History of Construction

CFR 257.73(c)(1)

Bottom Ash Complex WV DEP Dam # 07918

John E Amos Plant
Putnam County, West Virginia

October, 2016

Prepared for : Appalachian Power Company – John E Amos Plant

1530 Winfield Rd

Winfield, West Virginia 25213

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

AEP AMERICAN® ELECTRIC POWER

Document Id: GERS-16-072

Table of CONTENTS

Attachments

1.0 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.73(c)(1) with an evaluation of the facility.

2.0 DESCRIPTION OF CCR THE IMPOUNDMENT

The bottom ash pond complex is located in Putnam County, West Virginia immediately northwest of the John E. Amos Plant between State Route 817 and the Kanawha River. The pond is used for sedimentation and storage of bottom ash produced as a waste product in burning pulverized coal at the John E Amos Plant. The bottom ash pond consists of bottom ash ponds 1A and 1B. The pond complex also receives various streams of waste water from the plant.

Decant water from the bottom ash pond is piped to the reclaim water pond. Discharge water from the reclaim water pond is pumped back to the plant for reuse with the remaining flow directed to the treatment / clear water pond that is decanted to the Kanawha River.

The bottom ash pond, reclaim water pond and treatment/clear water pond were generally formed by constructing an embankment along the north, west and east sides of the pond complex. The south side is incised with the pond excavation below natural ground surface and therefore do not contain any water retaining dikes.

The north dike is approximately 800 feet long and is the highest dike at about 29 feet with a design crest width of 10 feet. The dike is comprised of concrete blocks back-filled with compacted soil that transitions to an earthen embankment. The top of the dike is at elevation 588.0 feet with the natural ground surface beneath the dikes is at about elevation 559 feet.

The dike is located across a small tributary to Bill's Creek. This portion of Bill's Creek is controlled by the backwaters of the Kanawha River. The side slopes of embankment fill are designed to be 3(H) to 1(V) that transition to design side slopes 2(H) to 1(V).

Remedial repairs were performed on the upstream slope of the dike in 1971, due to seepage through the basal rock fill. A crushed limestone filter blanket was placed and covered with a clay blanket. In 1973, an asphalt stabilization blanket was placed on the upstream slope. In 2010, the top of the dike was raised vertically 5 feet using a concrete block facing back filled with compacted soil between each wall that transitions to an earthen embankment of compacted fill.

Discharge water from the bottom ash pond flows into the reclaim water pond through a 36 inch diameter pipe. A portion of the flow into the reclaim water pond is pumped back to the plant for reuse.

The remaining portion flows through a 36 inch diameter pipe into the treatment / clear water pond that decants into a concrete weir connected to a 24 in x 38 in elliptical reinforced concrete pipe. The reinforced concrete elliptical pipe transitions to a 36 inch diameter steel pipe and then to a 36 inch diameter HDPE pipe that extends into the Kanawha along the river bed allowing the flow to be discharged into a mixing zone.

The 24 x 38 concrete elliptical pipe discharge pipe was slip lined in 2013 due to leakage at the joints.

An overflow spillway pipe (36 inch diameter) is located along the reclaim pond with an invert elevation set at 583.1 ft. Bottom ash pond 1B also has a 36 in diameter overflow spillway pipe that discharges to Bill's Creek with an invert elevation of 583.8 feet.

The interior splitter dikes between the pond 1A, 1B, the Reclaim Water Pond and the Treatment Basin will be inundated during the ½ PMF event. The dike between the Reclaim Pond and the Treatment Pond will be inundated from a smaller storm event.

3.0 SUMMARY OF OWNERSHIP 275.73(c)(1)(i)

[The name and address of the person(s) owning or operating the CCR unit: the name associated with the CCR unit: and the identification number of the CCR unit if one has been assigned by the state.]

The John E Amos Plant is located at 1530 Winfield Road, Winfield West Virginia. It is owned and operated by Appalachian Power Co. The facility operates two surface impoundments for storing CCR called the bottom ash pond 1A and bottom ash pond 1B.

4.0 LOCATION OF THE CCR UNIT 275.73 (c)(1)(ii)

[The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 ½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.]

A location map is included in Attachment A.

5.0 STATEMENT OF PURPOSE 275.73 (c)(1)(iii)

[A statement of the purpose for which the CCR unit is being used.]

The Bottom Ash Pond Complex is a surface impoundment for storing CCR. The bottom ash ponds within the complex are used for primary settling and storage of bottom ash. The bottom ash ponds are decanted to the reclaim pond. Additional facility wastewaters (non-ash) are also discharged to the pond complex. Decant water from the reclaim pond is recycled back to the plant for reuse or is decanted to a treatment / clear water pond.

6.0 NAME AND SIZE OF WATERSHED THE CCR UNIT IS LOCATED

275.73 (c)(1)(iv)

[The name and size in acres of the watershed within which the CCR unit is located.]

The Bottom Ash Pond Complex is located within the Kanawha River Water Shed (HUC 05050008) which is approximately 916.54 square miles (586,240 Acres) (USGS).

The bottom ash pond complex is comprised of diked embankments along three sides which direct storm water away from the impoundment. The watershed that drains into the bottom ash pond complex is approximately 50 acres.

7.0 DESCRIPTION OF THE FOUNDATION AND ABUTMENT MATERIALS

275.73(c)(1)(v)

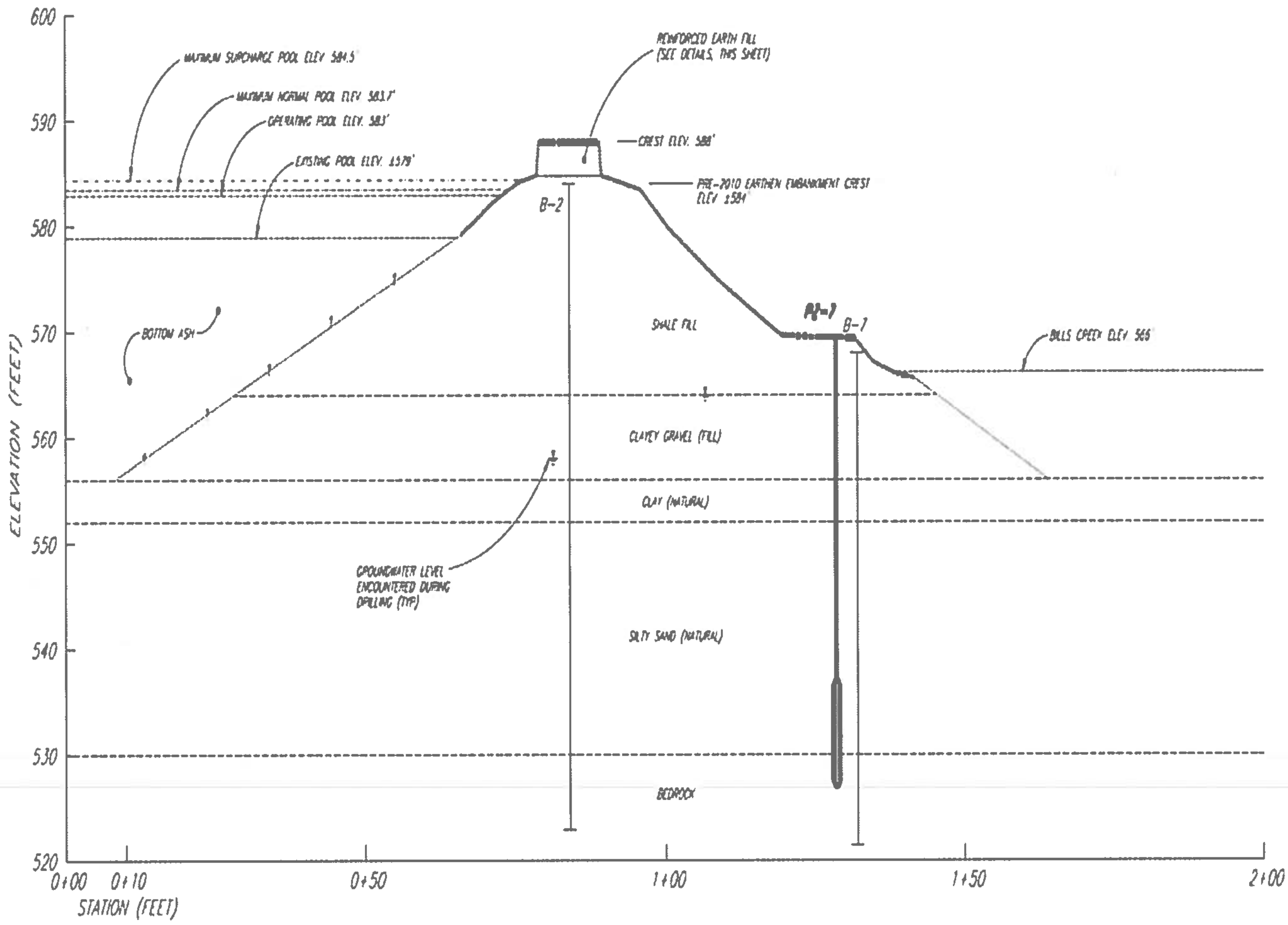
[A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is located.]

Borings were drilled along the dike embankment that penetrated stiff lean clay (shale) fill to depths ranging from 15 to 20 ft. It is underlain by 8 to 10 ft. thick layer of gravelly clay (rock-fill). Alluvial deposits underlie these embankment fills and are comprised of a 4 to 6 ft. thick deposit of soft clay that overlies silty sand.

The material properties for the embankment fills and underlying alluvial deposits are listed in the table and are illustrated in a cross sectional profile below.

Reference: Geo/Environmental Assc., Inc. 2015, "CCR Rules Certification Report John E Amos Plant, Bottom ash Pond Complex, Putnam County West Virginia" GA project No.15055009

Material	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)
Stiff Clay (Shale) Fill	135	370	27.2
Gravelly Clay Fill	135	300	32
Soft Clay	115	150	35.2
Silty Sand	130	0	36.8



Reference: Geo/Environmental Assc., Inc. 2015, "CCR Rules Certification Report John E Amos Plant, Bottom ash Pond Complex, Putnam County West Virginia" GA project No.15055009

<u>8.0</u> DESCRIPTION OF EACH CONSTRUCTED ZONE OR STAGE OF THE CCR UNIT 275.73 (c)(1)(vi)

[A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.]

The original dike was constructed of soil borrowed from the existing plant site in the early 1970s. The dike was raised in 2010 from a crest elevation of 584 ft msl to 588 ft msl to be able to pass the ½ PMP storm waters. Geotechnical details of the dike system are included in Attachment B and Attachment C.

9.0 ENGINEERING STRUCTURES AND APPURTENANCES, 275.73 (c)(1)(vii)

[At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection...]

Discharge water from the bottom ash pond flows into the reclaim water pond through a 36 inch diameter pipe. A portion of the flow into the reclaim water pond is pumped back to the plant for reuse.

The remaining portion flows through a 36 inch diameter pipe into the treatment / clear water pond that decants into a concrete weir connected to a 24 in x 38 in elliptical reinforced concrete pipe. The reinforced concrete elliptical pipe transitions to a 36 inch diameter steel pipe and then to a 36 inch diameter HDPE pipe that extends into the Kanawha River along the river bed allowing the flow to be discharged into a mixing zone.

The engineering drawings for the structures and appurtenances are included in Attachment C.

Drainage is diverted around the Bottom Ash Pond Complex by natural drainage channels and grass lined ditches. A small catchment area (50 acres) exists along the southern area of the bottom ash pond complex.

Slope protection along the outboard slope consists primarily of grass vegetation with the toe of the outboard slope protected by rip rap. The rip rap is an good condition and exhibits no deterioration and forms a uniform layer for erosion protection. All inboard slopes are protected by rip rap or have vegetated slopes that are maintained through regular mowing.

Four piezometers comprise the instrumentation for this facility that measure the phreatic surface within the embankment.

<u>10.0</u> SUMMARY OF POOL SURFACE ELEVATIONS, AND MAXIMUM DEPTH OF CCR, 275.73 (c)(1)(vii)

[...in addition to the normal operating pool surface elevation and the maximum pool elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment.]

The table below describes the normal pool elevations and maximum pool elevations as well as maximum depth of CCR within the impoundment.

Pond	*Pond Crest Elev. Ft msl*	*Normal Pool Elev. Ft msl*	*Peak Pool Elev ½ PMP Storm Ft msl*	*Maximum Depth of CCR Ft*
Pond 1A & Reclaim Pond	*588*	*583.2*	*585.43*	*24.2*
Pond 1B	*588*	*583.7*	*585.47*	*24.7*

Reference: Geo/Environmental Assc., Inc. 2015, "CCR Rules Certification Report John E Amos Plant, Bottom ash Pond Complex, Putnam County West Virginia" GA project No.15055009

<u>11.0</u> FEATURES THAT COULD ADVERSELY AFFECT OPERATION DUE TO MALFUNCTION OR MIS-OPERATION (275.73 (c)(1)(vii))

[...and any identifiable natural or manmade features that could adversely affect operations of the CCR runit due to malfunction or mis-operation]

The ponds operations could be adversely affected due to a malfunction or mis-operation of any of the pond's appurtenances. These structures include weir structures and piping between pond cells, weir structures, effluent return piping and pump structures and influent sluice pipes and structures. See design drawings in Attachment C for location and details of all appurtenances.

<u>12.0</u> DESCRIPTION OF THE TYPE, PURPOSE AND LOCATION OF EXISTING INSTRUMENTATION 275.73 (c)(1)(viii)

[A description of the type, purpose, and location of existing instrumentation.]

The bottom ash pond complex instrumentation consists of four piezometers installed along the north embankment dike and are measured on a monthly basis. A map is provided in Attachment D that depicts the piezometer locations.

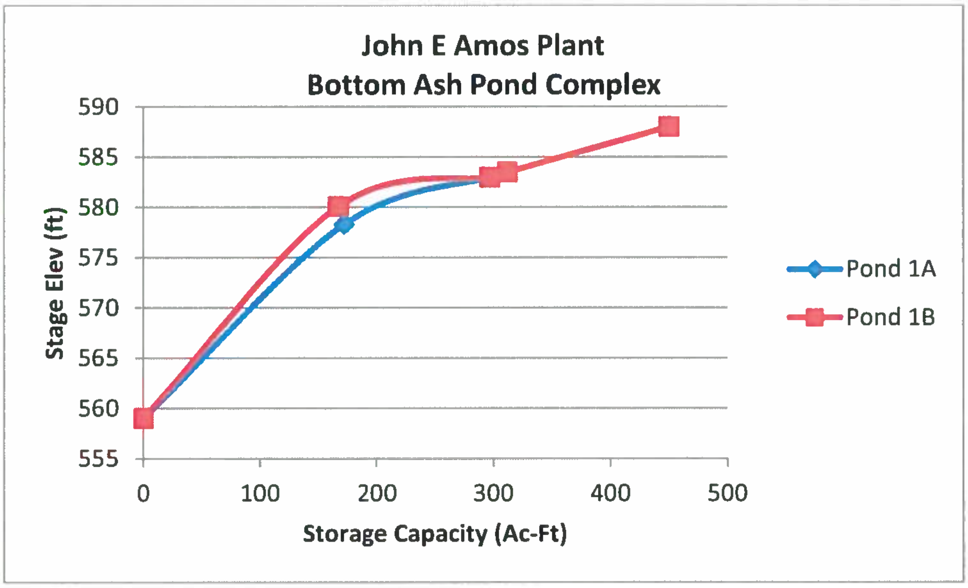
13.0 AREA – CAPACITY CURVES FOR THE CCR UNIT 275.73 (c)(1)(IX)

[Area-capacity curves for the CCR unit.]

The CCR capacity for the bottom ash ponds are listed in the following table and illustrated in the following figure.

John E Amos Plant
Bottom Ash Ponds

Pond 1A		Pond 1B	
stage elev. Ft	storage ac-ft	stage elev. ft	storage ac-ft
588	450	588	450
583.5	312	583.5	312
583	297	583	297
578.3	172	580.1	167
559	0	559	0



At stages above 583.0, the storage capacity of the entire pond complex is included within the above stage – storage capacity.

<u>14.0</u> 275.73 (c)(1)(x) DESCRIPTION OF EACH SPILLWAY AND DIVERSION

[A description of each spillway and diversion design features and capacities and calculations used in their determination.]

Discharge water from the bottom ash ponds flow into the reclaim water pond through their respective 36 inch diameter pipe into the Reclaim Water Pond. A portion of the flow into the reclaim water pond is pumped back to the plant for reuse. The remaining portion flows through a 36 inch diameter pipe to the treatment / clear water pond. From the treatment / clear water pond the water flows through a 24 in x 38 in elliptical reinforced concrete pipe to the Kanawha River. Flow continues into a 36 inch diameter steel pipe that transitions to a 36 inch diameter HDPE pipe embedded along the river bottom directing the discharge into the permitted mixing zone.

An overflow spillway pipe, 36 inch diameter, is located along the Reclaim Pond with an invert elevation set at 583.5 ft. Pond 1B also has a 36 in diameter overflow spillway pipe that discharges to Bill's Creek with an invert elevation of 583.5 feet.

Hydrology and Hydraulic Analysis which include calculations for each spillway structure are included in Attachment E.

<u>15.0</u> SUMMARY CONSTRUCTION SPECIFICATIONS AND PROVISIONS FOR SURVEILLANCE, MAINTENANCE AND REPAIR 275.73 (c)(1)(xi)

[The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.]

Construction of the Bottom Ash Complex was completed in around 1970-71.

As required by the CCR rules the bottom ash pond complex is inspected at least every 7 days by a qualified person. Also as a requirement of the CCR rules the impoundment is also inspected annually by a qualified person under the direction of a professional engineer.

If repairs are found to be necessary during any inspection they will be completed as needed. An impoundment maintenance plan is included in Attachment F.

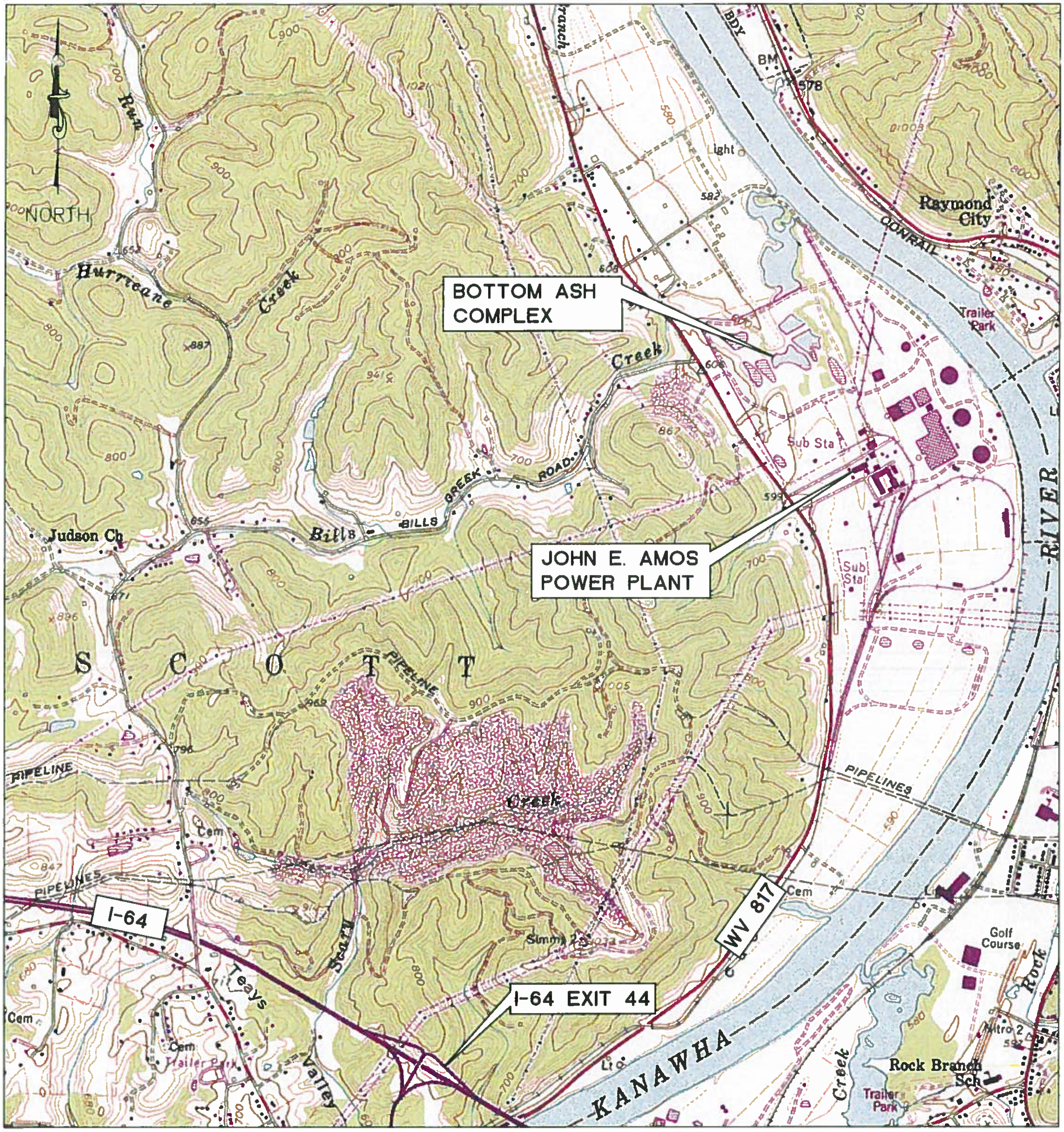
<u>16.0</u> RECORD OR KNOWLEDGE OF STRUCTURAL INSTABILITY 275.73 (c)(1)(xii)

[Any record or knowledge of the structural instability of the CCR unit.]

To date there has been no known record of structural instability of the CCR unit.

ATTACHMENT A

LOCATION MAP



SAINT ALBANS, WV
7.5 MINUTE SERIES
UPDATED 1976

SCALE 1" = 2000'

0 2000' 4000'

JOHN E. AMOS PLANT
BOTTOM ASH COMPLEX

LOCATION MAP

PUTNAM COUNTY

REV NO.

DATE

DESC.

gai consultants

CHARLESTON OFFICE
300 SUMMERS STREET,
SUITE 1100
CHARLESTON, WV 25301
304-926-8100

DATE	SCALE
7/8/13	1"=2000'

FIGURE NUMBER

1

ATTACHMENT B

DESIGN REPORTS

CCR RULES CERTIFICATION REPORT
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
PUTNAM COUNTY, WEST VIRGINIA

Prepared For:

AEP Service Corporation
Geotechnical Engineering Group
1 Riverside Plaza
Columbus, OH 43215-2373

Prepared By:

Geo/Environmental Associates, Inc.
3502 Overlook Circle
Knoxville, TN 37909

GA Project No. 15055009
December 21, 2015

GA

TABLE OF CONTENTS

APPENDICES

CCR RULES ASSESSMENT AND CERTIFICATION
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
POCA, PUTNAM COUNTY, WEST VIRGINIA
DECEMBER 21, 2015

INTRODUCTION

Geo/Environmental Associates, Inc. (GA) has performed a site visit, conducted an engineering assessment, and prepared a certification statement for the John Amos Plant - Bottom Ash Complex. These services were performed to meet specific requirements set forth in the Environmental Protection Agency's CCR Rules (i.e., 40 CFR Parts 257 and 261, "Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals From Electric Utilities, Final Rule," dated April 17, 2015). Provided in this report is a discussion of GA's findings and a certification statement pertaining to the facility. Photographs, supplemental field and laboratory data, engineering analyses, and a drawing are included in the appendices.

REVIEW OF PREVIOUS ANALYSES AND SITE DESCRIPTION

The Amos Power Plant is situated in Putnam County, West Virginia within the physiographic province of the Appalachian Plateau. A more detailed description of the site geology is included in Appendix II. The Amos Power Plant primary and ancillary facilities are located along the southern bank of the Kanawha River along S.R. 35 approximately two miles northwest of Interstate I-64 at Scary, WV. The Bottom Ash Complex consists of two dams #1A WVA ID #07918 and #1B WVA ID #07919. The dams share a common earthen embankment across Bill's Creek with a series of splitter dikes to create four distinct cells referred to as Bottom Ash Pond No. 1A, Bottom Ash Pond No. 1B, Reclaim Water Pond and the Treatment Basin.

The earliest record available of the Bottom Ash Complex is dated June 28, 1970. There was an open channel that acted as the emergency spillway of an earthen dike structure on the northwest corner of the Bottom Ash Pond No. 1B.

Modifications to the site include: the 1977 construction of a road embankment on the northwest corner of the Bottom Ash Pond No. 1B, a sedimentation pond, and a splitter dike constructed on the southeast corner of the Bottom Ash Pond No. 1A for the sedimentation of pyrites (referred to as the Pyrites Pond). The construction of the roadway embankment effectively eliminated the northwest corner of the Bottom Ash Pond No. 1B from collecting additional bottom ash and from ponding water. An open channel spillway, that was part of the original construction, was abandoned prior to 1977.

Subsequent modifications, mostly associated with the operations of the ponds, have taken place since 1977. Perhaps the most relevant has been the elimination, from active use, of the sedimentation pond located along the west side of the Bottom Ash Pond No. 1B, illustrated on the 1977 drawing. In addition, higher than anticipated operating water levels could occur sporadically in the ponds during certain plant maintenance operations. Ash handling operations can also result in the localized accumulation of bottom ash at or above the operational water levels. The current configuration of the Bottom Ash Complex is shown on the drawings in Appendix VI.

Current operations of the ponds consist of sluicing bottom ash into ponds #1A or #1B, allowing the particles to settle and the overflow to circulate to the reclaim pond from where the majority of the water is pumped back to the plant and the remaining water is allowed to overflow into the treatment pond before it is released into the Kanawha River at outfall No. 003. During the course of the year, the Bottom Ash Ponds are alternately taken out of service to allow for the removal of the bottom ash for beneficial re-use. Thus, it is commonly expected that, at the same time bottom ash slurry is sluiced into one pond, the other pond is being excavated.

The Bottom Ash Pond Complex is inspected by Plant personnel on a monthly basis and, under the direct supervision of a professional engineer, it is inspected annually. Reports of the engineer's inspection are forwarded to the West Virginia DEP Dam Safety office with the frequency established in the regulations for Class II facilities.

The main dike of the facility is about 1350 feet long. We were provided with a copy of a report titled "Report on Dam Safety Inspection Amos Fly Ash Dam and Amos Bottom Ash Dikes" dated March 1981, prepared by Woodward-Clyde Consultants. According to that report, the maximum height of the main dike above natural ground is about 24 feet.

GA performed design and analysis services for the facility in 2005 and 2008. We provided two reports, "Responses to February 15, 2005 DEP Review Letter," dated December 5, 2005 and "Responses to May 12, 2008 DEP Review Letter," dated May 22, 2008. Our work involved addressing West Virginia DEP concerns and also raising the main dikes from a minimum crest elevation of about 584 feet with a minimum crest width of about 15 feet, to a minimum elevation of 588 feet. The increased dike elevation was needed to operate the pool levels in Ash Ponds 1A and 1B and the Reclaim Pond as high as elevation 583 feet under certain operating conditions while providing adequate storm storage and routing and maintaining at least one foot of freeboard during the design storm. Our work at the time included hydrologic, hydraulic, and stability analyses. The facility previously had an open channel spillway with bottom elevation 581 feet through the main dike at the Reclaim Water Pond. In our design we proposed two 36-inch diameter polyethylene spillway pipes, both with inlet elevations of 583.5 feet.

In 2010, the main dikes were raised to the minimum proposed crest elevation of 588 feet. In addition to the main dike, the eastern side of the complex was raised to elevation 588 feet. In some areas the elevation 584 crest was wide enough such that it could be raised with 4 feet of soil fill and still maintain a minimum 10-foot-wide crest. In other areas that were too narrow to raise the crest with soil fill, a segmented retaining block system (Redi-rock) was used to achieve the elevation 588 feet crest. The drawings in Appendix VI show the areas where the block walls were constructed and a construction detail of the block wall system.

Field Investigation and Laboratory Testing

At the direction of AEPSC, eight borings were drilled through the main dike in August 2005 by H.C. Nutting Company of Charleston, West Virginia. The boring locations are shown on the drawings in Appendix VI. Boring logs are included in Appendix III. Standard Penetration Tests (SPT) were performed generally on 5-foot intervals. Relatively undisturbed samples were collected at selected locations using a thin walled sampler. Additionally, three standpipe piezometers were installed in the main dike during the drilling.

Borings B-1 through B-6 were drilled from the crest of the main dike. These borings generally encountered a stiff, lean clay, referred to as shale fill, from the ground surface to a depth of about 15 to 20 feet. Below the shale fill an interval of clayey gravel fill 8 to 10 feet thick was encountered. Below the clayey gravel, a 4 to 6-foot thick layer of soft clay and about a 20-foot thick layer of silty sand, both likely alluvial in origin, were encountered. Below the silty sand, residual weathered shale was encountered to the boring termination depths. Borings B-7 and B-8 were drilled on the downstream face of the main dike, near the water level of Bill's Creek. These two borings encountered strata consistent with borings B-1 through B-6.

Laboratory testing was performed by AEPSC on the SPT split-spoon samples and relatively undisturbed samples. Laboratory testing included moisture content, grain size analysis, classification, permeability, and strength testing. Laboratory test results are included in Appendix III. Laboratory test results are discussed in our comments regarding the stability of the dike.

SITE VISIT BY A PROFESSIONAL ENGINEER

At the request of AEPSC, GA personnel performed a site visit of the Bottom Ash Complex to observe and document the prevalent site conditions. Specifically, Seth W. Frank, P.E. (GA), performed a site inspection of the Bottom Ash Complex on August, 18, 2015. GA believes that the conditions observed, during the August 18, 2015, site visit, are representative of the conditions modeled in the assessment and analyses provided in this report. Pictures taken during the site visit are included in Appendix I.

HYDROLOGIC AND HYDRAULIC ANALYSES

GA's 2008 report included hydrologic and hydraulic analyses to meet WVDEP's design storm requirements for a Class II structure, which is one-half of the 6-hour Probable Maximum Precipitation (PMP) event (about 14 inches of rainfall in 6 hours). The spillway pipes, pool levels, and crest elevation were designed based on this event. GA used the U.S. Army Corps of Engineers HEC-1 computer program for the analyses. A summary of the results are shown in Table 1, and complete results are included in Appendix IV. As shown, the facility passes the design storm while maintaining adequate freeboard.

Table 1. Summary of Hydrologic Analyses

Pond	Crest Elev., ft	Normal Pool Elev., ft	Peak Pool Elev. During Storm, ft	Minimum Freeboard During Storm, ft
1A and Reclaim	588	583.2	585.43	2.57
1B	588	583.7	585.47	2.53

STABILITY ANALYSES AND ACTION VALUES

We have performed stability analyses in general accordance to EPA's CCR requirements.

The requirements specify the following stability assessments:

1. Static factor of safety under the long-term, maximum storage pool condition,
2. Static factor of safety under the maximum surcharge pool condition,
3. Seismic factor of safety,
4. Liquefaction factor of safety,
5. End-of-construction factor of safety,

Limit equilibrium stability analyses were performed on sections B-B and C-C to assess the stability of the embankment. The stability analyses were performed with *SLOPE/W*, a component of the *GeoStudio* software package. *SLOPE/W* is formulated in terms of moment and force equilibrium factor of safety equations. Specifically, the Morgenstern-Price method was used to calculate the factor of safety of each section.

Strength parameters for the various materials used in the analyses are listed in Table 2. The properties of the various materials that comprise the embankment were determined from laboratory tests where appropriate samples could be obtained for testing. The parameters for other materials are based on typical material properties and our experience with similar materials. The Redi-rock reinforced embankment was conservatively assumed to have the strength parameters of the shale fill.

Table 2. Summary of Strength Parameters

Material	Effective Strength Parameters	
	c′ (psf)	φ′ (°)
Bottom Ash (2)	0	28
Shale Fill (1)	370	27.2
Clayey Gravel Fill (1)	300	32
Clay (natural) (1)	150	35.2
Silty Sand (natural) (1)	0	36.8

(1) Estimated from laboratory tests (See Appendix III).
(2) Estimated based on material properties and experience with similar materials.

Stability analyses were performed with phreatic conditions at the maximum level measured in piezometers or during drilling. A summary of the safety factors is shown in Table 4. Stability analysis results are included in Appendix V.

Static Factor of Safety under the Long-Term Storage Pool Condition

The CCR regulations specify the factor of safety should meet or exceed 1.5 when the pool is at the maximum, long-term level (i.e., normal pool) and a steady state seepage condition has developed. GA selected two critical sections, designated as B-B and C-C, for the analyses. The sections and their locations are shown on the drawings in Appendix VI. GA determined the embankment material types and stratigraphy from the aforementioned drilling and laboratory testing performed by AEPSC.

Static Factor of Safety under the Maximum Surcharge Pool Condition

The CCR regulations specify the factor of safety should meet or exceed 1.4 when the pool is at the maximum surcharg pool condition. We performed the stability analyses with the pool at the peak level during the one-half PMP design storm event, discussed previously. As shown in Table 1, the peak level in either pond was elevation 585.5 feet. We used this level for the stability analyses of both B-B and C-C.

A summary of the safety factors, from the maximum surcharge stability analyses, is shown in Table 4. Stability analysis results are included in Appendix V.

Seismic Factor of Safety

The CCR regulations specify the factor of safety should meet or exceed 1.0 under seismic conditions. Furthermore, the recommended design earthquake event should have a 2% exceedance in 50 years (an approximate return period of 2,475 years). GA performed pseudo-static stability analyses on sections B-B and C-C with the elevation 583.5 normal pool level and steady state seepage conditions based on maximum, measured piezometric levels.

Based on the *2008 Interactive Deaggregations* website, provided online through the USGS Geologic Hazards Science Center, the Amos Bottom Ash Complex facility has a peak ground acceleration of 0.065g for a seismic loading event with a mean return time of 2,475 years. Conservatively assuming soft soil ground conditions above rock, translates to a peak horizontal ground surface acceleration of approximately 0.15g. Using a commonly applied factor of 0.5 times the peak horizontal acceleration yields the conservative horizontal seismic coefficient of 0.075 that was applied in the slope stability analyses.

A summary of the pseudo-static safety factors is shown in Table 4. Stability analysis results are included in Appendix V.

Liquefaction Assessment

The CCR regulations specify the liquefaction factor of safety should meet or exceed 1.2. This requirement applies to facilities with embankment materials that have been determined to contain soils susceptible to liquefaction.

We used the Standard Penetration Testing (SPT) results from the exploratory drilling program and laboratory testing results to determine the embankment soils' susceptibility to liquefaction. We used methods from Mine Safety and Health Administration's *Engineering and Design Manual for Coal Refuse Disposal Facilities* (2010) to make the determination. First, the SPT blow counts were corrected to $N_{1,60}$ values for each soil layer and a median value was calculated. Calculation spreadsheets are included in Appendix V, and the median values for embankment materials are in shown in Table 3.

Table 3. Corrected SPT Data and Soil Type

Soil	Median Corrected SPT Blow Count	Sand-like or Clay-like
Shale Fill	19.6	clay-like
Clayey Gravel	15.2	clay-like

MSHA manual guidelines state a clay-like soil can be susceptible to liquefaction if the corrected SPT value is less than 6. As shown in Table 3, using these guidelines, the shale fill and clayey gravel should not be susceptible to liquefaction. Because the embankment materials are not susceptible to liquefaction, no additional analyses were performed for this assessment. Note that this assessment does not extend to foundation materials, below the embankment.

End-of-construction Factor of Safety

The CCR regulations specify the factor of safety should meet or exceed 1.3 for the end-of-construction loading condition. End of construction factors of safety are typically calculated for new construction. Given that the facility has been in service for more than 40 years and is considered to be in its long-term condition, no additional analyses were performed.

Summary of Results

A summary of results from the slope stability analyses is provided in Table 4. *SLOPE/W* computer output, showing the modeled profiles, loading conditions, and critical failure surfaces are provided in Appendix V. As shown in the slope stability analysis results in Table 4, the factors of safety satisfy the requirements set forth in the CCR Rules.

Table 4. Summary of Slope Stability Analyses Results

Analysis Condition	Section B-B	Section C-C
Maximum Long Term Pool	2.1	2.2
Maximum Surcharge Pool	2.0	2.2
Pseudo Static (Downstream)	1.6	1.8
Pseudo Static (Upstream)	3.1	3.2

CERTIFICATION STATEMENT

Based on the site visit, the results of the field and laboratory testing of the materials used in the embankment construction, and our review of the as-built embankment geometry; it is our opinion that the Amos Plant Bottom Ash Complex has slope stability factors of safety that meet or exceed the requirements in the CCR Rules. Furthermore, based on our review of the as-built embankment geometry, current operating pool levels, and the spillway system; we believe that the facility is capable of storing/routing the runoff from one-half of the 6-hour PMP design storm event.

Accordingly, I hereby certify that the John Amos Plant – Bottom Ash Complex meets the applicable requirements in the CCR Rules. It should be clearly noted that this certification is not a legal guarantee. This certification is merely a statement by a registered professional engineer that, to the best of his knowledge, the facility meets the applicable requirements set forth in the CCR Rules. No warranties, expressed or implied, are provided.

Seth W. Frank 12-21-2015

Seth W. Frank, P.E. Date
West Virginia R.P.E. No. 20574

SETH W. FRANK REGISTERED 20574 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

GA

APPENDIX I
SITE PHOTOGRAPHS

Photograph 1. Pond 1B Spillway Pipe and Downstream Slope

Photograph 2. Reclaim Pond Spillway Pipe and Downstream Slope.

Photograph 3. Downstream Slope and Bills Creek.

Photograph 4. Redi-rock Soil Reinforcement.

Photograph 5. Pond 1B and Upstream Slope.

Photograph 6. Reclaim Pond and Upstream Slope.

RESPONSES TO MAY 12, 2008 DEP REVIEW LETTER
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
PUTNAM COUNTY, WEST VIRGINIA

Prepared For:

AEP Service Corporation
Geotechnical Engineering Group
1 Riverside Plaza
Columbus, OH 43215-2373

Prepared By:

Geo/Environmental Associates, Inc.
3502 Overlook Circle
Knoxville, TN 37909

GA Project No. 05-361
May 22, 2008

GA

TABLE OF CONTENTS

APPENDICES

Geo/Environmental Associates, Inc.

3502 Overlook Circle • Knoxville, TN 37909 • 865-584-0344 • Fax 865-584-0778 • www.geoe.com

May 22, 2008

AEP Service Corporation
Geotechnical Engineering Group
1 Riverside Plaza
Columbus, OH 43215-2373

ATTN: Mr. Pedro J. Amaya, P.E.

RE: Responses to May 12, 2008 DEP Review Letter
John Amos Plant - Bottom Ash Complex
Poca, Putnam County, West Virginia
WVDEP ID #07918 and #07919
GA File No. 05-361

Dear Mr. Amaya,

We previously provided to you a December 5, 2005 report titled "Responses to February 15, 2005 DEP Review Letter" for Ash Ponds 1A and 1B at the John Amos Plant Bottom Ash Complex. We have received a May 12, 2008 West Virginia Department of Environmental Protection (DEP) review letter regarding their review of our report. A copy of the letter is included in Appendix I. Presented herein are our responses to the DEP comments. We have summarized the DEP comments prior to each response for brevity.

RESPONSE TO DEP COMMENTS

Application Form

Comment 1: *The previously submitted application form indicates the facility will be classified as Class 3, Low Hazard. While the facility can be considered to have a low hazard potential, the storage volume and potential for environmental harm warrants a classification of 1 or 2.*

Response: We have modified the application form to indicate the facility will be classified as a Class 2 structure. The revised application form is included in Appendix II.

Comment 2: *Page 2 of the application form indicates the full PMP design storm was used in design which is not consistent with the hazard classification.*

Response: We have modified the application form to indicate the the design storm is a half PMP event (i.e., 14 inches in six hours), consistent with a Class 2 structure. The revised application form is included in Appendix II. The hydrologic hydraulic analyses have been modified with the revised design storm. The revised analyses are included in Appendix III.

Comment 3: *The application form indicates the watershed area for the facility to be 50 acres, however HEC-1 runs included in the report show an area less than 50 acres.*

Response: Previously submitted analyses included drainage areas of 0.04 square miles for Ash Pond 1A/Reclaim Pond and 0.03 square miles for Ash Pond 1B. Construction of an access road at the site will divert additional surface runoff from about 0.07 square miles to Ash Pond 1B. This area was not included in the previously submitted analyses. The revised analyses in Appendix III include the total area of 0.077 square miles (about 50 acres). It should be noted the total area for the 100-year event analyses is 0.063 square miles because the Treatment Pond area is not included in any of the analyses.

Hydraulics

Comment 1: *The writer believes the orifice flow calculations for the spillway pipes were performed using a centroid elevation at the pipe invert, but should have been at the center of pipe elevation. The writer believes the difference would be minimal, but requests comment.*

Response: As part of the revised hydrologic/hydraulic analyses that are included herein, we have also revised the referenced pipe capacity calculations. The revised analyses are included in Appendix III.

Comment 2: *The proposed spillway pipes are corrugated metal, which are not allowed by code in Class 1 or 2 structures.*

Response: The proposed spillway pipe materials have been changed from corrugated steel to high density polyethylene (HDPE). Specifically, 36-inch diameter SDR-17 pipes with an inside diameter of 31.51 inches are proposed. The hydrologic/hydraulic analyses (Appendix III), Construction Specifications (Appendix IV), and the drawings (Appendix V) have been revised accordingly. A summary of the spillway pipes and the hydrologic analyses is included in Table 1.

As described to you in a March 3, 2006 memorandum, the addition of area to the Pond 1B drainage basin results in the pond's inability to contain the 100-year storm between the maximum operating pool of 583 feet and the pipe spillway inlet of 583.5 feet, as was originally intended. Therefore, we recommended keeping the operating pool at least 0.7 feet below the pipe spillway invert (i.e., below elevation 582.8 feet) if a large precipitation event is anticipated.

Table 1. Summary of Revised Hydrologic Analyses

Pond, Crest Elev	Analysis	Initial Normal Pool Elev	Peak Pool Elev During Storm	Peak Outflow During Storm (cfs)	Freeboard During Storm (ft)
1A and Reclaim, 588	½ PMP	583.5'	585.6'	17	2.4'
1A and Reclaim, 588	½ PMP w/no outflow	583.5'	585.8'	0	2.2'
1A, 588'	100-Year Storm	583'	583.5'	0	4.5'
1B, 588	½ PMP	583.5'	585.3'	14	2.7'
1B, 588	½ PMP w/no outflow	583.5'	585.5'	0	2.5'
1B, 588'	100-Year Storm	583'	583.6'	0.4	4.4'
Reclaim, 588	100-Year Storm	583'	583.5'	0	4.5'

<u>Construction Specifications</u>

Comment 1: *The frequency of obtaining samples of the flowable fill for strength testing was not specified. Please specify.*

Response: The construction specifications have been revised to indicate compressive strength test cylinders shall be made at the frequency of 8 samples per 20 cubic yards placed, with at least 4 cylinders made per truck. The revised construction specifications are included in Appendix IV.

Comment 2: *The comment is regarding the proposed corrugated metal spillway pipes.*

Response: As stated above, the proposed spillway pipe materials have been changed to HDPE. The construction specifications have been changed accordingly.

Geo/Environmental Associates, Inc. appreciates the opportunity to be of continuing service to AEP Service Corporation. If you have any questions regarding this report, please contact the writers at (865) 584-0344.

Sincerely,
Geo/Environmental Associates, Inc.

Scott M. Arwood, P.E.

Roger W. Cecil, P.E.
WVPE Registration No. 14,367

ROGER W. CECIL
REGISTERED
14367
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

RESPONSES TO FEBRUARY 15, 2005 DEP REVIEW LETTER
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
PUTNAM COUNTY, WEST VIRGINIA

Prepared For:

AEP Service Corporation
Geotechnical Engineering Group
1 Riverside Plaza
Columbus, OH 43215-2373

Prepared By:

Geo/Environmental Associates, Inc.
3502 Overlook Circle
Knoxville, TN 37909

GA Project No. 05-361
December 5, 2005

RESPONSES TO FEBRUARY 15, 2005 DEP REVIEW LETTER
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
PUTNAM COUNTY, WEST VIRGINIA

Prepared For:

AEP Service Corporation
Geotechnical Engineering Group
1 Riverside Plaza
Columbus, OH 43215-2373

Prepared By:

Geo/Environmental Associates, Inc.
3502 Overlook Circle
Knoxville, TN 37909

GA Project No. 05-361
December 5, 2005

GA

TABLE OF CONTENTS

APPENDICES

GA

Geo/Environmental Associates, Inc.

3502 Overlook Circle • Knoxville, TN 37909 • 865-584-0344 • Fax 865-584-0778 • www.geoe.com

December 5, 2005

AEP Service Corporation
Geotechnical Engineering Group
1 Riverside Plaza
Columbus, OH 43215-2373

ATTN: Mr. Pedro J. Amaya, P.E.

RE: Responses to February 15, 2005 DEP Review Letter
John Amos Plant - Bottom Ash Complex
Poca, Putnam County, West Virginia
GA File No. 05-361

Dear Mr. Amaya,

At the request of AEP Service Corporation (AEP), Geo/Environmental Associates, Inc. (GA) has prepared these responses to a February 15, 2005 West Virginia Department of Environmental Protection (DEP) review letter regarding Ash Ponds 1A and 1B at the John Amos Plant Bottom Ash Complex. We understand the West Virginia Division of Water and Waste Management - Dam Safety Section (WVDWWM) has requested that the site shall be in compliance with state dam safety requirements. We further understand that during a March 21, 2005 meeting at the site eight issues were discussed that should be addressed. An April 20, 2005 letter prepared by WVDWWM was provided to us which lists the issues discussed. A copy of the letter has been included in Appendix I. Presented herein are a brief description of the current site conditions, a discussion of field investigation and laboratory testing, a discussion of the proposed facility modifications, and responses to the DEP comments.

SITE DESCRIPTION

The Bottom Ash Complex consists of Ash Ponds 1A and 1B, a Reclaim Water Pond, and a Treatment Pond. Water is decanted through existing low level pipes with tower inlet structures from each of the ash ponds to the Reclaim Water Pond, which provides some recirculation water to the power plant. Excess discharge is decanted to the Treatment Pond which treats the water before discharge into the Kanawha River.

We were provided topographic mapping by AEP which shows the facility was created by constructing the main dike across Bill's Creek, which is a tributary of the Kanawha River. The main dike is about 1350 feet long with a minimum crest elevation of about 584 feet. The crest of the main dike has a minimum width of about 15 feet. Secondary dikes separate the individual ponds. With the exception of the dike between Ash Pond 1A and Ash Pond 1B, the secondary dikes are generally lower than the main dike.

We were provided with a copy of a report titled "Report on Dam Safety Inspection Amos Fly Ash Dam and Amos Bottom Ash Dikes" dated March 1981, prepared by Woodward-Clyde Consultants. According to that report, the maximum height of the main dike above natural ground is about 24 feet.

The facility previously had an open channel spillway with bottom elevation 581 feet through the main dike at the Reclaim Water Pond. The open channel spillway has been filled, presumably for access road construction.

FIELD INVESTIGATION AND LABORATORY TESTING

At the direction of AEP, eight borings were drilled through the main dike in August 2005 by H.C. Nutting Company of Charleston, West Virginia. The boring locations are shown on the drawings in Appendix IX. Boring logs are included in Appendix II. Standard Penetration Tests (SPT) were performed generally on 5-foot intervals. Relatively undisturbed samples were collected at selected locations using a thin walled sampler. Additionally, three standpipe piezometers were installed in the main dike during the drilling.

Borings B-1 through B-6 were drilled from the crest of the main dike. These borings generally encountered a stiff, lean clay, referred to as shale fill, from the ground surface to a depth of about 15 to 20 feet. Below the shale fill an interval of clayey gravel fill 8 to 10 feet thick was encountered. Below the clayey gravel, a 4 to 6-foot thick layer of soft clay and about a 20-foot thick layer of silty sand, both likely alluvial in origin, were encountered. Below the silty sand, residual weathered shale was encountered to the boring termination depths. Borings B-7 and B-8 were drilled on the downstream face of the main dike, near the water level of Bill's Creek. These two borings encountered strata consistent with borings B-1 through B-6.

Laboratory testing was performed by AEP on the SPT split-spoon samples and relatively undisturbed samples. Laboratory testing included moisture content, grain size analysis, classification, permeability, and strength testing. Laboratory test results are included in Appendix II. Laboratory test results are discussed in detail later herein in our response to the comments regarding the stability of the dike.

PROPOSED MODIFICATIONS

We understand that AEP would like to operate the pool levels in Ash Ponds 1A and 1B and the Reclaim Pond as high as elevation 583 feet under certain operating conditions. To provide adequate storm storage and routing and maintain at least one foot of freeboard during the design storm, the main dike will be raised from its current elevation of about 584 feet to elevation 588 feet. In addition to the main dike, the eastern side of the complex will also need to be raised to a minimum elevation of 588 feet. The areas that need to be raised are shown on the plan view drawing in Appendix IX. As shown on the cross section drawings, portions of the main dike currently have a minimum crest width of about 15 feet at elevation 584 feet. In order to maintain a crest width of at least 10 feet, raising the crest 4 feet in these areas will require side slopes on the fill of about 0.5H:1V or steeper. As this slope is steeper than what is generally acceptable for soil fill, the fill will be reinforced with a geogrid system as shown on the drawings. We estimate about 1000 linear feet of the dike will require reinforcement. Construction specifications for the proposed fill are provided in Appendix VIII. In areas where sufficient existing crest width exists (i.e., minimum crest width approximately 26 feet) the fill shall be placed to elevation 588 feet with 2H:1V side slopes without reinforcement.

RESPONSE TO DEP COMMENTS

Comment 1: *Create a plan view map, which shows the total watershed area (drainage area). Dam Safety recognizes that the original design engineer is deceased, therefore, the existing drawings cannot be signed/sealed without considerable review and verification. It was agreed to simplify the original drawing No. 13-3550A. Pedro intends to sign and seal the simplified drawing for AEP.*

Response: The simplified plan view drawing is included in Appendix IX.

Comment 2: *The original project narrative does not adequately describe the history, operation, and maintenance of the structure. AEP will replace the narrative with up to date information.*

Response: The revised narrative is included in Appendix III.

Comment 3: *AEP will provide a hydraulic analysis for the existing dam demonstrating compliance with dam safety regulation requirements.*

Response: As discussed previously, the existing open channel spillway at the site has been filled. Moreover, AEP proposes to raise the operating pool and main dike elevation, and requested that we design new pipe spillways to comply with the dam safety requirements.

We developed watershed parameters and areas from topographic mapping provided by AEP. We then developed the required design storm, a 6-hour Probable Maximum Precipitation (PMP) event, using the Army Corps of Engineers program HMR-52. HMR-52 output is included in Appendix IV. The Army Corps of Engineers program HEC-1 was then used to perform flood routing analyses and to size potential spillway structures.

Upon review of the topographic mapping of the site, it became evident that a single spillway structure for the entire facility was not advantageous due to the current dike configuration. Specifically, the dike between Ash Pond 1A and Ash Pond 1B has a minimum elevation of 585 feet, with most of the dike at elevation 587 feet or greater. This interior dike would prevent storm water from flowing between Ash Pond 1A and Ash Pond 1B/Reclaim Water Pond/Treatment Pond, thereby decreasing the effectiveness of a single spillway structure located at the main dike in either ash pond. Therefore, we performed analyses that included a spillway structure through the main dike in Ash Pond 1B and through the main dike at the Reclaim Water Pond. The dikes between Ash Pond 1A and the Reclaim Water Pond, and between the Reclaim Water Pond and the Treatment Pond will overtop during the design storm. The dike between the Reclaim Water Pond and the Treatment Pond has a minimum elevation of about 583.5 feet. The dike between the Reclaim Water Pond and Ash Pond 1A has a minimum elevation of about 584 feet. The Treatment Pond has an existing discharge structure exiting to the Kanawha River which should provide for storm water decant below elevation 583.5 feet.

As discussed previously, AEP proposes to operate ponds with levels as high as elevation 583 feet under certain operating conditions. We chose spillway pipe invert elevations of 583.5 feet to allow for storage of runoff from the 100 year-24 hour storm event between the operating pool and the pipe invert. Flood routing analyses for the 100 year-24 hour storm which show no outflow through the spillway pipes is included in Appendix IV. In our analyses we assumed the existing dewatering structures (pipes with risers from each ash pond to the Reclaim Water Pond, from the Reclaim Water Pond to the Treatment Pond, and exiting the Treatment Pond) provide no flood routing capacity.

Excess storm flow will be discharged from Ash Pond 1B and the Reclaim Water Pond into Bill's Creek through the spillway pipes in the main dike. We performed the analyses assuming corrugated steel pipes will be used as spillway structures. The proposed spillway pipes are single 36-inch diameter, corrugated steel pipes (inside diameter 36 inches) with inlet invert elevations of 583.5 feet. Table 1 summarizes the proposed pipe structures.

Table 1. Summary of Spillway Structures

Pipe Location	Pipe	Invert Elev(ft)	Peak Pool During PMP, Elev(ft)
Discharging from Ash Pond 1B	1-36"⌀ corrugated steel, I.D.=36"	583.5	585.7
Discharging from Reclaim Water Pond	1-36"⌀ corrugated steel, I.D.=36"	583.5	586.3

Hydrologic and Hydraulic Analyses are included in Appendix IV which demonstrate that the design storm can be passed while maintaining at least one foot of freeboard at the main dike. Additionally, the analyses demonstrate the ponds can decant the peak stormwater storage in less than 10 days. Also included in Appendix IV are PMP storm analyses assuming no flow through the proposed spillway pipes which show that the facility can store the design storm without outflow.
A plan view drawing showing the proposed pipe spillway locations is included in Appendix IX. Also included in Appendix IX are pipe profiles, pipe backfill details, and trash rack details. In general, installation of the pipes will consist of the following steps. A more detailed description

is included in the Construction Specifications in Appendix VIII.

1. A trench will be excavated to stable subgrade along the proposed pipe alignment to the dimensions shown on the drawings.

2. A 6-inch thick layer of flowable fill (a low shrink grout) will be placed in the excavated trench.

3. The pipe will be placed on the flowable fill pad for its entire length.

4. Flowable fill will be placed around and above the pipe to the dimensions shown on the drawings.

5. Soil fill will be placed and compacted above the flowable fill to the required dike crest elevation.

6. A trash rack will be placed on the upstream end of the pipe.

As discussed previously, the facility had a concrete lined open channel spillway (bottom elevation 581 feet) through the main dike at the Reclaim Water Pond. The channel has been filled to about the main dike elevation. To reduce the potential for seepage and to increase the stability of the spillway plug, we recommend that the fill be excavated and the concrete lining be removed. The removal should extend through the flat (control) section of the spillway. Thereafter, soil fill should be placed and compacted in the channel to the proposed crest elevation of 588 feet.

Comment 4: *AEP will rewrite the geology consideration portion of the narrative.*

Response: The revised geology narrative is included in Appendix V.

Comment 5: *A stability analysis is required for the main embankment with tested soil parameters on the existing embankment material. AEP will provide a stability analysis with liquefaction analysis.*

Response: We developed two cross sections through the main dike, designated as B-B and C-C, based on boring data. The cross sections and their locations are shown on the drawings in Appendix IX. Laboratory test results and published data were used to develop material parameters for use in seepage, stability, and liquefaction/dynamic stability analyses. A discussion of the methodology, material parameters, and results for each analysis is included in Appendix VI. A summary of the factors of safety is shown in Table 2.

Table 2. Summary of Stability Analysis Factors of Safety

Section	Analysis Type		
	Static	Pseudostatic	Dynamic
B-B	2.08	1.63	2.30
C-C	2.19	1.70	3.38

As shown, factors of safety exceed the minimum required values. The conservative phreatic levels used in the static and pseudostatic analyses were well above those obtained during the drilling. For the dynamic analysis, the phreatic level calculated from the seepage analysis was used. We believe the dynamic factors of safety are higher than the other factors of safety because they are calculated based on modulus values not shear strength values. As shown in the results in Appendix VI, the liquefaction analysis did predict some isolated areas where liquefaction could occur. However, no permanent deformations were predicted as yield accelerations of the potential failure surfaces were not exceeded. Based on our analyses, we believe the main dike has adequate factors of safety for stability.

Comment 6: *AEP will submit a new maintenance plan.*

Response: The revised maintenance plan is included in Appendix VII.

Comment 7: *AEP will update the EAP and submit for review.*

Response: We have prepared an EAP for the Bottom Ash Complex and included it with this report under a separate cover.

Comment 4: *December 15 is the due date to submit the plan to Dam Safety for review.*

Response: No response required.

Geo/Environmental Associates, Inc. appreciates the opportunity to be of continuing service to AEP Service Corporation. If you have any questions regarding this report, please contact the writers at (865) 584-0344.

Sincerely,
Geo/Environmental Associates, Inc.

Scott M. Arwood, P.E.

Roger W. Cecil, P.E.
WVPE Registration No. 14,367

ROGER W. CECIL
REGISTERED
14367
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

ATTACHMENT C

DESIGN DRAWINGS

AMERICAN ELECTRIC POWER

JOHN E. AMOS PLANT
SCARY (WINFIELD), WEST VIRGINIA

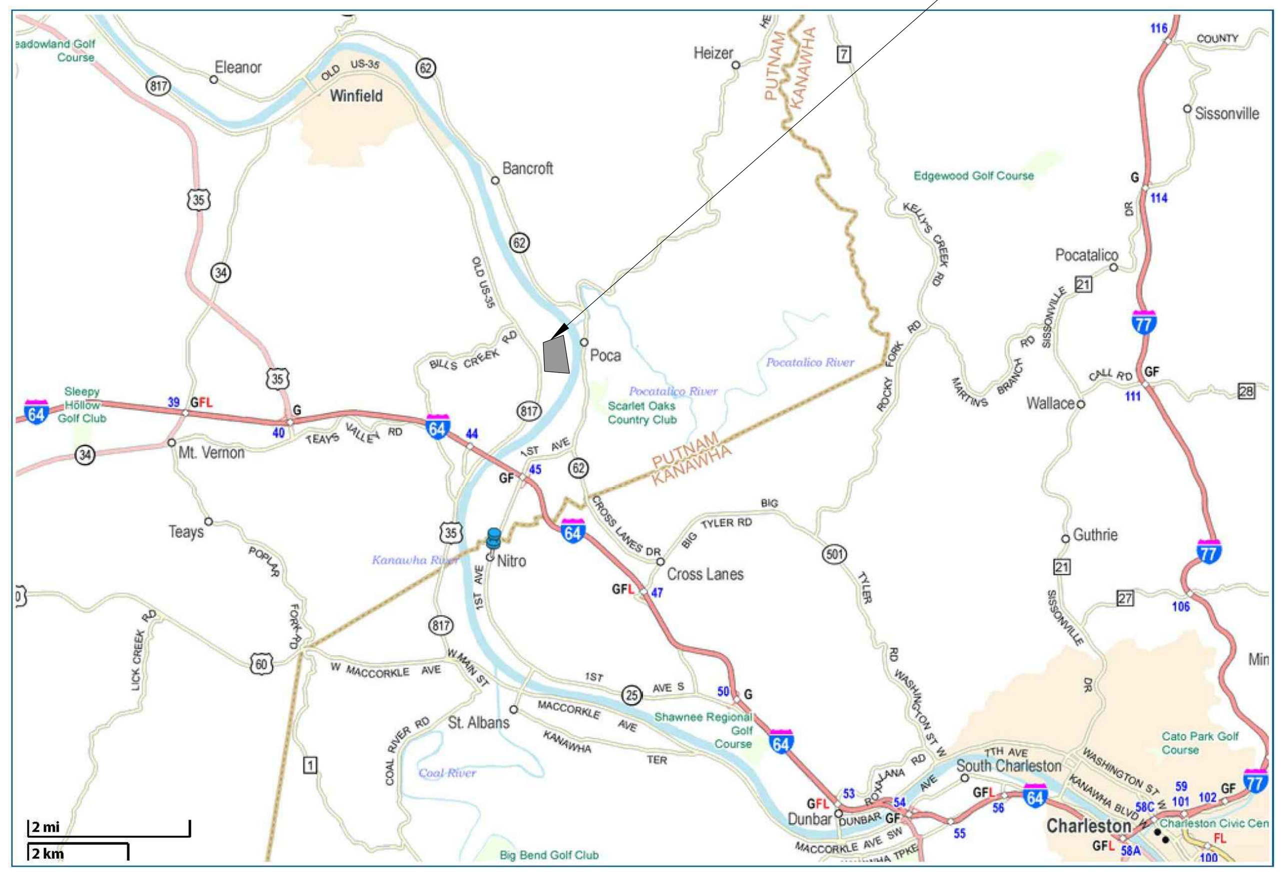
OUTFALL 003 MULTIPORT DIFFUSER

SEPTEMBER 2012

DRAWING NO.	TITLE
30330	TITLE PAGE AND DRAWING LIST
30331	NOTES
30332	OVERALL PLAN & DETAILS
30333	DIFFUSER PLAN & PROFILE
30334	ENLARGED PLAN & INSTALLATIONS DETAILS
30335	FABRICATION DETAILS
30336	FABRICATION DETAILS

REFERENCE DRAWING NO.	TITLE
03-32381E-1	OUTFALL 003 RECONSTRUCTION PLAN – PLAN VIEW & PROFILE

PROJECT SITE



WEST VIGINIA AREA MAP
N.T.S.

ENVIRON
INTERNATIONAL CORPORATION
NASHVILLE, TN

DATE	NO.	DESCRIPTION	APPD.
05SEP12	0	FOR CONSTRUCTION	

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP CONFIDENTIAL

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

APPALACHIAN POWER COMPANY
OHIO POWER COMPANY
AMOS PLANT

SCARY — WEST VIRGINIA

PIPING

OUTFALL 003
DISCHARGE DIFFUSER
TITLE PAGE AND DRAWING LIST

UNIT: 13 — DRAWING NUMBER: 30330 — REV: 0

SCALE: — CIVIL ENGINEERING

DR:
CH:
SUP:
ENG:
DATE: SEE REV 0
APPROVED BY

REV.	REV. DESCRIPTION:	REV. BY:	CHK. BY:	REV. DATE:
0	FOR CONSTRUCTION	LTE	CSR	05SEP12

DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE	LOGIN BY:	DRAWING SCALE:
LTE	TJP	CSR	5SEP12	LEANN ENGLE	AS SHOWN

FILE LOCATION: T:\PDM SANDBOX MY WORKING FILES\LEANN E\AMERICAN POWER\2021135C C-01.DWG

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: DD-MMM-YYYY
PLOT TIME: HOUR:MINUTE
BY: USERPLOT

CROSS REFS:

13-30330

DRAWING NUMBER: 13-30330

CROSS REFS:

GENERAL NOTES

1. THE CONTRACTOR SHALL INFORM THE OWNER A MINIMUM OF THREE WEEKS PRIOR TO MOBILIZATION TO ALLOW THE OWNER TO SUBMIT THE APPROPRIATE NOTIFICATIONS TO ALL REQUIRED AGENICES INCLUDING WVDEP AND US ARMY CORPS OF ENGINEERS (USACE).
2. CONTRACTOR MUST PERFORM THE WORK IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH IN U. S. ARMY CORPS OF ENGINEERS PERMIT FOR THIS PROJECT, AS WELL AS ALL LOCAL, STATE AND FEDERAL ENVIRONMENTAL REGULATIONS.
3. THE CONTRACTOR AND SUBCONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR COMPLYING WITH ALL FEDERAL, STATE, LOCAL SAFETY AND AEP SAFETY REQUIREMENTS TOGETHER WITH EXERCISING PRECAUTIONS AT ALL TIMES FOR THE PROTECTION OF PERSONS INCLUDING EMPLOYEES AND PROPERTY. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND SUBCONTRACTOR TO INITIATE, MAINTAIN, AND SUPERVISE ALL SAFETY REQUIREMENTS, PRECAUTIONS, AND PROGRAMS IN CONNECTION WITH THE WORK.
4. THE CONTRACTOR SHALL CONFINE HIS ACTIVITIES TO THE PROJECT SITE, EXISTING RIGHTS-OF-WAY, TEMPORARY EASEMENTS AND PERMANENT EASEMENTS.
5. ALL SIGNS, FENCES, DRAINAGE STRUCTURES, OR OTHER PHYSICAL FEATURES DISTURBED OR DAMAGED DURING WORK UNDER THIS CONTRACT SHALL BE RESTORED TO THEIR ORIGINAL CONDITION BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER. THE CONTRACTOR IS REQUIRED TO LEAVE AND MAINTAIN, DURING CONSTRUCTION, EXISTING ACCESS ROADS AND APPURTENANCES IN A CONDITION EQUAL TO OR BETTER THAN EXISTS UPON AWARD OF CONTRACT.
6. THE CONTRACTOR SHALL PROVIDE THE MEANS AND METHOD OF BYPASSING THE CURRENT OUTFALL 001 FLOW AS PART OF HIS SCOPE. THE CONTRACTOR SHALL MAKE PROVISIONS TO BYPASS A MINIMUM FLOW OF 10,000 GPM. THIS PLAN SHALL BE SUBMITTED TO OWNER FOR APPROVAL AND SUBMITTAL AND APPROVAL BY THE W.V. DEPARTMENT OF ENVIRONMENTAL PROTECTION. THE PLAN SHALL SHOW THE TEMPORARY DISCHARGE LOCATED AS CLOSE TO THE EXISTING OUTFALL AS PRACTICAL.
7. OUTFALL 006 IS INTERMITTENT BASED ON RAINFALL EVENTS. THE CONTRACTOR SHALL SCHEDULE WORK ACCORDINGLY.

EROSION AND SEDIMENT CONTROL

1. CONTRACTOR SHALL USE BEST MANAGEMENT PRACTICES FOR SEDIMENT AND EROSION CONTROL IN ACCORDANCE WITH THE WEST VIRGINIA EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES MANUAL, DATED 2006.
2. THE CONTRACTOR SHALL SUBMIT A STORMWATER POLLUTION PREVENTION PLAN TO AEP USING AN AEP PROVIDED TEMPLATE.
3. ALL WORK SHALL BE IN ACCORDANCE WITH THE PROJECT'S SWPPP PERMIT .

CONSTRUCTION

1. USE EXISTING ROADS AND TRAVEL PATHS WHENEVER POSSIBLE. MINIMIZE THE USE OF EQUIPMENT AT RIVER BANK TO REDUCE SEDIMENTATION RATES AND CHANNEL INSTABILITY.
2. ALL EQUIPMENT MUST BE CLEANED TO REMOVE EXTERNAL OIL, GREASE, DIRT, AND MUD BEFORE BEGINNING OPERATIONS IN OR AT THE RIVER BANK.
3. ALL STATIONARY POWER EQUIPMENT (E.G., GENERATORS) OPERATED WITHIN THE DRAINAGE BOUNDARY MUST BE DIAPERED TO PREVENT LEAKS AND/OR ENCLOSED IN A CONTAINMENT DEVICE (E.G., NON PERMEABLE DRIP PAN) OF ADEQUATE CAPACITY TO RETAIN EQUIPMENT FLUIDS (E.G., GASOLINE, DIESEL FUEL, AND OIL) IF A LEAK OCCURS.
4. THE BOUNDARY OF A PROJECT SITE MUST BE FLAGGED TO PREVENT SOIL DISTURBANCE TO AREAS OUTSIDE THE SITE. CONFINE CONSTRUCTION IMPACTS TO THE MINIMUM AREA NECESSARY TO COMPLETE THE PROJECT. LIMIT THE REMOVAL OF ANY NATIVE VEGETATION TO THE AMOUNT THAT IS ABSOLUTELY NECESSARY TO COMPLETE A CONSTRUCTION ACTIVITY.
5. STABILIZE ALL DISTURBED AREAS FOLLOWING ANY BREAK IN WORK UNLESS CONSTRUCTION WILL RESUME WITHIN SEVEN DAYS.
6. STREAM BANKS DAMAGED FROM PROJECT ACTIVITIES MUST BE RESTORED TO A NATURAL SLOPE, PATTERN, AND PROFILE THAT ARE SUITABLE FOR THE ESTABLISHMENT OF PERMANENT VEGETATION AS APPROPRIATE.
7. ALL EXCAVATIONS AND SUPPORT SYSTEMS SHALL CONFORM TO APPLICABLE OSHA EXCAVATION, TRENCHING, AND SHORING STANDARD WHICH ARE CONTAINED IN THE U.S. CODE OF FEDERAL REGULATIONS 29 (C.F.R.) L926.650-L926.653, OTHER FEDERAL, STATE OR LOCAL REQUIREMENTS. IN THE EVENT OF A CONFLICT, COMPLY WITH THE MORE RESTRICTIVE APPLICABLE REQUIREMENT.

RESTORATION

1. THE RIVER BANK SHALL BE STABILIZED USING SEED NETTING. SEED NETTING SHALL BE JUTE OR STRAW AND FIBER MATTING AND STAPLED IN PLACE. THE MATTING SHALL BE TYPE B WITH AN OPEN AREA OF 50 PERCENT. ALL MATTING SHALL BE MANUFACTURED USING NATURAL BIODEGRADABLE MATERIALS. DEPENDING ON THE TIME OF YEAR, SEEDING SHOULD INCLUDE A MIX ON KENTUCKY BLUEGRASS OR KENTUCKY 31 FESCUE AND PERENNIAL RYEGRASS.
2. THE CONTRACTOR SHALL SEED AND STRAW ALL OTHER AREAS TO RETURN THE AREA TO ITS ORIGINAL CONDITION.

HDPE PIPE SPECIFICATIONS

1. ALL HIGH DENSITY POLYETHYLENE (HDPE) MATERIALS SHALL CONFORM TO THE "SPECIFICATIONS, TEST METHODS AND CODES FOR POLYETHYLENE PIPING SYSTEMS" CHAPTER INCLUDED IN THE PPI HANDBOOK OF POLYETHYLENE PIPING (1998). THE MANUFACTURER SHALL PROVIDE MATERIAL CERTIFICATION DOCUMENTS.
2. THE HDPE PIPE SHALL BE MANUFACTURED IN A PLANT CAPABLE OF PROVIDING CONTINUOUS QUALITY CONTROL THROUGH INSPECTION. THE FACILITY SHALL HAVE THE NECESSARY TESTING EQUIPMENT TO VERIFY THAT THE PIPE MEETS THE REQUIREMENTS OF ASTM STANDARDS.
3. POLYETHYLENE PIPE AND FITTINGS SHALL BE MADE FROM RESIN MEETING THE REQUIREMENTS OF THE PLASTICS PIPE INSTITUTE AS PE 3408. THE RESIN SHALL MEET THE REQUIREMENTS OF ASTM D3350-02 WITH A CELL CLASSIFICATION OF 345464C.
4. PIPE SHALL HAVE A MANUFACTURING STANDARD OF ASTM F-714. PIPE NOMINAL O.D. SIZES 4" TO 24" SHALL BE PROVIDED IN STEEL PIPE SIZES (IPS). THE PIPE SHALL CONTAIN NO RECYCLED COMPOUNDS EXCEPT THAT GENERATED IN THE MANUFACTURER'S OWN PLANT FROM RESIN OF THE SAME SPECIFICATION FROM THE SAME RAW MATERIAL.
5. THE MANUFACTURER OF THE PIPE AND FITTINGS SHALL MAINTAIN PERMANENT QC AND QA RECORDS. DATALOGGER RECORDS SHALL BE MAINTAINED ON FABRICATED FITTINGS.

HDPE PIPE INSTALLATION PROCEDURES

1. THE CONTRACTOR SHALL TAKE CARE WHEN MOVING HDPE PIPE ONSITE. THE PIPE SHALL NOT BE HANDLED WITH CHAINS OR DRAGGED OVER SHARP ROCKS. CANVAS STRAPS SHALL BE USED FOR RIGGING PIPES FOR TRANSPORT. THE PIPE SHALL BE STORED IN A MANNER THAT MINIMIZES THE POSSIBILITY OF CRUSHING OR PIERCING.
2. THE INSTALLER SHALL INSPECT ALL HDPE PIPE FOR GOUGES, CUTS, AND DEEP SCRATCHES PRIOR TO INSTALLATION. THE PIPE SHALL BE REPLACED OR REPAIRED IF A GOUGE OR CUT IS DEEPER THAN 20 PERCENT THE NOMINAL PIPE WALL THICKNESS.
3. ALL CONNECTIONS TO HEADER SHALL USE BRANCH SADDLES. THE BRANCH SADDLES SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILED FABRICATION DRAWINGS. ALL BRANCH SADDLES SHALL BE INSTALLED IN ACCORDANCE WITH THE "POLYETHYLENE JOINING PROCEDURES" PUBLISHED BY THE PLASTICS PIPE INSTITUTE (1998) USING A SADDLE FUSION MACHINE.
4. PIPE SHALL BE JOINED USING THE FOLLOWING METHODS: FLANGE ADAPTERS, BUTT FUSION OR ELECTROFUSION COUPLINGS
5. PIPE SHALL BE CONNECTED USING A FLANGE ADAPTER AND STAINLESS STEEL FLANGE RINGS, HEX BOLTS, HEAVY HEX NUTS, AND PLAIN WASHERS MANUFACTURED IN ACCORDANCE WITH ASTM F594-02. AN ANTI-SEIZE COMPOUND SHALL BE APPLIED TO THE BOLTS PRIOR TO TIGHTENING. THE BOLTS SHALL BE TIGHTENED USING A TORQUE WRENCH WITH 20 PERCENT OF THE FINAL TORQUE TO TIGHTEN IN A CRISSCROSS PATTERN. THIS PROCEDURE SHALL BE REPEATED INCREASING THE TORQUE BY 20 PERCENT OF THE FINAL VALUE UNTIL THE FINAL VALUE IS REACHED. THE FINAL TORQUE VALUE FOR 10-IN PIPE IS 45 FT-LBS AND FOR 36-IN PIPE IS 60FT-LBS.
6. PRIOR TO BUTT FUSION, BOTH ENDS OF THE PIPES AND THE FUSION TOOLS SHALL BE CLEAN AND FREE OF CONTAMINANTS. BOTH ENDS OF PIPE SHALL BE TRIMMED USING A FACER, IF NEEDED, TO PRESENT SMOOTH, EVEN SURFACES FOR FUSION.
   a. BUTT FUSION TEMPERATURES SHALL BE BETWEEN 400°F AND 450°F IN ACCORDANCE WITH THE PLASTICS PIPE INSTITUTE "GENERIC BUTT FUSION JOINING PROCEDURE FOR POLYETHYLENE GAS PIPE". THE HEATER SURFACES SHALL BE ±10°F OF THE SPECIFIED TEMPERATURE.
   b. DURING THE HEATING PROCESS, VISUAL CHECKS SHALL BE MADE TO ENSURE THE MELT SWELL BEAD WIDTH IS BETWEEN 1/16-IN (1.5mm) AND 1/8-IN (3.0mm) AND THAT IT IS UNIFORM AROUND THE ENTIRE PIPE.
   c. AFTER HEATING IS COMPLETE, BRING PIPE ENDS TOGETHER WITH THE PROPER INTERFACE PRESSURE FOR THE COMPLETE COOLING CYCLE. THE COOLING CYCLE SHALL BE APPROXIMATELY 30 SECONDS PER INCH OF PIPE DIAMETER.

STAINLESS STEEL PIPE

1. PIPE MATERIAL
   1.1. 1/2" - 1-1/2": SCH 40, PLAIN END, SEAMLESS, ASTM A312/A778-TP316
   1.2. 2" - 48": SCH 40S, BEVELED ENDS, EFW, ASTM-312/A778, ASME B36.19
2. FITTINGS
   2.1. 1/2"-1-1/2": FORGED SS, ASTM A-182, ANSI B16.11, SOCKET WELD OR SCREWED 3000 LB.
   2.2. 2" - 48": SCH 40S, BUTT WELD ENDS, ASTM A403 TP316, ASME B16.9.
3. VALVES 1/2" - 1-1/2": APOLLO 76-100
4. BOLTING SHALL BE ALLOY STEEL STUDS WITH FULL LENGTH THREAD, ASTM A193 GRADE 8M AND NUTS SHALL BE ALLOY STEEL HEAVY HEX, ASTM A194, GRADE 2H.
5. PIPE TO BE WELDED PER ASME B31.3.5

DUCKBILL DIFFUSER SPECIFICATIONS

1. THE DIFFUSER CHECK VALVES ARE TO BE OF THE VARIABLE PORT AREA TYPE AND SHALL ALLOW PASSAGE OF FLOW IN ONE DIRECTION WHILE PREVENTING REVERSE FLOW. THE FLANGE AND FLEXIBLE DUCKBILL SLEEVE SHALL BE ONE-PIECE RUBBER CONSTRUCTION WITH NYLON REINFORCEMENT.
2. THE FLANGE DRILLING SHALL CONFORM TO ANSI B16.5, CLASS 150 STANDARDS FURNISHED WITH STAINLESS STEEL 316 BACK-UP RINGS FOR INSTALLATION.
3. THE MINIMUM JET VELOCITY SHALL BE 10 FPS WITH A HEADLOSS OF 1.7 FEET AT A DESIGN FLOW OF 2.34 MGD, AND MAXIMUM HEADLOSS OF 4.0 FEET AT A MAXIMUM DESIGN FLOW OF 5 MGD.
4. THE VALVES SHALL BE 8 INCH SERIES 35W AS MANUFACTURED BY THE RED VALVE CO. INC. OF CARNEGIE, PA OR EQUAL.
5. VALVE SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTALLATION AND OPERATION MANUAL AND APPROVED SUBMITTALS.

METAL FABRICATION

1. ALL WELDING IS PERFORMED IN ACCORDANCE WITH AWS D1.1 BY WELDERS QUALIFIED AND CERTIFIED PER THE REQUIREMENTS OF THIS CODE. ALL WELDING TO BE ACCOMPLISHED USING 70,000 PSI (480 MPA) NOMINAL TENSILE STRENGTH CONSUMABLES EXCEPT FOR E6010 ROOT PASS WELDS ON PIPE. E6010 IS A 60,000 PSI (400 MPA) ELECTRODE WITH A CELLULOSE TYPE FLUX USED FOR THE ROOT PASS IN FULL PENETRATION PIPE WELDS.
2. ALL FLUX, SPATTER AND SLAG SHALL BE REMOVED FROM SURFACES, WELDS AND BURNED EDGES. (ACCEPTABLE METHODS OF REMOVAL INCLUDE: CHIPPING, CHISELING OR CHEMICAL (ANTI-SPATTER)).
3. HOLES, EDGES AND CORNERS SHALL BE GROUND OR DEBURRED AS REQUIRED TO REMOVE ALL SHARP EDGES AND BURRS.
4. STAINLESS STEEL PLATES AND BARS SHALL COMPLY WITH ASTM 240/240M: "SPECIFICATION FOR CHROMIUM AND CHROMIUM-NICKEL STAINLESS STEEL PLATE, SHEET, AND STRIP FOR PRESSURE VESSELS AND FOR GENERAL APPLICATIONS" AND ASTM A666-10 "STANDARD SPECIFICATION FOR ANNEALED OR COLD-WORKED AUSTENITIC STAINLESS STEEL SHEET, STRIP, PLATE, AND FLAT BAR".
5. STAINLESS STEEL ANGLE SHALL CONFORM TO ASTM A480, TYPE 316
6. CARBON STEEL ANGLES, CHANNELS AND PLATE SHALL CONFORM TO ASTM A36.
7. STRUCTURAL STEEL SHALL BE FABRICATED AND ERECTED IN ACCORDANCE WITH AISC "CODE OF STRUCTURAL PRACTICE FOR STRUCTURAL STEEL BUILDING AND BRIDGES.
8. GRATING SHALL BE STEEL BAR (ASTM A569) TYPE, 1" DEEP x 3/16" THICK, SPACED AT 1 3/16", CROSS BARS SHALL BE SPACED AT 4".
9. HOT DIP GALVANIZED COATING SHALL BE IN ACCORDANCE WITH ASTM A123.
10. STAINLESS STEEL FASTENERS SHALL CONFORM TO ASTM F593-02(2008)e1: "STANDARD SPECIFICATION FOR STAINLESS STEEL BOLTS, HEX CAPS, SCREWS, AND STUDS"
11. CARBON STEEL BOLTS SHALL CONFORM TO ASTM A325.
12. ANCHORS
    a. EXPANSION ANCHORS SHALL BE HILTI KWIK BOLT III, POWERS WEDGE BOLTS, OR EQUAL. ALL ANCHORS SHALL BE 316 OR 416 STAINLESS STEEL OR SIMILAR.
    b. ADHESIVE ANCHORS SHALL BE HILTI HIT HY150 OR EQUAL.
13. CARBON STEEL TO BE COATED SHALL RECEIVE A COMMERCIAL BLAST CLEANED ACCORDING TO SPCC-SP6 AND PRIMED WITH A MODIFIED ALKYD ENAMEL, TNEMEC SERIES 10 OR EQUAL TO 2.5 MIL DFT. INTERMEDIATE AND TOPCOAT TO BE ACRYLIC POLYMER, TNEMEC SERIES 1029 OR EQUAL, TO 2.5 MIL DFT EACH COAT.

PIPE TRENCHING AND PLACEMENT

1. EXCAVATE TO LINES AND ELEVATIONS AS INDICATED ON THE DRAWINGS AND AS NECESSARY FOR THE PROPER CONSTRUCTION OF THE WORK. EXCAVATION MUST NOT EXTEND BEYOND THOSE AUTHORIZED BY THE US ARMY CORPS OF ENGINEERS.
2. EQUIPMENT AND METHODS SHALL BE SUITABLE FOR THE WORK AT HAND.
3. ALL EXCAVATION SHALL BE CONSIDERED AS UNCLASSIFIED EXCAVATION AND SHALL CONSIST OF EXCAVATING AND REMOVING ALL FORMATIONS AND MATERIALS, NATURAL OR MAN-MADE, IRRESPECTIVE OF NATURE OR CONDITION, ENCOUNTERED WITHIN THE LIMITS OF THE DEFINED TRENCHES AND OTHER NECESSARY AREAS OF EXCAVATION.
4. EXCAVATED MATERIAL IN EXCESS OF THAT REQUIRED FOR FILLS AND BACKFILLS SHALL REMAIN IN THE RIVER AND SPREAD OUT TO WITHIN SIX INCHES OF THE RIVER BOTTOM ELEVATION.
5. SHORE AND BRACE EXCAVATIONS AS NECESSARY TO PREVENT CAVE-INS.
6. SHEETING, SHORING OR BRACING MATERIALS SHALL NOT BE LEFT IN. SUCH MATERIALS SHALL BE REMOVED IN SUCH A MANNER THAT NO DANGER OR DAMAGE WILL OCCUR TO NEW OR EXISTING STRUCTURES OR PROPERTY, PUBLIC OR PRIVATE, AND SO THAT CAVE-INS OR SLIDES WILL NOT TAKE PLACE.
7. THE PIPE SHALL, AT ALL TIMES, BE HANDLED WITH EQUIPMENT DESIGNED TO PREVENT DAMAGE TO THE JOINTS, OR TO THE INSIDE OR OUTSIDE SURFACES OF THE PIPE.
8. THE BOTTOM OF THE TRENCH SHALL BE EXCAVATED TO PROPER LINE AND GRADE AND SHALL PROVIDE A UNIFORM BEARING FOR THE FULL LENGTH OF THE PIPE BARREL.
9. BEDDING MATERIAL AND GRANULAR BACKFILL SHALL BE PLACED TO THE DEPTH AS SPECIFIED ON DRAWINGS. MATERIAL SHALL BE CRUSHED STONE CONFORMING TO ASTM D448, SIZE NO. 57 OR EQUIVALENT.
10. IF REQUIRED BY THE US ARMY CORPS OF ENGINEERS OR AEP, THE CONTRACTOR SHALL PROVIDE TURBIDITY AND SEDIMENT CONTROL DURING ALL RIVER EXCAVATION AND BACKFILL ACTIVITIES.
11. AFTER BACKFILL AND PIPE INSTALLATION IS COMPLETE, CONTRACTOR SHALL PROVIDE A SURVEY IDENTIFYING THE LOCATION OF THE MULTIPORT DIFFUSER AND CONFIRM THAT THE HEIGHTS OF THE DIFFUSERS ARE ABOVE THE RIVER BED PER THE DRAWINGS.

CONCRETE

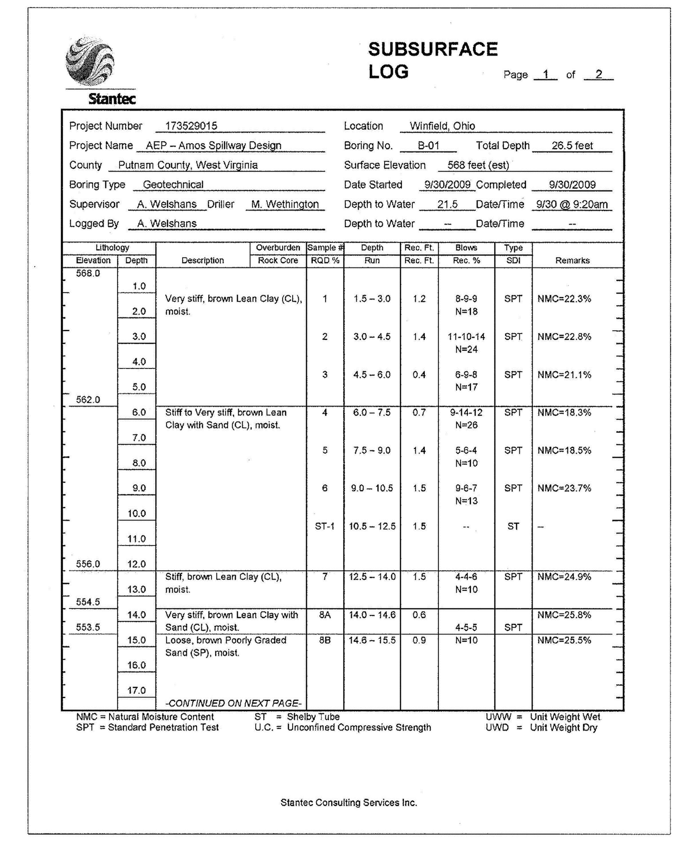
1. REINFORCING BARS TO CONFORM WITH ASTM A615, GRADE 60.
2. CONCRETE SHALL HAVE A 28-DAY COMPRESSIVE STRENGTH OF 3,000 PSI. THE CONTRACTOR SHALL TEST ONCE PER DAY AS FOLLOWS:
   a. MOLD FOUR (4) 6 X 12 CYLINDERS
   b. RECORD THE SLUMP, UNIT WEIGHT, TEMPERATURE (AMBIENT AND CONCRETE), AND ANY OTHER PERTINENT INFORMATION
   c. PERFORM ONE (1) 7-DAY COMPRESSIVE STRENGTH TEST
   d. PERFORM TWO (2) 28-DAY TESTS, SAVING THE LAST CYLINDER
3. PROVIDE TEST REPORT. IF THE CYLINDERS DO NOT PASS THE COMPRESSIVE STRENGTH TEST, NO PART MADE OF THAT BATCH OF CONCRETE CAN BE USED.
4. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4''.
5. NON-SHRINK GROUT SHALL BE NON-METALLIC WITH A MINIMUM COMPRESSIVE STRENGTH OF 5,000 PSI AT 28 DAYS

RIPRAP

1. RIPRAP SHALL BE COMPOSED OF A WELL-GRADED MIXTURE FROM 15-INCHES DOWN TO 1-INCH DIAMETER PARTICLES, SUCH THAT 50% OF THE MIXTURE BY WEIGHT SHALL BE LARGER THAN 6-IN DIAMETER. A WELL GRADED MIXTURE IS DEFINED AS A MIXTURE COMPOSED OF LARGER STONE SIZES WITH A SUFFICIENT MIXTURE OF SMALLER SIZES TO FILL THE PROGRESSIVELY SMALLER VOIDS BETWEEN THE STONES.
2. RIPRAP SHALL BE SOUND, DURABLE FIELD OR QUARRY STONE SHAPED ROUGHLY AS RECTANGULAR BLOCKS AND OF SUITABLE QUALITY AND PLACED TO INSURE PERMANENCE IN THE CONDITION IN WHICH IT IS TO BE USED. ROUNDED STONES, BOULDERS, SANDSTONE, OR SIMILAR SOFT STONE WILL NOT BE ACCEPTABLE. MATERIAL SHALL BE FREE FROM OVERBURDEN, SPOIL, SHALE, AND ORGANIC MATERIAL. EACH LOAD OF RIPRAP SHALL BE REASONABLY WELL GRADED FROM THE SMALLEST TO THE MAXIMUM SIZE SPECIFIED. ONE DIMENSION OF EACH EXPOSED RIPRAP SHALL NOT BE LESS THAN 12-IN. THE JOINTS IN THE RIPRAP SHALL BE FILLED WITH SPALLS OF SUITABLE SIZE TO CONSTRUCT A SOLID, STABLE SLOPE, FREE FROM LARGE VOIDS AND DEFECTS.

SOIL BORING

1. SOIL BORING B-01 IS SHOWN FOR INFORMATIONAL PURPOSES ONLY.THE BORING IN NO WAY GUARANTEES THE CONDITION OF THE SOIL TO BE ENCOUNTERED DURING THE EXCAVATION.



Stantec

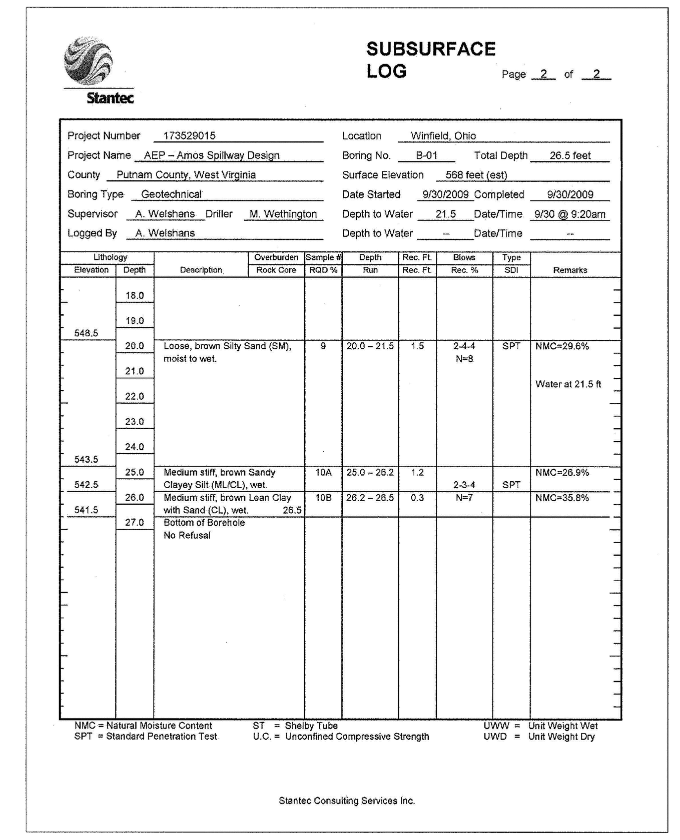
SUBSURFACE LOG Page 1 of 2

Project Number 173529015 — Location Winfield, Ohio
Project Name AEP – Amos Spillway Design — Boring No. B-01 — Total Depth 26.5 feet
County Putnam County, West Virginia — Surface Elevation 568 feet (est)
Boring Type Geotechnical — Date Started 9/30/2009 Completed 9/30/2009
Supervisor A. Welshans Driller M. Wethington — Depth to Water 21.5 Date/Time 9/30 @ 9:20am
Logged By A. Welshans — Depth to Water -- Date/Time --

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD %	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Type SDI	Remarks
568.0	1.0								
	2.0	Very stiff, brown Lean Clay (CL), moist.		1	1.5 – 3.0	1.2	8-9-9 N=18	SPT	NMC=22.3%
	3.0			2	3.0 – 4.5	1.4	11-10-14 N=24	SPT	NMC=22.8%
	4.0								
	5.0			3	4.5 – 6.0	0.4	6-9-8 N=17	SPT	NMC=21.1%
562.0	6.0	Stiff to Very stiff, brown Lean Clay with Sand (CL), moist.		4	6.0 – 7.5	0.7	9-14-12 N=26	SPT	NMC=18.3%
	7.0								
	8.0			5	7.5 – 9.0	1.4	5-6-4 N=10	SPT	NMC=18.5%
	9.0			6	9.0 – 10.5	1.5	9-6-7 N=13	SPT	NMC=23.7%
	10.0								
	11.0			ST-1	10.5 – 12.5	1.5	--	ST	--
556.0	12.0								
	13.0	Stiff, brown Lean Clay (CL), moist.		7	12.5 – 14.0	1.5	4-4-6 N=10	SPT	NMC=24.9%
554.5	14.0	Very stiff, brown Lean Clay with Sand (CL), moist.		8A	14.0 – 14.6	0.6	4-5-5	SPT	NMC=25.8%
553.5	15.0	Loose, brown Poorly Graded Sand (SP), moist.		8B	14.6 – 15.5	0.9	N=10		NMC=25.5%
	16.0								
	17.0	-CONTINUED ON NEXT PAGE-							

NMC = Natural Moisture Content — ST = Shelby Tube — UWW = Unit Weight Wet
SPT = Standard Penetration Test — U.C. = Unconfined Compressive Strength — UWD = Unit Weight Dry

Stantec Consulting Services Inc.



Stantec

SUBSURFACE LOG Page 2 of 2

Project Number 173529015 — Location Winfield, Ohio
Project Name AEP – Amos Spillway Design — Boring No. B-01 — Total Depth 26.5 feet
County Putnam County, West Virginia — Surface Elevation 568 feet (est)
Boring Type Geotechnical — Date Started 9/30/2009 Completed 9/30/2009
Supervisor A. Welshans Driller M. Wethington — Depth to Water 21.5 Date/Time 9/30 @ 9:20am
Logged By A. Welshans — Depth to Water -- Date/Time --

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD %	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Type SDI	Remarks
	18.0								
	19.0								
548.5	20.0	Loose, brown Silty Sand (SM), moist to wet.		9	20.0 – 21.5	1.5	2-4-4 N=8	SPT	NMC=29.6%
	21.0								Water at 21.5 ft
	22.0								
	23.0								
	24.0								
543.5	25.0	Medium stiff, brown Sandy Clayey Silt (ML/CL), wet.		10A	25.0 – 26.2	1.2	2-3-4	SPT	NMC=26.9%
542.5	26.0	Medium stiff, brown Lean Clay with Sand (CL), wet. 26.5		10B	26.2 – 26.5	0.3	N=7		NMC=35.8%
541.5	27.0	Bottom of Borehole No Refusal							

NMC = Natural Moisture Content — ST = Shelby Tube — UWW = Unit Weight Wet
SPT = Standard Penetration Test — U.C. = Unconfined Compressive Strength — UWD = Unit Weight Dry

Stantec Consulting Services Inc.

DATE	NO.	DESCRIPTION	APPD.
05SEP12	0	FOR CONSTRUCTION	

REVISIONS

APPALACHIAN POWER COMPANY
OHIO POWER COMPANY

AMOS PLANT

SCARY — WEST VIRGINIA

PIPING

OUTFALL 003 DISCHARGE DIFFUSER NOTES

UNIT: 13 — DRAWING NUMBER: 30331 — REV: 0

SCALE: — CIVIL ENGINEERING

DR:
CH:
SUP:
ENG:
DATE: SEE REV 0

APPROVED BY

0 FOR CONSTRUCTION LTE CSR 05SEP12

DRAWN BY: LTE — CHK. BY: TJP — APPROVED BY: CSR — REV. DATE: 05SEP12 — LOGIN BY: LEANN ENGLE — DRAWING SCALE: AS SHOWN

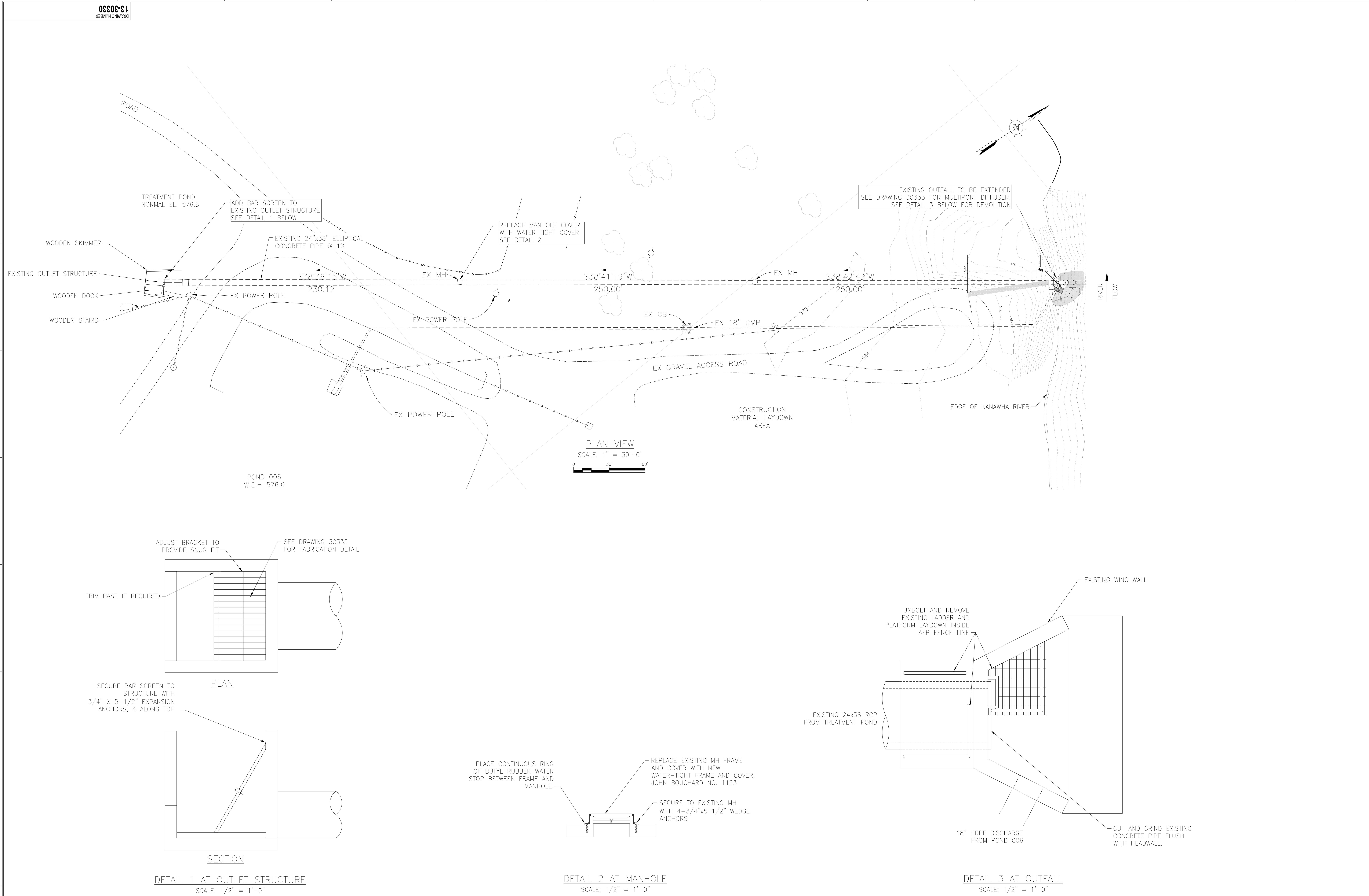
AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: DD-MMM-YYYY
PLOT TIME: HOUR:MINUTE
BY: USERPLOT

CROSS REFS:

13-30331



DATE	NO.	DESCRIPTION	APPD.
05SEP12	0	FOR CONSTRUCTION	

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP CONFIDENTIAL

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

APPALACHIAN POWER COMPANY
OHIO POWER COMPANY

AMOS PLANT

SCARY WEST VIRGINIA

PIPING

OUTFALL 003 DISCHARGE DIFFUSER OVERALL PLAN & DETAILS

UNIT: 13 | DRAWING NUMBER: 30332 | REV: 0

SCALE: | CIVIL ENGINEERING

DR:
CH:
SUP:
ENG:
DATE: SEE REV 0
APPROVED BY

ENVIRON

REV.	REV. DESCRIPTION:	REV. BY:	CHK. BY:	REV. DATE:
0	FOR CONSTRUCTION	LTE	CSR	05SEP12

DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE	LOGIN BY:	DRAWING SCALE:
LTE	TJP	CSR	05SEP12	LEANN ENGLE	AS SHOWN

FILE LOCATION: T:\PDM SANDBOX MY WORKING FILES\LEANN E\AMERICAN POWER\2021135C C-01.DWG

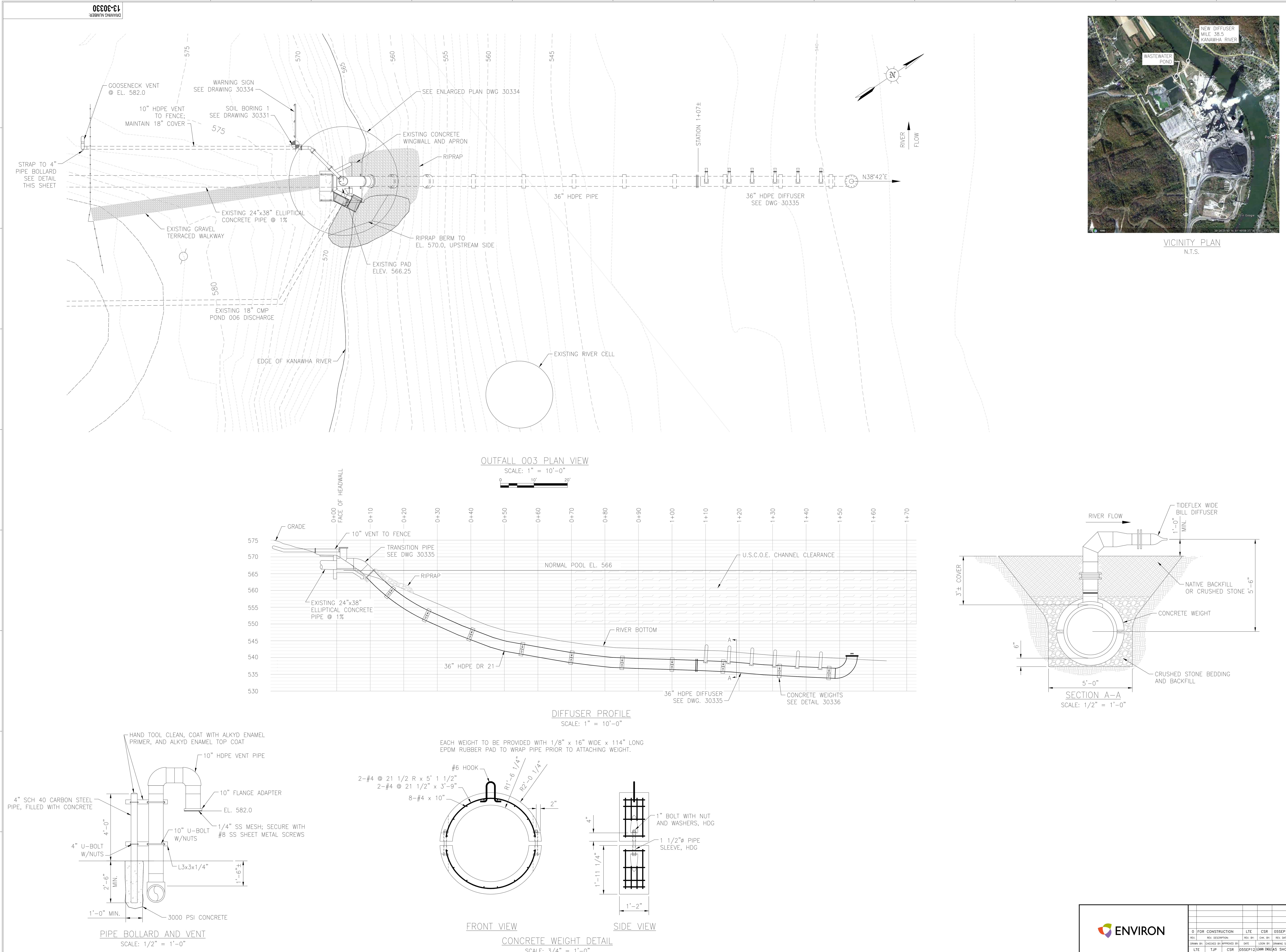
AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: DD-MMM-YYYY
PLOT TIME: HOUR:MINUTE
BY: USERPLOT

CROSS REFS:

13-30330



NOTES:

1. HYDROGRAPHIC SURVEY BY AEP DATED 5-14-08.

DATE	NO.	DESCRIPTION	APPD.
05SEP12	0	FOR CONSTRUCTION	

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP CONFIDENTIAL

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

APPALACHIAN POWER COMPANY
OHIO POWER COMPANY
AMOS PLANT

SCARY — WEST VIRGINIA

PIPING

OUTFALL 003
DISCHARGE DIFFUSER
DIFFUSER PLAN AND PROFILE

UNIT: 13 | DRAWING NUMBER: 30333 | REV: 0

SCALE: CIVIL ENGINEERING

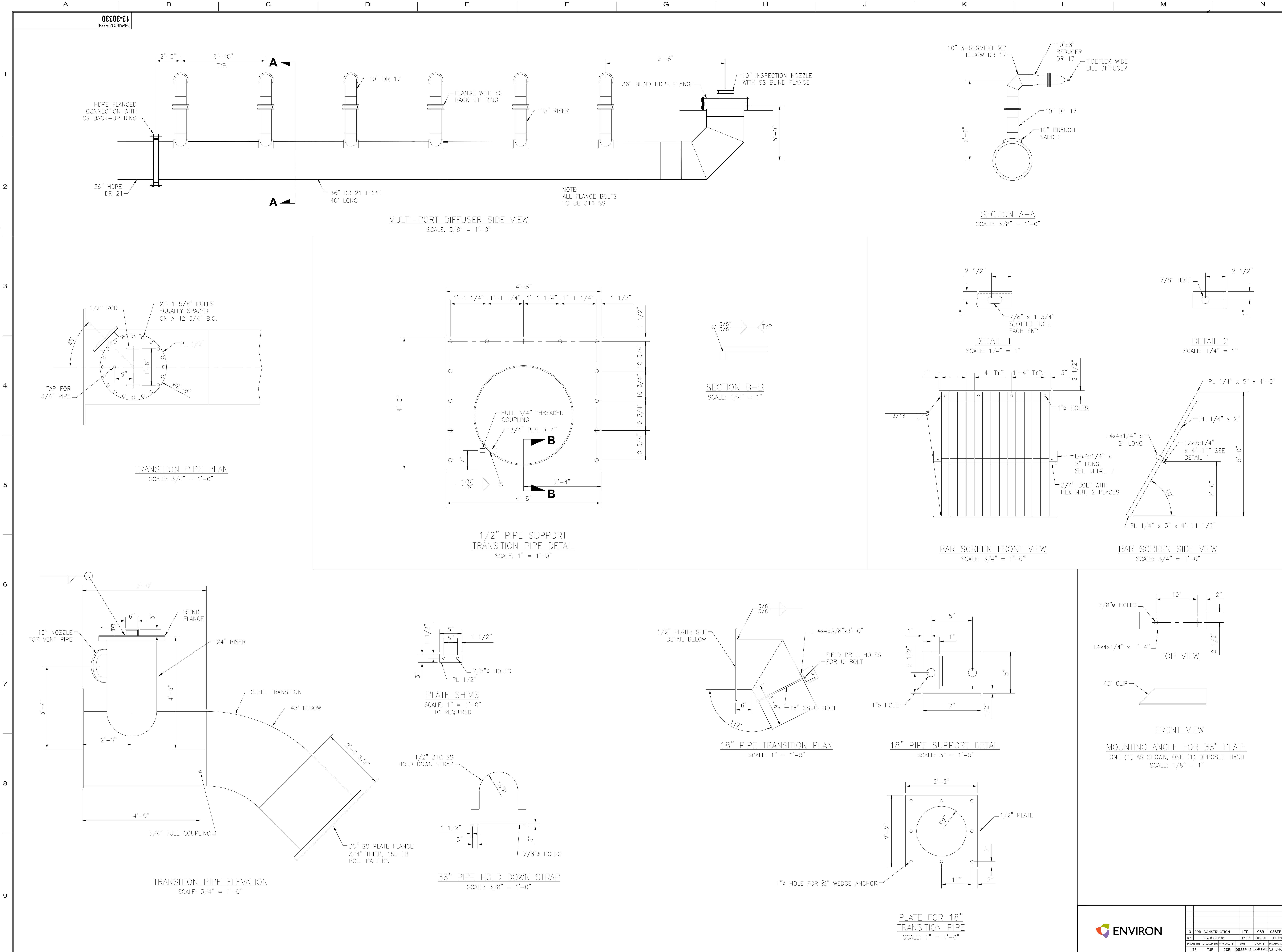
DR:
CH:
SUP:
ENG:
DATE: SEE REV.0

0 FOR CONSTRUCTION LTE CSR 05SEP12

AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

13-30330

CROSS REFS.
DRAWING NUMBER: 13-30330
NOTIFICATION SIGN, SEE DETAIL THIS SHEET
10" HDPE VENT PIPE
2'-6"
ROLL 45° ELBOW UPHILL AS REQUIRED.
10" SS, SCH 40 VENT PIPE
36" TRANSITION, SEE INSTALLATION DETAILS THIS SHEET
EDGE OF RIVER
PIPE SUPPORT SEE DETAIL THIS SHEET
PLACE RIPRAP TO LIMITS SHOWN
NEW HANDRAIL
10'-0"
3'-0"
EXISTING GRAVEL WALKWAY
EXTEND CONCRETE PAD SEE DETAIL THIS SHEET
NEW PLATFORM SEE DETAILS 30336
EXISTING OUTFALL 006
CREATE JETTY TO ELEVATION 570 WITH RIPRAP ROCK.
ENLARGED PLAN
SCALE: 3/8" = 1'-0"
2" WIDE SS PIPE STRAP FOR 10" PIPE
18"ø
3-#3 TIES
3/4"x5 1/2" SS WEDGE ANCHOR OR CAST HEX HEAD ANCHOR BOLTS
4-#4 VERT
1'-6" MIN
3" CL
6" CLEAN STONE
PIPE SUPPORT DETAIL
SCALE: 3/4" = 1'-0"
10'-0"
4'-10 3/4" TYP
4" x 4" x 1/4" x 10'-0" STRUCTURAL TUBE
L3" x 3" x 1/4" FRAME
L3" x 3" x 1/4" FRAME
WARNING
DO NOT ANCHOR OR DREDGE
DIFFUSER PIPE
APPALACHIAN POWER COMPANY
JOHN E. AMOS POWER PLANT
SECURE WITH 1/2" SS BOLTS
ASPHALTIC COATING WHERE IN CONTACT WITH CONCRETE
3,000 PSI CONCRETE
4'-0"
0'-6" TYP
2'-0"
0'-3"
4'-0"
2'-0"
NOTIFICATION SIGN
SCALE: 3/8" = 1'-0"
TUBE AND ANGLE TO BE MANUFACTURED FROM ALUMINUM ALLOY 6061.
CAP TUBES
ALUMINUM SIGN WITH WHITE REFLECTIVE BACKGROUND PER C.O.E. SPECS., LETTERS TO BE REFLECTIVE BLACK
#4@12 DOWEL INTO EXISTING PAD 6"
#4@12
ELEV = 570.5
5 1/2"
6" CLEAN STONE
2'-0"±
CONCRETE PAD EXTENSION DETAIL
SCALE: 1/2" = 1'-0"
INSTALL EXISTING GATE AT END OF UPPER PLATFORM
INSTALL NEW LADDER
TOP OF CONCRETE ELEV = 570.5
TOP OF GRATING ELEV = 569.92
2'-8 1/2"
MOUNT PLATFORM TO WALL WITH 5/8" WEDGE ANCHORS 5 PLACES
ATTACH WITH 3/4" BOLTS, NUTS AND WASHERS
CONNECT PLATFORMS, TWO PLACES WITH 3/4" BOLTS, NUTS AND WASHERS.
SECTION A-A
SCALE: 1/2" = 1'-0"
TOP OF CONCRETE ELEV = 570.5
MOUNT PLATFORM TO WALL WITH 5/8" WEDGE ANCHORS 5 PLACES
SECTION C-C
SCALE: 1/2" = 1'-0"
TOP OF CONCRETE ELEV = 570.5
ATTACH WITH 3/4" BOLTS, NUTS AND WASHERS
TO OUTFALL 006
MOUNT PLATFORM ANGLE TO WALL WITH 5/8" WEDGE ANCHORS, 3 PLACES.
SECTION D-D
SCALE: 1/2" = 1'-0"
EXISTING WING WALL
SEE PIPE ANCHOR DETAIL
10" SS STUB END AND FLANGE
10" SS VENT PIPE
36" TRANSITION; SEE DETAIL SHEET 30335
NEW CONCRETE PAD
ATTACH 18" TRANSITION TO WALL WITH 8-3/4" x 5 1/2" WEDGE ANCHORS. PROVIDE SEAL BETWEEN FLANGE AND CONCRETE WITH 1/4" x 2" WIDE BUTYL RUBBER SEALANT, EASY STIK OR EQUAL. SEE DETAIL SHEET 30335 FOR 18" TRANSITION FABRICATION.
INSTALL NEW HANDRAIL
EXISTING 18" CMP/HDPE POND 006 DISCHARGE
TRANSITION PIPE PLAN
(PLATFORM REMOVED FOR CLARITY)
SCALE: 1/2" = 1'-0"
3/4" SS BALL VALVE WITH PLUG
BLIND FLANGE
EXISTING 24"x38" ELLIPTICAL CONCRETE PIPE
36" SS TRANSITION
SECURE PIPE WITH STRAP AND ¾" x 7" WEDGE ANCHORS; TWO ANCHORS PER SIDE
2'-6"
36" FLANGE AND SS FLANGE BOLTS
INSTALL STAINLESS STEEL SHIMS AS REQUIRED.
36" HDPE DIFFUSER PIPE
TRANSITION PIPE ELEVATION
SCALE: 1/2" = 1'-0"
AFTER PRESSURE WASHING, SECURE 36" TRANSITION FLANGE TO WALL WITH 3/4"ø x 5 1/2" SS WEDGE ANCHORS AND SEAL BETWEEN FLANGE AND CONCRETE WITH 1/4" x2" WITH BUTYL RUBBER WATERSTOP, PRESS-SEAL EZ STIK OR EQUAL
ELEV = 570.5
EXISTING WING WALL
MOUNT ANGLE TIGHT AGAINST FACE OF PLATE
2"
3/4" ANCHORS (TYP)
SECTION B-B
SCALE: 1/2" = 1'-0"
05SEP12 | 0 | FOR CONSTRUCTION
DATE | NO. | DESCRIPTION | APPD.
REVISIONS
THIS DRAWING IS CLASSIFIED AS:
AEP CONFIDENTIAL
REFERENCE AEP'S CORPORATE INFORMATION SECURITY POLICY
"THIS DRAWING IS THE PROPERTY OF THE AMERICAN ELECTRIC POWER SERVICE CORP. AND IS LOANED UPON CONDITION THAT IT IS NOT TO BE REPRODUCED OR COPIED, IN WHOLE OR IN PART, OR USED FOR FURNISHING INFORMATION TO ANY PERSON WITHOUT THE WRITTEN CONSENT OF THE AEP SERVICE CORP., OR FOR ANY PURPOSE DETRIMENTAL TO THEIR INTEREST, AND IS TO BE RETURNED UPON REQUEST"
APPALACHIAN POWER COMPANY
OHIO POWER COMPANY
AMOS PLANT
SCARY
WEST VIRGINIA
GEOTECHNICAL
OUTFALL 003
DISCHARGE DIFFUSER
ENLARGED PLAN & INSTALL DETAILS
UNIT: 13
DRAWING NUMBER: 30334
REV: 0
SCALE:
CIVIL ENGINEERING
DR:
CH:
SUP:
ENG:
APPROVED BY
DATE: SEE REV 0
ENVIRON
0 | FOR CONSTRUCTION | LTE | CSR | 05SEP12
LTE | TJP | CSR | 05SEP12 | AS SHOWN
AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215
13-30330



NOTES:

1. ALL METALLIC PARTS 316/316L STAINLESS STEEL.

DATE	NO.	DESCRIPTION	APPD.
05SEP12	0	FOR CONSTRUCTION	

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP CONFIDENTIAL

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

APPALACHIAN POWER COMPANY
OHIO POWER COMPANY

AMOS PLANT

SCARY WEST VIRGINIA

GEOTECHNICAL

OUTFALL 003 DISCHARGE DIFFUSER FABRICATION DETAILS

UNIT: 13 | DRAWING NUMBER: 30335 | REV: 0

SCALE: | CIVIL ENGINEERING

DR:
CH:
SUP:
ENG:
DATE: SEE REV 0
APPROVED BY

ENVIRON

REV.	DESCRIPTION	DR. BY	CHK. BY	REV. DATE
0	FOR CONSTRUCTION	LTE	CSR	05SEP12

DRAWN BY: LTE | CHECKED BY: TJP | APPROVED BY: CSR | DATE: 05SEP12 | LOGIN BY: LEANN ENGLE | DRAWING SCALE: AS SHOWN
FILE LOCATION: E\AMERICAN POWER\2021135C C-01.DWG

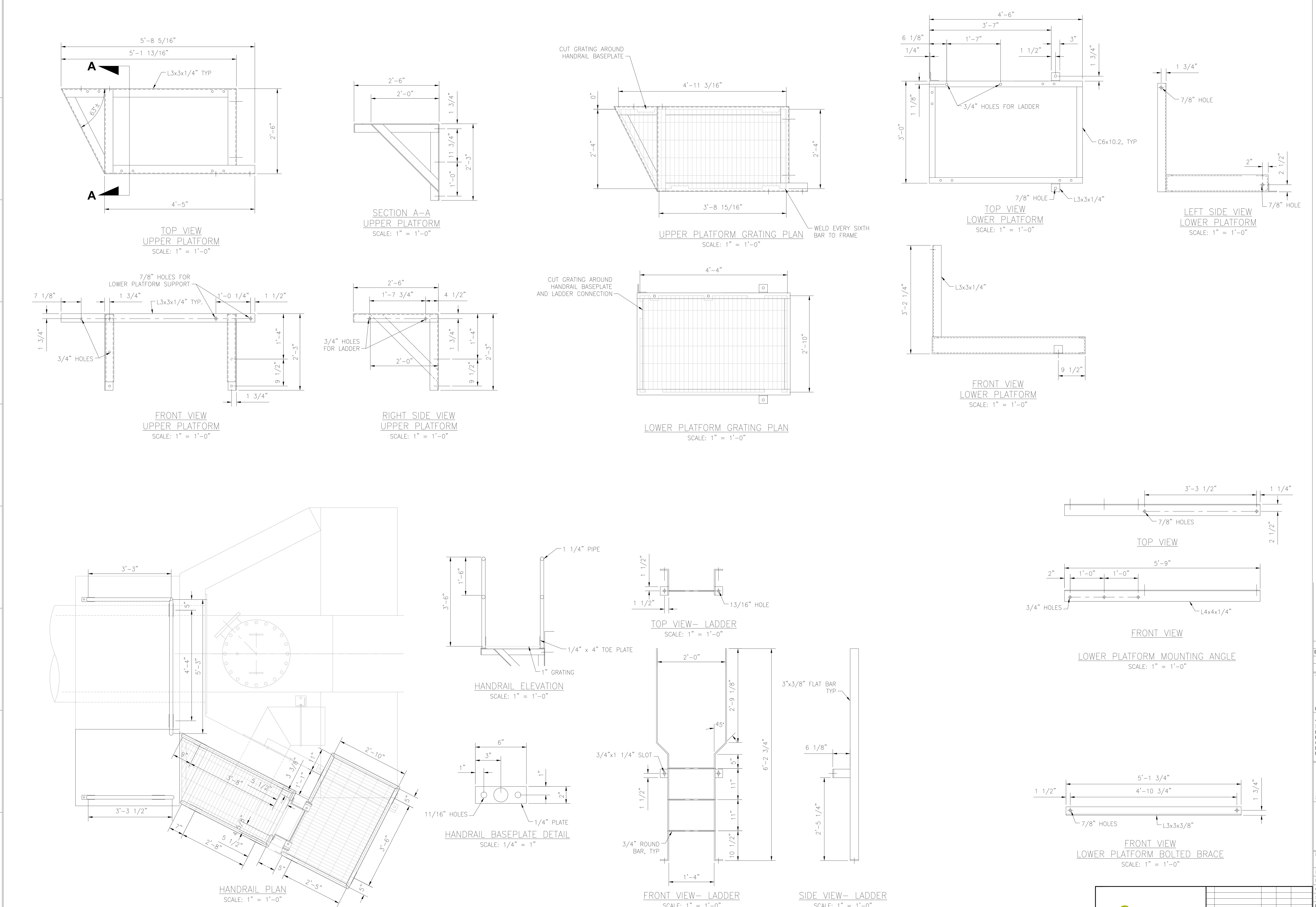
AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: DD-MMM-YYYY
PLOT TIME: HOUR:MINUTE
BY: USERPLOT

CROSS REFS:

13-30330



NOTES:

1. ALL METALLIC PARTS CARBON STEEL.
2. ALL PLATFORM WELDS ARE 3/16" FILLET UNLESS OTHERWISE NOTED.
3. PLATFORM AND GRATING TO BE HOT DIP GALVANIZED AFTER ASSEMBLY
4. HANDRAILS TO BE COATED PER SPECS. TOP COAT TO BE SAFETY YELLOW.

DATE	NO.	DESCRIPTION	APPD.
05SEP12	0	FOR CONSTRUCTION	

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP CONFIDENTIAL

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

APPALACHIAN POWER COMPANY
OHIO POWER COMPANY

AMOS PLANT

SCARY — WEST VIRGINIA

GEOTECHNICAL

OUTFALL 003 DISCHARGE DIFFUSER PLATFORM FABRICATION DETAILS

UNIT:	DRAWING NUMBER:	REV:
13	30336	0

SCALE: — CIVIL ENGINEERING

DR:
CH:
SUP:
ENG:
DATE: SEE REV 0
APPROVED BY

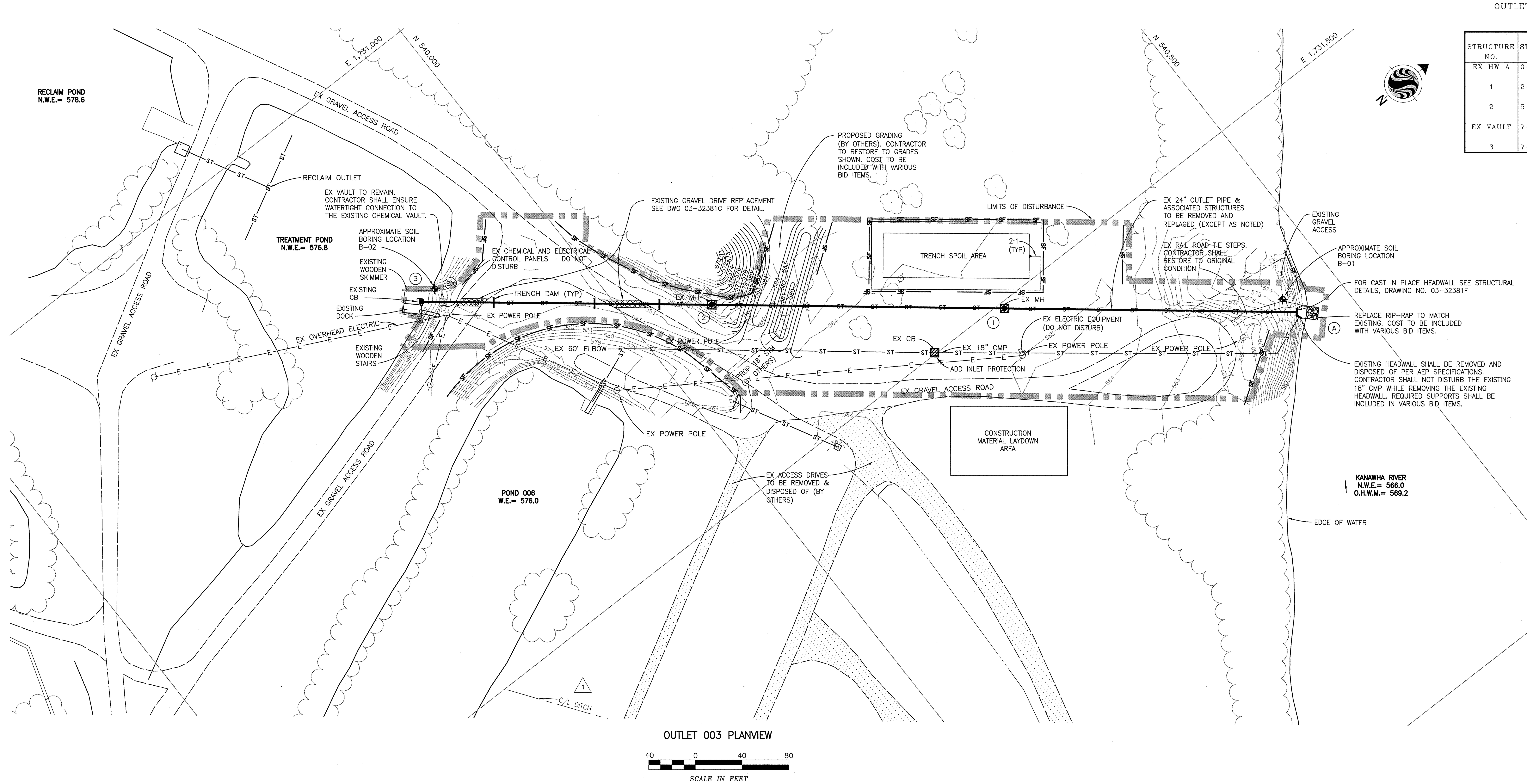
REV.	REV. DESCRIPTION:	REV. BY:	CHK. BY:	REV. DATE:
0	FOR CONSTRUCTION	LTE	CSR	05SEP12

DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE	LOGIN BY:	DRAWING SCALE:
LTE	TJP	CSR	05SEP12	LEANN ENGLE	AS SHOWN

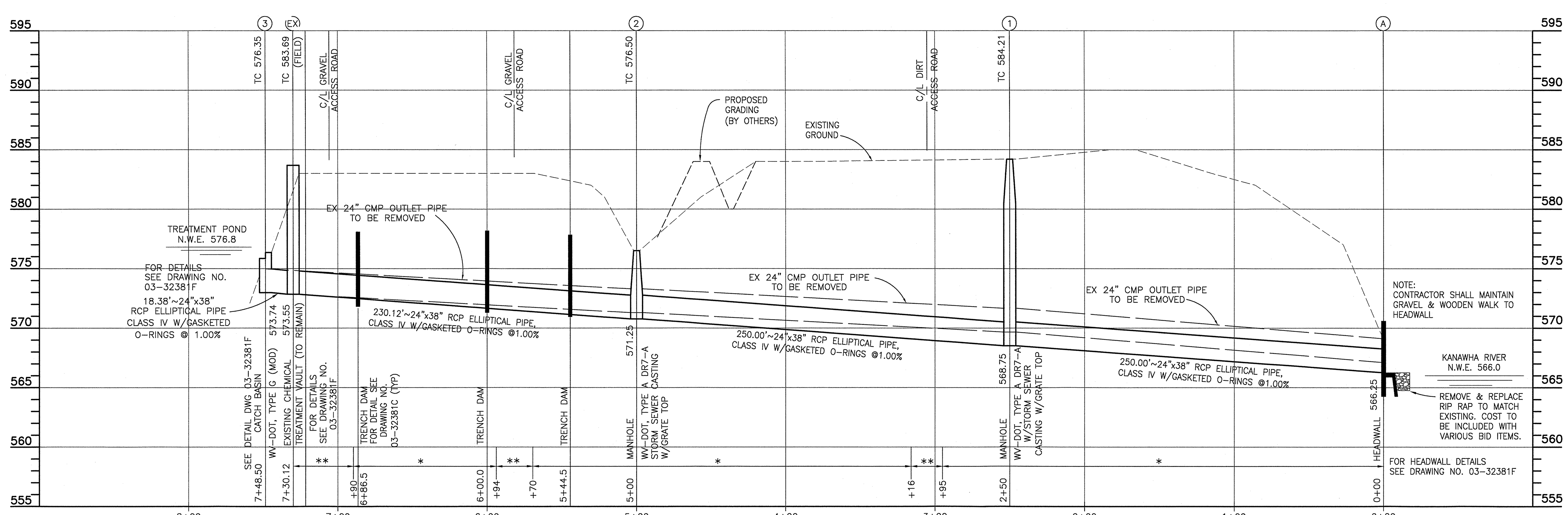
FILE LOCATION: T:\PDM SANDBOX MY WORKING FILES\LEANN E\AMERICAN POWER\2021135C C-01.DWG

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: DD-MMM-YYYY
PLOT TIME: HOUR:MINUTE
BY: USERPLOT



OUTLET 003 PLANVIEW



* CONTRACTOR SHALL BACKFILL PER TYPICAL STORM PIPE BEDDING DETAIL DWG. 03-32381C

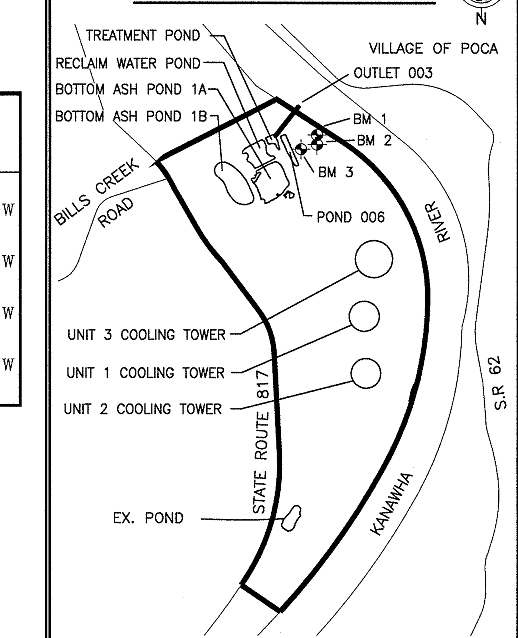
** CONTRACTOR SHALL BACKFILL PER ACCESS ROAD REPLACEMENT DETAIL DWG. 03-32381C

OUTLET 003 PROFILE
SCALE: HORIZ. 1"=40'
VERT. 1"=5'

OUTLET 003 STORM STRUCTURE LOCATION CHART (STATE PLANE COORDINATE SYSTEM)

STRUCTURE NO.	STATION	NORTHING	EASTING	DISTANCE	DIRECTION
EX HW A	0+00.00	540455.08	1731661.85		
				250.00	S 38-42-43 W
1	2+50.00	540260.00	1731505.50		
				250.00	S 38-41-19 W
2	5+00.00	540064.86	1731349.22		
				230.12	S 38-36-15 W
EX VAULT	7+30.12	539885.03	1731205.64		
				18.38	S 38-36-15 W
3	7+48.50	539870.66	1731194.17		

SITE LOCATION MAP



SEQUENCE OF CONSTRUCTION

1. CLEAR AS NECESSARY FOR THE INSTALLATION OF EROSION AND SEDIMENT CONTROL DEVICES.
2. INSTALL SILT FENCE.
3. UPON INSTALLATION OF ALL EROSION CONTROL DEVICES, CONTRACTOR MAY CLEAR AND GRUB AS NECESSARY.
4. INSTALL COFFERDAM.
5. REMOVE EXISTING & CONSTRUCT PROPOSED STORMLINES (SEE PROFILES). INSTALL INLET PROTECTION AND OTHER INLET CONTROL DEVICES AS STORM LINES ARE COMPLETED.
6. REMOVE COFFERDAM.
7. FINE GRADE.
8. PERMANENTLY STABILIZE & MULCH DISTURBED AREAS.
9. UPON SITE STABILIZATION REMOVE REMAINING SEDIMENT CONTROL DEVICES.

NOTES

1. REFER TO DWG 03-32381A FOR TYPICAL LEGEND.
2. ALL NORTHINGS & EASTINGS ARE BASED ON STATE PLANE.
3. EXISTING CONTOURS SHOWN ARE PER STANTEC FIELD SURVEY, PERFORMED SEPT. 2009.
4. TREE CLEARING SHALL ONLY BE PERFORMED FROM NOV. 15 THROUGH MARCH 31ST.
5. NO TREES OR VEGETATION IN CLOSE PROXIMITY TO THE RIVER BANK SHALL BE DISTURBED.
6. CONTRACTOR SHALL RESTORE ALL RAILING AND STEPS AT AND LEADING TO THE HEADWALL TO ORIGINAL CONDITION. COST TO BE INCLUDED WITH VARIOUS BID ITEMS.
7. CONTRACTOR SHALL RESTORE THE WOODEN DOCK AND SKIMMER AS NECESSARY. COST TO BE INCLUDED IN VARIOUS BID ITEMS.
8. CONTRACTOR SHALL ENSURE WATERTIGHT CONNECTIONS BETWEEN PROPOSED STORM SEWER AND EXISTING STRUCTURES AT POINTS OF CONNECTION.
9. ALL MANHOLES SHALL CONFORM TO CLASS III, WALL B, ASTM C478.
10. ALL CONCRETE PIPE SHALL CONFORM TO ASTM C507. ALL JOINTS SHALL CONFORM TO ASTM C443.
11. INSTALLATION OF STRUCTURE NO.3 MAY REQUIRE AN ADDITIONAL COFFERDAM.

DISTURBED AREA

TOTAL DISTURBED AREA = 1.88 AC.

RELEASED FOR CONSTRUCTION

REVISIONS

DATE	NO.	DESCRIPTION	APPD.
3-03-10	1	REVISED LIMITS OF DISTURBANCE & EROSION CONTROL DEVICES	

APPALACHIAN POWER COMPANY

JOHN E. AMOS PLANT

SCARY, WEST VIRGINIA

YARD PIPING UNITS 1, 2 & 3

OUTLET 003
RECONSTRUCTION PLAN
PLANVIEW AND PROFILE

DWG. NO. 03-32381E - 1

SCALE: | CIVIL ENGINEERING DIVISION
DR:
CH:
ARCH:
ENGR:
DATE:
APPROVED BY

RAYMOND H. GEORGE JR. REGISTERED 8395 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

3/4/10

SCALE: 1" = 40'
DR: RRP
CH: RDD
ENGR: RHG
DATE: 11-24-09

Stantec Consulting Services Inc.
1500 Lakeshore Drive Suite 100
Columbus, Ohio 43204
(614) 486-4383 FAX (614) 486-4387

AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

CONSTRUCTION DRAWINGS FOR THE BOTTOM ASH STORAGE AREA MODIFICATIONS 2010 DIKE RAISING

OPERATED BY:

APPALACHIAN POWER COMPANY

JOHN E. AMOS PLANT

PUTNAM COUNTY, WEST VIRGINIA

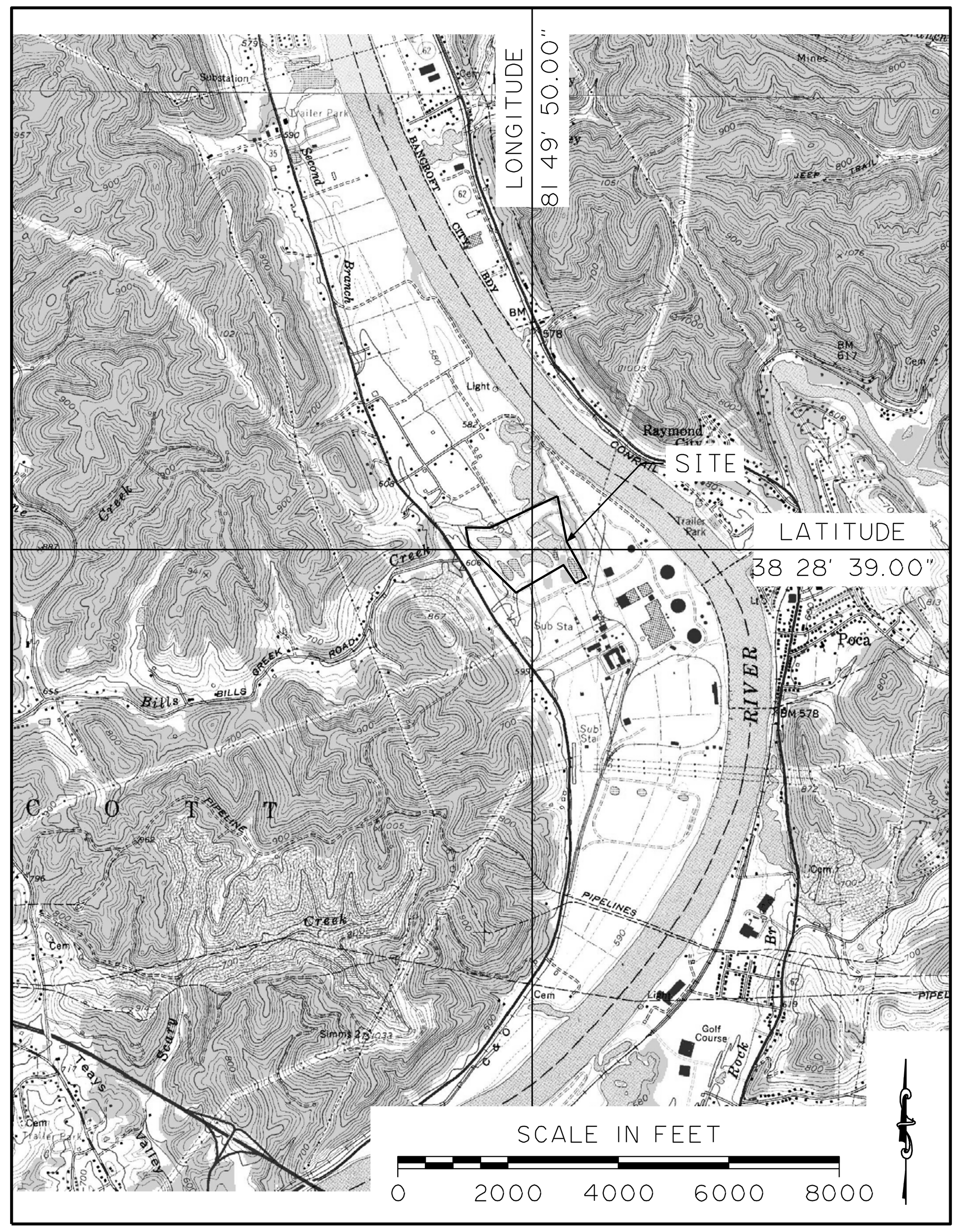
PREPARED BY:

BBCM ENGINEERING, INC.
6190 ENTERPRISE COURT, DUBLIN, OHIO 43016

FOR

AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA, COLUMBUS, OHIO 43215

JUNE 2010



LOCATION MAP

AS-BUILT DRAWINGS

DRAWING INDEX

NOTE: AS-BUILT SURVEY PROVIDED BY BIEDENBACH SURVEYING, INC. (ORIGINAL DATED 12/02/10, REVISED 3/10/11)

NOTE: AS-BUILT FIELD DATA WAS COLLECTED WITH TOPCON GPS EQUIPMENT, BASED ON CONTROL MONUMENT 1141 (AS PROVIDED BY AEP). SPOT ELEVATIONS ON THE WALL WERE NOT LOCATED AT THE EDGE OF THE BLOCK (BLOCK EDGE CHAMFERED).

THESE CONSTRUCTION DRAWINGS HAVE BEEN PREPARED BASED ON THE APPROVED DESIGN DRAWINGS PREPARED AND ENGINEERING ANALYSIS PERFORMED BY GEO/ENVIRONMENTAL ASSOCIATES, INC.
(DATED DECEMBER 5, 2005 AND REVISED AND STAMPED ON NOVEMBER 12, 2009).

BBCM
SOLUTIONS TO BUILD ON
Columbus (614) 793-2226
Cleveland (216) 901-1000
Cincinnati (513) 771-8471
Dayton (937) 424-1011

SHEET 1

Ronald T. Erb
RONALD T. ERB
NAME
6-4-10
DATE
BBC&M ENGINEERING

RONALD T. ERB
REGISTERED
15891
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

DATE	NO.	DESCRIPTION	APPD.
5/16/11	2	AS-BUILT DRAWINGS	MGR
6/4/10	1	ISSUED FOR CONSTRUCTION	RTE

REVISIONS

APPALACHIAN POWER COMPANY
AMOS PLANT
PUTNAM COUNTY WEST VIRGINIA

BOTTOM ASH STORAGE
AREA MODIFICATION
2010 DIKE RAISING
COVER SHEET

DWG. NO. 13-3550G-2

ARCH	—	ELEC	—	MECH	—	STR	GS

SCALE: 1"=100'
DR: RSH
CH: MGR
AP: RTE
DATE: 2/26/10
APPROVED BY
CIVIL ENGINEERING DIVISION

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE- DD-MMM-YYYY
SYSTEM TIME- HOUR:MINUTE

IGS0694

DWG. NO. 13-3550H-2

SPECIFICATION FOR REDI-ROCK 28" SERIES WALL SYSTEM

PART 1: GENERAL

1.1 Scope
Work includes furnishing and installing concrete retaining wall units to the lines and grades designated on the construction drawings and as specified herein.

1.2 Reference Standards
ASTM C94 Ready-Mixed Concrete
ASTM C1372 Segmental Retaining Wall Units

1.3 Delivery, Storage, and Handling

A. Contractor shall check the materials upon delivery to assure proper material has been received.

B. Contractor shall prevent excessive mud, wet cement and like materials from coming in contact with the SRW units.

C. Contractor shall protect the materials from damage. Damaged material shall not be incorporated in the project.

PART 2: MATERIALS

2.1 Wall Units

A. Wall units shall be Redi-Rock® as produced by a licensed manufacturer.

B. Wall units shall be made with Ready-Mixed concrete in accordance with ASTM C94, latest revision, and per the following chart:

Climate	Air Content	28 Day Compressive Strength, psi	Slump*
Severe	4½%-7½%	4000	5" ±1 ½"

*Higher slumps are allowed where achieved by use of appropriate admixtures.

Notwithstanding anything stated above, all material used in the wall units must meet applicable ASTM and local requirements for exterior concrete.

C. Exterior block dimensions shall be uniform and consistent. Maximum dimensional deviations shall be 1% excluding the architectural surface. Maximum width (face to back) deviation including the architectural surface shall be 1.0 inch.

D. Exposed face shall be finished as specified. Other surfaces to be smooth form type. Dime-size bug holes on the block face may be patched and/or shake-on color stain can be used to blend into the remainder of the block face.

2.2 Leveling Pad and Free Draining Backfill

A. Leveling pad shall be crushed stone consisting of WVDOH Item 704.6.

B. Free Draining Backfill material shall be washed WV DOH Item 703 No. 57 stone and shall be placed to a minimum of 1 foot width behind the back of the wall and shall extend vertically from the Leveling Pad to an elevation 4" below the top of wall.

C. Backfill material shall consist of low permeability cohesive soil consistent with the structural fill specification.

D. Geotextile filter fabric consistent with WV DOH Item 715.11.8 shall be placed between the Free Draining Backfill and retained soil as shown on the plans.

2.3 Drainage

A. Install 4 inch ADS 0441 perforated HDPE pipe within free draining backfill and daylight beneath wall using 4 inch ADS 0440 solid HDPE pipe every 40 feet on center.

PART 3: CONSTRUCTION OF WALL SYSTEM

3.1 Excavation

A. Contractor shall excavate to the lines and grades shown on the construction drawings.

3.2 Foundation Soil Preparation

A. Native foundation soil shall be compacted to 95% of standard proctor prior to placement of the Leveling Pad material.

B. In-situ foundation soil shall be examined by the Engineer to ensure that the actual foundation soil strength meets or exceeds **the strength considered for the design. Soil not meeting the required strength shall be removed and replaced with acceptable.**

3.3 Leveling Pad Placement

A. Leveling Pad shall be placed as shown on **the construction drawings.**

B. Leveling Pad shall be placed on undisturbed native soils or suitable replacements fills.

C. Leveling Pad shall be compacted to 95% of standard proctor to ensure a level, hard surface on which to place the first course blocks. Pad shall be constructed to the proper elevation to ensure the final elevation shown on the plans.

D. Leveling Pad shall have a 6 inch minimum depth. Pad dimensions shall extend beyond the blocks in all directions to a distance at least equal to the depth of the pad.

3.4 Unit Installation

A. The first course of wall units shall be placed on the prepared Leveling Pad with the aesthetic surface facing out and the front edges tight together. All units shall be checked for level and alignment as they are placed.

B. Ensure that units are in full contact with Leveling Pad. Proper care shall be taken to develop straight lines and smooth curves on base course as per wall layout.

C. The backfill in front and back of entire base row shall be placed and compacted to firmly lock them in place. Check all units again for level and alignment. All excess material shall be swept from top of units.

D. Install next course of wall units on top of base row. Position blocks to be offset from seams of blocks below. Blocks shall be placed fully forward so knob and groove are engaged. Check each block for proper alignment and level. Backfill to 12 inch width behind block with Free Draining Backfill. Spread backfill in uniform lifts not exceeding 9 inches. Employ methods using lightweight compaction equipment that will not disrupt the stability or batter of the wall. Hand-operated plate compaction equipment shall be used around the block and within 3 feet of the wall to achieve consolidation. Compact backfill in accordance with structural fill specification.

E. Install each subsequent course in like manner. Repeat procedure to the extent of wall height.

F. Allowable construction tolerance at the wall face is 2 degrees vertically and 1 inch in 10 feet horizontally.

AS-BUILT DRAWINGS

REVISIONS

DATE	NO.	DESCRIPTION	APPD.
5/16/11	2	AS-BUILT DRAWINGS	MCR
6/4/10	1	ISSUED FOR CONSTRUCTION	RTE

APPALACHIAN POWER COMPANY
AMOS PLANT
PUTNAM COUNTY WEST VIRGINIA

BOTTOM ASH STORAGE AREA MODIFICATION 2010 DIKE RAISING
GENERAL NOTES/SPECS

SHEET 2

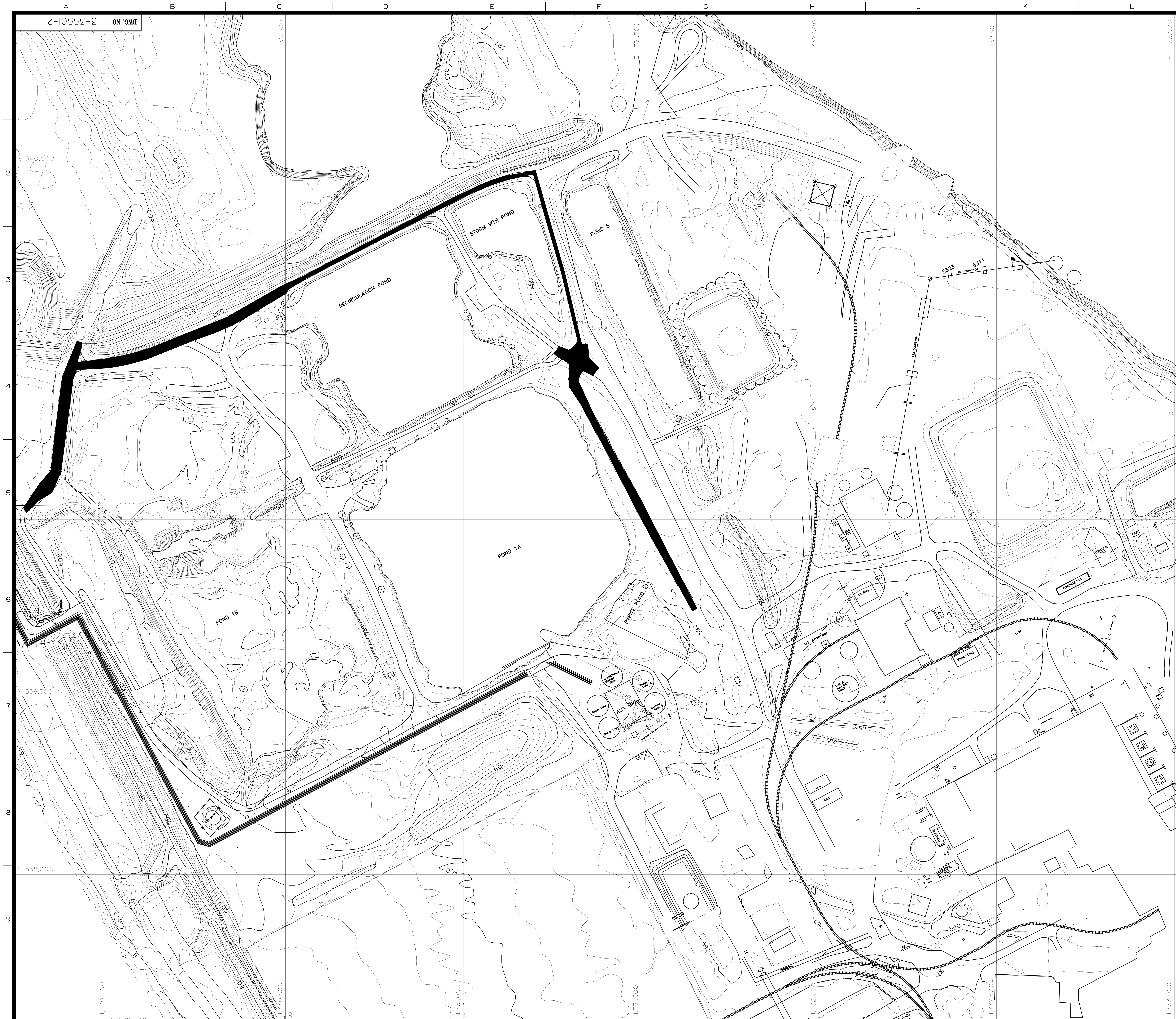
RONALD T. ERB
NAME
6-4-10
DATE
BBC&M ENGINEERING

RONALD T. ERB REGISTERED 15891 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

DWG. NO. 13-3550H-2

SCALE: 1"=100' CIVIL ENGINEERING DIVISION
DR: RSH
CK: MCR
AP: RTE
DATE: 2/26/10

AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA COLUMBUS, OH 43215



LEGEND:

EXISTING

EXISTING GROUND SURFACE

PREVIOUSLY CONSTRUCTED GRADES, AS PER THESE DRAWINGS

PROPOSED

LIMITS OF PROPOSED GRADING

0 50' 100' 200'

SCALE

AS-BUILT DRAWINGS

DATE	NO.	DESCRIPTION	APPD.
5/16/11	2	AS-BUILT DRAWINGS	MGR
6/4/10	1	ISSUED FOR CONSTRUCTION	RTE

REVISIONS

APPALACHIAN POWER COMPANY

AMOS PLANT

PUTNAM COUNTY WEST VIRGINIA

BOTTOM ASH STORAGE
AREA MODIFICATION
2010 DIKE RAISING

SITE PLAN

SHEET 3

Ronald T. Erb
RONALD T. ERB
NAME
6-4-10
DATE

BBC&M ENGINEERING

RONALD T. ERB REGISTERED 15891 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

DWG. NO. 13-35501-2

ARCH	—	ELEC	—	MECH	—	STR	GS

SCALE: 1"=100'
DR: RSH
CH: MGR
AP: RTE
DATE: 2/26/10
APPROVED BY
CIVIL ENGINEERING DIVISION

AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

IGS0694

SYSTEM DATE- DD-MMM-YYYY
SYSTEM TIME- HOUR:MINUTE

LEGEND:

PROPOSED

PROPOSED GRADES

CONSTRUCTION LIMITS

SCALE 0 30' 60' 120'

SURVEY BENCHMARKS

I.D.	DESCRIPTION	NORTHING	EASTING	ELEV.
MON-11404	IRON PIN W/CAP	537,598.92	1,731,729.93	585.56
MON-11406	IRON PIN W/CAP	539,012.66	1,732,742.10	594.18
MON-1141	CONCRETE MONUMENT	539,593.82	1,731,365.91	580.93
SURVEY CP 5917	IRON PIN W/CAP	537,598.92	1,731,729.93	ELEV.

SURVEY CONTROL POINTS

STATION	NORTHING	EASTING
0+00.00	539,022.67	1,729,765.04
1+43.05	539,135.50	1,729,852.98
4+06.42	539,396.63	1,729,887.28
4+44.68= 6+00.00	539,433.02	1,729,899.07
5+15.29	539,500.20	1,729,920.83
6+68.31	539,445.60	1,729,975.48
8+31.93	539,479.77	1,730,154.05
10+67.79	539,605.37	1,730,356.94
13+12.01	539,702.64	1,730,604.30
18+33.14	539,930.93	1,731,090.01
19+83.57	539,978.10	1,731,183.36
20+23.37	539,984.96	1,731,218.55
23+16.85	539,694.77	1,731,280.82
25+38.40	539,479.19	1,731,331.92
25+72.41	539,451.24	1,731,312.55
26+11.65	539,418.99	1,731,290.20
33+55.81	538,763.00	1,731,641.57

AS-BUILT DRAWINGS

DATE	NO.	DESCRIPTION	APPD.
5/16/11	2	AS-BUILT DRAWINGS	MGR
6/4/10	1	ISSUED FOR CONSTRUCTION	RTE

REVISIONS

APPALACHIAN POWER COMPANY

AMOS PLANT

PUTNAM COUNTY WEST VIRGINIA

BOTTOM ASH STORAGE
AREA MODIFICATIONS
2010 DIKE RAISING

SCHEMATIC PLAN

SHEET 4

Ronald T. Erb
RONALD T. ERB
NAME
6-4-10
DATE
BBC&M ENGINEERING

RONALD T. ERB REGISTERED 15891 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

DWG. NO. 13-3550J-2

ARCH	—	ELEC	—	MECH	—	STR	GS

SCALE: 1"=60'
DR: RSH
CH: MGR
AP: RTE
DATE: 2/26/10
APPROVED BY
CIVIL ENGINEERING DIVISION

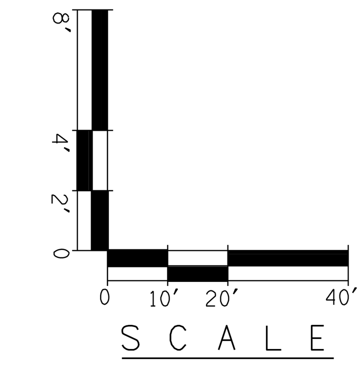
AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

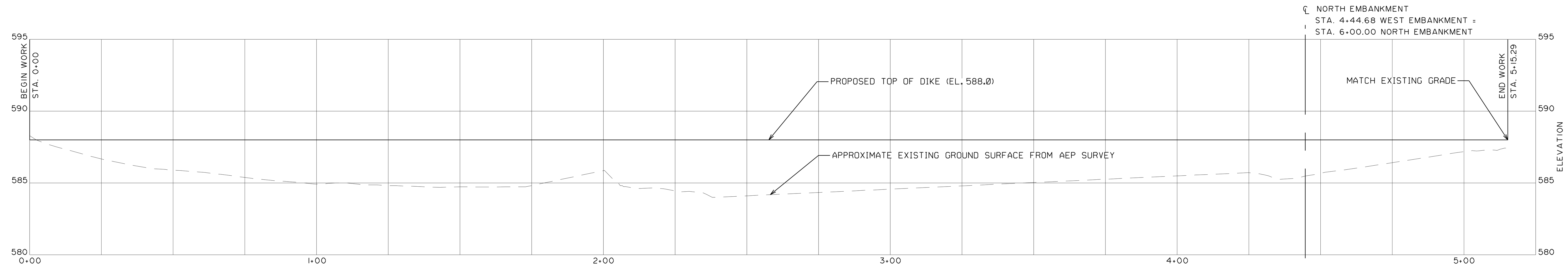
IGS0694

SYSTEM DATE- DD-MMM-YYYY
SYSTEM TIME- HOUR:MINUTE

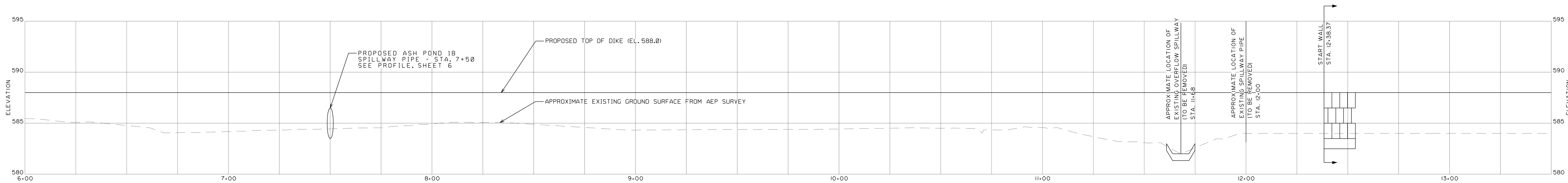
DWG. NO. 13-3550K-2

AS-BUILT PROFILE NOT SHOWN. SEE SHEET 4 FOR AS-BUILT SPOT ELEVATIONS.

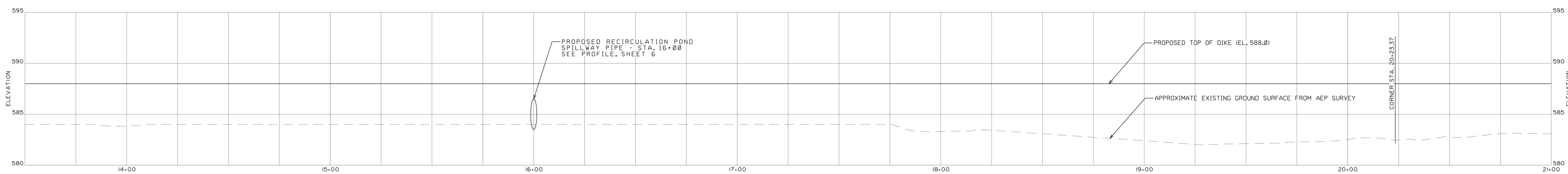




PROFILE - STA. 0+00 TO STA. 5+15.29

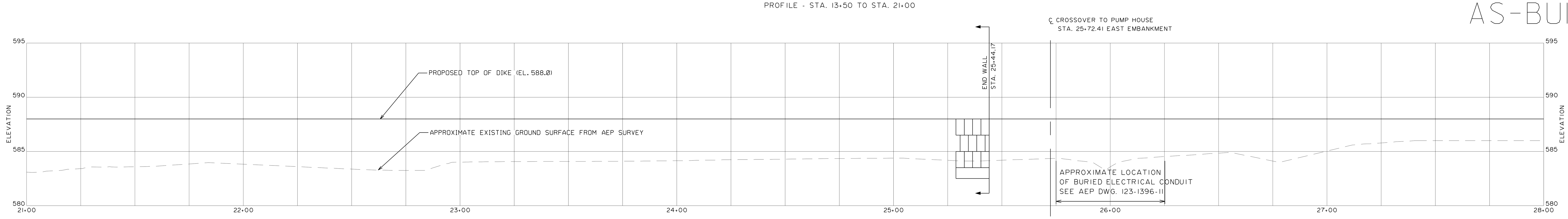


PROFILE - STA. 6+00 TO STA. 13+50

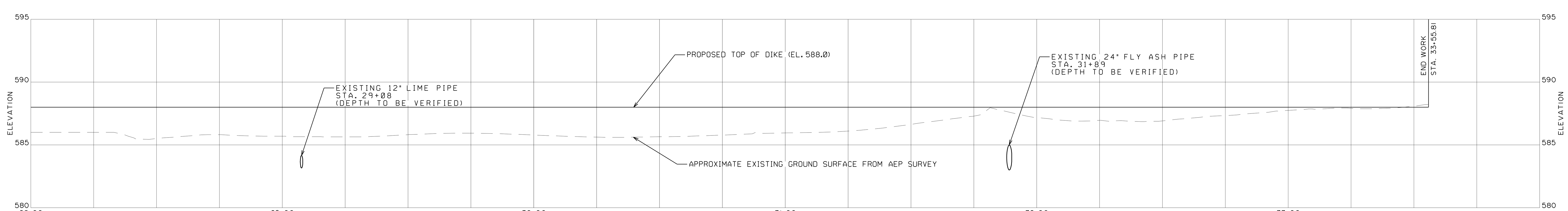


PROFILE - STA. 13+50 TO STA. 21+00

AS-BUILT DRAWINGS



PROFILE - STA. 21+00 TO STA. 28+00



PROFILE - STA. 28+00 TO STA. 33+55.81

SHEET 5

Ronald T. Erb (signature)
RONALD T. ERB
NAME
6-4-10
DATE
BBC&M ENGINEERING

RONALD T. ERB REGISTERED 15891 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

DATE	NO.	DESCRIPTION	APPD.
5/16/11	2	AS-BUILT DRAWINGS	MGR
6/4/10	1	ISSUED FOR CONSTRUCTION	RTE

REVISIONS

APPALACHIAN POWER COMPANY
AMOS PLANT
PUTNAM COUNTY WEST VIRGINIA

BOTTOM ASH STORAGE
AREA MODIFICATIONS
2010 DIKE RAISING
PROFILE - EMBANKMENT

DWG. NO. 13-3550K-2

ARCH — ELEC — MECH — STR GS

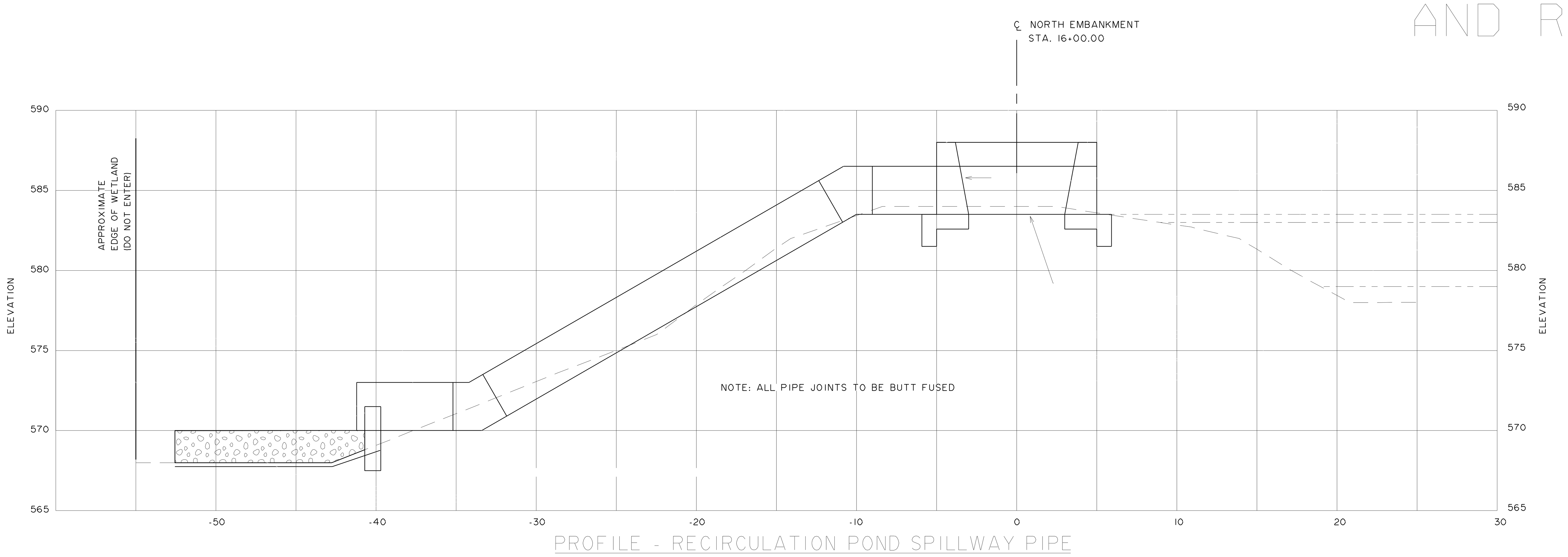
SCALE: 1"=100'
DR: RSH
CH: MGR
AP: RTE
DATE: 2/26/10
APPROVED BY
CIVIL ENGINEERING DIVISION

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

IGS0694

DWG. NO. 13-3550L-2

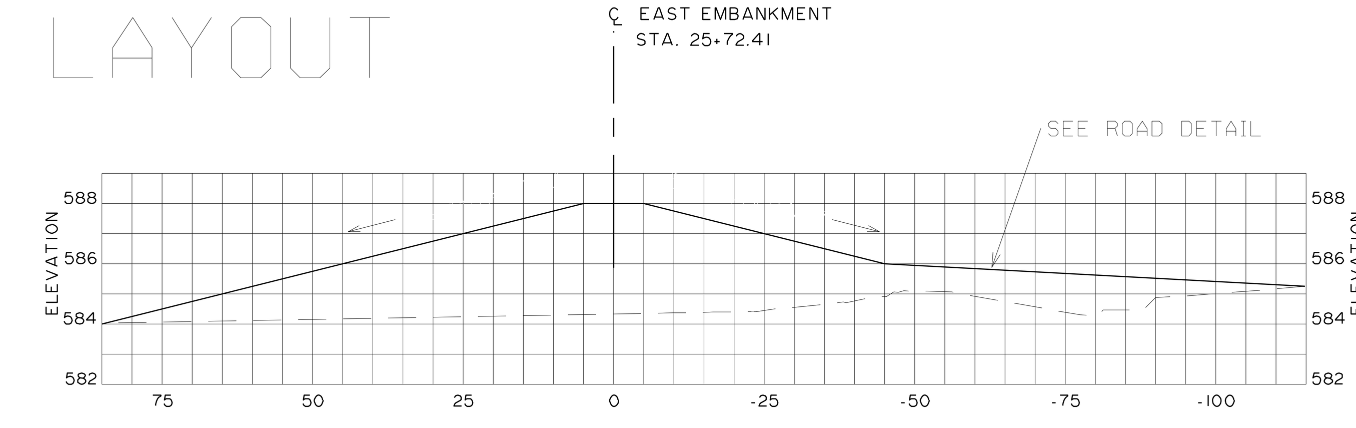
SEE SHEET 4 FOR AS-BUILT SPOT ELVATIONS AND RAMP LAYOUT



PROFILE - RECIRCULATION POND SPILLWAY PIPE

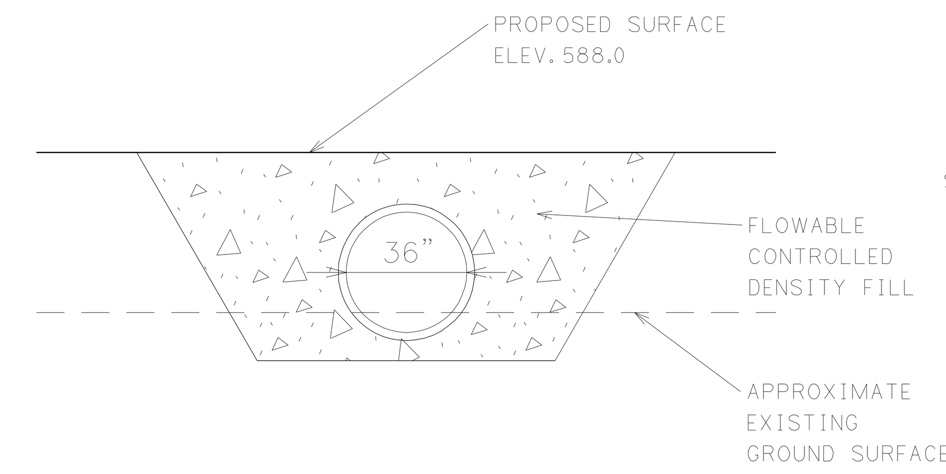
0 2' 4' 8'
SCALE

SEE SHEET 4 FOR AS-BUILT INVERTS AND LOCATION.



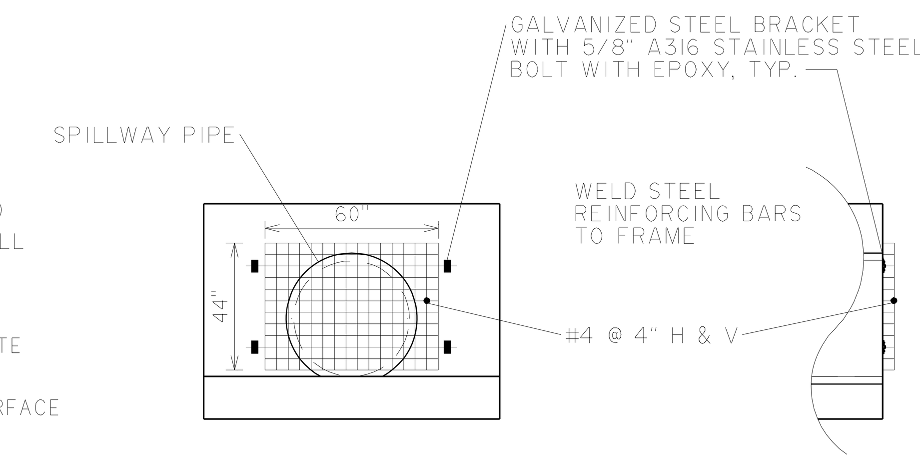
PROFILE - CROSSOVER ROAD

0 10' 20' 40'
SCALE

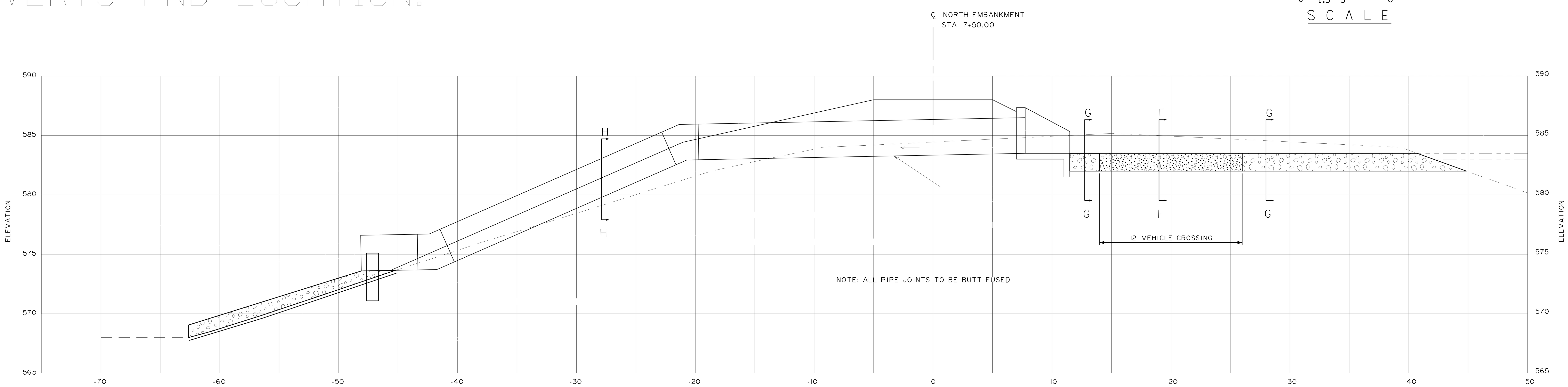


PIPE BACKFILL DETAIL

0 1.5' 3' 6'
SCALE



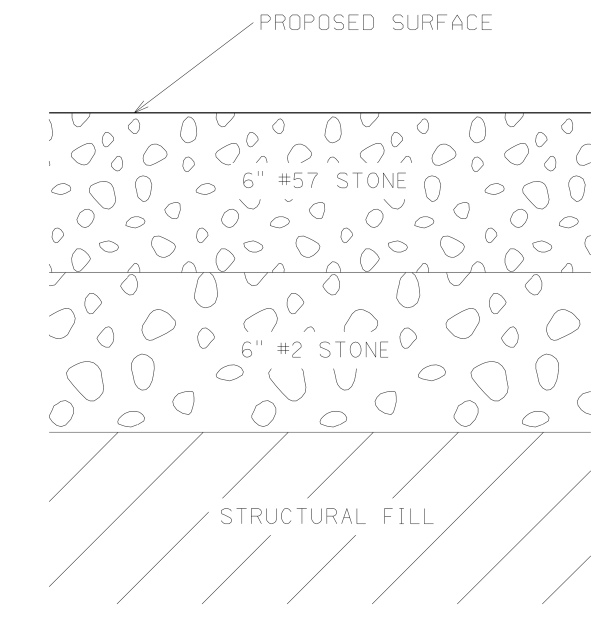
TRASH GUARD DETAIL
NOT TO SCALE



PROFILE - ASH POND 1B SPILLWAY PIPE

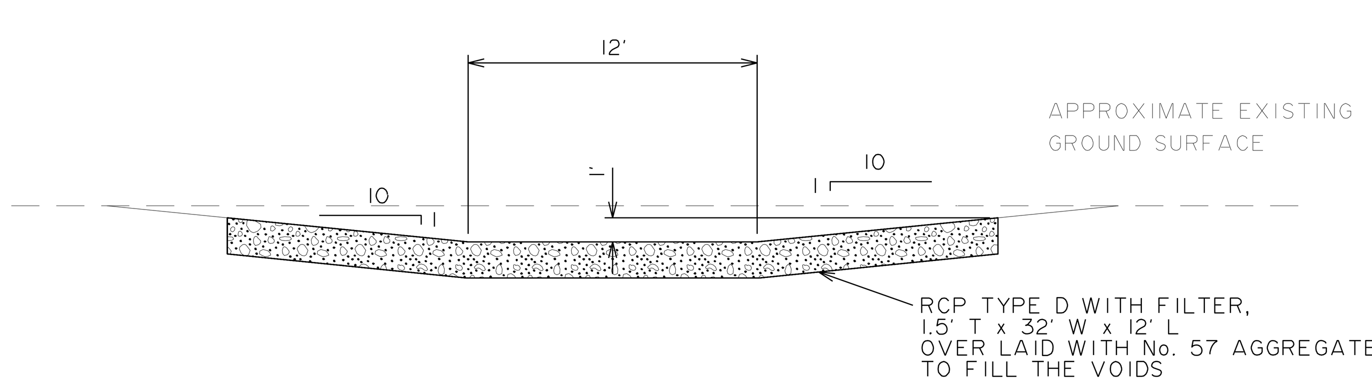
0 2' 4' 8'
SCALE

SEE SHEET 4 FOR AS-BUILT INVERTS AND LOCATION.



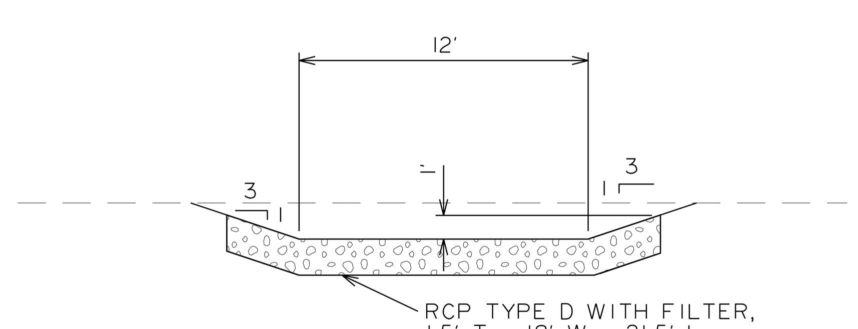
ROAD DETAIL
NOT TO SCALE

AS-BUILT DRAWINGS



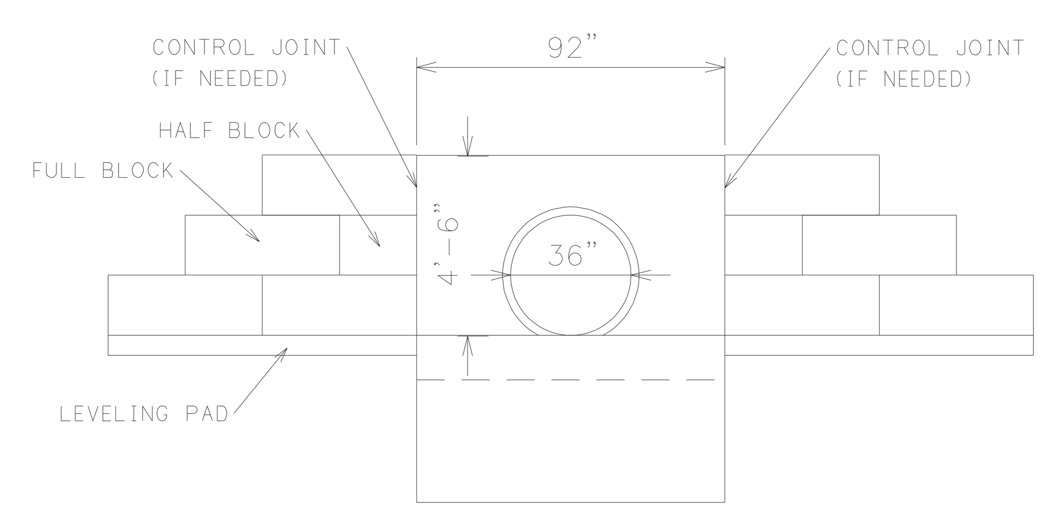
SECTION F-F - VEHICLE CROSSING

0 2.5' 5' 10'
SCALE



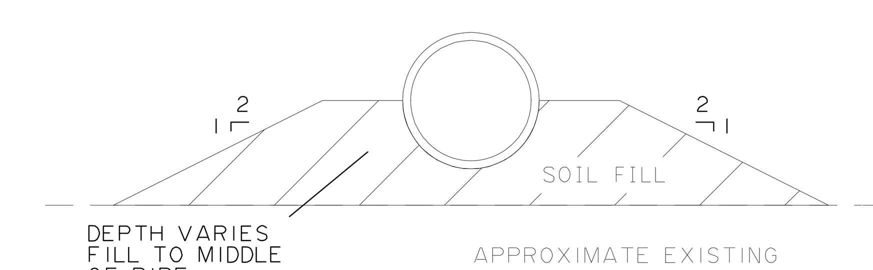
SECTION G-G - SPILLWAY CHANNEL

0 2.5' 5' 10'
SCALE



HEADWALL DETAIL

0 1.5' 3' 6'
SCALE



NOTE: TOPSOIL TO BE STRIPPED PRIOR TO PLACING FILL

SECTION H-H

0 1.5' 3' 6'
SCALE

DATE	NO.	DESCRIPTION	APPD.
5/16/11	2	AS-BUILT DRAWINGS	MGR
6/4/10	1	ISSUED FOR CONSTRUCTION	RTE

REVISIONS

APPALACHIAN POWER COMPANY
AMOS PLANT
PUTNAM COUNTY WEST VIRGINIA

BOTTOM ASH STORAGE AREA MODIFICATIONS 2010 DIKE RAISING
PROFILE - SPILLWAY PIPES/CROSSOVER

SHEET 6

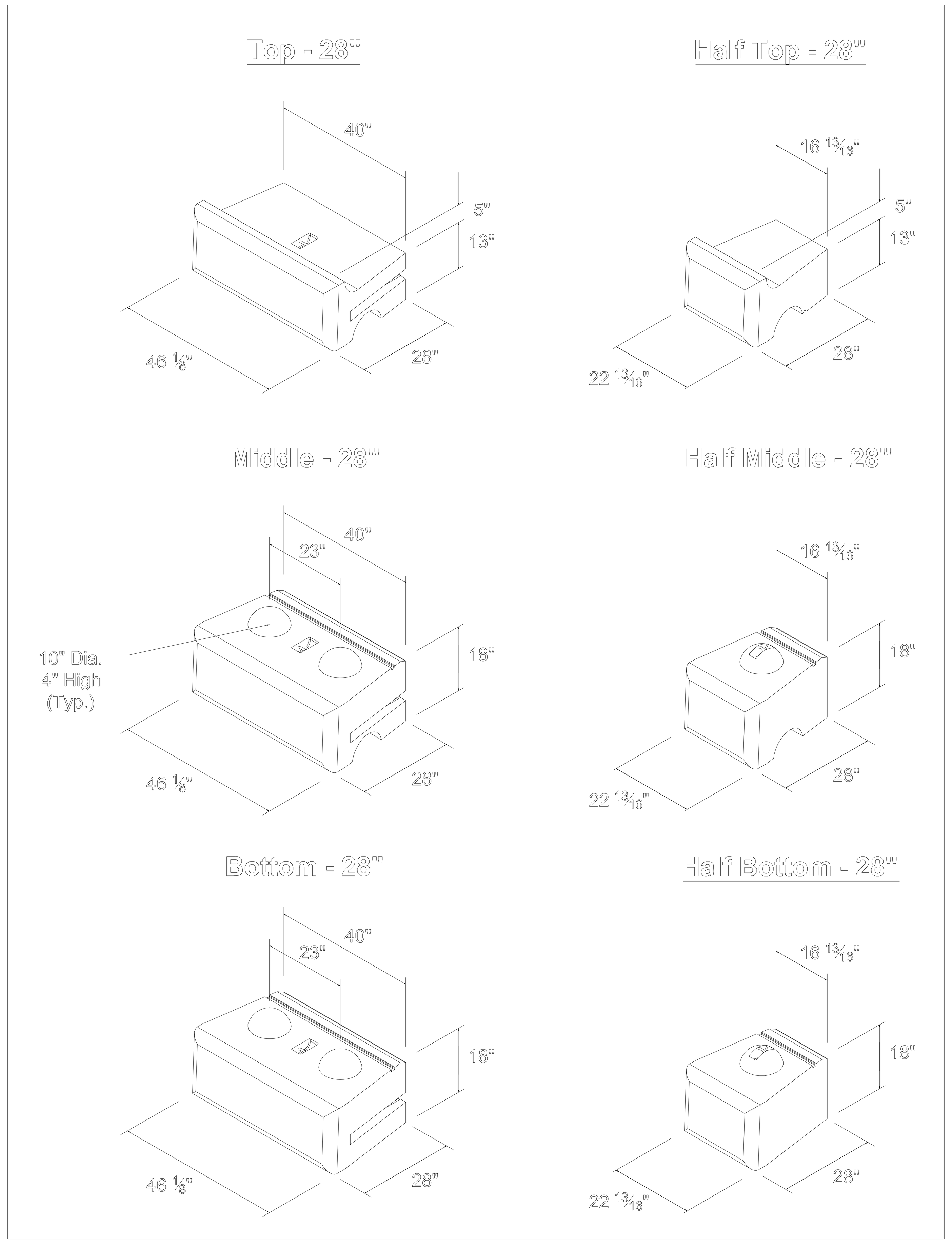
RONALD T. ERB
NAME
6-4-10
DATE
BBC&M ENGINEERING

RONALD T. ERB REGISTERED 15891 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

DWG. NO. 13-3550L-2

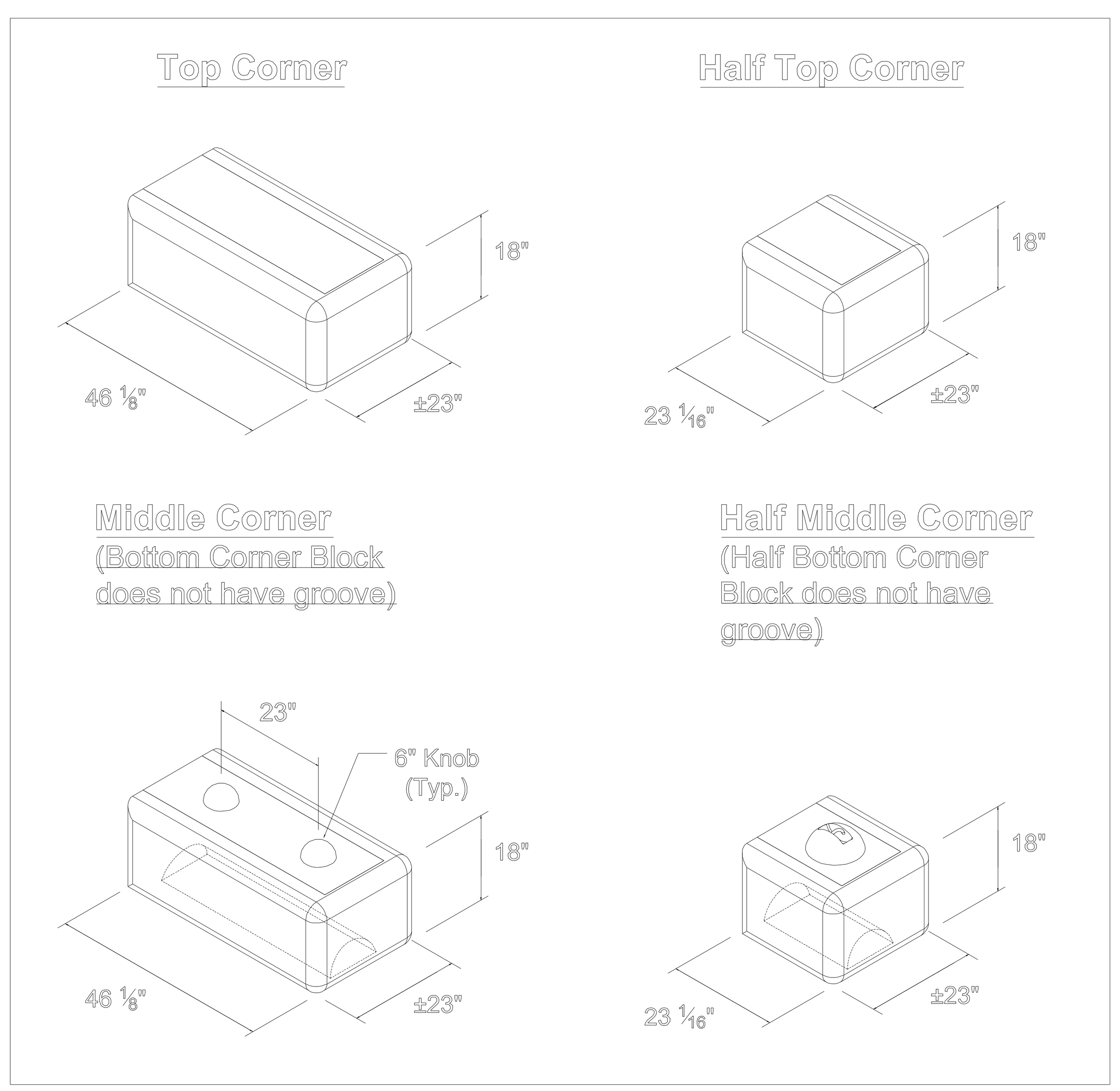
SCALE: 1"=100'
DR: RSH
CH: MGR
AP: RTE
DATE: 2/26/10
CIVIL ENGINEERING DIVISION

AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215



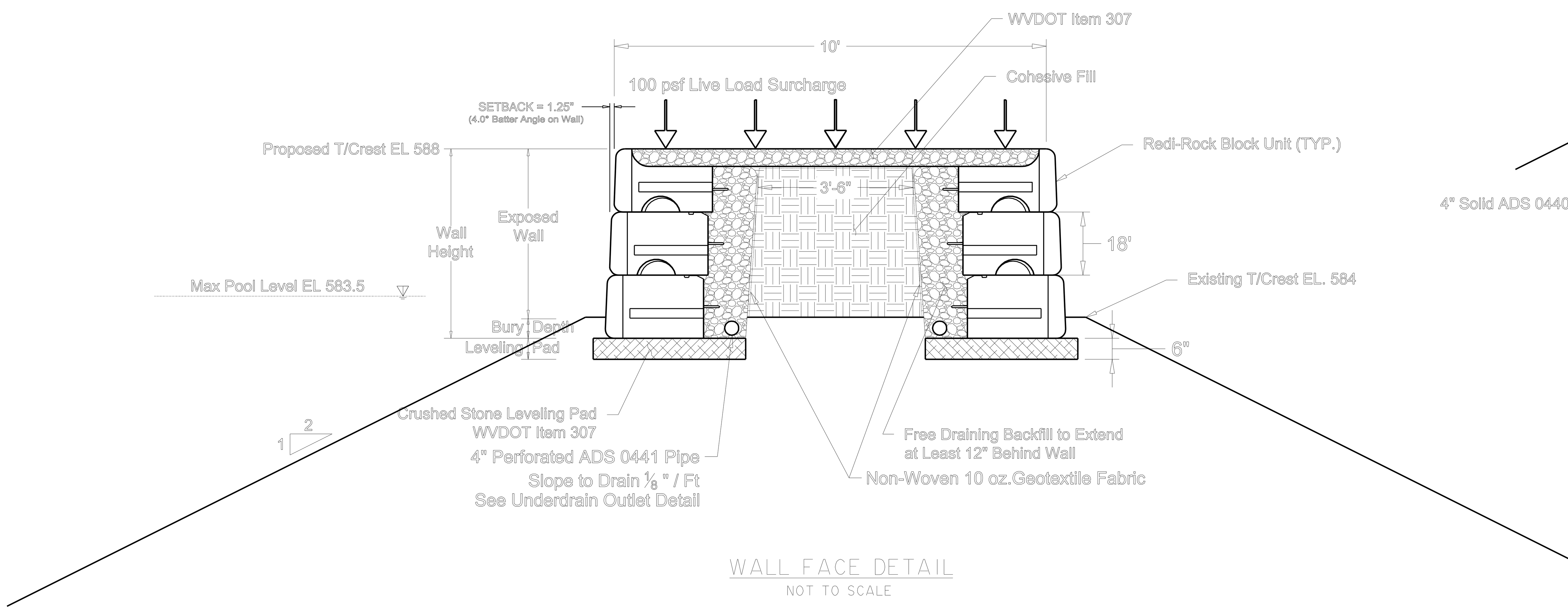
REDI-ROCK STANDARD BLOCK DETAIL

NOT TO SCALE



REDI-ROCK CORNER BLOCK DETAIL

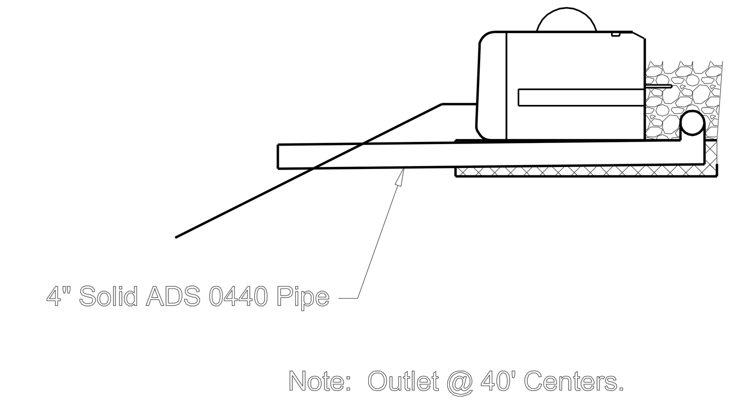
NOT TO SCALE



WALL FACE DETAIL

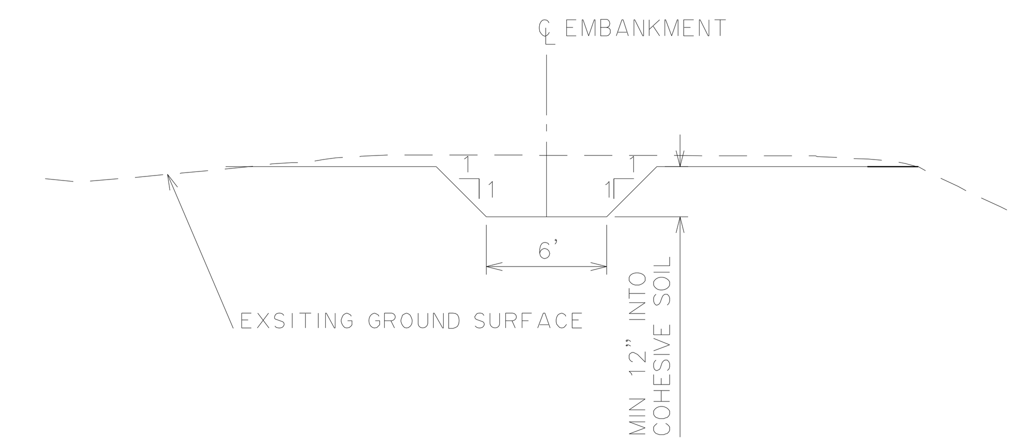
NOT TO SCALE

NOTE: Wall is designed for a height of no more than (3) three blocks.
Owner must be notified if actual grade is lower than anticipated existing grade.



UNDERDRAIN OUTLET DETAIL

NOT TO SCALE



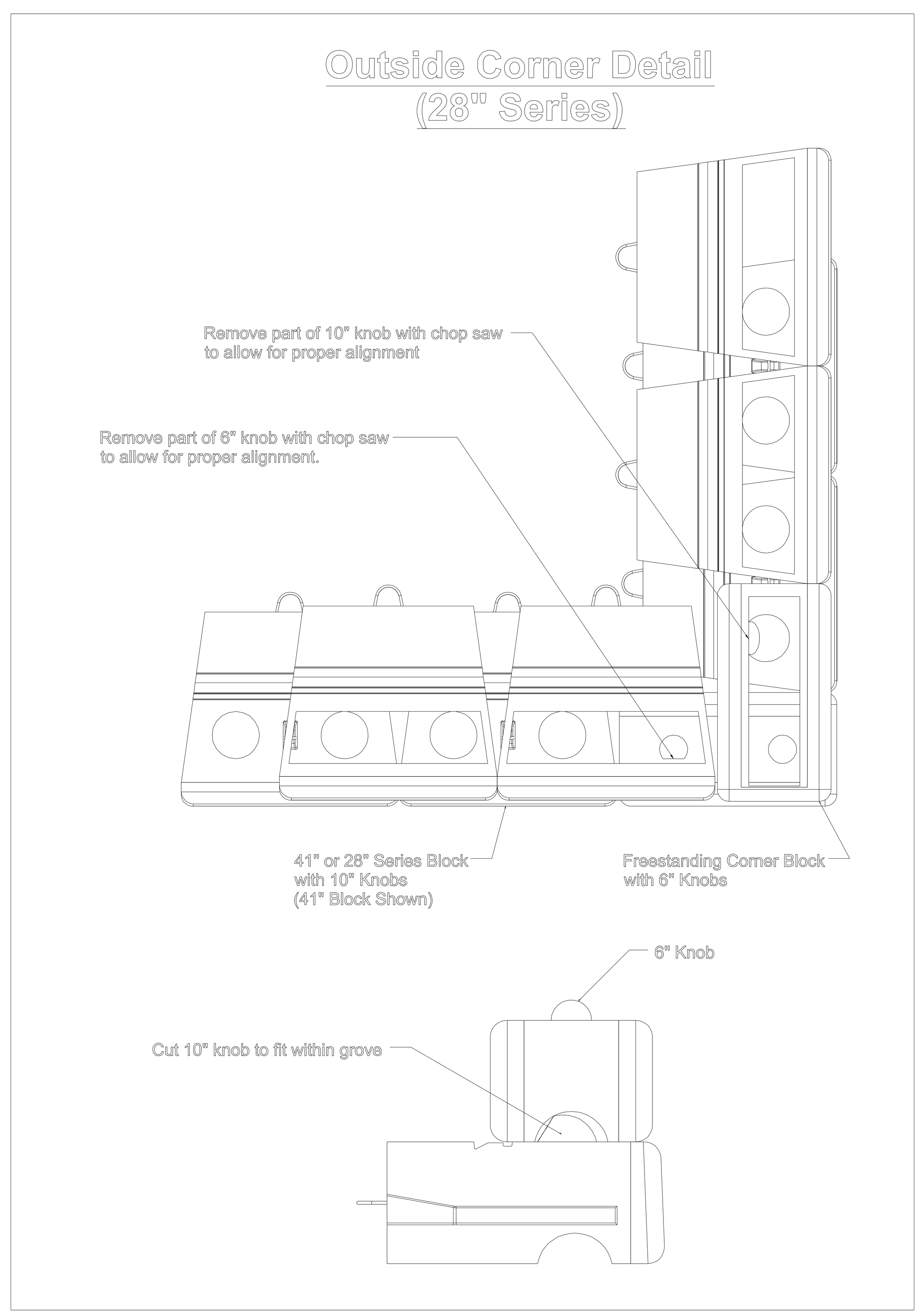
CUTOFF TRENCH DETAIL

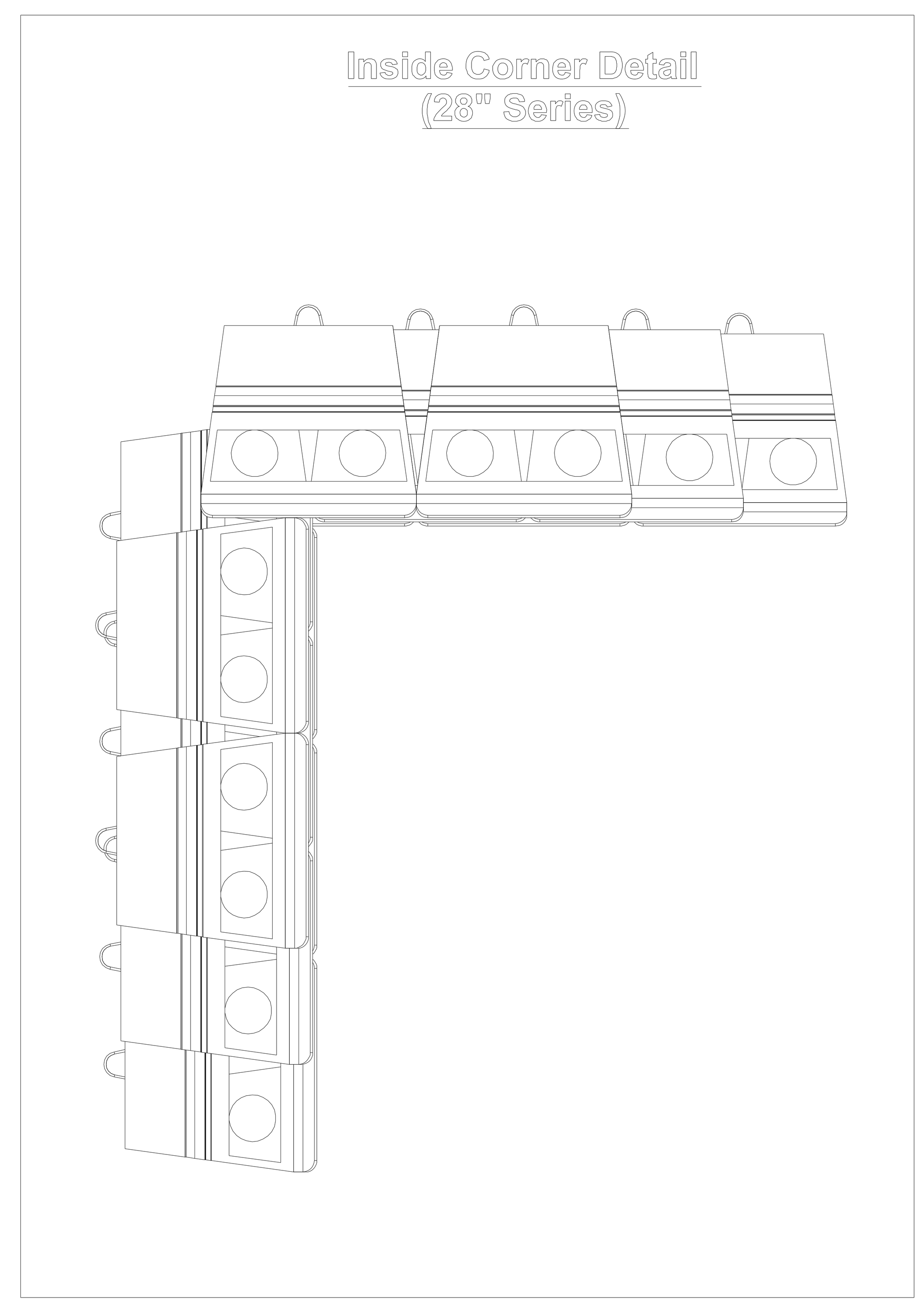
STA. 0+00 TO STA. 5+15.29

STA. 6+00 TO STA. 33+55.81

0 3' 6' 12'

SCALE





AS-BUILT DRAWINGS

DATE	NO.	DESCRIPTION	APPD.
5/16/11	2	AS-BUILT DRAWINGS	MGR
6/4/10	1	ISSUED FOR CONSTRUCTION	RTE

REVISIONS

APPALACHIAN POWER COMPANY

AMOS PLANT

PUTNAM COUNTY WEST VIRGINIA

BOTTOM ASH STORAGE
AREA MODIFICATION
2010 DIKE RAISING

SECTIONS & DETAILS

SHEET 7

DWG. NO. 13-3550M-2

ARCH	—	ELEC	—	MECH	—	STR	GS

SCALE: 1"=60'
DR: RSH
CH: MGR
AP: RTE
DATE: 2/26/10
APPROVED BY
CIVIL ENGINEERING DIVISION

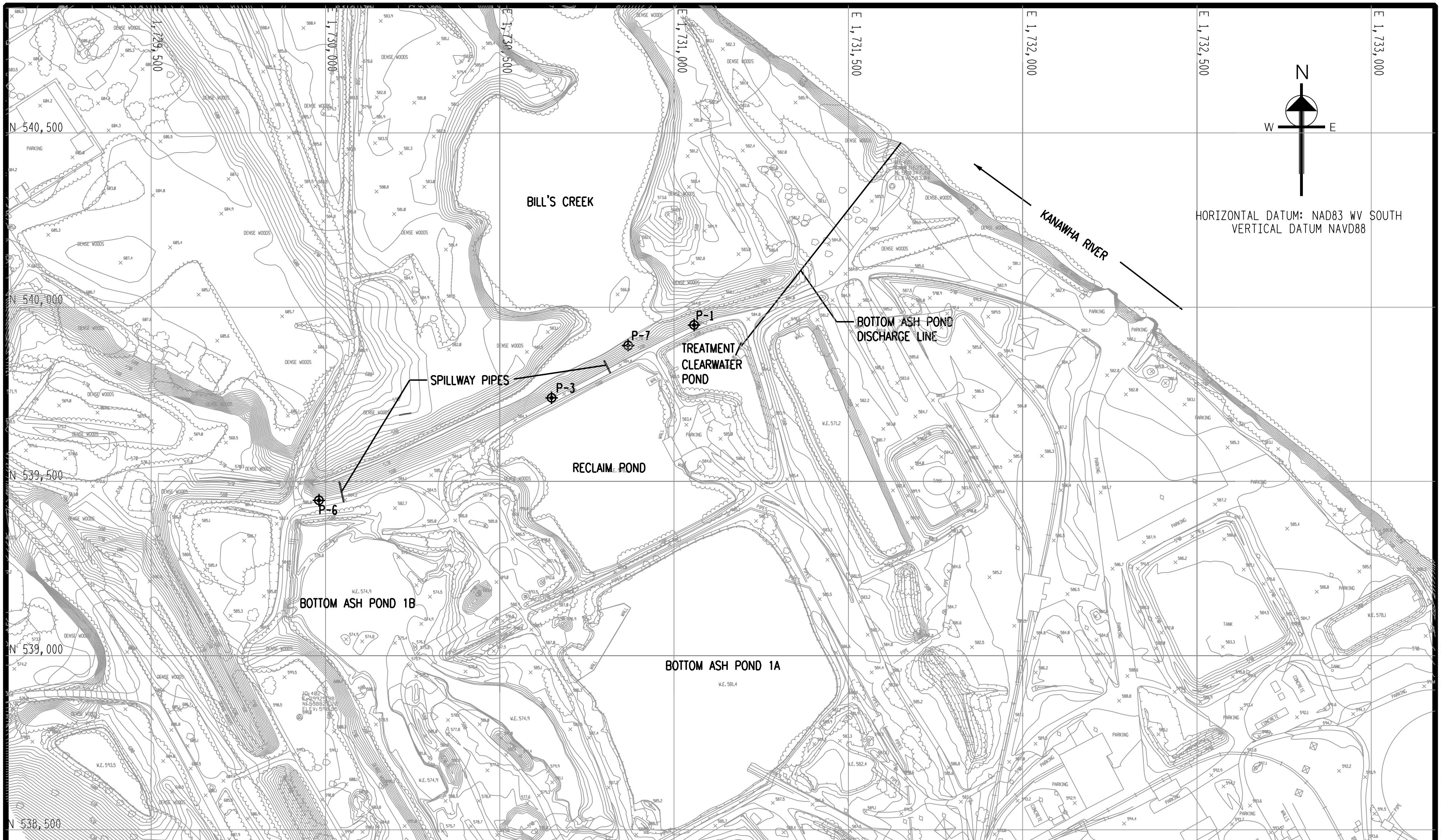
RONALD T. ERB
NAME
6-4-10
DATE
BBC&M ENGINEERING

RONALD T. ERB REGISTERED 15891 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

ATTACHMENT D

INSTRUMENTATION LOCATION MAP



DATE	NO.	DESCRIPTION	APPD.

REVISIONS

THIS DRAWING IS CLASSIFIED AS:

AEP PUBLIC

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

APPALACHIAN POWER COMPANY

AMOS PLANT

SCARY WEST VIRGINIA

BOTTOM ASH PONDS
INSTRUMENTATION PLAN

UNIT:

DRAWING NUMBER: FIGURE 1

REV:

SCALE:

DR:

CH:

SUP:

ENG:

DATE:

APPROVED BY

AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

BY: s145543

PLOT TIME: 10:24:20 AM

PLOT DATE: 10/5/2016

CROSS REFS:

A (8.5"x11")

ATTACHMENT E

HYDROLOGY AND HYDROLOGIC REPORT

Inflow Design Flood Control System Plan

CFR 257.82(c)

Bottom Ash Pond Complex

Amos Power Plant
Winfield, West Virginia

October, 2016

Prepared for : Appalachian Power Company – Amos Plant

Winfield, West Virginia

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

Document ID: GERS-16-118

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
CFR 257.82(c)
AMOS PLANT
BOTTOM ASH COMPLEX

PREPARED BY ______________________ DATE 9/26/2016
J.T. Massey-Norton

REVIEWED BY ______________________ DATE 10-3-2016
Shah Baig, P.E.

APPROVED BY ______________________ DATE 10/6/2016
Gary F. Zych, P.E.
Manager – AEP Geotechnical Engineering

I certify to the best of my knowledge, information, and belief that the information contained in this Inflow Design Flood Control System Plan meets the requirements of 40 CFR § 257.82.

Table of Contents

Attachments

1.0 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.82(c) for the Inflow Design Flood Control System Plan.

2.0 DESCRIPTIONS OF CCR IMPOUNDMENT

The John E. Amos Plant is located in Putnam County, West Virginia. It is owned and operated by Appalachian Power Company (APCO). The facility operates a surface impoundment for storing CCR called the Bottom Ash Pond Complex.

The Bottom Ash Complex consists of Bottom Ash Pond 1A Bottom Ash Pond 1B, Reclaim Water pond (RCWP) Area 3 and the Treatment pond (TP). The Main Perimeter Dike is located on three sides of the impoundment and grades into native ground along the southern boundary. The BAP-1B pond is bounded on the west by the filled former sedimentation pond and on the east by the BAP-1A. A splitter dike separates the BAP-1A and BAP-1B and the Reclaim Water pond. Figure 1 (aerial image – plan view) illustrates the bottom ash pond complex (Attachment A).

3.0 DESCRIPTION OF DESIGN FLOOD 257.82(a)(3)

The Bottom Ash Pond Complex has been determined to be a Significant Hazard potential CCR impoundment. Based on this hazard classification, the design flood as determined by section 257.82(a)(3) is to be the 1,000-year storm which corresponds to 7 inches for this site. The State of West Virginia regulations for Class II dams requires the dam to be able to pass the ½ PMP (Probable Maximum Precipitation), 6 hour storm event which is equivalent to 14 inches of rain. This plan includes an analysis for the ½ PMP event which exceeds the requirements of section 257.82(a)(3).

4.0 DESCRIPTION OF INFLOW DESIGN FLOOD CONTROL SYSTEM 257.82(c)

The Amos Bottom Ash Complex is comprised of diked embankments on three sides which directs storm water away from the impoundment and limits runoff to that which falls directly on the pond surface. The watershed area to the south is approximately 50 acres and drains into the pond. Inflows into the pond complex are collected and discharged though outlet structures within each area.

Discharge water from either bottom ash pond flows into the reclaim water pond through a 36 inch diameter pipes. A portion of the flow into the reclaim water pond is pumped backed to the plant for reuse.

The remaining portion flows through a 36 inch diameter pipe into the treatment / clear water pond that decants into a concrete weir connected to a 24 in x 38 in elliptical reinforced concrete pipe.

The 24 x 38 concrete elliptical pipe transitions to a 36 inch diameter steel pipe to a 36 inch diameter HDPE pipe that extends into the Kanawha River along the river bed allowing the flow to be discharged into a mixing zone.

The 24 x 38 concrete elliptical pipe discharge pipe was slip lined in 2013 due to leakage at the joints.

An overflow spillway pipe, 36 inch diameter, is located along the reclaim pond with an invert elevation set modeled at 583.2 ft. Bottom ash pond 1B also has a 36 in diameter overflow spillway pipe that discharges to Bill's Creek that was modeled with an invert elevation of 583.7 feet.

The interior splitter dikes between the pond 1A, 1B, the Reclaim Water Pond and the Treatment Basin will be inundated during the ½ PMF event. The dike between the Reclaim Pond and the Treatment Pond will be inundated from a smaller storm event.

5.0 SUMMARY OF INFLOWS, OUTFLOWS AND FLOOD ELEVATIONS

The following table provides the maximum inflows, outflows and flood elevations for each portion of the pond complex. See the analysis included in Attachment B for detailed calculations.

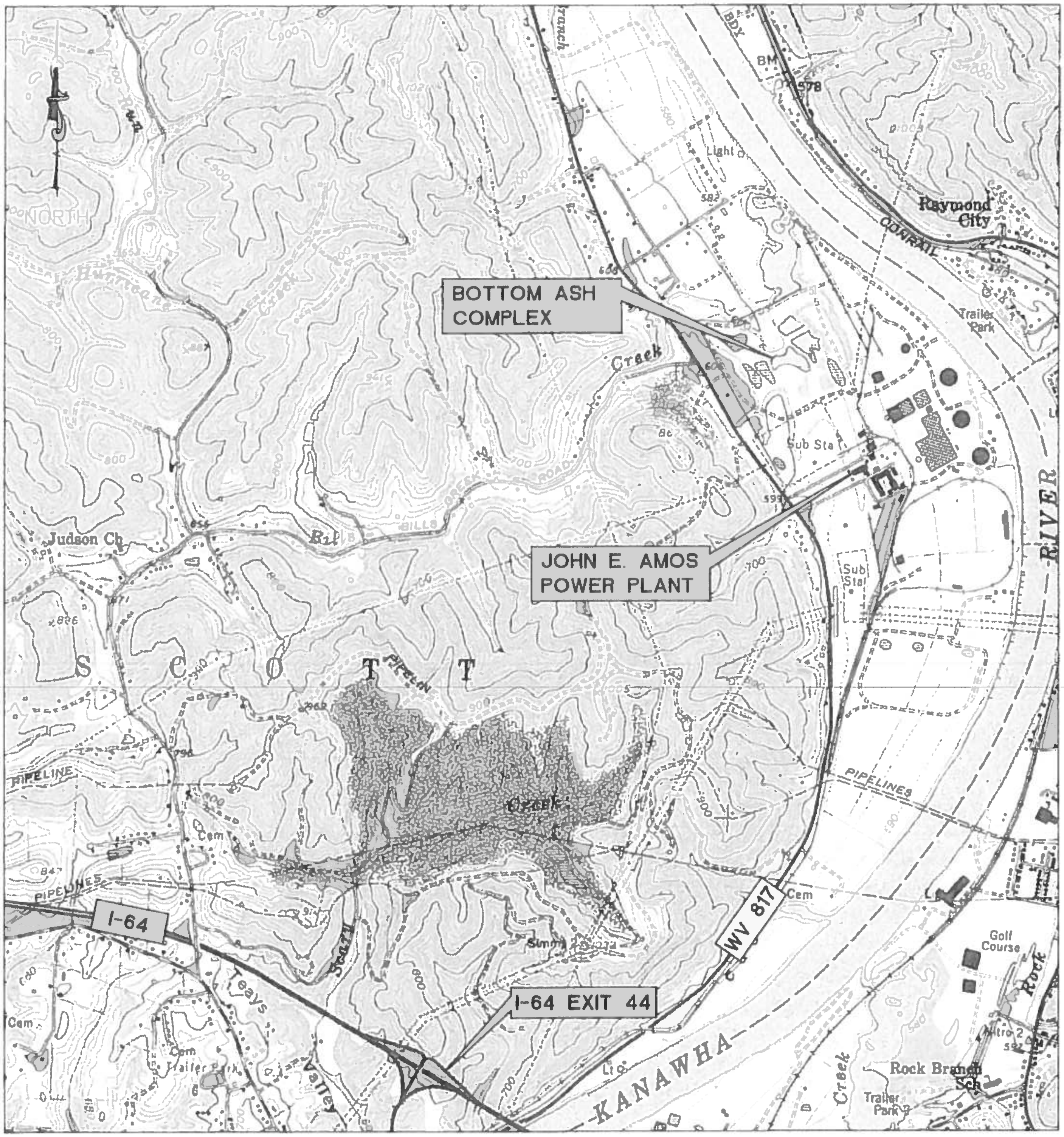
Bottom Ash Pond 1A & Reclaim Pond	
Storm Event	½ 6-hour PMP
Peak Inflow	243 cfs
Peak Outflow	19 cfs
Maximum Pool Elevation	585.4 ft.
Crest Elevation	588 ft.

Bottom Pond 1B & Reclaim Pond	
Storm Event	½ 6-hour PMP
Peak Inflow	225 cfs
Peak Outflow	14 cfs
Maximum Pool Elevation	585.5 ft.
Crest Elevation	588 ft.

Ref: Geo/Environmental Assc., Inc. December 2015, "CCR Rules Certification Report, John Amos Plant-Bottom Ash Complex, Putnam County West Virginia" GA Project No. 15055009, GA Assc. Knoxville TN.

ATTACHMENT A

LOCATION MAPS

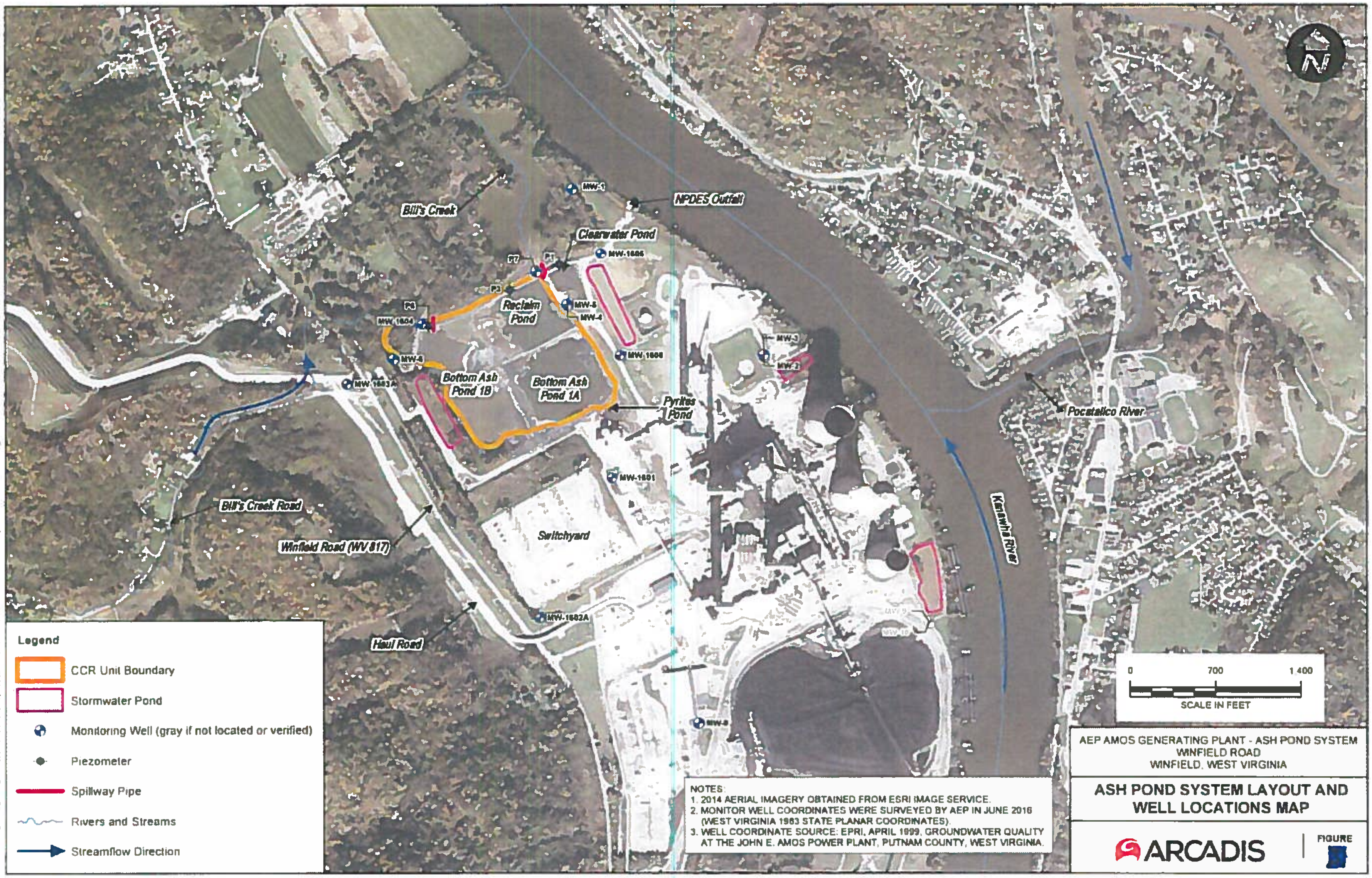


SAINT ALBANS, WV
7.5 MINUTE SERIES
UPDATED 1976

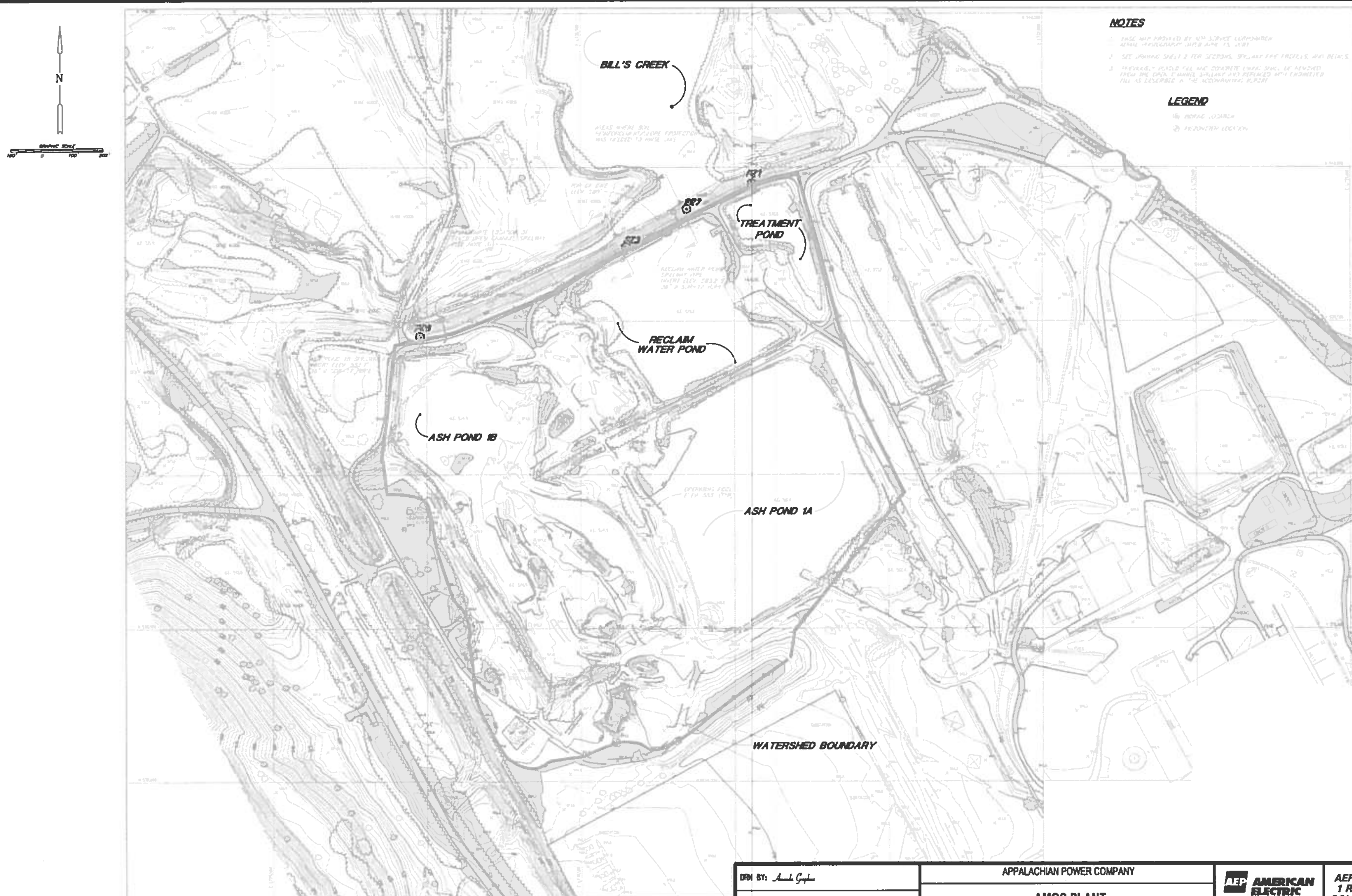
SCALE 1" = 2000'

0 2000' 4000'

JOHN E. AMOS PLANT BOTTOM ASH COMPLEX LOCATION MAP PUTNAM COUNTY	REV NO. DATE DESC.	gai consultants CHARLESTON OFFICE 300 SUMMERS STREET, SUITE 1100 CHARLESTON, WV 25301 304-926-8100
		DATE 7/8/13 SCALE 1"=2000'
		FIGURE NUMBER 1



Bill's Creek
MW-1
NPDES Outfall
Clearwater Pond
MW-1606
P7
P1
P3
P6
MW-1604
Reclaim Pond
MW-5
MW-4
MW-6
MW-1605
MW-3
MW-2
MW-1603A
Bottom Ash Pond 1B
Bottom Ash Pond 1A
Pyrites Pond
Pocatalico River
MW-1601
Kanawha River
Bill's Creek Road
Winfield Road (WV 817)
Switchyard
Haul Road
MW-1602A
MW-8
0
700
1 400
SCALE IN FEET
Legend
CCR Unit Boundary
Stormwater Pond
Monitoring Well (gray if not located or verified)
Piezometer
Spillway Pipe
Rivers and Streams
Streamflow Direction
NOTES:
1. 2014 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE.
2. MONITOR WELL COORDINATES WERE SURVEYED BY AEP IN JUNE 2016 (WEST VIRGINIA 1983 STATE PLANAR COORDINATES).
3. WELL COORDINATE SOURCE: EPRI, APRIL 1999, GROUNDWATER QUALITY AT THE JOHN E. AMOS POWER PLANT, PUTNAM COUNTY, WEST VIRGINIA.
AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA
ASH POND SYSTEM LAYOUT AND WELL LOCATIONS MAP
ARCADIS
FIGURE



DRN BY:	APPALACHIAN POWER COMPANY	AMERICAN ELECTRIC POWER	AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215
DATE: 07/12/2016	SCARY — AMOS PLANT — WEST VIRGINIA		
SCALE: N.T.S	BOTTOM ASH POND COMPLEX	FIGURE 2	

ATTACHMENT B

DESIGN REPORT

CCR RULES CERTIFICATION REPORT
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
PUTNAM COUNTY, WEST VIRGINIA

Prepared For:

AEP Service Corporation
Geotechnical Engineering Group
1 Riverside Plaza
Columbus, OH 43215-2373

Prepared By:

Geo/Environmental Associates, Inc.
3502 Overlook Circle
Knoxville, TN 37909

GA Project No. 15055009
December 21, 2015

GA

TABLE OF CONTENTS

APPENDICES

GA

CCR RULES ASSESSMENT AND CERTIFICATION
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
POCA, PUTNAM COUNTY, WEST VIRGINIA
DECEMBER 21, 2015

INTRODUCTION

Geo/Environmental Associates, Inc. (GA) has performed a site visit, conducted an engineering assessment, and prepared a certification statement for the John Amos Plant - Bottom Ash Complex. These services were performed to meet specific requirements set forth in the Environmental Protection Agency's CCR Rules (i.e., 40 CFR Parts 257 and 261, "Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals From Electric Utilities, Final Rule," dated April 17, 2015). Provided in this report is a discussion of GA's findings and a certification statement pertaining to the facility. Photographs, supplemental field and laboratory data, engineering analyses, and a drawing are included in the appendices.

REVIEW OF PREVIOUS ANALYSES AND SITE DESCRIPTION

The Amos Power Plant is situated in Putnam County, West Virginia within the physiographic province of the Appalachian Plateau. A more detailed description of the site geology is included in Appendix II. The Amos Power Plant primary and ancillary facilities are located along the southern bank of the Kanawha River along S.R. 35 approximately two miles northwest of Interstate I-64 at Scary, WV. The Bottom Ash Complex consists of two dams #1A WVA ID #07918 and #1B WVA ID #07919. The dams share a common earthen embankment across Bill's Creek with a series of splitter dikes to create four distinct cells referred to as Bottom Ash Pond No. 1A, Bottom Ash Pond No. 1B, Reclaim Water Pond and the Treatment Basin.

The earliest record available of the Bottom Ash Complex is dated June 28, 1970. There was an open channel that acted as the emergency spillway of an earthen dike structure on the northwest corner of the Bottom Ash Pond No. 1B.

Modifications to the site include: the 1977 construction of a road embankment on the northwest corner of the Bottom Ash Pond No. 1B, a sedimentation pond, and a splitter dike constructed on the southeast corner of the Bottom Ash Pond No. 1A for the sedimentation of pyrites (referred to as the Pyrites Pond). The construction of the roadway embankment effectively eliminated the northwest corner of the Bottom Ash Pond No. 1B from collecting additional bottom ash and from ponding water. An open channel spillway, that was part of the original construction, was abandoned prior to 1977.

Subsequent modifications, mostly associated with the operations of the ponds, have taken place since 1977. Perhaps the most relevant has been the elimination, from active use, of the sedimentation pond located along the west side of the Bottom Ash Pond No. 1B, illustrated on the 1977 drawing. In addition, higher than anticipated operating water levels could occur sporadically in the ponds during certain plant maintenance operations. Ash handling operations can also result in the localized accumulation of bottom ash at or above the operational water levels. The current configuration of the Bottom Ash Complex is shown on the drawings in Appendix VI.

Current operations of the ponds consist of sluicing bottom ash into ponds #1A or #1B, allowing the particles to settle and the overflow to circulate to the reclaim pond from where the majority of the water is pumped back to the plant and the remaining water is allowed to overflow into the treatment pond before it is released into the Kanawha River at outfall No. 003. During the course of the year, the Bottom Ash Ponds are alternately taken out of service to allow for the removal of the bottom ash for beneficial re-use. Thus, it is commonly expected that, at the same time bottom ash slurry is sluiced into one pond, the other pond is being excavated.

The Bottom Ash Pond Complex is inspected by Plant personnel on a monthly basis and, under the direct supervision of a professional engineer, it is inspected annually. Reports of the engineer's inspection are forwarded to the West Virginia DEP Dam Safety office with the frequency established in the regulations for Class II facilities.

The main dike of the facility is about 1350 feet long. We were provided with a copy of a report titled "Report on Dam Safety Inspection Amos Fly Ash Dam and Amos Bottom Ash Dikes" dated March 1981, prepared by Woodward-Clyde Consultants. According to that report, the maximum height of the main dike above natural ground is about 24 feet.

GA performed design and analysis services for the facility in 2005 and 2008. We provided two reports, "Responses to February 15, 2005 DEP Review Letter," dated December 5, 2005 and "Responses to May 12, 2008 DEP Review Letter," dated May 22, 2008. Our work involved addressing West Virginia DEP concerns and also raising the main dikes from a minimum crest elevation of about 584 feet with a minimum crest width of about 15 feet, to a minimum elevation of 588 feet. The increased dike elevation was needed to operate the pool levels in Ash Ponds 1A and 1B and the Reclaim Pond as high as elevation 583 feet under certain operating conditions while providing adequate storm storage and routing and maintaining at least one foot of freeboard during the design storm. Our work at the time included hydrologic, hydraulic, and stability analyses. The facility previously had an open channel spillway with bottom elevation 581 feet through the main dike at the Reclaim Water Pond. In our design we proposed two 36-inch diameter polyethylene spillway pipes, both with inlet elevations of 583.5 feet.

In 2010, the main dikes were raised to the minimum proposed crest elevation of 588 feet. In addition to the main dike, the eastern side of the complex was raised to elevation 588 feet. In some areas the elevation 584 crest was wide enough such that it could be raised with 4 feet of soil fill and still maintain a minimum 10-foot-wide crest. In other areas that were too narrow to raise the crest with soil fill, a segmented retaining block system (Redi-rock) was used to achieve the elevation 588 feet crest. The drawings in Appendix VI show the areas where the block walls were constructed and a construction detail of the block wall system.

Field Investigation and Laboratory Testing

At the direction of AEPSC, eight borings were drilled through the main dike in August 2005 by H.C. Nutting Company of Charleston, West Virginia. The boring locations are shown on the drawings in Appendix VI. Boring logs are included in Appendix III. Standard Penetration Tests (SPT) were performed generally on 5-foot intervals. Relatively undisturbed samples were collected at selected locations using a thin walled sampler. Additionally, three standpipe piezometers were installed in the main dike during the drilling.

Borings B-1 through B-6 were drilled from the crest of the main dike. These borings generally encountered a stiff, lean clay, referred to as shale fill, from the ground surface to a depth of about 15 to 20 feet. Below the shale fill an interval of clayey gravel fill 8 to 10 feet thick was encountered. Below the clayey gravel, a 4 to 6-foot thick layer of soft clay and about a 20-foot thick layer of silty sand, both likely alluvial in origin, were encountered. Below the silty sand, residual weathered shale was encountered to the boring termination depths. Borings B-7 and B-8 were drilled on the downstream face of the main dike, near the water level of Bill's Creek. These two borings encountered strata consistent with borings B-1 through B-6.

Laboratory testing was performed by AEPSC on the SPT split-spoon samples and relatively undisturbed samples. Laboratory testing included moisture content, grain size analysis, classification, permeability, and strength testing. Laboratory test results are included in Appendix III. Laboratory test results are discussed in our comments regarding the stability of the dike.

SITE VISIT BY A PROFESSIONAL ENGINEER

At the request of AEPSC, GA personnel performed a site visit of the Bottom Ash Complex to observe and document the prevalent site conditions. Specifically, Seth W. Frank, P.E. (GA), performed a site inspection of the Bottom Ash Complex on August, 18, 2015. GA believes that the conditions observed, during the August 18, 2015, site visit, are representative of the conditions modeled in the assessment and analyses provided in this report. Pictures taken during the site visit are included in Appendix I.

HYDROLOGIC AND HYDRAULIC ANALYSES

GA's 2008 report included hydrologic and hydraulic analyses to meet WVDEP's design storm requirements for a Class II structure, which is one-half of the 6-hour Probable Maximum Precipitation (PMP) event (about 14 inches of rainfall in 6 hours). The spillway pipes, pool levels, and crest elevation were designed based on this event. GA used the U.S. Army Corps of Engineers HEC-1 computer program for the analyses. A summary of the results are shown in Table 1, and complete results are included in Appendix IV. As shown, the facility passes the design storm while maintaining adequate freeboard.

Table 1. Summary of Hydrologic Analyses

Pond	Crest Elev., ft	Normal Pool Elev., ft	Peak Pool Elev. During Storm, ft	Minimum Freeboard During Storm, ft
1A and Reclaim	588	583.2	585.43	2.57
1B	588	583.7	585.47	2.53

STABILITY ANALYSES AND ACTION VALUES

We have performed stability analyses in general accordance to EPA's CCR requirements.

The requirements specify the following stability assessments:

1. Static factor of safety under the long-term, maximum storage pool condition,
2. Static factor of safety under the maximum surcharge pool condition.
3. Seismic factor of safety,
4. Liquefaction factor of safety,
5. End-of-construction factor of safety,

Limit equilibrium stability analyses were performed on sections B-B and C-C to assess the stability of the embankment. The stability analyses were performed with *SLOPE/W*, a component of the *GeoStudio* software package. *SLOPE/W* is formulated in terms of moment and force equilibrium factor of safety equations. Specifically, the Morgenstern-Price method was used to calculate the factor of safety of each section.

Strength parameters for the various materials used in the analyses are listed in Table 2. The properties of the various materials that comprise the embankment were determined from laboratory tests where appropriate samples could be obtained for testing. The parameters for other materials are based on typical material properties and our experience with similar materials. The Redi-rock reinforced embankment was conservatively assumed to have the strength parameters of the shale fill.

Table 2. Summary of Strength Parameters

Material	Effective Strength Parameters	
	c' (psf)	φ' (°)
Bottom Ash [(2)]	0	28
Shale Fill [(1)]	370	27.2
Clayey Gravel Fill [(1)]	300	32
Clay (natural) [(1)]	150	35.2
Silty Sand (natural) [(1)]	0	36.8

(1) Estimated from laboratory tests (See Appendix III).
(2) Estimated based on material properties and experience with similar materials.

Stability analyses were performed with phreatic conditions at the maximum level measured in piezometers or during drilling. A summary of the safety factors is shown in Table 4. Stability analysis results are included in Appendix V.

Static Factor of Safety under the Long-Term Storage Pool Condition

The CCR regulations specify the factor of safety should meet or exceed 1.5 when the pool is at the maximum, long-term level (i.e., normal pool) and a steady state seepage condition has developed. GA selected two critical sections, designated as B-B and C-C, for the analyses. The sections and their locations are shown on the drawings in Appendix VI. GA determined the embankment material types and stratigraphy from the aforementioned drilling and laboratory testing performed by AEPSC.

Static Factor of Safety under the Maximum Surcharge Pool Condition

The CCR regulations specify the factor of safety should meet or exceed 1.4 when the pool is at the maximum surcharg pool condition. We performed the stability analyses with the pool at the peak level during the one-half PMP design storm event, discussed previously. As shown in Table 1, the peak level in either pond was elevation 585.5 feet. We used this level for the stability analyses of both B-B and C-C.

A summary of the safety factors, from the maximum surcharge stability analyses, is shown in Table 4. Stability analysis results are included in Appendix V.

Seismic Factor of Safety

The CCR regulations specify the factor of safety should meet or exceed 1.0 under seismic conditions. Furthermore, the recommended design earthquake event should have a 2% exceedance in 50 years (an approximate return period of 2,475 years). GA performed pseudo-static stability analyses on sections B-B and C-C with the elevation 583.5 normal pool level and steady state seepage conditions based on maximum, measured piezometric levels.

Based on the *2008 Interactive Deaggregations* website, provided online through the USGS Geologic Hazards Science Center, the Amos Bottom Ash Complex facility has a peak ground acceleration of 0.065g for a seismic loading event with a mean return time of 2,475 years. Conservatively assuming soft soil ground conditions above rock, translates to a peak horizontal ground surface acceleration of approximately 0.15g. Using a commonly applied factor of 0.5 times the peak horizontal acceleration yields the conservative horizontal seismic coefficient of 0.075 that was applied in the slope stability analyses.

A summary of the pseudo-static safety factors is shown in Table 4. Stability analysis results are included in Appendix V.

Liquefaction Assessment

The CCR regulations specify the liquefaction factor of safety should meet or exceed 1.2. This requirement applies to facilities with embankment materials that have been determined to contain soils susceptible to liquefaction.

We used the Standard Penetration Testing (SPT) results from the exploratory drilling program and laboratory testing results to determine the embankment soils' susceptibility to liquefaction. We used methods from Mine Safety and Health Administration's *Engineering and Design Manual for Coal Refuse Disposal Facilities* (2010) to make the determination. First, the SPT blow counts were corrected to $N_{1,60}$ values for each soil layer and a median value was calculated. Calculation spreadsheets are included in Appendix V, and the median values for embankment materials are in shown in Table 3.

Table 3. Corrected SPT Data and Soil Type

Soil	Median Corrected SPT Blow Count	Sand-like or Clay-like
Shale Fill	19.6	clay-like
Clayey Gravel	15.2	clay-like

MSHA manual guidelines state a clay-like soil can be susceptible to liquefaction if the corrected SPT value is less than 6. As shown in Table 3, using these guidelines, the shale fill and clayey gravel should not be susceptible to liquefaction. Because the embankment materials are not susceptible to liquefaction, no additional analyses were performed for this assessment. Note that this assessment does not extend to foundation materials, below the embankment.

End-of-construction Factor of Safety

The CCR regulations specify the factor of safety should meet or exceed 1.3 for the end-of-construction loading condition. End of construction factors of safety are typically calculated for new construction. Given that the facility has been in service for more than 40 years and is considered to be in its long-term condition, no additional analyses were performed.

Summary of Results

A summary of results from the slope stability analyses is provided in Table 4. *SLOPE/W* computer output, showing the modeled profiles, loading conditions, and critical failure surfaces are provided in Appendix V. As shown in the slope stability analysis results in Table 4, the factors of safety satisfy the requirements set forth in the CCR Rules.

Table 4. Summary of Slope Stability Analyses Results

Analysis Condition	Section B-B	Section C-C
Maximum Long Term Pool	2.1	2.2
Maximum Surcharge Pool	2.0	2.2
Pseudo Static (Downstream)	1.6	1.8
Pseudo Static (Upstream)	3.1	3.2

CERTIFICATION STATEMENT

Based on the site visit, the results of the field and laboratory testing of the materials used in the embankment construction, and our review of the as-built embankment geometry; it is our opinion that the Amos Plant Bottom Ash Complex has slope stability factors of safety that meet or exceed the requirements in the CCR Rules. Furthermore, based on our review of the as-built embankment geometry, current operating pool levels, and the spillway system; we believe that the facility is capable of storing/routing the runoff from one-half of the 6-hour PMP design storm event.

Accordingly, I hereby certify that the John Amos Plant – Bottom Ash Complex meets the applicable requirements in the CCR Rules. It should be clearly noted that this certification is not a legal guarantee. This certification is merely a statement by a registered professional engineer that, to the best of his knowledge, the facility meets the applicable requirements set forth in the CCR Rules. No warranties, expressed or implied, are provided.

Seth W. Frank — 12-21-2015

Seth W. Frank, P.E. — Date
West Virginia R.P.E. No. 20574

SETH W. FRANK
REGISTERED
20574
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

GA

APPENDIX IV
HYDROLOGIC AND HYDRAULIC ANALYSES

COMPUTATION OF INFLOW HYDROGRAPH (1/2 6-Hour PMP) AND FLOOD ROUTING THROUGH THE PROPOSED PIPE SPILLWAY

Pond 1A

Crest Elevation	=	588 ft
Pipe Spillway Invert Elevation	=	583.2 ft
Normal Pool Elevation used for Routing	=	583.2 ft
Peak Inflow During Design Storm	=	242.86 cfs
Peak Outflow During Design Storm	=	18.91 cfs
Maximum Pool Elevation During Design Storm	=	585.43 ft
Minimum Freeboard During Design Storm	=	2.57 ft
Peak Storage Volume	=	24.43 ac-ft
Days to Decant 90% of Peak Storage Volume	=	1.44 days

POND 1A SPILLWAY PIPE

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
31.51	50.00	26.00	0.0100	583.20	0.90	0.00

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
581.00	0.000	0.000
581.50	0.000	0.000
582.00	0.000	0.000
582.50	0.000	0.000
583.00	0.000	0.000
583.20	0.000	0.000
583.50	(3)>0.929	0.929
584.00	(3)>3.997	3.997
584.50	(3)>8.280	8.280
585.00	(3)>13.485	13.485
585.50	(3)>19.484	19.484
586.00	(3)>26.165	26.165
586.50	(5)>32.642	32.642
587.00	(5)>38.091	38.091

```
1***************************************
*                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1) *
*           SEPTEMBER 1990            *
*             VERSION 4.0             *
*                                     *
* RUN DATE  12/10/2015  TIME  11:22:48 *
*                                     *
***************************************
```

```
***************************************
*                                     *
*   U.S. ARMY CORPS OF ENGINEERS      *
*   HYDROLOGIC ENGINEERING CENTER     *
*        609 SECOND STREET            *
*     DAVIS, CALIFORNIA 95616         *
*         (916) 756-1104              *
*                                     *
***************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X       XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

*** FREE ***
ID ***************************************************************************
ID *                                                                         *
ID *      AEP Amos Plant Hydraulic Assessment   File: 6HRPMPA1.inp           *
ID *      Flood Routing for Ash Pond 1A and Reclaim Pond                     *
ID *      1/2 6 Hour PMP  36" Pipe Invert Elev. 583.2'                       *
ID *      GA Project No. 05-361                                              *
ID *                                                                         *
ID *      Analyses by: Geo/Environmental Associates                          *
ID *                   Knoxville, TN                                         *
ID *                   December 12, 2015                                     *
ID *                                                                         *
ID ***************************************************************************
IT      15       0       0     300
IO       3
JR    FLOW     0.5
VS   BASIN     IMP     IMP     IMP
VV    2.11    2.11    6.11    7.11
IN      15

KK   BASIN
KM   PRECIPITATION
PB       0
PI   0.287   0.373   0.445   0.502   0.545   0.573   0.653   0.834   0.825   0.980
PI   2.322   4.564   4.922   3.344   1.264   0.834   0.864   0.763   0.581   0.560
PI   0.525   0.475   0.411   0.332
BA   0.040
LU       0    0.05      60
UD     0.0

KK     IMP
KM   ROUTE COMPUTED HYDROGRAPH THROUGH IMPOUNDMENT
RS       1    ELEV   583.2
SA    6.01    6.25   17.65   19.97   22.28
SQ       0    4.00   13.48   26.16   38.09
SE   583.2     584     585     586     587
ZZ
```

```
1*****************************************                                        ***************************************
 *                                       *                                        *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                        *   U.S. ARMY CORPS OF ENGINEERS      *
 *            SEPTEMBER 1990             *                                        *   HYDROLOGIC ENGINEERING CENTER     *
 *              VERSION 4.0              *                                        *         609 SECOND STREET           *
 *                                       *                                        *      DAVIS, CALIFORNIA 95616        *
 * RUN DATE  12/10/2015  TIME  11:22:48 *                                         *           (916) 756-1104            *
 *                                       *                                        *                                     *
*****************************************                                         ***************************************


                          *******************************************************************************
                          *                                                                             *
                          *      AEP Amos Plant Hydraulic Assessment   File: 6HRPMPA1.inp               *
                          *      Flood Routing for Ash Pond 1A and Reclaim Pond                         *
                          *      1/2 6 Hour PMP  36" Pipe Invert Elev. 583.2'                           *
                          *      GA Project No. 05-361                                                  *
                          *                                                                             *
                          *      Analyses by: Geo/Environmental Associates                              *
                          *                   Knoxville, TN                                             *
                          *                   December 12, 2015                                         *
                          *                                                                             *
                          *******************************************************************************

  14 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN         15  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      4   0  ENDING DATE
                     NDTIME       0245  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .25 HOURS
                       TOTAL TIME BASE   74.75 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT

                USER-DEFINED OUTPUT SPECIFICATIONS

        TABLE 1
    VS     STATION    BASIN      IMP       IMP       IMP
    VV VARIABLE CODE    2.11      2.11      6.11      7.11       .00       .00       .00       .00       .00       .00

    JP          MULTI-PLAN OPTION
                      NPLAN          1  NUMBER OF PLANS

    JR          MULTI-RATIO OPTION
                    RATIOS OF RUNOFF
                      .50

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
  19 KK       *    BASIN   *
              *            *
              **************
                               PRECIPITATION

  18 IN         TIME DATA FOR INPUT TIME SERIES
                      JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE      1   0  STARTING DATE
```

```
                JXTIME           0  STARTING TIME

          SUBBASIN RUNOFF DATA

  25 BA       SUBBASIN CHARACTERISTICS
                TAREA         .04  SUBBASIN AREA

            PRECIPITATION DATA

  21 PB         STORM       27.78  BASIN TOTAL PRECIPITATION

  22 PI         INCREMENTAL PRECIPITATION PATTERN
                  .29       .37       .45       .50       .54       .57       .65       .83       .82       .98
                 2.32      4.56      4.92      3.34      1.26       .83       .86       .76       .58       .56
                  .52       .48       .41       .33

  26 LU       UNIFORM LOSS RATE
                STRTL         .00  INITIAL LOSS
                CNSTL         .05  UNIFORM LOSS RATE
                RTIMP       60.00  PERCENT IMPERVIOUS AREA

  27 UD       SCS DIMENSIONLESS UNITGRAPH
                 TLAG         .00  LAG

                                                ***

                                         UNIT HYDROGRAPH
                                      5 END-OF-PERIOD ORDINATES
          77.       21.       4.        1.        0.

     ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION    BASIN
                      FOR PLAN 1, RATIO =  .50

   TOTAL RAINFALL =   27.78, TOTAL LOSS =     .12, TOTAL EXCESS =   27.66

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     74.75-HR
+   (CFS)      (HR)
                         (CFS)
+     486.     3.25                 118.         30.         10.         10.
                      (INCHES)    27.490      27.658      27.658      27.658
                       (AC-FT)       59.         59.         59.         59.

                      CUMULATIVE AREA =      .04 SQ MI

     ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION    BASIN
                      FOR PLAN 1, RATIO =  .50

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     74.75-HR
+   (CFS)      (HR)
                         (CFS)
+     243.     3.25                  59.         15.          5.          5.
                      (INCHES)    13.745      13.829      13.829      13.829
                       (AC-FT)       29.         30.         30.         30.

                      CUMULATIVE AREA =      .04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
  28 KK   *       IMP  *
          *            *
          **************
                    ROUTE COMPUTED HYDROGRAPH THROUGH IMPOUNDMENT

          HYDROGRAPH ROUTING DATA

  30 RS       STORAGE ROUTING
                NSTPS           1  NUMBER OF SUBREACHES
                 ITYP        ELEV  TYPE OF INITIAL CONDITION
```

```
                    RSVRIC      583.20  INITIAL CONDITION
                         X         .00 WORKING R AND D COEFFICIENT

  31 SA               AREA        6.0        6.3       17.6       20.0       22.3

  32 SQ          DISCHARGE         0.         4.        13.        26.        38.

  33 SE          ELEVATION     583.20     584.00     585.00     586.00     587.00

                                                                   ***

                                                       COMPUTED STORAGE-ELEVATION DATA

            STORAGE        .00       4.90      16.37      35.17      56.28
          ELEVATION     583.20     584.00     585.00     586.00     587.00

       ***              ***            ***              ***              ***

                            HYDROGRAPH AT STATION      IMP
                              FOR PLAN 1, RATIO =  .50

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR     74.75-HR
+   (CFS)        (HR)
                              (CFS)
+       19.      6.00                      18.          12.           5.           5.
                           (INCHES)      4.099       10.751       13.695       13.716
                            (AC-FT)         9.          23.          29.          29.

  PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR     74.75-HR
+  (AC-FT)       (HR)
        24.      6.00                      23.          14.           6.           6.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR     74.75-HR
+   (FEET)       (HR)
     585.43      6.00                   585.33       584.77       583.93       583.91

                              CUMULATIVE AREA =      .04 SQ MI
```

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO FLOWS RATIO 1 .50
HYDROGRAPH AT					
+	BASIN	.04	1	FLOW	243.
				TIME	3.25
ROUTED TO					
+	IMP	.04	1	FLOW	19.
				TIME	6.00
			** PEAK STAGES IN FEET **		
			1	STAGE	585.43
				TIME	6.00

1TABLE 1			STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1
			RATIO	.50	.50	.50	.50
PER	DAY	MON	HRMN				
1	1		0000	.00	.00	.00	583.20
2	1		0015	10.82	.09	.11	583.22
3	1		0030	17.14	.32	.40	583.26
4	1		0045	21.42	.64	.78	583.33
5	1		0100	24.68	1.01	1.24	583.40
6	1		0115	27.13	1.43	1.75	583.49
7	1		0130	28.82	1.87	2.30	583.57
8	1		0145	32.30	2.35	2.88	583.67
9	1		0200	40.18	2.92	3.58	583.78
10	1		0215	41.96	3.56	4.36	583.91
11	1		0230	48.23	4.25	5.21	584.03
12	1		0245	101.42	5.45	6.66	584.15
13	1		0300	202.15	7.93	9.66	584.41
14	1		0315	242.86	11.56	14.05	584.80
15	1		0330	191.47	14.76	18.27	585.10
16	1		0345	96.45	16.55	20.92	585.24
17	1		0400	54.44	17.36	22.13	585.31
18	1		0415	45.92	17.82	22.80	585.34
19	1		0430	40.58	18.17	23.32	585.37
20	1		0445	32.40	18.42	23.70	585.39
21	1		0500	29.43	18.59	23.95	585.40
22	1		0515	27.44	18.73	24.15	585.41
23	1		0530	25.03	18.83	24.31	585.42
24	1		0545	21.95	18.90	24.40	585.43
25	1		0600	18.11	18.91	**24.43**	**585.43** ← **Maximum Stage/Storage 6.0 Hours after onset of event**
26	1		0615	4.57	18.81	24.27	585.42
27	1		0630	.86	18.59	23.94	585.40
28	1		0645	.14	18.34	23.57	585.38
29	1		0700	.00	18.08	23.20	585.36
30	1		0715	.00	17.83	22.82	585.34
31	1		0730	.00	17.59	22.46	585.32
32	1		0745	.00	17.34	22.10	585.30
33	1		0800	.00	17.10	21.74	585.29
34	1		0815	.00	16.87	21.39	585.27
35	1		0830	.00	16.63	21.05	585.25
36	1		0845	.00	16.40	20.70	585.23
37	1		0900	.00	16.18	20.37	585.21
38	1		0915	.00	15.95	20.04	585.19
39	1		0930	.00	15.73	19.71	585.18
40	1		0945	.00	15.51	19.39	585.16
41	1		1000	.00	15.30	19.07	585.14
42	1		1015	.00	15.09	18.75	585.13
43	1		1030	.00	14.88	18.44	585.11
44	1		1045	.00	14.67	18.14	585.09
45	1		1100	.00	14.47	17.84	585.08
46	1		1115	.00	14.27	17.54	585.06
47	1		1130	.00	14.07	17.25	585.05
48	1		1145	.00	13.88	16.96	585.03
49	1		1200	.00	13.68	16.67	585.02
50	1		1215	.00	13.50	16.39	585.00

1TABLE 1 (CONT.)			STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1
			RATIO	.50	.50	.50	.50
PER	DAY	MON	HRMN				
51	1		1230	.00	13.27	16.12	584.98
52	1		1245	.00	13.05	15.85	584.95
53	1		1300	.00	12.82	15.58	584.93
54	1		1315	.00	12.61	15.32	584.91
55	1		1330	.00	12.39	15.06	584.89
56	1		1345	.00	12.18	14.80	584.86
57	1		1400	.00	11.98	14.55	584.84
58	1		1415	.00	11.77	14.31	584.82
59	1		1430	.00	11.58	14.07	584.80
60	1		1445	.00	11.38	13.83	584.78
61	1		1500	.00	11.19	13.60	584.76
62	1		1515	.00	11.00	13.37	584.74
63	1		1530	.00	10.81	13.14	584.72
64	1		1545	.00	10.63	12.92	584.70
65	1		1600	.00	10.45	12.70	584.68
66	1		1615	.00	10.27	12.49	584.66
67	1		1630	.00	10.10	12.28	584.64
68	1		1645	.00	9.93	12.07	584.63
69	1		1700	.00	9.76	11.87	584.61
70	1		1715	.00	9.59	11.67	584.59
71	1		1730	.00	9.43	11.47	584.57
72	1		1745	.00	9.27	11.28	584.56
73	1		1800	.00	9.11	11.09	584.54
74	1		1815	.00	8.96	10.90	584.52
75	1		1830	.00	8.81	10.72	584.51
76	1		1845	.00	8.66	10.54	584.49
77	1		1900	.00	8.51	10.36	584.48
78	1		1915	.00	8.37	10.19	584.46
79	1		1930	.00	8.23	10.02	584.45
80	1		1945	.00	8.09	9.85	584.43
81	1		2000	.00	7.95	9.68	584.42
82	1		2015	.00	7.81	9.52	584.40
83	1		2030	.00	7.68	9.36	584.39
84	1		2045	.00	7.55	9.20	584.37
85	1		2100	.00	7.42	9.05	584.36
86	1		2115	.00	7.30	8.89	584.35
87	1		2130	.00	7.17	8.74	584.33
88	1		2145	.00	7.05	8.60	584.32
89	1		2200	.00	6.93	8.45	584.31
90	1		2215	.00	6.82	8.31	584.30
91	1		2230	.00	6.70	8.17	584.28
92	1		2245	.00	6.59	8.03	584.27
93	1		2300	.00	6.48	7.90	584.26
94	1		2315	.00	6.37	7.77	584.25
95	1		2330	.00	6.26	7.64	584.24
96	1		2345	.00	6.15	7.51	584.23
97	2		0000	.00	6.05	7.38	584.22
98	2		0015	.00	5.95	7.26	584.21
99	2		0030	.00	5.85	7.14	584.19
100	2		0045	.00	5.75	7.02	584.18

1TABLE 1 (CONT.)	STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY MON	HRMN				
101	2	0100	.00	5.65	6.90	584.17
102	2	0115	.00	5.55	6.78	584.16
103	2	0130	.00	5.46	6.67	584.15
104	2	0145	.00	5.37	6.56	584.14
105	2	0200	.00	5.28	6.45	584.13
106	2	0215	.00	5.19	6.34	584.13
107	2	0230	.00	5.10	6.23	584.12
108	2	0245	.00	5.01	6.13	584.11
109	2	0300	.00	4.93	6.03	584.10
110	2	0315	.00	4.84	5.92	584.09
111	2	0330	.00	4.76	5.83	584.08
112	2	0345	.00	4.68	5.73	584.07
113	2	0400	.00	4.60	5.63	584.06
114	2	0415	.00	4.52	5.54	584.06
115	2	0430	.00	4.45	5.44	584.05
116	2	0445	.00	4.37	5.35	584.04
117	2	0500	.00	4.30	5.26	584.03
118	2	0515	.00	4.23	5.18	584.02
119	2	0530	.00	4.15	5.09	584.02
120	2	0545	.00	4.08	5.00	584.01
121	2	0600	.00	4.01	4.92	584.00
122	2	0615	.00	3.95	4.84	583.99
123	2	0630	.00	3.88	4.76	583.98
124	2	0645	.00	3.82	4.68	583.96
125	2	0700	.00	3.75	4.60	583.95
126	2	0715	.00	3.69	4.52	583.94
127	2	0730	.00	3.63	4.45	583.93
128	2	0745	.00	3.57	4.37	583.91
129	2	0800	.00	3.51	4.30	583.90
130	2	0815	.00	3.45	4.23	583.89
131	2	0830	.00	3.39	4.16	583.88
132	2	0845	.00	3.33	4.09	583.87
133	2	0900	.00	3.28	4.02	583.86
134	2	0915	.00	3.22	3.95	583.84
135	2	0930	.00	3.17	3.89	583.83
136	2	0945	.00	3.12	3.82	583.82
137	2	1000	.00	3.07	3.76	583.81
138	2	1015	.00	3.01	3.69	583.80
139	2	1030	.00	2.96	3.63	583.79
140	2	1045	.00	2.91	3.57	583.78
141	2	1100	.00	2.87	3.51	583.77
142	2	1115	.00	2.82	3.45	583.76
143	2	1130	.00	2.77	3.40	583.75
144	2	1145	.00	2.72	3.34	583.74
145	2	1200	.00	2.68	3.28	583.74
146	2	1215	.00	2.63	3.23	583.73
147	2	1230	.00	2.59	3.17	583.72
148	2	1245	.00	2.55	3.12	583.71
149	2	1300	.00	2.50	3.07	583.70
150	2	1315	.00	2.46	3.02	583.69

1TABLE 1 (CONT.)	STATION		BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
	PLAN		1	1	1	1
	RATIO		.50	.50	.50	.50
PER	DAY MON	HRMN				
151	2	1330	.00	2.42	2.97	583.68
152	2	1345	.00	2.38	2.92	583.68
153	2	1400	.00	2.34	2.87	583.67
154	2	1415	.00	2.30	2.82	583.66
155	2	1430	.00	2.26	2.77	583.65
156	2	1445	.00	2.23	2.73	583.65
157	2	1500	.00	2.19	2.68	583.64
158	2	1515	.00	2.15	2.64	583.63
159	2	1530	.00	2.12	2.59	583.62
160	2	1545	.00	2.08	2.55	583.62
161	2	1600	.00	2.05	2.51	583.61
162	2	1615	.00	2.01	2.47	583.60
163	2	1630	.00	1.98	2.42	583.60 ← **Time to decant 90% maximum storage = 34.5 hours (1.44 days)**
164	2	1645	.00	1.94	2.38	583.59
165	2	1700	.00	1.91	2.34	583.58
166	2	1715	.00	1.88	2.30	583.58
167	2	1730	.00	1.85	2.27	583.57
168	2	1745	.00	1.82	2.23	583.56
169	2	1800	.00	1.79	2.19	583.56
170	2	1815	.00	1.76	2.15	583.55
171	2	1830	.00	1.73	2.12	583.55
172	2	1845	.00	1.70	2.08	583.54
173	2	1900	.00	1.67	2.05	583.53
174	2	1915	.00	1.64	2.01	583.53
175	2	1930	.00	1.62	1.98	583.52
176	2	1945	.00	1.59	1.95	583.52
177	2	2000	.00	1.56	1.91	583.51
178	2	2015	.00	1.54	1.88	583.51
179	2	2030	.00	1.51	1.85	583.50
180	2	2045	.00	1.49	1.82	583.50
181	2	2100	.00	1.46	1.79	583.49
182	2	2115	.00	1.44	1.76	583.49
183	2	2130	.00	1.41	1.73	583.48
184	2	2145	.00	1.39	1.70	583.48
185	2	2200	.00	1.36	1.67	583.47
186	2	2215	.00	1.34	1.65	583.47
187	2	2230	.00	1.32	1.62	583.46
188	2	2245	.00	1.30	1.59	583.46
189	2	2300	.00	1.28	1.56	583.46
190	2	2315	.00	1.25	1.54	583.45
191	2	2330	.00	1.23	1.51	583.45
192	2	2345	.00	1.21	1.49	583.44
193	3	0000	.00	1.19	1.46	583.44
194	3	0015	.00	1.17	1.44	583.43
195	3	0030	.00	1.15	1.41	583.43
196	3	0045	.00	1.13	1.39	583.43
197	3	0100	.00	1.12	1.37	583.42
198	3	0115	.00	1.10	1.34	583.42
199	3	0130	.00	1.08	1.32	583.42
200	3	0145	.00	1.06	1.30	583.41

1TABLE 1 (CONT.)			STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1
			RATIO	.50	.50	.50	.50
PER	DAY	MON	HRMN				
201	3		0200	.00	1.04	1.28	583.41
202	3		0215	.00	1.02	1.26	583.40
203	3		0230	.00	1.01	1.24	583.40
204	3		0245	.00	.99	1.21	583.40
205	3		0300	.00	.97	1.19	583.39
206	3		0315	.00	.96	1.17	583.39
207	3		0330	.00	.94	1.15	583.39
208	3		0345	.00	.93	1.14	583.39
209	3		0400	.00	.91	1.12	583.38
210	3		0415	.00	.90	1.10	583.38
211	3		0430	.00	.88	1.08	583.38
212	3		0445	.00	.87	1.06	583.37
213	3		0500	.00	.85	1.04	583.37
214	3		0515	.00	.84	1.03	583.37
215	3		0530	.00	.82	1.01	583.36
216	3		0545	.00	.81	.99	583.36
217	3		0600	.00	.80	.98	583.36
218	3		0615	.00	.78	.96	583.36
219	3		0630	.00	.77	.94	583.35
220	3		0645	.00	.76	.93	583.35
221	3		0700	.00	.74	.91	583.35
222	3		0715	.00	.73	.90	583.35
223	3		0730	.00	.72	.88	583.34
224	3		0745	.00	.71	.87	583.34
225	3		0800	.00	.70	.85	583.34
226	3		0815	.00	.68	.84	583.34
227	3		0830	.00	.67	.82	583.33
228	3		0845	.00	.66	.81	583.33
229	3		0900	.00	.65	.80	583.33
230	3		0915	.00	.64	.78	583.33
231	3		0930	.00	.63	.77	583.33
232	3		0945	.00	.62	.76	583.32
233	3		1000	.00	.61	.75	583.32
234	3		1015	.00	.60	.73	583.32
235	3		1030	.00	.59	.72	583.32
236	3		1045	.00	.58	.71	583.32
237	3		1100	.00	.57	.70	583.31
238	3		1115	.00	.56	.68	583.31
239	3		1130	.00	.55	.67	583.31
240	3		1145	.00	.54	.66	583.31
241	3		1200	.00	.53	.65	583.31
242	3		1215	.00	.52	.64	583.30
243	3		1230	.00	.51	.63	583.30
244	3		1245	.00	.50	.62	583.30
245	3		1300	.00	.50	.61	583.30
246	3		1315	.00	.49	.60	583.30
247	3		1330	.00	.48	.59	583.30
248	3		1345	.00	.47	.58	583.29
249	3		1400	.00	.46	.57	583.29
250	3		1415	.00	.46	.56	583.29

1TABLE 1 (CONT.)			STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1
			RATIO	.50	.50	.50	.50
PER	DAY	MON	HRMN				
251	3		1430	.00	.45	.55	583.29
252	3		1445	.00	.44	.54	583.29
253	3		1500	.00	.43	.53	583.29
254	3		1515	.00	.43	.52	583.29
255	3		1530	.00	.42	.51	583.28
256	3		1545	.00	.41	.51	583.28
257	3		1600	.00	.41	.50	583.28
258	3		1615	.00	.40	.49	583.28
259	3		1630	.00	.39	.48	583.28
260	3		1645	.00	.39	.47	583.28
261	3		1700	.00	.38	.46	583.28
262	3		1715	.00	.37	.46	583.27
263	3		1730	.00	.37	.45	583.27
264	3		1745	.00	.36	.44	583.27
265	3		1800	.00	.35	.43	583.27
266	3		1815	.00	.35	.43	583.27
267	3		1830	.00	.34	.42	583.27
268	3		1845	.00	.34	.41	583.27
269	3		1900	.00	.33	.41	583.27
270	3		1915	.00	.33	.40	583.27
271	3		1930	.00	.32	.39	583.26
272	3		1945	.00	.32	.39	583.26
273	3		2000	.00	.31	.38	583.26
274	3		2015	.00	.30	.37	583.26
275	3		2030	.00	.30	.37	583.26
276	3		2045	.00	.29	.36	583.26
277	3		2100	.00	.29	.35	583.26
278	3		2115	.00	.28	.35	583.26
279	3		2130	.00	.28	.34	583.26
280	3		2145	.00	.28	.34	583.26
281	3		2200	.00	.27	.33	583.25
282	3		2215	.00	.27	.33	583.25
283	3		2230	.00	.26	.32	583.25
284	3		2245	.00	.26	.32	583.25
285	3		2300	.00	.25	.31	583.25
286	3		2315	.00	.25	.30	583.25
287	3		2330	.00	.24	.30	583.25
288	3		2345	.00	.24	.29	583.25
289	4		0000	.00	.24	.29	583.25
290	4		0015	.00	.23	.29	583.25
291	4		0030	.00	.23	.28	583.25
292	4		0045	.00	.22	.28	583.24
293	4		0100	.00	.22	.27	583.24
294	4		0115	.00	.22	.27	583.24
295	4		0130	.00	.21	.26	583.24
296	4		0145	.00	.21	.26	583.24
297	4		0200	.00	.21	.25	583.24
298	4		0215	.00	.20	.25	583.24
299	4		0230	.00	.20	.24	583.24
300	4		0245	.00	.20	.24	583.24
			MAX	242.86	18.91	24.43	585.43
			MIN	.00	.00	.00	583.20
			AVE	4.76	4.72	5.85	583.90

*** NORMAL END OF HEC-1 ***

COMPUTATION OF INFLOW HYDROGRAPH (1/2 6-Hour PMP) AND FLOOD ROUTING THROUGH THE PROPOSED PIPE SPILLWAY

POND 1B

Crest Elevation	=	588 ft
Pipe Spillway Invert Elevation	=	583.7 ft
Normal Pool Elevation used for Routing	=	583.7 ft
Peak Inflow During Design Storm	=	224.68 cfs
Peak Outflow During Design Storm	=	13.51 cfs
Maximum Pool Elevation During Design Storm	=	585.47 ft
Minimum Freeboard During Design Storm	=	2.53 ft
Peak Storage Volume	=	25.05 ac-ft
Days to Decant 90% of Peak Storage Volume	=	3.25 days

POND 1B SPILLWAY PIPE

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
31.51	55.00	18.00	0.0100	583.70	0.90	0.00

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
581.00	0.000	0.000
581.50	0.000	0.000
582.00	0.000	0.000
582.50	0.000	0.000
583.00	0.000	0.000
583.50	0.000	0.000
583.70	0.000	0.000
584.00	(3)>0.929	0.929
584.50	(3)>3.997	3.997
585.00	(3)>8.280	8.280
585.50	(3)>13.485	13.485
586.00	(3)>19.484	19.484
586.50	(3)>26.165	26.165
587.00	(5)>32.642	32.642

```
1****************************************                                                              ****************************************
*                                       *                                                              *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                              *  U.S. ARMY CORPS OF ENGINEERS        *
*            SEPTEMBER 1990             *                                                              *  HYDROLOGIC ENGINEERING CENTER       *
*             VERSION 4.0               *                                                              *         609 SECOND STREET            *
*                                       *                                                              *     DAVIS, CALIFORNIA 95616          *
* RUN DATE  12/10/2015  TIME  11:52:36  *                                                              *         (916) 756-1104               *
*                                       *                                                              *                                      *
*****************************************                                                              ****************************************



                                                       X     X  XXXXXXX   XXXXX          X
                                                       X     X  X        X     X        XX
                                                       X     X  X        X               X
                                                       XXXXXXX  XXXX     X       XXXXX   X
                                                       X     X  X        X               X
                                                       X     X  X        X     X         X
                                                       X     X  XXXXXXX   XXXXX         XXX



            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
```

```
 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

*** FREE ***
    1          ID  ************************************************************************
    2          ID  *                                                                      *
    3          ID  *      AEP Amos Plant Hydraulic Assessment   File: 6HRPMPB1.inp        *
    4          ID  *      Flood Routing for Ash Pond 1A and Reclaim Pond                  *
    5          ID  *      1/2 6 Hour PMP  36" Pipe Invert Elev. 583.7'                    *
    6          ID  *      GA Project No. 05-361                                           *
    7          ID  *                                                                      *
    8          ID  *      Analyses by: Geo/Environmental Associates                       *
    9          ID  *                   Knoxville, TN                                      *
   10          ID  *                   December 12, 2015                                  *
   11          ID  *                                                                      *
   12          ID  ************************************************************************
   13          IT      15       0       0     300
   14          IO       3
   15          JR    FLOW     0.5
   16          VS   BASIN     IMP     IMP     IMP
   17          VV    2.11    2.11    6.11    7.11
   18          IN      15

   19          KK   BASIN
   20          KM   PRECIPITATION
   21          PB       0
   22          PI   0.287   0.373   0.445   0.502   0.545   0.573   0.653   0.834   0.825   0.980
   23          PI   2.322   4.564   4.922   3.344   1.264   0.834   0.864   0.763   0.581   0.560
   24          PI   0.525   0.475   0.411   0.332
   25          BA   0.037
   26          LU       0    0.05      66
   27          UD     0.0

   28          KK     IMP
   29          KM   ROUTE COMPUTED HYDROGRAPH THROUGH IMPOUNDMENT
   30          RS       1    ELEV   583.7
   31          SA   12.75   13.00   13.93   14.87   15.80
   32          SQ       0    0.93    8.28   19.48   32.64
   33          SE   583.7     584     585     586     587
   34          ZZ
```

```
1***************************************                                       ***************************************
 *                                      *                                       *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                       *   U.S. ARMY CORPS OF ENGINEERS      *
 *           SEPTEMBER 1990             *                                       *   HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0              *                                       *       609 SECOND STREET             *
 *                                      *                                       *     DAVIS, CALIFORNIA 95616         *
 *  RUN DATE  12/10/2015  TIME  11:52:36 *                                      *         (916) 756-1104              *
 *                                      *                                       *                                     *
 ****************************************                                       ***************************************


                         ************************************************************************
                         *                                                                      *
                         *      AEP Amos Plant Hydraulic Assessment   File: 6HRPMPB1.inp        *
                         *      Flood Routing for Ash Pond 1A and Reclaim Pond                  *
                         *      1/2 6 Hour PMP  36" Pipe Invert Elev. 583.7'                    *
                         *      GA Project No. 05-361                                           *
                         *                                                                      *
                         *      Analyses by: Geo/Environmental Associates                       *
                         *                   Knoxville, TN                                      *
                         *                   December 12, 2015                                  *
                         *                                                                      *
                         ************************************************************************

  14 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          3  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN         15  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1   0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      4   0  ENDING DATE
                      NDTIME       0245  ENDING TIME
                       ICENT         19  CENTURY MARK

                   COMPUTATION INTERVAL     .25 HOURS
                        TOTAL TIME BASE   74.75 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

                 USER-DEFINED OUTPUT SPECIFICATIONS

         TABLE 1
     VS      STATION     BASIN      IMP       IMP       IMP
     VV VARIABLE CODE     2.11      2.11      6.11      7.11       .00       .00       .00       .00       .00       .00

     JP          MULTI-PLAN OPTION
                       NPLAN          1  NUMBER OF PLANS

     JR          MULTI-RATIO OPTION
                     RATIOS OF RUNOFF
                       .50


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


             **************
             *            *
  19 KK      *   BASIN    *
             *            *
             **************
                            PRECIPITATION

  18 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         15  TIME INTERVAL IN MINUTES
                      JXDATE      1   0  STARTING DATE
```

```
                   JXTIME           0  STARTING TIME

            SUBBASIN RUNOFF DATA

  25 BA       SUBBASIN CHARACTERISTICS
                    TAREA         .04  SUBBASIN AREA

              PRECIPITATION DATA

  21 PB             STORM       27.78  BASIN TOTAL PRECIPITATION

  22 PI         INCREMENTAL PRECIPITATION PATTERN
                     .29       .37       .45       .50       .54       .57       .65       .83       .82       .98
                    2.32      4.56      4.92      3.34      1.26       .83       .86       .76       .58       .56
                     .52       .48       .41       .33

  26 LU       UNIFORM LOSS RATE
                    STRTL         .00  INITIAL LOSS
                    CNSTL         .05  UNIFORM LOSS RATE
                    RTIMP       66.00  PERCENT IMPERVIOUS AREA

  27 UD       SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .00  LAG

                                                                 ***

                                                         UNIT HYDROGRAPH
                                                     5 END-OF-PERIOD ORDINATES
            71.       20.        4.        1.        0.

      ***             ***             ***             ***             ***

                     HYDROGRAPH AT STATION    BASIN
                       FOR PLAN 1, RATIO =  .50

    TOTAL RAINFALL =   27.78, TOTAL LOSS =      .10, TOTAL EXCESS =   27.68

  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     74.75-HR
+    (CFS)      (HR)
                           (CFS)
+     449.      3.25                    109.         28.         9.           9.
                         (INCHES)     27.507      27.676      27.676       27.676
                          (AC-FT)        54.         55.         55.          55.

                         CUMULATIVE AREA =      .04 SQ MI

      ***             ***             ***             ***             ***

                     HYDROGRAPH AT STATION    BASIN
                       FOR PLAN 1, RATIO =  .50

  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     74.75-HR
+    (CFS)      (HR)
                           (CFS)
+     225.      3.25                     55.         14.         5.           4.
                         (INCHES)     13.754      13.838      13.838       13.838
                          (AC-FT)        27.         27.         27.          27.

                         CUMULATIVE AREA =      .04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

           **************
           *            *
  28 KK    *       IMP  *
           *            *
           **************
                       ROUTE COMPUTED HYDROGRAPH THROUGH IMPOUNDMENT

            HYDROGRAPH ROUTING DATA

  30 RS       STORAGE ROUTING
                    NSTPS           1  NUMBER OF SUBREACHES
                     ITYP        ELEV  TYPE OF INITIAL CONDITION
```

```
                    RSVRIC      583.70  INITIAL CONDITION
                         X         .00 WORKING R AND D COEFFICIENT

   31 SA                 AREA        12.8      13.0      13.9      14.9      15.8

   32 SQ            DISCHARGE          0.        1.        8.       19.       33.

   33 SE            ELEVATION     583.70    584.00    585.00    586.00    587.00

                                                                   ***

                                                   COMPUTED STORAGE-ELEVATION DATA

           STORAGE          .00      3.86     17.32     31.72     47.05
         ELEVATION       583.70    584.00    585.00    586.00    587.00

      ***             ***              ***              ***              ***

                       HYDROGRAPH AT STATION      IMP
                         FOR PLAN 1, RATIO =  .50

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR     74.75-HR
+    (CFS)       (HR)
                             (CFS)
+      14.       6.00                 12.           8.           4.           4.
                          (INCHES)    3.095       8.391       12.260       12.310
                           (AC-FT)       6.          17.          24.          24.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR     74.75-HR
+  (AC-FT)       (HR)
       24.       6.00                 23.          17.           9.           9.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR     74.75-HR
+   (FEET)       (HR)
    585.47       6.00               585.36      584.95      584.40      584.38

                             CUMULATIVE AREA =     .04 SQ MI
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO FLOWS RATIO 1 .50
HYDROGRAPH AT					
+	BASIN	.04	1	FLOW	225.
				TIME	3.25
ROUTED TO					
+	IMP	.04	1	FLOW	14.
				TIME	6.00
			** PEAK STAGES IN FEET **		
			1	STAGE	585.47
				TIME	6.00

1TABLE 1		STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
		PLAN	1	1	1	1
		RATIO	.50	.50	.50	.50
PER	DAY MON	HRMN				
1	1	0000	.00	.00	.00	583.70
2	1	0015	10.03	.02	.10	583.71
3	1	0030	15.89	.09	.37	583.73
4	1	0045	19.85	.18	.74	583.76
5	1	0100	22.87	.28	1.17	583.79
6	1	0115	25.13	.40	1.66	583.83
7	1	0130	26.69	.53	2.19	583.87
8	1	0145	29.92	.66	2.76	583.91
9	1	0200	37.20	.83	3.44	583.97
10	1	0215	38.85	1.12	4.20	584.03
11	1	0230	44.64	1.57	5.04	584.09
12	1	0245	93.85	2.33	6.43	584.19
13	1	0300	187.02	3.88	9.27	584.40
14	1	0315	224.68	6.15	13.42	584.71
15	1	0330	177.15	8.35	17.42	585.01
16	1	0345	89.25	10.34	19.98	585.18
17	1	0400	50.39	11.29	21.20	585.27
18	1	0415	42.51	11.85	21.92	585.32
19	1	0430	37.57	12.30	22.49	585.36
20	1	0445	30.00	12.64	22.93	585.39
21	1	0500	27.26	12.90	23.26	585.41
22	1	0515	25.42	13.11	23.54	585.43
23	1	0530	23.18	13.29	23.77	585.45
24	1	0545	20.34	13.43	23.94	585.46
25	1	0600	16.79	13.51	**24.05**	**585.47** ← **Maximum Stage/Storage 6 hours after onset of event**
26	1	0615	4.23	13.46	23.98	585.46
27	1	0630	.80	13.29	23.76	585.45
28	1	0645	.13	13.08	23.50	585.43
29	1	0700	.00	12.87	23.23	585.41
30	1	0715	.00	12.67	22.97	585.39
31	1	0730	.00	12.47	22.71	585.37
32	1	0745	.00	12.27	22.45	585.36
33	1	0800	.00	12.07	22.20	585.34
34	1	0815	.00	11.88	21.95	585.32
35	1	0830	.00	11.69	21.71	585.30
36	1	0845	.00	11.50	21.47	585.29
37	1	0900	.00	11.32	21.23	585.27
38	1	0915	.00	11.14	21.00	585.26
39	1	0930	.00	10.96	20.77	585.24
40	1	0945	.00	10.79	20.55	585.22
41	1	1000	.00	10.62	20.33	585.21
42	1	1015	.00	10.45	20.11	585.19
43	1	1030	.00	10.28	19.90	585.18
44	1	1045	.00	10.12	19.68	585.16
45	1	1100	.00	9.95	19.48	585.15
46	1	1115	.00	9.80	19.27	585.14
47	1	1130	.00	9.64	19.07	585.12
48	1	1145	.00	9.49	18.87	585.11
49	1	1200	.00	9.33	18.68	585.09
50	1	1215	.00	9.19	18.49	585.08

1TABLE 1 (CONT.)			STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1
			RATIO	.50	.50	.50	.50
PER	DAY	MON	HRMN				
51	1		1230	.00	9.04	18.30	585.07
52	1		1245	.00	8.90	18.12	585.05
53	1		1300	.00	8.75	17.93	585.04
54	1		1315	.00	8.61	17.75	585.03
55	1		1330	.00	8.48	17.58	585.02
56	1		1345	.00	8.34	17.40	585.01
57	1		1400	.00	8.23	17.23	584.99
58	1		1415	.00	8.14	17.06	584.98
59	1		1430	.00	8.05	16.90	584.97
60	1		1445	.00	7.96	16.73	584.96
61	1		1500	.00	7.87	16.57	584.94
62	1		1515	.00	7.78	16.41	584.93
63	1		1530	.00	7.69	16.25	584.92
64	1		1545	.00	7.60	16.09	584.91
65	1		1600	.00	7.52	15.93	584.90
66	1		1615	.00	7.44	15.78	584.89
67	1		1630	.00	7.35	15.62	584.87
68	1		1645	.00	7.27	15.47	584.86
69	1		1700	.00	7.19	15.32	584.85
70	1		1715	.00	7.11	15.18	584.84
71	1		1730	.00	7.03	15.03	584.83
72	1		1745	.00	6.95	14.89	584.82
73	1		1800	.00	6.87	14.74	584.81
74	1		1815	.00	6.79	14.60	584.80
75	1		1830	.00	6.72	14.46	584.79
76	1		1845	.00	6.64	14.32	584.78
77	1		1900	.00	6.57	14.19	584.77
78	1		1915	.00	6.49	14.05	584.76
79	1		1930	.00	6.42	13.92	584.75
80	1		1945	.00	6.35	13.79	584.74
81	1		2000	.00	6.28	13.66	584.73
82	1		2015	.00	6.21	13.53	584.72
83	1		2030	.00	6.14	13.40	584.71
84	1		2045	.00	6.07	13.27	584.70
85	1		2100	.00	6.00	13.15	584.69
86	1		2115	.00	5.93	13.03	584.68
87	1		2130	.00	5.87	12.90	584.67
88	1		2145	.00	5.80	12.78	584.66
89	1		2200	.00	5.74	12.67	584.65
90	1		2215	.00	5.67	12.55	584.65
91	1		2230	.00	5.61	12.43	584.64
92	1		2245	.00	5.55	12.32	584.63
93	1		2300	.00	5.48	12.20	584.62
94	1		2315	.00	5.42	12.09	584.61
95	1		2330	.00	5.36	11.98	584.60
96	1		2345	.00	5.30	11.87	584.59
97	2		0000	.00	5.24	11.76	584.59
98	2		0015	.00	5.18	11.65	584.58
99	2		0030	.00	5.12	11.54	584.57
100	2		0045	.00	5.07	11.44	584.56

1TABLE 1 (CONT.)			STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1
			RATIO	.50	.50	.50	.50
PER	DAY	MON	HRMN				
101	2		0100	.00	5.01	11.33	584.56
102	2		0115	.00	4.95	11.23	584.55
103	2		0130	.00	4.90	11.13	584.54
104	2		0145	.00	4.84	11.03	584.53
105	2		0200	.00	4.79	10.93	584.53
106	2		0215	.00	4.74	10.83	584.52
107	2		0230	.00	4.68	10.73	584.51
108	2		0245	.00	4.63	10.64	584.50
109	2		0300	.00	4.58	10.54	584.50
110	2		0315	.00	4.53	10.45	584.49
111	2		0330	.00	4.48	10.36	584.48
112	2		0345	.00	4.43	10.26	584.48
113	2		0400	.00	4.38	10.17	584.47
114	2		0415	.00	4.33	10.08	584.46
115	2		0430	.00	4.28	9.99	584.46
116	2		0445	.00	4.23	9.91	584.45
117	2		0500	.00	4.18	9.82	584.44
118	2		0515	.00	4.14	9.73	584.44
119	2		0530	.00	4.09	9.65	584.43
120	2		0545	.00	4.04	9.56	584.42
121	2		0600	.00	4.00	9.48	584.42
122	2		0615	.00	3.95	9.40	584.41
123	2		0630	.00	3.91	9.32	584.41
124	2		0645	.00	3.86	9.24	584.40
125	2		0700	.00	3.82	9.16	584.39
126	2		0715	.00	3.78	9.08	584.39
127	2		0730	.00	3.74	9.00	584.38
128	2		0745	.00	3.69	8.93	584.38
129	2		0800	.00	3.65	8.85	584.37
130	2		0815	.00	3.61	8.77	584.36
131	2		0830	.00	3.57	8.70	584.36
132	2		0845	.00	3.53	8.63	584.35
133	2		0900	.00	3.49	8.55	584.35
134	2		0915	.00	3.45	8.48	584.34
135	2		0930	.00	3.41	8.41	584.34
136	2		0945	.00	3.38	8.34	584.33
137	2		1000	.00	3.34	8.27	584.33
138	2		1015	.00	3.30	8.20	584.32
139	2		1030	.00	3.26	8.14	584.32
140	2		1045	.00	3.23	8.07	584.31
141	2		1100	.00	3.19	8.00	584.31
142	2		1115	.00	3.15	7.94	584.30
143	2		1130	.00	3.12	7.87	584.30
144	2		1145	.00	3.08	7.81	584.29
145	2		1200	.00	3.05	7.74	584.29
146	2		1215	.00	3.02	7.68	584.28
147	2		1230	.00	2.98	7.62	584.28
148	2		1245	.00	2.95	7.56	584.27
149	2		1300	.00	2.92	7.50	584.27
150	2		1315	.00	2.88	7.44	584.27

1TABLE 1 (CONT.)			STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1
			RATIO	.50	.50	.50	.50
PER	DAY	MON	HRMN				
151	2		1330	.00	2.85	7.38	584.26
152	2		1345	.00	2.82	7.32	584.26
153	2		1400	.00	2.79	7.26	584.25
154	2		1415	.00	2.76	7.21	584.25
155	2		1430	.00	2.72	7.15	584.24
156	2		1445	.00	2.69	7.09	584.24
157	2		1500	.00	2.66	7.04	584.24
158	2		1515	.00	2.63	6.98	584.23
159	2		1530	.00	2.60	6.93	584.23
160	2		1545	.00	2.58	6.88	584.22
161	2		1600	.00	2.55	6.82	584.22
162	2		1615	.00	2.52	6.77	584.22
163	2		1630	.00	2.49	6.72	584.21
164	2		1645	.00	2.46	6.67	584.21
165	2		1700	.00	2.43	6.62	584.20
166	2		1715	.00	2.41	6.57	584.20
167	2		1730	.00	2.38	6.52	584.20
168	2		1745	.00	2.35	6.47	584.19
169	2		1800	.00	2.33	6.42	584.19
170	2		1815	.00	2.30	6.37	584.19
171	2		1830	.00	2.27	6.32	584.18
172	2		1845	.00	2.25	6.28	584.18
173	2		1900	.00	2.22	6.23	584.18
174	2		1915	.00	2.20	6.19	584.17
175	2		1930	.00	2.17	6.14	584.17
176	2		1945	.00	2.15	6.10	584.17
177	2		2000	.00	2.13	6.05	584.16
178	2		2015	.00	2.10	6.01	584.16
179	2		2030	.00	2.08	5.97	584.16
180	2		2045	.00	2.05	5.92	584.15
181	2		2100	.00	2.03	5.88	584.15
182	2		2115	.00	2.01	5.84	584.15
183	2		2130	.00	1.99	5.80	584.14
184	2		2145	.00	1.96	5.76	584.14
185	2		2200	.00	1.94	5.72	584.14
186	2		2215	.00	1.92	5.68	584.13
187	2		2230	.00	1.90	5.64	584.13
188	2		2245	.00	1.88	5.60	584.13
189	2		2300	.00	1.86	5.56	584.13
190	2		2315	.00	1.84	5.52	584.12
191	2		2330	.00	1.82	5.48	584.12
192	2		2345	.00	1.79	5.45	584.12
193	3		0000	.00	1.77	5.41	584.11
194	3		0015	.00	1.75	5.37	584.11
195	3		0030	.00	1.74	5.34	584.11
196	3		0045	.00	1.72	5.30	584.11
197	3		0100	.00	1.70	5.27	584.10
198	3		0115	.00	1.68	5.23	584.10
199	3		0130	.00	1.66	5.20	584.10
200	3		0145	.00	1.64	5.16	584.10

1TABLE 1 (CONT.)

PER	DAY	MON	HRMN	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
STATION							
PLAN				1	1	1	1
RATIO				.50	.50	.50	.50
201	3		0200	.00	1.62	5.13	584.09
202	3		0215	.00	1.60	5.10	584.09
203	3		0230	.00	1.59	5.06	584.09
204	3		0245	.00	1.57	5.03	584.09
205	3		0300	.00	1.55	5.00	584.08
206	3		0315	.00	1.53	4.97	584.08
207	3		0330	.00	1.52	4.93	584.08
208	3		0345	.00	1.50	4.90	584.08
209	3		0400	.00	1.48	4.87	584.08
210	3		0415	.00	1.46	4.84	584.07
211	3		0430	.00	1.45	4.81	584.07
212	3		0445	.00	1.43	4.78	584.07
213	3		0500	.00	1.42	4.75	584.07
214	3		0515	.00	1.40	4.72	584.06
215	3		0530	.00	1.38	4.69	584.06
216	3		0545	.00	1.37	4.67	584.06
217	3		0600	.00	1.35	4.64	584.06
218	3		0615	.00	1.34	4.61	584.06
219	3		0630	.00	1.32	4.58	584.05
220	3		0645	.00	1.31	4.56	584.05
221	3		0700	.00	1.29	4.53	584.05
222	3		0715	.00	1.28	4.50	584.05
223	3		0730	.00	1.27	4.48	584.05
224	3		0745	.00	1.25	4.45	584.04
225	3		0800	.00	1.24	4.42	584.04
226	3		0815	.00	1.22	4.40	584.04
227	3		0830	.00	1.21	4.37	584.04
228	3		0845	.00	1.20	4.35	584.04
229	3		0900	.00	1.18	4.32	584.03
230	3		0915	.00	1.17	4.30	584.03
231	3		0930	.00	1.16	4.28	584.03
232	3		0945	.00	1.14	4.25	584.03
233	3		1000	.00	1.13	4.23	584.03
234	3		1015	.00	1.12	4.21	584.03
235	3		1030	.00	1.10	4.18	584.02
236	3		1045	.00	1.09	4.16	584.02
237	3		1100	.00	1.08	4.14	584.02
238	3		1115	.00	1.07	4.12	584.02
239	3		1130	.00	1.06	4.09	584.02
240	3		1145	.00	1.04	4.07	584.02
241	3		1200	.00	1.03	4.05	584.01
242	3		1215	.00	1.02	4.03	584.01
243	3		1230	.00	1.01	4.01	584.01
244	3		1245	.00	1.00	3.99	584.01
245	3		1300	.00	.99	3.97	584.01
246	3		1315	.00	.98	3.95	584.01
247	3		1330	.00	.97	3.93	584.00
248	3		1345	.00	.95	3.91	584.00
249	3		1400	.00	.94	3.89	584.00
250	3		1415	.00	.93	3.87	584.00

1TABLE 1 (CONT.)	STATION	BASIN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY MON	HRMN				
251	3	1430	.00	.93	3.85	584.00
252	3	1445	.00	.92	3.83	584.00
253	3	1500	.00	.92	3.81	584.00
254	3	1515	.00	.91	3.79	583.99
255	3	1530	.00	.91	3.77	583.99
256	3	1545	.00	.90	3.75	583.99
257	3	1600	.00	.90	3.74	583.99
258	3	1615	.00	.89	3.72	583.99
259	3	1630	.00	.89	3.70	583.99
260	3	1645	.00	.89	3.68	583.99
261	3	1700	.00	.88	3.66	583.98
262	3	1715	.00	.88	3.64	583.98
263	3	1730	.00	.87	3.63	583.98
264	3	1745	.00	.87	3.61	583.98
265	3	1800	.00	.86	3.59	583.98
266	3	1815	.00	.86	3.57	583.98
267	3	1830	.00	.86	3.55	583.98
268	3	1845	.00	.85	3.54	583.97
269	3	1900	.00	.85	3.52	583.97
270	3	1915	.00	.84	3.50	583.97
271	3	1930	.00	.84	3.48	583.97
272	3	1945	.00	.83	3.47	583.97
273	3	2000	.00	.83	3.45	583.97
274	3	2015	.00	.83	3.43	583.97
275	3	2030	.00	.82	3.42	583.97
276	3	2045	.00	.82	3.40	583.96
277	3	2100	.00	.81	3.38	583.96
278	3	2115	.00	.81	3.36	583.96
279	3	2130	.00	.81	3.35	583.96
280	3	2145	.00	.80	3.33	583.96
281	3	2200	.00	.80	3.31	583.96
282	3	2215	.00	.79	3.30	583.96
283	3	2230	.00	.79	3.28	583.95
284	3	2245	.00	.79	3.27	583.95
285	3	2300	.00	.78	3.25	583.95
286	3	2315	.00	.78	3.23	583.95
287	3	2330	.00	.77	3.22	583.95
288	3	2345	.00	.77	3.20	583.95
289	4	0000	.00	.77	3.19	583.95
290	4	0015	.00	.76	3.17	583.95
291	4	0030	.00	.76	3.15	583.95
292	4	0045	.00	.76	3.14	583.94
293	4	0100	.00	.75	3.12	583.94
294	4	0115	.00	.75	3.11	583.94
295	4	0130	.00	.74	3.09	583.94
296	4	0145	.00	.74	3.08	583.94
297	4	0200	.00	.74	3.06	583.94
298	4	0215	.00	.73	3.05	583.94
299	4	0230	.00	.73	3.03	583.94
300	4	0245	.00	.73	3.02	583.93 ← **Stage/Storage 68.75 Hours after maximum stage/storage**
		MAX	224.68	13.51	24.05	585.47
		MIN	.00	.00	.00	583.70
		AVE	4.41	3.92	9.04	584.38

*** NORMAL END OF HEC-1 ***

```
1***************************************                                     ***************************************
 *                                     *                                     *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                     *   U.S. ARMY CORPS OF ENGINEERS      *
 *           SEPTEMBER 1990             *                                     *   HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0              *                                     *         609 SECOND STREET           *
 *                                     *                                     *      DAVIS, CALIFORNIA 95616        *
 * RUN DATE  12/10/2015  TIME  12:41:06 *                                     *          (916) 756-1104             *
 *                                     *                                     *                                     *
***************************************                                     ***************************************


                              X     X  XXXXXXX   XXXXX           X
                              X     X  X        X     X         XX
                              X     X  X        X                X
                              XXXXXXX  XXXX     X         XXXXX  X
                              X     X  X        X                X
                              X     X  X        X     X          X
                              X     X  XXXXXXX   XXXXX          XXX


           THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

           THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
           THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
           NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
           DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
           KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
```

```
 LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

*** FREE ***
             ID  ***************************************************************************
             ID  *                                                                         *
             ID  *      AEP Amos Plant Bottom Ash Complex     File: PMPB1DD.inp            *
             ID  *      Flood Routing for Ash Pond 1A and Reclaim Pond                     *
             ID  *      1/2 6 Hour PMP Storm Drawdown   36" Pipe Invert Elev 583.2'        *
             ID  *      GA Project No. 15055009.01                                         *
             ID  *                                                                         *
             ID  *      Analyses by: Geo/Environmental Associates                          *
             ID  *                   Knoxville, TN                                         *
             ID  *                   October 2015                                          *
             ID  *                                                                         *
             ID  ***************************************************************************
             IT      15       0       0      50
             IO       3
             VS     IMP     IMP     IMP
             VV    2.11    6.11    7.11

             KK     IMP
             KM   continue drawdown 68.75 hours after peak
             RS       1    ELEV  583.93
             SA    6.01    6.25   17.65   19.97   22.28
             SQ       0    4.00   13.48   26.16   38.09
             SE   583.2     584     585     586     587
             ZZ
```

```
1*****************************************                                  ***************************************
 *                                       *                                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                  *   U.S. ARMY CORPS OF ENGINEERS      *
 *           SEPTEMBER 1990              *                                  *   HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0               *                                  *         609 SECOND STREET           *
 *                                       *                                  *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE  12/10/2015  TIME  12:41:06 *                                  *          (916) 756-1104             *
 *                                       *                                  *                                     *
 *****************************************                                  ***************************************


                  ****************************************************************************
                  *                                                                          *
                  *      AEP Amos Plant Bottom Ash Complex     File: PMPB1DD.inp             *
                  *      Flood Routing for Ash Pond 1A and Reclaim Pond                      *
                  *      1/2 6 Hour PMP Storm Drawdown   36" Pipe Invert Elev 583.2'          *
                  *      GA Project No. 15055009.01                                          *
                  *                                                                          *
                  *      Analyses by: Geo/Environmental Associates                           *
                  *                   Knoxville, TN                                          *
                  *                   October 2015                                           *
                  *                                                                          *
                  ****************************************************************************

   14 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          3  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN         15  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1     0  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ         50  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      1     0  ENDING DATE
                       NDTIME       1215  ENDING TIME
                        ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .25 HOURS
                      TOTAL TIME BASE   12.25 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

                 USER-DEFINED OUTPUT SPECIFICATIONS

          TABLE 1
      VS       STATION       IMP       IMP       IMP
      VV VARIABLE CODE      2.11      6.11      7.11       .00       .00       .00       .00       .00       .00       .00


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             **************
             *            *
   17 KK     *      IMP   *
             *            *
             **************
                     continue drawdown 68.75 hours after peak

               HYDROGRAPH ROUTING DATA

   19 RS          STORAGE ROUTING
                        NSTPS          1  NUMBER OF SUBREACHES
                         ITYP       ELEV  TYPE OF INITIAL CONDITION
                       RSVRIC     583.93  INITIAL CONDITION
                            X        .00 WORKING R AND D COEFFICIENT

   20 SA                 AREA        6.0       6.3      17.6      20.0      22.3
```

```
  21 SQ          DISCHARGE          0.         4.        13.        26.        38.

  22 SE          ELEVATION      583.20    584.00    585.00    586.00    587.00
                                                                       ***

                                                       COMPUTED STORAGE-ELEVATION DATA

           STORAGE         .00      4.90     16.37     35.17     56.28
         ELEVATION     583.20    584.00    585.00    586.00    587.00

      ***            ***             ***             ***             ***

                              HYDROGRAPH AT STATION       IMP

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR      12.25-HR
+   (CFS)       (HR)
                              (CFS)
+        4.       .25                     3.           2.           2.            2.
                            (INCHES)    .000         .000         .000          .000
                             (AC-FT)      1.           3.           3.            3.

 PEAK STORAGE   TIME                           MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR      12.25-HR
+  (AC-FT)      (HR)
         4.       .25                     4.           3.           3.            3.

  PEAK STAGE    TIME                            MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR      12.25-HR
+   (FEET)      (HR)
    583.93       .00                  583.80       583.70       583.70        583.70

                             CUMULATIVE AREA =      .00 SQ MI
```

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+										
	ROUTED TO									
+		IMP	4.	.25	3.	2.	2.	.00		
+									583.93	.00

1TABLE 1	STATION			IMP FLOW	IMP STORAGE	IMP STAGE
PER	DAY	MON	HRMN			
1	1		0000	3.65	4.47	583.93
2	1		0015	3.58	4.39	583.92
3	1		0030	3.52	4.32	583.90
4	1		0045	3.46	4.25	583.89
5	1		0100	3.41	4.18	583.88
6	1		0115	3.35	4.11	583.87
7	1		0130	3.29	4.04	583.86
8	1		0145	3.24	3.97	583.85
9	1		0200	3.18	3.90	583.84
10	1		0215	3.13	3.84	583.83
11	1		0230	3.08	3.77	583.82
12	1		0245	3.03	3.71	583.81
13	1		0300	2.98	3.65	583.80
14	1		0315	2.93	3.59	583.79
15	1		0330	2.88	3.53	583.78
16	1		0345	2.83	3.47	583.77
17	1		0400	2.78	3.41	583.76
18	1		0415	2.74	3.35	583.75
19	1		0430	2.69	3.30	583.74
20	1		0445	2.65	3.24	583.73
21	1		0500	2.60	3.19	583.72
22	1		0515	2.56	3.14	583.71
23	1		0530	2.51	3.08	583.70
24	1		0545	2.47	3.03	583.69
25	1		0600	2.43	2.98	583.69
26	1		0615	2.39	2.93	583.68
27	1		0630	2.35	2.88	583.67
28	1		0645	2.31	2.83	583.66
29	1		0700	2.27	2.79	583.65
30	1		0715	2.23	2.74	583.65
31	1		0730	2.20	2.69	583.64
32	1		0745	2.16	2.65	583.63
33	1		0800	2.12	2.60	583.62
34	1		0815	2.09	2.56	583.62
35	1		0830	2.05	2.52	583.61
36	1		0845	2.02	2.48	583.60
37	1		0900	1.99	2.43	583.60
38	1		**0915**	**1.95**	**2.39**	**583.59** ← **Time to decant 90% maximum storage = 78.0 hours (3.25 days)**
39	1		0930	1.92	2.35	583.58
40	1		0945	1.89	2.31	583.58
41	1		1000	1.86	2.28	583.57
42	1		1015	1.83	2.24	583.57
43	1		1030	1.80	2.20	583.56
44	1		1045	1.77	2.16	583.55
45	1		1100	1.74	2.13	583.55
46	1		1115	1.71	2.09	583.54
47	1		1130	1.68	2.06	583.54
48	1		1145	1.65	2.02	583.53
49	1		1200	1.62	1.99	583.52
50	1		1215	1.60	1.96	583.52
			MAX	3.65	4.47	583.93
			MIN	1.60	1.96	583.52
			AVE	2.48	3.04	583.70

*** NORMAL END OF HEC-1 ***

ATTACHMENT F

MAINTENANCE PLAN

MAINTENANCE PLAN FOR John Amos Plant Bottom Ash Dams **DAM ID** #07918 and # 07919 **20** 06

Type of Maintenance	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Monitoring Plan Inspection	X	X	X	X	X	X	X	X	X	X	X	X
Annual Engineer Inspection									X			
Embankment												
Mow Embankment								X				
Repair Erosion Gullies *												
Revegetate Bare Areas *												
Clean Embankment Outlet Pipe								X				
Repair All Animal Burrows *												
Remove Trees/Brush								X				
Pipes and Conduits												
Inspection PSW Pipe Interior												
Repair/Replace Animal Guards N/A												
Clear Subdrain Outlets N/A												
Clear Debris from Stilling Basin *												
Clear Brush/Trees from Outlet Channel				X				X				
Rock Rip-Rap N/A												
Replace Missing/Moved Rock N/A												
Remove Vegetation from Rocks N/A												

Comments: *Activity performed as required.

MAINTENANCE PLAN FOR John Amos Plant Bottom Ash Dams **DAM ID** # 07918 and # 07919 **20** 06

Type of Maintenance		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Mechanical													
Exercise Gates/Machinery	N/A												
Lubricate Fittings/Bearings	N/A												
Remove Rust	N/A												
Repaint Metal Parts	N/A												
Concrete													
Remove Vegetation from Joints *									X				
Reseal Joints/Cracks *									X				
Repair Spalls/Cracks *									X				
Clear Weep Holes	N/A												
Earth Spillways													
Repair Grass/Reseed	N/A												
Remove Obstructions	N/A												
Clear Side Slope Slides	N/A												
Clear Trees/Brush	N/A												
Repair Vehicle/Traffic Damage *									X				
Repair/Replace Access Gates *									X				

Comments: *Activity performed as required