INITIAL STRUCTURAL STABILITY ASSESSMENT REPORT

ASH BASIN NO. 1

MONTOUR STEAM ELECTRIC STATION
DERRY TOWNSHIP, MONTOUR COUNTY, PENNSYLVANIA

Prepared for:

TALEN GENERATION, LLC

Prepared by:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

CEC Project 150-989.0005

October 13, 2016

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1.0 PURPOSE

The purpose of this report is to present the results of the Initial Structural Stability Assessment of the Montour Steam Electric Station (MSES) Ash Basin 1. The assessment was performed in accordance with the United States Environmental Protection Agency (USEPA) 40 CFR Parts 257 and 261 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule, dated April 17, 2015 (CCR Rule). In accordance with Section 257.73(d) of the CCR Rule, and based on the information available at the time of the assessment, CEC evaluated Basin 1 regarding:

- Stable foundations and abutments;
- Slope protection;
- Compaction of dike materials;
- Dike Vegetation;
- Spillway Adequacy;
- Hydraulic structures underlying or passing through the dike; and
- Stability of downstream slopes after flooding.

2.0 SITE DESCRIPTION

Montour, LLC (Montour) operates a coal combustion residuals (CCR) management facility, known as Ash Basin 1, at their MSES near Washingtonville, Pennsylvania. Basin 1 is regulated under the Pennsylvania Residual Waste Regulations of Title 25 PA Code, Chapters 287 and 289. Basin 1 is permitted as a PADEP Class II Residual Waste Disposal Impoundment. Basin 1 is operated under Permit No. 301315, which expires in April 2018. Basin 1 is also regulated by the PADEP Bureau of Waterways Engineering Division of Dam Safety under Permit No. 47-009 and under the National Pollutant Discharge Elimination System (NPDES) Permit No. PA0008443.

Basin 1 went into service in 1971 and was developed by excavating site soils to construct an embankment dike around the excavation. The top of the dike is set at Elevation 564 (NGVD 1929). The perimeter of Basin 1 is approximately 11,000 feet in length and up to approximately 40 feet high. The dike ties into natural grade along the eastern side of the basin. Basin 1 is divided into Subbasins A, B, and C by internal dikes referred to as the Median Dike and the Splitter Dike as shown on Figure 2 in Appendix A.

The CCRs disposed in Basin 1 have historically included coal fly ash (ceased in 1982), coal bottom ash (presently managed elsewhere), Stabil-Fil (lime-amended fly ash), and mill rejects (presently managed elsewhere). Bottom ash fines are currently sluiced into the western portion of Subbasin B, which functions as a settling basin. The water is decanted by culverts through the splitter dike into Subbasin C. Water is discharged from Subbasin C through a spillway consisting of a 36-inch reinforced concrete riser and culvert pipe to the on-site detention basin before discharging to Chillisquaque Creek where it is monitored under an NPDES Permit. Conditioned Fly Ash (CFA), which is fly ash conditioned with moisture, is currently being placed in Subbasin A in accordance with a Major Permit Modification issued by PADEP on June 18, 2015. Refer to Figures 1 and 2 in Appendix A for site location and layout.

3.0 DOCUMENT REVIEW

CEC reviewed documents provided by Talen related to the Basin construction and operation. Basin 1 has been inspected in accordance with the PADEP requirements for many years. The Initial Annual Inspection Report of Basin 1 in accordance with the CCR Rule was performed on June 11, 2015 by HDR Engineering, Inc. (HDR). Geosyntec Consultants prepared a History of Construction Report of Basin 1 in accordance with the CCR Rule and a Lake Chillisquaque Dambreak Analysis was prepared in 1999. CEC prepared an Initial Inflow Design Flood Control System Plan for Basin 1 in October 2016, and the Initial Safety Factor Assessment Report in October 2016. These documents were reviewed and used as references to assess the requirements in the CCR Rule.

4.0 INITIAL STRUCTURAL STABILITY SITE VISIT

On June 17, 2016, Mr. Jonathan Niemiec, P.E. of CEC performed a site visit to observe the conditions of Basin 1 as it relates to the structural stability assessment required by the CCR Rule. A comprehensive site walk of the entire basin and discussions with Talen personnel were performed during this visit. A PADEP Dam Inspection Checklist was completed by CEC during the inspection. The completed checklist associated with this site visit is included in Appendix C. Select photographs taken during this site visit are included in Appendix B and the photograph locations are shown on Figure 2 in Appendix A.

5.0 STRUCTURAL STABILITY CRITERIA

To comply with the CCR Rule, this report documents if the facility displays evidence of the requirements outlined in Section 257.73(d)(1) of the CCR Rule. The following sections address these requirements.

5.1 STABLE FOUNDATIONS AND ABUTMENTS

Based on CEC's site visit, and the documents reviewed, CEC concludes that the dike foundations and abutments appear to be stable. In accordance with Section 257.83(a)(i) of the CCR Rule, Talen will monitor the dike slopes, foundations, and abutments for signs of instability on a weekly basis.

According to Section 3.5 of the Basin 1 History of Construction Report, the Basin 1 perimeter dike was primarily founded on bedrock consisting of weathered shale. The perimeter dike ties into natural existing grade at the northern and southeastern corners of the basin. According to the History of Construction Report, the abutment material at these locations consists of residual soils overlying weathered shale. A view of these northern and southeastern dike corners are shown in Photographs 1 and 2 in Appendix B.

During CEC's site visit, a seep at the toe of the northern dike slope, just upstream of the seepage collection system, was observed. The seep was observed to be flowing and the seepage water appeared to be clear. Iron oxidation was observed on the riprap at the seep. This seep can be seen in Photograph 3 in Appendix B. Talen is currently investigating the cause of this seep so that the issue can be addressed.

Ponding water was observed between the existing rail line and the toe of the southwestern dike slope, east of the pipe bridge, at the time of our site visit as shown in Photograph 4 in Appendix B. The area between the toe of slope and rail line to the west of the pipe bridge was wet; however, no ponding water was observed in this area. The Initial Annual Inspection indicates that this area is generally wet. No signs of slope instability were observed along the southwestern dike slope. A rock buttress was constructed in 2007 along the southwestern downstream dike slope in the area of the pipe bridge to increase stability.

5.2 SLOPE PROTECTION

Most of Basin 1 has CCRs placed to the top of the dike elevation which covers the upstream side of the dike. Subbasin C and the western portion of Subbasin B are the only areas within Basin 1 where the upstream dike slopes are exposed. The upstream slopes in these two areas are mostly covered with vegetation and are mowed as needed. Section 3.6.4 of the History of Construction Report states that a berm was constructed along the perimeter dike to protect against erosion from wave action. This document states that the berm was constructed of reclaimed bottom ash and mill rejects. Recent topography indicates that this berm has remained in place. Photographs 5 through 7 in Appendix B show the condition of the vegetation on the upstream dike slopes at the time of our site visit.

5.3 COMPACTION OF DIKE MATERIALS

The History of Construction Report states that based on Drawing G-199944-11 by Ebasco Services, Inc. dated March 28, 1968, the materials used to construct the dike were to be compacted to at least 95% of the maximum dry density based on the standard Proctor (ASTM D698). The Initial Safety Factor Assessment Report indicates that the dike materials are adequate to withstand the range of loading conditions expected to be experienced by the dike. The conditions of the dike materials used in the Initial Safety Factor Assessment Report were based on field and laboratory testing data obtained during CEC's 2015 subsurface investigation and from previous subsurface investigations.

5.4 DIKE VEGETATION

The CCR Rule currently states that the vegetation on the dikes and surrounding areas shall not exceed 6 inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection. According to the CCR Rule Litigation between USEPA and Utility Solid Waste Activities Group (USWAG) Petitioners and Environmental Petitioners, this requirement has been removed from the CCR Rule.

Talen's vegetation control program calls for cutting vegetation at least three times a year during the growing season. In accordance with Section 257.83(a)(i) of the CCR Rule, Talen will perform weekly inspections of the dike slopes. During these inspections the condition of the vegetation will be documented and any issues reported will be promptly addressed.

At the time of CEC's inspection, the dike slopes were mostly covered with grassy vegetation. Larger vegetation such as shrubs or trees were not present on the dike slopes. The downstream slopes contain vegetation along the entire dike excluding the areas where riprap has been placed. Photographs 1, 2, 3, 4, 9, 11, 12, and 13 show the condition of the vegetation on the downstream dike slopes at the time of our site visit.

5.5 SPILLWAY ADEQUACY

The current spillway is located in Subbasin C and consists of a 36-inch reinforced concrete riser and culvert pipe. This spillway discharges into the on-site detention basin before discharging to Chillisquaque Creek. The top of the spillway riser is shown in Photograph 8 in Appendix B.

Based on the assessment presented in the Initial Inflow Design Flood Control System Plan by CEC dated October, 2015, the existing discharge structures in Basin 1 cannot manage the CCR Rule design storm during the existing or final conditions.

During the Initial Annual Inspection by HDR, the spillway in Subbasin C was inspected with a remotely operated vehicle (ROV). The ROV encountered an obstruction approximately 45 feet downstream of the Subbasin C spillway riser. According to the report, the obstruction appears to be blocking approximately 80 to 90 percent of the spillway culvert opening. Based on the pool level measurements provided by Talen, the normal pool in Subbasin C does not appear to have been affected by the obstruction under normal operating conditions. Talen is currently taking measures to investigate the removal of the obstruction. A detailed inspection of the spillway was not performed as part of this assessment.

5.6 HYDRAULIC STRUCTURES UNDERLYING OR PASSING THROUGH THE DIKE

The integrity of the spillway located in Subbasin C is inspected as part of the annual inspection by HDR. An inspection of this pipe was attempted during the Initial Annual Inspection with a ROV; however, very little of the structure could be seen due to the obstruction. Past inspections indicate that the integrity of the spillway pipe is satisfactory.

Two abandoned reinforced concrete pipe culverts are present beneath the dike on the north side of Basin 1 as shown on Figure 2. The outlet of the western plugged culvert is exposed and is shown in Photograph 9 in Appendix B. According to the Initial Annual Inspection Report, this pipe was inspected from the downstream end with a ROV by Talen in 2014. A concrete plug was encountered during the inspection approximately 59 feet from the outlet end. Drawing G-199945-13 by Ebasco Services, Inc. dated March 15, 1968 indicates that the eastern plugged culvert was temporarily installed to allow flow of an existing creek through the dike embankment, most likely during construction. The exact location of the eastern plugged culvert is unknown.

Several 15-inch to 24-inch HDPE stormwater pipes pass through the dike in Subbasin A. These pipes are currently plugged as part of the Major Permit Modification to place CFA in Basin 1 and to direct all surface water run-off to Subbasin C. These pipes were not observed during our site visit. These pipes were inspected with a ROV as part of the Initial Annual Inspection and were found to be in satisfactory condition.

In 1973, a seepage collection system was installed on the northwestern side of the basin for collecting seepage water and conveying it back to Basin 1. In 1979, the system was extended farther to the northeast and an additional pump station was added to convey the seepage water back to the basin. The collection system consists of a buried interceptor trench at the downstream toe of the northern dike. The trench contains a pipe that is sloped to convey water to four manholes positioned along its length. The manholes are equipped with submersible pumps that operate via level controls to pump the accumulated water back into the basin. Pipes pass through the northern dike to convey pumped water from the seepage collection system to Subbasin B. Some of the pipes were observed to be flowing during our inspection and based on our observations and conversations with Talen, are buried at a relatively shallow depth, just below the crest. One of these pipes is shown in Photograph 10 in Appendix B.

5.7 STABILITY OF DOWNSTREAM SLOPES AFTER FLOODING

Based on the Montour SES Lake Chillisquaque Dambreak Analysis dated November 1999, inundation of a portion of the northern dike slope adjacent to the Chillisquaque Creek is possible if a dam breach should occur. Therefore, CEC evaluated the stability of the exterior embankment at Cross Section 1-1 considering a rapid drawdown scenario of the maximum flood elevation. Figure 2 in Appendix A shows the location of Cross Section 1-1.

CEC reviewed the Federal Emergency Management Agency (FEMA) flood insurance rate map and the Montour SES Lake Chillisquaque Dambreak Analysis dated November 1999. The Dambreak Analysis reported a maximum flood level at the Montour Power Plant (located approximately 2.4 miles downstream of the dam) of approximately Elevation 528. The FEMA map reports a flood elevation of approximately Elevation 524 at the location of Basin 1. Elevation 528 was used in our analysis. The dike does not extend down to Elevation 528 at Cross Sections 2-2, 3-3, and 4-4, so they were not evaluated for rapid drawdown. The FEMA flood map and an excerpt from the dambreak analysis are included in Attachment J.

Section 257.73(e) of the CCR Rule does not specify a minimum FS for rapid drawdown. However, the regulations suggest that this evaluation be completed, if applicable. ACOE Engineering Manual EM 1110-2-1902 ”Slope Stability” (October 2003) recommends a minimum FS of 1.1 (drawdown from maximum surcharge pool) and 1.3 (drawdown from maximum storage pool). The maximum water level used in the analysis is an extreme event (dam breach under the probable maximum precipitation event) so the lower FS is recommended. Based on our analysis, a FS of 1.4 was calculated for this drawdown scenario. Refer to the Basin 1 Initial Safety Factor Assessment Report for more information regarding the subsurface conditions and analysis methodology.

6.0 CONCLUSIONS

Based on our site visit and document review, CEC concludes that Basin 1 generally meets the criteria outlined in Section 257.73(d)(1) of the CCR Rule with the exception of the requirements for spillway capacity.

7.0 RECOMMENDATIONS

In accordance with Section 257.73(d)(2) of the Final Rule, if a deficiency or release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measure taken. CEC recommends that the following be performed to maintain compliance with the CCR Rule.

- Remove the obstruction in the spillway as soon as possible to increase the flow capacity of the spillway, and investigate the cause of the spillway obstruction and implementing measures to reduce the chances of future obstructions.
- Modify the spillway to increase the capacity to convey the CCR Rule design storm.
- Investigate the seepage collection system at the northern dike slope to address the seep observed during CEC's site visit.
- Inspect the outlet of the plugged western culvert near Chillisquaque Creek as part of the weekly inspections to be performed in accordance with the CCR Rule.

8.0 CERTIFICATION

The following is provided in accordance with Section 257.73(d)(3) of the CCR Rule.

> By affixing my seal to this, I do hereby certify to the best of my knowledge, information, and belief that the information contained in this report is true and correct. I further certify I am licensed to practice in the Commonwealth of Pennsylvania and that it is within my professional expertise to verify the correctness of the information. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment.
>
> Jonathan M. Niemiec, P.E.
> P.E. License Number: PE078190
> Signature: ____________________
> Date: 10/13/16

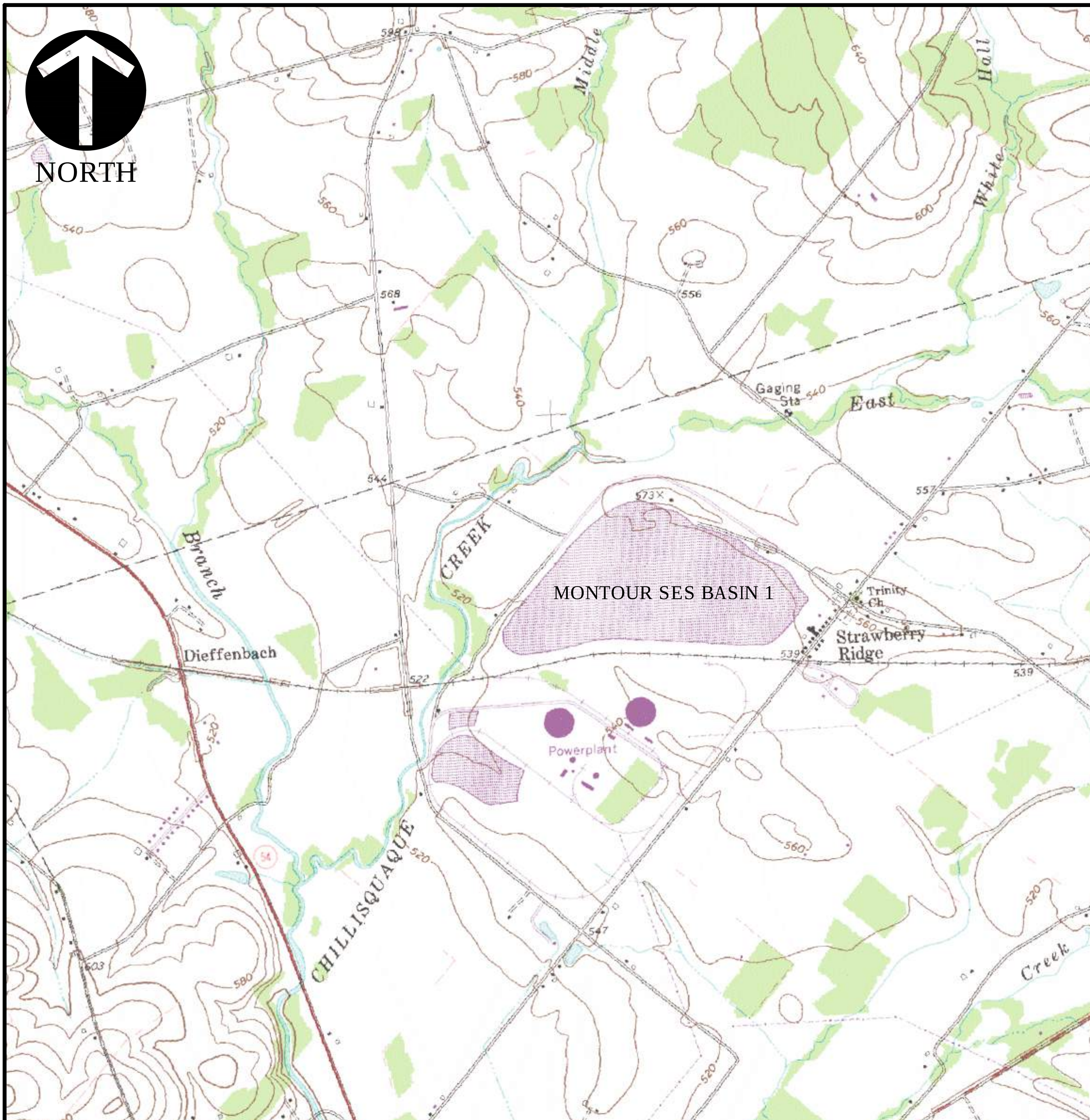
COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
JONATHAN MORGAN NIEMIEC
ENGINEER
No. PE078190

9.0 REFERENCES

1. HDR Engineering, Inc. January 2016. *Initial Annual Inspection Report of Basin 1*.
2. Geosyntec Consultants. October 2016. *History of Construction Report*.
3. November 1999. *Montour SES Lake Chillisquaque Dambreak Analysis*.
4. Civil & Environmental Consultants, Inc. October 2016. *Initial Inflow Design Flood Control System Plan Montour Ash Basin No. 1*.
5. Civil & Environmental Consultants, Inc. October 2016. *Initial Safety Factor Assessment Safety Factor Assessment Report*.

APPENDIX A

FIGURES



REFERENCE

1. U.S.G.S. 7.5' TOPOGRAPHIC MAP, WASHINGTONVILLE QUADRANGLE, PA DATED: 1969, PHOTOREVISED: 1977. PHOTOINSPECTED: 1983.

SCALE IN FEET

0 2000 4000

*HAND SIGNATURE ON FILE

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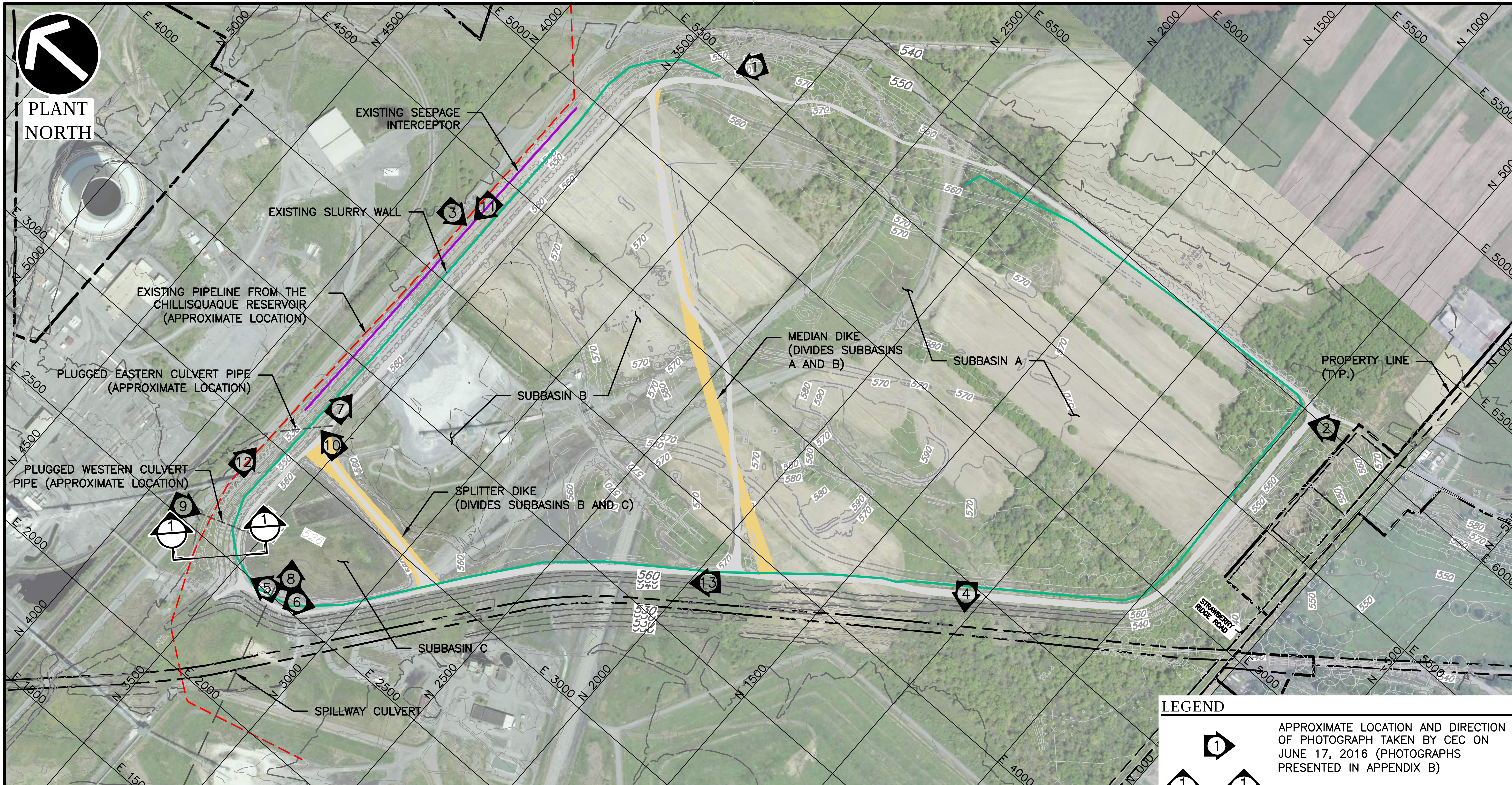
MONTOUR SES
WASHINGTONVILLE, PA

SITE LOCATION MAP

DRAWN BY: JAH	CHECKED BY:	JMN	APPROVED BY:	*DMC	FIGURE NO.: 1
DATE: 07/27/16	DWG SCALE:	1"=2000'	PROJECT NO:	150-989.0005	

P:\2015\150-989\-CADD\Dwg\GT01\150989-GT01-SITE LOCATION MAP.dwg{FIGURE NO.1} LS:(10/11/2016 - jhendrickson) - LP: 10/12/2016 3:08 PM



LEGEND

APPROXIMATE LOCATION AND DIRECTION OF PHOTOGRAPH TAKEN BY CEC ON JUNE 17, 2016 (PHOTOGRAPHS PRESENTED IN APPENDIX B)

CROSS SECTION LOCATION

SCALE IN FEET

0 400 800

*HAND SIGNATURE ON FILE

REFERENCES

1. BACKGROUND IMAGERY PROVIDED TO CEC BY TALEN IN JUNE 2016.
2. EXISTING TOPOGRAPHY BASED ON 2016 TOPOGRAPHIC MAPPING FOR 2015 OPERATION REPORT, DRAWING NO. E376172 BY CDI L.R. KIMBALL.
3. A SITE SPECIFIC COORDINATE SYSTEM IS SHOWN. MONTOUR S.E.S. USES A NGVD 1929 VERTICAL DATUM INSIDE BASIN 1.
4. EXISTING CONTOURS TO SOUTH OF BASIN 1 WERE DERIVED FROM THE PAMAP PROGRAM 3.2 FT DIGITAL ELEVATION MODEL OF PENNSYLVANIA; DEVELOPED BY PAMAP PROGRAM, PA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY; DATED 2008.
5. PROPERTY BOUNDARIES AND OWNERS HAVE BEEN PROVIDED BY PPL THROUGH A GIS DATA RELEASE AGREEMENT, DATED SEPTEMBER 4, 2014.COPYRIGHT 2011, ALL RIGHTS RESERVED THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY PROPERTY OF THE CONTRIBUTOR SUPPLIED UNDER LICENSE AND MAY NOT BE REPRODUCED EXCEPT AS LICENSED BY DIGITAL MAP PRODUCTS.

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MONTOUR SES
WASHINGTONVILLE, PA

PHOTOGRAPH LOCATION PLAN

DRAWN BY: JAH	CHECKED BY: JMN	APPROVED BY: *DMC	FIGURE NO.: 2
DATE: 07/26/16	DWG SCALE: 1"=400'	PROJECT NO: 150-989.0005	

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APPENDIX B

PHOTOGRAPHS

Photograph 1 – Northern Abutment

Photograph 2 – Southern Abutment

Photograph 3 – Seep at Toe of Northern Dike Slope (looking west)

Photograph 4 – Ponding Water at Toe of Southwestern Dike Slope

Photograph 5 – Western Upstream Slope of Subbasin C

Photograph 6 – Southern Upstream Slope of Subbasin C

Photograph 7 – Northwestern Upstream Slope of Subbasin B (looking northeast)

Photograph 8 – Top of Spillway Riser in Subbasin C (looking north)

Photograph 9 –Abandoned Overflow Culvert Pipe Outlet (plugged)

Photograph 10 – Seepage Collection System Outlet Pipe

Photograph 11 – Northern Downstream Slope (looking west)

Photograph 12 – Northern Downstream Slope (looking east)

Photograph 13 – Southern Downstream Slope and Dike Crest (looking west)

APPENDIX C

PADEP DAM INSPECTION CHECKLIST

DAM INSPECTION CHECKLIST
Department of Environmental Protection
Bureau of Waterways Engineering
Division of Dam Safety

NAME OF DAM: Montour SES Ash Basin 1

DEP DAM NO.: 47-009

LOCATION: **Municipality:** Washingtonville

County: Montour

DEP CLASSIFICATION DATA: **Size:**

Hazard:

PHYSICAL DATA:

Type of Dam:	Height of Dam:	Normal Pool Storage Capacity:
Earth	Varies (40 FT max)	8,760,470 Tons

ELEVATIONS (Est.):

Subbasin C Normal Pool:	Subbasin C at Inspection:	Subbasin B at Inspection:
552 FT MSL		

DAM OWNER: Talen Energy

OPERATOR: Talen Energy

Address: 18 McMicheal Road
Danville, PA 17821

Phone:

FAX No.:

E-Mail Address:

A completed and signed Dam Owners Notice Checklist is to accompany this Inspection Checklist.

PERSONS PRESENT AT INSPECTION:

Name:	Title/Position:	Representing:
Jonathan M. Niemiec, P.E.	Project Manager	Civil & Environmental Consultants, Inc.

DATE OF INSPECTION: 6/17/16

WEATHER:
Clear

TEMPERATURE:
60 to 80 degrees F

NAME OF DAM: Montour SES Ash Basin 1	DEP DAM NO.: 47-009	DATE: 6/17/16

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
EMBANKMENT: CREST					
1	Surface Cracking	None observed.	☐	☐	☐
2	Sinkhole, Animal Burrow	None observed.	☐	☐	☐
3	Low Area(s)	None observed.	☐	☐	☐
4	Horizontal Alignment	No observed.	☐	☐	☐
5	Ruts and/or Puddles	None observed.	☐	☐	☐
6	Vegetation Condition	Not Applicable – Gravel Surface is in good condition.	☐	☐	☐
7	Warning Signs	Not observed	☐	☐	☐
8			☐	☐	☐
9			☐	☐	☐

Additional Comments (Refer to item number if applicable):

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
EMBANKMENT: UPSTREAM FACE					
10	Slide, Slough, Scarp	None observed.	☐	☐	☐
11	Slope Protection	See comment below.	☐	☒	☐
12	Sinkhole, Animal Burrow	None observed.	☐	☐	☐
13	Emb.-Abut. Contact	Good contact, no separation observed.	☐	☐	☐
14	Erosion	None observed.	☐	☐	☐
15	Vegetation Condition	See comment below.	☐	☒	☐
16			☐	☐	☐
17			☐	☐	☐

Additional Comments:
Items 11 and 15 – Vegetation on upstream face in Subbasins B and C was generally well established, but some areas lack vegetation.

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR

EMBANKMENT: DOWNSTREAM FACE

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
18	Wet Area(s) (No Flow)	None observed.	☐	☐	☐
19	Seepage	See comment below.	☐	☒	☐
20	Slide, Slough, Scarp	None observed.	☐	☐	☐
21	Emb. - Abut. Contact	Good contact, no separation observed.	☐	☐	☐
22	Sinkhole, Animal Burrow	See comment below.	☐	☐	☒
23	Erosion	None observed.	☐	☐	☐
24	Unusual Movement	None observed.	☐	☐	☐
25	Vegetation Control	Well established.	☐	☐	☐
26			☐	☐	☐

Additional Comments:
Item 19 – One seep was observed at the approximate location shown on the attached figure. Clear water was observed flowing. Iron oxidation was observed.

Item 21 – One animal burrow was observed at the approximate location shown on the attached figure. Signs of burrow grouting were observed in this area and along the entire northwest downstream slope.

EMBANKMENT: INSTRUMENTATION

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
28	Piezometers/Observ. Wells	See comment below.	☐	☐	☐
29	Staff Gauge and Recorder	Not observed.	☐	☐	☐
30	Weirs	None observed.	☐	☐	☐
31	Survey Monuments	None observed.	☐	☐	☐
32	Drains	See comment below.	☐	☐	☐
33	Low Flow Release	None observed.	☐	☐	☐
34	Frequency of Readings	Piezometers are measured on a monthly basis.	☐	☐	☐
35	Location of Records	See comment below.	☐	☐	☐
36			☐	☐	☐
37			☐	☐	☐

Additional Comments:
Items 28 & 35 – Piezometers are measured regularly.

Item 32 – The seepage collection system was operating and water was being discharged into the basin.

NAME OF DAM: Montour SES Ash Basin 1	DEP DAM NO.: 47-009	DATE: 6/17/16

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM AREA					
38	Abutment Leakage	None observed.	☐	☐	☐
39	Foundation Seepage	See comment below.	☐	☐	☐
40	Slide, Slough, Scarp	None observed.	☐	☐	☐
41	Drainage System	None observed.	☐	☐	☐
42	Boils	None observed.	☐	☐	☐
43	Wet Areas	See comment below.	☒	☐	☐
44	Reservoir Slopes		☐	☐	☐
45	Access Roads		☐	☐	☐
46	Security Devices		☐	☐	☐
47	Act 91 Run-of-the-River Signs or Buoys		☐	☐	☐
48			☐	☐	☐
49			☐	☐	☐

Additional Comments:

Item 39 – Seepage through the foundation is known to occur. Ponding water was observed along the toe of the downstream slope on the south side of the basin. Seepage was also observed entering a stormwater catch basin on the northern side of the basin. A seepage collection system is located along the northwestern toe of slope. This water is collected and pumped back into the basin.

Item 43 – The relatively flat area immediately downstream of the dike to the south of Subbasin C was wet. See attached figure for approximate location.

NAME OF DAM: Montour SES Ash Basin 1	DEP DAM NO.: 47-009	DATE: 6/17/16

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
SPILLWAYS: ERODABLE CHANNEL (See comment below)					
50	Slide, Slough, Scarp		☐	☐	☐
51	Erosion		☐	☐	☐
52	Vegetation Condition		☐	☐	☐
53	Debris		☐	☐	☐
54	Sidewalls		☐	☐	☐
55	Channel Floor		☐	☐	☐
56	Unusual Movement		☐	☐	☐
57	Approach Area		☐	☐	☐
58	Weir or Control		☐	☐	☐
59	Discharge Channel		☐	☐	☐
60	Boils		☐	☐	☐
61			☐	☐	☐
62			☐	☐	☐
63			☐	☐	☐
64			☐	☐	☐

Additional Comments:
There are no erodible channel spillways associated with Basin 1.

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
SPILLWAYS: DROP INLET (See comment below)					
65	Intake Structure		☐	☐	☐
66	Trashrack		☐	☐	☐
67	Stilling Basin		☐	☐	☐
68			☐	☐	☐
69			☐	☐	☐

Additional Comments:
Inspection of the primary spillway is performed as part of the annual Basin 1 inspection.

NAME OF DAM: Montour SES Ash Basin 1	DEP DAM NO.: 47-009	DATE: 6/17/16

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS (See comment below)					
70	Intake Structure		☐	☐	☐
71	Trashrack		☐	☐	☐
72	Stilling Basin		☐	☐	☐
73	Primary Closure		☐	☐	☐
74	Secondary Closure		☐	☐	☐
75	Control Mechanism		☐	☐	☐
76	Outlet Pipe		☐	☐	☐
77	Outlet Tower		☐	☐	☐
78	Outlet Structure		☐	☐	☐
79	Seepage		☐	☐	☐
80	Unusual Movement		☐	☐	☐
81	Intake Tower		☐	☐	☐
82			☐	☐	☐
Additional Comments: Inspection of the primary spillway is performed as part of the annual Basin 1 inspection.					
CONCRETE/MASONRY DAMS: UPSTREAM FACE (See comment below)					
83	Surface Conditions		☐	☐	☐
84	Condition of Joints		☐	☐	☐
85	Unusual Movement		☐	☐	☐
86	Abutment-Dam Contacts		☐	☐	☐
87			☐	☐	☐
88			☐	☐	☐
Additional Comments: Basin 1 is an formed by an earthen embankment, not a concrete or masonry structure.					
CONCRETE/MASONRY DAMS: DOWNSTREAM FACE (See comment below)					
89	Surface Conditions		☐	☐	☐
90	Condition of Joints		☐	☐	☐
91	Unusual Movement		☐	☐	☐
92	Abutment-Dam Contacts		☐	☐	☐
93	Drains		☐	☐	☐
94	Leakage		☐	☐	☐
95			☐	☐	☐
96			☐	☐	☐
Additional Comments: Basin 1 is an formed by an earthen embankment, not a concrete or masonry structure.					

NAME OF DAM: Montour SES Ash Basin 1	DEP DAM NO.: 47-009	DATE: 6/17/16

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
CONCRETE/MASONRY DAMS: CREST (See comment below)					
97	Surface Conditions	Not applicable.	☐	☐	☐
98	Horizontal Alignment	Not applicable.	☐	☐	☐
99	Vertical Alignment	Not applicable.	☐	☐	☐
100	Condition of Joints	Not applicable.	☐	☐	☐
101	Unusual Movements	Not applicable.	☐	☐	☐
102			☐	☐	☐
103			☐	☐	☐
Additional Comments: Basin 1 was formed by an earthen embankment, not a concrete or masonry structure.					
RESERVOIR AREA					
104	Sedimentation		☐	☐	☐
105	Slope Stability		☐	☐	☐
106	Sinkholes		☐	☐	☐
107	Fractures		☐	☐	☐
108	Unwanted Growth		☐	☐	☐
109	Storage Gage		☐	☐	☐
110			☐	☐	☐
111			☐	☐	☐
Additional Comments:					

Final Comments:

DAM OWNERS NOTICE CHECKLIST
Department of Environmental Protection
Bureau of Waterways Engineering
Division of Dam Safety

NAME OF DAM: Montour SES Ash Basin 1 | **DEP DAM NO.:** 47-009

This is to certify that both the Downstream Hazard Description is accurate and the Posted Notice locations listed below have been inspected and the following are the results of these inspections.

Talen Energy

Name of Dam Owner | Signature of Dam Owner | Date

This Dam Owners Notice Checklist is to accompany the Inspection Checklist filed by the Engineer.

EMERGENCY ACTION PLAN

Date of Last Update of Emergency Plan:

Downstream Hazard Description (Refer to sections II.C and II.D in the EAP), additionally, specify any new developments, structures, etc. downstream within the inundation area:

POSTED NOTICES (Refer to section V.A in the EAP)

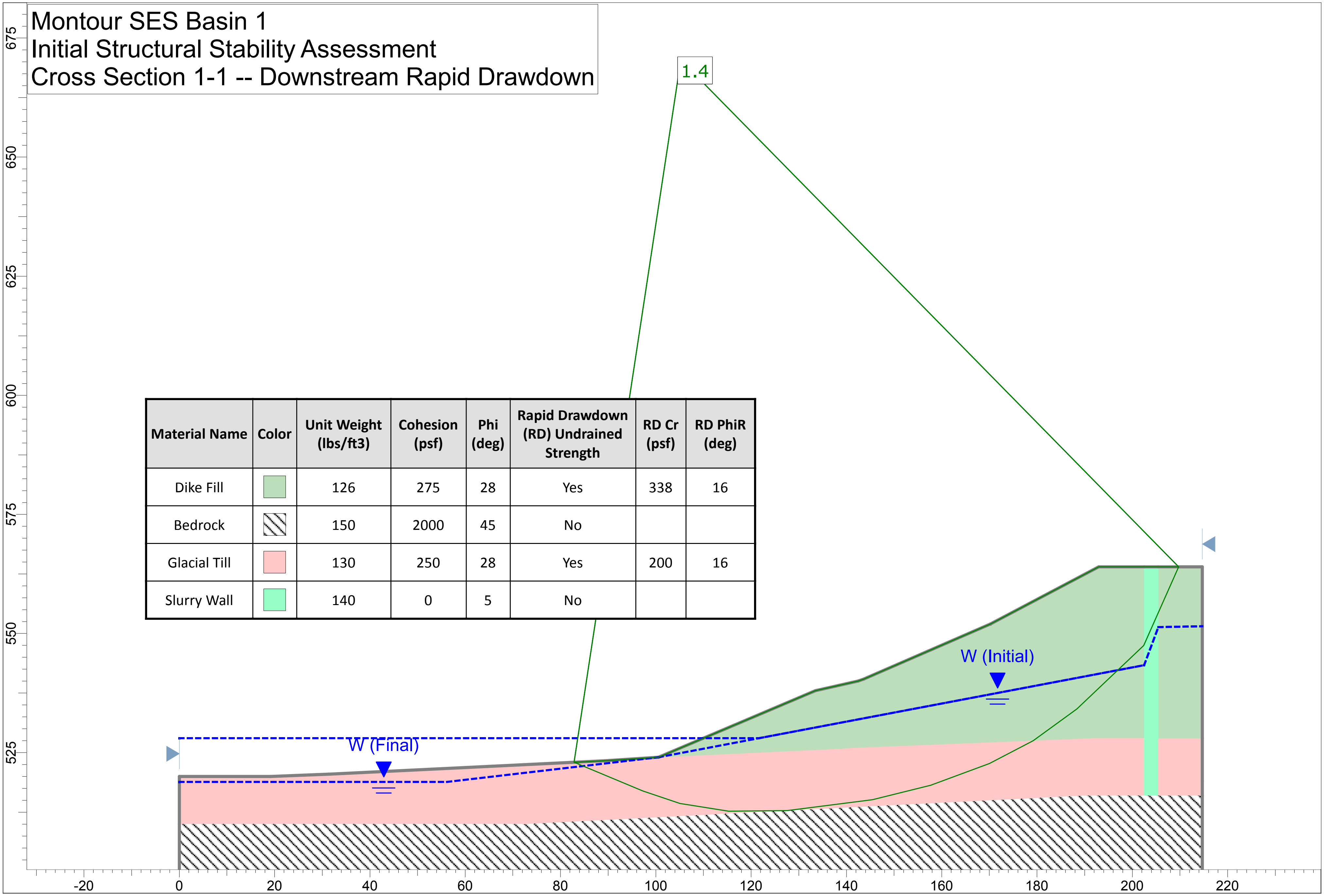
ITEM	DATE INSPECTED	LOCATION	COMMENTS	EXISTING	MISSING	REPLACED
1				☐	☐	☐
2				☐	☐	☐
3				☐	☐	☐
4				☐	☐	☐
5				☐	☐	☐

Additional Comments (Refer to item number if applicable):

APPENDIX D

RAPID DRAWDOWN ANALYSIS OUTPUT AND REFERENCES

Montour SES Basin 1
Initial Structural Stability Assessment
Cross Section 1-1 -- Downstream Rapid Drawdown



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)
Dike Fill		126	275	28	Yes	338	16
Bedrock		150	2000	45	No		
Glacial Till		130	250	28	Yes	200	16
Slurry Wall		140	0	5	No		

EXCERPT FROM: ACOE ENGINEERING MANUAL EM 1110-2-1902
“SLOPE STABILITY” (October 2003)

EM 1110-2-1902
31 Oct 2003

US Army Corps
of Engineers®

ENGINEERING AND DESIGN

Slope Stability

ENGINEER MANUAL

Table 3-1
Minimum Required Factors of Safety: New Earth and Rock-Fill Dams

Analysis Condition[1]	Required Minimum Factor of Safety	Slope
End-of-Construction (including staged construction)[2]	1.3	Upstream and Downstream
Long-term (Steady seepage, maximum storage pool, spillway crest or top of gates)	1.5	Downstream
Maximum surcharge pool[3]	1.4	Downstream
Rapid drawdown	1.1-1.3[4,5]	Upstream

[1] For earthquake loading, see ER 1110-2-1806 for guidance. An Engineer Circular, "Dynamic Analysis of Embankment Dams," is still in preparation.

[2] For embankments over 50 feet high on soft foundations and for embankments that will be subjected to pool loading during construction, a higher minimum end-of-construction factor of safety may be appropriate.

[3] Pool thrust from maximum surcharge level. Pore pressures are usually taken as those developed under steady-state seepage at maximum storage pool. However, for pervious foundations with no positive cutoff steady-state seepage may develop under maximum surcharge pool.

[4] Factor of safety (FS) to be used with improved method of analysis described in Appendix G.

[5] FS = 1.1 applies to drawdown from maximum surcharge pool; FS = 1.3 applies to drawdown from maximum storage pool.

For dams used in pump storage schemes or similar applications where rapid drawdown is a routine operating condition, higher factors of safety, e.g., 1.4-1.5, are appropriate. If consequences of an upstream failure are great, such as blockage of the outlet works resulting in a potential catastrophic failure, higher factors of safety should be considered.

(1) During construction of embankments, materials should be examined to ensure that they are consistent with the materials on which the design was based. Records of compaction, moisture, and density for fill materials should be compared with the compaction conditions on which the undrained shear strengths used in stability analyses were based.

(2) Particular attention should be given to determining if field compaction moisture contents of cohesive materials are significantly higher or dry unit weights are significantly lower than values on which design strengths were based. If so, undrained (UU, Q) shear strengths may be lower than the values used for design, and end-of-construction stability should be reevaluated. Undisturbed samples of cohesive materials should be taken during construction and unconsolidated-undrained (UU, Q) tests should be performed to verify end-of-construction stability.

d. Pore water pressure. Seepage analyses (flow nets or numerical analyses) should be performed to estimate pore water pressures for use in long-term stability computations. During operation of the reservoir, especially during initial filling and as each new record pool is experienced, an appropriate monitoring and evaluation program must be carried out. This is imperative to identify unexpected seepage conditions, abnormally high piezometric levels, and unexpected deformations or rates of deformations. As the reservoir is brought up and as higher pools are experienced, trends of piezometric levels versus reservoir stage can be used to project piezometric levels for maximum storage and maximum surcharge pool levels. This allows comparison of anticipated actual performance to the piezometric levels assumed during original design studies and analysis. These projections provide a firm basis to assess the stability of the downstream slope of the dam for future maximum loading conditions. If this process indicates that pore water pressures will be higher than those used in design stability analyses, additional analyses should be performed to verify long-term stability.

e. Loads on slopes. Loads imposed on slopes, such as those resulting from structures, vehicles, stored materials, etc. should be accounted for in stability analyses.

EXCERPT FROM: MONTOUR SES LAKE CHILLASQUAQUE DAMBREAK ANALYSIS

MONTOUR SES
LAKE CHILLASQUAQUE
DAMBREAK ANALYSIS

PP&L, INC.
2 N. 9TH STREET
ALLENTOWN, PA 18101

NOVEMBER 1999

PREPARED BY: G.D. Hopper
SENIOR ENGINEER

138 Sheets

7

MONTOUR SES
LAKE CHILLASQUAQUE
DAMBREAK STUDY

1. Description of Dam

The dam is a 54' high by 2,000 feet long earthfill structure built in 1971 to impound a make-up water supply for PP&L's Montour Steam Electric Station. The crest elevation is 605.0 feet. The maximum reservoir volume is 4,400 acre-feet. The outlet facilities for normal operation include an 8-inch bypass valve, an 18-inch Howell-Bunger valve and a 36-inch sluice gate. There is a 750-foot long emergency spillway channel with outlet crest at elevation 600 feet.

Normal operating level of the lake is elevation 595 feet. Lake level operating limit is elevation 596.5 to 596.7 feet, per agreement with the Susquehanna River Basin Commission. The lake is used as a plant water supply only when there is low flow in the Susquehanna River or when the river intake pumps are out of service.

The dam can be located on the Washingtonville quadrangle of the USGS topographic map 7.5-minute series for the Commonwealth of Pennsylvania.

PP&L owns the dam and regularly inspects it under its inspection program.

2. Description of Watershed

The study area is comprised of the Chillasquaque Creek watershed located primarily in Montour County, Pennsylvania. The watershed is a 112 square mile rural area draining to the west branch of the Susquehanna River. The upper reaches of Chillasquaque Creek include a west, middle and east branch. Lake Chillasquaque is a 185-acre man-made impoundment located on the middle branch.

On its journey to the Susquehanna, the Chillasquaque Creek passes PP&L's Montour power station and the towns of Washingtonville, Pottsgrove, and Chillasquaque. The portion of creek that serves as the receiving stream for Lake Chillasquaque travels 19.6 miles and passes under 20 bridges including the Interstate 80 bridge. In addition to the east and west branches in the upper watershed, two other major tributaries join the creek further downstream: Mud Creek, at the town of Washingtonville, and Beaver Run, just south of Pottsgrove.

The watershed is comprised of a mixture of gently rolling rural terrain and a few mountain ridges. Most of its soils are classified as hydrologic soil type "C".

3. Stream Hydraulics and Controls

The receiving channel has a channel slope ranging from 20 feet per mile (fpm) in the upper reaches to 2 ½ fpm further downstream, with an average of 6 fpm. The entire stream slope is subcritical. The downstream control is the Susquehanna River level.

Aside from the overall channel size, the appearance of the stream is fairly consistent over its entire length: a defined rocky earthen channel with moderately vegetated overbanks. Manning's n-values used in the program range from .030 for the main channel to .040- .050 for the overbanks.

4. Approach to Modeling

Streamflow and water surface profiles through the above-described stream network are computed for "with-break" and "without break" conditions for the PMF, 100-year and sunny day background conditions. The modeling program used is the National Weather Service DAMBRK computer program. Modeling "Option 12" is the selected option: simultaneous dynamic computation for multiple dams and/or bridges.

A runoff hydrograph for the lake's inflow is computed using the "Pondpack" program. The SCS dimensionless unit hydrograph method, utilizing watershed CN runoff coefficients, times of concentration, and appropriate rainfall amounts is the selected hydrologic option. The highest expected normal lake level (596.7) is used as the starting lake level.

Runoff hydrographs for five additional subwatersheds are computed using Pondpack and introduced to the main creek channel as lateral inflows. For the sunny day condition, only nominal average flows are considered throughout the stream network.

The 20 bridges were examined during field inspections. Seven of the more significant bridge contractions were selected for modeling in the DAMBRK program and are included in all of the runs.

The downstream control of Chillasquaque Creek is taken as the Susquehanna River level at 10-year flood stage.

5. Breach Characteristics

In all cases a 100' wide breach with 1H:2V side slopes is the assumed failure shape in the 2,000-ft long earthen embankment. Average breach width is 126 ft., or 2.33 times the height of the dam. The trigger elevation for the breach is the highest pond elevation computed during the "without breach" modeling runs. Time of complete breach formation is taken as 45 minutes in all cases. The breach is assumed to progress down to El. 560, which is the bottom of the dam.

6. Discussion of Results

Water surface elevations and stream flows computed for the respective "break" and "no break" conditions are summarized on the attached charts.

As expected, the "with break" flows for the PMF background condition produce the highest overall water surface elevations. Immediately downstream of the Lake Chillasquaque dam, the additional flood surge resulting from the PMF dambreak amounts to 70,000 cfs and a 7 ft. rise in stream level. The surge quickly attenuates to a 1 ½' rise in stream level at Washingtonville and a little more than a 1' rise at Pottsgrove. At the mouth of the Chillasquaque, the flow surge from this dambreak decreases to approximately 10,000 cfs.

The time to peak flow at downstream locations, as measured from the beginning of the dam break formation for the PMF background condition, is as follows:

Location	Time (hh:mm)
Montour power plant	1:19
Washingtonville, Rt. 54	2:13
Route I80	3:56
Chillasquaque village, Rt. 147	6:34
Susquehanna River	7:17

For the 100-year and sunny day background conditions, the overall dambreak flood levels are less than those for the PMF background condition, but the amount of water level rise due to the dambreak is greater than for the PMF background condition. For all three background conditions, the amount of water level rise due to the dambreak dissipates to less than one foot between the towns of Pottsgrove and Chillasquaque.

7. Effect on Population

The attached map delineates the inundated area for the PMF background condition superimposed with the dambreak flood surge.

PP&L has several buildings immediately downstream of the dam. These would be severely flooded. The Montour power station is outside of the flood zone.

Low-lying portions of the town of Washingtonville would be covered with slightly greater than an additional foot of water as a result of the dambreak.

Approximately 1/3 of the town of Pottsgrove would be covered with an additional foot of water.

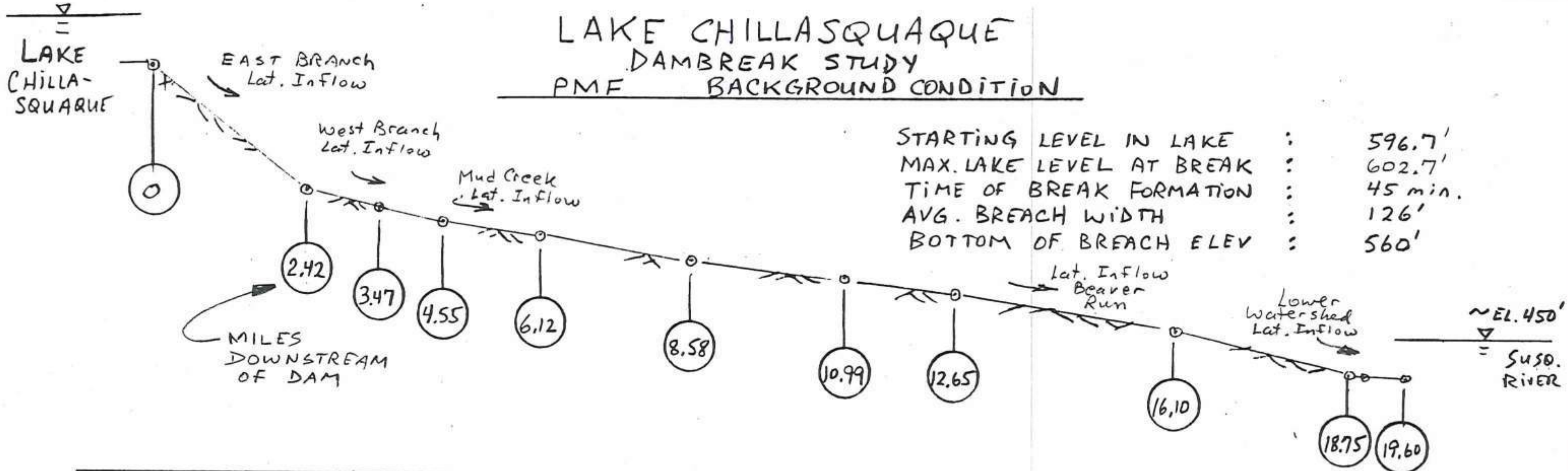
Low-lying portions of the town of Chillasquaque would see an additional few inches of water as a result of the dambreak.

Most of the bridge decks crossing Chillasquaque Creek would be flooded under PMF conditions even without a dambreak. With a PMF dambreak, only two additional bridge decks (immediately downstream of the lake) would be flooded. For the 100-year flood background condition, seven of the bridge decks (in the upper watershed) would be flooded due to the dambreak whereas none is flooded with no dambreak. For sunny day background condition, none of the bridge decks is flooded with or without a dambreak. A table of flood levels for each of the 20 bridge decks is included in the report.

8. Conclusion

It is proposed to use the PMF plus dambreak flooding levels as the basis in preparing the inundation map for the Lake Chillasquaque dambreak emergency action plan.

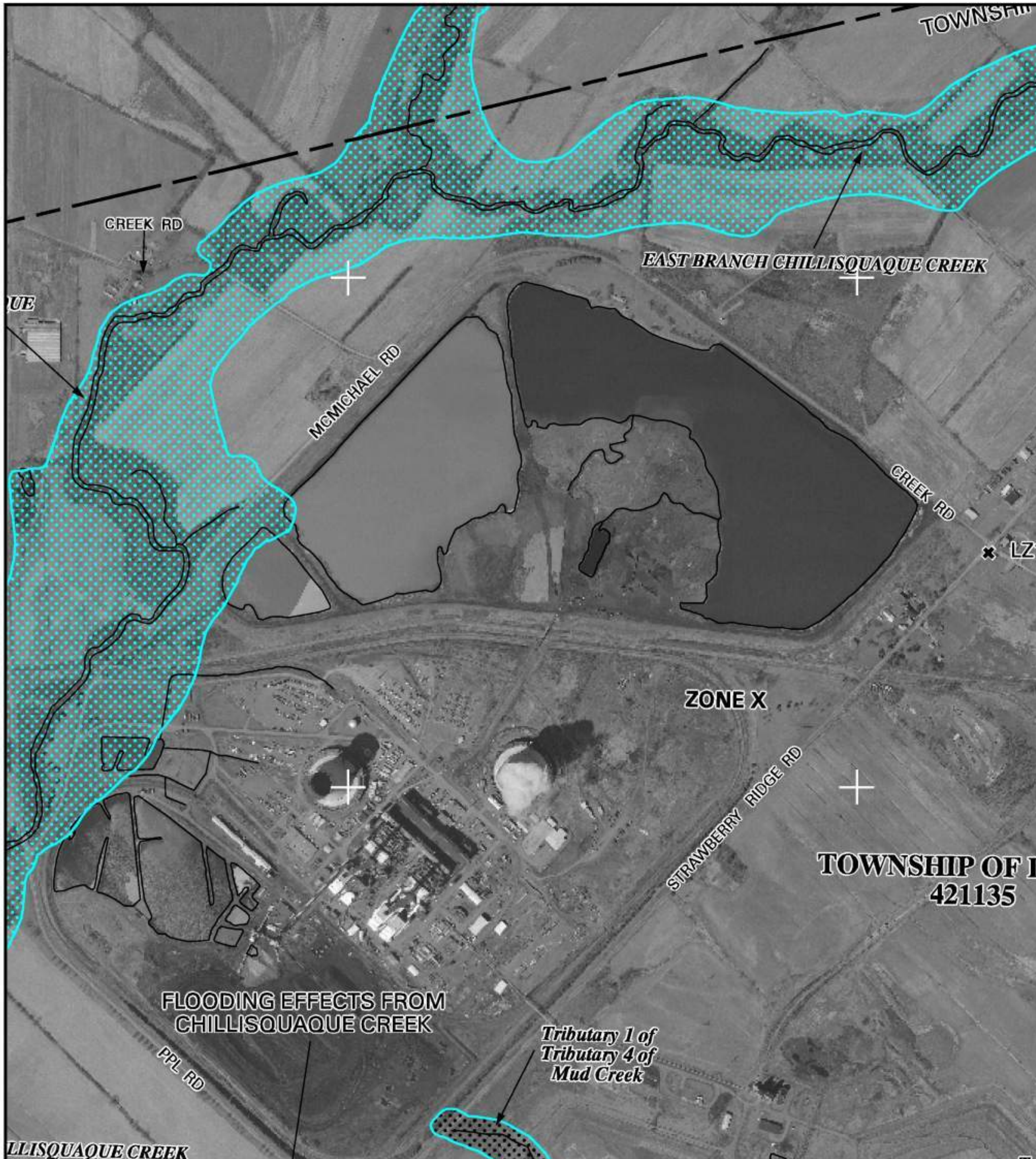
LAKE CHILLASQUAQUE
DAMBREAK STUDY
PMF BACKGROUND CONDITION



STARTING LEVEL IN LAKE	:	596.7'
MAX. LAKE LEVEL AT BREAK	:	602.7'
TIME OF BREAK FORMATION	:	45 min.
AVG. BREACH WIDTH	:	126'
BOTTOM OF BREACH ELEV	:	560'

LOCATION	JUST D/S OF DAM	MONTOUR POWER PLANT	WASHVILLE RT 254	WASHVILLE RT 54	COVERED BRIDGE	METAL BRIDGE	RT. I80	POTTSGROVE RT. 642	RISHEL COV'D BRIDGE	CHILL'SQUE RT. 147	CHILL'SQUE RT. 405	SUSQ. RIVER
STREAM CHANNEL MILE	0	2.424	3.466	4.545	6.117	8.580	10.985	12.652	16.098	18.750	18.939	19.602
W.S.E.L. WITH DAMBREAK	569.29	527.95	518.76	515.00	512.06	508.24	3.3 502.30	496.20	485.14	461.10	452.12	452.22
W.S.E.L. WITH NO DAMBREAK	562.38	525.77	517.09	513.68	510.58	507.00	2.7 501.70	495.05	483.87	460.27	451.86	451.96
Δ W.S.E.L. (Ft.)	6.91	2.18	1.67	1.32	1.48	1.24	0.6	1.15	1.27	0.83	0.26	0.26
Q PEAK WITH BREAK (CFS)	80,676	63,006	84,647	79,004	99,554	89,258	87,514	85,176	101,254	108,803	108,773	108,281
Q PEAK WITH NO BRK (CFS)	10,786	21,861	52,719	52,909	77,104	75,291	74,405	73,798	91,220	98,302	98,317	98,372
Δ Q (CFS)	69,890	41,145	31,928	26,095	22,450	13,967	13,109	11,378	10,034	10,501	10,456	9,909
TIME TO PEAK FOLLOWING START OF BREAK (MIN.)	41	1h+19	1h+39	2h+13	3h+5	3h+25	3h+56	4h+35	6h+41	6h+34	7h+17	7h+17
CHANNEL INVERT EL. (Ft.)	555	507	500	495	490	480	472	468	452	435	435	435

FEMA FLOOD MAP



ne if flood insurance is available in this community, co
l the National Flood Insurance Program at (800) 638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FE

NATIONAL FLOOD INSURANCE PROGRAM

NFIP

PANEL 0060C

FIRM

FLOOD INSURANCE RATE MAP

MONTOUR COUNTY,
PENNSYLVANIA
(ALL JURISDICTIONS)

PANEL 60 OF 170

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ANTHONY, TOWNSHIP OF	421232	0060	C
DERRY, TOWNSHIP OF	421135	0060	C

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
42093C0060C

EFFECTIVE DATE:
MAY 16, 2008

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov