Stantec Consulting Services Inc.
10509 Timberwood Circle, Suite 100, Louisville, KY 40223

October 6, 2016
File: rpt_001_let_172675014
Revision 0

Tennessee Valley Authority
1101 Market Street
Chattanooga, Tennessee 37402

RE: Liner Design Demonstration
East Ash Disposal Area
EPA Final Coal Combustion Residual (CCR) Rule
TVA Allen Fossil Plant
Shelby County, Tennessee

1.0 PURPOSE

This letter documents Stantec's certification of the existing liner assessment for the TVA Allen Fossil Plant's East Ash Disposal Area. Based on the assessment, the East Ash Disposal Area is considered an unlined CCR surface impoundment as described in the Final CCR Rule at 40 CFR 257.71(a)(3).

2.0 EXISTING LINER ASSESSMENT

An existing surface impoundment must be evaluated as to whether or not it was constructed with a liner as described in 40 CFR 257.71(a)(1)(i)-(iii).

3.0 SUMMARY OF FINDINGS

The attached report presents the analysis for the existing liner assessment. The report concludes that the East Ash Disposal Area at the Allen Fossil Plant was not constructed with a liner that complies with the requirements of §257.71 of the EAP CCR Rule. Therefore, this unit is considered an unlined surface impoundment that is allowed to remain in operation in compliance with the requirements of §257.101(a).

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stephen H. Bickel, being a Professional Engineer in good standing in the State of Tennessee, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;

2. that the information contained herein is accurate as of the date of my signature below; and

RE: **Liner Design Demonstration**
East Ash Disposal Area
EPA Final Coal Combustion Residual (CCR) Rule
TVA Allen Fossil Plant
Shelby County, Tennessee

3. that the TVA Allen Fossil Plant's East Ash Disposal Area is considered an unlined CCR surface impoundment as described in 40 CFR 257.71(a)(3).

SIGNATURE _____ DATE 10/6/2016

ADDRESS: Stantec Consulting Services Inc.
10509 Timberwood Circle, Suite 100
Louisville, KY 40223

TELEPHONE: (502) 212-5000

ATTACHMENTS: ALF East Ash Disposal Area Liner Design Demonstration

Liner Design Demonstration

Allen Fossil Plant
East Ash Disposal Area
Shelby County, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:
Stantec Consulting Services Inc.

October 6, 2016
Revision 0

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LIST OF FIGURES

LIST OF APPENDICES

1.0 BACKGROUND

1.1 INTRODUCTION

On April 17, 2015, the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Final Rule was published in the Federal Register. The Tennessee Valley Authority (TVA) contracted Stantec Consulting Services Inc. (Stantec) to determine whether the East Ash Disposal Area at Allen Fossil Plant (ALF) met liner design criteria described in §257.71 of the EPA Final CCR Rule.

ALF is a coal-fired, electric generating plant. The plant is located on McKellar Lake, in Shelby County, Tennessee. The East Ash Disposal Area is an existing CCR surface impoundment as defined by the EPA Final CCR Rule. It includes an area of approximately 80 acres, and a constructed perimeter dike system that varies in height from 20 to 25 feet.

This assessment concludes that while the unit is underlain by native clays, silts, sands, and gravel, it is classified as an unlined CCR surface impoundment per the EPA Final CCR Rule. The East Ash Disposal Area consists of the boundary area denoted in Figure 1.

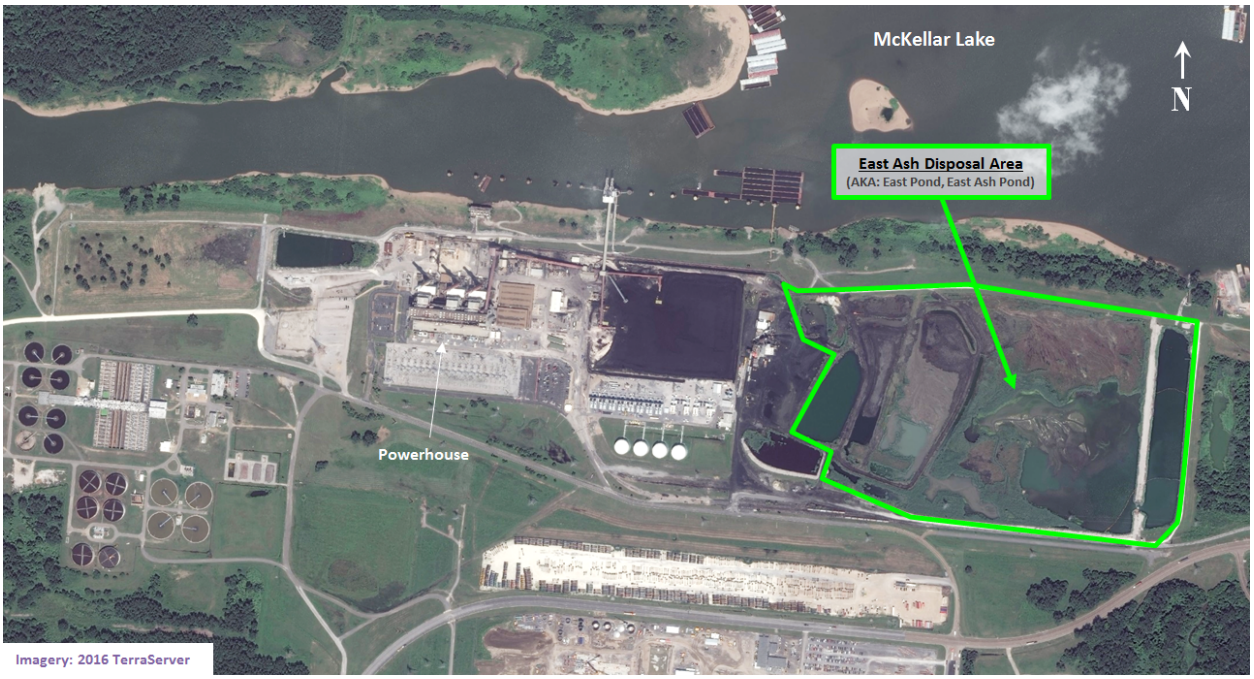


Figure 1 East Ash Disposal Area Approximate Boundary

1.2 OBJECTIVE

The objective of this demonstration is to evaluate compliance related to §257.71, specifically whether the East Ash Disposal Area was constructed with one of the following:

- A liner consisting of a minimum of two feet of compacted soil with a hydraulic conductivity of no greater than 1 x 10-7 cm/sec;
- A composite liner that meets the requirements of § 257.70(b); or
- An alternative composite liner that meets the requirements of § 257.70(c).

Based on the EPA presentation dated April 15, 2015 and titled, "Top 20 Questions on EPA's CCR Final Rule", compacted soil means soil that is *mechanically* compacted in lifts.

1.3 SUMMARY OF HISTORICAL INFORMATION

In the early 1960s, the United States Army Corps of Engineers (USACE) constructed the East Ash Disposal Area's northern perimeter dike (USACE levee) using soils excavated from the area that is now the East Ash Disposal Area (Item No. L-725, Drawing No. 1). Between 1976 and 1978, the East Ash Disposal Area was temporarily taken off-line and the East Dike was constructed to approximate Elevation 237 feet. Applicable Record Drawings are included in Appendix A.

The following geotechnical reports have been reviewed:

- Stantec Consulting Services Inc. 2010. Report of Geotechnical Engineering: Evaluation of East Ash Pond Liner. Prepared for Tennessee Valley Authority. March 2, 2010.
- Stantec Consulting Services Inc. 2010. Report of Geotechnical Exploration and Evaluation of Slope Stability. Prepared for Tennessee Valley Authority. March 25, 2010.
- Stantec Consulting Services Inc. 2011. Geotechnical Report for the Evaluation of Dike Stability. Prepared for Tennessee Valley Authority. May 11, 2011.
- Stantec Consulting Services Inc. 2015. Geotechnical Exploration Data Report – East Ash Disposal Area. Prepared for Tennessee Valley Authority. December 11, 2015.

These reports include soil borings drilled along the northern perimeter dike, eastern perimeter dike, and the divider dike. The boring logs indicate natural clay foundation soils were encountered with an average thickness of 14.4 feet. Laboratory testing of 10 borings with clay foundation soils indicated a permeability ranging from 9.11×10^{-6} to 5.4×10^{-9} cm/sec. Review of these reports could not conclude whether a mechanically compacted clay liner was placed across the extent of the East Ash Disposal Area.

2.0 FIELD EXPLORATION

There have been no additional field explorations at this facility.

3.0 CONCLUSION

Based on a review of historical construction documents and existing geotechnical reports, the East Ash Disposal Area at Allen Fossil Plant was not constructed with a liner that complies with the requirements of §257.71 of the EPA Final CCR Rule. Therefore, this unit is considered an unlined surface impoundment in accordance to the EPA Final CCR Rule and is allowed to remain in operation in compliance with the requirements of §257.101(a).

4.0 REFERENCES

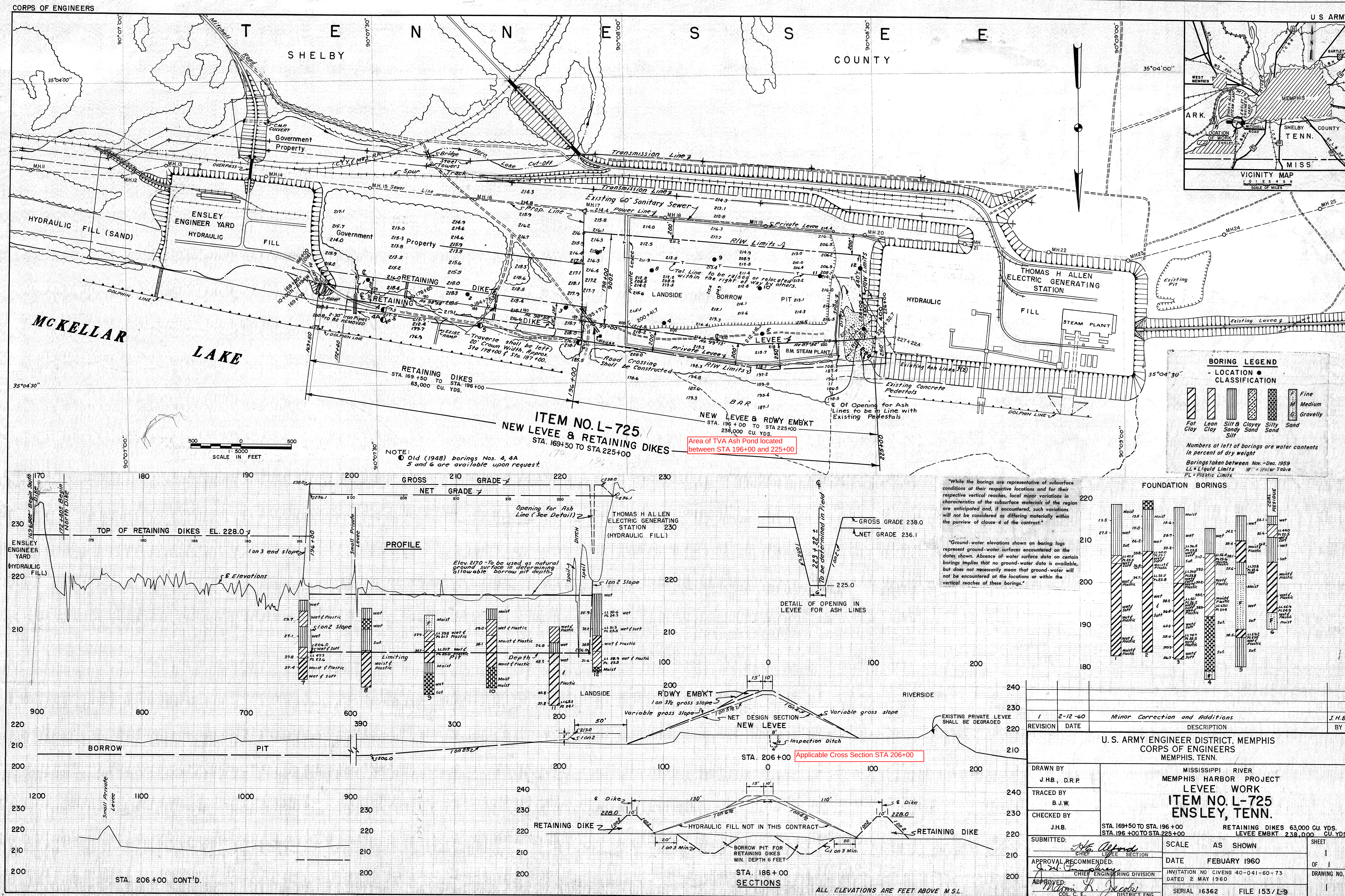
Stantec Consulting Services Inc. 2010. Report of Geotechnical Engineering: Evaluation of East Ash Pond Liner. Prepared for Tennessee Valley Authority. March 2, 2010.

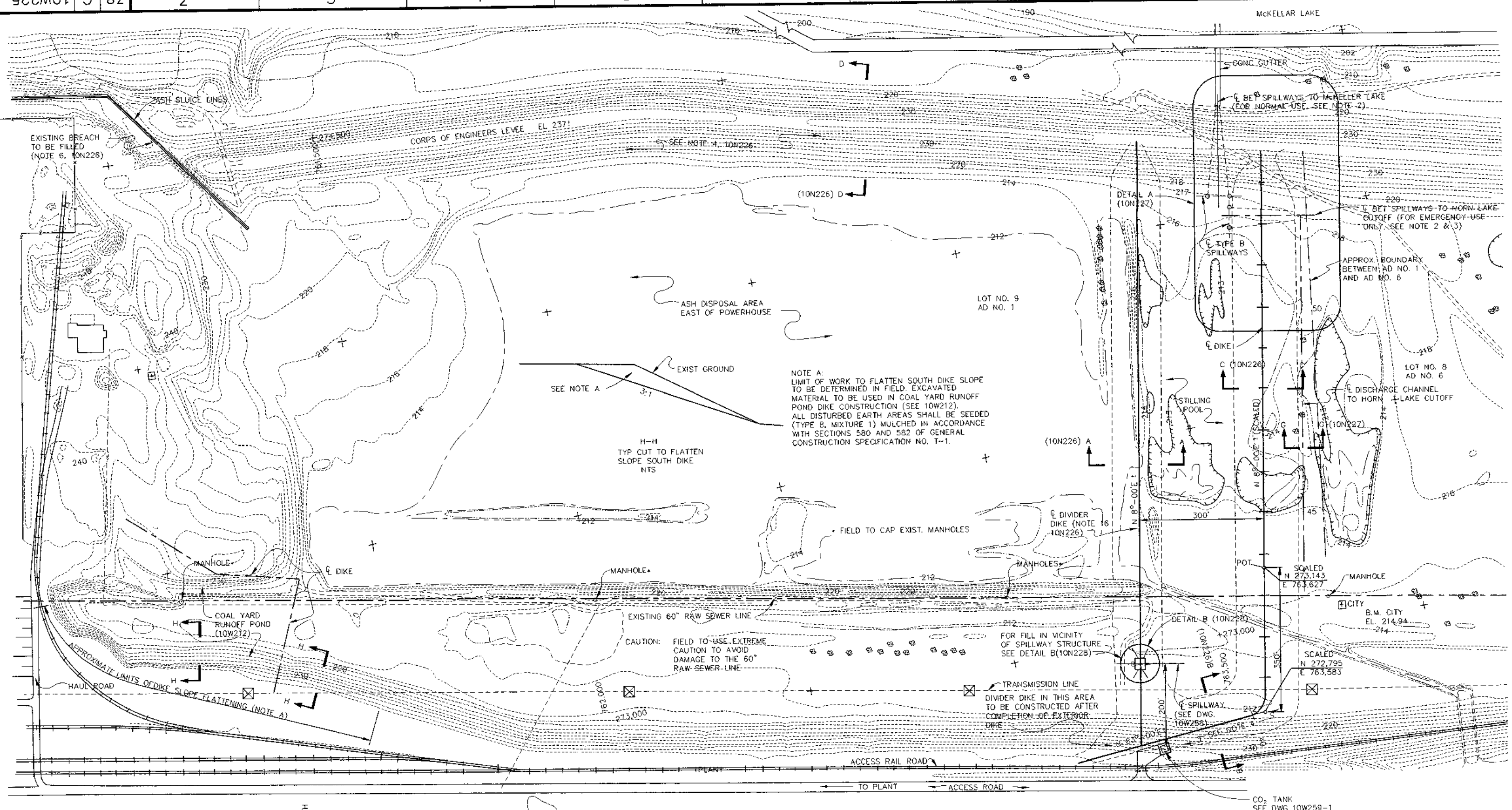
Stantec Consulting Services Inc. 2010. Report of Geotechnical Exploration and Evaluation of Slope Stability. Prepared for Tennessee Valley Authority. March 25, 2010.

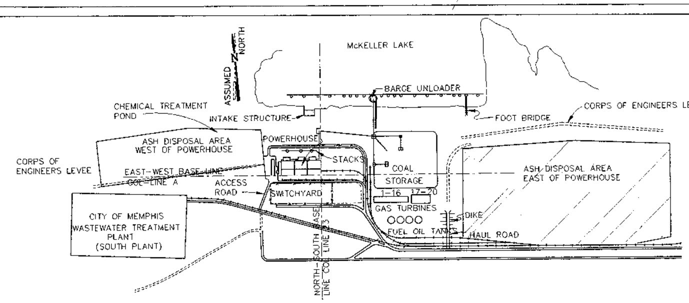
Stantec Consulting Services Inc. 2011. Geotechnical Report for the Evaluation of Dike Stability. Prepared for Tennessee Valley Authority. May 11, 2011.

Stantec Consulting Services Inc. 2015. Geotechnical Exploration Data Report – East Ash Disposal Area. Prepared for Tennessee Valley Authority. December 11, 2015.

APPENDIX
HISTORICAL DRAWINGS


CORPS OF ENGINEERS
U S ARMY
T E N N E S S E E
SHELBY COUNTY
McKELLAR LAKE
HYDRAULIC FILL (SAND)
ENSLEY ENGINEER YARD
HYDRAULIC FILL
Government Property
RETAINING DIKE
LANDSIDE BORROW PIT
THOMAS H ALLEN ELECTRIC GENERATING STATION
HYDRAULIC FILL
STEAM PLANT
Existing Levee
Transmission Line
Existing 60" Sanitary Sewer
R/W Limits
Private Levee
LEVEE
Existing Ash Lines (2)
Existing Concrete Pedestals
BAR
DOLPHIN LINE
RETAINING DIKES
STA. 169+50 TO STA. 196+00
63,000 CU. YDS.
NEW LEVEE & RDWY EMBKT
STA. 196+00 TO STA 225+00
238,000 CU. YDS.
ITEM NO. L-725
NEW LEVEE & RETAINING DIKES
STA. 169+50 TO STA. 225+00
Area of TVA Ash Pond located between STA 196+00 and 225+00
NOTE:
Old (1948) borings Nos. 4, 4A 5 and 6 are available upon request.
SCALE IN FEET 1:5000
VICINITY MAP
SCALE OF MILES
BORING LEGEND
- LOCATION
CLASSIFICATION
Fat Clay
Lean Clay
Silt & Sandy Silt
Clayey Sand
Silty Sand
Sand
Fine
Medium
Gravelly
Numbers at left of borings are water contents in percent of dry weight
Borings taken between Nov.-Dec. 1959
LL = Liquid Limits
PL = Plastic Limits
"While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local minor variations in characteristics of the subsurface materials of the region are anticipated and, if encountered, such variations will not be considered as differing materially within the purview of clause 4 of the contract."
"Ground-water elevations shown on boring logs represent ground-water surfaces encountered on the dates shown. Absence of water surface data on certain borings implies that no ground-water was available, but does not necessarily mean that ground-water will not be encountered at the locations or within the vertical reaches of these borings."
FOUNDATION BORINGS
PROFILE
GROSS GRADE
NET GRADE
TOP OF RETAINING DIKES EL. 228.0
1 on 3 end slope
Elevations
Elev. 217.0 - To be used as natural ground surface in determining allowable borrow pit depth.
Opening for Ash Line (See Detail)
THOMAS H ALLEN ELECTRIC GENERATING STATION (HYDRAULIC FILL)
1 on 2 Slope
Limiting Depth
DETAIL OF OPENING IN LEVEE FOR ASH LINES
GROSS GRADE 238.0
NET GRADE 236.1
LANDSIDE
RIVERSIDE
R'DWY EMBK'T
1 on 3½ grass slope
Variable grass slope
NET DESIGN SECTION
NEW LEVEE
Inspection Ditch
EXISTING PRIVATE LEVEE SHALL BE DEGRADED
BORROW PIT
STA. 206+00
Applicable Cross Section STA 206+00
STA. 206+00 CONT'D.
RETAINING DIKE
HYDRAULIC FILL NOT IN THIS CONTRACT
BORROW PIT FOR RETAINING DIKES MIN. DEPTH 6 FEET
STA. 186+00
SECTIONS
ALL ELEVATIONS ARE FEET ABOVE M.S.L.
1 | 2-12-60 | Minor Correction and Additions | J.H.B.
REVISION | DATE | DESCRIPTION | BY
U. S. ARMY ENGINEER DISTRICT, MEMPHIS
CORPS OF ENGINEERS
MEMPHIS, TENN.
DRAWN BY J.H.B., D.R.P.
TRACED BY B.J.W.
CHECKED BY J.H.B.
MISSISSIPPI RIVER
MEMPHIS HARBOR PROJECT
LEVEE WORK
ITEM NO. L-725
ENSLEY, TENN.
STA. 169+50 TO STA. 196+00 RETAINING DIKES 63,000 CU. YDS.
STA. 196+00 TO STA. 225+00 LEVEE EMBKT 238,000 CU. YDS.
SUBMITTED: CHIEF LEVEE SECTION
APPROVAL RECOMMENDED: CHIEF ENGINEERING DIVISION
APPROVED: COL. C. E. DISTRICT ENG.
SCALE AS SHOWN
DATE FEBUARY 1960
INVITATION NO CIVENG 40-041-60-73 DATED 2 MAY 1960
SERIAL 16362
FILE 153/L-9
SHEET 1 OF 1
DRAWING NO. 1





LOCATION PLAN
SCALE: 1"=600'

NOTES:

1. FOR GENERAL NOTES SEE DWG 10N226.
2. THE STANDARD SPILLWAYS TO HORN LAKE CUTOFF ARE FOR EMERGENCY USE ONLY. NORMAL DISCHARGE FROM THE EAST DISPOSAL AREA SHALL BE THROUGH THE STANDARD SPILLWAYS TO McKELLAR LAKE. WHEN THE WATER LEVEL OF McKELLER LAKE REACHES A LEVEL THAT PROHIBITS THE DISCHARGE FROM THE EAST DISPOSAL AREA TO McKELLAR LAKE, THE GATES TO THESE SPILLWAYS ARE TO BE CLOSED AND THE STANDARD SPILLWAYS TO HORN LAKE CUTOFF ACTIVATED. THE SPILLWAYS TO McKELLAR LAKE ARE TO BE REACTIVATED AS SOON AS PRACTICAL.
3. SPILLWAYS TO HORN LAKE CUTOFF ARE TO BE TEMPORARILY PLUGGED. BY FIELF. UNTIL BREACH THROUGH CORPS OF ENGINEERS' LEVEE FOR CONSTRUCTION OF SPILLWAYS TO McKELLAR LAKE HAS BEEN BACKFILLED AND SPILLWAY GATES HAVE BEEN CONSTRUCTED.
4. WHEN CONNECTING THE DIKE TO THE RAILROAD FILL EXTREME CARE SHALL BE USED TO INSURE AN IMPERVIOUS AND STABLE CONNECTION.

P.A. 3092
AND W.O. P33-544-82-31401-J6

COMPANION DWGS. 10N223, 224, 226, 227, 228, 229-1, 229-2, 10W259-1, 259-2, 259-3

SCALE: 1"=100"
EXCEPT AS NOTED

REV NO	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 6	10-2-95	BKE	MGH	HLP	HLP	KWB	RCJ	WDH	ALF007	
AS-BUILT										
R 5	10-27-94	BKE	MGH	HLP	HLP	KWB	RCJ	WDH	ALF007	
ADDED CO2 TANK & REFERENCE TO "W" SIZE.										

SCALE: 1"=100' EXCEPT AS NOTED — EXCEPT AS NOTED

MAIN PLANT
ASH DISPOSAL AREAS

ASH DISPOSAL AREA EAST OF POWERHOUSE SHEET 1

DESIGNED BY	DRAWN BY	CHECKED BY	SUPERVISED BY	REVIEWED BY	APPROVED BY	ISSUED BY
B.K.ELDER	M.G.HRANEK	H.L.PETTY	H.L.PETTY	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

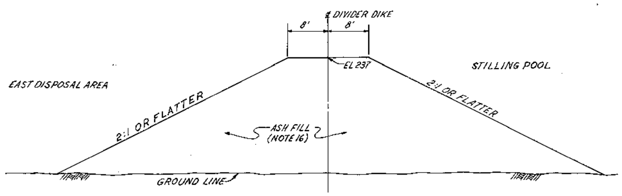
THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R12 | DATE | 38 | C | 10W225 | R 6

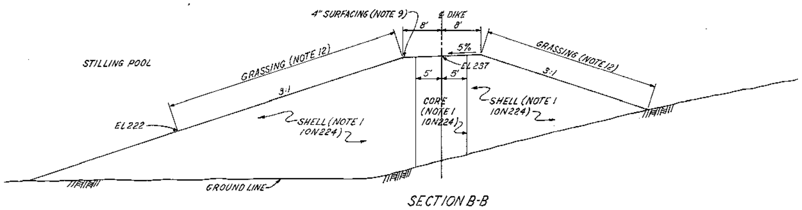
ELECTRONICALLY RESTORED DRAWING
THIS DRAWING HAS BEEN COMPLETELY REDRAWN AND SUPERSEDES :(10N225 & R4)

TASK COMPLETED BY: | REV NO.

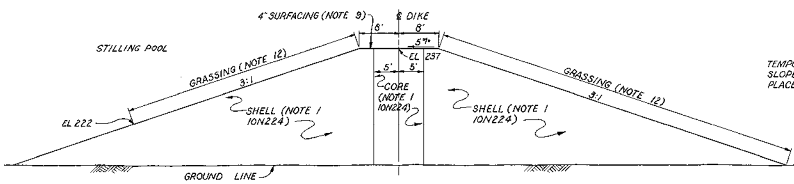
PLOT FACTOR:1/1200 - ACTUAL 1:1
W_TVA
FILENAME: AF225.DWG
C.A.D. DRAWING
DO NOT ALTER MANUALLY



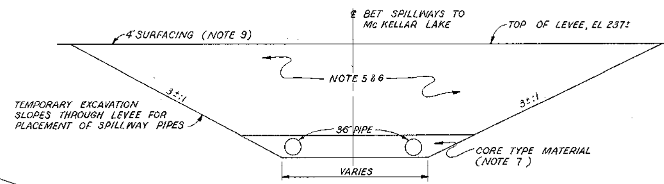
SECTION A-A
TYPICAL DIVIDER DIKE SECTION



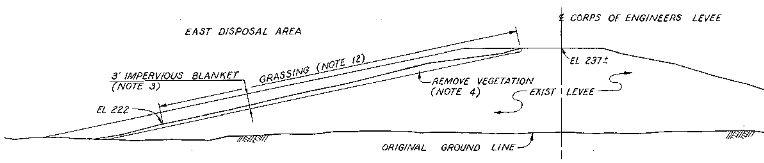
SECTION B-B



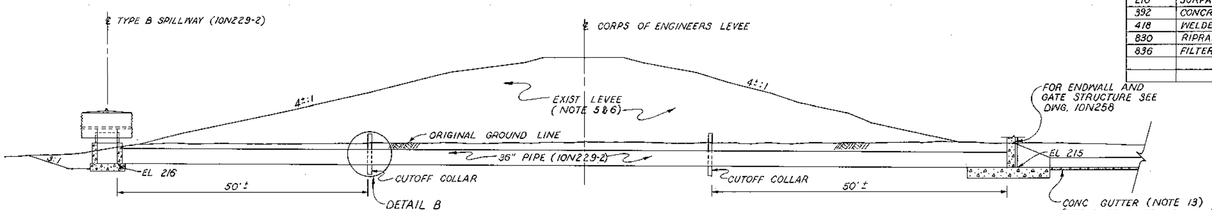
SECTION C-C
TYPICAL DIKE SECTION
STA 41+00± TO STA 53+00±



SECTION J-J
BREACH OF LEVEE SECTION



SECTION D-D
TYPICAL LEVEE SECTION



SECTION F-F
SPILLWAY TO McKELLAR LAKE

NOTES:

1. FOR GENERAL NOTES SEE DRAWING 10N224.
2. FIELD SHALL USE EXTREME CAUTION TO AVOID DAMAGE TO THE 60" RAW SEWER LINE LYING OUTSIDE AND SOUTH OF THE DISPOSAL AREA.
3. THE IMPERVIOUS BLANKET PLACED ON THE LANDSIDE SLOPE OF THE CORPS OF ENGINEERS' LEVEE SHALL BE OF CORE TYPE MATERIAL (MINIMUM 3 FEET THICK). PLACEMENT AND COMPACTION SHALL BE AS SPECIFIED FOR THE CORE MATERIAL (NOTE 1, 10N224). AT THE INTERSECTION OF THE LEVEE AND THE DIKE, THE IMPERVIOUS BLANKET ON THE SLOPE OF THE LEVEE SHALL EXTEND TO INTERSECT WITH THE CORE OF THE DIKE.
4. EXISTING VEGETATION SHALL BE STRIPPED FROM THE LANDSIDE SLOPE OF THE LEVEE BEFORE PLACEMENT OF THE IMPERVIOUS BLANKET AND STOCKPILED. AFTER PLACEMENT OF THE IMPERVIOUS BLANKET, THE STOCKPILED MATERIAL SHALL BE UNIFORMLY SPREAD OVER THE IMPERVIOUS BLANKET. THIS SLOPE SHALL THEN BE SEEDED PER NOTE 7, DRAWING 10N224.
5. THE BREACH IN THE LEVEE FOR CONSTRUCTION OF THE DISCHARGE SPILLWAYS TO McKELLAR LAKE SHALL NOT BE MADE UNTIL THE DIKES FOR THE EAST DISPOSAL AREA ARE CONSTRUCTED.
6. MATERIALS EXCAVATED FROM THE BREACH IN THE LEVEE SHALL BE STOCKPILED AND USED IN REFILLING THE BREACH AFTER INSTALLATION OF THE SPILLWAY PIPES. COMPACTION SHALL BE AS SPECIFIED FOR OTHER DIKE MATERIALS, (NOTE 1, 10N224), WITH CONTROLS AS ESTABLISHED BY THE CENTRAL SOILS LABORATORY. THE EXISTING LEVEE BREACH WHERE THE ASH SLUICE PIPES ARE LOCATED SHALL BE FILLED WITH SHELL TYPE MATERIAL, (NOTE 1, 10N224). THE LANDSIDE LEVEE SLOPE AT BOTH BREACHES SHALL BE PROVIDED WITH THE IMPERVIOUS BLANKET OF NOTE 3. SEVERAL ROUTINE FILL COMPACTION TESTS SHALL BE MADE ON THE COMPACTED FILL IN EACH BREACH, WELL DISTRIBUTED IN PLAN AND ELEVATION TO OBTAIN GOOD REPRESENTATION THROUGHOUT THE FILLS.
7. PIPE BACKFILL AND BEDDING MATERIAL SHALL CONSIST OF CORE TYPE MATERIAL (NOTE 1 10N224) AND SHALL BE PLACED IN ACCORDANCE WITH SECTION 7.7 OF THE G-9 SPECIFICATIONS.
8. THE ASH, HYDRAULIC FILL, AND FOUNDATION STRIPPING, EXCEPT FOR THAT REMOVED FROM THE CORPS OF ENGINEERS' LEVEE EXCAVATED FOR CONSTRUCTION OF THE EAST DISPOSAL AREA DIKES SHALL BE DISPOSED OF INSIDE THE DISPOSAL AREA.
9. CRUSHED STONE OR GRAVEL SURFACING, 4" THICK, SHALL BE APPLIED FOR THE FULL WIDTH OF THE TOP OF DIKE AND ALL DISTURBED SECTIONS OF THE CORPS OF ENGINEERS' LEVEE IN ACCORDANCE WITH SECTION 210 OF T-1 SPECIFICATIONS.
10. RIPRAP SHALL BE PLACED AT SPILLWAY OUTLETS AS SHOWN. AT LEAST 50%, BY WEIGHT, OF THE RIPRAP SHALL CONSIST OF STONES AT LEAST 200 POUNDS EACH. RIPRAP SHALL CONFORM TO SECTION 830 OF THE T-1 SPECIFICATIONS.
11. FILTER SHALL CONFORM TO SECTION 836.
12. ALL CUT AND FILL SLOPES AND OTHER DISTURBED AREAS SHALL BE SEEDED WITH TYPE 6, MIXTURE B OR TYPE 7, MIXTURE A IN ACCORDANCE WITH SECTION 180 OF T-1 SPECIFICATIONS. DEPENDING ON THE TIME OF CONSTRUCTION, IT MAY BE NECESSARY TO PROVIDE A TEMPORARY COVER (TYPE 9) ON THE DIKE AND LEVEE SLOPES. ALL GRASSED AREAS SHALL BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTIONS 180 AND 182 RESPECTIVELY.
13. CONCRETE GUTTER SHALL CONFORM TO SECTION 390. INTERMEDIATE ANCHORS AND 3/4" EXPANSION JOINTS SHALL BE PLACED AT INTERVALS NOT TO EXCEED 50'.
14. WELDED WIRE FABRIC SHALL CONFORM TO ASTM SPECIFICATION A185 PLAIN FINISH, AND SHALL HAVE A MINIMUM LAP DISTANCE OF 8 INCHES.
15. THE MINIMUM FACTOR OF SAFETY FOR ALL LOADING CONDITIONS ON THE EAST DISPOSAL AREA IS 1.42. THIS FACTOR OF SAFETY IS FOR THE END OF CONSTRUCTION CONDITION.
16. THE DIVIDER DIKE SHALL BE CONSTRUCTED OF BOTTOM ASH PLACED IN NOT MORE THAN 9-INCH LAYERS, AND WELL COMPACTED WITH RUBBER-TIRED HAULING EQUIPMENT.

SUMMARY OF QUANTITIES EAST DISPOSAL AREA

ITEM	DESCRIPTION	QUANTITY	UNIT
101	CLEARING AND GRUBBING (DIKE)	3.4	AC.
120	CHAN EXCAV (TO HORN LAKE CUTOFF)	290	C.Y.
	ASH FILL (DIVIDER DIKE)	74,000	C.Y.
120	UNCLASSIFIED EXCAVATION (BREACH LEVEE)	4,745	C.Y.
123	EARTH BORROW - SHELL MATERIAL (DIKE)	102,000	C.Y.
	- CORE MATERIAL (DIKE)	13,500	C.Y.
	- SHELL MATERIAL (LEVEE)	5,945	C.Y.
	- CORE MATERIAL (LEVEE)	26,000	C.Y.
180	GRASSING (DIKE)	21,000	S.Y.
	GRASSING (LEVEE)	26,000	S.Y.
210	SURFACING (DIKE)	610	TONS
392	CONCRETE GUTTER (LEVEE)	300	L.F.
418	WELDED WIRE FABRIC	810	S.Y.
830	RIPRAP (DIKE)	990	C.Y.
836	FILTER (DIKE)	460	TONS

P.A. 3092
AND W.O. P33-544-82-31401-J6

COMPANION DWGS., 10N223, 224, 225, 227, 228, 229-1, 229-2
SCALE 1" = 10'

INSPECTED AND APPROVED FOR ISSUE
[signature]

REV NO.	ECN NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPR				
2		3-16-77	RDP	JSB	RDP	JLG	KWB		RJB		GLB				WMB
REVISED RIPRAP & FILTER QUANTITIES P.A. 3076															
1		10-19-76	RDP	GRD	RDP	JLG	KWB		RJB		GLB				BSM
ADD DIVIDER DIKE - P.A. 3076; EXTEND ASH AREA DIKE TO RR FILL - P.A. 3092															

DSGN J.L. GLOVER
DRWN J.S. BERRY
CHKD R.W. SCHENK
SUPV J.L. GLOVER
INSP
OHR
ENGINEER K.W. Burnett

MAIN PLANT - ASH DISPOSAL AREAS

ASH DISPOSAL AREA
EAST OF POWERHOUSE
SHEET 2

THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
Robert J. Bowman	[signature]	[signature]

KNOXVILLE | 9-5-75 | 38 | C | 10N226 | R2

RECORD DRAWING AS CONSTRUCTED
[signature] 11-6-78 R2

38 | C | 10N226