INFLOW DESIGN FLOOD CONTROL PLAN PERIODIC 5-YEAR REVIEW

CFR 257.82

Bottom Ash Complex

Mountaineer Plant
New Haven, West Virginia

October, 2021

Prepared for: Appalachian Power Company

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

DOCUMENT ID: GERS-21-051

Inflow Design Flood Control Plan
Periodic 5-Year Review
CFR 257.82
Mountaineer Plant
Bottom Ash Complex

PREPARED BY Brett A. Dreger DATE 10/4/2021
Brett A. Dreger, P.E.

REVIEWED BY DATE 10-04-2021
Shah Baig, P.E.

APPROVED BY Gary F. Zych DATE 10/6/2021
Gary F. Zych, P.E.
Section Manager – AEP Geotechnical Engineering

Gary F. Zych
GARY F. ZYCH
REGISTERED
21201
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
10/6/2021

I certify to the best of my knowledge, information, and belief that the information contained in this inflow design flood control plan meets the requirements of 40 CFR § 257.82

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Attachment A – Hydrologic and Hydraulic Analysis Report for Mountaineer Plant

<u>1.0</u> OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.82 for the hydrologic and hydraulic evaluation of CCR surface impoundments. This is the first periodic 5-year review of the inflow design flood control plan.

<u>2.0</u> DESCRIPTION OF THE CCR UNIT

The Mountaineer Power Plant is located near the City of New Haven, Mason County, West Virginia. It is owned and operated by Appalachian Power Company (APCo). The facility operates one surface impoundment for storing CCR called the Bottom Ash Complex.

The Bottom Ash Complex is comprised of diked embankments on the north, east, and west sides. The south side of the Bottom Ash Complex is incised. There are six main ponds within the Bottom Ash Complex as listed below. The Bottom Ash Ponds and Wastewater Ponds were designed in tandem; one Bottom Ash Pond and one Wastewater Pond are in service at a given time.

<u>*List of Main Ponds within the Bottom Ash Complex*</u>
East Bottom Ash Pond
West Bottom Ash Pond
East Wastewater Pond
West Wastewater Pond
Reclaim Pond
Clearwater Pond

<u>3.0</u> INFLOW DESIGN FLOOD 257.82(a)(3)

The Bottom Ash Pond Complex has been determined to be a Significant Hazard potential CCR impoundment. This classification has not changed since the initial evaluation. Based on this hazard classification, the Inflow Design flood was determined by section 257.82(a)(3) to be the 1000-year storm which for the Mountaineer Plant is 6.98 inches in 24 hours.

<u>4.0</u> FLOOD CONTROL PLAN 257.82(c)

The only inflows from the inflow design flood is the direct rainfall within the ponds dikes and pumped storm water from the main plant area. The design to safely pass the inflow design flood without overtopping the crest of the dam is based on the spillway system and surcharge flood storage capacity above the maximum operating level.

The analysis in Attachment A provides the description of the spillway system, flood storage capacity, inflow peak discharge and volume, peak discharge from the facility and maximum pool elevation.

Results of this analysis show that the Bottom Ash Complex has adequate hydrologic and hydraulic capacity to collect and control peak discharge resulting from the 1000-year inflow design.

There has not been any changes to spillway system, flood storage capacity or rainfall estimates that would change the results presented in Attachment A. The calculations show that the facility has the capacity to manage the inflow design flood, as well as larger flood events.

ATTACHMENT A

Hydrologic and Hydraulic Analysis Report

For

Mountaineer Plant

Hydrologic and Hydraulic Analysis Report

Mountaineer Plant Bottom Ash Pond Complex

New Haven, West Virginia

September 2015

Terracon Project Number: N4155129

Prepared for:

American Electric Power
1 Riverside Plaza
Columbus, Ohio

Prepared by:

Terracon Consultants, Inc.
Columbus, Ohio

September 30, 2015

American Electric Power
1 Riverside Plaza
Columbus, OH 43215

Attn: Mr. Brett Dreger
P: [614] 716 2258
E: badreger@aep.com

Re: Hydrologic and Hydraulic Analysis, and Professional Engineer Certification
Mountaineer Plant Bottom Ash Pond Complex, New Haven, West Virginia
Terracon Project Number: N4155129

Dear Mr. Dreger:

Terracon Consultants, Inc. is submitting the enclosed report for the Hydrologic and Hydraulic analysis and P.E. Certification for AEP Mountaineer Plant Bottom Ash Pond Complex located near New Haven, West Virginia. The report analyzes the impoundment's existing design and outlet structures for conformance with the recently mandated USEPA rule 40 CFR Part 257, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (CCR rules) and provides a professional engineer certification.

If you have any questions regarding this submittal, please contact me at (614) 328-5184.

Sincerely,
Terracon Consultants, Inc.

Baba M. Yahaya, P.E.
Project Engineer

Mohammad S. Finy, P.E
Department Manager, Geo-Environmental Services

Enclosure

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1.0 INTRODUCTION

This report provides hydrologic and hydraulic analysis of the existing Bottom Ash Pond Complex (impoundment facility) of the Mountaineer Plant (plant) located near Mason County, West Virginia. The site location is shown on Exhibit 1. The plant uses the impoundment facility to temporarily store Coal Combustion Residuals (CCR). The impoundment facility consists of a series of ponds, and a metal cleaning tank secondary containment basin as shown on Exhibit 2. Six of the ponds including: East Bottom Ash Pond, West Bottom Ash Pond, East Wastewater Pond, West Wastewater Pond, Reclaim Water Pond, and Clearwater Pond are interconnected and receive mainly CCR and stormwater pumped from the plant to the system as its major external influent. The other source of influent is direct precipitation that falls within the perimeter of the impoundment facility during a storm event. The pond complex is isolated from any significant storm water inflow from adjacent catchment areas. The CCR is pumped into the system at the active Bottom Ash Pond and Wastewater Pond, and the effluent from the system eventually discharges through an outlet structure located in the Clearwater Pond.

The intent of this analysis is to determine whether or not the impoundment facility meets the April 17, 2015 USEPA mandated CCR rules requirements.

According to the CCR rules, CCR surface impoundments shall comply with the hydrologic and hydraulic capacity requirements specified under Section 257.82 of the rules and presented below:

Section 257.82

(a) The owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (a)(2) of this section.

  (1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.
  (2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.
  (3) The inflow design flood is:
    (i) For a high hazard potential CCR surface impoundment, as determined under section 257.73(a)(2) or section 257.74(a)(2), the probable maximum flood;
    (ii) For a significant hazard potential CCR surface impoundment, as determined under section 257.73(a)(2) or section 257.74(a)(2), the 1,000-year flood;

(iii) For a low hazard potential CCR surface impoundment, as determined under section 257.73(a)(2) or section 257.74(a)(2), the 100-year flood; or

(iv) For an incised CCR surface impoundment, the 25-year flood.

(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under section 257.3-3.

(c) Inflow design flood control system plan.

(1) Content of the plan. The owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (c)(4) of this section. These plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator of the CCR unit has completed the inflow design flood control system plan when the plan has been placed in the facility's operating record as required by section 257.105(g)(4).

(2) Amendment of the plan. The owner or operator of the CCR unit may amend the written inflow design flood control system plan at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(g)(4). The owner or operator must amend the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.

(3) Timeframes for preparing the initial plan.

(i) Existing CCR surface impoundments. The owner or operator of the CCR unit must prepare the initial inflow design flood control system plan no later than October 17, 2016.

(ii) New CCR surface impoundments and any lateral expansion of a CCR surface impoundment. The owner or operator must prepare the initial inflow design flood control system plan no later than the date of initial receipt of CCR in the CCR unit.

(4) Frequency for revising the plan. The owner or operator must prepare periodic inflow design flood control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first periodic plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph, the owner or operator has completed an inflow design flood control system plan when the plan has been placed in the facility's operating record as required by section 257.105(g)(4).

(5) The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plans meet the requirements of this section.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in section 257.105(g), the notification requirements specified in section 257.106(g), and the internet requirements specified in section 257.107(g).

2.0 INFLOW DESIGN FLOOD CONTROL SYSTEM

As mentioned in section 1.0, inflow into the impoundment facility include CCR and stormwater from various sources pumped into the facility; and direct precipitation that falls within the perimeter of the facility. Water from the Bottom Ash Ponds flow to the Wastewater Pond, which flow into the valve structure and can be discharged into the Reclaim Water Pond or the Clearwater Pond. Discharge water from the Reclaim Water Pond is either pumped back to the plant for recirculation, or flows to the Clearwater Pond and then to the Ohio River via an outfall structure. The CCR and stormwater are pumped into the facility through a series of pipes designed to handle the various required capacities. The pipes discharge into the facility through concrete vaults to handle the inflows. The Water from the Bottom Ash Ponds flows into the Wastewater Ponds through a reinforced concrete vertical drop inlet connected to a 48 inch diameter steel pipe located in the southern dikes of the Bottom Ash Ponds. The Wastewater Ponds drain either to the Reclaim Water Pond or the Clearwater Pond through a gated distribution structure. A 36 inch diameter steel pipe connects the Reclaim Pond to the Clearwater Pond. Effluent from the impoundment facility is discharged through an outlet structure located in the Clearwater Pond. The outlet structure consists of a concrete overflow channel leading to a vault/riser with a 30-inch diameter metal outflow pipe. The outflow pipe leads to a dissipation structure and another 30 inch steel pipe from the dissipation structure to an outfall at the Ohio River.

Water balance information provided by AEP indicates that influent is pumped into the facility at the rate of approximately 15 million gallons per day (MGD) (24 cfs) to the Bottom Ash Pond, 4 MGD (6 cfs) to the Wastewater pond; and 1 MGD (2cfs) to the Clearwater Pond. Information on the influent is presented in Attachment 1. The additional inflow due to direct precipitation is dependent on the hazard potential classification of the facility. For the purpose of this analysis, the facility is classified as a “significant hazard potential” facility. The hazard potential classification approach is presented in Section 2.2 of this report. The additional inflow under this significant hazard potential classification is estimated as the peak discharge during and following the 1000-year flood. The peak discharge from the 1000-year inflow design flood is estimated using Bentley’s PondPack software (see Section 2.3 of this report).

2.1 Hazard Potential Classification

Hazard potential classification means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances. The hazardous potential classifications for CCR surface impoundment include high hazard potential, significant hazard potential, and low hazard potential.

- A High hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.

- A significant hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

- A Low hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

The Mountaineer Plant Bottom Ash Pond Complex is bounded to the north by the Mountaineer Plant, to the south by a power substation to the west by a material processing unit and to the east by Highway 62. A breach of the dikes and loss of the impoundment may result in a release of bottom ash and wastewater into Little Broad Run and the Ohio River, which would be a moderate environmental and economic concern. Minor flooding would be expected within plant property, along the haul road and State Route 62, and onto the property of the adjacent decommissioned Sporn Plant. The facility's location, configuration, and operation are such that failure or mis-operation may result in no probable loss of human life, but can cause economic loss, environmental damage, and disruption to lifeline facilities. As a result of this assessment, the facility is classified as a significant hazard potential impoundment.

Pursuant to Section 257.73(a)(2) of the CCR rules, the hazard potential classification assessments of this facility will be performed every five years.

2.2 Computation Methods

The impoundment facility was modeled and analyzed for its adequacy to collect and control the peak discharge resulting from 1000-year design storm using Bentley's PondPack software (PondPack).

PondPack is a versatile software program to model site drainage studies. The program can be used to model rainfall and runoff from watersheds to detention and retention facilities, outlet structures, and channels.

Development of the PondPack model requires catchment area, runoff curve number and time of concentration and input defining the facility's structural components, including pond, inlet, and outlet structures. Operationally, the east and west Bottom Ash/Wastewater Ponds operate in alternate sequences where the active set receives influent and the inactive set is cleaned out. For this analysis, a scenario in which water flow from the East Bottom Ash Pond to the East Wastewater Pond and to the Clearwater Pond is considered and modeled (See Exhibit 3). Each ponds surface area defines it catchment area. A precipitation depth of 7 inches corresponding to the 1000 year storm (see Attachment 1) was used. A curve number of 100 was used since the rainfall will be direct runoff. A minimum time of concentration of 5 minutes was used. The Water from the Bottom Ash Ponds flows into the Wastewater Ponds through a reinforced concrete vertical drop inlet connected to a 48 inch diameter steel pipe located in the southern dikes of the Bottom Ash Ponds. The Wastewater Ponds drain either to the Reclaim Water Pond or the Clearwater Pond through a gated distribution structure. A 36 inch diameter steel pipe connects the Reclaim Pond to the Clearwater Pond. A 30 inch diameter steel pipe leads from the Clearwater Pond to a dissipation structure, and another 30 inch steel pipe from the dissipation structure to an outfall at the Ohio River.

2.3 Results

The PondPack analysis, the maximum water surface elevation and freeboard resulting from the 1000-year flood are summarized in the table below:

Pond	Maximum Water Elevation (ft)	Freeboard (ft)
East Bottom Ash Pond	613.3	6.7
East Wastewater Pond	609.3	2.7
Clearwater Pond	603.6	6.4

It can be concluded from the above results that the Bottom Ash Pond Complex has adequate hydrologic and hydraulic capacity to collect and control the peak discharge resulting from the 1000-year inflow design flood and therefore meets the April 17, 2015 USEPA mandated CCR rules requirements.

3.0 DISCHARGE FROM THE IMPOUNDMENT FACILITY

The discharge from the impoundment facility to the Ohio River is handled in accordance with the Plant's NPDES Permit. This conforms to the requirements Section 257.82 (b) of the CCR rules.

4.0 INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

The inflow design flood control system plan will be prepared pursuant to Section 257.82 (c) of the CCR rules. The plan will document how the inflow design flood control system has been designed and constructed to meet the rules requirements.

5.0 RECORDKEEPING, NOTIFICATION, AND INTERNET REQUIREMENTS

Pursuant to Sections 257.105(g), 257.106(g) and 257.107(g), the initial and periodic inflow design flood control system plan as required by Section 257.82(c) will be placed in the facility's operating records, as well as published on the facility's CCR rule compliance data information website. AEP will notify the Director of West Virginia Department of Environmental Protection when the information is placed in the operating record and on the website.

6.0 REFERENCES

- AEP Project Number 1301 Drawing Numbers 1-3018A-7, 1-3018B-8, and 1-3018C, containing cross section and details for the Mountaineer Bottom Ash Complex.

- Report on Dam Safety Inspection, Bottom Ash Pond Complex. Prepared by Woodward-Clyde Consultants, Inc. Wayne, New. January 1985.

7.0 P.E. CERTIFICATION

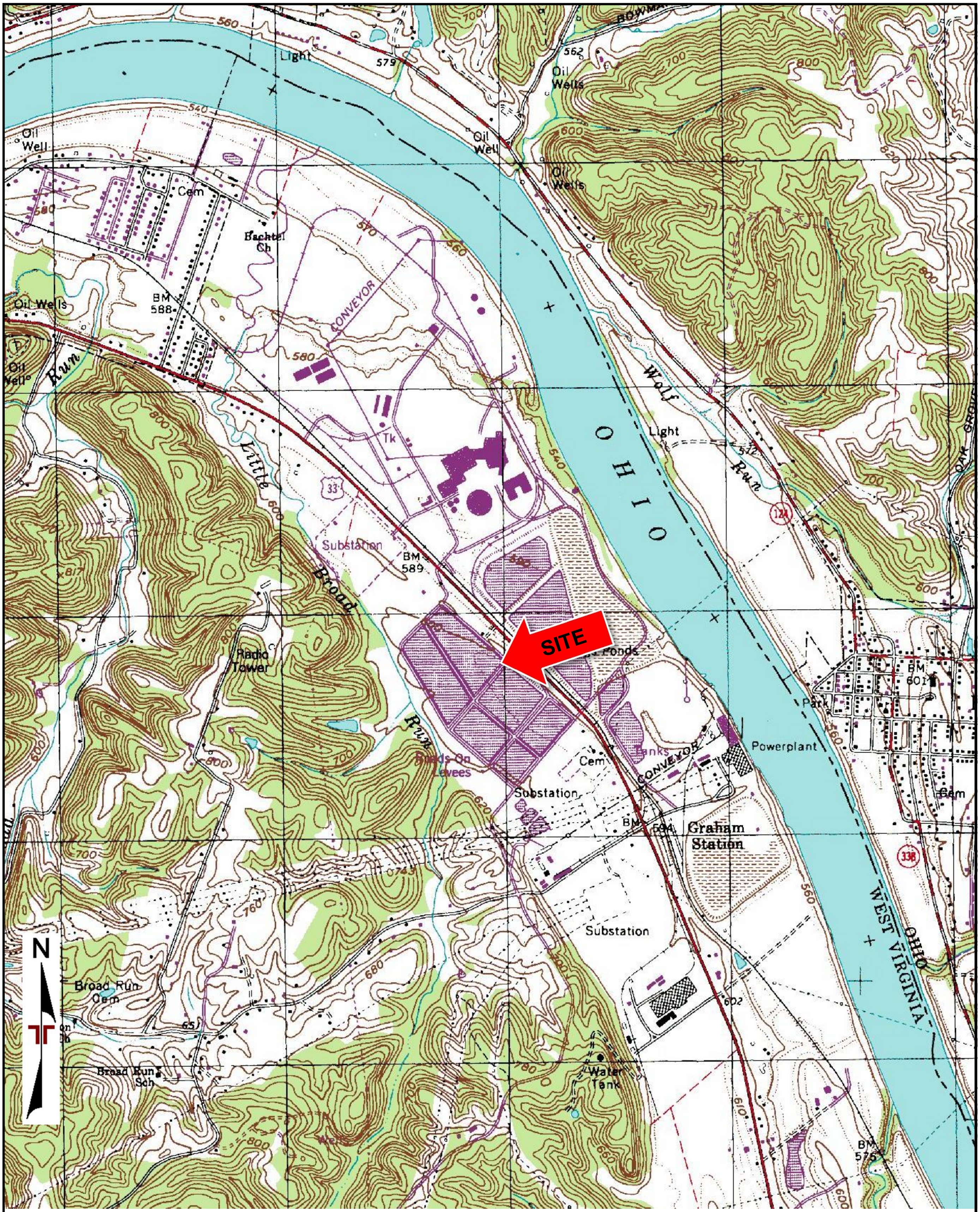
Based on the site reconnaissance visit, hazard potential assessment, and the hydrologic and hydraulic analysis performed by Terracon personnel, I hereby certify that the significant hazard potential classification for the Mountaineer Plant Bottom Ash Pond Complex in this report was conducted in accordance with requirements of Section 257.73 of the CCR Rules and that the facility has adequate hydrologic and hydraulic capacity to collect and control the peak discharge resulting from 1000-year design storm.

STATE OF OHIO
MOHAMMAD S. FINY 69705
REGISTERED PROFESSIONAL ENGINEER

9-30-2015

Mohammad S. Finy, P.E.
Certifying Engineer
E-69705

EXHIBITS



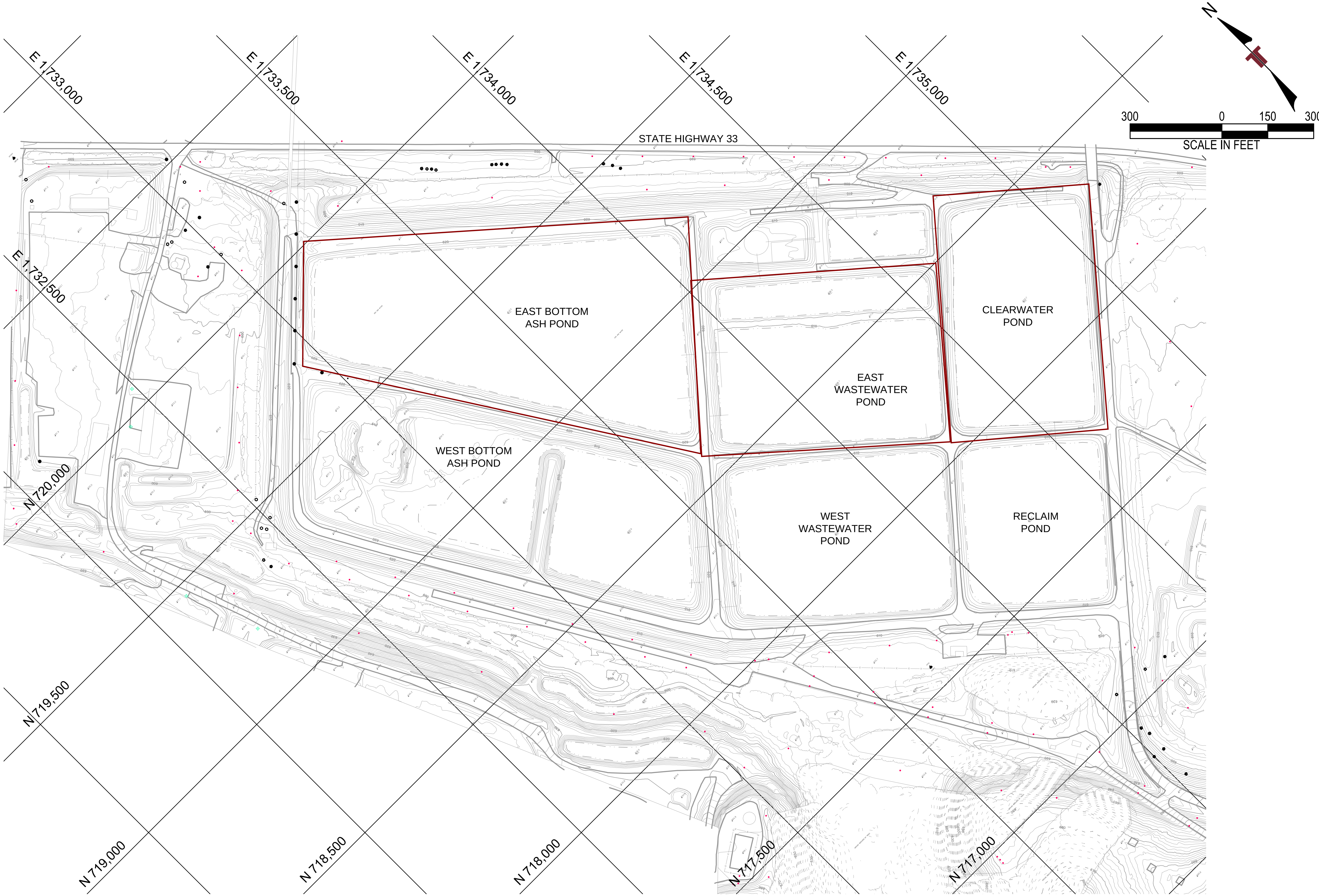
TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: NEW HAVEN, WV (1/1/1994).

Project Manager: BYM	Project No. N4155129	Terracon	SITE LOCATION MAP	Exhibit
Drawn by: DAB	Scale: 1"=24,000 SF	800 MORRISON ROAD	MOUNTAINEER PLANT IMPOUNDMENT CERTIFICATION	1-A
Checked by: MSF	File Name: Siteloc2	COLUMBUS, OHIO 43230	AMERICAN ELECTRIC POWER	
Approved by: KMF	Date: 9/29/15		MOUNTAINEER PLANT BOTTOM ASH POND COMPLEX	

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Project Manager: BYM	Project No. N4155129	Terracon	SITE LOCATION MAP	Exhibit
Drawn by: DAB	Scale: AS SHOWN	800 MORRISON ROAD COLUMBUS, OHIO 43230	MOUNTAINEER PLANT IMPOUNDMENT CERTIFICATION AMERICAN ELECTRIC POWER MOUNTAINEER PLANT BOTTOM ASH POND COMPLEX	1-B
Checked by: MSF	File Name: Siteloc2			
Approved by: KME	Date: 9/29/15			



NOTE

THE AERIAL TOPOGRAPHY WAS OBTAINED FROM HENDERSON AERIAL SURVEYS INC., DATED 3/20/2012.

POND DRAINAGE AREA

EXHIBIT 2

DESIGNED BY:	BMY
DRAWN BY:	DAB
APPVD. BY:	MSF
SCALE:	1"=300'
DATE:	9/29/15
JOB NO.	N4155129
ACAD NO.	SET1
SHEET NO.:	2 OF 3

SITE PLAN

MOUNTAINEER PLANT IMPOUNDMENT CERTIFICATION

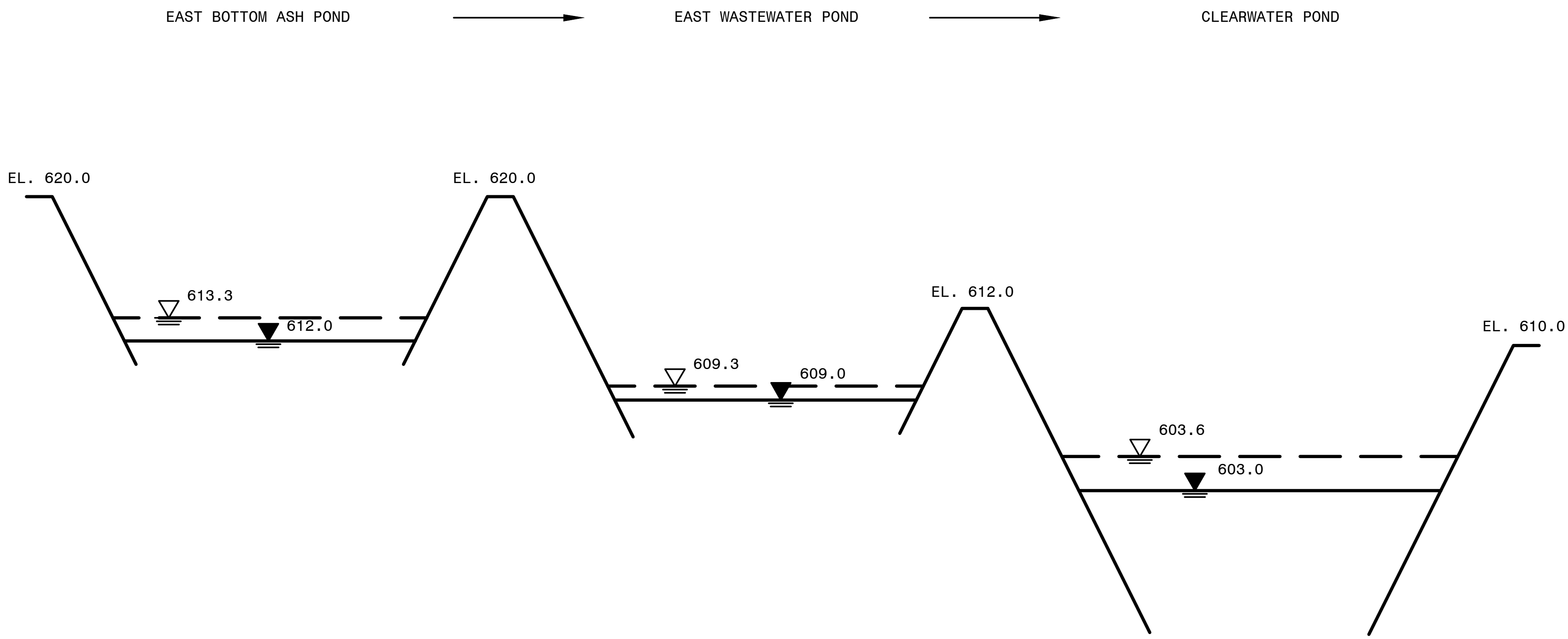
AMERICAN ELECTRIC POWER

MOUNTAINEER PLANT BOTTOM ASH POND COMPLEX

NEW HAVEN, MASON COUNTY WV

Terracon
Consulting Engineers and Scientists
800 MORRISON ROAD COLUMBUS, OHIO 43230
PH. (614) 863-3113 FAX. (614) 863-0475

REV.	DATE	BY	DESCRIPTION



LEGEND

613.3 MAX. RESULTANT POOL LEVELS DURING THE DESIGN STORM

603.0 NORMAL OPERATING POOL LEVELS

NOTE:

EMBANKMENT CREST ELEVATIONS AND NORMAL OPERATING POOL LEVELS SHOWN TAKEN FROM AEP PROVIDED DRAWINGS 1-3018A-7, 1-3018B-8, AND 1-3018C-5, CONTAINING SECTIONS AND DETAILS FOR THE POND COMPLEX.

REV.	DATE	BY	DESCRIPTION

Terracon
Consulting Engineers and Scientists
800 MORRISON ROAD COLUMBUS, OHIO 43230
PH. (614) 863-3113 FAX. (614) 863-0475

POND SCHEMATIC
MOUNTAINEER PLANT IMPOUNDMENT CERTIFICATION
AMERICAN ELECTRIC POWER
MOUNTAINEER PLANT BOTTOM ASH POND COMPLEX
NEW HAVEN, MASON COUNTY WV

EXHIBIT 3

DESIGNED BY:	BMY
DRAWN BY:	DAB
APPVD. BY:	MSF
SCALE:	NTS
DATE:	9/30/15
JOB NO.	N4155129
ACAD NO.	SET1
SHEET NO.:	3 OF 3

ATTACHMENT 1

Pumped Influent and Water Balance Information

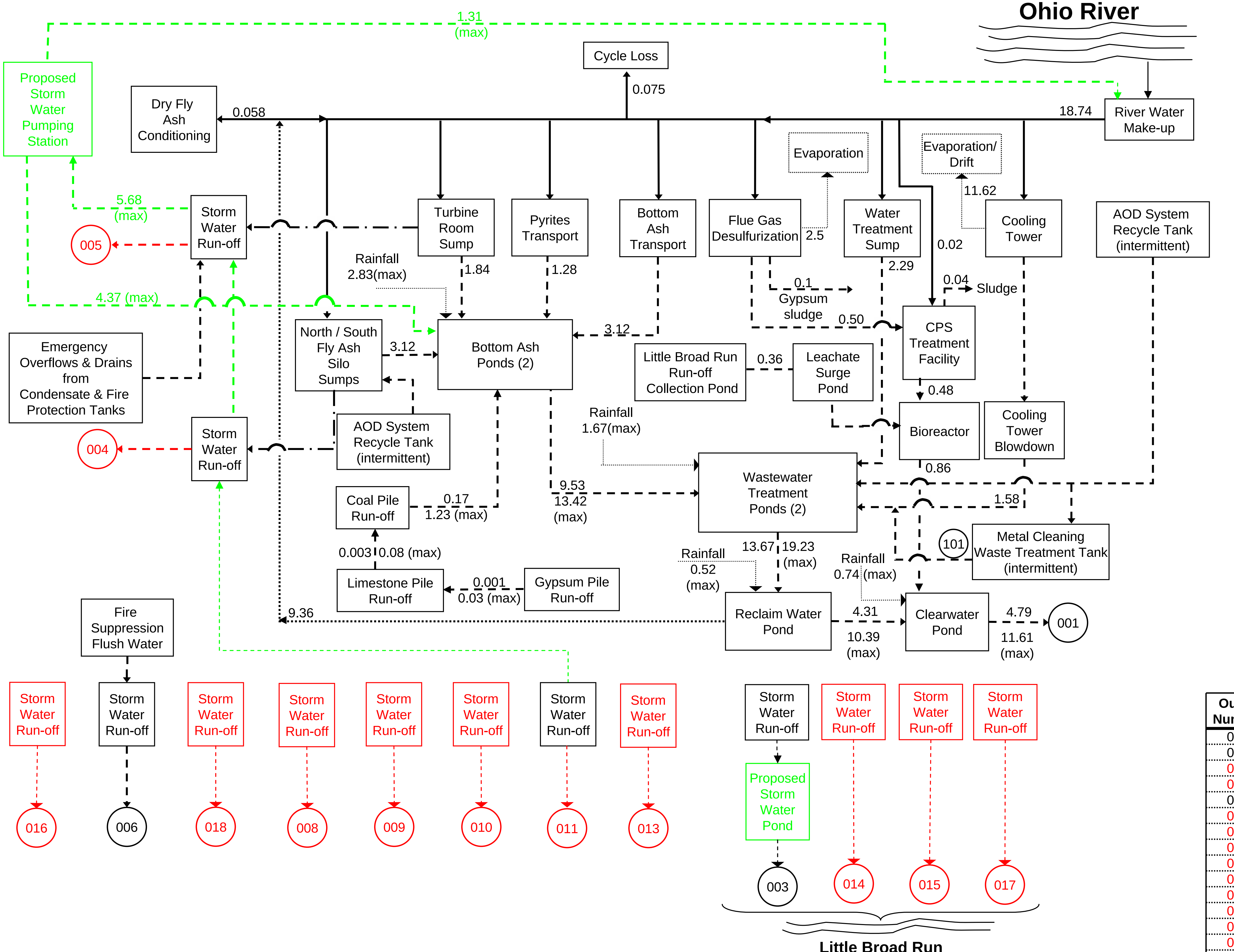
Mountaineer Plant Impoundment System
Pumped Influent

Influent Sources	Rate (mgd)	cfs
To Bottom Ash Pond		
Coal Pile Run-off	1.23	
Fly Ash Silo Sumps	3.12	
Stormwater	4.37	
Turbine Room Sump	1.84	
Pyrites Transport	1.28	
Bottom Ash Transport	3.12	
Total	**14.96**	**24**
To Wastewater Pond		
Water Treatment Sump	2.29	
Cooling Tower Blowdown	1.58	
Total	**3.87**	**6**
To Bottom Ash Pond		
Bioreactor	0.86	**2**

Note:
Influent pumped is compiled from the attached water balance data provided by AEP.

Appalachian Power Co. Mountaineer Plant

Water Balance Flow Diagram



NOTES

Note 1: All flows represent average water usage with the unit operating at full load.

Note 2: Maximum (max) flows include rainfall for a 10-year/24-hour storm event.

Note 3: Maximum (max) flow entering the Storm Water Pumping Station (SWPS) is the 24 hours of highest intensity in a 10 year/24-hour storm event.

Note 4: The design overflow of the SWPS to the River Water Make-up is anything over a 1" storm in a 24-hour period.

Note 5: Proposed storm water management modifications indicated in **GREEN**, and proposed storm water management terminations indicated in **RED**.

LEGEND

- Supply Water
- Waste Water
- Reclaim Water
- Storm Water
- Evaporation/Rainfall
- No flow associated with normal operating conditions (emergency overflow)
- ### Outlet Number

Outlet Number	Receiving Water	Average Discharge	Maximum Discharge
001	Ohio River	4.79	11.61
003	Little Broad Run	0.169	3.978
004	Ohio River	0.110	2.605
005	Ohio River	0.307	7.238
006	Ohio River	0.019	0.458
008	Ohio River	0.003	0.062
009	Ohio River	0.006	0.134
010	Ohio River	0.001	0.029
011	Ohio River	0.009	0.216
013	Ohio River	0.012	0.273
014	Little Broad Run	0.001	0.026
015	Little Broad Run	0.011	0.252
016	Ohio River	0.004	0.098
017	Little Broad Run	0.002	0.064
018	Ohio River	0.001	0.024

Revision date 12/28/2012 - Drawing is intended to communicate water flow for NPDES Permitting purposes. Not to be used for any other purposes.

All flows measured in million gallons per day (MGD)

ATTACHMENT 2

Precipitation Data

NOAA Atlas 14, Volume 2, Version 3
Location name: Letart, West Virginia, US*
Latitude: 38.9697°, Longitude: -81.9364°
Elevation: 621 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.337 (0.305-0.371)	0.401 (0.364-0.442)	0.481 (0.436-0.530)	0.542 (0.491-0.597)	0.619 (0.558-0.680)	0.677 (0.610-0.742)	0.732 (0.656-0.801)	0.786 (0.703-0.859)	0.857 (0.761-0.934)	0.907 (0.803-0.988)
10-min	0.523 (0.474-0.576)	0.625 (0.568-0.691)	0.747 (0.678-0.824)	0.837 (0.758-0.921)	0.947 (0.854-1.04)	1.03 (0.924-1.13)	1.10 (0.988-1.21)	1.17 (1.05-1.28)	1.26 (1.12-1.37)	1.32 (1.17-1.44)
15-min	0.641 (0.581-0.706)	0.765 (0.694-0.845)	0.917 (0.832-1.01)	1.03 (0.933-1.13)	1.17 (1.06-1.29)	1.27 (1.14-1.39)	1.37 (1.23-1.50)	1.46 (1.31-1.60)	1.57 (1.40-1.71)	1.65 (1.46-1.80)
30-min	0.848 (0.769-0.934)	1.02 (0.929-1.13)	1.26 (1.14-1.39)	1.43 (1.30-1.57)	1.65 (1.49-1.81)	1.82 (1.64-1.99)	1.98 (1.77-2.16)	2.13 (1.90-2.33)	2.33 (2.07-2.54)	2.48 (2.19-2.70)
60-min	1.04 (0.939-1.14)	1.26 (1.14-1.39)	1.58 (1.43-1.74)	1.82 (1.65-2.00)	2.14 (1.93-2.35)	2.39 (2.15-2.62)	2.64 (2.37-2.89)	2.89 (2.58-3.16)	3.22 (2.86-3.51)	3.48 (3.08-3.79)
2-hr	1.21 (1.10-1.33)	1.46 (1.33-1.61)	1.84 (1.67-2.02)	2.13 (1.92-2.33)	2.52 (2.27-2.76)	2.84 (2.55-3.10)	3.16 (2.82-3.45)	3.50 (3.11-3.80)	3.95 (3.48-4.28)	4.31 (3.78-4.66)
3-hr	1.28 (1.16-1.41)	1.54 (1.40-1.70)	1.93 (1.76-2.13)	2.24 (2.03-2.47)	2.66 (2.41-2.92)	3.00 (2.70-3.29)	3.36 (3.01-3.67)	3.72 (3.31-4.06)	4.23 (3.73-4.60)	4.62 (4.06-5.02)
6-hr	1.52 (1.39-1.67)	1.82 (1.67-2.01)	2.26 (2.07-2.49)	2.62 (2.39-2.87)	3.12 (2.83-3.41)	3.54 (3.19-3.85)	3.96 (3.56-4.31)	4.41 (3.94-4.78)	5.04 (4.45-5.44)	5.54 (4.86-5.97)
12-hr	1.79 (1.65-1.94)	2.13 (1.96-2.32)	2.61 (2.41-2.85)	3.02 (2.78-3.28)	3.59 (3.29-3.88)	4.06 (3.70-4.38)	4.56 (4.13-4.90)	5.08 (4.58-5.45)	5.82 (5.19-6.23)	6.42 (5.68-6.85)
24-hr	2.14 (2.01-2.28)	2.55 (2.40-2.72)	3.09 (2.90-3.29)	3.53 (3.31-3.76)	4.14 (3.88-4.40)	4.64 (4.33-4.92)	5.15 (4.79-5.46)	5.68 (5.27-6.01)	6.41 (5.92-6.77)	6.98 (6.42-7.37)
2-day	2.55 (2.40-2.71)	3.02 (2.85-3.22)	3.63 (3.41-3.86)	4.11 (3.87-4.37)	4.78 (4.48-5.07)	5.31 (4.96-5.63)	5.85 (5.45-6.20)	6.40 (5.95-6.78)	7.16 (6.61-7.58)	7.74 (7.12-8.19)
3-day	2.74 (2.58-2.90)	3.24 (3.06-3.45)	3.87 (3.65-4.11)	4.37 (4.12-4.64)	5.05 (4.75-5.35)	5.59 (5.24-5.92)	6.13 (5.73-6.48)	6.68 (6.23-7.07)	7.42 (6.88-7.84)	7.98 (7.37-8.43)
4-day	2.93 (2.77-3.10)	3.46 (3.27-3.67)	4.12 (3.89-4.37)	4.64 (4.38-4.91)	5.33 (5.02-5.64)	5.87 (5.51-6.21)	6.41 (6.01-6.77)	6.96 (6.50-7.35)	7.67 (7.14-8.10)	8.22 (7.63-8.67)
7-day	3.52 (3.33-3.72)	4.16 (3.94-4.40)	4.90 (4.63-5.17)	5.46 (5.16-5.76)	6.20 (5.85-6.54)	6.76 (6.37-7.13)	7.32 (6.88-7.71)	7.86 (7.37-8.27)	8.56 (8.00-9.01)	9.08 (8.46-9.57)
10-day	4.03 (3.82-4.25)	4.75 (4.50-5.01)	5.53 (5.24-5.83)	6.12 (5.80-6.45)	6.89 (6.51-7.25)	7.47 (7.05-7.85)	8.02 (7.56-8.44)	8.56 (8.05-9.00)	9.24 (8.67-9.72)	9.73 (9.11-10.2)
20-day	5.62 (5.34-5.91)	6.59 (6.26-6.92)	7.56 (7.18-7.94)	8.28 (7.87-8.69)	9.20 (8.73-9.65)	9.87 (9.37-10.4)	10.5 (9.96-11.0)	11.1 (10.5-11.6)	11.8 (11.2-12.4)	12.4 (11.7-13.0)
30-day	6.94 (6.64-7.26)	8.11 (7.76-8.49)	9.20 (8.80-9.63)	10.0 (9.57-10.5)	11.0 (10.5-11.5)	11.8 (11.2-12.3)	12.4 (11.9-13.0)	13.1 (12.4-13.7)	13.8 (13.1-14.5)	14.4 (13.6-15.0)
45-day	8.87 (8.50-9.26)	10.3 (9.89-10.8)	11.6 (11.1-12.1)	12.5 (12.0-13.1)	13.6 (13.1-14.2)	14.4 (13.8-15.1)	15.2 (14.5-15.9)	15.9 (15.1-16.6)	16.6 (15.9-17.4)	17.2 (16.4-18.0)
60-day	10.5 (10.1-11.0)	12.2 (11.7-12.7)	13.6 (13.1-14.2)	14.6 (14.0-15.2)	15.8 (15.2-16.5)	16.7 (16.0-17.4)	17.5 (16.7-18.2)	18.1 (17.4-18.9)	18.9 (18.1-19.7)	19.5 (18.6-20.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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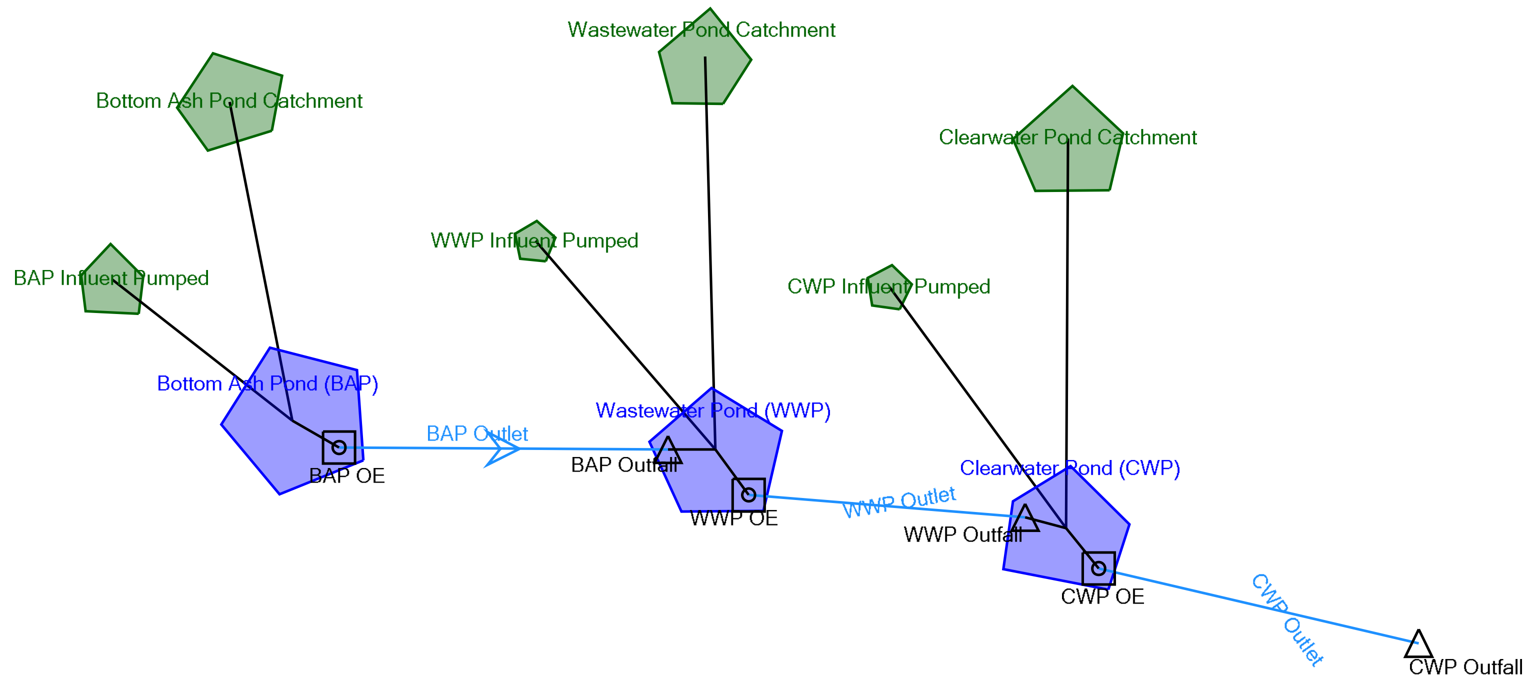
PF graphical

ATTACHMENT 3

PondPack Model Output

Scenario: Post-Development 1000 Year



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Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
BAP Influent Pumped	Post-Development 1000 Year	1,000	47.603	0.000	24.00
Bottom Ash Pond Catchment	Post-Development 1000 Year	1,000	9.300	11.900	143.80
CWP Influent Pumped	Post-Development 1000 Year	1,000	3.967	0.000	2.00
Clearwater Pond Catchment	Post-Development 1000 Year	1,000	5.230	11.950	76.86
WWP Influent Pumped	Post-Development 1000 Year	1,000	11.901	0.000	6.00
Wastewater Pond Catchment	Post-Development 1000 Year	1,000	6.102	11.950	89.67

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
CWP Outfall	Post-Development 1000 Year	1,000	73.655	12.350	77.07

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Bottom Ash Pond (BAP) (IN)	Post-Development 1000 Year	1,000	56.903	11.900	167.80	(N/A)	(N/A)
Bottom Ash Pond (BAP) (OUT)	Post-Development 1000 Year	1,000	50.508	12.400	37.74	613.25	16.505
Clearwater Pond (CWP) (IN)	Post-Development 1000 Year	1,000	74.860	11.950	168.12	(N/A)	(N/A)
Clearwater Pond (CWP) (OUT)	Post-Development 1000 Year	1,000	73.655	12.350	77.07	603.55	3.877
Wastewater Pond (WWP) (IN)	Post-Development 1000 Year	1,000	68.511	11.950	129.67	(N/A)	(N/A)
Wastewater Pond (WWP) (OUT)	Post-Development 1000 Year	1,000	65.663	12.050	100.24	609.29	3.775

Peak Discharge	24.00 ft³/s
Time to Peak	7.900 hours
Hydrograph Volume	47.603 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	24.00	24.00	24.00	24.00	24.00
0.500	24.00	24.00	24.00	24.00	24.00
1.000	24.00	24.00	24.00	24.00	24.00
1.500	24.00	24.00	24.00	24.00	24.00
2.000	24.00	24.00	24.00	24.00	24.00
2.500	24.00	24.00	24.00	24.00	24.00
3.000	24.00	24.00	24.00	24.00	24.00
3.500	24.00	24.00	24.00	24.00	24.00
4.000	24.00	24.00	24.00	24.00	24.00
4.500	24.00	24.00	24.00	24.00	24.00
5.000	24.00	24.00	24.00	24.00	24.00
5.500	24.00	24.00	24.00	24.00	24.00
6.000	24.00	24.00	24.00	24.00	24.00
6.500	24.00	24.00	24.00	24.00	24.00
7.000	24.00	24.00	24.00	24.00	24.00
7.500	24.00	24.00	24.00	24.00	24.00
8.000	24.00	24.00	24.00	24.00	24.00
8.500	24.00	24.00	24.00	24.00	24.00
9.000	24.00	24.00	24.00	24.00	24.00
9.500	24.00	24.00	24.00	24.00	24.00
10.000	24.00	24.00	24.00	24.00	24.00
10.500	24.00	24.00	24.00	24.00	24.00
11.000	24.00	24.00	24.00	24.00	24.00
11.500	24.00	24.00	24.00	24.00	24.00
12.000	24.00	24.00	24.00	24.00	24.00
12.500	24.00	24.00	24.00	24.00	24.00
13.000	24.00	24.00	24.00	24.00	24.00
13.500	24.00	24.00	24.00	24.00	24.00
14.000	24.00	24.00	24.00	24.00	24.00
14.500	24.00	24.00	24.00	24.00	24.00
15.000	24.00	24.00	24.00	24.00	24.00
15.500	24.00	24.00	24.00	24.00	24.00
16.000	24.00	24.00	24.00	24.00	24.00
16.500	24.00	24.00	24.00	24.00	24.00
17.000	24.00	24.00	24.00	24.00	24.00
17.500	24.00	24.00	24.00	24.00	24.00
18.000	24.00	24.00	24.00	24.00	24.00
18.500	24.00	24.00	24.00	24.00	24.00
19.000	24.00	24.00	24.00	24.00	24.00

Subsection: Read Hydrograph
Label: BAP Influent Pumped

Return Event: 1,000 years
Storm Event: 1000 Year

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
19.500	24.00	24.00	24.00	24.00	24.00
20.000	24.00	24.00	24.00	24.00	24.00
20.500	24.00	24.00	24.00	24.00	24.00
21.000	24.00	24.00	24.00	24.00	24.00
21.500	24.00	24.00	24.00	24.00	24.00
22.000	24.00	24.00	24.00	24.00	24.00
22.500	24.00	24.00	24.00	24.00	24.00
23.000	24.00	24.00	24.00	24.00	24.00
23.500	24.00	24.00	24.00	24.00	24.00
24.000	24.00	(N/A)	(N/A)	(N/A)	(N/A)

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	7.0 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	16.000 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.911 hours
Flow (Peak, Computed)	146.03 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.900 hours
Flow (Peak Interpolated Output)	143.80 ft³/s

Drainage Area	
SCS CN (Composite)	100.000
Area (User Defined)	16.000 acres
Maximum Retention (Pervious)	0.0 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	7.0 in
Runoff Volume (Pervious)	9.307 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	9.300 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	217.54 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	7.0 in
Time of Concentration (Composite)	0.100 hours
Area (User Defined)	9.000 acres

Computational Time Increment	0.013 hours
Time to Peak (Computed)	11.920 hours
Flow (Peak, Computed)	79.77 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	76.86 ft³/s

Drainage Area	
SCS CN (Composite)	100.000
Area (User Defined)	9.000 acres
Maximum Retention (Pervious)	0.0 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	7.0 in
Runoff Volume (Pervious)	5.235 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	5.230 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.100 hours
Computational Time Increment	0.013 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	101.97 ft³/s
Unit peak time, Tp	0.067 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.267 hours
Total unit time, Tb	0.333 hours

Peak Discharge	2.00 ft³/s
Time to Peak	7.900 hours
Hydrograph Volume	3.967 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	2.00	2.00	2.00	2.00	2.00
0.500	2.00	2.00	2.00	2.00	2.00
1.000	2.00	2.00	2.00	2.00	2.00
1.500	2.00	2.00	2.00	2.00	2.00
2.000	2.00	2.00	2.00	2.00	2.00
2.500	2.00	2.00	2.00	2.00	2.00
3.000	2.00	2.00	2.00	2.00	2.00
3.500	2.00	2.00	2.00	2.00	2.00
4.000	2.00	2.00	2.00	2.00	2.00
4.500	2.00	2.00	2.00	2.00	2.00
5.000	2.00	2.00	2.00	2.00	2.00
5.500	2.00	2.00	2.00	2.00	2.00
6.000	2.00	2.00	2.00	2.00	2.00
6.500	2.00	2.00	2.00	2.00	2.00
7.000	2.00	2.00	2.00	2.00	2.00
7.500	2.00	2.00	2.00	2.00	2.00
8.000	2.00	2.00	2.00	2.00	2.00
8.500	2.00	2.00	2.00	2.00	2.00
9.000	2.00	2.00	2.00	2.00	2.00
9.500	2.00	2.00	2.00	2.00	2.00
10.000	2.00	2.00	2.00	2.00	2.00
10.500	2.00	2.00	2.00	2.00	2.00
11.000	2.00	2.00	2.00	2.00	2.00
11.500	2.00	2.00	2.00	2.00	2.00
12.000	2.00	2.00	2.00	2.00	2.00
12.500	2.00	2.00	2.00	2.00	2.00
13.000	2.00	2.00	2.00	2.00	2.00
13.500	2.00	2.00	2.00	2.00	2.00
14.000	2.00	2.00	2.00	2.00	2.00
14.500	2.00	2.00	2.00	2.00	2.00
15.000	2.00	2.00	2.00	2.00	2.00
15.500	2.00	2.00	2.00	2.00	2.00
16.000	2.00	2.00	2.00	2.00	2.00
16.500	2.00	2.00	2.00	2.00	2.00
17.000	2.00	2.00	2.00	2.00	2.00
17.500	2.00	2.00	2.00	2.00	2.00
18.000	2.00	2.00	2.00	2.00	2.00
18.500	2.00	2.00	2.00	2.00	2.00
19.000	2.00	2.00	2.00	2.00	2.00

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
19.500	2.00	2.00	2.00	2.00	2.00
20.000	2.00	2.00	2.00	2.00	2.00
20.500	2.00	2.00	2.00	2.00	2.00
21.000	2.00	2.00	2.00	2.00	2.00
21.500	2.00	2.00	2.00	2.00	2.00
22.000	2.00	2.00	2.00	2.00	2.00
22.500	2.00	2.00	2.00	2.00	2.00
23.000	2.00	2.00	2.00	2.00	2.00
23.500	2.00	2.00	2.00	2.00	2.00
24.000	2.00	(N/A)	(N/A)	(N/A)	(N/A)

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	7.0 in
Time of Concentration (Composite)	0.100 hours
Area (User Defined)	10.500 acres

Computational Time Increment	0.013 hours
Time to Peak (Computed)	11.920 hours
Flow (Peak, Computed)	93.07 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	89.67 ft³/s

Drainage Area	
SCS CN (Composite)	100.000
Area (User Defined)	10.500 acres
Maximum Retention (Pervious)	0.0 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	7.0 in
Runoff Volume (Pervious)	6.108 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	6.102 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.100 hours
Computational Time Increment	0.013 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	118.97 ft³/s
Unit peak time, Tp	0.067 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.267 hours
Total unit time, Tb	0.333 hours

Peak Discharge	6.00 ft³/s
Time to Peak	7.900 hours
Hydrograph Volume	11.901 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	6.00	6.00	6.00	6.00	6.00
0.500	6.00	6.00	6.00	6.00	6.00
1.000	6.00	6.00	6.00	6.00	6.00
1.500	6.00	6.00	6.00	6.00	6.00
2.000	6.00	6.00	6.00	6.00	6.00
2.500	6.00	6.00	6.00	6.00	6.00
3.000	6.00	6.00	6.00	6.00	6.00
3.500	6.00	6.00	6.00	6.00	6.00
4.000	6.00	6.00	6.00	6.00	6.00
4.500	6.00	6.00	6.00	6.00	6.00
5.000	6.00	6.00	6.00	6.00	6.00
5.500	6.00	6.00	6.00	6.00	6.00
6.000	6.00	6.00	6.00	6.00	6.00
6.500	6.00	6.00	6.00	6.00	6.00
7.000	6.00	6.00	6.00	6.00	6.00
7.500	6.00	6.00	6.00	6.00	6.00
8.000	6.00	6.00	6.00	6.00	6.00
8.500	6.00	6.00	6.00	6.00	6.00
9.000	6.00	6.00	6.00	6.00	6.00
9.500	6.00	6.00	6.00	6.00	6.00
10.000	6.00	6.00	6.00	6.00	6.00
10.500	6.00	6.00	6.00	6.00	6.00
11.000	6.00	6.00	6.00	6.00	6.00
11.500	6.00	6.00	6.00	6.00	6.00
12.000	6.00	6.00	6.00	6.00	6.00
12.500	6.00	6.00	6.00	6.00	6.00
13.000	6.00	6.00	6.00	6.00	6.00
13.500	6.00	6.00	6.00	6.00	6.00
14.000	6.00	6.00	6.00	6.00	6.00
14.500	6.00	6.00	6.00	6.00	6.00
15.000	6.00	6.00	6.00	6.00	6.00
15.500	6.00	6.00	6.00	6.00	6.00
16.000	6.00	6.00	6.00	6.00	6.00
16.500	6.00	6.00	6.00	6.00	6.00
17.000	6.00	6.00	6.00	6.00	6.00
17.500	6.00	6.00	6.00	6.00	6.00
18.000	6.00	6.00	6.00	6.00	6.00
18.500	6.00	6.00	6.00	6.00	6.00
19.000	6.00	6.00	6.00	6.00	6.00

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
19.500	6.00	6.00	6.00	6.00	6.00
20.000	6.00	6.00	6.00	6.00	6.00
20.500	6.00	6.00	6.00	6.00	6.00
21.000	6.00	6.00	6.00	6.00	6.00
21.500	6.00	6.00	6.00	6.00	6.00
22.000	6.00	6.00	6.00	6.00	6.00
22.500	6.00	6.00	6.00	6.00	6.00
23.000	6.00	6.00	6.00	6.00	6.00
23.500	6.00	6.00	6.00	6.00	6.00
24.000	6.00	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Elevation-Area Volume Curve
Label: Bottom Ash Pond (BAP)

Return Event: 1,000 years
Storm Event: 1000 Year

Elevation (ft)	Planimeter (ft²)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
612.00	0.0	13.000	0.000	0.000	0.000
613.00	0.0	13.290	39.434	13.145	13.145
614.00	0.0	13.606	40.343	13.448	26.592
616.00	0.0	14.191	41.692	27.795	54.387
618.00	0.0	14.725	43.372	28.915	83.302
620.00	0.0	15.326	45.074	30.049	113.351

Subsection: Elevation-Area Volume Curve
Label: Clearwater Pond (CWP)

Return Event: 1,000 years
Storm Event: 1000 Year

Elevation (ft)	Planimeter (ft²)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
603.00	0.0	6.900	0.000	0.000	0.000
603.70	0.0	7.159	21.087	4.920	4.920
604.00	0.0	7.209	21.551	2.155	7.075
606.00	0.0	7.571	22.167	14.778	21.853
608.00	0.0	7.929	23.248	15.498	37.352
610.00	0.0	8.299	24.340	16.226	53.578

Elevation (ft)	Planimeter (ft^2)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
608.70	0.0	6.240	0.000	0.000	0.000
610.00	0.0	6.492	19.096	8.275	8.275
612.00	0.0	9.265	23.512	15.674	23.949

Requested Pond Water Surface Elevations	
Minimum (Headwater)	612.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	620.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	BAP Riser	Forward	BAP Culvert	612.00	620.00
Culvert-Circular	BAP Culvert	Forward	TW	606.67	620.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: BAP Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	612.00 ft
Orifice Area	28.3 ft²
Orifice Coefficient	0.600
Weir Length	9.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: BAP Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	48.0 in
Length	125.00 ft
Length (Computed Barrel)	125.00 ft
Slope (Computed)	0.005 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.900
Kb	0.005
Kr	0.900
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0340
M	1.5000
C	0.0553
Y	0.5400
T1 ratio (HW/D)	1.260
T2 ratio (HW/D)	1.422
Slope Correction Factor	-0.500

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

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

T1 Elevation	611.71 ft	T1 Flow	87.96 ft³/s
T2 Elevation	612.36 ft	T2 Flow	100.53 ft³/s

Requested Pond Water Surface Elevations	
Minimum (Headwater)	603.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	610.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	CWP Riser	Forward	CWP Culvert	610.00	610.00
Rectangular Weir	CWP Weir	Forward	CWP Culvert	603.00	610.00
Culvert-Circular	CWP Culvert	Forward	TW	588.55	610.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: CWP Riser
Structure Type: Inlet Box

Number of Openings	1
Elevation	610.00 ft
Orifice Area	28.3 ft²
Orifice Coefficient	0.600
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: CWP Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	30.0 in
Length	140.00 ft
Length (Computed Barrel)	140.00 ft
Slope (Computed)	0.004 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.900
Kb	0.009
Kr	0.900
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0340
M	1.5000
C	0.0553
Y	0.5400
T1 ratio (HW/D)	1.261
T2 ratio (HW/D)	1.423
Slope Correction Factor	-0.500

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

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

T1 Elevation	591.70 ft	T1 Flow	27.16 ft³/s
T2 Elevation	592.11 ft	T2 Flow	31.05 ft³/s

Structure ID: CWP Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	603.00 ft
Weir Length	180.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

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

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

Requested Pond Water Surface Elevations	
Minimum (Headwater)	608.70 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	612.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	WWP Weir	Forward + Reverse	WWP Culvert	609.00	612.00
Culvert-Box	WWP Culvert	Forward	TW	603.00	612.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: WWP Culvert Structure Type: Culvert-Box	
Number of Barrels	1
Width	3.00 ft
Height	4.00 ft
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.000 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.000
Kb	0.006
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 2
K	0.5000
M	0.6670
C	0.0446
Y	0.6500
T1 ratio (HW/D)	1.153
T2 ratio (HW/D)	1.364
Slope Correction Factor	-0.500

Use unsubmerged inlet control 1 equation below T1 elevation.
Use submerged inlet control 1 equation above T2 elevation

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

T1 Elevation	607.61 ft	T1 Flow	84.00 ft³/s
T2 Elevation	608.45 ft	T2 Flow	96.00 ft³/s

Structure ID: WWP Weir
Structure Type: Rectangular Weir

Number of Openings	1
Elevation	609.00 ft
Weir Length	210.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

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