HISTORY OF CONSTRUCTION

CFR 257.73(c)(1)

Primary Bottom Ash Pond

Welsh Plant
Pittsburg, Texas

October, 2016
(Corrected)

Prepared for: AEP/SWEPCO - Welsh Plant

Pittsburg, Texas

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

AEP AMERICAN ELECTRIC POWER®

GERS – 16 – 129

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Attachments

1.0 OBJECTIVE

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

2.0 DESCRIPTION OF CCR THE IMPOUNDMENT

The AEP J. Robert Welsh Plant is located in southern Titus County, approximately 8 miles northeast of Pittsburg, Texas, and approximately two miles northwest of Cason, Texas. The facility operates two surface impoundments for storing CCR materials called the Primary Bottom Ash pond and the Bottom Ash Storage pond. The Primary Bottom Ash pond CCR unit is located southwest of the Plant and directly west of the Welsh Reservoir.

The Primary Bottom Ash pond is bounded by natural ground surface (topographically higher areas) to the north and west, and embankment dikes to the south and east. The elevation at the top of embankment along the crest area is approximately 340.0 feet above msl. Presently, economizer ash from the generating plant is sluiced to the Primary Bottom Ash pond. On occasion, bottom ash is sluiced to the Primary Bottom Ash pond.

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 AEP J. Robert Welsh Plant is located at 1187 County Road 4865, Pittsburg, TX, 75686, in southern Titus County. The plant is approximately 8 miles northeast of Pittsburg, Texas, and approximately two miles northwest of Cason, Texas. The primary ash pond CCR unit is located southwest of the Plant and directly west of the Welsh Reservoir. It is owned and operated by Southwestern Electric Power Company (SWEPCO). The facilities Ash Pond Complex operates two surface impoundments for storing CCR and a clear water pond for decant water.

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 Primary Bottom Ash Pond is a surface impoundment for storing CCR. Presently, economizer ash from the generating plant is sluiced to the primary ash pond. On occasion, bottom ash is sluiced to the primary ash pond. The Primary Bottom Ash Pond also receives storm water run-off from the main plant area and the coal yard area. All of the water from the primary bottom ash pond flows into a secondary pond that provides storage of decant water. Additional facility wastewaters (non-ash) are also discharged to the primary bottom ash 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 Welsh Primary Bottom Ash Pond is comprised of a diked embankments constructed across a natural draw area which separates it from the main body of the adjacent cooling lake. The primary ash pond is bounded by natural ground surface (topographically higher areas) to the north and west, and embankment dikes to the south and east. Therefore, there are areas surrounding the impoundment that contributes to the run-off. The watershed for the ponds is equal to approximately 349 acres.

The Primary Bottom Ash Pond is located within the Region 11 – Arkansas –White –Red Region Watershed and are part of the sub group HUC = 11140305 Lake O' the Pines watershed area. The area is approximately 571,731.2 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.]

The foundaion materials for the Primary Bottom Ash Pond embankment consist primarily of stiff to hard lean clay (CL) and fat clay (CH) with intermittent layers of medium dense to very dense clayey sand (SC) and silty sand (SM). A thick layer of very dense silty sand (SM) which is apparently the native surficial soils is present near the previous creek bed. Atterberg Plasticity Indices of the tested soils ranged between a low of 9 to a high of 44. The engineering properties of foundation soils had a cohesion that ranged between 300 psf and 320 psf and a friction angle that ranged between 15 degrees and 30 degrees. Additioanl details on the engineering properties of the foundaiton soils is in the design reports presented in Attachment B.

8.0 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 Primary Bottom Ash Pond embankment was constructed in 1974 and is constructed of compacted earth fill. The source and type of soils used for earth fill is unknown. However, AEP contracted with

ETTL Engineers & Consultants Inc. of Tyler, Texas to perform a Geotechnical Investigation of Existing Ash Storage Ponds Embankments on June 21, 2010 (copy of this report is provided in Attachment C). The evaluation of the existing earthen embankments consisted of slope stability and seepage analyses for the embankments. The soil properties provided are based on the information obtained from soil borings located along the crest area of the primary bottom ash pond. Three borings were drilled to a depth of 50 feet below the existing crest of the embankment (Appendix C). Based on the soil borings, the fill material in the embankment consists primarily of stiff to hard lean clay (CL), fat clay (CH) and medium dense clayey sand (SC) overlying the native soils which consist primarily of stiff to hard lean clay (CL) and fat clay (CH) with intermittent layers of medium dense to very dense clayey sand (SC) and silty sand (SM). Atterberg Plasticity Indices of the tested soils ranged between a low of 9 to a high of 44. The engineering properties of embankment soils had a cohesion of 310 psf and a friction angle of 23 degrees. Additioanl details on the engineering properties of the foundaiton soils is in the design reports presented in Attachment B.

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…]

The Primary Bottom Ash Pond receives effluent from the ash sluice lines that discharge the ash slurry on the east side of the pond. The ash settles, and the decant water flows through a 48-inch wide concrete weir box and into the Secondary Pond via an approximate 1,950-foot long discharge canal which originates at the southwest corner of the Primary bottom Ash Pond. The weir box has a minimum crest elevation of 325.0 feet, and flows through the weir box are controlled by installing 12-inch stop logs that are 55 inches long. Flows are conveyed through the weir box by sheet piling installed across the discharge canal, on either side of the weir box. The Primary Bottom Ash Pond has a 90-foot wide earthen emergency spillway on the south side of the pond; the spillway crest elevation is 334.0 feet. The emergency spillway overflows from the Primary Bottom Ash Pond directly into the discharge canal at the approximate midpoint of the discharge canal. A copy of the design drawings are presented in Attachment C.

10.0 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. The Inflow Design Flood is the 100-year storm event.

	Primary Bottom Ash Pond
Normal Pool Elevation	333.0 ft.
Maximum Pool Elevation following peak discharge from inflow design flood	337.46 ft.
Expected Maximum depth of CCR within impoundment	33.0 ft.

11.0 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 unit due to malfunction or mis-operation]

In the event of malfunction or mis-operation of any of the pond's appurtenances the ponds operations could be adversely affected. These structures include weir structures, effluent return piping and pump structures and influent sluicing piping and structures. See design drawings in Attachment C for location and details of all appurtenances.

12.0 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 Primary Bottom Ash Pond has 2 piezometers located within the structure of the dam. These piezometers are read on a minimum of every 30 days for the purpose of determining the phreatic water level within the dike. A location map is provided in Attachment D.

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

[Area-capacity curves for the CCR unit.]

The area capacity curves for the Primary Bottom Ash Pond is included in the Hydrology and Hydraulic Analysis Report by Freese and Nichols, Inc., dated 2010 located in Attachment E.

14.0 275.73 (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.]

Complete details of each spillway structure are included with the design drawings in Attachment C. Hydrology and Hydraulic Analysis which include calculations for each spillway structure are included in Attachment E.

The principal spillway for the Primary Bottom Ash Pond is located in the canal connecting the Primary and Secondary Ash Ponds. It consists of a weir box with bottom elevation of 325.0 ft amsl and a 4-foot wide by 2-foot tall opening. During normal operations pf the pond stop logs are not used. However, stop logs are placed in this opening according to regular dredging operation records by AEP. This structure also consists of sheet piling to each side of the weir box, which functions as a sharp-crested weir when water levels reach the top elevation of 336.0 ft amsl. Additionally, the Primary Bottom Ash Pond has a 90-foot wide emergency spillway with a crest elevation of 334.0 ft-msl. Both the orifice and weir equations were utilized in calculating the discharge rating curves the discharge rating curve for both spillways is shown in Attachment E.

15.0 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.]

As required by the CCR rules the Primary Ash Pond is inspected at least every 7 days by a qualified person. Instrumentation data is collected at least every 30 days and reviewed by AEP Engineering Services. Also as a requirement of the CCR rules the impoundment is inspected annually by a professional engineer.

If repairs are found to be necessary during any inspection they will be completed as needed.

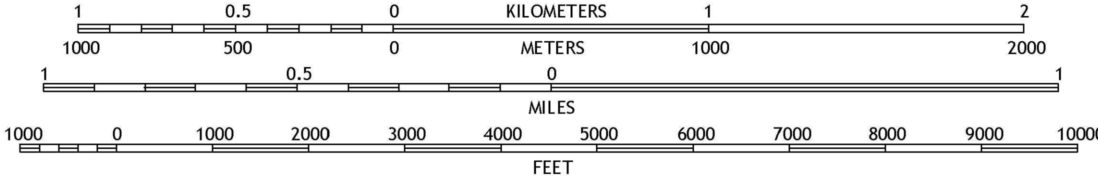
16.0 RECORD OR KNOWLEDGE OF STRUCTURAL INSTABILITY 275.73 (C)(1)(XII)

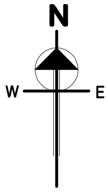
[Any record or knowledge of the structural instability of the CCR unit.]

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

ATTACHMENT A

LOCATION MAP





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AEP PUBLIC

REFERENCE AEP's CORPORATE INFORMATION SECURITY POLICY

SOUTHWESTERN ELECTRIC POWER COMPANY

WELSH PLANT

CASON TEXAS

UNIT: 13

DRAWING NUMBER: LOCATION MAP

REV: 1

SCALE: 1"=2000'

CIVIL ENGINEERING

DR:

CH:

SUP:

ENG:

DATE: 10/4/16

PRIMARY BOTTOM ASH POND

USGS TOPO MAP

7.5-MINUTE SERIES

AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

<u>ATTACHMENT B</u>

DESIGN REPORTS

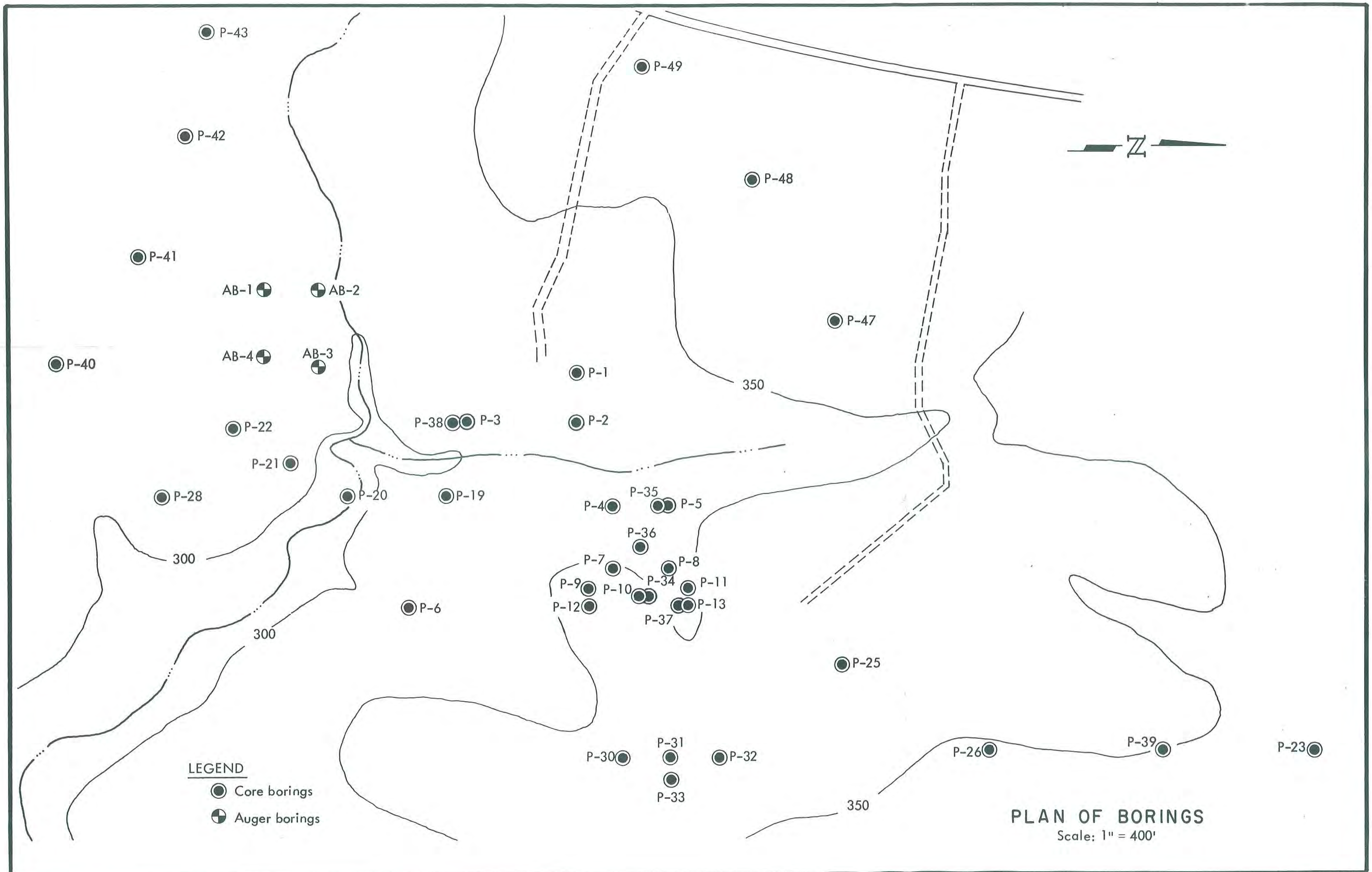
PRELIMINARY REPORT

SOILS INVESTIGATION
WELSH POWER PLANT
CASON, TEXAS

Report to

SOUTHWESTERN ELECTRIC POWER COMPANY
Shreveport, Louisiana

McClelland
engineers, inc.
geotechnical
consultants


P-43
P-42
P-41
P-40
AB-1
AB-2
AB-3
AB-4
P-49
P-48
P-47
P-1
P-2
P-3
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P-6
P-25
P-30
P-31
P-32
P-33
P-26
P-39
P-23
300
300
350
350
N
LEGEND
Core borings
Auger borings
PLAN OF BORINGS
Scale: 1" = 400'

McClelland engineers, inc. / geotechnical consultants

6100 HILLCROFT / HOUSTON, TEXAS 77036
TEL. 713 / 772-3701 / TELEX 762-447

August 31, 1973
Job No. 73-085

Southwestern Electric Power Company
P. O. box 1106
Shreveport, Louisiana 71156

Attention: Mr. W. H. Holley

Preliminary Report
Soils Investigation
Welsh Power Plant
Cason, Texas

Gentlemen:

Presented here are the logs of borings and the results of laboratory soil tests made to investigate soil conditions at the proposed Welsh Power Plant near Cason, Texas. This study was authorized by your Purchase Order No. Y-14567 dated March 27, 1973 and was performed in accordance with our letters of February 20, March 20, and April 30, 1973.

Soil conditions at the site were investigated by 38 undisturbed-sample or core borings and 4 disturbed-sample or auger borings drilled at the locations shown on Plate 1. The core borings were drilled to depths ranging from 25 to 198.5 ft, and the auger borings were drilled to depths ranging from 12.5 to 20 ft. Samples of the foundation materials were obtained in general accordance with specifications issued by Sargent & Lundy. Samples were generally obtained at about 5-ft intervals in the core borings using 3-in. thin-wall-tube, 2-in. split-barrel and Denison barrel samplers. Samples were obtained continuously in the auger borings using a 4-in. auger.

Detailed descriptions of the soils encountered in the borings are given on the logs of borings presented on Plates 2 through 43. The logs of borings presented on Plates 31 through 43 are presented in preliminary form and will be resubmitted in final form when laboratory testing on samples from these borings is complete. Most of the terms and symbols appearing on the logs are identified on Plate 44.

RECEIVED
SEP 4 - 1973
OFFICE OF
W. H. HOLLEY

The following tabulation gives the types of soil tests performed and the symbols used in plotting test results on the logs of borings.

Type of Test	Symbol
Shear Strength	
Unconfined Compression	○
Unconsolidated-undrained Triaxial	△
Hand Penetrometer	⊗
Water Content	●
Plastic and Liquid Limits	+-----+
Consolidation	(see Plates 45 thru 57)
Specific Gravity	(recorded with consolidation test results)
Sieve Analysis	(see Plates 58 thru 60)
Percent finer than No. 200 Sieve	(listed under -#200,% on logs)

Blow counts from standard penetration tests are shown in the "Blows Per Foot" column on the boring logs. The results of water level observations in the boreholes are recorded at the bottom of most boring logs.

We appreciate the opportunity to work with you on this project. If you have any questions, please call us.

Very truly yours,

McCLELLAND ENGINEERS, INC.

Clarence J. Ehlers, P.E.
Project Manager

CJE/mmf
Copies Submitted:
Southwestern Electric Power Company: (6)
Sargent & Lundy: (6)

Form 108-1 (57) Job No. 73-085

LOG OF BORING NO. P-1

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube, 2" split-barrel & 3" Denison barrel LOCATION: See Plate 1

SURF. EL: 342.8'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	-#200,%
0–4	Tan sandy silt	3-6-5		
4–8	Very stiff red & light gray sandy clay with ferrous nodules	11-18-35		
8–30	Red silty fine sand			50
	-with clay seams and pockets and sandstone nodules, 13' to 19'	10-9-10		16
	-gray below 18'	7-24-22		21
	-with lignite seams, 24' to 26'	9-17-33		
	-with sandstone layer, 28' to 29.5'			
30–42	Hard gray clay	18-23-43		
	-with silt partings and seams	17-40-60/3"		
		33-60/6"		
42–47	Gray sandy silt with organic pockets and seams (Non-Plastic)	33-48-60/5"		
47–50	Hard brown and gray clay with sand pockets and partings	24-42-60/6"	109	65

Cohesion, ton/sq ft at 50': 2.0 (plotted off scale →). Plastic limit, water content and liquid limit are also plotted at 50'.

(Continued on next page)

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PLATE 2

Form 106-3 (97) Job No. 73-085

LOG OF BORING NO. P-1 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2–1.4); PLASTIC LIMIT / WATER CONTENT, % / LIQUID LIMIT (10–70)	-#200, %
52–66			Gray silty fine sand				
54		X		42-60/5"			
59		X		31-60/6"		Non-Plastic	
64		X		40-60/6"			
66–75			Hard gray clay -with sandy silt partings and pockets to 70.5' -with sandstone seams and layers below 70.5'				
69		X		25-38-60/5"			

Depth scale: 55, 60, 65, 70, 75, 80, 85, 90, 95, 100

COMPLETION DEPTH: 75'
DATE: April 26, 1973

DEPTH TO WATER IN BORING: 8.0'
DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 2a

Form 106-1 (57) Job No. 73-085

LOG OF BORING NO. P-2

WELSH POWER PLANT

CASON, TEXAS

TYPE: 3" thin-wall-tube, 2" split-barrel & 3" Denison barrel   LOCATION: See Plate 1

SURF. EL: 338.8'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT	-#200, %
0–5.5	Very stiff red and tan sandy clay -with sand pockets and seams at 2.5' to 5'	1-1-3 8-9-10			
5.5–23.5	Red silty fine sand -with sandy clay pockets and seams to 15' -with ferrous nodules to 16' -with light gray clay seams, 9' to 15' -sandstone layer, 16.5' to 17' -gray below 17' -lignite layer, 21' to 23'	16-13-16 4-5-7 9-14-18			28
23.5–33.5	Very stiff gray clay -with sand pockets and seams to 25' -with silt partings, seams, & pockets below 25'	11-14-13 7-14-18		1.35+	
33.5–36.5	Gray fine sand				
36.5–42.5	Hard gray clay with sand pockets and partings	15-32-60/4"		4.0	
42.5–50	Gray silty fine sand -with clay pockets to 49' -clayey sand layer, 48.5' to 49'	20-30-60/3" 28-60/6"			

(Continued on next page)

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PLATE 3

Form 106-3 (57) Job No. 73-085

LOG OF BORING NO. P-2 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

Depth, ft	Description of Material	Blows per ft	Unit Dry Wt lb/cu ft	Cohesion, ton/sq ft	-#200, %
52–65	Gray silty fine sand				
55		29-46-60/3"			
60		29-37-60/3"			24
61.5–64	-with clay pockets, 61.5' to 64'				
65		22-31-60/3"			
65–74.5	Hard gray clay with sand pockets and mica				
68–68.5	-sandstone layer, 68' to 68.5'				
70		16-24-48		2.8	
74.5		33-60/3"			

Legend: Cohesion, ton/sq ft (0.2–1.4); Plastic limit, Water content, %, Liquid limit (10–70)

COMPLETION DEPTH: 74.5'
DATE: April 28, 1973

DEPTH TO WATER IN BORING: 13.3'
DATE: May 3, 1973

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PLATE 3a

Form 108-- (57) Job No. 73-085

LOG OF BORING NO. P-3

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube, 2" split-barrel & 3" Denison barrel   LOCATION: See Plate 1

SURF. EL: 329.4'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / WATER CONTENT, %
0–5	Stiff red clay with sand pockets and seams -with ferrous partings, 3.5' to 4.5'			
5–22	Red silty fine sand with ferrous nodules and sandy clay seams and partings -with sandstone nodules, 8' to 13' -with sandstone layer, 14' to 15' -with coarse sand and gravel, 18.5' to 19'			
22–38	Hard gray clay -with sand pockets to 28' -with silt partings and pockets below 28'		99	4.2; 3.3; 4.6
38–42	Gray silty fine sand with clay pockets and seams	35-50/6"		
42–46	Hard gray sandy clay with sand pockets		110	
46–50	Gray silty fine sand -lignite layer, 49.5' to 50'			

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Form 108-3 (57) Job No. 73-085

LOG OF BORING NO. P-3 (Cont'd)
WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT
	Gray silty fine sand			
55	Hard gray clay -with organic partings to 55' -with sandy silt pockets and partings below 58'	29-35-15		3.3
65	Gray sandy silt	50/5"		
70	Hard gray sandy clay -with silt pockets to 70'		109	3.5
75				4.5

COMPLETION DEPTH: 75'
DATE: April 17, 1973

DEPTH TO WATER IN BORING: 10.4'
DATE: May 3, 1973

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PLATE 4a

Form 08-1-(57) Job No. 79-085

LOG OF BORING NO. P-4

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel & 3" Denison barrel   LOCATION: See Plate 1

DEPTH, FT	DESCRIPTION OF MATERIAL (SURF. EL: 343.7')	BLOWS PER FT	UNIT DRY WT LB/CU FT	-#200, %
0–2	Tan silty fine sand			
2–4	Very stiff red and tan very silty clay -with sand pockets to 4'			
4–13	Stiff red and tan very sandy clay -with sandstone seams and nodules, 6' to 8.5'		112	
13–18	Tan and light gray silty fine sand with clay seams and pockets and scattered gravel			48, 70
18–25	Stiff tan and light gray sandy clay with sand and ferrous seams -gray below 23.5'	13-6-10		
25–33	Gray silty fine sand with sandstone nodules	18-50/9"		
33–43	Very stiff gray clay -with sandy silt pockets, partings, and seams to 43'	11-14-25; 17-50/8"		
43–50	Gray silty fine sand -clayey fine sand, 46' to 53'	43-50/5"	110	

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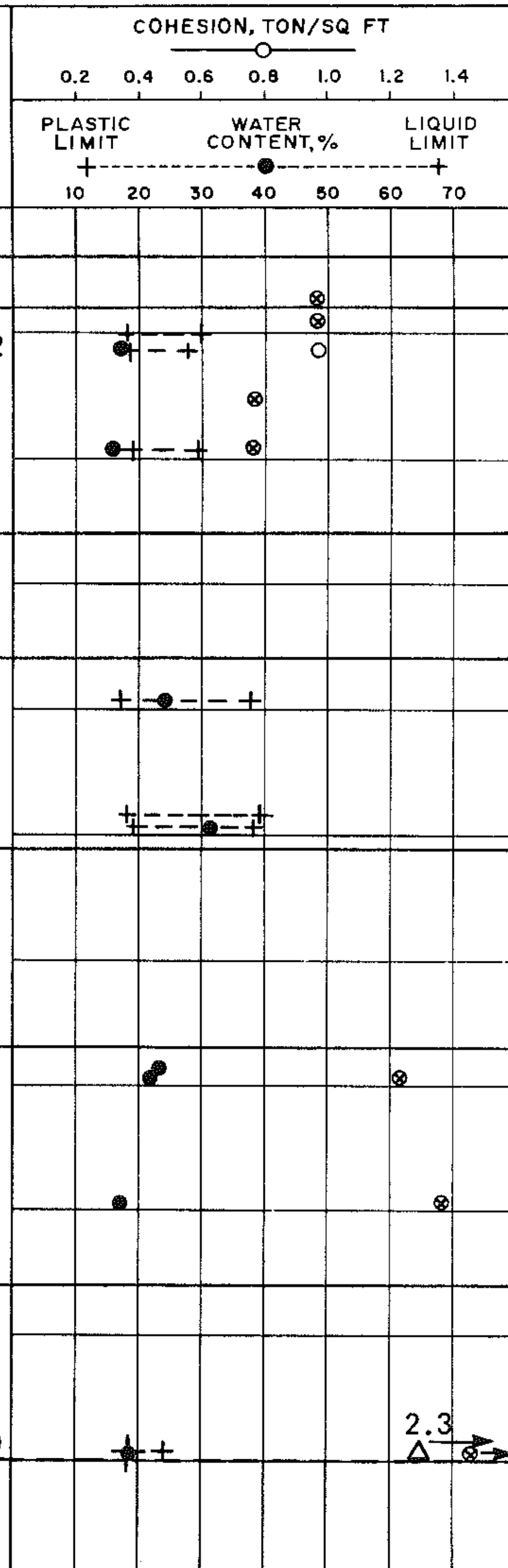

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LOG OF BORING NO. P-4 (Cont'd)
WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT
50–53	Gray silty fine sand -clayey to 53'			
59		50-50/4"		
64		50-50/3"		
68	-clayey below 68'			
69		25-50/5"		+ ● + (approx. 16 / 21 / 26)
74		33-50/5"		
78	-sandstone below 78'			
79	Hard gray sandy clay with sand pockets and partings	32-50/4"		● (approx. 17)
	-with silt partings and pockets to 93'			
84				1.35+ ⊗→
88				● (approx. 15); 1.35+ ⊗→
94				1.35+ ⊗→
99				● (approx. 16); 1.35+ ⊗→

COMPLETION DEPTH: 100'
DATE: March 28, 1973

DEPTH TO WATER IN BORING: 17.3'
Caved at: 34'
DATE: May 3, 1973

McCLELLAND ENGINEERS

LOG OF BORING NO. P-5

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

SURF. EL: 344.1'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT	-#200, %
0–4.5	Very stiff red & tan very sandy clay -with sandstone nodules to 2.5' -with ferrous deposits, 2' to 4'				
4.5–28	Red and tan silty fine sand with light gray clay partings, pockets and seams -with sandstone nodules to 23' -tan, 13' to 23' -with ferrous partings and seams, 17' to 23' -gray below 23' -gray clay, 23' to 23.5'	10-20-23			32 33
28–33	Hard gray sandy clay with sand pockets and partings		103	2.2	
33–38	Gray silty fine sand -with clay pockets and seams to 35'				
38–41.5	Hard groy sandy clay		110	2.3	
41.5–50	Gray clayey fine sand	30-50/6"			

(Continued on next page)

McCLELLAND ENGINEERS

Form 10 Job No. 73-085

LOG OF BORING NO. P-5 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / WATER CONTENT, %	-#200,%
	Gray clayey sand				
53–68	Gray silty fine sand	35-50/6"			
		30-50/6"			28
		40-50/5"			
68–88	Hard gray sandy clay	25-50/5"			
	-with sandstone layer, 71.5' to 72'			1.35+	
	-with sandy silt pockets below 73'				
		50/6"		1.35+	
88–100	Gray silty fine sand	50/6"			
		65/6"			

COMPLETION DEPTH: 100'
DATE: March 22, 1973

DEPTH TO WATER IN BORING: 12.5' Caved at: 24'

DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 6a

Form 108-1 (5?) Job No 73-085

LOG OF BORING NO. P-6

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel

LOCATION: NNW of staked location
See Plate 1; Offset 29'

SURF. EL: 322.7' (Approx.)

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT
0 – 7.5	Fill: Tan and light gray clay, intermixed with sandy silt			
7.5 – 16	Very stiff tan & light gray clay -with sand partings and ferrous nodules to 10' -with sand pockets to 15' -sandstone layer, 15' to 15.5'			1.35+ 1.35+ 1.35+
16 – 23.5	Gray silty fine sand with sandstone nodules			
23.5 – 27.5	Very stiff clay with sand pockets			
27.5 – 36.5	Gray silty fine sand with clay seams and pockets	14-50/8" 22-100/5"		
36.5 – 43.5	Very stiff gray silty clay with silt partings and pockets			
43.5 – 46.5	Gray sandy silt with clay seams	15-56/12"		
46.5 – 49	Hard gray clay with silt seams and partings			
49 – 50	Gray silty fine sand	26-20/6"		

Plastic limit, water content (%) and liquid limit scale: 10 20 30 40 50 60 70

(Continued on next page)

McCLELLAND ENGINEERS

PLATE 7

Form 108-5 (57) Job No. 73-085

LOG OF BORING NO. P-6 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / WATER CONTENT, %
	Gray silty fine sand			
55	Hard gray sandy clay with mica & sand pockets and seams	22-58/6"		
60	Gray sandy silt with clay seams and pockets	39-56/6"		
65–70	Hard gray clay -with lignite partings and seams to 66.5' -with silty sand partings & pockets below 66.5'	30-53/6" 36-58/6"		1.35+
75	Gray silty sand with sandy clay seams			
80	Gray cemented sand -with sandstone seams and layers to 78.5'	31-100/7"		1.35+
85–90	Hard gray sandy clay with sand pockets and mica	53-87/6" 100/9"		1.35+
95–100	Gray sandy silt with mica	40-60/3" 42-100/5"		

COHESION, TON/SQ FT: 0.2 0.4 0.6 0.8 1.0 1.2 1.4
PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10 20 30 40 50 60 70

COMPLETION DEPTH: 99.5'
DATE: April 12, 1973

DEPTH TO WATER IN BORING: 6.4'
DATE: April 23, 1973

McCLELLAND ENGINEERS

PLATE 7a

Form 108-1 (57) Job No 73-085

LOG OF BORING NO. P-7

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel & 3" Denison barrel LOCATION: See Plate 1

SURF. EL: 352.8'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT
0–2	Tan silty sand		
2–8	Stiff red and tan sandy clay -very sandy at 4'		
8–20	Tan silty fine sand -with sandstone nodules to 10' -with clay pockets to 15' -tan and light gray at 18'		
20–38	Stiff light gray clay with sand pockets and partings -with ferrous nodules and seams to 30' -very stiff gray sandy clay with sand seams and pockets below 33'		91
38–48	Gray clayey fine sand with sandstone nodules and clay pockets	12-50/4"	
48–50	Very stiff gray sandy clay		

(Continued on next page)

COHESION, TON/SQ FT: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4

PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10, 20, 30, 40, 50, 60, 70

McCLELLAND ENGINEERS

PLATE 8

Form 108-5 1971 Job No 73-085

LOG OF BORING NO. P-7 (Cont'd)
WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / PLASTIC LIMIT, WATER CONTENT %, LIQUID LIMIT
52–55	Very stiff gray sandy clay			
55–63	Gray silty fine sand with clay pockets			
63–68	Hard gray sandy clay with sand pockets	22-50/6"		
68–73	Gray clayey fine sand		108	
73–76.5	Gray silty fine sand			
76.5–83	Black lignite	100/6"		
83–99	Hard gray sandy clay -with sandy silt pockets to 90' -with siltstone nodules, 89.5' to 90' -sandstone, 98.5' to 99'	100/3"		1.35+

COMPLETION DEPTH: 99'
DATE: March 29, 1973

DEPTH TO WATER IN BORING: 25.0' Caved at: 74'
DATE: April 23, 1973

McCLELLAND ENGINEERS

PLATE 8a

Form OB-1 (57) Job No. 73-085

LOG OF BORING NO. P-8

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel & 3" Denison barrel   LOCATION: See Plate 1

SURF. EL: 346.5'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	-#200,%
0–2	Tan & light gray clayey fine sand			
2–13	Stiff tan sandy clay -with ferrous nodules and sand pockets to 8' -red and tan at 6'			
13–37	Light gray silty fine sand with clay seams -with ferrous nodules to 20.5'			32
				20
	-red, 29' to 33.5'			
35		11-21-22		31
37–47.5	Very stiff gray sandy clay with silt partings and pockets -with sandstone seams, 39' to 42'			
47.5–50	Gray silty fine sand			

COHESION, TON/SQ FT: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4 (1.35+ at about 44 ft)

PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10, 20, 30, 40, 50, 60, 70

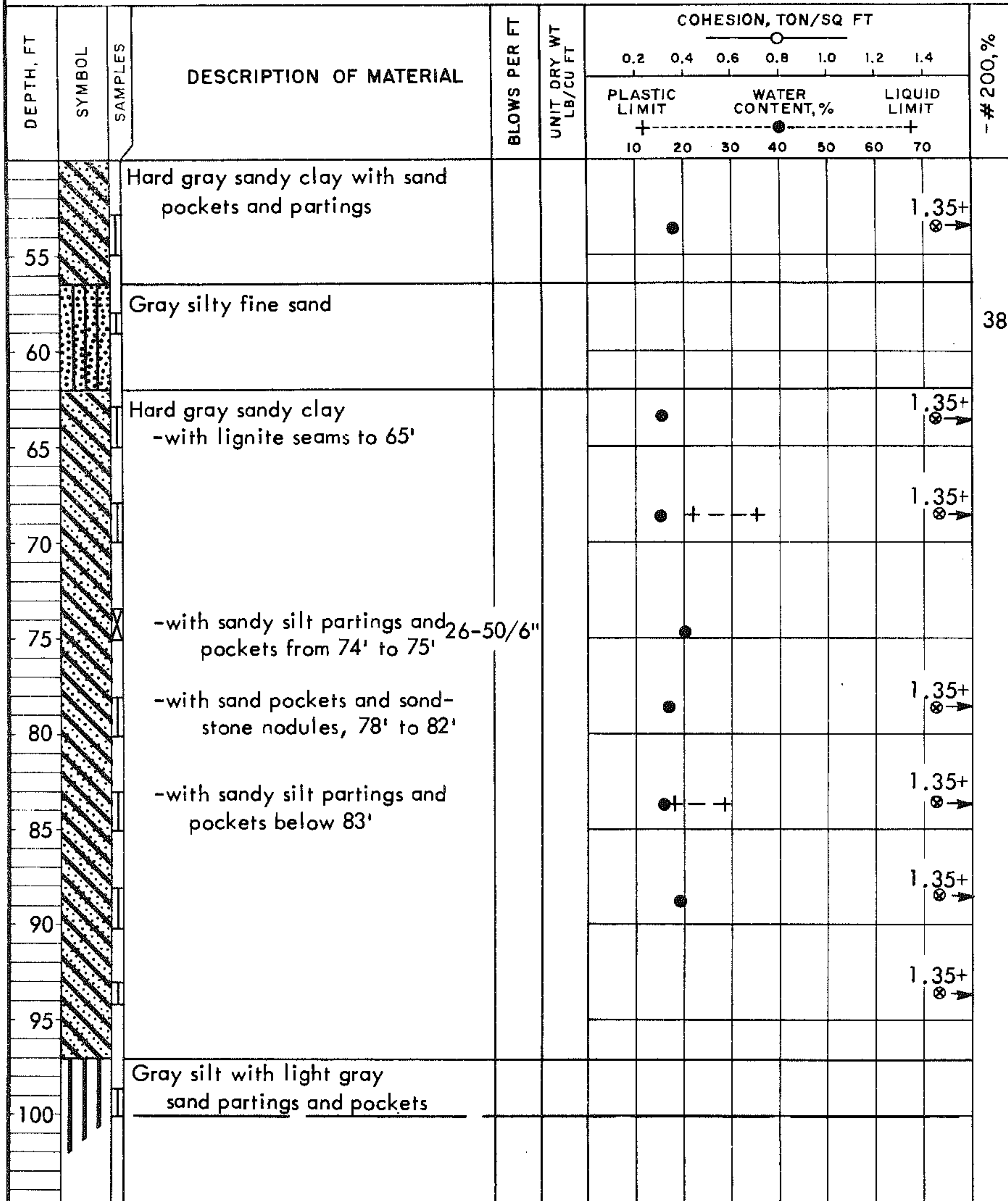
(Continued on next page)

Form 108-3 (57) Job No 73-085

LOG OF BORING NO. P-8 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT	-#200,%
52–56	Hard gray sandy clay with sand pockets and partings			1.35+	
56–61	Gray silty fine sand				38
61–	Hard gray sandy clay -with lignite seams to 65'			1.35+	
				1.35+	
	-with sandy silt partings and pockets from 74' to 75'	26-50/6"			
	-with sand pockets and sand-stone nodules, 78' to 82'			1.35+	
	-with sandy silt partings and pockets below 83'			1.35+	
				1.35+	
–97				1.35+	
97–100	Gray silt with light gray sand partings and pockets				



COMPLETION DEPTH: 100'
DATE: April 8, 1973

DEPTH TO WATER IN BORING: 16.8' Caved at: 44'
DATE: April 23, 1973

McCLELLAND ENGINEERS

PLATE 9a

LOG OF BORING NO. P-9
WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel & 3" Denison barrel LOCATION: See Plate 1

SURF. EL: 355.8'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT
0–20	Stiff red and tan sandy clay		
	-becomes very stiff by 13'		
20–28	Tan fine sand	8-10-15	
28–38	Very stiff light gray clay		
	-with silt partings to 30'		96
	-gray sandy clay with sand pockets and partings below 33'		98
38–48	Gray silty fine sand with gray clay seams and partings	15-33-50/3"	
		15-50/7"	
48–50	Very stiff gray sandy clay with silt partings	10-50/8"	
	-with sand pockets to 50'		

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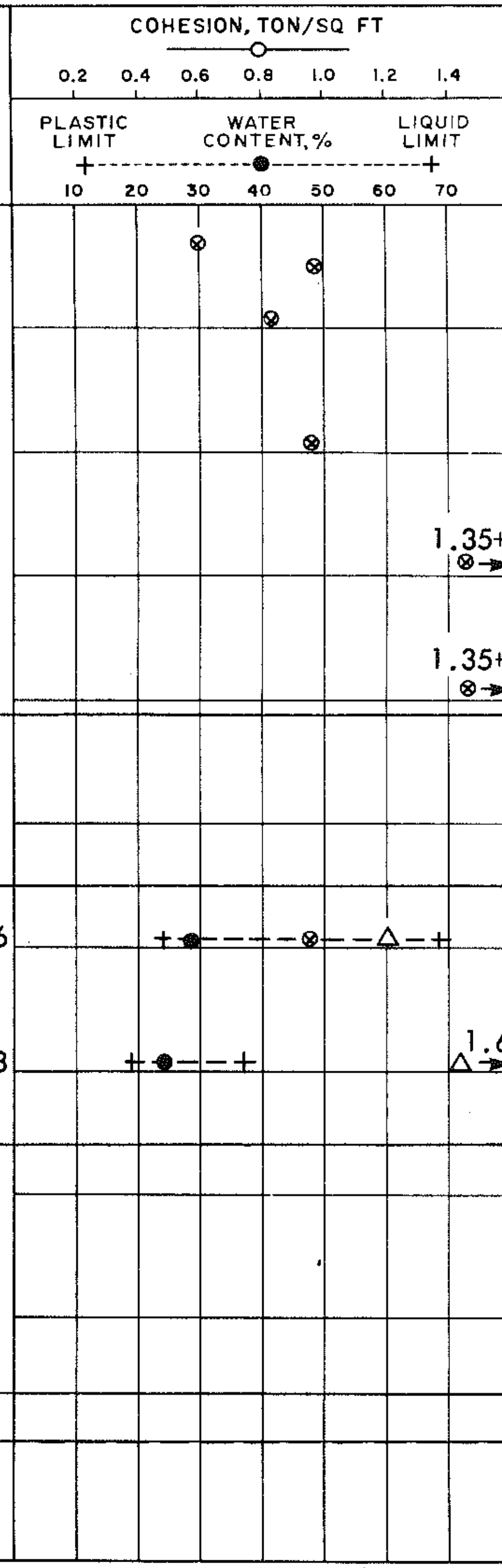

LOG OF BORING NO. P-9 (Cont'd)
WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / WATER CONTENT, %
55	Very stiff gray sandy clay -with sandy silt seams below 53'		103	1.35+
60	Gray fine sand			
65	Stiff gray sandy clay -with sand pockets to 68'			
70	Tan clayey fine sand with clay seams and layers			
75	Hard gray clay			1.35+
80	-with sand seams below 78'			1.35+
85–90	Gray silty fine sand	50/5"		
95	Hard gray sandy clay	26-50/5"		
100	Gray sandstone layer			

Cohesion scale: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4. Plastic limit – Water content, % – Liquid limit scale: 10, 20, 30, 40, 50, 60, 70.

COMPLETION DEPTH: 98.5'
DATE: April 3, 1973

DEPTH TO WATER IN BORING: 24.3' Caved at: 41' DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 10a

Form 08-1 (57) Job No. 72-085

LOG OF BORING NO. P-10
WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel & 3" Denison barrel

LOCATION: See Plate 1

SURF. EL: 352.7'

Depth, ft	Description of Material	Blows per ft	Unit Dry Wt lb/cu ft	Cohesion, ton/sq ft
0–8	Very stiff red and tan clay with sand pockets			1.35+
8–23	Red and tan fine sand -slightly clayey to 13' -with sandstone nodules, 14' to 15' -with ferrous deposits, 19' to 20'			
23–27.5	Light gray sandy silt -with sand pockets ond seams	3-5-5		
27.5–41	Tan silty fine sand -with ferrous seams at 34' -gray with clay seams below 36.5'	6-3-5 10-16-26		
41–50	Very stiff gray sandy clay with silt partings and seams		102 105	1.7 1.35+

(Continued on next page)

Cohesion, ton/sq ft: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4

Plastic Limit, Water Content, %, Liquid Limit: 10, 20, 30, 40, 50, 60, 70

McCLELLAND ENGINEERS

PLATE 11

Form 108-3 (57) Job No 73-085

LOG OF BORING NO. P-10 (Cont'd)
WELSH POWER PLANT
CASON TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT
	Very stiff gray sandy clay with silt partings and seams			
55	Gray silty fine sand	38-50/2"		
60	Gray clayey fine sand with sand pockets		114	3.6
	-shaley clay seams, 63' to 63.5'			1.35+
65–70	Gray silty fine sand -with clay seams to 78' -with lignite seams at 68'			
73		50/3"		
84	-lignite, 84' to 85.5'	50/5"		
87	Hard gray clay -with silt partings and pockets to 90'			1.35+
93				1.35+
97				1.35+
100	(Continued on next page)			

Legend: PLASTIC LIMIT + ; WATER CONTENT, % ● ; LIQUID LIMIT + (scale 10–70). Cohesion scale 0.2–1.4.

McCLELLAND ENGINEERS

PLATE 11a

Form 108-3 (57) Job No. 73-085

Note Scale Change

LOG OF BORING NO. P-10 (Cont'd)

WELSH POWER PLANT

CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT
100–112	Hard gray clay -with sand pockets below 100'			
112–135	Gray silty fine sand -with clay seams and pockets to 128' -light gray at 128'	50/6" 50/5" 50/3"		
135–145.5	Hard gray clay, slightly silty -with silt partings to 138.5'			1.35+
145.5–148	Soft gray silty clay -with rock cuttings to 148'			
148–157	Hard gray shaley clay			1.35+
157–164	Light gray silty sand			
164–172	Hard gray clay with silt partings and pockets			1.35+
172–183	Hard brown and tan lignite			1.35+
183–198.5	Hard gray clay with silt partings			1.35+ 1.35+

Chart scales: COHESION, TON/SQ FT: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4; PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10, 20, 30, 40, 50, 60, 70

COMPLETION DEPTH: 198.5'
DATE: April 5, 1973

DEPTH TO WATER IN BORING: 27.2' Caved at: 36' DATE: April 11, 1973

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PLATE 11b

LOG OF BORING NO. P-11

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel & 3" Denison barrel   LOCATION: See Plate 1

SURF. EL: 342.2'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	COHESION, TON/SQ FT
0–4.5	Stiff tan and light gray clay, slightly sandy with ferrous and organic matter and sand pockets		1.35+
4.5–12.5	Very stiff tan and light gray sandy clay -with ferrous and organic matter to 6' -tan at 6'		1.35+ 1.35+
12.5–37.5	Tan fine sand -with ferrous partings and seams to 18' -with clay seams to 30' -sandstone layer, 19' to 19.5' -gray below 27' -ferrous and sandstone seams, 34' to 34.5'	28-50/2" 6-50/10" 10-13-25	
37.5–48.5	Hard gray clay -with silt partings to 40' -with sand pockets below 43.5'		1.35+ 1.35+
48.5–52	Gray clayey fine sand		

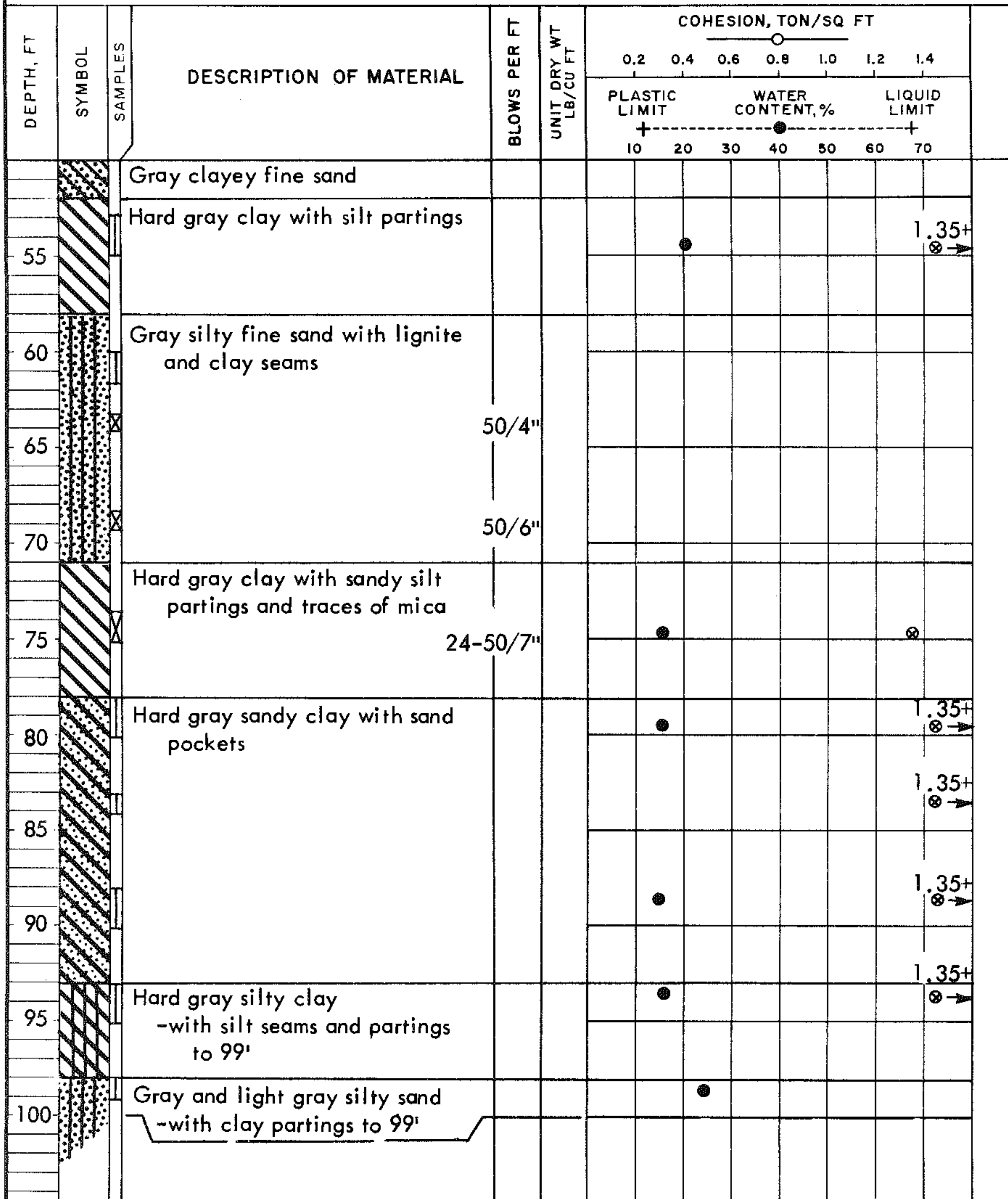
(Continued on next page)

McCLELLAND ENGINEERS

Form 108-3 (57) Job No 73-085

LOG OF BORING NO. P-11 (Cont'd)
WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT
	Gray clayey fine sand		
	Hard gray clay with silt partings		
	Gray silty fine sand with lignite and clay seams	50/4"; 50/6"	
	Hard gray clay with sandy silt partings and traces of mica	24-50/7"	
	Hard gray sandy clay with sand pockets		
	Hard gray silty clay -with silt seams and partings to 99'		
	Gray and light gray silty sand -with clay partings to 99'		



COMPLETION DEPTH: 100'
DATE: April 8, 1973

DEPTH TO WATER IN BORING: 14' Caved at: 39' DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 12a

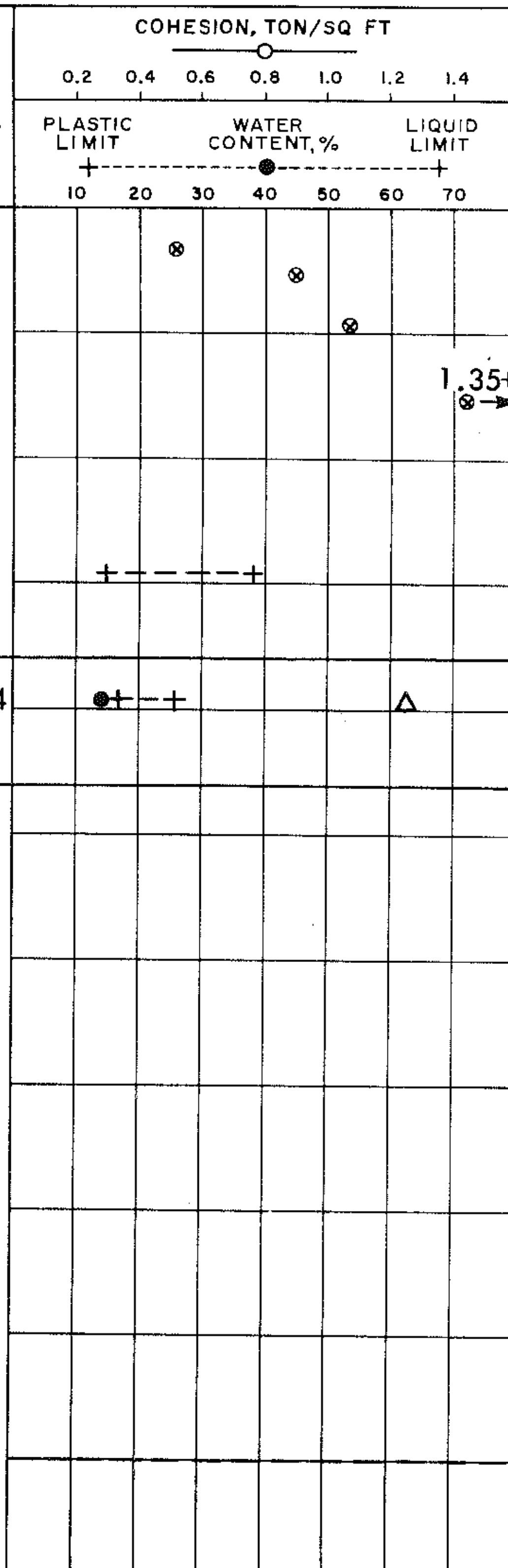
LOG OF BORING NO. P-12

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel & 3" Denison barrel   LOCATION: See Plate 1

SURF. EL: 353.4'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	- # 200, %
0–17	Stiff red and tan sandy clay -with sand pockets and seams to 8' -very stiff below 4'	20-25-18 (at 15')		
17–22	Red and tan clayey fine sand with sand and clay pockets		114	
22–50	Red and tan silty fine sand	9-10-12 (at 25')		
	-with ferrous seams and deposits, 29' to 33'	15-14-15 (at 30')		36
	-tan, 33' to 38'			
	-gray with clay seams below 38'	36-42/6" (at 40')		
		20-42-50/4" (at 45')		37
	-sandstone, 48' to 50'			



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McCLELLAND ENGINEERS

Form 10 Job No. 73-085

LOG OF BORING NO. P-12 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT	- # 200, %
52–58	Gray silty fine sand				
58–77	Gray clayey fine sand with sand pockets	20-42-50/4"		++ (about 64')	56 (about 64')
					53 (about 73')
77–93	Gray fine sand -with clay seams to 84'	100/4" (about 84')			2 (about 84')
		100/6" (about 89')			
	-sandstone below 92.5'				
93–100	Hard gray sandy clay with sand pockets	24-50/7"		● (water content); cohesion 1.35+ (about 94')	
				● (water content); cohesion 1.35+ (about 100')	

COMPLETION DEPTH: 100'
DATE: March 26, 1973

DEPTH TO WATER IN BORING: 24.8'
Caved at: 44'

DATE: April 23, 1973

McCLELLAND ENGINEERS

PLATE 13a

Form DB-1 (57) Job No 73-085

LOG OF BORING NO. P-13

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel & 3" Denison barrel

LOCATION: See Plate 1

SURF. EL: 348.1'

Depth, ft	Description of Material	Blows per ft	Unit dry wt lb/cu ft	-#200, %
0	Firm tan and light gray clay			
	Very stiff tan and light gray sandy clay			
5				
	-with silt pockets and partings below 8'			
10	Tan silty fine sand			
				21
15				
				32
20				
	-with coarse sand layer at 23.5'	23-50/4"		
25				
30		2-6-11		21
	-gray below 34'			
35	-with gravel layer at 35.5'			
		23-50/10"		
40	Hard gray clay			
	Gray silty fine sand			
45				20
50				

Cohesion, ton/sq ft: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4

Plastic limit — Water content, % — Liquid limit: 10, 20, 30, 40, 50, 60, 70

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Form 108-... Job No. 73-1985

LOG OF BORING NO. P-13 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT	-#200,%
52–58	Gray silty fine sand				38
58–60.5	Hard gray clay with silt partings			1.35+	
60.5–69	Gray silty fine sand with lignite seams and mica	50/3"			

COMPLETION DEPTH: 69'
DATE: April 10, 1973

DEPTH TO WATER IN BORING: 15.8'
Caved at: 60'
DATE: April 11, 1973

McCLELLAND ENGINEERS

PLATE 14a

LOG OF BORING NO. P-19

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube, 2" split-barrel & 3" Denison barrel

LOCATION: See Plate 1

SURF. EL: 331.8'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT	-#200,%
0–2	Gray & tan silty fine sand				
2–9	Stiff tan and light gray clay with sand pockets -red and light gray, 4' to 6' -light gray with ferrous partings below 6'		99	⊗ ; ⊗ ; +●- - - - - -○+	
9–27	Red silty fine sand -with ferrous deposits to 14'	7-9-13			
	-with clay seams below 14'	9-12-17			24
	-gray below 17'				
		22-25-23			62
27–33	Hard gray clay with sand pockets			⊗ 3.5 →	
				⊗ 2.5 →	
33–37	Gray clayey silt with sandy silt pockets				
37–42	Hard gray clay with silt partings and pockets	22-50/9"		⊗ 3.6 →	
42–48	Gray silty fine sand with clay pockets				
48–50	Hard gray clay with sand pockets and seams and mica	47-50/5"		⊗ 4.5 →	

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McCLELLAND ENGINEERS

Form 10... Job No. 73-085

LOG OF BORING NO. P-19 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

Depth, ft	Description of Material	Blows per ft	Unit Dry Wt lb/cu ft	Cohesion, ton/sq ft	-#200, %
	Hard gray clay				
55	Gray sandy silt -with lignite layer, 56' to 56.5'				
60	Hard gray sandy clay with sandy silt pockets -with lignite partings to 65'	35-50/5"		4.5 ⊗→	
65	-with sand pockets below 64'			4.5 ⊗→	
70				3.7 ⊗→	
75				3.3 ⊗→	

Cohesion scale: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4 — Plastic Limit / Water Content, % / Liquid Limit: 10, 20, 30, 40, 50, 60, 70

Depth scale: 55, 60, 65, 70, 75, 80, 85, 90, 95, 100

COMPLETION DEPTH: 75'
DATE: April 18, 1973

DEPTH TO WATER IN BORING: 6.8'

DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 15a

Form 108-1 (57) Job No. 73-085

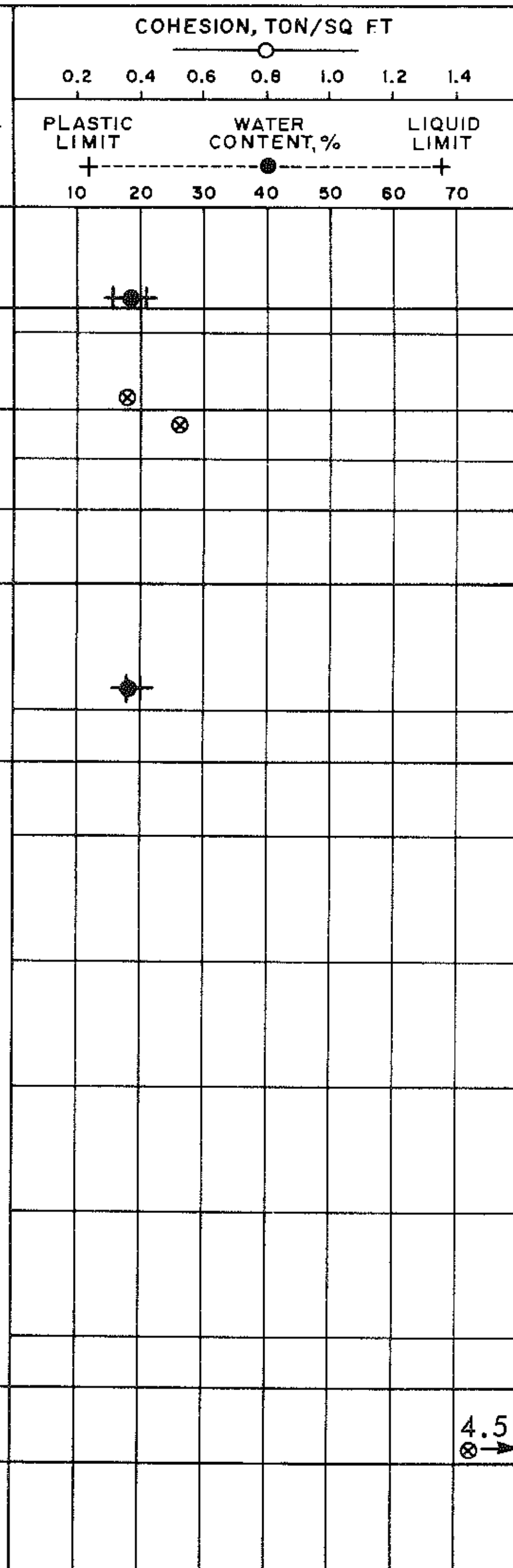
LOG OF BORING NO. P-20

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel   LOCATION: See Plate 1

SURF. EL: 303.6'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT
0–4	Tan clayey sand	1-1-3	
4–8	Firm tan and light gray sandy clay with ferrous deposits	2-2-3	
8–12	Stiff light gray clay with ferrous seams and partings		
12–15	Gray silty fine sand	17-24-37	
15–22	Gray clayey sand -with clay pockets to 18'	15-24-60/4"	
22–47	Gray silty fine sand	28-60/6"	
		29-54-60/3"	
		24-54-60/2"	
	-with clay pockets, 39' to 44'	19-60/6"	
	-fractured sandstone layer, 44' to 45.5'	21-53-60/3"	
47–50	Hard gray clay with sand pockets and partings	14-26-48	



COMPLETION DEPTH: 50'
DATE: April 28, 1973

DEPTH TO WATER IN BORING: 2.7'
DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 16

LOG OF BORING NO. P-21

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

SURF. EL: 323.6'

Description of Material	Blows per ft	Unit dry wt lb/cu ft	Cohesion, ton/sq ft	-#200, %
Stiff red and light gray clay with sand partings and pockets -with ferrous nodules, 2' to 6'	3-3-6			
Tan silty fine sand with light gray clay seams and pockets	12-16-27			28
Hard gray clay -with silt partings to 20'			3.8	
-brown, 18.5' to 19'	14-25-33		3.0	
-with sand pockets & partings, 23' to 25'		106	4.0	
-with silt partings & pockets, 28' to 30'	12-19-23		4.0	
Gray silty fine sand	31-36-60/3"			
Hard gray sandy clay with sand pockets	10-21-60/5"			
Gray silty fine sand	21-60/6"			30
	26-60/5"			
	32-60/5"			21
-sandstone layer, 57' to 57.5'	21-46-60/3"			

Note Scale Change

COMPLETION DEPTH: 60'
DATE: April 29, 1973

DEPTH TO WATER IN BORING: 11.6'

DATE: May 3, 1973

McCLELLAND ENGINEERS

Form 108-1 (57) Job No 73-085

LOG OF BORING NO. P-22

WELSH POWER PLANT

CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

SURF. EL: 338.1'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT
0–4	Stiff red and light gray sandy clay	4-4-7		1.6
4–46	Hard light gray and tan clay			2.1
	-with ferrous deposits to 10'			
	-with sand pockets and partings to 18'	5-8-10	99	2.1
	-with silt partings, 7' to 28'			
	-with vertical ferrous seams at 13.5'			
	-gray below 16'			2.9
	-with lignite seams, 22' to 23'	12-16-46		
	-with sand seams and pockets, 28' to 46'			3.0
			116	3.8
	-sandstone layer, 38.5' to 39'	10-21-31		4.5
46–50	Hard gray sandy clay with sand pockets and seams	16-27-60/4"		

Chart scales: COHESION, TON/SQ FT 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4; PLASTIC LIMIT + ---- WATER CONTENT, % ● ---- LIQUID LIMIT +: 10, 20, 30, 40, 50, 60, 70

COMPLETION DEPTH: 50'
DATE: April 30, 1973

DEPTH TO WATER IN BORING: 1.2'

DATE: May 3, 1973

McCLELLAND ENGINEERS

Form 108-1 (57) Job No 73-085

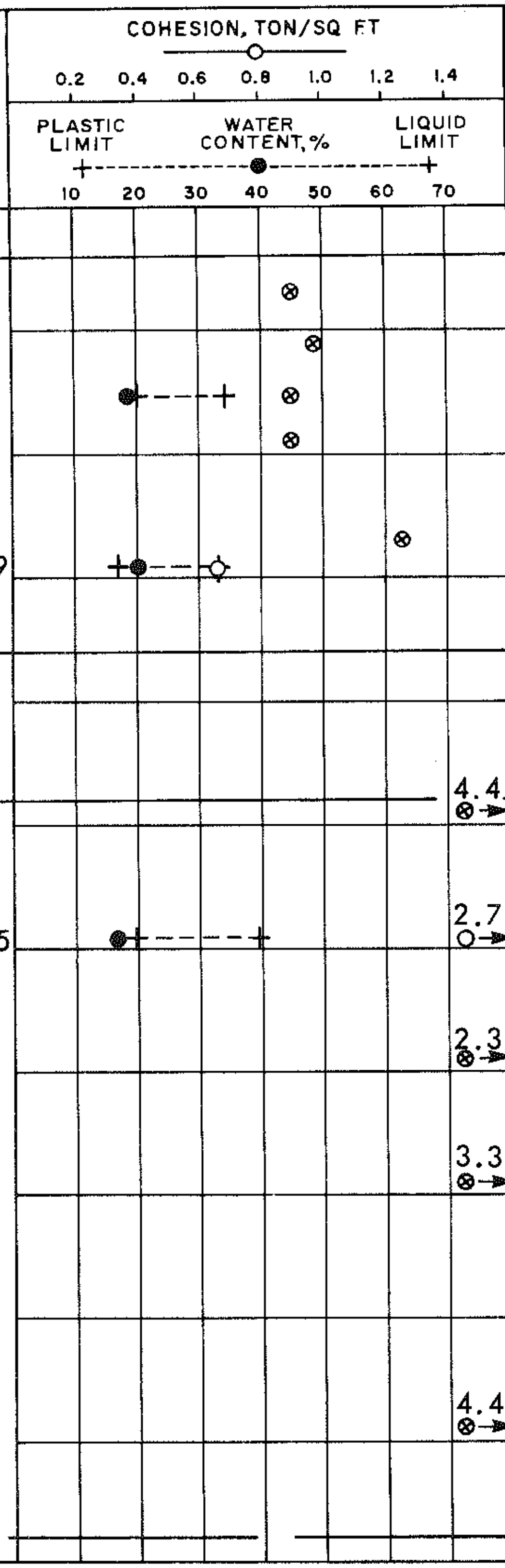
LOG OF BORING NO. P-23

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

SURF. EL: 304.2'

Depth, ft	Description of Material	Blows per ft	Unit dry wt lb/cu ft	-# 200, %
0–2	Tan sandy silt			
2–18	Stiff tan sandy clay with sand pockets -with gray clay seams, 12' to 18' -red and tan below 12'		109	60
18–24	Gray silty fine sand with clay pockets and seams -sandstone layer, 23.5' to 24'	15-21-25 50/0"		24
24–53.75	Hard gray clay -with sandy silt partings and pockets to 30' -silty clay, 38' to 40' -with sand pockets and seams, 38' to 45'	21-50/4" 50/6" 40-50/3"	115	



COMPLETION DEPTH: 53.75'
DATE: April 22, 1973

DEPTH TO WATER IN BORING: 6.6'
DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 19

Form 108-1 (57) Job No 73-085

LOG OF BORING NO. P-25

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel   LOCATION: See Plate 1

SURF. EL: 357.8'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2–1.4) / PLASTIC LIMIT, WATER CONTENT, %, LIQUID LIMIT (10–70)	-#200,%
0–4.5	Tan sandy silt				60, 64
4.5–19	Stiff gray and red sandy clay with sand pockets -with gray clay seams to 8' -very stiff red and tan below 7' -with red fine sand seams and layers below 13'	8-17-16		⊗ (about 5.5'); 2.7 ⊗→; 4.1 ⊗→; 1.2 ⊗→	
19–50	Tan silty fine sand -with ferrous nodules, 24' to 24.5' -with ferrous partings, 34' to 35' -with organic partings, 43' to 45.5' -gray below 43' -with clay seams, 49' to 54'	11-10-10 18-23-18 21-50/9" 28-50/8" 8-14-20 14-50/6"			32 16

(Continued on next page)

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PLATE 20

Form 108-3 (57) Job No. 73-085

LOG OF BORING NO. P-25 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / PLASTIC LIMIT, WATER CONTENT, %, LIQUID LIMIT	-#200,%
52–58	Tan silty fine sand	50/6"			
58–59	-sandstone layer, 58' to 59'				
60		50/6"			14
64	-with clay seams and sandstone nodules below 64'	32-50/6"			
69		50/4"			
74		24-50/7"			

COMPLETION DEPTH: 74.5'
DATE: April 21, 1973

DEPTH TO WATER IN BORING: 5.3'
DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 20a

Form OB-1 (57) Job No. 73-085

LOG OF BORING NO. P-26

WELSH POWER PLANT
CASON, TEXAS

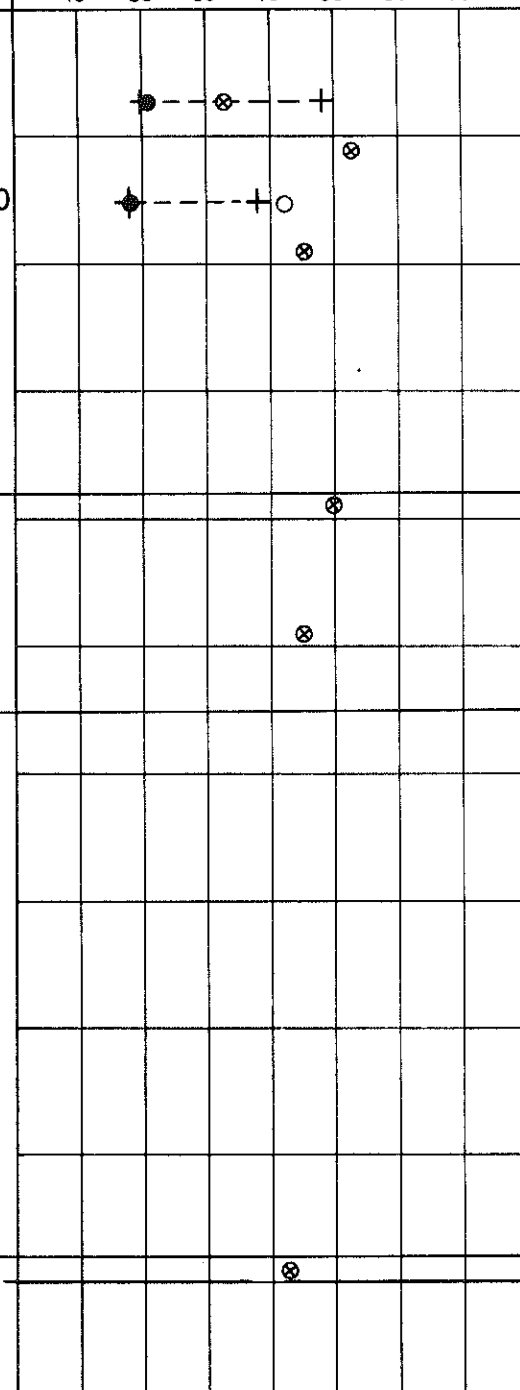
TYPE: 3" thin-wall-tube & 2" split-barrel   LOCATION: See Plate 1

SURF. EL: 346.2'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	-#200,%
0–19	Stiff tan sandy clay with sand pockets and seams			
	-with ferrous deposits, 4' to 10'			
	-red and tan below 6'		110	66
	-red fine sand layer, 13.5' to 14'	15-29-20		
	-with ferrous nodules below 14'			
19–27.5	Very stiff light gray and brown clay with ferrous partings and sand partings, seams and pockets			
	-gray below 24'	10-13-17		
27.5–58	Tan fine sand with clay seams and pockets	4-13-25		6
		28-35-15		
		6-4-7		27
		16-19-26		
		10-31-22		4
		10-10-25		
58–60	Stiff gray clay			

← Note Scale Change (at 40 ft)

COHESION, TON/SQ FT: 0.2 0.4 0.6 0.8 1.0 1.2 1.4
PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10 20 30 40 50 60 70



COMPLETION DEPTH: 60'
DATE: April 21, 1973

DEPTH TO WATER IN BORING: 19.7'   DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 21

Form 108-1 (57) Job No. 73-085

LOG OF BORING NO. P-28

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel   LOCATION: See Plate 1

SURF. EL: 332.7'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT	-#200,%
0–2	Tan silty fine sand				
2–4.5	Very stiff tan and light gray sandy clay			⊗	
4.5–13.5	Tan fine sand -with light gray clay seams below 7.5'	13-18-17 15-22-44			6
13.5–42	Very stiff red and light gray clay with sand and silt pockets and partings -hard below 18' -sandstone layer, 32.5' to 33'	13-18-22 20-35-60/5"		⊗ 4.0 ⊗→ 4.3 ⊗→ 3.3 ⊗→ 4.2 ⊗→	
42–46	Hard gray sandy clay	12-18-40			
46–50	Hard gray clay with silt partings and seams	13-22-32			

PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT (scale 10–70)

COMPLETION DEPTH: 50'
DATE: April 30, 1973

DEPTH TO WATER IN BORING: 5.0'   DATE: May 3, 1973

McCLELLAND ENGINEERS

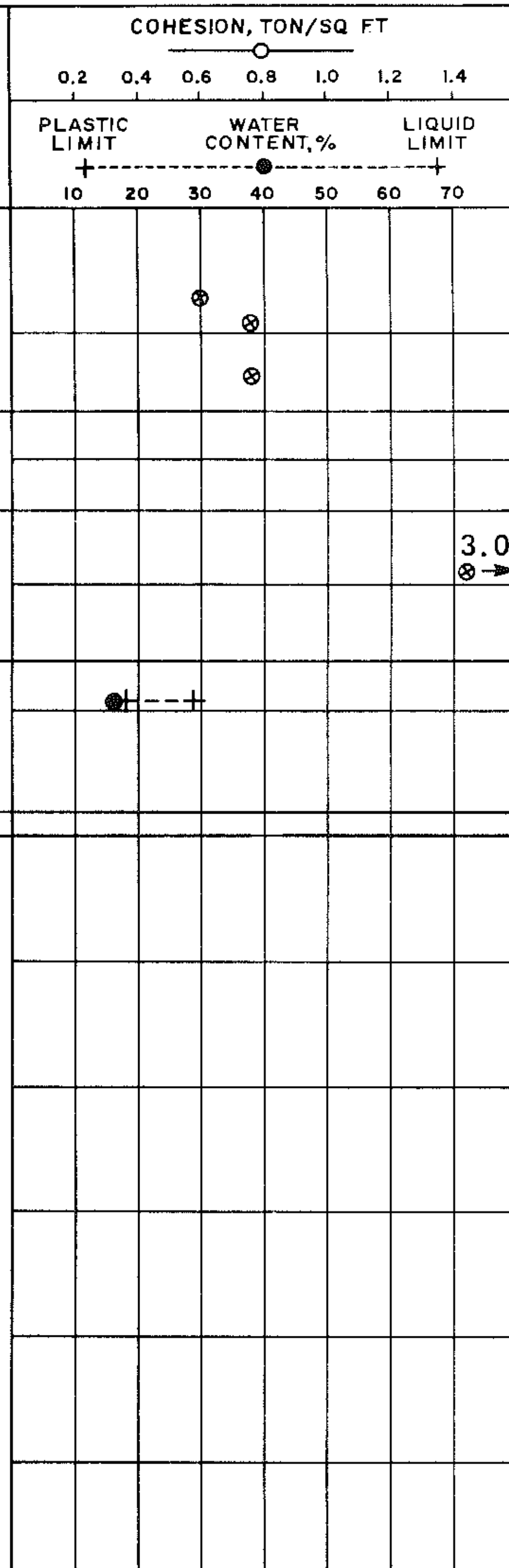
Form 108-1 (5?) Job No 73-085

LOG OF BORING NO. P-30

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

DEPTH, FT	DESCRIPTION OF MATERIAL (SURF. EL: 355.3')	BLOWS PER FT	UNIT DRY WT LB/CU FT
0–8	Stiff tan sandy clay -red and light gray below 6'		
8–12	Tan and light gray silty fine sand with clayey sand seams	30-50/6"	
12–18	Hard tan clay with ferrous partings		
18–24	Tan and light gray clayey sand	13-10-13	
24–25	Red and tan silty fine sand		



COMPLETION DEPTH: 25'
DATE: April 18, 1973

DEPTH TO WATER IN BORING: 19.0'

DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 23

LOG OF BORING NO. P-31

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel   LOCATION: See Plate 1

SURF. EL: 358.1'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2–1.4) / PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT (10–70)
0–5.5	Stiff red silty clay -with sandy silt pockets to 2' -firm at 2'			
5.5–17	Hard tan and light gray sandy clay with sand pockets -with ferrous nodules below 14.5'		116	2.6, 2.2, 2.8
17–25	Red silty fine sand with clay seams and ferrous partings	10-13-17		

COMPLETION DEPTH: 25'
DATE: April 18, 1973

DEPTH TO WATER IN BORING: 16.0'
DATE: May 3, 1973

McCLELLAND ENGINEERS

Form OP-- (47) Job No. 73-085

LOG OF BORING NO. P-32

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel   LOCATION: See Plate 1

DEPTH, FT	DESCRIPTION OF MATERIAL (SURF. EL: 354.7')	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT
0–9	Stiff tan sandy clay with sand pockets -very stiff below 7'			
9–13	Red and tan silty fine sand with sandy clay pockets			
13–22	Hard tan and light gray clay with sand pockets -with ferrous pockets and sandy clay seams to 15'	12-19-27		2.5 2.3
22–25	Red silty fine sand with ferrous partings and clay seams	13-50/9"		

COHESION, TON/SQ FT: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4
PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10, 20, 30, 40, 50, 60, 70

COMPLETION DEPTH: 25'
DATE: April 18, 1973

DEPTH TO WATER IN BORING: 14.7'

DATE: May 3, 1973

McCLELLAND ENGINEERS

Form -08-1 (57) Job No. 73-085

LOG OF BORING NO. P-33

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

SURF. EL: 355.0'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / WATER CONTENT, %	-# 200,%
0–8	Stiff red and tan sandy clay with sand pockets and ferrous pockets			⊗ ⊗	
8–12	Red and tan sandy silt with sand pockets				64
12–42	Red silty fine sand with ferrous nodules and pockets				
	-with sandy clay seams and pockets to 30'	7-15-27			11
	-tan and light gray, 19' to 38'	16-17-30			14
		28-28-50			
		11-14-22			
	-with ferrous layer, 34.5' to 35'	14-77/12"			28
	-gray with clay seams below 38'	12-40-48			
42–47	Hard gray clay	22-50/2"		1.35+ ⊗→	
47–49	Gray silty fine sand	50/4"			

Cohesion scale: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4. Plastic limit (+), water content, % (●), liquid limit (+): 10, 20, 30, 40, 50, 60, 70.

COMPLETION DEPTH: 49'
DATE: April 13, 1973

DEPTH TO WATER IN BORING: 15.4'
DATE: May 3, 1973

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PLATE 26

Form 108-1 (57) Job No 73-085

LOG OF BORING NO. P-34

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

SURF. EL: 352.2'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT	- #200, %
0–5	Very stiff red and tan clay				
5–15	Red and tan silty fine sand -with sandstone and red and light gray sandy clay below 8'	4-11-15 13-22-24			
15–19	Very stiff light gray clay with sand pockets and seams		105	1.7	
19–41	Light gray silty fine sand -tan, 24' to 36' -with clay seams and pockets below 24' -with sandstone nodules, 26' to 38' -gray below 36'	4-6-13 3-5-7 8-5-4 9-14-21			32
41–45	Hard gray sandy clay with silt seams and partings				49

COMPLETION DEPTH: 45'
DATE: May 1, 1973

DEPTH TO WATER IN BORING: 21.4'

DATE: May 3, 1973

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PLATE 27

73-085

LOG OF BORING NO. P-35

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

SURF. EL: 341.5'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT	-#200, %
0–5	Very stiff red and tan sandy clay				
5–22	Red and tan silty fine sand with sandstone seams and nodules -tan with light gray clay seams below 13' -with ferrous seams and partings, 17' to 19.5'	21-35-50 5-1-3			26
22–33	Hard gray sandy clay -with sand pockets and partings to 25' -with silt partings and pockets below 28'	13-18-26	102	4.5 3.2	
33–37	Gray silty fine sand with clay pockets and seams	8-7-50			
37–41	Hard gray sandy clay with sand pockets and seams		111	4.5	
41–45	Gray clayey sand	12-23-60/4"			

COMPLETION DEPTH: 45'
DATE: May 2, 1973

DEPTH TO WATER IN BORING: 10.9'
DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 28

Form 108-1 (57) Job No 73-085

LOG OF BORING NO. P-36

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube, 2" split-barrel & 3" Denison barrel   LOCATION: See Plate 1

DEPTH, FT	DESCRIPTION OF MATERIAL (SURF. EL: 347.8')	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT	-#200,%
	Tan silty fine sand				
5	Stiff red and tan sandy clay with sand pockets				
10	Red and tan silty fine sand -with sandy clay seams to 14'	11-14-14			
15	-with ferrous and sandstone nodules, 14.5' to 16'	8-8-8			22
20	-with light gray clay seams, 18' to 20'	10-16-16			
25		3-5-9			
30		8-16-23			26
35	-gray with lignite and clay seams below 32'	7-15-25			
40	Hard gray clay with sand seams and pockets -with sandstone seams, 39.5' to 40'			4.5 → 4.5 →	
50	Gray silty fine sand	13-26-60/4"			
	Hard gray sandy clay	29-60/5"		4.5 →	
60	Gray clayey sand	18-27-60/4"			

COMPLETION DEPTH: 60'
DATE: May 2, 1973

DEPTH TO WATER IN BORING: 18.0'

DATE: May 3, 1973

McCLELLAND ENGINEERS

Note Scale Change

PLATE 29

Form 108-I (57) Job No. 73-085

LOG OF BORING NO. P-37

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" thin-wall-tube & 2" split-barrel LOCATION: See Plate 1

SURF. EL: 348.1'

Depth, ft	Description of Material	Blows per ft	Unit Dry Wt lb/cu ft	Cohesion, ton/sq ft (0.2–1.4); Plastic Limit / Water Content, % / Liquid Limit (10–70)
0–5	Stiff tan silty clay with sand pockets and seams	2-3-5 4-8-9		
5–10	Stiff tan and light gray sandy clay with sand seams and pockets and sandstone nodules	3-4-6 6-8-13 4-6-11		
10–18	Tan silty fine sand -with sandy clay seams and pockets to 13'	8-14-15 8-17-16		
18–23	Stiff tan and light gray sandy clay	4-3-5		
23–38	Tan silty fine sand -gray below 32'	9-25-42 10-5-3 9-11-19		
38–42	Hard gray clay with sand seams and pockets			3.5
42–45	Gray silty fine sand	8-14-38		

COMPLETION DEPTH: 45'
DATE: May 1, 1973

DEPTH TO WATER IN BORING: 16.5'

DATE: May 3, 1973

McCLELLAND ENGINEERS

PLATE 30

Form 108-5 (57) Job No. 23-080

LOG OF BORING NO. P-38

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" Thin-Wall-Tube
2" Split-Spoon

LOCATION: See Plate 1

SURF. EL: 328.7'

DEPTH, FT	SYMBOL	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT
	J1, a1	Stiff Red & Tan Sandy Clay w/ferrous deposits @ 1.5		
5	J2	Red & Tan Sandy Silt	9/16/14	
		- w/clay seams 4.5-9.5		
	J3	- w/ferrous deposits @ 5	27/30/28	
10	J4	- w/ferrous layer @ 8' (3")	9/15/27	
		- w/ferrous layer 12.5-13.5		
15	J5	Gray Silty Fine Sand	6/10/12	
		- w/lignite seam @ 14.5 (3")		
		- w/sandstone layer 16'-17.5'		
20	J6	Stiff Gray Clay	18/15/22	
	UP1	- laminated with silt below 20'		
25	J7, J8	- Light Gray sandy silt seam @ 26	8/10/15	
30	J9, UP2		10/14/17	
35	J10	Gray Silty Fine Sand	29/37/60-2"	
	J11		24/34/60-2"	
40		Hard gray sandy clay		
		- with mica and sand pockets		
45	J12		29/60-6"	
		- lignite layer, 46'-47'		
50	J13		60-6"	

(Continued to next page)

COHESION, TON/SQ FT: 0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10 20 30 40 50 60 70

ELEVATION, FT

PRELIMINARY
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PLATE 31

Form 108-5 (57) Job No. 73-086

LOG OF BORING NO. P-38 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4); PLASTIC LIMIT, WATER CONTENT, %, LIQUID LIMIT (10 20 30 40 50 60 70)	ELEVATION, FT
			Hard Gray Sandy Clay				
55				27/39/63-3"			
60				30/45/60-5"			
			-w/lignite layer 63.5'-64.5'				
65			-w/scattered lignite seams, 64.5-67'				
70				27/40-3"			
75				40-6"			
80			-w/clay and sand seams below 79'	40-6"			
				40-4"			
85			Gray Sandy Silt				
			-w/clay seams below 84'				
90				40-5"			
95				40-3"			
100				50/4.5"			

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 100'
DATE: July 30, 1973

DEPTH TO WATER IN BORING: 9.6' Caved at: 49.6' DATE: July 31, 1973

McCLELLAND ENGINEERS

PLATE 3/9

Form 108-5 (57) Job No. [illegible]

LOG OF BORING NO. P-39

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" Thin-Wall-Tube, 2" Split-Spoon, Denison-barrel

LOCATION: See Plate 1

SURF. EL: 348.6'

DEPTH, FT	SYMBOL	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT	ELEVATION, FT
	UP1	Stiff Red & Tan Sandy Clay			0.8 (cohesion, plotted)	
5	J1	Red Sandy Silt w/clay pockets, 5' to 8'	22/24/39			
	J2		22/24/55			
10	J3		19/31/31			
		- Tan below 13'				
15	J4	- w/gravel, 17'-17.5'	30/37/30			
20	J5	- w/ Brown clay seams below 20'	7/14/20			
		Stiff Brown & Light Gray clay w/sandy silt seams				
25	J6					
	UP2	Tan & Light Gray Silty Fine Sand	7/8/14			
30	J7	- Tan 28.5'-33.5' - w/sandstone nodules below 28.5	42/60-5"			
35	J8	- Tan & Red 33.5-45 w/Lignite layer, 36' to 36.5'	30/60-6"			
40	J9		14/19/30			
45	J10	- Light Gray below 45	18/21/24			
		Hard Gray Clay				
50	J11	w/sand streaks @50	25/29/60			
		(Continued on next page)				

PRELIMINARY
McCLELLAND ENGINEERS

McCLELLAND ENGINEERS

PLATE 32

Form 108-5 (67) Job No. 73-085

LOG OF BORING NO. P-39 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2–1.4); PLASTIC LIMIT + — WATER CONTENT, % ● — LIQUID LIMIT + (10–70)	ELEVATION, FT
	J12		Hard gray Clay			⊗ (≈70)	
55	J13		– laminated w/silt, 55' to 70'	30/34/60			
	J14B		– w/silt stone Nodules, 54.5-56'				
60	J14A					1.35+ ⊗→	
	J14						
65	J15			27/40-3"			
70	J16			24/40-6"			
75			— — —	41/5-5"			
80							
85							
90							
95							
100							

PRELIMINARY
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COMPLETION DEPTH: 75'
DATE: July 27, 1973

DEPTH TO WATER IN BORING:
DATE:

McCLELLAND ENGINEERS

PLATE 329

Form 108-5 (57) Job No. 73-085

LOG OF BORING NO. P-40

Welsh Power Plant
Cason, Texas

TYPE: 3" Thin-Wall-Tube
2" Split-barrel

LOCATION: See Plate 1

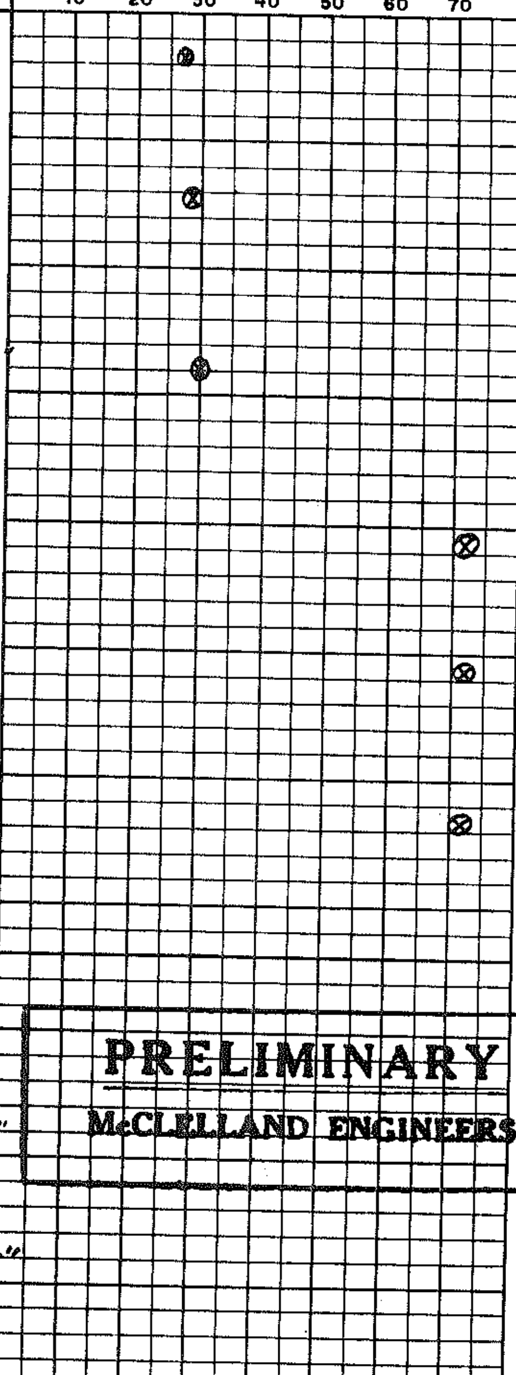
SURF. EL: 341.9'

DEPTH, FT	SYMBOL	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT
	UP1	Stiff Light Gray & Red Sandy Clay		
		-w/ferrous deposits 2'-3.5'		
5	J1	-w/ferrous seams 5'-14'	4/6/8	
		- light gray & tan 6.5'-20'		
	UP2			
10	J2	-w/sand seams and pockets below 10'	9/9/11	
	J3		23/28/60-4"	
15		-w/sand layer, 16'-16.5'		
20	J4		5/9/14	
	UP3	- Dark Gray below 20'		
		- w/organic matter 20.5'-22'		
		- Very Stiff below 21'		
25	J5		11/16/19	
	UP4			
30	J6		22/26/30	
	UP5			
35			42/60	
40	J7	Gray Silty Fine Sand w/organic matter 39'-40'	27/60-5"	
45	J8		27/26/60-5"	
50	J9		28/26/60-5"	

COHESION, TON/SQ FT: 0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10 20 30 40 50 60 70

ELEVATION, FT



PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 50'
DATE: Aug. 2, 1973

DEPTH TO WATER IN BORING:

DATE:

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PLATE 33

Form 108-5 (57) Job No. 73-085

LOG OF BORING NO. P-41

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" Thin-Wall-Tube
2" Split-Spoon

LOCATION: See Plate 1

SURF. EL: 347.7'

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT	ELEVATION, FT
	UP1		Stiff Red & TAN Sandy Clay				
5	J1		-w/fervous deposits, 5'-7'	4/7/10			
	UP2						
10	J2		TAN & Light Gray Silty Fine Sand	16/20/24			
15	J3		-Light Gray & TAN below 15'	13/23/25			
	J4		Very stiff brown & light gray clay				
20	UP4		-w/silt streaks, 17'-20'	7/10/13			
			-w/fervous deposits, 20'-21.5'				
25	J5			10/12/12			
	UP5		-Dark Gray below 25'				
30	J6						
	UP6			6/12/26			
35	J7			22/60-4"			
	J8		Gray Silty Fine Sand				
40			w/organic matter 39' 43'	37/60-3			
45	J9			37/60-6"			
50	J10			37/60-3"			
55'	J11			36/32/60-4"			

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 55'
DATE: Aug. 1, 1973

DEPTH TO WATER IN BORING: 7.3'
Caved at: 43.6'
DATE:

McCLELLAND ENGINEERS

PLATE 34

Form 108-5 (57) Job No.____

LOG OF BORING NO. P-42

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" Thin-Wall-Tube
2" Split-Spoon

LOCATION: See Plate 1

SURF. EL: 349.3'

DEPTH, FT	SYMBOL	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT	ELEVATION, FT
	J1	TAN SANDY Silt				
		Stiff Light Gray, Red & TAN SANDY CLAY				
5	J2	- w/SAND pockets	4/5/7			
	UP1					
10	J3	TAN Silty Fine Sand	15/30/60-4			
	J4		5/8/9			
15	UP2	Very stiff Brown & Light CLAY				
		- laminated with silty fine sand to 34'				
	J5	- with ferrous deposit, 20'-21'	8/13/23			
20	UP3	- Brown, 20'-34'			1.35+	
	J6					
25	UP4	- w/SAND pockets below 25'	10/15/21		1.35+	
	J7					
30	UP5		12/14/17		1.35+	
35	J8	- dark gray w/ mica below 34'	23/40/60-5"			
40	J9	DArk Gray Clayey SAND to Very SANDY CLAY	25/35/60-5"			
45	J10	- w/ organic matter and mica	45/48/60-3"			
50	J11		35/60-5"			
	J12		15/40-5"			

COHESION, TON/SQ FT: 0.2 0.4 0.6 0.8 1.0 1.2 1.4
PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10 20 30 40 50 60 70

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 55'
DATE: July 30, 1973

DEPTH TO WATER IN BORING:
DATE:

McCLELLAND ENGINEERS

PLATE 35

Form 108-5 (57) Job No. 73-085

LOG OF BORING NO. R-43

TYPE: 3" Thin Wall-Tube / 2" Split-Spoon

LOCATION: See Plate 1

SURF. EL: 351.8'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT
0–10	Firm Red & Light Sand Clay	
	- stiff below 3'	3/3/9
	- with ferrous deposits below 7.5'	4/5/7
10–30	Very stiff tan & light gray Clay	
	- Brown & Light Gray, 13'-20'	9/11/15
	- w/silt seams, 15'-19'	
	- w/ferrous deposit, 15'-20'	11/16/23
	- dark gray below 20'	
	- w/ sand pockets below 20'	15/24/60-5"
		13/13/24
30–50	Light Gray Sandy Silt, w/ silty clay seams, 30'-36'	
	- Dark Gray below 34'	18/35/60-4"
		24/42/60-4"
		36/41/60-4"
		43/60-4"

(Continued on next page)

COHESION, TON/SQ FT: 0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10 20 30 40 50 60 70

UNIT DRY WT LB/CU FT

ELEVATION, FT

PRELIMINARY
McCLELLAND ENGINEERS

McCLELLAND ENGINEERS

Form 108-5 (57) Job No. 73-085

LOG OF BORING NO. P-43 (Cont'd)

WELSH POWER PLANT
CASON, TEXAS

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT (10 20 30 40 50 60 70)	ELEVATION, FT
			Dark gray sandy silt				
55		☒		38/40-4"			
60		☒		40-6"			
65		◸		27/40			
70		☒	-w/sand stone layer, 70'-71'	32/40-5"			
			-w/sand stone seams 71'-73.5'				
75		☒		31/40			
80							
85							
90							
95							
100							

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 75'
DATE: July 31, 1973

DEPTH TO WATER IN BORING:
DATE:

McCLELLAND ENGINEERS

PLATE 36a

Form 108-5 (57) Job No. 73-085

LOG OF BORING NO. P-47

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" Thin Wall Tube
2" Split-Spoon

LOCATION: See Plate 1

SURF. EL: 361.5'

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT
0	Stiff Tan & Red Sandy Clay	
5	-w/sand streaks 4'-8'	8/11/16
	-w/light Gray below 7'	
10	Tan, Red & Light Gray Sandy Silt	
	-w/clay pockets 10-17	11/11/19
15	-w/ferrous deposits, 14'-16'	19/33/20
20	-w/clay partings below 20'	9/10/14
	-w/ferrous Nodules below 20	
25		11/23/39

Column headings: DEPTH, FT; SYMBOL; SAMPLES; DESCRIPTION OF MATERIAL; BLOWS PER FT; UNIT DRY WT LB/CU FT; COHESION, TON/SQ FT (0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4); PLASTIC LIMIT, WATER CONTENT, %, LIQUID LIMIT (10, 20, 30, 40, 50, 60, 70); ELEVATION, FT

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 25'
DATE: July 26, 1973

DEPTH TO WATER IN BORING: 9.2'   Caved at: 21.8'
DATE: July 30, 1973

McCLELLAND ENGINEERS

Form 108-5 (57) Job No. 73085

LOG OF BORING NO. P-48

WELSH POWER PLANT
CASON, TEXAS

TYPE: 3" Thin-Wall-Tube / 2" Split-Spoon

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (SURF. EL:)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2–1.4) / PLASTIC LIMIT, WATER CONTENT, %, LIQUID LIMIT (10–70)	ELEVATION, FT
	UP1		Stiff red & light gray clay w/ sand pockets				
5	J1			5/7/9			
	UP2						
10	J2		Red Silty fine Sand -w/clay pockets	14/15/20			
	J3		Very stiff Light gray clay -w/ ferrous nodules, 14'-18'	5/8/10			
15	UP3					1.35+	
			-shale layer, 16 - 16.5				
	J4			2/8/2			
20			Firm Gray Clay w/silty fine sand seam @ 19				
25	J5		Gray Silty Fine Sand	10/14/40			
			-w/shale seam at 24.5'				
			-w/scatterd sand stone seams, 26'-30.5'				
30	J6			13/60=9"			
			Very stiff Gray clay w/sandy silt partings w/sand stone below 32				
35	J7			18/24/39			
40							
45							
50							

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 35'
DATE: July 26, 1973

DEPTH TO WATER IN BORING: 6.8' Caved at: 27.5'
DATE: July 30, 1973

McCLELLAND ENGINEERS

PLATE 38

LOG OF BORING NO. P-49

WELSH POWER PLANT
CASON, TEXAS

TYPE: 2" Split-Spoon / 3" Thin-Wall-Tube

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (SURF. EL:)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT / WATER CONTENT, %	ELEVATION, FT
	UP1		Stiff Red & Light Gray Clay				
5	J1		- w/ferrous nodules below 1.5	4/5/9			
	UP2						
10	J2			11/12/13			
15	J3			13/19/20			
	UP3		Tan & Red silty fine Sand w/clay pockets				
20	J4		w/sandstone seam @ 20'	5/7/9			
	UP4		Stiff Brown Clay w/organic matter @ 22'				
25	J5		Dark gray silty fine sand	20/60-6"			

COHESION, TON/SQ FT: 0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT: 10 20 30 40 50 60 70

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 25'
DATE: July 25, 1973

DEPTH TO WATER IN BORING: 19.6' Caved at: 24.3' DATE: July 30, 1973

McCLELLAND ENGINEERS

Form 1 Job No. 7? 785

LOG OF BORING NO. AB-1

WELSH POWER PLANT
CASON, TEXAS

TYPE: 4" Auger LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (SURF. EL:)	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2–1.4); PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT (10–70)	ELEVATION, FT
0–10			Tan & Red Sandy Clay - Light Gray & Red w/sand streaks below 5			
10–15			Tan & Red & Light Gray Clay w/silt & sand streak below 10' - Brown & Tan below 13' Tan silty fine sand			

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 15'
DATE: July 31, 1973
DEPTH TO WATER IN BORING:
DATE:

McCLELLAND ENGINEERS

Form 108-5 (57) Job No. 73-085

LOG OF BORING NO. AB-2

WELSH POWER PLANT
CASON, TEXAS

TYPE: 4" Auger

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (SURF. EL:)	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2–1.4) / PLASTIC LIMIT – WATER CONTENT, % – LIQUID LIMIT (10–70)	ELEVATION, FT
0–20		(sample 0–20)	Tan Silty Fine Sand			
			Ferrous Deposits w/clay seams & parting below 3'			
			- w/ Dark Gray Clay Seam @ 14			

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 20'
DATE: Aug. 1, 1973

DEPTH TO WATER IN BORING:

DATE:

McCLELLAND ENGINEERS

PLATE 41

Form 108-5 (57) Job No. 23-085

LOG OF BORING NO. AB-3

WELSH POWER PLANT
CASON, TEXAS

TYPE: 4" Auger

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4); PLASTIC LIMIT + --- WATER CONTENT, % ● --- LIQUID LIMIT + (10 20 30 40 50 60 70)	ELEVATION, FT
			SURF. EL: 331.9'			
			TAN & Red Silty Fine SANDY			
			Light Gray Clay w/Red streaks below 2.5'			
5						
			-w/ferrous deposits 8'-11'			
10			- Brown Light Tan below 11'			
			TAN Silty Fine Sand			
15						
20						
25						
30						
35						
40						
45						
50						

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 12.5'
DATE: 8-1-73

DEPTH TO WATER IN BORING:

DATE:

McCLELLAND ENGINEERS

PLATE 42

Form 108-5 (57) Job No. 73-085

LOG OF BORING NO. AB-4

WELSH POWER PLANT
CASON, TEXAS

TYPE: 4" Auger

LOCATION: See Plate 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 – 1.4); PLASTIC LIMIT / WATER CONTENT, % / LIQUID LIMIT (10 – 70)	ELEVATION, FT
			SURF. EL: 337.5'			
			TAN Silty Fine Sand			
5			Red & Light Gray Sandy Clay			
10			TAN & Red & Light Gray Clay w/Ferrous deposits w/si seams 10-16 - Brown & Light Gray 11'-14' - Gray below 14'			
15						
20			TAN Silty Fine Sand			
25						
30						
35						
40						
45						
50						

PRELIMINARY
McCLELLAND ENGINEERS

COMPLETION DEPTH: 20'
DATE: Aug 1, 1973

DEPTH TO WATER IN BORING:

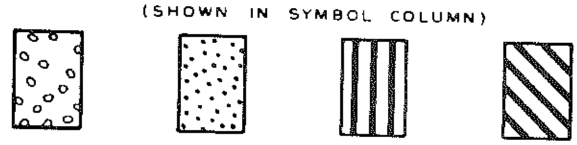
DATE:

McCLELLAND ENGINEERS

PLATE 43

SYMBOLS AND TERMS USED ON BORING LOGS

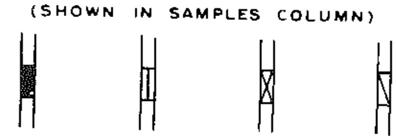
SOIL TYPES
(SHOWN IN SYMBOL COLUMN)



Gravel — Sand — Silt — Clay

Predominant type shown heavy

SAMPLER TYPES
(SHOWN IN SAMPLES COLUMN)



Shelby Tube — Denison Barrel — Split Spoon — No Recovery

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERM	RELATIVE DENSITY
Loose	0 to 40%
Medium dense	40 to 70%
Dense	70 to 100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH TON/SQ FT
Very soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very stiff	2.00 to 4.00
Hard	4.00 and higher

Note: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

TERMS CHARACTERIZING SOIL STRUCTURE

Slickensided – having inclined planes of weakness that are slick and glossy in appearance.

Fissured – containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.

Laminated – composed of thin layers of varying color and texture.

Interbedded – composed of alternate layers of different soil types.

Calcareous – containing appreciable quantities of calcium carbonate.

Well graded – having wide range in grain sizes and substantial amounts of all intermediate particle sizes.

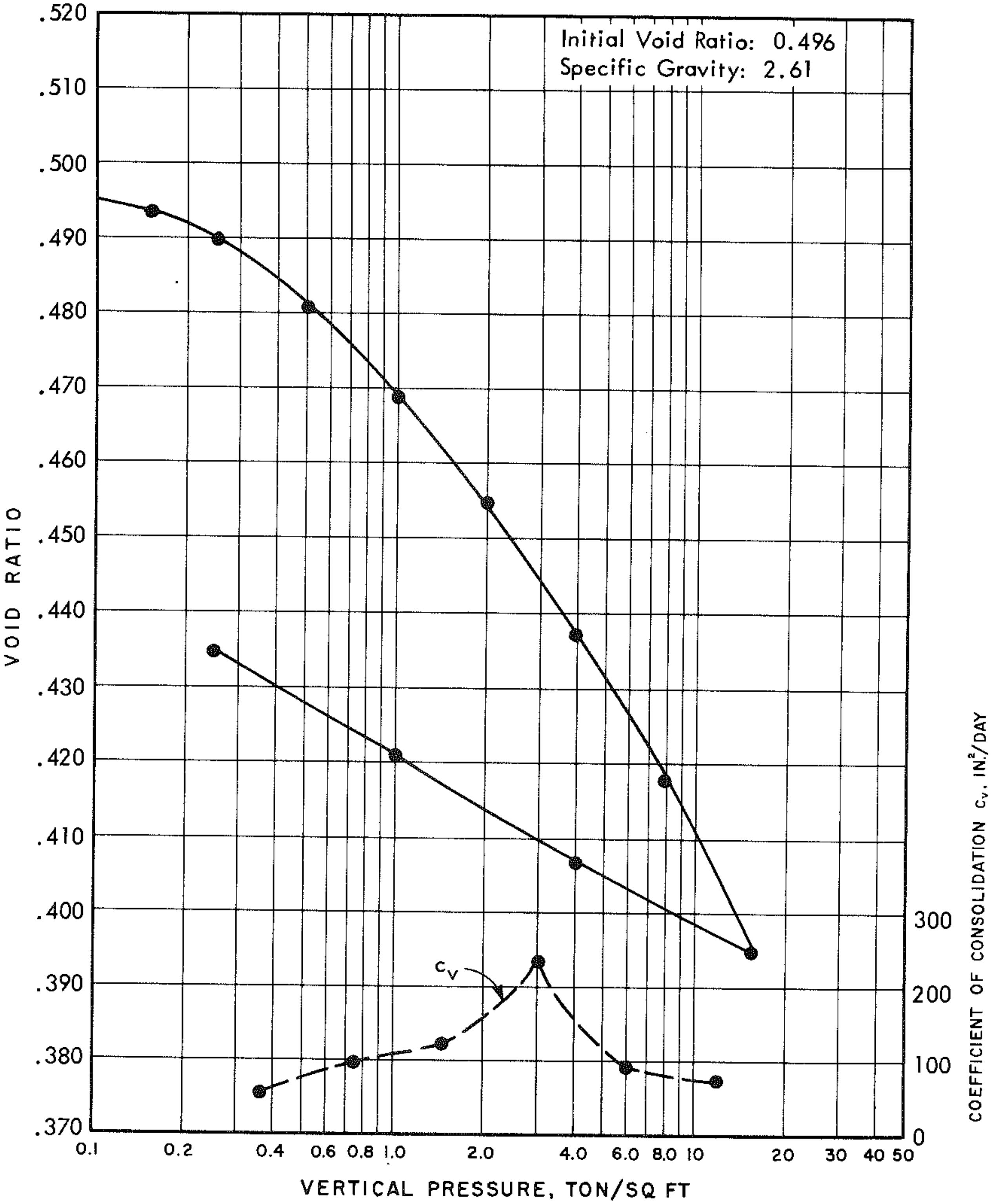
Poorly graded – predominantly of one grain size, or having a range of sizes with some intermediate size missing.

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in Technical Memorandum No. 3-357, Waterways Experiment Station, March 1953.

McCLELLAND ENGINEERS

BORING: P-1 DEPTH: 50'
MATERIAL: Hard brown and gray clay with sand pockets

UNIT DRY WEIGHT: 109 LB/CU FT
WATER CONTENT: 14 %
LIQUID LIMIT: 40
PLASTIC LIMIT: 20

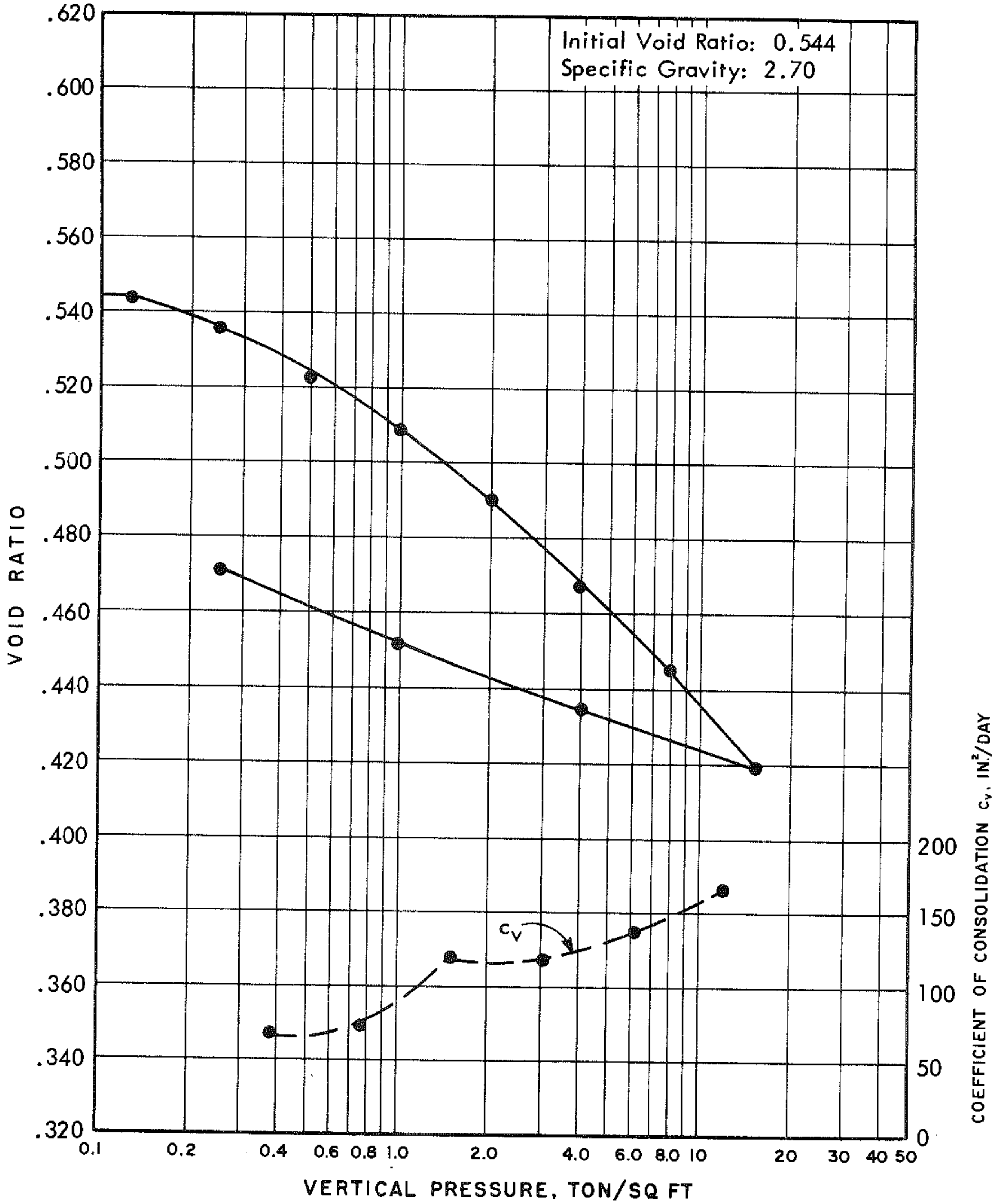


CONSOLIDATION TEST RESULTS

Form 06-3 57 Job No 23-086

BORING: P-3 DEPTH: 70'
MATERIAL: Hard gray sandy clay

UNIT DRY WEIGHT: 109 LB/CU FT
WATER CONTENT: 18 %
LIQUID LIMIT: 27
PLASTIC LIMIT: 16

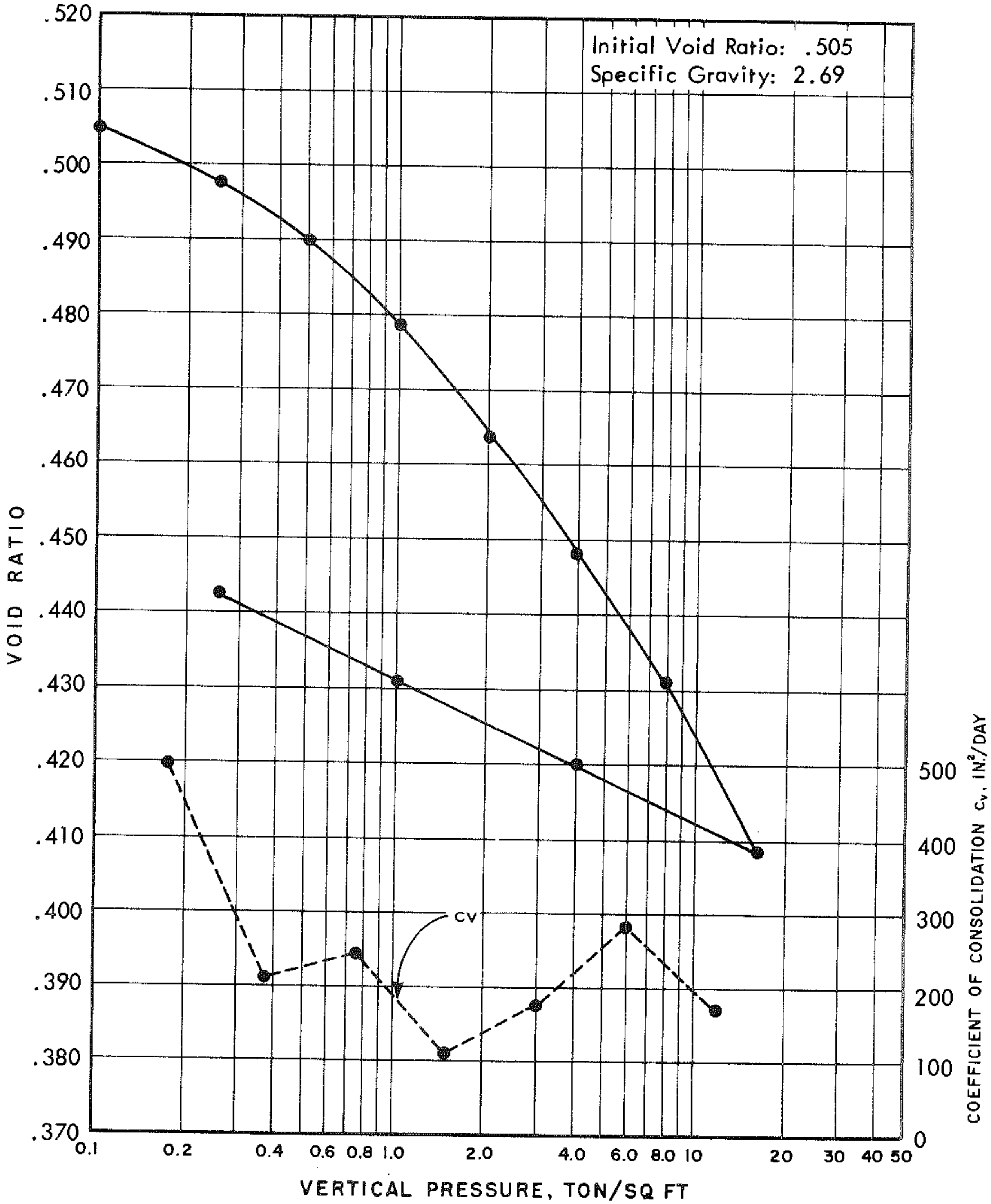


CONSOLIDATION TEST RESULTS

McCLELLAND ENGINEERS

BORING: P-4 DEPTH: 6'
MATERIAL: Stiff red and tan very sandy clay

UNIT DRY WEIGHT: 112 LB/CU FT
WATER CONTENT: 17 %
LIQUID LIMIT: 29
PLASTIC LIMIT: 18

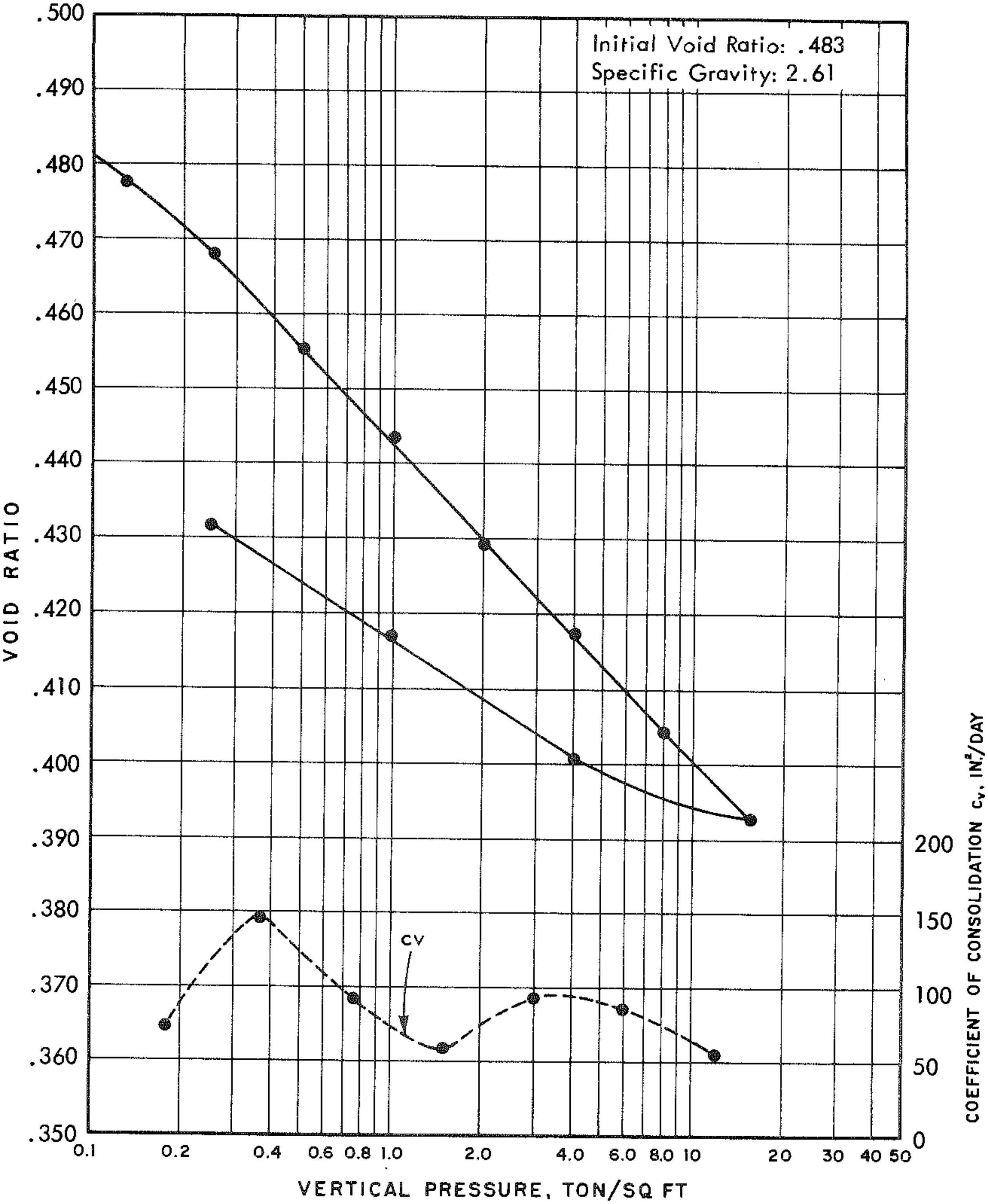


CONSOLIDATION TEST RESULTS

Form 06-3 57 Job No. 73-085

BORING: P-4 DEPTH: 50'
MATERIAL: Gray clayey fine sand

UNIT DRY WEIGHT: 110 LB/CU FT
WATER CONTENT: 17 %
LIQUID LIMIT: 24
PLASTIC LIMIT: 18



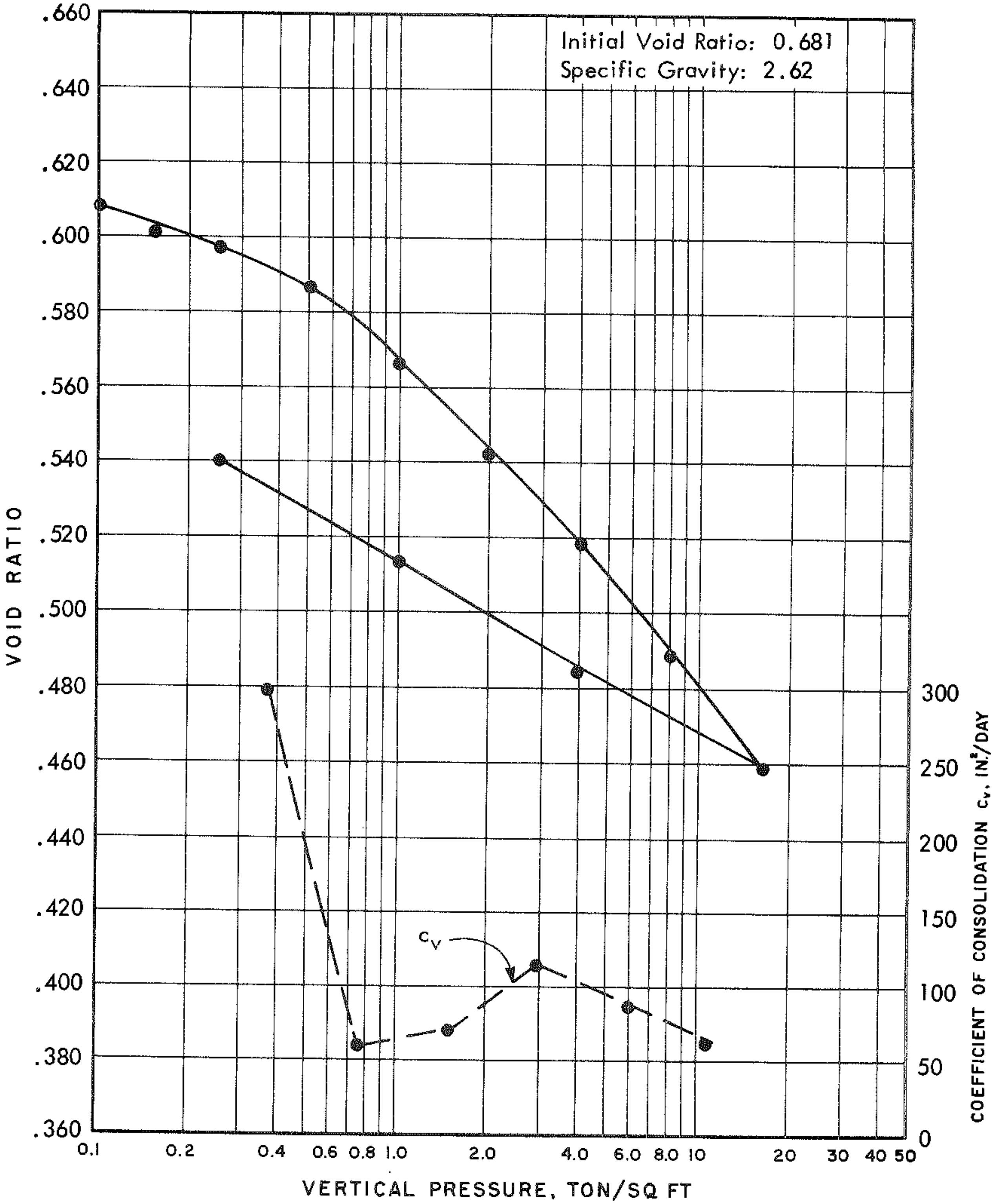
CONSOLIDATION TEST RESULTS

Form G6-3 '57 Job No. 73-085-

BORING: P-5 DEPTH: 30'

MATERIAL: Hard gray sandy clay with sand pockets and partings

UNIT DRY WEIGHT: 102 LB/CU FT
WATER CONTENT: 21 %
LIQUID LIMIT: 40
PLASTIC LIMIT: 19



CONSOLIDATION TEST RESULTS

McCLELLAND ENGINEERS

Form 26 3 57 Job No. 73.085

BORING: P-7 DEPTH: 24.5'

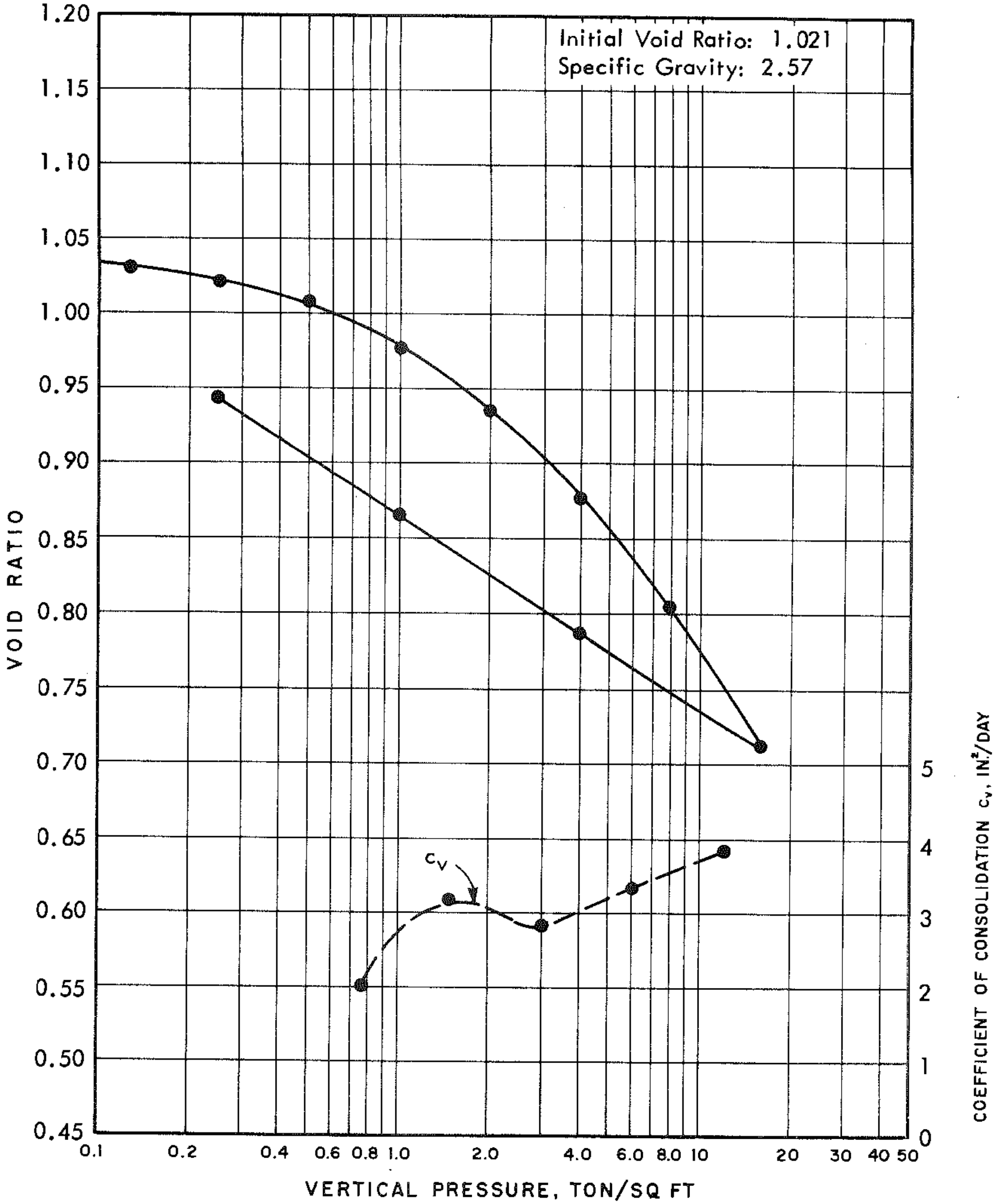
MATERIAL: Stiff light gray clay with sand pockets and ferrous nodules

UNIT DRY WEIGHT: 91 LB/CU FT

WATER CONTENT: 34 %

LIQUID LIMIT: 52

PLASTIC LIMIT: 18



CONSOLIDATION TEST RESULTS

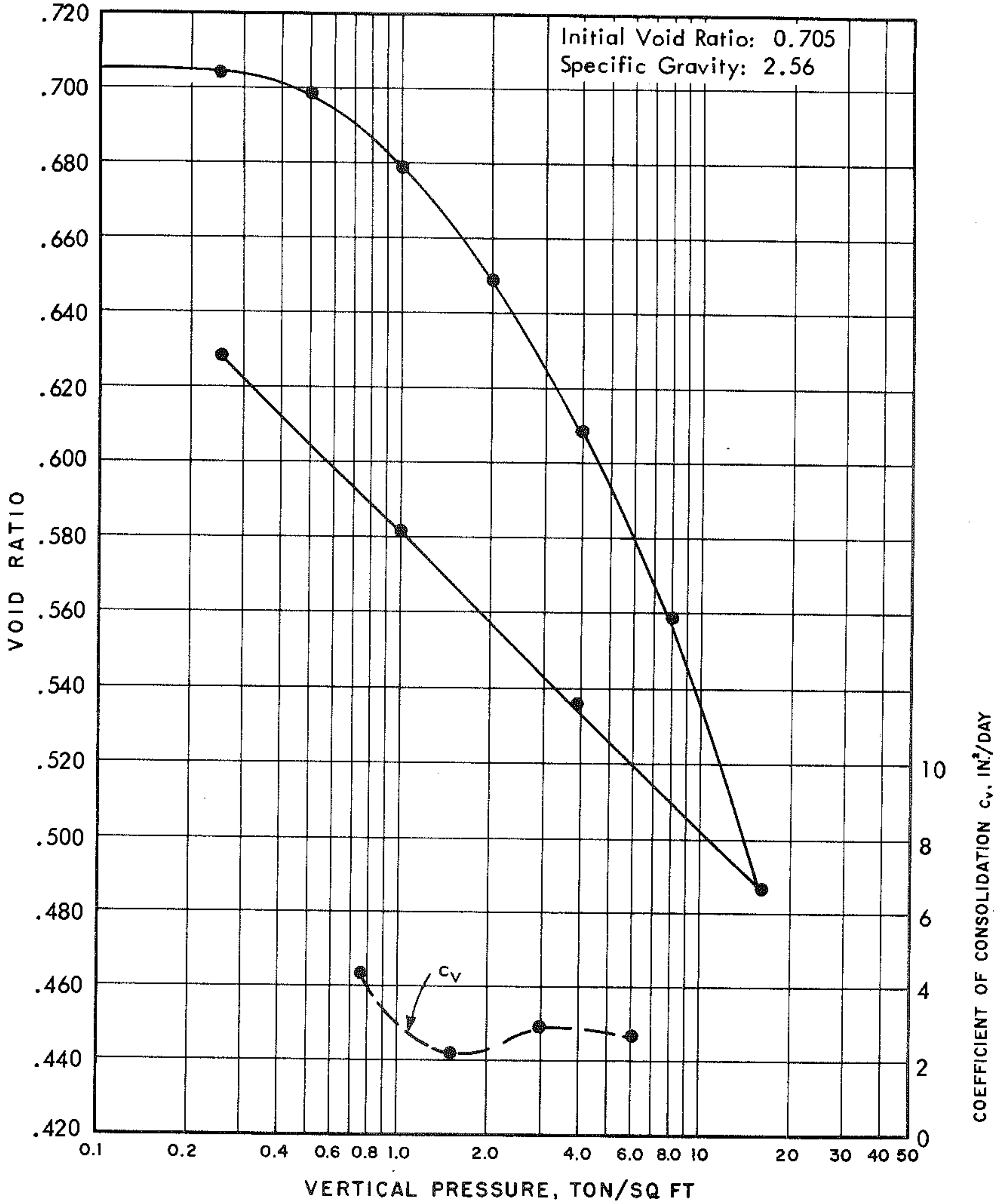
McCLELLAND ENGINEERS

PLATE 50

Form 06-3 57 Job No. 23-085

BORING: P-9 DEPTH: 29.5'
MATERIAL: Very stiff light gray clay with silt partings

UNIT DRY WEIGHT: 94 LB/CU FT
WATER CONTENT: 30 %
LIQUID LIMIT: 69
PLASTIC LIMIT: 23



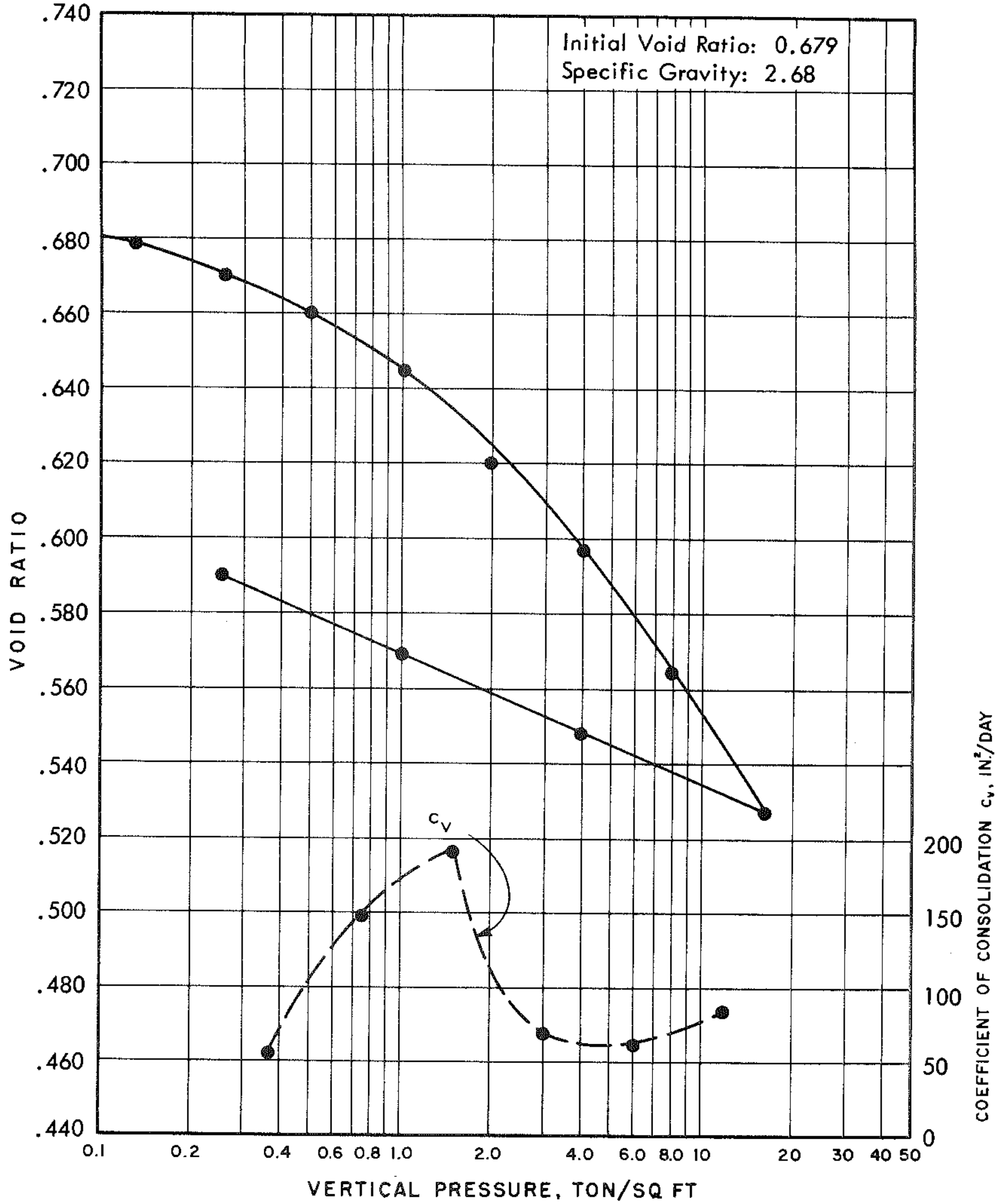
CONSOLIDATION TEST RESULTS

McCLELLAND ENGINEERS

PLATE 51

BORING: P-9 DEPTH: 35'
MATERIAL: Very stiff gray sandy clay with sand partings

UNIT DRY WEIGHT: 100 LB/CU FT
WATER CONTENT: 22 %
LIQUID LIMIT: 37
PLASTIC LIMIT: 19

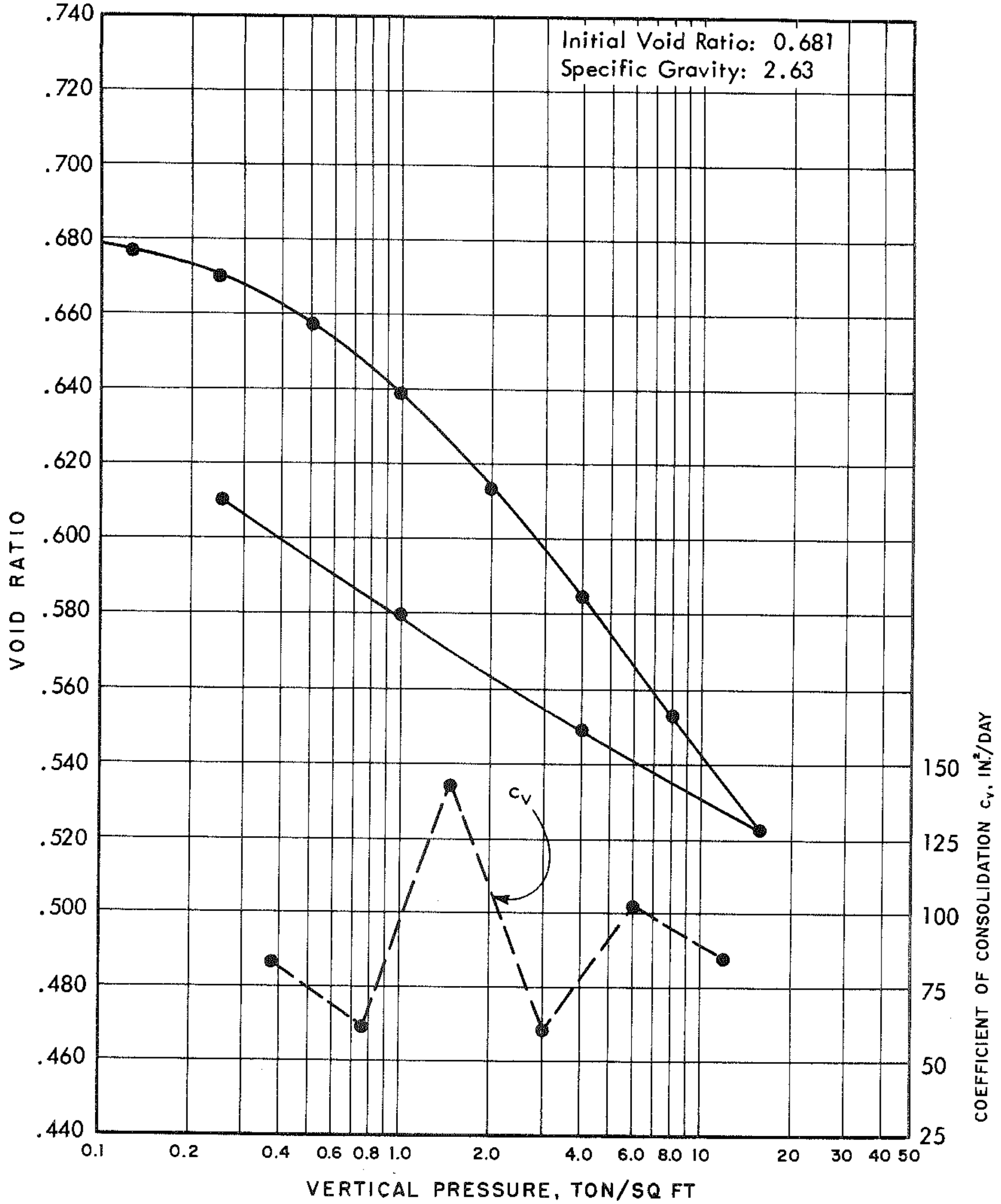


CONSOLIDATION TEST RESULTS

Form 06-3 57 Job No 73085

BORING: P-10 DEPTH: 45'
MATERIAL: Very stiff gray sandy clay with silt pockets

UNIT DRY WEIGHT: 98 LB/CU FT
WATER CONTENT: 22 %
LIQUID LIMIT: 38
PLASTIC LIMIT: 19

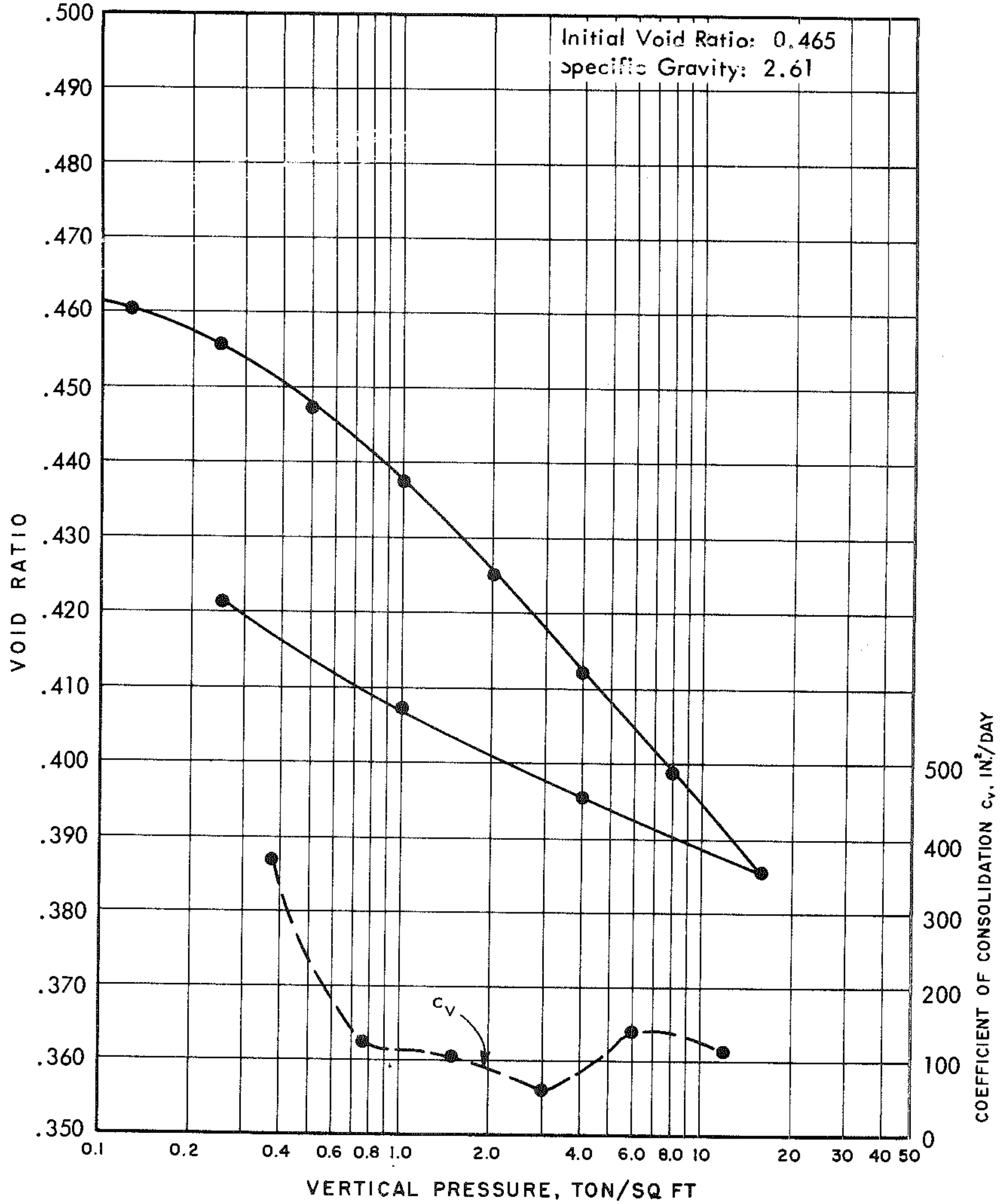


CONSOLIDATION TEST RESULTS

McCLELLAND ENGINEERS

BORING: P-10 DEPTH: 59'
MATERIAL: Gray clayey fine sand

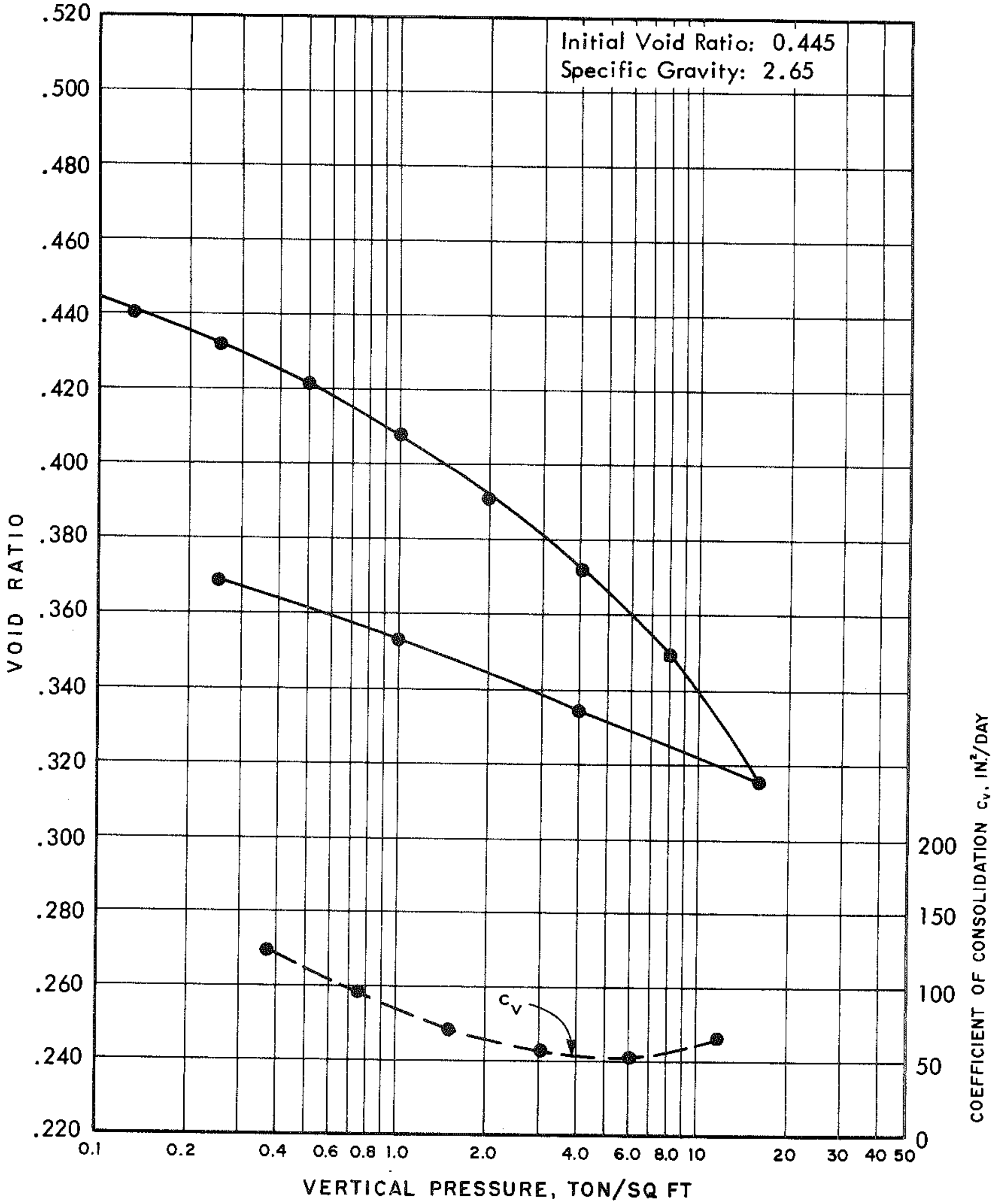
UNIT DRY WEIGHT: 111 LB/CU FT
WATER CONTENT: 17 %
LIQUID LIMIT: 22
PLASTIC LIMIT: 17



CONSOLIDATION TEST RESULTS

BORING: P-12 DEPTH: 20'
MATERIAL: Red and tan clayey fine sand with clay pockets

UNIT DRY WEIGHT: 115 LB/CU FT
WATER CONTENT: 16 %
LIQUID LIMIT: 26
PLASTIC LIMIT: 17

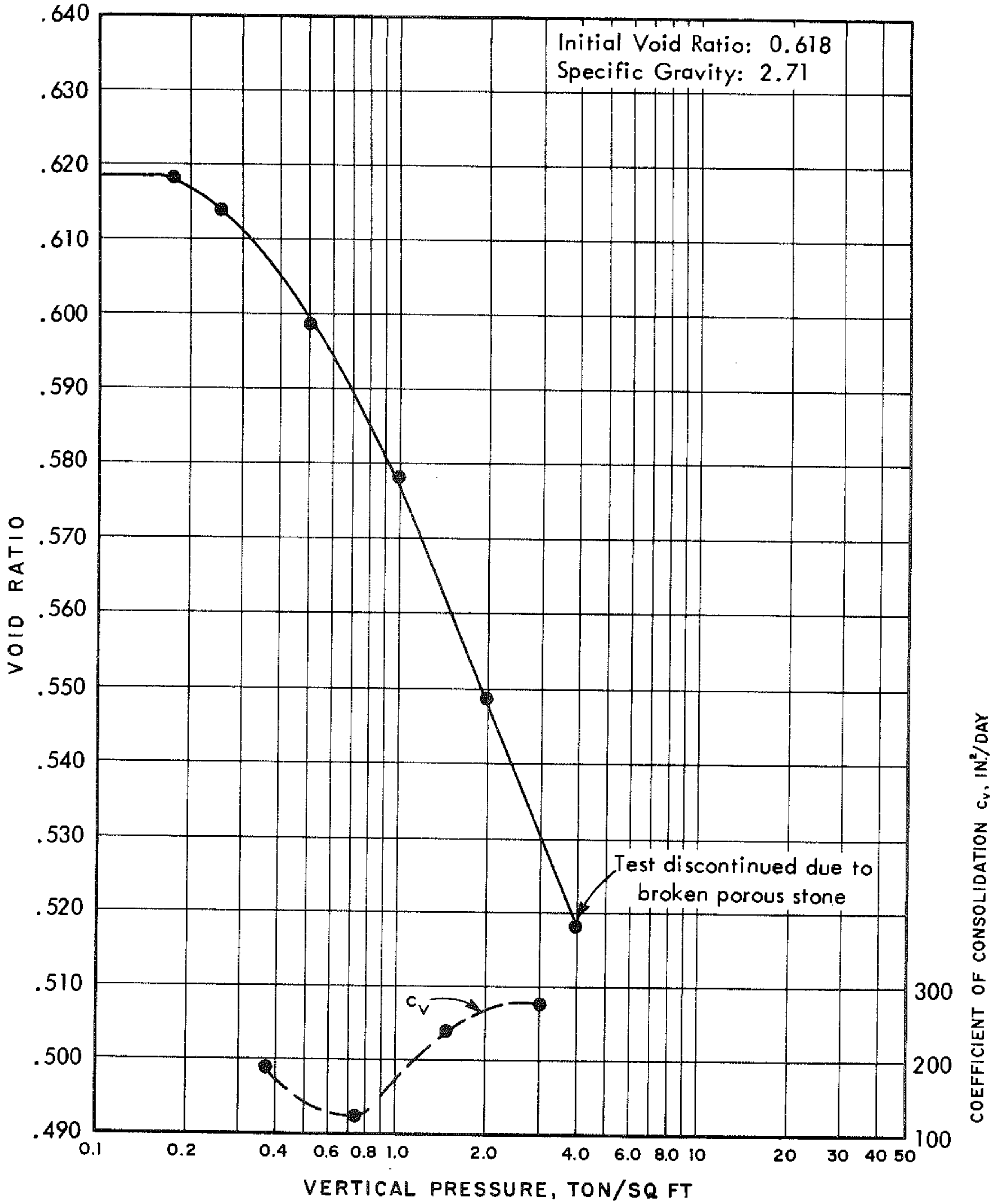


CONSOLIDATION TEST RESULTS

McCLELLAND ENGINEERS

BORING: P-34 DEPTH: 18'
MATERIAL: Very stiff light gray clay with sand pockets and seams

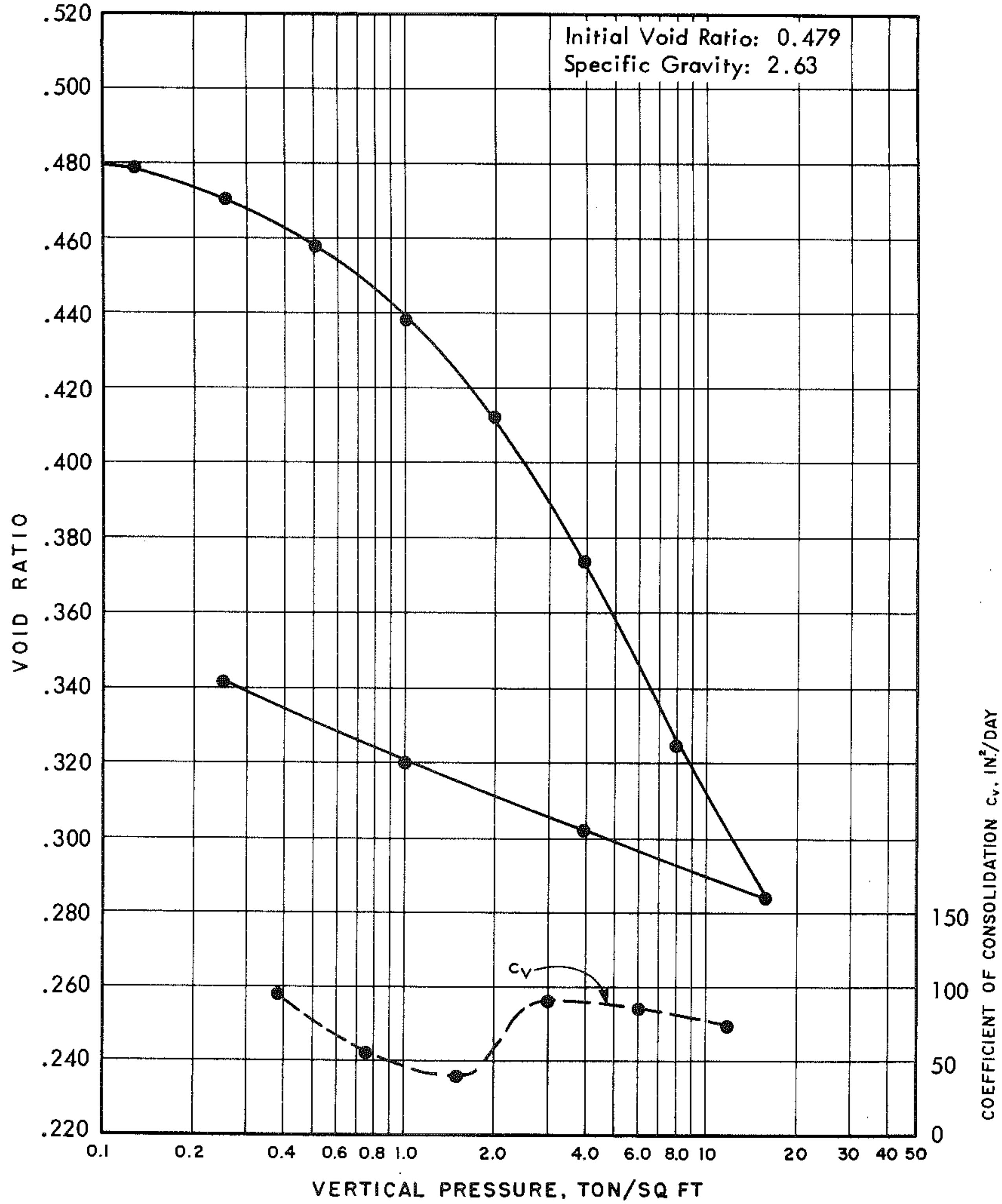
UNIT DRY WEIGHT: 104.5 LB/CU FT
WATER CONTENT: 13 %
LIQUID LIMIT: 31
PLASTIC LIMIT: 17



CONSOLIDATION TEST RESULTS

BORING: P-35 DEPTH: 39'
MATERIAL: Hard gray sandy clay with sand pockets

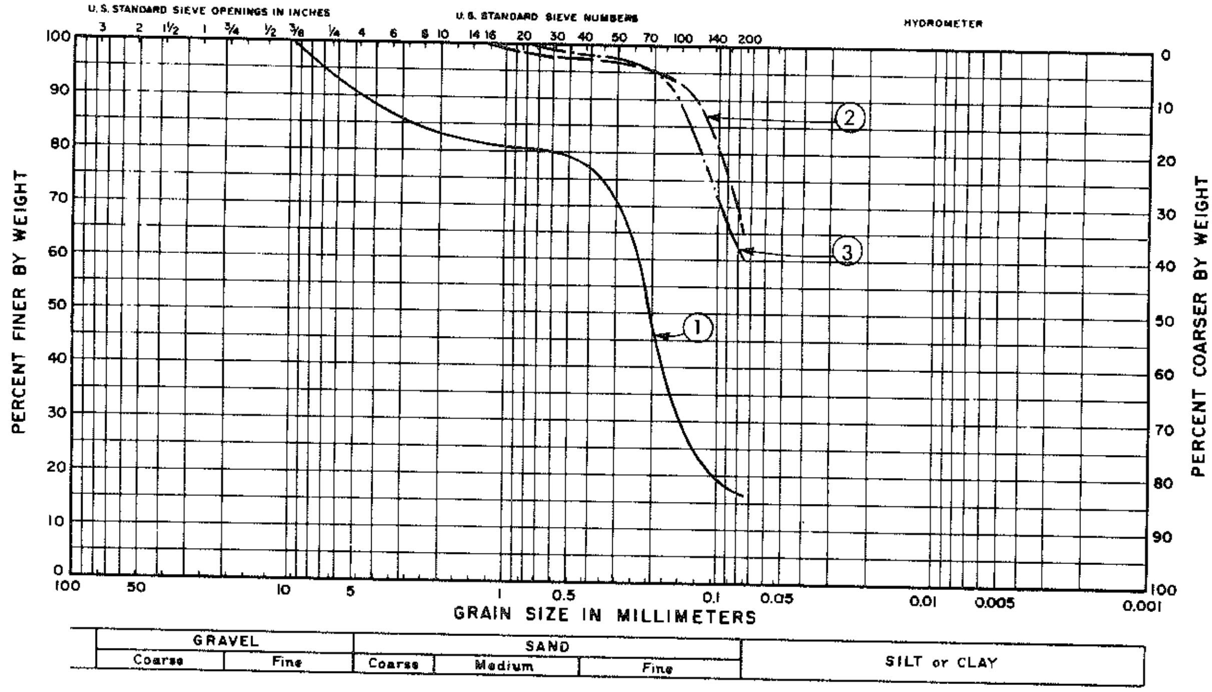
UNIT DRY WEIGHT: 111 LB/CU FT
WATER CONTENT: 18 %
LIQUID LIMIT: 25
PLASTIC LIMIT: 16



CONSOLIDATION TEST RESULTS

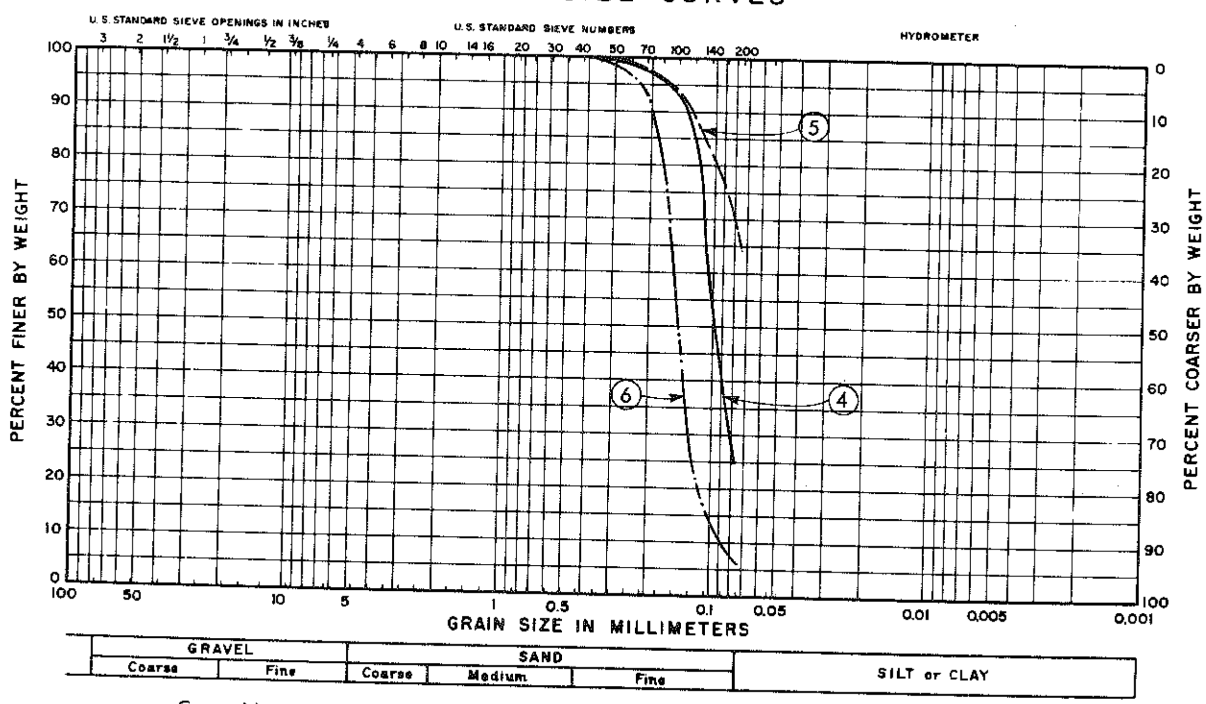
McCLELLAND ENGINEERS

GRAIN SIZE CURVES



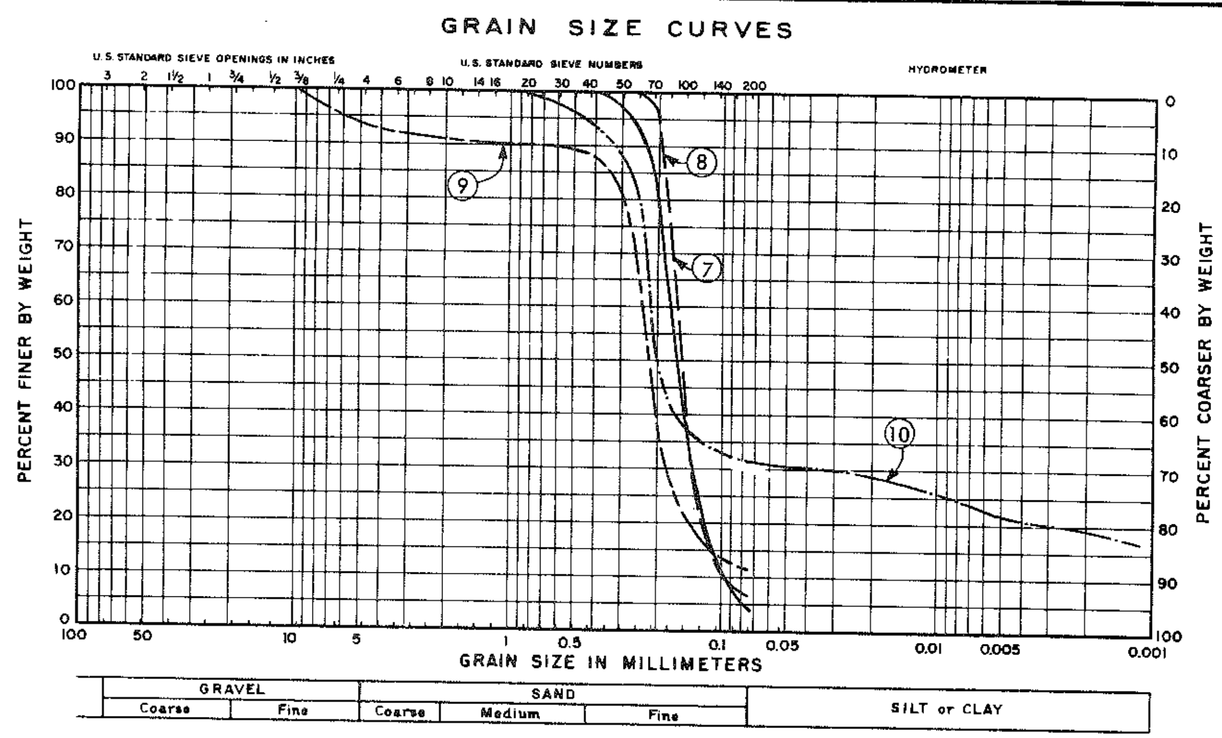
Curve No.	Boring No.	Depth, Ft.	Material
1	P- 1	15	Red silty fine sand with sandstone nodules
2	P- 1	50	Hard brown and gray clay with sand pockets
3	P-23	15	Red and tan sandy clay

GRAIN SIZE CURVES

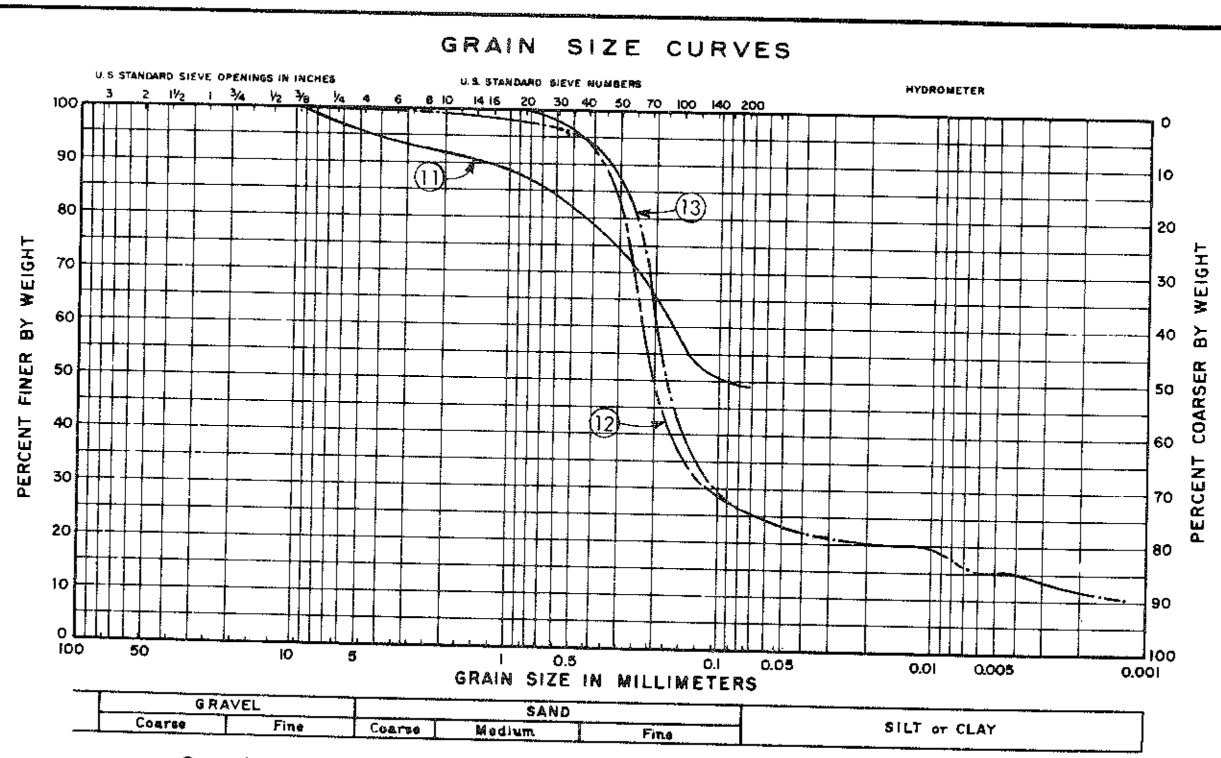


Curve No.	Boring No.	Depth, Ft.	Material
4	P-23	20	Gray silty fine sand
5	P-26	8	Red and tan sandy clay
6	P-26	30	Tan fine sand

McCLELLAND ENGINEERS



Curve No.	Boring No.	Depth, Ft.	Material
7	P-26	50	Tan fine sand
8	P-28	10	Tan fine sand
9	P-33	15.5	Red silty fine sand with ferrous nodules
10	P-34	30	Tan silty fine sand



Curve No.	Boring No.	Depth, Ft.	Material
11	P-34	45	Gray sandy clay
12	P-35	20	Tan silty fine sand
13	P-36	30	Red and tan silty fine sand

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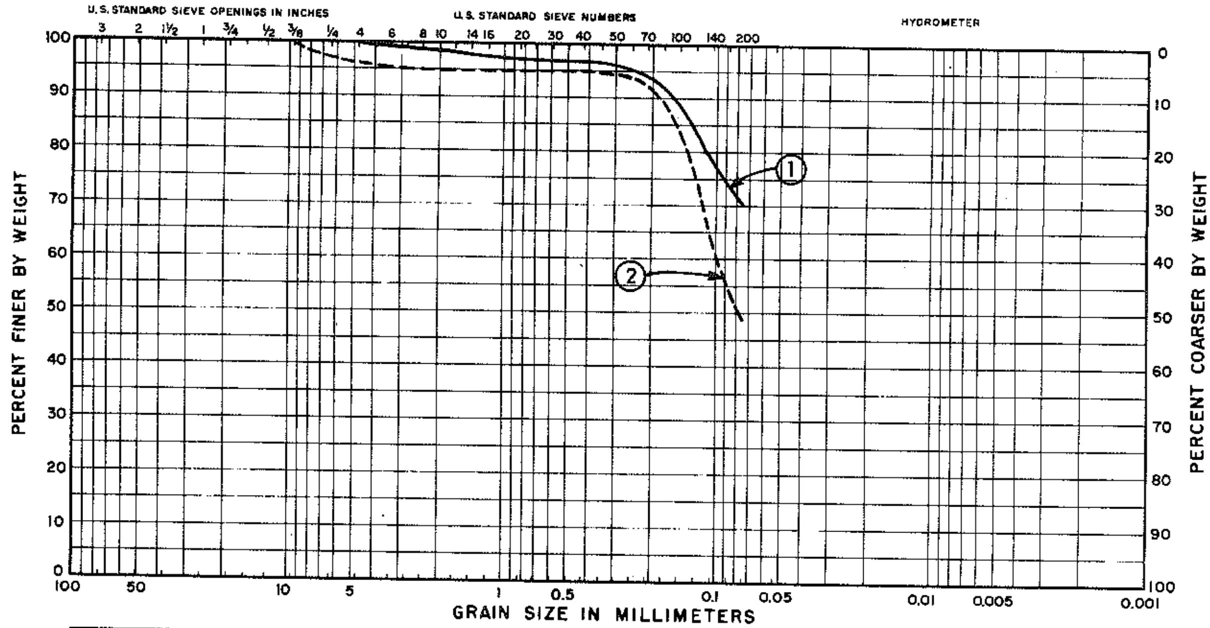
PLATE 59

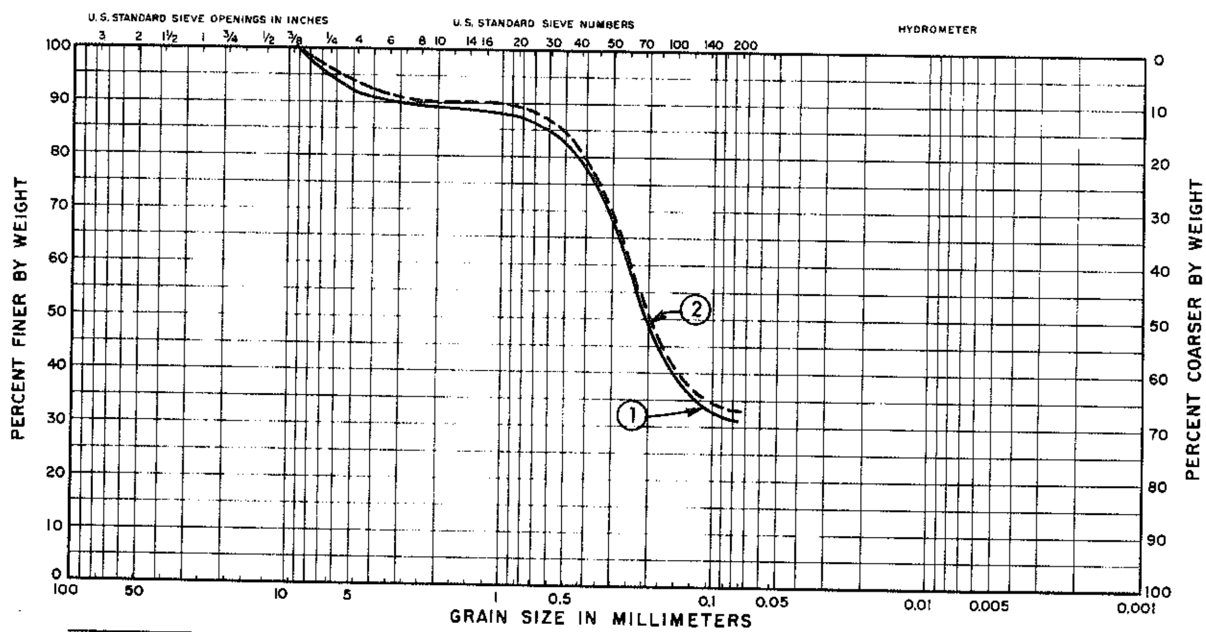
GRAIN SIZE CURVES



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

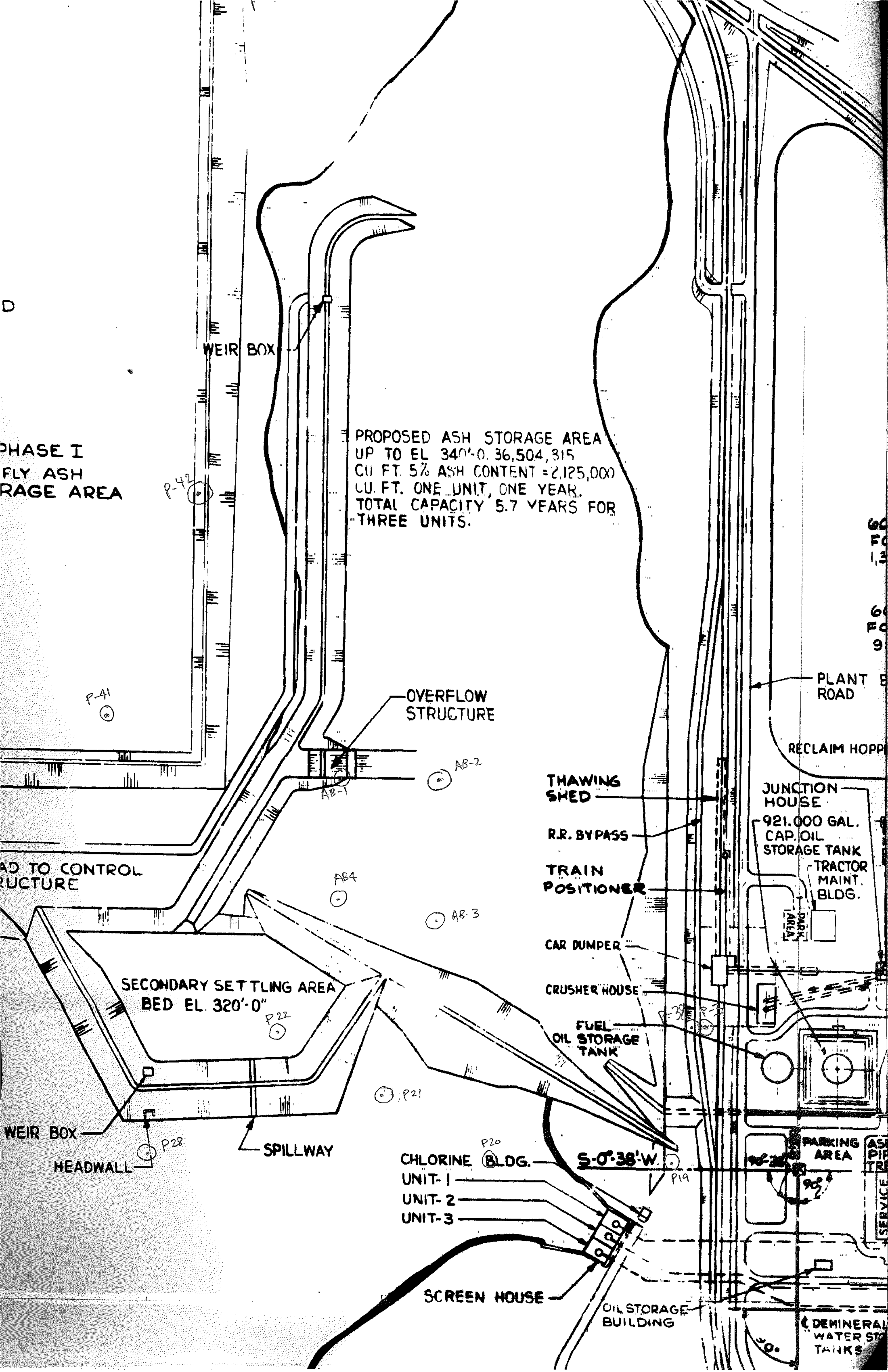
Curve No.	Boring No.	Depth, Ft.	Material
14	P-4	15	Tan silty fine sand with clay seams and gravel
15	P-4	15	Tan silty fine sand with clay seams and gravel

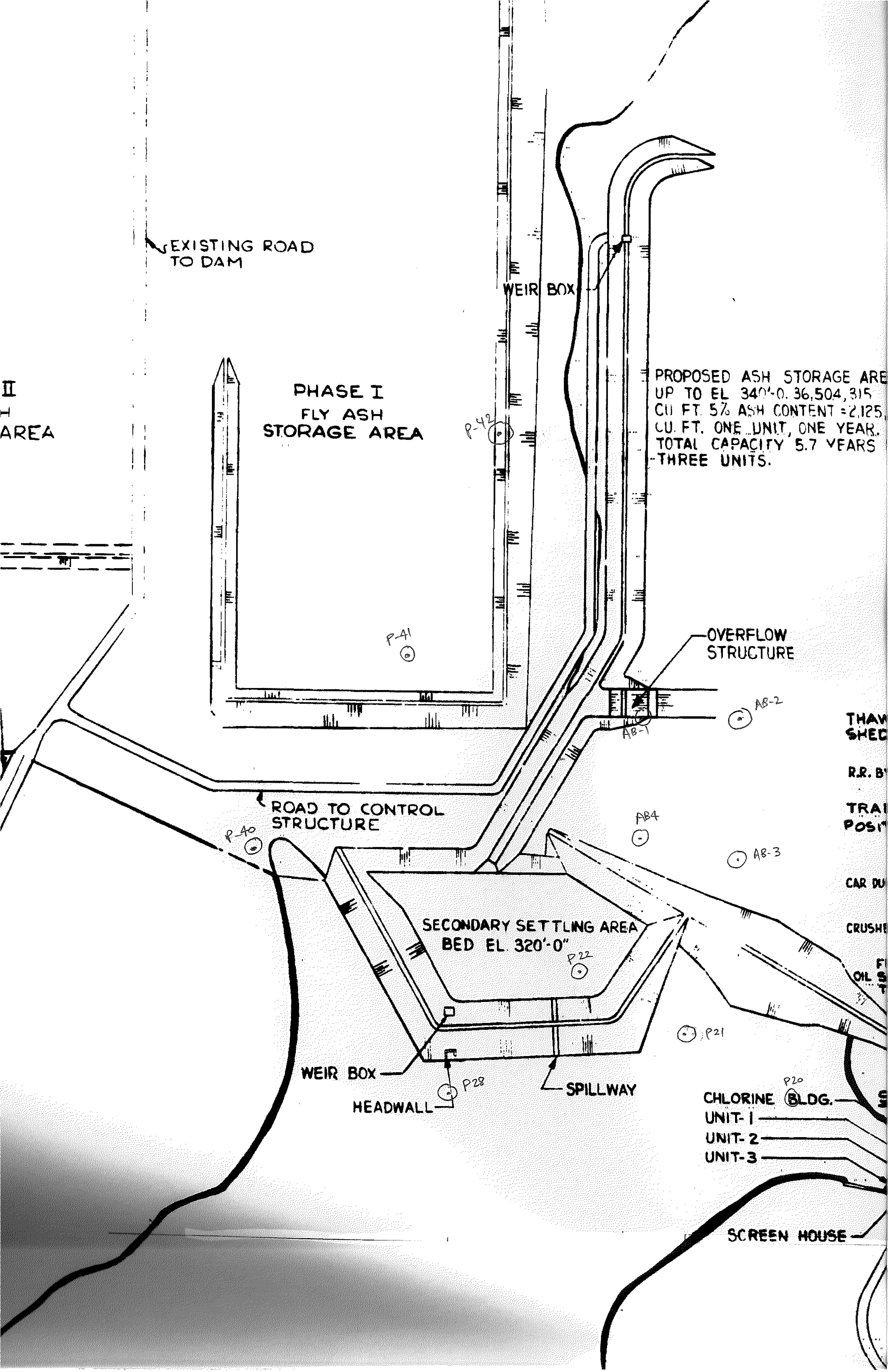
GRAIN SIZE CURVES



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Curve No.	Boring No.	Depth, Ft.	Material
16	P-5	15	Tan silty fine sand with sandstone nodules
17	P-5	15	Tan silty fine sand with sandstone nodules


PHASE I
FLY ASH
RAGE AREA
WEIR BOX
PROPOSED ASH STORAGE AREA UP TO EL 340'-0. 36,504,315 CU FT. 5% ASH CONTENT =2,125,000 CU. FT. ONE UNIT, ONE YEAR. TOTAL CAPACITY 5.7 YEARS FOR THREE UNITS.
P-42
P-41
OVERFLOW STRUCTURE
AB-1
AB-2
AB-3
AB4
AD TO CONTROL
RUCTURE
SECONDARY SETTLING AREA
BED EL. 320'-0"
P22
P21
P28
WEIR BOX
HEADWALL
SPILLWAY
PLANT
ROAD
RECLAIM HOPP
THAWING SHED
R.R. BYPASS
TRAIN POSITIONER
CAR DUMPER
CRUSHER HOUSE
FUEL OIL STORAGE TANK
JUNCTION HOUSE
921,000 GAL. CAP. OIL STORAGE TANK
TRACTOR MAINT. BLDG.
PARK AREA
PARKING AREA
S-0°-38'-W
P19
P20
CHLORINE BLDG.
UNIT-1
UNIT-2
UNIT-3
SCREEN HOUSE
OIL STORAGE BUILDING
SERVICE
DEMINERAL
WATER ST
TANKS


EXISTING ROAD TO DAM
WEIR BOX
PHASE I
FLY ASH
STORAGE AREA
P-42
P-41
II
AREA
PROPOSED ASH STORAGE ARE
UP TO EL 340'-0. 36,504,315
CU FT. 5% ASH CONTENT = 2,125,
CU. FT. ONE UNIT, ONE YEAR.
TOTAL CAPACITY 5.7 YEARS
THREE UNITS.
OVERFLOW
STRUCTURE
AB-2
AB-1
AB4
AB-3
ROAD TO CONTROL
STRUCTURE
P-40
SECONDARY SETTLING AREA
BED EL 320'-0"
P22
P21
WEIR BOX
P28
HEADWALL
SPILLWAY
P20
CHLORINE BLDG.
UNIT-1
UNIT-2
UNIT-3
SCREEN HOUSE
CAR DU
CRUSH
R.R. B

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ASH PIT DIKES
WELSH POWER PLANT - UNIT 1
SOUTHWESTERN ELECTRIC POWER COMPANY

DIVISION 2 - TECHNICAL REQUIREMENTS

SECTION 2-1: EARTHWORK

2-1.1 SECTION SCOPE

2-1.1.1 This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

- 2-1.2 Services of Testing Laboratory
- 2-1.3 Soil Data and Topography
- 2-1.4 Removal of Sod and Topsoil
- 2-1.5 Excavation
- 2-1.6 Compacted Fill
- 2-1.7 Equipment
- 2-1.8 Fill Placement
- 2-1.9 Backfill
- 2-1.10 Excavation & Fill for Corrugated Metal Drainage Piping
- 2-1.11 Drainage Ditches
- 2-1.12 Bedding Course for Riprap
- 2-1.13 Riprap
- 2-1.14 Grading
- 2-1.15 Seeding

2-1.2 SERVICES OF TESTING LABORATORY
Will be furnished by Purchaser for use in connection with controlled compacted fill, as specified in Article 6.2 of Form 1714.

2-1.3 SOIL DATA AND TOPOGRAPHY
As specified in Article 2 of Form 1714. Drawings are included, and borings will be available for inspection at SWEPCo or McClelland Engineers at Houston, Texas.

2-1.4 REMOVAL OF SOD AND TOPSOIL
As specified in Article 4.6 of Form 1714. Stockpile topsoil on site, where and as requested by Purchaser's representative, for later reuse. Dispose of sod on site as requested by Purchaser's representative.

2-1.5 EXCAVATION

2-1.5.1 As specified in Article 5 of Form 1714. Dispose of all excavated materials on site, either as fill material or in stockpile areas, as requested by Purchaser's representative. The Contractor's unit price fo[r] excavation shall be based on a free haul distance of 2000 feet. In the event that the Contracto[r is] required to haul dirt in excess of the 2000 foot free haul distance he shall be paid at the unit p[rice] bid for overhaul per yard - quarter. Item 140 (Overhaul) of the 1972 Texas Highway Standard Spe[c]ification is hereby referenced as the governing specification. The 2000 foot free haul distance is substituted for the 600 foot free haul distance specification in Item 140. Approval and authorizatio[n] in writing from the Engineer must be obtained before payment will be made for overhaul.

2-1.5.2 Area of stockpile shall be cleaned of vegetation and disposed of as specified in Article 4.5 of Form 1714.

2-1.5.3 Dewatering: As specified in Article 5.3 of Form 1714 and as indicated on the design drawings. During course of the WORK, Contractor shall maintain sufficient slope in excavation and on fill area to permit drainage of surface water and maintaining a dry working condition.

2-1.6 COMPACTED FILL

2-1.6.1 Conform to the applicable requirements of Article 6 of Form 1714 and requirements hereinafter specified.

2-1.6.2 Class and Type: One of the following as indicated on the drawings:

a. Class 1, Regular Compacted Fill, Type RCF1, Granular Material.

b. Class 1, Regular Compacted Fill, Type RCF2, Cohesive Material.

c. Class 2, Controlled Compacted Fill, Type CCF1, Granular Material.

d. Class 2, Controlled Compacted Fill, Type CCF2, Cohesive Material.

2-1.6.3 Material: Shall be impervious fill material obtained from excavation and borrow areas on site as indicated on the drawings, or from other approved stockpiles or borrow areas off site. All sources of dike fill shall be designated and approved by the Purchaser's representative. The fill material shall not contain any cobbles or broken rock larger than nine (9) inches maximum dimension at time of placement and compaction.

2-1.6.4 Compaction Densities: Dike fill shall be loosely placed in layers not exceeding ten (10) inches. Each layer of fill shall be thoroughly compacted by means of a sheepsfoot roller or pneumatic tired rollers of adequate capacity and through sufficient coverages to obtain not less than 95 percent of the maximum Modified Proctor density in accordance with ASTM Test D1557, latest edition. Compaction shall be performed within 2-1/2 percent of the optimum moisture content.

2-1.6.5 Disposal of Organic Materials: Vegetation, organic material, and other foreign materials removed in preparation of subgrade, as specified in Articles 6.3.3 and 6.4.3.2 of Form 1714, shall be disposed of on the site as requested by Purchaser's representative.

2-1.6.6 Preparation of Subgrade: Prior to placement of fill material and after stripping, the subgrade shall be compacted (proofrolled) through sufficient passes of an approved sheepsfoot roller capable of densifying the present surface to not less than 90 percent of the maximum Modified Proctor density in accordance with ASTM Test D1557.

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2-1.7 EQUIPMENT

2-1.7.1 Compaction Equipment: Equipment to be used for constructing fill may consist of any type normally considered suitable to construct embankments for dams or highways. Main compaction equipment, including heavy pneumatic tired rollers, sheepsfoot rollers, vibratory compactors, shall be subject to approval of Purchaser's representative.

a. In addition to the foregoing equipment, Contractor shall have the following equipment available at the WORK:

a.1 Power tampers to be used for compaction of material in areas where it is impractical to use a roller or tractor.

a.2 A plain cylindrical roller, weighing not less than 1,000 pounds per lineal foot for rolling the surface of fill smooth for drainage in case of heavy precipitation.

a.3 Discs, harrows, and motor graders for drying and maintaining fill.

2-1.8 FILL PLACEMENT

2-1.8.1 As specified in Paragraph 6.4.5 of Form 1714, and as follows:

a. Distribution and gradation of materials throughout rolled fill shall be such that fill will be free from lenses, pockets, streaks or layers of material differing materially in texture or gradation from surrounding material. Combined excavation and placing operations shall be such that materials when compacted in the fill will be blended sufficiently to secure the best practicable degree of compaction, and stability. Travel on the fill shall be satisfactorily controlled to prevent tracking or cutting fill.

b. Successive loads of material shall be dumped so as to produce the best practicable distribution of material, and for this purpose locations in earth fill where individual loads shall be deposited may be designated. If the surface of any layer of material to be placed thereon has formed a hard over-compacted crust from traffic, it shall be moistened or both moistened and scarified as required before the succeeding layer of material is placed.

c. When rain is expected, and at the end of each working day, fill shall be rolled with a plain cylindrical roller to form a smooth surface with sufficient slope to cause rapid runoff of rainwater. Before resuming placement, this surface shall be scarified and moistened, as required. If Purchaser's representative determines that the rolled surface of any layer of earth fill in place is too wet for proper compaction of fill thereon, it shall be removed, allowed to dry, or shall be worked with a harrow, scarifier or other suitable equipment, to reduce water content to the required amount, and then shall be recompacted. Do not place the next succeeding layer of fill until approval to proceed is given by Purchaser's representative and the Consulting Engineers.

d. All openings through embankments required for construction and temporary drainage purposes shall be subject to approval. Approach or construction ramps for dikes and embankments shall be removed and those on the outside face shall be removed and/or trimmed, as requested.

2-1.9 BACKFILL

2-1.9.1 As specified in Article 7 of Form 1714.

2-1.9.2 Material shall be same as indicated in Article 2-1.6.3 for Compacted Fill.

2-1.10 EXCAVATION AND FILL FOR CORRUGATED METAL DRAIN PIPING

As specified in Article 9 of Form 1746.

2-1.11 DRAINAGE DITCHES

Cut and/or fill drainage ditches (if required) to cross sections and profiles indicated on the drawings. All surfaces shall be well compacted.

2-1.12 BEDDING COURSE FOR RIPRAP

2-1.12.1 Material: Bedding shall consist of a clean, well graded mixture of sand and gravel, crushed stone or crushed gravel conforming to the following gradation limits:

Sieve Size	% Passing by Weight
3"	100
1½"	65-85
#4	40-60
#40	20-35
#50	15-25
#100	0-15
#200	0-5

2-1.12.2 Placing: Place by approved means to the minimum thickness indicated on the drawings.

2-1.13 RIPRAP

2-1.13.1 Material:

a. Riprap shall consist of quarried stone, or other stone, free from structural defects and of approved quality. Stone containing shale, unsound sandstone or any other material which will readily disintegrate under handling and placing or weathering, shall not be used. Any stone which is free from incipient fractures and seams and has given evidence of ability to withstand weathering after long exposure to the elements shall be considered suitable for this purpose. Upon presentation of satisfactory evidence of ability to withstand weathering, such stone may be used without laboratory testing.

b. In case newly quarried stone or stone of questionable weathering quality is proposed, it shall be subjected to the sodium sulphate soundness test and shall show a loss, after cycles, of not more than 25 percent. Materials failing this test may be approved if, when subjected to fifty cycles of freezing and thawing, it has a loss not greater than 25 percent. Soundness method AASHO T104 (ASTM C88), "Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate" or T103, "Method of Test for Soundness of Aggregates by Freezing and Thawing" shall be used.

c. The moist unit weight of riprap shall not be less than 164 pounds per cubic foot.

2-1.13.2 <u>Size and Gradation</u>

a. Riprap shall be reasonably well graded and quarried stone shall have a gradation conforming to the following weight limits:

a.1 Maximum size....................................450 lbs.

a.2 At least 25 percent greater than..............200 lbs.

a.3 45 percent - 75 percent from - to.............80-120 lbs.

a.4 Not more than 25 percent less than............50 lbs.

a.5 Sand and rock dust not more than..............5 percent

b. The shortest dimension of any stone shall be not less than 1/3 of the longest dimension for at least 60 percent of the riprap. For the balance, the shortest dimension shall be not less than 1/5 of the longest dimension.

c. Alternate sizes and gradations will be considered for the WORK if they will achieve the desired performance at less cost. If an alternate is proposed, size and gradation of alternate shall be stated in the Bid Proposal, together with the price saving.

2-1.13.3 Placing:

a. Riprap shall be placed by dragline, clamshell or similar equipment which shall be operated so as to place each load of material in approximately its final position without further reworking, and without excessive height of drop.

b. Placement operations, including handling, stockpiling and transporting, shall be accomplished in such manner so as to produce a reasonably well graded mass of rock with minimum percentage of voids, free from objectionable pockets of small stones and clusters of large stones and having a reasonably regular finished surface.

c. Riprap shall be placed on the face of the dikes to the lines and grades and to the minimum thickness indicated on the drawings. The riprap shall be placed to this full minimum thickness in one operation. Thickness shall not be less than the minimum at any point. Hand placing to a limited extent may be required, but only to the extent necessary to secure results specified foregoing.

d. In no case shall a bulldozer be used in shaping the riprap slopes.

2-1.14 GRADING

As specified in Article 8 of Form 1714, and as indicated on the drawings.

2-1.15 SEEDING

2-1.15.1 All slopes and surfaces, as indicated on the drawings, shall be seeded as hereinafter specified.

2-1.15.2 Topsoil:

a. Material: Approved topsoil from topsoil previously excavated and stockpiled on the site or approved topsoil from sources off the property or both.

b. Placing:

b.1 Spread topsoil evenly to a depth which, after settlement and compaction, shall be 4 inches. Do not spread when ground or topsoil is excessively wet or otherwise in any condit on detrimental to the work; if existing surface has become hardened or crusted, rake or otherwise break up to provide bond with layer of topsoil.

b.2 After spreading has been completed, rake up and remove large clods, stones larger than 2 inches in any dimension, roots, stumps, and other litter or deleterious material.

b.3 Completed finish grading shall provide a smooth grade, true to indicated elevations, cross sections and profiles, properly drained and free from pockets or high spots, and as approved for subsequent fertilizing and seeding operations as hereinafter specified.

2-1.15.3 Fertilizing:

a. Material: Ready-mixed material having an analysis of 16-8-8 nitrogen, available phosphoric acid and water soluble potash. Deliver to job in sealed containers with weight, analysis, and name of manufacturer clearly indicated on each container.

b. Storage: Store in such a manner as will not impair fertilizer's effectiveness.

c. Coverage: 300 lbs. per acre.

2-1.15.4 Seeding:

a. Seeding Time: Do fertilizing and seeding as soon as possible after completion of finish topsoil work. However, do no fertilizing or seeding during windy weather or when ground is wet or in an otherwise untillable condition.

b. Seed:

b1. Seed shall be un-Hulled Bermuda and Rye grass with purity and germination of 95 and 90, respectively.

b2. Coverage: Bermuda 5 lbs. per 1000 SY - Rye grass 21 lbs. per 1000SY

b3. All seed shall comply with all applicable laws and regulations of the State of Texas and of U.S. Department of Agriculture.

c. Have seed delivered to job in sealed containers.

d. Furnish to Purchaser duplicate signed copies of statement by seed vendor that each lot of seed has been tested by a recognized laboratory for seed testing within six months of date of delivery, and complies with all requirements for the specified seed.

e. Protection: Immediately after seeding, cover seeded areas with two (2) tons per acre of straw mulch and anchor this by spraying with cutback asphalt (RC-3) at the rate of .10 gallon per sq. yd.

f. Sowing and Maintaining, Etc.: Methods of preparation of seed beds, fertilizing, seeding, sprinkling, maintaining, repair, and reseeding as required will be at option of Contractor. Work shall not be considered complete until after a uniform and dense stand of healthy grass has been produced in accordance with these specifications, free from bare spots and gullies formed by erosion, and when accepted in writing by Purchaser.

Ash Pit Dikes

2-1.15.5

Estimated Quantities:	1,000	cubic yards excavation (common)
	97,000	cubic yards excavation (core trench)
	100,000	cubic yards excavation (discharge flume)
	160,000	cubic yards embankment (density control)
	19,000	square yards rip-rap (rock) (Layered rock 12" thick on 6" depth gravel base and 4" thick sand base)
(Alternate:)	19,000	square yards rip-rap (Conc. Cl. B) - Same ba
	10,000	square yards topsoil (4" thick layer)
	10,000	square yards fertilizing, seeding, mulching, and watering

Basis for Payment:

Price per cubic yard excavation (common)
Price per cubic yard excavation (core trench)
Price per cubic yard excavation (discharge flume)
Price per cubic yard embankment (density control)
Price per yard - quarter - overhaul
Price per square yard rip-rap (rock)

(Alternate:) Price per square yard rip-rap (Conc. Cl. B)

Price per square yard 4" layer of topsoil
Price per square yard fertilizing, seeding, mulching, and watering.

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ASH PIT DIKES
WELSH POWER PLANT - UNIT #1
SOUTHWESTERN ELECTRIC POWER COMPANY

DIVISION 2 - TECHNICAL REQUIREMENTS

SECTION 2-2: CLEARING AND GRUBBING

2-2.1 SECTION SCOPE

2-2.1.1 This Section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated, or as required to properly complete the WORK:

2-2.1.2 Requirements of Division 1, General Requirements, also apply to the WORK under this Section 2-2.

2-2.2 TREE REMOVAL AND CLEARING

2-2.2.1 Conform to applicable requirements of Article 4 of Form 1714, and to requirements hereinafter specified.

2-2.2.2 Tree Removal:

a. Clear and grub all trees in the following areas.

1. Dike borrow areas.

2. Within the toes (the entire base) of lake and ash pond dikes.

b. All other trees within the lake and ash pond dikes shall be shear dozed at ground level.

c. Remove and dispose of off the site all partially buried logs, down timber, snags, brush, hedges, bushes and all other vegetation or organic material, all rubbish, debris and other foreign or objectionable material above ground surface.

d. Remove all floating debris in swampy areas and dispose of off site. Cut all trees in swampy areas as directed by Owner's Engineer.

2-2.2.3 CLEARING

a. Contractor shall have full property rights to all timber cut by him, and may sell, off the site only, all merchantable timber which he cuts. Merchantable timber may be processed either on the site or off the site, as agreed to with Purchaser, but shall all be removed from the site before completion of the WORK.

2-2.2.4 ESTIMATED QUANTITY: 32 acres clearing
20 acres clearing and grubbing

2-2.2.5 BASIS FOR PAYMENT: Price per acre clearing
Price per acre clearing and grubbing

ASH PIT DIKES
WELSH POWER PLANT - UNIT #1
SOUTHWESTERN ELECTRIC POWER COMPANY

DIVISION 2 - TECHNICAL REQUIREMENTS

SECTION 2-4: CONCRETE WORK

2-4.1 SECTION SCOPE

2-4.1.1 This Section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

- 2-4.2 Services of Testing Laboratory
- 2-4.3 Class of Concrete
- 2-4.4 Cement
- 2-4.5 Fly Ash
- 2-4.6 Water-Reducing Admixtures
- 2-4.7 Reinforcing Steel
- 2-4.8 Formwork
- 2-4.9 Cold Weather Placing of Concrete
- 2-4.10 Hot Weather Placing of Concrete
- 2-4.11 Concrete Finishes

2-4.1.2 Requirements of Division 1, General Requirements, also apply to the WORK under this Section 2-4.

2-4.2 SERVICES OF TESTING LABORATORY

These services will be furnished by Purchaser, as specified in Article 9 of Form 1715.

2-4.3 CLASS OF CONCRETE

Class AA (air-entrained), as specified in Article 8 of Form 1715 for all WORK, unless otherwise indicated.

2-4.4 CEMENT

2-4.4.1 Type: As specified in Item 15-1A, Table 15-1 of Form 1715.

2-4.4.2 Brand and Source: Only one brand and source of cement shall be used for all concrete WORK.

2-4.5 FLY ASH

2-4.5.1 Material: As specified in Item 15-B, Table 15-1 of Form 1715, except that the ASTM Standard Specification Designation shall be revised to ASTM C618, "Fly Ash and Raw or Calcined Natural Pozzolans for Use in Portland Cement Concrete" and the Pozzolan Class shall be Type F.

2-4.5.2 After source of fly ash has been initially approved, changing of source of fly ash will not be permitted without approval of the Consulting Engineers.

2-4.6 <u>WATER-REDUCING ADMIXTURES</u>
Use of <u>any</u> water-reducing admixtures will <u>NOT BE PERMITTED</u>.

2-4.7 <u>REINFORCING STEEL</u>

2-4.7.1 <u>Reinforcing</u>: Domestic steel. Conform to requirements specified in Item 15-1E, Table 15-1 of Form 1715, except steel shall conform to the applicable requirements of ASTM A615, Grade 60.

2-4.2 <u>Splice Requirements</u>: In place of splice requirements specified in Item (2), Table 15-29, Page 15-6 of Form 1715, splice requirements indicated in the "Reinforcement Lap Splice Schedule" on the drawings shall govern. Reinforcing shop drawing setting plans for the work shall also clearly indicate length of lap for each bar.

2-4.7.3 <u>Heating of Reinforcing</u>: Heating of reinforcing for bending or for any other purposes <u>will not be permitted</u>.

2-4.8 <u>FORMWORK</u>
In addition to requirements of Article 5 of Form 1715, also conform to applicable requirements of ACI 347, "Recommended Practice for Concrete Formwork".

2-4.9 <u>COLD WEATHER PLACING OF CONCRETE</u>

2-4.9.1 In place of requirements specified in Paragraph 10.5 Article 10 of Form 1715, the requirements of ACI 306, "Recommended Practice for Cold Weather Concreting" shall govern cold weather placing of concrete, unless otherwise indicated.

2-4.9.2 Attention is especially directed to Table 1.4.1 of ACI 306 for minimum and maximum temperatures of material and of concrete.

2-4.9.3 The use of salts or other chemicals as an accelerating admixture to concrete to prevent freezing and develop strength of concrete in a shorter period of time as specified in Chapter 6 of ACI 306 <u>will not be permitted</u>.

2-4.10 <u>HOT WEATHER PLACING OF CONCRETE</u>
Conform to applicable requirements specified in Article 10.6 of Form 1715 for hot weather placing of concrete.

2-4.11 <u>CONCRETE FINISHES</u>
As specified in Article 11 of Form 1715 and as indicated on the drawings.

ASH PIT DIKES
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DIVISION 2 - TECHNICAL REQUIREMENTS

SECTION 2-5: GROUT WORK

2-5.1 SECTION SCOPE

2-5.1.1 This Section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

- 2-5.2 General
- 2-5.3 Antifreeze Solution for Anchor Bolt Sleeves (If Required)
- 2-5.4 Cold Weather Grouting
- 2-5.5 Hot Weather Grouting
- 2-5.6 Curing

2-5.1.2 Requirements of Division 1, General Requirements, also apply to the WORK under this Section 2-5.

2-5.2 GENERAL

2-5.2.1 Provide all grout required for the WORK, including, but not limited to grout for the following:

a. Anchor bolt sleeves.

b. Base plates.

2-5.2.2 Furnish, install and strip all formwork required for grout work.

2-5.3 ANTIFREEZE SOLUTION FOR ANCHOR BOLT SLEEVES (IF REQUIRED)

Place antifreeze solution for anchor bolt sleeves, as specified in Form 1737 and Article 11.1.4 of Form 1742, in all anchor bolt sleeves.

2-5.4 COLD WEATHER GROUTING

Conform to same requirements specified for cold weather placing of concrete in Article 2-4.9 of Section 2-4.

2-5.5 HOT WEATHER GROUTING

Conform to same requirements specified for hot weather placing of concrete in Article 2-4.10 of Section 2-4.

2-5.6 CURING

Use membrane curing, as specified for concrete work in Article 12 of Form 1715, in place of water curing as specified in Form 1741.

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DIVISION 2 - TECHNICAL REQUIREMENTS

SECTION 2-6: MISCELLANEOUS METALWORK AND EMBEDDED WORK

2-6.1 SECTION SCOPE

2-6.1.1 This Section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

2-6.2 General
2-6.3 Services of Testing Laboratory
2-6.4 Welding
2-6.5 Materials and Fabrication
2-6.6 Galvanizing
2-6.7 Prime Coat Cleaning and Painting

2-6.1.2 Requirements of Division 1, General Requirements, also apply to the WORK under this Section 2-6.

2-6.2 GENERAL

2-6.2.1 Work Included: Provide all applicable work included under Article 4 of Form 1742 and all similar work herein specified or indicated on the drawings.

2-6.2.2 Extent of Galvanizing: Galvanize all miscellaneous steelwork (except cast iron). For galvanizing requirements see Article 2-6.6.

2-6.3 SERVICES OF TESTING LABORATORY
Will be furnished by Purchaser for inspection of the following:

2-6.3.1 Materials: As specified in Article 7 of Form 1742.

2-6.3.2 Welding: As specified in Article 10 of Form 1701.

2-6.4 WELDING
Conform to applicable requirements of Form 1701.

2-6.5 MATERIALS AND FABRICATION

2-6.5.1 Material: ASTM A36 unless otherwise indicated; however, the use of Bessemer steel not permitted.

2-6.5.2 Anchor Bolts:

a. Contractor shall provide all anchor bolts required for the WORK, as specified in Article 11.1.2 of Form 1742, except that material shall be ASTM A36 for threaded rods and ASTM A307 for headed bolts and for all nuts for ASTM A36 threaded rods and ASTM A307 headed bolts.

b. Plugs: In place of hardwood plugs indicated in Form 1737, or on drawings, provide plastic plugs at top of sleeves with center opening 1/8 in. smaller in diameter than bolt size to insure tight weather-tight fit; shop or field punch or drill openings. Type and make of plastic plugs shall be as specified in Item 3, Table 07-4 of Form 1707.

c. Heating and Welding: Heating of <u>any</u> anchor bolt <u>in the field</u> for bending or other purposes will <u>not be permitted</u>, except that nuts for threaded rods or heads of headed bolts may be tack welded to the plate washers used for embedment in concrete.

2-6.5.3 <u>Expansion Anchors</u> Self-drilling type as specified in Item 8, Table 07-4 of Form 1707.

2-6.5.4 <u>Embedded Steel Plates</u>: Provide 4 nailing holes in each plate to permit ready attachment to formwork.

2-6.5.5 <u>Sluice Gates</u>: As indicated on the drawings.

2-6.5.6 <u>Stop Log Guides</u>: Conform to the applicable requirements of Form 1743.

2-6.5.7 <u>Stop Logs</u>: As specified in Article 8 of Form 1743 and as indicated on the drawings.

2-6.5.8 <u>Guardrails</u>: As specified in Paragraph 20.9 of Form 1742 and as indicated on the drawings.

2-6.6 <u>GALVANIZING</u>
As specified in Article 24 of Form 1742.

2-6.7 <u>PRIME COAT CLEANING AND PAINTING</u>

2-6.7.1 <u>Intent</u>: Clean and paint all ferrous metals, as specified in Article 3 of Form 1790, except the following:

a. Cast iron.

b. Galvanized steel (except for field touch-up).

2-6.7.2 <u>Shop Work</u>: As specified in Article 25 of Form 1742.

2-6.7.3 <u>Field Work for Ferrous Metals</u>: As specified in Articles 11, 12, 13 and 15 of Form 1790, as applicable.

SARGENT & LUNDY
ENGINEERS
CHICAGO

ASH PIT DIKES
WELSH POWER PLANT - UNIT #1
SOUTHWESTERN ELECTRIC POWER COMPANY

DIVISION 2 - TECHNICAL REQUIREMENTS

SECTION 2-7: DRAINAGE WORK

2-7.1 SECTION SCOPE

2-7.1.1 This Section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

2-7.2 General
2-7.3 Galvanized Corrugated Metal Drainage Piping
2-7.4 Manholes

2-7.1.2 Requirements of Division 1, General Requirements, also apply to the WORK under this Section 2-7.

2-7.2 GENERAL
All drainage work shall conform to applicable requirements of "The American Association of State Highway Officials", as indicated on the drawings and as hereinafter specified.

2-7.3 GALVANIZED CORRUGATED METAL DRAINAGE PIPING

2-7.3.1 Type: Riveted galvanized corrugated metal pipe (CMP), conforming to applicable requirements of AASHO M36, or helically corrugated galvanized metal culvert pipe, conforming to applicable requirements of AASHO M36 and to requirements hereinafter specified.

2-7.3.2 Manufacturers: Provide one of the following types and makes:

a. Standard Armco............ Armco Metal Products Division of Armco Steel Corporation

b. Corrugated................ Republic Steel Corporation

c. Corrugated................ Wheeling Corrugating Company

2-7.3.3 Shape and Material: Round pipe or pipe-arch, sizes and gauges, as indicated on the drawings. Base metal copper bearing steel with copper content 0.20% minimum.

2-7.3.4 Fabrication:

a. Riveted Pipe: As specified in AASHO M36.

b. Helically Corrugated Pipe:

b1. As specified in AASHO M36.

b2. Corrugation pitch 2-3/4 in.; corrugation depth not less than 7/16 in. Seams continuous lock or weld type extending from end to end of pipe. Fabricate seams in such manner as not to affect shape or nominal diameter of pipe nor to create an element of weakness in pipe.

2-7.3.5 Fittings: Provide standard fabricated fittings as indicated or as required.

2-7.3.6 Accessories: Provide standard belted coupling bands, bolts and all other accessories required for a complete installation.

2-7.3.7 Installation: In strict accordance with manufacturer's instructions, as approved, in accordance with applicable requirements of National Corrugated Metal Pipe Association Installation Manual and in accordance with the following requirements:

a. Excavation and Fill:

a1. Normally excavate trenches to match curve of pipe. Flat beds may also be used if as economical as curved beds.

a2. Curved Beds: Bed pipe evenly and firmly for width of 100% of pipe breadth.

a3. Flat Beds:

a3.1 After pipe in place on flat bed, provide well compacted granular fill under haunches. Use clean crushed stone, gravel or coarse sand, or other approved material, with 1½ in. maximum size.

a3.2 Provide same granular fill up to center line of pipe. Place in layers not exceeding 12 in. in depth before compaction.

a4. Fill above center line and up to grade with select, granular material, as approved and thoroughly compact. Place in layers as specified foregoing.

a5. Use fill material free of rocks, hard lumps, or clods larger than 3 in. Do not use sod, cinders or frozen fill.

a6. Use extreme care in placing all compacted fill to maintain fill at approximately the same level (not to exceed one foot differential) on both sides of pipes throughout entire placing of compacted fill.

b. Joints: Securely bolt all joints.

c. Provide beveled end section where indicated.

2-7.4 MANHOLES

2-7.4.1 Construct manholes of precast concrete, complete with cast iron frames and covers, steps, etc., as indicated on the drawings and as hereinafter specified.

2-7.4.2 Precast Concrete Manholes:

a. Type: Precast reinforced concrete ring type with precast reinforced concrete base and with rubber "O-Ring" or flat type rubber compression joints, conforming to applicable requirements of ASTM C478, "Specifications for Precast Reinforced Concrete Manhole Risers and Tops" and to requirements hereinafter specified.

b. Manufacturers: Provide precast elements and joint material as made by one of the following manufacturers:

b1. Continental Concrete Pipe Corporation.

b2. International Pipe & Ceramics Corporation (Lock-Joint Pipe Products).

b3. Concrete Pipe Division of Vulcan Materials Company.

b4. Material Service Division of General Dynamics Corporation.

c. Loading: Design manholes and catch basins for H-20 truck loading.

d. Precast Elements:

d1. Base: Closed-end pipe type with bell end.

d2. Ring Sections for Walls: Provide in multiples of 8 in. in height, with tongue and groove joints as required by depth of each manhole. Wall thickness for rings shall be 4 in. for 36 in. diameter manholes and 5 in. for 48 in. diameter manholes.

d3. Top section shall be eccentric cone type with minimum wall thickness of 4 in. for 36 in. diameter manholes and 5 in. for 48 in. diameter manholes, or shall be flat slab type not less than 8 in. thick, as indicated on drawings or as required by manhole depth. Arrange both types for taking cast iron manhole frame and cover.

d4. Rings and top cone shall have precast openings for field installation of cast iron steps and for all required drain pipes entering manholes.

e. Joints: Rubber "O-Ring" or flat type rubber compression type, with manufacturer's standard rubber ring. Mortar joints may be used if specifically approved.

2-7.4.3 Frames, Covers and Steps:

a. Cast iron, as made by one of the following:

a1. Neenah Foundry Company.

a2. James B. Clow & Sons.

b. Coating: Coat uniformly with coal tar pitch varnish.

c. Type: As indicated on the drawings.

2-7.4.4 Installation of Manholes:

a. Subgrade shall be level and free of projecting stones, rocks, etc.

b. Place a layer of sand, not less than 4 in. thick, over subgrade before installing precast base. Exercise care to install base dead level and with full bearing throughout on sand cushion, to insure that completed catch basins are plumb.

c. Installation of sections, using rubber rings, in strict accordance with manufacturer's instructions, as approved.

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JOB SPECIFICATIONS
FOR
EXCAVATION & EMBANKMENT FOR GENERATING PLANT AREA

GENERAL DESCRIPTION

The Generating Plant Area is a part of the plant site. As stated in the Technical Specifications TS-1 covering plant site grading, and shown by the drawings, grubbing, removing and stockpiling of topsoil, and general grading for the plant area under discussion have been performed. These items are included in the pay item quantities outlined under TS-1.

The Contractor shall be required to accomplish the excavation and embankment in the Generating Plant Area to line and grades as shown by drawings, S-148 and S-149, and in accordance with the following specification and Sargent & Lundy's Standard Specification for Earthwork (Form 1714).

EXCAVATION & EMBANKMENT FOR
GENERATING PLANT AREA- CONT'D

1. EARTHWORK

A. The excavation and embankment shall be formed to the sections, slopes and dimensions as shown by Drawings S-148 and S-149.

B. Sections, slopes and dimensions may be changed by the Engineer at his discretion.

C. The Contractor shall be especially careful to slope the excavation in the generating plant area in such a manner to maintain the backslopes with a minimum difficulty. It shall be the responsibility of the Contractor to determine the backslope necessary for the particular soils encountered. However, the slope shall not be steeper than 2:1 (2 horizontal to 1 vertical).

D. The fill material to construct the embankment for the Generating Plant Area shall be excavated from sources designated by the Engineer. A select material as outlined under Form 1714 of these specifications is required. If possible, the select material will be designated in such a manner that it may be obtained in conjunction with the grading of the Plant Site. Prior to starting the embankment for the area under discussion, the Contractor shall consult with the Engineer to determine the source of the fill material. Any fill placed without prior approval of the Engineer shall be removed and replaced as directed by the Engineer at the Contractor's expense.

E. The embankments required under this section shall start from a firm compacted surface from which muck vegetation and other unsuitable material shall have been removed. It shall be compacted to the density required for the embankment.

F. Any unsuitable material excavated in the process of obtaining the select material required shall be placed as directed by the Engineer.

EXCAVATION & EMBANKMENT FOR
GENERATING PLANT AREA - CONT'D

G. The embankment shall be loosely placed in layers not exceeding ten (10) inches. Each layer of fill shall be thoroughly compacted obtaining not less than 95% of the maximum Modified Procter density inaccordance with ASTM test D1557, latest addition. Compaction shall be performed within 2½% of the optimum moisture content.

H. The Contractor shall be required to excavate the area as shown by the referenced drawings in such a manner that will permit drainage of surface water and maintaining a dry area. Article 5.3 of Form 1714 shall apply.

I. When material varies from optimum moisture content, it shall be treated as follows: When wet, it shall be drained or worked until optimum moisture content is attained. When dry it shall be sprinkled with water and mixed until optimum moisture content is attained.

J. The Contractor's unit price for excavation shall be based on a free haul distance of 2000 feet. In the event that the Contractor is required to haul dirt in excess of the 2000 foot free haul distance he shall be paid at the unit price bid for overhaul per yard - quarter. Item 140 (Overhaul) of the 1972 Texas Highway Standard Specification is hereby referenced as the governing specification. The 2000 foot free haul distance is substituted for the 600 foot free haul distance specification in Item 140. Approval and authorization in writing from the Engineer must be obtained before payment will be made for overhaul.

K. Estimated Quantities:

105,000 cubic yards - excavation

86,000 cubic yards - embankment

L. Basis for Payment:

Price per cubic yard excavation
Price per cubic yard embankment
Price per yard-quarter overhaul

QUANTITIES SUMMARY SHEET
(For Contractor's Information)

Item No.	Description	Unit	Plant Site Area	RR Bed Const.	Ash Pit and Dikes	Excav. & Emb.-Gen. Plan	Total Estimated Quantity
1.	Clearing	Acre	---	---	32	---	32
2.	Clearing & Grubbing	Acre	21	10	20	---	51
3.	Re-Grubbing	LS	180 Ac.	---	---	---	180 Ac.
4.	Excav. (Comm. Unclassified)	CY	543,000	126,000	1,000	105,000	775,000
5.	Excavation(Core Trench)	CY	---	---	97,000	---	97,000
6.	Excavation (Discharge Flume)	CY	---	---	100,000	---	100,000
7.	Stockpile Topsoil	CY	30,000	15,000	2,000	---	47,000
8.	Embankment (Density Control)	CY	335,000	104,000	160,000	86,000	685,000
9.	Overhaul	YQ	40,500	20,500	12,500	43,000	116,500
10.	Placing 96" dia. Steel Conduit	LF	220	---	---	---	220
11.	Structural Excavation (Culverts)	CY	1,550	450	---	---	2,000
12.	Concrete (C. I. A.) (Headwalls)	CY	35	20	---	---	55
13.	CMP (8 gauge)(Bitum. Coated)(72" dia.)	LF	---	270	---	---	270
14.	CMP (8 gauge)(Bitum. Coated)(60" dia)	LF	304	---	---	---	304
15.	CMP (10 gauge)(Bitum. Coated)(48" dia.)	LF	72	---	---	---	72
16.	CMP (12 gauge)(Bitum. Coated)(36" dia.)	LF	328	---	---	---	328
17.	CMP (12 gauge)(Bitum. Coated)(30" dia.)	LF	120	---	---	---	120
18.	CMP (14 gauge)(Bitum. Coated)(24" dia.)	LF	116	---	124	---	240
19.	CMP (Arch)(36"x22")(14 gauge)(Bitum. Coated)	LF	84	36	---	---	120
20.	CMP (Arch)(22"x13")(14 gauge)(Bitum. Coated)	LF	70	---	---	---	70
21.	Rip-Rap (Rock)	SY	---	---	19,000	---	19,000
22.	Placing Topsoil (4" Compact.)	SY	---	130,000	10,000	---	140,000
23.	Erosion Control (Seeding, Fertilizing, mulching, and watering)	SY	---	130,000	10,000	---	140,000
21-Alt.	Rip-Rap (Con. Cl. B)(4")	SY	---	---	19,000	---	19,000

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ENGINEERS
CHICAGO

STANDARD SPECIFICATION FOR EARTHWORK

(Form 1714)

1. GENERAL

1.1 Earthwork shall conform to the requirements of this Standard Specification, the Job Specification, and the design drawings. In the event of variance between this Standard Specification and the Job Specification or design drawings, the Job Specification and the design drawings shall take precedence.

1.2 Where the terms "as indicated" or "indicated" are used in this Standard Specification, they shall mean "as shown, noted, called for or specified".

1.3 All references to the following publications are to the latest issue of each, together with the latest additions and/or amendments thereto, as of the date of Contract, unless otherwise indicated; references to the sponsoring agencies will be made in accordance with the abbreviations indicated:

1.3.1 ASTM .... American Society for Testing and Materials Standard Specifications.

1.3.2 ASA .... American Standards Association Standard Specifications.

1.3.3 AASHO .... American Association of State Highway Officials Standard Specifications.

2. SOIL DATA AND TOPOGRAPHY

2.1 Soil Data: Drawings show borings made at site, and logs given thereon indicate character of soil. This information furnished for Contractor's convenience; in using it Contractor assumes the risk, as Purchaser and the Consulting Engineers assume no responsibility for accuracy of information shown thereon. Contractor will be permitted to make his own soil investigations, but same shall be made at no cost to Purchaser.

2.2 Topography: Drawings indicate elevations, dimensions and/or cross sections, profiles and contour lines of existing ground. This information furnished for Contractor's convenience; in using it Contractor assumes the risk, as Purchaser and the Consulting Engineers assume no responsibility for accuracy of information shown thereon. Contractor will be permitted to make his own investigation of topography during bid period, but same shall be made at no cost to Purchaser.

3. LINES AND GRADES

3.1 Contractor shall lay out lines and grades from existing base lines and bench marks on property and be fully responsible for correctness of such lines and grades and for proper execution of WORK to such lines and grades.

3.2 Purchaser reserves right to verify correctness of lines and grades during progress of WORK. Such verification by Purchaser will not relieve Contractor of responsibility as specified foregoing.

3.3 Contractor shall notify Consulting Engineers of any differences in location of existing work from that indicated, wherever such differences may affect new work.

3.4 Contractor shall preserve and maintain all bench marks and reference points established by Purchaser. Should Contractor, during prosecution of WORK, destroy or remove any bench marks and/or reference points established by Purchaser, the cost to Purchaser of re-establishing these bench marks and/or reference points will be charged to Contractor.

4. CLEARING

4.1 Prior to performing excavation or fill work, areas in which such work is to be done shall be cleared, grubbed and the top soil and sod removed. No clearing, grubbing or removal of top soil and sod shall be done outside designated areas without specific approval.

4.2 If extensive clearing, grubbing and removal of top soil and sod is required, the Job Specification or drawings will specifically so indicate. If such work is incidental, then it will not be specifically indicated and shall be performed prior to, but as part of, excavation work.

4.3 Clearing:

4.3.1 Clearing is defined as removal and disposal of all trees, down timber, snags, brush, hedges, bushes and all other vegetation or organic materials, and also all rubbish, debris or other foreign or objectionable materials above ground surface, except removal of sod and top soil.

4.3.2 Removal of structures, such as buildings, roadways, fences, etc., is classified as demolition and not as clearing, and will be indicated in the Job Specification (under Demolition Work) or on drawings.

4.3.3 Trees shall be filled in such manner as not to damage other trees or other vegetation which are to remain in place nor damage existing structures and facilities nor constitute a hazard to traffic or life.

4.4 Grubbing: Grubbing is defined as removal and disposal of all stumps, large roots, buried logs and all other objectionable material from below ground surface. Explosives may be used only if specifically approved and their use shall conform to all applicable laws and safety regulations.

4.5 Disposal:

4.5.1 All materials from clearing and grubbing operations shall be Contractor's property and shall be promptly disposed of off the site unless otherwise indicated in the Job Specification or on drawings; accumulation of such materials on premises not permitted.

4.5.2 Burning of Debris on Premises: If burning of debris on premises is permitted by the Job Specification, drawings or Purchaser, conform to following requirements:

4.5.2.1 Burn debris only in areas specifically designated by Purchaser.

4.5.2.2 Prior to burning any material, secure approval and permits from, and comply with all regulations of all authorities and all public bodies having jurisdiction in area of WORK.

4.5.2.3 Neatly pile all combustible material and burn when in suitable condition. Do piling in such manner and in such locations as to cause least fire risk.

4.5.2.4 Burn material thoroughly and completely so that materials are reduced to ashes, with no charred pieces, such as charred logs, remaining. Ashes and charcoal residue need not be removed. Combustible materials difficult to burn, such as tree stumps and root clumps, may be buried below grade, with not less than 1'-0" of cover over them and level with surrounding grade, if grubbing is not required for the WORK; if grubbing is required, then all such unburnable materials shall be disposed of off the premises.

4.5.2.5 Fire Protection: Provide fire fighting facilities, satisfactory to authorities having jurisdiction and to Purchaser and maintain such facilities in first class operating condition during course of burning operations.

4.6 Removal of Top Soil and Sod:

4.6.1 Top soil and sod shall be removed as part of excavation work, unless the Job Specification or drawings indicate that top soil and/or sod shall be removed and stored for reuse by Contractor or by others.

4.6.2 If top soil is indicated to be removed for reuse, it shall be carefully stripped off, stored in separate stockpiles and kept clean and free of all foreign material. Sod and other vegetation shall be removed from the top soil before it is stockpiled.

4.6.3 If sod is indicated to be removed for reuse, it shall be carefully removed, rolled up, and stored in a suitable and well protected manner, as approved.

4.6.4 If top soil and/or sod is indicated to be reused by Contractor, any and all excess stockpiles remaining on completion of WORK shall be removed and disposed of off the premises unless otherwise requested.

5. EXCAVATION

5.1 Excavation is defined to include all incidental clearing, all excavation and disposal of excavated materials, all protection, sheeting, shoring, bracing and cofferdams, all dewatering, and preparation of bearing areas as required to properly install and complete the WORK, regardless of portions of WORK for which required, and regardless of nature of materials encountered in excavating. Dredging shall be performed only if specified in the Job Specification or on the drawings.

5.2 Classification: Excavation shall be classified as earth or rock excavation, as follows:

5.2.1 Earth excavation is all material not classified as rock excavation.

5.2.2 Rock Excavation:

5.2.2.1 Rock excavation is defined as any material that requires the continuous use of drilling and blasting, or drilling, channeling, etc., and shall include granite, trap, quartzite, chert, limestone, hard sandstone, hard shale or slate or other similarly hard materials, as well as rocks and boulders measuring 1/2 cubic yard or more.

5.2.2.2 The Job Specification or drawings will indicate whether blasting is permitted. Blasting, if permitted, shall conform to requirements of 5.11, following.

5.3 Dewatering: Contractor shall provide and operate all dewatering equipment required for areas excavated by Contractor, and be responsible for maintaining a dry site satisfactory to Purchaser and Consulting Engineers.

5.4 Protection and Support:

5.4.1 Contractor shall provide all protection and support as required to properly install the WORK, as required for protection and support of the WORK and of adjacent structures and improvements, and as required for safety of traffic and life.

5.4.2 Protection and support shall include temporary sheeting, bracing, shoring and cofferdams, and also, where indicated, permanent sheeting, bracing and shoring. All temporary sheeting, bracing, shoring and cofferdams shall be as approved, and all such temporary work shall be removed by Contractor when its use is no longer required, unless otherwise requested or approved.

5.4.3 Banks at excavations shall be protected and supported, where necessary or where requested, so that the banks and bottoms will be maintained and adjacent structures or other construction will be protected from damage caused by any earth or rock movement.

5.4.4 Protection and support shall be arranged for minimum interference with pipe laying, electrical ductwork installation and similar work.

5.4.5 Temporary Cofferdams: Contractor shall design temporary cofferdams required by him to perform his work and shall submit drawings thereof for approval. These drawings shall show all data on which the design is based. No such work shall be installed until such approval is received, and the work shall be done only in accordance with these approved drawings.

5.5 Earth excavations shall be of sufficient size to allow for placing of formwork for concrete, for inspection of formwork and surfaces of completed concrete, and for dampproofing, waterproofing, pipework, electrical ductwork, etc. Rock excavations shall be to neat lines unless otherwise indicated; where overbreak of rock occurs behind a vertical face of concrete placed against rock, overbreak shall be filled with the same concrete as required for the vertical face, and no payment will be made for concrete fill.

5.6 Excavations shall be carried to elevations indicated on drawings, and as follows:

5.6.1 Earth Excavation: Foundation excavations carried below the indicated level shall be filled with the same concrete as required for the foundation; other earth excavations carried below the indicated level shall be brought up to the proper level with compacted fill, sand, crushed stone, gravel or concrete, as determined most suitable by the Consulting Engineers.

5.6.2 Rock Excavation: When designated or approved elevations have been reached, rock surfaces shall be leveled off and all loose rock removed. Where overbreak of rock results in dropping elevations of rock surfaces below designated or approved elevations, overbreak shall be filled with the same concrete as required for the foundations.

5.6.3 No payment will be made for any of the foregoing specified fill required to remedy over-excavation in earth or overbreak in rock.

5.7 Hand excavation shall be used, if requested, for trenching or other excavation adjacent to structures or equipment where use of mechanical excavating equipment is not considered advisable by Purchaser or the Consulting Engineers.

5.8 Bearing Areas:

5.8.1 Bearing areas for all foundations shall be inspected and approved by Purchaser or the Consulting Engineers before any concrete is placed. If bearing areas are not suitable, as determined by the Consulting Engineers, Contractor may be requested to carry the excavations deeper to more suitable bearing material; such additional excavation will be paid for on the unit price basis set forth for the WORK. Contractor may also be requested by the Consulting Engineers to make auger borings or other tests at bearing areas to determine thickness of bearing stratum; these tests will be paid for on a unit price or cost plus basis, whichever is set forth for this item.

5.8.2 All foundations shall be placed on undisturbed soil unless otherwise indicated or approved.

5.8.3 Before placing any concrete for beams or slabs on fill, the soil shall be well tamped.

5.8.4 Before placing any concrete on soil that will absorb water, the surface of the soil shall be thoroughly wet with clean water immediately before the concrete is placed.

5.9 Excavation for Pipework and Electrical Ductwork:

5.9.1 Make excavation for this work true to grade, profile and alignment, and so as to provide full, even and continuous bedding. For pipework, normally excavate trenches to match curve of pipe; however, flat beds may be used if as economical as curved beds, or shall be used if indicated.

5.9.2 Where granular bedding under pipework or ductwork is indicated in the Job Specification or on drawings, excavate the additional amount required to place the indicated depth of bedding material.

5.10 Disposal of Excavated Materials:

5.10.1 Deposit and spread, or stockpile, excavation materials suitable (in opinion of Consulting Engineers) for fill or backfill, in quantities required and approved, on premises where requested.

5.10.2 For excavated materials not suitable for fill or backfill, the Job Specification or drawings will indicate whether such material is to be disposed of on or off premises, and disposal shall accordingly be as follows:

5.10.2.1 For such material to be disposed of on premises, deposit or spread on premises where approved or requested.

5.10.2.2 For such material to be disposed of off premises, promptly remove this material as excavated; stockpiling of such material will not be permitted.

5.10.3 After completion of fill and backfill work, or when approved or requested, dispose of any and all excess stockpiles or excess excavated materials either on or off the premises as specified in 5.10.2 foregoing.

5.11 Requirements for Blasting: If use of blasting is approved by Purchaser or Consulting Engineers, blasting shall conform to following requirements:

5.11.1 Blasting shall be perform-d only when proper precautions are taken for protection of persons, the work, private property, etc. Caps or other exploders or fuses shall in no case be stored or transported in same place in which dynamite or other explosives are transported. Location of storage magazines, methods of transportation and, in general, precautions taken to prevent accidents shall, at all times, be subject to approval of Purchaser or Consulting Engineers, but Contractor shall at all times be liable for any injuries to persons or property caused by explosives.

5.11.2 Every possible precaution shall be taken in blasting operations to preserve rock outside lines of excavation in soundest possible condition. Blasting shall be done only to lines and grades indicated on drawings or as approved by Consulting Engineers.

5.11.3 Explosives shall be of such quantity and power and shall be used in such locations as will not tend to open seals, or to crack or damage rock outside prescribed limits of excavation. If needed, firing of blast shall be controlled by use of delayed explosives. Whenever, in the opinion of Consulting Engineers, continuation of blasting may injure rock on which or against which concrete is to be placed, use of explosives shall be discontinued and excavation shall be completed by wedging, boring, channeling or other suitable means.

5.11.4 Contractor shall submit plans and methods of operation for rock excavation work before work is started. Approval of method of blasting or of strength and amount of explosives used will not relieve Contractor of responsibility for blasting operations.

5.11.5 For blasting, Contractor shall employ a supervisor thoroughly experienced in this type of work and shall at all times maintain rigid inspection to see that intent of these requirements are fully complied with.

5.11.6 Contractor shall maintain a complete and detailed record of blasting operations, in a form approved by Purchaser, and shall submit copies of such records to Purchaser as requested.

5.12 Dredging:

5.12.1 Before submittal of bid, Contractor shall obtain a sweeping map from The U. S. Army Corps of Engineers, and shall also determine from them the full extent of their requirements as it will affect the WORK.

5.12.2 Contractor shall furnish, establish and maintain in good order all range marks, stakes, gauges and buoys required for proper execution of this work, and furnish, on request, the use of such boats, boatmen, laborers and materials forming a part of the ordinary and usual equipment and crew used for this work as may be necessary for Purchaser, Consulting Engineers and Corps of Engineers to inspect work.

5.12.3 Contractor shall provide sounding and sweeping equipment and labor to sound and sweep dredged areas to establish that indicated grade, profile and alignment are met.

5.12.4 As soon as possible after completion of dredging work, Contractor shall thoroughly examine dredged area by sounding and sweeping to determine that completed work meets all requirements indicated on drawings and all requirements specified by Corps of Engineers. Arrange with Purchaser for representatives of Purchaser, Consulting Engineers and Corps of Engineers to be present when sounding and sweeping is performed. However, the presence of these representatives shall in no way relieve Contractor of responsibility for accuracy and proper completion of the work.

5.12.5 Any shoals, lumps or other lack of Contract dimensions disclosed by the foregoing examination shall be remedied by Contractor, and shall again be sounded, and swept if required, until the entire dredged area is satisfactory in every respect to Purchaser, Consulting Engineers and Corps of Engineers.

5.12.6 Contractor shall maintain a complete record of soundings, in a form approved by Consulting Engineers, and shall submit copies of such records to Consulting Engineers as requested.

6. FILL

6.1 Fill includes the following two classes, with two types under each class; the use of each shall be as indicated in the Job Specification or on the drawings:

6.1.1 Class 1: Regular compacted fill, Types RCF1 and RCF2.

6.1.2 Class 2: Controlled compacted fill, Types CCF1 and CCF2.

6.2 Services of Testing Laboratory: Where controlled compacted fill is specified, Purchaser will furnish services of a Testing Laboratory to determine suitability of fill material, to set optimum moisture contents, and to perform field tests to check on compliance with moisture and density requirements. Contractor shall furnish the Testing Laboratory with all required quantities of fill material, from the same source as will be used for the WORK, as required for test purposes.

6.3 Class 1, Regular Compacted Fill:

6.3.1 The two types are based on the materials specified for use as fill, as follows:

6.3.1.1 Type RCF1: Granular material (sand, crushed stone, gravel, etc).

6.3.1.2 Type RCF2: Cohesive material (clay, sandy loam, silty loam, etc).

6.3.2 Material: The Job Specification or drawings will indicate the source of materials to be used, such as material previously excavated at the site, or from borrow pits, or from off site sources, etc. All material used shall be as approved by Purchaser and/or the Consulting Engineers.

6.3.3 Preparation of Subgrade: Prior to placing regular compacted fill, strip areas to be covered of all vegetation or other organic material or other foreign or deleterious material.

6.3.4 Compaction Densities: Build up fill to grade elevations indicated or required, with suitable moisture control and compaction throughout placing, as specified in 6.3.5 following, to produce a completed fill capable of supporting trucks and other heavy construction equipment.

6.3.5 Placing of Fill: Place as follows, unless otherwise approved or requested:

6.3.5.1 Place fill, with suitable moisture content, in uniform horizontal layers not over 9" deep before compaction.

6.3.5.2 For Type RCF1 granular fill, compact by successive high speed passage of heavy tractors (with treads covering 100% of area), or with other vibratory type equipment, as approved.

6.3.5.3 For Type RCF2 cohesive fill, compact by use of sheeps foot roller or with other camming type equipment, as approved.

6.3.5.4 In places inaccessible to large equipment, obtain required compaction with mechanical vibrators for Type RCF1 granular fill, and with mechanical rammers for Type RCF2 cohesive fill.

6.4 Class 2, Controlled Compacted Fill:

6.4.1 The two types are based on the materials specified for use as fill, as follows:

6.4.1.1 Type CCF1: Granular material (sand, crushed stone, gravel, etc.)

6.4.1.2 Type CCF2: Cohesive material (clay, sandy loam, silty loam, etc.)

6.4.2 Material: Conform to same requirements specified in 6.3.2 for granular fill.

6.4.3 Preparation of Subgrade:

6.4.3.1 Subgrade to receive controlled compacted fill shall be inspected by Purchaser or the Consulting Engineers to determine if it is suitable and has sufficient bearing capacity for the fill material and loads to be placed over it. If subgrade is not suitable, as determined by the Consulting Engineers, Contractor may be requested to perform additional excavation as specified in 5.8 for Bearing Areas, with compensation as specified therein.

6.4.3.2 Prior to placing controlled compacted fill, strip areas to be covered of all vegetation, top soil and all organic material or other foreign or deleterious materials.

6.4.3.3 Thoroughly break and turn soil underlying the filled area to depth of 6" before deposition of fill material. No breaking of ground no more than 200 feet in advance of placing fill.

6.4.4 Compaction Densities: Build up fill to grade elevations indicated or required, with suitable moisture control and compaction throughout placing, as specified in 6.4.5 following, to produce following densities:

6.4.4.1 Decidedly granuler fill material: 90% of its maximum density.

6.4.4.2 All other fill material: 95% of its maximum density.

6.4.5 Placing of Fill: Place as follows, unless otherwise approved or requested:

6.4.5.1 Place fill, with optimum moisture content, in uniform horizontal layers not over 6" deep before compaction. Add water, or dry out fill, to maintain optimum moisture content throughout placing and compaction.

6.4.5.2 For Type CCF1 granuler fill, compact by successive high speed passage of heavy tractors (with treads covering 100% of area), or with other <u>vibratory type</u> equipment, as approved.

6.4.5.3 For Type CCF2 cohesive fill, compact by use of sheeps foot roller or with other <u>ramming type</u> equipment, as approved.

6.4.5.4 In places inaccessible to large equipment, obtain required compaction with mechanical vibrators for Type CCF1 granuler fill, and with mechanical rammers for Type CCF2 cohesive fill.

7. **BACKFILL**

7.1 Backfill includes general backfilling around all work excavated for by Contractor, and also all other backfill indicated on drawings as by Contractor.

7.2 Backfill shall be approved materials previously excavated at the site or materials obtained from approved borrow pits and shall be free of sod or other deleterious or foreign matter.

7.3 Backfill shall be built up to the grade elevations indicated or required, with suitable moisture control and compaction throughout placing, in the same manner as specified in 6.3 for Regular Compacted Fill, Types RCF1 and RCF2.

7.4 Backfill against foundation walls shall be placed only when directed.

7.5 Backfill Around Underground Piping: Place backfill around underground piping, drain lines, etc., only after piping, drain lines, etc., have been tested and/or inspected and approved. Use special care in backfilling to see that backfill is free of cinders or other materials which may be injurious, in opinion of Consulting Engineers, to such piping, drain lines, etc. Provide backfill free from rocks, hard lumps or clods larger than 3 inches. Do not use sod. Place backfill below top of piping, drain lines, etc., in alternate layers on each side of piping, drain lines, etc. Backfill around corrugated metal drainage pipe, corrugated structural plate pipe or welded steel plate pipe shall also conform to requirements specified in 7.6, following.

7.6 Backfill For Corrugated and Welded Steel Pipe:

7.6.1 Where flat beds for this piping is indicated in Job Specification or on drawings, provide flat granular bedding fill under pipe, with depth of bedding as indicated on drawings. Provide greater depth bedding fill if required by unsuitable soil conditions, as determined by the Consulting Engineers.

7.6.2 Granular Bedding: Use clean crushed stone or gravel, or other approved material, with 1-1/2" maximum size.

7.6.3 After pipe is in place on flat bed, provide controlled compacted granular fill under haunches. Use clean crushed stone, gravel or coarse sand, or other approved material, with 1-1/2" maximum size.

7.6.4 Also provide same controlled compacted granular fill up to center line of pipe.

7.6.5 Fill above center line of pipe and up to grade with select material, as approved, with controlled compaction.

7.6.6 Controlled compaction shall conform to requirements specified in 6.4 for Controlled Compacted Fill, Types CCF1 and CCF2. Services of Testing Laboratory will also be furnished for this work as specified in 6.2 foregoing.

7.6.7 Use extreme care in placing all compacted fill to maintain fill at approximately the same level (not to exceed one foot differential) on both sides of pipes throughout entire placing of compacted fill.

7.7 Backfill for Electrical Ductruns:

7.7.1 Requirement of Standard Specification STD-EF-103 that clay or loam backfill shall be used for ductruns shall not apply. Any approved previously excavated material may be used for backfill over ductruns that are cast in place, provided that maximum size of material shall not exceed two inches (2").

7.7.2 For precast concrete ductruns, provide a layer of clean, washed sand not less than 2" thick on SIDES AND TOP, with balance of backfill approved previously excavated material not exceeding 2" maximum size. Provide sand cushion for precast ductruns as specified in Job Specification under Concrete Work, or as indicated on drawings.

7.8 Backfill in Roadways: Where existing roadways are cut to install new work, backfill such areas as quickly as possible after completion (including testing, if required) of new work. Bring backfill to within 10" of road surface ready for installation of new roadway by Contractor or by others as indicated in Job Specification or on drawings.

8. GRADING: Consists of rough grading and finish grading, as follows:

8.1 Rough Grading: Cut, fill, spread and level during course of WORK to elevations indicated.

8.2 Finish Grading: Fine grade and level to provide a smooth finish grade free of debris, foreign matter, objectionable stones, slods, lumps, pockets or high spots, properly drained and true to indicated elevations. Do finish grading only near completion of WORK or when requested.

RKANA

'd. 4-8-74

Reserve Material
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SOUTHWESTERN LABORATORIES

CONSULTING ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

TEXARKANA

Texarkana, Texas, April 12, 1974 File No.

Report of tests on: Soil

To: Murray, Link, Thomas & Griffin

Received from: Same Date Rec'd. 4-8-74

Identification Marks: SWEPCO's Welsh Power Plant

The following samples were taken in order to depict the material available to construct the Ash Pit Dike. Based on the information we have received, it is believed that the higher clay content soils should be used in the core of the dike. We have located some moderate to high plasticity index material lying adjacent to the Ash Pit Dike. The following results were obtained on these materials.

Sieve Sizes % Passing	Gray Clay	Red & Gray Clay
No. 40	100.0	100.0
80	98.9	98.8
100	97.7	98.0
200	97.0	95.2
Liquid Limit	49	48
Plasticity Index	25	24

cc: 2: Murray, Link, Thomas & Griffin
1: Mr. Bill Millard
1: Mr. Emil Rizzio
1: Mr. Ed Bargainer

Lab. No. 14475

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Date Rec'd. 6-3-74

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CONSULTING ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Texarkana, Texas June 4,1974 File No. ________

Report of tests on: Soil

To: Murray,Link,Thomas & Griffin

Received from: Same Date Rec'd. 5-31-

Identification Marks: SWEPCO Walsh Power Plant, Caso.,Texas

FIELD DENSITY TESTS

No	Location	Percent Moisture	Dry Density Lbs. Cu Ft	Percent Proctor
463	Sta. 7+00 Right of Centerline Primary dike 3' above natural ground	21.0	105.2	96.
464	Sta. 5+75 Right of Centerline Primary dike 2½' above natural ground	22.0	104.3	15.
465	Sta. 4+80 Centerline of primary dike 3' below natural ground	20.1	105.2	96.

PROCTOR SERIES

Maximum Dry Density at Optimum Moisture 109.4 Lbs. Cu. Ft.

Optimum Moisture 19.0 %

cc: 3: Murray,Link,Thomas & Griffin
1: Mr. Emil Rizzio
1: Mr. Bill Millard
1: Mr. Ed Barguinsor

Lab No. 14730

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e No.

Date Rec'd. 6-4-74

Dry Density Lbs./Cu.Ft.	Percent Proctor
115.7	96.6
115.1	96.1
114.2	95.3

.bs./Cu. Ft.

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r products.

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CONSULTING ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Texarkana, Texas June 4, 1974 File No.

Report of tests on: Soil

To: Murray, Link, Thomas & Griffin

Received from: Same

Date Rec'd: 5-30-74

Identification Marks: SWEPCO Welsh Power Plant, Cason, Texas

FIELD DENSITY TESTS

No.	Location	Percent Moisture	Dry Density Lbs. Cu Ft	Percent Proctor
460	Sta. 5+70 Centerline of primary dike 5½' above natural ground	19.6	106.3	97.2
461	Sta. 6+00 3½' above natural ground left of primary dike	20.1	105.9	96.8
462	Sta. 7+00 Left of Centerline, primary dike 3' above natural ground	19.2	106.6	97.4

PROCTOR SERIES

Maximum Dry Density at Optimum Moisture: 109.4 Lbs. Cu Ft

Optimum Moisture: 19.0 %

cc: 3: Murray, Link, Thomas & Griffin
1: Mr. Emil Rizzio
1: Mr. Bill Millard
1: Mr. Ed Burgainer

Lab No. 14729

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JUN 25 1974
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FORT WORTH   DALLAS   HOUSTON   MIDLAND   BEAUMONT   TEXARKANA

CONSULTING ANALYTICAL CHEMISTS
AND TESTING ENGINEERS

Texarkana, Texas June 6, 1974   File No. ______

Report of tests on: Soil

To: Murray, Thomas & Griffin

Received from: Same   Date Rec'd 6-1-74

Identification Marks: SWEPCO Walsh Power Plant-Cason, Texas

FIELD DENSITY TESTS

No.	Location	Percent Moisture	Dry Density Lbs./Cu.Ft	Percent Proctor
466	Sta. 5+50 Rt. Primary Dike 3' Above Natural Ground	22.0	106.1	97.0
467	Sta. 8+00 Lt. Primary Dike 3½ Ft. Above Natural Ground	21.3	105.9	96.8
468	Sta. 7+00 Lt. Primary Dike 3½ Ft. above	20.7	105.1	96.0
469	Sta. 6+00 Rt. Primary Dike 3' above natural ground	20.4	106.4	97.2
470	Sta. 8+00 Rt. Primary Dike 2' Above Natural Ground	20.6	105.6	97.4

PROCTOR SERIES

Maximum Dry Density at Optimum Moisture	109.4	Lbs. Cu. Ft
Optimum Moisture	19.0	%

cc: 3: Murray, Thomas & Griffin
1: Mr. Emil Rismio
1: Mr. Ed Burgaineer
1: Mr. Bill Millard

Lab. No. 14731

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RATORIES

BEAUMONT TEXARKANA

EMISTS

File No.

Date Rec'd. 5-20-74

Dry Density Lbs./Cu.Ft.	Percent Proctor
105.5	96.4
106.2	97.1
106.0	96.9
107.4	98.2
106.5	97.4
105.3	96.3

Lbs./Cu. Ft.

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FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING ANALYTICAL CHEMISTS AND TESTING ENGINEERS

Texarkana Texas May 23,1974 File No

Report of tests on: Soil

To: Murray,Link,Thomas & Griffin

Received from: Same

Identification Marks: SWEPCO Welsh Power Plant, Cason,Texas

Date Rec'd 5-21-74

FIELD DENSITY TESTS

No.	Location	Percent Moisture	Dry Density Lbs. Cu.Ft.	Percent Proctor
437	Sta. 6+80 Left of Centerline, primary dike 4' above natural ground	19.8	106.3	97.2
438	Sta. 5+20 Centerline of primary dike 4' above natural ground	20.4	106.1	97.0
439	Sta. 7+00 Center of primary dike 4' above natural ground	20.2	105.9	96.8
440	Sta. 8+10 Core of primary dike 4' below natural ground	22.1	104.9	95.9

PROCTOR SERIES

Maximum Dry Density at Optimum Moisture: 109.4 Lbs. Cu. Ft.

Optimum Moisture: 19.0

cc: 2: Murray,Link, Thomas & Griffin
1: Mr. Emil Rizzio
1: Mr. Bill Millard
1: Mr. Ed Burgmaier

Lab No. 14666

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RATORIES
BEAUMONT TEXARKANA
MISTS

File No.

Date Rec'd. 5-18-74

Dry Density Lbs./Cu.Ft.	Percent Proctor
106.2	97.1
104.6	95.6
105.9	96.8

Lbs./Cu.Ft.

%

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FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS AND TESTING ENGINEERS

Texarkana, Texas May 21,1974 File No.

Report of tests on Soil

To Murray,Link,Thomas & Griffin

Received from Same

Identification Marks SWEPCO Welsh Power Plant, Cason,Texas

Date Rec'd. 5-20-74

FIELD DENSITY TESTS

No.	Location	Percent Moisture	Dry Density Lbs./Cu.Ft.	Percent Proctor
431	Sta. 2+00 Core of primary dike 4' below natural ground	21.1	105.5	96.4
432	Sta. 3+00 Core of primary dike 4' below natural ground	19.8	106.2	97.1
433	Sta. 4+20 core of primary dike 3' below natural ground	20.2	106.0	96.9
434	Sta. 5+50 Centerline of primary 3' above natural ground	19.3	107.4	98.2
435	Sta. 6+00 right of centerline, primary dike 3' above natural ground	20.7	106.5	97.4
436	Sta. 6+10 left of centerline, primary dike natural gound elevation	19.9	105.3	96.3

PROCTOR SERIES

Maximum Dry Density at Optimum Moisture 109.4 Lbs./Cu.Ft.

Optimum Moisture 19.0 %

cc: 2: Murray,Link,Thomas & Griffin
1: Mr. Emil Rizzio
1: Mr. Bill Millard
1: Mr. Ed Bargaineer

Lab No. 14659

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BEAUMONT TEXARKANA

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— File No.

Date Rec'd. 5-17-74

Dry Density Lbs./Cu.Ft.	Percent Proctor
105.5	96.4
106.3	97.2
106.0	96.9
105.9	96.8

[illegible]4 Lbs./Cu. Ft.

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FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS AND TESTING ENGINEERS

Texarkana, Texas May 21,1974 File No.

Report of tests on: Soil

To: Murray,Link,Thomas &Griffin

Received from: Same — Date Rec'd 5-18-7[illegible]

Identification Marks: SWEPCO, Welsh Power Plant-Cason,Texas

FIELD DENSITY TESTS

No.	Location	Percent Moisture	Dry Density Lbs./Cu.Ft.	Percent Proctor
428	Sta. 7+00 Core of primary dike 2' above natural ground	20.7	106.2	97.[illegible]
429	Sta. 6+80 natural ground core of primary dike	21.0	104.6	95.[illegible]
430	Sta. 6+80 2' above natural ground right side of primary dike	19.8	105.9	96.[illegible]

PROCTOR SERIES

Maximum Dry Density at Optimum Moisture 109.4 Lbs Cu Ft

Optimum Moisture 19.0 %

cc: 2: Murray,Link,Thomas & Griffin
1: Mr. Emil Rizzio
1: Mr. Bill Millard
1: Mr. Ed Burgaineer

Lab No 14658

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Rec'd. 5-16-74

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FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS AND TESTING ENGINEERS

Texarkana, Texas May 21,1974 File No.

Report of tests on: Soil

To: Murray,Link,Thomas & Griffin

Received from: Same

Date Rec'd. 5-17-74

Identification Marks: SWEPCO Welsh Power Plant, Cason,Texas

FIELD DENSITY TESTS

No.	Location	Percent Moisture	Dry Density Lbs./Cu.Ft.	Percent Proctor
424	Sta. 7+00 Natural Ground Elev. Core of Primary Dike			
425	Sta. 6+25 1' below natural ground core of primary dike	21.4	105.5	96.4
426	Sta. 7+10 Below natural ground core of primary dike	20.7	106.3	97.2
427	Sta. 6+75 Right side of primary dike 1' above natural ground	21.3	106.0	96.9
		20.9	105.9	96.8

PROCTOR SERIES

Maximum Dry Density at Optimum Moisture: 109.4 Lbs. Cu. Ft.

Optimum Moisture: 19.0 %

cc: 2: Murray,Link,Thomas & Griffin
1: Mr. Emil Rissio
1: Mr. Bill Millard
1: Mr. Ed Bargainer

Lab No. 14657

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[signature]

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FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING, ANALYTICAL CHEMISTS AND TESTING ENGINEERS

Texarkana, Texas May 21, 1974 File No.

Report of tests on: Soil

To: Murray, Link, Thomas & Griffin

Received from: Same Date Rec'd. 5-16-74

Identification Marks: SWEPCO, Walsh Power Plant, Carthage, Texas

FIELD DENSITY TESTS

No.	Location	Percent Moisture	Dry Density Lbs./Cu.Ft.	Percent Proctor
421	Sta. 6+50 Core of Dike 3' below natural ground primary dike	21.0	101.1	92.4
422	Sta. 7+00 Core of Dike 3' Below natural ground primary Dike	22.4	104.9	95.9
423	Sta. 6+50 Retest	20.8	106.2	97.1

PROCTOR SERIES

Maximum Dry Density at Optimum Moisture: 109.4 Lbs. Cu. Ft.

Optimum Moisture: 19.0 %

cc: 2: Murray, Link, Thomas & Griffin
1: Mr. Emil Rizzio
1: Mr. Bill Millard
1: Mr. Al Bargainer

Lab No. 14656

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FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

CONSULTING ANALYTICAL CHEMISTS AND TESTING ENGINEERS

Texarkana, Texas April 22, 1974 File No.

Report of tests on Soil

To Murray, Link, Thomas & Griffin

Received from Same

Identification Marks SWEPCO Welsh Power Plant, Cason, Texas Date Rec'd. 4-19-74

Sample # 1 Centerline of Dike-Sta. 7+00
Orange Sandy Clay With Iron Ore

% Passing # 40	89.9
% Passing # 60	84.9
% Passing # 100	66.5
% Passing # 200	49

Atterberg Limits

Liquid Limit	28.0
Plasticity Index	12

Sample # 2-Sta. 0+00 N, Sta. ~~0+00~~ 3+50W West
Red Sandy Clay

% Passing # 40	99.4
% Passing # 60	98.6
% Passing # 100	90.0
% Passing # 200	71.2

Atterberg Limits

Liquid Limit	36
Plasticity Index	18

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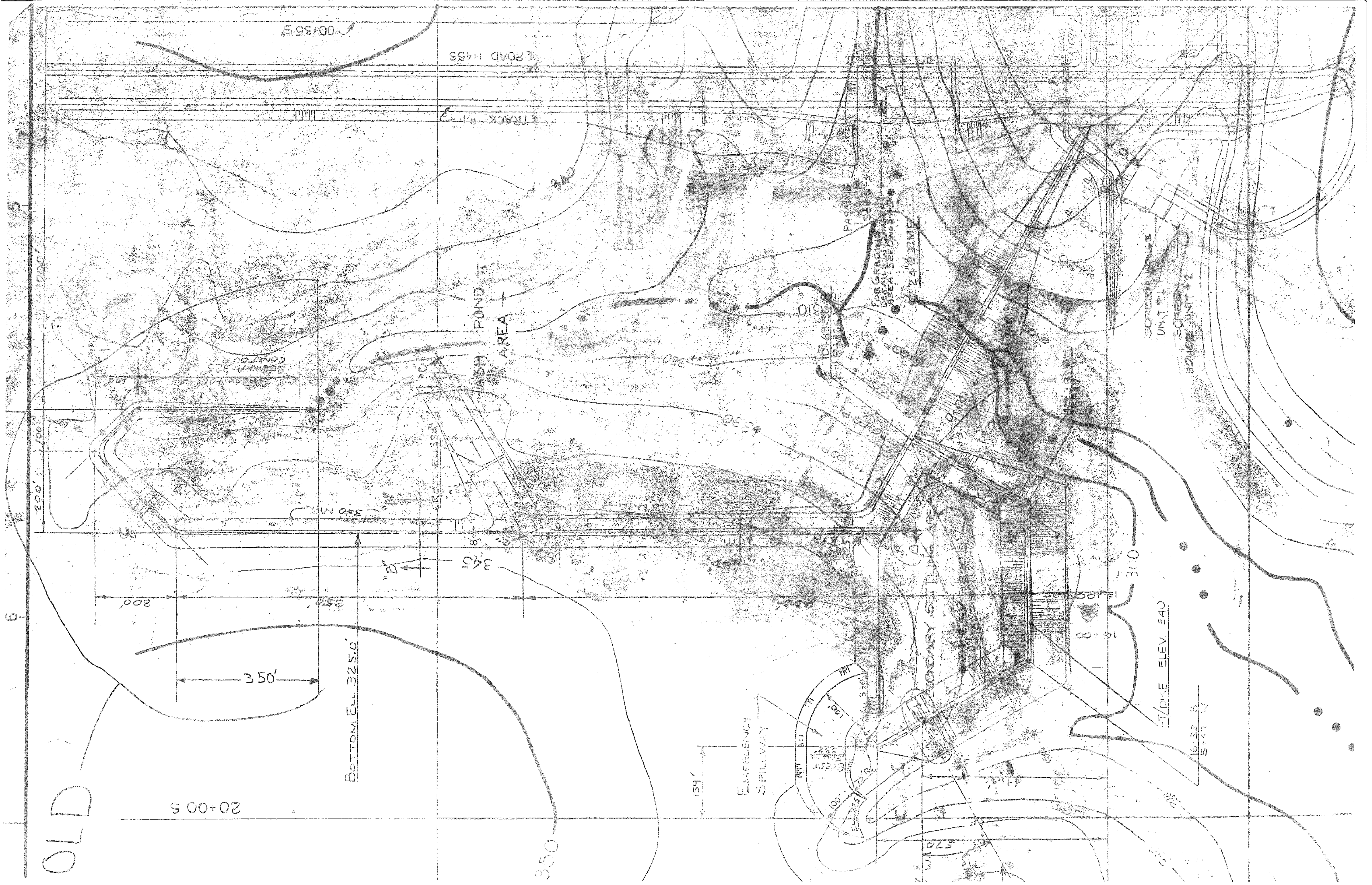
W. R. HOLLEY

cc: 2: Murray, Link, Thomas & Griffin
1: Mr. Emil Rizzio
1: Mr. Ed Bargaineer
1: Mr. Bill Millard

Lab No 14525

SOUTHWESTERN LABORATORIES

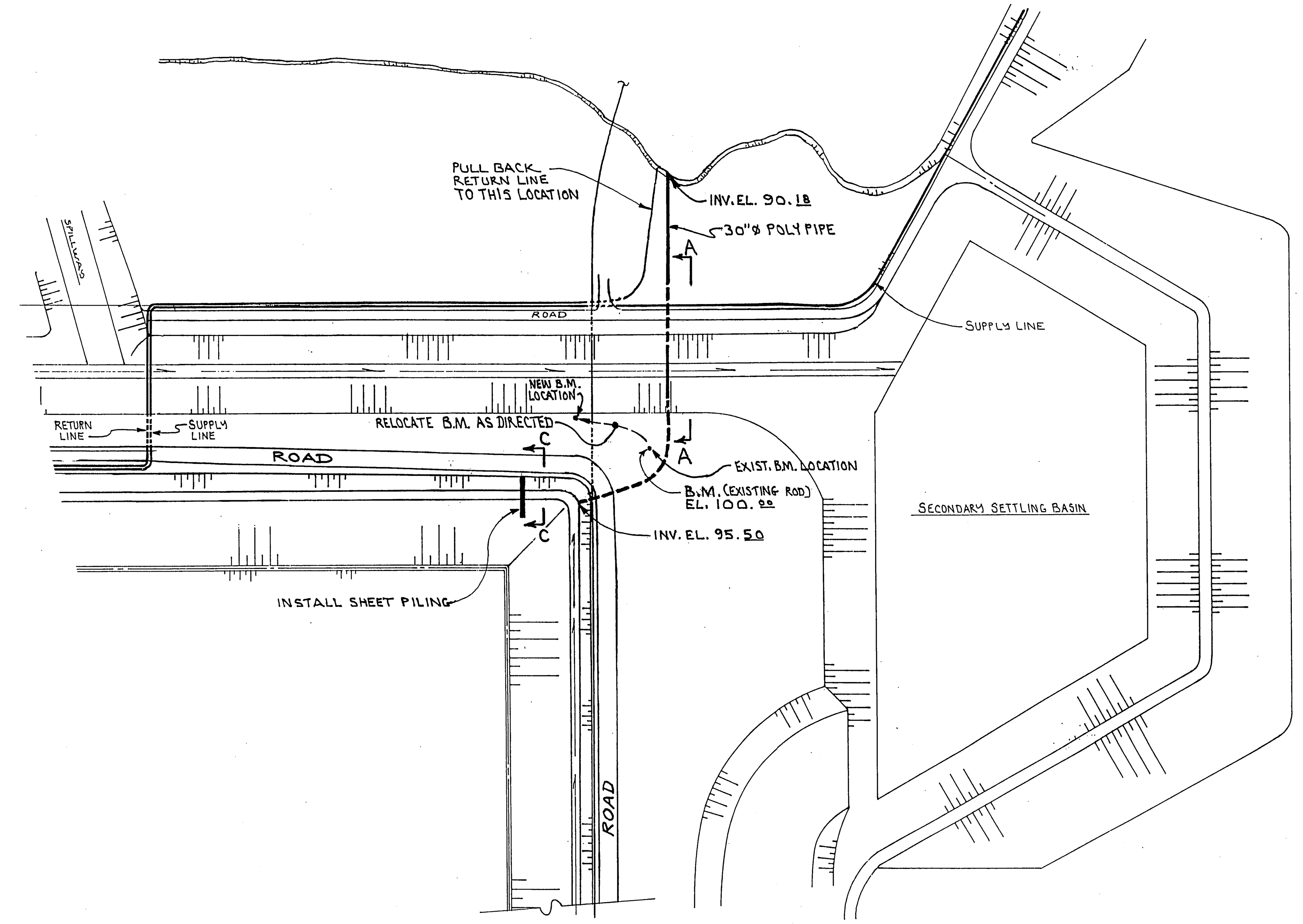


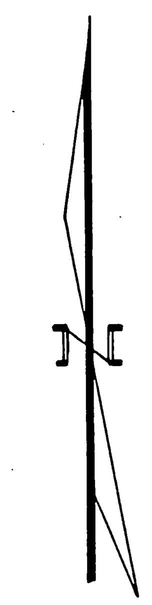
ASH POND AREA
BOTTOM EL. 325.0'
350'
EMERGENCY SPILLWAY
T/DIKE ELEV 340
PASSING TRACK
24" Ø CMP
SCREEN HOUSE UNIT #1
SCREEN HOUSE UNIT #2
20+00 S
OLD


PLAN OF WEIR BOX STRUCTURE (S-11, S-12)
SECTION N-N
SECTION A-A
SECTION C-C
VIEW B-B
SECTION L-L
SECTION F-F
DETAIL J
SECTION D-D
STOP LOG DETAIL (18 REQ'D)
ELEVATION
SECTION
SECTION E-E
SECTION G-G
SECTION H-H
SECTION M-M
℄ WEIR BOX STRUCTURE ℄ HEADWALL
TOP OF DIKE
TOP OF WEIR BOX EL. 340'-0"
HIGH WATER EL. 338'-0"
4" CARBON STL. SCH 40 PIPE
REINFORCING AROUND PIPE OPENING SIM. TO SECTION C-C
36" ⌀ C.S.P. DRAIN
NORMAL POOL EL. 320'-0"
NOTES
FOR GENERAL NOTES SEE DWG. S-102.
REFERENCE DRAWINGS
S-11 SITE DEVELOPMENT PLAN
S-12 ASH POND & SECONDARY SETTLING AREA
WEIR BOX
PLAN & SECTIONS
WELSH POWER PLANT UNIT 1
SOUTHWESTERN ELECTRIC POWER CO.
CASON, TEXAS
SCALE 3/8"=1'-0" UNLESS NOTED
DRAWN TOWNSEND 8-1-73
CHECKED
ENGINEER
APPROVED
JOB NO.
SARGENT & LUNDY ENGINEERS CHICAGO
DRAWING NO.
S-13
Released for Const. 3-3-77
S-13

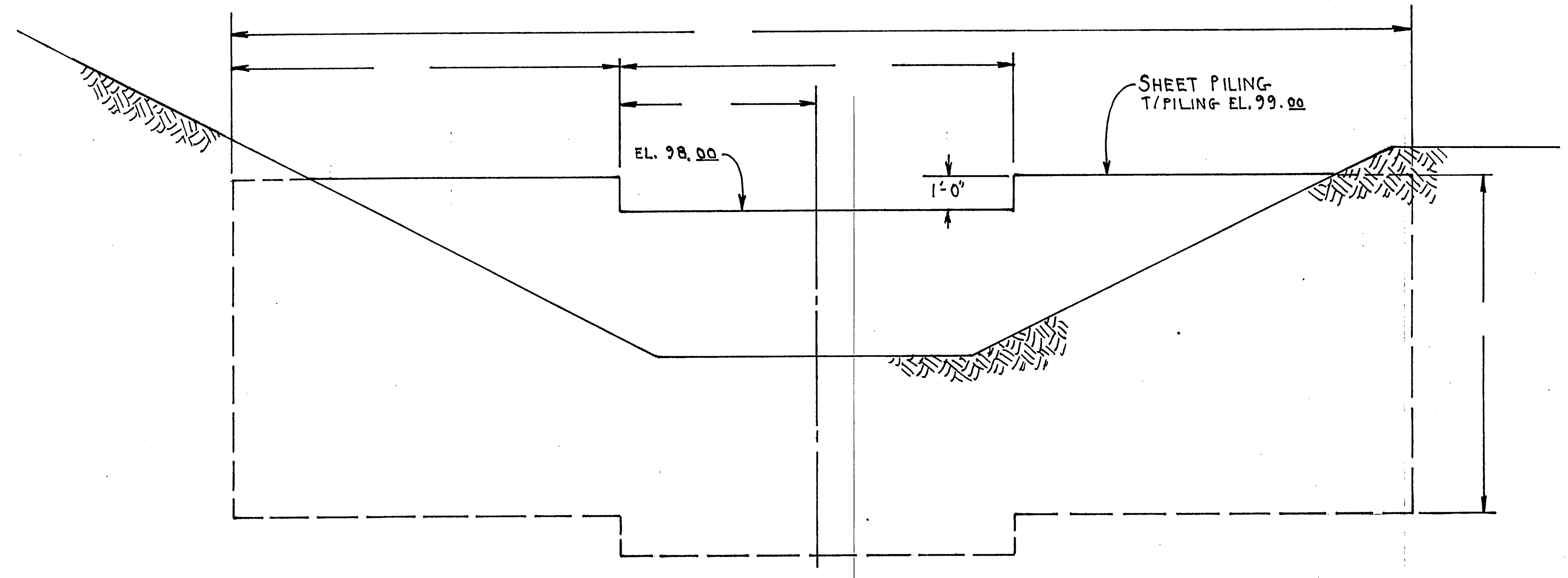
ATTACHMENT C

DESIGN DRAWINGS

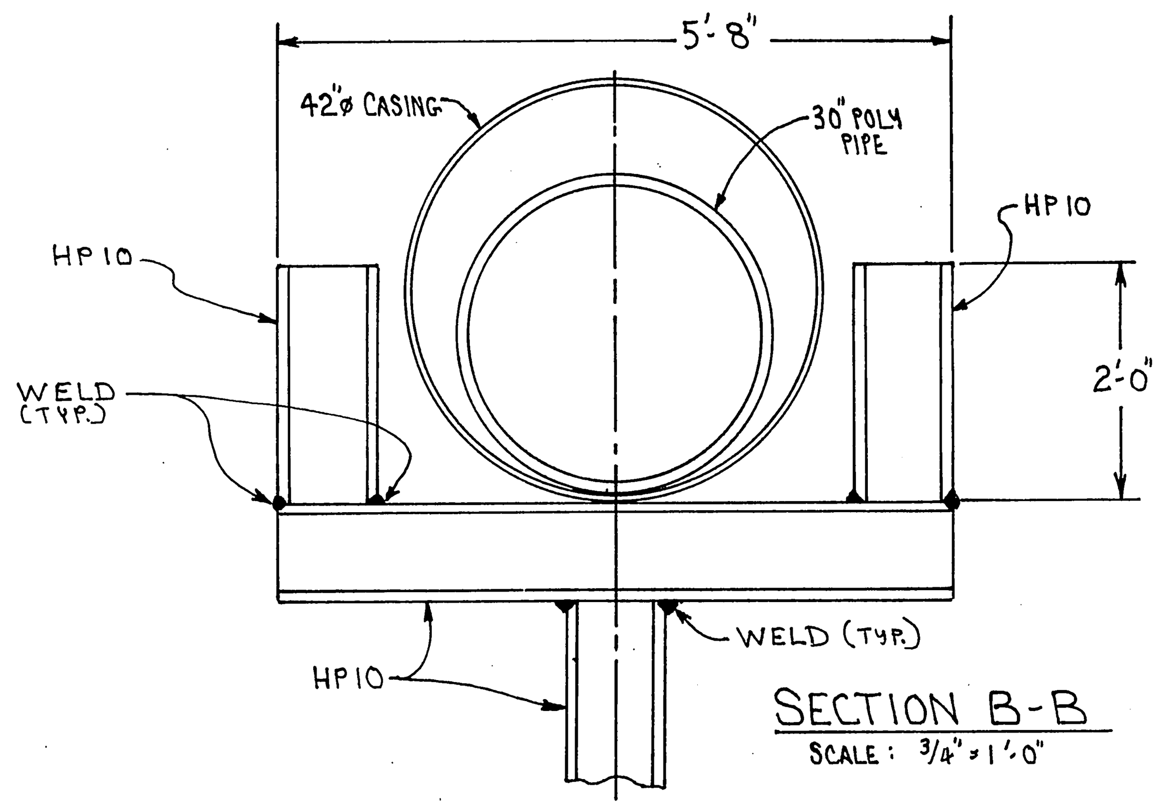




PLAN VIEW
SCALE: 1" = 100'



SECTION C-C
SCALE: 3/8" = 1'-0"



SECTION B-B
SCALE: 3/8" = 1'-0"

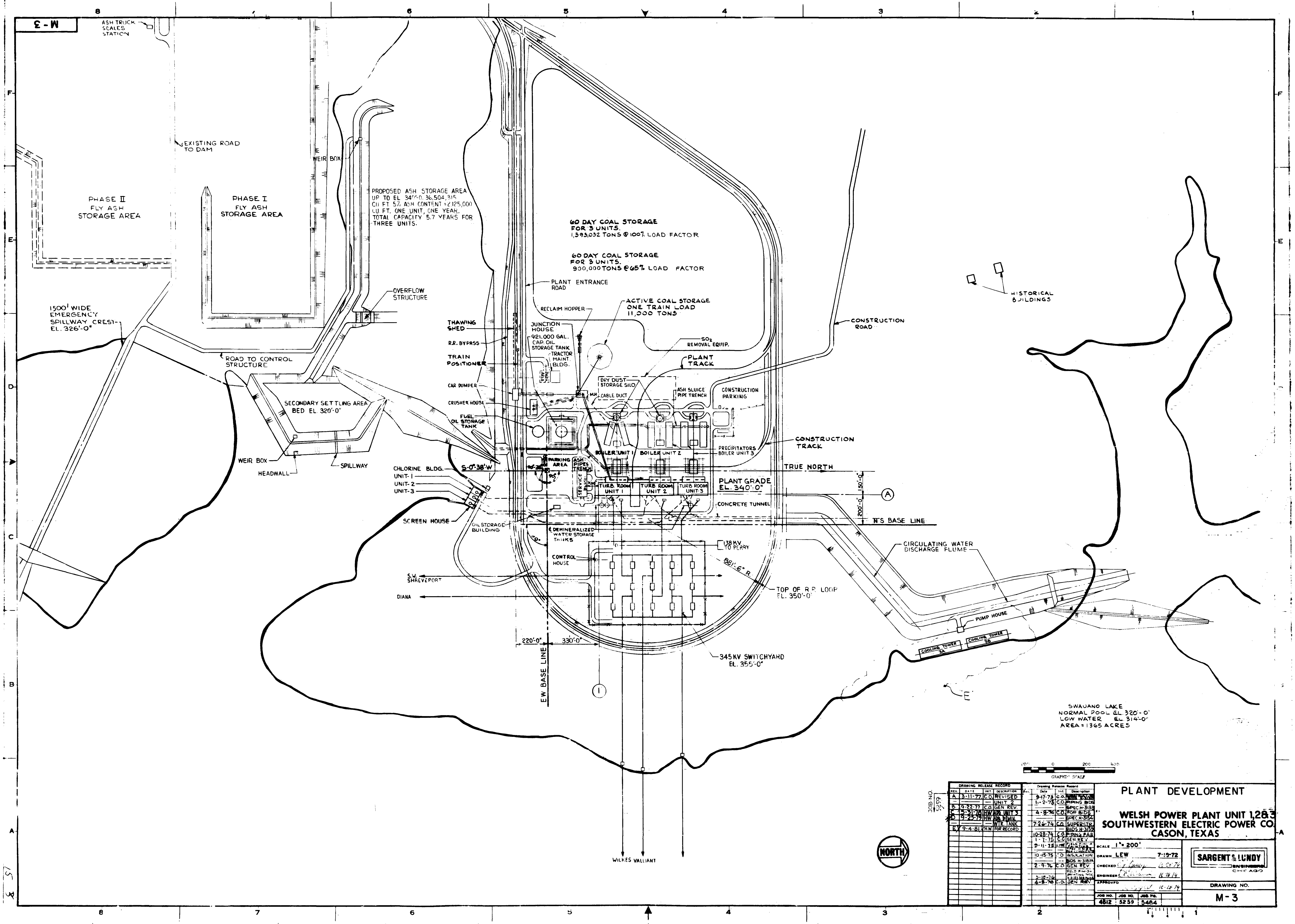
SECTION A-A
SCALE: 3/16" = 1'-0"

* ACTUAL LENGTH OF HP BEAM DRIVEN INTO GROUND TO BE SHOWN ON DRAWING AFTER COMPLETION

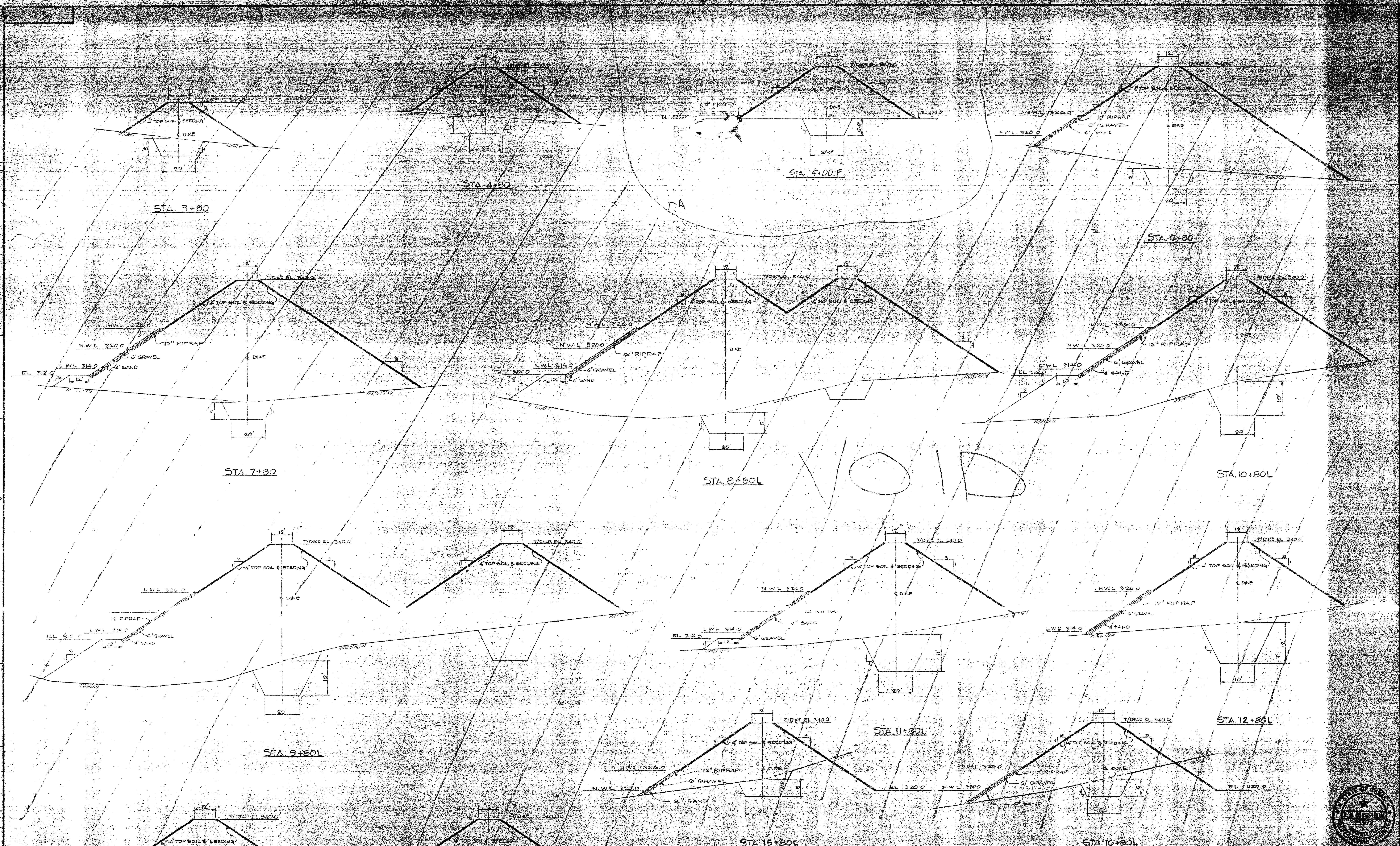
REV	W.O.	BY	DATE	SUBJECT	APPROVED

AREA DRAINAGE PLAN
BOTTOM ASH STORAGE AREA
WELSH POWER PLANT
A E P

DEPT.	
DIV.	
APPROVED	
DRWN. BY: B.	DATE: 12-5-00
SCALE: AS NOTED	W.O.
SH. 1	DRWG. NO. WEPX-343


M-3
ASH TRUCK SCALES STATION
EXISTING ROAD TO DAM
WEIR BOX
PHASE II FLY ASH STORAGE AREA
PHASE I FLY ASH STORAGE AREA
PROPOSED ASH STORAGE AREA UP TO EL 340'-0: 36,504,315 CU. FT. 5% ASH CONTENT = 2,125,000 CU. FT. ONE UNIT, ONE YEAR. TOTAL CAPACITY 5.7 YEARS FOR THREE UNITS.
60 DAY COAL STORAGE FOR 3 UNITS. 1,393,032 TONS @ 100% LOAD FACTOR
60 DAY COAL STORAGE FOR 3 UNITS. 900,000 TONS @ 65% LOAD FACTOR
PLANT ENTRANCE ROAD
OVERFLOW STRUCTURE
1500' WIDE EMERGENCY SPILLWAY CREST EL. 326'-0"
RECLAIM HOPPER
ACTIVE COAL STORAGE ONE TRAIN LOAD 11,000 TONS
HISTORICAL BUILDINGS
CONSTRUCTION ROAD
THAWING SHED
JUNCTION HOUSE
921,000 GAL. CAP. OIL STORAGE TANK
TRACTOR MAINT. BLDG.
R.R. BYPASS
TRAIN POSITIONER
SO_2 REMOVAL EQUIP.
PLANT TRACK
ROAD TO CONTROL STRUCTURE
CAR DUMPER
DRY DUST STORAGE SILO
CABLE DUCT
ASH SLUICE PIPE TRENCH
CONSTRUCTION PARKING
SECONDARY SETTLING AREA BED EL 320'-0"
CRUSHER HOUSE
FUEL OIL STORAGE TANK
CONSTRUCTION TRACK
PRECIPITATORS BOILER UNIT 3
BOILER UNIT 1
BOILER UNIT 2
WEIR BOX
HEADWALL
SPILLWAY
CHLORINE BLDG.
S-0°-38'-W
PARKING AREA
ASH PIPES TRENCH
TRUE NORTH
UNIT-1
UNIT-2
UNIT-3
SERVICE BLDG.
TURB. ROOM UNIT 1
TURB. ROOM UNIT 2
TURB. ROOM UNIT 3
PLANT GRADE EL. 340'-0"
150'-0"
A
CONCRETE TUNNEL
200'-0"
N-S BASE LINE
SCREEN HOUSE
OIL STORAGE BUILDING
DEMINERALIZED WATER STORAGE TANKS
138 KV TO PERRY
CIRCULATING WATER DISCHARGE FLUME
CONTROL HOUSE
881'-6" R.
S.W. SHREVEPORT
TOP OF R.R. LOOP EL. 350'-0"
DIANA
PUMP HOUSE
COOLING TOWER 3A
COOLING TOWER 3B
220'-0"
330'-0"
E-W BASE LINE
345 KV SWITCHYARD EL. 355'-0"
1
SWAUANO LAKE NORMAL POOL EL. 320'-0" LOW WATER EL. 314'-0" AREA = 1365 ACRES
200 0 200 400
GRAPHIC SCALE
WILKES VALLIANT
NORTH
JOB NO. 5259
DRAWING RELEASE RECORD
REV. | DATE | INIT. | DESCRIPTION
A | 3-11-77 | C.O. | REVISED
— | — | — | UNIT 2
B | 9-22-77 | C.O. | GEN. REV.
C | 5-31-78 | HW | ADD UNIT 3
D | 9-25-79 | HW | ADD DEMIN.
— | — | — | WTR. TANK
E | 9-4-81 | H.W. | FOR RECORD
Drawing Release Record
Rev. | Date | Init. | Description
9-17-73 | C.O.
1-2-73 | C.O. | PIPING BIDS
— | — | SPEC. H-3138
4-8-74 | C.O. | FOR BIDS
— | — | SPEC. H-3154
7-26-74 | C.O. | SUPERSTR.
— | — | BIDS H-3159
10-28-74 | C.O. | PIPING FAB.
1-7-75 | C.O. | GEN. REV.
9-11-75 | FIELD FINISH PAINTING SPEC H-3183 FOR COMMENTS
10-15-75 | C.O. | INSULATION
— | — | BIDS H-3187A
2-9-76 | C.O. | GEN. REV.
3-15-76 | FIELD FINISH PAINTING SPEC H-3183 FOR BIDS
4-5-78 | C.O. | GEN. REV.
PLANT DEVELOPMENT
WELSH POWER PLANT UNIT 1,2&3
SOUTHWESTERN ELECTRIC POWER CO.
CASON, TEXAS
SCALE 1" = 200'
DRAWN LEW 7-19-72
CHECKED 10-28-74
ENGINEER 10-28-74
APPROVED 10-28-74
SARGENT & LUNDY ENGINEERS CHICAGO
DRAWING NO. M-3
JOB NO. 4812 | JOB NO. 5259 | JOB NO. 5464

ASH POND AREA
BOTTOM EL. 325.0
SUBSTATION
DISCHARGE FLUME
DROP STRUCTURE
Existing Grade
Sec "AA" & "B-B"
As Noted
Scale 1" = 20'
Section "C-C"
No Scale
Section "D-D"
No Scale
Secondary Settling Area Bot. El. 320
6" x 2" Concrete Sill
Flume El. 325
NOTES
REFERENCE DRAWINGS
SITE DEVELOPMENT PLAN
ASH POND DIKE CROSS SECTIONS
SECONDARY SETTLING AREA SPILLWAY
PLAN, SECTION & PROFILE DISCHARGE FLUME
SECONDARY SETTLING AREA WEIR BOX STRUCTURE
B 10-25-73 GEN. REV.
C 12-6-73 ADDED NOTE
D 5-30-74 REVISE DRAWING
ASH POND & SECONDARY SETTLING AREA
WELSH POWER PLANT
SOUTHWESTERN ELECTRIC POWER CO.
CASON, TEXAS
SARGENT & LUNDY ENGINEERS CHICAGO
DRAWING NO.
S-12
NORTH



NOTES	REFERENCE DRAWINGS
1. FOR GENERAL NOTES SEE DWG. S-11	S-11 SITE DEVELOPMENT PLAN S-12 ASH POND & SECONDARY SETTLING AREA S-15 ASH POND DIKE CROSS-SECTIONS, SHEET 2 S-16 SECONDARY SETTLING AREA SPILLWAY S-18 PLAN, SECTIONS & PROFILE, DISCHARGE FLUME S-13 SECONDARY SETTLING AREA WEIR BOX STRUCTURE

Drawing Release Record

Rev.	Date	Init.	Description
	9-11-73		For Const.
A	9-18-73		Released Dwg.
B	9-17-74	MJM	Revise Sand

ASH POND DIKE CROSS SECTIONS SHEET 1

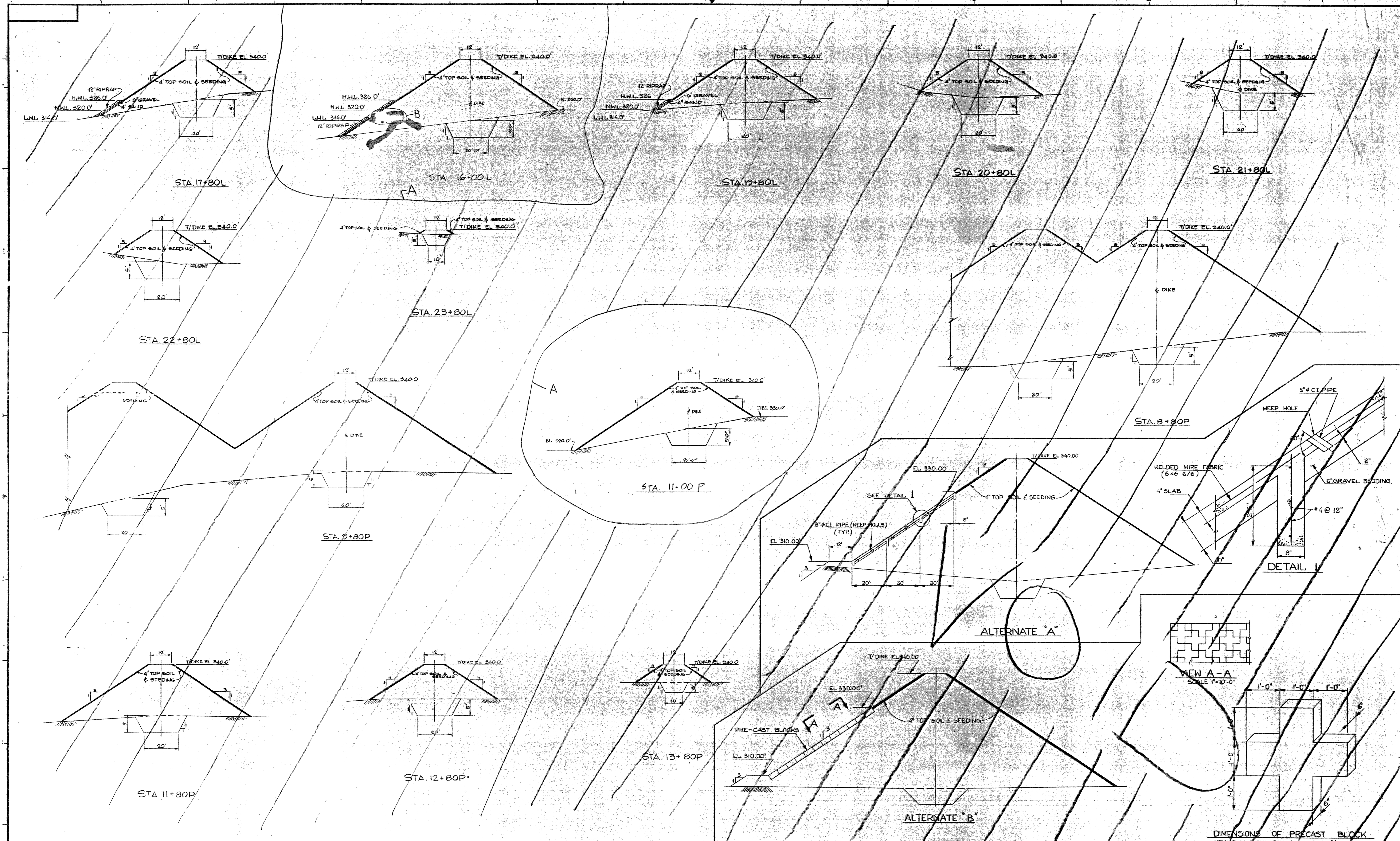
WELSH POWER PLANT
SOUTHWESTERN ELECTRIC POWER CO.
CASON, TEXAS

SCALE: HORIZONTAL 1" = 20'-0", VERTICAL 1" = 10'-0"
DRAWN: D. Cacel 6-17-73
CHECKED: R. P. Panati 9-6-73
ENGINEER: W. Millick 9-7-73
APPROVED: R.N. Bergstrom 9-10-73
JOB NO. 4512-05

SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO. S-14

STATE OF TEXAS — R. N. BERGSTROM — 25972 — REGISTERED PROFESSIONAL ENGINEER



NOTES

1. FOR GENERAL NOTES SEE DWG. S-11

REFERENCE DRAWINGS

S-11	SITE DEVELOPMENT PLAN
S-12	ASH POND & SECONDARY SETTLING AREA
S-14	ASH POND DIKE CROSS-SECTIONS, SHEET-1
S-16	SECONDARY SETTLING AREA SPILLWAY
S-18	PLAN, SECTIONS & PROFILE, DISCHARGE FLUME
S-15	SECONDARY SETTLING AREA, WEIR BOX STRUCTURE

Drawing Release Record

Rev.	Date	Init.	Description
	9-11-73		For Const.
A	9-18-73		Relocated Dikes

ASH POND DIKE CROSS SECTIONS SHEET 2

WELSH POWER PLANT
SOUTHWESTERN ELECTRIC POWER CO.
CASON, TEXAS

SCALE HORIZONTAL: 1"=20'-0" VERTICAL: 1"=10'-0"
DRAWN D. Cacal 6-8-73
CHECKED R.P. Pahati 9-6-73
ENGINEER W. Millard 9-7-73
APPROVED R.N. Bergstrom 9-10-73
JOB NO. 4512-03

SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO. S-15

STATE OF TEXAS R. N. BERGSTROM 25972 REGISTERED PROFESSIONAL ENGINEER

PROPOSED BORINGS (UNIT #3)			
BORING NO.	BASELINE COORDINATES		BORING DEPTH
P-101	9+20.00N	6+50.00W	75 FT.
P-102	9+10.00N	3+90.00W	75 FT.
P-103	9+80.00N	2+80.00W	75 FT.
* P-104	5+12.00S	1+50.00W	60 FT.
P-105	19+00.00N	3+00.00E	50 FT.
P-106	26+00.00N	8+00.00E	50 FT.

* SEE NOTE 4

NOTES

1. THE FOLLOWING BORINGS HAVE NOT BEEN TAKEN AND THEIR REFERENCE IS ELIMINATED FROM THE SEQUENCE SHOWN IN THE BORING SCHEDULE. BORINGS P-14, P-15, P-16 P-17, P-18, P-24, P-27.
2. BORINGS AB-1 THRU AB-4 ARE AUGER BORINGS.
3. LEGEND: ◐ BORINGS ALREADY DRILLED
   ⊕ BORINGS TO BE TAKEN
4. BORING P-104 HAS SPECIAL SAMPLING REQUIREMENTS. SEE SPECIFICATION FOR GEOTECHNICAL INVESTIGATION OF UNIT #3.

REFERENCE DRAWINGS

S-2	SOIL BORING LOGS, SHEET-1
S-3	SOIL BORING LOGS, SHEET-2

BORING SCHEDULE

BORING	DEPTH
P1, P2, P-3, P19, P25, P-39, P-43	75'
P4, P5, P6, P7, P8, P-9, P11, P-12, P-13, P-38	100'
P-30, P-31, P-32, P-47, P-49	25'
P-10	TO ROCK
P-20, P-22, P-28, P-33, P-40, P-44	50'
P-21, P23, P-26, P-36, P-45, P-46	60'
P-34, P-35, P-37	45'
P-48	35'
P-41, P-42	55'
AB-1, AB-2, AB-3, AB-4	20'

UNIT #3 UNITS #1&2

Drawing Release Record			
Rev.	Date	Init.	Description
	1-9-73		FOR BORINGS
A	4-30-73		REV. ENTIRE ARRANGEMENT ADD BORINGS P34 THRU 37
B	6-26-73	J.S.	ADD BORINGS P38 THRU 49 & AB-1 THRU AB-4
	10-15-73	J.S.	ADDENDUM #1 SPEC. H-3130
C	03-14-78		ADD BORINGS P-101 THRU P-106
			FOR UNIT 3 SCREEN HOUSE BID &
CX	08-01-78		SPEC. NO. H-4397

SOIL BORING LOCATION PLAN

WELSH POWER PLANT UNIT 1, 2&3
SOUTHWESTERN ELECTRIC POWER CO.
CASON, TEXAS

SCALE 1" = 200'
DRAWN W. MILLER 12-26-72
CHECKED
ENGINEER
APPROVED
JOB NO. 4512 5464-05

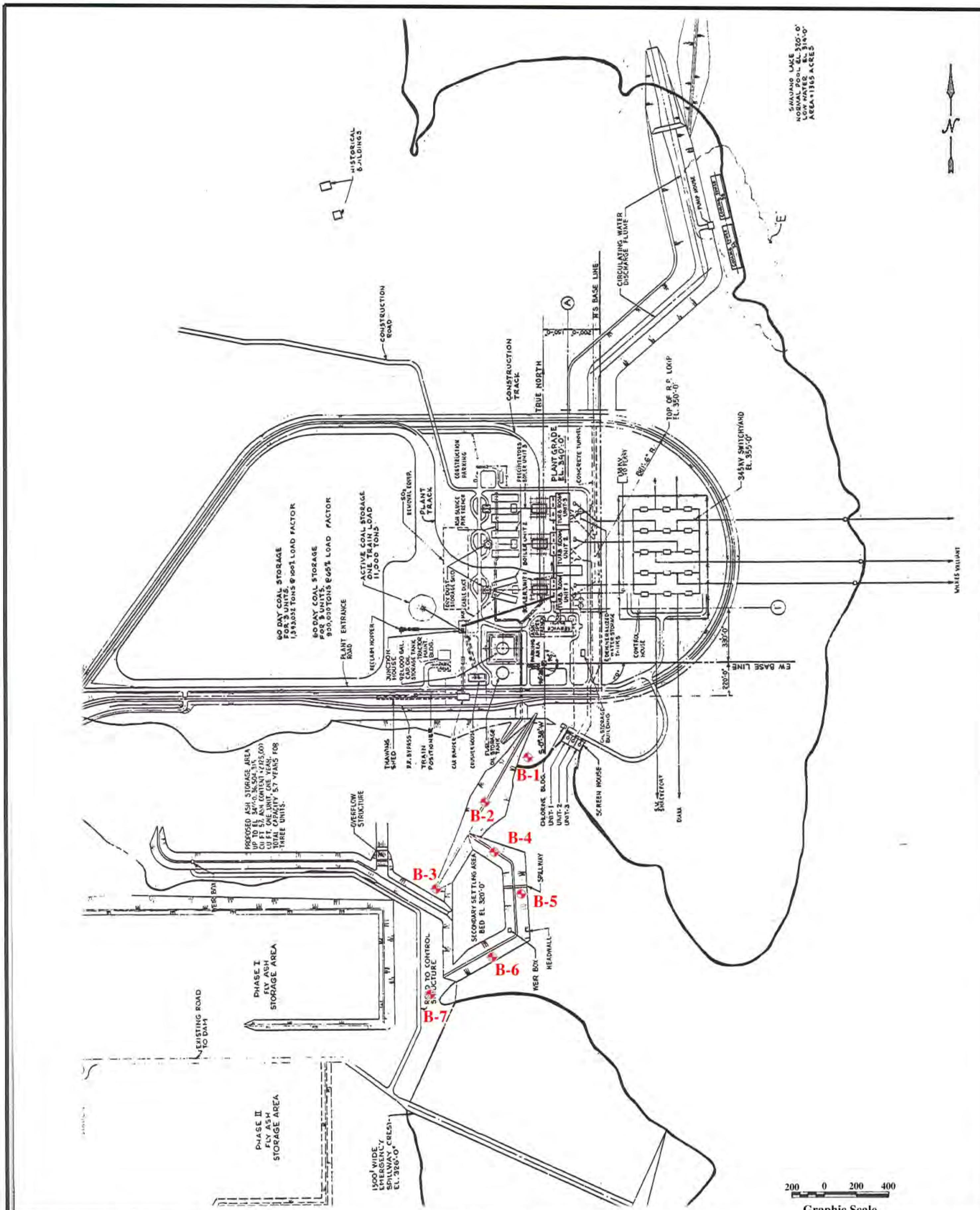
SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO. S-1

N
BOTTOM OF CANAL
T/SLOPED GROUND AT EL. 336'-0" ALONG THIS LINE
H.R.
3:1 SLOPE ON SIDEWALK
4" THICK CONCRETE W/ #6×6 WIRE MESH
C15×33.9
3/16"×5 1/2" GUARD PLATE
1 1/2" GRATING T/G EL. 336'-0"
MZ-27 SHEET PILING
1/2 GRATING
SPLIT GRATING HERE
℄ WIER BOX 24+50 W
STITCH WELD CAP TO PILING TYP
T/CONC. EL. 336'-0"
L 2"×2"×1/4"
W6×20 TYP
C8×11.5
6'-0" TYP
L 1 3/4"×1 3/4"×1/4"
4" THICK CONCRETE PAVING W/#6×6" WIRE MESH
1 1/2" HANDRAIL ℄ G.R.
15'-0"
PLAN VIEW
#6×6 WIRE MESH
SECTION "G-G"
NOTCH IN CONCRETE FOR REMOVABLE GRATING OVER STOP LOGS
4-1/4" ANCHOR STRAPS ON CHANNEL
NOTCH IN CONCRETE GROUT CHANNEL CAP IN NOTCH
SECTION "F-F"
1 1/2" HANDRAIL
3/16×5 1/2" G.R.
C15×33.9 T/S EL. 336'-0"
MZ-27 SHEET PILING
C8×11.5 T/STEEL EL. 335'-10 1/2"
L2"×2"×1/4" T/S EL. 335'-10 1/2"
W6×20
SECTION "C-C" SCALE 1"=1'-0"
T/CONCRETE 3" ABOVE NAT. GROUND
NAT. GROUND EL 348.5
8'-0" TYP
8'-0"
1 1/2" HANDRAIL
30'-10"
EL. 340'-0"
C15×33.9
3/16" GUARD PLATE
EL. 336'-0"
C8×11.5
EL 325'-0"
EL. 316'-0"
1/2 MP112
7'-0"
SECTION "1-1"
4" CONC. PAVING
EL. 325'-0"
#6@12"
#4@12"
#5@12" TYP
SECTION "E-E"
DETAIL D
#3 TIES
℄ WIER BOX
#5@12" TYP
SECTION "A-A"
1/2 MP112
1 1/2"×1/4"×1'-0" STRAP ANCHOR (ALTERNATE AT 1'-0")
1"×1/4" ANCHOR STRAPS @ 12" O.C.
GROOVED CONCRETE
DETAIL D N.T.S.
#3
2-1 1/2"Ø×1'-1" RODS
4-#4
1/4 CHAMFER (TYP)
STOP LOG DETAIL (9 REQUIRED) N.T.S.
1/2 MP 112
#5@12" TYP
SECTION "B-B"
B 3/17/75 MJM ADDED SIDEWALK REMOVED HOLD
A 10/18/74 MJM WIDEN CANAL TO 15' ADD PILING
8/2/74 ... FOR CONST.
REV. DATE BY SUBJECT
ASH SETTLING BASIN DISCHARGE CONTROL STRUCT.
WELSH POWER PLANT
SOUTHWESTERN ELECTRIC POWER CO.
G.O. CONSTRUCTION DEPARTMENT
DIVISION
APPROVED ENGR. IN CHARGE
APPROVED DIV. SUPT.
APPROVED CHIEF ENGR.
DRWN. BY MJM
TRAC. BY
DATE: 7-11-74
WORK ORDER
SCALE: 3/8"=1'-0"
DRWG. NO. WEPX-31
SHEET
FILE

<u>ATTACHMENT D</u>

INSTRUMENTATION LOCATION MAP



ETTL ENGINEERS & CONSULTANTS MAIN OFFICE 1717 East Erwin Tyler, Texas 75702 (903) 595-4421	**WELSH POWER PLANT** **PITTSBURGH, TEXAS**	**PLATE 1 - PLAN OF BORINGS**	APPROVED BY:
		JOB NO.: G3242-095	DRAWN BY: K.C.R.
		DATE: JAN. 2010 / SCALE: AS SHOWN	

LEGEND

—— E ——	OVERHEAD ELECTRIC LINE
—— · · · ——	EDGE OF WATER
— — — —	EDGE OF GRAVEL
- - - - - -	STORM DRAIN
⌒⌒⌒⌒	WOODLINE
- - - - - -	TOP OF BANK/SLOPE
—— · · · ——	TOE OF DITCH/SLOPE
- - - - - -	1.0' CONTOUR INTERVAL
— - — - —	5.0' CONTOUR INTERVAL
⊠	SOIL BORING LOCATION
✦	MONITOR WELL/PIEZOMETER LOCATION
⊙	POWER POLE
↓	GUY WIRE
⧓	VALVE
⊡	MISCELLANEOUS (LABELED)

Monitor Well Coordinate Table

Northing	Easting	TOC Elev	TOS Elev	NG Elev	Descriptor
7082649.9588	3088986.5724	333.28	Not Shot	Not Shot	AD-4
7082723.4133	3088944.5928	342.85	340.01	340.19	AD-4A
7082736.7044	3089027.6153	333.23	329.60	329.55	AD-4B
7085241.9050	3087322.4546	346.33	343.42	329.31	AD-6
7085379.0300	3088971.0772	350.82	347.90	347.86	AD-7
7085141.5536	3089572.1473	340.01	337.20	337.53	AD-8
7084426.2753	3089076.0299	343.09	340.51	340.32	AD-9
7084028.9574	3089541.4918	343.01	340.24	340.23	AD-10
7083806.9737	3089153.7064	342.18	339.55	339.61	AD-11
7083999.2913	3086633.7159	369.33	366.58	366.27	AD-12
7084143.6675	3088844.9078	347.00	344.15	344.12	AD-13
7083404.2266	3088923.7792	345.43	342.72	342.32	AD-14
7084922.5293	3089410.4800	339.67	339.95	339.87	B-2
7084518.8188	3089354.9016	340.63	340.89	340.74	B-4
7084252.5216	3089539.8565	339.98	340.29	340.22	B-5
7083922.5883	3089368.3732	340.10	340.42	340.44	B-6

NOTES:

1.) TOC ELEV DENOTES TOP OF CASING ELEVATION
2.) TOS ELEV DENOTES TOP OF CONCRETE SLAB ELEVATION
3.) NG ELEV DENOTES NATURAL GROUND ELEVATION

Soil Boring Coordinate Table

Northing	Easting	Elevation	Descriptor
7084415.3941	3089091.0855	339.63	B-3
7084981.0444	3089557.3777	324.07	B-1
7083836.1327	3089087.7883	330.38	B-7
7082299.4144	3090110.6561	325.90	NEW BORE NO. 1
7081836.9586	3089425.7638	323.63	NEW BORE NO. 2
7081271.2131	3089970.5504	320.85	NEW BORE NO. 3

THE BEARINGS ARE BASED ON GRID NORTH WITHIN THE "TEXAS COORDINATE SYSTEM OF 1983, NORTH CENTRAL ZONE", NAD83 (CORS96, EPOCH 2002.0), WITH A BEARING OF NORTH 87 DEGREES 57 MINUTES 35 SECONDS EAST. THE COMBINED SCALE FACTOR TO GO FROM GRID TO SURFACE IS 1.00012. THE FOLLOWING CONTROL MONUMENTS WERE USED TO ESTABLISH THE BASIS OF BEARINGS:

CONTROL MONUMENT NO. 30001
N-7085417.3416
E-3087023.3084

CONTROL MONUMENT NO. 30010
N-7085452.9367
E-3088022.5268

SURVEYOR CERTIFICATE:

I HEREBY CERTIFY THAT THIS TOPOGRAPHICAL SURVEY WAS MADE ON THE GROUND UNDER MY SUPERVISION ON NOVEMBER 6, 2009 AND NOVEMBER 17, 2009, THAT THIS PLAT (MAP OR DRAWING) REPRESENTS THE FACTS FOUND AT THE TIME.

MIKE GARDNER
REGISTERED PROFESSIONAL LAND SURVEYOR
NO. 5760, STATE OF TEXAS
FIRM CERTIFICATE NO. 101011-00
DATE: NOVEMBER 11, 2009
REVISED: NOVEMBER 18, 2009
REVISED: JUNE 22, 2010

MONITOR WELL & PIEZOMETER WELL LOCATIONS

WELSH POWER PLANT
CASON, TEXAS
FOR: AEP

Date		Revision/Description
11/18/09	1	ADDED ADDITIONAL PIPE LOCATION
11/18/09	2	ADDED ADDITIONAL BORING LOCATION
11/18/09	3	CHANGED NEW BORING LOCATION
11/18/09	4	MODIFIED BORING DESCRIPTOR

Drawn By	Checked By	Project No.	Dwg. Date
J.B.D.	M.G.	094026	11/11/09

MTG engineers & surveyors
5930 SUMMERHILL RD. | P.O. BOX 3786
TEXARKANA TEXAS 75501
P 903.838.8533 | F 903.832.4700
www.mtgengineers.com

 TBPE NO. 354

File No.

Sheet No. 2 OF 2

X:\2009 Projects\094026 TOPO AT WELSH POWER PLANT - GREG CARTER\094026 Grid_elev REVISED 6-22-10.pro
Tue Jun 22, 2010 11:42AM

ATTACHMENT E

HYDROLOGY AND HYDROLOGIC REPORT

Innovative approaches
Practical results
Outstanding service

`

Hydraulic Analysis of Welsh Power Plant Ash Ponds

American Electric Power Company

Prepared by:

FREESE AND NICHOLS, INC.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
817-735-7300

AEP10412

FREESE AND NICHOLS

Innovative approaches
Practical results
Outstanding service

Hydraulic Analysis of Welsh Power Plant Ash Ponds

American Electric Power Company

Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144

The seal appearing on this document was authorized by Travis N. Attanasio on December 29, 2010

Prepared by:

FREESE AND NICHOLS, INC.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109
817-735-7300

AEP10412

TABLE OF CONTENTS

LIST OF TABLES

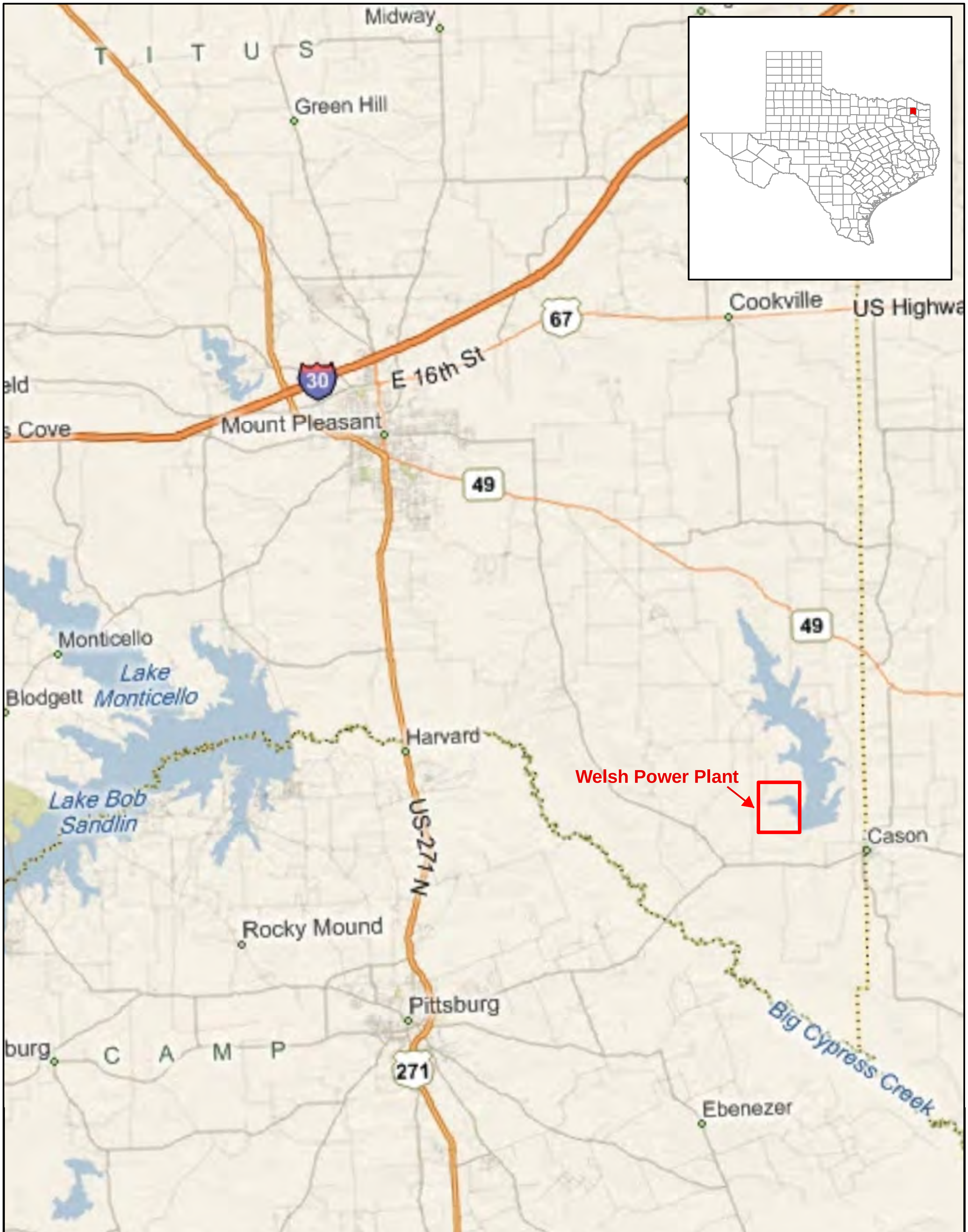
LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

In November of 2010, Freese and Nichols, Inc., (FNI) was retained by American Electric Power (AEP) to perform various hydrologic and hydraulic calculations to determine the hydraulic adequacy of the Primary Ash, Secondary Ash, and Bottom Ash Ponds for the Welsh Power Plant located near Pittsburg, TX. This report summarizes the results of the analysis for the 10-year, 25-year, 100-year, 25% PMF, 50% PMF, and 100% PMF events.

The three Ash Ponds are situated immediately south of the Welsh Power Plant on the west side of Welsh Reservoir. The general location of the power plant and associated reservoirs is shown in Figure 1.



FN PROJECT NO.	AEP10412
FILE NAME	H:\WR_DESIGN\FIGURES\ Figure1_LocationMap.mxd
DATUM & COORDINATE SYSTEM	NAD83 STATE PLANE TEXAS NORTH CENTRAL (FT)
DATE CREATED	DECEMBER 2010
PREPARED BY	JPM

FREESE AND NICHOLS
4055 International Plaza, Suite 200
Fort Worth, TX 76109-4895
817-735-7300

0 1.25 2.5 5 Miles

N

WELSH POWER PLANT ASH PONDS

LOCATION MAP

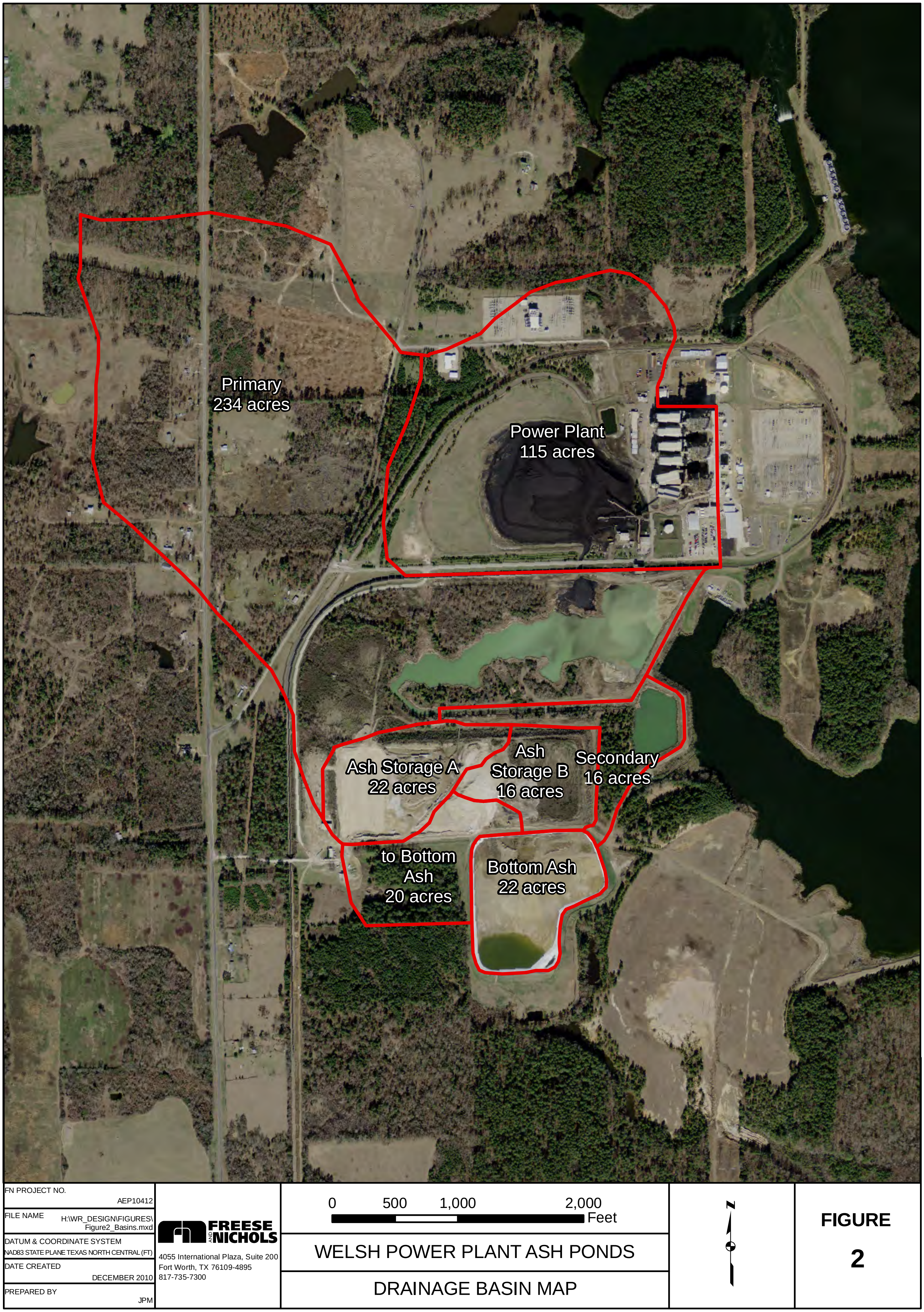
FIGURE 1

2.0 HYDROLOGIC MODEL DEVELOPMENT

2.1 BASIN DELINEATION & CONNECTIVITY

The hydrologic model for the Welsh Power Plant Ash Ponds was created in HEC-HMS[1] and consisted of seven total drainage basins, as shown in Figure 2. The total drainage area modeled is approximately 0.695 square miles, or 445 acres. Two basins, labeled *Primary* and *Power Plant*, drain directly into the Primary Ash Pond. The Ash Storage Area was divided into two drainage basins – *Ash Storage Area A* and *Ash Storage Area B* – based on a December 2009 survey of the area. A small portion of the Ash Storage Area, along with a small wooded area, drains into the Bottom Ash Pond and is shown as *to Bottom Ash* in Figure 2. Additionally, the area inside the embankment for the Bottom Ash Pond is labeled *Bottom Ash* and drains directly into the reservoir area. Finally, the basin labeled *Secondary* represents the area draining to the Secondary Ash Pond.

Each of the seven basins and three reservoir areas are connected in some way and form an intricate system of connectivity. The only discharges from the Primary Ash Pond flow through a drainage canal to the Secondary Ash Pond. This canal flows from west to east and is controlled by a weir box control structure. Discharges from the Primary Ash Pond emergency spillway also flow into this drainage canal; however, these flows enter the canal downstream of the weir box control structure. Runoff from the Ash Storage Area also enters the Primary Ash Pond via a small sump area with a 24-inch culvert. Rainfall is routed through a small ditch around the perimeter of the Ash Storage Area to this culvert. The principal spillway for the Bottom Ash Pond discharges into a 30-inch pipe which transports the outflows to the Ash Storage Area ditch. These outflows eventually discharge into the Primary Ash Pond. The emergency spillway for the Bottom Ash Pond discharges freely into the area downstream of the Welsh Reservoir emergency spillway. Finally, the combined flows from the drainage canal enter the Secondary Ash Pond, which has both a principal and emergency spillway. All discharges from the Secondary Ash Pond flow into Welsh Reservoir. Spillway capacities are discussed in further detail in Section 2.4.



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DATUM & COORDINATE SYSTEM NAD83 STATE PLANE TEXAS NORTH CENTRAL (FT)

DATE CREATED DECEMBER 2010

PREPARED BY JPM

FREESE AND NICHOLS
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WELSH POWER PLANT ASH PONDS

DRAINAGE BASIN MAP

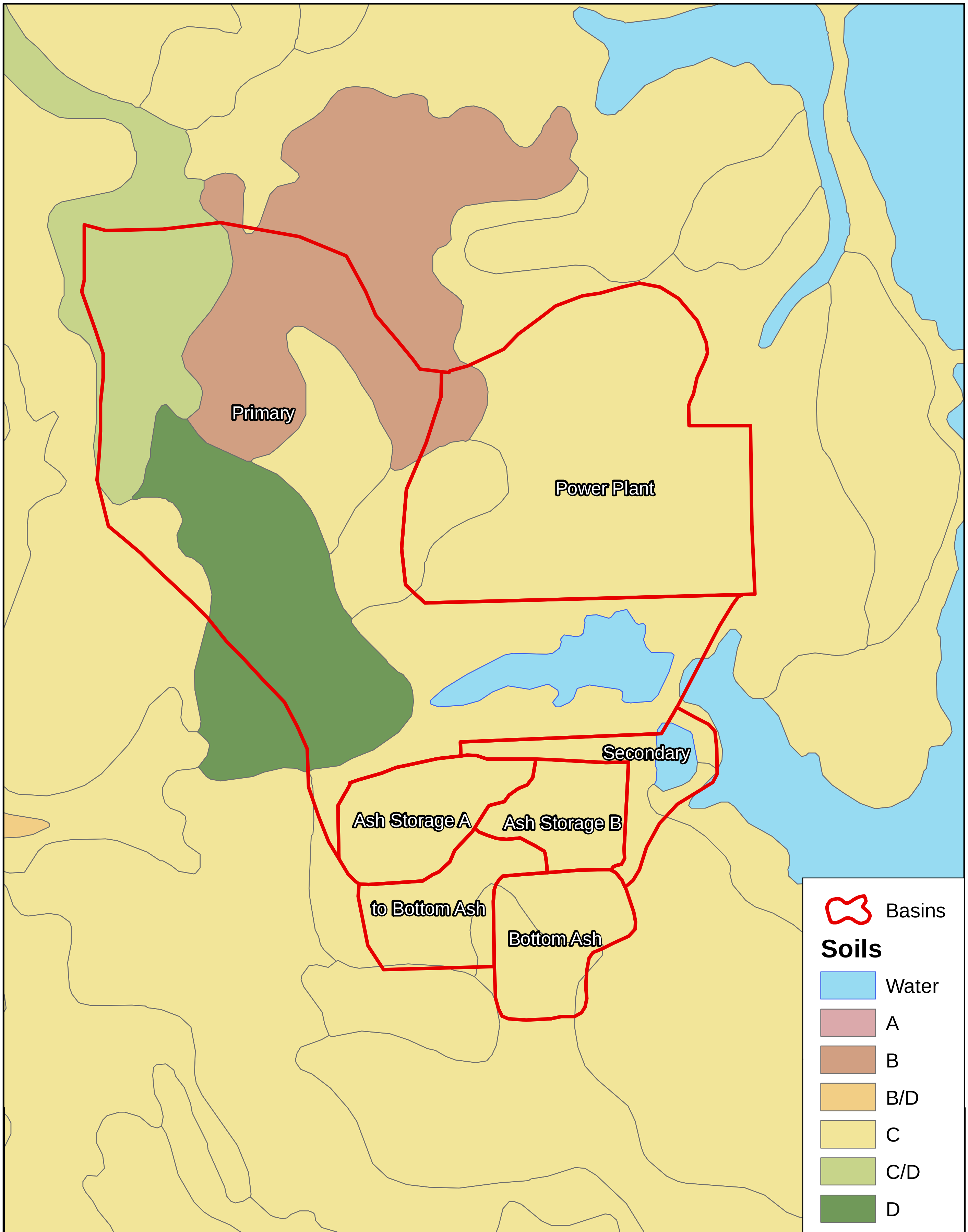
FIGURE 2

2.2 HYDROLOGIC PARAMETERS

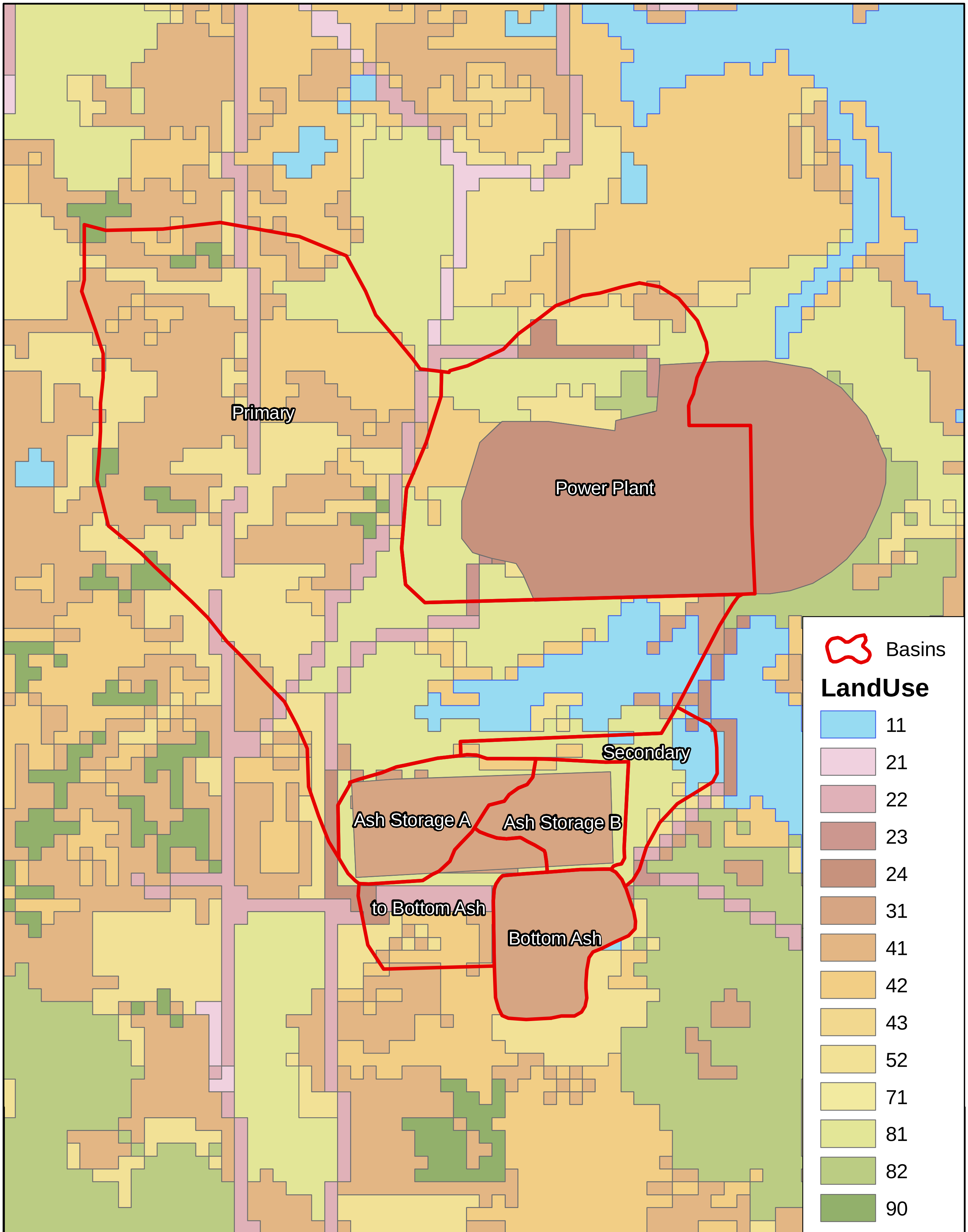
The HEC-HMS model incorporates the NRCS Curve Number and Unit Hydrograph methods for each basin. In this model, the curve numbers were based on hydrologic soil classifications and land cover. The instantaneous runoff effect of open water surfaces was accounted for in the development of the curve numbers. The soils dataset was obtained from the NRCS Soil Survey Geographic Database[2] (SSURGO), and land use dataset was obtained from the USGS Seamless Data Warehouse[3] in the form of the National Land Cover Dataset (NLCD) for 2001. Spatial information about soil types and land use classifications is presented in Figures 3 and 4, respectively. Table 1 provides the matrix used in determining the curve number for each basin. The curve numbers shown in Table 1 are for Antecedent Moisture Condition (AMC) II. These values were incorporated in the model for the frequency storm events, such as the 100-year storm event. In accordance with TCEQ recommendations, AMC III was applied to the model for PMF events. This represents a worst-case scenario with the ground fully saturated prior to the PMF event.

Table 1 – Curve Number Calculation Matrix

NLCD Classification		Curve Number (AMC II)					
#	Description	A	B	B/C	C	C/D	D
11	Open Water	100	100	100	100	100	100
21	Developed, Open Space	68	79	83	86	88	89
22	Developed, Low Intensity	51	68	74	79	82	84
23	Developed, Medium Intensity	77	85	88	90	91	92
24	Developed, High Intensity	89	92	93	94	95	95
31	Barren Land	77	86	89	91	93	94
41	Deciduous Forest	36	60	67	73	76	79
42	Evergreen Forest	36	60	67	73	76	79
43	Mixed Forest	36	60	67	73	76	79
52	Scrub/Shrub	35	56	63	70	74	77
71	Grassland/Herbaceous	39	61	68	74	77	80
81	Pasture/Hay	39	61	68	74	77	80
82	Cultivated Crops	67	78	82	85	87	89
90	Woody Wetlands	45	66	72	77	80	83



FN PROJECT NO. AEP10412	FREESE AND NICHOLS 4055 International Plaza, Suite 200 Fort Worth, TX 76109-4895 817-735-7300	WELSH POWER PLANT ASH PONDS	FIGURE 3
FILE NAME H:\WR_DESIGN\FIGURES\Figure3_Soils.mxd		HYDROLOGIC SOIL CLASSIFICATIONS	
DATUM & COORDINATE SYSTEM NAD83 STATE PLANE TEXAS NORTH CENTRAL (FT)			
DATE CREATED DECEMBER 2010			
PREPARED BY JPM			



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DATUM & COORDINATE SYSTEM NAD83 STATE PLANE TEXAS NORTH CENTRAL (FT)

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WELSH POWER PLANT ASH PONDS

LAND COVER DATA

FIGURE 4

The only input into HEC-HMS for the NRCS Dimensionless Unit Hydrograph is a lag time, which is calculated based on basin conditions, such as hydraulic length and average slope, according to the NRCS TR-55 Method. Table 2 provides a summary of the hydrologic parameters for each basin. Note that AMC II corresponds with the curve numbers used in the frequency model and that AMC III corresponds with the weighted curve numbers used in the PMP model.

Table 2 – Basin Parameters

Basin	Area (mi^2)	Lag Time (min)	Curve Number (AMC II)	Curve Number (AMC III)
Ash Storage A	0.034	5.28	87.1	93.9
Ash Storage B	0.025	7.51	87.1	93.9
Bottom Ash	0.034	4.78	91.0	95.9
Power Plant	0.180	18.77	85.3	93.0
Primary	0.366	36.14	76.0	88.0
Secondary	0.026	2.31	82.7	91.7
to Bottom Ash	0.031	16.51	77.8	89.0

2.3 ELEVATION-STORAGE DATA

Elevation-storage data for each reservoir was obtained from a combination of data sources. The elevation-storage relationship for the Primary Ash Pond was calculated from USGS 10-foot contours for the area and compared to calculations made by AEP. The Secondary Ash Pond used the AEP Calculations for elevation 320.0 ft-msl to elevation 330.0 ft-msl and a combination of USGS 10-foot contours and surveyed 2-foot contours. The Bottom Ash Pond used volume calculations from an April 2010 survey from elevation 346.13 ft-msl to elevation 355.92 ft-msl. The volume was then extrapolated to the top of dam elevation of 360.0 ft-msl by the average-end-area method and the assumption of 3:1 side slopes. These relationships were used in the hydrologic model for routing both frequency storm events and the PMF and are shown in Table 3 below.

Table 3 – Elevation-Storage Data

Primary	
Elevation (ft-msl)	Storage (acre-ft)
300	0.00
305	22.37
310	54.66
315	110.48
320	186.47
325	304.20
330	461.77
335	676.03
340	934.21

Secondary	
Elevation (ft-msl)	Storage (acre-ft)
320	0.00
330	36.87
331	41.31
332	46.30
333	51.82
334	57.67
335	63.77
336	70.09
337	76.59
338	83.26
339	90.22
340	97.45
341	105.06
342	112.68

Bottom Ash	
Elevation (ft-msl)	Storage (acre-ft)
346.13	0.00
347	0.22
348	1.31
349	3.17
350	5.51
351	8.33
352	11.94
353	16.77
354	23.57
355	33.04
356	45.07
357	65.66
358	86.50
359	107.61
360	128.98

2.4 DISCHARGE RATING CURVES

Each of the three dams has both a principal spillway and an emergency spillway. Information regarding the dimensions and elevations of each of these spillways was taken from a combination of original construction drawings, recent survey, and detailed descriptions from AEP personnel. Detailed calculations for the discharge rating curves of each spillway are included in Appendix B.

The principal spillway for the Primary Ash Pond is located in the canal connecting the Primary and Secondary Ash Ponds. It consists of a weir box with bottom elevation of 325.0 ft-msl and a 4-foot wide by 2-foot tall opening. Stop logs are placed in this opening according to regular dredging operations by AEP; however, normal conditions dictate that no stop logs are in place. This structure also consists of sheet piling to each side of the weir box, which will operate as a sharp-crested weir when flows reach the top elevation of 336.0 ft-msl. Additionally, the Primary Ash Pond has a 90-foot wide emergency spillway with a crest elevation of 334.0 ft-msl. Both the orifice and weir equations were utilized in calculating the discharge rating curves. The discharge rating curve for both spillways is shown in Table 4.

The principal spillway for the Secondary Ash Pond consists of a weir box with a 4-foot long weir discharging through a 36-inch conduit. The weir equation used for this weir box was obtained from Greg Carter of AEP from calculations he had performed in the design of a new weir plate, which is currently in place. Additionally, the Secondary Ash Pond has an approximately 45-foot wide earthen emergency spillway. The discharge rating curve for the emergency spillway was calculated with a simple HEC-RAS model with cross-sections cut through the spillway. The discharge rating curve for both spillways is shown in Table 4.

The principal spillway for the Bottom Ash Pond is a 40-foot long broad-crested weir with 6:1 side slopes and crest at elevation 355.0 ft-msl. It discharges into a small sump area connected to the 30-inch pipe directing flow back toward the Ash Storage Area. The emergency spillway is an 8-foot wide weir at elevation 358.0 ft-msl with a rock riprap discharge chute. The discharge rating curve for both spillways is shown in Table 4.

Table 4 – Discharge Rating Curves

Primary			
Elevation (ft-msl)	Principal Spillway (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
325	0	---	0
326	39	---	39
327	54	---	54
328	67	---	67
329	77	---	77
330	86	---	86
331	94	---	94
332	102	---	102
333	109	---	109
334	116	0	116
335	122	285	407
336	128	849	976
337	340	1,637	1,977
338	723	2,640	3,363
339	1,217	3,857	5,074
340	1,801	5,291	7,092

Secondary			
Elevation (ft-msl)	Principal Spillway (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
328.3	0	---	0
329	5	---	5
330	17	---	17
331	33	---	33
332	50	0	50
333	58	91	149
334	64	345	409
335	70	777	847
336	75	1,386	1,461
337	80	2,191	2,271
338	85	3,163	3,248
339	90	4,256	4,346
340	94	5,280	5,374

Bottom Ash			
Elevation (ft-msl)	Principal Spillway (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
355.0	0	---	0
355.5	50	---	50
356.0	161	---	161
356.5	330	---	330
357.0	561	---	561
357.5	858	---	858
358.0	1,224	0	1,224
358.5	1,664	11	1,676
359.0	2,182	39	2,221
359.5	2,782	85	2,867
360.0	3,466	153	3,619

2.5 FREQUENCY MODEL RESULTS

Three frequency storm events were analyzed for the Welsh Ash Pond system – the 10-year, 25-year, and 100-year storm events. The hydrologic model described in the preceding sections was implemented in analyzing these events. Curve numbers were set to Antecedent Moisture Condition II, and initial abstractions were calculated automatically by HEC-HMS. These assumptions represent normal conditions, as would be expected prior to one of these storm events. The precipitation data was obtained from the National Oceanic and Atmospheric Administration's Technical Memorandum NWS HYDRO-35[4] and Technical Paper 40.[5] These values are presented in Table 5. Each storm event was assumed to have a duration of 24 hours.

Table 5 – Frequency Precipitation Depths

Frequency (yrs)	Precipitation (in)							
	5 min	15 min	60 min	2 hr	3 hr	6 hr	12 hr	24hr
1	0.42	0.89	1.69	1.99	2.20	2.64	3.12	3.58
2	0.51	1.08	1.97	2.45	2.68	3.19	3.78	4.41
5	0.58	1.25	2.54	3.14	3.40	4.15	4.92	5.81
10	0.64	1.38	2.91	3.64	3.95	4.90	5.90	6.82
25	0.72	1.57	3.36	4.22	4.62	5.73	6.76	7.90
50	0.79	1.72	3.75	4.75	5.18	6.41	7.74	8.83
100	0.86	1.88	4.13	5.23	5.78	7.09	8.62	9.85
500	1.12	2.45	5.39	6.83	7.54	9.26	11.26	12.86

These precipitation depths serve as input data into the hydrologic model, and were routed through the model as described previously. According to TCEQ recommendations and standard engineering practice, flood routings were started at the lowest spillway crest elevation for each dam. This corresponds to elevation 325.0 ft-msl, 328.3 ft-msl, and 355.0 ft-msl for the Primary, Secondary, and Bottom Ash Ponds, respectively. The results of the 10-year, 25-year, and 100-year storm events are shown in Tables 6, 7, and 8, respectively.

Table 6 – 10-Year Storm Results

	Peak Elevation (ft-msl)	Peak Inflow (cfs)	Peak Outflow (cfs)
Primary	328.50	874.71	71.92
Secondary	332.37	112.41	72.35
Bottom Ash	355.53	157.81	55.99

Table 7 – 25-Year Storm Results

	Peak Elevation (ft-msl)	Peak Inflow (cfs)	Peak Outflow (cfs)
Primary	329.35	1079.37	80.24
Secondary	332.51	137.68	81.67
Bottom Ash	355.62	187.44	76.21

Table 8 – 100-Year Storm Results

	Peak Elevation (ft-msl)	Peak Inflow (cfs)	Peak Outflow (cfs)
Primary	330.80	1415.75	92.68
Secondary	332.62	177.95	95.96
Bottom Ash	355.76	234.22	108.10

2.6 PMF MODEL RESULTS

The Probable Maximum Flood (PMF) is defined as the greatest flood to be expected, and the Probable Maximum Precipitation (PMP) is theoretically the greatest depth of rainfall for a given duration that is physically possible over a given size storm area at a particular geographic location. Generally, the rainfall depth is calculated for the ten square miles of the watershed which receive the highest intensity rainfall.

Hydrometeorological Report No. 52 (HMR-52),[6] developed by the U.S. Army Corps of Engineers, was used to determine the rainfall for each basin. PMP estimates were taken from Hydrometeorological Report No. 51[7] and distributed according to HMR-52 to obtain average rainfall depths over the various drainage areas.

HMR-52 calculates rainfall depths for storm durations ranging from five minutes to seventy-two hours. Table 9 lists the point rainfall depths calculated by HMR-52 for storm durations from one hour to 72 hours. Because the total drainage area is less than ten square miles, these point rainfall depths were applied to each of the 7 basins. Additionally, the total rainfall depth was distributed according to the temporal distribution described by the TCEQ guidelines.

Table 9 – HMR-52 Point Rainfall Depths

Storm Duration (hr)	Depth (in)
1	16.62
2	20.86
3	24.18
6	30.47
12	36.82
24	42.10
48	46.98
72	49.74

Each PMF duration was modeled as described previously, with flood routing started at the lowest spillway crest elevation. The 12-hour event was critical for both the Primary and Secondary Ash Ponds, and the 1-hour event was critical for the Bottom Ash Pond. Additionally, the 25% and 50% PMF were calculated for the critical duration. Tables 10, 11, and 12 contain the results of these PMF model runs – the 25% PMF, 50% PMF, and 100% PMF, respectively.

Table 10 – 25% PMF Results

	Peak Elevation (ft-msl)	Peak Inflow (cfs)	Peak Outflow (cfs)
Primary	331.83	690.29	100.59
Secondary	332.68	110.63	105.57
Bottom Ash	355.70	171.14	94.27

Table 11 – 50% PMF Results

	Peak Elevation (ft-msl)	Peak Inflow (cfs)	Peak Outflow (cfs)
Primary	335.16	1385.23	122.79
Secondary	334.23	511.60	501.07
Bottom Ash	356.15	342.28	211.11

Table 12 – 100% PMF Results

	Peak Elevation (ft-msl)	Peak Inflow (cfs)	Peak Outflow (cfs)
Primary	337.46	2770.78	517.89
Secondary	337.39	2664.30	2637.73
Bottom Ash	356.78	684.55	458.48

3.0 SUMMARY AND CONCLUSIONS

Based on the results of the hydraulic analysis, each of the three dams is hydraulically adequate for the full range of storm events from the 10-year to the 100% PMF event. Table 13 lists the pertinent elevation data for each dam, including the top of dam elevation and principal and emergency spillway crest elevations. Comparing these elevations to the maximum water surface elevations shown in Table 14 indicates that, even during the 100% PMF event, each of the three dams would have almost 3 feet of freeboard. Additionally, the emergency spillway for the Primary Ash Pond is not engaged during a storm event less than the 50% PMF, and the emergency spillway for the Bottom Ash Pond is not engaged, even during the 100% PMF event. The emergency spillway for the Secondary Ash Pond is, however, engaged much more frequently, even during a storm event as low as the 10-year storm. This should have no adverse affects on this area though, as it appears to have been designed to withstand frequent engaging.

Table 13 – Pertinent Dam Information

	Top of Dam (ft-msl)	Principal Spillway (ft-msl)	Emergency Spillway (ft-msl)
Primary	340.0	325.0	334.0
Secondary	340.0	328.3	332.0
Bottom Ash	360.0	355.0	358.0

Table 14 – Summary of Results

	10-year	25-year	100-year	25% PMF	50% PMF	100% PMF
Primary	328.50	329.35	330.80	331.83	335.16	337.46
Secondary	332.37	332.51	332.62	332.68	334.23	337.39
Bottom Ash	355.53	355.62	355.76	355.70	356.15	356.78

It should be noted that these results reflect the best understanding of existing conditions and could be significantly affected by major changes to any of the three reservoirs. Specifically, major fluctuations in the available storage in each reservoir, as could be caused by the regular dredging and movement of bottom ash in and out of the pond areas, would greatly impact the results of this analysis. However, in their current conditions, the Primary Ash, Secondary Ash, and Bottom Ash Ponds associated with the Welsh Power Plant are deemed to be hydraulically adequate for any storm event up to the 100% PMF. Pertinent drawings for existing conditions are included in Appendix C.

Appendix A
References

References

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5. U.S. Department of Commerce, Weather Bureau: *Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years*, Washington, D.C., May 1961.

6. U.S. Department of Commerce, National Oceanic and Atmospheric Administration and U.S. Department of the Army, Corps of Engineers: *Hydrometeorological Report No. 52, Application of Probable Maximum Precipitation Estimates, United States East of the 105th Meridian*, Washington, D.C., 1982.

7. U.S. Department of Commerce, National Oceanic and Atmospheric Administration and U.S. Department of the Army, Corps of Engineers: *Hydrometeorological Report No. 51, Probable Maximum Precipitation Estimates, United States East of the 105th Meridian*, Washington, D.C., 1978.

Appendix B
Calculations

Discharge Rating Curve
Primary Ash Pond

Elevation [ft-msl]	Orifice [cfs]	Sheet Pile [cfs]	Main [cfs]	Emerg [cfs]	Total [cfs]
325.00	0.00	0.00	0.00	0.00	0.00
326.00	38.52	0.00	38.52	0.00	38.52
327.00	54.48	0.00	54.48	0.00	54.48
328.00	66.72	0.00	66.72	0.00	66.72
329.00	77.04	0.00	77.04	0.00	77.04
330.00	86.13	0.00	86.13	0.00	86.13
331.00	94.35	0.00	94.35	0.00	94.35
332.00	101.91	0.00	101.91	0.00	101.91
333.00	108.95	0.00	108.95	0.00	108.95
334.00	115.56	0.00	115.56	0.00	115.56
335.00	121.81	0.00	121.81	285.00	406.81
336.00	127.76	0.00	127.76	848.53	976.28
337.00	133.44	206.46	339.90	1636.79	1976.68
338.00	138.89	583.96	722.84	2640.00	3362.84
339.00	144.13	1072.80	1216.93	3857.22	5074.14
340.00	149.19	1651.68	1800.87	5290.90	7091.76

Main Spillway		
Sill Crest	325	ft-msl
Height	2	ft
Sill Width	4	ft
Orifice C	0.6	
$Q = C*A*\sqrt{2*g*H}$		
Sheet Pile	336	ft-msl
Top Width	62	ft
Weir C	3.33	
$Q = C*L*H^{3/2}$		

Emergency Spillway		
Crest	334	ft-msl
Length	90	ft
SS	2.5	:1
Weir C	3	
$Q = C*(L+2*SS*H)*H^{3/2}$		

Discharge Rating Curve
Secondary Ash Pond

Elevation [ft-msl]	Weir [cfs]	Conduit [cfs]	Main [cfs]	Emerg [cfs]	Total [cfs]
328.30	0.00	12.77	0.00		0.00
328.50	0.75	15.39	0.75		0.75
329.00	4.85	22.36	4.85		4.85
329.50	10.62	29.44	10.62		10.62
330.00	17.43	35.94	17.43		17.43
330.50	24.97	40.33	24.97		24.97
331.00	33.01	44.34	33.01		33.01
331.50	41.36	48.10	41.36		41.36
332.00	49.90	51.65	49.90	0.00	49.90
332.50	58.50	55.03	55.03	25.00	80.03
333.00	67.07	58.27	58.27	90.91	149.18
333.50	75.51	61.37	61.37	193.62	254.99
334.00	83.73	64.36	64.36	344.83	409.19
334.50	91.67	67.24	67.24	537.74	604.98
335.00	99.25	70.03	70.03	777.17	847.20
335.50	106.41	72.72	72.72	1056.25	1128.97
336.00	113.09	75.34	75.34	1385.71	1461.05
336.50	119.24	77.87	77.87	1769.84	1847.71
337.00	124.79	80.34	80.34	2190.91	2271.25
337.50	129.70	82.74	82.74	2656.86	2739.60
338.00	133.91	85.08	85.08	3163.04	3248.12
338.50	137.39	87.36	87.36	3697.92	3785.28
339.00	140.09	89.59	89.59	4256.10	4345.69
339.50	141.96	91.76	91.76	4767.86	4859.62
340.00	142.96	93.89	93.89	5279.62	5373.51

Main Spillway		
Weir Box		
Crest	328.30	ft-msl
Length	4	ft
Weir C	2.152	

$Q = C*(L-0.2H)*H^{1/2}$

Weir Equation from AEP

Conduit		
Diameter	36	in
Length	350	ft
U/S Invert	326.5	ft-msl
D/S Invert	326	ft-msl

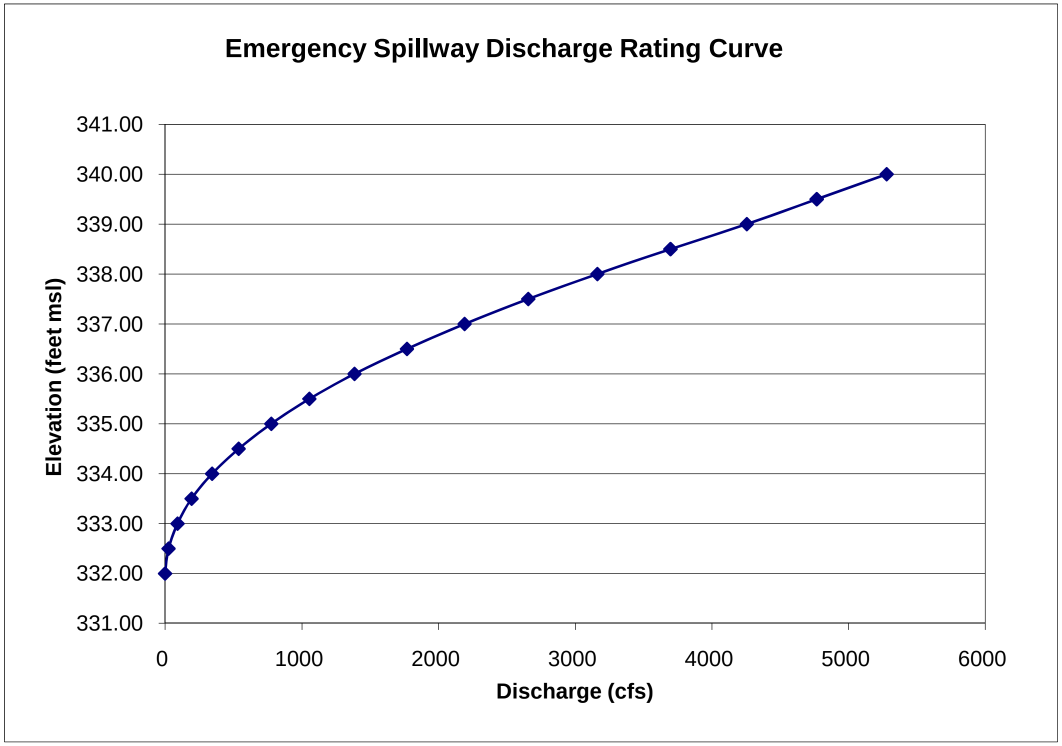
Calculated in FlowMaster

Emergency Spillway

Calculated in HEC-RAS; refer to following sheets for details.

Invert	332	Feet msl
Increment	0.5	Feet

Lake Level (feet msl)	**Discharge (cfs)**
332.00	0
332.50	25
333.00	91
333.50	194
334.00	345
334.50	538
335.00	777
335.50	1,056
336.00	1,386
336.50	1,770
337.00	2,191
337.50	2,657
338.00	3,163
338.50	3,698
339.00	4,256
339.50	4,768
340.00	5,280



HEC-RAS Results for most upstream cross section

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
SecondaryPon	EmergSpwy	871	PF 1	1	330	332.07		332.07	0	0	380.1	195.63	0
SecondaryPon	EmergSpwy	871	PF 2	10	330	332.29		332.29	0	0.02	423.67	197.71	0
SecondaryPon	EmergSpwy	871	PF 3	25	330	332.5		332.5	0.000002	0.06	465.34	200.66	0.01
SecondaryPon	EmergSpwy	871	PF 4	50	330	332.73		332.73	0.000005	0.1	511.65	204.53	0.01
SecondaryPon	EmergSpwy	871	PF 5	100	330	333.06		333.06	0.000012	0.18	579.79	208.93	0.02
SecondaryPon	EmergSpwy	871	PF 6	200	330	333.52		333.53	0.000031	0.32	677.95	215.13	0.03
SecondaryPon	EmergSpwy	871	PF 7	300	330	333.87		333.87	0.000051	0.43	752.96	221.16	0.04
SecondaryPon	EmergSpwy	871	PF 8	400	330	334.16		334.16	0.000071	0.54	818.24	228.29	0.05
SecondaryPon	EmergSpwy	871	PF 9	500	330	334.41		334.42	0.000091	0.64	876.57	234.47	0.05
SecondaryPon	EmergSpwy	871	PF 10	750	330	334.94		334.95	0.00014	0.85	1005.18	248.81	0.07
SecondaryPon	EmergSpwy	871	PF 11	1000	330	335.4		335.41	0.000184	1.03	1120.39	261.11	0.08
SecondaryPon	EmergSpwy	871	PF 12	1250	330	335.79		335.81	0.000224	1.19	1225.76	271.83	0.09
SecondaryPon	EmergSpwy	871	PF 13	1500	330	336.14		336.16	0.000261	1.34	1322.88	281.28	0.1
SecondaryPon	EmergSpwy	871	PF 14	2000	330	336.77		336.79	0.000326	1.6	1503.25	297.77	0.11
SecondaryPon	EmergSpwy	871	PF 15	2500	330	337.31		337.34	0.000381	1.82	1668.85	312.15	0.12
SecondaryPon	EmergSpwy	871	PF 16	3000	330	337.81		337.85	0.000427	2.01	1827.39	325.32	0.13
SecondaryPon	EmergSpwy	871	PF 17	3500	330	338.26		338.31	0.000468	2.19	1978.88	337.7	0.13
SecondaryPon	EmergSpwy	871	PF 18	4000	330	338.73		338.79	0.000495	2.34	2139.91	350.57	0.14
SecondaryPon	EmergSpwy	871	PF 19	4500	330	339.13		339.2	0.000525	2.48	2282.96	361.62	0.14
SecondaryPon	EmergSpwy	871	PF 20	5000	330	339.69		339.76	0.000513	2.55	2489.43	376.54	0.14

Discharge Rating Curve
Bottom Ash Pond

Elevation [ft-msl]	Main [cfs]	Emerg [cfs]	Total [cfs]
355.00	0.00	0.00	0.00
355.50	50.42	0.00	50.42
356.00	161.20	0.00	161.20
356.50	330.31	0.00	330.31
357.00	561.16	0.00	561.16
358.00	1224.21	0.00	1224.21
359.00	2182.40	39.00	2221.40
360.00	3465.91	152.74	3618.64
361.00	5102.78	358.53	5461.31
362.00	7119.19	672.00	7791.19
363.00	9539.72	1106.85	10646.57

Main Spillway		
Crest	355	ft-msl
Length	40	ft
SS	6	:1
Weir C	3.1	

$$Q = C*(L+2*SS*H)*H^{3/2}$$

Emergency Spillway		
Crest	358	ft-msl
Length	8	ft
SS	2.5	:1
Weir C	3	

$$Q = C*(L+2*SS*H)*H^{3/2}$$

Name	GRIDCODE	HSG	Area_ft^2	Area_acre	CN	Inc. CN
Ash Storage	31	C	1324276.445	30.401	91	70.06793
Ash Storage	42	C	53818.662	1.236	73	2.28431
Ash Storage	81	C	341795.137	7.847	74	14.70608
Bottom Ash	31	C	948778.856	21.781	91	91
Power Plant	41	B	1095.992	0.025	60	0.013099
Power Plant	42	B	101918.155	2.340	60	1.218085
Power Plant	81	B	99556.094	2.285	61	1.209685
Power Plant	22	C	15964.935	0.367	79	0.251229
Power Plant	23	C	70296.650	1.614	90	1.260236
Power Plant	24	C	2954103.082	67.817	94	55.31313
Power Plant	41	C	90963.024	2.088	73	1.322703
Power Plant	42	C	239129.961	5.490	73	3.477215
Power Plant	52	C	407500.071	9.355	70	5.68199
Power Plant	81	C	944143.815	21.675	74	13.91697
Power Plant	82	C	95577.482	2.194	85	1.618263
Primary	11	W	458394.580	10.523	100	4.490426
Primary	31	W	14036.955	0.322	100	0.137506
Primary	42	W	104596.947	2.401	100	1.02463
Primary	52	W	11325.853	0.260	100	0.110948
Primary	81	W	69931.187	1.605	100	0.685045
Primary	22	B	242034.352	5.556	68	1.612256
Primary	41	B	564582.710	12.961	60	3.318386
Primary	42	B	631114.853	14.488	60	3.709435
Primary	52	B	220919.125	5.072	56	1.211907
Primary	81	B	286358.868	6.574	61	1.711152
Primary	11	C	480754.464	11.037	100	4.709463
Primary	22	C	209907.569	4.819	79	1.624438
Primary	23	C	10746.609	0.247	90	0.094746
Primary	24	C	67309.636	1.545	94	0.619802
Primary	31	C	150242.962	3.449	91	1.339318
Primary	41	C	540228.652	12.402	73	3.863212
Primary	42	C	316050.970	7.256	73	2.260102
Primary	43	C	93028.069	2.136	73	0.66525
Primary	52	C	572546.147	13.144	70	3.926057
Primary	81	C	1192671.364	27.380	74	8.645709
Primary	82	C	10291.113	0.236	85	0.08569
Primary	90	C	82404.904	1.892	77	0.621573
Primary	41	C/D	916028.058	21.029	76	6.819781
Primary	42	C/D	135572.435	3.112	76	1.00933
Primary	52	C/D	331086.513	7.601	74	2.383839
Primary	90	C/D	101862.212	2.338	80	0.798273
Primary	22	D	301628.331	6.924	84	2.481987
Primary	31	D	13591.654	0.312	94	0.125155
Primary	41	D	558509.208	12.822	79	4.322207
Primary	42	D	58185.234	1.336	79	0.450286
Primary	43	D	21907.998	0.503	79	0.169542
Primary	52	D	973523.140	22.349	77	7.343195
Primary	81	D	435789.772	10.004	80	3.415192
Primary	90	D	31102.113	0.714	83	0.252881
Secondary	11	W	61159.403	1.404	100	8.574385
Secondary	22	W	0.178	0.000	100	2.49E-05
Secondary	24	W	284.987	0.007	100	0.039954
Secondary	52	W	3328.994	0.076	100	0.466716
Secondary	81	W	66883.300	1.535	100	9.37686
Secondary	11	C	100304.658	2.303	100	14.06244
Secondary	22	C	7813.937	0.179	79	0.865439
Secondary	23	C	5348.021	0.123	90	0.6748
Secondary	24	C	9873.918	0.227	94	1.301239
Secondary	31	C	300.129	0.007	91	0.03829
Secondary	42	C	37168.223	0.853	73	3.803946
Secondary	52	C	28941.171	0.664	70	2.840232
Secondary	81	C	391873.463	8.996	74	40.65531
to Bottom Ash	22	C	173034.687	3.972	79	17.29527

Basin	Area_acre
Ash Storage	39.48
Bottom Ash	21.78
Power Plant	115.25
Primary	234.35
Secondary	16.37
to Bottom Ash	18.14

Name	GRIDCODE	HSG	Area_ft^2	Area_acre	CN	Inc. CN
to Bottom Ash	23	C	2352.284	0.054	90	0.267855
to Bottom Ash	24	C	44395.328	1.019	94	5.279978
to Bottom Ash	31	C	108930.225	2.501	91	12.54171
to Bottom Ash	41	C	104222.261	2.393	73	9.626099
to Bottom Ash	42	C	197025.981	4.523	73	18.19757
to Bottom Ash	52	C	82351.521	1.891	70	7.293511
to Bottom Ash	81	C	78062.412	1.792	74	7.308709

Basin	Area_acre

BASIN LAG TIME CALCULATION

USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION

Existing Conditions

Project Data:		Comments:
PROJECT	AEP10412	
LOCATION	Welsh Power Plant	
DATE	Dec-10	
BASIN COND.		
BY:	JPM	
WSHED NAME	Ash Storage A	

SHEET FLOW: (100' MAX)

Land Use Undeveloped	n value	% Land use	Inc n
Conc.,gravel,asphalt,bare soil	0.015	100	0.015
Grass Short Prairie	0.15	0	0
Maintained Grass	0.03	0	0
Woods Light Underbrush	0.4	0	0
Woods Dense underbrush	0.8	0	0
TOTAL		100	0.015

LENGTH	100	FT.	MAX 100'
2 YR. 24 HOUR PRECIP	4.31	IN.	
SLOPE	0.010	FT/FT	

$$T_1 = 0.007 \times \frac{(n \times L)^{0.8}}{R^{0.5} \times S^{0.4}}$$

SHALLOW CONCENTRATED FLOW

1=PAVED 2=UNPAVED	2	
LENGTH	919.70	FT
SLOPE	0.021	FT/FT
COMPUTED VELOCITY FROM FIGURE 3.1=	2.319	

$$T_2 = \frac{L}{60 \times V}$$

PIPE FLOW - SOLVE FOR FULL FLOW VELOCITY

DIAMETER =	36	IN.
XSECT AREA =	7.07	SQ FT
WETTED PERIMETER	9.42	FT
SLOPE	0.002	FT/FT
MANNINGS N	0.024	
COMPUTED VELOCITY	2.39	FT/S
LENGTH	60	FT

$$V = \frac{1.49 \times \left(\frac{a}{p_w}\right)^{\frac{2}{3}} \times s^{\frac{1}{2}}}{n}$$

$$T_4 = \frac{L}{60 \times V}$$

	Conditions	Adjusted	NRCS Method	Selected
WATERSHED NUMBER	Ash Storage A	Tc (Min)	Tc (Min)	Tc (Min)
SHEET FLOW	Max 30 Min	30.0	1.77	1.77
SHALLOW CONCENTRATED FLOW			6.61	6.61
SHALLOW CONCENTRATED FLOW			0.00	0.00
SHALLOW CHANNEL FLOW				0.00
PIPE FLOW			0.42	0.42
CHANNEL FLOW				0.00
TOTAL			8.79	8.79
			Lag (Hrs) =	0.09

$$T_c = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$$

Lag(min) =	5.28

BASIN LAG TIME CALCULATION					
USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION					

Existing Conditions

Project Data:		Comments:
PROJECT	AEP10412	
LOCATION	Welsh Power Plant	
DATE	Dec-10	
BASIN COND.		
BY:	JPM	
WSHED NAME	Ash Storage B	

SHEET FLOW: (100' MAX)

Land Use Undeveloped	n value	% Land use	Inc n
Conc.,gravel,asphalt,bare soil	0.015	100	0.015
Grass Short Prairie	0.15	0	0
Maintained Grass	0.03	0	0
Woods Light Underbrush	0.4	0	0
Woods Dense underbrush	0.8	0	0
TOTAL		100	0.015

LENGTH	100	FT.	MAX 100'
2 YR. 24 HOUR PRECIP	4.31	IN.	
SLOPE	0.025	FT/FT	

$$T_1 = 0.007 \times \frac{(n \times L)^{0.8}}{R^{0.5} \times S^{0.4}}$$

SHALLOW CONCENTRATED FLOW

1=PAVED 2=UNPAVED	2	
LENGTH	796.31	FT
SLOPE	0.020	FT/FT
COMPUTED VELOCITY FROM FIGURE 3.1=	2.287	

$$T_2 = \frac{L}{60 \times V}$$

CHANNEL FLOW

			TOPWIDTH	50
XSECT AREA=	112.000	SQ FT	BOTTOM	6
			DEPTH	4
WETTED PERIMETER	50.721	FT		
SLOPE	0.008	FT/FT		
MANNINGS N	0.08			
COMPUTED VELOCITY	2.768	FT/S		
LENGTH	911.59	FT		

$$V = \frac{1.49 \times \left(\frac{a}{p_w}\right)^{\frac{2}{3}} \times s^{\frac{1}{2}}}{n}$$

$$T_6 = \frac{L}{60 \times V}$$

	Conditions	Adjusted Tc (Min)	NRCS Method Tc (Min)	Selected Tc (Min)
WATERSHED NUMBER	Ash Storage B			
SHEET FLOW	Max 30 Min	30.0	1.22	1.22
SHALLOW CONCENTRATED FLOW			5.80	5.80
CHANNEL FLOW			5.49	5.49
TOTAL			12.52	12.52
			Lag (Hrs) =	0.13

$$T_c = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$$

Lag(min) =	7.51

BASIN LAG TIME CALCULATION

USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION

Existing Conditions

Project Data:		**Comments:**					
PROJECT	AEP10412						
LOCATION	Welsh Power Plant						
DATE	Dec-10						
BASIN COND.							
BY:	JPM						
WSHED NAME	Bottom Ash						
SHEET FLOW: (100' MAX)							
Land Use Undeveloped				**n value**	**% Land use**	**Inc n**	
Conc.,gravel,asphalt,bare soil				0.015	100	0.015	
Grass Short Prairie				0.15	0	0	
Maintained Grass				0.03	0	0	
Woods Light Underbrush				0.4	0	0	
Woods Dense underbrush				0.8	0	0	
			TOTAL		100	0.015	
		LENGTH	100	**FT.**	**MAX 100'**		$T_1 = 0.007 \times \frac{(n \times L)^{0.8}}{R^{0.5} \times S^{0.4}}$
		2 YR. 24 HOUR PRECIP	4.31	**IN.**			
		SLOPE	0.020	**FT/FT**			
SHALLOW CONCENTRATED FLOW							
		1=PAVED 2=UNPAVED	2				$T_2 = \frac{L}{60 \times V}$
		LENGTH	627.21	**FT**			
		SLOPE	0.010	**FT/FT**			
		COMPUTED VELOCITY FROM FIGURE 3.1=	1.578				
			Conditions	**Adjusted**	**NRCS Method**	**Selected**	
		WATERSHED NUMBER	**Bottom Ash**	**Tc (Min)**	**Tc (Min)**	**Tc (Min)**	
		SHEET FLOW	**Max 30 Min**	30.0	1.34	1.34	
		SHALLOW CONCENTRATED FLOW			6.62	6.62	
		TOTAL			7.96	7.96	$T_c = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$
					Lag (Hrs) =	**0.08**	

Lag(min) =	**4.78**

984.648438

BASIN LAG TIME CALCULATION

USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION

Existing Conditions

Project Data:		Comments:
PROJECT	AEP10412	
LOCATION	Welsh Power Plant	
DATE	Dec-10	
BASIN COND.		
BY:	JPM	
WSHED NAME	Power Plant	

SHEET FLOW: (100' MAX)

Land Use Undeveloped	n value	% Land use	Inc n
Conc.,gravel,asphalt,bare soil	0.015	0	0
Grass Short Prairie	0.15	0	0
Maintained Grass	0.03	0	0
Woods Light Underbrush	0.4	100	0.4
Woods Dense underbrush	0.8	0	0
TOTAL		100	0.4

LENGTH	100	FT.	MAX 100'
2 YR. 24 HOUR PRECIP	4.31	IN.	
SLOPE	0.020	FT/FT	

$$T_1 = 0.007 \times \frac{(n \times L)^{0.8}}{R^{0.5} \times S^{0.4}}$$

SHALLOW CONCENTRATED FLOW

1=PAVED 2=UNPAVED	2	
LENGTH	558.86	FT
SLOPE	0.036	FT/FT
COMPUTED VELOCITY FROM FIGURE 3.1=	3.052	

$$T_2 = \frac{L}{60 \times V}$$

CHANNEL FLOW

			TOPWIDTH	7
XSECT AREA=	8.000	SQ FT	BOTTOM	1
			DEPTH	2
WETTED PERIMETER	8.211	FT		
SLOPE	0.016	FT/FT		
MANNINGS N	0.05			
COMPUTED VELOCITY	3.720	FT/S		
LENGTH	2169.79	FT		

$$V = \frac{1.49 \times \left(\frac{a}{p_w}\right)^{\frac{2}{3}} \times s^{\frac{1}{2}}}{n}$$

$$T_6 = \frac{L}{60 \times V}$$

	Conditions	Adjusted	NRCS Method	Selected
WATERSHED NUMBER	Power Plant	Tc (Min)	Tc (Min)	Tc (Min)
SHEET FLOW	Max 30 Min	30.0	18.50	18.50
SHALLOW CONCENTRATED FLOW			3.05	3.05
CHANNEL FLOW			9.72	9.72
TOTAL			31.28	31.28
			Lag (Hrs) =	0.31

$$T_c = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$$

Lag(min) =	18.77

BASIN LAG TIME CALCULATION
USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION

Existing Conditions

Project Data:		Comments:
PROJECT	AEP10412	
LOCATION	Welsh Power Plant	
DATE	Dec-10	
BASIN COND.		
BY:	JPM	
WSHED NAME	Primary	

SHEET FLOW: (100' MAX)

Land Use Undeveloped	n value	% Land use	Inc n
Conc.,gravel,asphalt,bare soil	0.015	0	0
Grass Short Prairie	0.15	0	0
Maintained Grass	0.03	0	0
Woods Light Underbrush	0.4	100	0.4
Woods Dense underbrush	0.8	0	0
TOTAL		100	0.4

LENGTH	100	FT.	MAX 100'
2 YR. 24 HOUR PRECIP	4.31	IN.	
SLOPE	0.020	FT/FT	

$$T_1 = 0.007 \times \frac{(n \times L)^{0.8}}{R^{0.5} \times S^{0.4}}$$

SHALLOW CONCENTRATED FLOW

1=PAVED 2=UNPAVED	2	
LENGTH	2757.28	FT
SLOPE	0.009	FT/FT
COMPUTED VELOCITY FROM FIGURE 3.1=	1.536	

$$T_2 = \frac{L}{60 \times V}$$

CHANNEL FLOW

			TOPWIDTH	10
XSECT AREA=	18.000	SQ FT	BOTTOM	2
			DEPTH	3
WETTED PERIMETER	12.000	FT		
SLOPE	0.010	FT/FT		
MANNINGS N	0.07			
COMPUTED VELOCITY	2.800	FT/S		
LENGTH	1984.65	FT		

$$V = \frac{1.49 \times \left(\frac{a}{p_w}\right)^{\frac{2}{3}} \times s^{\frac{1}{2}}}{n}$$

$$T_6 = \frac{L}{60 \times V}$$

	Conditions	Adjusted	NRCS Method	Selected
WATERSHED NUMBER	Primary	Tc (Min)	Tc (Min)	Tc (Min)
SHEET FLOW	Max 30 Min	30.0	18.50	18.50
SHALLOW CONCENTRATED FLOW			29.91	29.91
CHANNEL FLOW			11.81	11.81
TOTAL			60.23	60.23
			Lag (Hrs) =	0.60

$$T_c = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$$

Lag(min) =	36.14

BASIN LAG TIME CALCULATION						
USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION						

Existing Conditions

Project Data:		Comments:				
PROJECT	AEP10412					
LOCATION	Welsh Power Plant					
DATE	Dec-10					
BASIN COND.						
BY:	JPM					
WSHED NAME	Secondary					

SHEET FLOW: (100' MAX)

Land Use Undeveloped	n value	% Land use	Inc n
Conc.,gravel,asphalt,bare soil	0.015	100	0.015
Grass Short Prairie	0.15	0	0
Maintained Grass	0.03	0	0
Woods Light Underbrush	0.4	0	0
Woods Dense underbrush	0.8	0	0
TOTAL		100	0.015

LENGTH	100	FT.	MAX 100'
2 YR. 24 HOUR PRECIP	4.31	IN.	
SLOPE	0.150	FT/FT	

$$T_1 = 0.007 \times \frac{(n \times L)^{0.8}}{R^{0.5} \times S^{0.4}}$$

SHALLOW CONCENTRATED FLOW

1=PAVED 2=UNPAVED	2	
LENGTH	599.56	FT
SLOPE	0.036	FT/FT
COMPUTED VELOCITY FROM FIGURE 3.1=	3.070	

$$T_2 = \frac{L}{60 \times V}$$

	Conditions	Adjusted	NRCS Method	Selected
WATERSHED NUMBER	Secondary	Tc (Min)	Tc (Min)	Tc (Min)
SHEET FLOW	Max 30 Min	30.0	0.60	0.60
SHALLOW CONCENTRATED FLOW			3.26	3.26
TOTAL			3.85	3.85
			Lag (Hrs) =	0.04

$$T_c = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$$

Lag(min) =	2.31

BASIN LAG TIME CALCULATION

USING NRCS TR55 METHOD TO COMPUTE TIME OF CONCENTRATION

Existing Conditions

Project Data:		Comments:
PROJECT	AEP10412	
LOCATION	Welsh Power Plant	
DATE	Dec-10	
BASIN COND.		
BY:	JPM	
WSHED NAME	to Bottom Ash	

SHEET FLOW: (100' MAX)

Land Use Undeveloped	n value	% Land use	Inc n
Conc.,gravel,asphalt,bare soil	0.015	0	0
Grass Short Prairie	0.15	0	0
Maintained Grass	0.03	0	0
Woods Light Underbrush	0.4	100	0.4
Woods Dense underbrush	0.8	0	0
TOTAL		100	0.4

LENGTH	100	**FT.**	**MAX 100'**
2 YR. 24 HOUR PRECIP	4.31	**IN.**	
SLOPE	0.050	**FT/FT**	

$$T_1 = 0.007 \times \frac{(n \times L)^{0.8}}{R^{0.5} \times S^{0.4}}$$

SHALLOW CONCENTRATED FLOW

1=PAVED 2=UNPAVED	2	
LENGTH	763.95	**FT**
SLOPE	0.004	**FT/FT**
COMPUTED VELOCITY FROM FIGURE 3.1=	1.011	

$$T_2 = \frac{L}{60 \times V}$$

CHANNEL FLOW

			TOPWIDTH	16
XSECT AREA=	20.000	**SQ FT**	**BOTTOM**	4
			DEPTH	2
WETTED PERIMETER	16.649	**FT**		
SLOPE	0.008	**FT/FT**		
MANNINGS N	0.05			
COMPUTED VELOCITY	3.001	**FT/S**		
LENGTH	377.81	**FT**		

$$V = \frac{1.49 \times \left(\frac{a}{p_w}\right)^{\frac{2}{3}} \times s^{\frac{1}{2}}}{n}$$

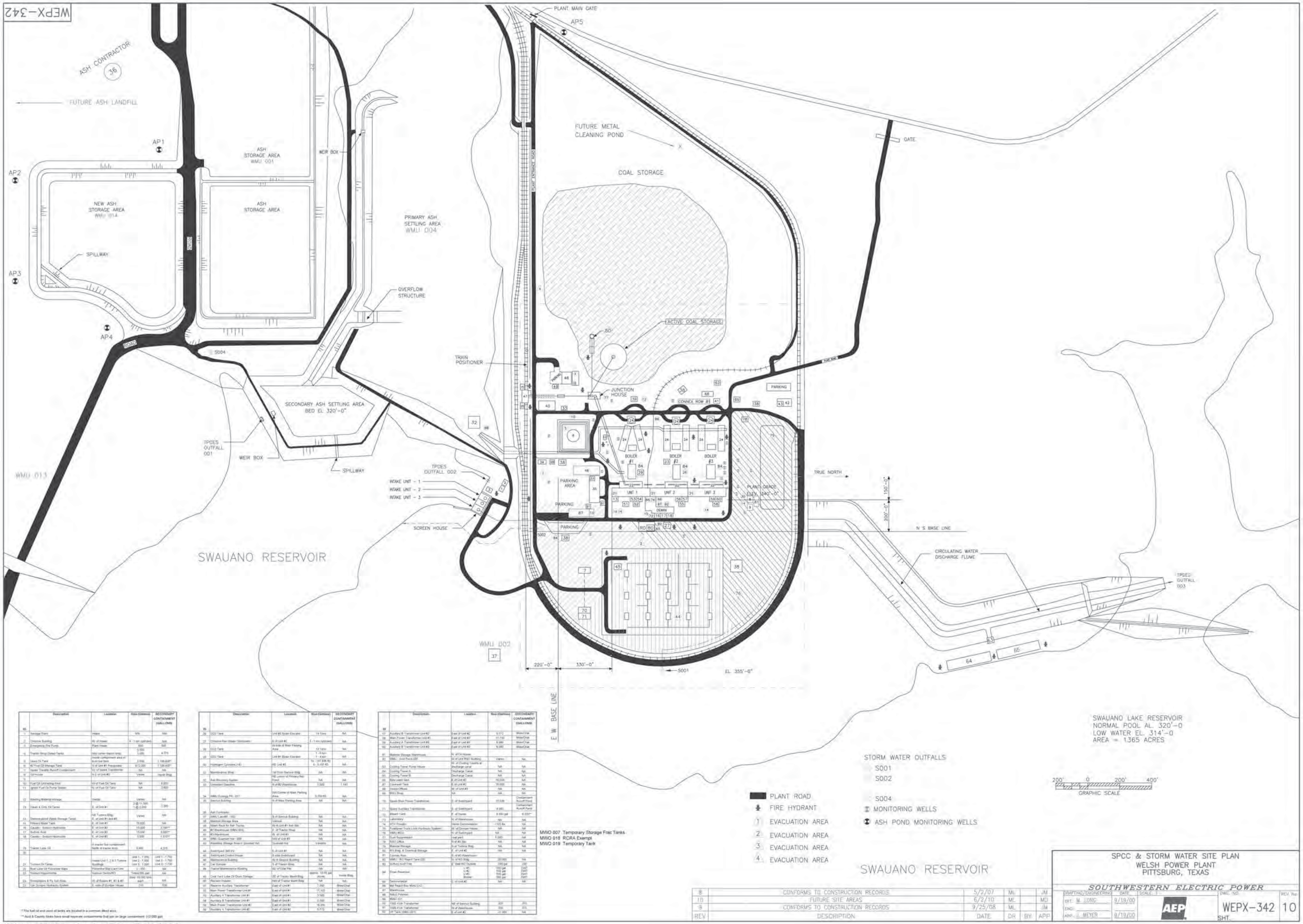
$$T_6 = \frac{L}{60 \times V}$$

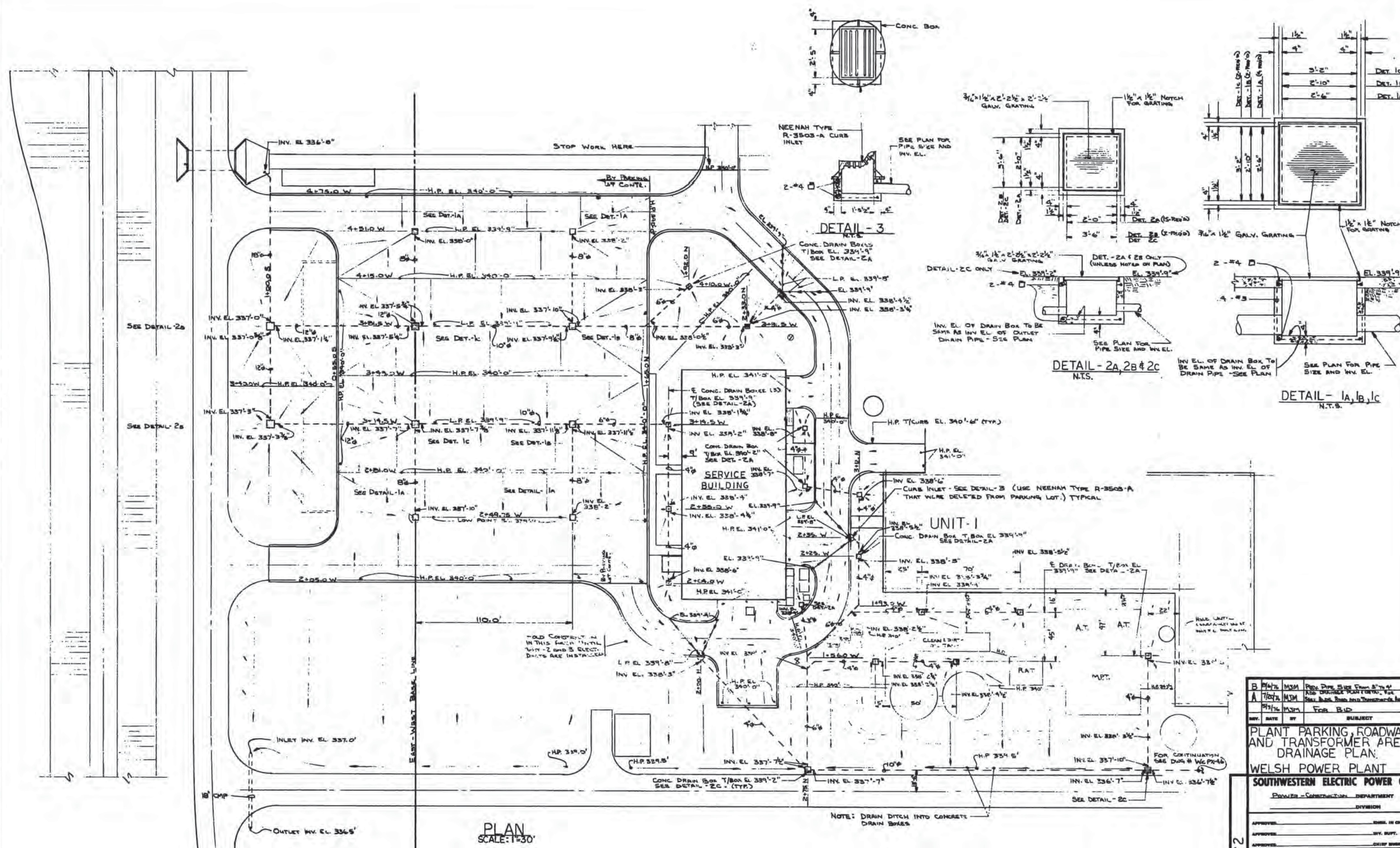
	Conditions	Adjusted	NRCS Method	Selected
WATERSHED NUMBER	**to Bottom Ash**	**Tc (Min)**	**Tc (Min)**	**Tc (Min)**
SHEET FLOW	**Max 30 Min**	30.0	12.83	12.83
SHALLOW CONCENTRATED FLOW			12.59	12.59
CHANNEL FLOW			2.10	2.10
TOTAL			27.52	27.52
			Lag (Hrs) =	**0.28**

$$T_c = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$$

Lag(min) =	**16.51**

Appendix C
Pertinent Drawings


WEPX-342
ASH CONTRACTOR
36
FUTURE ASH LANDFILL
AP1
AP2
AP3
AP4
AP5
PLANT MAIN GATE
ASH STORAGE AREA WMU 001
NEW ASH STORAGE AREA WMU 014
ASH STORAGE AREA
SPILLWAY
WEIR BOX
OVERFLOW STRUCTURE
PRIMARY ASH SETTLING AREA WMU 004
FUTURE METAL CLEANING POND
COAL STORAGE
ACTIVE COAL STORAGE
GATE
TRAIN POSITIONER
JUNCTION HOUSE
CONNEX ROW
PARKING
SECONDARY ASH SETTLING AREA BED EL 320'-0"
TPDES OUTFALL 001
TPDES OUTFALL 002
TPDES OUTFALL 003
WMU 013
WMU 002
INTAKE UNIT - 1
INTAKE UNIT - 2
INTAKE UNIT - 3
SCREEN HOUSE
BOILER
UNIT 1
UNIT 2
UNIT 3
DEMIN
PARKING AREA
PLANT GRADE ELEV. 340'-0"
TRUE NORTH
N-S BASE LINE
E-W BASE LINE
CIRCULATING WATER DISCHARGE FLUME
SWAUANO RESERVOIR
220'-0"
330'-0"
EL. 355'-0"
S001
S002
S004
SWAUANO LAKE RESERVOIR
NORMAL POOL AL. 320'-0
LOW WATER EL. 314'-0
AREA = 1,365 ACRES
STORM WATER OUTFALLS
S001
S002
S004
PLANT ROAD
FIRE HYDRANT
MONITORING WELLS
ASH POND MONITORING WELLS
1 EVACUATION AREA
2 EVACUATION AREA
3 EVACUATION AREA
4 EVACUATION AREA
MWO 007 Temporary Storage Frac Tanks
MWO 018 RCRA Exempt
MWO 019 Temporary Tank
200' 0 200' 400'
GRAPHIC SCALE
SWAUANO RESERVOIR
SPCC & STORM WATER SITE PLAN
WELSH POWER PLANT
PITTSBURG, TEXAS
SOUTHWESTERN ELECTRIC POWER
B CONFORMS TO CONSTRUCTION RECORDS 5/2/07 ML JM
10 FUTURE SITE AREAS 6/2/10 ML MD
9 CONFORMS TO CONSTRUCTION RECORDS 9/25/08 ML JM
REV DESCRIPTION DATE DR BY APP
DFT. M. LONG 9/19/00
APP. J. MEYER 9/19/00
AEP
WEPX-342 10



REV.	DATE	BY	SUBJECT
B	9/6/76	MJM	Rev. Pipe Size From 5" to 4"
A	7/20/76	MJM	Add Drainage Plan & Detail for Serv. Bldg. Road and Transformer Area
	5/3/76	MJM	For Bid

PLANT PARKING, ROADWAY AND TRANSFORMER AREA DRAINAGE PLAN.

WELSH POWER PLANT

SOUTHWESTERN ELECTRIC POWER CO.

Power - Construction DEPARTMENT

DIVISION

APPROVED ENGR. IN CHARGE

APPROVED DIV. SUPT.

APPROVED CHIEF ENGR.

SHEET 2

DRWN. BY MJM

TRAC. BY

DATE 2-9-76

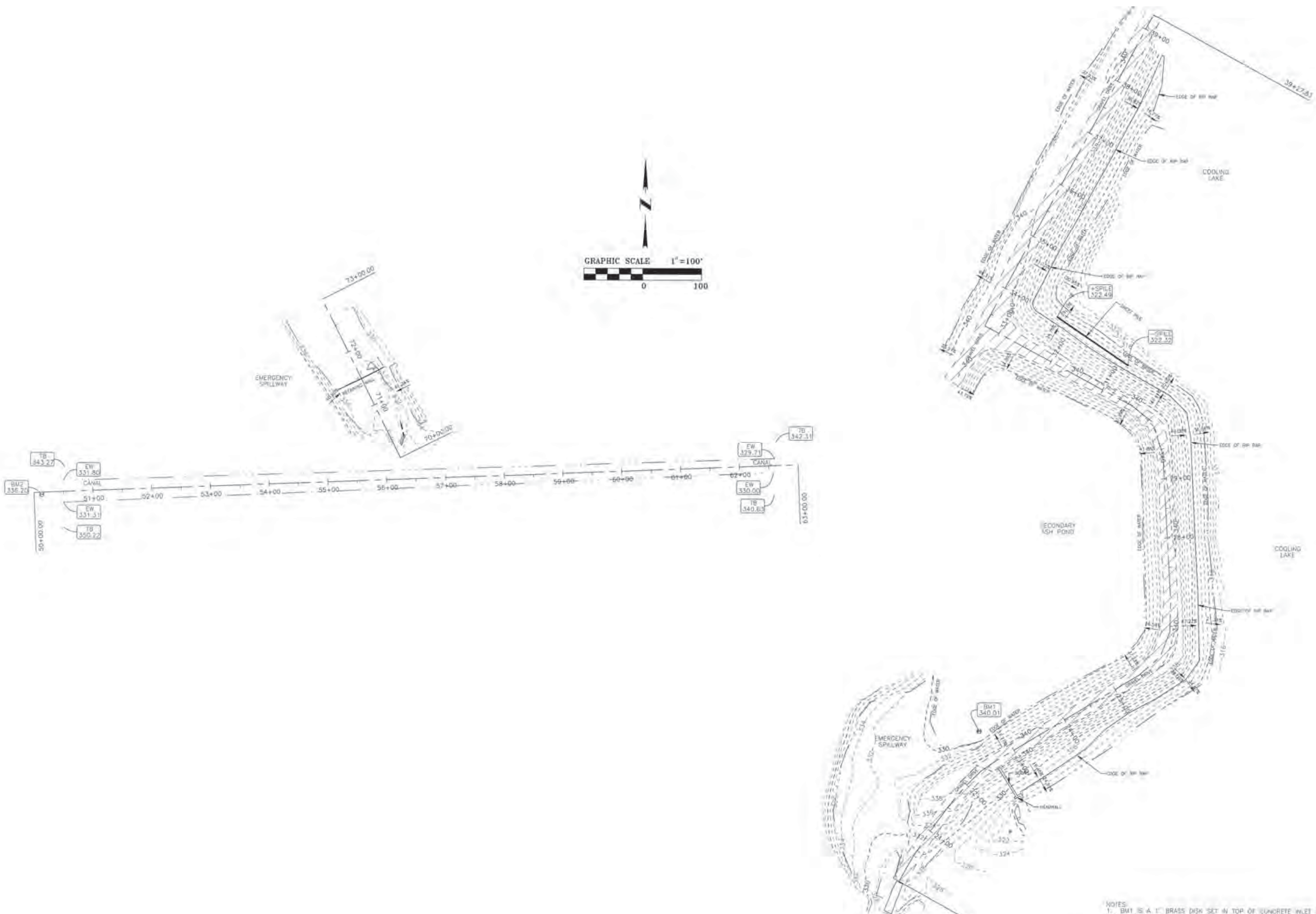
SCALE: As Noted

WORK ORDER

DRWG. NO. WePX-69

Sh. 2 of 2

FILE



NOTES:
1. BM1 IS A 1" BRASS DISK SET IN TOP OF CONCRETE INLET BOX FOR THE SECONDARY POND. ELEVATION = 340.01'

2. BM2 IS A 1" BRASS SET IN CONCRETE SPILLWAY ALONG THE CANAL. ELEVATION = 336.20'

3. TB=TOP OF BANK
EW=EDGE OF WATER
BM=BENCH MARK

4. CONTOURS ARE ARE 2.0' APART.

5. LAKE ELEVATION PER WELSH POWER PLANT ON NOVEMBER 18, 2010 WAS 317.57 FEET MSL.

SURVEYOR CERTIFICATE:

I HEREBY CERTIFY THAT THIS TOPOGRAPHICAL SURVEY WAS MADE ON THE GROUND UNDER MY SUPERVISION ON NOVEMBER 18, 2010, THAT THIS PLAT (MAP OR DRAWING) REPRESENTS THE FACTS FOUND AT THE TIME.

MIKE GARDNER
REGISTERED PROFESSIONAL LAND SURVEYOR
NO. 5760, STATE OF TEXAS
FIRM CERTIFICATE NO. 101011-00
DATE: NOVEMBER 23, 2010
REVISED: DECEMBER 6, 2010

STATE OF TEXAS REGISTERED MIKE GARDNER #5760 PROFESSIONAL LAND SURVEYOR

TOPOGRAPHIC SURVEY

DIKE'S AT WELSH POWER PLANT
FOR: GREG CARTER

Date	Revision/Description
12/8/10	ADDED LAKE LEVEL NOTE
12/6/10	ADDED CROSS SECTION SHEETS

Drawn By	Checked By	Project No.	Dwg. Date
MG	DW	104021	11/19/10

MTG engineers & surveyors
5930 SUMMERHILL RD. P.O. BOX 3786
TEXARKANA TEXAS 75501
P 903.838.8533 | F 903.832.4700
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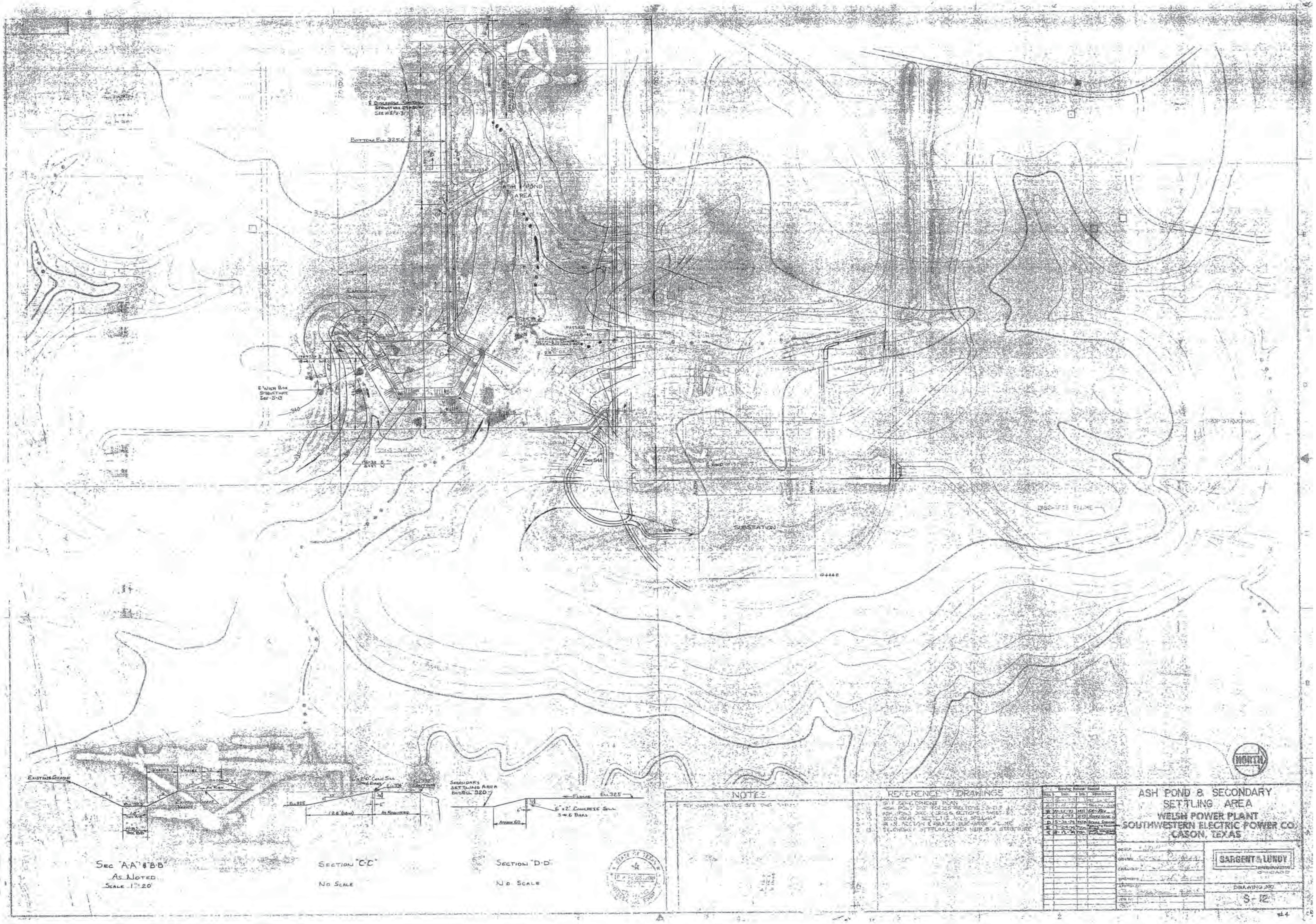
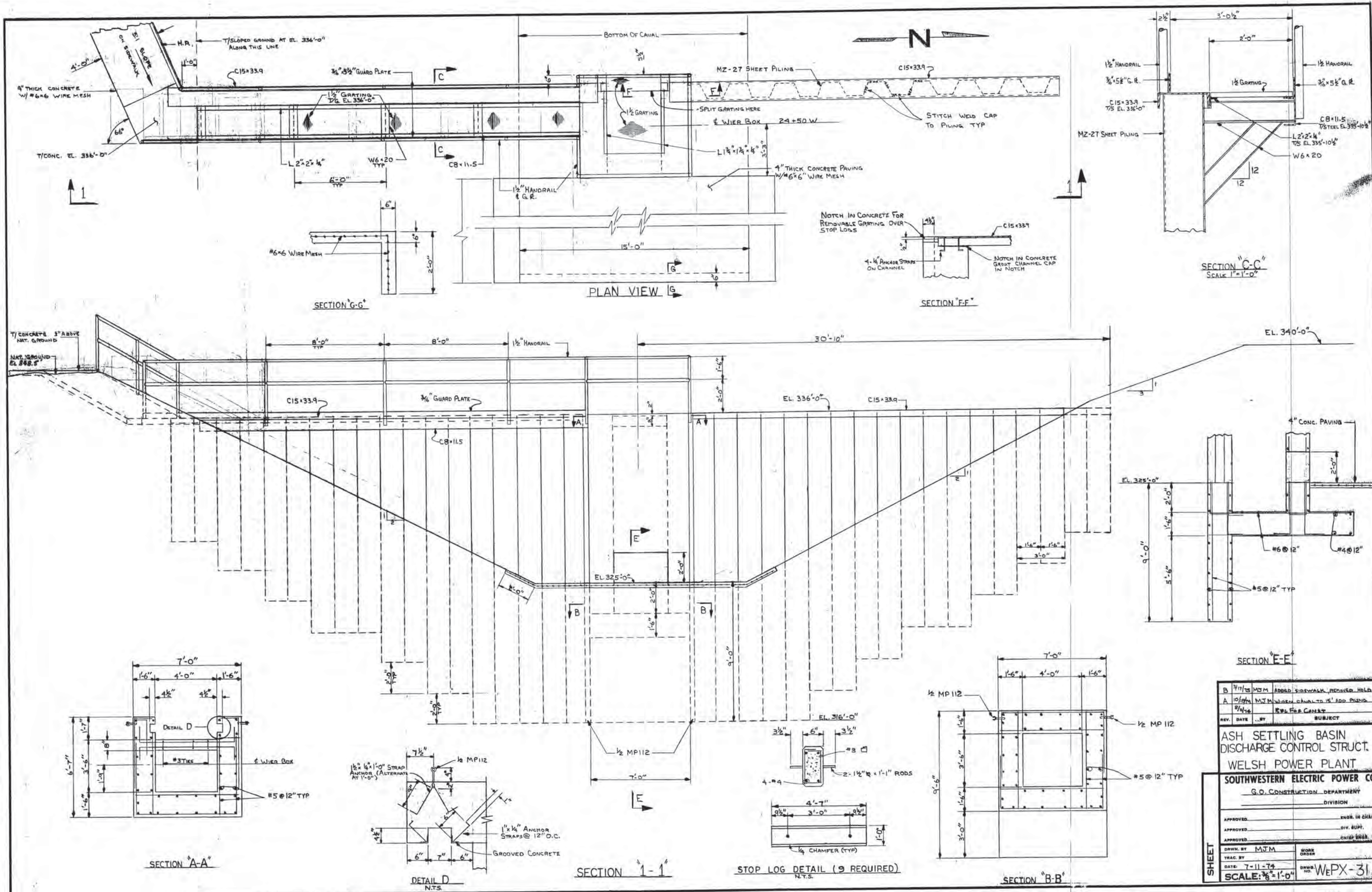
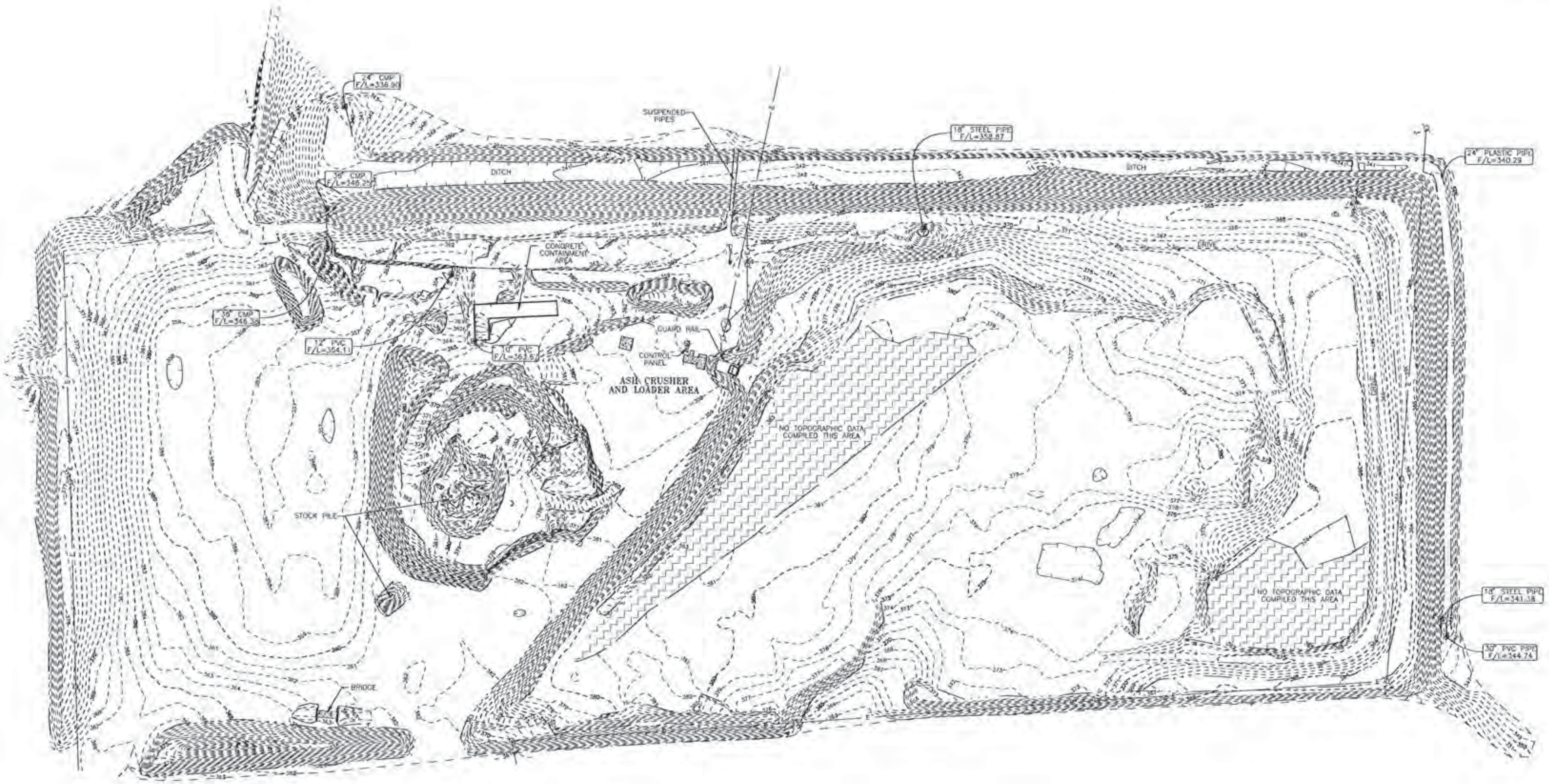
 TBPE NO. 354

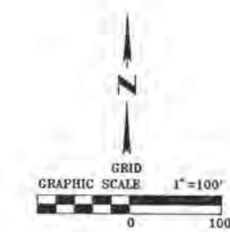
File No.: Sheet No. 1


ASH POND AREA
SUBSTATION
ROAD
DROP STRUCTURE
Bottom El. 325.0
Sec "A-A" & "B-B"
As Noted
Scale 1" = 20'
Section "C-C"
No Scale
Section "D-D"
No Scale
Existing Grade
Secondary Settling Area Bottom El. 320
6" x 2" Concrete Sill
NOTES
REFERENCE DRAWINGS
NORTH
ASH POND & SECONDARY
SETTLING AREA
WELSH POWER PLANT
SOUTHWESTERN ELECTRIC POWER CO.
CASON, TEXAS
SARGENT & LUNDY
ENGINEERS
CHICAGO
DRAWING NO.
S-12



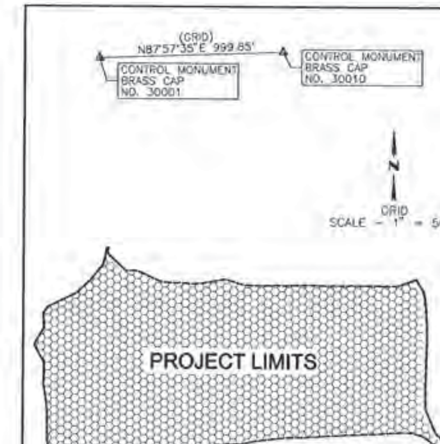
PLAN VIEW
SECTION "G-G"
SECTION "F-F"
SECTION "C-C"
SCALE 1"=1'-0"
SECTION "1-1"
SECTION "E-E"
SECTION "A-A"
DETAIL D
N.T.S.
STOP LOG DETAIL (9 REQUIRED)
N.T.S.
SECTION "B-B"
N
BOTTOM OF CANAL
T/SLOPED GROUND AT EL. 336'-0" ALONG THIS LINE
3:1 SLOPE ON SIDEWALK
4" THICK CONCRETE W/ #6×6 WIRE MESH
C15×33.9
3/8"×5 1/2" GUARD PLATE
1 1/2" GRATING T/G EL. 336'-0"
MZ-27 SHEET PILING
SPLIT GRATING HERE
℄ WIER BOX 24+50 W
STITCH WELD CAP TO PILING TYP
4" THICK CONCRETE PAVING W/#6×6" WIRE MESH
T/CONC. EL. 336'-0"
L2"×2"×1/4"
W6×20
C8×11.5
1 1/2" HANDRAIL ℄ G.R.
15'-0"
#6×6 WIRE MESH
NOTCH IN CONCRETE FOR REMOVABLE GRATING OVER STOP LOGS
4-1/4" ANCHOR STRAPS ON CHANNEL
NOTCH IN CONCRETE GROUT CHANNEL CAP IN NOTCH
T/CONCRETE 3" ABOVE NAT. GROUND
EL. 340'-0"
EL. 336'-0"
EL. 325'-0"
EL. 316'-0"
30'-10"
4" CONC. PAVING
#6@12"
#4@12"
#5@12" TYP
#3 TIES
℄ WIER BOX
DETAIL D
1/2 MP112
1 1/2"×1/4"×1'-0" STRAP ANCHOR (ALTERNATE AT 1'-0")
1"×1/4" ANCHOR STRAPS @ 12" O.C.
GROOVED CONCRETE
2-1 1/2"Ø×1'-1" RODS
4-#4
1/4 CHAMFER (TYP)
B | 4/11/75 | MJM | ADDED SIDEWALK, REMOVED HOLD
A | 10/8/74 | MJM | WIDEN CANAL TO 15', ADD PILING
8/4/74 | REL. FOR CONST.
REV. | DATE | BY | SUBJECT
ASH SETTLING BASIN DISCHARGE CONTROL STRUCT.
WELSH POWER PLANT
SOUTHWESTERN ELECTRIC POWER CO.
G.O. CONSTRUCTION DEPARTMENT
DRWN. BY MJM
DATE: 7-11-74
SCALE: 3/8"=1'-0"
DRWG. NO. WePX-31
SHEET





LEGEND

— E —	OVERHEAD ELECTRIC LINE
	TOP OF BANK / SLOPE
	TOE OF SLOPE / BANK
	PIPING
	EDGE OF DRIVE
	EDGE OF GRAVEL
— 348 —	1.0' CONTOUR INTERVAL
— 370 —	5.0' CONTOUR INTERVAL
	POWER POLE
	PIPE LOCATION
	GUY WIRE
Δ	CONTROL MONUMENT
	LIGHT POLE
	CONCRETE SURFACE
	AREA NOT SURVEYED



CONTROL MONUMENT LOCATIONS

THE BEARINGS ARE BASED ON GRID NORTH WITHIN THE "TEXAS COORDINATE SYSTEM OF 1983, NORTH CENTRAL ZONE", NAD83 (CORS96, EPOCH 2002.0), WITH A BEARING OF NORTH 87 DEGREES 57 MINUTES 35 SECONDS EAST. THE COMBINED SCALE FACTOR TO GO FROM GRID TO SURFACE IS 1.00012. THE FOLLOWING CONTROL MONUMENTS WERE USED TO ESTABLISH THE BASIS OF BEARINGS:

CONTROL MONUMENT NO. 30001	CONTROL MONUMENT NO. 30010
N-7085417.3416	N-7085452.9387
E-3087023.3084	E-3088022.5268

STATE OF TEXAS
REGISTERED
MIKE GARDNER
5760
PROFESSIONAL
LAND SURVEYOR

SURVEYOR CERTIFICATE:

I HEREBY CERTIFY THAT THIS TOPOGRAPHICAL SURVEY WAS MADE ON THE GROUND UNDER MY SUPERVISION ON DECEMBER 14, 2009, THAT THIS PLAT (MAP OR DRAWING) REPRESENTS THE FACTS FOUND AT THE TIME.

MIKE GARDNER
REGISTERED PROFESSIONAL LAND SURVEYOR
NO. 5760, STATE OF TEXAS
FIRM CERTIFICATE NO. 101011-00
DATE: DECEMBER 17, 2009

TOPOGRAPHIC SURVEY

ASH STORAGE AREA
WELSH POWER PLANT
FOR: AEP

Date	Revision/Description

Drawn By	Checked By	Project No.	Dwg. Date	File No.	Sheet No.
J.B.O.	M.G.	094027	12-17-09		

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www.mtgengineers.com

 TBPE NO. 354

X:\2009 Projects\094027 TOPO AT WELSH POWER PLANT - GREG CARTER\MERGE TOPO G.dwg
Thu Dec 17, 2009 10:13am