

INITIAL DESIGN FLOOD CONTROL PLAN

40 CFR 257.82

Auxiliary Ash Pond Complex

Glen Lyn Plant Site

Glen Lyn, Virginia

May, 2026

Prepared for: Appalachian Power Company

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215



Glen Lyn Plant
Auxiliary Ash Pond Complex
Initial Design Flood Control Plan

PREPARED BY _____ DATE _____
Dan Murphy, P.E.

REVIEWED BY _____ DATE _____
Blake Arthur, P.E.

APPROVED BY David Anthony Miller DATE 05.04.2026
David Anthony Miller, P.E.
Director- Ash Management Services



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: Initial Inflow Design Flood Control Plan

1.0 OBJECTIVE

The “Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Legacy CCR Surface Impoundments”, 89 Fed. Reg. 38950 (May 8, 2024) (amending 40 C.F.R. §257) requires owners and operators of facilities with a legacy coal combustion residual (CCR) surface impoundment to prepare an initial inflow design flood control plan for each legacy CCR surface impoundment at the facility.

The Auxiliary Ash Pond Complex at the Glen Lyn Plant Site is subjected to this rule.

2.0 DESCRIPTION OF THE CCR UNIT

The Glen Lyn Plant Site is located adjacent to the New River in Giles County, Virginia, approximately 10 miles east of Princeton, West Virginia. The latitude/longitude of the facility is: 37 ° 22' 12" N/ 80° 51' 48" W. The facility address is 100 APCO Road, Glen Lyn, VA, 24093. The Auxiliary Ash Pond Complex is located approximately 0.5 miles northwest of the Plant site.

The Glen Lyn Plant operated from 1919 to 2015. The total length of the perimeter dike containing the Auxiliary Ash Pond Complex is nearly 5,000 linear feet, and the Auxiliary Ash Complex is roughly 70 acres in size.

The Auxiliary Ash Pond Complex encompasses areas also known as the West Pond, Auxiliary Pond (Fly Ash Dam), and Glen Lyn Landfill.

3.0 INFLOW DESIGN FLOOD CONTROL PLAN 40 CFR § 257.82

The Initial inflow design flood control plan was prepared by GAI Consultants, Inc. and is included as Attachment A. Two separate reports were prepared for the West Pond and Auxiliary Ash Pond, together capturing the full extent of the Auxiliary Ash Pond Complex.

The results of the inflow flood routing calculations demonstrate that the Glen Lyn Auxiliary Ash Pond Complex can adequately manage flow into and out of the CCR unit during the design flood. Therefore, it is concluded that the Glen Lyn Auxiliary Ash Pond Complex meets the requirements of 40 CFR §257.82

ATTACHMENT A

Initial Inflow Design Flood Control Plan



Coal Combustion Residuals Inflow Design Flood Control System Plan

American Electric Power
Auxiliary Fly Ash Pond
Glen Lyn Power Plant
Glen Lyn, Virginia

GAI Project Number: C121043.12

April 2026



BOUNDLESS ENERGYSM

Prepared by: GAI Consultants, Inc.
Pittsburgh Office
385 East Waterfront Drive
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Prepared for: American Electric Power
1 Riverside Plaza
Columbus, Ohio 43215

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Appendix A Hydrologic and Hydraulic Assessment

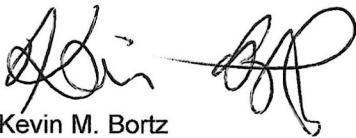
Certification/Statement of Professional Opinion

This Inflow Design Flood Control System Plan (Plan) for the Auxiliary Fly Ash Pond Complex (Aux Pond) at the American Electrical Power (AEP) Glen Lyn Power Plant was prepared by GAI Consultants, Inc. (GAI). The Plan is based on certain information that, other than for information GAI originally prepared, GAI has relied on but not independently verified. This Certification/Statement of Professional Opinion is, therefore, limited to the information available to GAI at the time the Plan was written.

On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the Commonwealth of Virginia that the Closure Plan has been prepared in accordance with good and accepted engineering practices as exercised by other engineers practicing in the same discipline(s), under similar circumstances, at the same time, and in same locale. It is my professional opinion that the Plan was prepared consistent with the requirements of §257.102 of the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (CCR Rule), as required by §257.82(c) of the CCR Rule. It is also my professional opinion that the Plan was prepared consistent with the requirements of §9VAC20-81-800 of the Virginia Code.

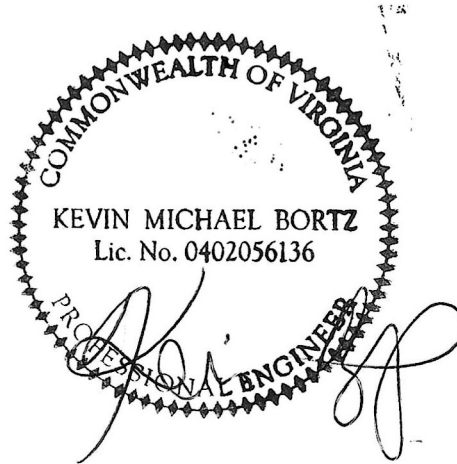
The use of the word "certification" and/or "certify" in this document shall be interpreted and construed as a Statement of Professional Opinion and is not and shall not be interpreted or construed as a guarantee, warranty, or legal opinion.

GAI Consultants, Inc.



Kevin M. Bortz
Senior Engineering Manager 2

Date 04/29/2026



1.0 Introduction

The Glen Lyn Power Station (Station) is owned by Appalachian Power Company, doing business as American Electric Power (AEP) and is located in Giles County, Virginia (VA). The Station includes the Auxiliary Ash Pond (Aux Pond) containing a closed pond with a center swale, cap collection ditch, and riprap slope discharge point to convey drainage from the Aux Pond.

The Aux Pond is considered to be a part of the Auxiliary Ash Pond Complex and has been operated and maintained in accordance with VA Department of Environmental Quality (VDEQ) regulations. The Aux Pond is permitted as a dam through the Division of Dam Safety and Floodplain Management of the VA Department of Conservation and Recreation (VDCR) (VDCR Inventory Number 071001).

2.0 Purpose

This Inflow Design Flood Control System Plan (Plan) is prepared pursuant to the requirements in the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," published in the Federal Register on April 17, 2015, with an effective date October 19, 2015 (CCR Rule), §257.82(c) [40 CFR §257.82(c)]. 40 CFR §257.82 requires CCR surface impoundments to have an inflow design flood control system and §257.82(a)(3) outlines the design flood for CCR surface impoundments. AEP has determined that the Aux Pond is a significant hazard potential CCR surface impoundment, and as such, the inflow design flood shall be the 1,000-year, 24-hour storm. This plan has been prepared to demonstrate that the inflow design flood control system for the Aux Pond complex adequately manages flow during the 1,000-year storm.

Flood controls at the Aux Pond complex include the following:

- ▶ Center Swale
- ▶ Cap Collection Ditch
- ▶ Riprap slope to discharge point

3.0 Initial Inflow Design Flood Control System Plan

This Plan provides a description of the Impoundment design and hydrologic and hydraulic (H&H) capacity.

3.1 Site Configuration

The area that comprises the Aux Pond was originally constructed in 1957 but underwent several modifications since then. Presently, the Aux Pond is a closed and capped pond with a vegetated central swale draining to the southeast and a vegetated cap collection ditch running along the west edge of the pond.

3.2 Flow Into Surface Impoundment

The drainage area to center swale is 7.02 acres and is comprised of the capped and vegetated Aux Pond, with minimal drainage coming from impervious surfaces. The drainage area to the cap collection ditch is 2.83 acres and is of a similar land use category. The precipitation data defining the 1,000-year flood event is 6.64 inches of precipitation with a duration of 24 hours.

3.3 Flow From Surface Impoundment

As required by §257.82(a)(2), an inflow design flood control system (IDFCS) must be in place for the Aux Pond that is designed, constructed, operated, and maintained to control flow from the impoundment for the Inflow Design Flood (1,000-year). The central swale, cap collection ditch, and riprap slope comprise the IDFCS for the Aux Pond as shown in the calculations (Appendix A).

The central swale has a 10-foot bottom width, 50H:1V side slopes, and is 2 feet deep. The cap collection ditch has a 2-foot bottom width, 2.5H:1V side slopes, and is 2 feet deep. Both structures discharge onto a VDOT Class AI riprap lined slope which directs the discharge to Adair Run.

In this Plan, management of the inflow design flood is defined as having the capacity to convey the peak discharge resulting from the flood. The peak discharge from the Aux Pond for the 1,000-year storm is 22.4 cubic feet per second (cfs) in the center swale (normal depth of 6.2 inches) and 18.4 cfs in the cap collection ditch (normal depth of 19.8 inches).

3.4 Surface Water Requirements

40 CFR 257.3-3 states that “a facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.” DEQ administers the NPDES program in Virginia under the VPDES program. The Aux Pond is regulated under an existing VPDES Permit, which functions to satisfy the requirements of § 257.82(b) of the CCR Rule.

3.5 Hydrologic and Hydraulic Capacity Requirements

The Federal CCR Rule states that significant hazard surface impoundments must be designed to effectively manage the 1,000-year storm event. As such, the 1,000-year, 24-hour storm was modeled to determine if the impoundment is in compliance with the CCR Rule.

The 1,000-year storm was routed through the diversion channels using the Bentley FlowMaster program to identify if each channel’s conveyance capabilities are in compliance with the CCR Rule. Refer to Appendix A for the H&H Assessment which includes routing calculations for the 1,000-year storm.

As described in the H&H Assessment (Appendix A), modeling shows that the normal depth in both diversion channels for the 1,000-year storm is below the corresponding top of bank elevations. Thus, demonstrating that the channels have adequate capacity to convey the 1,000-year storm and that they are in compliance with the CCR Rule.

The computed shear stress for the riprap slope to the discharge point in Adair Run is higher than the allowable shear stress for the installed VDOT Class AI riprap.

4.0 Conclusion

A hydrologic and hydraulic assessment was conducted to estimate the normal depth in the diversion channels and the shear stress on the riprap slope for the 1,000-year event. It was found that the Station’s Aux Pond diversion channels are adequately sized to convey the 1,000-year event as required for a significant hazard impoundment by the CCR Rule.

The riprap lining the slope to Adair Run does not meet the requirements to withstand the shear stresses resulting from the 1,000-year event. The in-place riprap does not show any signs of displacement or erosion, and hydrologic modeling shows that the peak flow rates resulting from the 1,000-year event occur over a very limited duration (approximately 90 – 100 minutes).

Closure activities for the Aux Pond have commenced as required by the CCR Rule.

5.0 References

1. United States Environmental Protection Agency *40 CFR Parts 257 and 261 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule*. April 17, 2015.

2. GAI Consultant's Inc., "*Auxiliary Fly Ash Pond Closure Plan, Glen Lyn Station, Virginia.*" February 2013.
3. GAI Consultant's Inc., "*No-Rise Certification Letter, Glen Lyn Station, Virginia.*" January 2013.

APPENDIX A

H&H Assessment

SUBJECT AEP - Glen Lyn Power Station – Auxiliary Fly Ash Pond
Hydrologic and Hydraulic Capacity Assessment

BY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12

CHKD. BY WebstDI DATE 04/21/2026



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APPENDIX A

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*Appendix sheet numbers correspond to *italic* numbers in the upper right hand corner of each page.

SUBJECT AEP - Glen Lyn Power Station – Auxiliary Fly Ash PondHydrologic and Hydraulic Capacity AssessmentBY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12CHKD. BY WebstDI DATE 04/21/2026

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OBJECTIVE

The purpose of this assessment is to estimate the hydrologic and hydraulic (H&H) capacity for the current site configuration at the Glen Lyn Auxiliary Fly Ash Pond Complex (Aux FAP), located at the Glen Lyn Power Station (Station) in Giles County, Virginia, for the inflow design flood event to show compliance with the updated CCR Rule.

Section 257.82 of the Environmental Protection Agency (EPA) Coal Combustion Residual (CCR) Rule established in April 2015 states that “the inflow design flood control system (for CCR surface impoundments) must adequately manage flow into the Impoundment during and following the peak discharge of the inflow design flood.” Per the CCR Rule, the inflow design flood is the 1,000-year event.

This calculation will estimate peak discharges for the 1,000-year event for surface runoff control structures (Aux FAP center swale and cap collection ditch) that control and contain stormwater discharge from the impoundment. The peak discharges will be compared to calculated hydraulic capacity for each structure to demonstrate compliance with the CCR Rule.

METHODOLOGY

Modeling for the 1000-year event for the Aux FAP drainage ditches was done using the Autodesk computer program Hydraflow Hydrographs and Bentley Flowmaster. Drainage areas to site features were delineated using project mapping. TR-55 methodology was previously used to determine the runoff curve number and time of concentration input design parameters for Hydraflow. Rainfall data for the site was obtained from NOAA Atlas 14.

REFERENCES

1. Hydraflow Hydrographs, Autodesk, 2022.
2. Bentley Flowmaster, Connect Edition 10.03.00.03, March 20, 2020.
3. TR-55, Urban Hydrology For Small Watersheds, Natural Resources Conservation Services, June 1986.
4. NOAA Atlas 14. Rainfall data for Glen Lyn, Virginia.

SUBJECT AEP - Glen Lyn Power Station – Auxiliary Fly Ash Pond

Hydrologic and Hydraulic Capacity Assessment

BY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12

CHKD. BY WebstDI DATE 04/21/2026



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HYDROLOGY

PRECIPITATION

Rainfall data for the site was obtained from Reference 4. The 1,000-year, 24-hour event rainfall accumulation is 6.64 inches.



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
24-hr	2.06 (1.94-2.20)	2.46 (2.32-2.62)	2.98 (2.80-3.17)	3.40 (3.19-3.62)	3.98 (3.72-4.24)	4.45 (4.14-4.74)	4.93 (4.56-5.26)	5.43 (4.99-5.81)	6.11 (5.55-6.55)	6.64 (5.98-7.15)

WATERSHED AREA, RUNOFF COEFFICIENTS, AND TIME OF CONCENTRATION

The results of the previous hydrology calculation were coded into Hydraflow and are listed below for each area of the Aux FAP Complex. The previous calculation is included as Attachment 1 to this calculation brief.

Aux FAP Center Swale

Drainage Area = 7.02 acres
 Time of Concentration = 27.2 minutes
Runoff Curve Number = 72
 Resulting Flow = 22.40 cfs

Aux FAP Cap Collection Ditch

Drainage Area = 2.83 acres
 Time of Concentration = 5 minutes
Runoff Curve Number = 72
 Resulting Flow = 18.40 cfs

SUBJECT AEP - Glen Lyn Power Station – Auxiliary Fly Ash PondHydrologic and Hydraulic Capacity AssessmentBY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12CHKD. BY WebstDI DATE 04/21/2026

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HYDRAULICS

AUX FAP CENTER SWALE

The swale design parameters were input into the computer program Flowmaster as seen in the image below and the program was run to calculate normal depth in the swale.

Roughness Coefficient	0.055	...	Flow Area:	18.5	ft ²
Channel Slope:	0.010	ft/ft	Wetted Perimeter:	61.7	ft
Normal Depth:	6.2	in	Hydraulic Radius:	3.6	in
Left Side Slope:	50.000	H:V	Top Width:	61.64	ft
Right Side Slope:	50.000	H:V	Critical Depth:	4.0	in
Bottom Width:	10.00	ft	Critical Slope:	0.075	ft/ft
Discharge:	22.40	cfs	Velocity:	1.21	ft/s
			Velocity Head:	0.02	ft
			Specific Energy:	0.54	ft
			Froude Number:	0.390	
			Flow Type:	Subcritical	

The swale is designed to be 24 inches deep, therefore, at a normal depth of 6.2 inches, the swale will not overtop in the 1,000-year, 24-hour storm.

AUX FAP CAP COLLECTION DITCH

The cap collection ditch design parameters were input into the computer program Flowmaster as seen in the image below and the program was run to calculate normal depth in the ditch.

SUBJECT AEP - Glen Lyn Power Station – Auxiliary Fly Ash PondHydrologic and Hydraulic Capacity AssessmentBY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12CHKD. BY WebstDI DATE 04/21/2026

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Roughness Coefficient	0.055	...	Flow Area:	10.1	ft ²
Channel Slope:	0.005	ft/ft	Wetted Perimeter:	10.9	ft
Normal Depth:	19.8	in	Hydraulic Radius:	11.1	in
Left Side Slope:	2.500	H:V	Top Width:	10.26	ft
Right Side Slope:	2.500	H:V	Critical Depth:	11.4	in
Bottom Width:	2.00	ft	Critical Slope:	0.056	ft/ft
Discharge:	18.40	cfs	Velocity:	1.82	ft/s
			Velocity Head:	0.05	ft
			Specific Energy:	1.70	ft
			Froude Number:	0.323	
			Flow Type:	Subcritical	

The ditch is designed to be 24 inches deep, therefore, at a normal depth of 19.8 inches, the ditch will not overtop in the 1,000-year, 24-hour storm.

AUX FAP RIPRAP SLOPE TO ADAIR RUN

The center swale and cap collection ditch combine to flow down a riprap slope and into Adair Run. The current design has VDOT Class A1 riprap placed at a thickness of 1'-6" on approximately a 2H:1V slope. The maximum allowable shear stress for these conditions is 4 pounds-per-square-foot (psf), while the computed shear stress is almost 10 psf for the 1,000-year, 24-hour storm. At these conditions, a minimum of Class II or grouted riprap would be required to withstand the shear stresses.

RESULTS

The Aux FAP center swale and cap collection ditch both have the capacity to manage the 1,000-year, 24-hour storm event without overtopping. However, the riprap slope off the Aux FAP to Adair Run is not designed to manage a storm event of this magnitude.

SUBJECT AEP - Glen Lyn Power Station – Auxiliary Fly Ash Pond

Hydrologic and Hydraulic Capacity Assessment

BY AbeleCE

DATE 04/08/2026 PROJ. NO. C121043.12

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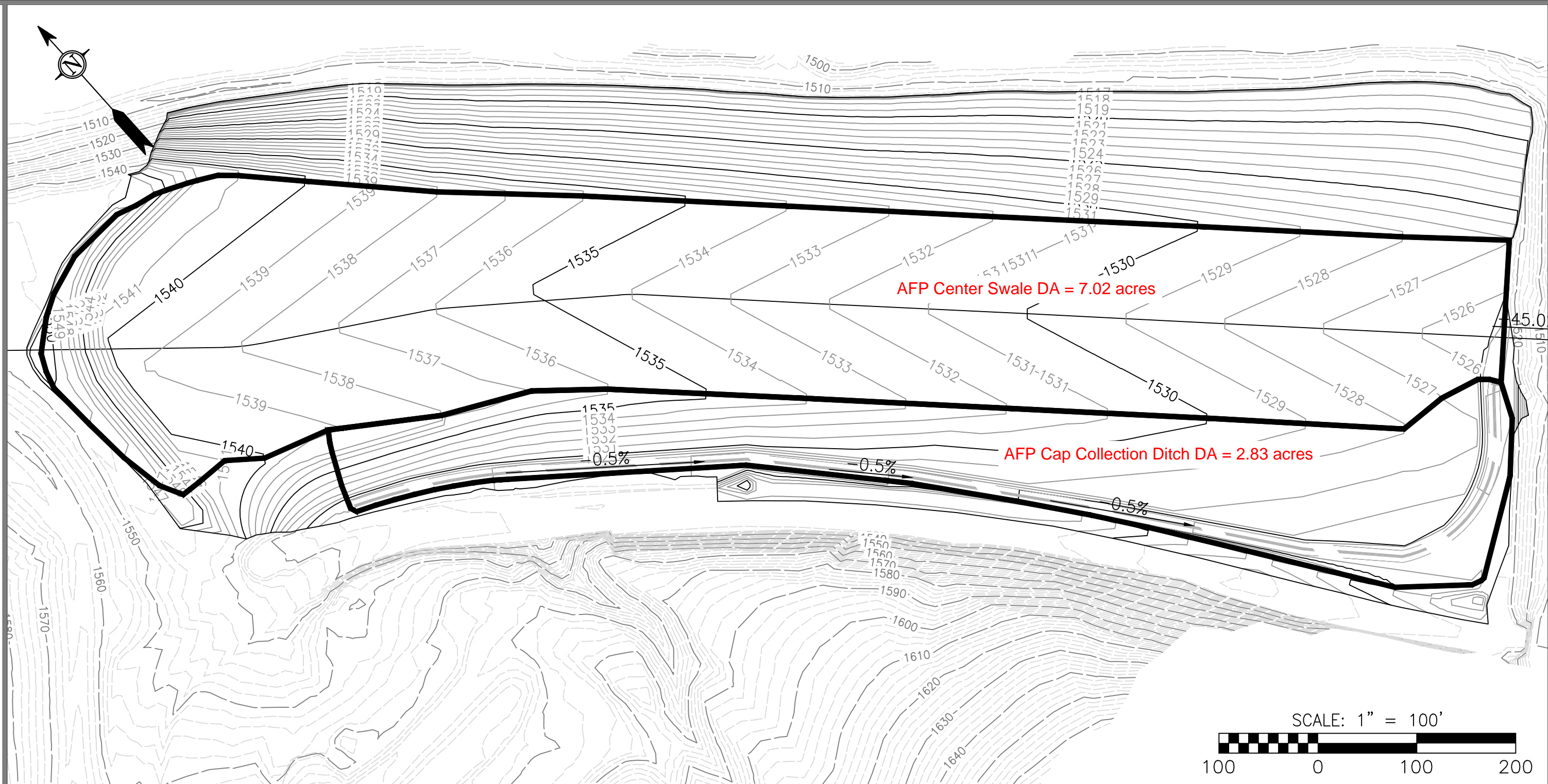
DATE 04/21/2026



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ATTACHMENT 1

UPDATED HYDROLOGIC CALCULATIONS




PLOTTED ON: 4/9/2026 10:25:07 AM PLOTTED BY: Claire E. Abele PLOT FILE: GAI.stb

NO.:	DATE:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DESCRIPTION:

REVISION RECORD

DRAWING TITLE DRAINAGE AREA MAP		
PROJECT AUXILIARY FLY ASH POND INFLOW DESIGN REPORT GLEN LYN PLANT VIRGINIA		CLIENT APPALACHIAN POWER CO GLEN LYN PLANT GLEN LYN VIRGINIA

ISSUE DATE: 04/09/2026	DRAWN BY: ABELECE
SCALE: AS SHOWN	CHECKED BY: WEBSTDI
REVISION 	APPROVED BY: BORTZKM
SHEET NO.: 1 OF 1	

Hydrograph Report

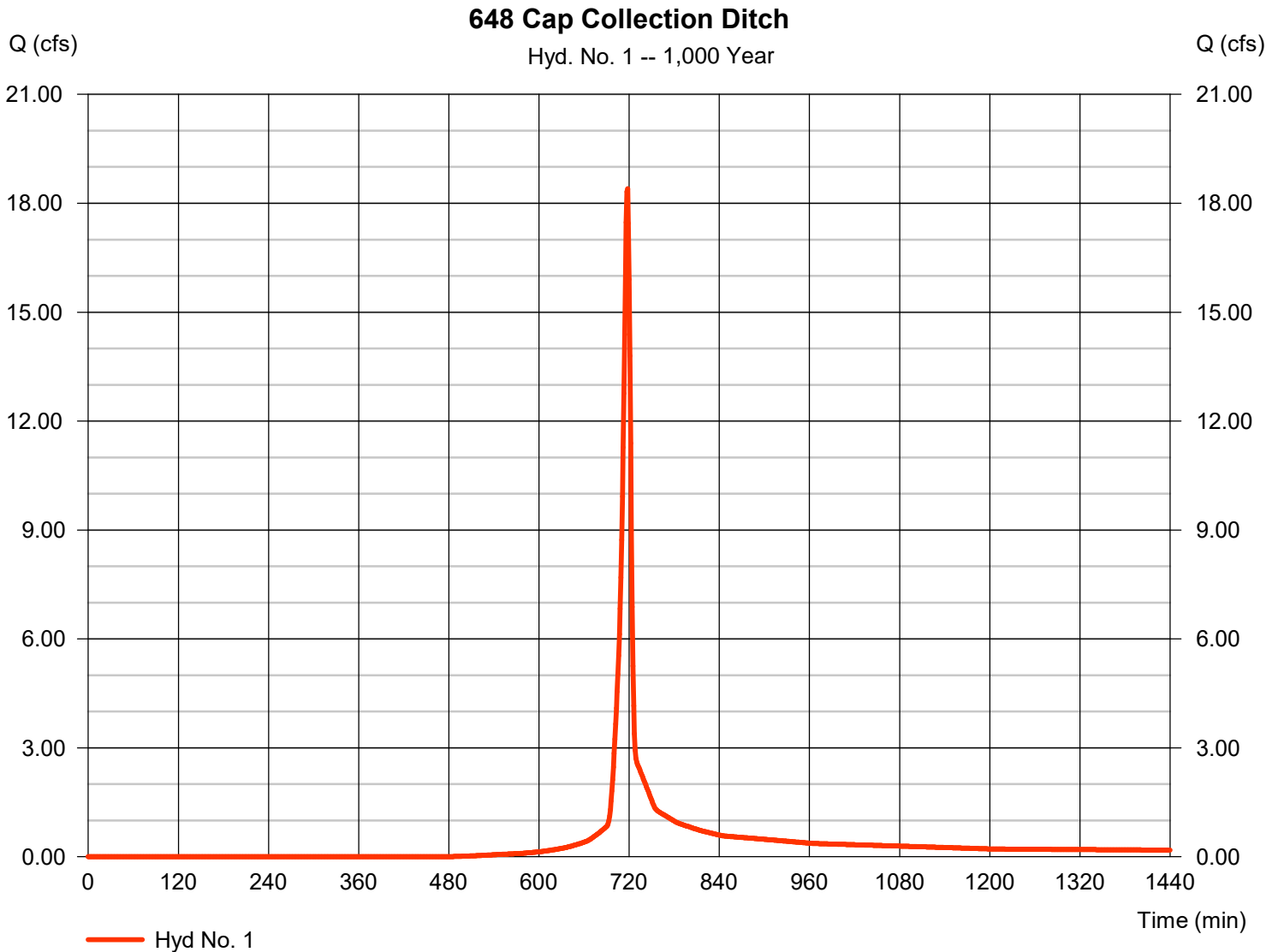
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Thursday, 04 / 9 / 2026

Hyd. No. 1

648 Cap Collection Ditch

Hydrograph type	= SCS Runoff	Peak discharge	= 18.40 cfs
Storm frequency	= 1,000 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 37,336 cuft
Drainage area	= 2.830 ac	Curve number	= 72
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

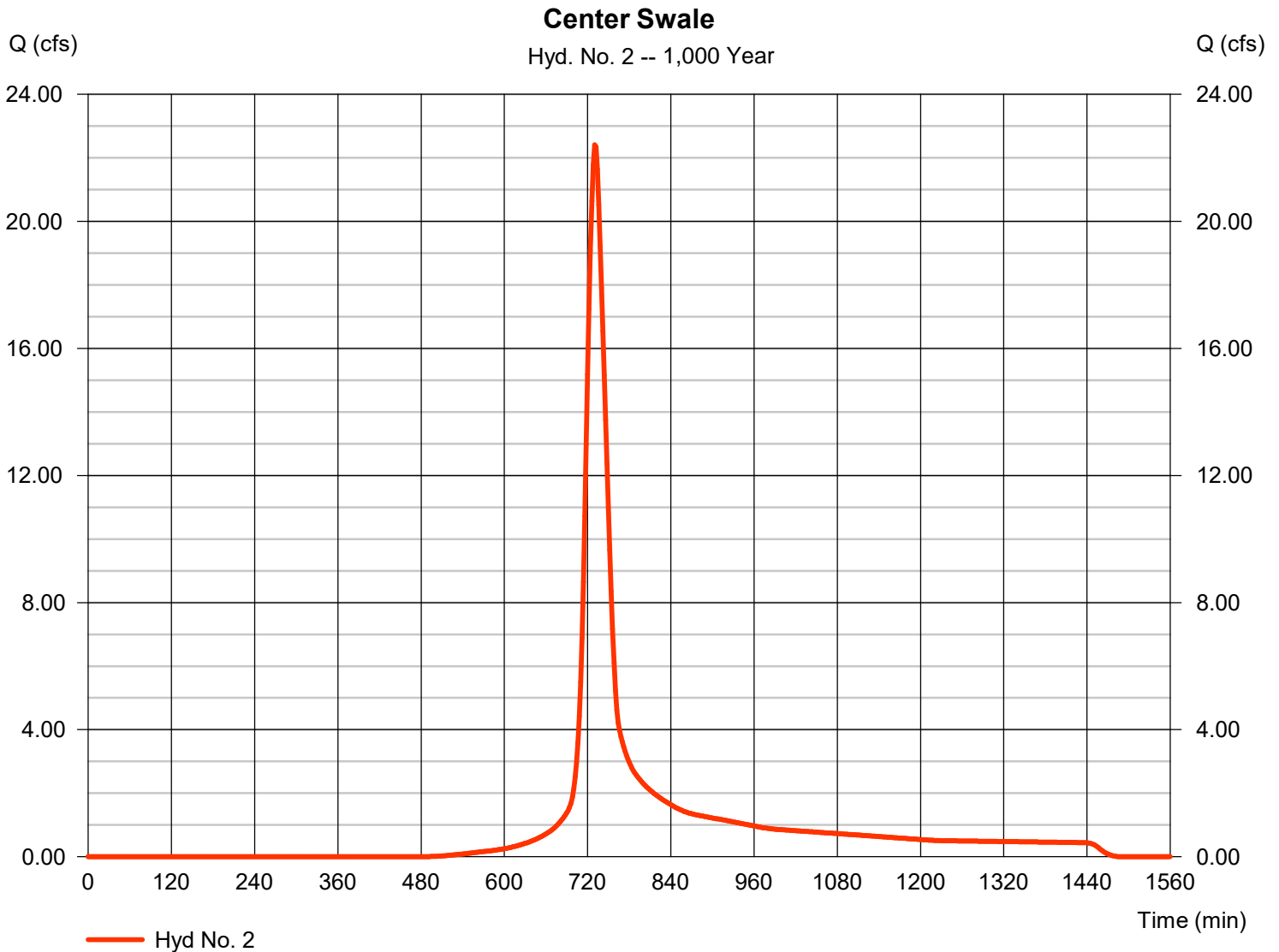
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Thursday, 04 / 9 / 2026

Hyd. No. 2

Center Swale

Hydrograph type	= SCS Runoff	Peak discharge	= 22.40 cfs
Storm frequency	= 1,000 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 89,808 cuft
Drainage area	= 7.020 ac	Curve number	= 72
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.20 min
Total precip.	= 6.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Glen Lyn Auxiliary Fly Ash Pond

Inflow Analysis

SHEAR STRESS ANALYSIS

Riprap Slope Shear Stress Check

By: CEA

Date: 4/17/2026

References:

1. Virginia Department of Transportation Location and Design Manual. Chapter 7 - Ditches and Channels. Virginia Department of Transportation. July, 2016.

Known Values

Flow Rate =	40.8 cfs
Normal Depth =	3.8 in
	0.32 ft
Slope =	0.5 ft/ft
Riprap Class =	AI

Shear Stress

Shear Stress = $62.4 \times \text{Hydraulic Radius} \times \text{Channel Slope}$

Due to being a wide channel, the equation can be rewritten

$$\text{Shear Stress} = 62.4 \times \text{Normal Depth} \times \text{Channel Slope}$$

$$\text{Shear Stress} = 9.88 \text{ psf}$$

$$\text{Allowable Shear Stress} = 4 \text{ psf for Class AI}$$

Results

The calculated shear stress for the current conditions of the riprap slope is over the allowable shear stress limit for Class AI riprap.

SUBJECT AEP - Glen Lyn Power Station – Auxiliary Fly Ash Pond

Hydrologic and Hydraulic Capacity Assessment

BY AbeleCE

DATE 04/08/2026 PROJ. NO. C121043.12

CHKD. BY WebstDI

DATE 04/21/2026



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ATTACHMENT 2

HYDROLOGIC CALCULATIONS (PREVIOUSLY DEVELOPED)



West Pond Temporary Spillway VDCR Inventory No. 071008

American Electric Power
West Pond
Glen Lyn Power Plant, Glen Lyn, Virginia

GAI Project Number: C121043.07, Task 006
January 2019



Prepared by: GAI Consultants, Inc.
Murrysville Office
4200 Triangle Lane
Export, Pennsylvania 15632

Prepared for: American Electric Power
One Riverside Plaza
Columbus, Ohio 43215

West Pond Temporary Spillway, VDCR Inventory No. 071008
American Electric Power
West Pond, Glen Lyn Power Plant, Glen Lyn, Virginia

SECTION C1

Hydrology



SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
CHKD. BY KLF DATE 12/18/2018 SHEET NO. 4 OF 19

WATERSHED AREAS

The drainage area to the existing diversion channel along the west side of the WP Complex area is determined by using USGS Quadrangles, along with existing site contours, as shown in the image below.



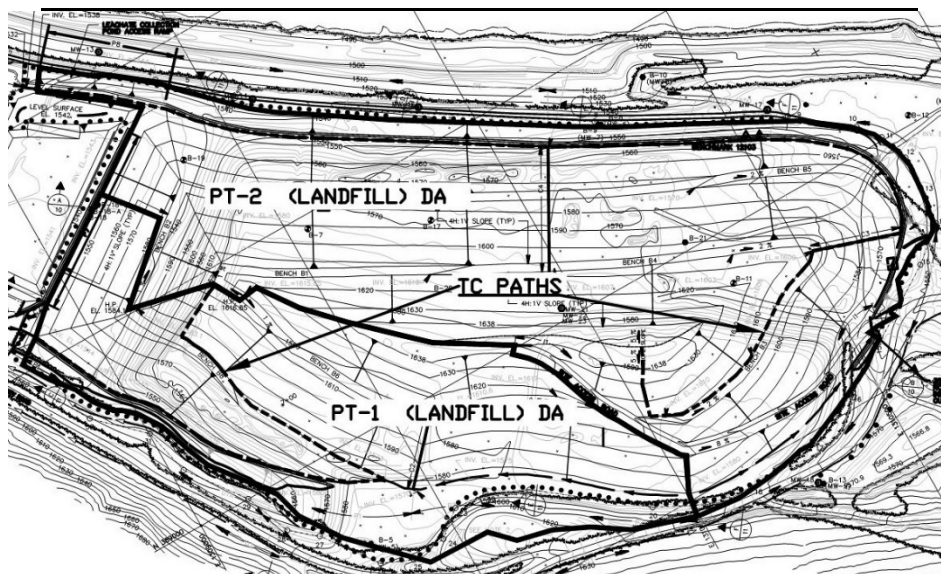
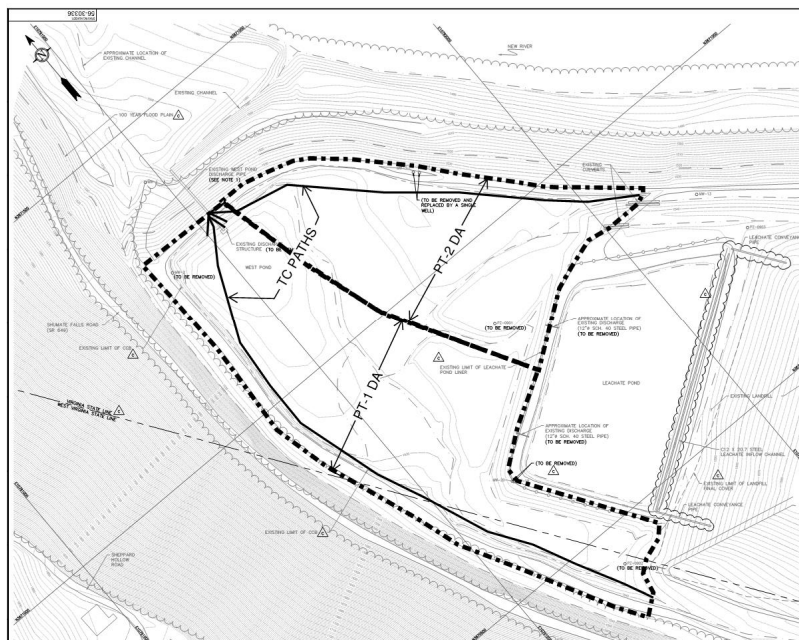
SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES



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BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
CHKD. BY KLF DATE 12/18/2018 SHEET NO. 5 OF 19

Under existing conditions, drainage from the landfill enters the WP at points east (PT-2) and west (PT-1) of the leachate basin. For the purposes of this analysis, channels have been assumed to convey the landfill drainage, plus runoff from the WP itself, to the WP spillway. The drainage areas to PT-1 and PT-2 along the WP Complex area are determined by using a composite of a MicroStation file of the WP Complex area landfill and an AutoCAD® drawing depicting the existing WP area topography. Figures showing the landfill and WP watershed boundaries are below. For the purposes of analysis, division of the west pond area is made, maintaining the separate landfill drainage discharge points.





SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
 CHKD. BY KLF DATE 12/18/2018 SHEET NO. 6 OF 19

SOIL CONDITIONS – (Curve Number, Hydrologic Soil Group, Initial Abstraction)

Curve Number: The percentages of area covered for each respective curve number generated in the tables on the following sheet were obtained from the images shown above. The curve numbers are TR-55 AMC-II condition soils for hydrologic group C and were verified using the USGS Web Soil Survey map, shown below. Hydrologic Soil Group (HSG) "C" was assumed representative for both existing conditions and for future closure and post- closure conditions, the latter based on examination of cover soils to be obtained from the proposed borrow site.

Borrow Area Web Soil Survey Map



Tables – Hydrologic Soil Group – Summary By Map Unit				
Summary by Map Unit – Mercer and Summers Counties Area, West Virginia (WV713)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CeD	Cateache-Berks channery silt loams, 15 to 30 percent slopes	C	41.8	75.5%
CeF	Cateache-Berks channery silt loams, 30 to 70 percent slopes	C	7.3	13.2%
ChF	Cateache-Berks channery silt loams, 30 to 70 percent slopes, very stony	C	6.3	11.4%
Totals for Area of Interest			55.4	100.0%



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SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
 CHKD. BY KLF DATE 12/18/2018 SHEET NO. 7 OF 19

Hydrologic Soil Group: To find the HSG, the USGS Web Soil Survey Map was used to identify the soils located within the borrow area, which is one of the existing off-site sources of cover soil for the future closure of the WP. The Web Soil Survey shows that the soils located at the borrow area are classified as HSG C.

Initial Abstraction: Using Eq. 2-2 and Eq. 2-4 from the TR-55 Manual. The initial abstraction values used in this analysis are presented in "HEC-HMS MODELING – INPUTS" section of this document.

CN Values:

Wooded	70
Meadow	71
Gravel	89

Drainage Area	Area of terrain type (ac)			Total Area (ac)	Weighted CN
	Wooded	Meadow	Gravel		
Existing Diversion Channel (ED1)	163.5	9.6	2.7	175.7	70

		CN Values:	Vegetated	79	
			Gravel	89	
Drainage Area	Area of terrain type (ac)		Total Area (ac)	Weighted CN	
	Vegetated	Gravel			
PT-1	17.8	0.5	18.3	79	
PT-2	25.1	1.2	26.3	79	

SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES



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The 2-year, 24-hour storm, obtained from the NOAA Atlas Precipitation Data Frequency Server and outlined in red below, is used in the time of concentration calculations on pages 8-12.



NOAA Atlas 14, Volume 2, Version 3
 Location name: Glen Lyn, Virginia, US*
 Latitude: 37.3808°, Longitude: -80.8794°
 Elevation: 1540ft*
 * 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 & aeriels](#)

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	0.282 (0.255-0.313)	0.335 (0.303-0.372)	0.399 (0.360-0.442)	0.445 (0.399-0.493)	0.502 (0.447-0.556)	0.541 (0.478-0.602)	0.580 (0.507-0.649)	0.615 (0.531-0.692)	0.658 (0.557-0.747)	0.688 (0.574-0.789)
10-min	0.450 (0.407-0.499)	0.536 (0.484-0.595)	0.638 (0.576-0.708)	0.711 (0.639-0.788)	0.800 (0.712-0.887)	0.862 (0.761-0.959)	0.922 (0.805-1.03)	0.975 (0.842-1.10)	1.04 (0.881-1.18)	1.08 (0.904-1.24)
15-min	0.562 (0.508-0.624)	0.674 (0.609-0.748)	0.808 (0.729-0.895)	0.899 (0.808-0.997)	1.01 (0.902-1.12)	1.09 (0.963-1.22)	1.17 (1.02-1.30)	1.23 (1.06-1.39)	1.31 (1.11-1.49)	1.36 (1.13-1.56)
30-min	0.771 (0.697-0.856)	0.931 (0.841-1.03)	1.15 (1.04-1.27)	1.30 (1.17-1.45)	1.50 (1.34-1.67)	1.64 (1.45-1.83)	1.79 (1.56-2.00)	1.92 (1.65-2.16)	2.08 (1.77-2.37)	2.20 (1.84-2.53)
60-min	0.961 (0.869-1.07)	1.17 (1.06-1.30)	1.47 (1.33-1.63)	1.70 (1.52-1.88)	2.00 (1.78-2.22)	2.23 (1.97-2.48)	2.46 (2.15-2.75)	2.69 (2.32-3.02)	2.99 (2.53-3.39)	3.22 (2.68-3.69)
2-hr	1.10 (0.998-1.21)	1.32 (1.20-1.46)	1.67 (1.52-1.84)	1.93 (1.75-2.13)	2.28 (2.04-2.53)	2.56 (2.27-2.84)	2.83 (2.48-3.15)	3.10 (2.68-3.48)	3.46 (2.93-3.93)	3.72 (3.11-4.28)
3-hr	1.16 (1.06-1.28)	1.39 (1.27-1.53)	1.74 (1.59-1.92)	2.02 (1.84-2.22)	2.38 (2.15-2.62)	2.67 (2.38-2.95)	2.96 (2.61-3.28)	3.25 (2.83-3.63)	3.64 (3.10-4.12)	3.93 (3.29-4.50)
6-hr	1.39 (1.28-1.51)	1.66 (1.53-1.81)	2.05 (1.89-2.24)	2.36 (2.17-2.58)	2.79 (2.53-3.05)	3.14 (2.82-3.44)	3.49 (3.09-3.85)	3.85 (3.37-4.27)	4.35 (3.71-4.89)	4.72 (3.95-5.37)
12-hr	1.66 (1.54-1.79)	1.97 (1.84-2.13)	2.41 (2.25-2.61)	2.78 (2.57-3.01)	3.30 (3.02-3.57)	3.72 (3.36-4.04)	4.16 (3.71-4.54)	4.63 (4.05-5.08)	5.28 (4.50-5.88)	5.80 (4.85-6.54)
24-hr	2.06 (1.94-2.19)	2.45 (2.31-2.61)	2.96 (2.79-3.15)	3.37 (3.17-3.59)	3.94 (3.68-4.19)	4.39 (4.09-4.68)	4.86 (4.50-5.19)	5.34 (4.91-5.71)	5.99 (5.45-6.42)	6.49 (5.86-6.98)

SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

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TIME OF CONCENTRATION

The times-of-concentration are based on the existing diversion channel, and the existing landfill drainage and channels. The times-of-concentration for future closure and post-closure conditions would be comparable to the times for existing conditions, as no changes are proposed in the off-site watershed area or in the landfill.



SUBJECT: GLEN LYN WEST POND
 SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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Existing Diversion Channel (ED1):

Sheet Flow

	Segment ID	
Surface Description (Table 3-1).....	Hillside	
Manning's Roughness Coefficient, n (table 3-1).....	Wooded	
Flow Length, L.....	0.4	
Two-year 24-hour Rainfall, P ₂	100	ft
Land Slope, s.....	2.45	in
Travel Time, T _t = (0.007*(n*L) ^{0.8}) / (P ₂ ^{0.5} *s ^{0.4}).....	0.14	ft/ft
	0.1878	hrs

Shallow Concentrated Flow

	Segment ID	
Surface Description (Paved / Unpaved).....	Undisturbed	
Surface Description Coefficient, C.....	Unpaved	
Flow Length, L.....	16.1435	
Watercourse Slope, s.....	1632	ft
Average Velocity, V = C*s ^{0.5}	0.343	ft/ft
Travel Time, T _t = (L) / (3600*V).....	9.46	ft/sec
	0.0479	hrs

Channel Flow

	Segment ID		
	Hillside	ED1	
Section Base, b.....	2	2	
Section Depth, d.....	2	2	
Section Side Slope 1, z ₁	2	2	
Cross Sectional Flow Area, a = b*d + z*d ²	12.0	12.0	
Wetted Perimeter, p _w = b + (2*d)*(z ² + 1) ^{0.5}	10.94	10.94	
Hydraulic Radius, r = a / p _w	1.10	1.10	
Channel Slope, s.....	0.11	0.03	
Manning's Roughness Coefficient, n.....	0.065	0.065	
Average Velocity, V = (1.49*r ^{2/3} *s ^{1/2}) / (n).....	7.99	4.56	ft/sec
Flow Length, L.....	3086	572	ft
Travel Time, T _t = (L) / (3600*V).....	0.1072	0.0349	hrs

Time of Concentration

Sheet Flow T _t	0.1878	
Shallow Concentrated Flow T _t	0.0479	
Channel Flow T _t	0.1421	
Time of Concentration, T _c	0.3778	hrs
	22.67	min

HEC-HMS requires the time of concentration in the form of Lag Time, which equals 60% of the time of concentration. (Lag time = 0.6*TC = 13.6 min).



SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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PT-1 (West Portion of WP Drainage):

Sheet Flow

	Segment ID	
Surface Description (Table 3-1).....	Hillside	
Manning's Roughness Coefficient, n (table 3-1).....	Grass	
Flow Length, L.....	0.15	
Two-year 24-hour Rainfall, P ₂	100	ft
Land Slope, s.....	2.45	in
Travel Time, T _t = (0.007*(n*L) ^{0.8}) / (P ₂ ^{0.5} *s ^{0.4}).....	0.25	ft/ft
	0.0680	hrs

Shallow Concentrated Flow

	Segment ID	
Surface Description (Paved / Unpaved).....	Undisturbed	
Surface Description Coefficient, C.....	Unpaved	
Flow Length, L.....	16.1435	
Watercourse Slope, s.....	36	ft
Average Velocity, V = C*s ^{0.5}	0.250	ft/ft
Travel Time, T _t = (L) / (3600*V).....	8.07	ft/sec
	0.0012	hrs

Channel Flow

	Segment ID	B3	P1	P1-EXTEND	
Section Base, b.....		0	2	4	
Section Depth, d.....		0.8	1.5	2	
Section Side Slope 1, z ₁		20	2	2	
Section Side Slope 2, z ₂		4	4	2	
Cross Sectional Flow Area, a = b*d + [(0.5*z ₁ *d ²) + (0.5*z ₂ *d ²)].....		7.7	9.8	16.0	
Wetted Perimeter, p _w = b + (2*d)*(z ² + 1) ^{0.5}		32.04	8.71	12.94	
Hydraulic Radius, r = a / p _w		0.24	1.12	1.24	
Channel Slope, s.....		0.02	0.032	0.010	
Manning's Roughness Coefficient, n.....		0.065	0.04	0.04	
Average Velocity, V = (1.49*r ^{2/3} *s ^{1/2}) / (n).....		1.08	7.18	4.29	ft/sec
Flow Length, L.....		572	889	987	ft
Travel Time, T _t = (L) / (3600*V).....		0.1467	0.0344	0.0639	hrs

Time of Concentration

Sheet Flow T _t	0.0680	
Shallow Concentrated Flow T _t	0.0012	
Channel Flow T _t	0.2449	
Time of Concentration, T _c	0.3141	hrs
	18.85	min

HEC-HMS requires the time of concentration in the form of Lag Time, which equals 60% of the time of concentration. (Lag time = 0.6*TC = 11.3 min).



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 SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

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PT-2 (East Portion of WP Drainage):

Sheet Flow

	Segment ID	
Surface Description (Table 3-1).....	Hillside	
Manning's Roughness Coefficient, n (table 3-1).....	Grass	
Flow Length, L.....	0.15	
Two-year 24-hour Rainfall, P ₂	50	ft
Land Slope, s.....	2.45	in
Travel Time, T _t = (0.007*(n*L) ^{0.8}) / (P ₂ ^{0.5} *s ^{0.4}).....	0.05	ft/ft
	0.0743	hrs

Shallow Concentrated Flow

	Segment ID	
Surface Description (Paved / Unpaved).....	Undisturbed	
Surface Description Coefficient, C.....	Unpaved	
Flow Length, L.....	16.1435	
Watercourse Slope, s.....	110	ft
Average Velocity, V = C*s ^{0.5}	0.250	ft/ft
Travel Time, T _t = (L) / (3600*V).....	8.07	ft/sec
	0.0038	hrs

Channel Flow

	Segment ID	B3	C3	P5	P5-EXTEND	
Section Base, b.....		0	4	2	4	
Section Depth, d.....		0.8	0.5	2	2	
Section Side Slope 1, z ₁		20	2	2	2	
Section Side Slope 2, z ₂		4	2	4	2	
Cross Sectional Flow Area, a = b*d + [(0.5*z ₁ *d ²) + (0.5*z ₂ *d ²)].....		7.7	2.5	12.0	16.0	
Wetted Perimeter, p _w = b + (2*d)*(z ² + 1) ^{0.5}		32.04	6.24	10.94	12.94	
Hydraulic Radius, r = a / p _w		0.24	0.40	1.10	1.24	
Channel Slope, s.....		0.02	0.20	0.010	0.010	
Manning's Roughness Coefficient, n.....		0.065	0.04	0.06	0.06	
Average Velocity, V = (1.49*r ^{2/3} *s ^{1/2}) / (n).....		1.25	8.97	2.64	2.86	ft/sec
Flow Length, L.....		561	204	2116	670	ft
Travel Time, T _t = (L) / (3600*V).....		0.1246	0.0063	0.2226	0.0651	hrs

Time of Concentration

Sheet Flow T _t	0.0743	
Shallow Concentrated Flow T _t	0.0038	
Channel Flow T _t	0.4186	
Time of Concentration, T _c	0.4966	hrs
	29.80	min

HEC-HMS requires the time of concentration in the form of Lag Time, which equals 60% of the time of concentration. (Lag time = 0.6*TC = 17.9 min).

West Pond Temporary Spillway, VDCR Inventory No. 071008
American Electric Power
West Pond, Glen Lyn Power Plant, Glen Lyn, Virginia

SECTION C2

HEC-HMS Modeling

SUBJECT: GLEN LYN WEST POND
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PROPOSED TEMPORARY SPILLWAY DESIGN

HEC-HMS MODELING

HEC-HMS MODELING – INPUT

The computer program HEC-HMS (HMS) is used to evaluate the full 6-, 12-, and 24-hour peak flows for the Existing Diversion Channel, PT-1 and PT-2, and ultimately for the outlet of the proposed temporary spillway. The storm event that yields the greatest peak discharge is then utilized as the design flow for temporary spillway design. The HMS inputs are presented in the following tables.

Diversion channel

ED1 HEC-HMS INPUTS			
Drainage Area =	0.2745	sq. mi	
Time of Concentration =	22.67	min	
CN Value =	70		
Lag time = .6 * TC =	13.602	min	
Initial Abstraction = 0.2S	0.8571	in	(TR55 method)
	Where S = (1000/CN)-10		
	S=	4.2857	

PT-1/West Side

PT-1 HEC-HMS INPUTS			
Drainage Area =	0.0288	sq. mi	
Time of Concentration =	18.85	min	
CN Value =	79		
Lag time = .6 * TC =	11.31	min	
Initial Abstraction = 0.2S	0.5316	in	(TR55 method)
	Where S = (1000/CN)-10		
	S=	2.6582	

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PT-2/East Side

PT-2 HEC-HMS INPUTS			
Drainage Area =	0.04125	sq. mi	
Time of Concentration =	29.8	min	
CN Value =	79		
Lag time = .6 * TC =	17.88	min	
Initial Abstraction = 0.2S	0.5316	in	(TR55 method)
	Where S = (1000/CN)-10		
	S=	2.658228	

Given a trapezoidal, broad-crested overflow spillway configuration, various geometries were assumed, and hydraulic capacities were calculated in a trial and error evaluation process to develop the proposed spillway design. Elevation-Discharge, Elevation-Storage, and Storage-Discharge relationships were generated for the HEC-HMS analyses. The side slopes of the spillway at its crest for the analyses were set at 2H:1V on the east and west sides. The analyses therefore evaluated various bottom widths to predict the resulting depth of flow at the spillway crest.

The existing crest at the northern side of the WP area and the outer slope of the embankment will be re-graded to accommodate a fabric form lined, temporary spillway designed to pass the flow of the 24-hour 0.9 PMP storm event. The calculation procedure for this analysis is detailed below.

The proposed spillway design is a trapezoidal, broad-crested overflow spillway, with a crest elevation of 1532, a bottom width of 91 feet, and side slopes of 2H:1V on the west and east sides at the crest. The crest elevation is based on avoiding excavation depths that impact the phreatic surface elevation in the existing dam. The proposed spillway will pass the design flow with a head of 2.8 feet.

The WP provides some amount of storage; however, the design flow used in the spillway configuration design and sizing is assumed to be equal to the peak flow into the WP with no routing of flow through the WP. This approach assumes negligible storage in the WP, which, as an approximation for existing conditions, while not accurate, is conservative, as the predicted outflow from and peak water level in the WP are higher than if an Elevation-Storage table based on the existing conditions is used.



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GEVR-13-031

Closure Plan

Auxiliary Fly Ash Pond
Glen Lyn Power Plant, Glen Lyn, Virginia

GAI Project Number: C121043.00

February 2013

Prepared for: American Electric Power
1 Riverside Plaza
Columbus, Ohio 43215

Prepared by: GAI Consultants, Inc.
Murrysville Office
4101 Triangle Lane
Export, Pennsylvania 15632



AEP: America's Energy PartnerSM

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Closure Plan
American Electric Power
Auxiliary Fly Ash Pond
Glen Lyn Power Plant, Glen Lyn, Virginia

APPENDIX C DRAINAGE AND EROSION AND SEDIMENT CONTROL CALCULATIONS

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00CHKD. BY CRM DATE 1/28/13 SHEET NO. 1 of 7

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INTRODUCTION

Due to the closure of the Glen Lyn Power Plant, the existing Auxiliary Fly Ash Pond (Aux FAP) is to be capped and closed. Closure of the pond will involve the necessary re-grading of the existing perimeter dikes in order to achieve a final cap system that will prevent the impounding of water after closure. The final surface will be graded to drain towards the south for ultimate discharge to Adair Run. The final grading will result essentially in a swale, which is analyzed for capacity and lining stability to conform to the design criteria set forth in the 1992 Virginia DCR Erosion and Sediment Control Handbook.

PROJECT PARAMETERS

Hydrology

The design will look at both unvegetated and vegetated conditions, given a 25-year, 24-hour storm event.

Curve Number: 72
 Curve Number: 89
 Precipitation: 3.96 in.
 Drainage Area: 7.28 Acres

Reference

TR-55 Manual (vegetated) and proposed site topography
 TR-55 Manual (unvegetated) and existing site topography
 NOAA Precipitation Frequency Data Server (25-yr, 24-hr)
 AutoCAD Civil 3D 2012

Proposed Swale

Swale Features	
Bottom Width	10 ft
Total Depth	2 ft +/-
Side Slopes	50H:1V*
Bed Slope	0.01 ft/ft
Manning's n	0.055

*Swale side slopes vary slightly, with 50H:1V representing a reasonable average value.

**Manning's n of 0.055 represents an unvegetated condition in which the proposed flow depth is at or below 0.5 ft. (See attached Reference: Tensar: North American Green – S75BN Erosion Control Blanket Specification Sheet)

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00CHKD. BY CRM DATE 1/28/13 SHEET NO. 2 of 7

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TIME OF CONCENTRATION**Unvegetated Condition:**

Sheet Flow

	Segment ID	
Surface Description (Table 3-1).....	1	Soil
Manning's Roughness Coefficient, n.....	0.03	Mix of smooth/fallow (TR-55)
Flow Length, L.....	69	ft
Two-year 24-hour Rainfall, P ₂	2.45	in
Land Slope, s.....	0.12	ft/ft
Travel Time, T _t = (0.007*(n*L) ^{0.8}) / (P ₂ ^{0.5} *s ^{0.4}).....	0.0189	hrs

Shallow Concentrated Flow

	Segment ID	
Surface Description (Paved / Unpaved).....	2	Unpaved
Surface Description Coefficient, C.....	16.1435	
Flow Length, L.....	134	ft
Watercourse Slope, s.....	0.01	ft/ft
Average Velocity, V = C*s ^{0.5}	1.97	ft/sec
Travel Time, T _t = (L) / (3600*V).....	0.0189	hrs

Swale Flow

	Segment ID	
Section Base, b.....	3	ECB/TRM
Section Depth, d.....	10	
Section Side Slope, z.....	0.52	
Section Side Slope, z.....	50	
Cross Sectional Flow Area, a = b*d + z*d ²	18.7	
Wetted Perimeter, p _w = b + (2*d)*(z ² + 1) ^{0.5}	62.01	
Hydraulic Radius, r = a / p _w	0.30	
Channel Slope, s.....	0.010	
Manning's Roughness Coefficient, n.....	0.053	
Average Velocity, V = (1.49*r ^{2/3} *s ^{1/2}) / (n).....	1.27	ft/sec
Flow Length, L.....	1275	ft
Travel Time, T _t = (L) / (3600*V).....	0.2799	hrs

Time of Concentration

Sheet Flow T _t	0.0189	
Shallow Concentrated Flow T _t	0.0189	
Channel Flow T _t	0.2799	
Time of Concentration, T _c	0.3178	hrs
	19.07	min

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

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Vegetated Condition:

Sheet Flow

Segment ID	1	
Surface Description (Table 3-1).....	Grass	
Manning's Roughness Coefficient, n.....	0.15	(TR-55)
Flow Length, L.....	69	ft
Two-year 24-hour Rainfall, P ₂	2.45	in
Land Slope, s.....	0.12	ft/ft
Travel Time, T _t = (0.007*(n*L) ^{0.8}) / (P ₂ ^{0.5} *s ^{0.4}).....	0.0687	hrs

Shallow Concentrated Flow

Segment ID	2	
Surface Description (Paved / Unpaved).....	Unpaved	
Surface Description Coefficient, C.....	16.1435	
Flow Length, L.....	134	ft
Watercourse Slope, s.....	0.01	ft/ft
Average Velocity, V = C*s ^{0.5}	1.97	ft/sec
Travel Time, T _t = (L) / (3600*V).....	0.0189	hrs

Swale Flow

Segment ID	3	ECB/TRM
Section Base, b.....	10	
Section Depth, d.....	0.35	
Section Side Slope, z.....	50	
Cross Sectional Flow Area, a = b*d + z*d ²	9.6	
Wetted Perimeter, p _w = b + (2*d)*(z ² + 1) ^{0.5}	45.01	
Hydraulic Radius, r = a / p _w	0.21	
Channel Slope, s.....	0.010	
Manning's Roughness Coefficient, n.....	0.055	
Average Velocity, V = (1.49*r ^{2/3} *s ^{1/2}) / (n).....	0.97	ft/sec
Flow Length, L.....	1275	ft
Travel Time, T _t = (L) / (3600*V).....	0.3656	hrs

Time of Concentration

Sheet Flow T _t	0.0687	
Shallow Concentrated Flow T _t	0.0189	
Channel Flow T _t	0.3656	
Time of Concentration, T _c	0.4531	hrs
	27.19	min

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

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PEAK FLOWS

The computer program Hydraflow Hydrographs 2004 was used to calculate the peak flow in the swale resulting from a 25-year, 24-hour storm, and the hydrograph outputs for the unvegetated and final vegetated conditions are shown below.

Hydrograph Plot

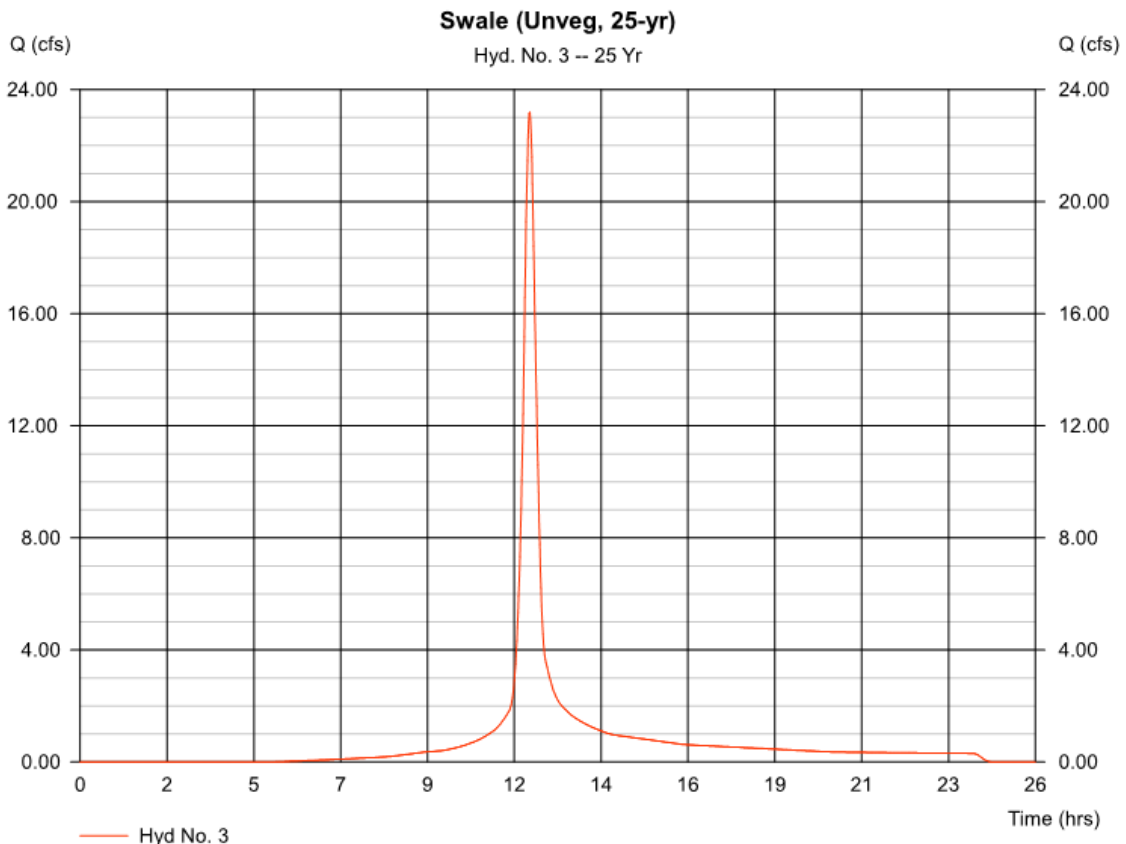
Hydraflow Hydrographs by Intelisolve Wednesday, Jan 9 2013, 3:18 PM

Hyd. No. 3

Swale (Unveg, 25-yr)

Hydrograph type	= SCS Runoff	Peak discharge	= 23.19 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 7.280 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 19.10 min
Total precip.	= 3.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 73,612 cuft



SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/28/13 SHEET NO. 5 of 7



gai consultants

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

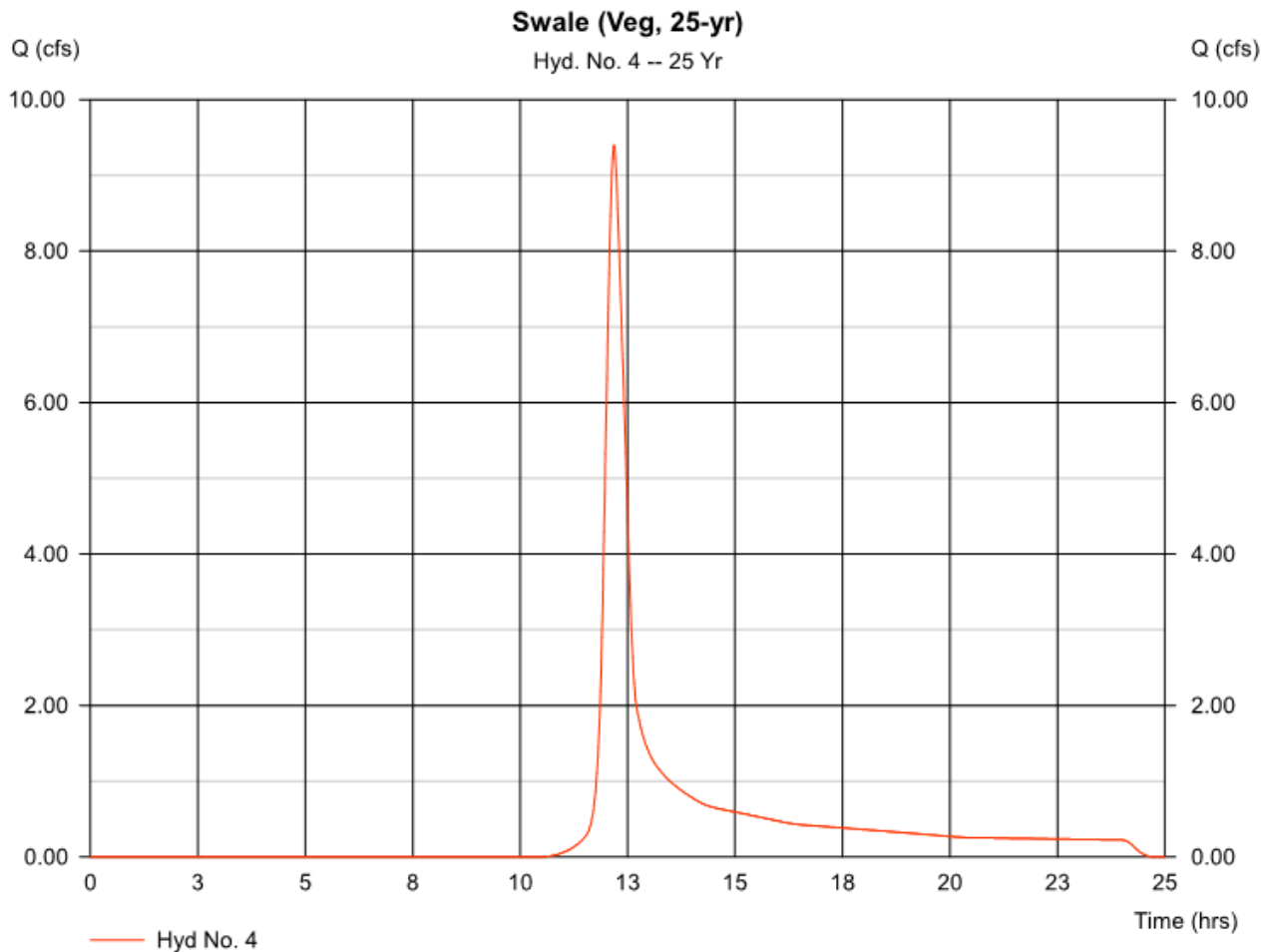
Wednesday, Jan 9 2013, 3:19 PM

Hyd. No. 4

Swale (Veg, 25-yr)

Hydrograph type	= SCS Runoff	Peak discharge	= 9.40 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 7.280 ac	Curve number	= 72
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 27.20 min
Total precip.	= 3.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 37,567 cuft



SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00CHKD. BY CRM DATE 1/28/13 SHEET NO. 6 of 7

gai consultants

SWALE DESIGN

The calculation below analyzes the use of an erosion control blanket (soil stabilization blanket) as a temporary liner along the centerline of the swale. It can be seen that the peak shear stress and peak velocity do not exceed the maximum allowed for the product in question (North American Green, S75BN Erosion Control Blanket), and for the vegetated swale. The specification sheet for the S75BN Erosion Control Blanket can be seen on the following sheet.

	Center Swale	
	S75BN (Unveg.)	S75BN (Veg.)
Channel Protective Lining		
Channel Top Width (ft)	210	210
Channel Width at Flow Depth (ft)	61.5	45.1
Channel Side Slopes (H:V)	50	50
Channel Bottom Width (ft)	10	10
Flow Depth (ft)	0.515	0.351
Area (square feet)	18.4	9.7
Wetted Perimeter (ft)	61.5	45.1
Hydraulic Radius (ft)	0.30	0.21
Slope	0.010	0.010
Vegetative Lining Retardance	C	C
Manning's n	0.053	0.055
Velocity at Flow Depth (ft/s)	1.26	0.97
Flow at Flow Depth (cfs)	23.2	9.4
Required Capacity (cfs)	23.2	9.4
Minimum Required Freeboard (ft)	0.30	0.30
Total Depth Required (ft)	0.82	0.65
Actual Depth (ft)	2.00	2.00
Allowable Velocity (ft/s)	5.00	3.00
Actual Velocity (ft/s)	1.26	0.97
Shear Stress at Flow Depth (lb /sf)	0.32	0.22
Max. Allowable Shear Stress (lb/sf)	1.60	N/A
Froude Number	0.41	0.37

The design of the channel shows that the capacity and channel lining is adequate to pass the 25-year, 24-hour storm peak flow.

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/28/13 SHEET NO. 7 of 7



gai consultants



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 Poseyville, Indiana 47633
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 Fax 812.867.0247
 www.nagreen.com

Material and Performance Specification S75BN Erosion Control Blanket

Description	
<p>The short-term single net erosion control blanket shall be a machine-produced mat of 100% agricultural straw with a functional longevity of up to 12 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a 100% biodegradable woven natural organic fiber net. The netting shall consist of machine directional strands formed from two intertwined yarns with across directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form approximate 0.50 x 1.0 (1.27 x 2.54 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.</p> <p>The S75BN shall meet Type 2.C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) <i>FP-03 Section 713.17</i></p>	

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.24 in (6.1 mm)
Resiliency	ECTC Guidelines	81.4%
Water Absorbency	ASTM D1117	257%
Mass/Unit Area	ASTM 6475	9.99 oz/yd ² (339.7 g/m ²)
Swell	ECTC Guidelines	15.7%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	6.92 oz-in
Light Penetration	ECTC Guidelines	9.1%
Tensile Strength -MD	ASTM D6818	187.2 lbs/ft (2.78 kN/m)
Elongation - MD	ASTM D6818	6.7%
Tensile Strength - TD	ASTM D6818	193.2 lbs/ft (2.86 kN/m)
Elongation - TD	ASTM D6818	8.5%

Material Content		
Matrix	100% Straw Fiber	0.5 lbs/yd ² (0.27 kg/m ²)
Netting	Top side only, Leno woven 100% biodegradable natural organic fiber	9.3 lb/1000 ft ² (4.5 kg/100 m ²) approx. weight
Thread	biodegradable	

Maximum Permissible Shear Stress	
Unvegetated Shear Stress	1.60 lbs/ft ² (76 Pa)
Unvegetated Velocity	5.00 ft/s (1.52 m/s)

Standard Roll Sizes		
Width	6.67 ft (2.03 m)	8.0 ft (2.44 m)
Length	108 ft (32.92 m)	112 ft (34.14 m)
Weight ± 10%	46.4 lbs (21.05 kg)	58 lbs (26.31 kg)
Area	80 yd ² (66.9 m ²)	100 yd ² (83.61 m ²)

Slope Design Data: C Factors			
Slope Length (L)	Slope Gradients (S)		
	≤ 3:1	3:1 - 2:1	≥ 2:1
≤ 20 ft (6 m)	0.029	NA	NA
20-50 ft	0.11	NA	NA
≥ 50 ft (15.2 m)	0.19	NA	NA

Bench Scale Testing (NTPEP)		
Test Method	Parameters	Results
ECTC 2 Rainfall	50 mm (2 in)/hr-30 min 100mm (4 in)/hr-30 min 150 mm (6 in)/hr-30 min	SLR** = 6.63 SLR** = 7.25 SLR** = 7.92
ECTC 3 Shear Res.	Shear at 0.50 inch soil loss	2.07 lbs/ft ²
ECTC 4 Germination	Top Soil, Fescue, 21 day incubation	464% improvement of biomass

* Bench Scale tests should not be used for design purposes
 ** Soil Loss Ratio = Soil Loss Bare Soil/Soil Loss with RECP

Roughness Coefficients- Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.055
0.50 - 2.0 ft	0.055 - 0.021
≥ 2.0 ft (0.60 m)	0.021

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Tensar International Corporation warrants that at the time of delivery the product furnished hereunder shall conform to the specification stated herein. Any other warranty including merchantability and fitness for a particular purpose, are hereby executed. If the product does not meet specifications on this page and Tensar is notified prior to installation, Tensar will replace the product at no cost to the customer. **This product specification supersedes all prior specifications for the product described above and is not applicable to any products shipped prior to January 1, 2011.**

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

RT. 648 CAP COLLECTION CHANNEL

BY KMB2 DATE 1/22/2013 PROJ. NO. C121043.00CHKD. BY CRM DATE 1/23/2013 SHEET NO. 1 of 4

gai consultants

INTRODUCTION

The cap collection channel is necessary in order to collect runoff from areas along the outer embankment of the proposed capped Auxiliary Fly Ash Pond along Rt. 648 and to prevent it from entering the roadside diversion channel. The channel will span the length of the proposed capped facility, and will extend around the south end of the proposed facility which will outlet onto a proposed riprap blanket. This document serves to present the hydrologic and hydraulic information and the channel design.

HYDROLOGY

Curve Number: 89

Precipitation: 3.96 in.

Drainage Area: 3.5 Acres

Time of Concentration: 5 min.

Reference

Unvegetated graded slopes

NOAA Precipitation Frequency Data Server (25-yr, 24-hr)

AutoCAD Civil 3D 2012

Hydraflow Hydrographs 2004

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

RT. 648 CAP COLLECTION CHANNEL

BY KMB2 DATE 1/22/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/23/2013 SHEET NO. 2 of 4



gai consultants

DESIGN FLOW

The computer program Hydraflow Hydrographs 2004 was run to estimate the design flow for the collection channel. The 25-year, 24-hour storm was evaluated and the resulting hydrograph can be seen below.

Hydrograph Plot

Hydraflow Hydrographs by Intellisolve

Tuesday, Jan 8 2013, 11:19 AM

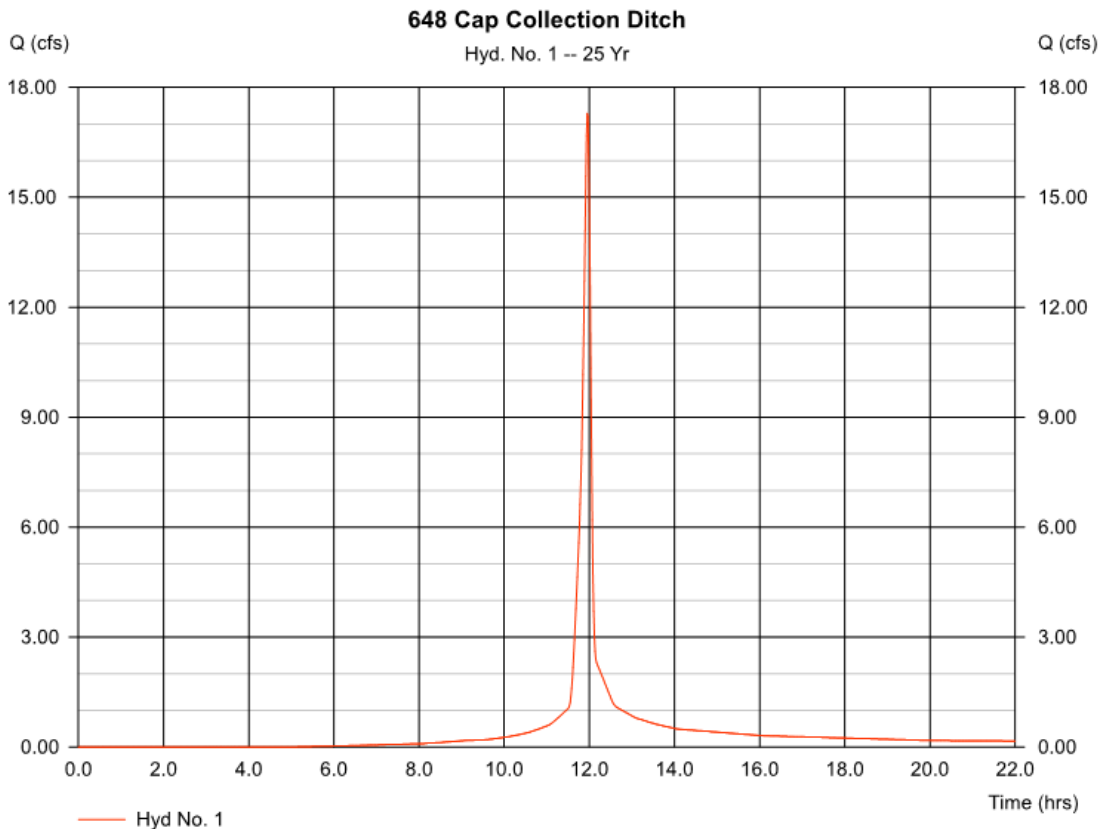
Hyd. No. 1

648 Cap Collection Ditch

Hydrograph type = SCS Runoff
 Storm frequency = 25 yrs
 Drainage area = 3.500 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 3.96 in
 Storm duration = 24 hrs

Peak discharge = 17.29 cfs
 Time interval = 1 min
 Curve number = 89
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 5.00 min
 Distribution = Type II
 Shape factor = 484

Hydrograph Volume = 36,496 cuft



SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURERT. 648 CAP COLLECTION CHANNELBY KMB2 DATE 1/22/2013 PROJ. NO. C121043.00CHKD. BY CRM DATE 1/23/2013 SHEET NO. 3 of 4

gai consultants

COLLECTION CHANNEL DESIGN

The channel will be evaluated using North American Green S75BN Erosion Control Blanket, for both unvegetated and vegetated conditions. The specification sheet for the specific lining can be seen on the following page.

	Cap Collection Channel	
	S75BN (Unveg.)	S75BN (Veg.)
Channel Protective Lining		
Channel Top Width (ft)	10.75	12
Channel Width at Flow Depth (ft)	8.64	10.47
Channel Side Slopes (H:V)	2.5	2.5
Channel Bottom Width (ft)	2	2
Flow Depth (ft)	1.328	1.69
Bottom Width:Depth (12:1 max)	1.5	1.2
Area (square feet)	7.1	10.6
Wetted Perimeter (ft)	9.2	11.1
Hydraulic Radius (ft)	0.77	0.95
Slope	0.005	0.005
Vegetative Lining Retardance	C	C
Manning's n	0.036	0.062
Velocity at Flow Depth (ft/s)	2.45	1.64
Flow at Flow Depth (cfs)	17.3	17.3
Required Capacity (cfs)	17.3	17.3
Minimum Required Freeboard (ft)	0.30	0.30
Total Depth Required (ft)	1.63	1.99
Actual Depth (ft)	1.75	2.00
Allowable Velocity (ft/s)	5.00	3.00
Actual Velocity (ft/s)	2.45	1.64
Shear Stress at Flow Depth (lb /sf)	0.41	0.53
Max. Allowable Shear Stress (lb/sf)	1.60	NA
Froude Number	0.48	0.29

The results show that the required channel dimensions are:

Bottom Width = 2 feet

Top Width = 12 feet

Side Slopes = 2.5H:1V

Total Depth = 2 feet

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURERT. 648 CAP COLLECTION CHANNELBY KMB2 DATE 1/22/2013 PROJ. NO. C121043.00CHKD. BY CRM DATE 1/23/2013 SHEET NO. 4 of 4

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Material and Performance Specification S75BN Erosion Control Blanket

Description				
<p>The short-term single net erosion control blanket shall be a machine-produced mat of 100% agricultural straw with a functional longevity of up to 12 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a 100% biodegradable woven natural organic fiber net. The netting shall consist of machine directional strands formed from two intertwined yarns with across directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form approximate 0.50 x 1.0 (1.27 x 2.54 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.</p> <p>The S75BN shall meet Type 2.C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) <i>FP-03 Section 713.17</i></p>				
Material Content				
Matrix	100% Straw Fiber	0.5 lbs/yd ² (0.27 kg/m ²)		
Netting	Top side only, Leno woven 100% biodegradable natural organic fiber	9.3 lb/1000 ft ² (4.5 kg/100 m ²) approx. weight		
Thread	biodegradable			
Standard Roll Sizes				
Width	6.67 ft (2.03 m)	8.0 ft (2.44 m)		
Length	108 ft (32.92 m)	112 ft (34.14 m)		
Weight ± 10%	46.4 lbs (21.05 kg)	58 lbs (26.31 kg)		
Area	80 yd ² (66.9 m ²)	100 yd ² (83.61 m ²)		
Bench Scale Testing (NTPEP)				
Test Method	Parameters	Results		
ECTC 2 Rainfall	50 mm (2 in)/hr-30 min 100mm (4 in)/hr-30 min 150 mm (6 in)/hr-30 min	SLR** = 6.63 SLR** = 7.25 SLR** = 7.92		
ECTC 3 Shear Res.	Shear at 0.50 inch soil loss	2.07 lbs/ft ²		
ECTC 4 Germination	Top Soil, Fescue, 21 day incubation	464% improvement of biomass		
* Bench Scale tests should not be used for design purposes ** Soil Loss Ratio = Soil Loss Bare Soil/Soil Loss with RECP				
Index Property			Test Method	Typical
Thickness	ASTM D6525	0.24 in (6.1 mm)		
Resiliency	ECTC Guidelines	81.4%		
Water Absorbency	ASTM D1117	257%		
Mass/Unit Area	ASTM 6475	9.99 oz/yd ² (339.7 q/m ²)		
Swell	ECTC Guidelines	15.7%		
Smolder Resistance	ECTC Guidelines	Yes		
Stiffness	ASTM D1388	6.92 oz-in		
Light Penetration	ECTC Guidelines	9.1%		
Tensile Strength –MD	ASTM D6818	187.2 lbs/ft (2.78 kN/m)		
Elongation – MD	ASTM D6818	6.7%		
Tensile Strength – TD	ASTM D6818	193.2 lbs/ft (2.86 kN/m)		
Elongation – TD	ASTM D6818	8.5%		
Maximum Permissible Shear Stress				
Unvegetated Shear Stress	1.60 lbs/ft ² (76 Pa)			
Unvegetated Velocity	5.00 ft/s (1.52 m/s)			
Slope Design Data: C Factors				
	Slope Gradients (S)			
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1	
≤ 20 ft (6 m)	0.029	NA	NA	
20-50 ft	0.11	NA	NA	
≥ 50 ft (15.2 m)	0.19	NA	NA	
Roughness Coefficients- Unveg.				
Flow Depth	Manning's n			
≤ 0.50 ft (0.15 m)	0.055			
0.50 – 2.0 ft	0.055 – 0.021			
≥ 2.0 ft (0.60 m)	0.021			
Proud Participant of:				

Tensar International Corporation warrants that at the time of delivery the product furnished hereunder shall conform to the specification stated herein. Any other warranty including merchantability and fitness for a particular purpose, are hereby executed. If the product does not meet specifications on this page and Tensar is notified prior to installation, Tensar will replace the product at no cost to the customer. **This product specification supersedes all prior specifications for the product described above and is not applicable to any products shipped prior to January 1, 2011.**

Coal Combustion Residuals Inflow Design Flood Control System Plan

American Electric Power
West Pond
Glen Lyn Power Plant
Glen Lyn, Virginia

GAI Project Number: C121043.12

April 2026



BOUNDLESS ENERGYSM

Prepared by: GAI Consultants, Inc.
Pittsburgh Office
385 East Waterfront Drive
Pittsburgh, Pennsylvania 15120

Prepared for: American Electric Power
1 Riverside Plaza
Columbus, Ohio 43215

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4.0 Conclusion2

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Appendix A Hydrologic and Hydraulic Assessment


Certification/Statement of Professional Opinion

This Inflow Design Flood Control System Plan (Plan) for the West Pond at the American Electrical Power (AEP) Glen Lyn Power Plant was prepared by GAI Consultants, Inc. (GAI). The Plan is based on certain information that, other than for information GAI originally prepared, GAI has relied on but not independently verified. This Certification/Statement of Professional Opinion is, therefore, limited to the information available to GAI at the time the Plan was written.

On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the Commonwealth of Virginia that the Closure Plan has been prepared in accordance with good and accepted engineering practices as exercised by other engineers practicing in the same discipline(s), under similar circumstances, at the same time, and in same locale. It is my professional opinion that the Plan was prepared consistent with the requirements of §257.102 of the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (CCR Rule), as required by §257.82(c) of the CCR Rule. It is also my professional opinion that the Plan was prepared consistent with the requirements of §9VAC20-81-800 of the Virginia Code.

The use of the word "certification" and/or "certify" in this document shall be interpreted and construed as a Statement of Professional Opinion and is not and shall not be interpreted or construed as a guarantee, warranty, or legal opinion.

GAI Consultants, Inc.


Kevin M. Bortz
Senior Engineering Manager 2

Date 04/29/2016



1.0 Introduction

The Glen Lyn Power Station (Station) is owned by Appalachian Power Company, doing business as American Electric Power (AEP) and is located in Giles County, Virginia (VA). The Station includes West Pond (Site), which operated as an ash pond until the early 1970s, when an adjacent landfill was constructed. The West Pond is currently used as a sedimentation pond.

The Site is considered to be a part of the Auxiliary Ash Pond Complex and has been operated and maintained in accordance with VA Department of Environmental Quality (VDEQ) regulations. The Site is permitted as a dam through the Division of Dam Safety and Floodplain Management of the VA Department of Conservation and Recreation (VDCR) (VDCR Inventory Number 071008).

2.0 Purpose

This Inflow Design Flood Control System Plan (Plan) is prepared pursuant to the requirements in the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," published in the Federal Register on April 17, 2015, with an effective date October 19, 2015 (CCR Rule), §257.82(c) [40 CFR §257.82(c)]. 40 CFR §257.82 requires CCR surface impoundments to have an inflow design flood control system and §257.82(a)(3) outlines the design flood for CCR surface impoundments. AEP has determined that the Auxiliary Ash Pond Complex is a significant hazard potential CCR surface impoundment, and as such, the inflow design flood for the West Pond portion of the Complex shall be the 1,000-year, 24-hour storm. This plan has been prepared to demonstrate that the inflow design flood control system at the Site adequately manages flow during the 1,000-year storm. Flood controls at the Site include a spillway lined with fabric-formed concrete.

3.0 Initial Inflow Design Flood Control System Plan

This Plan provides a description of the Impoundment design and hydrologic and hydraulic (H&H) capacity.

3.1 Site Configuration

Current conditions of the Site include an existing diversion channel located along the western side of the Site and a leachate holding basin to the south. The Site spillway discharges across the northern side into a channel that runs to the New River. The spillway weir crest is trapezoidal with a crest elevation of 1,532 feet.

3.2 Flow Into Surface Impoundment

The Site receives surface runoff from the adjacent landfill to the south (which is currently inactive) via perimeter collection channels that discharge to the Site at the southwest and southeast corners of the pond.

The precipitation data defining the 1,000-year flood event is 6.64 inches of precipitation with a duration of 24 hours. The direct runoff volume for the 1,000-year storm to the impoundment was calculated to be 64.5 acre-feet, and the peak inflow rate is 656 cubic feet per second (cfs).

3.3 Flow From Surface Impoundment

As required by §257.82(a)(2), an inflow design flood control system (IDFCS) must be in place for the Site that is designed, constructed, operated, and maintained to control flow from the impoundment for the Inflow Design Flood (1,000-year). The spillway structure is the main IDFCS for the Site as shown in the drawings and photographs (Appendix A). The analyses in this assessment consider only discharge via the spillway.

The spillway weir crest is a trapezoid with a bottom width of 91 feet, 2H:1V side slopes, and a crest elevation of 1,532 feet. The spillway channel slopes at 33 percent down the embankment.

and then at a 10 percent grade into a receiving channel. The downstream area of the Site spillway is through an undeveloped, wooded valley that drains to the New River.

In this Plan, management of the inflow design flood is defined as having the capacity to convey the peak discharge resulting from the flood. The peak discharge from the Site for the 1,000-year storm is 653 cfs.

3.4 Surface Water Requirements

40 CFR 257.3-3 states that “a facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.” DEQ administers the NPDES program in Virginia under the VPDES program. The Site is regulated under an existing VPDES Permit, which functions to satisfy the requirements of § 257.82(b) of the CCR Rule.

3.5 Hydrologic and Hydraulic Capacity Requirements

The Federal CCR Rule states that significant hazard surface impoundments must be designed to effectively manage the 1,000-year storm event. As such, the 1,000-year, 24-hour storm was modeled to determine if the impoundment is in compliance with the CCR Rule.

The 1,000-year storm was routed through the impoundment using the United States Army Corps of Engineers HEC-HMS program (version 4.9) to identify if the impoundment’s storage and discharge capabilities are in compliance with the CCR Rule. Refer to Appendix A for the H&H Assessment which includes routing calculations for the 1,000-year storm.

As described in the H&H Assessment (Appendix A), when the 1,000-year storm occurs, modeling shows that the peak water surface elevation in the West Pond will be 1,533.6 feet, as compared to an impoundment crest elevation of 1,536 feet. The peak discharge through the spillway structure is approximately 653 cfs and the spillway channel is capable of conveying the discharge away from the Site.

The hydraulic capacity estimate demonstrates that Impoundment has adequate storage and discharge capability to pass the 1,000-year event. The Impoundment is therefore in compliance with the CCR Rule.

4.0 Conclusion

A hydrologic and hydraulic assessment was conducted to estimate the water surface elevation in and discharge from the West Pond for the 1,000-year event. It was found that the Station’s West Pond has adequate storage and discharge capability to pass the 1,000-year event as required for a high hazard impoundment by the CCR Rule.

5.0 References

1. United States Environmental Protection Agency *40 CFR Parts 257 and 261 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule*. April 17, 2015.
2. GAI Consultant’s Inc., “*West Pond Temporary Spillway Report, Glen Lyn Station, Virginia.*” January, 2019.

APPENDIX A

H&H Assessment

SUBJECT AEP - Glen Lyn Power Station – West Pond

Hydrologic and Hydraulic Capacity Assessment

BY AbeleCE

DATE 04/08/2026 PROJ. NO. C121043.12

CHKD. BY WebstDI

DATE 04/21/2026



gai consultants

APPENDIX A

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*Appendix sheet numbers correspond to *italic* numbers in the upper right hand corner of each page.

SUBJECT AEP - Glen Lyn Power Station – West PondHydrologic and Hydraulic Capacity AssessmentBY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12CHKD. BY WebstDI DATE 04/21/2026

gai consultants

OBJECTIVE

The purpose of this assessment is to estimate the hydrologic and hydraulic (H&H) capacity for the current site configuration at the Glen Lyn Auxiliary Fly Ash Pond Complex (Complex) containing the West Pond, located at the Glen Lyn Power Station (Station) in Giles County, Virginia, for the inflow design flood event to show compliance with the updated CCR Rule.

Section 257.82 of the Environmental Protection Agency (EPA) Coal Combustion Residual (CCR) Rule established in April 2015 states that “the inflow design flood control system (for CCR surface impoundments) must adequately manage flow into the Impoundment during and following the peak discharge of the inflow design flood.” The Complex is classified as a High Hazard dam by the Virginia Department of Conservation and Recreation (VA DCR) with a VA DCR Identification Number for the dam of 071008. Per the CCR Rule, the inflow design flood is the 1,000-year event.

This calculation will estimate peak discharges for the 1,000-year event for surface runoff control structures (West Pond spillway) that control and contain stormwater discharge from the impoundment. The peak discharge will be compared to the calculated hydraulic capacity for the structure to demonstrate compliance with the CCR Rule.

METHODOLOGY

Modeling for the 1000-year event for the West Pond spillway was done using the United States Army Corps of Engineers computer program HEC-HMS. Drainage areas to site features were delineated using project mapping. TR-55 methodology was previously used to determine the runoff curve number and time of concentration input design parameters for the HEC-HMS program. Rainfall data for the site was obtained from NOAA Atlas 14.

REFERENCES

1. Hydrologic Modeling System (HEC-HMS), Version 4.9, U.S Army Corps of Engineers Institute for Water Resources, Hydraulic Engineering Center, January 20, 2022.
2. TR-55, Urban Hydrology For Small Watersheds, Natural Resources Conservation Services, June 1986.
3. NOAA Atlas 14. Rainfall data for Glen Lyn, Virginia.

SUBJECT AEP - Glen Lyn Power Station – West Pond

Hydrologic and Hydraulic Capacity Assessment

BY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12

CHKD. BY WebstDI DATE 04/21/2026



gai consultants

HYDROLOGY

PRECIPITATION

Rainfall data for the site was obtained from Reference 4. The 1,000-year, 24-hour event rainfall accumulation is 6.64 inches.



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
24-hr	2.06 (1.94-2.20)	2.46 (2.32-2.62)	2.98 (2.80-3.17)	3.40 (3.19-3.62)	3.98 (3.72-4.24)	4.45 (4.14-4.74)	4.93 (4.56-5.26)	5.43 (4.99-5.81)	6.11 (5.55-6.55)	6.64 (5.98-7.15)

WATERSHED AREA, RUNOFF COEFFICIENTS, AND TIME OF CONCENTRATION

The results of the previous hydrology calculation were coded into HEC-HMS. The previous calculation is included as Attachment 1 to this calculation brief.

HYDRAULICS

WEST POND SPILLWAY

The computer program HEC-HMS was used to evaluate the 1,000-year, 24-hour storm event for the West Pond spillway. Copies of the HEC-HMS inputs are presented in the following images and tables.

SUBJECT AEP - Glen Lyn Power Station – West PondHydrologic and Hydraulic Capacity AssessmentBY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12CHKD. BY WebstDI DATE 04/21/2026

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Storm Data:

Met Name: 1000-YR	
Storm Type:	HYDRO35 TP40 TP49
Annual-Partial Conversion:	--None--
Annual-Partial Ratio:	1.00
Storm Duration:	1 Day
Intensity Duration:	5 Minutes
Intensity Position:	50 Percent
Area Reduction:	--None--
Curve:	Uniform For All Subbasins
Duration	Depth (IN)
5 Minutes	0.694
15 Minutes	1.370
1 Hour	3.240
2 Hours	3.770
3 Hours	3.980
6 Hours	4.790
12 Hours	5.880
1 Day	6.640

Stage-Storage Table:

Elevation (FT)	Storage (ACRE-FT)
1524.0	0.000
1526.0	0.533
1528.0	0.928
1530.0	1.578
1532.0	2.585
1534.0	3.899
1536.0	4.973

Storage-Discharge Table:

Storage (ACRE-FT)	Discharge (CFS)
0.000	0.00
0.533	0.00
0.928	0.00
1.578	0.00
2.585	0.00
3.899	832.97
4.973	2455.20

SUBJECT AEP - Glen Lyn Power Station – West PondHydrologic and Hydraulic Capacity AssessmentBY AbeleCE DATE 04/08/2026 PROJ. NO. C121043.12CHKD. BY WebstDI DATE 04/21/2026

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The model was run with the same drainage area, curve number, time of concentration, and control specifications as were previously used for design.

RESULTS

HMS OUTPUT

The maximum elevation in the pond during the 1,000-year, 24-hour storm was 1,533.6', which is 2.4' below the crest of the embankment. The maximum discharge over the spillway during the 1,000-year storm was 653.3 cfs, while the design discharge for the PMP, 24-hour event was 1,355.7 cfs.

Project: 2018-11-30 REV WP Spillway		Simulation Run: 1000-YR	
Reservoir: Existing West Pond			
Start of Run:	28Mar2018, 00:00	Basin Model:	Spillway Analysis
End of Run:	29Mar2018, 12:00	Meteorologic Model:	1000-YR
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	Control 1
Volume Units: <input type="radio"/> IN <input checked="" type="radio"/> ACRE-FT			
Computed Results			
Peak Inflow:	656.433 (CFS)	Date/Time of Peak Inflow:	28Mar2018, 12:18
Peak Discharge:	653.320 (CFS)	Date/Time of Peak Discharge:	28Mar2018, 12:18
Inflow Volume:	64.527 (ACRE-FT)	Peak Storage:	3.616 (ACRE-FT)
Discharge Volume:	63.520 (ACRE-FT)	Peak Elevation:	1533.569 (FT)

The maximum water surface elevation in the West Pond during the 1,000-year storm is over 2 feet below the embankment crest, thus, the West Pond does not overtop in the 1,000-year, 24-hour event. The resulting discharge is less than half the impoundment's design discharge, therefore, the West Pond spillway can adequately convey the 1,000-year storm.

SUBJECT AEP - Glen Lyn Power Station – West Pond

Hydrologic and Hydraulic Capacity Assessment

BY AbeleCE

DATE 04/08/2026 PROJ. NO. C121043.12

CHKD. BY WebstDI

DATE 04/21/2026



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ATTACHMENT 1

HYDROLOGIC CALCULATIONS (PREVIOUSLY DEVELOPED)



West Pond Temporary Spillway VDCR Inventory No. 071008

American Electric Power
West Pond
Glen Lyn Power Plant, Glen Lyn, Virginia

GAI Project Number: C121043.07, Task 006
January 2019



Prepared by: GAI Consultants, Inc.
Murrysville Office
4200 Triangle Lane
Export, Pennsylvania 15632

Prepared for: American Electric Power
One Riverside Plaza
Columbus, Ohio 43215

West Pond Temporary Spillway, VDCR Inventory No. 071008
American Electric Power
West Pond, Glen Lyn Power Plant, Glen Lyn, Virginia

SECTION C1

Hydrology

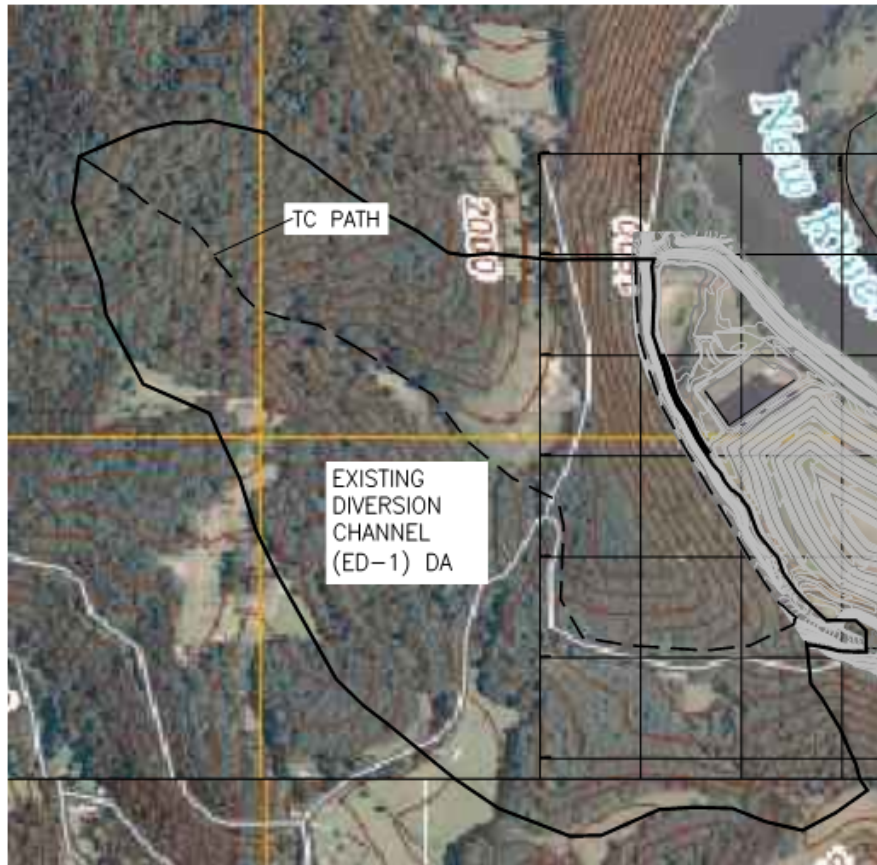


SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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WATERSHED AREAS

The drainage area to the existing diversion channel along the west side of the WP Complex area is determined by using USGS Quadrangles, along with existing site contours, as shown in the image below.



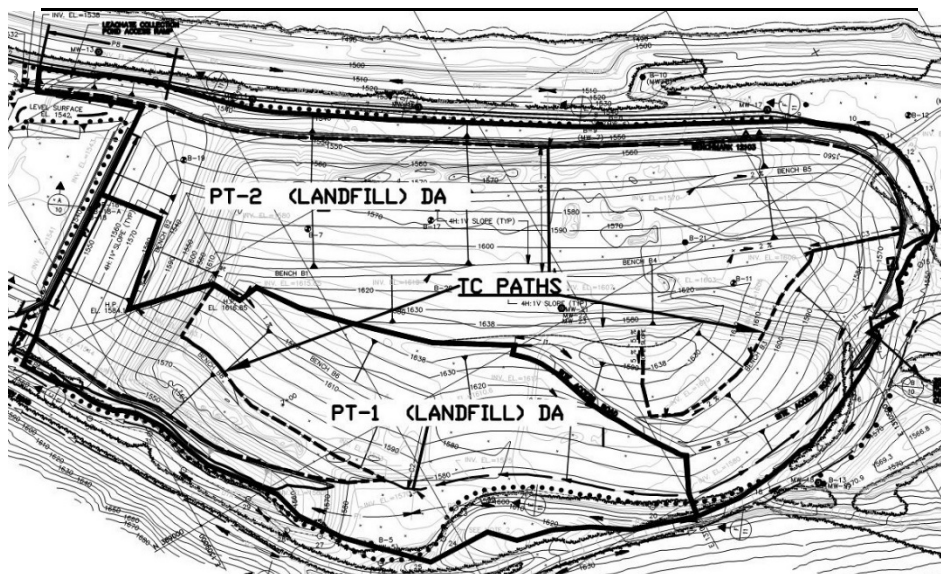
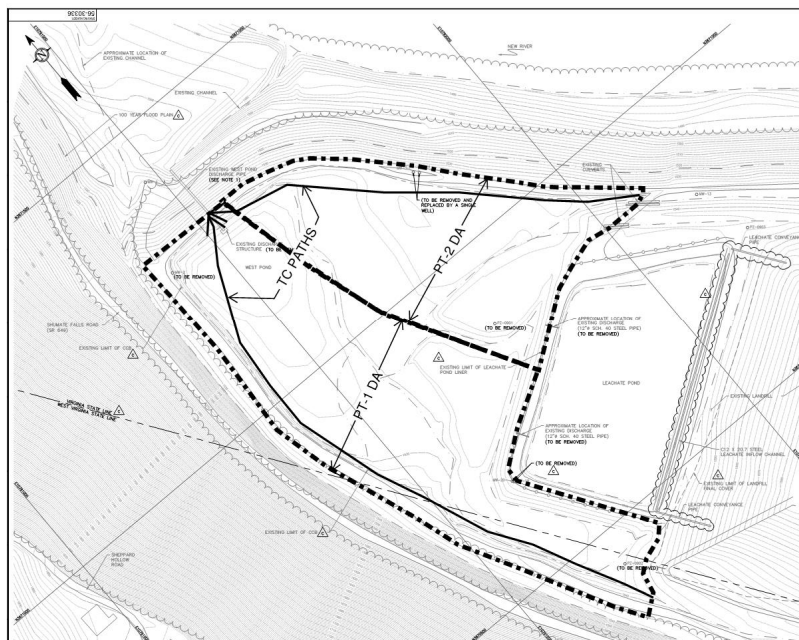
SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES



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Under existing conditions, drainage from the landfill enters the WP at points east (PT-2) and west (PT-1) of the leachate basin. For the purposes of this analysis, channels have been assumed to convey the landfill drainage, plus runoff from the WP itself, to the WP spillway. The drainage areas to PT-1 and PT-2 along the WP Complex area are determined by using a composite of a MicroStation file of the WP Complex area landfill and an AutoCAD® drawing depicting the existing WP area topography. Figures showing the landfill and WP watershed boundaries are below. For the purposes of analysis, division of the west pond area is made, maintaining the separate landfill drainage discharge points.



SUBJECT: GLEN LYN WEST POND
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BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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SOIL CONDITIONS – (Curve Number, Hydrologic Soil Group, Initial Abstraction)

Curve Number: The percentages of area covered for each respective curve number generated in the tables on the following sheet were obtained from the images shown above. The curve numbers are TR-55 AMC-II condition soils for hydrologic group C and were verified using the USGS Web Soil Survey map, shown below. Hydrologic Soil Group (HSG) "C" was assumed representative for both existing conditions and for future closure and post- closure conditions, the latter based on examination of cover soils to be obtained from the proposed borrow site.

Borrow Area Web Soil Survey Map



Tables – Hydrologic Soil Group – Summary By Map Unit				
Summary by Map Unit – Mercer and Summers Counties Area, West Virginia (WV713)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CeD	Cateache-Berks channery silt loams, 15 to 30 percent slopes	C	41.8	75.5%
CeF	Cateache-Berks channery silt loams, 30 to 70 percent slopes	C	7.3	13.2%
ChF	Cateache-Berks channery silt loams, 30 to 70 percent slopes, very stony	C	6.3	11.4%
Totals for Area of Interest			55.4	100.0%



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SUBJECT: GLEN LYN WEST POND
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Hydrologic Soil Group: To find the HSG, the USGS Web Soil Survey Map was used to identify the soils located within the borrow area, which is one of the existing off-site sources of cover soil for the future closure of the WP. The Web Soil Survey shows that the soils located at the borrow area are classified as HSG C.

Initial Abstraction: Using Eq. 2-2 and Eq. 2-4 from the TR-55 Manual. The initial abstraction values used in this analysis are presented in "HEC-HMS MODELING – INPUTS" section of this document.

CN Values:

Wooded	70
Meadow	71
Gravel	89

Drainage Area	Area of terrain type (ac)			Total Area (ac)	Weighted CN
	Wooded	Meadow	Gravel		
Existing Diversion Channel (ED1)	163.5	9.6	2.7	175.7	70

		CN Values:	Vegetated	79	
			Gravel	89	
Drainage Area	Area of terrain type (ac)		Total Area (ac)	Weighted CN	
	Vegetated	Gravel			
PT-1	17.8	0.5	18.3	79	
PT-2	25.1	1.2	26.3	79	

SUBJECT: GLEN LYN WEST POND
 SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

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The 2-year, 24-hour storm, obtained from the NOAA Atlas Precipitation Data Frequency Server and outlined in red below, is used in the time of concentration calculations on pages 8-12.



NOAA Atlas 14, Volume 2, Version 3
 Location name: Glen Lyn, Virginia, US*
 Latitude: 37.3808°, Longitude: -80.8794°
 Elevation: 1540ft*
 * 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 & aeriels](#)

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	0.282 (0.255-0.313)	0.335 (0.303-0.372)	0.399 (0.360-0.442)	0.445 (0.399-0.493)	0.502 (0.447-0.556)	0.541 (0.478-0.602)	0.580 (0.507-0.649)	0.615 (0.531-0.692)	0.658 (0.557-0.747)	0.688 (0.574-0.789)
10-min	0.450 (0.407-0.499)	0.536 (0.484-0.595)	0.638 (0.576-0.708)	0.711 (0.639-0.788)	0.800 (0.712-0.887)	0.862 (0.761-0.959)	0.922 (0.805-1.03)	0.975 (0.842-1.10)	1.04 (0.881-1.18)	1.08 (0.904-1.24)
15-min	0.562 (0.508-0.624)	0.674 (0.609-0.748)	0.808 (0.729-0.895)	0.899 (0.808-0.997)	1.01 (0.902-1.12)	1.09 (0.963-1.22)	1.17 (1.02-1.30)	1.23 (1.06-1.39)	1.31 (1.11-1.49)	1.36 (1.13-1.56)
30-min	0.771 (0.697-0.856)	0.931 (0.841-1.03)	1.15 (1.04-1.27)	1.30 (1.17-1.45)	1.50 (1.34-1.67)	1.64 (1.45-1.83)	1.79 (1.56-2.00)	1.92 (1.65-2.16)	2.08 (1.77-2.37)	2.20 (1.84-2.53)
60-min	0.961 (0.869-1.07)	1.17 (1.06-1.30)	1.47 (1.33-1.63)	1.70 (1.52-1.88)	2.00 (1.78-2.22)	2.23 (1.97-2.48)	2.46 (2.15-2.75)	2.69 (2.32-3.02)	2.99 (2.53-3.39)	3.22 (2.68-3.69)
2-hr	1.10 (0.998-1.21)	1.32 (1.20-1.46)	1.67 (1.52-1.84)	1.93 (1.75-2.13)	2.28 (2.04-2.53)	2.56 (2.27-2.84)	2.83 (2.48-3.15)	3.10 (2.68-3.48)	3.46 (2.93-3.93)	3.72 (3.11-4.28)
3-hr	1.16 (1.06-1.28)	1.39 (1.27-1.53)	1.74 (1.59-1.92)	2.02 (1.84-2.22)	2.38 (2.15-2.62)	2.67 (2.38-2.95)	2.96 (2.61-3.28)	3.25 (2.83-3.63)	3.64 (3.10-4.12)	3.93 (3.29-4.50)
6-hr	1.39 (1.28-1.51)	1.66 (1.53-1.81)	2.05 (1.89-2.24)	2.36 (2.17-2.58)	2.79 (2.53-3.05)	3.14 (2.82-3.44)	3.49 (3.09-3.85)	3.85 (3.37-4.27)	4.35 (3.71-4.89)	4.72 (3.95-5.37)
12-hr	1.66 (1.54-1.79)	1.97 (1.84-2.13)	2.41 (2.25-2.61)	2.78 (2.57-3.01)	3.30 (3.02-3.57)	3.72 (3.36-4.04)	4.16 (3.71-4.54)	4.63 (4.05-5.08)	5.28 (4.50-5.88)	5.80 (4.85-6.54)
24-hr	2.06 (1.94-2.19)	2.45 (2.31-2.61)	2.96 (2.79-3.15)	3.37 (3.17-3.59)	3.94 (3.68-4.19)	4.39 (4.09-4.68)	4.86 (4.50-5.19)	5.34 (4.91-5.71)	5.99 (5.45-6.42)	6.49 (5.86-6.98)

SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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TIME OF CONCENTRATION

The times-of-concentration are based on the existing diversion channel, and the existing landfill drainage and channels. The times-of-concentration for future closure and post-closure conditions would be comparable to the times for existing conditions, as no changes are proposed in the off-site watershed area or in the landfill.



SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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Existing Diversion Channel (ED1):

Sheet Flow

	Segment ID	
Surface Description (Table 3-1).....	Hillside	
Manning's Roughness Coefficient, n (table 3-1).....	Wooded	
Flow Length, L.....	0.4	
Two-year 24-hour Rainfall, P ₂	100	ft
Land Slope, s.....	2.45	in
Travel Time, T _t = (0.007*(n*L) ^{0.8}) / (P ₂ ^{0.5} *s ^{0.4}).....	0.14	ft/ft
	0.1878	hrs

Shallow Concentrated Flow

	Segment ID	
Surface Description (Paved / Unpaved).....	Undisturbed	
Surface Description Coefficient, C.....	Unpaved	
Flow Length, L.....	16.1435	
Watercourse Slope, s.....	1632	ft
Average Velocity, V = C*s ^{0.5}	0.343	ft/ft
Travel Time, T _t = (L) / (3600*V).....	9.46	ft/sec
	0.0479	hrs

Channel Flow

	Segment ID		
	Hillside	ED1	
Section Base, b.....	2	2	
Section Depth, d.....	2	2	
Section Side Slope 1, z ₁	2	2	
Cross Sectional Flow Area, a = b*d + z*d ²	12.0	12.0	
Wetted Perimeter, p _w = b + (2*d)*(z ² + 1) ^{0.5}	10.94	10.94	
Hydraulic Radius, r = a / p _w	1.10	1.10	
Channel Slope, s.....	0.11	0.03	
Manning's Roughness Coefficient, n.....	0.065	0.065	
Average Velocity, V = (1.49*r ^{2/3} *s ^{1/2}) / (n).....	7.99	4.56	ft/sec
Flow Length, L.....	3086	572	ft
Travel Time, T _t = (L) / (3600*V).....	0.1072	0.0349	hrs

Time of Concentration

Sheet Flow T _t	0.1878	
Shallow Concentrated Flow T _t	0.0479	
Channel Flow T _t	0.1421	
Time of Concentration, T _c	0.3778	hrs
	22.67	min

HEC-HMS requires the time of concentration in the form of Lag Time, which equals 60% of the time of concentration. (Lag time = 0.6*TC = 13.6 min).



SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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PT-1 (West Portion of WP Drainage):

Sheet Flow

	Segment ID	
Surface Description (Table 3-1).....	Hillside	
Manning's Roughness Coefficient, n (table 3-1).....	Grass	
Flow Length, L.....	0.15	
Two-year 24-hour Rainfall, P ₂	100	ft
Land Slope, s.....	2.45	in
Travel Time, T _t = (0.007*(n*L) ^{0.8}) / (P ₂ ^{0.5} *s ^{0.4}).....	0.25	ft/ft
	0.0680	hrs

Shallow Concentrated Flow

	Segment ID	
Surface Description (Paved / Unpaved).....	Undisturbed	
Surface Description Coefficient, C.....	Unpaved	
Flow Length, L.....	16.1435	
Watercourse Slope, s.....	36	ft
Average Velocity, V = C*s ^{0.5}	0.250	ft/ft
Travel Time, T _t = (L) / (3600*V).....	8.07	ft/sec
	0.0012	hrs

Channel Flow

	Segment ID	B3	P1	P1-EXTEND	
Section Base, b.....		0	2	4	
Section Depth, d.....		0.8	1.5	2	
Section Side Slope 1, z ₁		20	2	2	
Section Side Slope 2, z ₂		4	4	2	
Cross Sectional Flow Area, a = b*d + [(0.5*z ₁ *d ²) + (0.5*z ₂ *d ²)].....		7.7	9.8	16.0	
Wetted Perimeter, p _w = b + (2*d)*(z ² + 1) ^{0.5}		32.04	8.71	12.94	
Hydraulic Radius, r = a / p _w		0.24	1.12	1.24	
Channel Slope, s.....		0.02	0.032	0.010	
Manning's Roughness Coefficient, n.....		0.065	0.04	0.04	
Average Velocity, V = (1.49*r ^{2/3} *s ^{1/2}) / (n).....		1.08	7.18	4.29	ft/sec
Flow Length, L.....		572	889	987	ft
Travel Time, T _t = (L) / (3600*V).....		0.1467	0.0344	0.0639	hrs

Time of Concentration

Sheet Flow T _t	0.0680	
Shallow Concentrated Flow T _t	0.0012	
Channel Flow T _t	0.2449	
Time of Concentration, T _c	0.3141	hrs
	18.85	min

HEC-HMS requires the time of concentration in the form of Lag Time, which equals 60% of the time of concentration. (Lag time = 0.6*TC = 11.3 min).



SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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PT-2 (East Portion of WP Drainage):

Sheet Flow

	Segment ID	
Surface Description (Table 3-1).....	Hillside	
Manning's Roughness Coefficient, n (table 3-1).....	Grass	
Flow Length, L.....	0.15	
Two-year 24-hour Rainfall, P ₂	50	ft
Land Slope, s.....	2.45	in
Travel Time, T _t = (0.007*(n*L) ^{0.8}) / (P ₂ ^{0.5} *s ^{0.4}).....	0.05	ft/ft
	0.0743	hrs

Shallow Concentrated Flow

	Segment ID	
Surface Description (Paved / Unpaved).....	Undisturbed	
Surface Description Coefficient, C.....	Unpaved	
Flow Length, L.....	16.1435	
Watercourse Slope, s.....	110	ft
Average Velocity, V = C*s ^{0.5}	0.250	ft/ft
Travel Time, T _t = (L) / (3600*V).....	8.07	ft/sec
	0.0038	hrs

Channel Flow

	Segment ID	B3	C3	P5	P5-EXTEND	
Section Base, b.....		0	4	2	4	
Section Depth, d.....		0.8	0.5	2	2	
Section Side Slope 1, z ₁		20	2	2	2	
Section Side Slope 2, z ₂		4	2	4	2	
Cross Sectional Flow Area, a = b*d + [(0.5*z ₁ *d ²) + (0.5*z ₂ *d ²)].....		7.7	2.5	12.0	16.0	
Wetted Perimeter, p _w = b + (2*d)*(z ² + 1) ^{0.5}		32.04	6.24	10.94	12.94	
Hydraulic Radius, r = a / p _w		0.24	0.40	1.10	1.24	
Channel Slope, s.....		0.02	0.20	0.010	0.010	
Manning's Roughness Coefficient, n.....		0.065	0.04	0.06	0.06	
Average Velocity, V = (1.49*r ^{2/3} *s ^{1/2}) / (n).....		1.25	8.97	2.64	2.86	ft/sec
Flow Length, L.....		561	204	2116	670	ft
Travel Time, T _t = (L) / (3600*V).....		0.1246	0.0063	0.2226	0.0651	hrs

Time of Concentration

Sheet Flow T _t	0.0743	
Shallow Concentrated Flow T _t	0.0038	
Channel Flow T _t	0.4186	
Time of Concentration, T _c	0.4966	hrs
	29.80	min

HEC-HMS requires the time of concentration in the form of Lag Time, which equals 60% of the time of concentration. (Lag time = 0.6*TC = 17.9 min).

West Pond Temporary Spillway, VDCR Inventory No. 071008
American Electric Power
West Pond, Glen Lyn Power Plant, Glen Lyn, Virginia

SECTION C2

HEC-HMS Modeling

SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
 CHKD. BY KLF DATE 12/18/2018 SHEET NO. 13 OF 19



PROPOSED TEMPORARY SPILLWAY DESIGN

HEC-HMS MODELING

HEC-HMS MODELING – INPUT

The computer program HEC-HMS (HMS) is used to evaluate the full 6-, 12-, and 24-hour peak flows for the Existing Diversion Channel, PT-1 and PT-2, and ultimately for the outlet of the proposed temporary spillway. The storm event that yields the greatest peak discharge is then utilized as the design flow for temporary spillway design. The HMS inputs are presented in the following tables.

Diversion channel

ED1 HEC-HMS INPUTS			
Drainage Area =	0.2745	sq. mi	
Time of Concentration =	22.67	min	
CN Value =	70		
Lag time = .6 * TC =	13.602	min	
Initial Abstraction = 0.2S	0.8571	in	(TR55 method)
	Where S = (1000/CN)-10		
	S=	4.2857	

PT-1/West Side

PT-1 HEC-HMS INPUTS			
Drainage Area =	0.0288	sq. mi	
Time of Concentration =	18.85	min	
CN Value =	79		
Lag time = .6 * TC =	11.31	min	
Initial Abstraction = 0.2S	0.5316	in	(TR55 method)
	Where S = (1000/CN)-10		
	S=	2.6582	

SUBJECT: GLEN LYN WEST POND
SUMMARY OF 0.9 PMP CALCULATION PROCEDURES

BY MMP DATE 12/13/2018 PROJ. NO. C121043.07
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PT-2/East Side

PT-2 HEC-HMS INPUTS			
Drainage Area =	0.04125	sq. mi	
Time of Concentration =	29.8	min	
CN Value =	79		
Lag time = .6 * TC =	17.88	min	
Initial Abstraction = 0.2S	0.5316	in	(TR55 method)
	Where S = (1000/CN)-10		
	S=	2.658228	

Given a trapezoidal, broad-crested overflow spillway configuration, various geometries were assumed, and hydraulic capacities were calculated in a trial and error evaluation process to develop the proposed spillway design. Elevation-Discharge, Elevation-Storage, and Storage-Discharge relationships were generated for the HEC-HMS analyses. The side slopes of the spillway at its crest for the analyses were set at 2H:1V on the east and west sides. The analyses therefore evaluated various bottom widths to predict the resulting depth of flow at the spillway crest.

The existing crest at the northern side of the WP area and the outer slope of the embankment will be re-graded to accommodate a fabric form lined, temporary spillway designed to pass the flow of the 24-hour 0.9 PMP storm event. The calculation procedure for this analysis is detailed below.

The proposed spillway design is a trapezoidal, broad-crested overflow spillway, with a crest elevation of 1532, a bottom width of 91 feet, and side slopes of 2H:1V on the west and east sides at the crest. The crest elevation is based on avoiding excavation depths that impact the phreatic surface elevation in the existing dam. The proposed spillway will pass the design flow with a head of 2.8 feet.

The WP provides some amount of storage; however, the design flow used in the spillway configuration design and sizing is assumed to be equal to the peak flow into the WP with no routing of flow through the WP. This approach assumes negligible storage in the WP, which, as an approximation for existing conditions, while not accurate, is conservative, as the predicted outflow from and peak water level in the WP are higher than if an Elevation-Storage table based on the existing conditions is used.