOR PERCHED WATER THAT COULD SATURATE AND WEAKEN THE FINE-GRAINED SOILS. THE FINE-GRAINED SOILS WHICH ARE TO OCCUR AT LEAST 3-FEET BELOW THE BASE OF THE PROCESSED AGGREGATE, MUST ALSO BE COMPACTED PROPERLY AND TO THE SPECIFIED DENSITY, VERIFIED BY NUCLEAR DENSITY GAUGE TESTING.

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL ENGINEER — MICHAEL DEAN RACE — NO. PE083105

This Drawing shall not be used for tender or construction unless sealed.

I do hereby certify to the best of my knowledge, information, and belief that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 78a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

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No.	Revision	Date	By

designed	ALG	scale	AS NOTED
checked	MDR	date	01/17/2020
drawn	JAW	project no.	190736

E&S DETAILS (SHEET 3 OF 4)
EROSION AND SEDIMENT CONTROL PLAN

LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.

GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

Sheet 10

GENERAL NOTES

1. A COPY OF THIS EROSION AND SEDIMENT CONTROL PLAN MUST BE KEPT AVAILABLE AT THE PROJECT SITE AT ALL TIMES.
2. ARCHAEOLOGICAL ARTIFACTS DISCOVERED DURING THE PERFORMANCE OF THE WORK MUST BE ADEQUATELY PROTECTED AND THEIR DISCOVERY PROMPTLY REPORTED TO THE BUREAU FOR HISTORIC PRESERVATION, HISTORICAL AND MUSEUM COMMISSION, 400 NORTH STREET, SECOND FLOOR, HARRISBURG, PA 17120-0093. TELEPHONE (717) 783-8946.
3. ALL BUILDING MATERIALS AND WASTES MUST BE REMOVED FROM THE SITE AND RECYCLED OR DISPOSED OF IN ACCORDANCE WITH THE DEPARTMENT'S SOLID WASTE MANAGEMENT REGULATIONS AT 25 PA. CODE §260.1 ET SEQ., §271.1 ET SEQ., AND §287.1 ET SEQ. NO BUILDING MATERIAL OR WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURNED, BURIED, DUMPED, OR DISCHARGED AT THE SITE.
4. SURFACE-WATER RUNOFF FROM THE STOCKPILE AREAS SHALL TRAVEL AS SHEET FLOW. FILTER SOCK THAT WILL RECEIVE THE RUNOFF FROM THE STOCKPILE AREAS SHALL BE MONITORED PERIODICALLY TO VERIFY THAT DISCHARGES TO THE RECEIVING WATERWAYS ARE NOT SEDIMENT LADEN. IF THE DISCHARGE DOES NOT MEET THIS REQUIREMENT, SEDIMENT CONTROL MEASURES SHALL BE INCREASED. ALSO, DURING CONSTRUCTION, TEMPORARY DIVERSION CHANNELS OR BERMS SHALL BE PLACED AS NEEDED AROUND THE UPSLOPE SIDE OF STOCKPILE AREAS TO PREVENT RUN-ON. SEDIMENT LADEN WATERS SHALL NOT BE ALLOWED TO ENTER STORMWATER MANAGEMENT FACILITIES.
5. THE PERMIT COVERS THE "MOVING, DEPOSITING, STOCKPILING, OR STORING OF SOIL, ROCK, OR EARTH MATERIALS". IF THE SITE WILL NEED TO HAVE FILL IMPORTED FROM AN OFF SITE LOCATION, THE RESPONSIBILITY FOR PERFORMING ENVIRONMENTAL DUE DILIGENCE AND THE DETERMINATION OF CLEAN FILL WILL RESIDE WITH THE OPERATOR. IF THE SITE WILL HAVE EXCESS FILL THAT WILL NEED TO BE EXPORTED TO AN OFF SITE LOCATION, THE RESPONSIBILITY OF CLEAN FILL DETERMINATION AND ENVIRONMENTAL DUE DILIGENCE RESTS ON THE APPLICANT.
6. DEFINITIONS
   - 6.1. CLEAN FILL: UNCONTAMINATED, NON-WATER SOLUBLE, NON-DECOMPOSABLE, INERT, SOLID MATERIAL. THE TERM INCLUDES SOIL, ROCK, STONE, DREDGED MATERIAL, USED ASPHALT, AND BRICK, BLOCK OR CONCRETE FROM CONSTRUCTION AND DEMOLITION ACTIVITIES THAT IS SEPARATE FROM OTHER WASTE AND RECOGNIZABLE AS SUCH. THE TERM DOES NOT INCLUDE MATERIALS PLACED IN OR ON THE WATERS OF THE COMMONWEALTH UNLESS OTHERWISE AUTHORIZED. (THE TERM "USED ASPHALT" DOES NOT INCLUDE MILLED ASPHALT OR ASPHALT THAT HAS BEEN PROCESSED FOR RE-USE.)
     - 6.1.1. FILL MATERIAL THAT DOES NOT QUALIFY AS CLEAN FILL IS REGULATED FILL. REGULATED FILL IS WASTE AND MUST BE MANAGED IN ACCORDANCE WITH THE DEPARTMENT'S MUNICIPAL OR RESIDUAL WASTE REGULATIONS BASED ON PA CODE CHAPTERS 287 RESIDUAL WASTE MANAGEMENT OR 271 MUNICIPAL WASTE MANAGEMENT, WHICHEVER IS APPLICABLE.
     - 6.1.2. ANY PERSON PLACING CLEAN FILL THAT HAS BEEN AFFECTED BY A SPILL OR RELEASE OF A REGULATED SUBSTANCE MUST USE FORM FP-001 TO CERTIFY THE ORIGIN OF THE FILL MATERIAL AND THE RESULTS OF THE ANALYTICAL TESTING TO QUALIFY THE MATERIAL AS CLEAN FILL. FORM FP-001 MUST BE RETAINED BY THE OWNER OF THE PROPERTY RECEIVING THE FILL.
   - 6.2. ENVIRONMENTAL DUE DILIGENCE: ACCEPTABLE INVESTIGATIVE TECHNIQUES INCLUDE, BUT ARE NOT LIMITED TO, VISUAL PROPERTY INSPECTIONS, ELECTRONIC DATA BASE SEARCHES, REVIEW OF PROPERTY OWNERSHIP, REVIEW OF PROPERTY USE HISTORY, SANBORN MAPS, ENVIRONMENTAL QUESTIONNAIRES, TRANSACTION SCREENS, ANALYTICAL TESTING, ENVIRONMENTAL ASSESSMENTS OR AUDITS. ANALYTICAL TESTING IS NOT A REQUIRED PART OF DUE DILIGENCE UNLESS VISUAL INSPECTION AND/OR REVIEW OF THE PAST LAND USE OF THE PROPERTY INDICATES THAT THE FILL MAY HAVE BEEN SUBJECTED TO A SPILL OR RELEASE OF REGULATED SUBSTANCES. IF THE FILL MAY HAVE BEEN AFFECTED BY A SPILL OR RELEASE OF A REGULATED SUBSTANCE, IT MUST BE TESTED TO DETERMINE IF IT QUALIFIES AS CLEAN FILL. TESTING SHOULD BE PERFORMED IN ACCORDANCE WITH APPENDIX A OF THE DEPARTMENT'S POLICY "MANAGEMENT OF FILL".
7. FOR STRIP MINED AREAS, SOIL TESTING WILL BE DONE AT THE START OF EARTH DISTURBANCE ACTIVITIES TO DETERMINE THE FORMATION ACIDITY. IF IT IS FOUND THAT THE TOTAL SULFUR CONTENT EXCEEDS 0.5%, A LIME DOSAGE WILL BE APPLIED AT A RATE ACCORDING TO DEP PUBLICATION 5600-FS-DEP4284. THE REQUIRED LIMING RATE WILL ALSO BE APPLIED WHEN THE SITE IS RECLAIMED.

STANDARD E&S PLAN NOTES

1. ALL EARTH DISTURBANCES, INCLUDING CLEARING AND GRUBBING AS WELL AS CUTS AND FILLS SHALL BE DONE IN ACCORDANCE WITH THE APPROVED E&S PLAN. A COPY OF THE APPROVED DRAWINGS MUST BE AVAILABLE AT THE PROJECT SITE AT ALL TIMES. THE REVIEWING AGENCY SHALL BE NOTIFIED OF ANY CHANGES TO THE APPROVED PLAN PRIOR TO IMPLEMENTATION OF THOSE CHANGES. THE REVIEWING AGENCY MAY REQUIRE A WRITTEN SUBMITTAL OF THOSE CHANGES FOR REVIEW AND APPROVAL AT ITS DISCRETION.
2. AT LEAST 7 DAYS PRIOR TO STARTING ANY EARTH DISTURBANCE ACTIVITIES, INCLUDING CLEARING AND GRUBBING, THE OWNER AND/OR OPERATOR SHALL INVITE ALL CONTRACTORS, INSPECTORS, THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION TO AN ON-SITE PRECONSTRUCTION MEETING.
3. AT LEAST 3 DAYS PRIOR TO STARTING ANY EARTH DISTURBANCE ACTIVITIES, OR EXPANDING INTO AN AREA PREVIOUSLY UNMARKED, THE PENNSYLVANIA ONE CALL SYSTEM INC. SHALL BE NOTIFIED AT 1-800-242-1776 FOR THE LOCATION OF EXISTING UNDERGROUND UTILITIES.
4. ALL EARTH DISTURBANCE ACTIVITIES SHALL PROCEED IN ACCORDANCE WITH THE SEQUENCE PROVIDED ON THE PLAN DRAWINGS. DEVIATION FROM THE SEQUENCE MUST BE APPROVED IN WRITING BY THE DEPARTMENT PRIOR TO IMPLEMENTATIONS.
5. AREAS TO BE FILLED ARE TO BE CLEARED, GRUBBED, AND STRIPPED OF TOPSOIL TO REMOVE TREES, VEGETATION, ROOTS AND OTHER OBJECTIONABLE MATERIAL.
6. CLEARING, GRUBBING, AND TOPSOIL STRIPPING SHALL BE LIMITED TO THOSE AREAS DESCRIBED IN EACH STAGE OF THE CONSTRUCTION SEQUENCE. GENERAL SITE CLEARING, GRUBBING AND TOPSOIL STRIPPING MAY NOT COMMENCE IN ANY STAGE OR PHASE OF THE PROJECT UNTIL THE E&S BMPS SPECIFIED BY THE BMP SEQUENCE FOR THAT STAGE OR PHASE HAVE BEEN INSTALLED AND ARE FUNCTIONING AS DESCRIBED IN THE E&S PLAN.
7. AT NO TIME SHALL CONSTRUCTION VEHICLES BE ALLOWED TO ENTER AREAS OUTSIDE THE LIMIT OF DISTURBANCE BOUNDARIES SHOWN ON THE PLAN MAPS. THESE AREAS MUST BE CLEARLY MARKED BEFORE CLEARING AND GRUBBING OPERATIONS BEGIN.
8. TOPSOIL REQUIRED FOR THE ESTABLISHMENT OF VEGETATION SHALL BE STOCKPILED AT THE LOCATION(S) SHOWN ON THE PLAN MAP(S) IN THE AMOUNT NECESSARY TO COMPLETE THE FINISH GRADING OF ALL EXPOSED AREAS THAT ARE TO BE STABILIZED BY VEGETATION. EACH STOCKPILE SHALL BE PROTECTED IN THE MANNER SHOWN ON THE PLAN DRAWINGS. STOCKPILE HEIGHTS SHALL NOT EXCEED 35 FEET. STOCKPILE SLOPES SHALL BE 2H:1V OR FLATTER.
9. IMMEDIATELY UPON DISCOVERING UNFORESEEN CIRCUMSTANCES POSING THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION, THE OPERATOR SHALL IMPLEMENT APPROPRIATE BEST MANAGEMENT PRACTICES TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT POLLUTION AND NOTIFY THE REGIONAL OFFICE OF THE DEPARTMENT.
10. ALL OFF-SITE WASTE AND BORROW AREAS MUST HAVE AN E&S PLAN APPROVED BY THE LOCAL CONSERVATION DISTRICT OR THE DEPARTMENT FULLY IMPLEMENTED PRIOR TO BEING ACTIVATED.
11. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ANY MATERIAL BROUGHT ON SITE IS CLEAN FILL. FORM FP-001 MUST BE RETAINED BY THE PROPERTY OWNER FOR ANY FILL MATERIAL AFFECTED BY A SPILL OR RELEASE OF A REGULATED SUBSTANCE BUT QUALIFYING AS CLEAN FILL DUE TO ANALYTICAL TESTING.
12. ALL PUMPING OF WATER FROM ANY WORK AREA SHALL BE DONE ACCORDING TO THE PROCEDURE DESCRIBED IN THIS PLAN, OVER UNDISTURBED VEGETATED AREAS.
13. VEHICLES AND EQUIPMENT MAY NEITHER ENTER DIRECTLY NOR EXIT DIRECTLY FROM THE PROJECT SITE ONTO STATE OR MUNICIPAL ROADS. ONLY THE APPROVED ACCESS LOCATIONS DEPICTED ON THE PLANS SHALL BE UTILIZED.
14. UNTIL THE SITE IS STABILIZED, ALL EROSION AND SEDIMENT BMPS SHALL BE MAINTAINED PROPERLY. MAINTENANCE SHALL INCLUDE INSPECTIONS OF ALL EROSION AND SEDIMENT BMPS AFTER EACH RUNOFF EVENT AND ON A WEEKLY BASIS. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN OUT, REPAIR, REPLACEMENT, REGARDING, RESEEDING, REMULCHING AND RENETTING MUST BE PERFORMED IMMEDIATELY. IF THE E&S BMPS FAIL TO PERFORM AS EXPECTED, REPLACEMENT BMPS, OR MODIFICATIONS OF THOSE INSTALLED WILL BE REQUIRED.
15. E&S BMP INSPECTION REPORTS AS WELL AS ANY DEFICIENCIES FOUND AND THE DATE THEY WERE CORRECTED SHALL BE MAINTAINED ON THE SITE BY OWNER AND BE MADE AVAILABLE TO REGULATORY AGENCY OFFICIALS AT THE TIME OF INSPECTION.
16. SEDIMENT TRACKED ONTO ANY PUBLIC ROADWAY OR SIDEWALK SHALL BE RETURNED TO THE CONSTRUCTION IMMEDIATELY AND DISPOSED IN THE MANNER DESCRIBED IN THIS PLAN. IN NO CASE SHALL THE SEDIMENT BE WASHED, SHOVELED, OR SWEPT INTO ANY ROADSIDE DITCH, STORM SEWER, OR SURFACE WATER.
17. ALL SEDIMENT REMOVED FROM BMPS SHALL BE DISPOSED OF IN THE MANNER DESCRIBED ON THE PLAN DRAWINGS.
18. AREAS WHICH ARE TO BE TOPSOILED SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 3 TO 5 INCHES - 6 TO 12 INCHES ON COMPACTED SOILS - PRIOR TO PLACEMENT OF TOPSOIL. AREAS TO BE VEGETATED SHALL HAVE A MINIMUM OF 5 INCHES OF TOPSOIL IN PLACE PRIOR TO SEEDING AND MULCHING. FILL OUTSLOPES SHALL HAVE A MINIMUM OF 2 INCHES OF TOPSOIL.
19. ALL FILLS SHALL BE COMPACTED AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, SUBSIDENCE, OR OTHER RELATED PROBLEMS. FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES AND CONDUITS, ETC. SHALL BE COMPACTED IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES.
20. ALL EARTHEN FILLS SHALL BE PLACED IN COMPACTED LAYERS NOT TO EXCEED 9 INCHES IN THICKNESS.
21. FILL MATERIALS SHALL BE FREE OF FROZEN PARTICLES, BRUSH, ROOTS, SOD, OR OTHER FOREIGN OR OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
22. FROZEN MATERIALS OR SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS SHALL NOT BE INCORPORATED INTO FILLS.
23. FILL SHALL NOT BE PLACED ON SATURATED OR FROZEN SURFACES.
24. SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION SHALL BE HANDLED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS FOR SUBSURFACE DRAINS OR OTHER APPROVED METHOD.
25. ALL GRADED AREAS SHALL BE PERMANENTLY STABILIZED IMMEDIATELY UPON REACHING FINISHED GRADE. CUT SLOPES IN COMPETENT BEDROCK AND ROCK FILLS NEED NOT BE VEGETATED. SEEDED AREAS WITHIN 50 FEET OF A SURFACE WATER, OR AS OTHERWISE SHOWN ON THE PLAN DRAWINGS, SHALL BE BLANKETED ACCORDING TO THE STANDARDS OF THIS PLAN.
26. IMMEDIATELY AFTER EARTH DISTURBANCE ACTIVITIES CEASE IN ANY AREA OR SUBAREA OF THE PROJECT, THE OPERATOR SHALL STABILIZE ALL DISTURBED AREAS. DURING NON-GERMINATING MONTHS, MULCH OR PROTECTIVE BLANKETING SHALL BE APPLIED AS DESCRIBED IN THE PLAN. AREAS NOT AT FINISHED GRADE, WHICH WILL BE REACTIVATED WITHIN 1 YEAR, MAY BE STABILIZED IN ACCORDANCE WITH THE TEMPORARY STABILIZATION SPECIFICATIONS. THOSE AREAS WHICH WILL NOT BE REACTIVATED WITHIN 1 YEAR SHALL BE STABILIZED IN ACCORDANCE WITH THE PERMANENT STABILIZATION SPECIFICATIONS.
27. PERMANENT STABILIZATION IS DEFINED AS A MINIMUM UNIFORM, PERENNIAL 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED EROSION. CUT AND FILL SLOPES SHALL BE CAPABLE OF RESISTING FAILURE DUE TO SLUMPING, SLIDING, OR OTHER MOVEMENTS.
28. E&S BMPS SHALL REMAIN FUNCTIONAL AS SUCH UNTIL ALL AREAS TRIBUTARY TO THEM ARE PERMANENTLY STABILIZED OR UNTIL THEY ARE REPLACED BY ANOTHER BMP APPROVED BY THE DEPARTMENT.
29. AFTER FINAL SITE STABILIZATION HAS BEEN ACHIEVED, TEMPORARY EROSION AND SEDIMENT BMPS MUST BE REMOVED OR CONVERTED TO PERMANENT POST CONSTRUCTION STORMWATER MANAGEMENT BMPS. AREAS DISTURBED DURING REMOVAL OR CONVERSION OF THE BMPS SHALL BE STABILIZED IMMEDIATELY. IN ORDER TO ENSURE RAPID REVEGETATION OF DISTURBED AREAS, SUCH REMOVAL/CONVERSIONS ARE TO BE DONE ONLY DURING THE GERMINATING SEASON.
30. FAILURE TO CORRECTLY INSTALL E&S BMPS, FAILURE TO PREVENT SEDIMENT LADEN RUNOFF FROM LEAVING THE CONSTRUCTION SITE, OR FAILURE TO TAKE IMMEDIATE CORRECTIVE ACTION TO RESOLVE FAILURE OF E&S BMPS MAY RESULT IN ADMINISTRATIVE, CIVIL, AND/OR CRIMINAL PENALTIES BEING INSTITUTED BY THE DEPARTMENT AS DEFINED IN SECTION 602 OF THE PENNSYLVANIA CLEAN STREAMS LAW. THE CLEAN STREAMS LAW PROVIDES FOR UP TO $10,000 PER DAY IN CIVIL PENALTIES, UP TO $10,000 IN SUMMARY CRIMINAL PENALTIES, AND UP TO $25,000 IN MISDEMEANOR CRIMINAL PENALTIES FOR EACH VIOLATION.
31. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR OPERATOR SHALL CONTACT THE PA DEPARTMENT OF ENVIRONMENTAL PROTECTION FOR AN INSPECTION PRIOR TO REMOVAL/CONVERSION OF THE E&S BMPS.
32. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR OPERATOR SHALL CONTACT THE PA DEPARTMENT OF ENVIRONMENTAL PROTECTION TO SCHEDULE A FINAL INSPECTION.

SEQUENCE OF CONSTRUCTION

ALL EARTH DISTURBANCE ACTIVITIES WILL PROCEED IN ACCORDANCE WITH THE FOLLOWING SEQUENCE. DEVIATION FROM THE ESCP MUST BE APPROVED IN WRITING FROM THE ENGINEER.

1. AN ON-SITE PRECONSTRUCTION MEETING SHALL TAKE PLACE BEFORE STARTING ANY EARTH DISTURBANCE ACTIVITIES (INCLUDING CLEARING AND GRUBBING), AND THE OWNER AND/OR OPERATOR SHALL INVITE ALL CONTRACTORS INVOLVED IN THOSE ACTIVITIES, THE LANDOWNER, AND THE ENGINEER. PADEP SHALL BE NOTIFIED OF THE PRECONSTRUCTION MEETING AT LEAST SEVEN (7) DAYS BEFORE THE MEETING OCCURS.
2. AT LEAST SEVEN (7) DAYS BEFORE STARTING ANY EARTH DISTURBANCE ACTIVITIES, THE ENGINEER SHALL NOTIFY ALL APPROPRIATE MUNICIPAL OFFICIALS, PADEP, AND THE PENNSYLVANIA FISH AND BOAT COMMISSION (IF REQUIRED BY PERMIT), OF THE INTENT TO BEGIN CONSTRUCTION.
3. AT LEAST THREE (3) DAYS BEFORE STARTING ANY EARTH DISTURBANCE ACTIVITIES, ALL CONTRACTORS INVOLVED IN THOSE ACTIVITIES SHALL NOTIFY THE PENNSYLVANIA ONE CALL SYSTEM, INC. AT 1-800-242-1776 TO LOCATE EXISTING UNDERGROUND UTILITIES.
4. AT LEAST THREE (3) DAYS PRIOR TO COMMENCING BULK EARTH DISTURBANCE (AFTER PLACING THE ACCESS ROAD PERIMETER BMPS), ALL CONTRACTORS INVOLVED IN THOSE ACTIVITIES WILL NOTIFY PADEP.
5. MARK THE PROJECT LIMITS OF DISTURBANCE FOR THE PROJECT SITE.
6. INSTALL ORANGE EXCLUSION FENCING AROUND ADJACENT STREAMS, WETLANDS, PROPOSED INFILTRATION BMP PONDING AREAS, AND OTHER SENSITIVE AREAS FOR PROTECTION.
7. INSTALL THE ROCK CONSTRUCTION ENTRANCES (WEST OF SR 0087) AND ALL COMPOST FILTER SOCKS AS SHOWN ON THE DRAWINGS.

   NOTE: A TEMPORARY ACCESS ROUTE MAY BE UTILIZED ON APPROXIMATE EXISTING GRADE WITHIN THE WOODED AREA (EAST OF SR0087) TO PROVIDE ADEQUATE EQUIPMENT ACCESS DURING THE INSTALLATION OF PERIMETER EROSION AND SEDIMENT CONTROLS AND CHANNELS 1 - 3. TREE CLEARING MAY OCCUR, AS NEEDED, TO PROVIDE EQUIPMENT ACCESS; HOWEVER, GRUBBING SHALL OCCUR AT A LATER STAGE, AS OUTLINED IN THIS CONSTRUCTION SEQUENCE.
8. INSTALL CHANNELS 1-3 WITH ASSOCIATED RIPRAP PLUNGE POOLS.
9. IN ACCORDANCE WITH PENNDOT'S REQUIREMENTS, PERFORM THE BANK REMOVAL EXCAVATION AND INSTALL THE SITE ENTRANCE (STA. 0+00 TO -3+50) ALONG WITH THE 150-FOOT LONG ROCK CONSTRUCTION ENTRANCE (EAST OF SR 0087). THIS INCLUDES THE CONSTRUCTION OF CHANNEL 4, CHANNEL 5A, CHANNEL 7, AND A PORTION OF CHANNEL 5B. THIS ALSO INCLUDES THE CONSTRUCTION OF CULVERT 2 AND CULVERT 3 WITH ASSOCIATED RIPRAP PLUNGE POOLS.

   NOTE:
   a. THIS ENTRANCE AND ASSOCIATED SITE FEATURES MUST BE INSTALLED INITIALLY TO PROVIDE SITE ACCESS.

SITE WORK IS BROKEN INTO FOUR SUB-SEQUENCES BELOW THAT ARE INDEPENDENT OF ONE ANOTHER BUT MAY BE COMPLETED CONCURRENTLY. THESE SUB-SEQUENCES WILL BE COMPLETED IN AN ORDER DICTATED BY WEATHER AND OTHER FACTORS AT THE TIME OF CONSTRUCTION.

BOOSTER PUMP STATION PAD AND ACCESS ROAD (EAST OF SR 0087)

1. CLEAR AND GRUB WITHIN DISTURBANCE LIMITS (EAST OF SR 0087). STRIP TOPSOIL AND STOCKPILE AS CLEARING PROGRESSES.

   NOTE: TEMPORARY STABILIZATION MEASURES ARE TO BE IMPLEMENTED WHENEVER EARTHWORK ACTIVITIES AT A PARTICULAR LOCATION CEASE FOR MORE THAN 4 DAYS.
2. CONSTRUCT THE REMAINDER OF THE ACCESS ROAD AND ASSOCIATED SITE FEATURES EAST OF SR 0087 FROM THE SITE ENTRANCE TO THE BOOSTER PUMP STATION PAD (INCLUDING THE CHANNELS, CULVERTS, AND RIPRAP PLUNGE POOLS, WHERE INDICATED). STRIP THE TOPSOIL AS CONSTRUCTION PROGRESSES.

   NOTE: THE AREA EAST OF THE BOOSTER PUMP STATION PAD SHALL BE UTILIZED FOR TEMPORARY SOIL STOCKPILING, AND RE-WORKING (AS NEEDED).
3. CONSTRUCT THE BOOSTER PUMP STATION PAD AND PERMANENT STOCKPILE.
4. UPON REACHING FINISHED GRADES, SEED AND MULCH AS SPECIFIED ON THE DRAWINGS AND APPLY EROSION CONTROL PRODUCT AS SHOWN ON THE PLANS.

   NOTES:
   a. EVERY EFFORT MUST BE TAKEN TO AVOID EARTH DISTURBANCE AND EQUIPMENT TRACKING WITHIN THE PROPOSED INFILTRATION BERM AREAS, AND THE PROPOSED PONDING AREAS IMMEDIATELY UPGRADIENT OF THESE BMPS. THESE INSTALLATIONS MUST BE ACCOMPLISHED WITH CARE. ALL SOILS WITHIN THE BMP PONDING AREAS SHALL REMAIN UNCOMPACTED TO MAINTAIN THE DESIRED INFILTRATION WITHIN THE BMPS. A LICENSED PROFESSIONAL OR DESIGNEE SHALL MONITOR THE INSTALLATION OF THESE BMP FACILITIES.

   b. CULVERTS SHALL BE EXTENDED OR TEMPORARILY DIVERTED AWAY FROM THE BMP FACILITIES UNTIL THE DRAINAGE AREAS UPGRADIENT ARE STABILIZED. SEDIMENT ACCUMULATION SHALL BE AVOIDED IN THESE AREAS. ADDITIONAL FILTER SOCK MAY BE INSTALLED TO ACCOMPLISH THIS.

FRESHWATER INTAKE & WITHDRAWAL SYSTEM (WEST OF SR 0087)

1. CLEAR AND GRUB WITHIN DISTURBANCE LIMITS (WEST OF SR 0087). STRIP TOPSOIL AND STOCKPILE AS CLEARING PROGRESSES.

   NOTE: TEMPORARY STABILIZATION MEASURES ARE TO BE IMPLEMENTED WHENEVER EARTHWORK ACTIVITIES AT A PARTICULAR LOCATION CEASE FOR MORE THAN 4 DAYS.
2. CONSTRUCT THE FRESHWATER INTAKE AND WITHDRAWAL SYSTEM (INCLUDING THE WET WELL AND VALVE VAULT). STRIP THE TOPSOIL AS CONSTRUCTION PROGRESSES. (SEE NOTE B. BELOW).
3. UPON REACHING FINISHED GRADES, SEED AND MULCH AS SPECIFIED ON THE DRAWINGS AND APPLY EROSION CONTROL PRODUCT AS SHOWN ON THE PLANS AND ANYWHERE GRADE IS EQUAL TO OR GREATER THAN 3:1 AND ALL DISTURBED AREAS TO BE REVEGETATED WITHIN 50 FEET OF SURFACE WATERS.

   NOTES:
   b. REFER TO THE DRAWING DETAILS FOR SPECIFIC BMP INSTALLATION INSTRUCTIONS.

   c. EXCESS MATERIAL SHALL BE STOCKPILED AT THE LOCATIONS SHOWN ON THE DRAWINGS.

PERMANENT UNDERGROUND UTILITY CORRIDOR

1. CONSTRUCT THE UNDERGROUND UTILITY CORRIDOR (INCLUDING THE BURIED WATERLINE, NATURAL GAS PIPELINE, AND UTILITY CONDUIT) FROM THE BOOSTER PUMP STATION TO THE PROPOSED FUTURE TIE-IN / WESTERN TERMINUS. REGRADE AND REVEGETATE PIPELINE CORRIDOR WITH PERMANENT VEGETATION AS CONSTRUCTION PROGRESSES.

   NOTE: EXCLUSION FENCE SHALL BE INSTALLED AROUND ADJACENT STREAMS FOR PROTECTION. CARE MUST BE TAKEN TO ENSURE THAT NO VEHICLES OR CONSTRUCTION EQUIPMENT ENTER THE STREAMS ADJACENT TO THE PROJECT AREA. REFER TO THE DRAWINGS FOR EXCLUSION FENCE LOCATIONS.

UNDERGROUND FRESHWATER WITHDRAWAL SYSTEM PIPELINE

1. CONSTRUCT THE UNDERGROUND FRESHWATER WITHDRAWAL SYSTEM PIPELINE (INCLUDING THE BURIED WATERLINE, ELECTRICAL UTILITY LINE AND COMPRESSED AIR LINE) FROM THE INTAKE TO THE BOOSTER PUMP STATION. REGRADE AND REVEGETATE PIPELINE CORRIDOR WITH PERMANENT VEGETATION AS CONSTRUCTION PROGRESSES.

SITE STABILIZATION

TEMPORARY STABILIZATION - UPON TEMPORARY CESSATION OF AN EARTH DISTURBANCE ACTIVITY OR ANY STAGE OR PHASE OF AN ACTIVITY WHERE A CESSATION OF EARTH DISTURBANCE ACTIVITIES WILL EXCEED 4 DAYS, THE SITE WILL BE IMMEDIATELY SEEDED, MULCHED, OR OTHERWISE PROTECTED FROM ACCELERATED EROSION AND SEDIMENTATION PENDING FUTURE EARTH DISTURBANCE ACTIVITIES.

PERMANENT STABILIZATION - UPON FINAL COMPLETION OF AN EARTH DISTURBANCE ACTIVITY OR ANY STAGE OR PHASE OF AN ACTIVITY, THE SITE WILL IMMEDIATELY HAVE TOPSOIL RESTORED, REPLACED, OR AMENDED, SEEDED, MULCHED, OR OTHERWISE PERMANENTLY STABILIZED AND PROTECTED FROM ACCELERATED EROSION AND SEDIMENTATION.

1. STABILIZE WITH EROSION CONTROL MATTING ON STEEP SLOPES WHERE SPECIFIED ON THE DRAWINGS AND DETAILS, AND PROVIDE REVEGETATION OF PERMANENT, NATIVE AREAS AS SPECIFIED IN THE DRAWINGS AND LISTED IN SECTION 3.2. NOTE: ALL NON-GRAVEL AREAS WILL BE RECLAIMED TO MEADOW CONDITIONS, OR BETTER, AND WILL BE SEEDED AND MULCHED TO HELP STABILIZE THE DISTURBED AREAS.
2. CLEAN UP SITE TO SATISFACTION OF OWNER OR THEIR REPRESENTATIVE.
3. REMOVE TEMPORARY EROSION MEASURES WHEN PERMANENT STABILIZATION IS ACHIEVED. PERMANENT STABILIZATION IS DEFINED AS A MINIMUM UNIFORM 70% PERENNIAL VEGETATIVE COVER, WITH A DENSITY CAPABLE OF RESISTING ACCELERATED EROSION.
4. UPON COMPLETION OF EARTH DISTURBANCE ACTIVITIES AND INSTALLATION OF PERMANENT BEST MANAGEMENT PRACTICES, A NOTICE OF TERMINATION WILL BE SUBMITTED TO THE PADEP.

   NOTES:
   - ALL DISTURBED AREAS WILL BE STABILIZED IMMEDIATELY WITH ROCK AND/OR SEEDING AND MULCHING.
   - ONLY CLEAN, NON-POLLUTING MATERIALS WILL BE USED AS FILL. MINIMUM STONE SIZE SHOULD BE R-4, AS RATED BY THE NATIONAL STONE ASSOCIATION.
   - ALL EARTHMOVING ACTIVITIES MUST INCORPORATE MEASURES TO MINIMIZE ACCELERATED EROSION. THE ESCP MUST BE AT THE SITE OF ACTIVITY AT ALL TIMES AND AVAILABLE FOR INSPECTION BY A REPRESENTATIVE OF PADEP.
   - ALL EARTH DISTURBANCE ACTIVITIES WILL PROCEED IN ACCORDANCE WITH THE SEQUENCE PROVIDED IN THE PLAN DRAWINGS. DEVIATION FROM THE SEQUENCE MUST BE REDLINED AND INITIALED. PADEP WILL BE NOTIFIED SEVEN (7) DAYS PRIOR TO THE START OF THE PROJECT CONSTRUCTION AND PRIOR TO ANY PLAN CHANGES.

PERMANENT CONTROLS

AN EROSION CONTROL PRODUCT WILL BE INSTALLED ON ALL DISTURBED SLOPES STEEPER OR EQUAL TO 3:1, ALL AREAS OF CONCENTRATED FLOWS, AND DISTURBED AREAS WITHIN ONE HUNDRED (100) FEET OF STREAMS AND WETLAND CROSSINGS.

1. UPON FINAL COMPLETION OF AN EARTH DISTURBANCE ACTIVITY OR ANY STAGE OR PHASE OF AN ACTIVITY, THE SITE SHALL IMMEDIATELY HAVE TOPSOIL RESTORED, REPLACED, OR AMENDED, SEEDED, MULCHED, OR OTHERWISE PERMANENTLY STABILIZED AND PROTECTED FROM ACCELERATED EROSION AND SEDIMENTATION.
2. E&S BMPS SHALL BE IMPLEMENTED AND MAINTAINED UNTIL THE PERMANENT STABILIZATION IS COMPLETED. ONCE PERMANENT STABILIZATION HAS BEEN ESTABLISHED, THE TEMPORARY E&S BMPS SHALL BE REMOVED. ANY AREAS DISTURBED IN THE ACT OF REMOVING TEMPORARY E&S BMPS SHALL BE PERMANENTLY STABILIZED UPON COMPLETION OF THE TEMPORARY E&S BMP REMOVAL ACTIVITY.
3. FOR AN EARTH DISTURBANCE ACTIVITY OR ANY STAGE OR PHASE OF AN ACTIVITY TO BE CONSIDERED PERMANENTLY STABILIZED, THE DISTURBANCE AREAS SHALL BE COVERED WITH ONE OF THE FOLLOWING:
   - 3.1. A MINIMUM UNIFORM 70% PERENNIAL VEGETATIVE COVER, WITH A DENSITY CAPABLE OF RESISTING ACCELERATED EROSION AND SEDIMENTATION.
   - 3.2. AN ACCEPTABLE BMP WHICH PERMANENTLY MINIMIZES ACCELERATED EROSION AND SEDIMENTATION.
4. PERMANENT SEEDING AND MULCHING WILL BE INCORPORATED INTO THE OPERATIONS DURING THE APPROVED PLANTING SEASONS. SEED APPLICATION WILL BE WITH CYCLONE SEEDER, DRILL, OR CULTI-PACKER SEEDER. MULCH WILL BE SPREAD AND ANCHORED MECHANICALLY OR UNIFORMLY BY HAND.
5. ALL AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHALL BE STABILIZED BY APPLYING A SEED MIXTURE TO ESTABLISH AN EROSION-RESISTANT STAND OF VEGETATION IN THE LEAST AMOUNT OF TIME.
   - 5.1. ALL SEEDS, AS SPECIFIED, SHALL CONFORM TO THE PENNSYLVANIA SEED ACT OF 1965, AS AMENDED, AND REGULATIONS OF THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY.
   - 5.2. ALL SEEDS SHALL BE FURNISHED TO THE PROJECT SITE IN MIX PREPARED BY THE SEED PROCESSOR. THE MIX SHALL HAVE A CERTIFICATION TAG WHICH SHALL BE PRESENTED TO THE OWNER'S REPRESENTATIVE. THE MIXTURE SHALL BE AS FOLLOWS:
     - 5.2.1. NATIVE REVEGETATION (DISTURBED SITES AND STEEP SLOPES): SEE NATIVE SEEDING SCHEDULE ON THIS SHEET. THIS IS TO BE USED ON ALL DISTURBED AREAS.
   - 5.3. BEFORE SEEDING, APPLY THE FOLLOWING SOIL AMENDMENTS WITH TOPSOIL AND WORK INTO A FOUR-INCH TO SIX-INCH (4-6") SOIL DEPTH.
     - 5.3.1. APPLY 6 TONS OF AGRICULTURAL-GRADE LIMESTONE PER ACRE.
     - 5.3.2. APPLY NPK 10-20-20 FERTILIZER BY BROADCASTING AT A RATE OF 1,000 LBS/ACRE.
   - 5.4. THE PREPARED AREAS SHALL THEN BE SEEDED WITH THE SPECIFIED SEED BY MEANS OF A MECHANICAL HOPPER TYPE SEEDER AT THE RATE SPECIFIED IN THE NATIVE SEEDING SCHEDULE.
   - 5.5. THE SEED SHALL BE SOWN EVENLY IN TWO DIRECTIONS, WITH 1/2 OF THE SEED BEING SOWN IN A DIRECTION AT RIGHT ANGLES TO THE OTHER HALF. SEEDING SHALL BE DONE ON A DAY WHEN THERE IS NO WIND.
   - 5.6. AFTER SOWING THE SEED, THE AREA SHALL BE LIGHTLY RAKED TO COVER SEED TO AN AVERAGE DEPTH OF ONE-FOURTH INCH (1/4") AND ROLLED WITH A 200-POUND ROLLER. THE COMPLETED AREAS SHALL PRESENT A SMOOTH AND FINISHED APPEARANCE. THE SEEDING AND COMPACTING OF THE LARGE AREAS MAY BE ACCOMPLISHED BY USE OF A "GILL SEEDER" OR OTHER MECHANICAL SEEDER.
6. ALL EROSION AND SEDIMENTATION CONTROLS SHALL BE IMPLEMENTED IN ACCORDANCE WITH THE NATIONAL RESOURCE CONSERVATION SERVICE (NRCS) SOIL CONSERVATION SERVICE (SCS) STANDARD RECOMMENDATIONS AND THE PA DEP SOIL EROSION AND SEDIMENTATION POLLUTION CONTROL PROGRAM MANUAL. MEASURES PRESENTED HEREIN SHALL BE SUPPLEMENTED OR MODIFIED BY CONTRACTOR DURING THE WORK BASED ON ACTUAL SEQUENCE, TIMING, AND METHODS OF CONSTRUCTION AS NECESSARY TO COMPLY WITH PA DEP EROSION AND SEDIMENT CONTROL REQUIREMENTS.

MAINTENANCE PROGRAM

EROSION AND SEDIMENT CONTROL MEASURES WILL BE MAINTAINED ACCORDING TO THE APPLICABLE PADEP REQUIREMENTS AND STANDARD BEST MANAGEMENT PRACTICES. IN GENERAL, MAINTENANCE WILL INCLUDE INSPECTIONS ON A WEEKLY BASIS AND AFTER EACH STORMWATER EVENT, AND PERIODIC REMOVAL OF ANY SEDIMENT ACCUMULATED. COMPLETE DETAILS REGARDING MAINTENANCE OF EROSION AND SEDIMENT CONTROL MEASURES ARE PRESENTED ON THE ESCP DRAWINGS.

THE FOLLOWING MAINTENANCE PROGRAM WILL BE FOLLOWED UNTIL THE SITE IS COMPLETELY STABILIZED AFTER CONSTRUCTION. DURING CONSTRUCTION, THE CONTRACTOR WILL BE RESPONSIBLE FOR INSPECTION AND MAINTENANCE OF ALL E&S FEATURES.

1. ALL TEMPORARY E&S CONTROL MEASURES WILL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. ALL DEFECTIVE EROSION CONTROL MEASURES WILL BE REPAIRED IMMEDIATELY.

   a) *FILTER SOCKS*: SPLIT, TORN, UNRAVELING OR SLUMPING FILTER SOCKS WILL BE REPAIRED OR REPLACED. SEDIMENT WILL BE REMOVED WHEN ACCUMULATIONS REACH 1/2 THE DIAMETER OF THE FILTER SOCK.

   b) *EROSION CONTROL PRODUCT*: EROSION CONTROL PRODUCT DAMAGED BEFORE SUFFICIENT STABILIZATION OF UP-GRADIENT VEGETATION WILL BE IMMEDIATELY REPLACED.

   c) *ROCK CONSTRUCTION ENTRANCES (150-FOOT LONG OR WITH WASH RACKS)*: CONSTRUCTION ENTRANCE THICKNESS SHALL BE CONSTANTLY MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK. A STOCKPILE SHALL BE MAINTAINED ON SITE FOR THIS PURPOSE. DRAIN SPACE UNDER WASH RACK SHALL BE KEPT OPEN AT ALL TIMES. DAMAGE TO THE WASH RACK SHALL BE REPAIRED PRIOR TO FURTHER USE OF THE RACK. AT THE END OF EACH CONSTRUCTION DAY, ALL SEDIMENT DEPOSITED ON PAVED ROADWAYS SHALL BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE. CULVERTS SHOULD BE KEPT FREE OF OBSTRUCTIONS, INCLUDING BUT NOT LIMITED TO FILL, ROCKS, LEAVES, WOODY DEBRIS, ACCUMULATED SEDIMENT, EXCESS VEGETATION, AND CONSTRUCTION MATERIAL/WASTES.
2. ALL PERMANENT E&S CONTROL MEASURES SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT UNTIL FINAL STABILIZATION IS ACHIEVED AND THE NOTICE OF TERMINATION (NOT) FOR THE PERMIT IS APPROVED. ALL DEFECTIVE EROSION CONTROL MEASURES WILL BE REPAIRED IMMEDIATELY.

   a) *PERMANENT SEEDING*: SEEDING WILL BE APPLIED IN THE LOCATIONS AND RATES SPECIFIED ON THE DRAWINGS. SEEDED AREAS WILL BE INSPECTED ONCE STABILIZED, PRIOR TO LEAVING THE SITE, AT SIX MONTH INTERVALS FOR ONE YEAR, THEN YEARLY FOR EACH SUBSEQUENT YEAR. VEGETATION COVER AND SIGNS OF EROSION WILL ALSO BE CHECKED AND RE-SEEDED AND FERTILIZED, AS NECESSARY.

   OBSERVATION OF THE GROWTH OF DESIRED SPECIES AND WEED COMPETITION IS ESSENTIAL TO MAKING MAINTENANCE DECISIONS. ADHERE TO SUPPLIER'S MAINTENANCE DIRECTIONS FOR EACH SEED MIX.

   b) *CHANNELS AND CULVERTS*: THE DIMENSIONS OF THESE STRUCTURES WILL BE MAINTAINED. SEDIMENT DEPOSITS WILL BE REMOVED. DAMAGED LININGS WILL BE REPAIRED OR REPLACED. ALL CHANNELS AND CULVERTS SHOULD BE KEPT FREE OF OBSTRUCTIONS, INCLUDING BUT NOT LIMITED TO FILL, ROCKS, LEAVES, WOODY DEBRIS, ACCUMULATED SEDIMENT, EXCESS VEGETATION, AND CONSTRUCTION MATERIAL/WASTES. ALL CHANNELS AND CULVERTS WILL BE INSPECTED ON A WEEKLY BASIS AND AFTER EACH RUNOFF EVENT.

   c) *RIPRAP APRONS & PLUNGE POOLS*: DISPLACED RIPRAP IN THE APRONS & PLUNGE POOLS SHALL BE REPLACED IMMEDIATELY. THE MINIMUM POOL DEPTH SPECIFIED IN THE DRAWINGS SHOULD BE MAINTAINED. ANY ACCUMULATED SEDIMENT BUILDUP SHOULD BE REMOVED. ALL APRONS & PLUNGE POOLS SHALL BE INSPECTED ON AT LEAST A WEEKLY BASIS AND AFTER EACH RUNOFF EVENT.

   d) *WATERBARS*: SEDIMENT MUST BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE HEIGHT OF THE WATERBAR FILL BERM. MAINTENANCE OF WATERBARS AND THE SURROUNDING AREAS STABILIZED WITH VEGETATION SHALL BE PROVIDED UNTIL THE RIGHT-OF-WAY HAS ACHIEVED PERMANENT STABILIZATION. WATERBARS ON RIGHT-OF-WAY SHALL BE LEFT IN PLACE AFTER PERMANENT STABILIZATION HAS BEEN ACHIEVED, UNLESS IN AN AGRICULTURAL FIELD OR YARD.

MAINTENANCE FOR BOTH THE TEMPORARY AND PERMANENT E&S CONTROL BMPS WILL INCLUDE PROPER REMOVAL AND DISPOSAL OF MATERIALS IN THE PROJECT AREA. ACCUMULATED SEDIMENT WILL BE SPREAD WITHIN THE EASEMENT AREAS AND PREPARED FOR PERMANENT EROSION CONTROL MEASURES. NO SEDIMENT WILL BE PLACED WITHIN 100 FEET OF STREAMS, LAKES, PONDS, AND WETLANDS.

CONSTRUCTION WASTES, SUCH AS BUILDING MATERIALS, CONCRETE WASH WATER, SANITARY WASTES, ETC., SHALL BE REMOVED FROM THE SITE AND RECYCLED OR DISPOSED OF IN ACCORDANCE WITH THE PADEP'S SOLID WASTE MANAGEMENT REGULATIONS AT 25 PA. CODE 260.1 ET SEQ., 271.1, AND 287.1 ET SEQ. NO BUILDING MATERIALS OR WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURNED, BURIED, DUMPED, OR DISCHARGED AT THE SITE. THESE MATERIALS SHOULD BE RECYCLED WHERE FEASIBLE AND IS PREFERRED VERSUS DISPOSAL. WASTE MATERIALS COULD ADVERSELY IMPACT THE WATER QUALITY OF THE STREAMS, LAKES, PONDS, AND WETLANDS. IF THESE MATERIALS CANNOT BE RECYCLED, THEY MUST BE TRANSFERRED TO AN OFFSITE FACILITY, AND DISPOSED OF IN ACCORDANCE WITH PADEP REGULATIONS.

TEMPORARY CONTROLS

AN EROSION CONTROL PRODUCT WILL BE INSTALLED ON ALL DISTURBED SLOPES STEEPER OR EQUAL TO 3:1, ALL AREAS OF CONCENTRATED FLOWS, AND DISTURBED AREAS WITHIN FIFTY (50) FEET OF WATERS OF THE COMMONWEALTH.

1. UPON TEMPORARY CESSATION OF AN EARTH DISTURBANCE ACTIVITY OF ANY STAGE OR PHASE OF AN ACTIVITY WHERE A CESSATION OF EARTH DISTURBANCE ACTIVITIES WILL EXCEED 4 DAYS, THE SITE SHALL BE IMMEDIATELY SEEDED, MULCHED, OR OTHERWISE PROTECTED FROM ACCELERATED EROSION AND SEDIMENTATION PENDING FUTURE EARTH DISTURBANCE ACTIVITIES.
2. FOR AN EARTH DISTURBANCE ACTIVITY OR ANY STAGE OR PHASE OF AN ACTIVITY TO BE CONSIDERED TEMPORARILY STABILIZED, THE DISTURBED AREAS SHALL BE COVERED WITH ONE OF THE FOLLOWING:
   - 2.1. A MINIMUM UNIFORM COVERAGE OF MULCH AND SEED, WITH A DENSITY CAPABLE OF RESISTING ACCELERATED EROSION AND SEDIMENTATION.
   - 2.2. AN ACCEPTABLE BMP WHICH TEMPORARILY MINIMIZES ACCELERATED EROSION AND SEDIMENTATION.
3. BEFORE SEEDING, APPLY THE FOLLOWING SOIL AMENDMENTS WITH TOPSOIL AND WORK INTO A FOUR-INCH TO SIX-INCH (4-6") SOIL DEPTH.
   - 3.1. APPLY 1 TON OF AGRICULTURAL-GRADE LIMESTONE PER ACRE.
   - 3.2. APPLY NPK 10-10-10 FERTILIZER BY BROADCASTING AT A RATE OF 500 LBS/ACRE.
4. THOROUGHLY LOOSEN THE AREAS TO BE SEEDED BY AN APPROVED METHOD UNTIL THE TILLAGE IS ACCEPTED. IRREGULARITIES IN THE SURFACE, RESULTING FROM TILLAGE OR FROM OTHER OPERATIONS, SHALL BE SMOOTHED BEFORE SEEDING OPERATIONS BEGIN TO PREVENT THE FORMATION OF WATER-COLLECTING POCKETS.
5. ALL SEEDS SHALL BE FURNISHED TO THE PROJECT SITE IN MIX PREPARED BY THE SEED PROCESSOR. THE MIX SHALL HAVE A CERTIFICATION TAG WHICH SHALL BE PRESENTED TO THE OWNER'S REPRESENTATIVE. THE MIXTURE SHALL BE AS FOLLOWS:
   - 5.1. TEMPORARY MIXTURE: THIS MIX SHALL BE USED ON ALL AREAS TO BE SEEDED AFTER DISTURBANCE, BUT PRIOR TO IMPLEMENTATION OF PERMANENT CONTROL MEASURES.

MIX	% MIX	PURITY	GERMINATION
ANNUAL RYEGRASS	100%	95%	90%

6. THE PREPARED AREAS SHALL THEN BE SEEDED WITH THE SPECIFIED SEED BY MEANS OF A MECHANICAL HOPPER TYPE SEEDER AT THE RATE OF 50 LBS/ACRE.
7. THE SEED SHALL BE SOWN EVENLY IN TWO DIRECTIONS, WITH ONE-HALF (1/2) OF THE SEED BEING SOWN IN A DIRECTION AT RIGHT ANGLES TO THE OTHER HALF. SEEDING SHALL BE DONE ON A DAY WHEN THERE IS NO WIND.
8. AFTER SOWING THE SEED, THE AREA SHALL BE LIGHTLY RAKED TO COVER SEED TO AN AVERAGE DEPTH OF ONE-FOURTH INCH (1/4") AND ROLLED WITH A 200-POUND ROLLER. THE COMPLETED AREAS SHALL PRESENT A SMOOTH AND FINISHED APPEARANCE. THE SEEDING AND COMPACTING OF THE LARGE AREAS MAY BE ACCOMPLISHED BY USE OF A "GILL SEEDER" OR OTHER MECHANICAL SEEDER.

MULCHING

CLEAN OAT OR WHEAT STRAW SHALL BE FREE FROM MATURE SEED-BEARING STALKS OR ROOTS OF PROHIBITED OR NOXIOUS WEEDS AS DEFINED BY THE PENNSYLVANIA SEED ACT OF 1947. APPLY AT A RATE OF THREE (3) TONS PER ACRE (ONE-HUNDRED TWENTY-FIVE (125) POUNDS PER ONE-HUNDRED (100) SQUARE YARDS). PRECAUTIONS SHALL BE TAKEN TO STABILIZE THE MULCH UNTIL THE VEGETATIVE COVER IS ESTABLISHED. MULCH SHALL BE ANCHORED IMMEDIATELY AFTER APPLICATION TO PREVENT WINDBLOWN TRANSPORT.

MULCH SHALL BE PLACED OVER DISTURBED AREAS WITHIN FORTY-EIGHT (48) HOURS AFTER RAKING AND SEEDING OR PLANTING HAS BEEN PERFORMED. SALT HAY OR OTHER SALINE MARSH GRASSES ARE NOT ACCEPTABLE. THE MATERIAL SHALL BE APPLIED AT AN AVERAGE MINIMUM DEPTH OF TWO INCHES (2") LOOSE MEASUREMENT. CARE SHALL BE TAKEN WHEN PLACING THE MULCH SO AS NOT TO DISTURB THE SEEDED SURFACES. THE MULCH SHALL BE SECURED BY THE FOLLOWING METHOD, OR OTHER METHOD PRESENTED BY THE CONTRACTOR AND ACCEPTABLE TO THE OWNER'S REPRESENTATIVE.

1. AS AN ALTERNATIVE TO ECM, HYDROMULCH SHALL BE USED UNLESS SPECIFIED BY THE OWNER OR ENGINEER.
2. ROLL EROSION CONTROL MATTING MAY BE USED. IF THIS OPTION IS SELECTED, NAG S150BN OR APPROVED EQUAL SHALL BE USED. NAG S150BN SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
3. TERRA TACK II MAY BE USED TO SECURE MULCH. TERRA TACK II IS PRODUCED BY GRASS GROWERS OF PLAINFIELD, NEW JERSEY, AND SHALL BE APPLIED BY A HYDROSEEDER AS AN OVERSPRAY TO STRAW MULCH. TERRA TACK II SHALL BE MIXED AS PER THE MANUFACTURER'S INSTRUCTIONS AND SHALL BE APPLIED AT THE RATE OF FORTY-FIVE POUNDS (45 LBS) OF TERRA TACK II (PARTS A & B), SEVEN HUNDRED FIFTY (750) GALLONS OF WATER AND ONE HUNDRED FIFTY POUNDS (150 LBS) OF WOOD CELLULOSE FIBER PER ACRE. TERRA TACK II IN THE PREVIOUS MIX IS AN OVERSPRAY TO STRAW ONLY AND IS NOT MEANT AS A MULCH IN ITSELF.

DURING THE LIFE OF THE CONTRACT, PROPERLY CARE FOR ALL AREAS AND MULCHES, PERFORMING SUCH MULCHING AS NECESSARY TO PROVIDE PROTECTION FOR ESTABLISHED GROWTH ON THE TREATED AREAS.

PLANT MIX SCHEDULE

PLANTING ZONE	QUANTITY	SEED MIX	COMMENT
DISTURBED SITES	15 BULK POUNDS	NATIVE BIOMASS MIX	SEE COMMENTS 1 AND 2
AND STEEP	PER ACRE	FOR STRIP MINES & GAS	
SLOPES		PRODUCTION SITES	
		ERNMX-110	

NOTES:

1. REFER TO NATIVE SEEDING SCHEDULE FOR A LIST OF SPECIES CONTAINED WITHIN THE MIX.
2. DISTURBED SITES AND STEEP SLOPES MIX (NATIVE BIOMASS MIX FOR STRIP MINES & GAS PRODUCTION SITES) ERNMX-110 BY ERNST CONSERVATION SEEDS, 9006 MERCER PIKE, MEADVILLE, PA 16335, 1-800-873-3321, OR APPROVED EQUAL.
3. ALTERNATE SEED, LIME AND FERTILIZER SPECIFICATIONS MAY BE USED IN EXISTING AGRICULTURAL AREAS BASED ON LANDOWNERS REQUESTS.

NATIVE SEEDING SCHEDULE

COMMON NAME	SCIENTIFIC NAME	
DISTURBED SITES AND STEEP SLOPES		15 BULK POUNDS PER ACRE
BIG BLUESTEM	ANDROPOGON GERARDII	30%
SWITCHGRASS	PANICUM VIRGATUM	26%
RIVERBANK WILDRYE	ELYMUS RIPARIUS	12%
PARTRIDGE PEA	CHAMAECRISTA FASCICULATA	4%
SHOWY TICKTREFOIL	DESMODIUM CANADENSE	2%
COASTAL PANICGRASS	PANICUM AMARUM	26%

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL DEAN RACE
ENGINEER
NO. PE083105

This Drawing shall not be used for tender or construction unless sealed.

I do hereby certify to the best of my knowledge, information, and belief, that the E & S Control and PCSM/SR BMPs are true and correct, represent actual field conditions and are in accordance with the 25 Pa. Code Chapters 78 / 78a and 102 of the Department's rules and regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

MICHAEL DEAN RACE, PE - 083105

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No.	Revision	Date	By

AS NOTED
01/17/2020
190736
ALG
MDR
JAW

E&S DETAILS (SHEET 4 OF 4)
EROSION AND SEDIMENT CONTROL PLAN

LOYALSOCK / SHAWNEE FRESHWATER SYSTEM, PENNSYLVANIA GENERAL ENERGY COMPANY, L.L.C.
GAMBLE & PLUNKETTS CREEK TOWNSHIPS
LYCOMING COUNTY, PENNSYLVANIA

Sheet 11

APPENDIX C

Soil Survey Data

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Lycoming County, Pennsylvania

Loyalsock / Shawnee Freshwater System

January 6, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,900 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 40, 80, 160, 240

Feet: 0, 100, 200, 400, 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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:
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: Lycoming County, Pennsylvania
Survey Area Data: Version 14, Sep 17, 2019

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

Date(s) aerial images were photographed: May 25, 2010—Nov 11, 2016

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Bb	Barbour fine sandy loam, occasionally flooded	1.5	15.1%
MrB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony	0.2	1.8%
OxE	Oquaga and Lordstown very stony loams, 25 to 70 percent slopes	3.3	33.7%
TuB	Tunkhannock gravelly loam, 3 to 8 percent slopes	4.4	44.8%
W	Water	0.4	4.5%
Totals for Area of Interest		**9.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Lycoming County, Pennsylvania

Bb—Barbour fine sandy loam, occasionally flooded

Map Unit Setting

National map unit symbol: l2xs
Elevation: 1,000 to 1,170 feet
Mean annual precipitation: 38 to 46 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 140 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Barbour and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Barbour

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Reddish coarse-loamy alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 9 inches: fine sandy loam
H2 - 9 to 28 inches: fine sandy loam
H3 - 28 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Holly

Percent of map unit: 3 percent
Landform: Depressions
Down-slope shape: Concave

Across-slope shape: Concave
Hydric soil rating: Yes

MrB—Morris channery silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vxct
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Morris, extremely stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Morris, Extremely Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: channery silt loam
Bw - 5 to 12 inches: channery silt loam
Eg - 12 to 16 inches: channery silt loam
Bx - 16 to 60 inches: channery silt loam
C - 60 to 72 inches: channery loam

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 7.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Wellsboro, extremely stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope, head slope
Down-slope shape: Convex, concave
Across-slope shape: Convex, linear
Hydric soil rating: No

Norwich, extremely stony

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

OxE—Oquaga and Lordstown very stony loams, 25 to 70 percent slopes

Map Unit Setting

National map unit symbol: l2zp
Elevation: 700 to 1,800 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Oquaga and similar soils: 65 percent
Lordstown and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oquaga

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Reddish ablation till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery loam
Bw - 7 to 30 inches: very channery loam
R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 70 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Lordstown

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Till derived from sandstone and siltstone

Typical profile

A - 0 to 7 inches: channery loam
Bw - 7 to 26 inches: channery silt loam
C - 26 to 30 inches: very channery silt loam
2R - 30 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 70 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

TuB—Tunkhannock gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l2zz
Elevation: 700 to 2,000 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 46 to 55 degrees F
Frost-free period: 130 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Tunkhannock and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tunkhannock

Setting

Landform: Outwash terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Water sorted gravelly outwash derived from sandstone and siltstone and/or shale

Typical profile

H1 - 0 to 8 inches: gravelly loam
H2 - 8 to 30 inches: very gravelly sandy loam
H3 - 30 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: I307
Mean annual precipitation: 38 to 46 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

Custom Soil Resource Report
Map—Hydrologic Soil Group

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:
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: Lycoming County, Pennsylvania
Survey Area Data: Version 14, Sep 17, 2019

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

Date(s) aerial images were photographed: May 25, 2010—Nov 11, 2016

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Bb	Barbour fine sandy loam, occasionally flooded	B	1.5	15.1%
MrB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony	D	0.2	1.8%
OxE	Oquaga and Lordstown very stony loams, 25 to 70 percent slopes	C	3.3	33.7%
TuB	Tunkhannock gravelly loam, 3 to 8 percent slopes	A	4.4	44.8%
W	Water		0.4	4.5%
Totals for Area of Interest			**9.8**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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APPENDIX D

Geohazards Desktop Analysis

Geohazards Desktop Analysis

Pennsylvania General Energy Company, LLC

Loyalsock / Shawnee Fresh Water System

Plunketts Creek & Gamble Townships, Lycoming County, PA

December 2019

1. Introduction

The Geohazard Analysis Report has been prepared by ARM Group Inc. (ARM) for Pennsylvania General Energy Company, LLC (PGE) as a requirement of the ESCGP-3 Application for the above referenced project. The overall project includes a freshwater intake and withdrawal system, a 130' x 130' booster pump station pad and associated 0.1-mile long, 15-foot wide access road, and 0.3-mile permanent underground utility corridor that crosses Loyalsock Creek.

This report is based on a desktop review of publicly available geologic and soils resources. The following report is divided into the six sections as follows: Soils Mapping (Section 2.), Geologic Mapping (Section 3.), Geologic Hazard Description and Assessment (Section 4.), Report Limitations (Section 5.), and References Cited (Section 6.).

2. Soils Mapping

Based on NRCS Web Soil Survey, the project site and adjacent area are underlain by five soil map units as listed below:

1) Bb – Barbour fine sandy loam
2) MrB – Morris channery silt loam
3) OxE – Oquaga and Lordstown very stony loams, 25 to 70 percent slopes
4) TuB – Tunkhannock gravelly loam - 3 to 8% slopes
5) W – Water

Below is a brief NRCS summary of each soil mapping unit based on Web Soil Survey information:

Barbour fine sandy loam (Bb) – Very deep, well drained soils formed in recent alluvial deposits derived from areas of acid, reddish sandstone, siltstone, and shale.

nearly level or gently sloping soils on flood plain. Depth to bedrock is usually 60-100 inches.

Morris channery silt loam (MrB) – Very deep (>60 inches to BR), somewhat poorly drained (10 - 20 inches to SHWT) formed in glacial till developed from red sandstone, siltstone, and shale bedrock. Morris soils have a dense fragipan (Bx) layer from 25 to 56 cm (10 to 22 in) depth that restricts root penetration and water movement. Slopes range from 0 to 25 percent. Saturated hydraulic conductivity is moderately high or

high above the fragipan and is low or moderately low in the fragipan and substratum. Rock fragment contents range from 10 to 50%, being highest within the in Bx layer.

Oquaga and Lordstown very stony loams (OxE) – The Oquaga series consists of moderately deep, somewhat excessively drained and well drained soils formed in a thin mantle of till over sandstone, siltstone, and shale bedrock on nearly level to very steep uplands. The Lordstown series consists of moderately deep, well drained soils formed in till and cryoturbated material derived from siltstone and sandstone on bedrock-controlled landforms of glaciated dissected plateaus. They are nearly level to very steep soils on hillsides and hilltops.

Tunkhannock gravelly loam (TuB) – Very deep (BR 42 inches to >10 ft.), well to excessively well drained (SHWT at >40-60 inches) formed in water-sorted glacial material derived from reddish sandstone, siltstone, and shale. Permeability is moderately rapid in the solum and rapid in the substratum.

Water (W) – 100% Water (Loyalsock Creek).

3. Geological Mapping

The following narrative section provides geologic information for shallow bedrock stratigraphy and structure beneath the project site.

Stratigraphy

Based information provided Wells and Bucek the project area is underlain by Mississippian and Mississippian-Devonian aged bedrock in descending order as follows in Table 1.

Table 1
Summary of Bedrock Geology

Formation Name	Landscape / Approximate Elevation of Occurrence	Description / Thickness
Mauch Chunk Lower Member (Mmclm)	Ridgetop Area 1,500 to 1,700 ft. (aMSL).	Approx. equal amounts of light-olive-gray, dark-gray, and reddish-gray sandstone and shale and light-olive-gray siltstone. (~100 ft.)
Burgoon Upper and Lower Members (Mbl and Mbu)	Near ridgetop and upper sideslopes 1,100 to 1,600 ft. (aMSL)	Light gray to white sandstone (fine to medium grained); some conglomerate, minor siltstone and shale. Some mica; thin to thick bedded. (~300 ft.)
Huntley Mountain (MDhm)	Lower sideslopes and valley bottom 960 to 1,100 ft. (aMSL)	Light-gray, greenish-gray, olive-gray, minor reddish-gray resistant sandstone (~75%) with minor mudstone and siltstone. (~550 ft.)

At elevations below approximately 850 ft. (aMSL), glacial till and colluvial deposits mantle the side slopes and valley bottom per mapping completed by Wells and Bucek. In addition, the deposits are described as follows:

Table 2
Summary of Glacial and Colluvial Deposits.

Deposit Name/ Type	Landscape / Approximate Elevation of Occurrence	Description / Thickness
Alluvium and Outwash, Undifferentiated (QaO)	Valley Bottom 630-660 ft. (aMSL).	Well sorted stratified sand and gravel, fining upward. Well-rounded siltstone and sandstone. Underlies present floodplain of Loyalsock Creek. Bordered by steep escarpment separating the floodplain from the first outwash terrace. (~100 feet).
Glaciofluvial Terrace (Qgt1)	Valley bottom to lower sideslopes 660 - 730 ft. (aMSL)	Well sorted, very well rounded stratified sandy gravel and gravelly sand. Grain size decreases downstream. Mostly clastic sandstone or siltstone derived from upper Devonian and Mississippian bedrock. Three primary terrace levels recognized in Loyalsock Creek Valley. (~100 + ft.)
Colluvium (Qc)	Lower sideslopes 960 to 1,100 ft. (aMSL)	Crudely stratified, poorly to moderately well sorted mixture of clay, silt, sand and pebbles. Most clasts are angular or subangular. Materials are locally derived from bedrock and/or older unconsolidated surface deposits. Locally includes colluviated glacial drift. Occurs on lower slopes of stream valleys. Usually there is little or no break in slope at the contact with bedrock or other surface deposits. Often undercut or incised by streams. (1-10 ft.)
Colluvium, till, and bedrock - undivided. (rQct)	Upland / plateau landscapes at approximately 1,500+ ft. (aMSL).	Includes areas of mixed colluvium and till interspersed with areas of bed rock outcrops, bedrock float and regolith. Colluvium is crudely stratified, poorly sorted to moderately well sorted mixture of clay silt sand and pebbles. Clasts angular to sub angular and lithologically similar to underlying bedrock. Till has approximately equal proportions of clay, silt and sand, containing weathered pebbles and cobbles of diverse lithology. (highly variable)

The proposed freshwater intake structure is underlain by Alluvium and Outwash deposits (QaO) and underlying Huntley Mountain (MDhm) bedrock. The proposed pump station pad (approximately 740 ft. aMSL) and associated access road are underlain Huntley Mountain (MDhm) bedrock with intervening Glaciofluvial Terrace (Qgt1) and Colluvium (Qc) deposits overlying the MDhm bedrock.

Structure

Per information provided by Wells and Bucek, the Scofield Mountain Synclinal axis passes beneath the project site, at a bearing or strike of approximately N20°E. Near the proposed project area, the axis runs approximately parallel to Loyalsock Creek, positioned approximately 1,500 feet south of the creek. The axis plunges or tilts slightly to the northwest. Thus, bedrock along the axis will be nearly level or have a slight westerly dip (i.e. SW, NW or nearly due west). North of the axis (toward Loyalsock Creek) bedrock is dipping very gently to the SW. Along the banks of Loyalsock Creek, near the proposed stream intake, bedrock dips very gently nearly due southwest.

Wells and Bucek did not map or report any joints or faults within the project area. Numerous joint sets are mapped 3,000 to 5,000 feet east and west of the project area along deeply incised drainage courses. Wells and Bucek do not report any faulting of significance for the entire Montoursville North USGS Quadrangle.

Delano and Wilshusen report, in general, that Huntley Mountain Formation (MDhm) bedrock forms well-developed, steeply dipping joints and bedding plane openings. As noted in Table 1 above, the MDhm bedrock forms the lower valley wall slopes along Loyalsock Creek.

4. Geologic Hazard Description and Assessment

Section 4 provides ARM's assessment of 10 specific "geologic hazards" as listed by PADEP within Item 11 of Section 3 of the NOI Form for ESCGP-3 application. Refer also to Sheet 3 for a summary listing of these 10 geohazards. As noted below and in Sheet 3, two of the 10 listed hazards (Steep Slopes and Landslides) are identified as being present for the project area.

a. Steep Slopes.

Steep slopes are a concern for portions of the proposed utility corridor, where existing topographic slope are approximately 50%. The proposed water line (beginning at Loyalsock Creek) have slopes ranging from approximately two to 15%.

Proposed development activity will be minimized to the greatest extent possible on steep slopes. The proposed pipelines will be installed underground (perpendicular to contour on steep slopes) with limited tree clearing and/or earth disturbance expected. The pipelines will be installed using standard pipeline engineering practices. A proactive approach to erosion and sediment control will limit the impact of unforeseen runoff hazards.

b. Landslides

Delano and Wilshusen report that the project area, below contour elevations of 1,500 ft. (aMSL) extending to the banks of the Loyalsock Creek, lie within a "High Susceptibility Zone" (HSZ) for landslide occurrence. This rating or susceptibility is due the steep valley sides in the dissected Deep Valleys and Glaciated High Plateau

sections of the western part of the map area, which are underlain mostly by the Huntley Mountain and Catskill Formations. These surface materials are typically old alluvium, glacial tills, colluvium and residual soils. Debris slides, debris avalanches, rockslides, and rockfalls are the most common slope- failure types for these areas per Delano and Wilshusen.

This HSZ for landslides along Loyalsock Creek includes both Huntley Mountain Formation (MDhm)) and Burgoon Formation (Mbl and Mbu) bedrock. Delano and Wilshusen provide a detailed landslide inventory of approximately 90 USGS quadrangles in northcentral PA. This inventory identified approximately 1,300 landslides based on field work and desktop map review completed in 1984. Delano and Wilshusen identified 11 relatively small landslides in the Montoursville North USGS quadrangle. Two of these slides were mapped near the project area. One lies approximately 3,000 feet upstream (NE) of the project area, along the south side of the Loyalsock Creek. The second slide feature lies approximately 12,000 feet down stream along the northern side of Loyalsock Creek. These slides appear to be approximately one to four acres in area and are confined to areas immediately along outside bends of the stream bank.

Special attention will be paid during earthwork excavation in particular for all steep slope sections of the project site.

A desktop geotechnical review was performed for the booster pump station and access road. The underlying soils and bedrock are generally stable within the project area and where steep slopes are not present. Excavated soils should be re-worked and placed as compacted fill, while monitoring the moisture content. Oftentimes, especially in the winter, glacial till may be too wet to effectively place as fill. Toe keys with underdrains should also be installed along the booster pump station toe of slope. An experienced construction inspector or Geotechnical Engineer that is aware of the site conditions and design constraints for this project should be present during construction. All cut slopes were widened from 2H:1V to 2.5H:1V to alleviate slope stability concerns, in the event that seeps are encountered. Fill slopes will be placed at 3H:1V. The pump station building, and tank should be located on the eastern side of the pad, where the pad surface is at or near in-situ soil or bedrock (i.e. not in a fill condition).

c. *Karst Terrain / Sinkhole Formation*

No limestone/carbonate bedrock is mapped within bedrock layers which underlie the site (i.e., within ~500+ feet below ground surface). Thus, sinkhole formation related to limestone/carbonate type bedrock is not considered a concern. But, Wells and Bucek do note sinkholes/voids can be created when large Burgoon Formation sandstone blocks subside/move, in some situations resulting in the creation of subsurface voids or cavities. Close site inspections should be made in the area of project construction for these features. Burgoon Formation sandstones will only underlie proposed waterline construction areas within the upper elevations of the project area.

d. Radioactive Bearing Formations

Per the World Nuclear Association (2019), "All minerals and raw materials contain radionuclides of natural origin. The most important for the purposes of radiation protection are the radionuclides in the U-238 and Th-232 decay series. For most human activities involving minerals and raw materials, the levels of exposure to these radionuclides are not significantly greater than normal background levels and are not of concern for radiation protection. Long-lived radioactive elements such as uranium, thorium, and their decay products, such as radium and radon are examples of naturally occurring radioactive material (NORM).

Schultz (1999) indicates that uranium and associated thorium deposits occur primarily in Eastern and Central PA and can be associated with granites, gneiss, and marbles in southeastern PA and Devonian, Mississippian, and Triassic aged sandstones and shales of central and eastern PA. Per Shultz, uranium can be present in the Mississippian-aged Mauch Chunk Formation. Mauch Chunk Formation bedrock lies at the highest elevations of the project area. The uranium deposits reported by Schultz were found in Mauch Chunk bedrock in Carbon Co., PA, located approximately 70 miles southeast of the project site. No uranium /thorium deposits were reported to have been identified by Schultz in Lycoming Co.

e. Arsenic Bearing Formations

Per Gross (2013), arsenic is a naturally occurring trace element in rocks, it is commonly present as a trace component in naturally occurring minerals, such as sulfides (pyrite), hydrous metal oxides (iron oxides), coal, ironstones, clays, phosphates, silicates, and carbonates. Pyrite and iron oxides are important sources of elevated arsenic in groundwater because they are abundant in aquifers, leading to their dissemination throughout the aquifer matrix or accumulation in fractures, joints, or bedding planes.

Arsenic is more likely to occur as arsenate rather than arsenite (Gross, 2013). Arsenate is the less toxic of these two forms. Arsenite is formed in reducing groundwater conditions while arsenate within oxidizing groundwater conditions. ARM's geologic literature review did not identify any specific arsenic mineralogy for any onsite bedrock.

Based on information from Gross (Figure 5) for the project area, the predicted probability that arsenic concentrations in surficial and bedrock aquifer groundwater will be $\geq$ 4ug/L is 21-30%. The PADEP's maximum contaminant level for arsenic for public water supplies is 10 ug/L. Overall, there a appears to be a moderate to low risk of naturally occurring arsenic in bedrock, based on the relatively low groundwater arsenic concentrations as noted above.

f. Coal Seams / Acid Producing Rock (APR)

As noted in Section 3., no coal bearing units are mapped within the bedrock beneath the project area to depths of approximately 100 to 500 feet below ground surface. Per a PADEP "Coal Status Report" for the project area, the project area falls outside of the

Bituminous Coal Fields of Pennsylvania. Thus, no shallow or deep coal deposits are expected to be encountered or known to be present beneath the project area.

Per Sheetz and Ellsworth, Burgoon Formation sandstones encountered during Interstate 80 construction in the 1960's Centre Co. PA were found to have nodular pyrite present that was a significant APR source. Therefore, excavations into the Burgoon Formation sandstones at project site should be alert to this potential for encountering pyritic material.

g. Surface Coal Mining

ARM found no evidence of current or past surface coal mining for the project area.

h. Mine Spoil Dump Areas

ARM found no evidence of current or past mine spoil dump areas for the project area.

i. *Deep Coal Mining*

As noted in Item f. above, no coal units are mapped as present within or adjacent to the project area. Therefore, no deep coal mining is known or believed to have occurred within the project site or adjacent areas.

j. Abandoned Mine Drainage / Treatment Systems

ARM did not identify any current evidence or indications of abandoned mine drainage / treatment systems for the project area or adjacent areas.

5. Report Limitations
   a. This report has been prepared for PGE for the purposes of identifying potential geologic hazards related to surficial and near surface land development activities for the proposed Loyalsock / Shawnee Fresh Water System. The conclusions and recommendations of this study may not be appropriate for significantly varied site development plans or alternate locations, and ARM cannot be responsible for the failure of other parties to properly interpret, disseminate, implement, and/or modify the recommendations presented herein.
   b. This report is based on a limited review and interpretation of publicly available soils and geologic resource documents, as listed in Section 6 (References Cited) of the report.
   c. ARM assumes no responsibility for the accuracy or completeness of the Section 6 References.
   d. No site-specific geologic mapping, sampling, testing, etc. was performed by ARM as part of this assessment.
   e. This report is not intended to serve as a surface or subsurface geotechnical investigation report for the project site(s).

6. References Cited

a. Delano, H.L. and J. P. Wilshusen, "Landslide Susceptibility In The Williamsport 1 By 2-Degree Quadrangle, Pennsylvania", PA Bureau of Topographic and Geologic Survey; Environmental Geology Report 9, 1999.
b. Evans, Mara, Pennsylvania Department of Environmental Protection, District Mining Operations, "Coal Status Report for the PGE Proposed Loyalsock Intake", Prepared November 7, 2019.
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e. Sheetz, B.E. and C. Ellsworth; PA Department of Transportation, "Preliminary Assessment of Acid Producing Rock on Future PennDOT Construction" PennDOT/MATUC Work Order No. 5, June 8, 2007.
f. USDA Department of Natural Resources, "Web Soil Survey"; https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx
g. USGS and USEPA; "Geologic Radon Potential of EPA Region 3 Delaware Maryland Pennsylvania Virginia West Virginia"; Open-File Report #93-292-C; 1993.
h. Wells, R.B. and M. F. Bucek, "Geology And Mineral Resources Of The Montoursville North And Huntersville Quadrangles, Lycoming County, Pennsylvania", PA Bureau of Topographic and Geologic Survey; Atlas 143cd; 1980.
i. World Nuclear Association, http://www.world-nuclear.org/information-library/safety-and-security/radiation-and-health/naturally-occurring-radioactive-materials-norm.aspx; April 2, 2019

Respectfully submitted:
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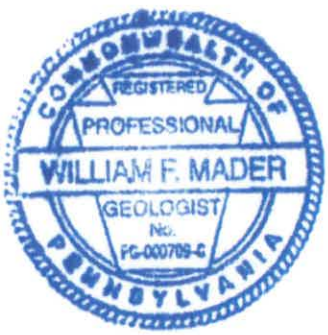

REQUIREMENT N

Hydrologic and Hydraulic Analysis

A R M G r o u p L L C

PROPOSED UTILITY CROSSING & FRESHWATER INTAKE CONSTRUCTION LOYALSOCK CREEK GAMBLE & PLUNKETTS CREEK TOWNSHIPS LYCOMING COUNTY, PA

Hydrologic & Hydraulic Evaluation Report

ARM Project 190736

Prepared for:

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December 2019

Proposed Utility Crossing & Freshwater Intake Construction
Loyalsock Creek
Gamble & Plunketts Creek Townships
Lycoming County, PA

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ATTACHMENTS

Attachment A USGS StreamStats Report ..... Following Text
Attachment B USGS Water-Year Summaries 2007-2019 ..... Following Text
Attachment C HEC-RAS Baseline Model ..... Following Text
Attachment D HEC-RAS Construction-Phase Encroachment Model ..... Following Text

1.0 INTRODUCTION

ARM Group LLC (ARM) has prepared this report for Pennsylvania General Energy (PGE) to summarize the findings and recommendations from a hydrologic and hydraulic (H&H) evaluation of the proposed Loyalsock Creek utility crossing site (the "Site") located in the area immediately upstream of Butternut Grove, Gamble Township, Lycoming County, Pennsylvania. This work was conducted to support the planning for proposed phased temporary coffer dams during the future construction of a new freshwater intake and two-phased utility line stream crossing. The scope of this project was based on ARM's Proposal P190997-R1.1 and subsequent discussions with PGE and the Pennsylvania Department of Environmental Protection {PADEP), and included a desktop H&H study, generation and calibration of a baseline (i.e., existing conditions) US Army Corps of Engineers (USACE) Hydraulic Engineering Center River Analysis System (HEC-RAS) hydraulic model, generation of a proposed construction-phase coffer dam scenario HEC-RAS hydraulic model, and compilation of this summary report. The primary purposes of this focused H&H study include: 1) evaluating the expected operational range (with respect to adjacent stream discharge and overtopping) of the proposed temporary 7-foot cofferdam structure to be selected by PGE; and 2) evaluating the expected temporary, construction-phase hydraulic impacts of the coffer dam stream encroachments on Loyalsock Creek.

1.1 Site Description

The proposed project site includes a short reach of the Loyalsock Creek in the area immediately upstream of Butternut Grove, Gamble Township, Lycoming County, Pennsylvania. The site is upstream of the confluence with Wallis Run, and downstream of the confluence with Dry Run. Loyalsock Creek represents the municipal boundary of Gamble Township (to the north-northwest, or right overbank area) and Plunketts Creek Township (to the south-southeast, or left overbank area). Coordinates of the proposed work site are approximately 41.35516° (latitude), -76.88876° (longitude).

1.2 Proposed Construction

The proposed construction consists of 1) the installation of a freshwater intake (i.e., proposed Loyalsock/Shawnee Freshwater System in Plunketts Creek Township, Lycoming County) utilizing a temporary coffer dam; and 2) a two-phased utility line stream crossing (i.e., open-cut installation) utilizing phased coffer dam extending from each stream bank (i.e., Gamble Township bank and Plunketts Creek Township bank), The construction will be facilitated by three separate temporary coffer dam set-ups (i.e., one for the freshwater intake installation, and one extending from each bank of Loyalsock Creek); at any given time during the construction, the expected worst-case coffer dam encroachment will maintain at least 80 feet of streambed flow width over the course of an approximately 6-week construction phase schedule. The construction is proposed to occur during the summer months, which anecdotally and statistically tend represent lower seasonal average flow rates than the computed annual means, as discussed herein.

2.0 HYDROLOGIC & HYDRAULIC (H&H) DATA REVIEW

2.1 Desktop Review References

ARM compiled and reviewed available published documents, including the following, to develop an initial understanding of the baseline conditions at the site:

- USGS StreamStats Report (Clicked Point: 41.35523, -76.88891), United States Geologic Survey (USGS), StreamStats (v. 4.3.11) Web-based Geographic Information Systems (GIS) application (https://streamstats.usgs.gove/ss/), accessed December 10, 2019.
- USGS 01552000 Loyalsock Creek at Loyalsockville, PA, United States Geologic Survey (USGS), National Water Information System: Web Interface (https://waterdata.usgs.gove/usa/nwis/uv?01552000), accessed December 2019.
- Flood Insurance Study (FIS), Lycoming County, Pennsylvania (All Jurisdictions), Federal Emergency Management Agency (FEMA), FIS No. 42081CV001C, revised June 2, 2016.
- Flood Insurance Rate Map, Lycoming County, Pennsylvania (All Jurisdictions), Federal Emergency Management Agency (FEMA), Panel 0290F, Map No. 42081C0290F, revised June 2, 2016.
- PAMAP Program Topographic Contours (2-ft Interval) of Pennsylvania and PAMAP Program 3.2 ft Digital Elevation Model of Pennsylvania, PA Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey; constructed from PAMAP LiDAR (Light Detection and Ranging) elevation points; collected between March 21 and May 2, 2006, published December 13, 2006
- USGS QL2 LiDAR for Lycoming County, PA, U.S. Geological Survey, collected between November 21 and December 21, 2017 (USGS Contract No. G16PC00016, Task Order No. G17PD01254, Contractor: Quantum Spatial, Inc.); published October 26, 2018.
- FEMA HEC-RAS v. 3.0 model for Upper Loyalsock Creek in Lycoming County, PA, completed as part of a 2003-2004 restudy of Loyalsock Creek, furnished to ARM by AECOM on December 19, 2019.
- Recent and historic aerial imagery available through the Pennsylvania Spatial Data Access (PASDA) PA Imagery Navigator (maps.psiee.psu.edu/imagery/Navigator/), accessed December 2019.
- Available Google Maps and Google Earth Imagery (1993 – 2019), accessed December 2019.

2.2 Available Hydrologic and Hydraulic Data Summary

ARM compiled, reviewed, and compared three primary sources of desktop hydrologic data: 1) the United States Geologic Survey (USGS) StreamStats Report (Version 4.3.11), included as Attachment A of this report; 2) the Federal Emergency Management Agency (FEMA) Flood Insurance Study No. 42081CV001C, dated June 2, 2016, and the associated Flood Insurance Rate Map (FIRM) Panel (Map No. 42081C0290F); and 3) electronically-available current and historic discharge and gage height data associated with the closest downstream USGS stream gage (i.e., USGS 01552000 Loyalsock at Loyalsockville, PA), which is approximately 30 feet

downstream from the State Highway 973 bridge at Loyalsockville, PA (approximately 3.6 miles downstream of the proposed project site).

ARM completed a Bulletin 17 statistical analysis of the available annual peak streamflow data recorded at USGS Stream Gage 01552000 (record extends from 1926 to 2019) utilizing the USACE Hydrologic Engineering Center Statistical Software Package (HEC-SSP); the resulting approximately 1-year to 500-year return period expected discharge values computed are presented in Table 2.2.1, below, for comparison with the available published FIS discharge values (associated with available effective flood mapping) and USGS StreamStats values (based on available regression equations for ungaged streams in Pennsylvania).

Table 2.2.1 – Summary of Peak Discharges by Source (Annual Peak Analyses)

Return Period (year)	USGS StreamStats Report*	FEMA FIS** at USGS Gage (*at Site*)	USGS Stream Gage 01552000 Bulletin 17***
1.01	N/A	N/A	5,705 cfs [4,631-6,714]
1.05	N/A	N/A	7,348 cfs [6,415-8,144]
1.11	N/A	N/A	8,507 cfs [7,631-9,322]
1.25	N/A	N/A	10,270 cfs [9,370-11,227]
2	11,600 cfs [76.1%]	N/A	15,247 cfs [13,875-16,753]
5	18,600 cfs [78.4%]	N/A	23,735 cfs [21,381-26,813]
10	24,100 cfs [79.0%]	28,400 / *26,400 cfs* [93.0% / 86.5%]	30,503 cfs [26,986-35,985]
50	38,700 cfs [79.0%]	44,700 / *41,600 cfs* [93.1% / 84.9%]	48,988 cfs [40,628-68,392]
100	46,000 cfs [78.6%]	53,100 / *49,500 cfs* [93.2% / 84.6%]	58,510 cfs [46,947-89,320]

* Peak-Flow Statistics Flow Report based on USGS Scientific Investigations Report 2008-5102. Percentages in brackets are relative to the computed Bulletin 17 discharge values based on the downstream USGS Gage data.

** Values from Table 6 of the FEMA FIS for 1) Loyalsock Creek at State Route 973 bridge (i.e., "at USGS Gage") and 2) Loyalsock Creek above Wallis Run (i.e., "at Site"). Percentages in brackets are computed as 1) FEMA FIS peak discharges at Site vs. at downstream USGS Gage, and 2) FEMA FIS peak discharge at Site vs. the computed Bulletin 17 discharge values based on the downstream USGS Gage data. The approximate drainage area of Loyalsock Creek at a) the USGS Gage is approximately 435 square miles, and b) the Site is approximately 394 square miles (90.6%).

*** Bulletin 17 statistical analysis based on available annual peak flow events recorded at downstream USGS Gage 01552000; includes computed value along with 5%/95% confidence limits range.

The statistical analyses and probabilistic data presented in Table 2.2.1. are primarily based on peak annual flow data (i.e., the peak flow rate recorded in a given year); however, based on the relatively short duration of the proposed construction, further evaluation and analysis of available recent and historic mean daily flow records is considered appropriate when evaluating and weighing expected risks.

ARM performed a similar probabilistic analysis of daily mean streamflow data (instead of peak annual streamflow data) recorded at USGS Stream Gage 01552000 using HEC-SSP. The results of this analysis are presented in Table 2.2.2, below.

Table 2.2.2 – Summary of Daily Mean Discharge Probabilities

Return Period (day)	At USGS Stream Gage 01552000*	Estimated at Site** (USGS Gage x 76%)	Estimated at Site** (USGS Gage x 93%)
1.01	19 cfs	14 cfs	18 cfs
1.05	67 cfs	51 cfs	62 cfs
1.11	126 cfs	96 cfs	117 cfs
1.25	245 cfs	186 cfs	228 cfs
2	601 cfs	457 cfs	559 cfs
5	1,178 cfs	895 cfs	1,096 cfs
10	1,790 cfs	1,360 cfs	1,665 cfs
20	2,711 cfs	2,060 cfs	2,521 cfs
50	4,353 cfs	3,308 cfs	4,048 cfs
100	5,994 cfs	4,555 cfs	5,574 cfs
200	8,013 cfs	6,090 cfs	7,452 cfs

* Computed expected daily mean discharge probabilities disclosed from HEC-SSP analysis of the available record daily mean discharge for USGS Stream Gage 01552000; includes full available record at site as of December 2019, not adjusted for seasonality.

** Estimated range of corresponding discharge probabilities at the upstream work site location based on computed reduction factors presented in Table 2.2.1.

ARM understands from anecdotal evidence from individuals well acquainted with the Loyalsock Creek that 1) the Creek should be considered relatively flashy (e.g., relatively rapid changes in the flow depth occur due to upstream rainfall events), and 2) seasonal influences are generally expected and the summer months tend to represent lower average flow conditions than other times of the year. ARM's review of the available data, including time series gage height information (disclosing flashiness) and Water-Year Summary Reports published by USGS from 2006 through 2019 at the downstream USGS Stream Gage 01552000 (disclosing apparent seasonal trends) is generally consistent with this anecdotal evidence, for example:

- The two surveyed water surface elevations that were noted in the field at the proposed work site (approximate elevation 637.35 ft on December 18, 2018, at 12:00 AM; and approximate elevation 636.51 ft on December 20, 2018, at 11:00AM) appear to correspond with approximately 10-day and 5-day return period events, respectively. However, available time series gage height data at the downstream USGS gage indicates there was a 6.6-ft rise at the USGS gage location over the course of a half day on December 21, 2018, the day after the field measurement were recorded, which supports the expected time-domain variability in water surface elevation of the stream (i.e., flashiness).

- ARM's review of the available USGS Water-Year Summaries for USGS 01552000 (published for water years 2006 through 2019) disclose statistics of monthly mean data for water years 1926 through 2019 (the tabulated summary table from the USGS Water-Year Summary 2019 report is reproduced below as Table 2.2.3, and is included in Attachment B, herein). According to these USGS summaries, the monthly mean discharge values tend to be lowest during the summer months (June through August), consistent with the anecdotal evidence. Relative to a criteria of 2,980 cfs (expected to represent the approximate functional limit of a 7-ft tall temporary construction-phase coffer dam system, as detailed in the next sections of this report), the daily mean discharge values presented in the 2006 through 2019 USGS Water-Data Reports indicate exceedances during these summer months occurred on the following dates:

    - August 13-16, 2018 (3,530 to 16,600 cfs);
    - August 3-5, 2018 (3,620 to 14,800 cfs);
    - July 24-27, 2018 (3,790 to 20,200 cfs);
    - July 24, 2017 (4,700 cfs);
    - July 1, 4-5, 2015 (3,610 to 4,410 cfs);
    - July 3, 2013 (3,270 cfs);
    - August 28-29, 2011 (5,430 to 8,620 cfs) [Hurricane Irene]; and
    - June 27-29, 2006 (3,720 to 13,600 cfs);

Table 2.2.3 – Monthly Mean Discharge Data Statistics for Water Years (WY) 1926 – 2019

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean (cfs)	531	840	941	830	820	1,433	1,510	945	510	316	314	353
Max (cfs)	2,512	2,856	3,033	3,070	2,960	4,490	4,236	2,693	4,327	2,050	3,204	4,550
WY	1991	1951	1974	1996	1981	1936	1993	1946	1972	2018	2018	2011
Min (cfs)	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
WY	1965	1965	1931	1931	1931	2006	1946	1941	1991	1962	1964	1964

Table reproduced from USGS Water-Year Summary for Site USGS 01552000 report, also included in full in Attachment B of this report.

Available hydraulic information and parameters (e.g., Manning's roughness coefficients for the channel and overbanks, etc.) from ARM's review of the previous 2003-2004 HEC-RAS model for the Upper Loyalsock Creek, provided by AECOM, as well as the effective FIS, were incorporated into ARM's current Site-specific hydraulic model (as discussed in the following sections of this report).

3.0 BASELINE HYDRAULIC MODEL GENERATION & CALIBRATION

3.1 Baseline Hydraulic Model Summary

ARM's baseline hydraulic model was generated in HEC-RAS (Version 5.0.6). The model consists of four cross sections:

- Cross Section 0.000: Downstream boundary condition, coincident with FEMA cross section "BM";
- Cross Section 1.000: Intermediate cross section between proposed work site and downstream boundary condition; location is based on an apparent slope change based on the available published 2017 LiDAR digital elevation model;
- Cross Section 2.000: Proposed crossing location / work site (i.e., approximate location of temporary coffer dams); also, approximately coincident with FEMA cross section "BN"; and,
- Cross Section 3.000: Upstream limit of study, approximately 150 feet upstream of the proposed work site.

The baseline HEC-RAS model geometry is presented in plan view overlain on available recent Google aerial imagery in Figure 3.1.1, which follows.

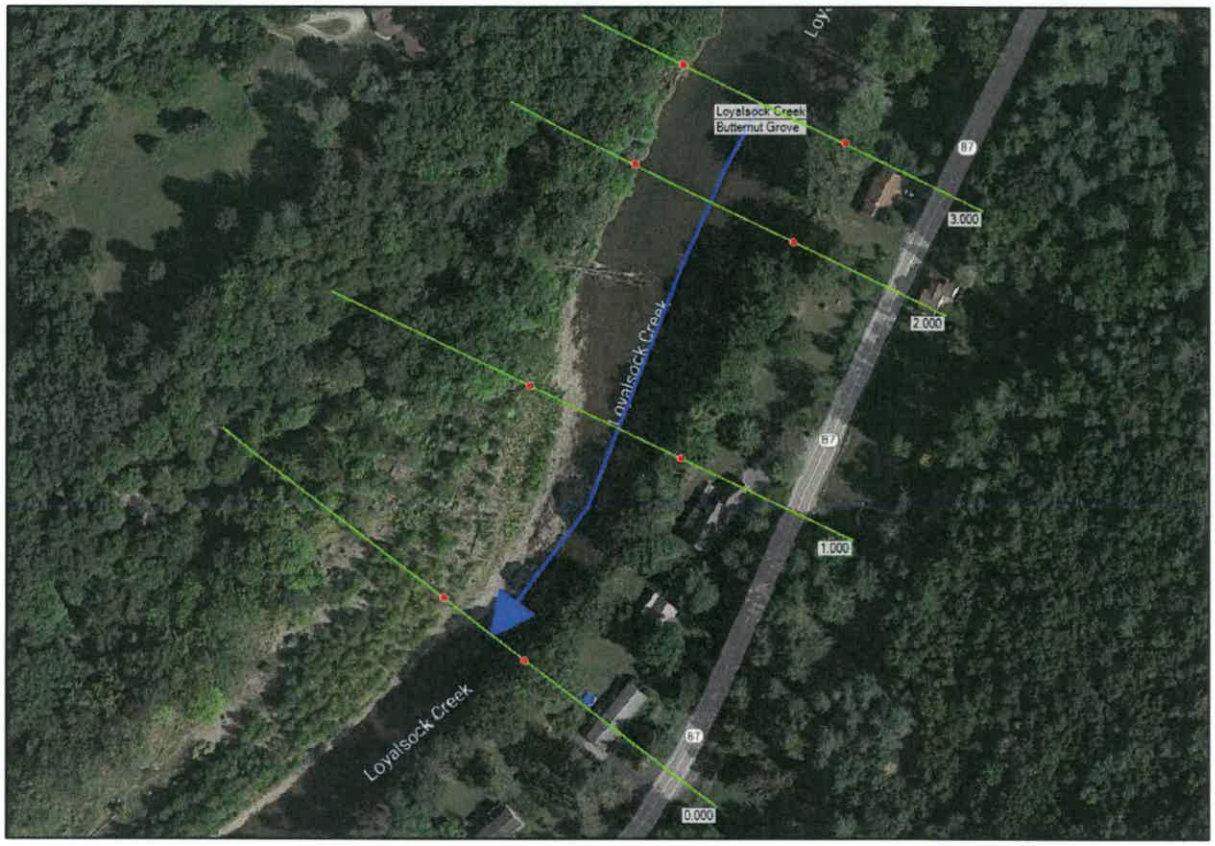


Figure 3.1.1. Plan view of HEC-RAS baseline model over available Google imagery

Cross sections 0.000, 1.000, and 3.000 were generated based on the published South Central Pennsylvania 2017 QL2 LiDAR; Bare Earth digital elevation model (DEM), available through the Pennsylvania Spatial Data Access (PASDA) PA Imagery Navigator Application. This LiDAR data was collected between November 21 and December 21, 2017, and at a time when Loyalsock Creek flow depths were relatively low. The stream bed elevation at cross section 0.000 was estimated based on the value included in the FEMA effective HEC-RAS model following conversion from NGVD 29 to NAVD 88; the stream bed elevations at cross sections 1.000 and 3.000 were estimated as nearly as reasonable based on the available information, as LiDAR does not penetrate water.

Cross section 2.000 (i.e., at the proposed work site) was generated based on a recent survey, including the existing stream bed profile, by Hawbaker Engineering, dated November 2019.

Manning's roughness coefficients ("n"-values) were reproduced directly from the FEMA effective HEC-RAS model. Channel "n"-values range between 0.043 and 0.045, and overbank "n"-values range between 0.10 and 0.12, consistent with the typical values for Loyalsock Creek that are presented within the text of the published FEMA FIS.

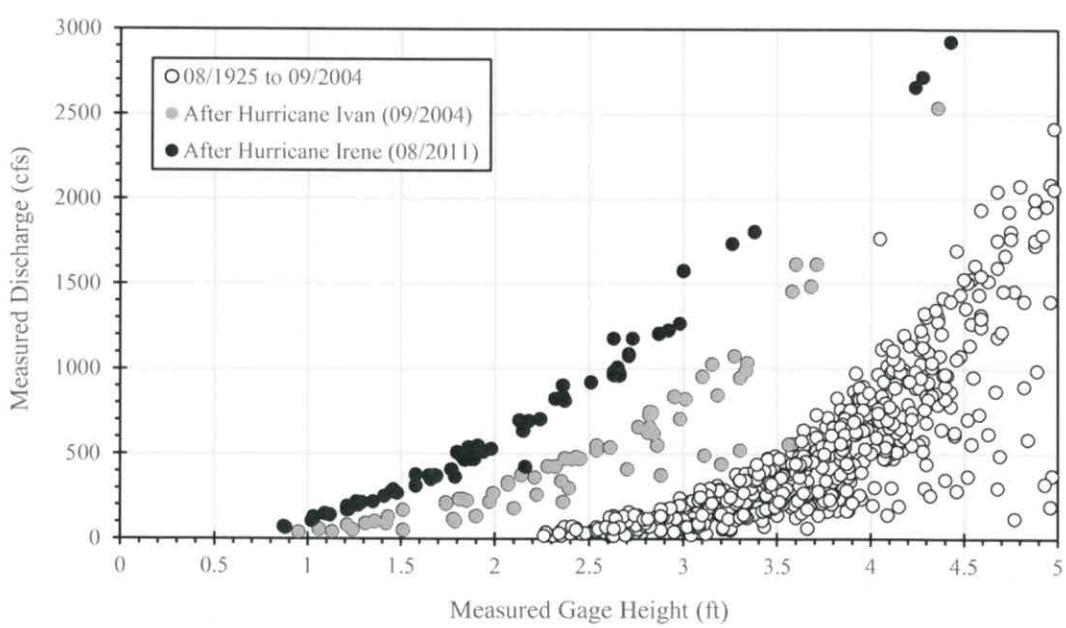
3.2 Model Calibration

The baseline HEC-RAS model was calibrated based on three available events where reasonable estimates of discharge vs. water surface were identified for various cross sections:

- 10-year storm event based on the published effective FEMA FIS; high flow event
- 2006 LiDAR (March 21 – May 2, 2006), intermediate flow event
- 2017 LiDAR (November 21 – December 21, 2017), low flow event

The relationship of water surface elevation vs. discharge for the high flow event was derived directly from the FEMA FIS, particularly at cross sections 0.000 and 2.000, which are approximately coincident with FEMA cross sections "BM" and "BN". Observed water surface elevations for the low flow event and intermediate flow event were derived directly from the respective LiDAR digital elevation models, which include reflections off the approximate instantaneous water surface elevation at the time the LiDAR was collected.

Flow rates for the low flow event and intermediate flow event were estimated based on ARM's analysis of the concurrent LiDAR-derived water surface elevation at the location of the downstream USGS Stream Gage paired with a review of published USGS measurements comparing historic gage heights with stream flow at the same Gage Station. As illustrated on Graph 3.2.1, although historic observed streamflow vs. gage height data is available for the Gage Station since 1925, notable shifts in the long-term trends were realized following Hurricane Ivan (2004) and, most recently, Hurricane Irene (2011).



Graph 3.2.1 – Historic Discharge vs. Gage Height Measurements at USGS 01552000.

Based on the post-Hurricane Irene data, which includes USGS field measurements through December 2019, the low flow event corresponds with a discharge of approximately 100 to 140 cfs at the USGS Gage location, and the intermediate flow event corresponds with a discharge of approximately 2,000 to 2,400 cfs at the USGS Gage location.

Utilizing discharge at ARM's HEC-RAS study area as a fine-tune calibration term, best fits to iteratively match the LiDAR-derived "observed" water surface elevations at cross sections 2.000 and 3.000 for the low flow event and intermediate flow event were 93 cfs and 2,170 cfs, respectively. Relative to the interpolated values at the USGS Gage, these computed discharge values at the study site correspond with similar reduction factors and appear reasonably realistic and logical based on the available information. Based on these cumulative analyses and data review, the following rating curve (summarized in Table 3.2.1) is included for computation of the downstream reach boundary condition in ARM's subcritical, steady flow HEC-RAS model.

Table 3.2.1 – Steady Flow Boundary Conditions Rating Curve for ARM's HEC-RAS model

Stage (ft)	Flow (cfs)
629.83	0
631.70	93
635.95	2,170
645.64	26,400

The HEC-RAS information and output data for ARM's calibrated baseline model (e.g., profiles, cross sections, and summary table) are included as Attachment C of this report.

4.0 CONSTRUCTION-PHASE COFFER DAM ENCROACHMENT MODEL

4.1 HEC-RAS Model Adjustments for Proposed Construction-Phase Geometry

A copy of the baseline HEC-RAS model geometry file was updated to represent the theoretical worst-case coffer dam encroachment during the proposed construction. This was accomplished through the following adjustments:

- A levee was added to cross section 2.000 (i.e., the work site location) to represent the proposed coffer dam such that the approximate remaining channel width is 80 feet (similar to the maximum coffer dam encroachment during installation of the two-phase utility crossing installation). The top elevation of the levee is modelled as 640.5 feet, based on the proposed coffer dam height of 7 feet, and an approximate average streambed elevation of 633.5 feet within the work site.

- An ineffective flow area was designated for the area within the modelled levee (i.e., within the coffer dam) should water overtop the levee in the model.

- The contraction and expansion coefficients for cross sections 2.000 and 3.000 were increased from 0.1 and 0.3 to 0.3 and 0.5, respectively to represent the anticipated energy losses due to the relatively abrupt channel contraction in the area of the temporary coffer dam (similar to values used during bridge contraction modelling).

4.2 Summary of Proposed Construction-Phase Coffer Dam Model Results

A steady flow profile, labeled "Coffer Dam Analysis" was added to the HEC-RAS model steady flow file. An iterative process was used to vary the discharge value of this profile until the computed water surface elevation of the constricted model at the upstream cross section (i.e., 3.000) equaled elevation 640.5 feet (i.e., the approximate top of levee). Based on this analysis, a flow rate of approximately 2,980 cfs represents the estimated peak discharge prior to overtopping of the temporary 7-ft coffer dam.

A summary of the computed water level rises (relative to the baseline condition) upstream of the temporary coffer dam and due to the contracted channel is included as Table 4.2.1, below. Furthermore, the HEC-RAS information and output data for ARM's proposed construction-phase coffer dam model (e.g., profiles, cross sections, and summary table) are included as Attachment D of this report.

Table 4.2.1 – Summary of Computed Water Level Rises Upstream of Temporary Coffer Dam

Flow Profile	Discharge (cfs)	Baseline Water Surface Elevation* (ft)	Coffer Dam Contraction Water Surface Elevation* (ft)	Increase (ft)
Low Flow Condition	93	635.06	635.67	0.61
Intermediate Flow Condition	2,170	638.04	639.57	1.53
Coffer Dam Peak Flow	2,980	638.69	640.50	1.81
FEMA 10-yr Flow**	26,400	647.99	648.05	0.06

* Computed water surface elevation at cross section 3.000 (immediately upstream of temporary coffer dam)

** Note that this scenario represents a hypothetical condition where the temporary coffer dam is significantly overtopped (i.e., beyond the intended functional limit of the temporary coffer dam); minor water level increase is associated with the minor velocity decrease due to the ineffective flow zone within the coffer dam, which presumes the integrity of the coffer dam system is maintained during a hypothetical higher-return period storm event.

As discussed herein, and based on the available data, a flow rate of 2,980 cfs is expected to represent an approximately 30- to 42-day return period event on the Loyalsock Creek at the proposed work site, disregarding apparent seasonal trends indicating lower average flows during the summer months (as discussed previously).

5.0 CONCLUSIONS

ARM's H&H evaluation and HEC-RAS modeling of the Site, as presented herein, indicates that PGE's selected 7-ft tall temporary, construction phase coffer dam with top elevation 450.5 feet, is expected to generally function as intended (i.e., without overtopping) when subjected to stream flows of less than or equal to approximately 2,980 cfs (i.e., an approximately 30- to 42-day return period event on the Loyalsock Creek at the proposed work site). Relative to the baseline condition, the channel contraction due to the "worst case" temporary coffer dam geometry (i.e., maintaining an 80-ft minimum channel bed flow width on the Loyalsock Creek) is expected to cause up to an approximately 1.81 ft increase in the water surface elevation in the area immediately upstream of the coffer dam when subjected to stream flows of less than or equal to approximately 2,980 cfs. The corresponding flow profile upstream of the temporary coffer dam is expected to mimic a M1 curve (mild channel slope, type 1 curve where the actual flow depth is greater than both the critical flow depth and the normal flow depth, representing pooled, subcritical flow); this approximately horizontal M1 curve (i.e., wedge shape above the baseline flow profile) is expected to gradually grade back into the normal flow depth condition within approximately 1,700 to 2,300 feet upstream of the coffer dam (based on an average energy grade line slope of 0.000848 ft/ft, from the baseline model at river station 3.000), near the upstream horizontal curve in the Loyalsock Creek and downstream of the confluence of Dry Run.

The Loyalsock Creek should be regarded as flashy, and construction planning should appropriately consider and weigh the potential for and implications of relatively rapid increases in water level due to upstream rainfall events. Available data published by the USGS at the downstream Stream Gage support anecdotal evidence that the summer months (i.e., proposed construction schedule) tend to experience lower daily mean flowrates on average due to seasonal influences. However, daily mean flow rates recorded at the downstream USGS Gage indicate exceedances of 2,980 cfs occurred on approximately 20 days between 2006 and 2019 (on a daily mean basis). It is possible that some additional "instantaneous" flow rate exceedances have occurred throughout time given the apparent flashiness of the Loyalsock Creek; however, review of the available published daily mean flow rates indicates the approximately 20 days mentioned above.

Based on the available published data and the information provided herein, and in consideration of the relatively limited duration of the proposed construction, PGE's preferred 7-ft high coffer for the proposed construction appears to represent a reasonable and appropriate balance between expected flow exceedance risks and anticipated construction costs. However, PGE must understand that, regardless of recent and historic trends and averages, the occurrence of future storms is indeterminate; furthermore, return periods are meant to represent the estimated probability that a storm will occur on any given year (e.g., a 10-year return period event has a 10% chance of occurrence/exceedance during any given year) or day (e.g., 30-day return period

event has a 3.3% chance of occurrence/exceedance during any given day), and multiple return period events can occur within a given time interval (e.g., multiple 1-year return period events can occur within a 1 year window). As such, ARM does not and cannot guarantee that the proposed 7-ft high system will not overtop during the future construction. Coffer dam system selection for short-term construction projects within streams should inherently include a cost-risk analysis, and contingencies and planning for potential overtopping events should be incorporated into the construction planning, as appropriate.

6.0 LIMITATIONS

This report and associated details are for informational purposes only and should not be considered part of the contract documents for project construction. The opinions expressed in this report are those of the Engineer, and represent his interpretation of the conditions, available published data referenced herein, tests, and the results of the analyses conducted. Should the data presented in this report not be adequate for the Contractor's purposes, the Contractor shall make, prior to bidding, his own investigation, tests and analyses. Based on the inherent variability in hydrologic and hydraulic conditions and the interpolation of information, actual conditions could vary from those estimated herein. ARM will not be responsible for any such differences and/or associated cost implications, if any.

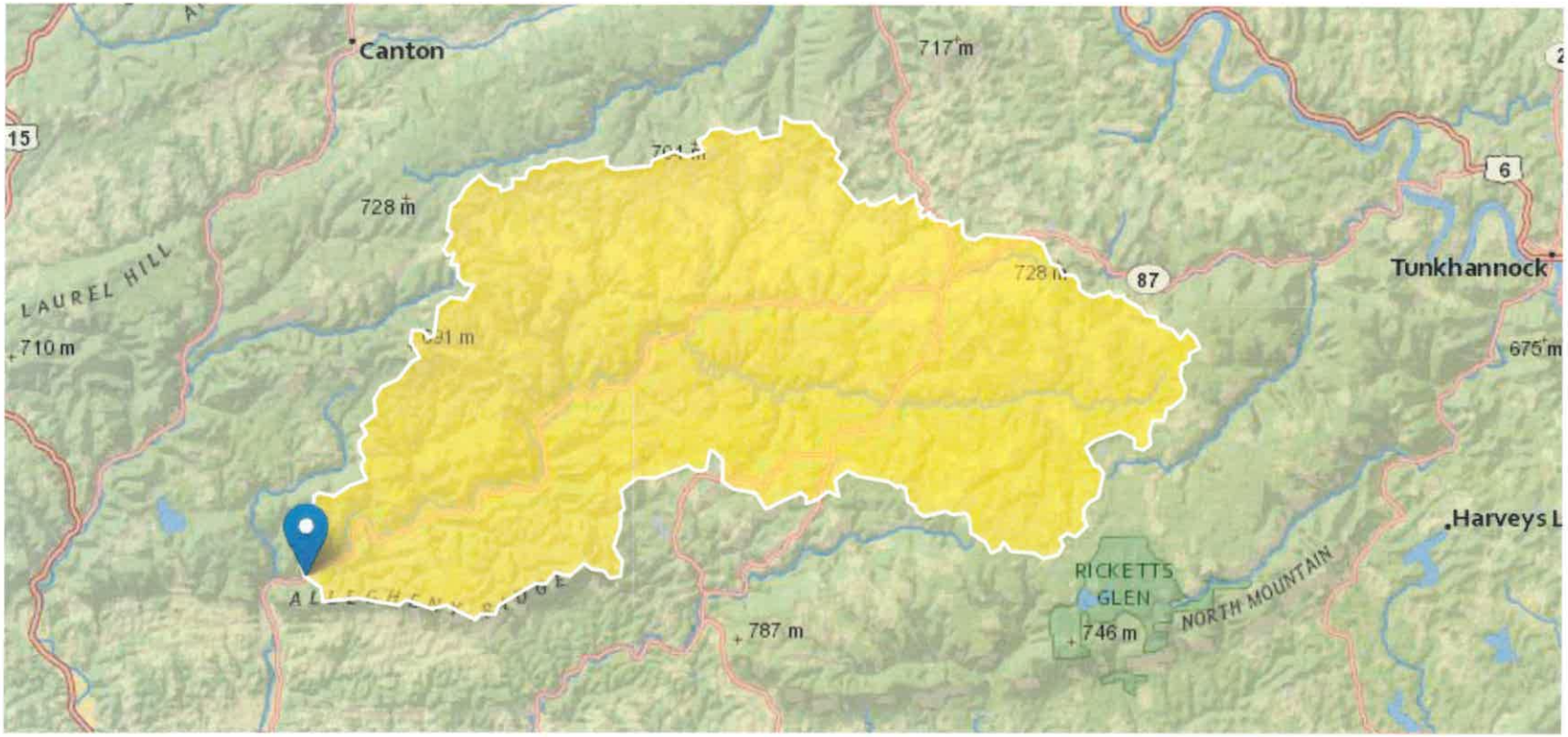
Any use of this report by others is considered to be a recognition and acceptance of the potential for overtopping of or damage to the proposed coffer dam at this site during construction, and the risks and associated costs for addressing such events lies solely with the project Owner, developer, and/or construction contractor as applicable. ARM's evaluation activities and recommendations are intended to help understand and quantify the expected risks in association with this project and any associated response costs, but no guarantee or warranty, either express or implied, is made by ARM through the issuance of this report.

ATTACHMENT A

USGS StreamStats Report

StreamStats Report

Region ID: PA
Workspace ID: PA20191210184731268000
Clicked Point (Latitude, Longitude): 41.35523, -76.88891
Time: 2019-12-10 13:47:47 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLOPD	Mean basin slope measured in degrees	8.6	degrees
BSLOPDRAW	Unadjusted basin slope, in degrees	8.87	degrees
CARBON	Percentage of area of carbonate rock	0	percent
CENTROXA83	X coordinate of the centroid, in NAD_1983_Albers, meters	119418.6	meters
CENTROYA83	Basin centroid horizontal (y) location in NAD 1983 Albers	275381	meters
DRN	Drainage quality index from STATSGO	4	dimensionless
DRNAREA	Area that drains to a point on a stream	394	square miles
ELEV	Mean Basin Elevation	1714.9	feet
FOREST	Percentage of area covered by forest	88	percent
GLACIATED	Percentage of basin area that was historically covered by glaciers	98	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	0	percent
LC01DEV	Percentage of land-use from NLCD 2001 classes 21-24	3	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	2.65	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.22	percent
LONG_OUT	Longitude of Basin Outlet	-76.88889	degrees
MAXTEMP	Mean annual maximum air temperature over basin area from PRISM 1971-2000 800-m grid	54	degrees F
OUTLETXA83	X coordinate of the outlet, in NAD_1983_Albers,meters	92965	meters
OUTLETYA83	Y coordinate of the outlet, in NAD_1983_Albers, meters	262105	meters
PRECIP	Mean Annual Precipitation	40	inches
ROCKDEP	Depth to rock	4.4	feet

Parameter Code	Parameter Description	Value	Unit
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	1	percent
STRDEN	Stream Density -- total length of streams divided by drainage area	1.77	miles per square mile
STRMTOT	total length of all mapped streams (1:24,000-scale) in the basin	698.56	miles
URBAN	Percentage of basin with urban development	0	percent

Low-Flow Statistics Parameters[100 Percent (393 square miles) Low Flow Region 2]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	394	square miles	4.93	1280
PRECIP	Mean Annual Precipitation	40	inches	35	50.4
STRDEN	Stream Density	1.77	miles per square mile	0.51	3.1
ROCKDEP	Depth to Rock	4.4	feet	3.32	5.65
CARBON	Percent Carbonate	0	percent	0	99

Low-Flow Statistics Flow Report[100 Percent (393 square miles) Low Flow Region 2]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp
7 Day 2 Year Low Flow	51.3	ft^3/s	38	38
30 Day 2 Year Low Flow	66.8	ft^3/s	33	33
7 Day 10 Year Low Flow	28.4	ft^3/s	51	51
30 Day 10 Year Low Flow	37	ft^3/s	46	46

Statistic	Value	Unit	SE	SEp
90 Day 10 Year Low Flow	54.6	ft^3/s	36	36

Low-Flow Statistics Citations

Stuckey, M.H.,2006, Low-flow, base-flow, and mean-flow regression equations for Pennsylvania streams: U.S. Geological Survey Scientific Investigations Report 2006-5130, 84 p. (http://pubs.usgs.gov/sir/2006/5130/)

Annual Flow Statistics Parameters[Statewide Mean and Base Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	394	square miles	2.26	1720
ELEV	Mean Basin Elevation	1714.9	feet	130	2700
PRECIP	Mean Annual Precipitation	40	inches	33.1	50.4
FOREST	Percent Forest	88	percent	5.1	100
URBAN	Percent Urban	0	percent	0	89
CARBON	Percent Carbonate	0	percent	0	99

Annual Flow Statistics Flow Report[Statewide Mean and Base Flow]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp
Mean Annual Flow	608	ft^3/s	12	12
Harmonic Mean Streamflow	140	ft^3/s	38	38

Annual Flow Statistics Citations

Stuckey, M.H.,2006, Low-flow, base-flow, and mean-flow regression equations for Pennsylvania streams: U.S. Geological Survey Scientific Investigations Report 2006-5130, 84 p. (http://pubs.usgs.gov/sir/2006/5130/)

Base Flow Statistics Parameters[Statewide Mean and Base Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	394	square miles	2.26	1720
PRECIP	Mean Annual Precipitation	40	inches	33.1	50.4
CARBON	Percent Carbonate	0	percent	0	99
FOREST	Percent Forest	88	percent	5.1	100
URBAN	Percent Urban	0	percent	0	89

Base Flow Statistics Flow Report[Statewide Mean and Base Flow]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp
Base Flow 10 Year Recurrence Interval	227	ft^3/s	21	21
Base Flow 25 Year Recurrence Interval	202	ft^3/s	21	21
Base Flow 50 Year Recurrence Interval	187	ft^3/s	23	23

Base Flow Statistics Citations

Stuckey, M.H.,2006, Low-flow, base-flow, and mean-flow regression equations for Pennsylvania streams: U.S. Geological Survey Scientific Investigations Report 2006-5130, 84 p. (http://pubs.usgs.gov/sir/2006/5130/)

Peak-Flow Statistics Parameters[Peak Flow Region 1]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	394	square miles	1.72	1280
STORAGE	Percent Storage	1	percent	0	21.2

Peak-Flow Statistics Flow Report[Peak Flow Region 1]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	11600	ft^3/s	33	33	3
5 Year Peak Flood	18600	ft^3/s	31	31	6
10 Year Peak Flood	24100	ft^3/s	31	31	9
50 Year Peak Flood	38700	ft^3/s	36	36	13
100 Year Peak Flood	46000	ft^3/s	38	38	13
500 Year Peak Flood	65900	ft^3/s	46	46	14

Peak-Flow Statistics Citations

Roland, M.A., and Stuckey, M.H.,2008, Regression equations for estimating flood flows at selected recurrence intervals for ungaged streams in Pennsylvania: U.S. Geological Survey Scientific Investigations Report 2008-5102, 57p. (http://pubs.usgs.gov/sir/2008/5102/)

Bankfull Statistics Parameters[Statewide Bankfull Noncarbonate 2018 5066]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	394	square miles	2.62	207
CARBON	Percent Carbonate	0	percent		

Bankfull Statistics Disclaimers[Statewide Bankfull Noncarbonate 2018 5066]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Bankfull Statistics Flow Report[Statewide Bankfull Noncarbonate 2018 5066]

Statistic	Value	Unit
Bankfull Area	1420	ft^2
Bankfull Streamflow	7740	ft^3/s
Bankfull Width	222	ft
Bankfull Depth	6.2	ft

Bankfull Statistics Citations

Clune, J.W., Chaplin, J.J., and White, K.E.,2018, Comparison of regression relations of bankfull discharge and channel geometry for the glaciated and nonglaciated settings of Pennsylvania and southern New York: U.S. Geological Survey Scientific Investigations Report 2018–5066, 20 p. (https://doi.org/10.3133/sir20185066)

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

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Application Version: 4.3.11

ATTACHMENT B

USGS Water-Year Summaries 2007-2019

2006

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

West Branch Susquehanna Basin
Lower West Branch Susquehanna Subbasin

LOCATION.--Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA.--435 mi^2.

SURFACE-WATER RECORDS

PERIOD OF RECORD.--August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

REVISED RECORDS.--WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

GAGE.--Water-stage recorder. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, nonrecording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION.--Station established and maintained by the U.S. Geological Survey in cooperation with the National Weather Service and the Pennsylvania Department of Environmental Protection.

REMARKS.--Records good except those for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s, from rating curve extended above 16,000 ft^3/s on basis of slope-area measurement of peak flow.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 6,400 ft^3/s and (or) maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov 30	0530	*20,700	*11.07
Jan 18	1530	15,100	9.48
Jun 28	0730	18,800	10.55

Minimum discharge, 58 ft^3/s, Oct 5, 6, 7, gage height, 1.24 ft.

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2005 TO SEPTEMBER 2006
DAILY MEAN VALUES
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	104	1,030	4,430	1,340	1,670	e290	278	429	360	1,760	302	349
2	89	1,180	2,730	1,210	1,360	e280	276	396	286	1,350	277	975
3	76	1,080	1,990	2,470	2,220	e260	269	372	492	1,520	239	2,150
4	66	910	1,600	2,200	2,400	e250	276	351	736	1,120	247	1,270
5	60	806	1,340	1,950	3,920	283	277	328	513	902	237	809
6	59	728	1,140	1,830	2,720	277	262	307	417	715	195	631
7	292	788	944	1,510	2,010	268	261	287	352	585	174	538
8	3,120	732	781	1,300	1,620	255	282	269	328	505	162	451
9	1,680	659	e740	1,150	1,350	268	285	253	312	456	150	386
10	1,090	731	e690	1,080	1,160	293	258	237	342	458	135	373
11	823	701	e630	1,020	1,010	360	241	226	327	430	124	428
12	667	612	e610	1,510	906	347	229	1,020	273	614	114	348
13	673	556	e500	1,420	746	383	223	926	246	805	105	305
14	1,310	532	e440	1,880	734	781	226	695	230	597	99	296
15	1,240	659	e510	2,050	669	705	281	617	246	511	99	316
16	990	1,420	e690	1,510	642	537	291	898	225	639	125	356
17	801	2,370	e670	1,310	660	473	255	763	192	494	115	453
18	692	1,600	e600	8,720	675	431	234	681	170	396	98	356
19	607	1,290	e550	6,000	e490	405	222	680	171	339	94	294
20	519	1,100	e540	3,250	e530	386	211	681	271	296	120	255
21	457	982	e550	2,340	487	353	202	595	268	297	153	227
22	485	906	e520	1,810	462	363	285	538	208	478	123	215
23	1,420	873	e500	1,560	461	348	1,260	485	188	1,130	108	200
24	1,150	795	e480	1,390	425	333	1,140	440	194	666	87	194
25	1,640	701	e550	1,230	374	331	862	401	225	479	83	190
26	2,890	612	e810	1,040	e350	333	737	381	743	387	102	172
27	2,300	586	e760	788	e250	326	654	368	3,720	343	151	162
28	1,700	621	e720	816	e300	313	569	340	13,600	457	340	158
29	1,380	1,870	e900	812	---	304	508	306	4,850	499	574	621
30	1,190	12,500	1,920	1,010	---	291	465	274	2,490	410	1,090	560
31	1,100	---	1,560	1,450	---	283	---	384	---	337	531	---
Total	30,670	39,930	31,395	58,956	30,601	11,110	11,819	14,928	32,975	19,975	6,553	14,038
Mean	989	1,331	1,013	1,902	1,093	358	394	482	1,099	644	211	468
Max	3,120	12,500	4,430	8,720	3,920	781	1,260	1,020	13,600	1,760	1,090	2,150
Min	59	532	440	788	250	250	202	226	170	296	83	158
Cfsm	2.27	3.06	2.33	4.37	2.51	0.82	0.91	1.11	2.53	1.48	0.49	1.08
In.	2.62	3.41	2.68	5.04	2.62	0.95	1.01	1.28	2.82	1.71	0.56	1.20

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2006, BY WATER YEAR (WY)

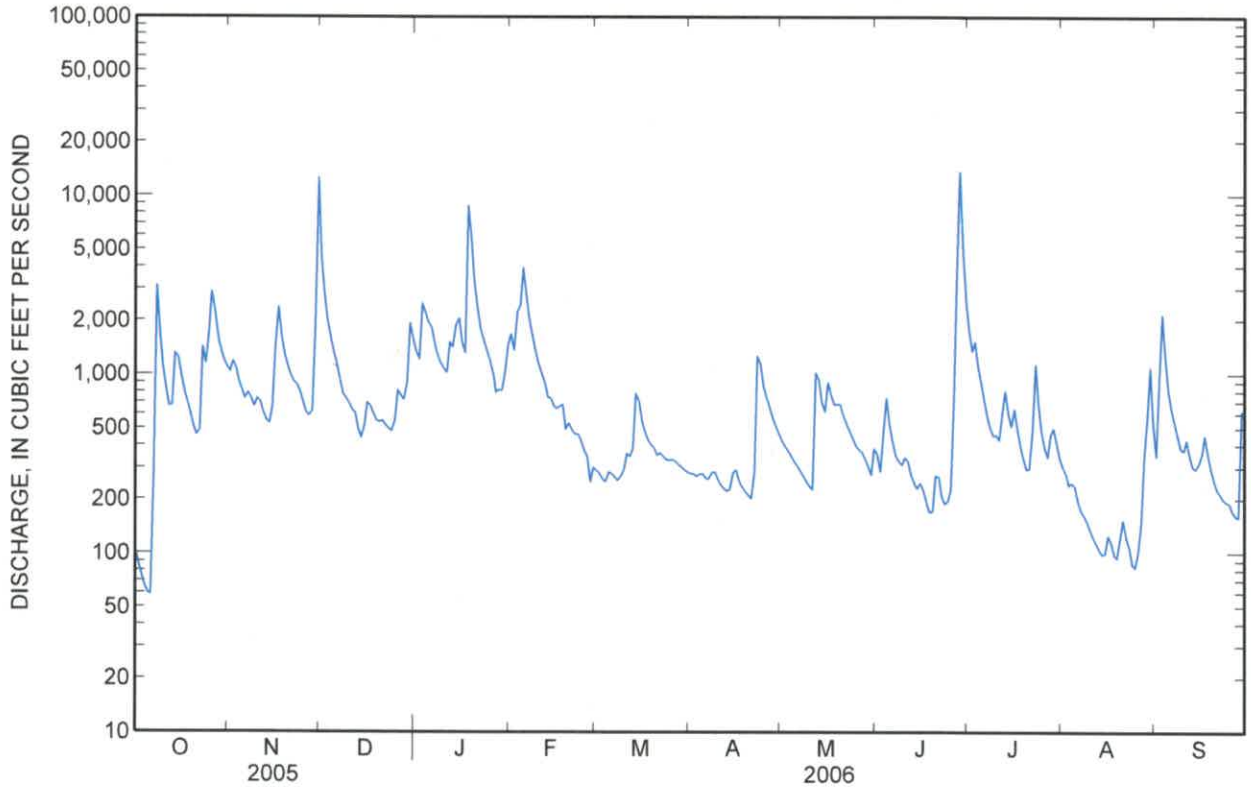
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	501	854	914	801	817	1,458	1,537	940	525	286	278	307
Max	2,512	2,856	3,033	3,070	2,961	4,490	4,236	2,694	4,327	1,206	1,797	2,037
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2004)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

SUMMARY STATISTICS

	Calendar Year 2005		Water Year 2006		Water Years 1926 - 2006	
Annual total	298,810		302,950			
Annual mean	819		830		767	
Highest annual mean					1,312	1978
Lowest annual mean					332	1965
Highest daily mean	13,500	Apr 3	13,600	Jun 28	45,000	Jun 23, 1972
Lowest daily mean	37	Aug 27	59	Oct 6	11	Sep 25, 1964
Annual seven-day minimum	41	Aug 23	105	Aug 13	12	Sep 20, 1964
Maximum peak flow			[a]20,700	Nov 30	[a]55,800	Jan 19, 1996
Maximum peak stage			11.07	Nov 30	[b]17.93	Jan 19, 1996
Instantaneous low flow			58	Oct 5[c]	11	Sep 25, 1964[d]
Annual runoff (cfsm)	1.88		1.91		1.76	
Annual runoff (inches)	25.55		25.91		23.97	
10 percent exceeds	1,650		1,630		1,690	
50 percent exceeds	510		505		410	
90 percent exceeds	76		194		70	

[a] From rating curve extended above 11,000 ft³/s on basis of slope-area measurement of peak flow.
[b] From floodmark in gage.
[c] Also Oct 6, 7.
[d] Also Sep 26, 1964, Nov 24, 1964.



WATER-QUALITY RECORDS

PERIOD OF RECORD.--April 2002 to current year.

COOPERATION.--Water-quality samples were collected as part of the Pennsylvania Department of Environmental Protection Water-Quality Network (WQN) with cooperation from the Pennsylvania Department of Environmental Protection.

REMARKS.--Some values for filtered parameters exceed values for the corresponding unfiltered parameter. These results are within the limits of analytical precision and methods.

WATER-QUALITY DATA
WATER YEAR OCTOBER 2005 TO SEPTEMBER 2006

Part 1 of 3

[Remark codes: <, less than; E, estimated; M, presence verified but not quantified.]

Date	Time	Agency analyzing sample, code (00028)	Instantaneous discharge, cfs (00061)	Dissolved oxygen, mg/L (00300)	pH, water, unfltrd field, std units (00400)	pH, water, unfltrd lab, std units (00403)	Specif. conductance, wat unf lab, uS/cm 25 degC (90095)	Specif. conductance, wat unf uS/cm 25 degC (00095)	Temperature, water, deg C (00010)	Hardness, water, mg/L as CaCO3 (00900)	Calcium water, fltrd, mg/L (00915)	Calcium water unfltrd recoverable, mg/L (00916)	Magnesium, water, fltrd, mg/L (00925)
Oct													
24...	1115	9813	1,130	11.9	7.2	7.3	58	57	9.1	22	6.82	6.9	1.10
Dec													
29...	1200	9813	E900	13.5	7.2	7.0	55	56	2.8	20	6.56	6.4	1.03
Feb													
22...	1145	9813	437	14.9	7.3	7.1	57	57	1.6	18	5.67	5.7	.93
Apr													
27...	1330	9813	651	11.0	7.6	7.3	54	41	11.8	18	5.85	5.8	.95
Jun													
07...	1130	9813	349	10.3	7.4	7.5	58	60	18.1	22	6.99	7.0	1.11
Aug													
15...	1500	9813	100	9.8	8.7	8.3	70	73	25.7	26	8.23	8.5	1.25

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2005 TO SEPTEMBER 2006
Part 2 of 3
[Remark codes: <, less than; E, estimated; M, presence verified but not quantified.]

Date	Magnesium, water, unfltrd recover-able, mg/L (00927)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (00417)	Sulfate water, fltrd, mg/L (00945)	Residue on evap. at 105degC wat flt mg/L (00515)	Residue total at 105 deg. C, suspended, mg/L (00530)	Ammonia water, unfltrd mg/L as N (00610)	Nitrate water unfltrd mg/L as N (00620)	Nitrite water, unfltrd mg/L as N (00615)	Total nitrogen, water, unfltrd mg/L (00600)	Orthophosphate, water, unfltrd mg/L as P (70507)	Phosphorus, water, unfltrd mg/L (00665)	BOD, water, unfltrd 5 day, 20 degC mg/L (00310)	Aluminum, water, fltrd, ug/L (01106)
Oct													
24...	1.1	12	8.9	42	<2	.030	--	<.040	.21	<.01	<.010	.4	20
Dec													
29...	1.0	13	8.3	38	<2	<.020	.31	<.040	.29	<.01	<.010	2.3	18
Feb													
22...	.9	11	8.6	34	<2	.020	.34	<.040	.36	<.01	<.010	2.3	15
Apr													
27...	1.0	9	7.9	70	8	<.020	.18	<.040	.23	<.01	<.010	.6	12
Jun													
07...	1.1	13	7.2	58	<2	.030	.16	<.040	.16	<.01	<.010	1.3	11
Aug													
15...	1.3	17	8.3	76	<2	.030	.15	<.040	.26	<.01	.010	1.5	10

WATER-QUALITY DATA
WATER YEAR OCTOBER 2005 TO SEPTEMBER 2006
Part 3 of 3
[Remark codes: <, less than; E, estimated; M, presence verified but not quantified.]

Date	Aluminum, water, unfltrd recover-able, ug/L (01105)	Copper, water, fltrd, ug/L (01040)	Copper, water, unfltrd recover-able, ug/L (01042)	Iron, water, fltrd, ug/L (01046)	Iron, water, unfltrd recover-able, ug/L (01045)	Lead, water, fltrd, ug/L (01049)	Lead, water, unfltrd recover-able, ug/L (01051)	Manganese, water, fltrd, ug/L (01056)	Manganese, water, unfltrd recover-able, ug/L (01055)	Nickel, water, fltrd, ug/L (01065)	Nickel, water, unfltrd recover-able, ug/L (01067)	Zinc, water, fltrd, ug/L (01090)	Zinc, water, unfltrd recover-able, ug/L (01092)
Oct													
24...	M	<4	<4	20	60	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Dec													
29...	M	<4	<4	<20	30	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Feb													
22...	M	<4	<4	<20	<20	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Apr													
27...	M	<4	<4	<20	<20	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Jun													
07...	M	<4	<4	<20	30	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Aug													
15...	M	<4	<4	<20	90	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0

ECOLOGICAL RECORDS

PERIOD OF RECORD.--April 2002 to current year.

REMARKS.-- Samples were collected using rapid bioassessment protocols for benthic macroinvertebrates using a D-Frame net with a mesh size of 500 mm. Counts are based on a randomly-selected 100-organism (approximate) subsample.

BIOLOGICAL DATA-BENTHIC MACROINVERTEBRATES

Date	10/04/05	
Benthic Macroinvertebrate	Count	
Nemertea (PROBOSCIS WORMS)	•	
Enopla	•	
Hoplonemertea	•	
Tetrastemmatidae	•	
Prostoma	•	4
Arthropoda	•	
Acariformes	•	
Hydrachnidia (WATER MITES)	•	4
Insecta	•	
Ephemeroptera (MAYFLIES)	•	
Ephemerellidae	•	
Eurylophella	•	8
Serratella	•	2
Heptageniidae	•	
Cinygmula	•	1
Epeorus	•	6
Leucrocuta	•	28
Maccaffertium	•	13
Stenacron	•	1
Isonychiidae	•	
Isonychia	•	20
Odonata (DRAGONFLIES AND DAMSELFLIES)	•	
Coenagrionidae	•	
Argia	•	1
Plecoptera (STONEFLIES)	•	
Perlidae	•	
Acroneuria	•	1
Taeniopterygidae	•	
Taeniopteryx	•	2
Trichoptera (CADDISFLIES)	•	
Brachycentridae	•	
Micrasema	•	1
Hydropsychidae	•	
Cheumatopsyche	•	10
Hydropsyche	•	4
Philopotamidae	•	
Chimarra	•	1

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

Date	10/04/05
Benthic Macroinvertebrate	Count
Coleoptera (BEETLES)	•
Elmidae (RIFFLE BEETLES)	•
Optioservus	• 8
Stenelmis	• 2
Psephenidae (WATER PENNIES)	•
Psephenus	• 1
Diptera (TRUE FLIES)	•
Chironomidae (MIDGES)	• 25
Empididae (DANCE FLIES)	•
Hemerodromia	• 2
Tanyderidae	•
Protoplasa	• 1
Tipulidae (CRANE FLIES)	•
Antocha	• 1
Total Organisms	147

2007

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

West Branch Susquehanna Basin
Lower West Branch Susquehanna Subbasin

LOCATION.--Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA.--435 mi^2.

SURFACE-WATER RECORDS

PERIOD OF RECORD.--August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

REVISED RECORDS.--WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

GAGE.--Water-stage recorder. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, nonrecording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION.--Station established and maintained by the U.S. Geological Survey in cooperation with the National Weather Service and the Pennsylvania Department of Environmental Protection.

REMARKS.--Records good except those for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sep 26, l975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s, from rating curve extended above 16,000 ft^3/s on basis of slope-area measurement of peak flow.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 6,400 ft^3/s and (or) maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov 17	0100	*18,300	*10.43
Mar 15	1715	7,610	6.75

Minimum discharge, 25 ft^3/s, Aug. 19, gage height, 0.83 ft.

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2006 TO SEPTEMBER 2007
DAILY MEAN VALUES
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	431	1,030	645	1,120	e390	e280	1,080	723	246	92	e37	112
2	498	1,200	1,480	1,200	e380	e1,100	1,200	1,450	223	79	e35	76
3	411	1,170	1,050	977	e340	e1,800	1,030	1,240	217	71	e32	59
4	354	931	861	876	e320	e1,100	900	1,010	240	68	e30	50
5	369	807	759	888	e300	e900	848	879	234	68	e29	43
6	392	737	688	2,250	e280	e700	759	772	214	82	e28	39
7	327	685	657	2,250	e270	e600	692	690	195	155	27	36
8	295	690	603	3,270	e260	e570	641	640	173	116	76	34
9	275	807	539	2,850	e250	e550	587	568	173	91	65	33
10	257	707	530	2,040	e240	e500	547	555	180	76	92	39
11	241	630	504	1,570	e230	e550	516	778	168	68	72	100
12	244	1,180	488	1,340	e250	e600	667	633	150	64	59	222
13	268	1,360	487	1,250	e240	800	1,010	544	145	57	52	163
14	244	1,260	522	1,310	e220	1,950	822	490	179	56	44	115
15	224	1,190	481	2,240	e250	5,610	969	451	151	53	38	94
16	211	3,860	446	2,820	e240	4,350	1,450	477	144	50	34	79
17	242	9,440	412	2,010	e240	2,580	1,530	777	136	e35	31	71
18	581	3,690	402	e1,700	e230	1,880	1,600	619	122	e36	27	64
19	547	2,400	416	e1,500	e220	1,460	2,020	520	126	e37	26	57
20	3,010	1,800	389	1,250	e230	1,300	2,310	477	142	e38	32	51
21	3,040	1,440	366	964	e250	1,100	2,060	447	117	e42	114	47
22	1,770	1,210	370	931	e280	1,110	1,610	405	106	56	244	43
23	1,350	1,090	1,030	850	e250	3,260	1,300	370	107	e40	196	40
24	1,070	1,080	1,140	751	e210	2,940	1,100	342	98	54	141	37
25	869	913	876	685	e200	3,070	964	315	88	e40	109	35
26	729	780	1,290	e580	e190	2,920	1,410	307	82	56	109	33
27	648	711	1,310	e620	e240	2,780	1,160	295	77	56	86	34
28	1,740	657	1,080	e590	e220	2,360	1,000	310	87	58	74	45
29	2,250	607	932	e500	---	1,760	917	281	122	58	63	70
30	1,510	578	832	e380	---	1,420	814	246	103	62	57	75
31	1,220	---	763	e370	---	1,210	---	228	---	56	169	---
Total	25,617	44,640	22,348	41,932	7,220	53,110	33,513	17,839	4,545	1,970	2,228	1,996
Mean	826	1,488	721	1,353	258	1,713	1,117	575	152	63.5	71.9	66.5
Max	3,040	9,440	1,480	3,270	390	5,610	2,310	1,450	246	155	244	222
Min	211	578	366	370	190	280	516	228	77	35	26	33
Cfsm	1.90	3.42	1.66	3.11	0.59	3.94	2.57	1.32	0.35	0.15	0.17	0.15
In.	2.19	3.82	1.91	3.59	0.62	4.54	2.87	1.53	0.39	0.17	0.19	0.17

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2007, BY WATER YEAR (WY)

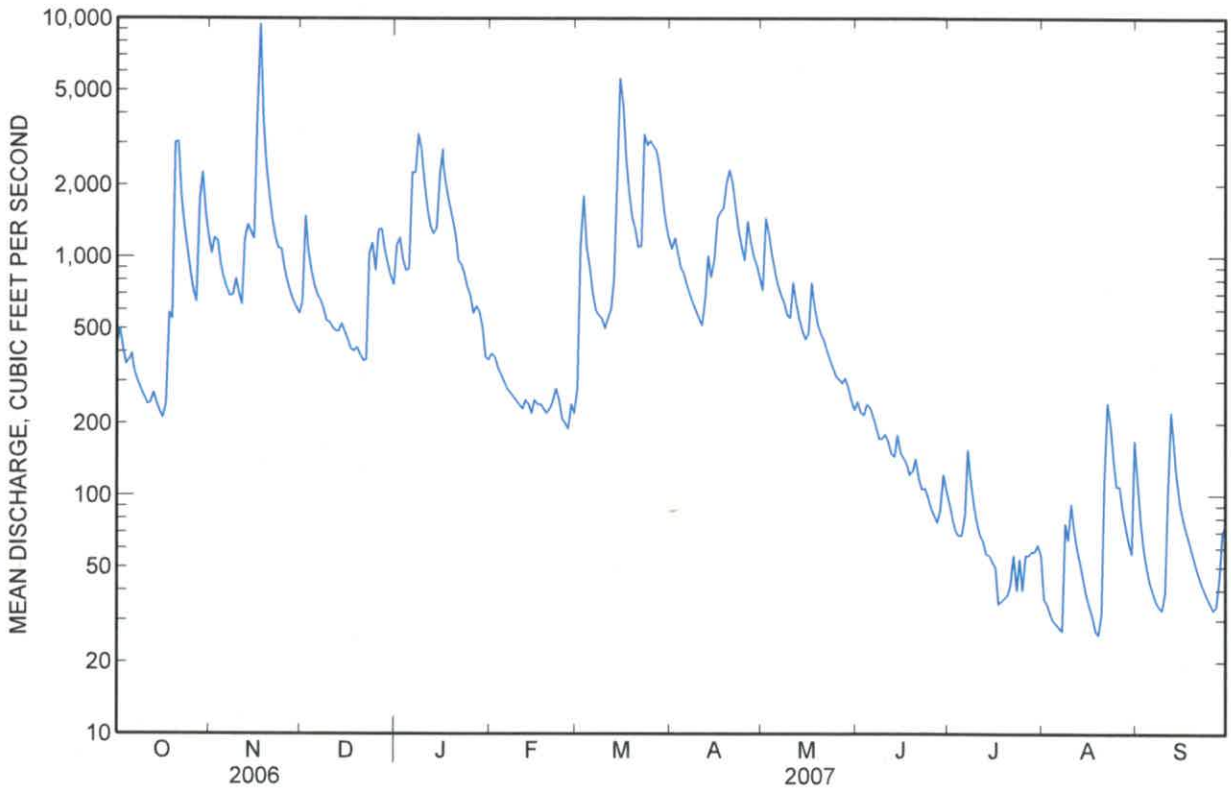
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	505	862	912	807	810	1,461	1,532	936	520	283	276	304
Max	2,512	2,856	3,033	3,070	2,961	4,490	4,236	2,694	4,327	1,206	1,797	2,037
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2004)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

SUMMARY STATISTICS

	Calendar Year 2006		Water Year 2007		Water Years 1926 - 2007	
Annual total	293,560		256,958			
Annual mean	804		704		767	
Highest annual mean					1,312	1978
Lowest annual mean					332	1965
Highest daily mean	13,600	Jun 28	9,440	Nov 17	45,000	Jun 23, 1972
Lowest daily mean	83	Aug 25	26	Aug 19	11	Sep 25, 1964
Annual seven-day minimum	105	Aug 13	[a]31	Aug 1	12	Sep 20, 1964
Maximum peak flow			[b]18,300	Nov 17	[b]55,800	Jan 19, 1996
Maximum peak stage			10.43	Nov 17	[c]17.93	Jan 19, 1996
Instantaneous low flow			25	Aug 19	11	Sep 25, 1964[d]
Annual runoff (cfsm)	1.85		1.62		1.76	
Annual runoff (inches)	25.10		21.97		23.94	
10 percent exceeds	1,510		1,600		1,690	
50 percent exceeds	465		412		410	
90 percent exceeds	211		50		70	

[a] Computed using estimated daily discharges.
[b] From rating curve extended above 11,000 ft³/s on basis of slope-area measurement of peak flow.
[c] From floodmark in gage.
[d] Also Sep 26, 1964, Nov 24, 1964.



01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--April 2002 to current year.

REMARKS.--Analysis for pH, water temperature, specific conductance, and dissolved oxygen is performed on site. All other sample analyses were performed at the Pennsylvania Department of Environmental Protection laboratory in Harrisburg, Pa. Some values for filtered parameters exceed values for the corresponding unfiltered parameter. These results are within the limits of analytical precision and methods.

COOPERATION.--Water-quality samples were collected as part of the Pennsylvania Department of Environmental Protection Water-Quality Network (WQN) with cooperation from the Pennsylvania Department of Environmental Protection.

WATER-QUALITY DATA
WATER YEAR OCTOBER 2006 TO SEPTEMBER 2007

Part 1 of 3

[Remark codes: <, less than; M, presence verified but not quantified.]

Date	Time	Instantaneous discharge, cfs (00061)	Dissolved oxygen, mg/L (00300)	pH, water, unfltrd field, std units (00400)	pH, water, unfltrd lab, std units (00403)	Specif. conductance, wat unf lab, µS/cm 25 degC (90095)	Specific conductance, wat unf µS/cm 25 degC (00095)	Temperature, water, deg C (00010)	Hardness, water, mg/L as CaCO3 (00900)	Calcium water, fltrd, mg/L (00915)	Calcium water unfltrd recoverable, mg/L (00916)	Magnesium, water, fltrd, mg/L (00925)	Magnesium, water, unfltrd recoverable, mg/L (00927)
Nov													
07...	1430	684	13.5	7.4	7.4	52	54	6.2	18	5.76	5.8	.97	1.0
Jan													
08...	1430	3,840	10.9	7.0	6.9	43	45	6.3	16	4.80	5.0	.82	.9
Mar													
06...	1500	1,250	15.0	7.1	7.2	56	58	.3	20	5.74	6.1	.96	1.0
May													
14...	1400	485	11.3	7.9	7.5	57	58	14.3	20	6.10	6.1	1.03	1.0
Jul													
09...	1100	91	9.0	7.8	7.6	70	75	24.1	26	8.15	8.3	1.28	1.3
Sep													
25...	1400	34	10.1	8.1	8.0	79	82	19.3	30	9.30	9.7	1.38	1.4

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2006 TO SEPTEMBER 2007
Part 2 of 3
[Remark codes: <, less than; M, presence verified but not quantified.]

Date	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (00417)	Sulfate water, fltrd, mg/L (00945)	Residue on evap. at 105degC wat flt mg/L (00515)	Residue total non-filter-able, mg/L (00530)	Ammonia water, unfltrd mg/L as N (00610)	Nitrate water unfltrd mg/L as N (00620)	Nitrite water, unfltrd mg/L as N (00615)	Total nitro-gen, water, unfltrd mg/L (00600)	Ortho-phos-phate, water, unfltrd mg/L as P (70507)	Phos-phorus, water, unfltrd mg/L (00665)	BOD, water, unfltrd 5 day, 20 degC mg/L (00310)	Alum-inum, water, fltrd, µg/L (01106)	Alum-inum, water, unfltrd recover-able, µg/L (01105)
Nov													
07...	10	8.1	76	<2	<.020	.17	<.040	.24	<.01	<.010	2.2	18	M
Jan													
08...	7	7.6	52	<2	<.020	.31	<.040	.47	.01	.014	8.4	39	200
Mar													
06...	9	7.8	70	<2	<.020	.55	<.040	.68	<.01	<.010	.9	15	M
May													
14...	11	8.2	60	<2	.020	.21	<.040	.28	<.01	<.010	<.2	14	M
Jul													
09...	18	8.4	70	<2	<.020	.21	<.040	.33	<.01	.011	<.2	<10	M
Sep													
25...	22	8.7	80	10	.030	.16	<.040	.28	<.01	<.010	<.2	10	<10

WATER-QUALITY DATA
WATER YEAR OCTOBER 2006 TO SEPTEMBER 2007
Part 3 of 3
[Remark codes: <, less than; M, presence verified but not quantified.]

Date	Copper, water, fltrd, µg/L (01040)	Copper, water, unfltrd recover-able, µg/L (01042)	Iron, water, fltrd, µg/L (01046)	Iron, water, unfltrd recover-able, µg/L (01045)	Lead, water, fltrd, µg/L (01049)	Lead, water, unfltrd recover-able, µg/L (01051)	Mangan-ese, water, fltrd, µg/L (01056)	Mangan-ese, water, unfltrd recover-able, µg/L (01055)	Nickel, water, fltrd, µg/L (01065)	Nickel, water, unfltrd recover-able, µg/L (01067)	Zinc, water, fltrd, µg/L (01090)	Zinc, water, unfltrd recover-able, µg/L (01092)
Nov												
07...	<4	<4	<20	<20	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Jan												
08...	<4	<4	30	440	<1.0	<1.0	M	40	<4.0	<4.0	<5.0	M
Mar												
06...	<4	<4	<20	60	<1.0	<1.0	M	10	<4.0	<4.0	<5.0	<5.0
May												
14...	<4	<4	<20	20	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Jul												
09...	<4	<4	<20	20	<1.0	<1.0	M	10	<4.0	<4.0	<5.0	<5.0
Sep												
25...	<4	<4	<20	60	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0

2008

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

West Branch Susquehanna Basin
Lower West Branch Susquehanna Subbasin

LOCATION.--Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA.--435 mi^2.

SURFACE-WATER RECORDS

PERIOD OF RECORD.--August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

REVISED RECORDS.--WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

GAGE.--Water-stage recorder. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, nonrecording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION.--Station established and maintained by the U.S. Geological Survey in cooperation with the National Weather Service and the Pennsylvania Department of Environmental Protection.

REMARKS.--Records good except those for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sep 26, l975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s, from rating curve extended above 16,000 ft^3/s on basis of slope-area measurement of peak flow.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 6,400 ft^3/s and (or) maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec 24	0030	13,500	8.97
Jan 11	1945	6,720	6.35
Feb 18	1945	6,450	6.23
Mar 5	1015	*19,900	*10.86
Mar 8	1930	9,670	7.61

Minimum discharge, 30 ft^3/s, Oct. 9, 10, 11, gage height, 0.88 ft.

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	62	305	924	1,200	e700	924	1,350	520	347	328	230	58
2	53	274	770	e1,060	2,810	631	1,340	489	320	228	211	54
3	47	246	821	e800	1,620	579	1,170	475	287	183	195	51
4	43	227	828	e750	1,360	1,230	1,170	744	278	171	176	46
5	40	213	686	e770	1,430	12,500	1,380	857	309	186	167	43
6	38	231	571	716	3,850	5,450	1,260	693	278	161	163	51
7	35	293	e510	829	5,000	3,250	1,120	623	248	141	165	64
8	33	262	513	1,180	2,970	7,390	1,030	559	226	125	172	78
9	32	233	478	1,350	2,090	6,030	953	599	210	117	199	101
10	31	224	511	1,390	1,670	3,140	878	732	203	113	174	138
11	38	217	637	3,750	e1,230	2,260	828	656	185	104	146	140
12	94	211	1,600	4,080	e1,020	1,870	988	597	162	94	139	111
13	141	222	2,080	2,440	e1,160	1,550	938	563	145	242	135	122
14	121	285	1,550	1,860	e1,420	1,380	820	481	134	757	121	128
15	94	865	1,240	1,520	e1,090	1,620	727	452	149	411	109	113
16	78	1,700	1,150	1,260	e910	1,700	653	585	194	251	109	91
17	68	1,030	1,070	1,050	e720	1,440	594	1,460	237	194	103	77
18	61	757	852	943	3,800	1,280	543	1,350	251	687	95	67
19	66	682	735	813	3,680	1,440	502	1,370	220	384	85	60
20	281	868	677	e700	2,050	4,330	469	1,160	198	260	79	55
21	364	1,550	626	e540	e1,510	2,720	444	1,030	176	232	73	53
22	232	1,580	577	e550	1,310	1,980	409	932	412	258	68	54
23	190	1,190	2,320	e560	1,140	1,610	382	830	463	1,050	64	57
24	470	883	7,590	e490	e890	1,360	439	714	354	2,130	62	60
25	692	721	3,120	e450	e810	1,180	407	609	268	1,070	59	55
26	444	873	2,030	e380	833	1,090	372	530	218	701	54	50
27	583	3,080	1,590	e400	1,030	984	406	479	195	543	55	237
28	933	2,050	1,330	e370	e750	1,210	451	591	179	424	55	710
29	553	1,470	1,610	e370	e640	1,240	723	503	169	344	55	922
30	418	1,160	1,570	e610	---	1,010	613	411	296	292	57	474
31	351	---	1,350	e530	---	1,050	---	365	---	259	58	---
Total	6,686	23,902	41,916	33,711	49,493	75,428	23,359	21,959	7,311	12,440	3,633	4,320
Mean	216	797	1,352	1,087	1,707	2,433	779	708	244	401	117	144
Max	933	3,080	7,590	4,080	5,000	12,500	1,380	1,460	463	2,130	230	922
Min	31	211	478	370	640	579	372	365	134	94	54	43
Cfsm	0.50	1.83	3.11	2.50	3.92	5.59	1.79	1.63	0.56	0.92	0.27	0.33
In.	0.57	2.04	3.58	2.88	4.23	6.45	2.00	1.88	0.63	1.06	0.31	0.37

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2008, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	501	861	917	811	822	1,473	1,523	933	517	285	274	302
Max	2,512	2,856	3,033	3,070	2,961	4,490	4,236	2,694	4,327	1,206	1,797	2,037
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2004)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

SUMMARY STATISTICS

	Calendar Year 2007		Water Year 2008		Water Years 1926 - 2008	
Annual total	236,857		304,158			
Annual mean	649		831		767	
Highest annual mean					1,312	1978
Lowest annual mean					332	1965
Highest daily mean	7,590	Dec 24	12,500	Mar 5	45,000	Jun 23, 1972
Lowest daily mean	26	Aug 19	31	Oct 10	11	Sep 25, 1964
Annual seven-day minimum	[a]31	Aug 1	35	Oct 5	12	Sep 20, 1964
Maximum peak flow			[b]19,900	Mar 5	[b]55,800	Jan 19, 1996
Maximum peak stage			10.86	Mar 5	[c]17.93	Jan 19, 1996
Instantaneous low flow			30	Oct 9[d]	11	Sep 25, 1964[e]
Annual runoff (cfsm)	1.49		1.91		1.76	
Annual runoff (inches)	20.26		26.01		23.97	
10 percent exceeds	1,600		1,610		1,680	
50 percent exceeds	285		525		411	
90 percent exceeds	41		65		70	

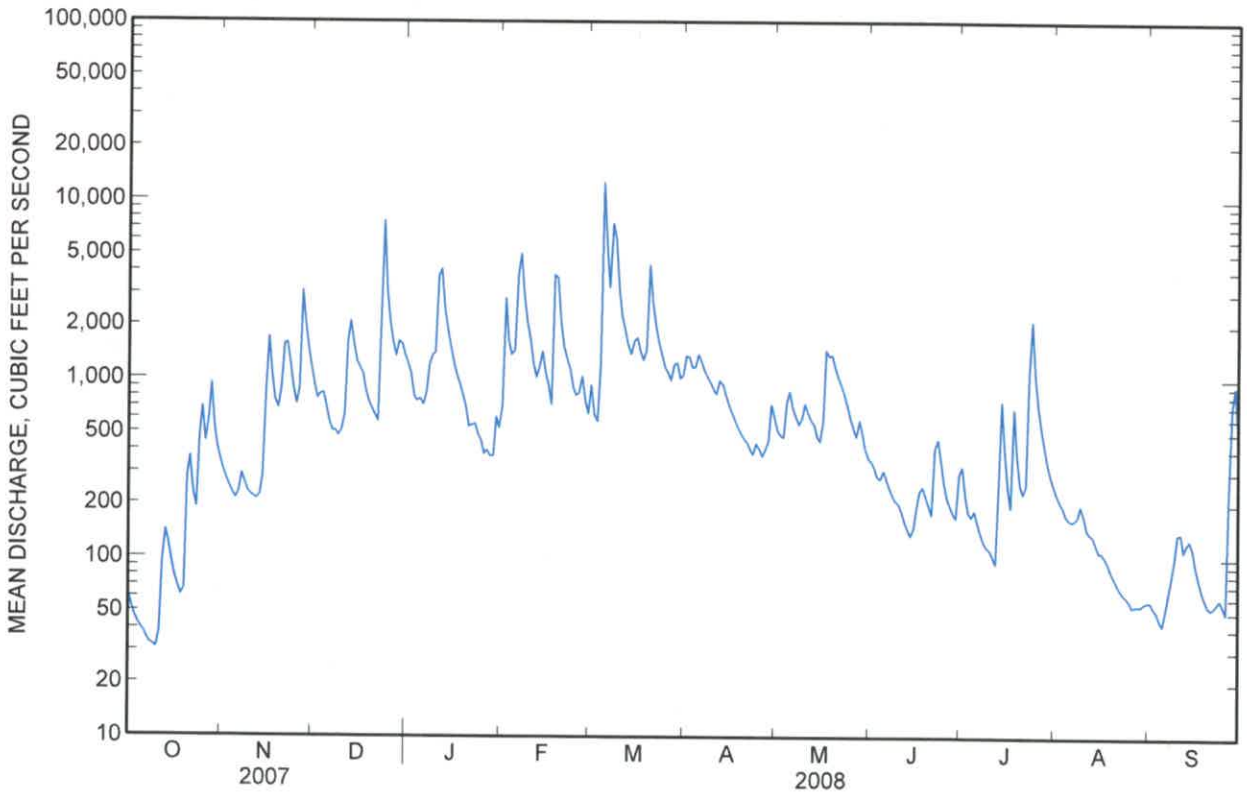
[a] Computed using estimated daily discharges.

[b] From rating curve extended above 11,000 ft³/s on basis of slope-area measurement of peak flow.

[c] From floodmark in gage.

[d] Also Oct 10, 11.

[e] Also Sep 26, 1964, Nov 24, 1964.



01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--April 2002 to current year.

REMARKS.--Analyses for pH, water temperature, specific conductance, and dissolved oxygen were performed on site. All other sample analyses were performed at the Pennsylvania Department of Environmental Protection laboratory in Harrisburg, Pa. Some values for filtered parameters exceed values for the corresponding unfiltered parameter. These results are within the limits of analytical precision and methods.

COOPERATION.--Water-quality samples were collected as part of the Pennsylvania Department of Environmental Protection Water-Quality Network (WQN) with cooperation from the Pennsylvania Department of Environmental Protection.

WATER-QUALITY DATA
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008

Part 1 of 3

[Remark codes: <, less than; M, presence verified but not quantified.]

Date	Time	Instantaneous discharge, cfs (00061)	Dissolved oxygen, mg/L (00300)	pH, water, unfltrd field, std units (00400)	pH, water, unfltrd lab, std units (00403)	Specif. conductance, wat unf lab, µS/cm 25 degC (90095)	Specific conductance, wat unf µS/cm 25 degC (00095)	Temperature, water, deg C (00010)	Hardness, water, mg/L as CaCO3 (00900)	Calcium water, fltrd, mg/L (00915)	Calcium water unfltrd recoverable, mg/L (00916)	Magnesium, water, fltrd, mg/L (00925)	Magnesium, water, unfltrd recoverable, mg/L (00927)
Oct													
25...	1400	645	10.6	7.5	7.6	73	75	13.5	25	7.85	7.8	1.28	1.3
Dec													
20...	1245	697	14.2	7.2	7.3	59	61	2.1	20	5.85	6.1	1.00	1.1
Feb													
28...	1345	729	15.4	7.2	7.2	58	60	.3	18	5.53	5.6	.96	1.0
Apr													
03...	1430	1,140	13.6	7.3	7.1	49	50	6.1	17	5.00	5.3	.87	.9
Jun													
24...	1345	342	9.7	8.6	7.5	71	72	22.2	25	7.66	8.1	1.16	1.2
Aug													
14...	1430	120	9.7	8.8	7.6	72	75	23.5	27	8.25	8.6	1.27	1.3

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
Part 2 of 3
[Remark codes: <, less than; M, presence verified but not quantified.]

Date	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (00417)	Sulfate water, fltrd, mg/L (00945)	Residue on evap. at 105degC wat flt mg/L (00515)	Residue total non-filter-able, mg/L (00530)	Ammonia water, unfltrd mg/L as N (00610)	Nitrate water unfltrd mg/L as N (00620)	Nitrite water, unfltrd mg/L as N (00615)	Total nitro-gen, water, unfltrd mg/L (00600)	Ortho-phos-phate, water, unfltrd mg/L as P (70507)	Phos-phorus, water, unfltrd mg/L as P (00665)	BOD, water, unfltrd 5 day, 20 degC mg/L (00310)	Alum-inum, water, fltrd, µg/L (01106)	Alum-inum, water, unfltrd recover -able, µg/L (01105)
Oct													
25...	14	10.5	74	<2	.040	.11	<.040	.30	<.01	<.010	1.1	15	M
Dec													
20...	9	9.4	64	<2	<.020	.31	<.040	.42	<.01	<.010	.7	16	M
Feb													
28...	7	8.1	68	<2	<.020	.30	<.040	.33	<.01	<.010	.5	29	M
Apr													
03...	8	7.9	28	2	<.020	.20	<.040	.29	<.01	<.010	<.2	17	M
Jun													
24...	17	6.7	52	6	<.020	.15	<.040	.30	<.01	<.010	1.1	17	M
Aug													
14...	21	7.7	54	<5	<.020	.11	<.040	.25	<.01	<.010	2.2	16	M

WATER-QUALITY DATA
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
Part 3 of 3
[Remark codes: <, less than; M, presence verified but not quantified.]

Date	Copper, water, fltrd, µg/L (01040)	Copper, water, unfltrd recover -able, µg/L (01042)	Iron, water, fltrd, µg/L (01046)	Iron, water, unfltrd recover -able, µg/L (01045)	Lead, water, fltrd, µg/L (01049)	Lead, water, unfltrd recover -able, µg/L (01051)	Mangan-ese, water, fltrd, µg/L (01056)	Mangan-ese, water, unfltrd recover -able, µg/L (01055)	Nickel, water, fltrd, µg/L (01065)	Nickel, water, unfltrd recover -able, µg/L (01067)	Zinc, water, fltrd, µg/L (01090)	Zinc, water, unfltrd recover -able, µg/L (01092)
Oct												
25...	<4	<4	<20	70	<1.0	<1.0	M	10	<4.0	<4.0	<5.0	<5.0
Dec												
20...	<4	<4	<20	<20	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Feb												
28...	<4	<4	<20	20	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Apr												
03...	<4	<4	<20	20	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Jun												
24...	<4	<4	<20	50	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Aug												
14...	<4	<4	<20	20	<1.0	<1.0	M	10	<4.0	<4.0	<5.0	<5.0

2009

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

West Branch Susquehanna Basin
Lower West Branch Susquehanna Subbasin

LOCATION.--Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA.--435 mi^2.

SURFACE-WATER RECORDS

PERIOD OF RECORD.--August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

REVISED RECORDS.--WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

GAGE.--Water-stage recorder. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, nonrecording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION.--Station established and maintained by the U.S. Geological Survey in cooperation with the National Weather Service and the Pennsylvania Department of Environmental Protection.

REMARKS.--Records good except those for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s, from rating curve extended above 16,000 ft^3/s on basis of slope-area measurement of peak flow.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 6,400 ft^3/s and (or) maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Feb 12	0600	Ice jam	*10.06
(No peaks above base discharge)			

Minimum discharge, 66 ft^3/s, Oct. 22, 23, 24, 25, gage height, 1.15 ft.

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2008 TO SEPTEMBER 2009
DAILY MEAN VALUES
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	323	666	1,120	e1,090	e220	881	431	427	565	856	2,870	554
2	267	716	1,440	e1,020	e230	e680	460	461	489	667	1,270	442
3	234	633	1,050	e930	e220	e580	694	462	464	1,040	1,140	372
4	196	544	884	e780	e220	e580	2,140	420	444	821	771	320
5	165	487	808	773	e210	e560	1,550	493	403	586	546	276
6	145	440	686	671	e200	537	1,390	590	388	454	430	248
7	129	404	e610	748	e190	568	1,390	830	366	390	352	222
8	118	379	e540	1,160	e370	784	1,170	831	317	386	297	207
9	111	363	e550	860	e520	3,020	1,020	802	289	341	395	194
10	104	334	1,040	e550	e480	2,340	901	784	271	287	1,020	179
11	102	303	2,080	e520	e620	1,780	886	650	249	255	606	176
12	94	279	3,500	e440	e3,440	1,460	800	572	503	272	982	230
13	89	279	2,190	e440	e2,040	1,200	700	505	566	260	921	314
14	81	294	1,600	e380	1,510	1,060	641	535	541	212	651	262
15	82	353	1,470	e350	1,210	955	797	987	516	184	507	213
16	80	1,570	1,940	e290	995	863	791	872	410	165	420	179
17	76	1,090	1,570	e260	e780	785	663	3,100	342	157	360	167
18	74	840	1,340	e290	e730	729	605	1,820	764	152	320	186
19	72	703	1,200	e310	765	715	566	1,320	944	148	380	169
20	71	615	1,100	e300	e640	706	559	1,070	738	134	559	143
21	70	552	e930	e300	e590	613	861	885	987	122	441	129
22	68	477	e810	e300	552	555	965	735	852	114	387	121
23	67	434	e750	e290	e440	516	857	621	647	124	345	119
24	67	408	e920	e280	e400	462	744	563	516	241	292	119
25	137	434	e2,300	e240	e360	447	669	584	429	238	258	111
26	1,850	440	1,560	e230	413	441	606	492	375	195	231	107
27	959	411	1,210	e220	512	499	549	636	918	214	209	140
28	853	387	1,670	e230	1,160	484	501	660	657	181	209	275
29	1,370	368	2,400	e280	---	468	463	955	498	144	984	384
30	900	357	1,760	e280	---	500	431	1,030	433	1,290	1,300	278
31	703	---	1,440	e230	---	460	---	727	---	1,730	776	---
Total	9,657	15,560	42,468	15,042	20,017	26,228	24,800	25,419	15,881	12,360	20,229	6,836
Mean	312	519	1,370	485	715	846	827	820	529	399	653	228
Max	1,850	1,570	3,500	1,160	3,440	3,020	2,140	3,100	987	1,730	2,870	554
Min	67	279	540	220	190	441	431	420	249	114	209	107
Cfsm	0.72	1.19	3.15	1.12	1.64	1.94	1.90	1.88	1.22	0.92	1.50	0.52
In.	0.83	1.33	3.63	1.29	1.71	2.24	2.12	2.17	1.36	1.06	1.73	0.58

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2009, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	499	857	923	807	820	1,466	1,514	931	517	286	278	301
Max	2,512	2,856	3,033	3,070	2,961	4,490	4,236	2,694	4,327	1,206	1,797	2,037
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2004)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

SUMMARY STATISTICS

	Calendar Year 2008		Water Year 2009		Water Years 1926 - 2009	
Annual total	299,339		234,497			
Annual mean	818		642		766	
Highest annual mean					1,312	1978
Lowest annual mean					332	1965
Highest daily mean	12,500	Mar 5	3,500	Dec 12	45,000	Jun 23, 1972
Lowest daily mean	43	Sep 5	67	Oct 23[a]	11	Sep 25, 1964
Annual seven-day minimum	52	Aug 31	70	Oct 18	12	Sep 20, 1964
Maximum peak flow			[b]4,370	Dec 12	[c]55,800	Jan 19, 1996
Maximum peak stage			[d]10.06	Feb 12	[e]17.93	Jan 19, 1996
Instantaneous low flow			66	Oct 22[f]	11	Sep 25, 1964[g]
Annual runoff (cfsm)	1.88		1.48		1.76	
Annual runoff (inches)	25.60		20.05		23.92	
10 percent exceeds	1,620		1,280		1,680	
50 percent exceeds	525		503		413	
90 percent exceeds	78		162		70	

[a] Also Oct 24.

[b] At gage height 5.34 ft.

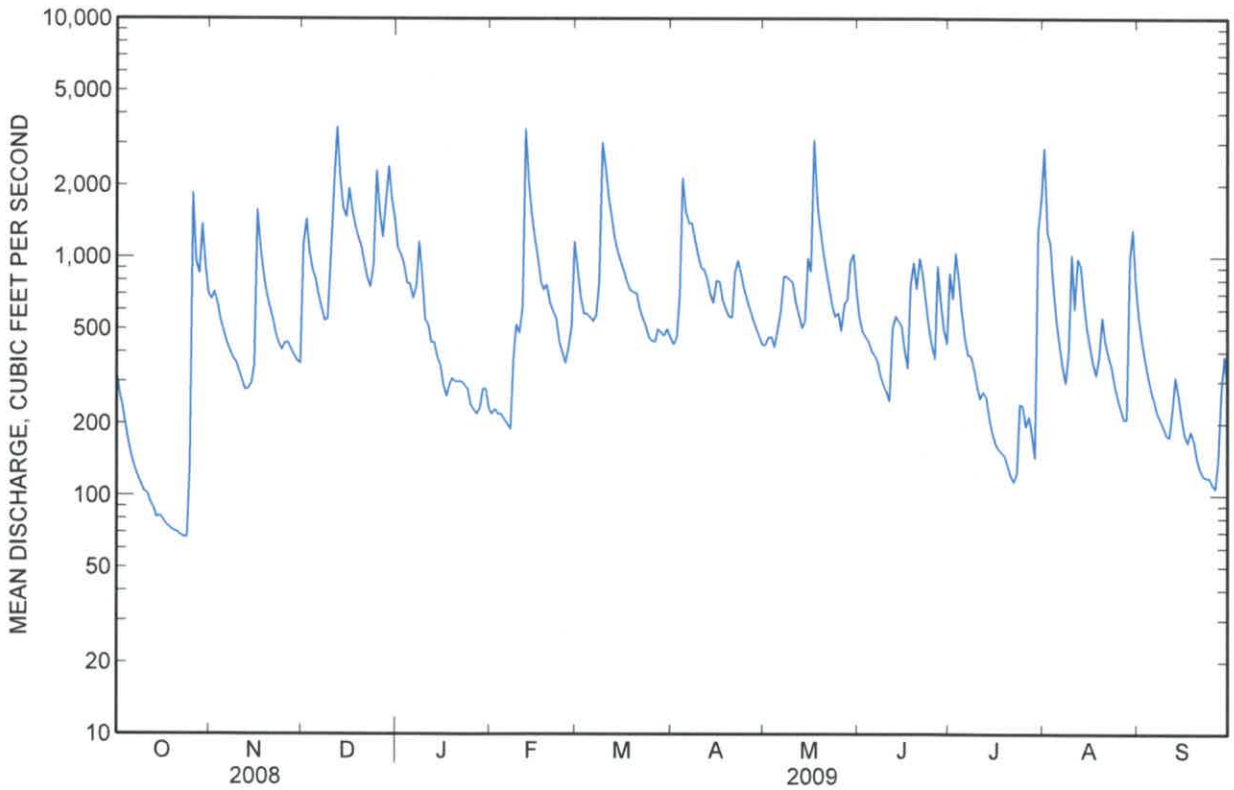
[c] From rating curve extended above 11,000 ft^3/s on basis of slope-area measurement of peak flow.

[d] Ice jam.

[e] From floodmark in gage.

[f] Also Oct 23-25.

[g] Also Sep 26, 1964, Nov 24, 1964.



WATER-QUALITY RECORDS

PERIOD OF RECORD.--April 2002 to current year.

REMARKS.--Analyses for pH, water temperature, specific conductance, and dissolved oxygen were performed on site. All other sample analyses were performed at the Pennsylvania Department of Environmental Protection laboratory in Harrisburg, Pa. Some values for filtered parameters exceed values for the corresponding unfiltered parameter. These results are within the limits of analytical precision and methods.

COOPERATION.--Water-quality samples were collected as part of the Pennsylvania Department of Environmental Protection Water-Quality Network (WQN) with cooperation from the Pennsylvania Department of Environmental Protection.

WATER-QUALITY DATA
WATER YEAR OCTOBER 2008 TO SEPTEMBER 2009

Part 1 of 3

[Remark codes: E, Estimated; <, less than; M, presence verified but not quantified.]

Date	Time	Instantaneous discharge, ft³/s (00061)	Dissolved oxygen, mg/L (00300)	pH, water, unfltrd field, std units (00400)	pH, water, unfltrd lab, std units (00403)	Specif. conductance, wat unf lab, µS/cm @ 25 degC (90095)	Specific conductance, wat unf µS/cm @ 25 degC (00095)	Temperature, water, deg C (00010)	BOD, water, unfltrd 5 day, 20 degC mg/L (00310)	Dissolved solids dried @ 105degC wat flt mg/L (00515)	Hardness, water, mg/L as CaCO3 (00900)	Suspended solids, water, unfltrd mg/L (00530)	Calcium water, fltrd, mg/L (00915)
Nov													
25...	1330	432	14.2	7.3	7.3	57	58	2.7	1.8	46	20	6	5.87
Feb													
03...	1300	E220	15.6	7.3	7.4	64	64	-.1	2.9	46	22	<5	6.72
Mar													
04...	1200	E580	15.0	6.8	7.1	58	60	.8	.3	58	19	<5	6.16
May													
26...	1345	470	10.5	8.0	7.2	65	66	15.4	.8	56	24	<5	6.97
Jul													
15...	1500	181	10.0	8.8	7.2	72	74	22.9	1.1	46	26	<5	8.00
Sep													
30...	1530	261	11.0	8.3	7.6	62	62	13.8	<.2	62	22	6	6.87

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2008 TO SEPTEMBER 2009
Part 2 of 3
[Remark codes: <, less than; M, presence verified but not quantified.]

Date	Calcium water unfltrd recover -able, mg/L (00916)	Magnes- ium, water, fltrd, mg/L (00925)	Magnes- ium, water, unfltrd recover -able, mg/L (00927)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (00417)	Sulfate water, fltrd, mg/L (00945)	Ammonia water, unfltrd mg/L as N (00610)	Nitrate water unfltrd mg/L as N (00620)	Nitrite water, unfltrd mg/L as N (00615)	Ortho- phos- phate, water, unfltrd mg/L as P (70507)	Phos- phorus, water, unfltrd mg/L as P (00665)	Total nitro- gen, water, unfltrd mg/L (00600)	Alum- inum, water, fltrd, µg/L (01106)	Alum- inum, water, unfltrd recover -able, µg/L (01105)
Nov													
25...	6.2	1.01	1.1	11	8.6	<.020	.20	<.040	<.01	<.010	.26	17	M
Feb													
03...	7.0	1.12	1.2	11	8.5	<.020	.32	<.040	<.01	<.010	.44	<10	M
Mar													
04...	6.0	1.06	1.1	9	8.5	<.020	.33	<.040	<.01	<.010	.40	19	M
May													
26...	7.5	1.13	1.2	15	8.1	<.020	.16	<.040	<.01	<.010	.31	18	M
Jul													
15...	8.3	1.21	1.3	17	7.9	<.020	.10	<.040	<.01	.010	.31	24	M
Sep													
30...	7.1	1.10	1.1	15	6.7	<.020	.08	<.040	<.01	<.010	.20	21	M

WATER-QUALITY DATA
WATER YEAR OCTOBER 2008 TO SEPTEMBER 2009
Part 3 of 3
[Remark codes: <, less than; M, presence verified but not quantified.]

Date	Copper, water, fltrd, µg/L (01040)	Copper, water, unfltrd recover -able, µg/L (01042)	Iron, water, fltrd, µg/L (01046)	Iron, water, unfltrd recover -able, µg/L (01045)	Lead, water, fltrd, µg/L (01049)	Lead, water, unfltrd recover -able, µg/L (01051)	Mangan- ese, water, fltrd, µg/L (01056)	Mangan- ese, water, unfltrd recover -able, µg/L (01055)	Nickel, water, fltrd, µg/L (01065)	Nickel, water, unfltrd recover -able, µg/L (01067)	Zinc, water, fltrd, µg/L (01090)	Zinc, water, unfltrd recover -able, µg/L (01092)
Nov												
25...	<4	<4	<20	20	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
Feb												
03...	<4	<4	<20	<20	<1.0	<1.0	<2.0	M	<4.0	<4.0	<5.0	<5.0
Mar												
04...	<4	<4	20	30	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0
May												
26...	M	<4	<20	50	<1.0	<1.0	M	10	<4.0	<4.0	<5.0	<5.0
Jul												
15...	<4	<4	<20	40	<1.0	<1.0	M	10	<4.0	<4.0	<5.0	<5.0
Sep												
30...	<4	<4	30	80	<1.0	<1.0	M	M	<4.0	<4.0	<5.0	<5.0

2010

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

West Branch Susquehanna Basin
Lower West Branch Susquehanna Subbasin

LOCATION.--Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA.--435 mi^2.

SURFACE-WATER RECORDS

PERIOD OF RECORD.--August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

REVISED RECORDS.--WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

GAGE.--Water-stage recorder. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, non-recording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION.--Station established and maintained by the U.S. Geological Survey National Streamflow Information Program in cooperation with the National Weather Service, and the Pennsylvania Department of Environmental Protection

REMARKS.--Records good except those for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s, from rating curve extended above 16,000 ft^3/s on basis of slope-area measurement of peak flow.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 6,400 ft^3/s and (or) maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct 24	2045	9,820	7.67
Jan 25	1845	*34,900	*14.20

Minimum discharge, 34 ft^3/s, Aug. 11, 12, gage height, 1.38 ft.

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2009 TO SEPTEMBER 2010
DAILY MEAN VALUES
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	218	1,600	839	832	e890	254	2,950	552	225	77	66	72
2	192	1,300	750	e692	e810	245	2,370	494	222	69	59	66
3	305	1,130	1,230	e530	778	249	1,790	464	205	64	55	61
4	358	978	1,330	e530	659	249	1,390	454	170	61	55	56
5	264	866	1,100	e520	573	244	1,130	425	156	57	52	53
6	221	805	991	e490	e500	234	1,000	383	173	54	50	50
7	205	705	876	e470	e430	238	944	349	268	50	45	47
8	208	634	794	e460	e380	292	804	443	216	47	42	45
9	203	564	968	e410	e400	445	869	562	178	50	40	43
10	214	516	1,630	e400	407	640	785	409	209	114	37	41
11	246	476	1,200	e380	371	775	668	360	205	158	35	40
12	220	442	e998	e400	e340	1,590	595	720	168	123	41	42
13	199	414	e960	e370	e320	2,190	534	737	175	109	273	42
14	190	394	1,390	e370	329	3,440	488	720	181	109	218	42
15	192	378	1,500	e370	320	2,520	449	775	157	101	142	43
16	242	357	1,590	366	311	2,150	430	624	145	94	139	45
17	356	332	1,350	e350	294	1,660	451	537	146	82	146	49
18	506	311	1,150	e640	288	1,340	440	492	138	76	115	49
19	516	309	1,090	934	281	1,140	396	492	128	74	92	49
20	455	1,070	947	715	271	978	364	459	114	69	76	48
21	410	983	847	574	262	860	342	395	102	67	66	45
22	379	738	764	542	256	790	326	348	96	66	371	43
23	354	630	616	457	264	1,480	310	319	99	64	674	50
24	3,780	590	e570	483	261	1,380	290	298	103	64	351	49
25	4,860	638	e530	16,200	260	1,080	331	277	106	113	245	49
26	2,260	681	924	8,300	245	1,130	630	253	101	141	191	47
27	1,610	1,090	1,660	3,590	250	1,030	1,160	232	94	135	154	50
28	3,170	1,110	1,410	2,270	281	921	906	211	90	104	126	93
29	3,490	952	e1,100	e1,300	---	1,660	722	207	89	85	106	271
30	2,270	879	e850	e1,000	---	1,500	618	219	81	74	92	1,400
31	1,810	---	e890	e920	---	2,150	---	185	---	73	81	---
Total	29,903	21,872	32,844	45,865	11,031	34,854	24,482	13,395	4,540	2,624	4,235	3,080
Mean	965	729	1,059	1,480	394	1,124	816	432	151	84.6	137	103
Max	4,860	1,600	1,660	16,200	890	3,440	2,950	775	268	158	674	1,400
Min	190	309	530	350	245	234	290	185	81	47	35	40
Cfsm	2.22	1.68	2.44	3.40	0.91	2.58	1.88	0.99	0.35	0.19	0.31	0.24
In.	2.56	1.87	2.81	3.92	0.94	2.98	2.09	1.15	0.39	0.22	0.36	0.26

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2010, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	505	855	924	815	815	1,462	1,506	925	513	284	277	299
Max	2,512	2,856	3,033	3,070	2,961	4,490	4,236	2,694	4,327	1,206	1,797	2,037
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2004)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

SUMMARY STATISTICS

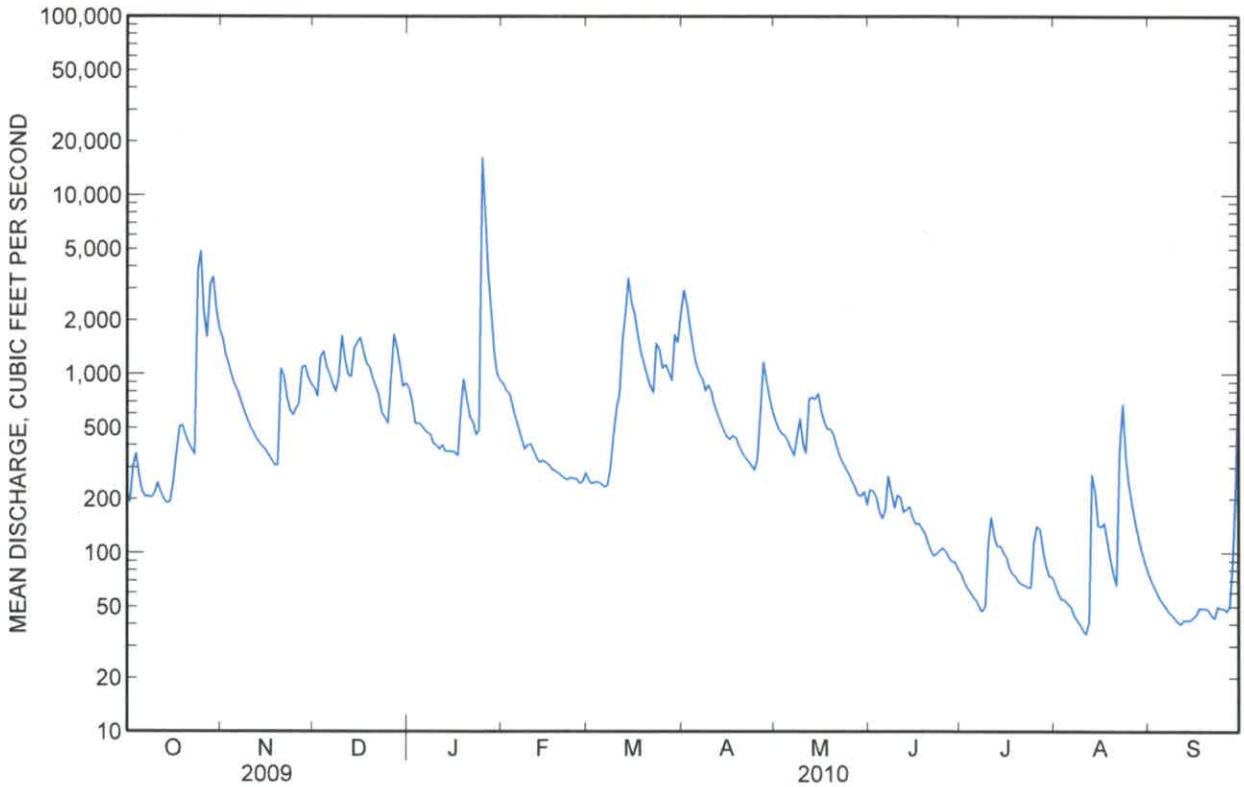
	Calendar Year 2009		Water Year 2010		Water Years 1926 - 2010	
Annual total	251,431		228,725			
Annual mean	689		627		764	
Highest annual mean					1,312	1978
Lowest annual mean					332	1965
Highest daily mean	4,860	Oct 25	16,200	Jan 25	45,000	Jun 23, 1972
Lowest daily mean	107	Sep 26	35	Aug 11	11	Sep 25, 1964
Annual seven-day minimum	121	Sep 21	41	Aug 6	12	Sep 20, 1964
Maximum peak flow			[a]34,900	Jan 25	[a]55,800	Jan 19, 1996
Maximum peak stage			14.20	Jan 25	[b]17.93	Jan 19, 1996
Instantaneous low flow			34	Aug 11[c]	11	Sep 25, 1964[d]
Annual runoff (cfsm)	1.58		1.44		1.76	
Annual runoff (inches)	21.50		19.56		23.87	
10 percent exceeds	1,280		1,340		1,680	
50 percent exceeds	541		358		412	
90 percent exceeds	208		55		70	

[a] From rating curve extended above 11,000 ft³/s on basis of slope-area measurement of peak flow.

[b] From floodmark in gage.

[c] Also Aug 12.

[d] Also Sep 26, 1964, Nov 24, 1964.



01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--April 2002 to current year.

REMARKS.--Analyses for pH, water temperature, specific conductance, and dissolved oxygen were performed on site. All other sample analyses were performed at the Pennsylvania Department of Environmental Protection laboratory in Harrisburg, Pa. Some values for filtered parameters exceed values for the corresponding unfiltered parameter. These results are within the limits of analytical precision and methods.

COOPERATION.--Water-quality samples were collected as part of the Pennsylvania Department of Environmental Protection Water-Quality Network (WQN) with cooperation from the Pennsylvania Department of Environmental Protection.

WATER-QUALITY DATA
WATER YEAR OCTOBER 2009 TO SEPTEMBER 2010

Part 1 of 5

[ANC, acid neutralizing capacity; CaCO3, calcium carbonate; MF, membrane filter; N, nitrogen; P, phosphorus; col/100 mL, colonies per 100 milliliters; ft³/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than]

Date	Sample start time	Discharge, instantaneous, ft³/s (00061)	Dissolved oxygen, water, unfiltered, mg/L (00300)	Osmotic pressure, water, unfiltered, milliosmoles per kilogram (82550)	pH, water, unfiltered, field, standard units (00400)	pH, water, unfiltered, laboratory, standard units (00403)	Specific conductance, water, unfiltered, laboratory, µS/cm at 25 °C (90095)	Specific conductance, water, unfiltered, µS/cm at 25 °C (00095)	Temperature, water, °C (00010)	Biochemical oxygen demand, water, unfiltered, 5 days at 20 °C, mg/L (00310)
10-29-2009	1445	3,190	10.9	--	7.1	7.1	45	45	11.0	1.9
12-22-2009	1200	772	13.8	--	7.1	7.1	54	55	1.8	.9
02-25-2010	1330	262	14.1	--	7.3	7.2	65	65	2.5	1.3
04-07-2010	1215	939	9.6	< 1	7.8	6.9	55	50	12.4	< .2
06-23-2010	1045	98	7.5	< 1	7.0	7.4	77	77	22.0	2.1
08-11-2010	1030	36	7.6	1	7.7	7.0	87	88	25.5	.4

WATER-QUALITY DATA
WATER YEAR OCTOBER 2009 TO SEPTEMBER 2010

Part 2 of 5

[ANC, acid neutralizing capacity; CaCO3, calcium carbonate; MF, membrane filter; N, nitrogen; P, phosphorus; col/100 mL, colonies per 100 milliliters; ft³/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than]

Date	Dissolved solids dried at 105 degrees Celsius, water, filtered, milligrams per liter (00515)	Hardness, water, mg/L as CaCO3 (00900)	Suspended solids, water, unfiltered, mg/L (00530)	Calcium, water, unfiltered, recoverable, mg/L (00916)	Magnesium, water, unfiltered, recoverable, mg/L (00927)	ANC, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, mg/L as CaCO3 (00417)	Chloride, water, filtered, mg/L (00940)	Fluoride, water, unfiltered, mg/L (00951)	Sulfate, water, filtered, mg/L (00945)	Ammonia, water, unfiltered, mg/L as N (00610)
10-29-2009	52	15	< 5	4.7	.8	9	2.2	--	6.5	< .020
12-22-2009	34	19	6	5.8	1.0	11	3.0	--	8.2	< .020
02-25-2010	42	22	< 5	6.8	1.1	12	3.9	--	8.2	< .020
04-07-2010	38	18	< 5	5.6	.9	10	13.5	< 1.0	1.8	< .020
06-23-2010	56	27	12	8.6	1.3	22	4.2	< .2	7.1	< .020
08-11-2010	52	33	< 5	10.8	1.5	26	4.9	< .2	7.8	< .020

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2009 TO SEPTEMBER 2010

Part 3 of 5

[ANC, acid neutralizing capacity; CaCO3, calcium carbonate; MF, membrane filter; N, nitrogen; P, phosphorus; col/100 mL, colonies per 100 milliliters; ft³/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than]

Date	Nitrate, water, unfiltered, mg/L as N (00620)	Nitrite, water, unfiltered, mg/L as N (00615)	Orthophosphate, water, unfiltered, mg/L as P (70507)	Phosphorus, water, unfiltered, mg/L as P (00665)	Total nitrogen, water, unfiltered, mg/L (00600)	Fecal coliform, M-FC MF (0.45 micron) method, water, col/100 mL (31616)	Aluminum, water, filtered, µg/L (01106)	Aluminum, water, unfiltered, recoverable, µg/L (01105)	Barium, water, unfiltered, recoverable, µg/L (01007)	Cadmium, water, filtered, µg/L (01025)
10-29-2009	.15	< .040	.01	.013	.30	--	73	200	--	--
12-22-2009	.28	< .040	< .01	< .010	.33	--	19	30	--	--
02-25-2010	.36	< .040	< .01	< .010	.39	--	11	--	--	--
04-07-2010	.07	< .040	< .01	< .010	.30	10	19	30	22	< .20
06-23-2010	.14	< .040	< .01	.011	.21	--	< 10	20	26	< .20
08-11-2010	.12	< .040	< .01	< .010	.29	< 5	< 10	10	30	< .20

WATER-QUALITY DATA
WATER YEAR OCTOBER 2009 TO SEPTEMBER 2010

Part 4 of 5

[ANC, acid neutralizing capacity; CaCO3, calcium carbonate; MF, membrane filter; N, nitrogen; P, phosphorus; col/100 mL, colonies per 100 milliliters; ft³/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than]

Date	Copper, water, filtered, µg/L (01040)	Copper, water, unfiltered, recoverable, µg/L (01042)	Iron, water, filtered, µg/L (01046)	Iron, water, unfiltered, recoverable, µg/L (01045)	Lead, water, filtered, µg/L (01049)	Lead, water, unfiltered, recoverable, µg/L (01051)	Manganese, water, filtered, µg/L (01056)	Manganese, water, unfiltered, recoverable, µg/L (01055)	Nickel, water, filtered, µg/L (01065)	Nickel, water, unfiltered, recoverable, µg/L (01067)
10-29-2009	< 4	< 4	40	200	< 1.0	< 1.0	7	20	< 4.0	< 4.0
12-22-2009	< 4	< 4	< 20	30	< 1.0	< 1.0	2	3	< 4.0	< 4.0
02-25-2010	< 4	< 4	< 20	50	< 1.0	< 1.0	2	3	< 4.0	< 4.0
04-07-2010	< 4	< 4	< 20	20	< 1.0	< 1.0	3	5	< 4.0	< 4.0
06-23-2010	< 4	< 4	< 20	110	< 1.0	< 1.0	7	10	< 4.0	< 4.0
08-11-2010	< 4	< 4	< 20	40	< 1.0	< 1.0	14	20	< 4.0	< 4.0

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2009 TO SEPTEMBER 2010

Part 5 of 5

[ANC, acid neutralizing capacity; CaCO3, calcium carbonate; MF, membrane filter; N, nitrogen; P, phosphorus; col/100 mL, colonies per 100 milliliters; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than]

Date	Zinc, water, filtered, µg/L (01090)	Zinc, water, unfiltered, recoverable, µg/L (01092)	Arsenic, water, filtered, µg/L (01000)	Phenolic compounds, water, unfiltered, recoverable, micrograms per liter (32730)
10-29-2009	5.9	7.4	--	--
12-22-2009	< 5.0	< 5.0	--	--
02-25-2010	7.8	--	--	--
04-07-2010	7.1	7.2	< 3.0	< 5.0
06-23-2010	5.5	7.1	< 3.0	< 5.0
08-11-2010	8.4	8.1	< 3.0	< 5.0

2011

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

West Branch Susquehanna Basin
Lower West Branch Susquehanna Subbasin

LOCATION.--Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA.--435 mi^2.

SURFACE-WATER RECORDS

PERIOD OF RECORD.--August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

REVISED RECORDS.--WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

GAGE.--Water-stage recorder. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, nonrecording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION.--Station established and maintained by the U.S. Geological Survey National Streamflow Information Program in cooperation with the Pennsylvania Department of Environmental Protection.

REMARKS.--Records good except those for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 6,400 ft^3/s and (or) maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct 1	0500	16,100	9.79
Dec 1	1545	20,800	11.09
Mar 6	1730	22,600	10.38
Mar 11	0545	30,200	12.39
Apr 5	1800	7,940	6.23
Apr 17	0500	22,800	10.42
Apr 27	0545	17,400	8.95
Apr 28	1515	18,900	9.34
May 4	1100	8,750	6.47
May 28	0730	7,710	6.16
Aug 28	1930	28,700	11.99
Sep 7	2100	*69,100	*19.78
Sep 29	1000	13,500	7.80

Minimum discharge, 39 ft^3/s, Aug. 1, gage height, 1.35 ft.

Suggested citation: U.S. Geological Survey, 2012, Water-resources data for the United States, Water Year 2011: U.S. Geological Survey Water-Data Report WDR-US-2011, site 01552000, accessed at http://wdr.water.usgs.gov/wy2011/pdfs/01552000.2011.pdf

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011
DAILY MEAN VALUES
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10,700	388	11,700	258	158	2,930	1,040	2,470	1,560	206	44	668
2	2,910	358	7,630	272	176	1,950	1,140	1,860	1,210	164	95	502
3	1,410	338	3,500	267	e184	1,440	1,130	1,670	958	207	107	390
4	951	355	2,300	222	e167	1,190	1,380	7,290	776	405	96	328
5	1,060	794	1,720	241	e160	1,090	5,540	4,400	668	267	80	1,240
6	1,790	757	1,370	e190	233	12,200	4,870	2,690	560	197	185	3,150
7	2,230	611	1,130	e205	259	8,750	4,040	2,010	465	166	557	28,000
8	1,480	538	946	e183	244	4,250	3,210	1,640	390	138	382	e49,000
9	1,070	500	780	e212	e174	2,770	2,600	1,320	327	125	287	e7,500
10	836	458	633	e174	e193	6,060	2,130	1,100	280	126	351	5,460
11	703	423	e600	e197	e170	21,200	1,870	933	279	128	256	3,440
12	1,470	389	913	e202	e191	7,180	1,700	798	475	118	175	2,510
13	1,220	366	2,500	e190	e176	4,570	2,390	693	459	107	128	1,770
14	925	353	1,500	e176	e188	3,040	2,580	646	323	90	142	1,350
15	838	343	e1,060	e160	e204	2,270	1,900	690	330	79	1,010	1,150
16	742	343	e920	e183	e196	2,230	2,770	1,060	261	74	786	1,150
17	627	2,890	e850	e174	e179	2,380	14,800	1,060	255	67	843	873
18	542	2,260	e740	197	e319	2,930	5,250	1,130	263	64	482	700
19	479	1,570	e630	183	e1,890	3,490	3,220	1,430	219	120	346	599
20	428	1,240	e600	181	e1,180	2,350	3,180	2,210	182	151	510	554
21	390	1,040	535	181	e915	2,330	2,250	1,980	158	101	472	522
22	360	891	473	e146	e813	2,510	1,750	1,600	255	71	340	510
23	329	800	435	e142	e721	2,120	1,970	1,340	545	56	258	617
24	307	708	385	e136	e721	1,910	1,960	1,330	493	54	208	1,290
25	296	655	356	e156	789	1,570	2,070	1,110	433	55	205	1,110
26	303	1,400	e310	e163	1,090	1,300	5,850	1,020	364	85	275	807
27	592	1,400	e260	e161	862	1,150	10,500	1,630	302	84	236	891
28	771	1,090	e270	e156	1,810	1,030	14,100	4,850	254	57	8,620	3,790
29	558	924	e290	e154	---	933	7,430	2,710	220	52	5,430	10,100
30	469	1,040	e260	160	---	900	3,890	2,930	265	53	1,700	6,520
31	423	---	268	140	---	966	---	2,190	---	48	987	---
Total	37,209	25,222	45,864	5,762	14,362	110,989	118,510	59,790	13,529	3,715	25,593	136,491
Mean	1,200	841	1,479	186	513	3,580	3,950	1,929	451	120	826	4,550
Max	10,700	2,890	11,700	272	1,890	21,200	14,800	7,290	1,560	405	8,620	49,000
Min	296	338	260	136	158	900	1,040	646	158	48	44	328
Cfsm	2.76	1.93	3.40	0.43	1.18	8.23	9.08	4.43	1.04	0.28	1.90	10.5
In.	3.18	2.16	3.92	0.49	1.23	9.49	10.13	5.11	1.16	0.32	2.19	11.67

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2011, BY WATER YEAR (WY)

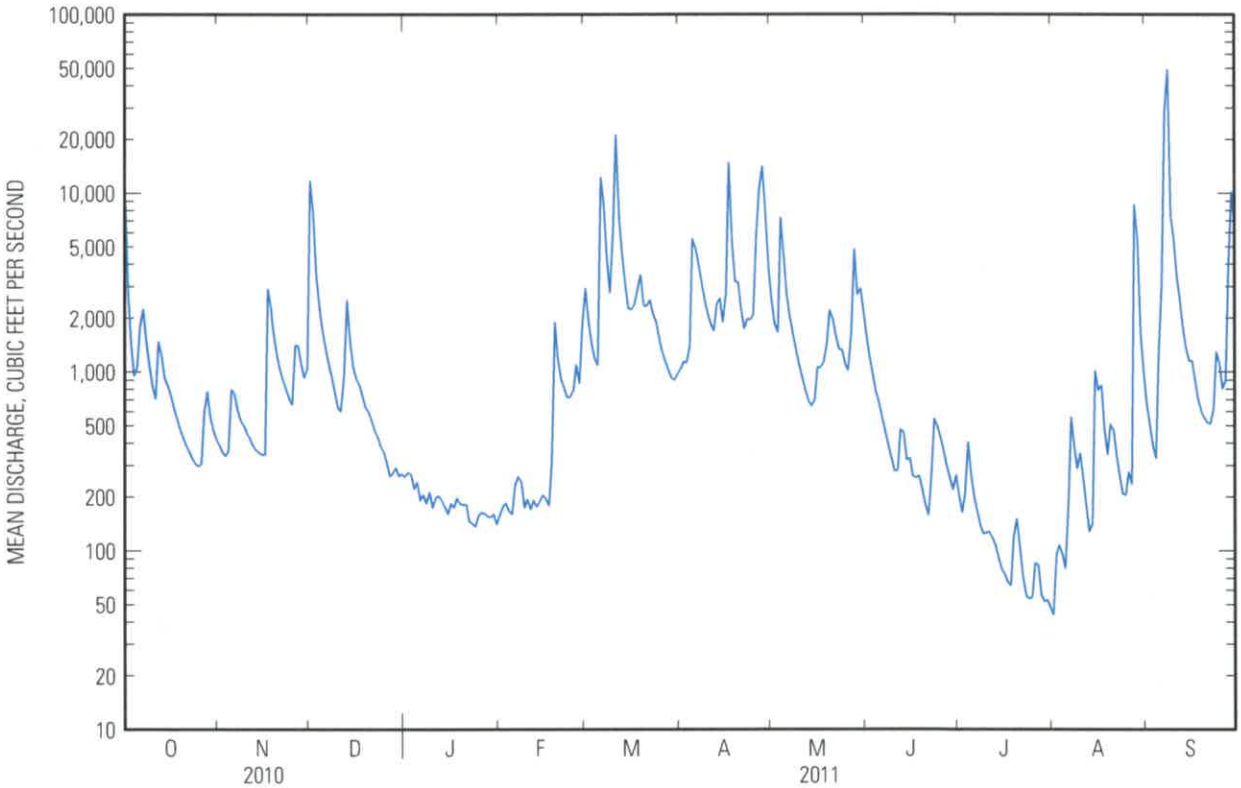
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	513	855	931	807	812	1,486	1,535	937	512	282	283	349
Max	2,512	2,856	3,033	3,070	2,961	4,490	4,236	2,694	4,327	1,206	1,797	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

SUMMARY STATISTICS

	Calendar Year 2010		Water Year 2011		Water Years 1926 - 2011	
Annual total	252,401		597,036			
Annual mean	692		1,636		774	
Highest annual mean					1,636	2011
Lowest annual mean					332	1965
Highest daily mean	16,200	Jan 25	[a]49,000	Sep 8	[a]49,000	Sep 8, 2011
Lowest daily mean	35	Aug 11	44	Aug 1	11	Sep 25, 1964
Annual seven-day minimum	41	Aug 6	60	Jul 26	12	Sep 20, 1964
Maximum peak flow			[b]69,100	Sep 7	[b]69,100	Sep 7, 2011
Maximum peak stage			19.78	Sep 7	19.78	Sep 7, 2011
Instantaneous low flow			39	Aug 1	11	Sep 25, 1964[c]
Annual runoff (cfsm)	1.59		3.76		1.78	
Annual runoff (inches)	21.58		51.06		24.19	
10 percent exceeds	1,400		3,210		1,690	
50 percent exceeds	366		668		414	
90 percent exceeds	55		155		71	

[a] Estimated.
[b] From rating curve extended above 19,000 ft³/s on basis of slope-area measurement of peak flow at gage height 17.93 ft.
[c] Also Sep 26, 1964, Nov 24, 1964.



01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--April 2002 to current year.

REMARKS.--Analyses for pH, water temperature, specific conductance, and dissolved oxygen were performed on site. All other sample analyses were performed at the Pennsylvania Department of Environmental Protection laboratory in Harrisburg, Pa. Some values for filtered parameters exceed values for the corresponding unfiltered parameter. These results are within the limits of analytical precision and methods.

COOPERATION.--Water-quality samples were collected as part of the Pennsylvania Department of Environmental Protection Water-Quality Network (WQN) with cooperation from the Pennsylvania Department of Environmental Protection.

WATER-QUALITY DATA
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011

Part 1 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than; M, presence verified but not quantified]

Date	Sample start time	Discharge, instantaneous, ft^3/s (00061)	Dissolved oxygen, water, unfiltered, mg/L (00300)	Osmotic pressure, water, unfiltered, milliosmoles per kilogram (82550)	pH, water, unfiltered, field, standard units (00400)	pH, water, unfiltered, laboratory, standard units (00403)	Specific conductance, water, unfiltered, laboratory, µS/cm at 25 °C (90095)	Specific conductance, water, unfiltered, µS/cm at 25 °C (00095)	Temperature, water, °C (00010)	Biochemical oxygen demand, water, unfiltered, 5 days at 20 °C, mg/L (00310)
11-08-2010	0946	544	15.0	1.0	7.2	6.9	58	56	5.2	1.4
01-03-2011	0930	285	12.1	4.0	6.4	7.0	61	58	.0	1.2
03-09-2011	1115	2,790	13.3	2.0	6.9	6.8	52	46	1.7	1.0
05-17-2011	1015	1,010	11.0	3.0	7.3	7.2	55	50	12.3	1.1
07-26-2011	0845	91	8.3	1.0	7.6	7.5	81	73	24.0	.8
09-21-2011	0930	525	10.4	< 1.0	7.3	7.0	69	71	14.6	.6

WATER-QUALITY DATA
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011

Part 2 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than; M, presence verified but not quantified]

Date	Sample start time	Dissolved solids dried at 180 °C, water, filtered, mg/L (70300)	Hardness, water, mg/L as $CaCO_3$ (00900)	Suspended solids, water, unfiltered, mg/L (00530)	Calcium, water, filtered, mg/L (00915)	Calcium, water, unfiltered, recoverable, mg/L (00916)	Magnesium, water, filtered, mg/L (00925)	Magnesium, water, unfiltered, recoverable, mg/L (00927)	Sodium, water, unfiltered, recoverable, mg/L (00929)	ANC, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, mg/L as $CaCO_3$ (00417)
11-08-2010	0946	20	21	< 5	6.44	6.6	1.02	1.0	2.2	13
01-03-2011	0930	60	20	< 5	6.10	6.3	1.01	1.0	2.0	11
03-09-2011	1115	32	15	< 5	4.32	4.6	.76	.8	2.0	6
05-17-2011	1015	46	17	< 5	5.25	5.3	.87	.9	1.9	11
07-26-2011	0845	74	27	< 5	8.70	8.7	1.30	1.3	2.5	21
09-21-2011	0930	68	26	< 5	8.35	8.5	1.21	1.2	2.1	20

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011

Part 3 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than; M, presence verified but not quantified]

Date	Sample start time	Bromide, water, filtered, mg/L (71870)	Chloride, water, filtered, mg/L (00940)	Sulfate, water, filtered, mg/L (00945)	Ammonia, water, unfiltered, mg/L as N (00610)	Nitrate, water, unfiltered, mg/L as N (00620)	Nitrite, water, unfiltered, mg/L as N (00615)	Orthophosphate, water, unfiltered, mg/L as P (70507)	Phosphorus, water, unfiltered, mg/L as P (00665)	Total nitrogen, water, unfiltered, mg/L (00600)
11-08-2010	0946	< .1	3.6	8.0	< .020	.10	< .040	< .01	< .010	.18
01-03-2011	0930	< .1	3.2	8.2	< .020	.29	< .040	< .01	< .010	.37
03-09-2011	1115	< .1	3.4	7.2	< .020	.28	< .040	.01	.010	.34
05-17-2011	1015	< .1	2.7	6.9	.020	.07	< .040	< .01	< .010	.17
07-26-2011	0845	< .1	3.8	7.5	< .020	.09	< .040	< .01	< .010	< .25
09-21-2011	0930	< .1	2.7	8.4	< .020	.23	< .040	< .01	< .010	.34

WATER-QUALITY DATA
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011

Part 4 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than; M, presence verified but not quantified]

Date	Sample start time	Aluminum, water, filtered, µg/L (01106)	Aluminum, water, unfiltered, recoverable, µg/L (01105)	Barium, water, unfiltered, recoverable, µg/L (01007)	Copper, water, filtered, µg/L (01040)	Copper, water, unfiltered, recoverable, µg/L (01042)	Iron, water, filtered, µg/L (01046)	Iron, water, unfiltered, recoverable, µg/L (01045)	Lead, water, filtered, µg/L (01049)	Lead, water, unfiltered, recoverable, µg/L (01051)
11-08-2010	0946	16	M	M	< 4	< 4	< 20	60	< 1.0	< 1.0
01-03-2011	0930	10	M	M	< 4	< 4	< 20	< 20	< 1.0	< 1.0
03-09-2011	1115	45	M	M	< 4	< 4	20	100	< 1.0	< 1.0
05-17-2011	1015	21	M	M	< 4	< 4	20	60	< 1.0	< 1.0
07-26-2011	0845	10	M	M	< 4	< 4	< 20	20	< 1.0	< 1.0
09-21-2011	0930	12	M	M	< 4	< 4	< 20	50	< 1.0	< 1.0

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011

Part 5 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; <, less than; M, presence verified but not quantified]

Date	Sample start time	Manganese, water, filtered, µg/L (01056)	Manganese, water, unfiltered, recoverable, µg/L (01055)	Nickel, water, filtered, µg/L (01065)	Nickel, water, unfiltered, recoverable, µg/L (01067)	Strontium, water, unfiltered, recoverable, micrograms per liter (01082)	Zinc, water, filtered, µg/L (01090)	Zinc, water, unfiltered, recoverable, µg/L (01092)	Boron, water, unfiltered, recoverable, micrograms per liter (01022)	Selenium, water, unfiltered, µg/L (01147)
11-08-2010	0946	M	M	< 4.0	< 4.0	30	M	M	< 200	< 7
01-03-2011	0930	M	M	< 4.0	< 4.0	30	< 5.0	M	< 200	< 7
03-09-2011	1115	10	20	< 4.0	< 4.0	20	10	M	< 200	< 7
05-17-2011	1015	M	M	< 4.0	< 4.0	30	M	< 5.0	< 200	< 7
07-26-2011	0845	M	10	< 4.0	< 4.0	40	< 5.0	< 5.0	< 200	< 7
09-21-2011	0930	10	10	< 4.0	< 4.0	40	M	M	< 200	< 7

2012

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

West Branch Susquehanna Basin
Lower West Branch Susquehanna Subbasin

LOCATION.--Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA.--435 mi^2.

SURFACE-WATER RECORDS

PERIOD OF RECORD.--August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

REVISED RECORDS.--WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

GAGE.--Water-stage recorder. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, nonrecording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION.--Station established and maintained by the U.S. Geological Survey National Streamflow Information Program in cooperation with the Pennsylvania Department of Environmental Protection.

REMARKS.--Records good except those for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 6,400 ft^3/s and (or) maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct 3	0630	6,430	5.50
Oct 14	2345	7,680	5.95
Dec 8	0045	6,580	5.68
May 15	1745	*8,100	*6.21

Minimum discharge, 68 ft^3/s, July 14, 15, gage height, 0.83 ft.

Suggested citation: U.S. Geological Survey, 2013, Water-resources data for the United States, Water Year 2012: U.S. Geological Survey Water-Data Report WDR-US-2012, site 01552000, accessed at http://wdr.water.usgs.gov/wy2012/pdfs/01552000.2012.pdf

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2011 TO SEPTEMBER 2012
DAILY MEAN VALUES
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	3,850	1,140	2,190	1,150	1,190	839	293	462	385	120	345	101
2	3,920	1,070	1,600	1,120	1,090	1,210	311	467	1,430	107	245	91
3	5,560	1,020	1,320	968	937	1,530	316	660	940	99	198	87
4	4,420	968	1,140	677	833	1,550	276	732	839	95	160	86
5	3,080	869	1,010	720	755	1,250	290	1,100	933	93	166	109
6	2,190	761	1,020	687	667	999	284	936	812	88	251	119
7	1,660	696	2,270	643	615	898	263	731	636	98	282	1,190
8	1,320	640	5,190	590	558	876	252	958	563	105	192	763
9	1,080	593	3,160	518	510	2,840	239	2,140	471	102	167	910
10	905	556	2,370	468	461	2,040	230	1,720	409	87	338	541
11	773	530	1,800	435	444	1,520	227	1,240	365	81	328	369
12	698	494	1,450	805	386	1,270	228	960	356	75	284	299
13	1,260	448	1,240	3,010	365	1,120	226	782	403	72	217	248
14	5,320	415	1,100	2,310	362	986	211	711	366	70	194	220
15	5,910	449	1,080	e1,450	355	848	204	4,690	303	75	216	208
16	3,470	530	1,340	e1,140	351	753	200	5,160	265	109	251	197
17	2,590	701	1,150	1,210	374	673	189	2,830	235	134	191	180
18	1,960	643	974	1,200	397	598	178	1,850	213	121	167	944
19	1,550	519	870	e840	353	544	167	1,360	217	117	146	2,460
20	2,500	470	821	e780	317	523	163	1,040	210	213	135	1,170
21	2,200	444	873	e730	283	489	158	825	189	433	133	730
22	1,650	453	1,910	e680	282	439	166	723	170	305	138	544
23	1,380	4,450	2,910	e700	297	406	714	652	166	197	134	445
24	1,190	3,480	2,550	952	412	378	1,300	572	161	145	116	378
25	1,050	2,210	1,900	925	644	369	1,010	497	174	117	103	333
26	907	1,650	1,570	810	519	354	859	433	214	110	97	303
27	956	1,320	1,440	2,830	437	315	744	388	190	308	100	289
28	1,380	1,120	2,620	3,150	452	292	646	360	152	514	185	540
29	1,150	1,050	1,780	2,110	471	281	555	333	135	346	150	604
30	1,140	3,020	1,430	1,620	---	267	495	783	129	252	143	458
31	1,220	---	1,280	1,320	---	276	---	530	---	192	118	---
Total	68,239	32,709	53,358	36,548	15,117	26,733	11,394	36,625	12,031	4,980	5,890	14,916
Mean	2,201	1,090	1,721	1,179	521	862	380	1,181	401	161	190	497
Max	5,910	4,450	5,190	3,150	1,190	2,840	1,300	5,160	1,430	514	345	2,460
Min	698	415	821	435	282	267	158	333	129	70	97	86
Cfsm	5.06	2.51	3.96	2.71	1.20	1.98	0.87	2.72	0.92	0.37	0.44	1.14
In.	5.84	2.80	4.56	3.13	1.29	2.29	0.97	3.13	1.03	0.43	0.50	1.28

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2012, BY WATER YEAR (WY)

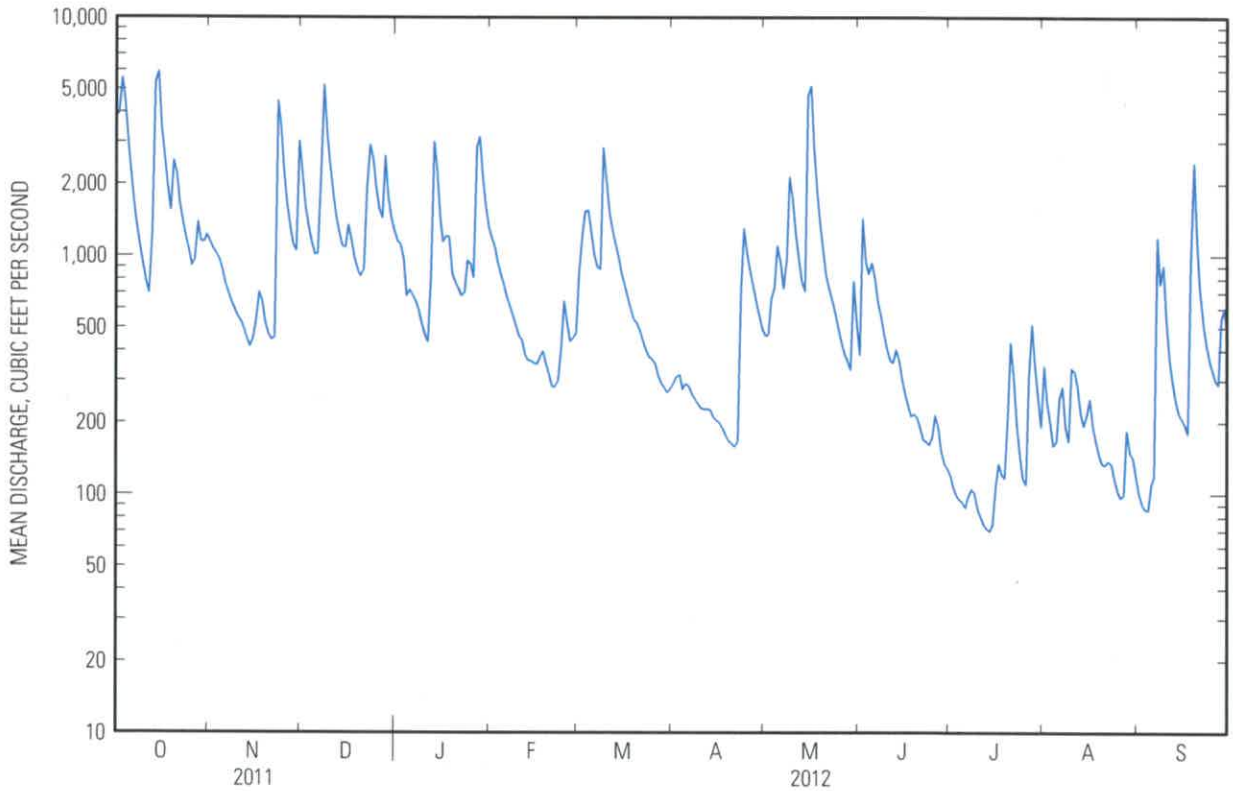
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	532	858	940	812	808	1,479	1,521	940	511	280	282	351
Max	2,512	2,856	3,033	3,070	2,961	4,490	4,236	2,694	4,327	1,206	1,797	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

SUMMARY STATISTICS

	Calendar Year 2011		Water Year 2012		Water Years 1926 - 2012	
Annual total	643,047		318,540			
Annual mean	1,762		870		776	
Highest annual mean					1,636	2011
Lowest annual mean					332	1965
Highest daily mean	[a]49,000	Sep 8	5,910	Oct 15	[a]49,000	Sep 8, 2011
Lowest daily mean	44	Aug 1	70	Jul 14	11	Sep 25, 1964
Annual seven-day minimum	60	Jul 26	80	Jul 9	12	Sep 20, 1964
Maximum peak flow			8,100	May 15	[b]69,100	Sep 7, 2011
Maximum peak stage			6.21	May 15	19.78	Sep 7, 2011
Instantaneous low flow			68	Jul 14[c]	11	Sep 25, 1964[d]
Annual runoff (cfsm)	4.05		2.00		1.78	
Annual runoff (inches)	54.99		27.24		24.23	
10 percent exceeds	3,810		1,980		1,700	
50 percent exceeds	933		544		415	
90 percent exceeds	155		135		71	

[a] Estimated.
[b] From rating curve extended above 19,000 ft³/s on basis of slope-area measurement of peak flow at gage height 17.93 ft.
[c] Also Jul 15.
[d] Also Sep 26, 1964, Nov 24, 1964.



01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--April 2002 to current year.

REMARKS.--Analyses for pH, water temperature, specific conductance, and dissolved oxygen were performed on site. All other sample analyses were performed at the Pennsylvania Department of Environmental Protection laboratory in Harrisburg, Pa. Some values for filtered parameters exceed values for the corresponding unfiltered parameter. These results are within the limits of analytical precision and methods.

COOPERATION.--Water-quality samples were collected as part of the Pennsylvania Department of Environmental Protection Water-Quality Network (WQN) with cooperation from the Pennsylvania Department of Environmental Protection.

WATER-QUALITY DATA
WATER YEAR OCTOBER 2011 TO SEPTEMBER 2012

Part 1 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Discharge, instantaneous, ft^3/s (00061)	Dissolved oxygen, water, unfiltered, mg/L (00300)	Osmotic pressure, water, unfiltered, milliosmoles per kilogram (82550)	pH, water, unfiltered, field, standard units (00400)	pH, water, unfiltered, laboratory, standard units (00403)	Specific conductance, water, unfiltered, laboratory, µS/cm at 25°C (90095)	Specific conductance, water, unfiltered, µS/cm at 25°C (00095)	Temperature, water, °C (00010)	Biochemical oxygen demand, water, unfiltered, 5 days at 20°C, mg/L (00310)
10-26-2011	1130	911	11.3	< 1.0	7.6	7.2	59	58	10.2	0.5
12-27-2011	1015	1,340	13.6	< 1.0	7.3	7.2	47	49	3.3	1.0
02-14-2012	0930	369	14.3	< 1.0	7.1	7.1	59	59	1.4	1.0
04-18-2012	0900	181	10.0	< 1.0	7.2	7.6	70	70	13.4	1.4
06-27-2012	0915	195	8.7	< 1.0	7.3	7.8	81	77	19.7	1.1
08-28-2012	0915	224	8.2	< 1.0	7.5	7.7	75	79	21.6	.9

WATER-QUALITY DATA
WATER YEAR OCTOBER 2011 TO SEPTEMBER 2012

Part 2 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Dissolved solids dried at 180°C, water, filtered, mg/L (70300)	Hardness, water, mg/L as $CaCO_3$ (00900)	Suspended solids, water, unfiltered, mg/L (00530)	Calcium, water, filtered, mg/L (00915)	Calcium, water, unfiltered, recoverable, mg/L (00916)	Magnesium, water, filtered, mg/L (00925)	Magnesium, water, unfiltered, recoverable, mg/L (00927)	Sodium, water, unfiltered, recoverable, mg/L (00929)	ANC, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, mg/L as $CaCO_3$ (00417)
10-26-2011	1130	36	23	< 5	7.03	7.4	0.98	1.0	1.8	18
12-27-2011	1015	48	18	< 5	5.38	5.7	.84	.9	1.6	8
02-14-2012	0930	56	21	< 5	6.65	6.8	1.03	1.0	2.0	12
04-18-2012	0900	66	27	6	8.31	8.6	1.19	1.2	2.4	18
06-27-2012	0915	58	30	< 5	8.97	9.7	1.24	1.3	2.4	24
08-28-2012	0915	56	30	12	9.47	9.8	1.32	1.4	2.2	27

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2011 TO SEPTEMBER 2012

Part 3 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Bromide, water, filtered, mg/L (71870)	Chloride, water, filtered, mg/L (00940)	Sulfate, water, filtered, mg/L (00945)	Ammonia, water, unfiltered, mg/L as N (00610)	Nitrate, water, unfiltered, mg/L as N (00620)	Nitrite, water, unfiltered, mg/L as N (00615)	Orthophosphate, water, unfiltered, mg/L as P (70507)	Phosphorus, water, unfiltered, mg/L as P (00665)	Total nitrogen, water, unfiltered, mg/L (00600)
10-26-2011	1130	< .1	2.2	7.1	< .020	0.11	< .040	< .01	< .010	< .25
12-27-2011	1015	< .1	1.9	7.4	.060	.29	< .040	< .01	< .010	.36
02-14-2012	0930	< .1	2.9	7.8	< .020	.36	< .040	< .01	< .010	.36
04-18-2012	0900	< .1	4.7	7.8	.020	.36	< .040	< .01	< .010	.37
06-27-2012	0915	< 0.025	3.4	7.2	< .020	.19	< .040	< .01	< .010	.28
08-28-2012	0915	< 0.025	3.1	6.6	< .020	.19	< .040	< .01	.012	.28

WATER-QUALITY DATA
WATER YEAR OCTOBER 2011 TO SEPTEMBER 2012

Part 4 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Aluminum, water, filtered, µg/L (01106)	Aluminum, water, unfiltered, recoverable, µg/L (01105)	Barium, water, unfiltered, recoverable, µg/L (01007)	Copper, water, filtered, µg/L (01040)	Copper, water, unfiltered, recoverable, µg/L (01042)	Iron, water, filtered, µg/L (01046)	Iron, water, unfiltered, recoverable, µg/L (01045)	Lead, water, filtered, µg/L (01049)	Lead, water, unfiltered, recoverable, µg/L (01051)
10-26-2011	1130	14	M	M	< 4	< 4	< 20	80	< 1.0	< 1.0
12-27-2011	1015	39	M	M	< 4	< 4	< 20	50	< 1.0	< 1.0
02-14-2012	0930	10	M	M	< 4	< 4	< 20	20	< 1.0	< 1.0
04-18-2012	0900	< 10	M	M	< 4	< 4	< 20	30	< 1.0	< 1.0
06-27-2012	0915	< 10	M	M	< 4	< 4	< 20	40	< 1.0	< 1.0
08-28-2012	0915	< 10	200	M	< 4	< 4	< 20	250	< 1.0	< 1.0

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2011 TO SEPTEMBER 2012

Part 5 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Manganese, water, filtered, µg/L (01056)	Manganese, water, unfiltered, recoverable, µg/L (01055)	Nickel, water, filtered, µg/L (01065)	Nickel, water, unfiltered, recoverable, µg/L (01067)	Strontium, water, unfiltered, recoverable, micrograms per liter (01082)	Zinc, water, filtered, µg/L (01090)	Zinc, water, unfiltered, recoverable, µg/L (01092)	Boron, water, unfiltered, recoverable, micrograms per liter (01022)	Selenium, water, unfiltered, µg/L (01147)
10-26-2011	1130	M	10	< 4.0	< 4.0	30	< 5.0	< 5.0	< 200	< 7
12-27-2011	1015	10	20	< 4.0	< 4.0	30	--	--	< 200	< 7
02-14-2012	0930	M	M	< 4.0	< 4.0	30	< 5.0	< 5.0	< 200	< 7
04-18-2012	0900	M	10	< 4.0	< 4.0	40	< 5.0	M	< 200	< 7
06-27-2012	0915	M	10	< 4.0	< 4.0	40	< 5.0	< 5.0	< 200	< 7
08-28-2012	0915	M	20	< 4.0	< 4.0	40	< 5.0	< 5.0	< 200	< 7

2013

Water-Data Report 2013

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

West Branch Susquehanna Basin
Lower West Branch Susquehanna Subbasin

LOCATION.--Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA.--435 mi^2.

SURFACE-WATER RECORDS

PERIOD OF RECORD.--August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

REVISED RECORDS.--WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

GAGE.--Water-stage recorder. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, nonrecording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION.--Station established and maintained by the U.S. Geological Survey. Funding for this station is provided by the Pennsylvania Department of Environmental Protection and the U.S. Geological Survey through the National Streamflow Information Program.

REMARKS.--Records good except those for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 6,400 ft^3/s and (or) maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct 30	0630	12,600	7.58
Dec 21	1400	12,900	7.66
Jan 31	0915	*14,100	*8.00
Mar 12	----	unknown	unknown

Minimum discharge, 83 ft^3/s, Sept. 30, gage height, 0.81 ft.

Suggested citation: U.S. Geological Survey, 2014, Water-resources data for the United States, Water Year 2013: U.S. Geological Survey Water-Data Report WDR-US-2013, site 01552000, accessed at http://wdr.water.usgs.gov/wy2013/pdfs/01552000.2013.pdf

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2012 TO SEPTEMBER 2013
DAILY MEAN VALUES
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	392	3,000	265	705	4,400	788	843	576	487	1,340	279	115
2	364	2,090	264	649	e2,130	634	911	507	415	2,740	313	113
3	362	1,560	275	552	1,650	553	749	459	366	3,270	280	109
4	380	1,220	278	582	1,350	499	665	423	325	1,610	249	106
5	362	998	300	535	1,170	477	623	397	293	1,120	217	101
6	339	846	329	514	1,020	450	583	369	277	932	195	96
7	321	738	310	494	788	427	541	348	294	754	183	93
8	307	659	374	473	786	412	510	365	287	1,150	185	90
9	296	590	508	452	704	395	489	443	264	1,460	294	88
10	279	535	496	440	e550	412	484	413	252	963	642	89
11	260	494	924	442	632	e700	870	661	382	832	383	88
12	245	454	1,020	650	592	e1,710	1,430	917	498	672	289	97
13	227	504	830	1,280	540	e4,000	1,930	701	608	565	280	120
14	212	635	726	3,150	513	e2,000	1,490	586	1,560	518	627	141
15	208	538	657	2,690	489	1,600	1,240	524	1,110	438	399	131
16	197	476	610	2,030	473	1,330	1,080	476	706	370	308	114
17	187	438	611	1,610	429	1,140	1,160	427	546	321	261	104
18	181	408	2,210	1,290	e324	943	1,090	380	455	289	229	97
19	242	391	2,230	1,050	386	898	1,000	356	391	265	210	92
20	423	377	1,620	997	377	878	3,240	341	340	239	198	88
21	444	366	7,600	875	347	752	1,880	323	302	218	181	87
22	351	353	5,580	e700	333	666	1,460	306	272	208	166	120
23	314	340	3,150	e655	330	608	1,240	510	246	424	159	179
24	319	335	2,200	e619	325	559	1,100	849	233	429	153	146
25	337	325	1,700	e612	320	553	1,110	738	238	290	142	120
26	316	308	1,380	e629	308	549	941	546	294	234	133	106
27	300	301	1,250	e635	515	548	782	447	250	206	131	97
28	301	299	1,070	e635	959	534	691	436	1,210	506	135	92
29	338	288	947	e624	---	514	644	927	1,460	782	136	88
30	8,030	275	862	1,220	---	501	638	849	868	425	128	85
31	4,960	---	753	10,300	---	506	---	600	---	319	120	---
Total	21,794	20,141	41,329	38,089	22,740	26,536	31,414	16,200	15,229	23,889	7,605	3,192
Mean	703	671	1,333	1,229	812	856	1,047	523	508	771	245	106
Max	8,030	3,000	7,600	10,300	4,400	4,000	3,240	927	1,560	3,270	642	179
Min	181	275	264	440	308	395	484	306	233	206	120	85
Cfsm	1.62	1.54	3.06	2.82	1.87	1.97	2.41	1.20	1.17	1.77	0.56	0.24
In.	1.86	1.72	3.53	3.26	1.94	2.27	2.69	1.39	1.30	2.04	0.65	0.27

STATISTICS OF MONTHLY MEAN DATA FOR PERIOD OF DAILY RECORD, BY WATER YEAR (WY)

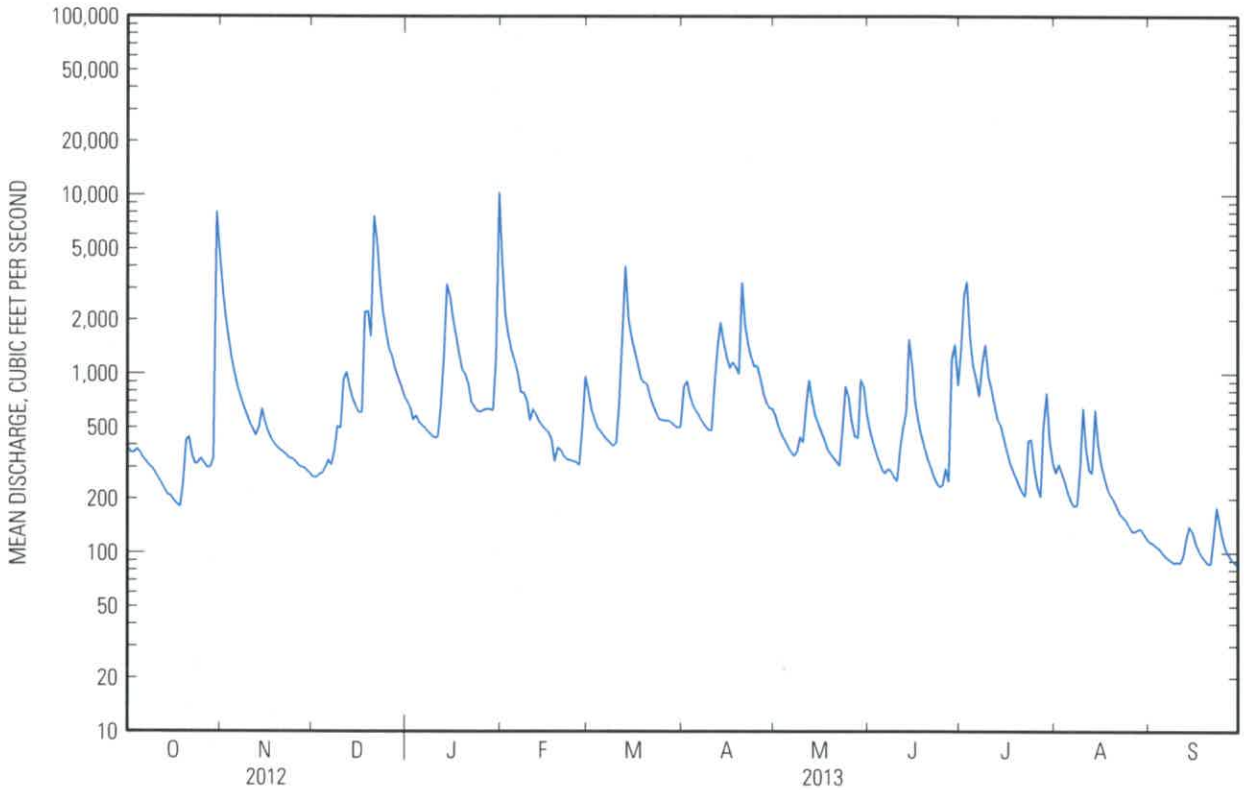
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	534	856	945	817	808	1,472	1,516	935	511	286	281	348
Max	2,512	2,856	3,033	3,070	2,961	4,490	4,236	2,694	4,327	1,206	1,797	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

SUMMARY STATISTICS

	Calendar Year 2012		Water Year 2013		For Period of Daily Record	
Annual total	247,498		268,158			
Annual mean	676		735		775	
Highest annual mean					1,636	2011
Lowest annual mean					332	1965
Highest daily mean	8,030	Oct 30	10,300	Jan 31	[a]49,000	Sep 8, 2011
Lowest daily mean	70	Jul 14	85	Sep 30	11	Sep 25, 1964
Annual seven-day minimum	80	Jul 9	92	Sep 6	12	Sep 20, 1964
Maximum peak flow			14,100	Jan 31	[b]69,100	Sep 7, 2011
Maximum peak stage			8.00	Jan 31	19.78	Sep 7, 2011
Instantaneous low flow			83	Sep 30	11	Sep 25, 1964[c]
Annual runoff (cfsm)	1.55		1.69		1.78	
Annual runoff (inches)	21.17		22.93		24.21	
10 percent exceeds	1,310		1,440		1,690	
50 percent exceeds	382		476		417	
90 percent exceeds	135		150		72	

[a] Estimated.
[b] From rating curve extended above 19,000 ft³/s on basis of slope-area measurement of peak flow at gage height 17.93 ft.
[c] Also Sep 26, 1964, Nov 24, 1964.



01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--April 2002 to current year.

REMARKS.--Analyses for pH, water temperature, specific conductance, and dissolved oxygen were performed on site. All other sample analyses were performed at the Pennsylvania Department of Environmental Protection laboratory in Harrisburg, Pa. Occasionally, values for filtered parameters may exceed values for the corresponding unfiltered parameter. These results are within the limits of analytical precision and methods.

COOPERATION.--Water-quality samples were collected as part of the Pennsylvania Department of Environmental Protection Water-Quality Network (WQN) with cooperation from the Pennsylvania Department of Environmental Protection.

WATER-QUALITY DATA
WATER YEAR OCTOBER 2012 TO SEPTEMBER 2013

Part 1 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Discharge, instantaneous, ft^3/s (00061)	Dissolved oxygen, water, unfiltered, mg/L (00300)	Osmotic pressure, water, unfiltered, milliosmoles per kilogram (82550)	pH, water, unfiltered, field, standard units (00400)	pH, water, unfiltered, laboratory, standard units (00403)	Specific conductance, water, unfiltered, laboratory, µS/cm at 25°C (90095)	Specific conductance, water, unfiltered, µS/cm at 25°C (00095)	Temperature, water, °C (00010)	Biochemical oxygen demand, water, unfiltered, 5 days at 20°C, mg/L (00310)
11-19-2012	0900	390	13.4	< 1.0	7.4	7.4	58	61	3.5	--
01-09-2013	1315	454	14.0	1.0	7.5	7.0	59	59	1.3	1.7
03-19-2013	1100	901	13.5	2.0	7.5	7.2	54	54	1.4	.2
05-22-2013	0830	299	9.1	3.0	7.1	7.6	61	61	18.3	1.1
07-09-2013	1000	1,470	8.4	4.0	7.2	7.6	60	58	20.6	.3
09-04-2013	1100	106	8.7	2.0	7.3	7.6	82	82	21.2	1.3

WATER-QUALITY DATA
WATER YEAR OCTOBER 2012 TO SEPTEMBER 2013

Part 2 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Dissolved solids dried at 180°C, water, filtered, mg/L (70300)	Hardness, water, mg/L as $CaCO_3$ (00900)	Suspended solids, water, unfiltered, mg/L (00530)	Calcium, water, filtered, mg/L (00915)	Calcium, water, unfiltered, recoverable, mg/L (00916)	Magnesium, water, filtered, mg/L (00925)	Magnesium, water, unfiltered, recoverable, mg/L (00927)	Sodium, water, unfiltered, recoverable, mg/L (00929)	ANC, water, unfiltered, fixed endpoint (pH 4.5) titration, laboratory, mg/L as $CaCO_3$ (00417)
11-19-2012	0900	40	22	< 5	6.91	7.1	1.05	1.1	2.0	14
01-09-2013	1315	56	22	< 5	6.58	7.2	.97	1.1	2.1	13
03-19-2013	1100	46	18	< 5	5.62	5.7	.91	.9	2.0	10
05-22-2013	0830	38	24	< 5	6.86	7.6	1.06	1.2	2.2	16
07-09-2013	1000	42	21	20	6.24	6.8	.92	1.1	2.2	17
09-04-2013	1100	50	31	< 5	9.37	9.9	1.38	1.4	2.7	27

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2012 TO SEPTEMBER 2013

Part 3 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Bromide, water, filtered, mg/L (71870)	Chloride, water, filtered, mg/L (00940)	Sulfate, water, filtered, mg/L (00945)	Ammonia, water, unfiltered, mg/L as N (00610)	Nitrate, water, unfiltered, mg/L as N (00620)	Nitrite, water, unfiltered, mg/L as N (00615)	Orthophosphate, water, unfiltered, mg/L as P (70507)	Phosphorus, water, unfiltered, mg/L as P (00665)	Total nitrogen, water, unfiltered, mg/L (00600)
11-19-2012	0900	< 0.025	2.7	7.3	< .020	0.26	< .040	< .01	< .010	0.33
01-09-2013	1315	< 0.025	2.7	7.7	< .020	.37	< .040	< .01	< .010	.42
03-19-2013	1100	< 0.025	3.1	7.0	< .020	.40	< .040	< .01	< .010	.45
05-22-2013	0830	< 0.025	2.8	6.8	< .020	.22	< .040	< .01	< .010	.28
07-09-2013	1000	< 0.025	2.9	5.3	.030	.22	< .040	< .01	.028	.47
09-04-2013	1100	< 0.025	3.6	7.1	< .020	.19	< .040	< .01	< .010	.32

WATER-QUALITY DATA
WATER YEAR OCTOBER 2012 TO SEPTEMBER 2013

Part 4 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Aluminum, water, filtered, µg/L (01106)	Aluminum, water, unfiltered, recoverable, µg/L (01105)	Barium, water, unfiltered, recoverable, µg/L (01007)	Copper, water, filtered, µg/L (01040)	Copper, water, unfiltered, recoverable, µg/L (01042)	Iron, water, filtered, µg/L (01046)	Iron, water, unfiltered, recoverable, µg/L (01045)	Lead, water, filtered, µg/L (01049)	Lead, water, unfiltered, recoverable, µg/L (01051)
11-19-2012	0900	14	M	M	< 4	< 4	< 20	30	< 1.0	< 1.0
01-09-2013	1315	10	M	M	< 4	< 4	< 20	20	< 1.0	< 1.0
03-19-2013	1100	21	M	M	< 4	< 4	< 20	30	< 1.0	< 1.0
05-22-2013	0830	< 10	M	M	< 4	< 4	< 20	20	< 1.0	< 1.0
07-09-2013	1000	31	300	M	< 4	< 4	70	660	< 1.0	< 1.0
09-04-2013	1100	12	M	M	< 4	< 4	< 20	30	< 1.0	< 1.0

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA—Continued

WATER-QUALITY DATA
WATER YEAR OCTOBER 2012 TO SEPTEMBER 2013

Part 5 of 5

[ANC, acid neutralizing capacity; $CaCO_3$, calcium carbonate; N, nitrogen; P, phosphorus; ft^3/s, cubic feet per second; mg/L, milligrams per liter; °C, degrees Celsius; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; --, no data; <, less than; M, presence verified but not quantified]

Date	Sample start time	Manganese, water, filtered, µg/L (01056)	Manganese, water, unfiltered, recoverable, µg/L (01055)	Nickel, water, filtered, µg/L (01065)	Nickel, water, unfiltered, recoverable, µg/L (01067)	Strontium, water, unfiltered, recoverable, micrograms per liter (01082)	Zinc, water, filtered, µg/L (01090)	Zinc, water, unfiltered, recoverable, µg/L (01092)	Boron, water, unfiltered, recoverable, micrograms per liter (01022)	Selenium, water, unfiltered, µg/L (01147)
11-19-2012	0900	M	M	< 4.0	< 4.0	30	M	M	< 200	< 7
01-09-2013	1315	M	M	< 4.0	< 4.0	30	--	--	< 200	< 7
03-19-2013	1100	M	M	< 4.0	< 4.0	30	M	< 5.0	< 200	< 7
05-22-2013	0830	M	M	< 4.0	< 4.0	40	< 5.0	< 5.0	< 200	< 7
07-09-2013	1000	M	70	< 4.0	< 4.0	40	< 5.0	M	< 200	< 7
09-04-2013	1100	M	10	< 4.0	< 4.0	40	M	M	< 200	< 7

2014

USGS Water-Year Summary 2014

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

LOCATION - Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA - 435 mi^2.

REVISIONS HISTORY - WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

SURFACE-WATER RECORDS

PERIOD OF RECORD - August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

GAGE - Water-stage recorder, crest-stage gage, and weighing bucket precipitation gage. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, non-recording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION - Station established and maintained by the U.S. Geological Survey in cooperation with the Pennsylvania Department of Environmental Protection.

REMARKS - Highest daily mean flow for period of record is an estimated value. Records for water year 2014 are rated good except those for estimated daily discharges, which are poor. Records for water year 2015 are rated good except those for estimated daily discharges, which are poor. Records for water year 2016 are rated good except those for estimated daily discharges, which are poor. Records for water year 2017 are rated good except those for estimated discharges, which are poor. Records for water year 2018 are rated good except those for estimated discharges, which are poor.

EXTREMES OUTSIDE PERIOD OF RECORD - Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

U.S. Department of the Interior
U.S. Geological Survey

Suggested citation: U.S. Geological Survey, 2019, National Water Information System data available on the World Wide Web (USGS Water Data for the Nation), accessed [December 12, 2019], https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&119073&adr_begin_date=2013-10-01&adr_end_date=2014-09-30&site_no=01552000&agency_cd=USGS

Water-Data Report 2014
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

DISCHARGE, CUBIC FEET PER SECOND
YEAR 2013-10-01 to 2014-09-30
DAILY MEAN VALUES
[e, Value has been estimated.]

Day	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014	May 2014	Jun 2014	Jul 2014	Aug 2014	Sep 2014
1	82.1	149	584	e922	e380	e385	2,420	1,190	492	146	125	177
2	80.1	301	518	e856	e369	e356	2,000	1,260	429	142	114	169
3	78.6	250	474	e802	e341	e310	1,890	999	386	203	107	244
4	77.7	194	469	e749	e329	e278	2,160	880	401	285	113	237
5	77.6	167	492	e822	e320	e252	2,610	779	398	265	133	184
6	76.2	154	1,080	e2,020	e315	e220	1,980	688	389	193	137	160
7	89.7	159	1,370	e921	e308	e235	1,670	623	326	167	128	149
8	172	213	1,050	e865	e300	e252	2,660	584	285	242	114	141
9	213	249	863	e785	e295	e263	2,300	570	266	720	104	132
10	156	210	760	e680	e275	e288	1,780	531	257	585	92.4	123
11	141	190	626	e1,170	e258	e396	1,530	516	254	391	85.7	128
12	132	177	e519	e1,610	e245	e1,070	1,950	457	265	286	237	130
13	126	170	e490	e1,270	e264	e1,540	1,590	425	446	236	1,870	135
14	115	162	e482	e1,310	e275	e977	1,380	406	485	325	847	149
15	106	154	e462	e1,550	e256	e934	2,170	385	372	332	446	142
16	100	151	e434	e1,280	e233	e891	3,960	3,280	293	271	317	129
17	101	152	e363	e1,170	e232	e760	2,380	3,460	250	270	268	117
18	112	266	e380	e1,040	e238	e714	1,820	2,050	222	218	229	110
19	138	357	e377	e945	e232	e689	1,490	1,490	221	188	199	104
20	152	292	378	e862	e260	e686	1,230	1,180	223	169	177	99.0
21	139	246	437	e752	e329	e714	1,050	1,020	204	156	172	96.3
22	129	223	1,870	e642	e716	e710	937	1,320	181	146	189	106
23	118	216	1,570	e624	e1,000	e757	890	1,520	165	138	454	116
24	111	206	1,460	e590	e732	e686	791	1,110	155	132	526	124
25	105	185	1,250	e563	e521	e625	687	909	187	123	353	108
26	105	176	1,120	e518	e457	585	651	759	334	115	266	99.1
27	107	1,550	963	e499	e421	471	609	668	284	110	220	92.8
28	106	1,630	849	e441	e410	572	543	1,500	215	113	194	88.3
29	104	997	1,080	e421		806	506	883	178	118	177	85.4
30	102	666	2,880	e406		8,910	588	706	158	128	164	83.0
31	102		e1,100	e425		3,440		587		129	169	
Total	3,554	10,210	26,750	27,510	10,310	29,770	48,220	32,729	8,721	7,042	8,727	3,958
Mean	115	340	863	887	368	960	1,607	1,056	291	227	282	132
Max	213	1630	2880	2020	1000	8910	3960	3460	492	720	1870	244
Min	76.2	149	363	406	232	220	506	385	155	110	85.7	83.0
Ac-ft	7,049	20,260	53,059	54,560	20,450	59,050	95,650	64,930	17,300	13,969	17,310	7,850

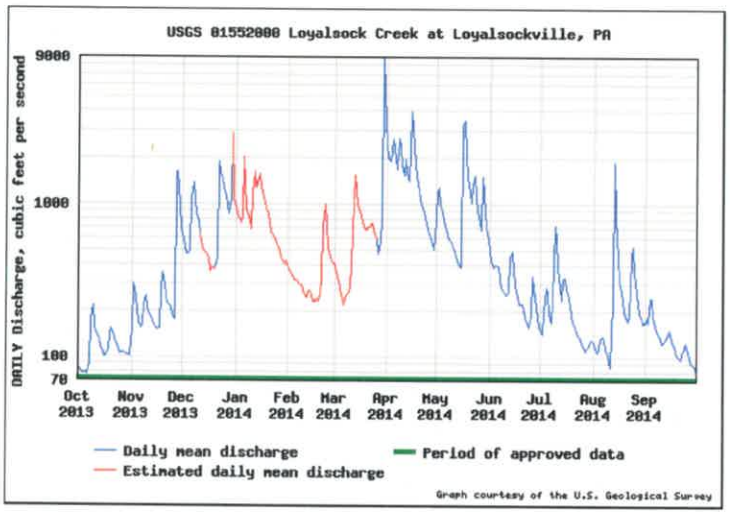
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2014, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	530	850	944	817	803	1,466	1,517	937	508	285	282	343
Max	2,512	2,856	3,033	3,070	2,960	4,490	4,236	2,693	4,327	1,206	1,797	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

Water-Data Report 2014
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

SUMMARY STATISTICS

	Water Year 2014		Water Years 1926 - 2014	
Annual total	217,500			
Annual mean	595.9		770.9	
Highest annual mean			1,636	2011
Lowest annual mean			331.8	1965
Highest daily mean	8,910	Mar 30	49,000	Sep 08, 2011
Lowest daily mean	76.2	Oct 06	11.0	Sep 25, 1964
Annual 7-day minimum	80.3	Oct 01	11.7	Sep 20, 1964
Maximum peak flow	15,700	Mar 30	69,100	Sep 07, 2011
Maximum peak stage	8.46	Mar 30	19.78	Sep 07, 2011
Annual runoff (cfsm)	1.37		1.78	
Annual runoff (inches)	18.6		24.1	
10 percent exceeds	1,472		1,680	
50 percent exceeds	329.0		415.0	
90 percent exceeds	113.0		73.0	



2015

USGS Water-Year Summary 2015

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

LOCATION - Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA - 435 mi^2.

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SURFACE-WATER RECORDS

PERIOD OF RECORD - August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

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EXTREMES OUTSIDE PERIOD OF RECORD - Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

U.S. Department of the Interior
U.S. Geological Survey

Suggested citation: U.S. Geological Survey, 2019, National Water Information System data available on the World Wide Web (USGS Water Data for the Nation), accessed [December 12, 2019], https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&119073&adr_begin_date=2014-10-01&adr_end_date=2015-09-30&site_no=01552000&agency_cd=USGS

Water-Data Report 2015
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

DISCHARGE, CUBIC FEET PER SECOND
YEAR 2014-10-01 to 2015-09-30
DAILY MEAN VALUES
[e, Value has been estimated.]

Day	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	May 2015	Jun 2015	Jul 2015	Aug 2015
1	83.0	177	327	568	e229	e181	667	641	243	3,610	167
2	81.0	171	461	582	e244	e186	764	578	296	2,210	150
3	84.7	165	537	541	e231	e189	1,760	520	263	1,400	137
4	101	160	699	710	e237	e191	3,760	466	226	4,410	128
5	101	151	572	917	e230	e194	2,840	422	197	4,360	119
6	104	148	1,000	e635	e192	e199	2,070	428	181	2,320	112
7	107	154	2,040	e567	e203	e193	1,820	454	166	2,030	107
8	123	162	1,270	e541	e212	e197	2,560	404	176	1,580	102
9	150	165	989	e512	e224	e209	2,480	358	345	1,240	97.3
10	144	159	878	e489	e250	e232	3,870	322	424	1,120	93.5
11	123	152	799	e470	e232	e257	3,600	297	308	863	753
12	111	147	690	e525	e226	e437	2,400	278	241	685	508
13	104	142	608	e487	e204	e400	1,810	255	268	575	291
14	102	138	561	e437	e207	e740	1,630	236	272	499	208
15	186	135	561	e431	e202	e1,050	1,410	223	338	1,380	168
16	927	133	576	e411	e200	922	1,140	235	790	898	158
17	760	158	725	e390	e202	1,090	1,020	324	765	625	171
18	442	252	821	e370	e197	1,430	925	360	516	539	140
19	331	246	714	e379	e199	1,160	800	738	453	516	125
20	283	e188	629	e366	e192	991	983	629	684	440	170
21	246	e170	569	e353	e189	840	6,890	453	1,200	388	454
22	223	e162	519	e326	e204	770	3,740	377	1,090	355	281
23	213	166	540	e294	e200	697	2,630	322	703	317	200
24	257	261	826	296	e188	620	1,920	283	564	268	164
25	280	616	2,020	282	e190	587	1,490	254	440	239	143
26	248	455	1,650	270	e191	569	1,230	233	375	219	127
27	223	394	1,230	256	e186	828	1,060	218	563	232	116
28	205	353	1,080	e236	e181	836	915	220	2,510	213	109
29	198	308	957	e218		652	799	237	1,870	188	102
30	190	306	813	e240		701	709	198	1,370	172	97.4
31	184		705	e232		689		208		171	96.9
Total	6,915	6,494	26,370	13,330	5,842	18,240	59,690	11,170	17,840	34,060	5,795
Mean	223	216	851	430	209	588	1,990	360	595	1,099	187
Max	927	616	2040	917	250	1430	6890	738	2510	4410	753
Min	81.0	133	327	218	181	181	667	198	166	171	93.5
Ac-ft	13,710	12,880	52,300	26,440	11,590	36,170	118,400	22,160	35,380	67,560	11,490

Day	Sep
2015	
1	90.8
2	85.9
3	81.1
4	78.9
5	75.6
6	78.6
7	75.7
8	71.0
9	70.6
10	86.3
11	116
12	130
13	139
14	132
15	109
16	93.3
17	88.0
18	77.8
19	71.6
20	68.3
21	66.8
22	65.5
23	62.7
24	60.6
25	58.7
26	57.0
27	55.4
28	54.1
29	62.0
30	127
--	
Total	2,489
Mean	83.0
Max	139
Min	54.1
Ac-ft	4,937

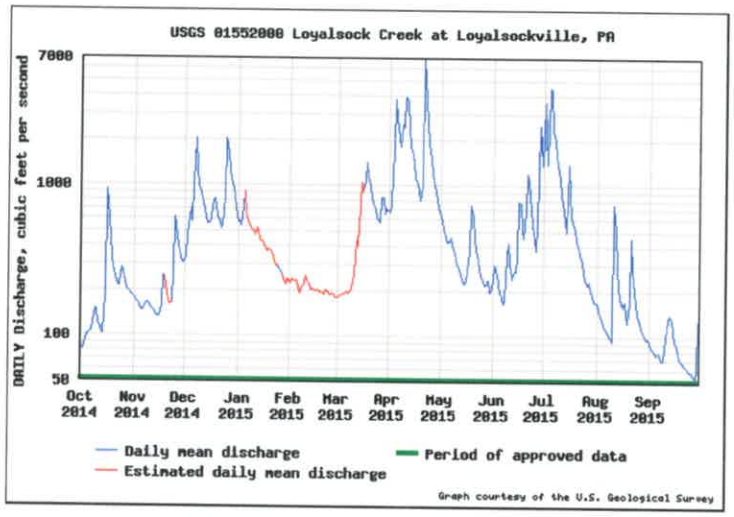
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2015, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	526	843	943	813	796	1,456	1,522	930	509	295	280	340
Max	2,512	2,856	3,033	3,070	2,960	4,490	4,236	2,693	4,327	1,206	1,797	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

Water-Data Report 2015
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

SUMMARY STATISTICS

	Water Year 2015		Water Years 1926 - 2015	
Annual total	208,200			
Annual mean	570.5		768.6	
Highest annual mean			1,636	2011
Lowest annual mean			331.8	1965
Highest daily mean	6,890	Apr 21	49,000	Sep 08, 2011
Lowest daily mean	54.1	Sep 28	11.0	Sep 25, 1964
Annual 7-day minimum	58.6	Sep 23	11.7	Sep 20, 1964
Maximum peak flow	9,970	Apr 21	69,100	Sep 07, 2011
Maximum peak stage	7.06	Apr 21	19.78	Sep 07, 2011
Annual runoff (cfsm)	1.31		1.77	
Annual runoff (inches)	17.8		24.1	
10 percent exceeds	1,234		1,680	
50 percent exceeds	282.0		414.0	
90 percent exceeds	103.2		73.0	



2016

USGS Water-Year Summary 2016

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

LOCATION - Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA - 435 mi^2.

REVISIONS HISTORY - WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

SURFACE-WATER RECORDS

PERIOD OF RECORD - August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

GAGE - Water-stage recorder, crest-stage gage, and weighing bucket precipitation gage. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, non-recording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION - Station established and maintained by the U.S. Geological Survey in cooperation with the Pennsylvania Department of Environmental Protection.

REMARKS - Highest daily mean flow for period of record is an estimated value. Records for water year 2014 are rated good except those for estimated daily discharges, which are poor. Records for water year 2015 are rated good except those for estimated daily discharges, which are poor. Records for water year 2016 are rated good except those for estimated daily discharges, which are poor. Records for water year 2017 are rated good except those for estimated discharges, which are poor. Records for water year 2018 are rated good except those for estimated discharges, which are poor.

EXTREMES OUTSIDE PERIOD OF RECORD - Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

U.S. Department of the Interior
U.S. Geological Survey

Suggested citation: U.S. Geological Survey, 2019, National Water Information System data available on the World Wide Web (USGS Water Data for the Nation), accessed [December 12, 2019], https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&119073&adr_begin_date=2015-10-01&adr_end_date=2016-09-30&site_no=01552000&agency_cd=USGS

Water-Data Report 2016
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

DISCHARGE, CUBIC FEET PER SECOND
YEAR 2015-10-01 to 2016-09-30
DAILY MEAN VALUES
[e, Value has been estimated.]

Day	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
1	195	248	252	1,280	307	1,320	402	366	208	83.2	252	81.0
2	177	202	497	1,070	308	1,230	414	747	189	77.4	386	75.0
3	154	173	941	918	847	1,070	418	1,170	178	72.4	201	69.8
4	161	155	781	793	1,620	931	412	1,010	178	68.9	134	65.1
5	166	143	636	616	1,050	827	401	954	195	69.2	102	60.8
6	139	133	553	e555	829	766	378	860	541	67.7	84.1	57.0
7	117	127	501	e523	726	696	421	982	388	67.2	72.1	53.9
8	103	122	455	e480	674	658	1,170	912	314	64.6	63.6	52.6
9	94.7	115	415	490	633	616	1,020	760	366	60.7	57.2	52.2
10	90.8	126	390	2,520	594	585	848	643	296	56.9	61.4	53.9
11	87.8	690	365	3,490	497	764	798	574	235	55.5	69.8	64.9
12	84.3	696	339	1,920	e383	831	828	528	201	54.1	291	59.5
13	81.7	615	317	1,390	e361	707	821	542	176	52.0	242	52.9
14	78.8	508	311	1,110	e347	720	714	687	159	50.5	254	50.4
15	76.4	401	486	1,000	e326	803	647	707	147	53.0	188	53.0
16	74.5	339	581	989	e3,620	727	588	624	147	56.1	147	58.1
17	72.8	302	486	1,050	6,470	677	540	542	148	54.5	212	52.9
18	72.0	271	486	838	2,780	616	500	493	139	52.6	211	55.8
19	71.2	284	446	e724	1,740	562	462	450	124	51.6	235	128
20	71.0	778	403	e660	1,530	516	433	410	111	48.7	172	354
21	69.8	646	376	e589	1,380	487	403	377	138	45.5	259	202
22	68.3	493	435	e514	1,160	458	381	396	135	42.6	803	138
23	67.0	410	737	e478	996	428	363	499	122	40.1	448	107
24	65.1	355	1,400	e460	1,480	405	341	443	109	38.0	279	90.8
25	73.3	318	1,340	e417	8,010	409	319	359	99.1	38.0	210	78.1
26	73.4	291	1,060	e396	4,010	423	319	309	91.5	38.7	176	70.4
27	75.1	269	967	404	2,500	376	335	281	84.3	46.3	148	68.6
28	98.6	260	1,020	369	1,890	422	320	285	83.7	50.8	126	63.0
29	489	253	1,160	355	1,590	544	310	257	98.6	45.3	109	69.6
30	609	241	1,610	324		456	325	229	98.0	43.7	96.6	81.1
31	345		1,530	313		408		229		155	86.9	
Total	4,202	9,964	21,280	27,030	48,660	20,440	15,630	17,620	5,499	1,801	6,177	2,519
Mean	136	332	686	872	1,678	659	521	569	183	58.1	199	84.0
Max	609	778	1610	3490	8010	1320	1170	1170	541	155	803	354
Min	65.1	115	252	313	307	376	310	229	83.7	38.0	57.2	50.4
Ac-ft	8,334	19,760	42,200	53,620	96,510	40,540	31,000	34,960	10,910	3,572	12,250	4,997

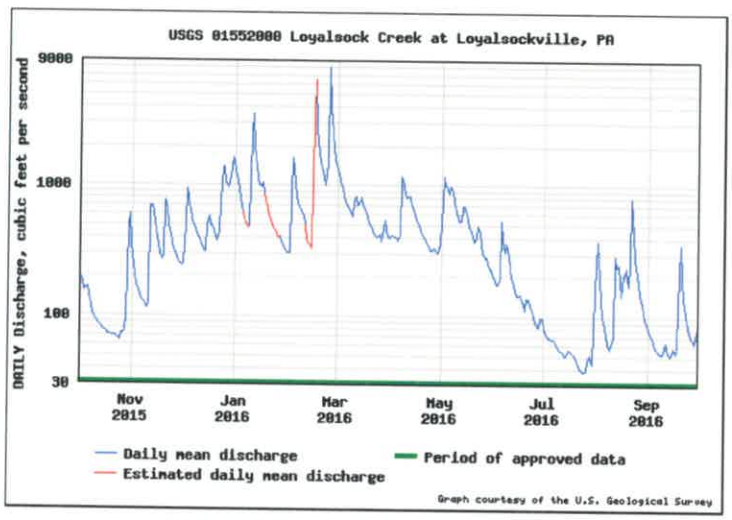
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2016, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	522	837	940	814	806	1,447	1,511	926	505	292	280	337
Max	2,512	2,856	3,033	3,070	2,960	4,490	4,236	2,693	4,327	1,206	1,797	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

Water-Data Report 2016
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

SUMMARY STATISTICS

	Water Year 2016		Water Years 1926 - 2016	
Annual total	180,800			
Annual mean	494.1		765.6	
Highest annual mean			1,636	2011
Lowest annual mean			331.8	1965
Highest daily mean	8,010	Feb 25	49,000	Sep 08, 2011
Lowest daily mean	38.0	Jul 24	11.0	Sep 25, 1964
Annual 7-day minimum	41.3	Jul 21	11.7	Sep 20, 1964
Maximum peak flow	16,300	Feb 16	69,100	Sep 07, 2011
Maximum peak stage	8.64	Feb 16	19.78	Sep 07, 2011
Annual runoff (cfsm)	1.14		1.76	
Annual runoff (inches)	15.5		24.0	
10 percent exceeds	1,013		1,670	
50 percent exceeds	339.0		412.0	
90 percent exceeds	61.2		73.0	



2017

USGS Water-Year Summary 2017

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

LOCATION - Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA - 435 mi^2.

REVISIONS HISTORY - WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

SURFACE-WATER RECORDS

PERIOD OF RECORD - August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

GAGE - Water-stage recorder, crest-stage gage, and weighing bucket precipitation gage. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, non-recording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION - Station established and maintained by the U.S. Geological Survey in cooperation with the Pennsylvania Department of Environmental Protection.

REMARKS - Highest daily mean flow for period of record is an estimated value. Records for water year 2014 are rated good except those for estimated daily discharges, which are poor. Records for water year 2015 are rated good except those for estimated daily discharges, which are poor. Records for water year 2016 are rated good except those for estimated daily discharges, which are poor. Records for water year 2017 are rated good except those for estimated discharges, which are poor. Records for water year 2018 are rated good except those for estimated discharges, which are poor.

EXTREMES OUTSIDE PERIOD OF RECORD - Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

U.S. Department of the Interior
U.S. Geological Survey

Suggested citation: U.S. Geological Survey, 2019, National Water Information System data available on the World Wide Web (USGS Water Data for the Nation), accessed [December 12, 2019], https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&119073&adr_begin_date=2016-10-01&adr_end_date=2017-09-30&site_no=01552000&agency_cd=USGS

Water-Data Report 2017
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

DISCHARGE, CUBIC FEET PER SECOND
YEAR 2016-10-01 to 2017-09-30
DAILY MEAN VALUES
[e, Value has been estimated.]

Day	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017
1	178	484	557	582	794	837	4,960	788	859	297	304
2	343	416	666	530	694	851	3,030	3,410	656	608	310
3	223	373	491	571	e562	731	2,170	2,050	492	419	742
4	171	337	413	1,380	e474	621	2,360	1,410	411	299	507
5	140	303	405	1,250	500	497	2,250	1,850	506	242	2,390
6	119	277	425	989	506	527	2,170	3,020	933	212	1,260
7	104	255	484	780	490	612	6,640	3,080	780	197	857
8	92.4	238	571	e742	772	844	3,590	2,380	622	187	758
9	86.1	234	504	e724	1,090	828	2,410	1,830	503	175	588
10	77.6	237	438	e711	794	714	1,830	1,470	438	163	467
11	71.3	229	386	e703	802	639	1,480	1,230	385	152	393
12	66.5	214	380	951	1,040	568	1,290	1,050	332	144	403
13	66.1	201	379	2,080	1,670	504	1,130	1,060	292	142	404
14	63.6	192	360	1,430	1,220	e515	951	1,270	261	152	337
15	60.4	186	e314	1,160	1,110	e524	830	1,020	234	277	301
16	57.8	181	e225	926	994	e540	772	884	224	307	277
17	62.9	175	298	956	854	e494	826	759	217	222	248
18	74.0	167	1,410	1,130	792	e502	724	637	216	480	263
19	77.9	163	2,840	1,160	933	499	639	545	1,710	346	345
20	74.7	170	e1,510	1,070	1,100	497	647	478	1,450	232	423
21	12,800	173	e1,250	1,410	1,000	547	4,970	432	822	433	397
22	2,260	165	952	1,340	927	968	3,500	422	579	376	331
23	1,120	157	763	1,290	932	809	2,220	417	476	276	891
24	834	150	657	1,730	906	795	1,660	371	433	4,700	637
25	672	146	612	1,490	914	991	1,350	407	369	2,110	446
26	504	149	579	1,710	1,260	1,870	1,170	504	316	1,110	359
27	497	160	673	1,720	1,030	2,190	1,020	488	282	782	310
28	910	164	903	1,400	888	2,780	1,070	442	265	610	271
29	701	166	798	1,180		2,660	888	458	240	496	246
30	571	193	730	1,010		1,890	792	551	222	407	231
31	558		641	865		2,660		1,000		347	218
Total	23,640	6,655	21,610	34,970	25,050	30,500	59,340	35,710	15,520	16,900	15,910
Mean	762	222	697	1,128	895	984	1,978	1,152	518	545	513
Max	12800	484	2840	2080	1670	2780	6640	3410	1710	4700	2390
Min	57.8	146	225	530	474	494	639	371	216	142	218
Ac-ft	46,880	13,200	42,870	69,360	49,680	60,500	117,700	70,840	30,790	33,520	31,560

Day	Sep
2017	
1	204
2	192
3	216
4	283
5	252
6	226
7	228
8	216
9	197
10	181
11	166
12	155
13	146
14	140
15	140
16	152
17	140
18	139
19	134
20	124
21	116
22	108
23	101
24	95.1
25	88.9
26	83.8
27	82.0
28	77.9
29	74.5
30	72.9
--	
Total	4,531
Mean	151
Max	283
Min	72.9
Ac-ft	8,987

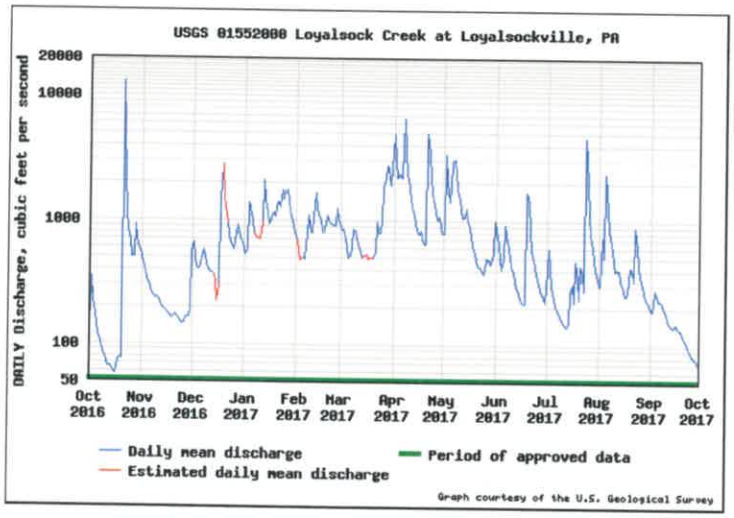
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2017, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	524	830	937	817	807	1,442	1,516	929	506	295	282	335
Max	2,512	2,856	3,033	3,070	2,960	4,490	4,236	2,693	4,327	1,206	1,797	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(1928)	(1994)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

Water-Data Report 2017
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

SUMMARY STATISTICS

	Water Year 2017		Water Years 1926 - 2017	
Annual total	290,300			
Annual mean	795.5		765.9	
Highest annual mean			1,636	2011
Lowest annual mean			331.8	1965
Highest daily mean	12,800	Oct 21	49,000	Sep 08, 2011
Lowest daily mean	57.8	Oct 16	11.0	Sep 25, 1964
Annual 7-day minimum	64.1	Oct 11	11.7	Sep 20, 1964
Maximum peak flow	29,100	Oct 21	69,100	Sep 07, 2011
Maximum peak stage	12.11	Oct 21	19.78	Sep 07, 2011
Annual runoff (cfsm)	1.83		1.77	
Annual runoff (inches)	24.8		24.0	
10 percent exceeds	1,710		1,670	
50 percent exceeds	506.0		414.0	
90 percent exceeds	147.8		73.0	



2018

USGS Water-Year Summary 2018

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

LOCATION - Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA - 435 mi^2.

REVISIONS HISTORY - WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

SURFACE-WATER RECORDS

PERIOD OF RECORD - August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

GAGE - Water-stage recorder, crest-stage gage, and weighing bucket precipitation gage. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, non-recording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION - Station established and maintained by the U.S. Geological Survey in cooperation with the Pennsylvania Department of Environmental Protection.

REMARKS - Highest daily mean flow for period of record is an estimated value. Records for water year 2014 are rated good except those for estimated daily discharges, which are poor. Records for water year 2015 are rated good except those for estimated daily discharges, which are poor. Records for water year 2016 are rated good except those for estimated daily discharges, which are poor. Records for water year 2017 are rated good except those for estimated discharges, which are poor. Records for water year 2018 are rated good except those for estimated discharges, which are poor.

EXTREMES OUTSIDE PERIOD OF RECORD - Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

U.S. Department of the Interior
U.S. Geological Survey

Suggested citation: U.S. Geological Survey, 2019, National Water Information System data available on the World Wide Web (USGS Water Data for the Nation), accessed [December 12, 2019], https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&119073&adr_begin_date=2017-10-01&adr_end_date=2018-09-30&site_no=01552000&agency_cd=USGS

Water-Data Report 2018
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

DISCHARGE, CUBIC FEET PER SECOND
YEAR 2017-10-01 to 2018-09-30
DAILY MEAN VALUES
[e, Value has been estimated.]

Day	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018
1	71.4	1,990	323	e258	687	1,620	636	627	742	203	884
2	70.3	1,610	310	e260	e648	5,450	601	572	661	175	2,850
3	68.5	1,280	297	e258	e514	3,340	726	531	580	240	14,800
4	67.3	1,030	288	e259	e488	2,270	1,280	541	524	393	10,300
5	67.0	896	295	e247	e463	1,770	1,340	539	470	1,730	3,620
6	66.7	988	595	e232	e442	1,440	1,100	545	424	879	2,140
7	66.5	1,040	574	e223	e433	1,290	1,020	885	383	624	1,540
8	71.1	899	469	e224	e431	1,150	880	764	344	406	3,350
9	120	806	423	e238	e421	992	765	650	318	314	1,400
10	270	733	394	e244	e415	879	698	626	347	261	1,000
11	236	637	381	e252	452	770	632	900	484	234	1,970
12	608	573	368	e1,520	850	702	592	1,360	394	211	2,570
13	500	538	344	10,100	851	674	553	2,800	314	185	9,500
14	323	511	e311	e3,470	713	616	509	2,220	401	167	16,600
15	259	474	e279	e2,460	723	568	468	1,930	370	177	8,860
16	266	458	e307	e1,940	3,120	550	1,510	3,830	284	234	3,530
17	270	459	332	1,440	2,790	474	2,670	4,490	246	248	2,430
18	229	437	316	e1,220	1,860	489	1,780	2,700	225	223	2,030
19	205	627	311	e1,150	1,470	458	1,430	3,150	229	206	1,540
20	189	677	331	948	1,650	425	1,260	3,290	209	168	1,230
21	174	571	314	771	2,210	410	1,080	2,280	194	156	1,050
22	162	527	287	724	2,650	383	942	2,970	180	577	1,060
23	153	499	299	2,120	3,190	366	836	7,220	178	2,170	950
24	565	466	436	3,460	3,190	352	750	4,030	198	12,700	770
25	930	438	425	1,870	5,130	337	820	2,510	203	20,200	642
26	569	422	e326	1,310	3,780	326	972	1,810	192	11,000	567
27	438	394	e241	1,140	2,490	319	862	1,780	179	3,790	517
28	372	370	e222	1,060	1,890	341	866	1,600	275	2,180	468
29	1,300	351	e220	979		384	e784	1,230	344	1,450	419
30	8,050	333	e235	865		589	704	993	260	1,090	381
31	3,600		e250	656		846		822		958	350
Total	20,340	21,030	10,500	41,900	43,950	30,580	29,070	60,190	10,150	63,549	99,320
Mean	656	701	339	1,351	1,570	986	969	1,942	338	2,050	3,204
Max	8050	1990	595	10100	5130	5450	2670	7220	742	20200	16600
Min	66.5	333	220	223	415	319	468	531	178	156	350
Ac-ft	40,340	41,720	20,830	83,100	87,180	60,660	57,650	119,400	20,140	126,000	197,000

Day	Sep
2018	
1	390
2	358
3	334
4	556
5	472
6	379
7	520
8	441
9	405
10	7,260
11	7,030
12	3,000
13	5,960
14	4,020
15	2,190
16	1,570
17	1,280
18	3,860
19	2,530
20	1,740
21	1,360
22	1,740
23	1,360
24	1,110
25	2,140
26	2,820
27	3,350
28	3,130
29	2,440
30	1,810
--	
Total	65,550
Mean	2,185
Max	7260
Min	334
Ac-ft	130,000

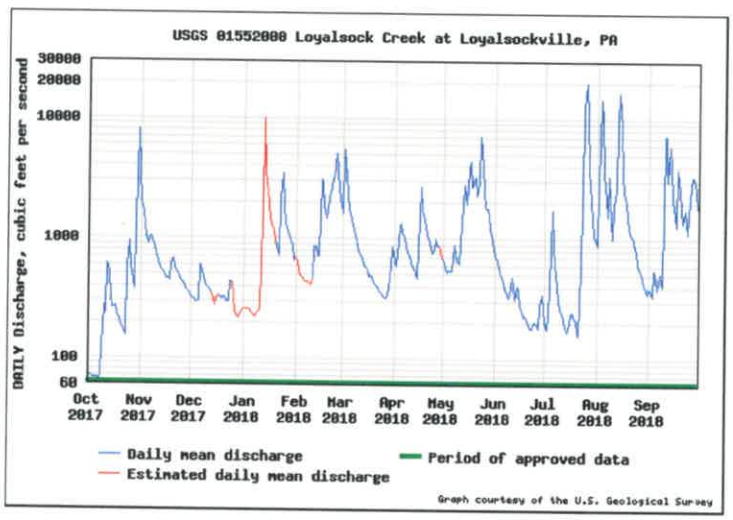
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2018, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	526	829	931	823	815	1,437	1,510	940	504	314	314	355
Max	2,512	2,856	3,033	3,070	2,960	4,490	4,236	2,693	4,327	2,050	3,204	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(2018)	(2018)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

Water-Data Report 2018
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

SUMMARY STATISTICS

	Water Year 2018		Water Years 1926 - 2018	
Annual total	496,100			
Annual mean	1,359		772.4	
Highest annual mean			1,636	2011
Lowest annual mean			331.8	1965
Highest daily mean	20,200	Jul 25	49,000	Sep 08, 2011
Lowest daily mean	66.5	Oct 07	11.0	Sep 25, 1964
Annual 7-day minimum	68.2	Oct 02	11.7	Sep 20, 1964
Maximum peak flow	27,300	Aug 14	69,100	Sep 07, 2011
Maximum peak stage	11.66	Aug 14	19.78	Sep 07, 2011
Annual runoff (cfsm)	3.12		1.78	
Annual runoff (inches)	42.4		24.2	
10 percent exceeds	3,124		1,690	
50 percent exceeds	608.0		417.0	
90 percent exceeds	224.6		74.0	



2019

USGS Water-Year Summary 2019

01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA

LOCATION - Lat 41°19'30", long 76°54'46" referenced to North American Datum of 1927, Lycoming County, PA, Hydrologic Unit 02050206, on right bank 30 ft downstream from bridge on State Highway 973 at Loyalsockville, 2.5 mi downstream from Wallis Run, and 7.3 mi upstream from mouth.

DRAINAGE AREA - 435 mi^2.

REVISIONS HISTORY - WSP 871: 1938(M). WSP 1051: 1926(M), 1933(M), 1936(M). WSP 1302: 1926-30. WSP 1502: 1932-33, 1935(M), 1937(M). WDR PA-99-2: Drainage area, 1972(M). WDR PA-02-2: 1926-95(M).

SURFACE-WATER RECORDS

PERIOD OF RECORD - August 1925 to September 1974, October 1975 to current year. Prior to October 1925, monthly discharge only, published in WSP 1302. Prior to October 1969, published as "at Loyalsock".

GAGE - Water-stage recorder, crest-stage gage, and weighing bucket precipitation gage. Datum of gage is 586.33 ft above National Geodetic Vertical Datum of 1929. Aug 1925 to Sep 16, 1926, non-recording gage, and Sep 17, 1926, to Jun 13, 1988, water-stage recorder at site 500 feet downstream on left bank at same datum. Satellite and landline telemetry at station.

COOPERATION - Station established and maintained by the U.S. Geological Survey in cooperation with the Pennsylvania Department of Environmental Protection.

REMARKS - Highest daily mean flow for period of record is an estimated value. Records for water year 2014 are rated good except those for estimated daily discharges, which are poor. Records for water year 2015 are rated good except those for estimated daily discharges, which are poor. Records for water year 2016 are rated good except those for estimated daily discharges, which are poor. Records for water year 2017 are rated good except those for estimated discharges, which are poor. Records for water year 2018 are rated good except those for estimated discharges, which are poor.

EXTREMES OUTSIDE PERIOD OF RECORD - Flood of Sep 26, 1975, reached a stage of 14.50 ft, from floodmark, discharge, 46,000 ft^3/s.

U.S. Department of the Interior
U.S. Geological Survey

Suggested citation: U.S. Geological Survey, 2019, National Water Information System data available on the World Wide Web (USGS Water Data for the Nation), accessed [December 12, 2019], https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&119073&adr_begin_date=2018-10-01&adr_end_date=2019-09-30&site_no=01552000&agency_cd=USGS

Water-Data Report 2019
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

DISCHARGE, CUBIC FEET PER SECOND
YEAR 2018-10-01 to 2019-09-30
DAILY MEAN VALUES
[e, Value has been estimated.]

Day	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019
1	1,460	919	1,530	2,140	e1,050	607	946	986	1,680	503	355
2	1,370	950	1,800	1,690	e1,040	595	836	912	1,630	406	293
3	3,980	1,260	2,300	1,450	e998	568	767	856	1,310	450	307
4	2,060	1,330	1,980	1,270	e1,010	557	690	1,020	1,050	456	322
5	1,550	1,270	1,620	1,990	e1,210	e476	657	1,250	909	563	253
6	1,250	2,530	1,370	2,070	1,540	e394	750	1,370	870	595	217
7	1,100	2,250	1,200	1,550	1,910	e392	714	1,170	759	648	242
8	965	1,700	1,040	1,360	4,300	e438	842	1,050	627	817	303
9	864	1,550	908	1,420	2,870	457	898	943	533	1,120	350
10	781	2,670	831	1,220	1,890	500	805	903	504	729	288
11	907	1,940	761	992	1,620	567	723	861	661	540	225
12	1,080	1,570	711	e792	1,380	687	686	1,590	554	452	189
13	883	1,650	655	e681	1,240	580	999	2,920	481	389	169
14	847	1,680	615	e614	1,070	648	981	3,600	582	338	158
15	779	1,370	639	e570	981	1,710	4,060	2,510	478	289	157
16	771	1,390	2,150	e533	1,020	2,550	2,660	1,900	463	265	886
17	697	1,240	2,390	e515	880	1,720	1,950	1,520	629	401	570
18	634	1,150	1,660	e521	841	1,340	1,560	1,290	2,720	764	488
19	581	1,160	1,300	e529	705	1,130	1,410	1,130	2,700	525	519
20	557	1,690	1,150	e535	660	1,000	5,860	1,570	1,630	412	396
21	586	1,710	8,850	e567	739	1,020	3,010	1,220	2,610	364	312
22	583	1,390	7,270	e611	804	3,610	2,230	970	1,960	535	270
23	521	1,110	3,360	e804	705	2,450	1,760	943	1,380	1,190	276
24	486	1,140	2,310	e7,050	714	1,740	1,510	928	1,080	772	260
25	456	2,380	1,770	5,390	1,040	1,420	1,250	777	931	531	218
26	424	3,310	1,440	2,580	755	1,190	1,240	1,010	783	419	196
27	587	6,590	1,230	1,950	672	1,030	1,940	1,380	662	410	180
28	1,670	3,360	1,300	1,470	655	926	1,410	1,090	558	363	176
29	1,270	2,300	1,310	1,300		912	1,250	1,740	554	311	201
30	1,090	1,820	1,110	e1,170		1,040	1,090	2,400	598	295	191
31	948		1,060	e1,090		1,040		2,280		355	162
Total	31,740	56,380	57,620	46,420	34,300	33,290	45,480	44,090	31,890	16,210	9,129
Mean	1,024	1,879	1,859	1,498	1,225	1,074	1,516	1,422	1,063	523	294
Max	3980	6590	8850	7050	4300	3610	5860	3600	2720	1190	886
Min	424	919	615	515	655	392	657	777	463	265	157
Ac-ft	62,949	111,800	114,300	92,080	68,030	66,040	90,220	87,450	63,239	32,150	18,110

Day	Sep
2019	
1	145
2	172
3	313
4	268
5	203
6	171
7	154
8	138
9	129
10	122
11	116
12	137
13	211
14	196
15	159
16	141
17	127
18	117
19	106
20	99.3
21	95.1
22	91.1
23	88.5
24	87.9
25	85.7
26	87.7
27	92.6
28	98.3
29	91.6
30	83.7
--	
Total	4,127
Mean	138
Max	313
Min	83.7
Ac-ft	8,185

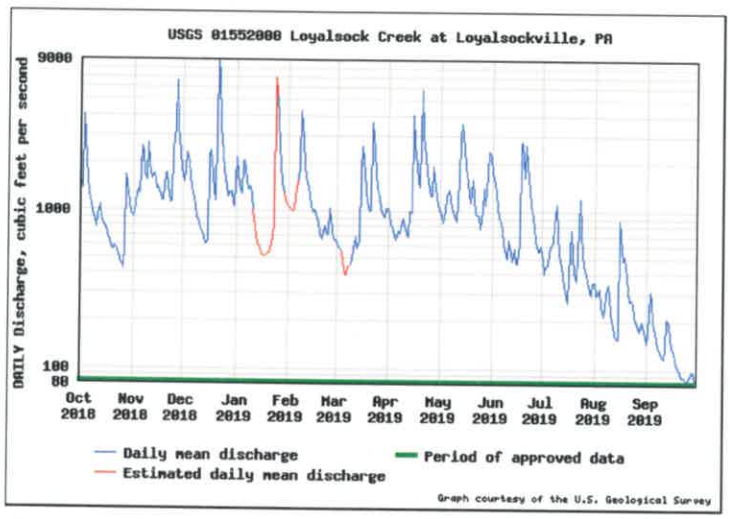
STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1926 - 2019, BY WATER YEAR (WY)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	531	840	941	830	820	1,433	1,510	945	510	316	314	353
Max	2,512	2,856	3,033	3,070	2,960	4,490	4,236	2,693	4,327	2,050	3,204	4,550
(WY)	(1991)	(1951)	(1974)	(1996)	(1981)	(1936)	(1993)	(1946)	(1972)	(2018)	(2018)	(2011)
Min	20.2	28.4	80.5	34.1	108	358	363	220	92.4	41.6	31.5	13.8
(WY)	(1965)	(1965)	(1931)	(1931)	(1931)	(2006)	(1946)	(1941)	(1991)	(1962)	(1964)	(1964)

Water-Data Report 2019
01552000 LOYALSOCK CREEK AT LOYALSOCKVILLE, PA -- Continued

SUMMARY STATISTICS

	Water Year 2019		Water Years 1926 - 2019	
Annual total	410,700			
Annual mean	1,125		776.2	
Highest annual mean			1,636	2011
Lowest annual mean			331.8	1965
Highest daily mean	8,850	Dec 21	49,000	Sep 08, 2011
Lowest daily mean	83.7	Sep 30	11.0	Sep 25, 1964
Annual 7-day minimum	89.6	Sep 24	11.7	Sep 20, 1964
Maximum peak flow			69,100	Sep 07, 2011
Maximum peak stage			19.78	Sep 07, 2011
Annual runoff (cfsm)	2.59		1.79	
Annual runoff (inches)	35.1		24.3	
10 percent exceeds	2,182		1,700	
50 percent exceeds	907.0		420.0	
90 percent exceeds	202.2		74.0	

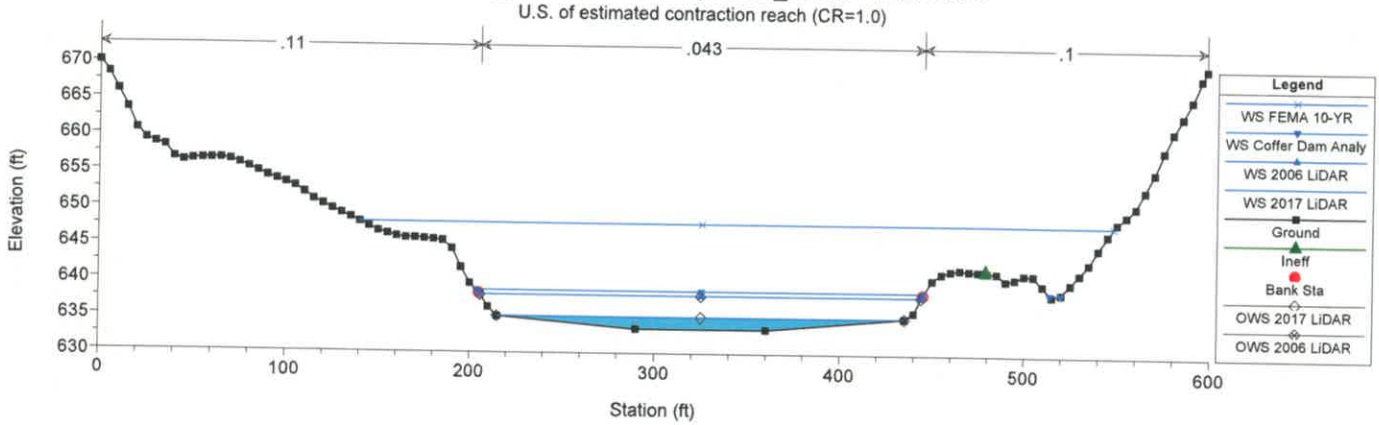


ATTACHMENT C

HEC-RAS Baseline Model

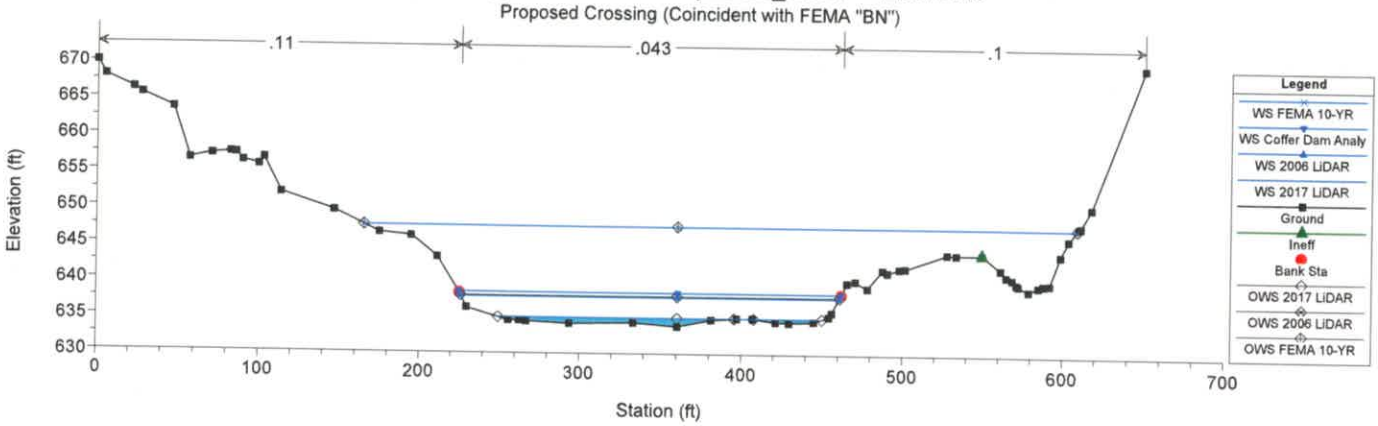
Loyalsock_Creek Plan: Loyalsock_Creek 12/31/2019

U.S. of estimated contraction reach (CR=1.0)



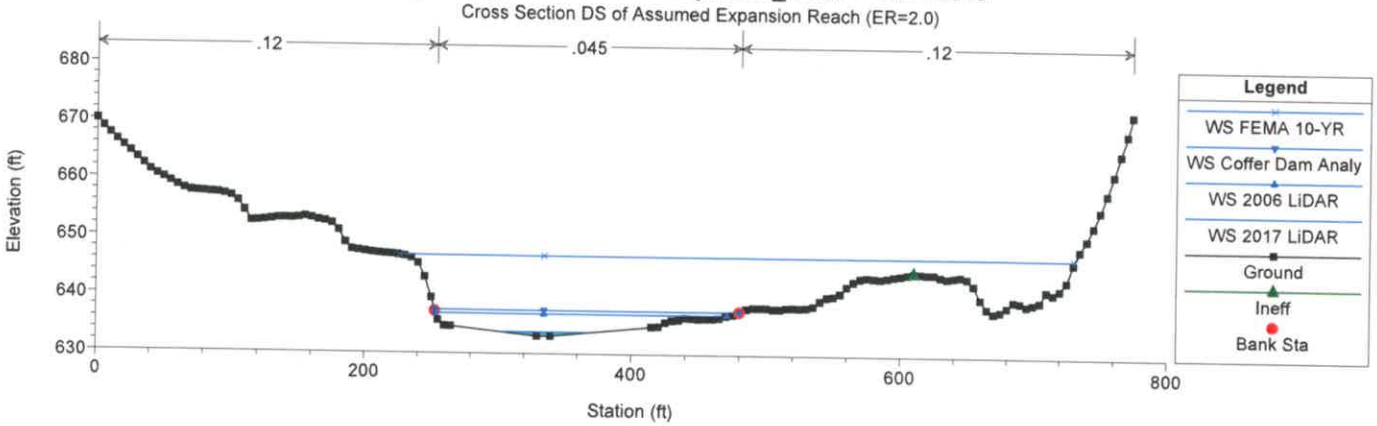
Loyalsock_Creek Plan: Loyalsock_Creek 12/31/2019

Proposed Crossing (Coincident with FEMA "BN")



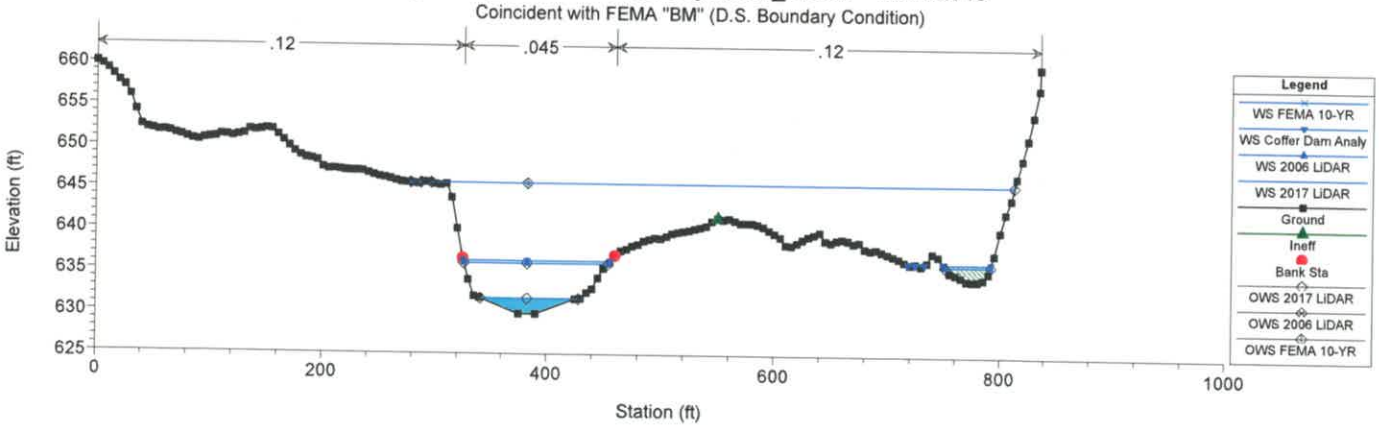
Loyalsock_Creek Plan: Loyalsock_Creek 12/31/2019

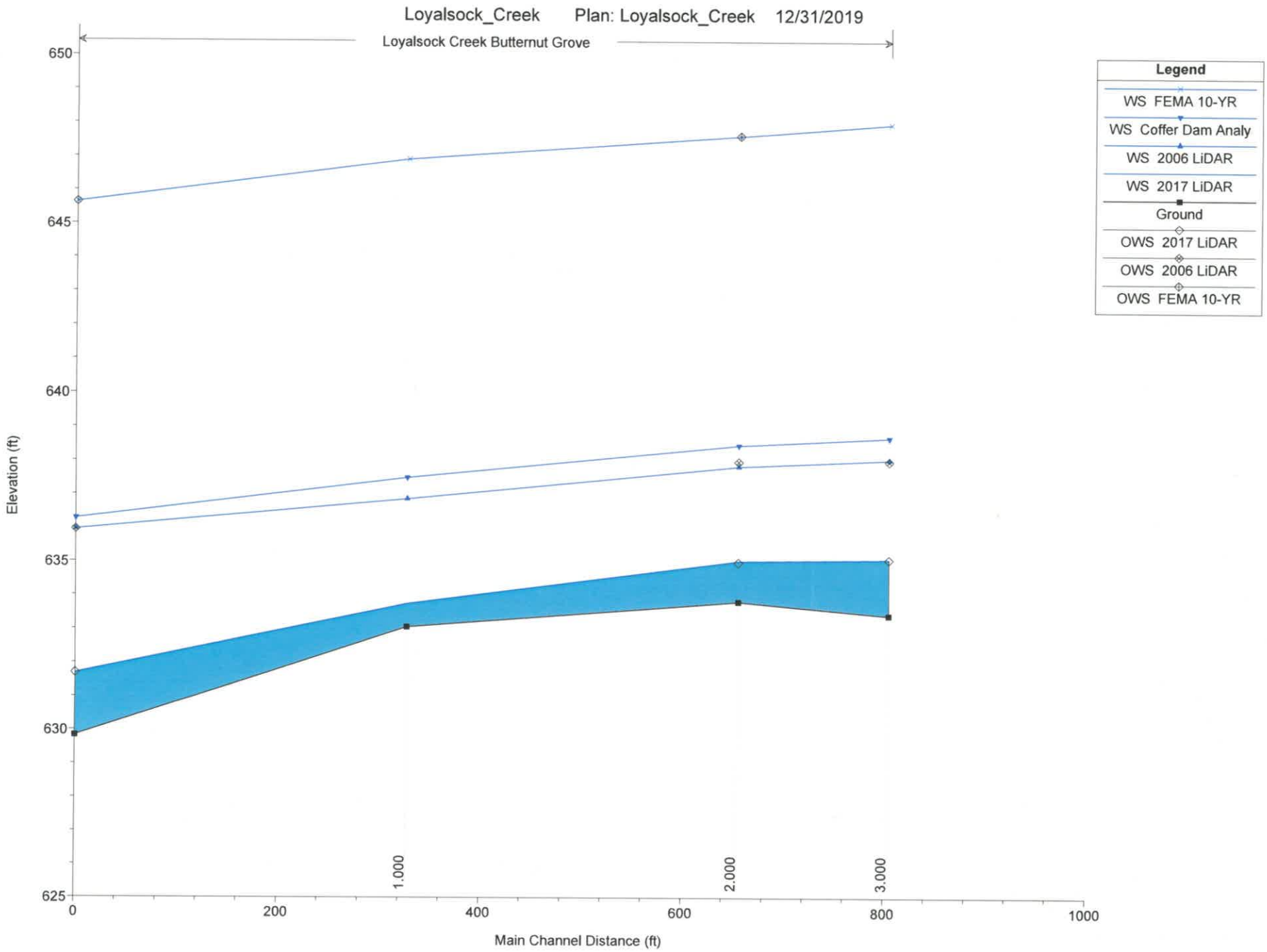
Cross Section DS of Assumed Expansion Reach (ER=2.0)



Loyalsock_Creek Plan: Loyalsock_Creek 12/31/2019

Coincident with FEMA "BM" (D.S. Boundary Condition)




Loyalsock_Creek Plan: Loyalsock_Creek 12/31/2019
Loyalsock Creek Butternut Grove
Elevation (ft)
650
645
640
635
630
625
0
200
400
600
800
1000
Main Channel Distance (ft)
1.000
2.000
3.000
Legend
WS FEMA 10-YR
WS Coffer Dam Analy
WS 2006 LiDAR
WS 2017 LiDAR
Ground
OWS 2017 LiDAR
OWS 2006 LiDAR
OWS FEMA 10-YR

HEC-RAS River: Loyalsock Creek Reach: Butternut Grove

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Butternut Grove	3.000	2017 LiDAR	Calibration	93.00	633.40	635.06	633.75	635.06	0.000109	0.38	241.74	220.11	0.06
Butternut Grove	3.000	2017 LiDAR	Coffer Dam	93.00	633.40	635.67	633.75	635.67	0.000026	0.25	376.60	225.97	0.03
Butternut Grove	3.000	2006 LiDAR	Calibration	2170.00	633.40	638.04	635.41	638.12	0.000749	2.33	929.57	238.72	0.21
Butternut Grove	3.000	2006 LiDAR	Coffer Dam	2170.00	633.40	639.57	635.41	639.61	0.000249	1.67	1301.49	260.23	0.13
Butternut Grove	3.000	Coffer Dam Analy	Calibration	2980.00	633.40	638.69	635.75	638.81	0.000848	2.74	1086.46	248.30	0.23
Butternut Grove	3.000	Coffer Dam Analy	Coffer Dam	2980.00	633.40	640.50	635.75	640.56	0.000276	1.96	1533.91	273.44	0.14
Butternut Grove	3.000	FEMA 10-YR	Calibration	26400.00	633.40	647.99	641.41	648.81	0.001429	7.50	4195.60	408.10	0.36
Butternut Grove	3.000	FEMA 10-YR	Coffer Dam	26400.00	633.40	648.05	641.41	648.87	0.001406	7.46	4221.45	408.80	0.35
Butternut Grove	2.000	2017 LiDAR	Calibration	93.00	633.81	635.01	634.49	635.02	0.001122	0.80	116.12	201.67	0.19
Butternut Grove	2.000	2017 LiDAR	Coffer Dam	93.00	633.81	635.62	635.09	635.65	0.001885	1.34	69.43	81.04	0.26
Butternut Grove	2.000	2006 LiDAR	Calibration	2170.00	633.81	637.83	635.95	637.97	0.001506	2.90	748.54	234.59	0.29
Butternut Grove	2.000	2006 LiDAR	Coffer Dam	2170.00	633.81	638.60	637.58	639.31	0.007209	6.74	321.93	88.09	0.62
Butternut Grove	2.000	Coffer Dam Analy	Calibration	2980.00	633.81	638.46	636.32	638.63	0.001578	3.32	896.84	237.50	0.30
Butternut Grove	2.000	Coffer Dam Analy	Coffer Dam	2980.00	633.81	639.14	638.22	640.15	0.008682	8.07	369.70	89.88	0.69
Butternut Grove	2.000	FEMA 10-YR	Calibration	26400.00	633.81	647.63	642.00	648.57	0.001785	8.03	4055.17	443.71	0.39
Butternut Grove	2.000	FEMA 10-YR	Coffer Dam	26400.00	633.81	647.67	642.00	648.60	0.001875	7.98	4074.73	444.28	0.39
Butternut Grove	1.000	2017 LiDAR	Calibration	93.00	633.05	633.73	633.73	633.93	0.039680	3.53	26.36	67.09	0.99
Butternut Grove	1.000	2017 LiDAR	Coffer Dam	93.00	633.05	633.73	633.73	633.93	0.039680	3.53	26.36	67.09	0.99
Butternut Grove	1.000	2006 LiDAR	Calibration	2170.00	633.05	636.85	635.69	637.13	0.005040	4.18	519.29	217.56	0.48
Butternut Grove	1.000	2006 LiDAR	Coffer Dam	2170.00	633.05	636.85	635.69	637.13	0.005040	4.18	519.29	217.56	0.48
Butternut Grove	1.000	Coffer Dam Analy	Calibration	2980.00	633.05	637.49	636.13	637.80	0.004522	4.51	660.21	227.41	0.47
Butternut Grove	1.000	Coffer Dam Analy	Coffer Dam	2980.00	633.05	637.49	636.13	637.80	0.004522	4.51	660.21	227.41	0.47
Butternut Grove	1.000	FEMA 10-YR	Calibration	26400.00	633.05	646.92	642.05	647.90	0.002277	8.40	4345.32	505.19	0.42
Butternut Grove	1.000	FEMA 10-YR	Coffer Dam	26400.00	633.05	646.92	642.05	647.90	0.002277	8.40	4345.32	505.19	0.42
Butternut Grove	0.000	2017 LiDAR	Calibration	93.00	629.83	631.70	630.61	631.72	0.000835	1.00	93.22	87.09	0.17
Butternut Grove	0.000	2017 LiDAR	Coffer Dam	93.00	629.83	631.70	630.61	631.72	0.000835	1.00	93.22	87.09	0.17
Butternut Grove	0.000	2006 LiDAR	Calibration	2170.00	629.83	635.95	633.26	636.18	0.001847	3.81	569.43	168.56	0.32
Butternut Grove	0.000	2006 LiDAR	Coffer Dam	2170.00	629.83	635.95	633.26	636.18	0.001847	3.81	569.43	168.56	0.32
Butternut Grove	0.000	Coffer Dam Analy	Calibration	2980.00	629.83	636.27	633.83	636.64	0.002827	4.87	611.35	186.82	0.40
Butternut Grove	0.000	Coffer Dam Analy	Coffer Dam	2980.00	629.83	636.27	633.83	636.64	0.002827	4.87	611.35	186.82	0.40
Butternut Grove	0.000	FEMA 10-YR	Calibration	26400.00	629.83	645.64	642.35	647.00	0.003175	10.66	4425.23	525.44	0.50
Butternut Grove	0.000	FEMA 10-YR	Coffer Dam	26400.00	629.83	645.64	642.35	647.00	0.003175	10.66	4425.23	525.44	0.50

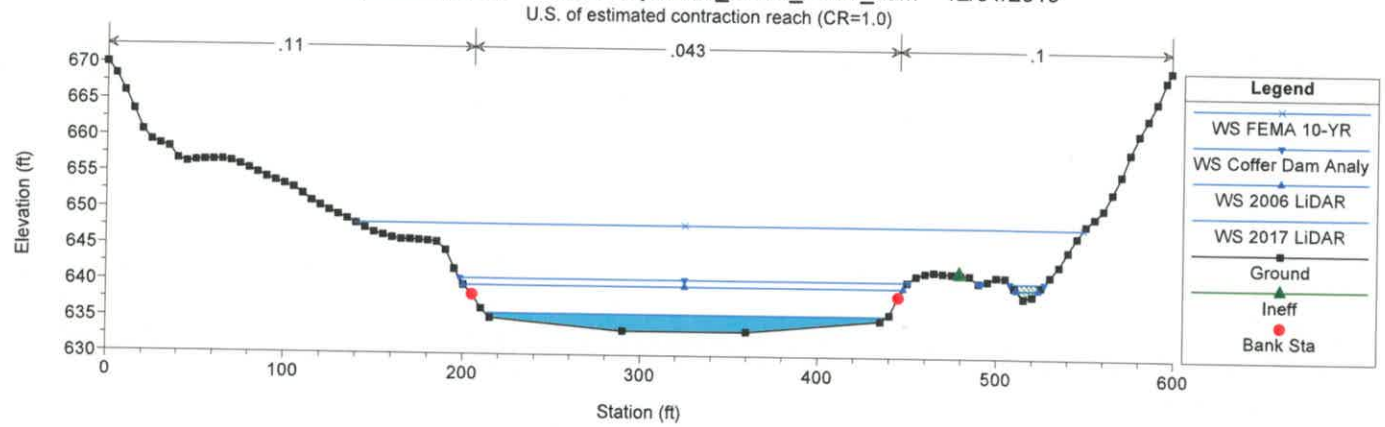
ATTACHMENT D

HEC-RAS Construction-Phase Encroachment Model

A R M G r o u p L L C

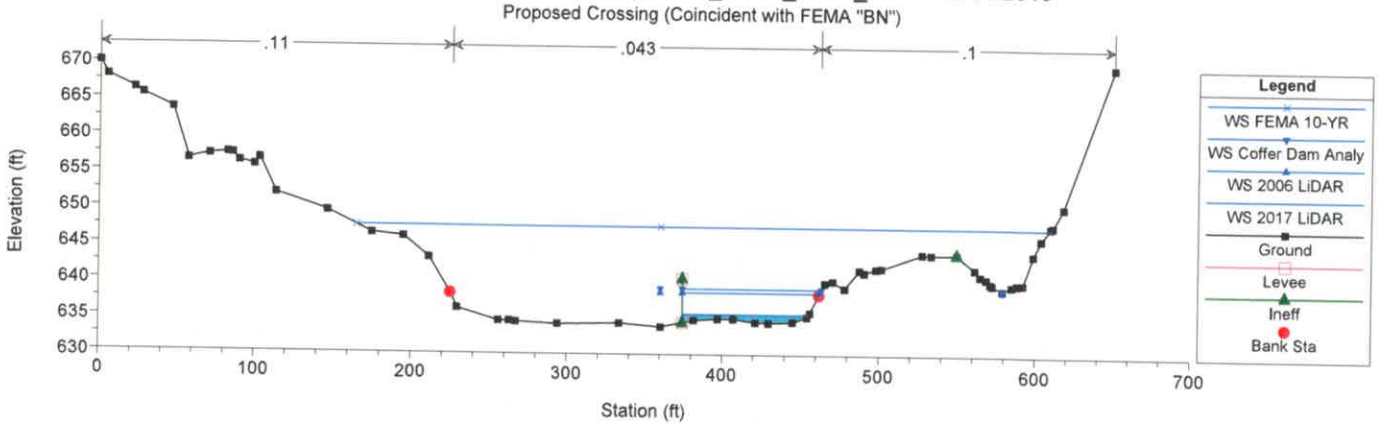
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam 12/31/2019

U.S. of estimated contraction reach (CR=1.0)



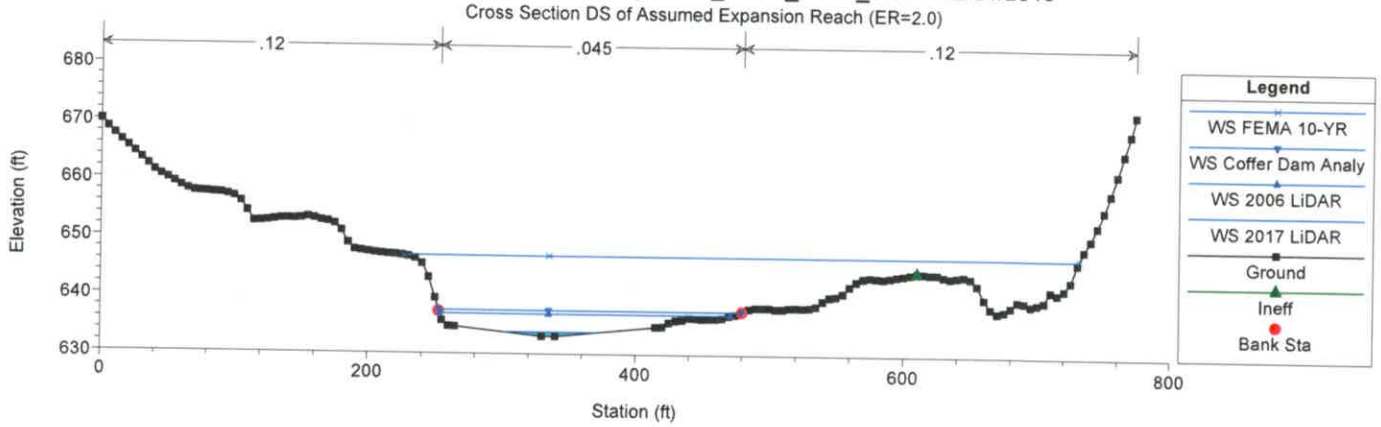
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam 12/31/2019

Proposed Crossing (Coincident with FEMA "BN")



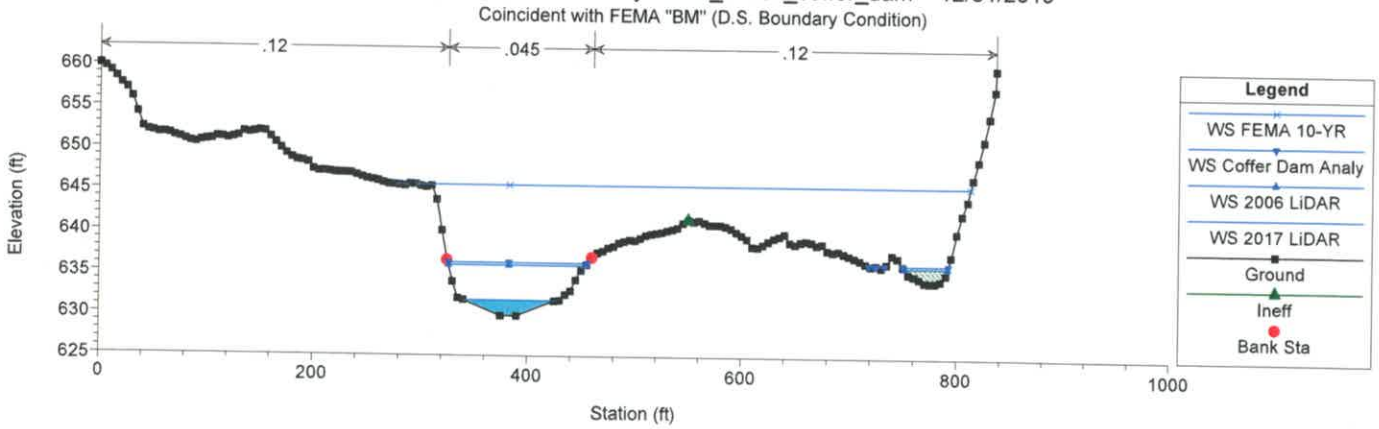
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam 12/31/2019

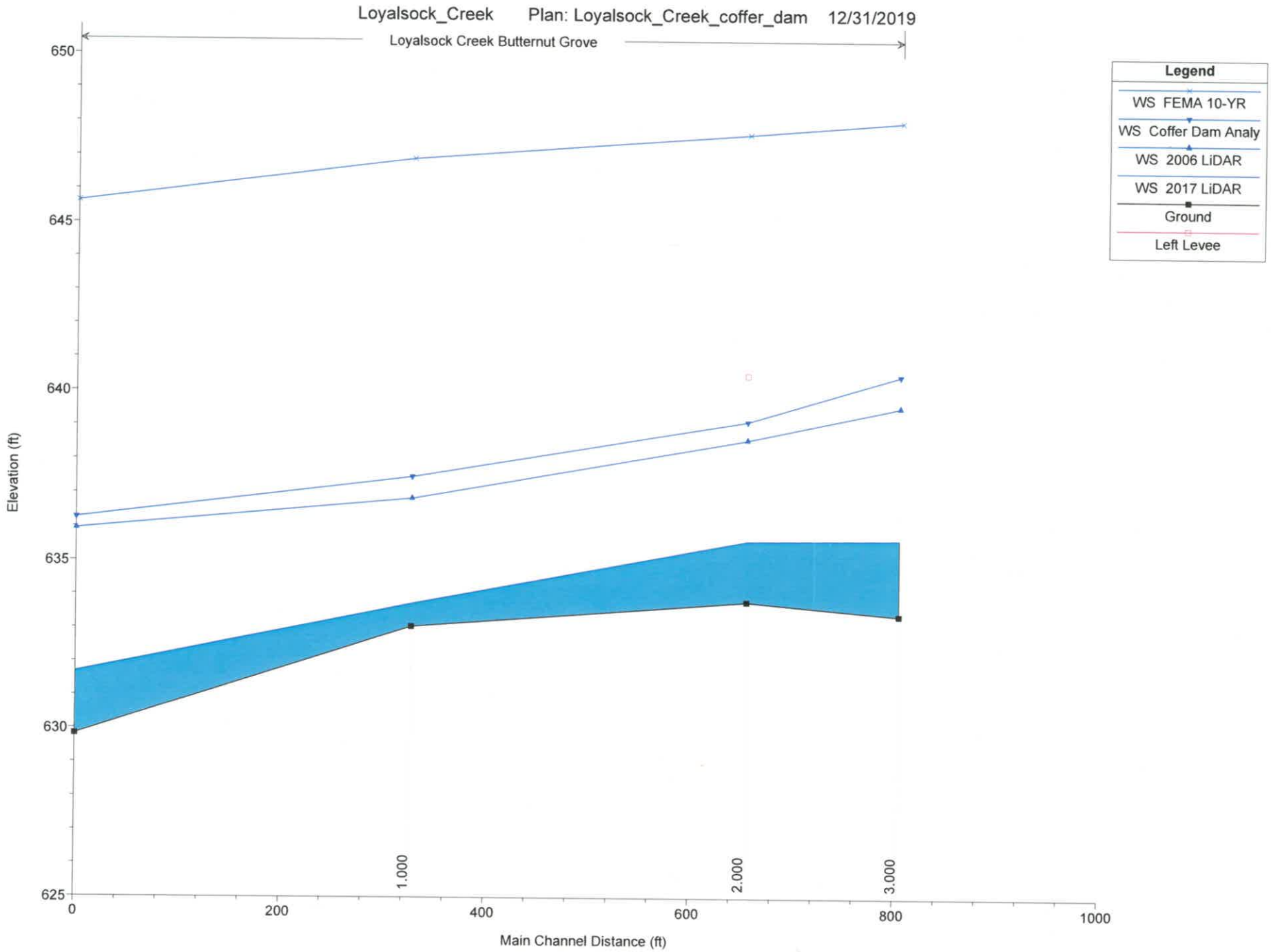
Cross Section DS of Assumed Expansion Reach (ER=2.0)



Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam 12/31/2019

Coincident with FEMA "BM" (D.S. Boundary Condition)




Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam 12/31/2019
Loyalsock Creek Butternut Grove
Legend
WS FEMA 10-YR
WS Coffer Dam Analy
WS 2006 LiDAR
WS 2017 LiDAR
Ground
Left Levee
Elevation (ft)
650
645
640
635
630
625
1.000
2.000
3.000
0
200
400
600
800
1000
Main Channel Distance (ft)

HEC-RAS River: Loyalsock Creek Reach: Butternut Grove

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Butternut Grove	3.000	2017 LiDAR	Calibration	93.00	633.40	635.06	633.75	635.06	0.000109	0.38	241.74	220.11	0.06
Butternut Grove	3.000	2017 LiDAR	Coffer Dam	93.00	633.40	635.67	633.75	635.67	0.000026	0.25	376.60	225.97	0.03
Butternut Grove	3.000	2006 LiDAR	Calibration	2170.00	633.40	638.04	635.41	638.12	0.000749	2.33	929.57	238.72	0.21
Butternut Grove	3.000	2006 LiDAR	Coffer Dam	2170.00	633.40	639.57	635.41	639.61	0.000249	1.67	1301.49	260.23	0.13
Butternut Grove	3.000	Coffer Dam Analy	Calibration	2980.00	633.40	638.69	635.75	638.81	0.000848	2.74	1086.46	248.30	0.23
Butternut Grove	3.000	Coffer Dam Analy	Coffer Dam	2980.00	633.40	640.50	635.75	640.56	0.000276	1.96	1533.91	273.44	0.14
Butternut Grove	3.000	FEMA 10-YR	Calibration	26400.00	633.40	647.99	641.41	648.81	0.001429	7.50	4195.60	408.10	0.36
Butternut Grove	3.000	FEMA 10-YR	Coffer Dam	26400.00	633.40	648.05	641.41	648.87	0.001406	7.46	4221.45	408.80	0.35
Butternut Grove	2.000	2017 LiDAR	Calibration	93.00	633.81	635.01	634.49	635.02	0.001122	0.80	116.12	201.67	0.19
Butternut Grove	2.000	2017 LiDAR	Coffer Dam	93.00	633.81	635.62	635.09	635.65	0.001885	1.34	69.43	81.04	0.26
Butternut Grove	2.000	2006 LiDAR	Calibration	2170.00	633.81	637.83	635.95	637.97	0.001506	2.90	748.54	234.59	0.29
Butternut Grove	2.000	2006 LiDAR	Coffer Dam	2170.00	633.81	638.60	637.58	639.31	0.007209	6.74	321.93	88.09	0.62
Butternut Grove	2.000	Coffer Dam Analy	Calibration	2980.00	633.81	638.46	636.32	638.63	0.001578	3.32	896.84	237.50	0.30
Butternut Grove	2.000	Coffer Dam Analy	Coffer Dam	2980.00	633.81	639.14	638.22	640.15	0.008682	8.07	369.70	89.88	0.69
Butternut Grove	2.000	FEMA 10-YR	Calibration	26400.00	633.81	647.63	642.00	648.57	0.001785	8.03	4055.17	443.71	0.39
Butternut Grove	2.000	FEMA 10-YR	Coffer Dam	26400.00	633.81	647.67	642.00	648.60	0.001875	7.98	4074.73	444.28	0.39
Butternut Grove	1.000	2017 LiDAR	Calibration	93.00	633.05	633.73	633.73	633.93	0.039680	3.53	26.36	67.09	0.99
Butternut Grove	1.000	2017 LiDAR	Coffer Dam	93.00	633.05	633.73	633.73	633.93	0.039680	3.53	26.36	67.09	0.99
Butternut Grove	1.000	2006 LiDAR	Calibration	2170.00	633.05	636.85	635.69	637.13	0.005040	4.18	519.29	217.56	0.48
Butternut Grove	1.000	2006 LiDAR	Coffer Dam	2170.00	633.05	636.85	635.69	637.13	0.005040	4.18	519.29	217.56	0.48
Butternut Grove	1.000	Coffer Dam Analy	Calibration	2980.00	633.05	637.49	636.13	637.80	0.004522	4.51	660.21	227.41	0.47
Butternut Grove	1.000	Coffer Dam Analy	Coffer Dam	2980.00	633.05	637.49	636.13	637.80	0.004522	4.51	660.21	227.41	0.47
Butternut Grove	1.000	FEMA 10-YR	Calibration	26400.00	633.05	646.92	642.05	647.90	0.002277	8.40	4345.32	505.19	0.42
Butternut Grove	1.000	FEMA 10-YR	Coffer Dam	26400.00	633.05	646.92	642.05	647.90	0.002277	8.40	4345.32	505.19	0.42
Butternut Grove	0.000	2017 LiDAR	Calibration	93.00	629.83	631.70	630.61	631.72	0.000835	1.00	93.22	87.09	0.17
Butternut Grove	0.000	2017 LiDAR	Coffer Dam	93.00	629.83	631.70	630.61	631.72	0.000835	1.00	93.22	87.09	0.17
Butternut Grove	0.000	2006 LiDAR	Calibration	2170.00	629.83	635.95	633.26	636.18	0.001847	3.81	569.43	168.56	0.32
Butternut Grove	0.000	2006 LiDAR	Coffer Dam	2170.00	629.83	635.95	633.26	636.18	0.001847	3.81	569.43	168.56	0.32
Butternut Grove	0.000	Coffer Dam Analy	Calibration	2980.00	629.83	636.27	633.83	636.64	0.002827	4.87	611.35	186.82	0.40
Butternut Grove	0.000	Coffer Dam Analy	Coffer Dam	2980.00	629.83	636.27	633.83	636.64	0.002827	4.87	611.35	186.82	0.40
Butternut Grove	0.000	FEMA 10-YR	Calibration	26400.00	629.83	645.64	642.35	647.00	0.003175	10.66	4425.23	525.44	0.50
Butternut Grove	0.000	FEMA 10-YR	Coffer Dam	26400.00	629.83	645.64	642.35	647.00	0.003175	10.66	4425.23	525.44	0.50

ATTACHMENT E

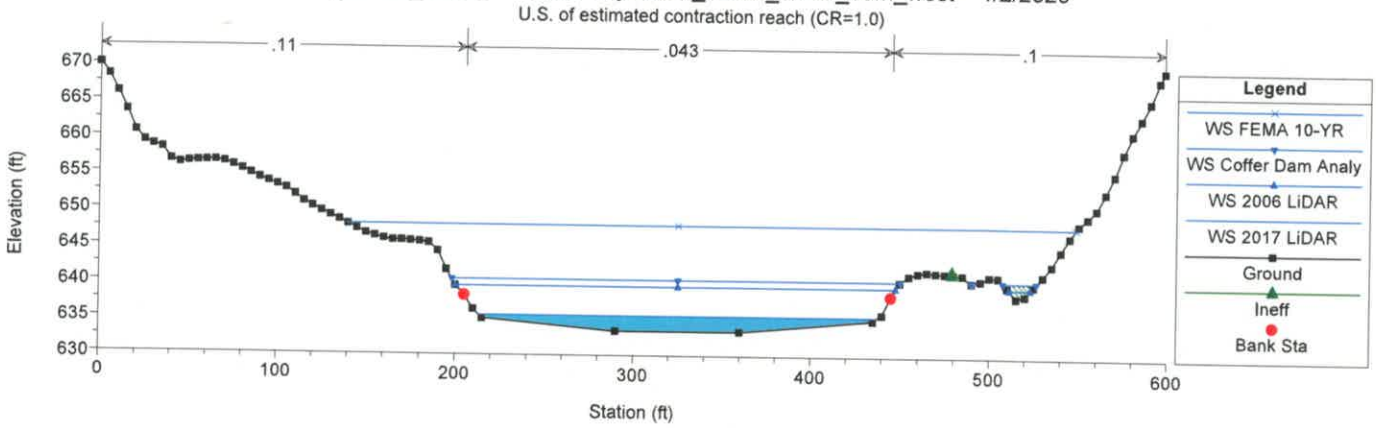
Additional HEC-RAS Construction-Phase Scenarios

A R M G r o u p L L C

West Bank Coffer Dam Scenario

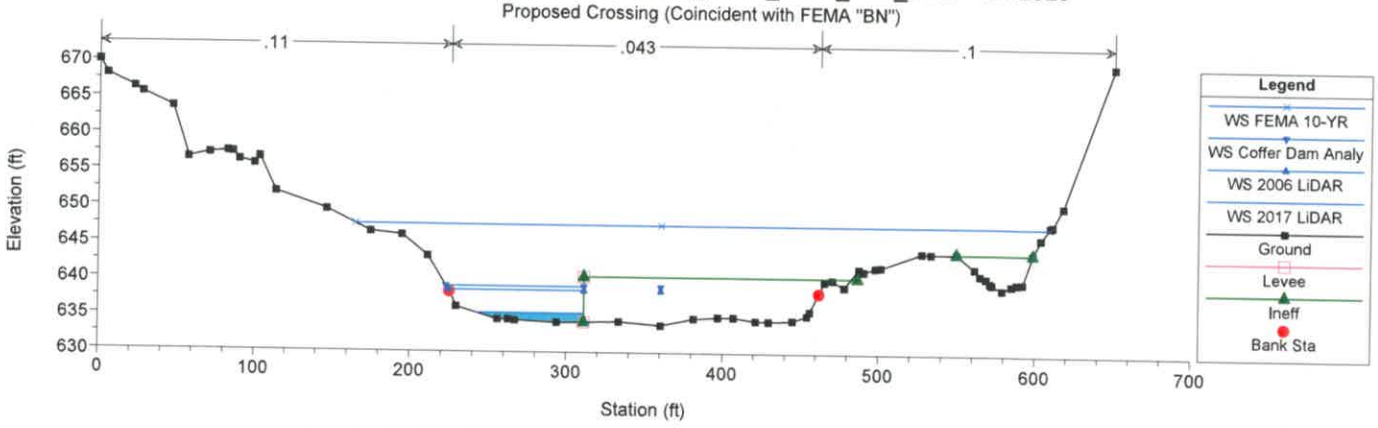
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_west 1/2/2020

U.S. of estimated contraction reach (CR=1.0)



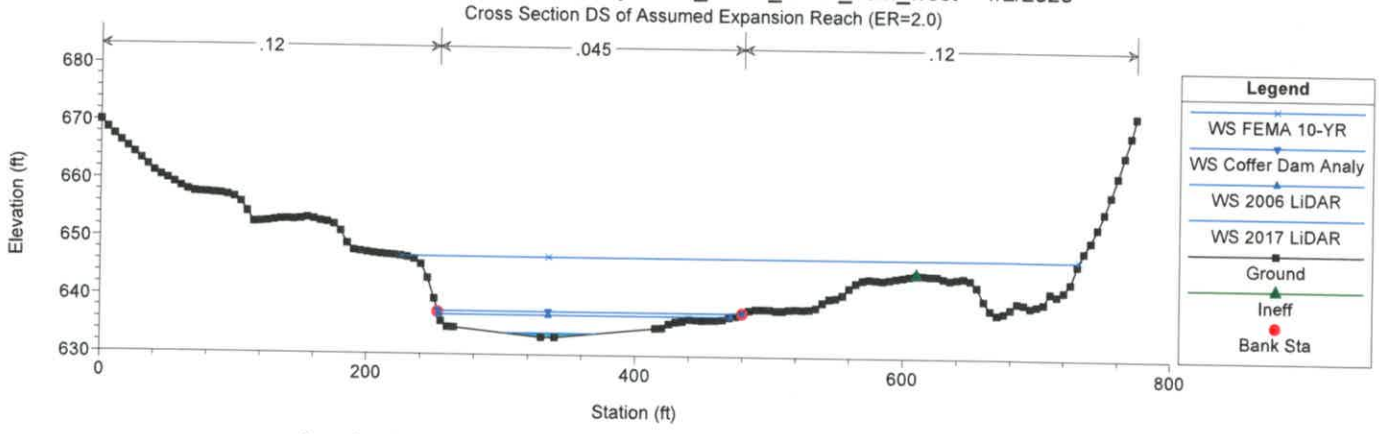
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_west 1/2/2020

Proposed Crossing (Coincident with FEMA "BN")



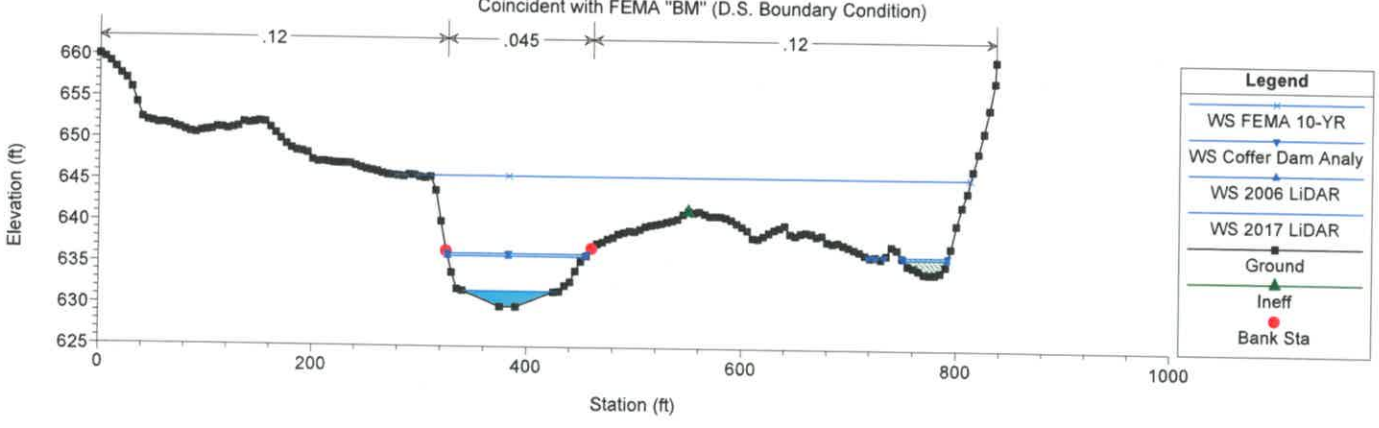
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_west 1/2/2020

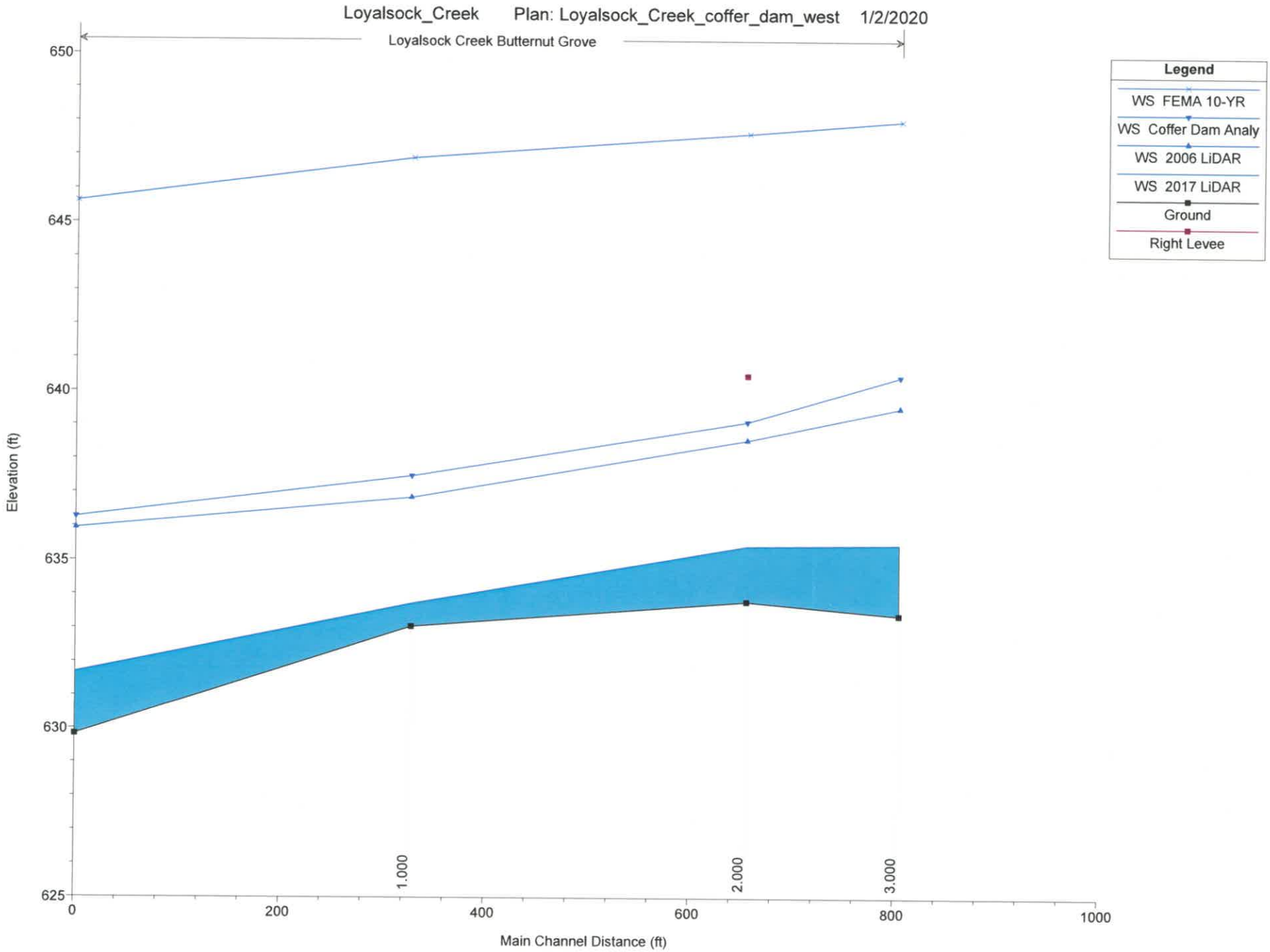
Cross Section DS of Assumed Expansion Reach (ER=2.0)



Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_west 1/2/2020

Coincident with FEMA "BM" (D.S. Boundary Condition)




Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_west 1/2/2020
Loyalsock Creek Butternut Grove
Legend
WS FEMA 10-YR
WS Coffer Dam Analy
WS 2006 LiDAR
WS 2017 LiDAR
Ground
Right Levee
Elevation (ft)
650
645
640
635
630
625
1.000
2.000
3.000
0
200
400
600
800
1000
Main Channel Distance (ft)

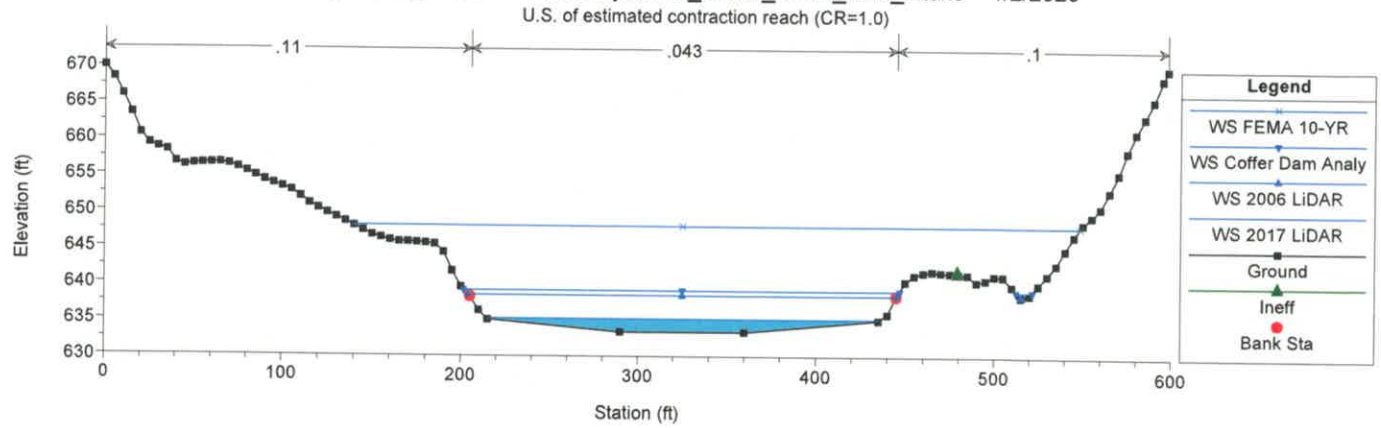
HEC-RAS Plan: coffer dam west River: Loyalsock Creek Reach: Butternut Grove Profile: Coffer Dam Analy

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Butternut Grove	3.000	Coffer Dam Analy	2980.00	633.40	640.47	635.75	640.53	0.000280	1.97	1526.96	272.40	0.14
Butternut Grove	2.000	Coffer Dam Analy	2980.00	633.81	639.12	638.16	640.13	0.008416	8.06	370.74	88.17	0.68
Butternut Grove	1.000	Coffer Dam Analy	2980.00	633.05	637.49	636.13	637.80	0.004522	4.51	660.21	227.41	0.47
Butternut Grove	0.000	Coffer Dam Analy	2980.00	629.83	636.27	633.83	636.64	0.002827	4.87	611.35	186.82	0.40

Freshwater Intake Coffer Dam Scenario

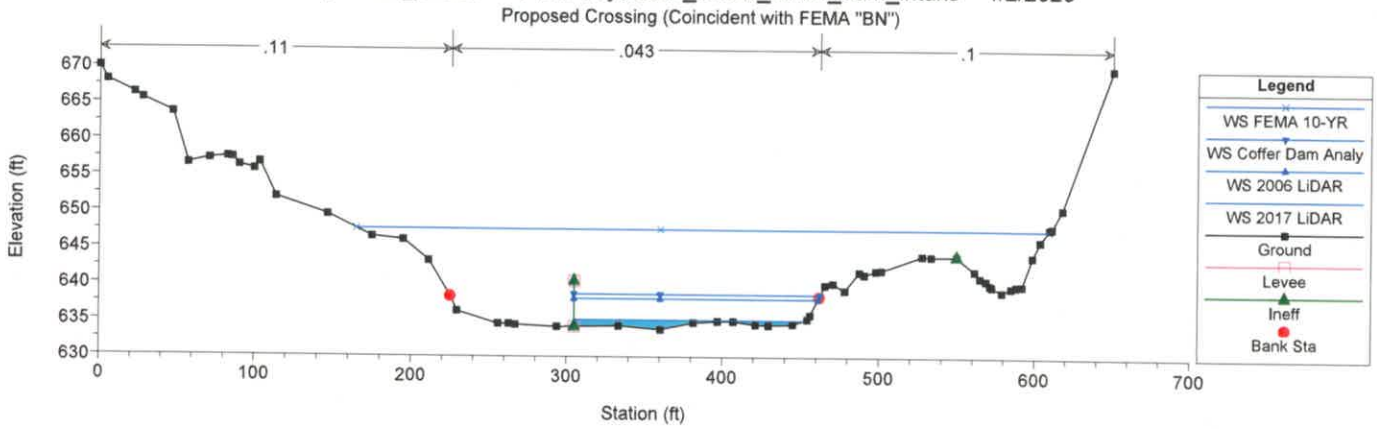
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_intake 1/2/2020

U.S. of estimated contraction reach (CR=1.0)



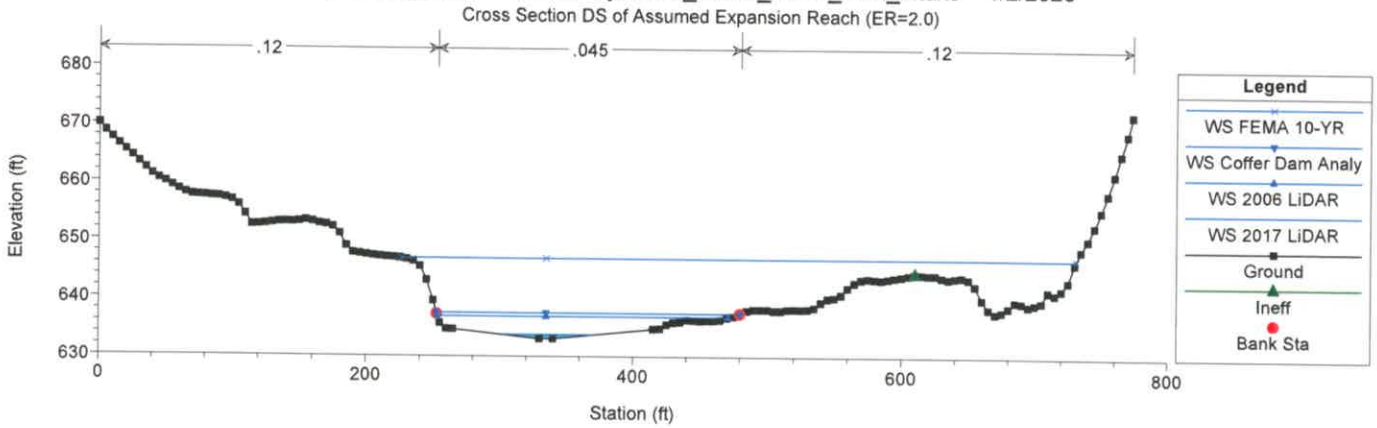
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_intake 1/2/2020

Proposed Crossing (Coincident with FEMA "BN")



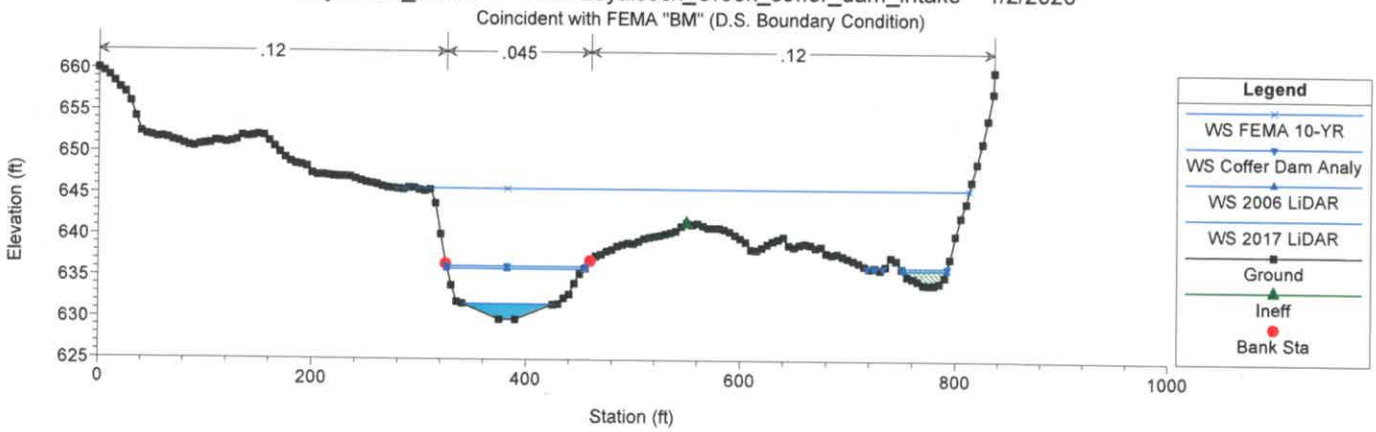
Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_intake 1/2/2020

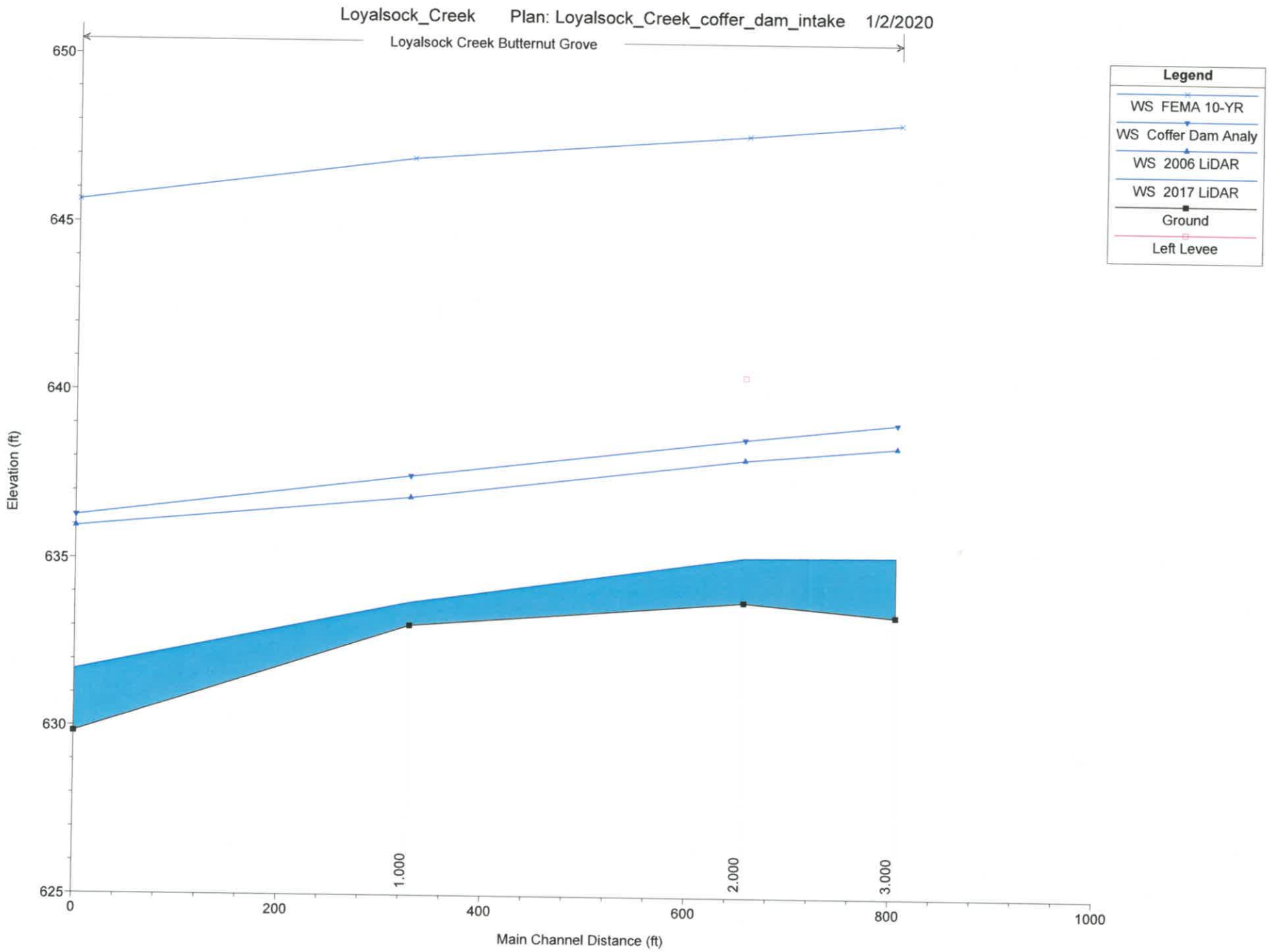
Cross Section DS of Assumed Expansion Reach (ER=2.0)



Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_intake 1/2/2020

Coincident with FEMA "BM" (D.S. Boundary Condition)




Loyalsock_Creek Plan: Loyalsock_Creek_coffer_dam_intake 1/2/2020
Loyalsock Creek Butternut Grove
Legend
WS FEMA 10-YR
WS Coffer Dam Analy
WS 2006 LiDAR
WS 2017 LiDAR
Ground
Left Levee
Elevation (ft)
650
645
640
635
630
625
0
200
400
600
800
1000
1.000
2.000
3.000
Main Channel Distance (ft)

HEC-RAS Plan: intake coffer dam River: Loyalsock Creek Reach: Butternut Grove Profile: Coffer Dam Analy

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Butternut Grove	3.000	Coffer Dam Analy	2980.00	633.40	639.14	635.75	639.24	0.000618	2.50	1196.12	254.47	0.20
Butternut Grove	2.000	Coffer Dam Analy	2980.00	633.81	638.65	636.78	638.99	0.002930	4.67	638.75	157.61	0.41
Butternut Grove	1.000	Coffer Dam Analy	2980.00	633.05	637.49	636.13	637.80	0.004522	4.51	660.21	227.41	0.47
Butternut Grove	0.000	Coffer Dam Analy	2980.00	629.83	636.27	633.83	636.64	0.002827	4.87	611.35	186.82	0.40

REQUIREMENT R

Professional Engineer's Seal and Certification

All Plans, Specifications, and Reports

A R M G r o u p L L C

REQUIREMENT S

Alternative Analysis

A R M G r o u p L L C

Alternatives Analysis

Proposed Location

The Loyalsock Creek Freshwater System is being proposed as a way to provide fresh water to support the development and completion of natural gas wells on leases located in Plunketts Creek and Gamble Townships. These lease holdings straddle Loyalsock Creek. The proposed project is located on a 10 acre parcel of land that is directly adjacent to these existing lease holdings and the Loyalsock Creek. In order to support the development of these leases, Pennsylvania General Energy Company, L.L.C. (PGE) is proposing to construct a 2,000,000 gallons per day (gpd) (at 1,500 gallons per minute [gpm]) surface water intake that allows PGE to pipe fresh water directly to its planned impoundments on either side of the Loyalsock Creek.

The proposed location was chosen due to PGE owning properties on each side of Loyalsock Creek, which in turn are adjacent to its leased properties. These parcels provide adequate access to Loyalsock Creek and allows sufficient area for construction of a pump station. This permits water to be pumped to freshwater impoundments, which will virtually eliminate the need for hauling water via trucking.

PGE considered the following factors when evaluating the proposed location:

- Water source capable of providing 2.0 mgd
- Accessibility to water source
- Parcels of 5 acres or more
- Located adjacent to water source and outside the floodplain / floodway
- Land suitable for construction of pad for a pump station
- Ability to transfer water to both development areas via pipeline

Initially, PGE reviewed water sources in the area that would be suitable for providing fresh water at a rate of 2 mgd. Once it was determined that Loyalsock Creek would be the best choice, a number of parcels were selected for discussions with the landowner(s). Several landowners denied PGE's request. A number of other parcels were deemed unusable due to either a lack of sufficient stream access, the majority of the parcel being in the floodplain / floodway, or the slopes of the parcel being too steep for the construction of a pump station. The Alternative Analysis maps show the areas that were considered along with the available parcels and ones that were deemed unusable for the previous reasons.

OTHER ALTERNATIVES CONSIDERED

Alternative 1 – Withdrawing from other stream(s) in the area (Wallis Run)

PGE examined the surrounding area for other water sources. Wallis Run is the closest and largest alternate water source available for a pipeline in this area. Most streams in the region have small drainage areas that are less than 50 mi^2 and also have an Exceptional Value (EV) designation. These streams fall under aquatic class 2 and are not suitable for large withdrawals as classified by the Susquehanna River Basin Commission (SRBC). Wallis Run is located at the northern and westerly side of one development area. This stream only has a drainage area of about 36 mi^2 and a mean annual flow of 55 cfs per USGS's Streamstats. This is less than 10% of the Loyalsock Creek's drainage area and flow. Wallis Run has naturally reproducing trout populations and also has an existing use designation of

Exceptional Value. Wallis Run and other smaller tributaries to Loyalsock Creek within PGE's project area are clearly not suitable to meet PGE's requested withdrawal rate and were dismissed as potential water sources.

Alternative 2 – Use of Lesser Quality Water

The area was reviewed for sources of impaired water. A brief review of the area showed two impaired streams: tributaries of Carpenters Run, to the southeast, and West Branch Murray Run to the northwest (tributary to Wallis Run). Both of these streams are very small, and the drainage area cannot provide enough water for PGE's consumptive use needs. Therefore, sources of lesser quality water cannot be considered a viable option for this project.

Acid mine drainage (AMD) is not being considered for this project. The Pennsylvania Department of Environmental Protection does not have a finalized guidance document for this, but initial indications are that double-lined impoundments would be required. The combination of increased costs of transportation, increased freshwater impoundment construction costs, increased risk, and lessor concerns resulted in the elimination of AMD sources from consideration.

Alternative 3 – Alternative Storage Options

If water cannot be piped, it must be trucked. Due to the technical limitations in trucking water to these remote leaseholds, water storage would have to double to pursue a source that must be trucked. This would significantly increase land disturbance and significantly increases the likelihood of wetland impacts on PGE's leaseholds. Moreover, PGE's leaseholds are within the Loyalsock State Forest. The Department of Conservation and Natural Resources (DCNR) limits the amount of land disturbance and will not grant enough land for development of enough freshwater impoundments required for completing fully developed pads by trucking water. This will increase the amount of times completions crews will have to return to each site, which increases costs and prolongs truck traffic.

An aerial photo review was conducted in order to locate impoundments from other operators that could be utilized along with PGE's future construction plans. Minimal impoundments were found. None of those impoundments are directly adjacent to the development areas as the topography isolates PGE's lease position from other operators. Due to the absence of impoundments by other operators in the area and the sharp increase in land disturbance, PGE rejected this alternative.

Alternative 4 – Source Sharing (Trucking)

PGE analyzed the possibility of sharing existing sources with other operators. Due to the remoteness of the development areas and the absence of nearby pipeline withdraws, only sources with truck loading facilities were considered. Only non-public water supply sources were considered in order to maximize the possibility of utilizing all of the volume approved by the SRBC Docket.

Analysis of Technical and Economic Feasibility and Water Resources

Several sources were reviewed for the ability of source sharing. The table below shows several sources that were considered.

Table 1. Summary of Shared Sources

	Loyalsock Creek, pipeline (Proposed Project)	Loyalsock Creek (20180907)	Lycoming Creek (20150610)	West Branch of Susquehanna River (Alternative point)	Loyalsock Creek (20150903)
Withdrawal rate (MGD)	2.0	1.7	1.0	1.0	1.5
Mode of transportation	Pipe	Truck	Truck	Truck	Truck
Aquatic Resource Class	4	4	3	6	4
Drainage Area (square miles)	394	442	149	5,234	215
Existing Use Designation	EV	EV	EV	WWF	EV
Feasibility	Possible	Possible	No	Possible	No

Two of these sources can be immediately removed from consideration. The Lycoming Creek source is simply too far away to be economically feasible. The Loyalsock Creek source (20150903) can also be removed due to the special conditions of that docket, which states that providing water to other operators is prohibited for this source. The West Branch of the Susquehanna is a source that represents a possible alternative source that PGE could develop. An explanation of why the other two sources were eliminated is explained below.

Trucking freshwater is a nuisance to local landowners, increases the risk of auto accidents, causes wear to local roads, is more expensive, and transportation is limited to times during which temperatures are above freezing. The discussed development areas have poor access, and the lessee has not permitted the construction of two-lane roads. Two lanes are necessary when trucking water to minimize standby time, prevent excessive congestion on local roads, and avoid the creation of large staging areas. Weather and DCNR hauling restrictions also limit the days available to truck water. The table below illustrates how weather and hauling restrictions negatively impact the days available to truck water.

Table 2. Hauling Restrictions

	Number of Days Unusable for Hauling
Lessor Hauling Restrictions/Holidays	45
Spring breakup	30
Cold Weather (can't haul at night)	65
Total Unusable Days	140

**There were 130 days where it was too cold to haul at night, so for those days transportation was limited to 12 hours. For calculation purposes, the number was divided to be used as whole days rather than half.*

Many variables can affect the efficiency of trucking water and the total volume that can be delivered per day. If PGE can have source access and secure a high number of trucks, the most water that can be hauled is typically around 1 MGD. This is equivalent to 217 truckloads in one day, which means that a truck would pass by a residence 434 times daily. Currently, there is a high demand for trucks in this area, and the possibility of getting a sufficient number of trucks to transport the full amount of water possible is unlikely. PGE recently completed a well in this area and was only able to secure an average of 14 (24-hr) trucks and only averaged 460,000 gpd. PGE estimates that due to the demand of other operators, the maximum number of trucks that may be available is 30 trucks running 24 hours a day. Sources that require more than 30 trucks are unlikely to consistently haul 1 MGD. The table below depicts the estimated trucks required from each source.

Table 3. Trucking Estimates

	Loyalsock Creek (20180907)	Lycoming Creek (20150610)	Susquehanna River (West branch) (20120302)
Trucks Needed for 1 MGD	29	39.5	31.5

Table 3 establishes that the Loyalsock Creek (20180907) would be the best candidate for source sharing. It is the closest source and would require the least amount of trucks. An examination of the lifespan of the development areas and their water requirements reveals that trucking water from this source would cost approximately $2.78 per barrel of water consumed. The costs for the West Branch of the Susquehanna River source would be even higher due to the added construction and operation of a truck filling facility. The estimated cost for trucking water from a shared source is more than double that of the proposed project without factoring in the construction of additional freshwater impoundments or the delays incurred during hydraulic fracturing operations due to the limited water volumes that can be hauled.

Due to the location of the proposed Susquehanna source, the area where a pump station can be installed is highly limited. The existing floodway constricts the location of a pump station and loading facility to the northern part of the property, which is still located within the floodplain. A desktop review showed that in order to connect the pump station to the intake, Tules Run and

additional wetland areas will be crossed. When viewing a hillshade layer of this area (see Proposed Susquehanna Intake maps), hummocky topography can be seen, which is indicative of wetlands being present. The land surrounding Tules Run also appears to have wetland complex within its floodway. As such, when compared with the selected option there will be two wetland impacts and two stream crossings whereas the selected options has no wetland impacts and one stream crossing. The combination of construction restrictions, wetland impacts, stream crossings, and additional costs all factored in removing the Susquehanna River source from consideration.

It was assumed that PGE would have unfettered access to shared sources in the analysis. This is an impractical assumption, as PGE would likely have to haul from a multitude of sources, which increases logistical complexity. This will drastically increase costs and reduce efficiency, therefore exacerbating the known problem of insufficient storage when water is trucked.

When compared to the proposed withdrawal to supply water for a pipeline system, trucking water from these sources has been deemed infeasible because of the following:

a. Trucking causes potential damage to roads
b. More travel increases the carbon footprint of the project.
c. Transportation costs make it less economic.
d. Additional truck traffic increases chances of an automobile accident.
e. There are limited impoundments and limited areas available for new impoundment construction, so not all of the water necessary can be stored.
f. Source availability is not guaranteed.
g. Truck availability is not guaranteed.
h. Extends fracing times.
i. Decreases amount of wells that can be completed at once.
j. Extends overall development plans.

PGE examined the technical, economic, and water resource aspects of the proposed withdrawal at the proposed project location, withdrawing water from a different stream, utilizing other producer's storage, and sharing sources (trucking) from other operators. The only feasible alternative to the proposed project is trucking water from shared sources. Considering the lifespan of this project and impacts on the development areas, PGE has concluded that the proposed surface water withdrawal has the ability to remove almost all trucking of water to PGE's leases, remove over 90,000 truck trips, decrease overall land disturbance (by decreasing the number of impoundments), and financially cost substantially less than the trucking alternative. For these reasons, the shared source (trucking) alternative has been removed from consideration.

Alternative 5 – Other intake locations along Loyalsock Creek

Land parcels were evaluated between the two development areas along the Loyalsock Creek for construction of a surface water intake and supplemental pump station suitable for pumping water via pipeline. The Alternative Analysis map categorizes these parcels into several groups for three different areas. As previously stated, all parcels along Loyalsock that were less than five acres in size were removed from consideration. These are designated in purple on the map. Next, any remaining parcel greater than 5 acres that had the majority of its land within the floodplain / floodway was also eliminated. This is due to the inability to build the pump station within the flood plain. These were categorized as, "Construction not Possible" and are shaded orange. Parcels where access to the creek

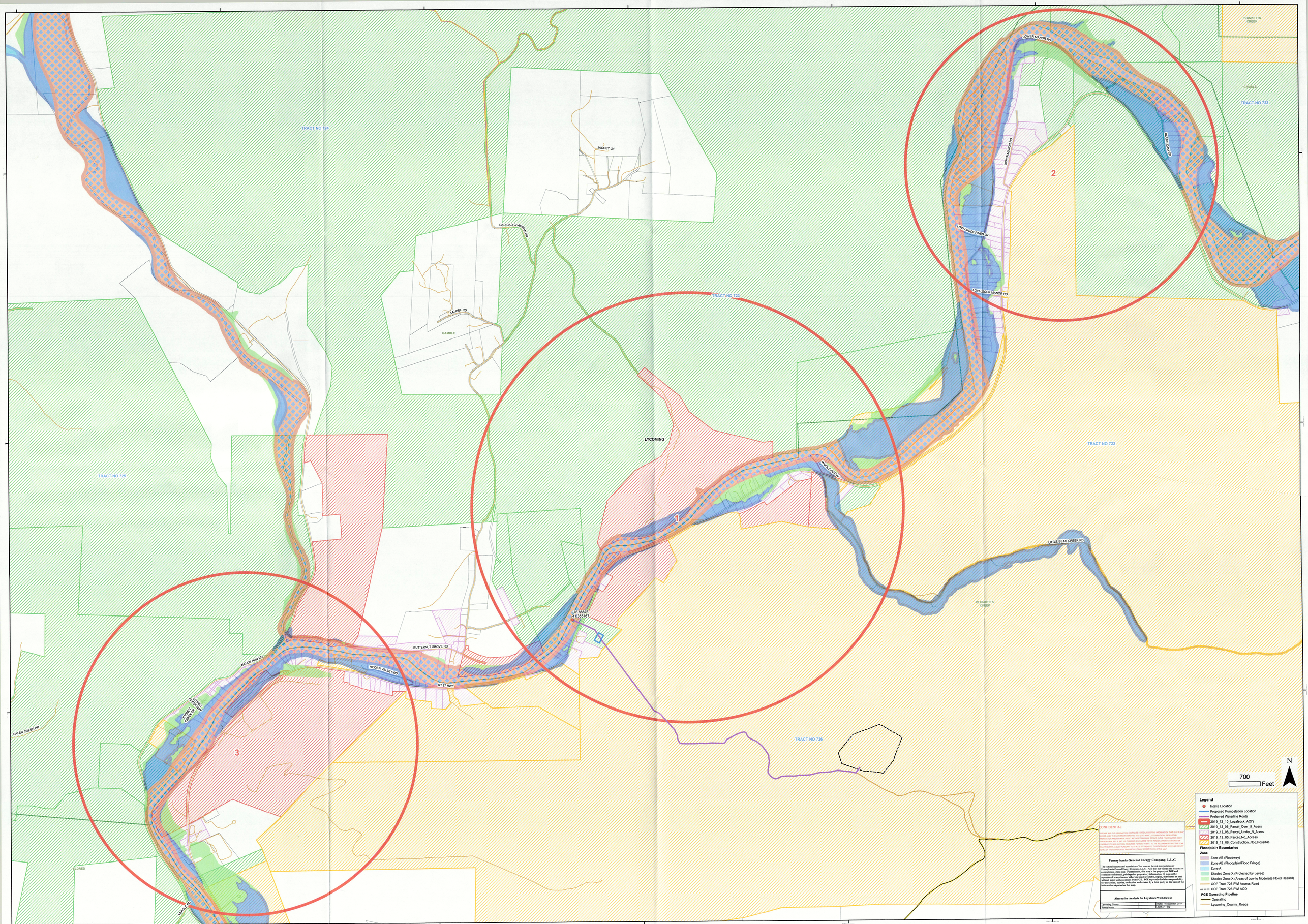
was insufficient or the area was too steep for pump station construction were also grouped into this category. The remaining parcels that are suitable for construction are shaded green.

After considering all of these factors, three different areas were investigated further for possible intake locations. Area 2 is the farthest away from the development areas. Area 2 also requires traversing an additional valley and crossing Little Painter Run. Since Little Bear Run is within the Loyalsock Creek watershed, it is also designated as an Exceptional Value (EV) stream. The DCNR is requiring that the water distribution line from the pump station be installed without a cleared right of way. This would typically be a temporary above ground line. This would be highly difficult to accomplish at this location due to the remoteness and sheer distance from the development area. For these reasons, Area 2 was removed from consideration.

Areas 1 and 3 were more suitable for the intake location. Landowner(s) were contacted about leasing opportunities. The locations of these parcels were strategically selected to give the best opportunity to provide water to both sides of the Loyalsock Creek. The parcels shown in red depict landowners that were contacted and denied PGE access to their property. As you can see from the map, the access denial from these landowners result in limited areas where the creek can be accessed for construction and/or crossed. Area 3 was removed from consideration because of the lack of accessible areas.

In Area 1, the southeastern side of the mountain on the northern side of the creek contains cliffs. This further excludes parcels in this area for consideration. Upon PGE's investigation, two parcels were found in Area 1 that are directly across from one another. These owners were interested in the opportunity to work with PGE and allowed access to the properties. Wetland investigations were completed and are present on both parcels, but will not be impacted by the installation of the intake and supporting pump station. Given their location adjacent to Loyalsock Creek, proximity to development areas, and absence of wetland impacts, these two parcels were chosen as the preferred locations for the intake and pump station, with the parcel on the southern side of the creek being the primary location.

PGE has examined several different water sources and methods for transporting water to its development areas that straddle Loyalsock Creek. As proposed above, the best method is to install an intake and pump water via a temporary above ground water line to the development area.


TRACT NO 724
TRACT NO 725
TRACT NO 723
TRACT NO 722
TRACT NO 726
JACOBY LN
DAD DAD CHAPMAN RD
LAUREL RD
GAMBLE
LYCOMING
LOWER MANOR RD
UPPER MANOR RD
BLAKE MILL RD
LOYALSOCK PINES LN
LOYALSOCK MANOR RD
WOOLSEY LN
LITTLE BEAR CREEK RD
PLUNKETTS CREEK
76.88876
41.355167
BUTTERNUT GROVE RD
HALLIS RUN RD
HIDDEN VALLEY RD
RT 87 HWY
STONY CREEK HWY
CALES CREEK RD
ELDRED
TEAGLE RD
1
2
3
N
700
Feet
Legend
Intake Location
Proposed Pumpstation Location
Preferred Waterline Route
2019_12_10_Loyalsock_AOI's
2019_12_06_Parcel_Over_5_Acers
2019_12_06_Parcel_Under_5_Acers
2019_12_05_Parcel_No_Access
2019_12_06_Construction_Not_Possible
Floodplain Boundaries
Zone
Zone AE (Floodway)
Zone AE (Floodplain/Flood Fringe)
Zone A
Shaded Zone X (Protected by Levee)
Shaded Zone X (Areas of Low to Moderate Flood Hazard)
COP Tract 726 FWI Access Road
COP Tract 726 FWI AOD
PGE Operating Pipeline
Operating
Lycoming_County_Roads
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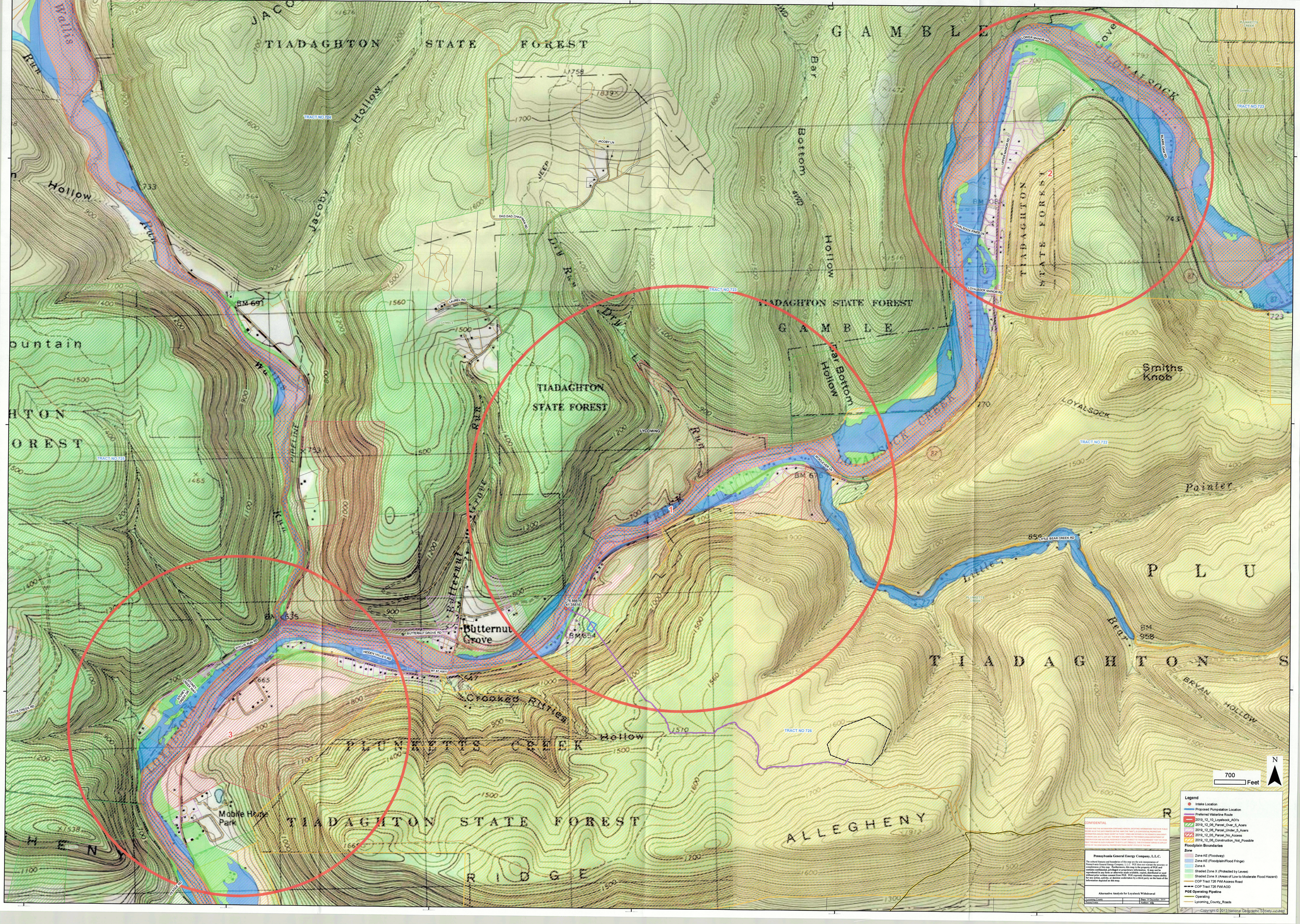
Alternative Analysis for Loyalsock Withdrawal
Lycoming County
Pennsylvania
Date: 11 December, 2019
Author: mjh


TIADAGHTON STATE FOREST
GAMBLE
TIADAGHTON STATE FOREST
GAMBLE
TIADAGHTON STATE FOREST
TIADAGHTON STATE FOREST
TIADAGHTON STATE FOREST
TIADAGHTON STATE FOREST
ALLEGHENY RIDGE
PLUNKETTS CREEK
Butternut Grove
Smiths Knob
Pointer
Mobile Home Park
LOYALSOCK
LOYALSOCK CREEK
Little Bear Creek
Jacoby Hollow
Jacoby Run
Bear Bottom Hollow
Bear Bottom
Cove
Walls Run
Walls Run Hollow
Butternut Grove
Cooper Ridge
Bryan Hollow
Little Bear Creek
Plunkett Creek
Lycoming Creek
Lycoming
TRACT NO 724
TRACT NO 723
TRACT NO 722
TRACT NO 725
TRACT NO 726
JACOBY LN
DAD DAD CHAPMAN RD
LAUREL RD
LOWER MANOR RD
UPPER MANOR RD
LOYALSOCK PINES LN
LOYALSOCK MANOR RD
BLACK OAK RD
WOODLEVER LN
LITTLE BEAR CREEK RD
BUTTERNUT GROVE RD
HIDDEN VALLEY RD
RT 87 HWY
WALLS RUN RD
CALEB CREEK RD
TEA CREEK RD
PIPELINE
BM 691
BM 635
BM 654
BM 675
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Alternative Analysis for Loyalsock Withdrawal
Lycoming County
Pennsylvania
Date: 10 December, 2019
Author: mh
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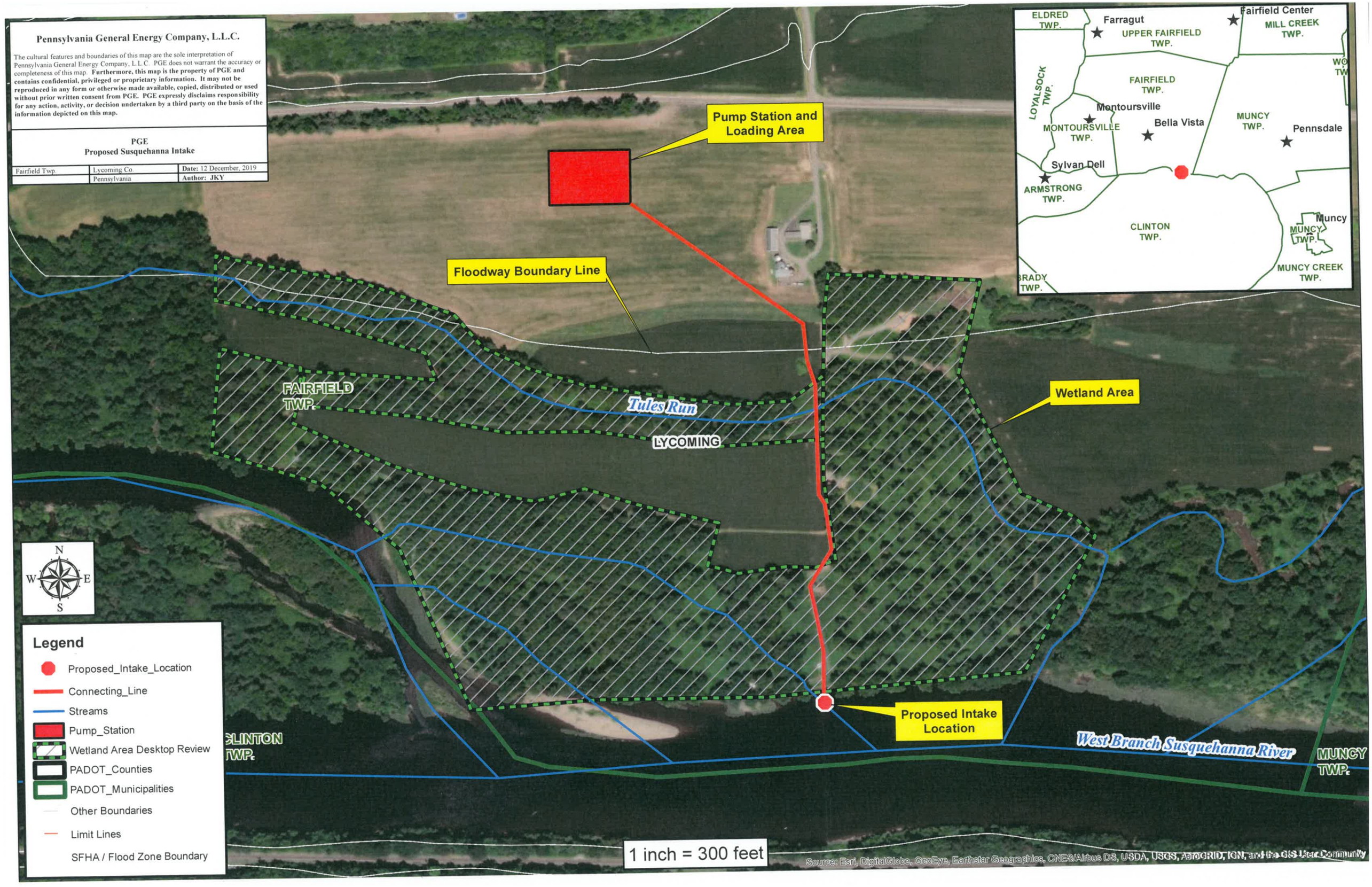
PGE
Proposed Susquehanna Intake

Fairfield Twp.	Lycoming Co.	**Date:** 12 December, 2019
	Pennsylvania	**Author:** JKY



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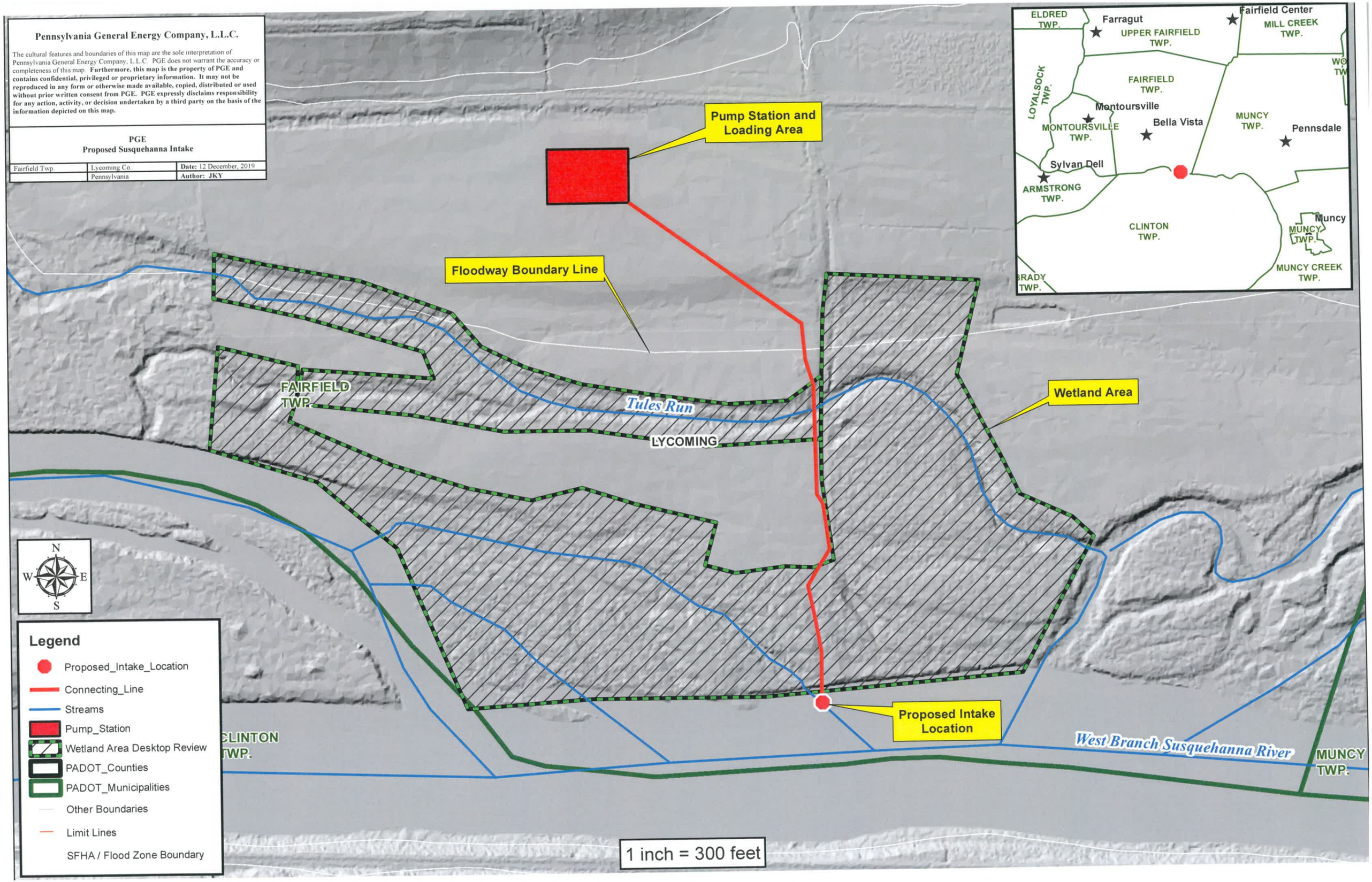

ATTACHMENT 1.0

PADEP Aquatic Resource Impact Table

A R M G r o u p L L C

3150-PM-BWEW0557 Rev 4/2018
Application

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATERWAYS ENGINEERING AND WETLANDS

Applicant's Name / Client Pennsylvania General Energy Company, L.L.C.

AQUATIC RESOURCE IMPACT TABLE

FOR PENNSYLVANIA CHAPTER 105 WATER OBSTRUCTION AND ENCROACHMENT APPLICATION / REGISTRATION

Project / Site Name: Loyalsock / Shawnee Freshwater System

Date: January 2020

DEP USE ONLY			Project Information									PADEP / 105		
PADEP Permit Number	Single Complete Crossing No.	Crossing Number	Fee	Structure / Activity unique identifier	Aquatic Resource Type	Latitude dd nad83	Longitude dd nad83	Waters Name	PA Code Chapter 93 Designation	Work Proposed	DEP Impact Type temp / perm	Watercourse Impact Top of Bank to Top of Bank Length and Width in feet	Floodway Impact Top of Bank Landward Length and Width in feet	Wetland Impact Dimension Length and Width in feet
			Joint Permit Application Fees are Calculated Based on the Overall Temporary & Permanent Disturbances. Refer to Chapter 105 Fee(s) Calculations Worksheet	Freshwater Intake and Withdrawal System	Perennial	41.355167	-76.888760	Loyalsock Creek	TSF, MF	Excavation	Perm	~48.7' x 2.2' Pipes, 7' x 3' Intake (128.1 SF)	~16.7' x 2.2' Pipes, ~7.5' x 1.8' Pipes, 10' Dia. Wet Well, 8' x 10' Valve Vault (204.2 SF)	N/A
				Utility Corridor (Five pipelines in common Trench)	Perennial	41.355312	-76.888918	Loyalsock Creek	TSF, MF	Excavation	Perm	~240' X 4.2' (1,008.0 SF)	~44.4' X 4.2' (186.5 SF)	N/A
				Temporary Impacts to Loyalsock Creek	Perennial	41.355312	-76.888918	Loyalsock Creek	TSF, MF	Excavation	Temp	~240' X 85.8' (19,495.4 SF)	~42' X 218.5' (8,743.7 SF)	N/A
				Utility Corridor (Five pipelines in common Trench)	Intermittent	41.355621	-76.889681	Loayalsock Creek Side Channel	TSF, MF	Excavation	Perm	~12.8' X 4.2' (53.8 SF)	No Separate Floodway Associated with Side Channel	N/A
				Temporary Impacts to Loyalsock Creek Side Channel (Utility Pipelines)	Intermittent	41.355621	-76.889681	Losyalsock Creek Side Channel	TSF, MF	Excavation	Temp	~13' X 50' (593 SF)	No Separate Floodway Associated with Side Channel	N/A
				Temporary Impacts to Loyalsock Creek Side Channel (Temporary Road Crossing)	Intermittent	41.355920	-76.889301	Losyalsock Creek Side Channel	TSF, MF	Aerial Bridge	Temp	~11' x 15' (162.7 SF)	No Separate Floodway Associated with Side Channel	N/A
												-	-	-
												-	-	-
												-	-	-
												-	-	-
												-	-	-

PADEP Impact Type: temporary or permanent.

Permanent Impacts are those areas affected by a water obstruction or encroachment that consist of both direct and indirect impacts that result from the placement or construction of a water obstruction or encroachment and include areas necessary for the operation and maintenance of the water obstruction or encroachment located in, along or across, or projecting into a watercourse, floodway or body of water.

Temporary Impacts are those areas affected during the construction of a water obstruction or encroachment that consists of both direct and indirect impacts located in, along or across, or projecting into a watercourse, floodway or body of water that are restored upon completion of construction. This does not include areas that will be maintained as a result of the operation and maintenance of the water obstruction or encroachment located in, along or across, or projecting into a watercourse, floodway or body of water (these are considered permanent impacts).