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Coal Combustion Residue Impoundment

Round 9 - Dam Assessment Report

H.L. Spurlock Power Station

Spurlock Ash Pond
East Kentucky Power Cooperative
Maysville, Kentucky

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

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INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The release of over five million cubic yards from the Tennessee Valley Authority's Kingston, Tennessee facility in December 2008, which flooded more than 300 acres of land, damaging homes and property, is a wake-up call for diligence on coal combustion residue disposal units. We must marshal our best efforts to prevent such catastrophic failure and damage. A first step toward this goal is to assess the stability and functionality of the ash impoundments and other units, then quickly take any needed corrective measures.

This assessment of the stability and functionality of the Spurlock Power Station Ash Pond is based on a review of available documents and on the site assessment conducted by Dewberry personnel on Tuesday, February 15, 2011. We found the supporting technical documentation adequate (Section 1.1.3). As detailed in Section(s) 1.2.1 and 1.2.2, there are recommendations based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Spurlock Power Station Ash Pond is **SATISFACTORY** for continued safe and reliable operation, with no recognized existing or potential management unit safety deficiencies.

PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is investigating the potential for catastrophic failure of Coal Combustion Residue (CCR) Surface Impoundments (i.e., management units) at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant, or High Hazard Potential ranking (for Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety).

In February 2009, the EPA sent letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material that store or dispose of coal combustion residue. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability and functionality of such

management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments.

EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Utility companies provided information on the size, design, age and the amount of material placed in the units (See Appendix D).

The purpose of this report is **to evaluate the condition and potential of residue release from management unit(s)**. This evaluation included a site visit. Prior to conducting the site visit, a two-person team reviewed the information submitted to EPA, reviewed any relevant publicly available information from state or federal agencies regarding the unit hazard potential classification (if any) and accepted information provided via telephone communication with the management unit owner. Also, after the field visit, additional information was received by Dewberry & Davis LLC about the H.L. Spurlock Power Station. This information was reviewed and used in preparation of this report.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management unit(s).

Note: The terms "embankment," "berm," "dike," and "dam" are used interchangeably within this report, as are the terms "pond," "basin," and "impoundment."

LIMITATIONS

The assessment of dam safety reported herein is based on field observations and review of readily available information provided by the owner/operator of the subject coal combustion residue management unit(s). Qualified Dewberry engineering personnel performed the field observations and review and made the assessment in conformance with the required scope of work and in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is made with regard to our assessment of dam safety.

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit, Tuesday, February 15, 2011, and review of technical documentation provided by East Kentucky Power Cooperative.

1.1.1 Conclusions Regarding the Structural Soundness of the Management Unit(s)

The dike embankments appear to be structurally sound.

1.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of the Management Unit(s)

Hydrologic and hydraulic analyses provided to Dewberry indicate adequate impoundment capacity to contain the 1 percent probability design storm without overtopping the dikes.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation is adequate. Engineering documentation reviewed is referenced in Appendix A and D.

1.1.4 Conclusions Regarding the Description of the Management Unit(s)

The description of the management unit provided by the owner was an accurate representation of what Dewberry observed in the field.

1.1.5 Conclusions Regarding the Field Observations

The visible parts of the embankment dikes and outlet structure (pump station) were observed to have no signs of overstress, significant settlement, shear failure, or other signs of instability. However, visual observations of the floodside embankments were restricted by the presence of thick vegetation, specifically phragmites, in some areas (See Appendix C, Photos 02 and 03).

Wet areas were observed at two locations during observations of the exterior slopes along the north dike (See Appendix C, Photo 04). Section 5.2.3 addresses this observation further.

Embankments appear structurally sound. There are no apparent indications of unsafe conditions or conditions needing remedial action. There was, however, some concern about past beaver habitation in/near the bottom of the southeast corner of the impoundment (See Appendix C, Photos 05 and 08). The beaver dam had recently been removed at the time of Dewberry's visual assessment.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The current maintenance and methods of operation appear to be adequate for the Spurlock Ash Pond. There was no evidence of significant embankment repairs or prior releases observed during the field assessment.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program appears to be adequate. The management unit dikes are instrumented.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The facility is SATISFACTORY for continued safe and reliable operation. No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Field Observations

Re-grading the low-lying areas that are collecting natural precipitation will reduce the potential for the ponding of water around the dam embankment, as mentioned in Section 1.1.5.

1.2.2 Recommendations Regarding the Maintenance and Methods of Operation

These recommendations should improve the safety and operation of the dike system:

- As recommended within the S&ME Instrumentation Report's recent recommendations (See Appendix A, Doc 03), all of the instruments are to be checked on a quarterly basis at a minimum.
- Maintenance staff at the plant should continue to monitor the area in the southeast corner of the outside embankment associated with the adjacent ditch along the railroad and possible beaver habitat in the area as well as the toe of the northern embankment as mentioned in Section 1.1.5 and 1.2.1, for signs of flow, leaks, or change in water color or clarity.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

Jerry Purvis, Environmental Manager, EKPC*
Matthew Clark, P.E., Environmental Engineer, EKPC*
Brad Condley, Senior Chemist, EKPC*
Brandon Bettinger, Spurlock Chemical Engineer, EKPC*
Joseph Vonderhaar, Assistant Manager, Spurlock, EKPC*
David Elkins, Spurlock Station Manager, EKPC*
Mark Brewer, P.E., P.L.S., Engineering Services Supervisor, G&T Operations, EKPC*
Glen Alexander, KYDEP/DS/DOW**
Gary Wells, P.E., Environmental Engineer II, KYDEP/DS/DOW**
Robert Edwards, P.E., Associate, Lead Site Engineer, Dewberry
Lauren Ohotzke, Staff Site Engineer, Dewberry

*East Kentucky Power Cooperative
**Kentucky Department for Environmental Protection/Dam Safety/Division of Water

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on February 15, 2011.

Robert Edwards, P.E. (KY#11983)	Lauren Ohotzke

2.0 DESCRIPTION OF THE COAL COMBUSTION RESIDUE MANAGEMENT UNIT(S)

2.1 LOCATION AND GENERAL DESCRIPTION

East Kentucky Power Cooperative (EKPC) owns and operates the H.L. Spurlock Power Station, located along the Southern banks of the Ohio River, near the town of Maysville, Kentucky, in Mason County. Access to the plant is from the main entrance off of KY 8, approximately five (5) miles west of downtown Maysville. The H.L. Spurlock Power Station is the largest plant owned by EKPC, containing one (1) impoundment designated for disposal of coal combustion residue, and referenced as the Spurlock Ash Pond.

The Spurlock Ash Pond is located near the northeastern limits of the power station property, directly south of the Ohio River at Mile 413, and shown on the project aerial photograph provided in Appendix A, Doc 01. The Spurlock Ash Pond has been outlined in yellow and labeled for identification within this document.

See Appendix A, Doc 02 for location of the H.L. Spurlock Power Station on a vicinity map.

The Spurlock Ash Pond was designed by Stanley Consultants and constructed under the supervision of a Professional Engineer in 1976.

The Spurlock Ash Pond consists of silty clay and clayey silt. Based upon data provided by the utility, the pond liner consists of a minimum of 15 to 18 inches of clay compacted with soil with an estimated seepage of 91 gal/min +/- 20%. Consolidation of the ash material through the years has most likely decreased the seepage losses.

Design drawings dated May 5, 1972 for the Proposed Ash Storage Area indicate the crest elevation of the perimeter dike is at elevation 830.0 feet, with a maximum berm height of 28 feet. The impoundment area is approximately 57 acres and has a capacity of 40.2 acre-feet.

Table 2.1: Summary of Dam Dimensions and Size

	Spurlock Ash Pond
Dam Height (ft)	28.0
Crest Width (ft)	16.0
Length (ft)	8,750
Side Slopes (upstream) H:V	3:1

2.2 COAL COMBUSTION RESIDUE HANDLING

The Spurlock Power Station consists of four units: Unit 1, Unit 2, Gilbert Unit 3, and Unit 4. Units 1 and 2 are both pulverized coal units, having similar configurations. The Gilbert Unit 3 and Unit 4 are nearly identical, circulating fluidized beds.

The Coal Combustion Residue (CCR) handling system of Units 1 and 2 consists of three major components: (1) electrostatic precipitators that remove fine ash particles which are then carried out of the furnace mixed in with the hot gases; (2) a bottom ash removal system that removes the heavier ash particles that have settled to the bottom of the furnace; and (3) a flue gas desulfurization (FGD) system ("scrubber") that removes sulfur dioxide from the flue gas, as a result, producing a byproduct (gypsum), which is then transported to the Spurlock Station Special Waste Landfill (i.e., SSSW Landfill).

2.2.1 Fly Ash

Fly ash particles are collected via an electrostatic precipitator (ESP or "precipitator"). The ESP works by inducing an electrical charge on the fly ash particles in the flue gas stream. The charged fly ash then collects on plates housed within the ESP. These plates are "rapped" causing the fly ash to drop into the hoppers below the plates. The fly ash is then transferred pneumatically from the hoppers to an ash silo. Underneath the ash silo there is a load-out that transfers the fly ash to trucks. The trucks transport the fly ash to the SSSW Landfill.

Should the fly ash system fail, EKPC can re-direct the fly ash to the "wet" ash sluice system. The sluiced fly ash is directed to the ash pond. Sluicing fly ash serves as a back-up to the "dry" fly ash system.

The Gilbert Unit 3 and Unit 4 produce two types of CCRs, fly ash and bed ash. In the fluidized bed, lime is added to the combustion process to "dry scrub" the sulfur from the coal. The sulfur reacts with the lime to form solids that are removed with the fly ash or bed ash. In these boilers a bed of ash circulates and re-circulates in the furnace providing heat transfer to the internal boiler tubing. The level of this bed ash is controlled by continually withdrawing a portion of the accumulating ash through a control device, depositing to a silo. From the silo the bed ash is loaded onto trucks and taken to the SSSW Landfill. The fly ash in these two units is removed from the flue gas by a series of bag filters. As in Units 1 and 2, after collecting the ash in hoppers, the fly ash is transferred

pneumatically to a silo, loaded onto trucks, and then transferred to the SSSW Landfill.

2.2.2 Bottom Ash

The bottom ash, approximately 20% of the ash component, collects in hoppers at the base of the furnace and is sluiced to the ash pond via 3 transport pipes, as seen in Appendix C, Photos 09 through 13. Additional photos of the bottom ash within the Pond can be found in Appendix C, Photos 17, 18, and 19.

2.2.3 Boiler Slag

Boiler slag is collected in hoppers at the base of the furnace, ground up in the clinker grinder, and then sluiced to the ash pond.

2.2.4 Flue Gas Desulfurization Sludge

The gypsum produced during the FGD process is dewatered on drum filters located in the scrubbers and then conveyed to a loading area. Within the loading area the gypsum is loaded onto trucks and transported to the SSSW Landfill.

2.3 SIZE AND HAZARD CLASSIFICATION

The classification for size, based on the height and storage capacity of the Spurlock Ash Pond is "Small" in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria summarized in Table 2.21.

Table 2.2a: USACE ER 1110-2-106 Size Classification

	Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

KDEP/DoW is responsible for performing safety inspections of dams and hazardous impoundments in Kentucky. The most recent inspection by the Division of Water was conducted on February 19, 2009.

This facility is classified as a Class (A) – Low Hazard Structure, in accordance with guidelines from the KDEP/DoW. This classification applies to structures located

such that failure would cause loss of the structure itself, but there would be little or no damage outside of the property.

The Spurlock Ash Pond is not in the National Inventory of Dams, and therefore the dike does not have an established hazard classification.

Dewberry conducted a qualitative hazard classification based on the 2004 Federal Guidelines for Dam Safety classification system (shown in Table 2.2b).

Table 2.2b: FEMA Federal Guidelines for Dam Safety Hazard Classification

	Loss of Human Life	**Economic, Environmental, Lifeline Losses**
Low	None Expected	Low and generally limited to owner
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for classification)

Loss of human life is not probable in the event of a catastrophic failure of the dike. In addition, failure of the dike would likely result in a low economic and/or environmental impact, such as limited bottom ash contamination of the Ohio River. Accordingly, Dewberry evaluated the dike as "**Low Hazard Potential**".

2.4 AMOUNT AND TYPE OF RESIDUALS CURRENTLY CONTAINED IN THE UNIT(S) AND MAXIMUM CAPACITY

EKPC's response (See Appendix D) to the EPA's request for information (as noted in paragraph 2 of the Purpose and Scope of this report on page iii), indicates that the Spurlock Station sluices only bottom ash to the Spurlock Ash Pond. Approximately 1,500,000 cubic yards of bottom ash is stored in the pond; pond capacity is calculated to be 1,750,000 cubic yards.

Table 2.3: Maximum Capacity of Unit	
Spurlock Ash Pond	
Surface Area (acre)[1]	57.0
Current Storage Capacity (cubic yards)[1]	1,500,000
Current Storage Capacity (acre-feet)	34.4
Total Storage Capacity (cubic yards)[1]	1,750,000
Total Storage Capacity (acre-feet)	40.2
Crest Elevation (feet)	530.0
Normal Pond Level (feet)	527.5

[1] Provided by EKPC

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

The impoundment is an earthen embankment dike with a crest measuring approximately 8,750 feet in length and averaging 16 feet in width. The inside and outside slopes of the embankments were designed with 3:1 slopes. The embankment material consists of brown silty clay or brown clayey silt containing some sand available within or adjacent to the pond area.

2.5.2 Outlet Structures

The 3 transport pipes as mentioned in Section 2.2.2 can be adjusted within the pond, resting them atop a series of pipe floaters (See Appendix C, Photos 14 and 15). Being able to relocate the pipes' inlet prevent the piles from growing too large. One of the 3 pipes' inlet to the Pond can be seen in Appendix C, Photo 16, depositing CCR, specifically bottom ash, into the Ash Pond.

The water atop the settled bottom ash within the Pond (See Appendix C, Photo 20) is pumped to the Primary Lagoon and Secondary Lagoon (See Appendix C, Photos 06 and 07, respectively), where additional settling occurs. From the Secondary Lagoon the water is either pumped back to the bottom ash sluicing system or discharged through a KPDES permitted outfall, into a ditch that empties into the Ohio River, which runs parallel to the Impoundment's Northern embankment (See Photo 21).

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

The nearest downstream town, Ripley, Ohio, is located approximately 3.5 miles from the Spurlock Ash Pond. Based on available area topographic maps, surface drainage in the area of the Ash Pond is intercepted by drainage ditches located parallel to the southern and eastern dikes which then empty to the Ohio River. Releases from the north and west side of the impoundment will discharge into the Ohio River directly. Releases from the east and south dikes will discharge into the drainage ditches that run parallel to the dikes and carried into the Ohio River. Based on available aerial photographs and a brief driving tour of the area, Dewberry did not identify any critical infrastructure assets down gradient of the Ash Pond.

During the site visit, Dewberry confirmed with EKPC that there was, in fact, not any critical infrastructure within a 5 mile radius downstream.

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

3.1 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

The dam, constructed in 1976, pre-dates any local or state permitting requirements.

Discharge from the impoundment is regulated by the Kentucky Department for Environmental Protection. The impoundment was issued a Kentucky Pollutant Discharge Elimination System (KPDES) Permit No. KY0022250 on September 5, 2000 (See Appendix A, Doc 04). Mr. Gary Wells, P.E., KYDEP/DS/DOW, confirmed that Permit No. KY0022250 is still current and the Pond is still regulated despite the fact that the Permit expired in 2004.

3.2 SUMMARY OF SPILL/RELEASE INCIDENTS

Data reviewed by Dewberry did not indicate any spills, unpermitted releases, or other performance related problems with the dam.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The Spurlock Ash Pond was designed by Stanley Consultants and originally constructed in 1976 (See Section 2.1 for a general description of the impoundment pond construction).

4.1.2 Significant Changes/Modifications in Design since Original Construction

A review of the original plans provided to the dam assessor, as well as the visual site assessment did not identify any significant changes/modifications in design since the original construction. EKPC has confirmed this to be true.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No evidence of prior releases, failures, or patchwork was observed on the earthen embankment during the visual site assessment and no documents or statements were provided to the dam assessor that indicated prior releases or failures have occurred. EKPC personnel stated that there had not been any significant repairs/rehabilitation since original construction. EKPC has confirmed this to be true.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

The impoundment was designed for and has/is operated for CCR sedimentation and control. This pond only receives plant coal combustion waste slurry and natural precipitation.

4.2.2 Significant Changes in Operational Procedures and Original Startup

No documents were provided to indicate any operational procedures have changed. Operations are conducted the same as described in Section 2.2.2, with the exception of the removal of fly ash from the waste stream entering the pond; the Ash Pond now receives only bottom ash, as stated by EKPC.

4.2.3 Other Notable Events since Original Startup

No additional information was provided to Dewberry of other notable events impacting the operation of the impoundment. However, EKPC has stated that there have not been any other notable events since original startup.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Robert Edwards, P.E. and Lauren Ohotzke performed a site visit on Tuesday, February 15, 2011 in company with the participants (See Section 1.3.1).

The site visit began at 12:45 PM. The weather was cool and overcast. Photographs were taken of conditions observed. Please refer to the EPA Checklist in Appendix B. Selected photographs are included here for ease of visual reference. All pictures were taken by Dewberry personnel during the site visit. Additional photos, referenced throughout this report, have been provided in Appendix C.

The overall assessment of the dam was that it was in satisfactory condition and no significant findings were noted.

5.2 EARTH EMBANKMENT

5.2.1 Crest

The crest of the Ash Pond had no signs of depressions, tension cracks, or other indications of settlement or shear failure, and appeared to be in satisfactory condition at the time of this assessment. Typical conditions of the Ash Pond's North, South, East, and West crests can be seen within Appendix C, as Photos 22, 23, 24, and 25, respectively.

5.2.2 Upstream/Inside Slope

As mentioned in Section 1.1.5, current grades of the interior slopes could not be verified because large segments of the interior embankment were covered by excessive vegetation, specifically tall phragmites (See Appendix C, Photos 02 and 03). The portion of embankment visually available indicated that the slopes were protected against erosion due to wind, water, and wave action by a layer of 18" thick riprap, and experiencing no erosion (See Appendix C, Photos 26 and 27).

5.2.3 Downstream/Outside Slope and Toe

The outside slope of the south and east dike are bordered by parallel ditches that drain to the Ohio River. The outside slope of the north dike runs parallel to and faces the Ohio River. The outside slopes were observed to measure approximately 3:1 with some variances. The exterior

embankments were generally in good condition with adequate grass cover and well maintained (See Appendix C, Photos 28,29,30,31 for the general condition of the North, South, East, and West exterior embankments, respectively). There were no observed scarps, sloughs, bulging, cracks, depressions, or other indications of slope instability or signs of erosion found during this assessment.

As discussed further in Sections 1.1.5, 1.2.1 as well as 1.2.2, wet areas were observed in two locations: one at the toe of the exterior slope along the north dike (See Appendix C, Photo 04), and one in the southeast corner of the outside embankment that appears to be associated with the adjacent ditch running parallel to the east dike as well as the ditch parallel to the railroad/ south dike, intersect coincidently with the beaver habitat, thus water accumulates from the dams constructed by the beaver habitation, slowing drainage to the Ohio River (See Appendix C, Photo 05). Recent precipitation suggests that these locations are susceptible to the ponding of water from natural run-off and not indicative of leaks or seepage from the Spurlock Ash Pond.

5.2.4 Abutments and Groin Areas

The dike is continuous, and therefore there are no abutments or groin areas.

5.3 OUTLET STRUCTURES

5.3.1 Overflow Structure

No overflow structure is present.

5.3.2 Outlet Conduit

See Section 2.2.2.

5.3.3 Emergency Spillway

No emergency spillway is present.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation has been provided about the flood of record.

6.1.2 Inflow Design Flood

Note that stormwater flow into the ash pond system is minimal and from direct precipitation only (there is no stormwater runoff entering the Ash Pond)

Note also that there is no emergency spillway, the water level within the pond is maintained using an ash water transfer pump station capable of discharging at a rate of 4800 gpm (See Appendix C, Photo 01). An engineering study was conducted in July 2010, referenced in Appendix A, Doc. 06, to evaluate risks of the 100-year rain event and freeboard requirement. Based on the study results it was recommended that the water surface elevation not exceed an elevation of 526.7. This would provide the recommended one (1) foot freeboard and storage for a 6-hour, 100-year rain event, and compensate for the lack of an emergency spillway protect against pump failure, and/or other contingencies that would further increase the potential for overtopping the dikes.

6.1.3 Downstream Flood Analysis

No downstream flood analysis data was provided for review.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting documentation provided for review by Dewberry is adequate to determine the risks of a 100-year rain event, as noted in Section 6.1.2.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

Based upon review of available topographic information, site plans, field observations, engineering studies, field inspections, and stormwater flow into the ash pond, dike failure by overtopping seems improbable.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

Stability analyses were performed and are included in the initial subsurface exploration program conducted by Dames & Moore in July 1975 for Stanley Consultants. Please find this information attached in Appendix A, Doc 05. The data utilized in the stability analyses provided by EKPC for Dewberry's review were obtained from laboratory tests performed on representative undisturbed samples, obtained from borings drilled within the area of the dikes, and on reconstituted samples, representative of compacted fill materials.

Various conditions of stability (See Table 7.1.4) were considered in the analyses as follows:

1 End of construction

2 Steady state seepage (water elevation at 517 no ash)

3 Steady state seepage (water elevation at 529, ash elevation 527.5)

4 Steady state seepage condition (3) but with earthquake force

Based on the results of the analyses it was concluded that the embankments have stability safety factors at or above the minimum recommended values.

7.1.2 Design Parameters and Dam Materials

The documentation in the initial subsurface exploration (See Appendix A, Doc 05) program is shown in Table 7.1.2.

Table 7.1.2: Engineering Properties

Material	Unit Wgt pcf	Friction Angle	Cohesion psf
Fill Material	125	25	3270
River Bank Upper Cohesive	128	25	3500
River Bank Silty Sand	120	32	100
River Bank Sand	125	35	0
Soft Soil Upper Cohesive*	106	25	450
Soft Soil Lower Cohesive*	112	25	550
Soft Soil Sand*	125	35	0

* The soft area indicated on the table is between Borings AS-28 and AS-30

7.1.3 Uplift and/or Phreatic Surface Assumptions

Phreatic surface readings since the installation of monuments, inclinometers, and piezometers in May 2010 (See Appendix – Doc 07), have been taken from piezometers-installed at two depths. The readings show that the deeper piezometers indicate a phreatic surface that corresponds with the elevation of the adjoining Ohio River and represents the stable or natural groundwater table. The shallower piezometer readings showed a consistent phreatic surface that occurs approximately eight (8) feet below the ground surface

7.1.4 Factors of Safety and Base Stresses

The safety factors for the Stability Analyses computed in the initial subsurface exploration program for the Spurlock Ash Pond (See Appendix A – Doc 05) are shown in Table 7.1.4.

Table 7.1.4: Stability Analysis Results

Location	Stability Condition	Remarks	Minimum F.S.
River Bank	1	(A)	3.96
River Bank	2	(B)	1.57
River Bank	3	(C)	1.28
River Bank	3	(B)	1.51
River Bank	4	(C)	1.08
River Bank	4	(B)	1.24
Soft Soil	1	(D)	1.93
Soft Soil	1	(E)	2.85
Soft Soil	1	(E)	3.52
Soft Soil	3	(E)	1.52
Soft Soil	4	(E)	1.24

Table 7.1.4 Remarks

(A) Pond Bottom at Elevation 503
(B) 50-foot wide berm from exterior dike toe to top of river bank
(C) 25-foot wide berm from exterior dike toe to top of river bank
(D) No soft soils removed below Elevation 503
(E) Soft soils extending to Elevation 495 removed and replaced with compacted fill

7.1.5 Liquefaction Potential

No documentation has been provided about the liquefaction potential.

7.1.6 Critical Geological Conditions

In the stability analyses (See Appendix A, Doc 05) a peak ground acceleration of 0.05g was used for seismic loading. This corresponds to a 2% probability of exceedence in 50 years in accordance with the current USGS Seismic Risk Map of the United States. The seismic design criteria used in the analyses are appropriate for the Spurlock Ash Pond.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is adequate.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability of the dam appears to be satisfactory based on the observations during the February 15, 2011 field visit by Dewberry and the Slope Stability Analysis provided within in the initial subsurface exploration program (See Appendix A – Doc 05). In addition to the information listed below, see the EPA checklist (Appendix B) and/or Sections 5.2.1 and 5.2.3 for more information.

- The crest appeared free of depressions and no significant vertical or horizontal alignment variations were observed.
- There was no indication of major scarps, sloughs or bulging along the dikes.
- Boils, sinks, or uncontrolled seepage was not observed along the slopes, groins, or toe of the dikes.
- The computed factors of safety comply with accepted criteria.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

The Spurlock Ash Pond is operated for temporary storage of bottom ash. For more information, please see Section 2.2.2.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Management at the H.L. Spurlock Power Station have established the following current maintenance procedures:

- Observed problems or malfunction issues are entered into the Asset Life Management (ALM) system as Condition Directed (CD) work orders. These are scheduled and completed based on assigned priority.
- Operators make visual dam, water level, and pump inspections as part of their twice-daily routine duties.
- Tasks are completed on predetermined intervals, including comprehensive annual dam inspections (including a detailed report and pond soundings), last performed by Stantec Consulting Services on June 22, 2009.
- Quarterly dam walk-down inspections
- Mowing activities during the growing season

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on the assessments described within this report, operating procedures appear to be adequate.

8.3.2 Adequacy of Maintenance

Although maintenance appears to be adequate, recommendations have been made and can be found in Section 1.2.1.

Based on site observations and discussions with plant personnel, operating procedures and maintenance procedures are adequate.

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

The instrumentation for the Spurlock Ash Pond consists of surface monuments, inclinometers, and piezometeres along the northern slope of the Ash Pond (See Appendix A, Doc 03). This installation was completed in May 2010 and is used to monitor the dam embankment for possible movement, sliding, or seepage. The monuments will help the facility to determine if any surface lateral movement or settlement has occurred. Inclinometers will measure lateral movement of the subsurface for evidence of unacceptable ground movement that could indicate a slide is forming. The piezometeres (small-diameter observation wells) are used to measure the phreatic surface beneath the ground to detect possible seepage, increasing pore pressures in the embankment, or other water-related issues of the embankment.

There is no emergency spillway. The water level in the impoundment is maintained using an ash water transfer pump station. The automated operation of the pump station is regulated with level control settings through float valve settings on the pumps that determine the stages (water elevation levels) in which the pumps are activated to control and maintain the recommended water surface elevation. Alarms will sound to advise of low and high water situations.

Based on the size of the dikes, the portion of the impoundment currently used to store wet bottom ash in addition to precipitation, the history of satisfactory performance and the current inspection program, there is no need for any additions to the existing dike monitoring system at this time.

9.2 INSTRUMENTATION MONITORING

The H.L. Spurlock Ash Pond dikes' instrumentation monitoring system is described above.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

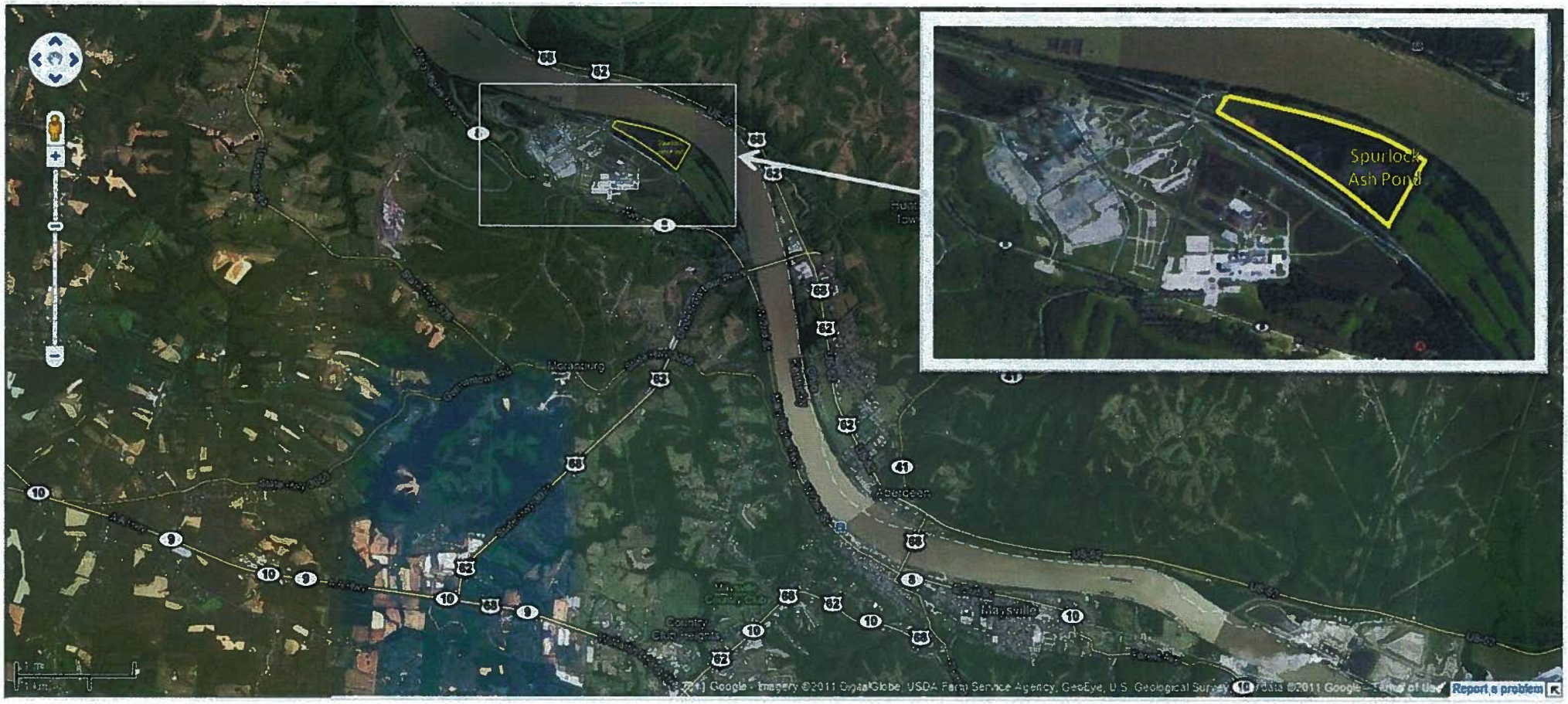
Based on the data reviewed by Dewberry, including observations during the site visit, the inspection program is adequate.

9.3.2 Adequacy of Instrumentation Monitoring Program

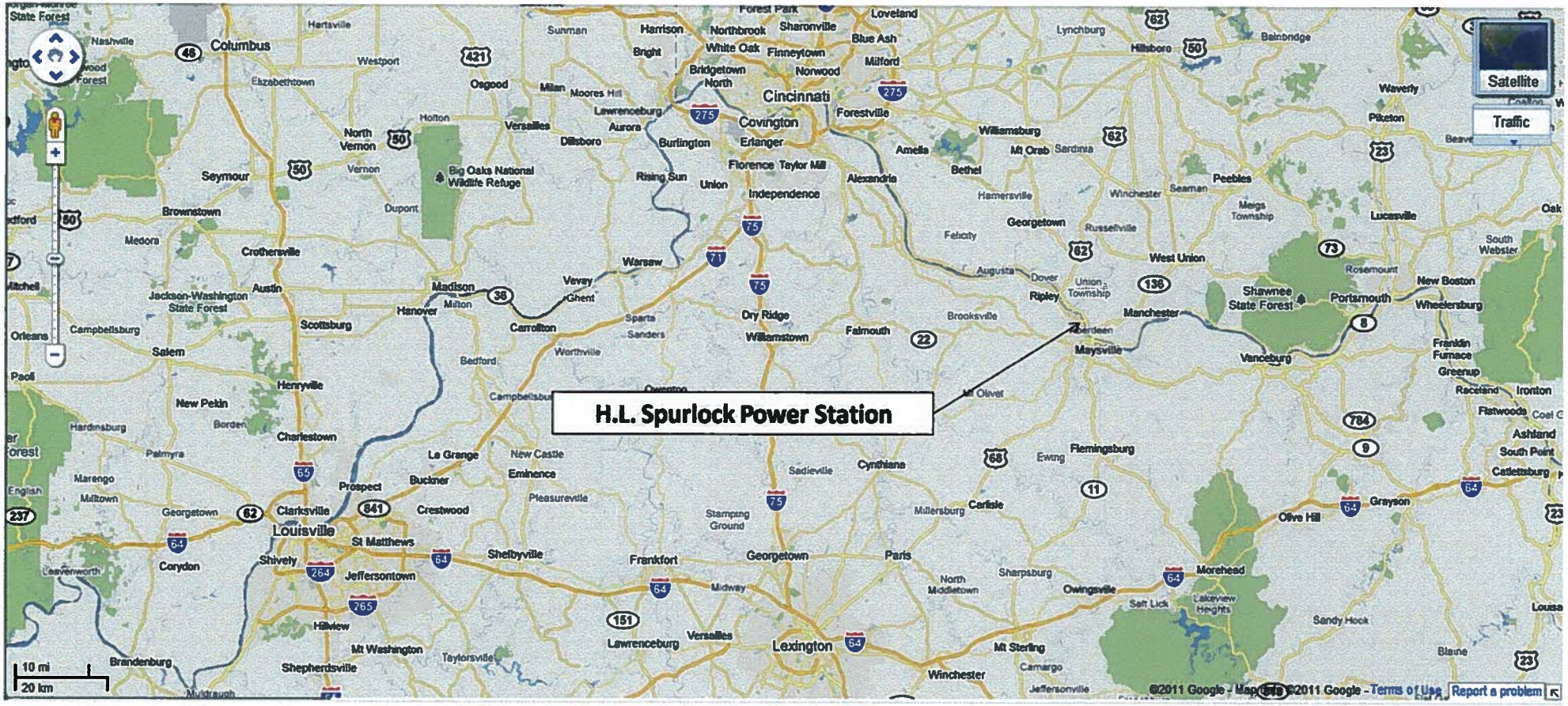
Based on the data reviewed by Dewberry, including observations during the site visit, the instrumentation monitoring program is adequate.

Appendix A

Doc 01- H.L. Spurlock Power Station Aerial View (Source: Google Maps 2011)



Doc 02- H.L. Spurlock Power Station Vicinity Map (Source: Google Maps 2011)



Doc 03: S&ME Instrumentation Report

INSTRUMENTATION REPORT

for

MONUMENTS, INCLINOMETERS AND PIEZOMETERS

at

SPURLOCK POWER STATION ASH POND
MASON COUNTY, KENTUCKY

S&ME Project No. 1831-10-5580

Prepared for:

EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy® Cooperative

4775 Lexington Road
Winchester, Kentucky

Prepared by:
S&ME, Inc.
422 Codell Drive
Lexington, Kentucky

S&ME
ENGINEERING INTEGRITY

SEPTEMBER 2010

SPURLOCK POWER STATION ASH POND
MASON COUNTY, KENTUCKY

Instrumentation Report for Monuments, Inclinometers and Piezometers

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2010 Ash Storage Pond

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For Monuments, Inclinometers and Piezometers
Spurlock Power Station
Mason County, Kentucky

1. Introduction

S&ME, Inc. (formerly QORE, Inc.) was retained by East Kentucky Power Cooperative (EKPC) to perform engineering services for the installation and monitoring of surface monuments, inclinometers and piezometers along the northern slope of the Ash Storage Pond.

Instrumentation was installed along the northern exterior slope (Ohio River side) of the ash pond dam. The purpose of the instrumentation was to allow monitoring of the dam embankment for possible movement, sliding or seepage. In accordance with the Emergency Action Plan, frequent monitoring of the instrumentation can used to determine emergency levels for the pond and alert Spurlock plant staff if corrective action procedures may be necessary.

The monitoring program is ongoing at the time of this report and is in the early stages. We do not have enough data to make any determinations at this time.

2. Site Information

Spurlock Power Station is located near Maysville in Mason County, Kentucky and is owned by East Kentucky Power Cooperative of Winchester, Kentucky. Spurlock Station is located adjacent to KY 8 on the south, Inland Container on the east and the Ohio River on the north.

The ash storage pond is located just south of the Ohio River (Mile 413) at the northeast corner of the station property (**See Appendix A**). The area of the pond is approximately 69 acres (measured at the existing water elevation). Based on

field survey information, the average top of dike elevation was 528.0 with a pond elevation of 526.6. The perimeter of the dam is approximately 8,772 feet (1.66 miles). For the Ohio River, the normal pool elevation is 485.0 and the base flood (100-yr) elevation is 515.0.

Interior and exterior slopes of approximately 3:1 (H:V) were proposed along the dike walls, except along the north (river) side, where the exterior slope is approximately 2:1. The top width of the dike is approximately 16 feet and is gravel-covered for access. The dam structure is classified as a Class (A) – Low Hazard Structure type in accordance with guidelines from the Kentucky Department of Environmental Protection (Division of Water). This classification applies to structures located such that failure would cause loss of the structure itself but little or no additional damage to other property.

3. Field Installation and Methodology

The types of instrumentation used to monitor movement and water levels at the ash pond included survey surface monuments, inclinometers and piezometers.

Monuments are used at the surface to establish horizontal and vertical control for a location established in the field. After an initial set of data is collected, subsequent readings can be used to determine if any surface lateral movement or settlement has occurred.

Inclinometers are used to measure lateral movement of the subsurface. For example inclinometers can detect sliding planes as one section of the ground moves relative to another. Inclinometers are flexible hollow casing that is installed in an open borehole and set into place using a weak cement grout. The casing pipe extends from the ground surface into a stable horizon beneath the ground. As the ground moves laterally, the casing flexes and the curvature of the casing changes. An instrument is lowered into the casing after the installation and at periodic intervals to measure the curvature of the casing over time. The engineer compares the profile (curvature) of the inclinometer pipe against the

initial reading to determine if unacceptable movement is occurring that could indicate a slide is forming.

Piezometers (standpipe-type) are small-diameter observation wells used to measure the phreatic surface beneath the ground. This information can used to detect possible seepage, increasing pore pressures in the embankment, or other water-related issues with the embankment. Specific descriptions of the each type of instrument used for this report are noted below.

1. Monuments

In order to monitor surface movement, S&ME installed six (6) ground settlement monuments near the northern toe of the dam (**See Appendix B**). The surface monuments were equally spaced along the entire northern length of the dam embankment. Each monument was installed by auguring a 12-inch diameter hole to a depth of two (2) feet into the ground. A six (6) foot long, ⅝-inch steel reinforcing bar was driven into the ground until it was approximately one (1) inch below the existing ground surface. An aluminum survey cap was then driven onto the bar. The top two (2) feet of the steel bar was encased in concrete and a PVC cover was placed on the concrete to protect the bar.

S&ME surveyors conducted a differential level loop through all of the monuments to determine the initial vertical readings on the top of the aluminum survey caps. Additionally, using a Sokkia Set 330R model total station, the surveyors completed a horizontal traverse through the monuments to generate baseline horizontal coordinates for each monument. The closure of the 7,023 foot horizontal traverse was calculated to be 1:187,816.

2. Inclinometers

The initial installation was started April 28, 2010 and completed May 6, 2010. A total of three (3) installation sites were selected along the northern exterior dam slope. These locations were selected near the west, middle and east side of the dam slope (**See Appendix B**). The inclinometers are designated SI-1, SI-2 and SI-3 and installed approximately 20 feet from the toe of the slope to the approximate depths shown below:

- SI-1 - 40.5 feet
- SI-2 - 45.5 feet
- SI-3 - 40.5 feet

Medium diameter (2.75-inch) casing pipe was used for each inclinometer (see the datasheet in **Appendix C**). Installation included a 3-¼ inch diameter drilled hole to a depth that was at least 10 feet below the sand-gravel layer of the subsurface.

See **Appendix D** for site photographs of a typical installation.

3. Piezometers

The installation was completed on May 6, 2010. A total of six (6) piezometers were installed at the toe of the northern dam slope (**See Appendix B**). Two (2) piezometers, labeled P-1A and P-1B were installed near SI-1. Piezometers labeled P-2A and P2B were installed near SI-2. Piezometers labeled P-3A and P-3B were installed near SI-3. Piezometers P-1A, P-2A and P-3A were installed to a depth of approximately 10 feet below the surface to monitor water levels. Piezometers P-1B, P-2B and P-3B were installed to a depth of approximately 30 feet below the surface. A water level indicator was used to determine water depths as measured from the top of the pipe.

See the report titled "Engineering Study for Seepage at Spurlock Ash Pond", dated October, 2010 for a detailed description of piezometer readings and conclusions related to possible seepage at the ash pond.

4. Monitoring and Data Collection

Monitoring

All of the instruments should be checked on a quarterly basis at a minimum. Data sheets for each type of instrument should be filled out in the field with the date, time and person responsible for all of the data collection. An original copy should be kept at the plant office in a secure place and only copies taken to the field. It is also recommended that all instrumentation data collection sheets be included in the emergency action plan as part of overall observation and maintenance procedures for the ash pond dam.

For surface monuments, survey data should be recorded to the nearest hundredth as shown in **Table 1** noted in this report. Inclinometers readings should be determined with a Durham Geo Slope Indicator (Digitilt Inclinometer Probe) or equivalent, as shown on the datasheet in **Appendix C**. In addition, the user will need DigiMate Manager and DigiPro software to input and interpret the data. Piezometers readings should be determined using a Water Level Indicator as shown on the datasheet in **Appendix C**.

Data Collection

The initial readings for the surface monuments are shown below in **Table 1** and included on the data collection sheet in **Appendix E.** Based on readings taken in the field on September 20, 2010, there has been no significant movement of the monuments. S&ME will continue to collect data on a quarterly basis and an addendum to this report will be submitted at that time.

Table 1. Monument Coordinates

INITIAL SETTLEMENT MONUMENT COORDINATES (MAY 15, 2010)			
MONUMENT NO.	**NORTHING**	**EASTING**	**ELEVATION**
MON 1	437209.52	1770088.11	503.21
MON 2	437589.16	1769316.60	505.63
MON 3	437801.12	1768703.08	506.53
MON 4	437934.64	1768194.40	506.29
MON 5	438062.15	1767581.18	505.60
MON 6	438160.41	1767039.54	508.22

Reference: Horizontal Datum – KY S.P.C.S North Zone
Vertical Datum – NAVD 88

Both inclinometer readings and piezometer readings are ongoing at this time and data monitoring will be updated through an addendum to this report.

5. Security

It is imperative that all of the installed instrumentation is protected to the maximum extent practical to ensure the data is accurate. During installation the monuments, inclinometers and piezometers were protected with steel fence posts and flagging.

Officials at Spurlock should continue protection of all of the instrumentation with appropriate markers and maintain said markers to prevent any damage, movement or defacing of the instruments. Maintenance staff and other personnel that may be within the instrumentation area of the dam are encouraged to be aware of the installations and are to prevent equipment (i.e., mowers, loaders, vehicles, etc.) from running into or over the instrumentation at any time. Any damaged markers should be replaced promptly but an initial reading will have to done over again.

6. Recommendations

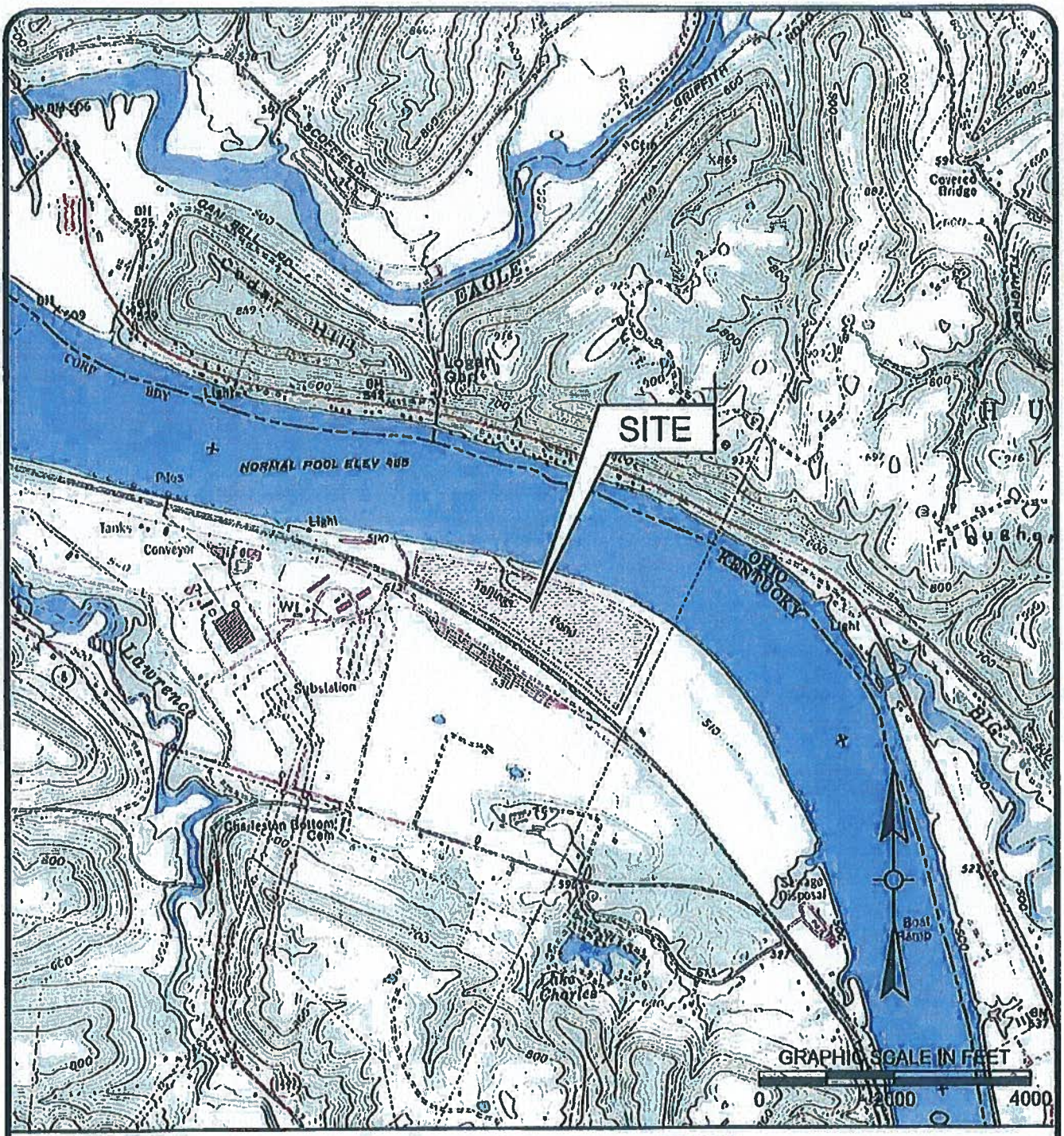
In summary, S&ME is contracted to install and monitor the instrumentation for the first year. Beyond that, we understand Spurlock staff is assigned the task of long term monitoring the instrumentation for the ash pond. They may elect to retain a consultant to perform the monitoring on their behalf. We provide the following guidance:

- Data collection and monitoring should be done on a quarterly basis at a minimum.
- All survey references for horizontal and vertical control should comply with **Table 1** listed in this report.
- Data collection sheets should include the date, time and person responsible for recording the field readings. The original should be kept in a secure place and a copy taken to the field. Copies are included in **Appendix E**.
- The instrumentation must be protected from damage at all times. If any instrumentation is considered damaged, that instrumentation should be marked as such and immediately reported. A replacement may be necessary to continue monitoring. Any change to instrument type or location should be noted accordingly.
- All data collections sheets should be included in the Emergency Action Plan for the Spurlock Power Plant as an appendix.

- It will be the responsibility of EKPC to determine if an emergency level change is warranted based on monitoring of the instrumentation, as described in the emergency action plan for the Spurlock Power Station.

APPENDIX A

▶Site Location Map



EAST KENTUCKY POWER COOPERATIVE
WINCHESTER, KENTUCKY
PHONE: (859) 744-4812

EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy Cooperative

SCALE:	1" = 2000'
DATE:	6/2/2010
DRAWN BY:	RLW
PROJECT NO:	24305580

S&ME
WWW.SMEINC.COM
422 CODELL DRIVE, LEXINGTON, KY 40509
PHONE: 859.293.5518

SITE LOCATION MAP
SPURLOCK POWER STATION
MAYSVILLE, KENTUCKY

FIGURE NO.
1

SS CBI 000076

APPENDIX B

- Instrumentation Location Photo

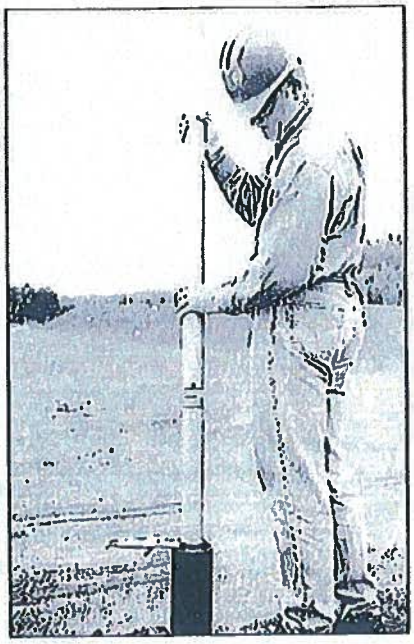
SHEET 1 of 1	INSTRUMENTATION LOCATION MAP ASH STORAGE POND SPURLOCK POWER STATION MAYSVILLE, KENTUCKY	S&ME 422 CODELL DRIVE LEXINGTON, KY 40509 (859)263-6518 WWW.SMEINC.COM	SCALE: 1"=500' PROJECT NO. 1831-10-5580 DATE: SEPT., 2010

SS CBI 000078

APPENDIX C

- Technical Datasheets

Inclinometer Casing



Inclinometer Casing

Inclinometer casing is a special purpose, grooved pipe used in inclinometer installations. It is typically installed in boreholes, but can also be embedded in fills, cast into concrete, or attached to structures.

Inclinometer casing provides access for the inclinometer probe, allowing it to obtain subsurface measurements. Grooves inside the casing control the orientation of the probe and provide a surface from which repeatable tilt measurements can be obtained.

Choosing Inclinometer Casing

Although Slope Indicator casing is competitively priced, price should never be the deciding factor in choosing inclinometer casing. The cost of casing is quite small relative to the cost of mobilizing a drill rig, and very small relative to the cost of a failed installation.

This page summarizes the most important factors to consider when choosing casing.

Casing Diameter

Casing is designed to deform with movement of the adjacent ground or structure. The useful life of the casing ends when continued movement of the ground pinches or shears the casing, preventing passage of the inclinometer probe. Larger diameter casing generally provides longer life.

85mm (3.34") Casing is suitable for landslides and long term monitoring. It is also appropriate for monitoring multiple shear zones or very narrow shear zones, and it is required for the horizontal Digitilt inclinometer probe.

70mm (2.75") Casing is suitable for construction projects. It can also be used for slope stability monitoring when only a moderate degree of deformation is anticipated.

48mm (1.9") Casing is suitable for applications where small deformations are distributed over broad zones. It is generally not installed in soils.

Casing Grooves

Measurement accuracy is directly influenced by the quality of casing grooves. Slope Indicator optimizes casing grooves for the wheels of the Digitilt inclinometer probe, providing a flat surface for the wheels and also the extra width needed when the probe must pass through cross-axis curvature. Groove spiral is also tightly controlled.

Casing Strength

In borehole installations, the annular space around the casing is usually backfilled with grout. The grouting process can generate pressure high enough to cause the casing to collapse. In deep installations, the pressure of grout must be controlled by stage grouting, but in other cases, the casing must be strong enough to withstand the normal pressure of grouting. Slope Indicator uses thick-walled pipe and carefully controls the depth of the grooves.

Sealable Couplings

If casing joints are not adequately sealed, grout can force its way into the casing and later prevent the probe from reaching its intended depth.

Slope Indicator offers several types of couplings and casings, all of which can be sealed easily and consistently. Our newest designs feature O-ring seals, and our older designs feature tight-fitting surfaces that are fused together with solvent cement.

Assembly

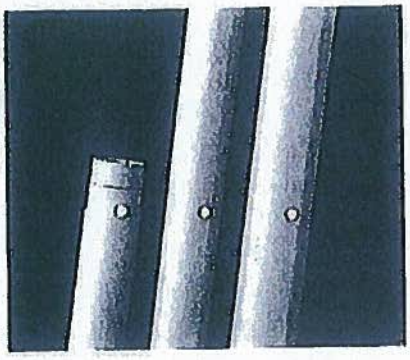
Inclinometer casing should be easy to assemble, even with an untrained crew. Slope Indicator's QC casing, which snaps together, is the current leader in quick and easy assembly. Other types of casing are assembled with shear wires or with solvent cement.

Casing Materials

Slope Indicator uses only ABS plastic for its casing for several reasons. ABS plastic retains its shape and flexibility over a wider range of temperatures than PVC plastic. ABS plastic is much easier to handle and seal than fiberglass casing. Finally, ABS plastic is suitable for long term contact with all types of soils, grouts, and ground water, unlike aluminum casing, which is no longer recommended for any application.

Installation Information

Visit the technical support section at www.slopeindicator.com to find recommended grout mixes, ways to counter casing buoyancy, and notes on other installation issues.



QC CASING

QC (Quick Connect) casing features snap-together convenience and strong, flush joints.

Grooves: Grooves are machine broached for excellent control of width, chamfer, depth, straightness, and spiral.

Sealing: O-ring seals prevent entry of grout.

Coupling: Built-in couplings snap together to make a flush joint. Unique locking mechanism engages full inner circumference of casing, providing much stronger joints than other snap-type casings.

Assembly: Press casing sections together until joint snaps closed. The resulting joint is strong, flush, and grout-proof. Solvent cement, rivets, or tape are not required. O-ring lubricant is applied at factory. Extra O-rings and lubricant are supplied with each box of casing.

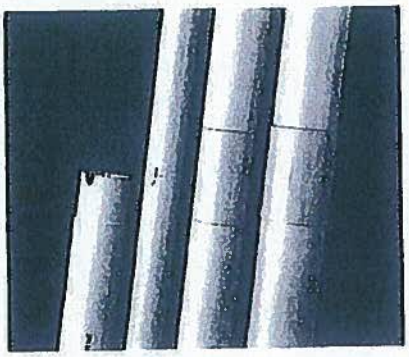
Best for: General use.

QC Casing 85mm · 3.34"

Casing OD: 85 mm, 3.34 inches.
Casing ID: 73 mm, 2.87 inches.
Collapse Rating: 12.4 bar, 180 psi.
Load Rating: 635 kg, 1400 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3m or 10' section.

QC Casing 70mm · 2.75"

Casing OD: 70 mm, 2.75 inches.
Casing ID: 59 mm, 2.32 inches.
Collapse Rating: 16.5 bar, 240 psi.
Load Rating: 635 kg, 1400 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3m or 10' section.



STANDARD CASING

Slope Indicator's traditional inclinometer casing features high-strength, flush joints and is available in three diameters.

Grooves: Grooves are machine broached for excellent control of width, chamfer, depth, straightness, and spiral.

Sealing: Solvent cement and tape.

Coupling: Precision molded couplings have interference fit for high-strength bonding. Small diameter version has integral couplings.

Assembly: Casing and couplings are glued together with ABS solvent cement, riveted, and wrapped with tape.

Best for: General use. The extra-strong joints are helpful in very deep boreholes and oversize boreholes in which casing is not well supported.

Standard Casing 85mm · 3.34"

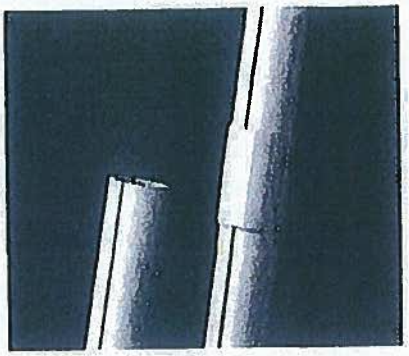
Coupling OD: 89 mm, 3.51 inches.
Casing OD: 85 mm, 3.34 inches.
Casing ID: 73 mm, 2.87 inches.
Collapse Rating: 10.6 bar, 155 psi.
Load Rating: 320 kg, 700 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3m or 10' section.

Standard Casing 70mm · 2.75"

Coupling OD: 70 mm, 2.75 inches.
Casing OD: 70 mm, 2.75 inches.
Casing ID: 59 mm, 2.32 inches.
Collapse Rating: 15 bar, 220 psi.
Load Rating: 320 kg, 700 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3 m or 10' section.

Standard Casing 48mm · 1.9"

Casing OD: 48 mm, 1.9 inches.
Casing ID: 38 mm, 1.5 inches.
Collapse Rating: 24 bar, 350 psi.
Load Rating: 320 kg, 700 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3 m or 10' section.



EPIC CASING

EPIC casing is an economical casing that can be cut and coupled at any point along its length.

Grooves: Grooves are formed during extrusion and are less precise than broached grooves.

Sealing: Solvent cement, mastic, and tape.

Coupling: Oversize couplings make very strong joints.

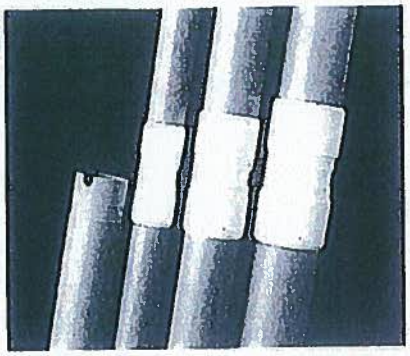
Assembly: Casing and couplings are glued together with ABS solvent cement. The joint must then be sealed with mastic and tape.

Best for: General use. Some care must he taken to seal the coupling.

EPIC Casing 70mm · 2.75" Only

Coupling OD: 78 mm, 3.07 inches.
Casing OD: 70 mm, 2.75 inches.
Casing ID: 60 mm, 2.32 inches.
Collapse Rating: 15 bar, 220 psi.
Load Rating: 320 kg, 700 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.5° per 3m or 10' section.

85mm (3.34") casing accomodates the most movement and provides the longest installation life. It is useful for landslides and long-term monitoring projects. 70mm (2.75" casing is suitable for medium to short-term construction projects. 48 mm (1.9") casing is used in rock or concrete where deformations will be small.



CPI CASING

CPI casing features quick assembly and disassembly and is available in 3 diameters.

Grooves: Grooves are machine broached for excellent control of width, chamfer, depth, straightness, and spiral.

Sealing: O-ring seals prevent entry of grout.

Coupling: Oversize couplings and shear wires make high strength joint.

Assembly: Apply grease to O-rings, press coupling onto casing, and insert shear wire.

Best for: Cold weather assembly or temporary installations that involve repeated disassembly.

CPI Casing 85mm • 3.34"

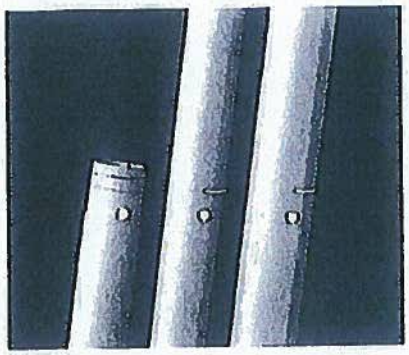
Coupling OD: 94 mm, 3.7 inches.
Casing OD: 85 mm, 3.34 inches.
Casing ID: 73 mm, 2.87 inches.
Collapse Rating: 11 bar, 155 psi.
Load Rating: 635 kg, 1400 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3m or 10' section.

CPI Casing 70mm • 2.75"

Coupling OD: 76 mm, 3 inches.
Casing OD: 70 mm, 2.75 inches.
Casing ID: 59 mm, 2.32 inches.
Collapse Rating: 15 bar, 220 psi.
Load Rating: 400 kg, 900 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3m or 10' section.

CPI Casing, 48mm • 1.9"

Coupling OD: 54 mm, 2.12 inches.
Casing OD: 48 mm, 1.9 inches.
Casing ID: 38 mm, 1.5 inches.
Collapse Rating: 24 bar, 350 psi.
Load Rating: 320 kg, 900 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3 m or 10' section.



SHEAR-WIRE CASING

Shear-Wire casing features flush joints that can be assembled easily in cold weather.

Grooves: Grooves are machine broached for excellent control of width, chamfer, depth, straightness, and spiral.

Sealing: O-ring seals prevent entry of grout.

Coupling: Built-in couplings lock together with removable nylon shear wire to make flush joint.

Assembly: Press casing sections together, then insert shear wire. The result is a flush, grout-proof joint. Solvent cement, rivets, and tape are not required. O-ring lubricant is applied at the factory. Extra O-rings, lubricant, and shear wires are supplied with each box of casing.

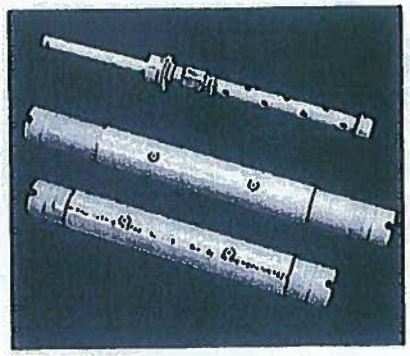
Best for: Easy assembly in weather that is too cold for solvent cement or snap-together joints. Generally used in water-filled boreholes.

Shear Wire Casing 85mm • 3.34"

Casing OD: 85 mm, 3.34 inches.
Casing ID: 73 mm, 2.87 inches.
Collapse Rating: 12.4 bar, 180 psi.
Load Rating: 225 kg, 500 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3m or 10' section.

Shear Wire Casing 70mm • 2.75"

Casing OD: 70 mm, 2.75 inches.
Casing ID: 59 mm, 2.32 inches.
Collapse Rating: 16.5 bar, 240 psi.
Load Rating: 225 kg, 500 lb.
Temp rating: -29 to 88 °C, -20 to 190 °F.
Spiral: ≤ 0.33° per 3m or 10' section.



GROUT VALVES

Grout valves allow placement of grout backfill in boreholes that cannot accommodate an external grout pipe. The one-way valve is installed in the bottom section of casing. A grout pipe is lowered through the casing to mate with the grout valve and deliver the grout.

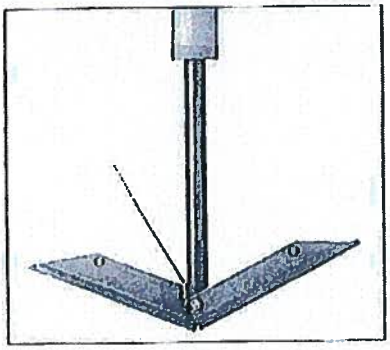
TELESCOPING SECTIONS

Optional telescoping sections accommodate 150 mm (6 inches) of compression or extension. Fully extended, each telescoping section adds 0.76 m (2.5 feet) of length to the casing

CASING ANCHORS

In its fluid state, grout exerts an uplift force that can push even water-filled casing out of the borehole. Holding the casing down from the top has unfortunate side-effects: the casing goes into compression and snakes from side to side in the borehole. Thus casing curvature is present from the start, and slight variations in the positioning of the probe are more likely to produce reading errors..

The casing anchor, installed in place of the bottom cap, provides a convenient way to counter casing buoyancy and reduces casing curvature, since the casing self-centers in the borehole. The anchor has spring loaded arms that are activated when a pin is pulled. Anchors are available for 70 mm and 85 mm casing.



QC CASING 85MM · 3.34"

Casing Section, 10' (3.05 m)	51150310
Casing Section, 5' (1.52 m)	51150311
Section, Telescoping	51150320
Cap, Bottom	51150330
Cap, Bottom, Heavy Duty	51100520
Grout Valve, Gasket Type	51100830
Cap, Top	51100500
Cap, Locking	51100550
Splice Kit, Male	51150350
Splice Kit, Female	51150351

QC CASING 70mm · 2.75"

Casing Section, 10' (3.05 m)	51150210
Casing Section, 5' (1.52 m)	51150211
Section, Telescoping	51150220
Cap, Bottom	51150230
Cap, Bottom, Heavy Duty	51101520
Grout Valve, Gasket Type	51100820
Cap, Top	51101500
Cap, Locking	51101550
Splice Kit, Male	51150250
Splice Kit, Female	51150251

STANDARD CASING 85mm · 3.34"

Casing Section, 10' (3.05 m)	51100100
Casing Section, 5' (1.52 m)	51100105
Telescoping Section	51106400
Coupling	51100200
Cap, Bottom, Heavy Duty	51100520
Grout Valve, Gasket Type	51100830
Cap	51100500
Cap, Locking	51100550
Pop Rivet AD44H	51103301

STANDARD CASING 70mm · 2.75"

Casing Section, 10' (3.05 m)	51101100
Casing Section, 5' (1.52 m)	51101105
Telescoping Section	51107400
Coupling	51101200
Cap, Bottom, Heavy Duty	51101520
Grout Valve, Gasket Type	51100820
Cap	51101500
Locking Cap with Padlock	51101550
Pop Rivet AD42H	51003303

STANDARD CASING 48mm · 1.9"

Casing Section, 5' (1.52 m)	51102305
Cap	51102500
Locking Cap with Padlock	51102550
Grout Valve, Gasket Type	51104000

EPIC CASING 70mm · 2.75"

Casing Section, 10' (3.05 m)	51111100
Coupling	51111200
Telescoping Coupling	51111400
Cap, Bottom, Heavy Duty	51101520
Grout Valve, Gasket Type	51100820
Cap	51111500
Locking Cap with Padlock	51101550
Pop Rivet AD46H	51003310
Lubricant for Telescoping Coupling	57504000

CPI CASING 85mm · 3.34"

Casing Section, 10' (3.05 m)	57500100
Casing Section, 5' (1.52 m)	57500105
Telescoping Section	57506400
Coupling with 2 Shear Wires	57500200
Cap with Shear Wire	57500500
Cap, Bottom, Heavy Duty	51100520
Grout Valve, Gasket Type	51100830
Cap, Top	51100500
Spare Nylon Shear Wire	57500700
O-Ring Lubricant	57504000

CPI CASING 70mm · 2.75"

Casing Section, 10' (3.05 m)	57501100
Casing Section, 5' (1.52 m)	57501105
Telescoping Section	57507400
Coupling with 2 Shear Wires	57501200
Cap with Shear Wire	57501500
Cap, Bottom, Heavy Duty	51101520
Grout Valve, Gasket Type	51100820
Cap, Top	51101500
Spare Nylon Shear Wire	57501700
O-Ring Lubricant	57504000

CPI CASING 48mm · 1.9"

Casing Section, 5' (1.52 m)	57502105
Coupling with 2 Shear Wires	57502200
Cap with Shear Wire	57502500
Grout Valve, Gasket Type	57503700
Cap, Top	51102500
Spare Nylon Shear Wire	57502700
O-Ring Lubricant	57504000

SHEAR WIRE CASING 85mm · 3.34"

10' (3.05 m) Casing Section	51160310
5' (1.52 m) Casing Section	51160311
Section, Telescoping	51160320
Cap, Bottom	51160330
Cap, Bottom, Heavy Duty	51100520
Grout Valve, Gasket Type	51100830
Cap, Top	51100500
Cap, Locking	51100550

SHEAR WIRE CASING 70mm · 2.75"

Casing Section, 10' (3.05 m)	51160210
Casing Section, 5' (1.52 m)	51160211
Section, Telescoping	51160220
Cap, Bottom	51160230
Cap, Bottom, Heavy Duty	51101520
Grout Valve, Gasket Type	51100820
Cap, Top	51101500
Cap, Locking	51101550

CASING ANCHORS

Casing Anchor, 85 mm (3.34")	51104385
Casing Anchor, 70 mm (2.75")	51104370
Anchor + Grout Valve, 85mm(3.34")	51104485
Anchor + Grout Valve, 70mm(2.75")	51104470

INSTALLATION ACCESSORIES

Mastic Sealing Tape	51003800
Vinyl Tape	51003900
Duct Tape	51004000
ABS Solvent Cement, 1/2 pint	51103401
ABS Solvent Cement, 1 pint	51103402
Pop Rivet Gun	50100202
Casing Clamp	50100200

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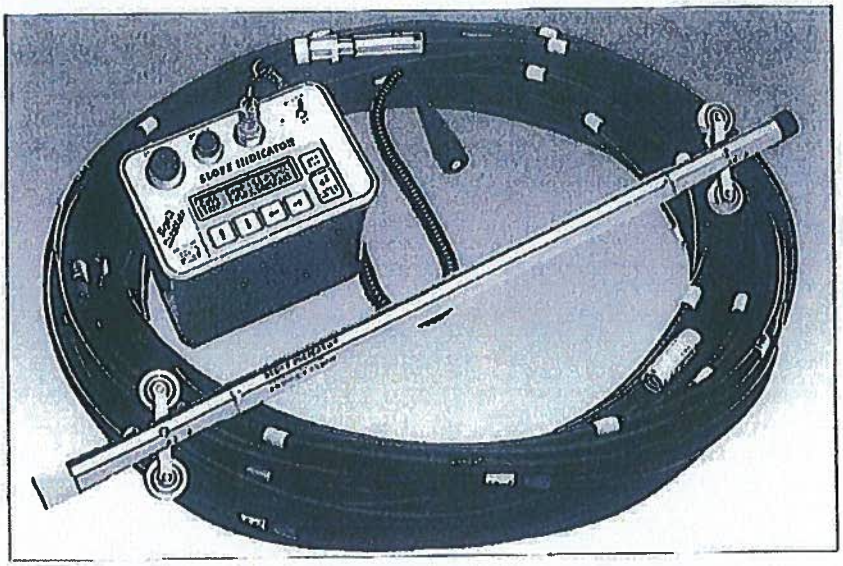
Digitilt Inclinometer Probe



Applications

Digitilt® inclinometers are used to monitor subsurface movements of earth in landslide areas and deep excavations. They are also used to monitor deformations in structures such as dams and embankments.

Operation

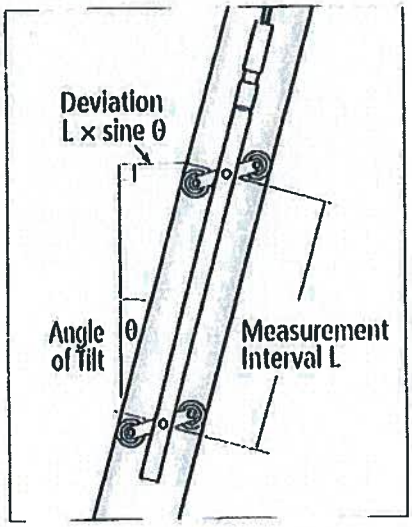
Inclinometer casing is typically installed in a vertical borehole that passes through suspected zones of movement into stable ground. The Digitilt inclinometer probe, control cable, pulley assembly, and readout are used to survey the casing. The first survey establishes the initial profile of the casing. Subsequent surveys reveal changes in the profile if ground movement occurs.

During a survey, the probe is drawn upwards from the bottom of the casing to the top, halted in its travel at 0.5 m or 2' intervals for tilt readings.

The inclination of the probe body is measured by two force-balanced, servo-accelerometers. One accelerometer measures tilt in the plane of the inclinometer wheels, which track the longitudinal grooves of the casing. The other accelerometer measures tilt in the plane perpendicular to the wheels.

Inclination measurements are converted to lateral deviations, as shown in the drawing below. Changes in deviation, determined by comparing current and initial surveys, indicate ground movement.

Plotting changes in deviation yields a high resolution displacement profile. Displacement profiles are useful for determining the magnitude, depth, direction, and rate of ground movement.



Advantages

Proven Performance: Digitilt inclinometer probes have earned a world-wide reputation for durability, high precision, and rapid response.

Repeatable Tracking: To ensure consistent tracking in all types of casing, the probe is equipped with robust wheel carriages, sealed wheel bearings, and specially designed wheels.

Extended Installation Life: The compact size of the Digitilt probe allows it to pass through small radius curves, extending the useful life of the installation beyond that provided by other inclinometer probes.

Computerized Testing: Each probe undergoes thorough testing on a computerized calibration table.

Reliable Control Cable: Digitilt control cable is durable and easy to handle, stays flexible in cold weather, resists chemicals and abrasion, and provides excellent dimensional stability. Flexible rubber depth marks are permanently vulcanized to the cable jacket. The marks cannot loosen and have no rigid edges that can damage the cable jacket and conductors.

Consistent Depth Control: The pulley assembly, a recommended accessory, helps the operator achieve uniform depth control. The one-way action of its cable clamp ensures consistent positioning of the probe.

Complete Solutions: Slope Indicator's inclinometer system includes high-quality casing, vertical and horizontal traversing probes, vertical and horizontal in-place sensors, recording readouts, graphing software, and specialized accessories.

DIGITILT INCLINOMETER PROBE

Metric-Unit Probe 50302510
English-Unit Probe 50302500

Digitilt inclinometer probe includes a carrying case and instruction manual. Control cable, pulley, and readout are not included.

METRIC PROBE SPECIFICATIONS

Wheel base: 500 mm.
Range: ±53° from vertical.
Resolution: 0.02 mm per 500 mm.
Repeatability: ±0.01% FS.
Calibration: 14 point calibration with NIST traceable calibration device.
Temperature Rating: -20 to +50 °C.
Dimensions: 25.4 x 653 mm. Control cable connector adds 92 mm to length of probe.
Weight: 1.8 kg.
Material: Stainless steel.

ENGLISH PROBE SPECIFICATIONS

Wheel base: 24".
Range: ±35° from vertical.
Resolution: 0.0012 inch per 24 inches.
Repeatability: ±0.01%FS.
Calibration: 14 point calibration with NIST traceable calibration device.
Temperature Rating: -4 to +122 °F.
Dimensions: 1 x 30". Control cable connector adds 3.75"to length of probe.
Weight: 4 lb.
Material: Stainless steel.

ACCURACY SPECIFICATIONS

Metric Systems: ±0.25 mm per reading and ±6 mm per 50 readings.

English Systems: ±0.01 inch per reading and ±0.3 inch per 50 readings.

These system accuracy specifications were derived empirically from the analysis of a large number of surveys and include both random and systematic errors introduced by casing, probe, cable, readout, and operator. Casing was installed within 3 degrees of vertical, and operators followed recommended reading practices.

When corrections for systematic error are made, the remaining error is random. It accumulates with the square root of the number of readings. Thus the best precision obtainable with a metric system is approximately ±1.4 mm per fifty readings, and the best precision of an English unit system is approximately ±0.05 inch per fifty readings.

CONTROL CABLE

30m Control Cable, Complete . . . 50601030
50m Control Cable, Complete . . . 50601050
100m Control Cable, Complete . . 50601100

100 ft Control Cable, Complete . . 50601002
150 ft Control Cable, Complete . . 50601003
300 ft Control Cable, Complete . . 50601004

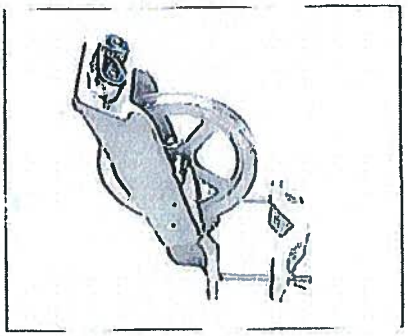
Metric Cable, Custom Length. . . . 50601010
English Cable, Custom Length . . . 50601000
Connector for Readout 50301800
Connector for Probe. 50303100

Control cables listed as complete are standard lengths of cable and include connectors. If you order a custom length cable, you must also order connectors.

Control cable is supplied with no splices or surface defects and has a rated strength of 480 lb and a working strength of 120 lb.

Metric cable is graduated with yellow 0.5-meter marks and red 1-meter marks. English cable is graduated with yellow 2-foot marks and red 10-foot marks.

Cable has a steel core wire to control stretching, a dacron torsion braid to counter cable torque and eliminate slipping of cable jacket relative to the steel core, and depth marks that are molded onto the cable jacket. The Santoprene cable jacket resists chemicals and abrasions and stays flexible in cold temperatures.



PULLEY ASSEMBLY

Small Pulley 51104604
Large Pulley 51104606

Pulley assembly clamps onto top of casing to help operator control depth of probe. Cable clamp serves as reference for depth marks. Clamp is made of carbon-fiber and does not freeze in cold weather. Removable pulley wheel facilitates insertion of probe into casing.

Use small pulley with 48 or 70 mm (1.9 or 2.75") casing. Use large pulley with 70 or 85mm (2.75 or 3.34") casing.

READOUTS

Digitilt DataMate II. 50310900

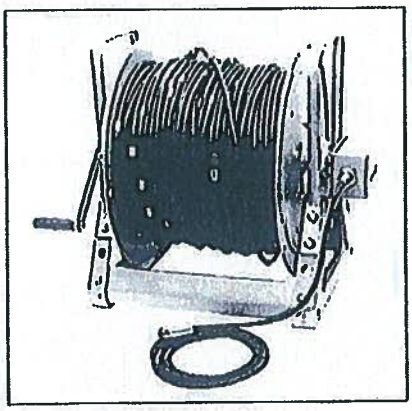
The Digitilt DataMate II is a recording readout. The Digitilt 09 is a manual readout. See separate data sheets for details.

DUMMY PROBE

Metric Wheel Base 50304810
English Wheel Base. 50304800
Reel & Line for Dummy Probe. . . .50304900

Dummy probe is used to test for casing continuity, groove continuity, and obstructions or severe distortions of casing that could hinder retrieval of Digitilt probe and control cable. Dummy probe is stainless steel and has dimensions and wheels identical to those of Digitilt probe.

Reel with 60 m (200') of nylon line is used to lower and retrieve dummy probe.



SLIP-RING REEL

200 m (650') capacity 50503100
300 m (1150') capacity 50503300

Slip-ring cable reel allows the readout to remain connected while the reel is operated. Includes jumper cable to connect reel to readout.

STORAGE REEL

30m (100') capacity. 50502030
70 m (230') capacity 50502050
100 m (360') capacity 50502110

Sturdy storage reel with large diameter hub keeps cable neat when not in use.

Note: The use of reels is optional. Cable can also be stored in a figure-8 or using the over-under method of coiling cable, as presented in the manual. If you choose to use a reel, be sure that the hub of the reel has a diameter of eight inches or larger (as do the reels above). Power reels should be sixteen inches or larger.

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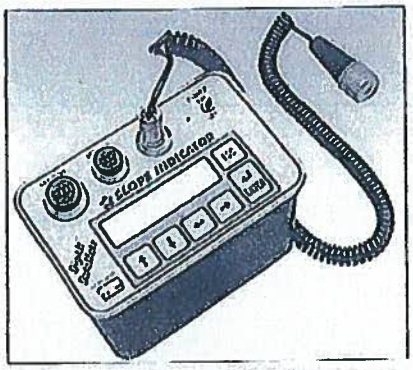
DigiTilt DataMate II



Simple to operate, the compact DigiTilt DataMate runs 16 hours on one charge, stores up to 320 surveys, and transfers data to a PC for processing.

The DigiTilt DataMate II

The DataMate records data from inclinometer probes, tiltmeters, and spiral sensors. It stores up to 320 complete inclinometer surveys and can power a DigiTilt inclinometer probe for 16 hours.

The DataMate II is compatible with the original DataMate but features updated electronics for faster operation, increased memory capacity, and a USB port for data transfers

The DataMate is designed for hard use in difficult environments. It has a bright, backlit display that is visible under all lighting conditions. The box is splashproof and sealed against humidity. In addition, all connectors are located on the top of the box, away from contact with mud, water, or snow.

Recording Surveys

The DigiTilt DataMate stores a list of inclinometer installations in memory, so to begin a survey, the operator selects an installation from the list.

The DataMate then displays the starting depth for that installation, and the operator positions the probe at that depth.

The display shows the depth, the A-axis reading, and the B-axis reading. When both readings are stable, the DataMate displays a "ready" signal. The operator then records the reading, using the hand switch or the keypad. The DataMate beeps confirmation and then displays the next depth. The operator raises the probe to this depth, waits for the ready signal, and then records the readings, repeating these steps until the probe reaches the top of the casing. The DataMate then prompts the operator to rotate the probe 180 degrees and begin the second pass through the casing.

The operator can correct a mistake at any time by simply scrolling through the data to any depth, repositioning the probe, and continuing the survey from that point.

Validating Surveys

The DataMate provides checksum statistics to help the operator validate the survey. By comparing the mean and standard deviation of checksums for the current survey with those of previous surveys, the operator can be confident that the data are good.

The DataMate provides routines to help the operator identify questionable readings, which can then be corrected by repositioning the probe. The DataMate displays "live" and recorded readings side by side for comparison, and the operator can overwrite the recorded reading with the live reading, if appropriate.

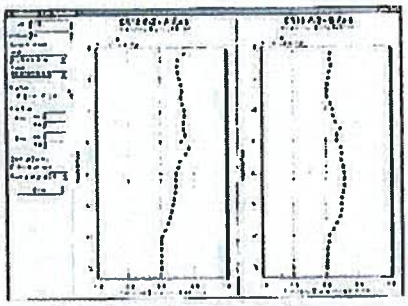
Convenient hand switch reduces fatigue and lets you keep the DataMate clear of the work area.

Retrieving Surveys

Returning to the office, the operator connects the DataMate to a PC, and then runs the DataMate Manager program. The manager program retrieves the recorded surveys and stores them in a database for easy access.

Processing Surveys

Slope Indicator inclinometer software eliminates repetitive work, ensures that calculations are performed accurately, and dramatically reduces the time required to process data.



DMM for Windows software lets you retrieve surveys and produce reports containing readings and graphics.

The DataMate Manager program is included with the DataMate. It can can print reports containing inclinometer readings, checksum statistics, and simple graphs. It also provides routines for settlement correction, spiral data set expansion, and bias shift analysis.

DigiPro for Windows is an optional graphing program that provides additional types of graphs, including some diagnostic plots, and a number of sophisticated correction routines. A trial version is available for download from the Slope Indicator web site.

DIGITILT DATAMATE II READOUT

Digitilt DataMate II.....50310900

The Digitilt DataMate is a portable readout for Digitilt sensors. It provides depth prompts and stores readings in memory for transfer to a PC. Includes hand switch, battery charger, USB interface cable for PC, and CD with DMM for Windows and manual. Specify type of plug required for the charger. DigiPro software is not included.

Sensor Compatibility: English and metric versions of vertical and horizontal Digitilt inclinometer probes, tiltmeters, and spiral sensors.

Displayed Units: Metric indicator displays readings as 25000 x the sine of the angle of tilt. English indicator displays readings as 20000 x the sine of the angle of tilt.

Survey Types: 2-pass survey for inclinometer probes; 4-pass survey for spiral sensors.

Memory Capacity: Stores 160 installations and nominally 320 surveys of 100 depths each (a total of 32000 depths allocated to any number of surveys up to a maximum of 320).

Maximum Survey Depth: 500m or 2000 feet.

Reading Intervals: Fixed intervals. Minimum interval is 0.5 m with metric probe or 1 foot with English-unit probes.

Menu-Selected Functions

Record: Prompts operator with starting depth. Displays A and B axis readings. Displays ready signal when readings are stable. Displays next depth after readings are recorded.

Manual Read: Allows use of DataMate when memory is full or depth display is not required.

Validate: Calculates checksum statistics.

Correct: Allows user to correct mistakes.

Compare: Calculates a single value for cumulative deviation or cumulative displacement.

Comm: For communication with PC.

Print: Outputs ASCII data to a terminal program running on a non-DOS/Windows computer.

Operating Time: 16 hours @ 20°C (68°F) of continuous power to probe. Backup battery preserves data for six months.

Temperature Rating: -20 to 50°C (-4 to 122°F).

Display: 20 x 2 backlit LCD rated for extended temperatures.

Battery: 6 volt, 6 Ah, gelled electrolyte, lead-acid battery. Recharges to 80% capacity in 16 hours using the included charger.

Case: Splashproof, non-submersible, aluminum case with plastic shell. Connectors are waterproof when capped or in use.

Dimensions: 127 x 178 x 178 mm (5 x 7 x 7").

Weight: 3 kg (6.5 lb).

DMM FOR WINDOWS

DMM for Windows.....50310970

The DataMate Manager program (DMM) transfers readings from Digitilt DataMate to a PC. DMM offers routines for checking surveys and maintaining the inclinometer database. DMM is supplied on a Resource CD with the purchase of the Digitilt DataMate. It can also also be downloaded free from www.slopeindicator.com. Note that DMM is not intended to replace DigiPro software. DigiPro software, available separately, is used to create presentation graphics and offers diagnostic and correction tools.

System Requirements: Windows computer with USB port.

Data Retrieval: DMM communicates with DataMate through a USB connection.

Data Storage: Surveys retrieved from DataMate are stored in an MDB database. DMM supports drag-and-drop operations between databases and provides easy functions for editing, renaming, moving, and archiving installations and surveys. Surveys retrieved from the DataMate can also be saved as ASCII files.

Data Manipulation: DMM provides a settlement correction routine and a spiral set expansion routine. Both routines generate new surveys.

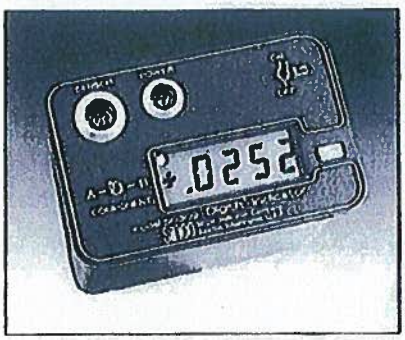
Import Capabilities: DMM imports legacy data from Slope Indicator's previous formats and from GTILT®. The program also allows manual entry of data.

Report Capabilities: DMM prints inclinometer readings with checksums, compares two surveys (typically current vs initial) to generate A and B-axis graphs of cumulative displacement. The program generates graphs of cumulative deviation. Graphs are displayed on screen and can be printed in a report. Reports can also include checksum statistics, bias-shift analysis tables, and tabular data in digi units (differences and changes).

DIGIPRO SOFTWARE

DigiPro Trial.....Free Download
DigiPro, 1-User License.....50310001
DigiPro, 3-User License.....50310000
DigiPro, 12-User License.....50310002

DigiPro software processes and plots inclinometer data recorded by the Digitilt DataMate readout. It creates high-resolution graphs and supports advanced routines for identifying and correcting systematic error. DigiPro is not included with the Digitilt DataMate. See separate datasheet for details.



DIGITILT 09 INDICATOR

Digitilt 09, Metric.....50300910
Digitilt 09, English.....50300900

The Digitilt 09 Indicator is a portable readout for Digitilt sensors. It displays readings, but does not record them. The user must keep track of depths and readings on a field data sheet. A battery charge is included. Please specify 100, 115, 220, or 240 volt and 50 or 60Hz.

Compatibility: Digitilt inclinometer probes, Digitilt tiltmeters, and spiral sensors.

Displayed Units: Metric indicator displays readings as 2.5 x the sine of the angle of tilt. English indicator displays readings as 2 x the sine of the angle of tilt.

Readings can be entered into the DMM for Windows database and graphed with DigiPro for Windows. If you chose to do this, write down readings without the displayed decimal point and enter the readings as integers.

Resolution: Metric indicator provides resolution of 1 in 25,000. English indicator provides resolution of 1 in 20,000.

Display: Large, backlit 4.5 digit LCD with heater for cold weather operation.

Battery: Rechargeable 6 volt, 6 Ah gelled electrolyte, lead-acid battery. Battery life is 12 hours with fully changed battery. LCD heater reduces operating time up to 50% when temperature is below 5° C (40° F).

Temperature Rating: -20 to 50°C (-4 to 122°F).

Dimensions: 127 x 178 x 178 mm (5 x 7 x 7").

Weight: 3.4 kg (7.5 lb).

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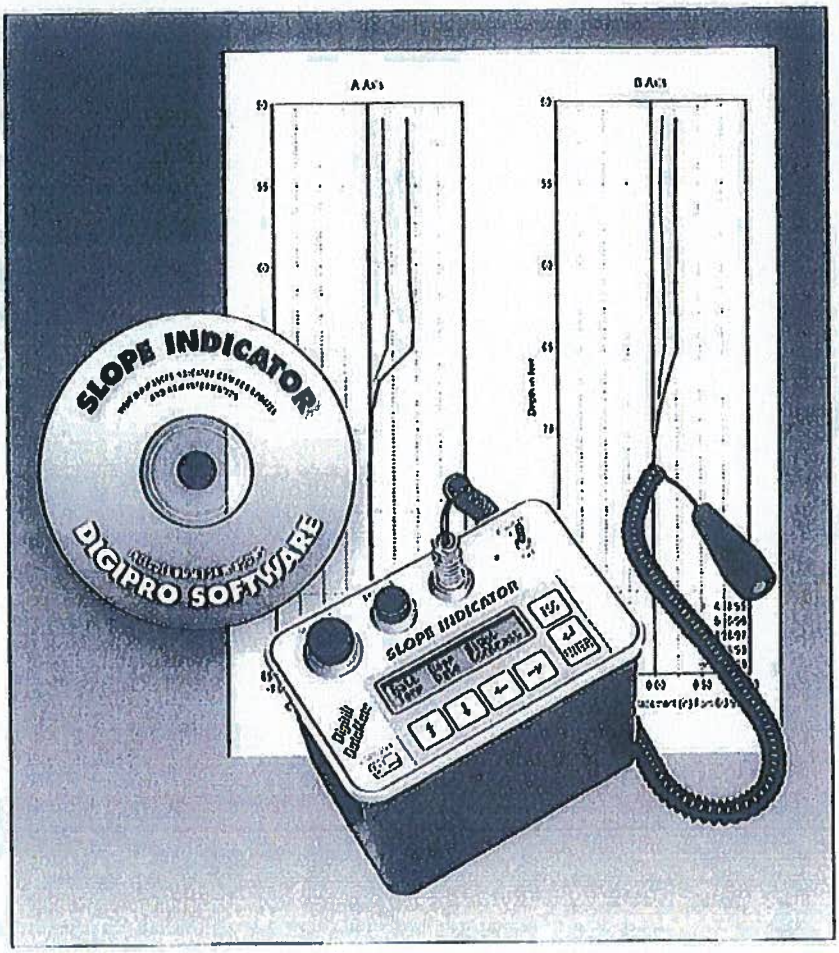
DigiPro Inclinometer Software

Applications

DigiPro software processes and plots inclinometer data recorded by the Digitilt DataMate readout. It creates high-resolution graphs and supports advanced routines for identifying and correcting systematic error.



Productivity Features

Easy Graphing: Choose an installation, choose the type of graph that you want, and click OK. With just three clicks, your inclinometer data is reduced and plotted. Generating the same results from spreadsheets would take hours of repetitive work.

Reusable Settings: When you save a graph, DigiPro automatically stores scales labels, legends, and other settings as a "report." To process new inclinometer surveys, just click on the report. Digipro retrieves your graph settings, automatically finds the new data, and creates an updated graph.

Uniform Style and Format: DigiPro supplies standard templates that you can customize, adding your company logo, standardizing scales, etc. These customized templates will ensure that all new reports have a uniform format and style.

Technical Features

Standard Plots: DigiPro supports all of the standard types of inclinometer plots that are used to analyze movements and deformations of soil, rock, and structures. Cumulative displacement plots show movement relative to a fixed point of origin, incremental displacement plots reveal shear planes, and time plots show acceleration or deceleration of movement.

Diagnostic Plots: To help identify and evaluate errors in the data, DigiPro provides various plots that help you check for instrument drift, evaluate the potential for depth errors, and identify errors caused by changes in cross-axis sensitivity of the probe (tilt in the B axis influencing A-axis readings and vice versa).

Advanced Corrections: DigiPro lets you correct for bias shift and changed cross-axis sensitivity. In addition, it uses spiral corrections and settlement corrections generated by DMM for Windows.

Note that correction values can be applied and removed at any time. the original data is not affected.

Automatic Conversions: DigiPro can produce metric-unit reports from English-unit data. DigiPro can also convert the depths stored with your inclinometer data to elevations.

Data Listings: When you print a report, you can choose to print a listing of the most recent data in addition to the graph. You can also print a listing of the plotted data points or export the listing to a file for use with a spreadsheet.

DIGIPRO FEATURES

Graph Types: Graph types include cumulative and incremental displacements, cumulative and incremental deviations, displacement vs time, and checksums and difference checksums. Different types of graphs can be displayed on the same page and you can specify top or bottom reference and different scales for each graph.

Reports: When you save a graph, DigiPro automatically creates a report so you can reuse scales, labels, legends, title block, and other settings. To process new surveys, you just click on the report. DigiPro automatically retrieves your settings, finds the new data and displays an updated graph.

Templates: DigiPro's graph templates provide a way for your organization to standardize the format and presentation of inclinometer reports. DigiPro's templates are preformatted graphs of various types that include title blocks with your company logo, standard scales, text, etc.

Data Listings: When you print a report, you can choose to print a listing of the most recent survey. You can also print a listing of the plotted data points.

GRAPH CONTROLS

Survey Selection: The total number of surveys (datasets) per graph is limited only by memory and legibility requirements. You can mark one survey as the initial, and you can control the number of most recent surveys that will be auto-selected for the graph. You can mark other surveys as permanently selected or permanently excluded from the graph (unmarked surveys are also excluded).

Data Units: You can choose millimeters, meters, inches, or feet for displacements and deviations. DigiPro can convert English-unit data to metric and vice versa.

Depth Units: You can choose depths or elevations and meters or feet for depth unit labels. DigiPro automatically converts units as required.

Corrections: Correction values are stored separately from data and do not affect stored data. The application of the various corrections can be toggled on and off. DigiPro supports corrections for spiralled casing and misaligned casing. Spiral correction requires a spiral dataset obtained with a spiral sensor. DigiPro supports corrections for systematic errors caused by bias shifts or changes in cross-axis sensitivity. Corrections for settlement are calculated by DMM for Windows and plotted by DigiPro as normal datasets.

Page Layout: Paper size, paper orientation, margins, graph size and placement have default settings that can be changed for individual reports. The layout of the default templates provides two graphs on the page with a title block at the bottom. You can specify A-axis or B-axis and top or bottom reference. Each report holds two graphs, and you can specify different types of graphs in the same report.

Graph Labels: Labels are supplied automatically or you can enter your own. You can change fonts and font sizes. Dataset identifiers can be toggled between date-only and date-and-time. The dataset legend can be placed in any corner of the graph.

Title Block and Logo: The title block provides two columns of four lines each to enter information about the graph. You can change fonts and font sizes for the text. You can also include your company name and logo. The logo must be a bitmap (.bmp) file

DATA COMPATIBILITY

Project Database: DigiPro works with data stored in Slope Indicator's project database format created by DMM for Windows or DMM for DOS. The DMM program can be downloaded free from Slope Indicator's website.

Legacy Data: TDMM imports legacy data from Slope Indicator's previous formats (PCSLIN, RPP, and DOS DMM) and from the GTILT program. DMM also provides a means of entering data manually.

SYSTEM REQUIREMENTS

Computer Requirements: DigiPro for Windows requires a Windows 95, 98, ME, NT4, 2000, or XP computer. The program does not run on Windows 3.x or DOS. A display resolution of 800 x 600 or higher is recommended, and a mouse or similar pointing device is required. DigiPro prints on any printer supported by Windows.

Network Information: Project databases can be stored on network file servers, but DigiPro itself must be installed on client computers (individual work stations).

Copy Protection: The program is copy protected, but a run-limited version can be installed and used immediately for 45 sessions.The user must then contact Slope Indicator by fax, phone, or e-mail to obtain an unlocking code that permits continued use of the program.

DIGIPRO PART NUMBERS

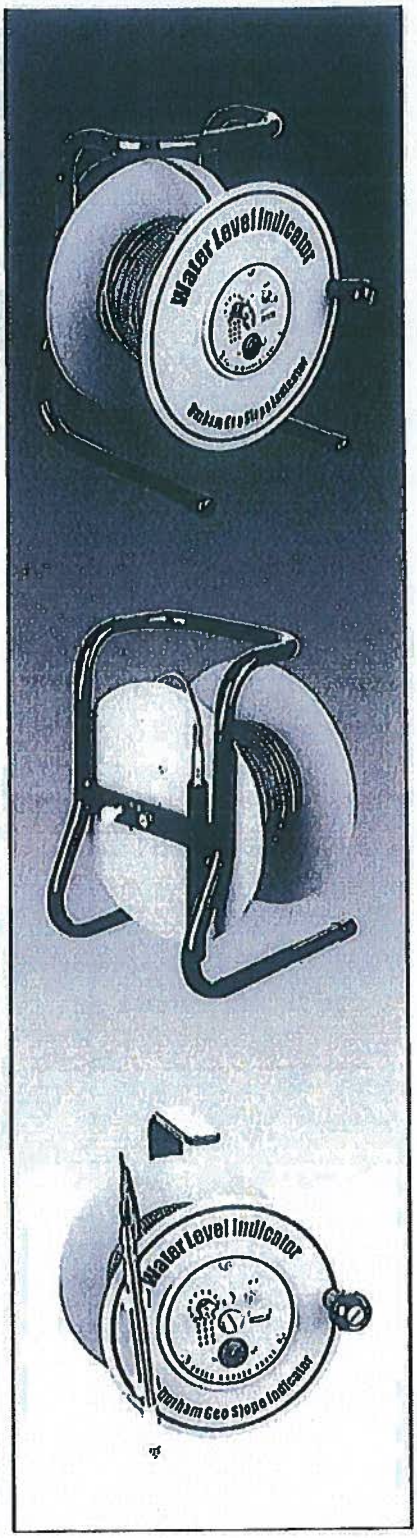
DigiPro for Windows Trial . . . . . Download
DigiPro, 3-User License 50310000
DigiPro, 1-User License 50310001
DigiPro, Site License 50310002

DigiPro is distributed on the Slope Indicator Resource CD and can also be downloaded from the Slope Indicator website. When installed, the software operates in trial mode for 45 runs. After that, continued use requires purchase of a license.

Durham Geo Slope Indicator, 12123 Harbour Reach Drive, Mukilteo, WA, 98275 USA
Tel: 425-493-6200 Tel: 866-916-0541 Fax: 425-493-6250 Email: solutions@slope.com

DGSI
DURHAM GEO SLOPE INDICATOR

Water Level Indicator



Application

Water level indicators are used to monitor water levels in standpipes and wells.

Operation

The indicator consists of a probe, a cable with laser-marked graduations, and a cable reel. The hub of the cable reel contains batteries, electronics, a bright LED lamp, and a beeper.

The operator lowers the probe into the standpipe or well. When the probe contacts the surface of the water, the LED illuminates and the beeper sounds.

The operator then reads the depth-to-water measurement from graduations on the cable.

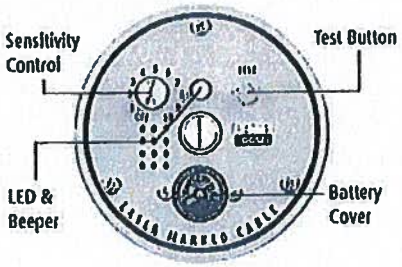
Indicator Controls

Sensitivity Control provides consistent results in different well and water conditions and helps eliminates false triggering.

LED and beeper provide a positive indication of contact with water.

Test button checks the batteries, beeper, and LED.

Battery Cover provides easy access to two AA batteries. Low-power circuits provide excellent battery life.



Indicator Controls

Advantages

Convenient Cable is easy to handle and winds up neatly on the reel. Steel conductors provide strength and excellent dimensional stability.

Laser-Marked Graduations are as durable as the cable itself. English-unit and metric-unit graduations are available.

Small Probe fits into most standpipes and wells. Weight can be attached to the probe tip.

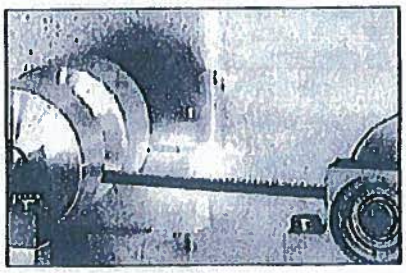
Sturdy Reel is built for years of daily use. It features bronze bearings and aluminum plate sides.

The smallest reel has a handle and clips to hold the probe. Larger reels are equipped with a stand made of strong steel tubing, a probe holder, and a reel brake.

About Laser-Marked Cable

The photograph below shows a water level indicator cable being drawn through the laser marking machine.

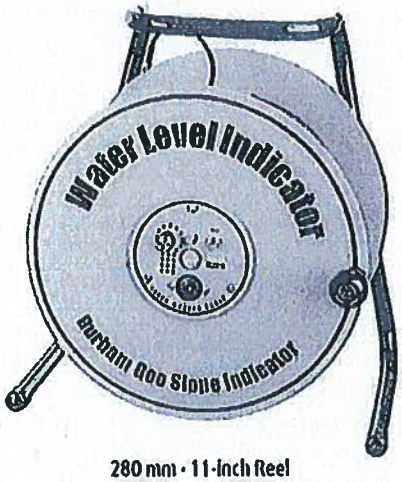
The machine directs a laser beam at the cable jacket. The jacket changes color where the beam strikes, and resulting marks and characters become a permanent part of the cable jacket.



Laser Marking Machine

180 mm · 7-inch Reel

230 mm · 9-inch Reel



280 mm · 11-inch Reel

SPECIFICATIONS

Reel Diameter: 180, 230, 280 mm (7, 9, 11").

Reel Construction: Heavy-gage aluminum plate sides, PVC spool, rotating knob. The smallest reel has an aluminum handle, but no stand. The larger two reels have steel stands.

Control Panel: Sensitivity adjustment, LED, beeper, test switch, and battery holder.

Batteries: Two 1.5 v alkaline AA cells.

Probe Size: 10 x 170 mm (3/8" x 6.6").

Probe Construction: Stainless steel body and tip, polyethylene insulator.

Cable Construction: 3.2 mm (1/8") diameter polyurethane jacket with two copper-clad, steel conductors inside. Jacket can be cleaned with laboratory grade detergent, such as Alconox® or Liquinox®.

Metric Graduations: Centimeters are marked and labelled. Numbers in the label serve as 2 mm graduations, as shown below.

English Graduations: English-unit cables have 0.01 foot graduations with labels at 0.1 foot and 1 foot intervals, as shown below.

METRIC-UNIT INDICATORS

Cable	Reel	Weight	Part Number
30 m	180 mm	1.6 kg	51690303
30 m	230 mm	2.3 kg	51690300
50 m	180 mm	1.8 kg	51690304
50 m	230 mm	2.5 kg	51690305
100 m	230 mm	3.4 kg	51690310
150 m	280 mm	4.7 kg	51690315
200 m	280 mm	5 kg	51690320
300 m	280 mm	7.7 kg	51690330

ENGLISH-UNIT INDICATORS

Cable	Reel	Weight	Part Number
100'	7"	3.5 lb	51690010
100'	9"	5 lb	51690012
150'	7"	4 lb	51690014
150'	9"	5.5 lb	51690015
300'	9"	7.5 lb	51690030
500'	11"	11 lb	51690050
1000'	11"	17 lb	51690100

PADDED NYLON CARRYING CASE

Case for 230mm 9" Reel.....51671009
Case for 280mm (11") Reel.....51671000
Padded nylon carrying case has strap and zipper closure.

REPLACEMENT PARTS

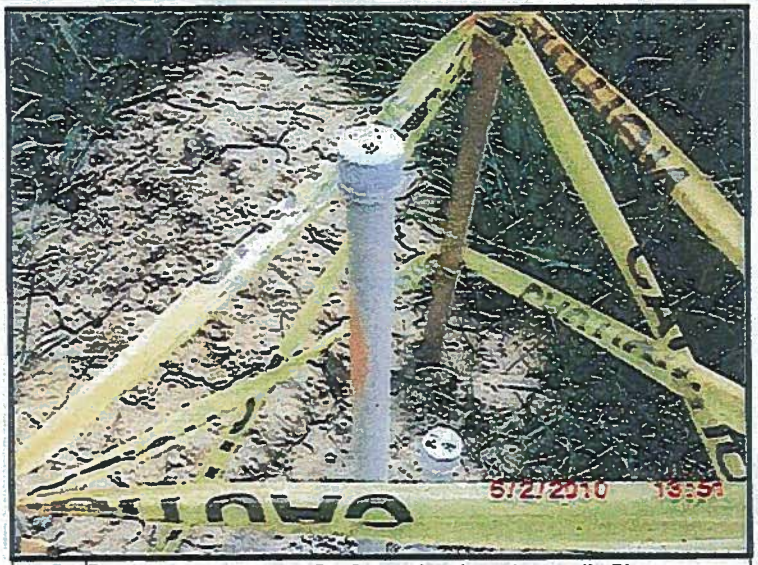
Replacement parts are listed on the Slope Indicator website, www.slopeindicator.com. Click on the link for Support and then the link for Water Level Indicator Parts.

Durham Geo Slope Indicator, 12123 Harbour Reach Drive, Mukilteo, WA, 98275 USA
Tel: 425-493-6200 Tel: 866-916-0541 Fax: 425-493-6250 Email: solutions@slope.com

DGSI Durham Geo Slope Indicator

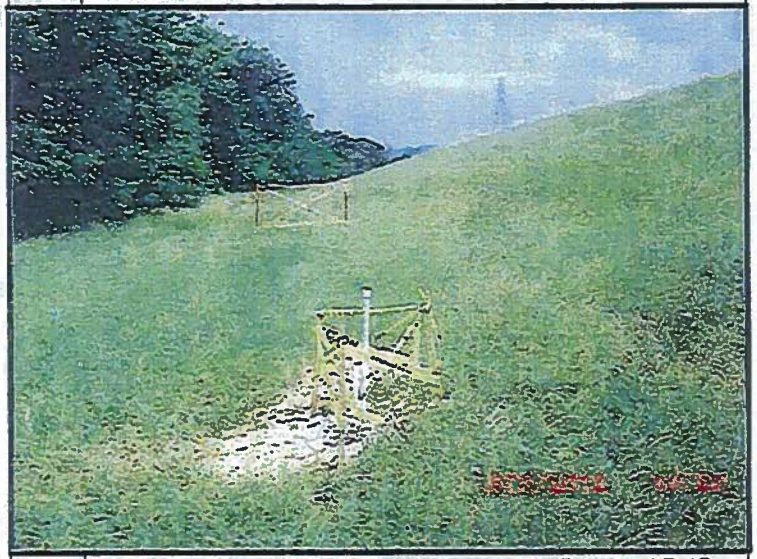
APPENDIX D

▶ Site Photographs

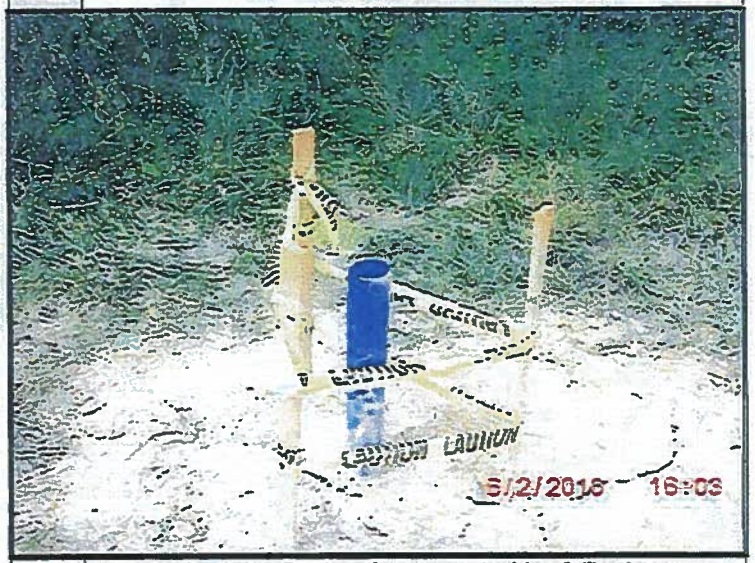


1 Piezometer P-1A and P-1B location (see Appendix B).

2 Looking at slope inclinometer pipe for B-2.



3 Looking east below toe of dike at piezometers P-1A and P-1B. Note flagged monumentation location (Mon 6) in background.



4 Slope Inclinometer B-1 location on north side of dike (see Appendix B).

SS CBI 000093

S&ME	Spurlock Power Station Ash Pond – Maysville, KY East Kentucky Power Cooperative – Winchester, KY	S&ME Project # 1831-10-5580	
		Taken by: MEM	Date Taken: 6-2-10

APPENDIX E

▶Data Collection Sheets

Inclinometer Data Collection Sheet
Spurlock Power Station

Date: _____ Time: _____

Site ID: _____ By: _____ Calibration Factor: 20,000

Depth, ft.	North		South	
	Ao	Bo	Ao	Bo
50				
48				
46				
44				
42				
40				
38				
36				
34				
32				
30				
28				
26				
24				
22				
20				
18				
16				
14				
12				
10				
8				
6				
4				
2				

Comments: _____

Piezometer Data Collection Sheet
Spurlock Ash Pond

PIEZOMETER READINGS			
ID NO.	DATE:	DATE:	DATE:
P-1A			
P-1B			
P-2A			
P-2B			
P-3A			
P-3B			
By:			

****

PIEZOMETER READINGS			
ID NO.	DATE:	DATE:	DATE:
P-1A			
P-1B			
P-2A			
P-2B			
P-3A			
P-3B			
By:			

Note: *Distance measured from top of pipe.*
Where, P-1A is 1.3' above ground surface
P-1B is 2.6' " "
P-2A is 1.0' " "
P-2B is 2.2' " "
P-3A is 0.8' " "
P-3B is 1.5' " "

Surface Monument Data Collection Sheet
Spurlock Ash Pond

Date:_____ Recorded By:_____

Time:_____

SETTLEMENT MONUMENT COORDINATES			
MONUMENT NO.	NORTHING	EASTING	ELEVATION
MON 1			
MON 2			
MON 3			
MON 4			
MON 5			
MON 6			

****

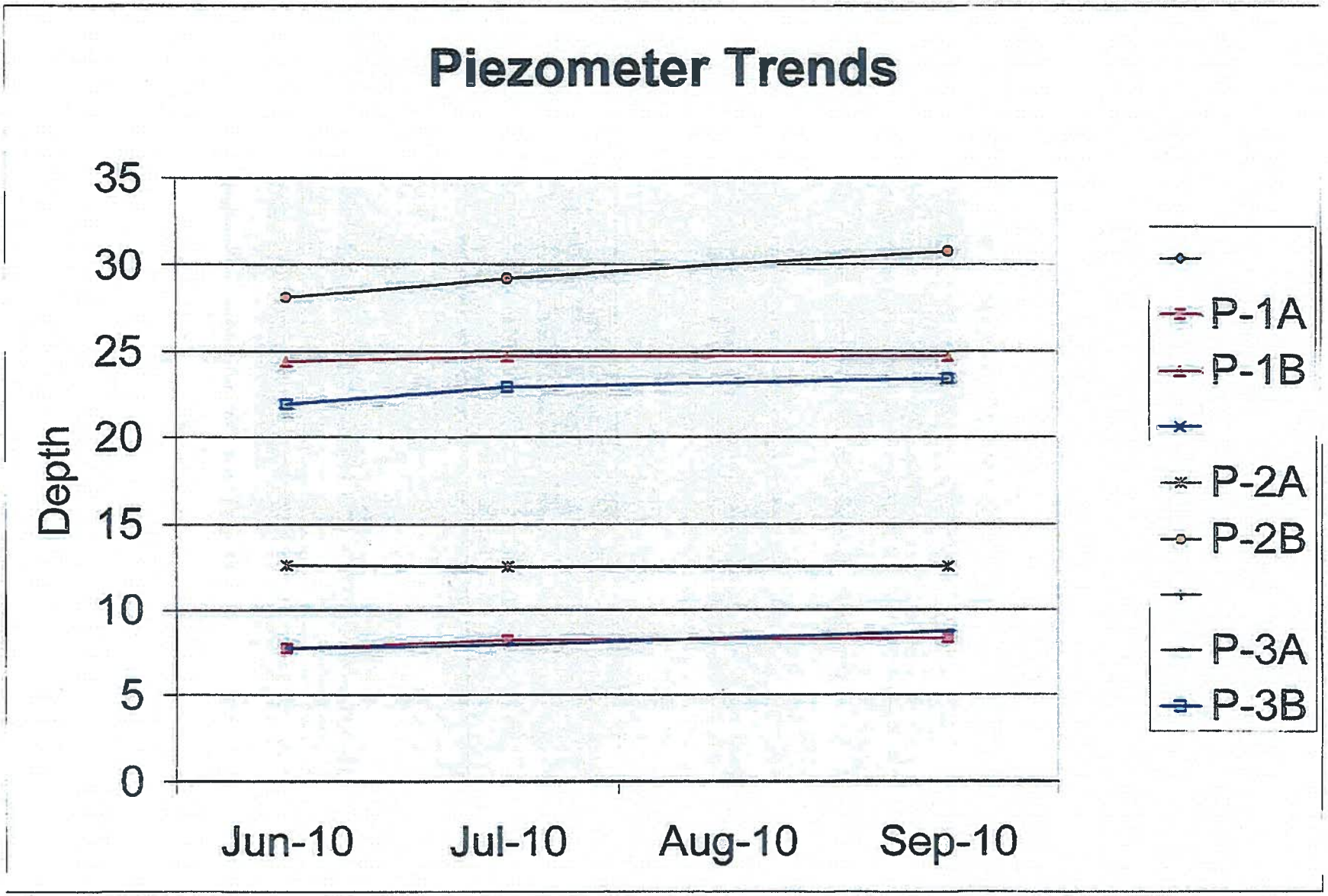
Date:_____ Recorded By:_____

Time:_____

SETTLEMENT MONUMENT COORDINATES			
MONUMENT NO.	NORTHING	EASTING	ELEVATION
MON 1			
MON 2			
MON 3			
MON 4			
MON 5			
MON 6			

Monumentation Readings
Spurlock Ash Pond
Updated: September 2010

Pt #	NORTHING	EASTING	ELEVATION	MONUMENT # - DATE	VERTICAL CHANGE (FT)	HORIZONTAL CHANGE (FT)	HORIZONTAL DIRECTION
1	437209.52	1770088.11	503.21	MON 1- 5/12/2010			
21	437209.54	1770088.11	503.17	MON 1- 9/20/2010	-0.035	0.019	N 03°57'46" W
2	437589.16	1769316.60	505.63	M0N 2- 5/12/2010			
22	437589.16	1769316.60	505.61	MON 2- 9/20/2010	-0.015	0.000	NA
3	437801.12	1768703.08	506.53	MON 3- 5/12/2010			
23	437801.15	1768703.08	506.51	MON 3- 9/20/2010	-0.015	0.030	N 00°21'08" E
4	437934.64	1768194.40	506.29	MON 4- 5/12/2010			
24	437934.67	1768194.40	506.30	MON 4- 9/20/2010	0.005	0.030	N 00°42'54" E
5	438062.15	1767581.18	505.60	MON 5- 5/12/2010			
25	438062.15	1767581.19	505.60	MON 5- 9/20/2010	0.000	0.004	S 74°45'13" E
6	438160.41	1767039.54	508.22	MON 6- 5/12/2010			
26	438160.41	1767039.53	508.22	MON 6- 9/20/2010	0.000	0.008	S 59°37'45" W



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 1/11/2011

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:
Van Gilder Insurance 1515 Wynkoop, Suite 200 Denver CO 80202	PHONE (A/C, No, Ext): FAX (A/C, No):
	E-MAIL ADDRESS:
	PRODUCER CUSTOMER ID #:

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
Utility Telecom Consulting Group Inc. 1554 St. Paul Street Denver CO 80206	INSURER A: Hartford Insurance Company	0
	INSURER B: ACE American Insurance Company	
	INSURER C:	
	INSURER D:	
	INSURER E:	
	INSURER F:	

COVERAGES **CERTIFICATE NUMBER: 1624619903** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY		Y	34SBABU8649	5/12/2010	5/12/2011	EACH OCCURRENCE	$2,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$300,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$10,000
							PERSONAL & ADV INJURY	$2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$4,000,000
	POLICY X PRO-JECT LOC						PRODUCTS - COMP/OP AGG	$4,000,000
								$
A	AUTOMOBILE LIABILITY			34SBABU8649	5/12/2010	5/12/2011	COMBINED SINGLE LIMIT (Ea accident)	$2,000,000
	ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS						BODILY INJURY (Per accident)	$
	SCHEDULED AUTOS						PROPERTY DAMAGE (Per accident)	$
	X HIRED AUTOS							$
	X NON-OWNED AUTOS							$
A	X UMBRELLA LIAB X OCCUR			34SBABU8649	5/12/2010	5/12/2011	EACH OCCURRENCE	$3,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$3,000,000
	DEDUCTIBLE							$
	X RETENTION $10,000							$
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N			34WECGK4873	6/4/2010	6/4/2011	X WC STATU-TORY LIMITS OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) N/A						E.L. EACH ACCIDENT	$1,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$1,000,000
							E.L. DISEASE - POLICY LIMIT	$1,000,000
B	Professional Liability Claims Made Retro Date: 11/01/05			EONG23638071002	11/1/2010	11/1/2011	Per Claim Limit: Aggregate Retention	$2,000,000 $2,000,000 $15,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

As required by written contract or written agreement, East Kentucky Power Cooperative, Inc. is included as Additional Insured for ongoing operations under General Liability & Automobile Liability, on a primary and non-contributory basis with respect to the above referenced. As required by written contract or written agreement, a Waiver of Subrogation in favor of the Certificate holder applies to General Liability.

CERTIFICATE HOLDER

East Kentucky Power Cooperative
Attn: Manager, Business Insurance
PO Box 707
Windchester KY 40392-0707

CANCELLATION

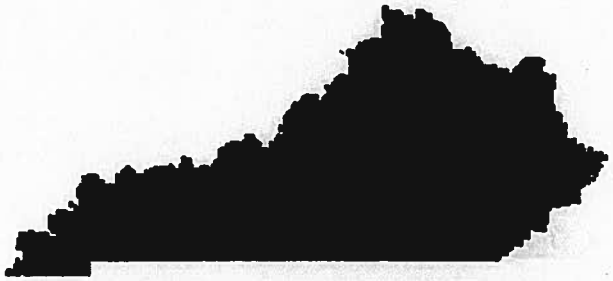
SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

SS CBI 000100

Doc 04: KPDES Permit

KPDES



KENTUCKY POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT

PERMIT NO.: KY0022250

AUTHORIZATION TO DISCHARGE UNDER THE KENTUCKY POLLUTANT DISCHARGE ELIMINATION SYSTEM

Pursuant to Authority in KRS 224,

East Kentucky Power Cooperative, Incorporated
4775 Lexington Road
Winchester, Kentucky 40392-0707

is authorized to discharge from a facility located at

East Kentucky Power Cooperative, Incorporated
H. L. Spurlock Power Station
KY 8
near Maysville, Mason County, Kentucky

to receiving waters named

Outfalls 001, 005, and 007 discharge to the Ohio River at milepoints 567.5, 567.6, and 567.8, respectively.

Outfalls 002, 003, 004, and 006 discharge to Outfall 001.

Outfall 008 discharges to Lawrence Creek.

Outfall 009 is the plant intake.

in accordance with effluent limitations, monitoring requirements and other conditions set forth in PARTS I, II, III, IV, and V hereof. The permit consists of this cover sheet, and PART I 10 pages, PART II 1 page, PART III 1 page, PART IV 2 pages, and PART V 3 pages.

This permit shall become effective on NOV 1 2000

This permit and the authorization to discharge shall expire at midnight, April 30, 2004.

SEP 5 2000
Date Signed

Jack A. Wilson, Director
Division of Water

Robert W. Logan
Commissioner

SS 000002

Doc 05: Dames & Moore Subsurface Exploration Program

LG-S1 BOOK 1

SUBSURFACE EXPLORATION
PROGRAM

FIRST UNIT
SPURLOCK STATION
EAST KENTUCKY POWER COOPERATIVE

WINCHESTER, KENTUCKY
KENTUCKY 59 FAYETTE

SS CBI 000111

SECTION D - ASH WATER STORAGE POND

ASH WATER STORAGE POND

INTRODUCTION

This section of the report covers our preliminary study of earthwork requirements for the proposed ash water storage pond to be located in the northeastern portion of the site, adjacent to the Ohio River. The location of the ash pond in relation to the borings drilled and test pits excavated in the proposed pond area and the remaining plant facilities is shown on Plate 1, Plot Plan, in the GENERAL section of this report.

The evaluations and conclusions presented herein are based on a limited amount of information. Additional field explorations and laboratory testing will be required to confirm foundation conditions, to provide more definitive data regarding potential borrow areas, and to provide data for final design.

DESIGN CONSIDERATIONS

The ash water storage pond will cover an area of approximately 115 acres and will have a storage capacity of approximately 1,750,000 cubic yards. We understand that the predicted useful life of the pond will be about seven years.

The top of the dikes encircling the ash water storage pond will be at elevation 530.0* and will have a crest width

*All elevations refer to Mean Sea Level Datum.

of 15 feet. The bottom of the pond has not yet been established, but the final elevation will range from elevation 503.0 to 510.0 The selected bottom elevation will depend on several factors such as seepage losses, storage capacity, the cost of transporting borrow material, and land development considerations. Water elevation inside the pond will always be maintained above the design high water Ohio River flood elevation of 517.0, to prevent hydrostatic uplift forces from developing within the pond area. The maximum elevation of water in the pond will be at elevation 529.0 and normal pool will be at elevation 528.0. The maximum elevation of the ash material will be at elevation 527.5. The dry density of the ash material will vary between 45 and 80 pounds per cubic foot. An ash water transfer pump and skimming weir will be located in the western corner of the ash pond.

SITE CONDITIONS

SURFACE CONDITIONS

The site for the proposed ash water storage pond covers an area of approximately 115 acres, and is situated in the northeastern portion of the site, adjacent to the Ohio River. Vehicle access to the ash water storage pond from the plant site is by means of a unpaved trail crossing the Chesapeake and Ohio Railway track in the vicinity of Boring W-2. The Chesapeake and Ohio Railway track bounds the site to the south and southwest.

Vegetation in the proposed ash water storage pond area consists of cornfield, pastures and brush. The river

bank is scattered with trees ranging in diameter from 10 to 14 inches. Two low valleys are located within the pond area: one valley is located along the line formed by Borings AS-18, AS-21 and AS-24, and another between Borings AS-6 and AS-22. Both valleys contain trees ranging in diameter from 10 to 12 inches.

The surface topography of the proposed ash water storage pond is relatively level at about elevation 510, except in the two valleys. The lowest ground surface elevation in the valleys, as measured at specific borings drilled in these areas, is approximately at elevation 490.

The surface and near surface soils over most of the ash pond are firm. The surface and near surface soils in the vicinity of Borings AS-28, AS-30 and AS-33, along the two valleys, and along two grass and weed covered swales extending southeast from the two valleys are soft. The surface soils in these areas will not support farm equipment.

A ten inch diameter PVC drain tile was encountered near Test Pit AS-40 which extends north to the valley located at the center of the site.

SUBSURFACE CONDITIONS

General - The subsurface conditions at the ash water storage pond location were investigated by drilling 35 exploration test borings to depths ranging from 20 feet to 100 feet and excavating 11 test pits to depths ranging between 10 feet to 18 feet below the existing ground surface. In addition, the permeability characteristics

of the near surface in-situ soils were investigated by performing five falling head field permeability tests. The permeability tests were performed in test pits excavated to a depth of approximately four feet below the existing ground surface. The results of the field permeability tests are presented on Plate D-6A.

Undisturbed soil samples were obtained in the borings using a Dames & Moore Type U Sampler illustrated on Plate E-2 of SECTION E of this report. Ground water level observations were made in the borings during the drilling operations and subsequently, when the water level had stabilized. Galvanized steel pipes with No. 80 screen well-points attached to the bottom of the pipes were installed in some borings for long-term water level readings.

Copies of the field borings and test pit logs were provided directly to Stanley Consultants, Inc., upon completion of each boring. Final logs of all borings and test pits with soil classification based on laboratory tests and visual examination, are presented in this section of the report. Keys to the symbols used on the Log of Borings and Log of Test Pits are presented on Plate E-1 of SECTION E of this report.

Soil Conditions - The site is generally free of topsoil, but roots were encountered in some borings and test pits to depths ranging between six inches to two feet below the existing ground surface. Based on the subsurface soils encountered, the ash water storage pond area can be divided into three

zones: (1) the portion of the site represented by the two valleys, (2) the area between Borings AS-28 and AS-30, and (3) the remainder of the ash pond area.

The subsurface conditions in the valley in Borings AS-18, AS-21 and AS-24, consists of soft to medium stiff brown sandy silts containing some clay extending to depths up to about 17 feet near the Ohio River. This upper sandy silt layer gradually grades to a silty sand which extends between 13 to 17 feet below the ground surface, and disappears altogether at the location of Boring AS-24. The upper sandy silt layer encountered near the river, and the silty sand layer encountered to the southeast along the main valley are underlain, to the maximum depths explored in the borings, by medium dense brown fine to coarse gravels and medium dense fine to coarse sands.

The subsurface conditions in the pond area between Borings AS-28 and AS-30 consists of a soft to medium stiff gray silty clay to gray clayey silt to the maximum depth explored of 20 feet in these two borings.

The subsurface conditions encountered in the remainder of the site, outside of the two areas indicated above, consist of an upper stiff to hard brown or mottled gray and brown silty clay or clayey silt extending to depths of between 6 feet and 17-1/2 feet below the existing ground surface. The elevations of the bottom of the upper clay and silt layer are tabulated for all borings and test pits in the ash pond area.

BORING AND TEST PIT NUMBER	GROUND SURFACE ELEVATION	BOTTOM ELEVATION OF UPPEI CLAY OR SILT STRATUM
AS-1	511.0	502.5
AS-2	507.9	498.9
AS-3	507.3	498.3
AS-4	506.4	496.4
AS-5	506.4	500.4
AS-6	506.6	484.6
AS-7	506.6	498.6
AS-8	506.3	493.8
AS-9	506.9	500.9
AS-10	505.7	493.2
AS-11	504.3	495.3
AS-12	504.8	492.8
AS-13	506.7	495.7
AS-14	509.5	500.5
AS-15	510.8	504.8
AS-16	509.4	496.9
AS-17	511.0	502.0
AS-18*	489.4	472.4
AS-19	508.3	495.8
AS-20	512.1	503.1
AS-21*	491.1	487.1
AS-22	510.8	501.8
AS-23	509.0	497.8
AS-24*	494.3	No clay or silt encounter
AS-25	510.9	493.9
AS-26	510.3	497.5
AS-27	510.7	500.7
AS-28**	506.0	486.0
AS-29	510.8	498.3
AS-30**	507.0	487.0
AS-31	512.2	501.2
AS-32	507.2	489.7
AS-33	511.9	494.9
AS-34	512.5	503.5
AS-35	512.8	500.0
AS-36	508.8	496.8
AS-37	510.5	499.5
AS-38	508.7	495.2
AS-39	510.5	500.5
AS-40	508.6	493.1
AS-41	510.3	501.3
AS-42	513.0	505.5
AS-43	507.2	492.7

* In Valley
** In Soft Area

Below the upper cohesive layers, the soils outside of the valleys and the soft area consisted of sands which become coarser and progressively denser with depth and contain some silt and gravel. At depths ranging between 75 feet and 84 feet below the ground surface, and extending to the bedrock surface in Borings AS-3, AS-6, AS-9 and AS-12 (drilled along the Ohio River), the sand becomes very gravelly, with occasional cobbles.

The bedrock was encountered in the Borings AS-3, AS-6, AS-9 and AS-12 at elevations ranging between elevation 412 and 413. The bedrock was not cored in the ash storage pond area.

Ground Water - Ground water level observations were made during and subsequent to the drilling operations. In addition, two well point piezometers were installed to depths of 75 feet below the ground surface. An outline of the piezometer installation procedure is presented in SECTION E of this report. Ground water was observed at between elevations 484.5 and 495.7 in the ash storage pond area. Perched ground water was encountered in Borings AS-28 and AS-30 at depths of 3.5 feet and 1.5 feet below the ground surface, respectively. Perched or standing water was also present along two grass and weed covered swales extending southeast from the two valleys.

It is anticipated that the ground water table will fluctuate during the course of the year and will be directly influenced during flooding of the Ohio River.

GENERAL DISCUSSION

The results of field explorations, laboratory tests, and foundation engineering analyses indicate that the ash water storage pond site is suitable, from a foundation standpoint, for the construction of the pond and its containment dikes.

Suitable borrow materials are available within and adjacent to the pond area and, with adequate design and construction provisions, seepage losses can be minimized. These general conclusions have been developed based on the available data; further verification of the subsurface conditions will be required prior to final design of the pond.

Seepage losses from the pond have been estimated for various elevations of the bottom of the pond area. From the point of view of assuring adequate cover of natural impermeable soils throughout the pond area, a minimum bottom elevation of about elevation 506.5 is suggested. Final selection of the bottom elevation will depend on several factors including seepage losses, storage capacity, cost of transporting off-site borrow materials, and land development considerations. Economic evaluation of these factors are required prior to final design.

Subsurface soils throughout the pond site area generally have a high in-situ moisture content which will require compaction of fill materials at higher than optimum moisture contents. Excessive drying of the in-situ materials

should generally not be required to achieve desirable strength and permeability characteristics at specified densities.

Based on the available subsurface information, near surface foundation materials are expected to consist of competent silty clays and clayey silts over about 90 percent of the dike embankment length. In the remainder of the embankment length, poor foundation materials were encountered (near Borings AS-18, AS-28 and AS-30). Treatment of the dike foundation soils by excavation and compaction and/or preloading will be required in these areas to improve subgrade conditions, and reduce the anticipated long-term settlement. It is recommended that the dikes be constructed on side slopes of three horizontal to one vertical (3:1) and that a minimum distance of 50 feet be maintained from the exterior toe of the dikes to the top of the river embankment. The portion of the dike crossing a partially filled valley (Near Boring AS-18) should be constructed on side slopes of five horizontal to one vertical (5:1).

Our evaluation of the subsurface conditions with respect to borrow materials, dike foundations, stability and settlement of embankments, seepage losses and earthwork criteria are presented in the following sections.

ASH POND CONSTRUCTION

SITE PREPARATION

Site preparation will consist of clearing, stripping, cutting and excavating.

Clearing - It is recommended that all trees, brush and vegetation be removed within the area of the dikes and impoundment and that this material be wasted.

Stripping- It is recommended that all loose soils containing roots and disturbed by cultivation be removed from the base area of the dikes and stockpiled for future use as slope protection. Care should be taken during the stripping operations to minimize disturbance of the underlying firm materials. Outside of the base area of the dikes and inside the ash pond area, loose soils containing roots and disturbed by cultivation need not be removed but should be compacted unless these loose soils are too wet for proper compaction.

Cutting - Cutting operations will be required to attain grades for the bottom of the pond area. Additional cutting will be required in isolated areas containing loose soils which are too wet for proper compaction.

Excavations - Partial excavation of the soft soils can be accomplished to reduce post-construction settlement of the dikes located over soft compressible soils. Estimated magnitude of settlements assuming no removal of the soft soils and replacement with fill are presented in the PRELIMINARY ASH POND DESIGN DATA section. It is our opinion that excavation by means of dragline may be required as the soils in the soft areas may be too weak to support construction equipment.

Perched water was encountered at shallow depths in the soft area located between Borings AS-28 and AS-30. It is our opinion that in this area, excavations on the order of 8 to 12 feet in depth can be dewatered by means of small

pumps. In the second soft area, located in the vicinity of Boring AS-18, excavation of the soft soils would extend below the water table and dewatering would be difficult. We recommend that in this area, that if excavations extend below the water table that they be filled with clean sands or sand and gravels which can be end-dumped into place without compaction.

Recommendations regarding fill placement in the soft areas and other portions of the ash pond are presented in the following section of this report.

EARTHWORK

Fill Materials - Materials suitable for the construction of the main portion of the dikes are available from within or adjacent to the pond area. These materials are either silty clays or clayey silts. The classification of the near-surface materials that will be encountered in the pond area has been discussed generally in a previous section.

Following the clearing and the stripping operations, the exposed surface should be graded in such a manner that good drainage is provided at all times. If necessary, the exposed surface should be sealed prior to inclement weather to prevent infiltration and/or ponding of surface water on the soils which will be subsequently used as fill materials.

On the basis of laboratory tests and visual examination of the soils, the near-surface materials available for fill within and adjacent to the ash pond (outside of the soft areas) can be divided into two basic types:

1 - A brown silty clay containing some sand.

2 - A brown clayey silt containing some sand.

The average and range of (1) in-situ moisture content determined from undisturbed and disturbed samples obtained in borings and test pits, (2) optimum moisture content and maximum dry density obtained from compaction tests, and (3) the plasticity index for the above two soil types are tabulated below:

SOIL TYPE	IN-SITU MOISTURE CONTENT (PERCENT) AVERAGE;RANGE	OPTIMUM MOISTURE CONTENT* (PERCENT) AVERAGE;RANGE	MAXIMUM DRY DENSITY* (pcf) AVERAGE;RANGE	PLASTICITY INDEX (PERCENT) AVERAGE;RANGE
1	22.6;19 to 37	14.6; (one test)	102; (one test)	13.7;9 to 15
2	24.9;10 to 34	14.5;13.5 to 15.6	116;114 to 118	13.5;7 to 17

*Based on The American Society for Testing Materials (ASTM), Compaction Test Designation D1557.

Since most of the available soils are at a moisture content above the optimum moisture content, it is not considered practical or necessary to require compaction of borrow materials to dry densities greater than 90 percent of the maximum dry density as determined by the ASTM Compaction Test Designation D1557. Compaction of the fill to 90 percent of the maximum dry density is sufficient to attain adequate fill strength, and this degree of compaction can be achieved with a reasonable reduction of the moisture content of fill materials prior to compaction.

Placement of fill materials at moisture contents ranging from optimum to as much as six percent above optimum is considered desirable. Placing the fill material at higher than optimum moisture content will result in a more impermeable and more flexible dike structures. The amount of drying of materials required to achieve the recommended range of moisture content should not be difficult during normal weather conditions, but may prove difficult during wet or freezing weather.

Specific recommendations pertaining to the placement and compaction of fill materials are presented in the following sections.

A limited search for off-site borrow materials was made during this study. Several local contractors in the Maysville, Kentucky Area were contacted to determine if there are local commercial areas supplying borrow clay. The contractors contacted did not know of any commercial borrow areas. However, based on the information obtained, areas with near-

surface clayey soils may be found outside of the river valley on the highlands.

A detailed study based on surface geological maps will be required coupled with an on-site survey of the available materials by means of borings and/or test pits to determine the availability of clay borrow materials near the site. We would be pleased to conduct this study should you decide to further investigate off-site borrow sources.

Placement of Fill in Earth Dikes - Areas which are to receive fill should be prepared in accordance with the recommendations presented in the SITE PREPARATION sections of this report. It is recommended that fill materials for embankment be placed in lifts not exceeding six inches in loose thickness and that each lift be compacted to at least 90 percent of the maximum dry density as determined in accordance with ASTM Compaction Test Designation D1557. It is recommended that the fill material be compacted at moisture contents ranging from optimum to six percent above optimum. Each layer of fill should be compacted to the required density prior to the placement of the succeeding layer. If the required density is not achieved, additional compaction effort should be applied or the in-place materials should be removed and replaced with properly compacted fill soils.

Since the available soils are at a moisture above the optimum moisture content, the soils will require some degree of drying by spreading and discing to attain the

required densities. It is essential that proper procedures for spreading and drying be established at the commencement of filling operations, and that the construction schedule throughout the construction period allow for adequate drying periods prior to the placement and compaction of fill materials. Moisture conditioning cannot be accomplished during periods of wet or freezing weather. Good construction practice dictates that moisture control be achieved in the borrow area, prior to delivery of the fill soils to the embankment areas.

During inclement weather, the exposed surface of the embankments should be sealed to prevent infiltration of surface water and should be sloped or otherwise drained in order to prevent the ponding of water on the surface of the fill materials. Sealed surfaces should be scarified prior to resuming fill placement.

The exposed crests and interior and exterior slopes should be protected from erosion during construction and subsequent to construction. Recommendations pertaining to erosion control are presented in a subsequent section of this report.

Surface Treatment of Bottom of Ash Pond - It is recommended that the upper 12 inches of exposed in-situ natural cohesive soils be scarified and then compacted to at least 90 percent of the maximum dry density as determined by ASTM Compaction Test Designation D1557. In areas where the lower silty sands are exposed during the cutting operations (this

would occur if the pond bottom were established below elevation 504 and along the sides and bottom of the two valleys) a minimum of 24 inches of silty clay fill cover is recommended. Areas which are to receive fill should be prepared in accordance with the recommendations presented in the SITE PREPARATION section of this report. It is recommended that fill materials for the bottom of the ash pond be placed in lifts not exceeding six inches in loose thickness and each lift be compacted to at least 90 percent of the maximum dry density as determined in accordance with ASTM Compaction Test Designation D1557. Fill materials should be compacted at moisture contents ranging from optimum to six percent above optimum. The procedures for moisture conditioning and surface protection during inclement weather presented in the previous section, Placement of Fill in Earth Dikes, are applicable for the ash pond bottom.

Placement of Drainage Blanket Material - It is recommended that an internal drainage blanket be provided for the dikes surrounding the ash water storage pond. The drainage blanket will prevent softening and deterioration of the exterior slope of the dikes and will contribute to the stability of the dikes.

Placement of select pervious filter materials will be required for adequate internal drainage of the dikes.

The drainage blanket may be placed directly on the compacted in-situ soils or on compacted cohesive fill.

The drainage blanket should be placed in 12-inch lifts and compacted to a minimum dry density of 90 percent of the maximum dry density determined in accordance with ASTM Compaction Test Designation D1557. The blanket should be maintained at least 6 inches above adjacent embankment grade to prevent contamination of the drainage blanket with the adjacent soils. Contaminated material should be removed from the drainage blanket. The area adjacent to the exterior dike toe should be graded to direct all seepage and surface runoff away from the drainage blanket.

Placement of Riprap - The bedding course for riprap and the riprap materials for erosion protection of the interior slopes for the dikes need not be compacted to any specified density. The primary criteria in the placement of these materials should be to produce a well-graded well-interlocked mass with a minimum percentage of voids. The materials can be dumped or spread over the surface to be protected.

PRELIMINARY ASH POND DESIGN DATA

DESIGN CRITERIA

This section of the report presents preliminary recommendations pertaining to the design of the proposed ash water storage pond. Our recommendations have been formulated primarily in accordance with the following design criteria:

1 - Maximum utilization should be made of materials available at the site.

2 - The slopes of the dikes must be stable during construction and under all conditions of reservoir operations, including under 0.05g horizontal acceleration due to the postulated design basis earthquake.

3 - The computed seepage line for the dikes must be within the exterior face.

4 - The interior and exterior slopes and crest of the dikes must be protected against erosion due to wind and water. The interior slope must also be protected against erosion by wave action.

5 - Seepage losses from the pond must be reduced to a minimum, but consistent with item (1) above.

6 - Settlement must be within tolerable limits.

RESULTS OF ENGINEERING ANALYSES

Stability Analyses - Stability analyses were performed to determine the inclinations of the slopes which would be stable, with a suitable factor of safety, under the various conditions of construction and operation. The data utilized in the stability analyses were obtained from laboratory tests performed on representative undisturbed samples obtained from borings drilled within the area of

the dikes, and on reconstituted samples representative of compacted fill materials. The test results are presented at the end of SECTION D.

The soil parameters used for dike design are tabulated below. The tabulated data has been obtained from laboratory tests, and from experience with similar soils. Additional testing will be required to confirm the tabulated effective stress parameters.

	Undrained Shear Strength		Effective Shear Strength			
	Angle of Internal Friction (degrees)	Cohesion (psf)	Angle of Internal Friction (degrees)	Cohesion (psf)	Saturated Unit Weight (pcf)	Assumed Range of Elevation (feet)
FILL MATERIAL	0	3270	25	200	125	530-505
FOUNDATION SOILS						
River Bank						
Upper Cohesive Stratum	0	3500	25	200	128	505-503
Silty Sand Stratum	32	100	32	100	120	503-475
Sand Stratum	35	0	35	0	125	475-425
Soft Soil Area						
Upper Cohesive Stratum	0	450	25	50	106	505-490
Lower Cohesive Stratum	0	550	25	50	112	490-480
Sand Stratum	35	0	35	0	125	480-425

The various conditions of stability which were considered in the analyses are as follows:

1 - End of construction.

2 - Steady state seepage (water elevation at 517 no ash).

3 - Steady state seepage (water elevation at 529, ash elevation 527.5).

4 - Steady state seepage condition (3) but with earthquake force.

The analysis was performed using the total and effective stress parameters presented above and pore pressures computed by gravity seepage theory. A drainage blanket, and side slopes of three horizontal to one vertical (3:1) were assumed. The critical dike section along the river bank showing the type of failure and corresponding factor of safety for condition 4, is presented on Plate D-1, Results of Stability Analyses. The results of the stability analyses for all the conditions and cases analyzed are tabulated on the following page. The soft area indicated on the table is between Borings AS-28 and AS-30.

RESULTS OF STABILITY ANALYSES

DIKE LOCATION	STABILITY CONDITION	HEIGHT (FEET)	SLOPE ANALYZED	EARTHQUAKE COEFFICIENT	REMARKS	MINIMUM COMPUTED FACTOR OF SAFETY
River Bank	1	27	Interior	0	Pond Bottom at Elev. 503	3.96
River Bank	2	25	Exterior	0	50-foot wide berm from exterior dike toe to top of river bank.	1.57
River Bank	3	25	Exterior	0	25-foot berm from exterior dike toe to top of river bank.	1.28
River Bank	3	25	Exterior	0	50-foot wide berm from exterior dike toe to top of river bank	1.51
River Bank	4	25	Exterior	.05g	25-foot wide berm from exterior dike toe to top of river bank.	1.08
River Bank	4	25	Exterior	.05g	50-foot wide berm from exterior dike toe to top of river bank	1.24
Soft Soil Area	1	27	Interior	0	No soft soils removed below Elev. 503.	1.93
Soft Soil Area	1	27	Interior	0	Soft soils extending to Elev. 495 removed and replaced with compacted fill.	2.85
Soft Soil Area	1	27	Interior	0	Soft soils extending to Elev. 490 removed and replaced with compacted fill.	3.52
Soft Soils Area	3	27	Exterior	0	Soft soils extending to Elev. 490 removed and replaced with compacted fill.	1.52
Soft Soil Area	4	27	Exterior	.05g	Soft soils extending to Elev. 490 removed and replaced with compacted fill.	1.24

Based on the results of the above described stability studies, it is concluded that the ash water storage pond dikes will be stable, with a suitable factor of safety, if constructed with side slopes no steeper than three horizontal to one vertical (3:1). Construction of the dikes should be in accordance with the recommendations presented in the proceding EARTHWORK and subsequent RECOMMENDED DESIGN DATA sections of this report.

An exception to the above recommended slope is at the location where the valleys intersect the dike area along the river. At this location, if the valleys are not filled to surrounding grade, the slope of all embankments constructed in the valleys should be no steeper than five horizontal to one vertical (5:1).

Should the dike heights be significantly increased from the heights assumed in this study, additional stability studies must be performed to establish required slope configuration.

Seepage Analyses - Seepage analyses were performed to determine seepage losses within the ash pond area for various bottom elevations. The data utilized in the seepage studies were obtained from laboratory tests performed on representative undisturbed samples obtained from borings drilled within the ash pond area, and on reconstituted samples representative of compacted fill materials and from field permeability tests. Laboratory and field test procedures are presented in SECTION E to this report. The test results are presented at the end of this section.

The three main conditions considered in the seepage studies are as follows:

1 - Bottom of pond at Elev. 503.0.
2 - Bottom of pond at Elev. 506.5.
3 - Bottom of pond at Elev. 510.0.

The analyses were performed by subdividing the total pond area into several subareas each having approximately similar permeabilities and thicknesses of impermeable materials.

Each of the above conditions was analyzed for a water level at elevation 517.0 with no ash in the pond, and a water level at elevation 528.0 and ash to elevation 527.5. A minimum of twelve to twenty four inches of compacted cohesive in-situ or fill soil was assumed over the entire pond area. The results of the seepage analyses for all the conditions analyzed are tabulated below.

RESULTS OF SEEPAGE ANALYSES

CONDITION	ASSUMED POND WATER ELEVATION	CALCULATED SEEPAGE LOSS (ft^3/day)
1	517.0	13,120
1	528.0	17,520
2	517.0	10,200
2	528.0	13,700
3	517.0	6,160
3	528.0	8,230

It is felt that the above calculated seepage loss for the pond filled with ash is conservative. Consolidation of the ash material under its own weight will take place with time decreasing the seepage losses. The change in the permeability characteristics of the ash can only be estimated by obtaining representative samples of ash and determining the permeability for various degrees of consolidation. This should be done in the final analyses to refine our estimated values.

The ash material will be retained above the impervious pond bottom and will not be transported with the seepage water.

For condition (1), with the bottom of the ash pond at elevation 503.0, the silty sands soils will be exposed in approximately ten to fifteen percent of the total pond area. Since the permeability of the silty sands is large compared to the relatively impermeable silty clays or clayey silts, the water will rapidly drain through the silty sands. The seepage losses presented in the previous table for condition (1) assume that the exposed sands are over-excavated 18 inches below elevation 503, and replaced by compacted silty clay fill.

The results of the above preliminary studies are based on information obtained from widely spaced borings and test pits and a limited number of permeability test data. Actual seepage losses are estimated at 80 percent to 120 percent of the tabulated values. More detailed studies are required to firmly establish seepage loss quantities. An outline of recommended future studies is presented at the end of this section.

Should the seepage losses tabulated in the preceding table be unacceptable, seepage losses can be minimized by lining the entire ash water storage pond. Several types of linings could be considered for seepage control. A summary of the characteristics of these is given below:

1 - Membrane Linings

Materials used for this type of lining include polyethelene, PVC and butyl rubber. The lining is constructed by placing sheets of the material on a prepared surface and subsequently covering the lining with a layer of soil for protection. The sheets are welded or glued to form a watertight seal. The major difficulties in this type of lining are achieving watertight joints and the poor resistance to abrasion and tearing.

2 - Concrete Lining

This type of lining is produced by placing concrete slabs tied together by water seals, or by application of gunite. The lining is rigid and can be relatively pervious because of leakage through joints and cracks. The advantage of this type of lining is the good wearing surface. The major disadvantage consists of the difficulty to repair and non-uniform settlement of the slabs under the weight of the ash material.

3 - Asphalt Lining

This type of lining generally consists of asphalt concrete mixed in the field, or placement of asphalt panels. The mixing of asphalt concrete is crucial and generally is difficult to control under field conditions. Outside of experimental projects, most usage of asphalt concrete in hydraulics has essentially been for control of wave action. Prefabricated asphalt panels are commonly applied in two layers, placed staggered to provide an effective seal. This type of lining does not provide a working surface, but the panels generally provide a good resistance to abrasion and tear. Settlement in the pond area due to the weight of the stored ash would probably eliminate the use of this liner.

4 - Soil Cement

This type of lining is produced by mixing cement with a specially graded soil. Good mixing compaction is very important in the placement of the soil cement. This type of lining therefore requires relatively flat embankment slopes. On slopes steeper than approximately 5 horizontal to 1 vertical, the placement and compaction is performed normal to the axis of the dike and therefore is relatively expensive. On flatter slopes the mixing and compaction equipment may work

along the length of the dikes. As with the case of concrete, this material is rigid and will crack.

It is recommended that detail cost comparisons be made of the above alternate lining types should the tabulated seepage losses presented prove unacceptable.

Settlement Analyses - Settlement analyses have been performed to determine total and differential settlements that can be expected to occur along dike alignment.

The data utilized in the settlement analyses were obtained from laboratory consolidation tests performed on representative undisturbed samples obtained within the ash pond area.

Settlement analyses were performed at various portions on the ash pond area under full dike loading conditions. The areas studied were as follows:

1 - Soft area at location of Boring AS-18.

2 - Soft area between Borings AS-28 and AS-30.

3 - Remainder of site, outside of the above two areas.

The results of the settlement analyses for the above three areas, assuming (1) no removal of soft soils and (2) partial removal of soft soils are tabulated below:

DIKE LOCATION	ULTIMATE SETTLEMENT OF DIKE (INCHES)	REMARKS
Soft Soil Area (1)	28	No removal of soft soils
Soft Soil Area (1)	18	Soft soils removed to Elevation 485
Soft Soil Area (1)	5	Soft soils removed to Elevation 480
Soft Soil Area (2)	24	No removal of soft soils
Soft Soil Area (2)	18	Soft soils removed to Elevation 495
Soft Soil Area (2)	8	Soft soils removed to Elevation 490
Area (3)	2	-

As indicated above, partial excavation of the soft soils will significantly reduce post-construction settlement in the soft areas. Excavation by means of dragline will be required as the soft soils are too weak to support construction equipment.

In our opinion, an alternate and more desirable means of reducing post-construction settlement would be to initially construct the portion of the dikes located over soft areas during the early plant construction stage and allow settlement

to take place over a period of several months. Subsequently, the remaining dike can be completed and remedial measures taken in the portion of the dikes located over soft areas. Assuming no excavation of soft soils in areas (1) and (2), it is estimated that approximately 50 to 70 percent of the indicated settlements will take place during the first six months following completion of the dike section overlying the soft areas. To allow for residual settlements, appropriate cambers should be constructed at the crest of the portion of dikes overlying soft areas.

RECOMMENDED DESIGN DATA

General - Details pertaining to the design of internal drainage facilities and erosion control facilities are considered to be of major importance in the design of a stable cross-section. Additional studies are required before specific design data can be developed. General recommendations for the design of internal drainage facilities and erosion control facilities are presented in the following sections.

Filter and Drainage Facilities - It is recommended that a internal drainage blanket be provided for the dikes. The provision of a drainage blanket will prevent softening and deterioration of the exterior toe and will contribute to stability of the exterior slopes.

The horizontal drainage blanket must be pervious so that drainage will be accomplished, and it must be designed to prevent movement of particles of the foundation or embankment into the filters as seepage water discharges. The drainage blanket should have an effective thickness of at least three feet. The length of the filter will be governed by the height of the dikes and the filter should begin at a distance from the centerline equal to the height of the dikes plus six feet.

The drainage blanket should be a clean, free draining, durable natural sand containing no more than four percent of material by weight passing the No. 200 sieve.

The exterior slope of the drainage blanket should be protected against erosion by a minimum thickness of one foot of bedding course material.

Slope Protection - The interior slope of the dikes will be exposed to water impoundment at various levels and will also be subject to erosion by wind, water and wave action. Erosion protection of the interior embankment materials should be provided by a bedding blanket of sand and gravel, at least 12 inches in thickness.

The slope area which will be subjected to wave action during fluctuations of the water level, should be protected by a layer of riprap. The riprap protection layer should be at least 18 inches in thickness.

The exterior slopes and crests of the dikes should be protected from erosion by the action of wind and water by an adequate growth of vegetation.

We recommend that an evaluation of the need to riprap the exterior dike slopes along the Ohio River be performed in the light of the anticipated short life of the ash storage pond. Riprap protection would only be required during high flood periods. Based on the results of this evaluation, riprap and bedding design can proceed as follows:

1 - Select the required average weight of stone for the riprap based on the maximum velocity computed.

2 - Select the riprap and bedding gradation based on the following criteria:

(a) $\frac{D_{15} \text{ of the bedding}}{D_{85} \text{ of the embankment soils}} = 5 \text{ or less}$

(b) $\frac{D_{15} \text{ of the riprap}}{D_{85} \text{ of the bedding}} = 5 \text{ or less}$

(c) The corresponding grain size curves should be roughly parallel.

In the above design formulas, D_{15} is the size at which 15 percent of the total particles are smaller, and D_{85} is the size at which 85 percent of the total particles are smaller.

The existing trees and vegetation along the Ohio River aid in stabilizing the river bank, and should not be removed. Riprap protection may be required in areas where evidence of bank erosion exists.

Other Facilities - Additional field studies are required to firmly establish that seepage of the impounded water will not occur through thin interbedded horizontal sand layers in the near cohesive surface soils. Evidence of their existence was not found in the present field investigation; however, the relatively high coefficient of permeability computed in the field permeability test performed adjacent to Boring AS-25 may be indicative of the presence of interbedded sand layers in the near surface cohesive soils.

Should interbedded horizontal sand layers be encountered in a more detailed study, cutoff trenches through these soils will be required to minimize seepage losses and to increase the lateral stability of the dikes.

LABORATORY TESTS

Laboratory tests were performed on selected undisturbed and reconstituted samples obtained from borings and test pits in the ash pond area in the manner described in SECTION E of this report.

Sieve analyses were performed on selected granular soil samples obtained from selected borings along the Ohio River for the purpose of estimating the permeability and transmissibility of the in-situ soils, principally for future well development studies.

Moisture content, dry density, Atterberg limit, direct shear, unconfined and unconsolidated-undrained triaxial test data are presented to the left of the Log of Borings, Plates D-2A through D-2U. The strength tests are indicated by symbols on

the Log of Borings. The key to these symbols is presented on Plate E-1, Unified Soil Classification System and Key to Test Data. Grain-size distribution and consolidation tests are presented graphically on Plates D-3A through D-3C and Plates D-4A through Plates D-4C, respectively. Compaction test data are presented graphically on Plates D-5A through D-5D. The results of field and laboratory permeability tests are tabulated on Plates D-6A through D-6C. The results of unconsolidated-undrained triaxial compression tests performed on remolded soil samples are tabulated on Plate D-7.

FUTURE STUDIES

GENERAL

The present study is intended to provide basic design criteria for the ash water storage pond for preliminary design purposes and for cost estimates. Additional detailed studies are required before final design can be completed. We recommend that the following additional studies be performed.

Field Explorations - Additional field explorations including borings, test pits and trenches excavated along dike alignments are required to better define soil foundation characteristics. In addition, it is recommended that additional field permeability tests be performed to establish vertical and horizontal permeability values.

Off-Site Borrow Areas - Should off-site borrow materials be required, a detailed study based on surface geological maps will be required coupled with an on-site survey of the available materials by means of borings and/or test

pits to determine the availability of clay borrow materials near the site.

Laboratory Tests - Coupled with the additional field explorations, laboratory strength tests, including consolidated undrained tests with pore pressure measurements to establish effective strength parameters (assumed in this study), are required. Additional laboratory permeability tests and, if possible, permeability tests of the typical ash materials are also required. Additional tests are also required to further define the consolidation characteristics of the soft soils that will be encountered along dike alignments.

Office Studies - Based on the additional field explorations and laboratory tests, the stability of the dikes, seepage losses and settlements can be more accurately determined. Specific design details pertaining to the design of internal drainage facilities and erosion control facilities are required.

Field Inspection - It is recommended that during construction a thorough inspection of the excavated bottom be carried out to confirm or modify the design assumptions, and/or modify earthwork operation, if required. It is recommended that a Dames & Moore representative be at the site during the various earthwork operations.

The following Plates are attached and complete SECTION D of the report:

Plate D-1 - Results of Stability Analyses

Plate D-2A - Log of Borings (Borings AS-1 and AS-2)

Plate D-2B - Log of Borings (Boring AS-3)

Plate D-2C - Log of Borings (Borings AS-4 and AS-5)

Plate D-2D - Log of Borings (Boring AS-6)

Plate D-2E - Log of Borings (Boring AS-7 and AS-8)

Plate D-2F - Log of Borings (Boring AS-9)

Plate D-2G - Log of Borings (Borings AS-10 and AS-11)

Plate D-2H - Log of Borings (Boring AS-12)

Plate D-2I - Log of Borings (Borings AS-13 and AS-14)

Plate D-2J - Log of Borings (Borings AS-15 and AS-16)

Plate D-2K - Log of Borings (Borings AS-17 and AS-18)

Plate D-2L - Log of Borings (Borings AS-19 and AS-20)

Plate D-2M - Log of Borings (Borings AS-21 and AS-22)

Plate D-2N - Log of Borings (Borings AS-23 and AS-24)

Plate D-2O - Log of Borings (Borings AS-25 and AS-26)

Plate D-2P - Log of Borings (Borings AS-27 and AS-28)

Plate D-2Q - Log of Borings (Borings AS-29 and AS-30)

Plate D-2R - Log of Borings (Borings AS-31 and AS-32)

Plate D-2S - Log of Borings (Borings AS-33, AS-34 and AS-35)

Plate D-2T - Log of Test Pits (Test Pits AS-36, AS-37, AS-38, AS-39, AS-40 and AS-41)

Plate D-2U - Log of Test Pits (Test Pits AS-42, AS-43, AS-44, AS-45 and AS-46)

Plate D-3A - Grain Size Analyses

Plate D-3B - Grain Size Analyses

Plate D-3C - Grain Size Analyses

Plate D-4A - Consolidation Test Data

Plate D-4B - Consolidation Test Data

Plate D-4C - Consolidation Test Data

Plate D-5A - Compaction Test Data

Plate D-5B - Compaction Test Data

Plate D-5C - Compaction Test Data

Plate D-5D - Compaction Test Data

Plate D-6A - Permeability Test Data

Plate D-6B - Permeability Test Data

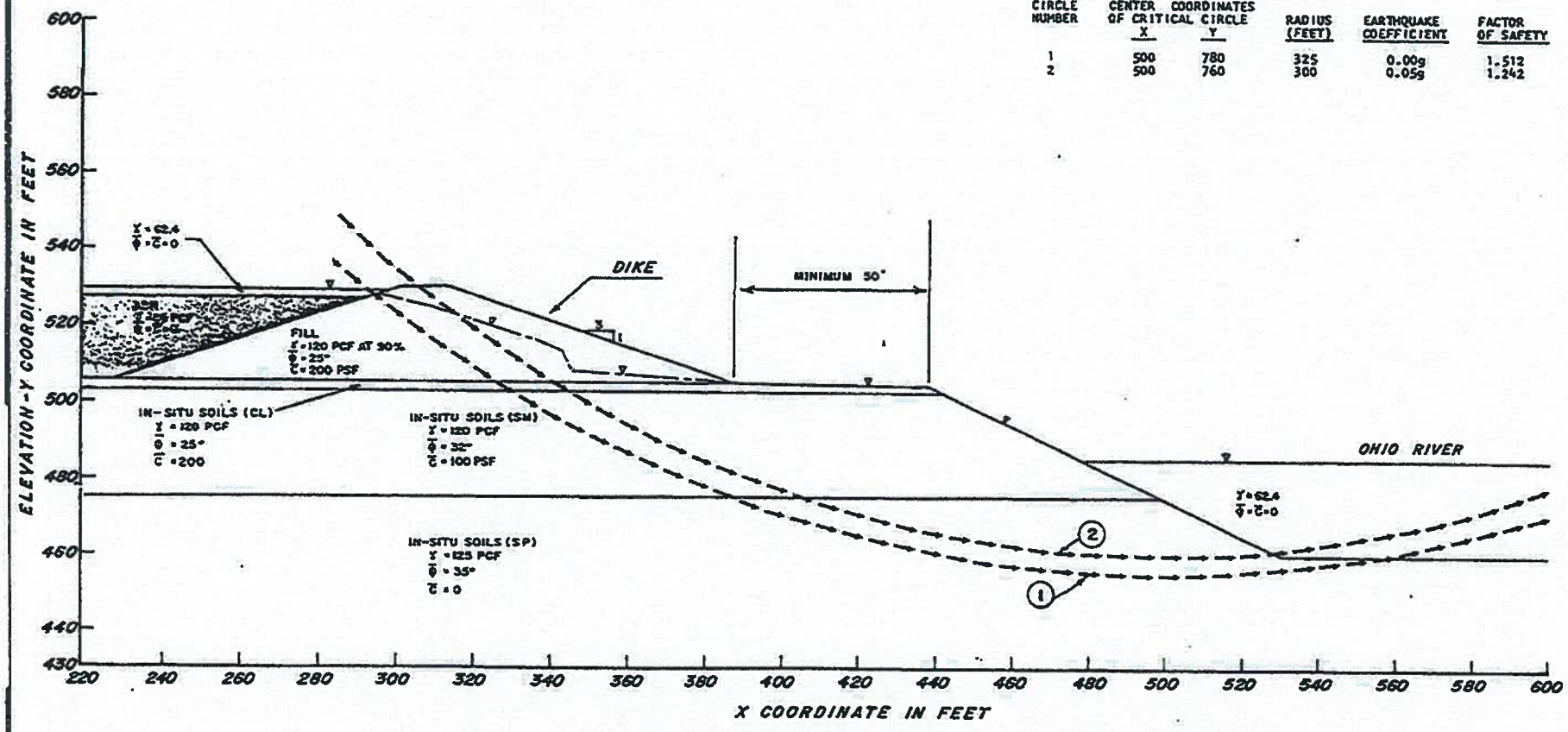
Plate D-6C - Permeability Test Data

Plate D-7 - Triaxial Test Data

FILE 757-04Y
BY SPK DATE
CHECKED BY DATE

REVISIONS
BY DATE
BY DATE
PLATE OF

CIRCLE NUMBER	CENTER OF CRITICAL CIRCLE X	CENTER OF CRITICAL CIRCLE Y	RADIUS (FEET)	EARTHQUAKE COEFFICIENT	FACTOR OF SAFETY
1	500	780	325	0.00g	1.512
2	500	760	300	0.05g	1.242



RESULTS OF STABILITY ANALYSES

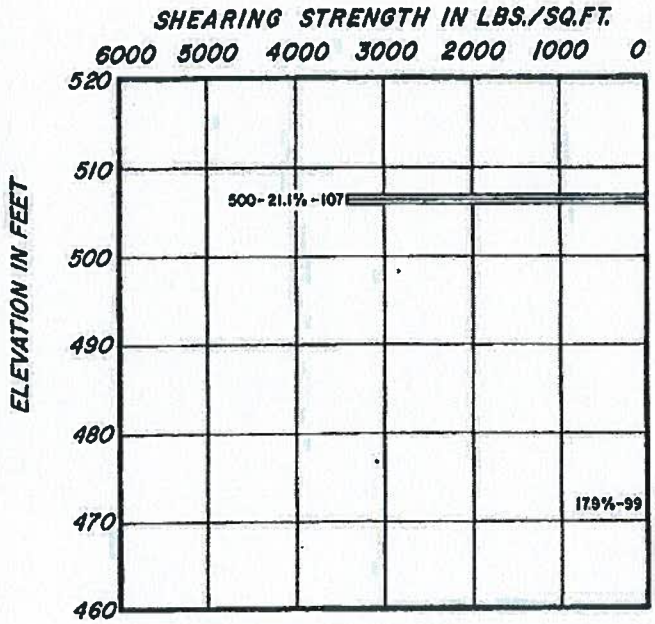
NOTES:

1. THE ABOVE SHOWN CROSS SECTION ILLUSTRATES THE SOIL CONDITIONS IN THE VICINITY OF BORING AS-9 WHICH IS CONSIDERED THE MOST CRITICAL AREA OF THE DIKE ALONG THE RIVER BANK. OTHER SOIL CONDITIONS ALONG THE RIVER BANK ARE MORE FAVORABLE FROM A STABILITY STANDPOINT.
2. THE PARAMETERS SHOWN ARE IN TERMS OF EFFECTIVE STRESSES AND WERE ESTIMATED FROM THE RESULTS OF THE STRENGTH TESTS AND EXPERIENCE WITH SIMILAR SOILS.

DAMES & MOORE

SS CBI 000149

PLATE D-1

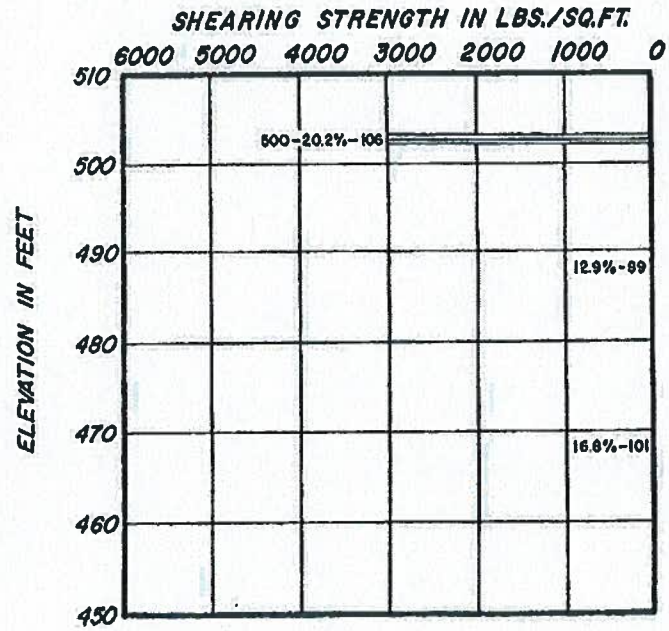


BORING AS-1

SURFACE ELEVATION 511.0

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
18 ■	ML CL	BROWN CLAYEY SILT (VERY STIFF)
22 ■		
20 ■		GRADING WITH SOME FINE SAND
10 ■	SM	BROWN SILTY FINE SAND (MEDIUM DENSE)
12 ■		GRADING WITH LESS SILT
12 ■		
16 ■	SP	BROWN FINE TO MEDIUM SAND WITH SOME SILT (MEDIUM DENSE)
15 ■		3 INCH LENSE OF BROWN CLAYEY SILT
40 ■	SW	BROWN FINE TO COARSE SAND WITH SOME SILT AND FINE GRAVEL (DENSE)
23 ■	SP	BROWN FINE TO MEDIUM SAND WITH TRACE OF SILT (MEDIUM DENSE)
21 ■		GRADING WITH COARSE SAND
17 ■		

BORING COMPLETED AT 50.0 FEET ON 1-10-72
AUGERED TO A DEPTH OF 11.0 FEET
ROTARY WASH USED BELOW 11.0 FEET
CASING USED TO A DEPTH OF 6.0 FEET
GROUND WATER RECORDED AT 23.2 FEET ON 1-12-72



BORING AS-2

SURFACE ELEVATION 507.9

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
14 ■	ML CL	BROWN CLAYEY SILT (VERY STIFF)
16 ■		
16 ■		GRADING WITH SOME FINE SAND
8 ■	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
9 ■		GRADING WITH LESS SILT
9 ■		
5 ■		GRADING TO LOOSE
71 ■	SW	BROWN FINE TO COARSE SAND WITH SOME SILT AND GRAVEL (VERY DENSE)
13 ■	SP	BROWN FINE TO MEDIUM SAND WITH TRACE OF SILT (MEDIUM DENSE)
19 ■		
18 ■		
21 ■		

BORING COMPLETED AT 50.0 FEET ON 1-10-72
AUGERED TO A DEPTH OF 11.0 FEET
ROTARY WASH USED BELOW 11.0 FEET
CASING USED TO A DEPTH OF 6.0 FEET
GROUND WATER RECORDED AT 21.5 FEET ON 1-12-72

NOTES:

ELEVATIONS ARE IN FEET AND REFER TO MEAN SEA LEVEL DATUM.

KEY:

↓ INDICATES NUMBER OF BLOWS REQUIRED TO DRIVE A DAMES & MOORE TYPE U SAMPLER ONE FOOT, WITH A 340 POUND HAMMER FALLING 24 INCHES.

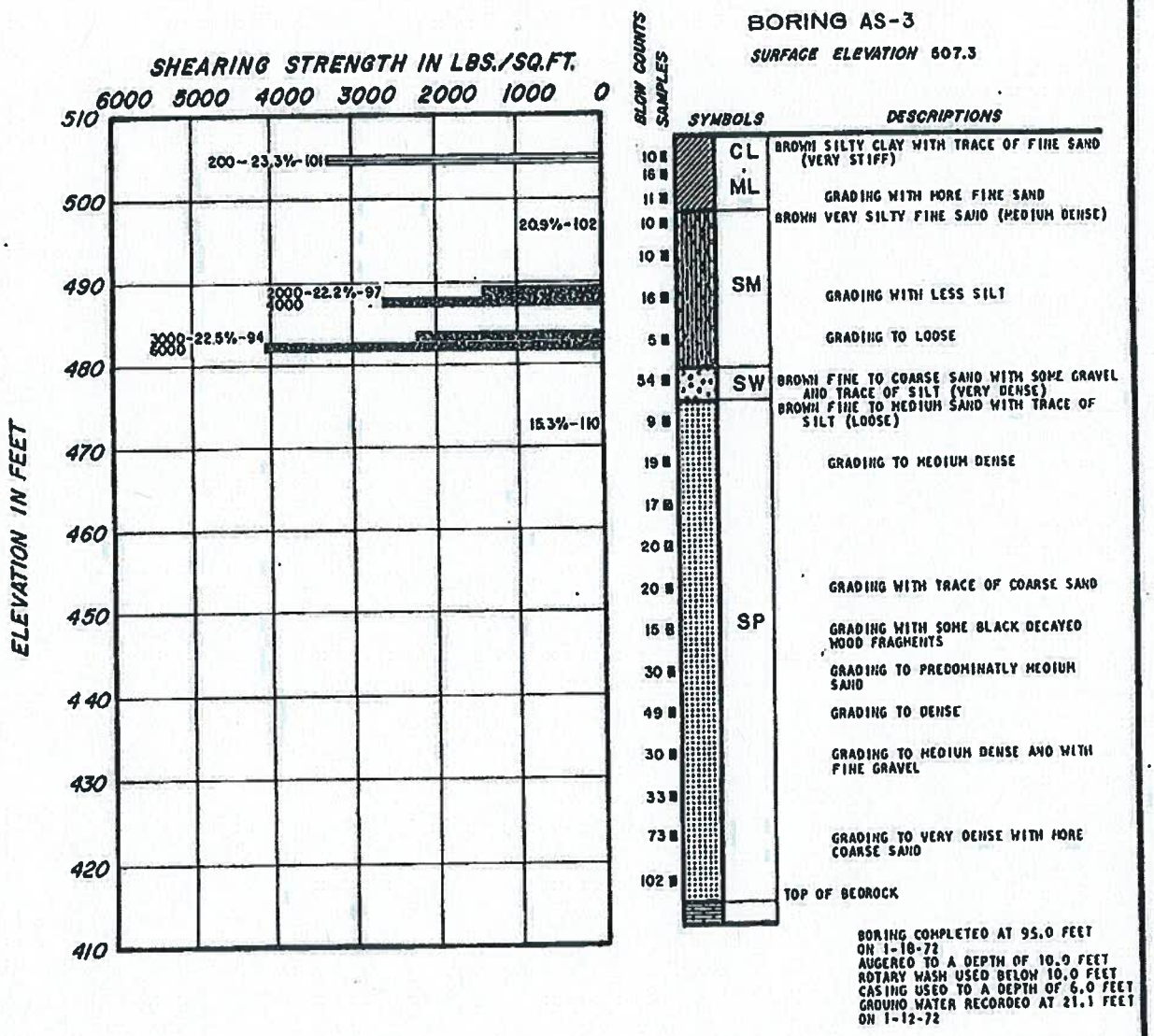
15 ■ INDICATES DEPTH OF SAMPLE OBTAINED WITH DAMES & MOORE TYPE U SAMPLER (3.25"O.D., 2.42"I.D.).

LOG OF BORINGS

THE DISCUSSION IN THE TEXT IS NECESSARY FOR PROPER UNDERSTANDING OF THE NATURE OF THE SUBSURFACE MATERIALS.

DAMES & MOORE

PLATE D-2A

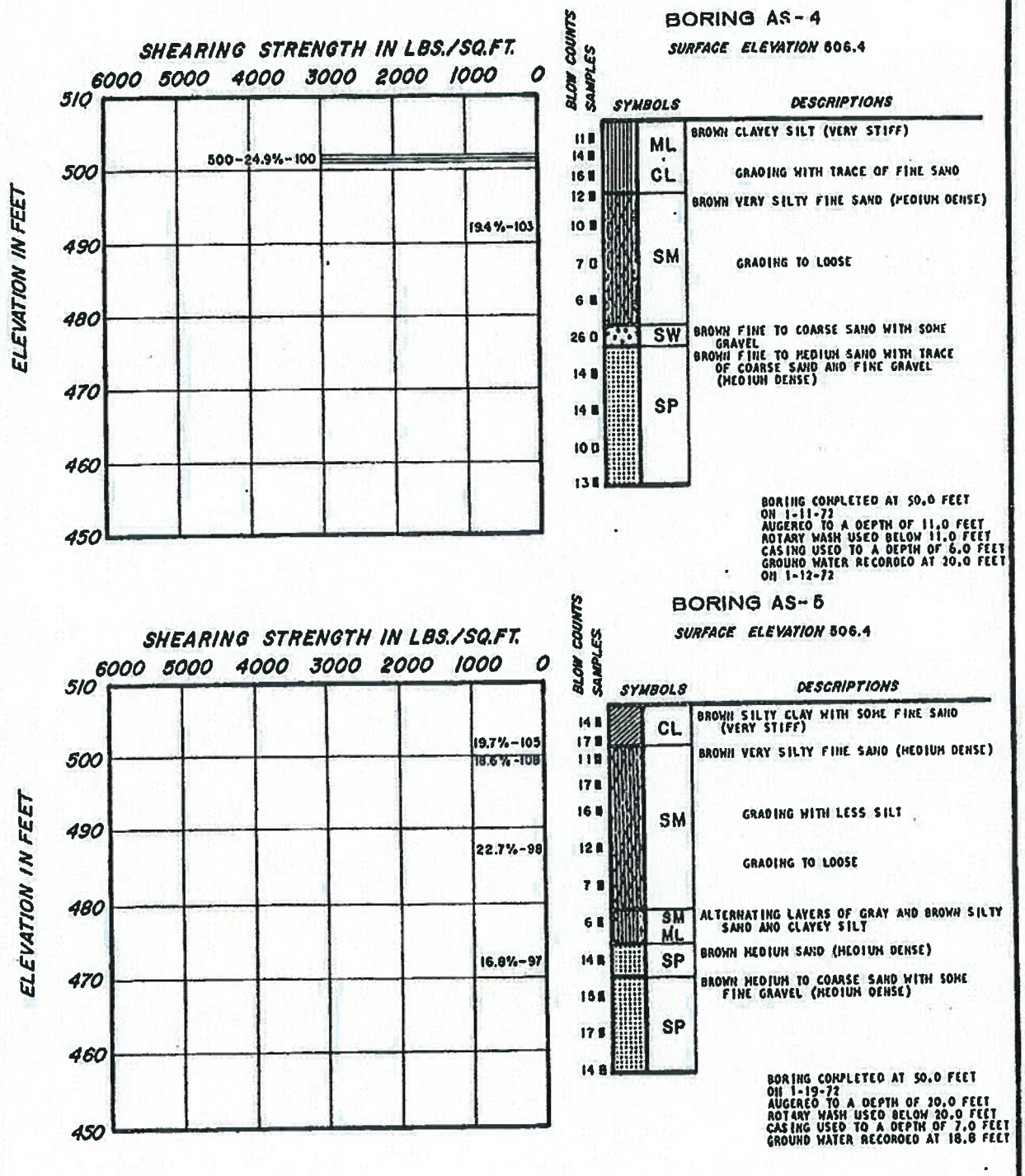


LOG OF BORINGS

SS CBI 000151

DAMES & MOORE

PLATE D-28

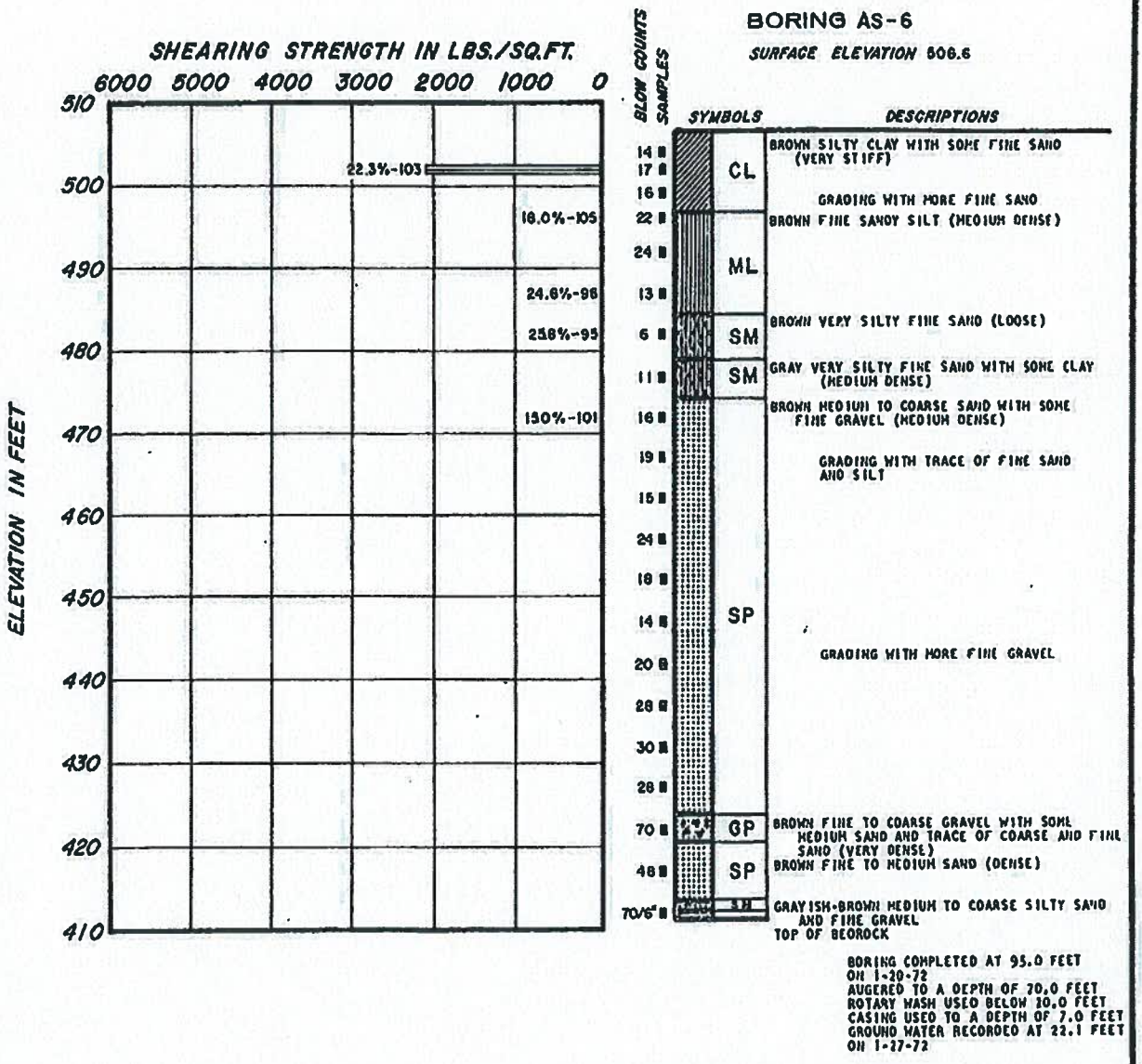


LOG OF BORINGS

SS CBI 000152

DAMES & MOORE

PLATE D-2C

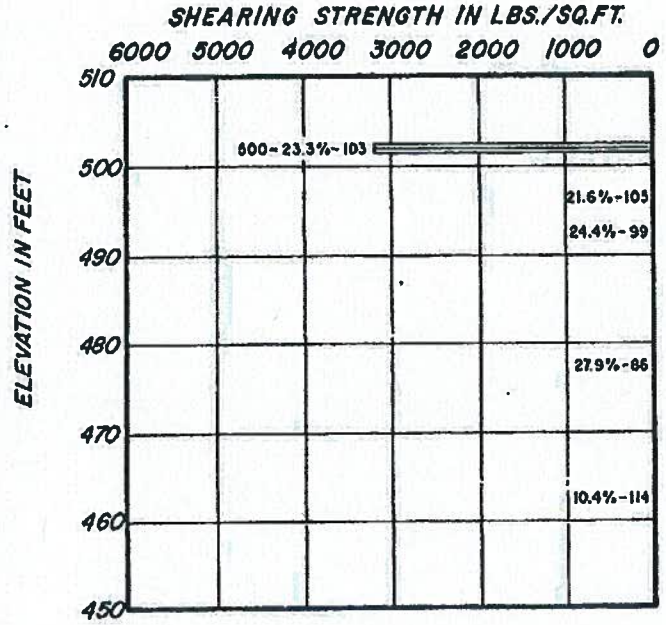


LOG OF BORINGS

SS CBI 000153

DAMES & MOORE

PLATE D-20

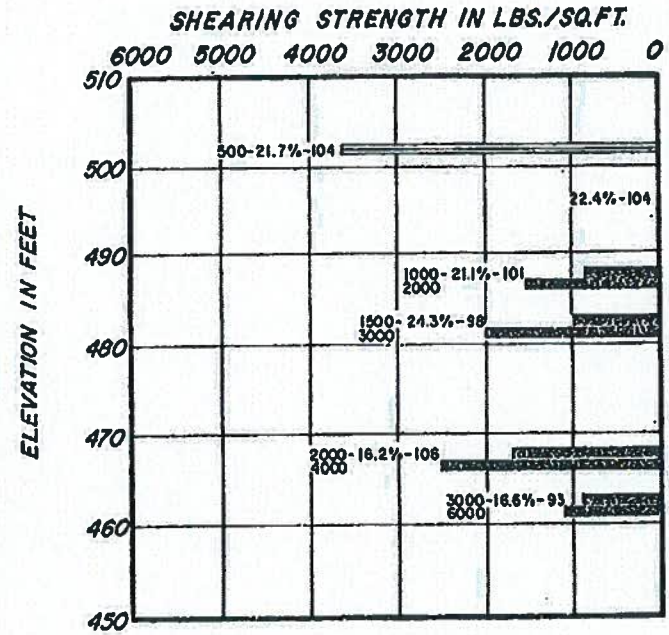


BORING AS-7

SURFACE ELEVATION 506.6

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
14 18	CL	BROWN SILTY CLAY WITH SOME FINE SAND (VERY STIFF)
14 10 8	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
8 10	SM	GRADING WITH LESS SILT
9	SM-CL	ALTERNATING LAYERS OF GRAY SILTY SAND AND SILTY CLAY
14 20 16 17	SP	BROWN MEDIUM TO COARSE SAND WITH SOME FINE GRAVEL (MEDIUM DENSE)

BORING COMPLETED AT 50.0 FEET
ON 1-21-72
AUGERED TO A DEPTH OF 20.0 FEET
ROTARY WASH USED BELOW 20.0 FEET
NO CASING USED
GROUND WATER RECORDED AT 17.5 FEET
ON 1-21-72



BORING AS-8

SURFACE ELEVATION 506.3

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
18 18 15 12	CL	BROWN SILTY CLAY WITH SOME FINE SAND (VERY STIFF)
	CL	GRADING WITH MORE FINE SAND
6 14	SM	BROWN VERY SILTY FINE SAND (LOOSE)
	SM	GRADING WITH LESS SILT (MEDIUM DENSE)
9	SM-CL	ALTERNATING LAYERS OF GRAY SILTY SAND AND SILTY CLAY
42	SP-GP	9 INCH LAYER OF BROWN MEDIUM TO COARSE SAND AND GRAVEL
17 20 18 36	SP	BROWN MEDIUM TO COARSE SAND (MEDIUM DENSE) GRADING FINER

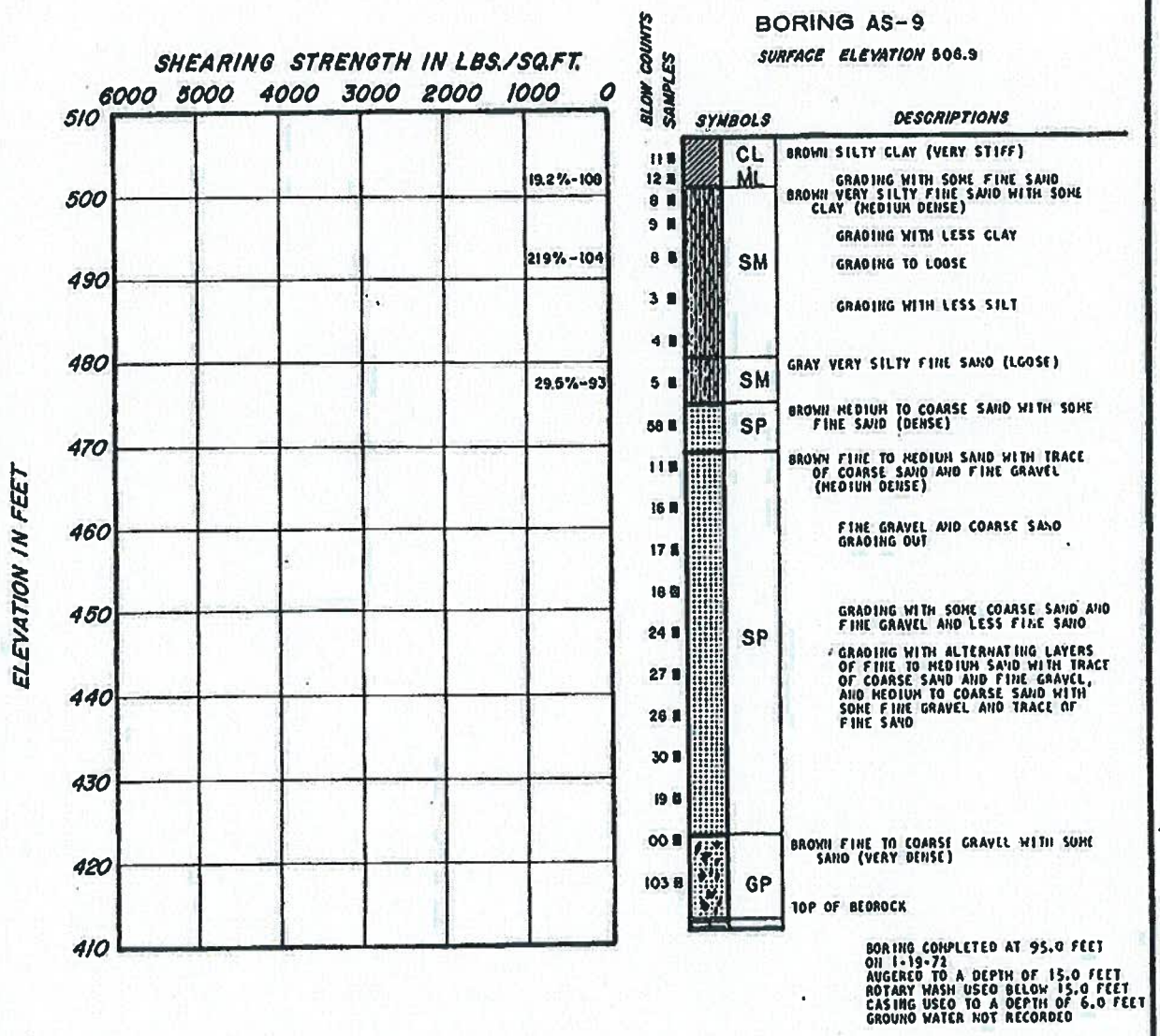
BORING COMPLETED AT 50.0 FEET
ON 1-22-72
AUGERED TO A DEPTH OF 20.0 FEET
ROTARY WASH USED BELOW 20.0 FEET
CASING USED TO A DEPTH OF 7.0 FEET
GROUND WATER NOT RECORDED

LOG OF BORINGS

SS CBI 000154

DAMES & MOORE

PLATE D-2E

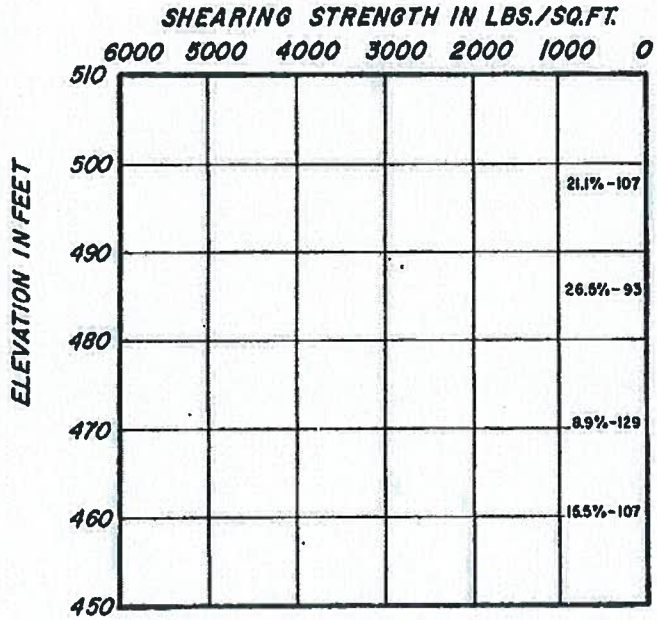


LOG OF BORINGS

SS CBI 000155

DAMES & MOORE

PLATE D-2F

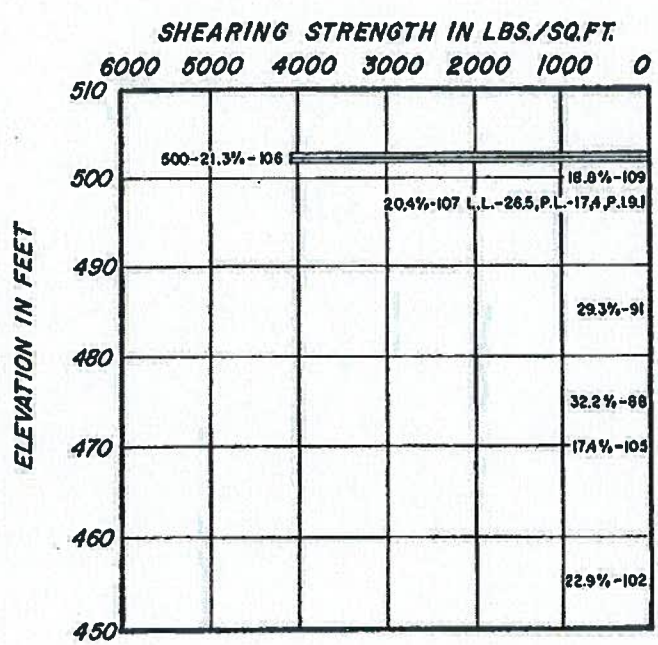


BORING AS-10

SURFACE ELEVATION 505.7

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
15, 13, 9, 10	CL · ML	BROWN SILTY CLAY WITH SOME FINE SAND (VERY STIFF)
		GRADING WITH MORE FINE SAND
9	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
4, 4	SM	GRADING WITH LESS SILT AND TO LOOSE
6	SM	GRAY VERY SILTY FINE SAND WITH SOME CLAY (LOOSE)
127	SP	BROWN MEDIUM TO COARSE SAND WITH SOME FINE GRAVEL (VERY DENSE)
20, 14, 9	SP	BROWN FINE TO MEDIUM SAND WITH SOME COARSE SAND AND FINE GRAVEL (MEDIUM DENSE)
		GRADING TO LOOSE

BORING COMPLETED AT 50.0 FEET ON 1-19-72
AUGERED TO A DEPTH OF 20.0 FEET
ROTARY WASH USED BELOW 20.0 FEET
CASING USED TO A DEPTH OF 7.5 FEET
GROUND WATER RECORDED AT 17.5 FEET ON 1-19-72



BORING AS-11

SURFACE ELEVATION 504.3

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
16, 16, 10	CL · ML	BROWN SILTY CLAY WITH SOME FINE SAND (VERY STIFF)
		GRADING WITH MORE FINE SAND
6	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
9	SM	GRADING WITH LESS SILT
5	SM	GRADING TO LOOSE
6	SM	GRADING WITH MORE SILT
6	SM	GRAY VERY SILTY FINE SAND (LOOSE)
17	SP	BROWN MEDIUM TO COARSE SAND WITH SOME FINE GRAVEL (MEDIUM DENSE)
17, 18, 35	SP	GRAVEL GRADES OUT

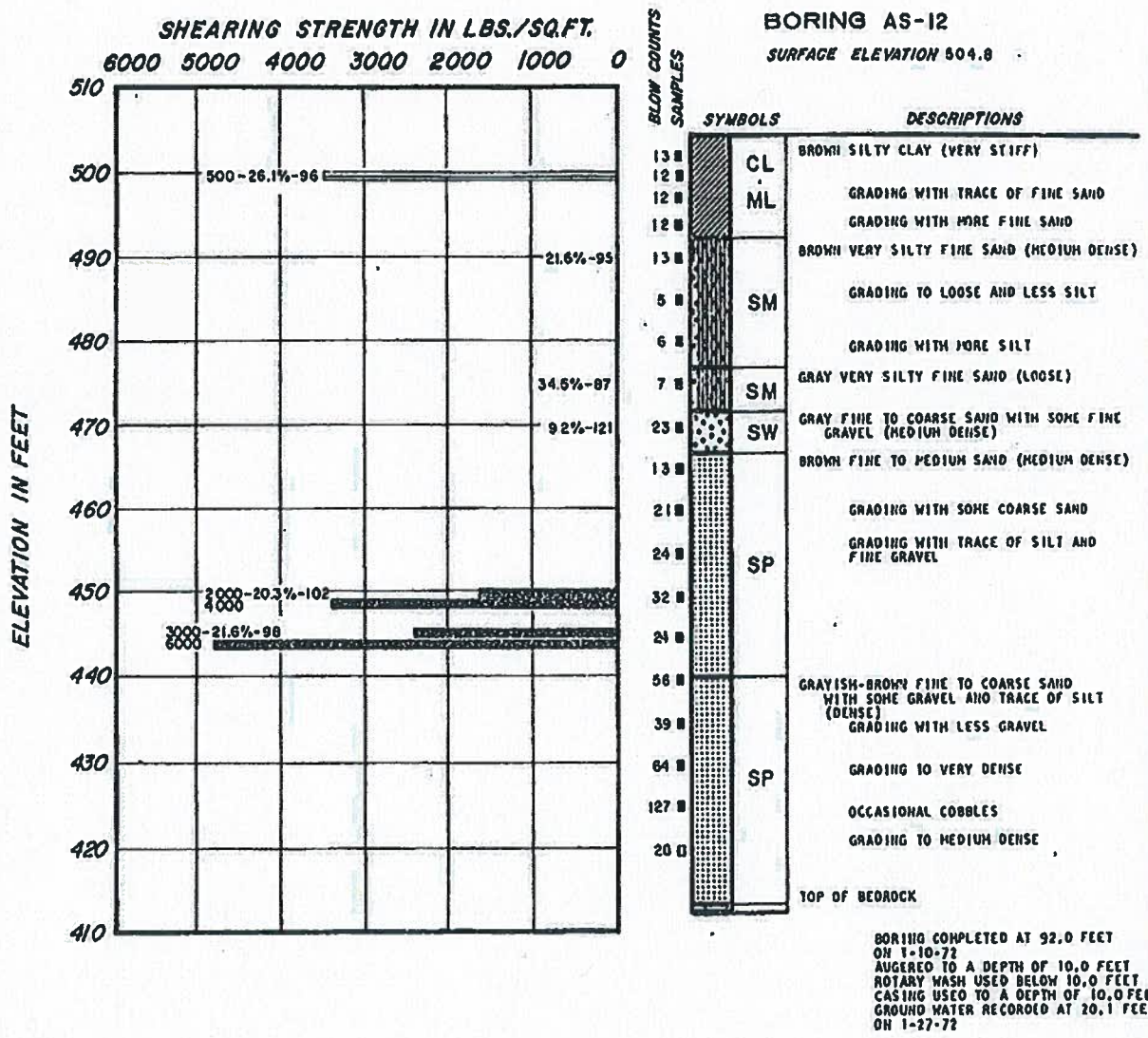
BORING COMPLETED AT 50.0 FEET ON 1-18-72
AUGERED TO A DEPTH OF 20.0 FEET
ROTARY WASH USED BELOW 20.0 FEET
CASING USED TO A DEPTH OF 7.5 FEET
GROUND WATER RECORDED AT 17.5 FEET ON 1-18-72

LOG OF BORINGS

SS CBI 000156

DAMES & MOORE

PLATE D-26



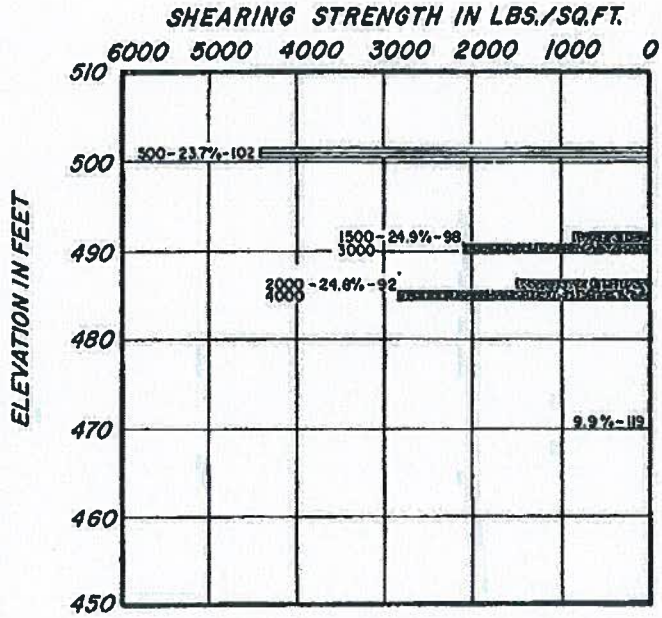
BORING COMPLETED AT 92.0 FEET ON 1-10-72
AUGERED TO A DEPTH OF 10.0 FEET
ROTARY WASH USED BELOW 10.0 FEET
CASING USED TO A DEPTH OF 10.0 FEET
GROUND WATER RECORDED AT 20.1 FEET ON 1-27-72

LOG OF BORINGS

SS CBI 000157

DAMES & MOORE

PLATE D-2H

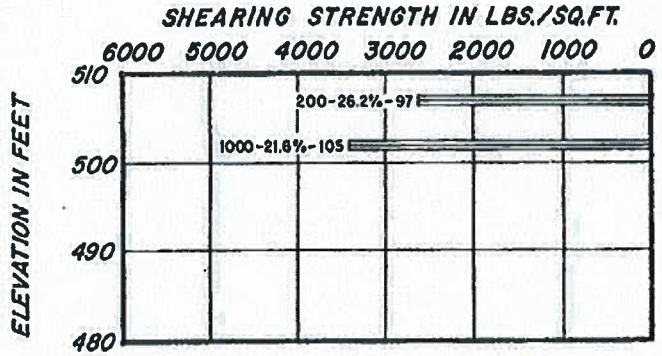


BORING AS-13

SURFACE ELEVATION 506.7

BLOW COUNTS SAMPLES	SYMBOLS	DESCRIPTIONS
10	CL ML	BROWN SILTY CLAY (STIFF)
19		
9		GRADING WITH SOME FINE SAND
9		GRADING WITH MORE FINE SAND
6	SM	BROWN VERY SILTY FINE SAND (LOOSE)
4		
4		GRADING WITH LESS SILT
7		
41	SW	GRAY FINE TO COARSE SAND WITH TRACE OF SILT (DENSE)
31	SP	BROWN FINE TO MEDIUM SAND (MEDIUM DENSE)
16	SW	BLACK AND BROWN FINE TO COARSE SAND (MEDIUM DENSE)
37	SW	BROWN FINE TO COARSE SAND WITH SOME GRAVEL (MEDIUM DENSE)

BORING COMPLETED AT 50.0 FEET
ON 1-11-71
AUGERED TO A DEPTH OF 11.0 FEET
ROTARY WASH USED BELOW 11.0 FEET
CASING USED TO A DEPTH OF 6.0 FEET
GROUND WATER NOT RECORDED



BORING AS-14

SURFACE ELEVATION 509.6

BLOW COUNTS SAMPLES	SYMBOLS	DESCRIPTIONS
13	ML CL	BROWN CLAYEY SILT WITH TRACE OF FINE SAND (VERY STIFF)
24		
15		
6	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
9		GRADING WITH LESS SILT
13		

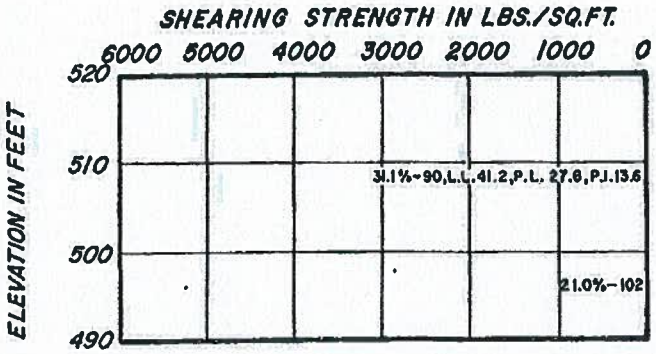
BORING COMPLETED AT 20.0 FEET
ON 1-16-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED

LOG OF BORINGS

SS CBI 000158

DAMES & MOORE

PLATE D-2 I

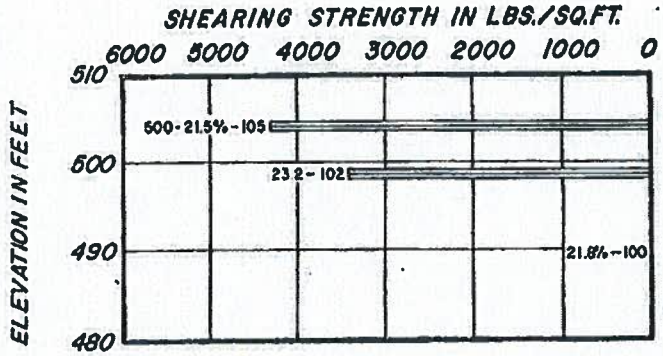


BORING AS-15

SURFACE ELEVATION 510.6

BLOW COUNTS SAMPLES	SYMBOLS	DESCRIPTIONS
5	ML	MOTTLED BROWN AND GRAY CLAYEY SILT WITH TRACE OF FINE SAND (STIFF)
23		GRADING TO HARD AND BROWN
12	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
6		
6		GRADING WITH LESS SILT
7		

BORING COMPLETED AT 20.0 FEET
ON 1-16-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED



BORING AS-16

SURFACE ELEVATION 509.4

BLOW COUNTS SAMPLES	SYMBOLS	DESCRIPTIONS
7	ML	BROWN CLAYEY SILT WITH SOME FINE SAND (VERY STIFF)
18		
21	CL	GRADING WITH LESS CLAY AND MORE FINE SAND
14		
8	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
14		

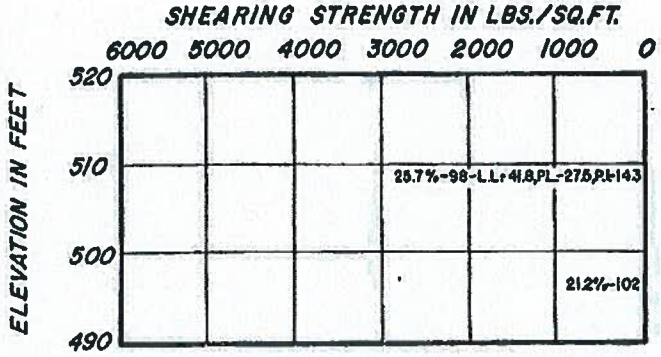
BORING COMPLETED AT 20.0 FEET
ON 1-16-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED

LOG OF BORINGS

SS CBI 000159

BARNES & MOORE

PLATE D-2J

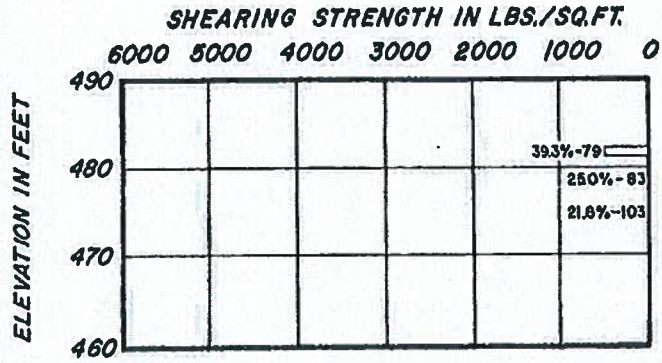


BORING AS-17

SURFACE ELEVATION 511.0

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
9 23 18	CL	MOTTLED BROWN AND GRAY SILTY CLAY WITH TRACE OF SAND (VERY STIFF) GRADING TO HARD AND BROWN
12 8 12	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE) GRADING WITH LESS SILT

BORING COMPLETED AT 20.0 FEET
ON 1-16-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED



BORING AS-18

SURFACE ELEVATION 489.4

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
4 3 4 2	ML	BROWN SANDY SILT WITH SOME CLAY (MEDIUM STIFF) GRADING WITH MORE FINE SAND
9	ML	GRADING TO STIFF
22	GP	BROWN FINE TO COARSE GRAVEL WITH MEDIUM TO COARSE SAND AND TRACE OF SILT (MEDIUM DENSE)

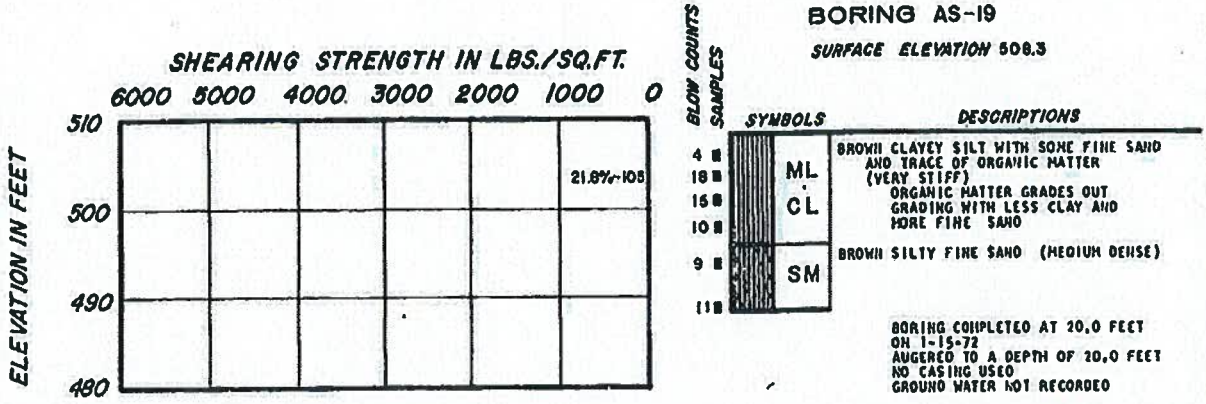
BORING COMPLETED AT 20.0 FEET
ON 1-14-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED

LOG OF BORINGS

SS CBI 000160

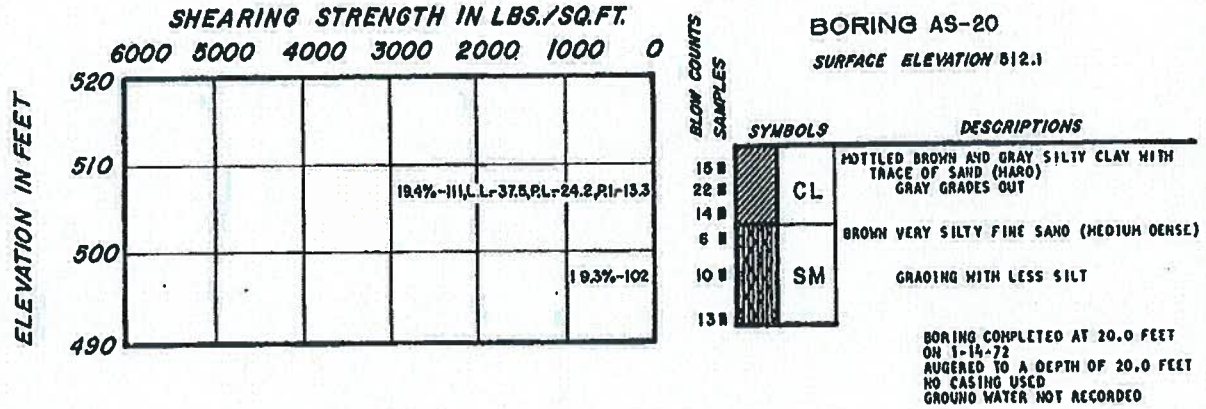
DAMES & MOORE

PLATE D-2K



BORING AS-19

SURFACE ELEVATION 508.3



BORING AS-20

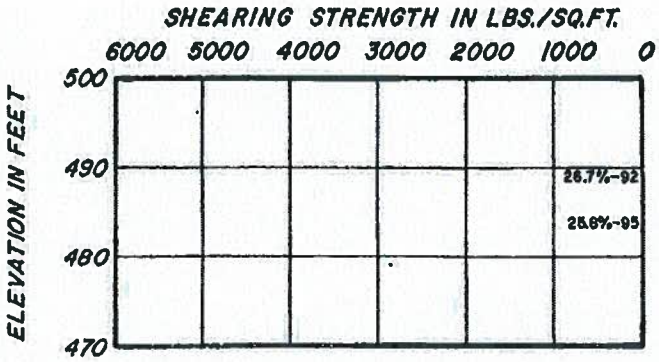
SURFACE ELEVATION 512.1

LOG OF BORINGS

SS CBI 000161

DAMES & MOORE

PLATE D-2L

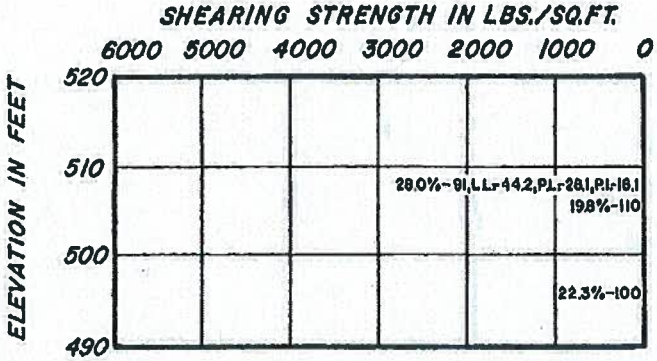


BORING AS-21

SURFACE ELEVATION 491.1

BLOW COUNTS SAMPLES	SYMBOLS	DESCRIPTIONS
2	ML	BROWN SANDY SILT WITH SOME CLAY (MEDIUM STIFF)
2		BROWN SILTY FINE SAND (LOOSE)
4	SM	
4		
32	SW	BROWN FINE TO COARSE SAND WITH GRAVEL (MEDIUM DENSE)
12		

BORING COMPLETED AT 20.0 FEET
ON 1-14-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED



BORING AS-22

SURFACE ELEVATION 510.8

BLOW COUNTS SAMPLES	SYMBOLS	DESCRIPTIONS
12	ML	BROWN CLAYEY SILT WITH SOME FINE SAND AND TRACE OF ORGANIC MATTER (VERY STIFF)
20		GRADING WITH LESS ORGANIC MATTER AND MORE FINE SAND
11		GRADING TO STIFF
6	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
6		GRADING WITH LESS SILT
12		

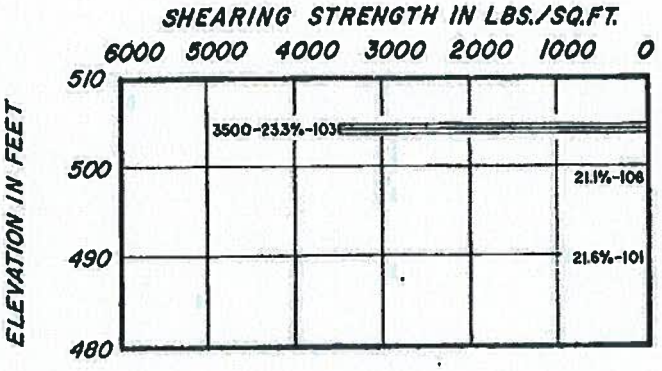
BORING COMPLETED AT 20.0 FEET
ON 1-15-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED

LOG OF BORINGS

SS CBI 000162

DAMES & MOORE

PLATE D-2M

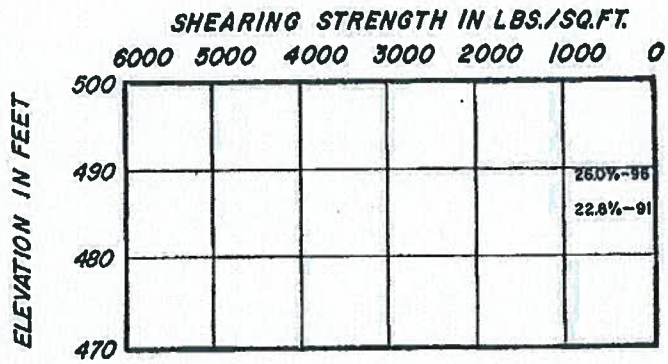


BORING AS-23

SURFACE ELEVATION 509.0

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
8	ML CL	BROWN CLAYEY SILT WITH SOME FINE SAND AND TRACE OF ORGANIC MATTER (VERY STIFF)
16		
22		
13		GRADING WITH MORE FINE SAND
8	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
12		

BORING COMPLETED AT 20.0 FEET ON 1-15-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED



BORING AS-24

SURFACE ELEVATION 494.3

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
2	SM	BROWN SILTY FINE TO COARSE SAND (LOOSE)
5		BROWN SILTY FINE SAND (LOOSE)
7	SM	GRADING WITH MORE SILT AND TO MEDIUM DENSE
9		
17	SP	GRAYISH-BROWN MEDIUM TO COARSE SAND (MEDIUM DENSE)

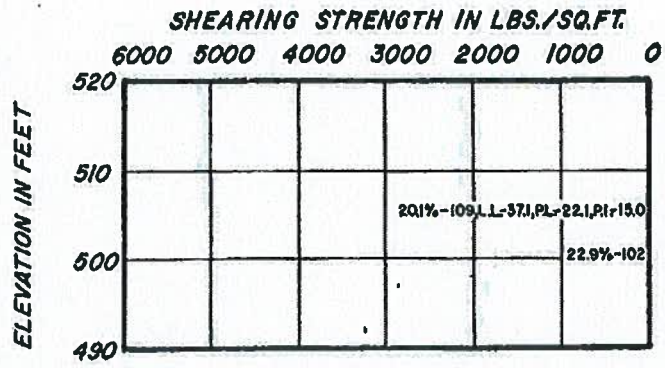
BORING COMPLETED AT 20.0 FEET ON 1-14-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED

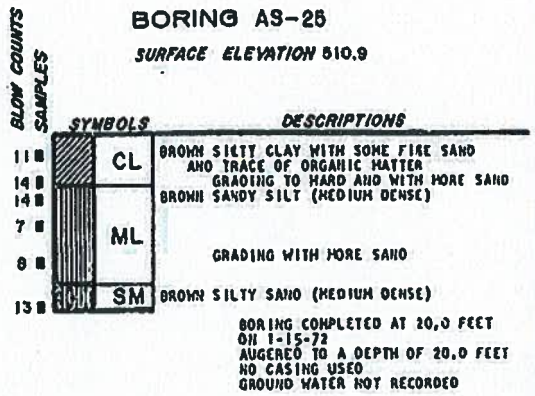
LOG OF BORINGS

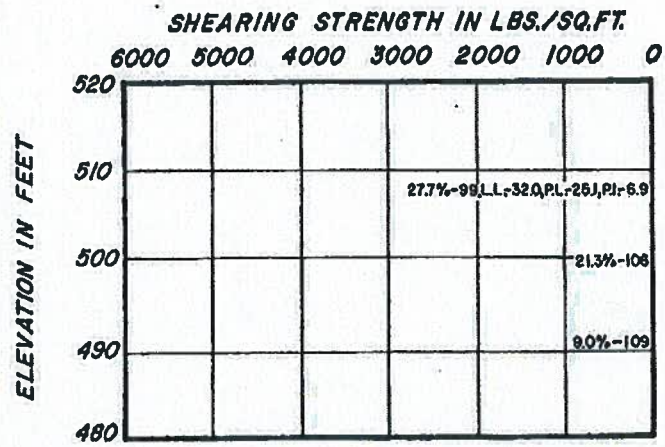
SS CBI 000163

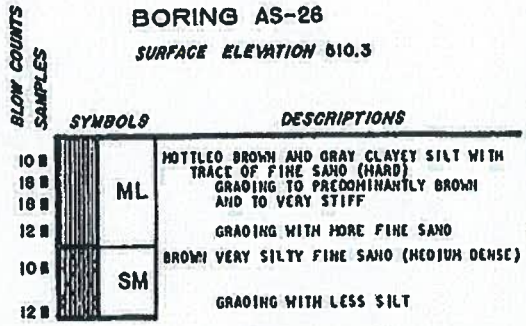
DAMES & MOORE

PLATE D-2N







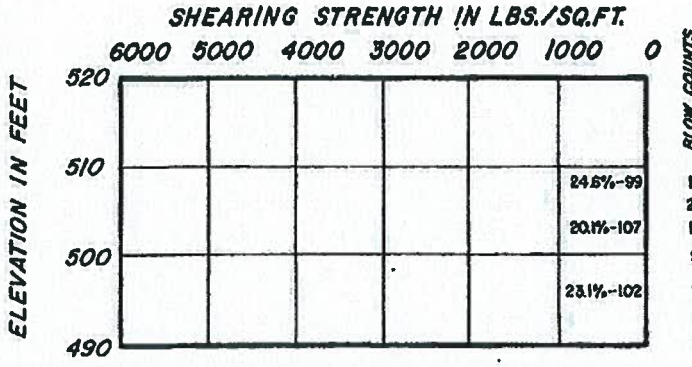


LOG OF BORINGS

SS CBI 000164

DAMES & MOORE

PLATE D-20

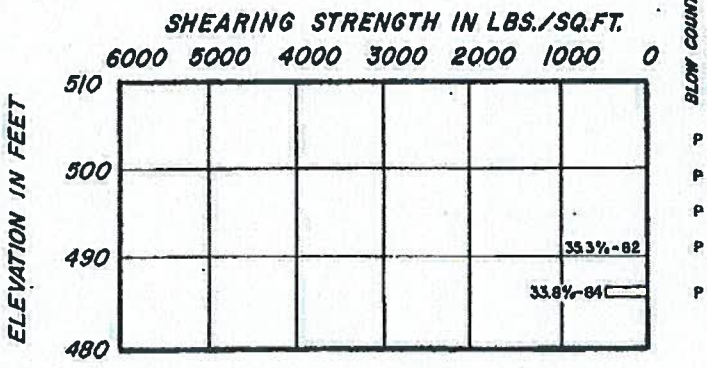


BORING AS-27

SURFACE ELEVATION 510.7

BLOW COUNTS SAMPLES	SYMBOLS	DESCRIPTIONS
10 B 22 B 19 B	ML	BROWN SILTY CLAY WITH SOME FINE SAND AND TRACE OF ORGANIC MATTER (VERY STIFF) ORGANIC MATTER GRADES OUT GRADING WITH MORE FINE SAND
9 B 7 B 9 B	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE) GRADING WITH LESS SILT

BORING COMPLETED AT 20.0 FEET
ON 1-15-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
NO GROUND WATER RECORDED



BORING AS-28

SURFACE ELEVATION 508.0

BLOW COUNTS SAMPLES	SYMBOLS	DESCRIPTIONS
P B	CL	GRAY SILTY CLAY (MEDIUM STIFF)
P B	ML CL	GRAY CLAYEY SILT WITH OCCASIONAL PIECES OF DECAYED VEGETATION
P B P B P B	ML	GRAY CLAYEY SILT WITH TRACE OF FINE SAND (MEDIUM STIFF)

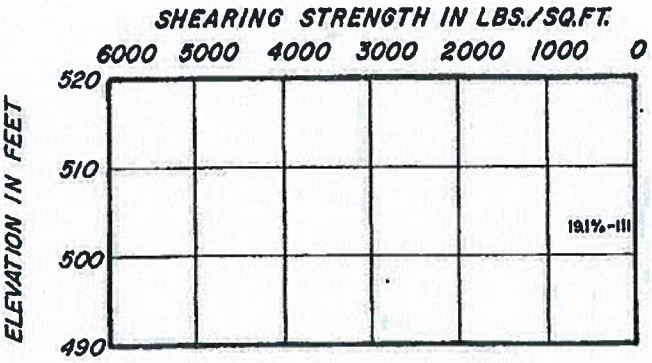
BORING COMPLETED AT 20.0 FEET
ON 1-20-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
NO GROUND WATER RECORDED

LOG OF BORINGS

SS CBI 000165

DAMES & MOORE

PLATE D-2P

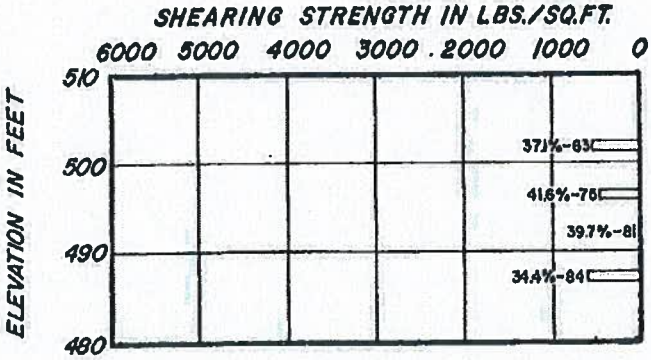


BORING AS-29

SURFACE ELEVATION 510.8

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
10 24 22 17	ML	MOTTLED BROWN AND GRAY CLAYEY SILT WITH TRACE OF SAND (VERY STIFF) GRADING TO PREDOMINANTLY BROWN AND TO VERY STIFF GRADING TO STIFF
9 11	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE) GRADING WITH LESS SILT

BORING COMPLETED AT 20.0 FEET
ON 1-16-72
AUGERED TO DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED



BORING AS-30

SURFACE ELEVATION 507.0

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
7 2	CL	GRAY SILTY CLAY (MEDIUM STIFF)
2 2 2	ML CL	GRAY CLAYEY SILT WITH OCCASIONAL PIECES OF DECAYED VEGETATION (SOFT TO MEDIUM STIFF) GRADING WITH MORE CLAY
3		GRADING WITH SOME FINE SAND

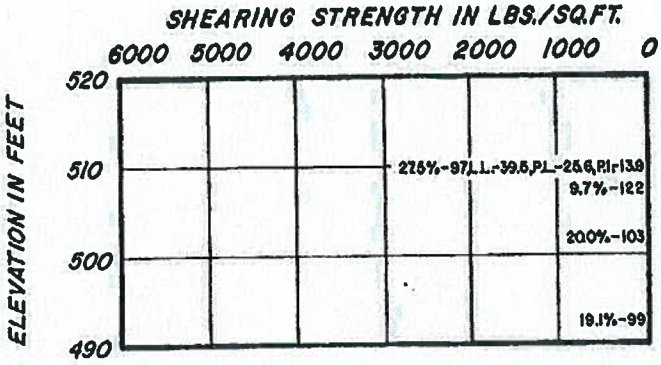
BORING COMPLETED AT 20.0 FEET
ON 1-15-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER RECORDED AT 1.5 FEET
ON 1-16-72

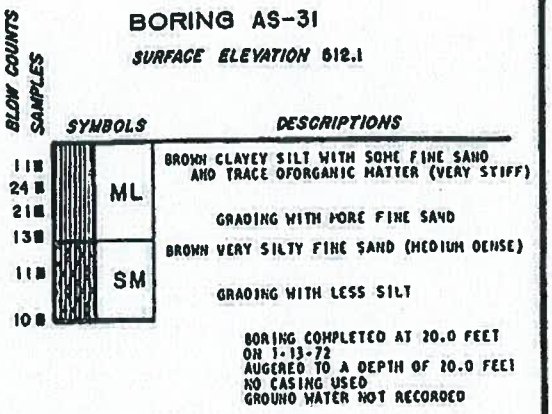
LOG OF BORINGS

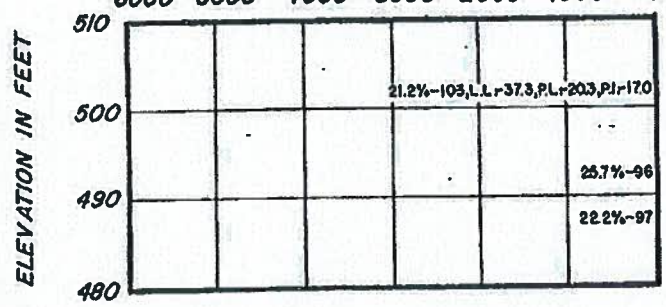
SS CBI 000166

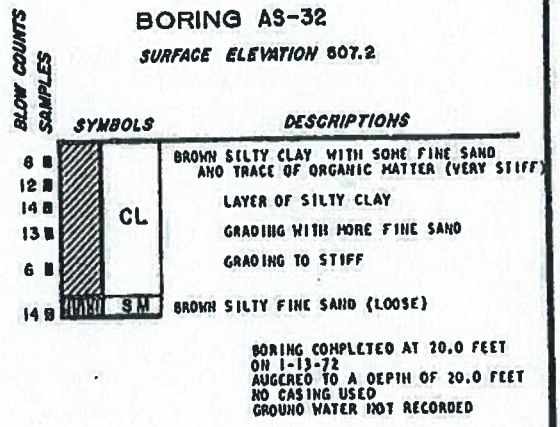
DAMES & MOORE

PLATE D-20







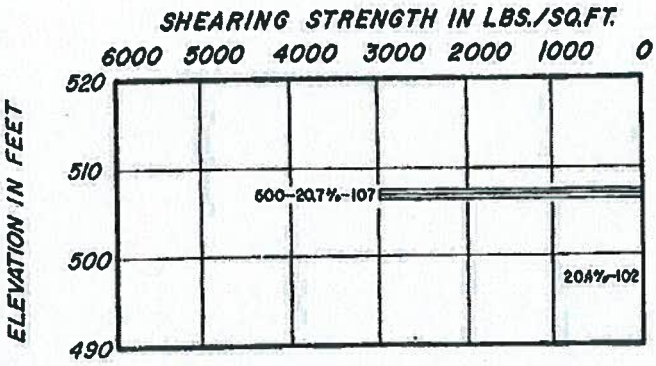


LOG OF BORINGS

SS CBI 000167

DAMES & MOORE

PLATE D-2R

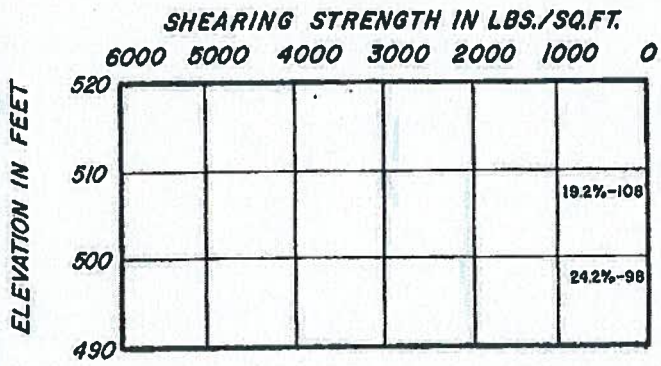


BORING AS-33

SURFACE ELEVATION 511.9

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
15, 16, 9, 6	ML	BROWN CLAYEY SILT WITH SOME FINE SAND AND TRACE OF ORGANIC MATTER (VERY STIFF)
		GRADING WITH MORE FINE SAND AND LESS CLAY
11	CL	GRADING WITH MORE SAND AND SOME SAND LENSES
15	SM	BROWN SILTY FINE SAND (MEDIUM DENSE)

BORING COMPLETED AT 20.0 FEET
ON 1-14-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED

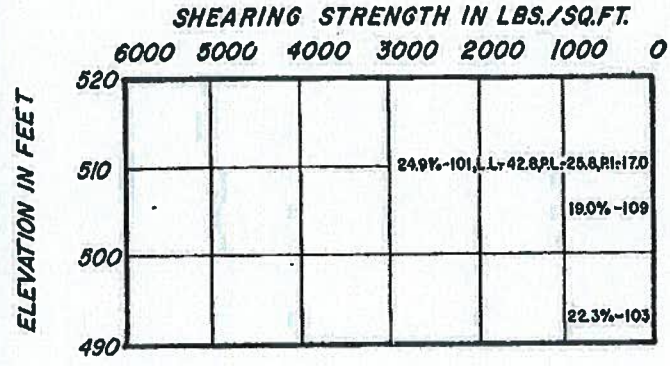


BORING AS-34

SURFACE ELEVATION 512.8

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
5, 19, 15	ML	MOTTLED BROWN AND GRAY CLAYEY SILT WITH TRACE OF SAND (VERY STIFF)
		GRAY GRADES OUT
7, 8, 14	SM	BROWN VERY SILTY FINE SAND (MEDIUM DENSE)
		GRADING WITH LESS SILT

BORING COMPLETED AT 20.0 FEET
ON 1-16-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED



BORING AS-35

SURFACE ELEVATION 512.8

BLOW COUNTS / SAMPLES	SYMBOLS	DESCRIPTIONS
12, 11, 16, 10	CL	BROWN SILTY CLAY WITH SOME FINE SAND AND TRACE OF ORGANIC MATTER (VERY STIFF)
		ORGANIC MATTER GRADES OUT
		GRADING WITH MORE FINE SAND
11	SM	BROWN SILTY FINE SAND (MEDIUM DENSE)
14		GRADING WITH LESS SILT

BORING COMPLETED AT 20.0 FEET
ON 1-13-72
AUGERED TO A DEPTH OF 20.0 FEET
NO CASING USED
GROUND WATER NOT RECORDED

LOG OF BORINGS

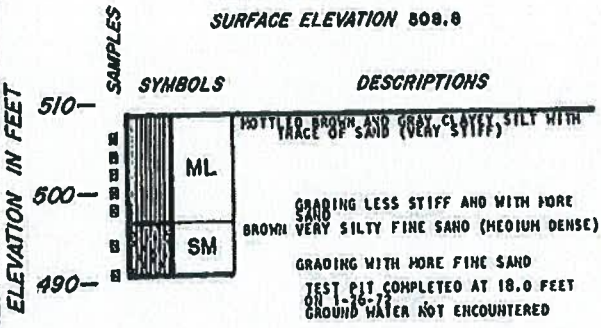
SS CBI 000168

DAMES & MOORE

PLATE D-2S

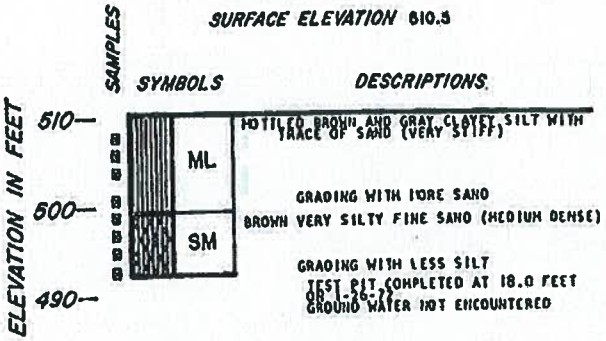
TEST PIT AS-36

SURFACE ELEVATION 508.8



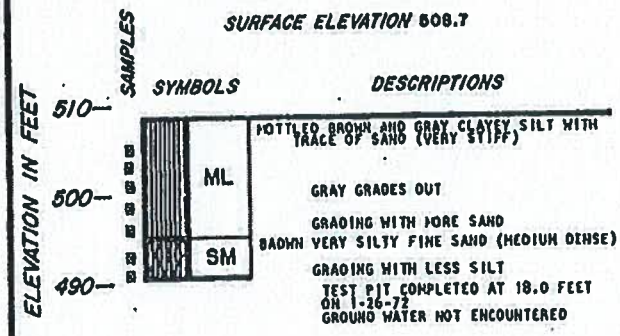
TEST PIT AS-37

SURFACE ELEVATION 510.5



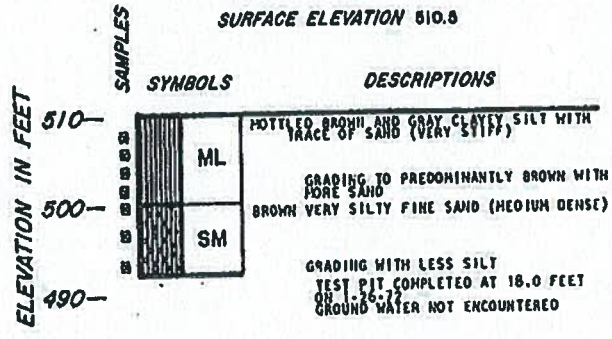
TEST PIT AS-38

SURFACE ELEVATION 508.7



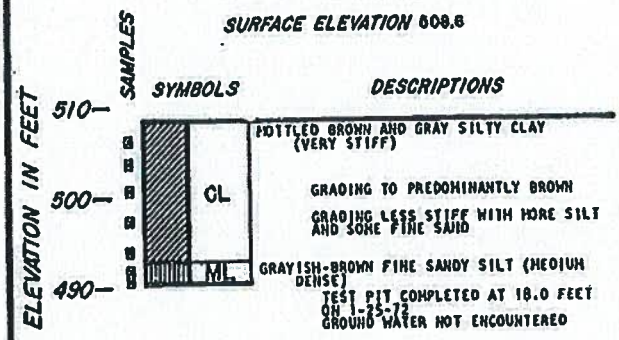
TEST PIT AS-39

SURFACE ELEVATION 510.8



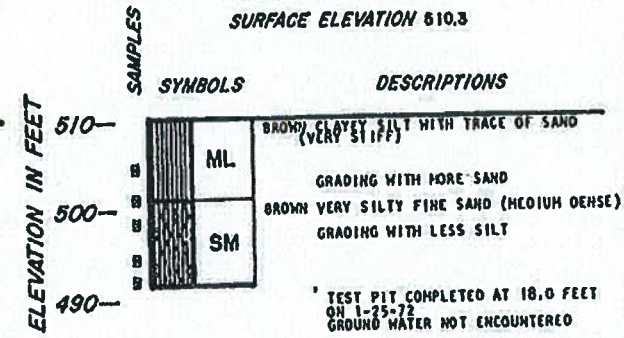
TEST PIT AS-40

SURFACE ELEVATION 508.6



TEST PIT AS-41

SURFACE ELEVATION 510.3



LOG OF TEST PITS

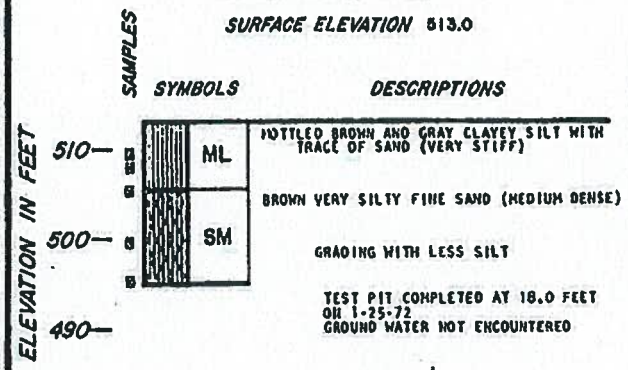
SS CBI 000169

DAMES & MOORE

PLATE D-2T

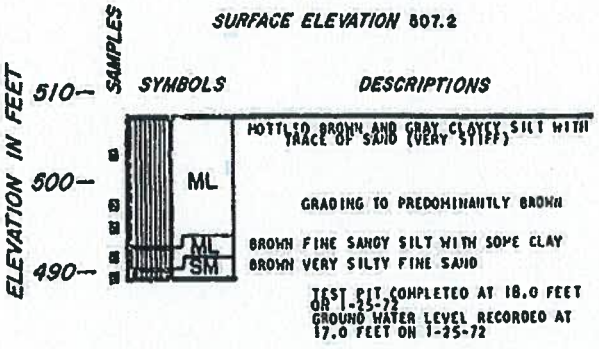
TEST PIT AS-42

SURFACE ELEVATION 513.0



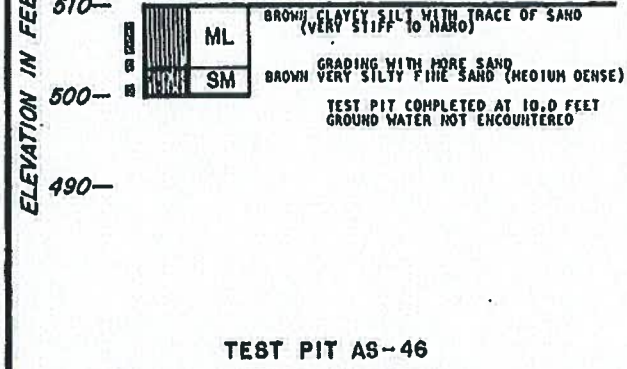
TEST PIT AS-43

SURFACE ELEVATION 507.2



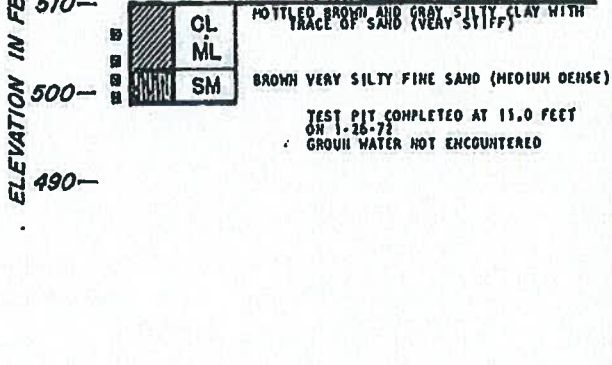
TEST PIT AS-44

SURFACE ELEVATION 510.0



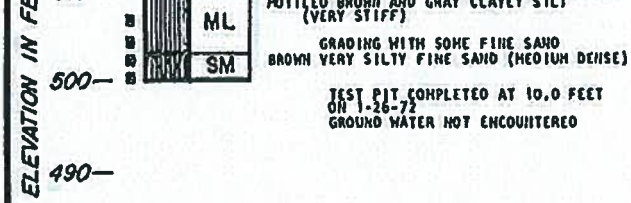
TEST PIT AS-45

SURFACE ELEVATION 510.0



TEST PIT AS-46

SURFACE ELEVATION 510.0

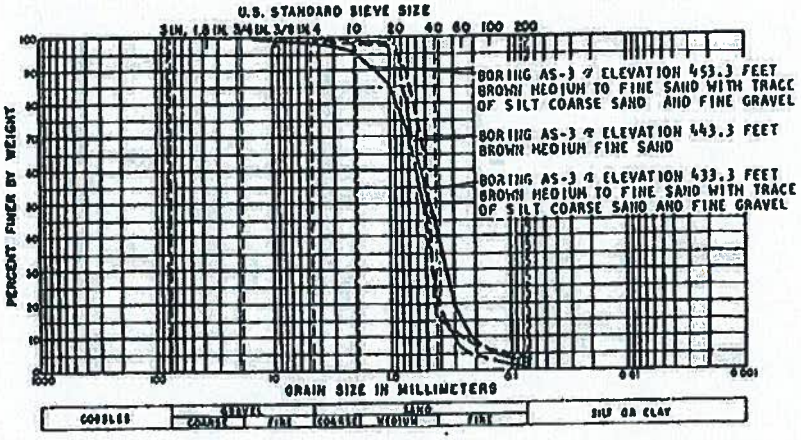


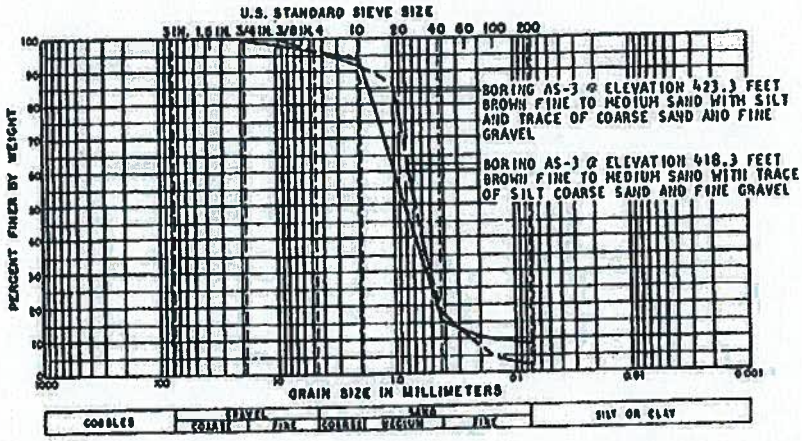
LOG OF TEST PITS

SS CBI 000170

DAMES & MOORE

PLATE D-2U



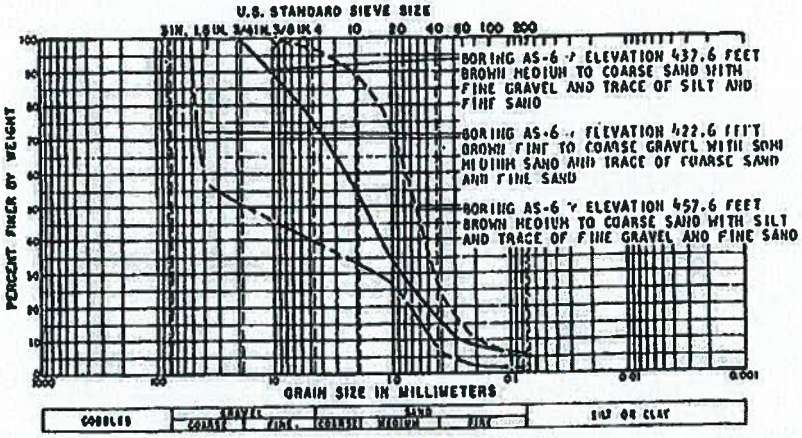


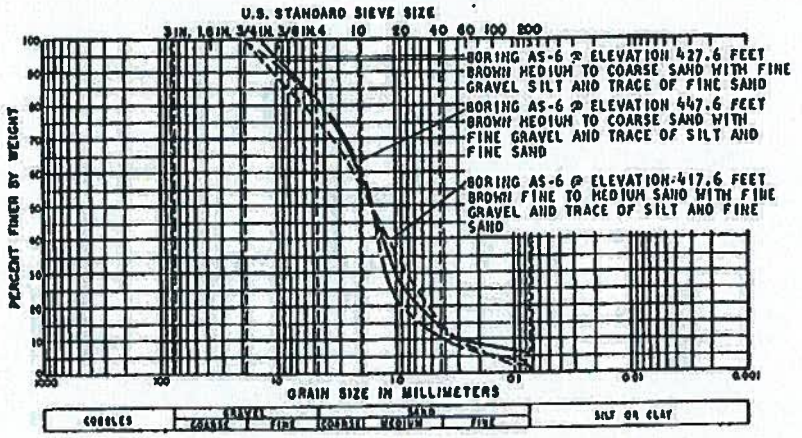
GRAIN SIZE ANALYSES

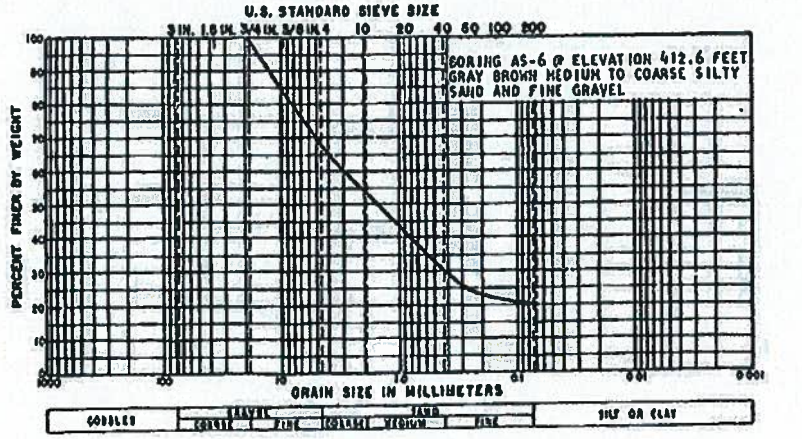
SS CBI 000171

DAMES & MOORE

PLATE D-3A





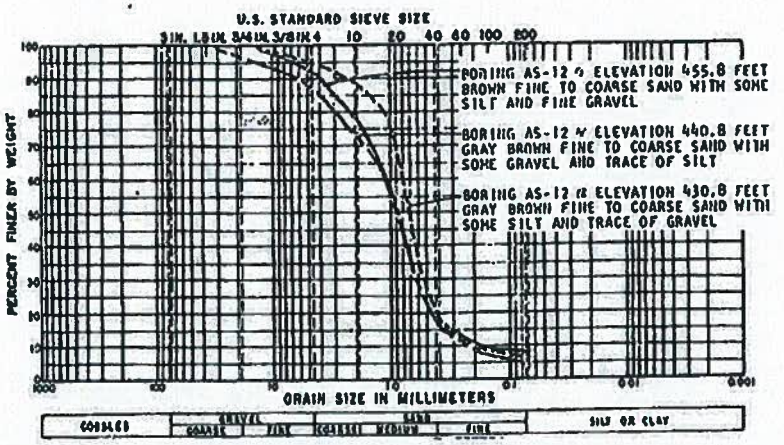


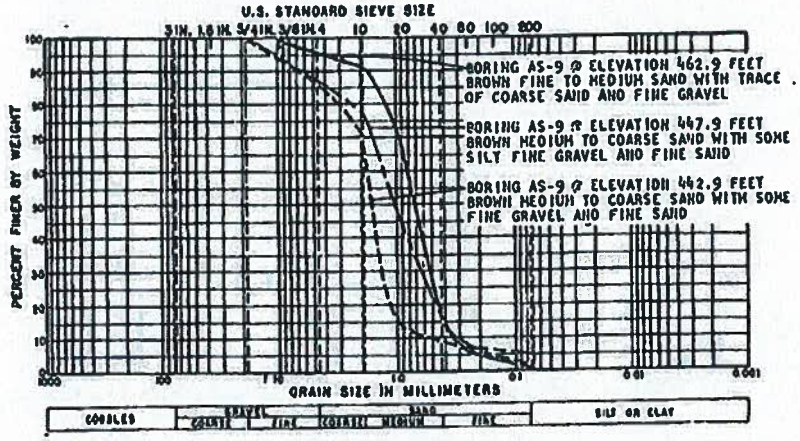
GRAIN SIZE ANALYSES

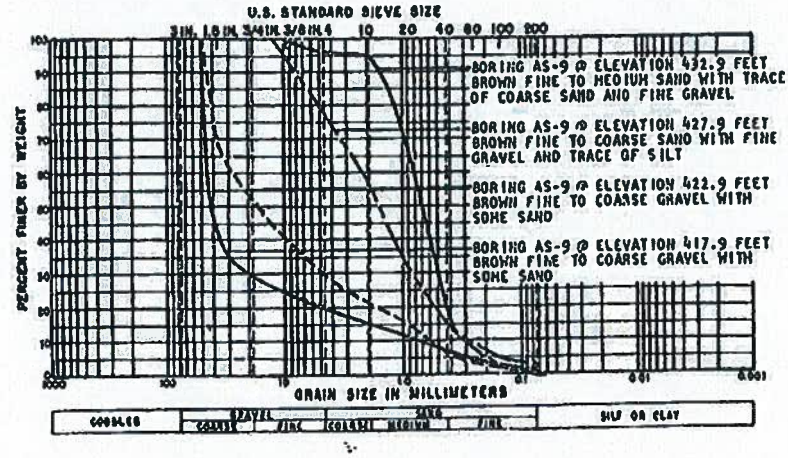
SS CBI 000172

DAMES & MOORE

PLATE D-38



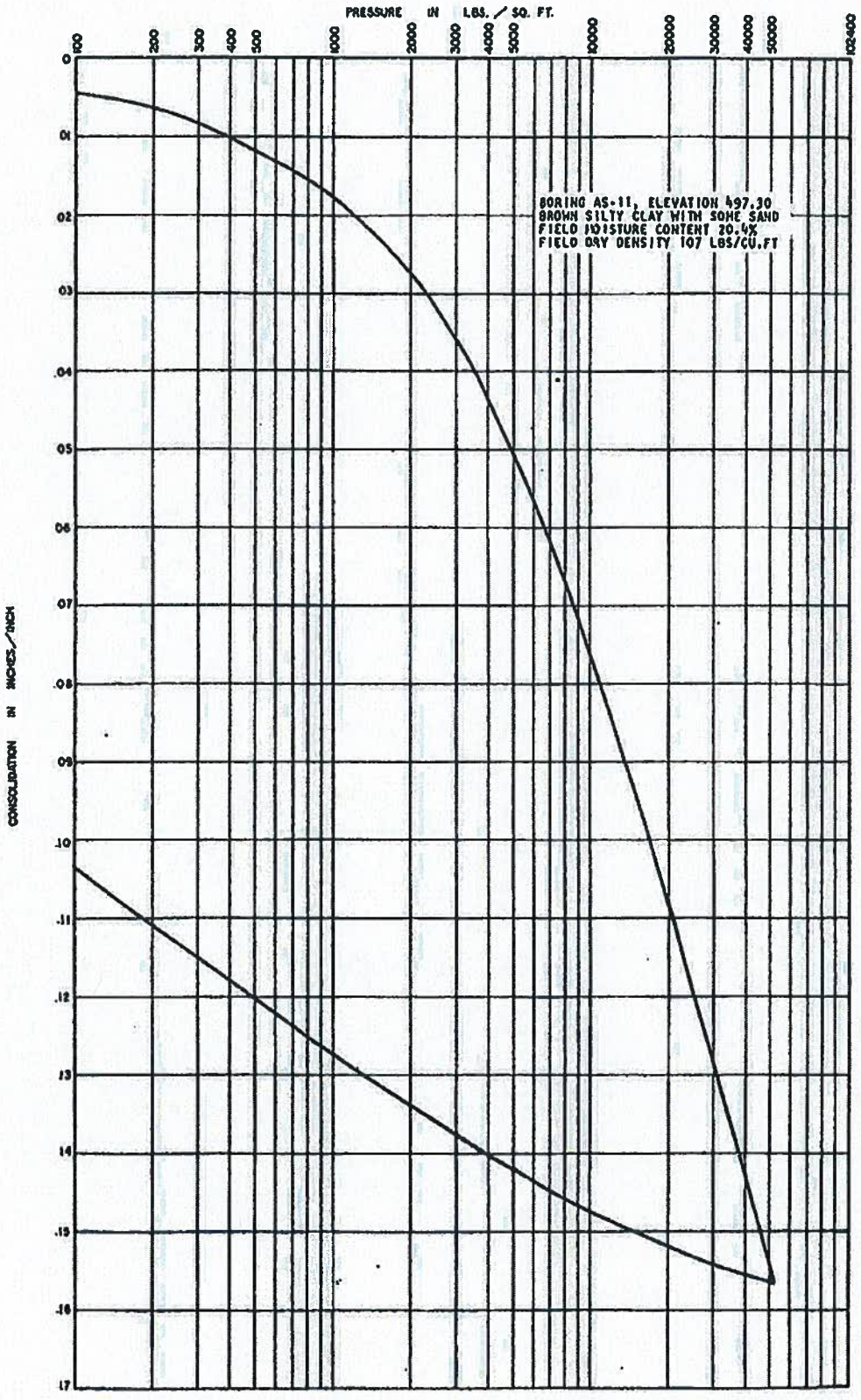




GRAIN SIZE ANALYSES

DAMES & MOORE

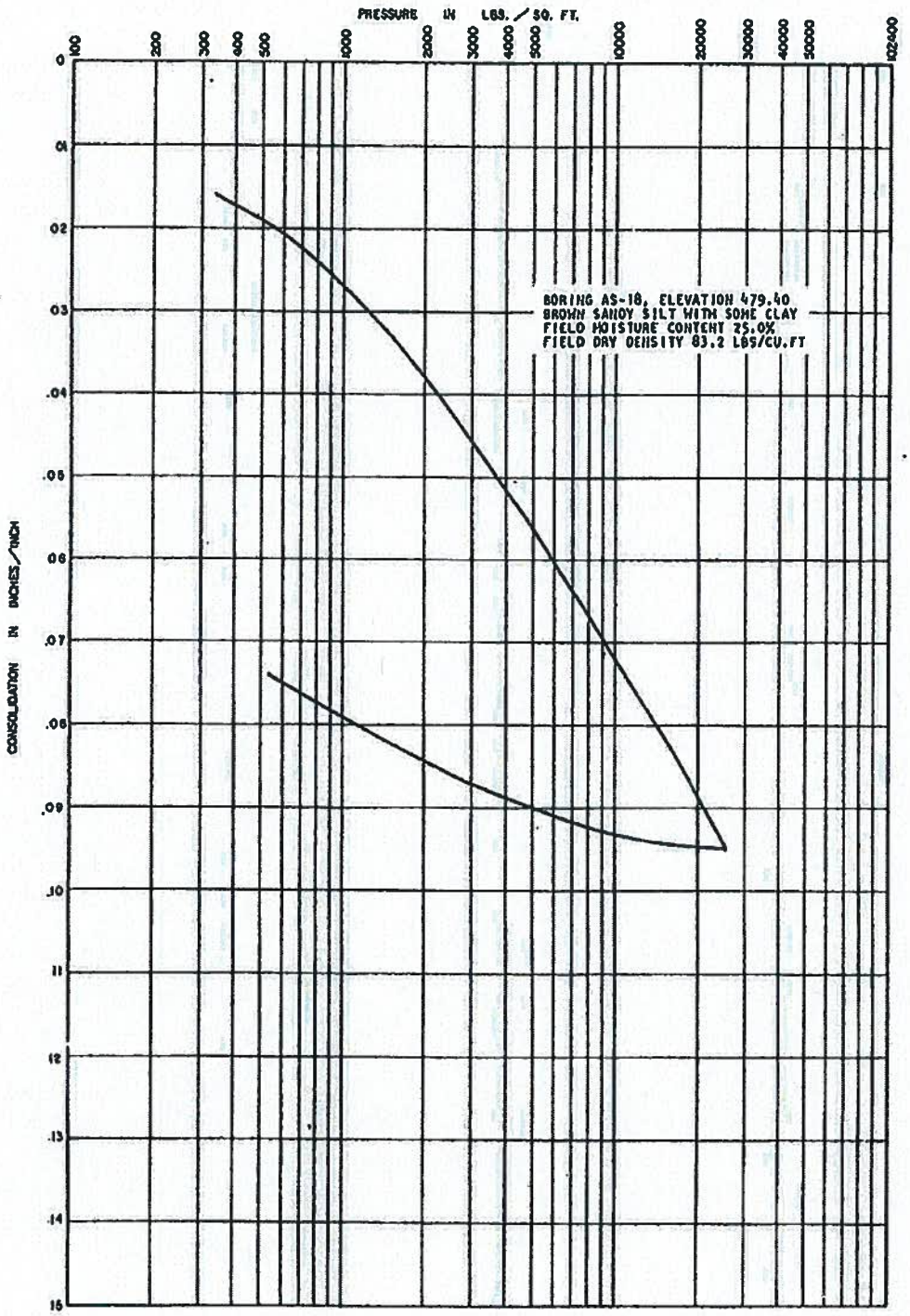
PLATE D-3C



CONSOLIDATION TEST DATA

DAMES & MOORE

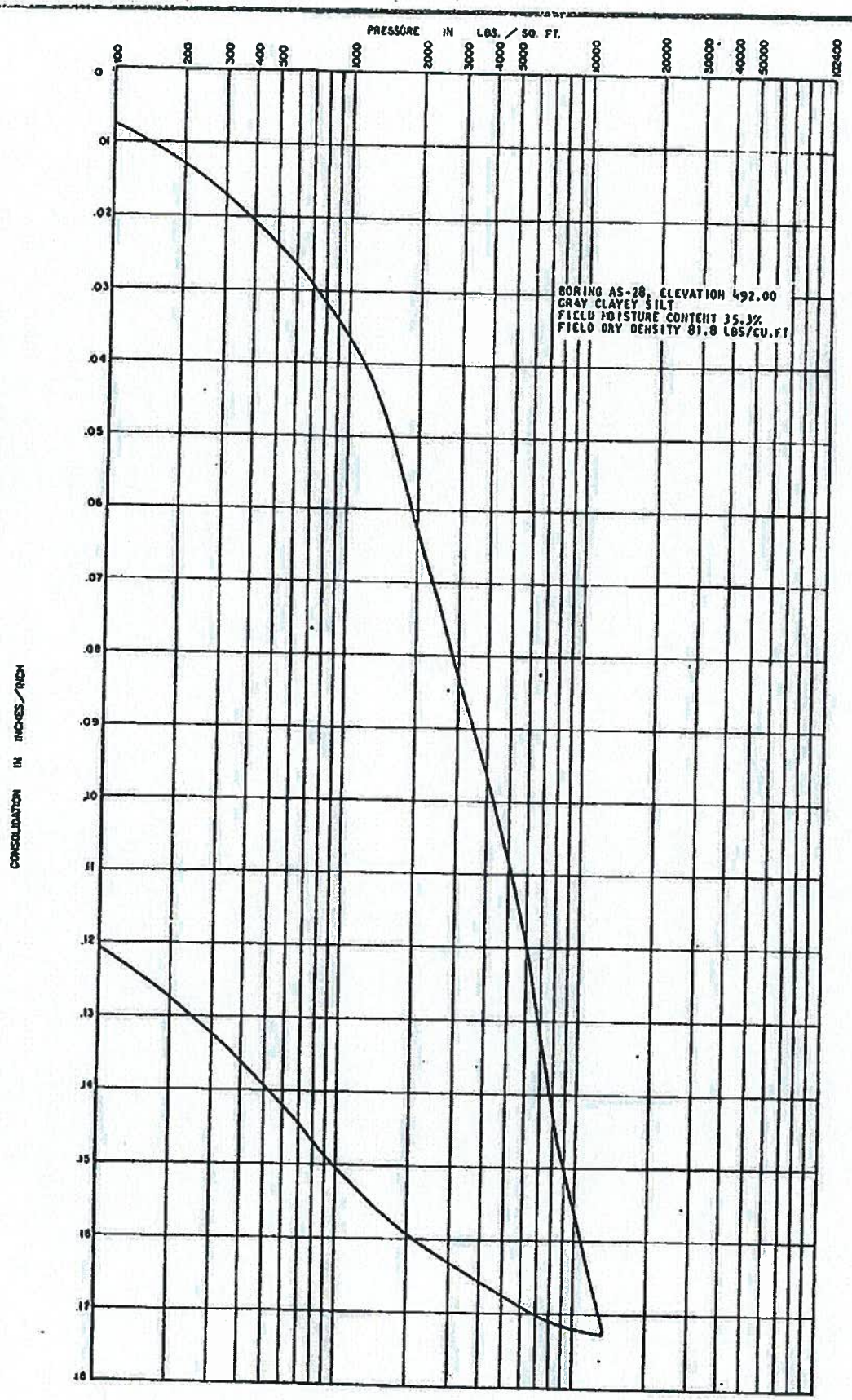
PLATE D-4A



CONSOLIDATION TEST DATA

DAMES & MOORE

PLATE D-4B



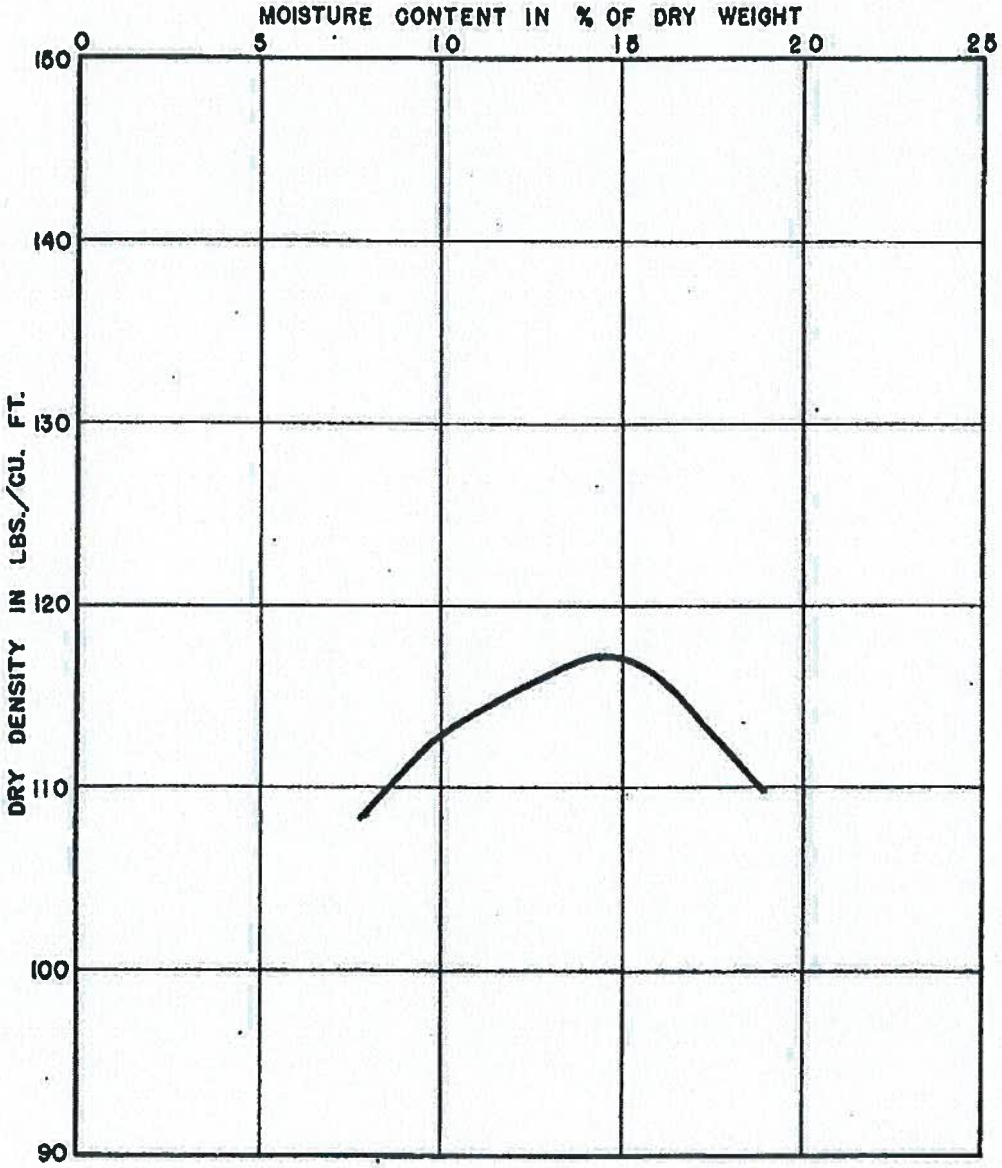
CONSOLIDATION TEST DATA

DAMES & MOORE

PLATE D-4C

SS CBI 000176

BORING AS 41@ ELEVATION 505.3 FEET
BROWN CLAYEY SILT WITH TRACE OF
COARSE SAND (VERY STIFF)
OPTIMUM MOISTURE CONTENT : 14.5%
MAXIMUM DRY DENSITY : 117.1 LBS/CU.FT.
METHOD OF COMPACTION: ASTM D-1557-64T



COMPACTION TEST DATA

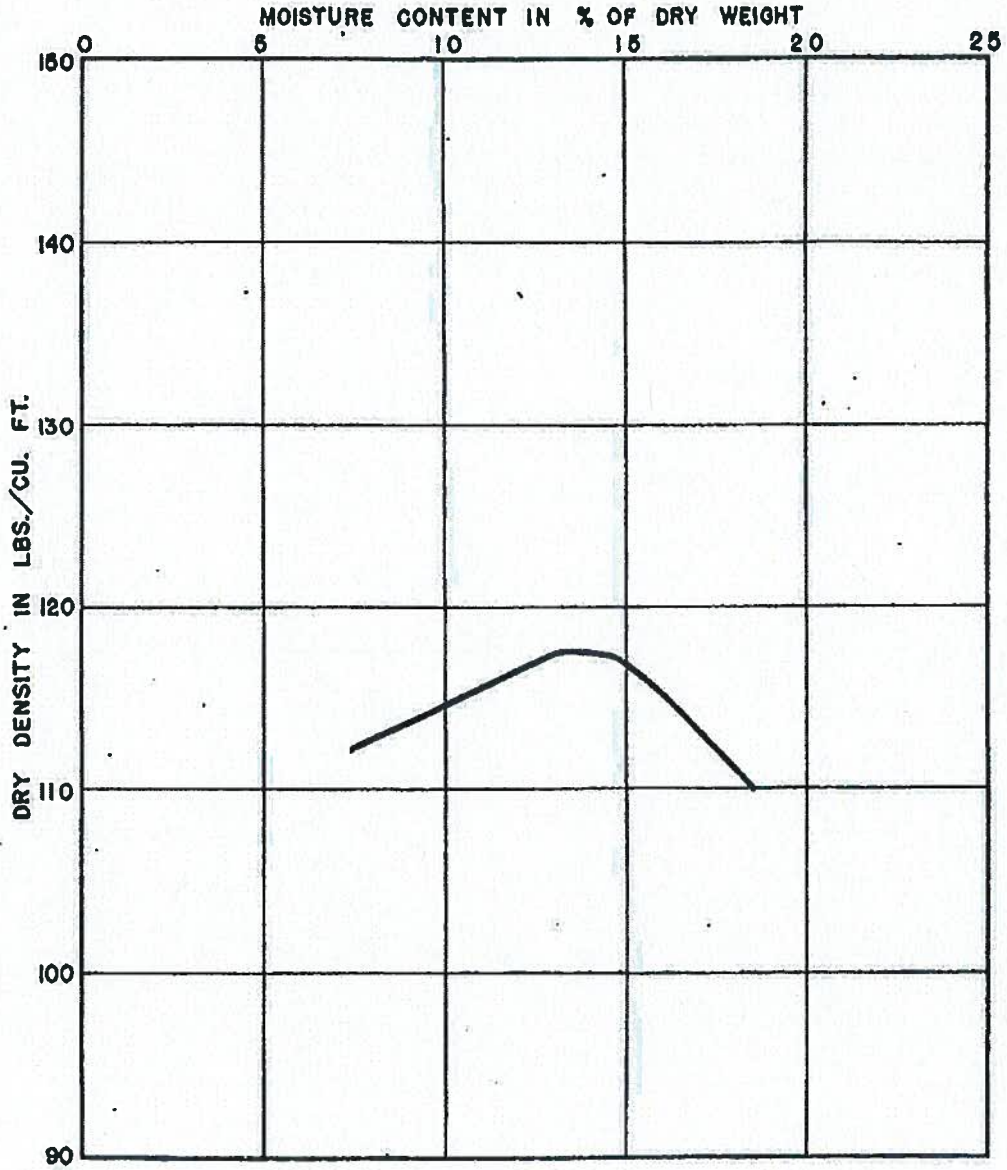
DAMES & MOORE

PLATE D-5A

SS CBI 000177

DRAWN BY _____ DATE _____
CHECKED BY _____ DATE _____
REVISION 2
BY _____
DATE _____
REVISION 1
BY _____
DATE _____
FILE _____

BORING AS 43@ ELEVATION 503.2 FEET
MOTTLED BROWN AND GRAY CLAYEY SILT
WITH TRACE OF SAND(VERY STIFF)
OPTIMUM MOISTURE CONTENT: 13.5%
MAXIMUM DRY DENSITY.: 117.8 LBS/CU.FT.
METHOD OF COMPACTION: ASTM D-1557 - 64T



COMPACTION TEST DATA

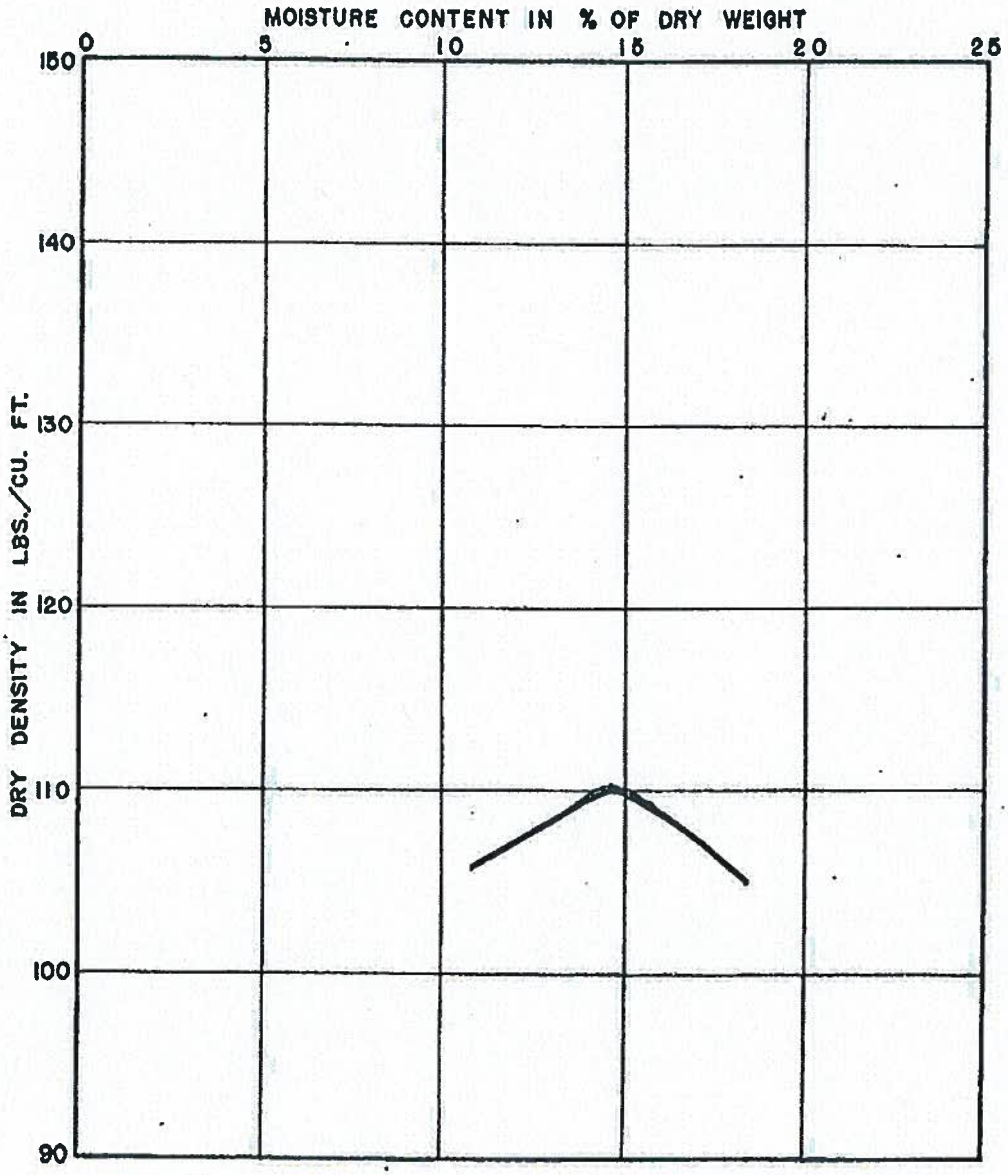
DAMES & MOORE

PLATE D-5B

SS CBI 000178

FILE _____ REVISION 1 BY _____ DATE _____ REVISION 2 BY _____ DATE _____ DRAWN BY _____ UNIT _____ CHECKED BY _____ DATE _____

BORING AS 45@ ELEVATION 507.1 FEET
MOTTLED BROWN AND GRAY SILTY CLAY
WITH TRACE OF COARSE SAND (VERY STIFF)
OPTIMUM MOISTURE CONTENT: 14.6%
MAXIMUM DRY DENSITY: 110.2 LBS/CU.FT.
METHOD OF COMPACTION: ASTM D-1557-64T



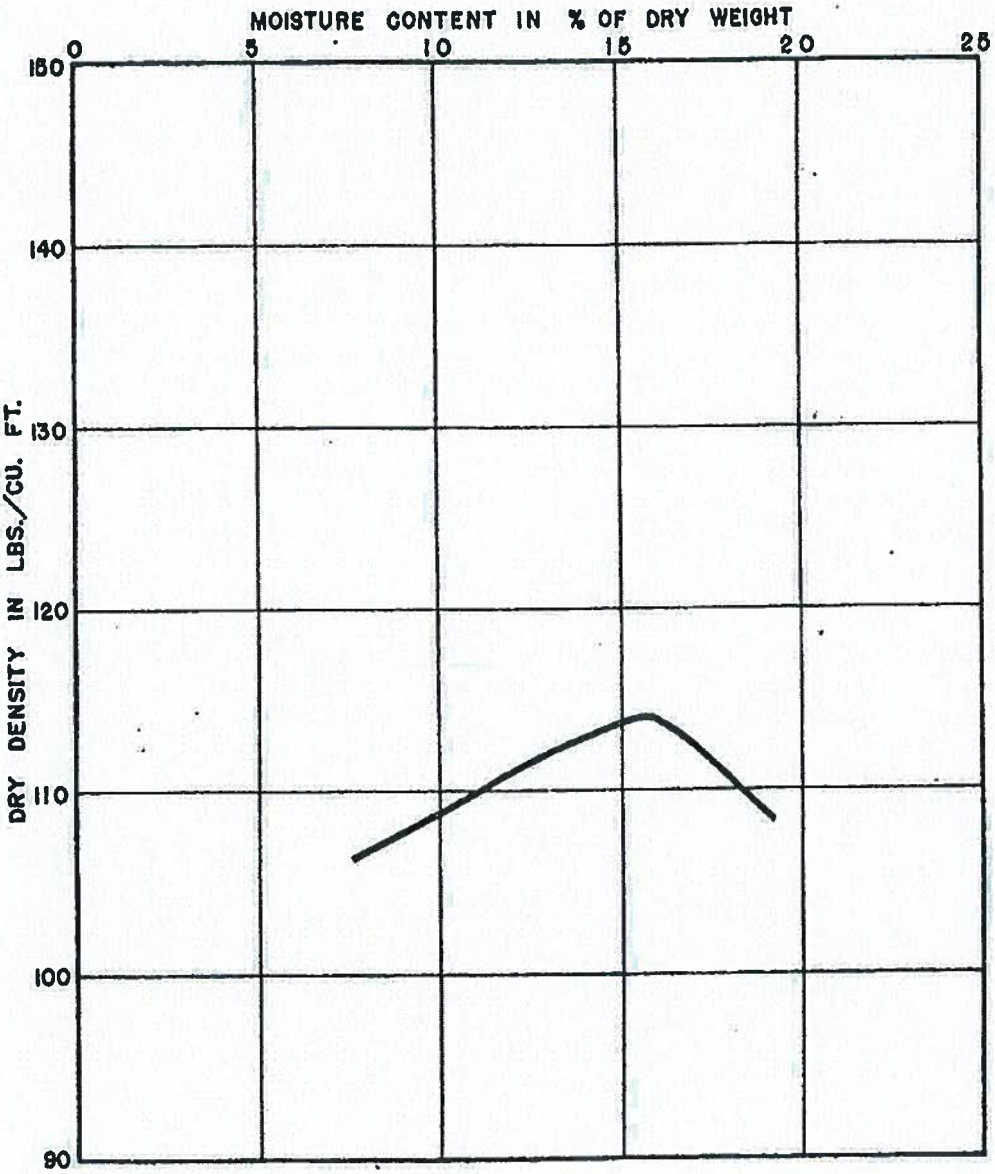
COMPACTION TEST DATA

DAMES & MOORE

PLATE D-5C

SS CBI 000179

BORING AS 46@ ELEVATION 507.1 FEET
MOTTLED BROWN AND GRAY CLAYEY SILT
(VERY STIFF)
OPTIMUM MOISTURE CONTENT: 15.6%
MAXIMUM DRY DENSITY: 114.2 LBS/CU.FT.
METHOD OF COMPACTION: ASTM D-1557-64T



COMPACTION TEST DATA

DRAWN BY _____ DATE _____
CHECKED BY _____ DATE _____
REVISION 2 BY _____ DATE _____
REVISION 1 BY _____ DATE _____
FILE _____

DAMES & MOORE

PLATE D-5D

FIELD PERMEABILITY TEST DATA

ADJACENT TEST PIT OR BORING NO.	SOIL CLASSI-FICATION	TYPE OF TEST	AVERAGE COEFFICIENT OF PERMEABILITY AT 20°C (cm/sec)
AS-20	CL	Falling Head	5.8×10^{-6}
AS-25	CL	Falling Head	$*1.3 \times 10^{-3}$
AS-38	ML	Falling Head	6.9×10^{-7}
AS-40	CL	Falling Head	2.4×10^{-5}
AS-42	ML	Falling Head	4.0×10^{-4}

*High permeability probably due to interbedded horizontal sand layer.

PERMEABILITY TEST DATA
FIELD TEST

UNDISTURBED SAMPLES

BORING NO.	SAMPLE ELEVATION	SOIL CLASSI-FICATION	TYPE OF TEST	AVERAGE COEFFICIENT OF PERMEABILITY AT 20°C (cm/sec)
W-2	479.8	SP/SM	Constant Head	5.0×10^{-6}
W-2	449.8	SP	Constant Head	1.5×10^{-4}
W-2	429.8	SP	Constant Head	7.1×10^{-4}
AS-15	508.8	ML (With sand and roots)	Constant Head	2.8×10^{-4}
AS-17	509.0	CL	Falling Head	1.2×10^{-7}
AS-17	497.0	ML/SM	Falling Head	2.4×10^{-7}
AS-20	507.6	CL (with roots)	Constant Head	6.8×10^{-4}
AS-22	508.8	ML	Falling Head	2.7×10^{-8}
AS-25	506.4	CL	Falling Head	6.8×10^{-8}
AS-35	510.8	CL (with roots)	Constant Head	1.5×10^{-4}

PERMEABILITY TEST DATA
LABORATORY TESTS

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS
(TEST PITS)

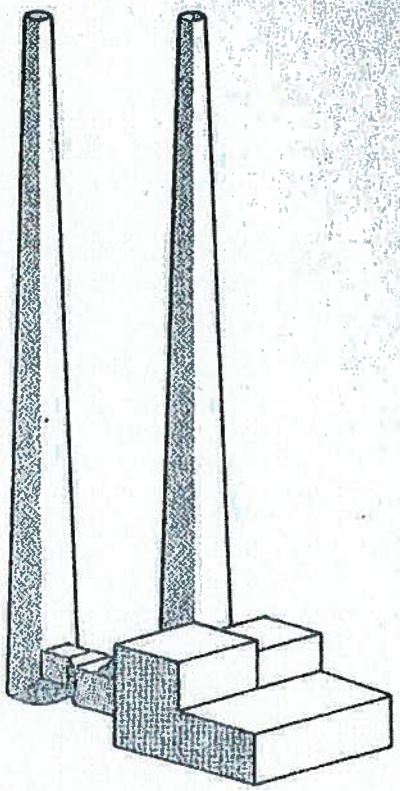
TEST PIT	ELEVATION	SOIL CLASSI-FICATION	REMOLDED DATA			TRIAXIAL CONFINING PRESSURE (PSF)	UNDRAINED SHEAR STRENGTH (PSF)
			DRY DENSITY (PCF)	PERCENT OF COMPACTION	MOISTURE CONTENT (%)		
AS-41	505.3	ML	106	91	20.8	500	3750
AS-41	505.3	ML	111	95	19.5	500	4600
AS-43	503.2	ML	103	87	23.6	500	3000
AS-43	503.2	ML	104	89	21.6	500	3200
AS-45	507.1	CL/ML	104	95	22.0	500	3800
AS-45	507.1	CL/ML	104	95	22.6	500	3500
AS-46	507.1	ML	102	89	23.3	500	2700
AS-46	507.1	ML	102	91	22.6	500	3700

SS CBI 000183

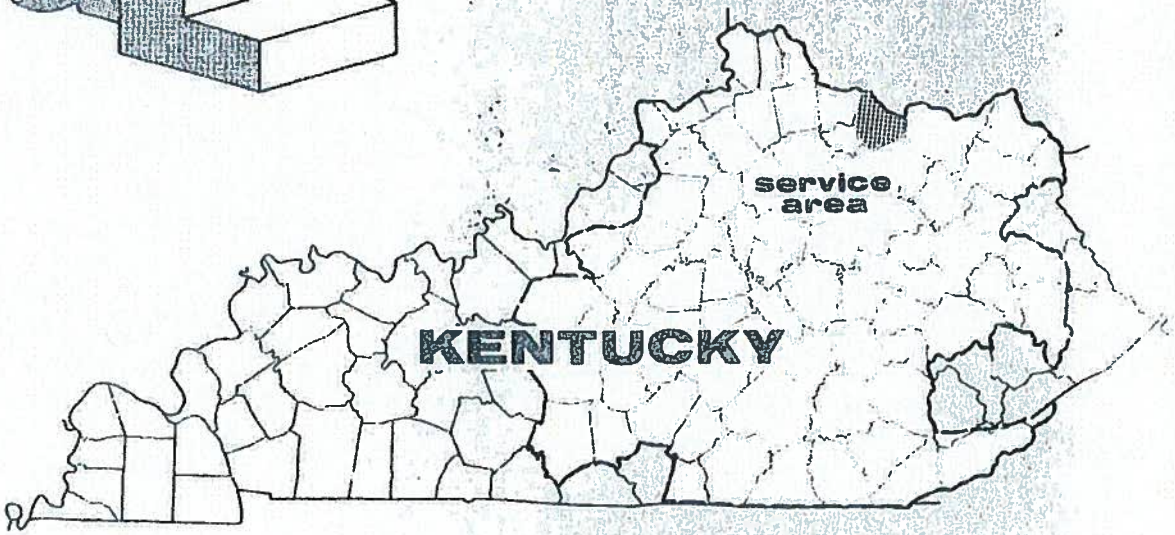
TRIAXIAL TEST DATA
REMOLDED SAMPLES

PLATE D-7

ENVIRONMENTAL ANALYSIS



SPURLOCK STATION
UNIT 2



Mason County, Kentucky

East Kentucky Power Cooperative

1976

STANLEY CONSULTANTS
INTERNATIONAL CONSULTANTS IN ENGINEERING, ARCHITECTURE, PLANNING, AND MANAGEMENT

Therefore, a dry tower is not an acceptable alternative for this project.

Wet towers obtain a high percentage of their cooling by evaporation of a portion of the cooling water. Under certain weather conditions, this creates a fogging plume leaving the cooling tower fans.

The wet/dry tower is a combination of the two above types with the dry portion so positioned and utilized to reduce or eliminate the fogging which results from the operation of a wet tower. The cost of a wet/dry tower is greater than the cost of a wet tower by factors from 2 to 1 to as much as 5 to 1, depending on the proportions of the wet and dry portions of the tower.

The wet type tower design was selected for this project, since plume propagation studies indicate no adverse environmental effects.

15. Chemical and Thermal Analysis of Effluent Before and After the Mixing Zone - The design and operation of Unit 2 will be in compliance with the U. S. Environmental Protection Agency effluent regulations for steam electric generating stations. Cooling towers are to be installed to minimize thermal effects upon the Ohio River. No in-depth chemical and thermal analysis of effluent upstream and downstream from the mixing zone is anticipated. Effluents leaving the secondary lagoon system will be monitored as described in Section II-B-13.

16. Ash Pond Description - Ash will be stored on-site in a water filled pond area formed by an earth embankment. The entire embankment will be well above the 100-year flood level for the Ohio River. The inner surface of the pond and embankments will be lined with an essentially impervious material. This lining will essentially prevent leaching into the water table. The lining for the ash pond for Unit 1 was a silty clay material 15 inches deep (or 18 inches deep where material was left in place). The bottom surface of the pond was compacted and proof rolled. Seepage from the whole 60-acre ash pond is estimated to be 91 gallons per minute plus or minus 20 percent. This is considered to be a minimal amount of seepage. The lining for the ash pond for Unit 2 will be of a similar type if possible. If on-site silty clay material is not available it will be obtained for lining purposes, or a plastic material with equivalent lining characteristics will be utilized. The outer slopes of the embankment will be seeded with vegetation to control rainwater

erosion. Embankment design will be based on soils investigations to determine appropriate embankment slopes and embankment protection. Ash pond water will be pumped to the secondary lagoon and combined with other wastewater. The ash pond dikes have elevations sufficient to prevent over-topping of dikes during times of maximum rainfall. Figure I-3 shows the proposed location of the new 80-acre ash pond.

Construction of the ash pond will entail disposal of approximately 4.5 million cubic yards of material. A disposal site for this material is yet to be located. The expected life of the ash pond is about 12 years. At the end of the expected life of the ash pond another location for ash disposal will be required. Studies are presently under way to determine the final locations for ash and material excavated during construction of the ash pond.

17. Intake Structure Design - No river intake structure is anticipated for Unit 2 at Spurlock Station.

18. Analysis of Chemical Wastewater and Method of Disposal - Chemical wastes, except for demineralizer regeneration wastes, will be both alkaline and acid cleaning solutions. For boiler boil-out and for turbine-boiler cycle cleaning, the material will be alkaline in character containing such materials as sodium hydroxide, various sodium phosphates, and wetting agents. Acid cleaning of the boiler will involve use of such materials as hydrochloric acid and organic inhibitors. Boiler and cycle cleaning solutions will be discharged to the primary lagoon through a separate drain system. During this period other plant wastes will be diverted to the secondary lagoons. In the primary lagoon the wastes will be neutralized and treated as required for controlled discharge to the plant waste system or by hauling to off-site disposal.

3. Coal and Ash System Dust Control Methods

(a) Coal Handling - The coal handling system will utilize an automatic dust control spray system at all transfer points. These transfer points will be dust tight enclosures and will be mechanically ventilated to prevent escape of dust. The vent fan discharge from this ventilation system will be fitted with dust removal equipment to assure quality of outlet air.

(b) Coal Stockpiles - The long term (dead) coal storage will be thoroughly compacted by means of mobile equipment. This will create a surface seal on the coal pile and prevent any serious dust problems. The active (live) coal storage pile will be composed of coal which has been recently transported, and will still be wetted as a result of exposure to the transfer point dust control sprays.

(c) Ash Ponds - Ash pond dust will be controlled by operating the ash pond so that all ash storage is below the water level. This will prevent dust problems from occurring.

4. Landscaping - Details of the site landscaping plan are shown on Figure II-9. Of particular note are the following items from the preliminary design outline prepared by Stanley Consultants:

> "The overall site will be landscaped to reflect the natural character of the Ohio River Valley. Landscape screening will be incorporated to screen wherever possible any features or structures that will be offensive in the landscape, as well as to enhance or create vistas of outstanding features.
>
> "Existing stands of mature trees will be retained and protected where economically feasible.
>
> "All landscaping will be designed for simplicity and ease of maintenance.
>
> "Native grasses will be used where suitable for large open areas to minimize maintenance time and costs.
>
> "Trees and shrubs introduced to the site will be indigenous to the Ohio River Valley and selected for their desirable traits, including hardiness, adaptability and disease resistance.

4. Solid Waste

(a) Construction Wastes

(1) Concern - The concern is that on-site burning of construction wastes would contribute to air pollution and be in violation of state law or that wastes would not be properly disposed of.

(2) Mitigation Measures - Construction wastes will be disposed of off-site in a licensed sanitary landfill.

(3) Effects and Significance - No adverse effects of disposal of construction wastes are expected. This does represent a commitment of landfill space to the project.

(b) Ash Pond Construction and Ash Disposal

(1) Concern - Construction of the ash pond for Unit 2 will require excavation of approximately 4.5 million cubic yards of alluvial material (the space equivalent of this volume is about 80 acres, 30 feet deep). One concern is where this material will be placed and what the effects would be. The other concern is that the life span of the ash ponds for Units 1 and 2 is expected to be less than 20 years, and what disposal methods or locations are available after the useful life of the ash ponds.

(2) Mitigation Measures - Planning is presently underway for location of sites for disposal of the excavated alluvial material and ash. Additional space, off-site or on-site, will be required for this material and for future ash disposal. Studies are underway for location and preliminary design of both short-term and long-term ash storage areas. Four major alternatives being considered include storage adjacent to present property, an alternative of construction of a retention dam to hold ash in a valley about a mile from the site and two on-site alternatives. Disposal methods will conform to state regulations relative to solid waste disposal and water quality, and relative to federal regulations or permit requirements protecting streams and stream related wildlife habitat. As described in Section II-B-16 for on-site ash ponds, any off-site disposal areas would be designed for protection of ground water, and embankments would be stable and planned for erosion and runoff control and for protection from flooding.

(3) Effects and Significance - Assuming a general estimate of 55 million tons of coal to be used for Units 1 and 2 to the year 2010, and assuming that 11.6 percent of the coal used becomes ash (in a typical situation), about 6 million tons of ash will be produced at Spurlock Station. Disposal of ash represents a commitment of on-site and off-site space for this material. Eventually, on-site space can be reclaimed for other industrial

purposes, and the same may be true for off-site disposal areas. Mitigation measures will be used to prevent on-site adverse effects on water resources from leachate or run-off, and similar measures will be used for additional on-site space or for off-site locations. Disturbance of vegetation and wildlife due to ash pond construction, disposal of excavated material, and ultimate ash disposal location represents a commitment of resources to the project. Eventual industrial use of disposal areas, or use for re-establishment of vegetation and wildlife would be expected.

5. Noise

(a) Concern - Unacceptable noise levels might create problems on the site for plant personnel, and might create a nuisance problem for persons living adjacent to the site.

(b) Mitigation Measures - Design and operation of the plant will comply with all legal requirements relative to noise limitation. Examples of noise reduction measures are as follows: 1) Provision of noise limits in specifications to manufacturers for plant equipment; 2) Consideration of noise levels in selection of equipment type or manufacturer; 3) Silencers and enclosures and acoustical insulation will be used where necessary; 4) Daytime utilization of some plant components is preferable to nighttime operation; and 5) the monitoring program. The amount of on-site distance between noise sources and the property lines will also make it possible to be in compliance with applicable state and federal standards.

(c) Effects and Significance - Noise levels within the plant will not exceed standards which protect operating personnel. Noise from outside sources will be in conformance to standards at the property boundaries. Infrequent blowing of steam lines is a noise heard off-site which cannot be avoided.

6. Fuel

(a) Concern - With the projected shortage of petroleum products within the next fifty years, and because coal is an abundant but non-renewable resource, there is concern that these resources should be wisely allocated and used efficiently.

(b) Mitigation Measures - Coal was selected as an abundant, available fuel in accordance with federal policy as stated in the Energy Supply and Environmental Coordination Act of 1974. An oil spill emergency plan will be on file. Necessary

Doc 06: S&ME Engineering Study:
Evaluation of Risks of 100-Yr Event & Freeboard Requirement

ENGINEERING STUDY

for

SPURLOCK POWER STATION ASH POND

EVALUATION OF RISKS OF 100-YR RAIN EVENT & FREEBOARD REQUIREMENT

S&ME Project No. 1831-10-5580

Prepared for:

EAST KENTUCKY POWER COOPERATIVE

A Touchstone Energy® Cooperative

4775 Lexington Road
Winchester, Kentucky

Prepared by:
S&ME, Inc.
422 Codell Drive
Lexington, Kentucky

S&ME
ENGINEERING INTEGRITY

JULY 2010

SS CBI 000043

SPURLOCK POWER STATION ASH POND
MAYSVILLE, KENTUCKY

Engineering Study for Evaluation of Risks of 100-YR Rain Event & Freeboard Requirement

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LIST OF APPENDICES

2010 Ash Storage Pond

Engineering Study
For Evaluation of Risks of 100-YR Storm Event and Freeboard Requirement
Spurlock Power Station
Mason County, Kentucky

1. Introduction

S&ME, Inc. (formerly QORE, Inc.) was retained by East Kentucky Power Cooperative (EKPC) to perform an engineering study for evaluation of the risks associated with a 100-YR storm event and the required freeboard for the existing ash pond located on the north side of the facility near the Ohio River.

Field evaluation and reconnaissance was performed by Alan Leake, PLS and Richard Wright of S&ME. EKPC provided S&ME with AutoCAD files of the site layout, including LIDAR (Light Detection and Ranging) contour data files for the pond.

2. Site Information

Spurlock Power Station is located near Maysville in Mason County, Kentucky and is owned by East Kentucky Power Cooperative of Winchester, Kentucky. Spurlock Station is located adjacent to KY 8 on the south, Inland Container on the east and the Ohio River on the north.

The ash storage pond is located just south of the Ohio River (Mile 413) at the northeast corner of the station property (**See Appendix A**). The area of the pond is approximately 69 acres (measured at the existing water elevation). Based on field survey information, the average top of dike elevation was 528.0 with a pond elevation of 526.6. The perimeter of the dam is approximately 8,772 feet (1.66 miles). For the Ohio River, the normal pool elevation is 485.0 and the base flood (100-yr) elevation is 515.0.

Interior and exterior slopes of approximately 3:1 (H:V) were proposed along the dike walls, except along the north (river) side, where the exterior slope is approximately 2:1. The top width of the dike is approximately 16 feet and is gravel-covered for access. The dam structure is classified as a Class (A) – Low Hazard Structure type in accordance with guidelines from the Kentucky Department of Environmental Protection (Division of Water). This classification

applies to structures located such that failure would cause loss of the structure itself but little or no additional damage to other property.

3. Field Assessment/Methodology

A hydrographic survey of the pond was conducted on February 23-24, 2010. S&ME provided a 2-man survey crew to assess the subsurface ash levels in the entire pond by using a boat-mounted Trimble R6 network GPS receiver. The receiver was linked to the Kentucky CORS (Continuously Operating Reference Stations) GPS network to determine horizontal coordinates on the surface of the pond. A single-beam sonar device capable of determining the depth of the pond to the nearest foot was used to establish the elevations of the pond bottom at approximately 2,300 random locations. The data was processed and a topographic map of the pond bottom was generated using Carlson Survey software. The hydrographic mapping was then merged with the LIDAR surface mapping provided by EKPC.

**Note that the original design plan elevations for the ash pond were based on the National Geodetic Vertical Datum (NGVD) of 1929. The current surveys are based on North American Vertical Datum (NAVD) of 1988, which has been updated based on additional survey information. The vertical datum shift is minus 0.807 feet (i.e., NAVD 88 Elevation – NGVD 29 Elevation), according to the National Geodetic Survey (NGS). Therefore, the top of dike design elevation of 530.000 (NGVD 29) at the Spurlock ash pond is now adjusted to a design elevation of 529.193 (530.000 – 0.807). All surveys noted on the plans and elevations discussed in this report are based on NAVD 88 control datum.*

Currently, ash is transferred from the plant to the pond by wet sluicing through a 10-inch diameter pipe that empties into the pond near the southwest corner, adjacent to the west dike. An ash water transfer pump station, capable of discharge rates of 4800 gpm (10.7 cfs), is located near the center of the west dike at the western side of the pond **(See Appendix B)**.

Surface ditches are evident along the southern and eastern dikes to drain water away from the pond area. Thus, excluding seepage, infiltration and evaporation, the pond volume and water elevation only changes with additional wet sluicing discharge, direct rainfall or pump discharge to an outlet structure.

Site photographs are provided in **Appendix E** showing various angles of the pond, dam, erosion control, vegetation and other topography.

4. Computer Modeling and Volume Calculations

Computer modeling to obtain volumes for the pond were done for the existing water surface elevation (526.6) and to the average dike elevation (528.0). A bottom elevation of 506.0 was used as the beginning surface area for the pond

since that was the lowest field-sounded elevation. Using field-obtained horizontal and vertical data for approximately 2,300 random locations throughout the entire pond, a site topographic map of the pond was developed. In addition, a profile along the center of the dam was completed beginning at the northwest corner and extending clockwise around the perimeter. The minimum profile elevation was 527.17. Therefore, the freeboard was as low as 0.57 feet at some locations.

Representative cross-sections for the pond are shown in **Appendix C** and noted as Section A-A, Section B-B, Section C-C, Section D-D and Section E-E. Based on the field survey data, the lowest elevation of 506.0 was used as the pond "bottom" and all volume calculations were referenced from this elevation. From field observation, ash was exposed at the surface at some locations throughout the pond as the material has settled and separated from the sluice effluent.

Storage allotment for a 100-year rainfall event and available freeboard must also be accounted for within the pond limits. In accordance with the dam classification noted in Section 2 and engineering memorandums from the Division of Water, the minimum rainfall storage for this structure is equal to the 6-hour design rainfall or 6-hour, 100-year precipitation[1]. The 6-hour, 100-year precipitation for Mason County is 4.2 inches[2]. In addition, the *minimum* freeboard shall be equal to the following equation[1]:

Freeboard = P100 + 0.12 x (PMP – P100),
where PMP is the 6-hour Probable Maximum Precipitation, which is 27.2 inches

i.e., Freeboard = 4.2 + 0.12 x (27.2-4.2) = 4.2 + 2.8 = 7.0 inches (min.)

Source:

[1]Kentucky Division of Water - Engineering Memorandum No. 5
[2]Kentucky Division of Water - Engineering Memorandum No. 2

5. Conclusions

Using the computer modeling algorithm techniques of triangulation around the contours of the pond, the total volume of the ash pond and the volume remaining were calculated. These volumes were derived from the estimated bottom elevation to the existing water surface and to the top of the dike, based on field-generated survey information.

As shown in **Table 1** below, the storage volume for the ash pond is estimated to be 891,514 cubic yards below the existing water elevation of 526.60 feet or 1,029,305 cubic yards below the existing dike elevation of 528.00 feet.

Additionally, enough freeboard would have to be provided to account for the 100-YR, 6-HR rainfall event of 4.2 inches and the probable maximum flood of an additional 7 inches (minimum). Based on the original design plans, the final ash level should be approximately 2.5 feet below the top of the dike elevation (currently 528.0 -2.5 or 525.5 feet).

TABLE 1. ESTIMATED AREA/VOLUME CALCULATIONS

SPURLOCK ASH POND CRITERIA	TO EXISTING POND ELEVATION 526.60'	TO EXISTING DIKE ELEVATION 528.00'
Area (Acres)	68.4	69.0
Total Volume (CY)	2,138,216	2,293,380
Total Volume (GAL)	431,834,103	463,171,025
Volume Used VU (CY)	1,246,702	1,264,075
Volume Used VU (GAL)	251,783,936	255,292,587
Percent Used (VU/TV)	58.3	55.1
Volume Remaining (CY)	891,514	1,029,305
Volume Remaining (GAL)	180,050,167	207,878,438
Percent Remaining (VR/TV)	41.7	44.9
100-YR, 6-HR Rainfall (in)	4.2	n/a
100-YR, 6-HR Rainfall (CY)	38,736*	n/a
100-YR, 6-HR Rainfall (GAL)	7,823,123*	n/a
De-water time (Hrs)	27.2**	
Freeboard--minimum (in)		11.2 (4.2+7)
Freeboard--preferred (in)		16.2 (4.2+12)

*68.6 acres at Elev. 527.0
**using 2-4800 gpm pumps

The top of the dam needs to be partially-filled and re-graded to a minimum elevation of 528.0 at the following six (6) locations, as shown in **Table 2** and

noted on the Profile in **Appendix D**. These location limits are approximate. Exact limits will have to be determined in the field during any construction.

TABLE 2. DAM RE-GRADE AREAS

AREA NO.	STATION TO STATION	LENGTH (FT)
1	9+60 – 14+82	522
2	19+45 – 22+60	315
3	25+16 – 27+14	198
4	40+28 – 45+00	472
5	68+41 – 70+18	177
6	76+63 – 84+80	817
Total Re-Grade Length		2,501
Total Dam Perimeter		8,772

6. Recommendations

If no changes are made to the minimum dike elevation of 528.0 of the ash pond dam, S&ME recommends that the water surface not exceed an elevation of 526.7 or 0.1 feet above what was field-measured. This would provide the recommended 1-foot freeboard and the storage for a 6-hour, 100-year rain event of approximately 4.2 inches. However, additional storage could be achieved if the dike height was increased and the exterior slopes widened accordingly. In lieu of this additional construction and related costs, the pond volume should be maintained with the current de-watering methods to adjust the control elevation as needed. Additionally, periodic inspection by EKPC personnel will be required to ensure that this elevation is maintained and to determine what, if any, corrective measures are necessary.

Although the minimum freeboard height is estimated to be 7 inches, a freeboard height of 12 inches is recommended to account for the lack of an emergency spillway, potential wave/bank action, pump failure and other contingencies. Any areas along the interior slope that show signs of erosion or lack of vegetation should be repaired as soon as practical to minimize further erosion and to protect the intended storage volume of the pond.

Based on the profile of the dam perimeter, some of the low-lying areas need to be re-graded and covered with clay to maintain the required freeboard. This will also include replacement of the crushed stone used for the road surface.

In summary:

- Maintain water elevation of 526.7 (currently at 526.6) or lower
- Use a 12-inch freeboard + addition of 4.2-inch rainfall event
- If a significant rainfall event should occur, de-water volume down to elevation 526.7 as soon as possible to maintain required freeboard

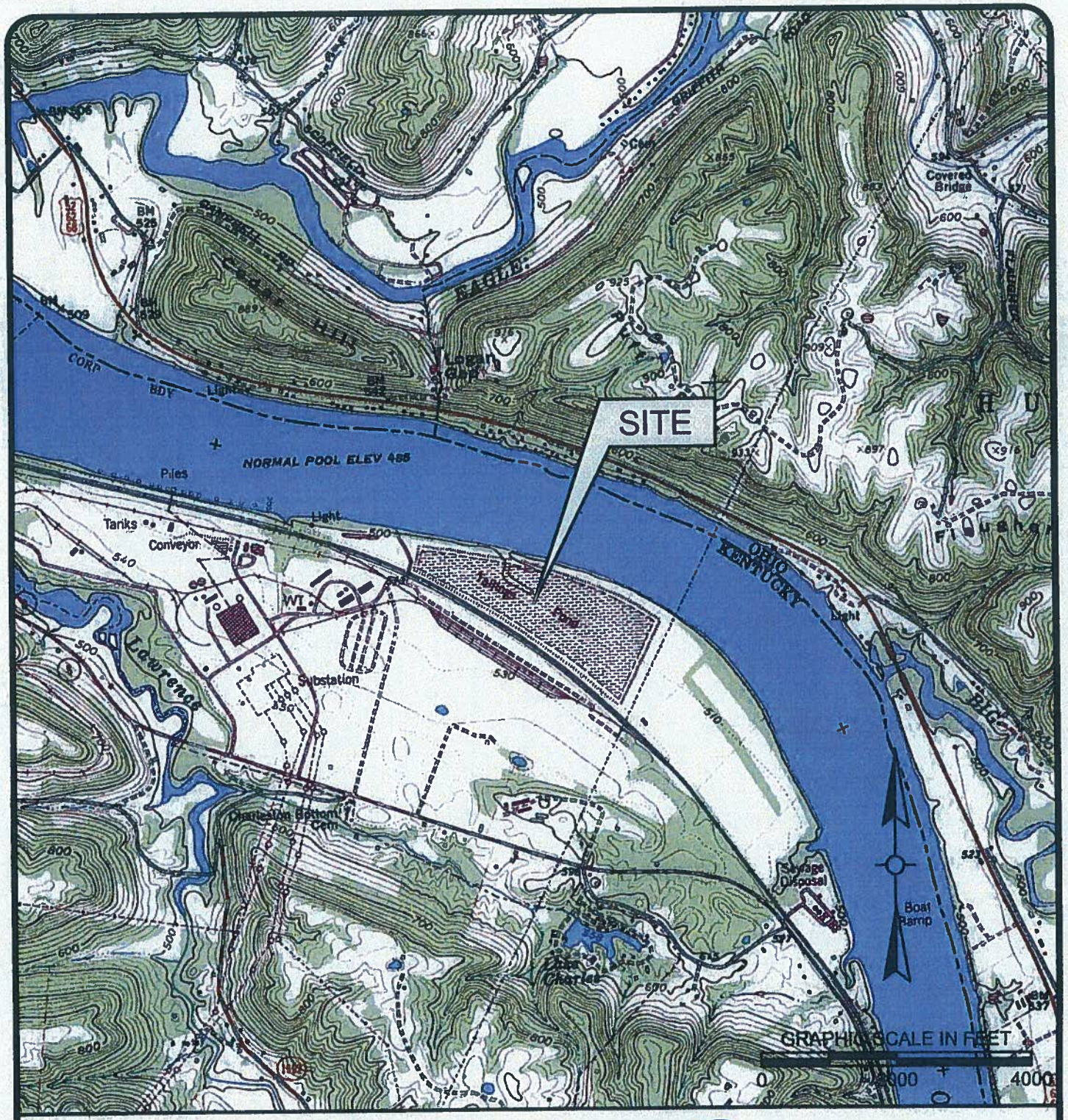
- Raise the grade of the dam, as noted, at the locations shown on the profile and discussed in the report to a minimum elevation of 528.0
- The final ash level in the pond should be approximately 2.5 feet below the top of the dam elevation or 525.5 currently, in accordance with the original design plans
- Correct any interior slope deficiencies, including erodible areas, etc.
- Additional volume can be achieved if dam height is raised and exterior slopes are adjusted accordingly
- EKPC plant personnel should periodically inspect and note water elevation and top of dam elevation is in compliance with requirements discussed in this report
- Volumes are subject to change since fieldwork was done in late February and construction at the pond has occurred since then or may be ongoing

---

[END REPORT]

APPENDIX A

▶Site Location Map



EAST KENTUCKY POWER COOPERATIVE
WINCHESTER, KENTUCKY
PHONE: (859) 744-4812

EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy Cooperative

SCALE:	1" = 2000'
DATE:	6/2/2010
DRAWN BY:	RLW
PROJECT NO:	24305580

S&ME
WWW.SMEINC.COM
422 CODELL DRIVE, LEXINGTON, KY 40509
PHONE: 859.293.5518

SITE LOCATION MAP
SPURLOCK POWER STATION
MAYSVILLE, KENTUCKY

FIGURE NO.
1

SS CBI 000052

APPENDIX B

▶Aerial Map of Ash Pond

SHEET 1 of 1

SITE LOCATION MAP

ASH STORAGE POND
SPURLOCK POWER STATION
MAYSVILLE, KENTUCKY

S&ME 422 CODELL DRIVE LEXINGTON, KY 40509 (859)293-5518
WWW.SMEINC.COM

SCALE: 1"=600'

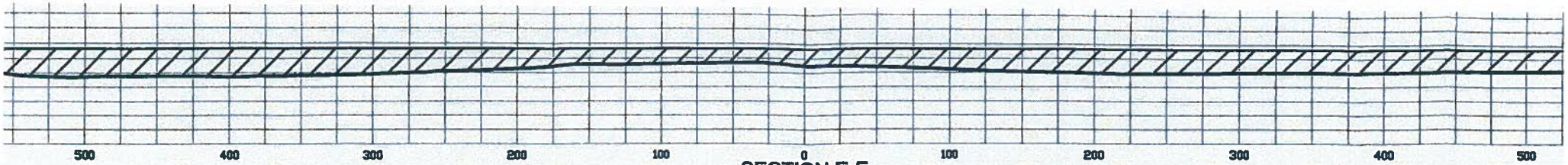
PROJECT NO. 1831-10-5580

DATE: JULY 23, 2010

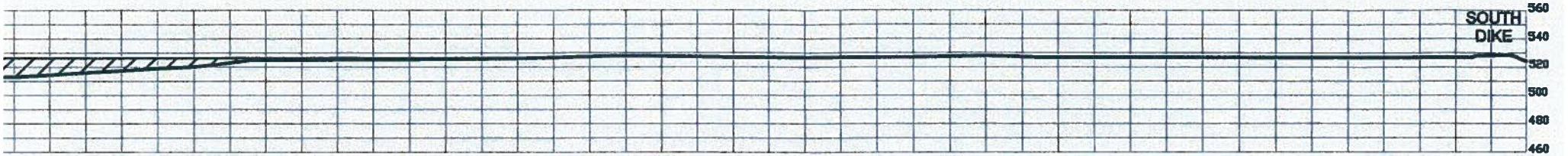
APPENDIX C

▶Typical Sections

PUMP STATION
SECTION A-A
SOUTH DIKE
SECTION B-B
EX. ASH
SECTION C-C
SECTION D-D
SECTION E-E
EAST DIKE
DITCH



SECTION E-E



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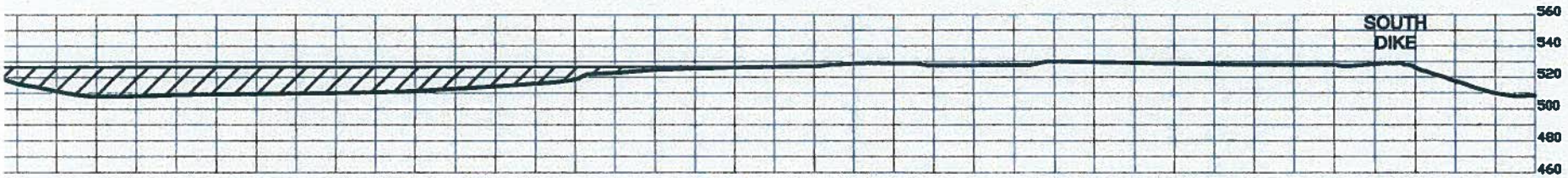

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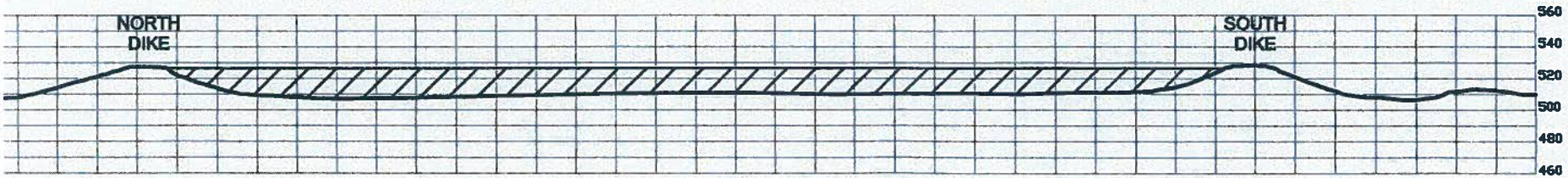
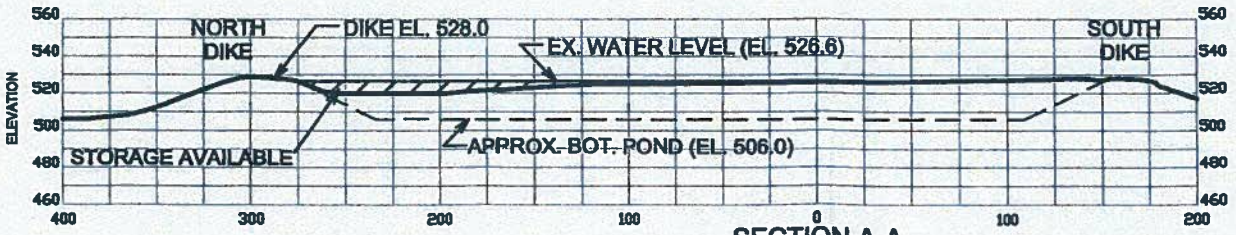


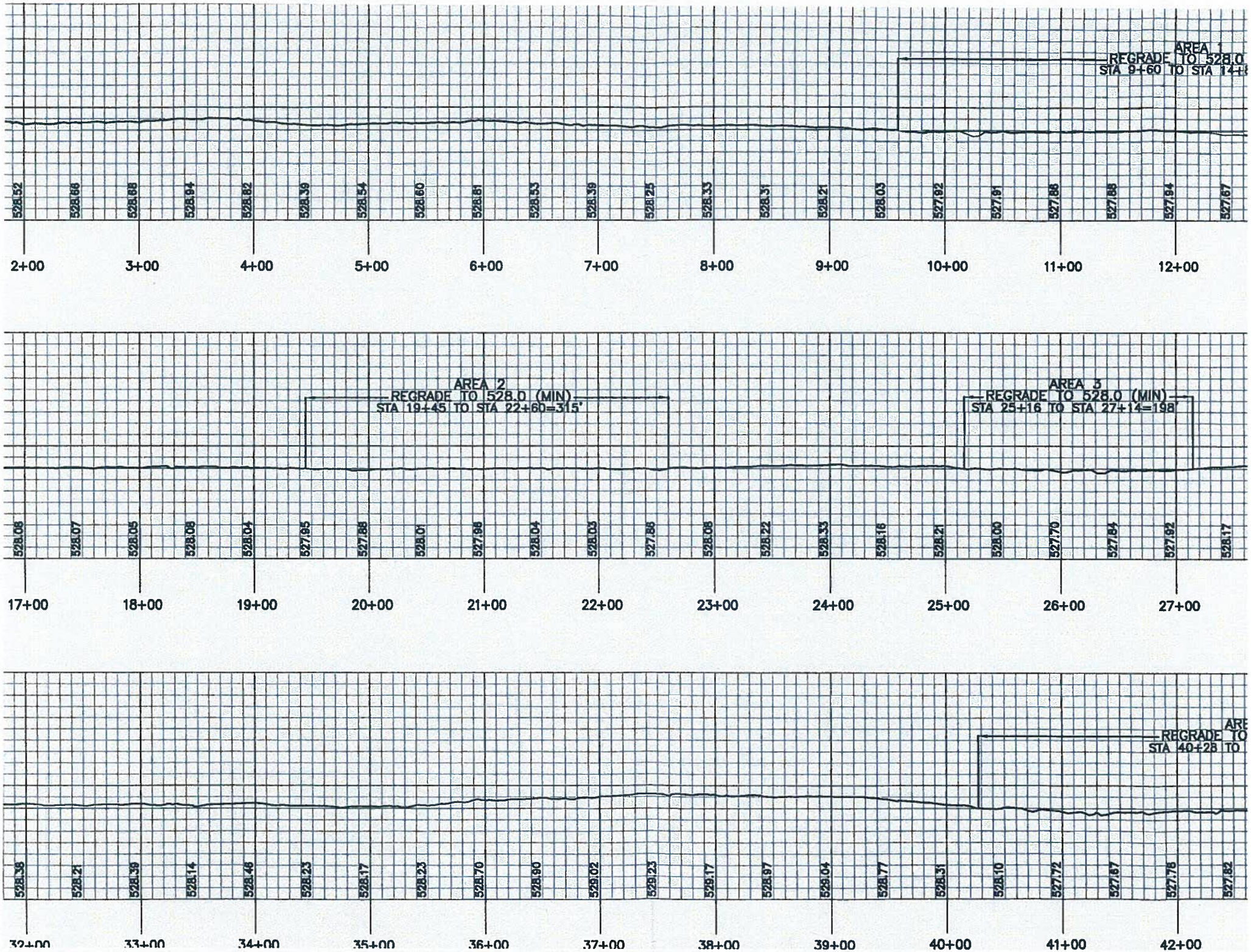
SECTION B-B

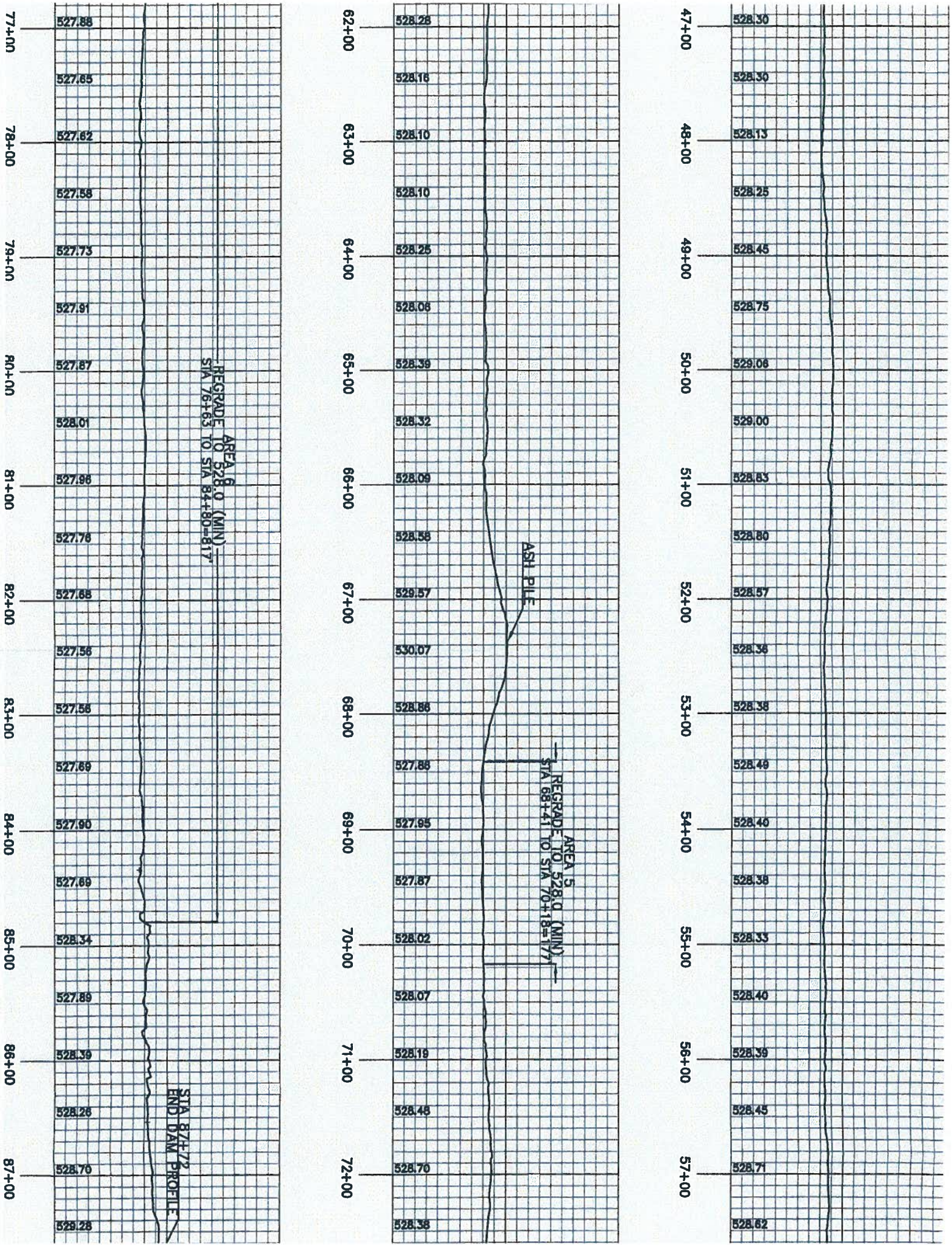


SECTION A-A

APPENDIX D

▶ Dam Profile

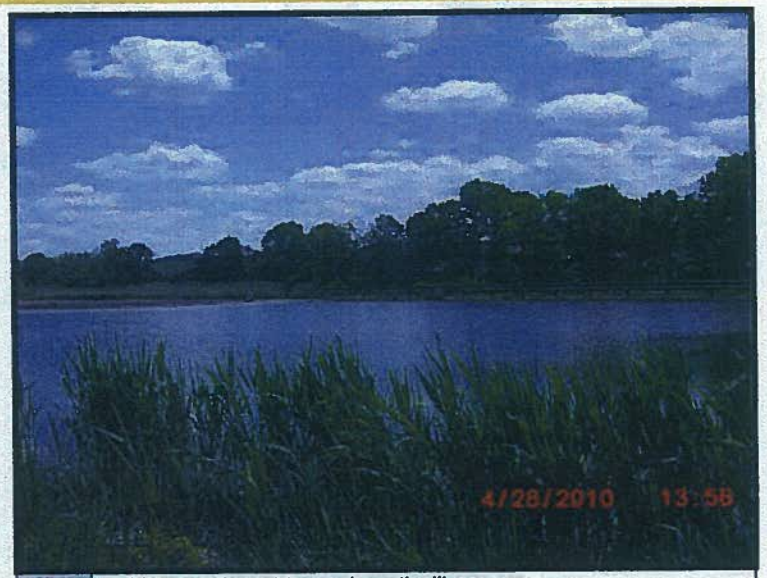

AREA 1
REGRADE TO 528.0
STA 9+60 TO STA 14+
528.52
528.66
528.68
528.94
528.82
528.39
528.54
528.60
528.61
528.53
528.39
528.25
528.33
528.31
528.21
528.03
527.92
527.91
527.88
527.88
527.94
527.67
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
AREA 2
REGRADE TO 528.0 (MIN)
STA 19+45 TO STA 22+60=315'
AREA 3
REGRADE TO 528.0 (MIN)
STA 25+16 TO STA 27+14=198'
528.08
528.07
528.05
528.08
528.04
527.95
527.88
528.01
527.98
528.04
528.03
527.86
528.08
528.22
528.33
528.16
528.21
528.00
527.70
527.84
527.92
528.17
17+00
18+00
19+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
REGRADE TO
STA 40+28 TO
528.36
528.21
528.39
528.14
528.46
528.23
528.17
528.23
528.70
528.90
529.02
529.23
529.17
528.97
529.04
528.77
528.31
528.10
527.72
527.87
527.78
527.82
32+00
33+00
34+00
35+00
36+00
37+00
38+00
39+00
40+00
41+00
42+00


77+00
527.88
527.65
78+00
527.62
527.58
79+00
527.73
527.91
80+00
527.87
528.01
81+00
527.96
527.76
82+00
527.68
527.56
83+00
527.58
527.69
84+00
527.90
527.69
85+00
528.34
527.89
86+00
528.39
528.26
87+00
528.70
529.28
REGRADE AREA 6 TO 528.0 (MIN) STA 76+63 TO STA 84+80=817'
STA 87+72 END DAM PROFILE
62+00
528.28
528.16
63+00
528.10
528.10
64+00
528.25
528.08
65+00
528.39
528.32
66+00
528.09
528.58
67+00
529.57
530.07
68+00
528.86
527.88
69+00
527.95
527.87
70+00
528.02
528.07
71+00
528.19
528.48
72+00
528.70
528.38
ASH PILE
REGRADE AREA 5 TO 528.0 (MIN) STA 68+41 TO STA 70+18=177'
47+00
528.30
528.30
48+00
528.13
528.25
49+00
528.45
528.75
50+00
529.06
529.00
51+00
528.83
528.80
52+00
528.57
528.36
53+00
528.38
528.49
54+00
528.40
528.38
55+00
528.33
528.40
56+00
528.39
528.45
57+00
528.71
528.62

APPENDIX E

▶ Site Photographs

1 Looking southwest to west dike and pump station. Note heavy vegetation on interior slope of north dike.



2 Looking southeast toward south dike.

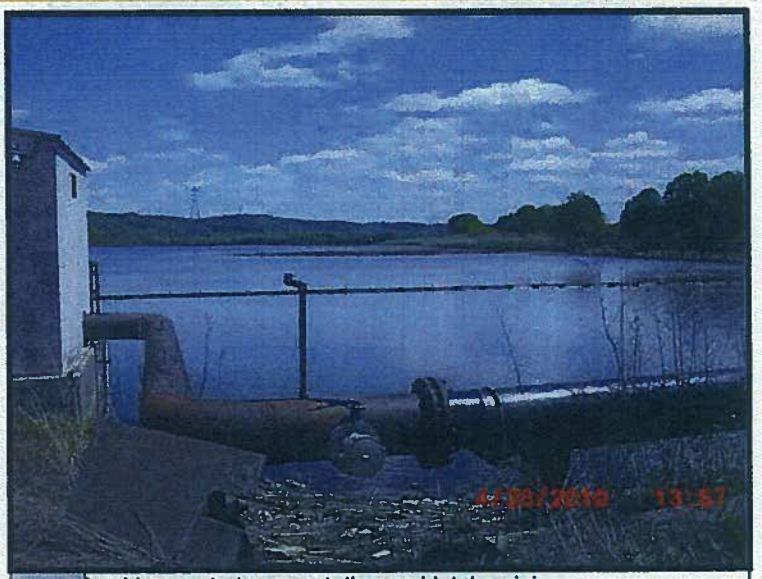
3 Looking east from north dike. Note heavy vegetation on interior slope.

4 Looking east from west dike, near pump station.

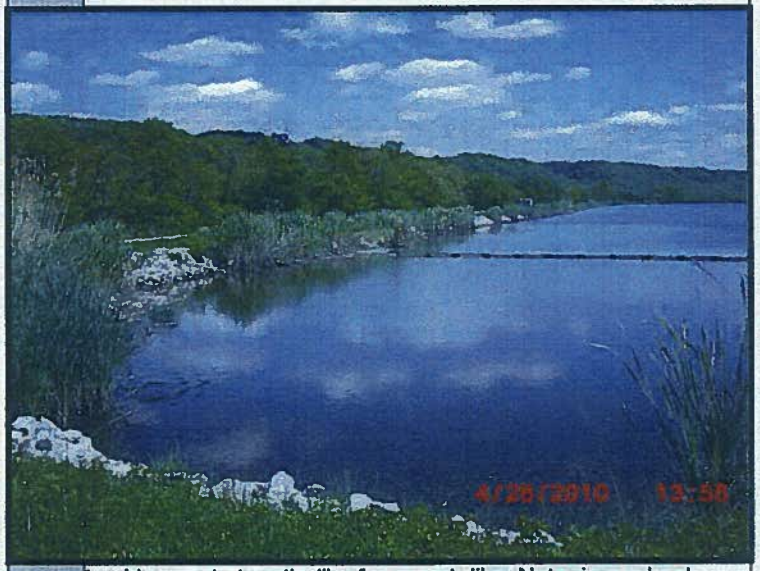
SS CBI 000062

S&ME	Spurlock Power Station Ash Pond – Maysville, KY East Kentucky Power Cooperative – Winchester, KY	S&ME Project # 1831105580	
		Taken by: MEM	Date Taken: 4-28-10

5 Looking southeast to pump station from west dike.



6 Looking east at pump station and intake piping.



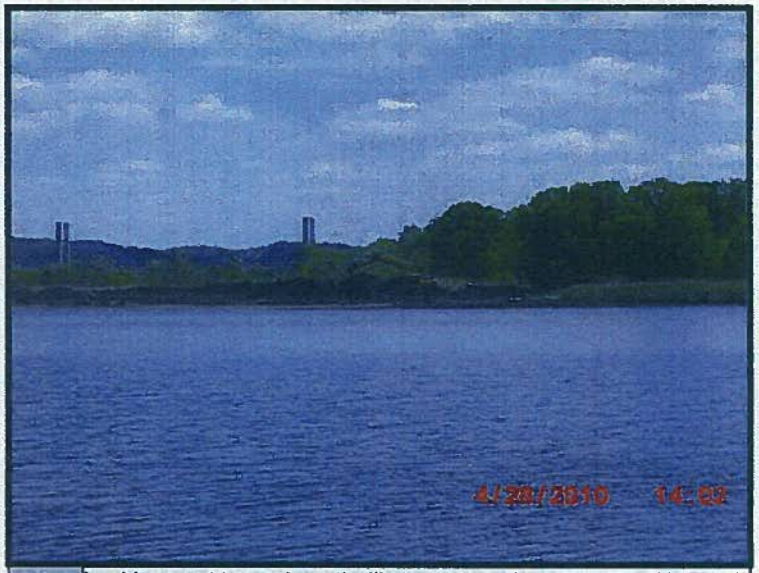
7 Looking east at north dike from west dike. Note rip-rap bank protection and heavy vegetation on interior slopes.

8 Looking east along north dike showing graveled roadway.

SS CBI 000063

S&ME	Spurlock Power Station Ash Pond – Maysville, KY East Kentucky Power Cooperative – Winchester, KY	S&ME Project # 1831105580	
		Taken by: MEM	Date Taken: 4-28-10

9 Looking south toward south/west dike. Note skimmer line and pump station in addition to rip-rap protection.



10 Looking east toward south dike, near southeast corner. Note ash pile excavation.

11 Looking west from north dike. Note heavy vegetation on interior slope.

12 Looking east along toe of north dike (slope approx. 2:1).

SS CBI 000064

S&ME	Spurlock Power Station Ash Pond – Maysville, KY East Kentucky Power Cooperative – Winchester, KY	S&ME Project # 1831105580	
		Taken by: MEM	Date Taken: 4-28-10

Doc 07: S&ME Engineering Study For Seepage

ENGINEERING STUDY FOR SEEPAGE AT SPURLOCK ASH POND

S&ME Project No. 1831-10-5580

Prepared for:

EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy® Cooperative

4775 Lexington Road
Winchester, Kentucky

Prepared by:
S&ME, Inc.
422 Codell Drive
Lexington, Kentucky 40509

S&ME
ENGINEERING INTEGRITY

October 2010

SS CBI 000101

Ash Storage Pond

Engineering Study
For Seepage
Spurlock Power Station
Maysville, Kentucky

1. Introduction

S&ME, Inc. (formerly QORE, Inc.) was retained by East Kentucky Power Cooperative (EKPC) to perform engineering services for the evaluation of seepage along the west end of the north dike and the east end of the south dike. These wet areas were identified on the Stantec drawing entitled Observed Physical Features, dated August 2009.

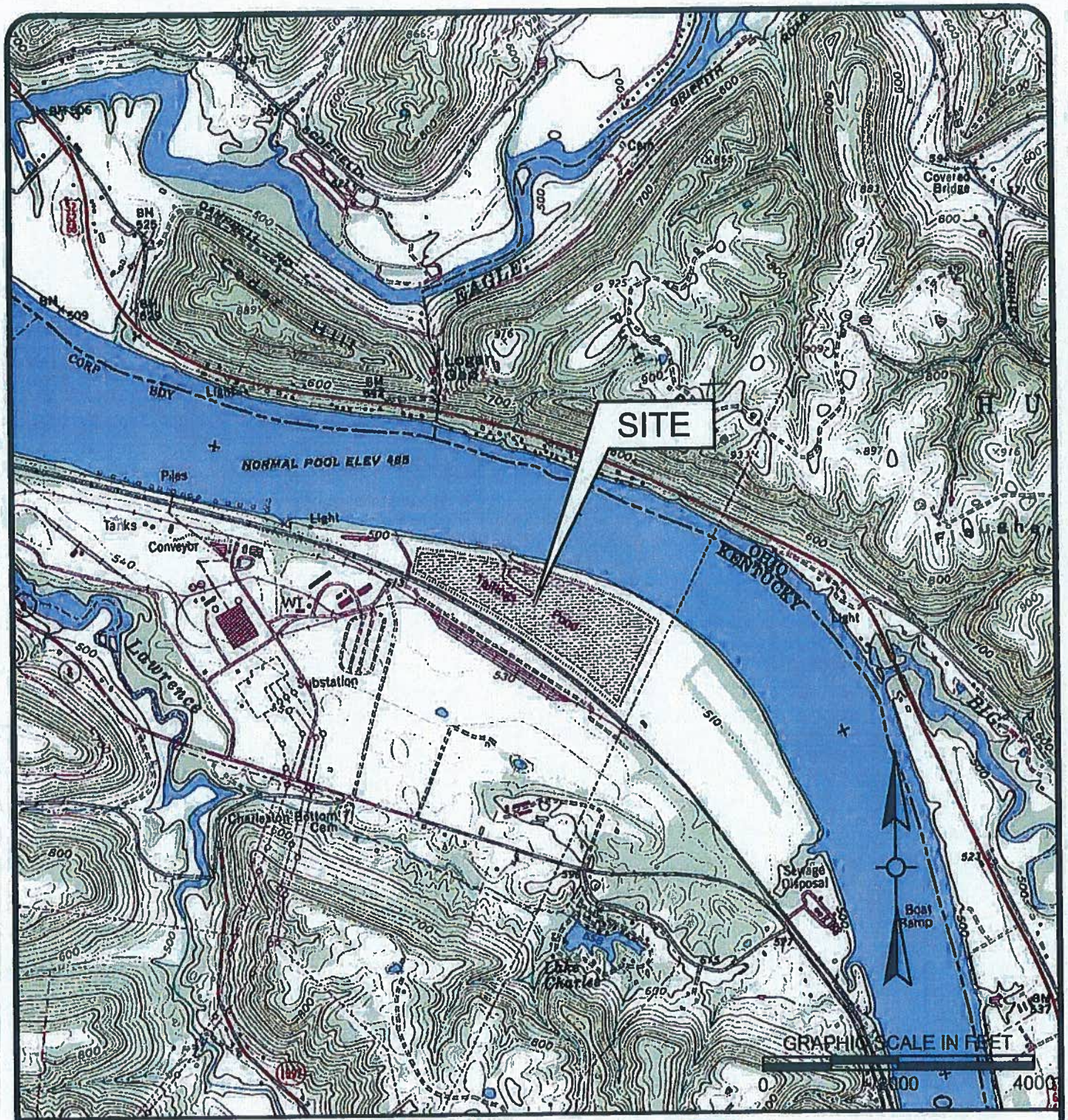
Field evaluation and reconnaissance was performed by Mr. Michael E. Merriman, PE, and Alan Leake, PLS of S&ME.

2. Site Information

Spurlock Power Station is located near Maysville in Mason County, Kentucky and is owned by East Kentucky Power Cooperative of Winchester, Kentucky. Spurlock Station is located adjacent to KY 8 on the south, Inland Container on the east and the Ohio River on the north.

The ash storage pond is located just south of the Ohio River (Mile 413) at the northeast corner of the station property (**See Figure 1**). The area of the pond is approximately 69 acres (measured at the existing water elevation). Based on field survey information, the average top of dike elevation was 528.0 with a pond elevation of 526.6. The perimeter of the dam is approximately 8,772 feet (1.66 miles). For the Ohio River, the normal pool elevation is 485.0 and the base flood (100-yr) elevation is 515.0.

Interior and exterior slopes of approximately 3:1 (H:V) were proposed along the dike walls, except along the north (river) side, where the exterior slope is approximately 2:1. The top width of the dike is approximately 16 feet and is gravel-covered for access. The dam structure is classified as a Class (A) – Low Hazard Structure type in accordance with guidelines from the Kentucky Department of Environmental Protection (Division of Water). This classification applies to structures located such that failure would cause loss of the structure itself but little or no additional damage to other property.



EAST KENTUCKY POWER COOPERATIVE
WINCHESTER, KENTUCKY
PHONE: (859) 744-4812

EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy Cooperative

SCALE:	1" = 2000'
DATE:	6/2/2010
DRAWN BY:	RLW
PROJECT NO:	24305580

S&ME
WWW.SMEINC.COM
422 CODELL DRIVE, LEXINGTON, KY 40509
PHONE: 859.293.5518

SITE LOCATION MAP
SPURLOCK POWER STATION
MAYSVILLE, KENTUCKY

FIGURE NO.
1

SS CBI 000103

3. Evaluation

To evaluate the observed wet areas S&ME installed three (3) nested piezometers along the northern dike, drilled shallow soil test borings in the area of the identified wet areas on the northern dike, and made several site visits to observe the ground conditions in the Stantec identified wet areas (**See Figure 2**).

Several shallow soil test borings were advanced in the area on the west end of the north dike that Stantec had identified as a possible seepage area. At the time of our soil borings, the ground was damp from a recent rain event. Our borings did not indicate evidence of a high water table and the soil was moist and not wet.

In the "seep/wet" areas indentified in the Stantec report along the northern dike, S&ME excavated shallow sump holes and left them open to observe if water seeped into the sumps. Over time we did not observe any water seeping into the sumps and the holes were filled back in.

At three (3) locations along the northern dike, including the wet area identified in the Stantec report, S&ME installed cluster piezometers. One piezometer was installed with a screen interval from 25 to 30 feet below the ground surface. Next to this piezometer, we installed another piezometer at a depth of 10 to 15 feet with a screen interval also at the bottom five feet of the borehole. The piezometers were backfilled with filter pack sand, a bentonite seal, and then grouted to the surface. The shallower piezometers screened intervals are isolated in the upper horizon described as a silty clay and sandy clay layer that extends along the northern dike and overlies the silty sand that extends 30 feet below the ground surface (bgs).

We have taken three readings thus far: June 2, 2010; July 30, 2010; and September 9, 2010. The readings show that the deeper piezometers (designated P-1B, P-2B, P-3B) indicated a phreatic surface that corresponded with the elevation of the adjoining Ohio River. This represents the stable or natural groundwater table. The shallower piezometers (designated P-1A, P-2A, P-3A) also showed a consistent phreatic surface that occurs approximately eight (8) feet below the ground surface at Piezometers No. 1 and No. 3, and approximately 12 feet bgs at Piezometer No. 2. The elevation of the upper phreatic surface has not changed appreciably over the three readings (**See Appendix A**).

During our site visits we documented the ground conditions at the three "seep/wet" areas identified on the Stantec drawing (Observed Physical Features). On the northern dike in all of our visits the ground was dry and firm with the exception of May 4, 2010, immediately after heavy rains from the previous weekend when approximately 8-10 inches of rainfall was recorded at the site. However, we noted that the ground surface was dry and firm

FIGURE 2	PREVIOUSLY IDENTIFIED SEEP / WET AREAS ASH STORAGE POND SPURLOCK POWER STATION MAYSVILLE, KENTUCKY	S&ME 422 CODELL DRIVE LEXINGTON, KY 40509 (859)293-6618 WWW.SMEINC.COM
SCALE: 1"=600'		
PROJECT NO. 1831-10-5580		
DATE: OCT., 2010		

approximately four weeks later. We did observe, periodically, water standing in the southeast corner of the pond, as identified on the Stantec drawing. We observed water only after rain events and only when water was flowing within the adjacent railroad ditch.

In our opinion, the three "seep/wet" areas identified on the Stantec drawing *Observed Physical Features* dated August 2009 are not from leaks or seepage from the Spurlock Ash Pond.

- For the northern dike, our multiple observations and explorations confirmed the ground is dry, except immediately after a rain event.

- For the southeast corner of the dike, the wet areas appear to be associated with the adjacent ditch along the railroad. Water from the ditch is allowed to migrate to this area because of negative drainage patterns.

- We identified a groundwater table beneath the embankment that corresponds with the adjacent Ohio River level. This water table occurs in the sand horizon beneath the overlying silty clay horizon.

- We identified an upper phreatic surface that is confined to the clay horizon. This phreatic surface did not rise to the ground surface and appears to be the seepage line associated with the impoundment. The phreatic line is eight (8) to 12 feet below the toe of the embankment.

4. Recommendations

The following recommendations are suggested to remove standing water from around the dam and to promote positive drainage to existing swales or ditching located in the vicinity of the study area.

- Re-grading the low-lying areas noted in this report will reduce the potential for ponding water around the dam embankment.

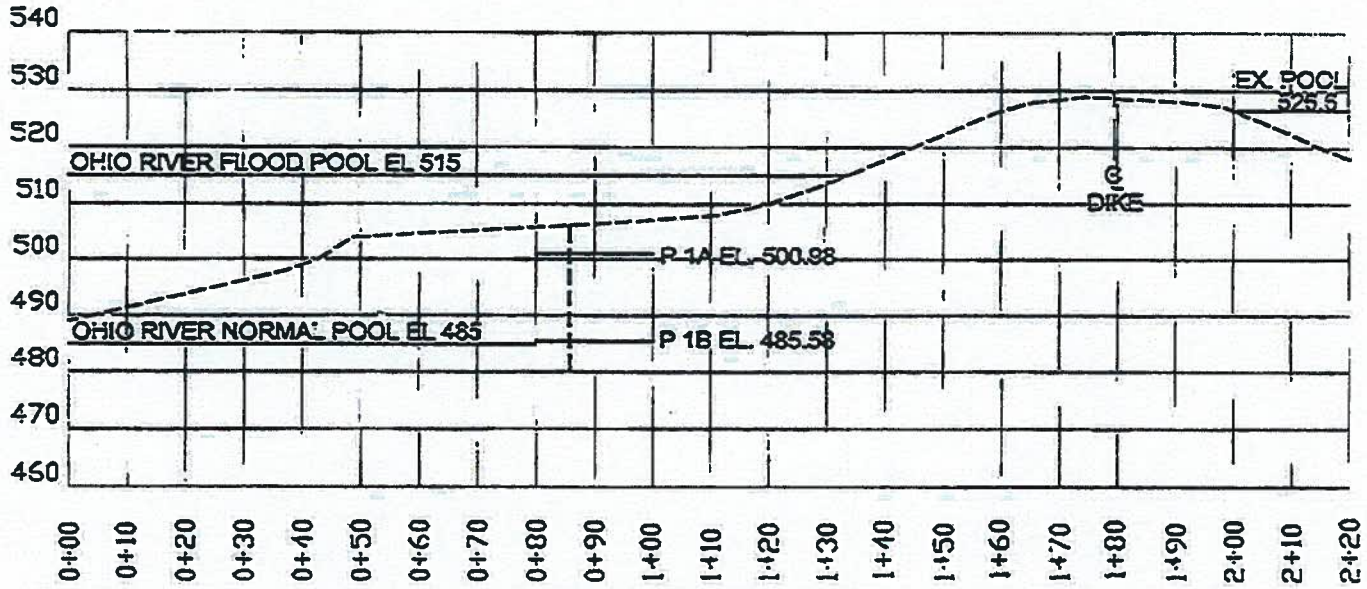
- Maintenance staff at the plant should continue to monitor this location for signs of flow, leaks, or change in water color or clarity. Any noted changes should be made known to the appropriate plant personnel. Guidelines for corrective action for this condition are noted in the Emergency Action Plan and should be followed to the maximum extent practical.

- No other remediation or corrective actions are necessary at this time. Readings on the instrumentation will continue at 3-month intervals and updates to this report will be included as an addendum. If any changes to the field readings warrant immediate action, S&ME will notify EKPC staff.

[END OF REPORT]

APPENDIX A

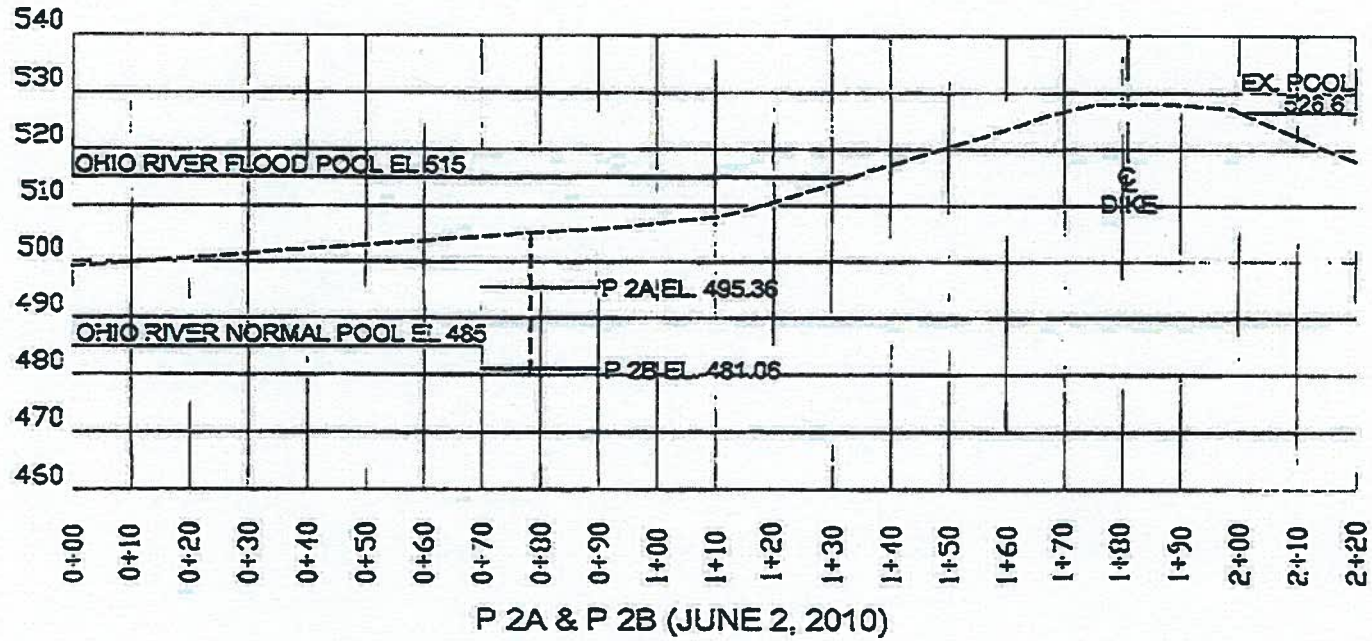
- Piezometer Readings
  - P-1A
  - P-1B
  - P-2A
  - P-2B
  - P-3A
  - P-3B



P 1A & P 1B (JUNE 2, 2010)

SPURLOCK ASH POND
PIEZOMETER READINGS

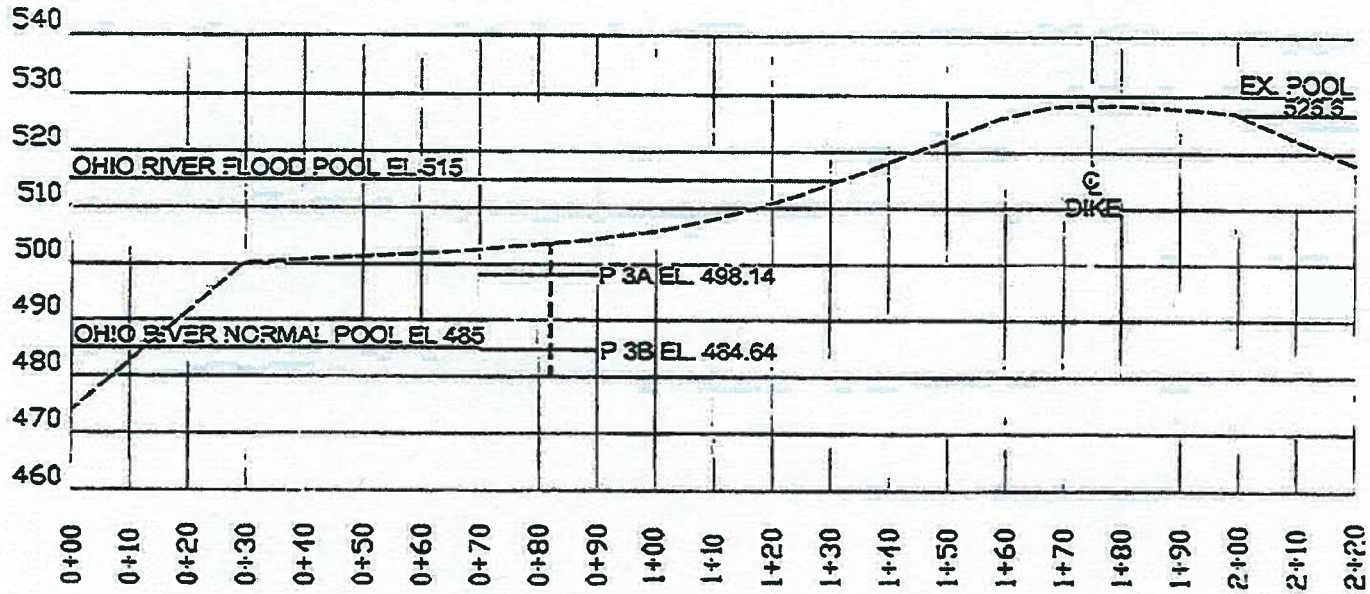
SS CBI 000108



P 2A & P 2B (JUNE 2, 2010)

SPURLOCK ASH POND
PIEZOMETER READINGS

SS CBI 000109



P 3A & P 3B (JUNE 2, 2010)

SPURLOCK ASH POND
PIEZOMETER READINGS

SS CBI 000110

Doc 08: Miscellaneous Maps & Drawings

Miscellaneous Maps & Drawings

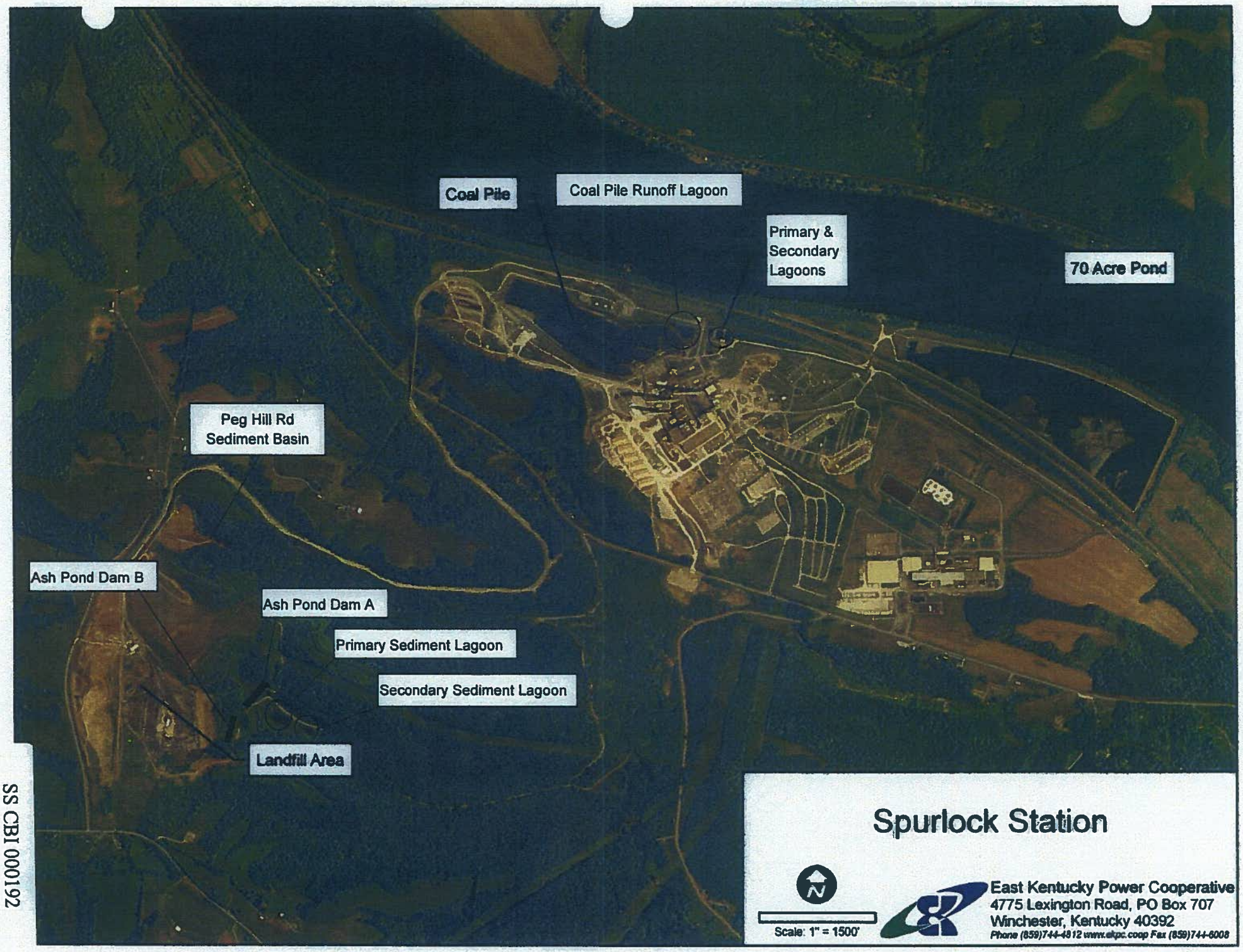
Ash Storage Pond

Spurlock Power Station

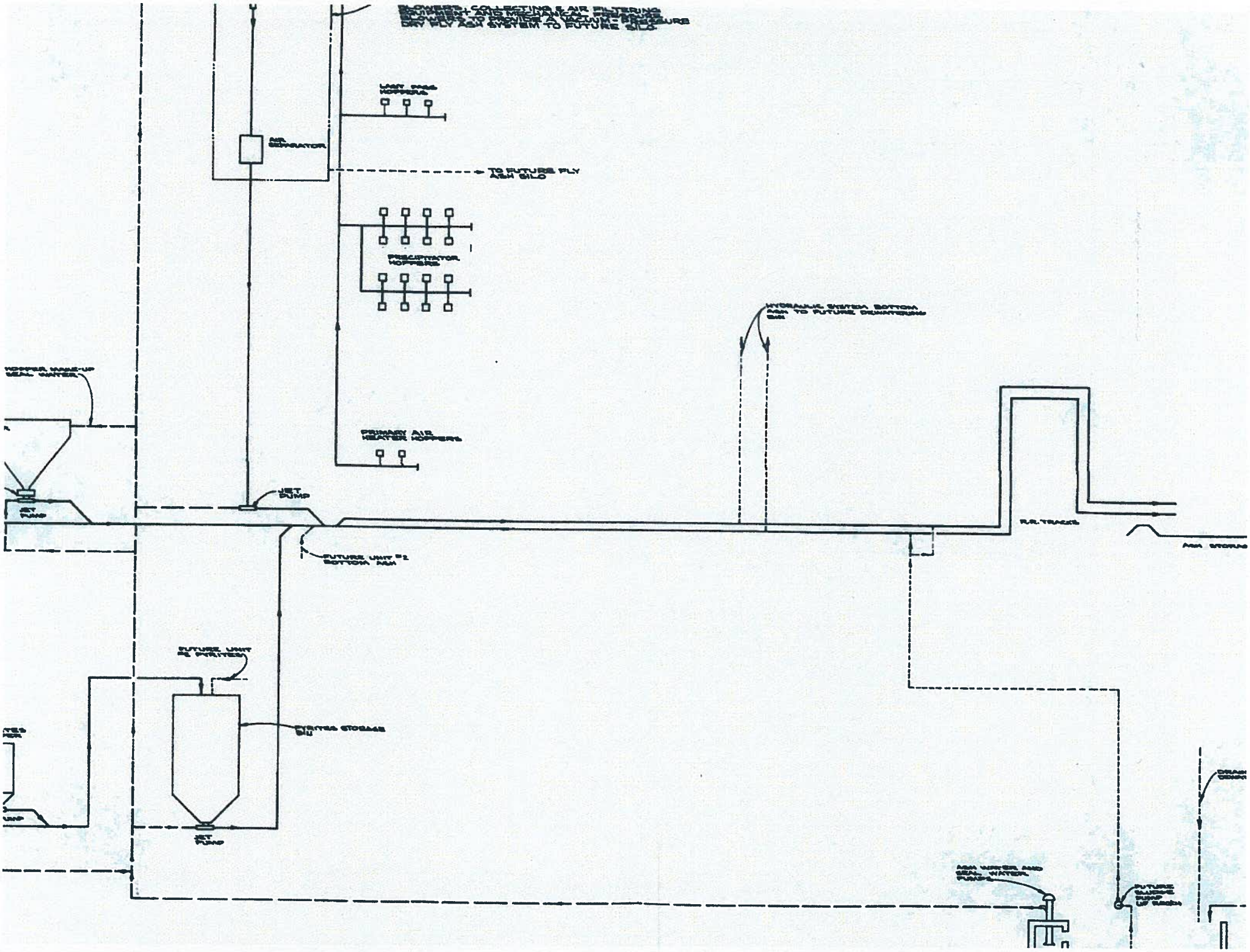
EAST KENTUCKY POWER COOPERATIVE

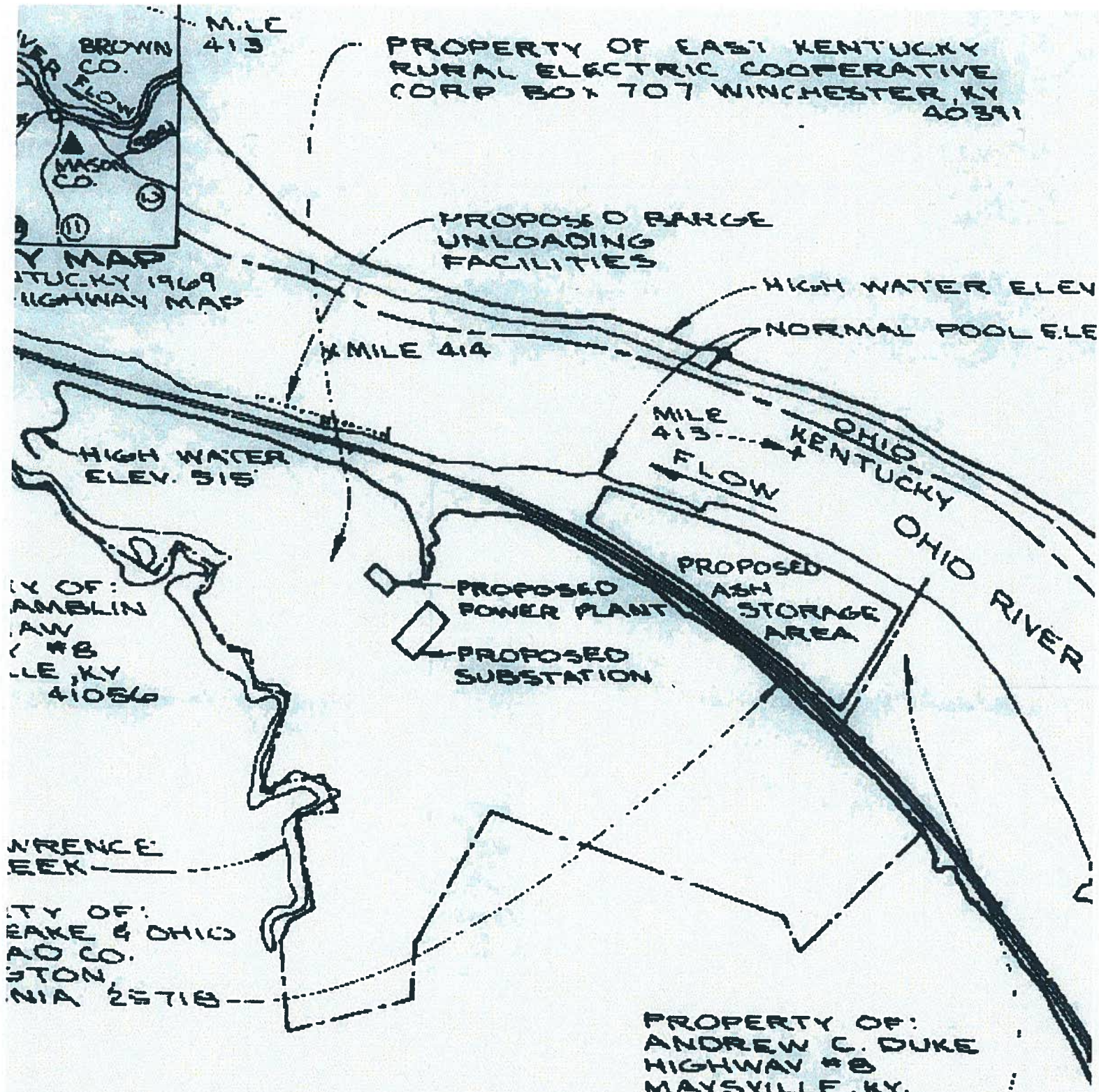
A Touchstone Energy® Cooperative

SS CBI 000191



SS CBI 000192


AIR SEPARATOR
TO FUTURE FLY ASH SILO
PRECIPITATOR HOPPERS
PRIMARY AIR HEATER HOPPERS
JET PUMP
JET PUMP
FUTURE UNIT #2 BOTTOM ASH
R.R. TRACKS
FUTURE UNIT #2 PRECIPITATOR
JET PUMP



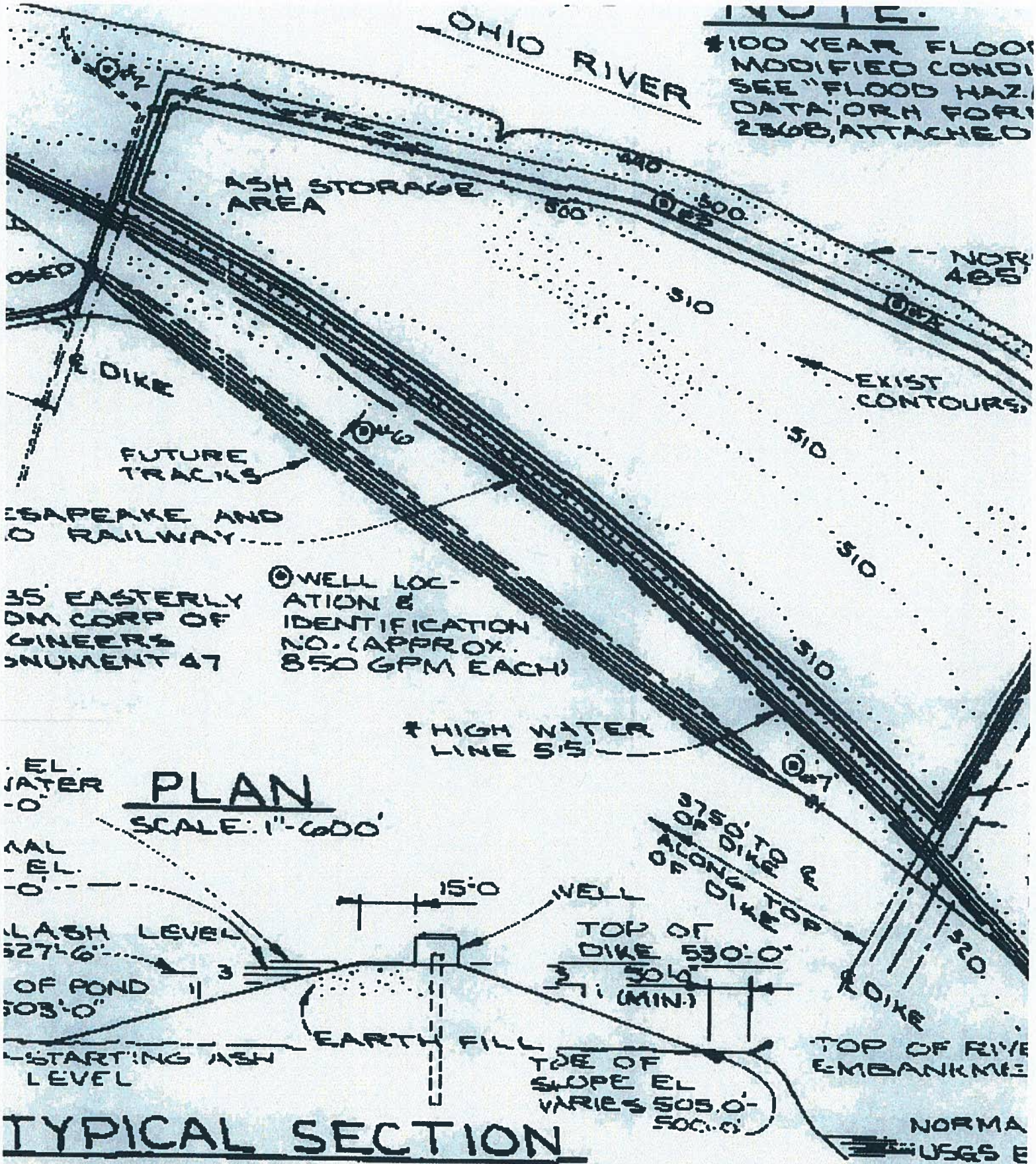
SITE LOCATION

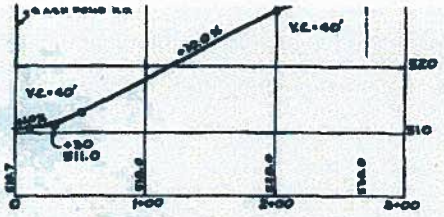
2000' 4000'

E: 1" = 2000'

RESS | SCALE 1" = 2000'

PROPOSED ASH STORAGE AREA ON OHIO RIVER AT MILE 413 NEAR MAYSVILLE, KENTUCKY

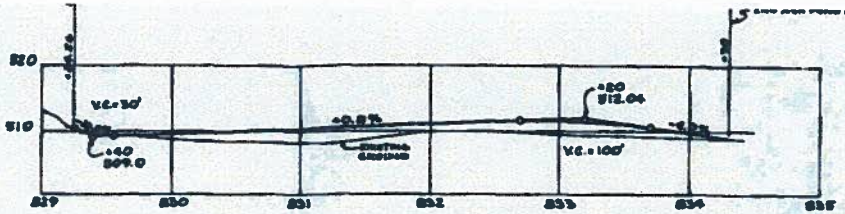

OHIO RIVER
NOTE:
#100 YEAR FLOOD
MODIFIED CONDI
SEE "FLOOD HAZ.
DATA" ORH FOR
2568, ATTACHED
ASH STORAGE AREA
500
510
NOR
485'
EXIST CONTOURS
DIKE
FUTURE TRACKS
ESAPEAKE AND
O RAILWAY
35' EASTERLY
DM CORP OF
GINEERS
ONUMENT 47
WELL LOCATION & IDENTIFICATION NO. (APPROX. 850 GPM EACH)
HIGH WATER LINE 515'
PLAN
SCALE: 1"-600'
375'0" TO DIKE & ALONG TOP OF DIKE
15'-0
WELL
TOP OF DIKE 530'-0"
50'-0"
3:1 (MIN.)
ASH LEVEL
527'-6"
OF POND
503'-0"
EARTH FILL
TOE OF SLOPE EL VARIES 505.0'-500.0'
STARTING ASH LEVEL
TOP OF RIVE
EMBANKME
NORMA
USGS E
TYPICAL SECTION
SCALE: NONE
600'
1200'
SCALE 1" = 600'
REV.2 5-5-72
REV.1 12-16-71
1" = 200'
PROPOSED ASH STORAGE AREA
ON OHIO RIVER
AT MILE 413 NEAR MAYSVIL



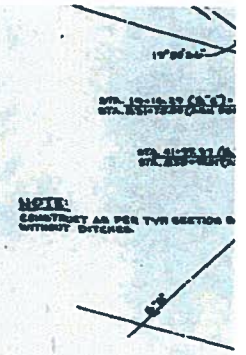
PROFILE-VEHICLE RAMP▲

NOTE:
RAMP TO RECEIVE 4" AGGREGATE SURFACING, 10' WIDE.

▲



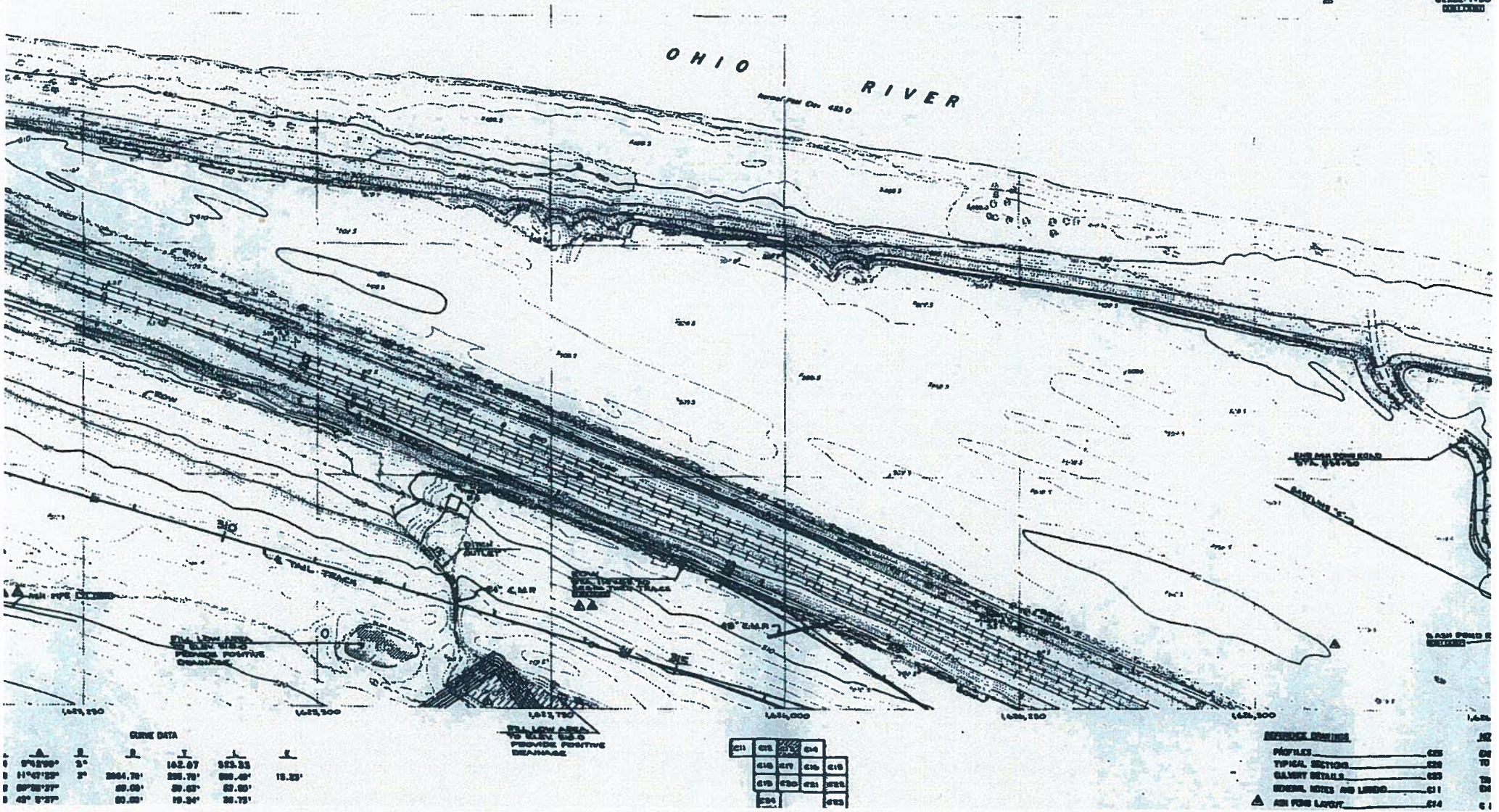
PROFILE-ASH POND ROAD▲



NOTE:
CONSTRUCT AS PER TYP SECTION B WITHOUT DITCHES.

ASH POND ROA

▲

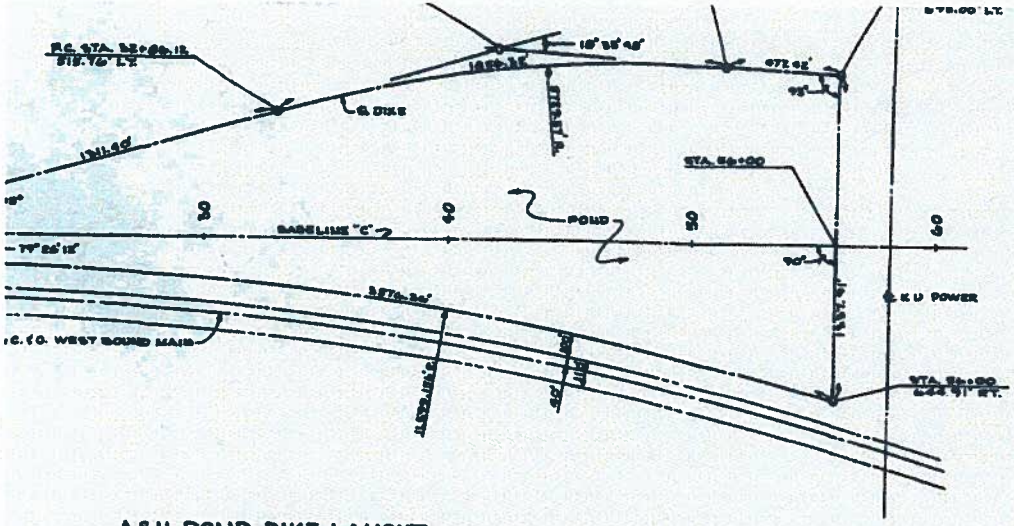


CURVE DATA

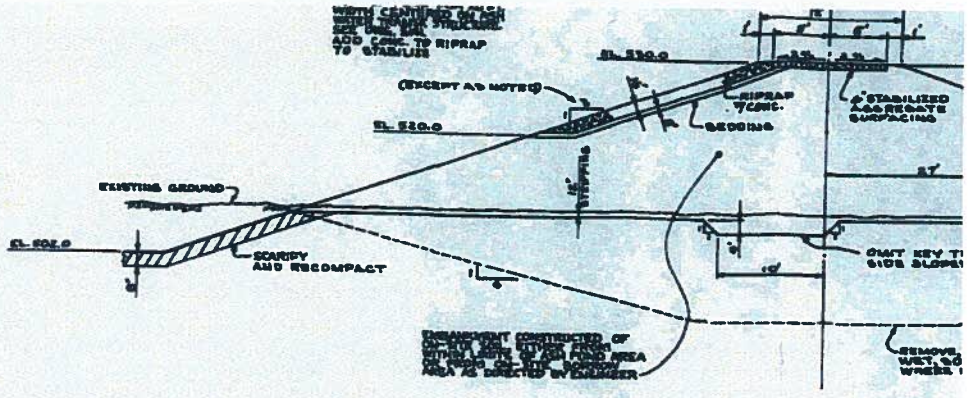
Δ	D	R	T	L	E
5°43'00"	2°		162.07	323.33	
11°47'23"	2°	2864.79'	298.79'	589.49'	15.33'
89°58'27"		50.00'	50.01'	62.83'	
45° 0'27"		50.00'	19.24'	39.29'	

REFERENCE DRAWINGS

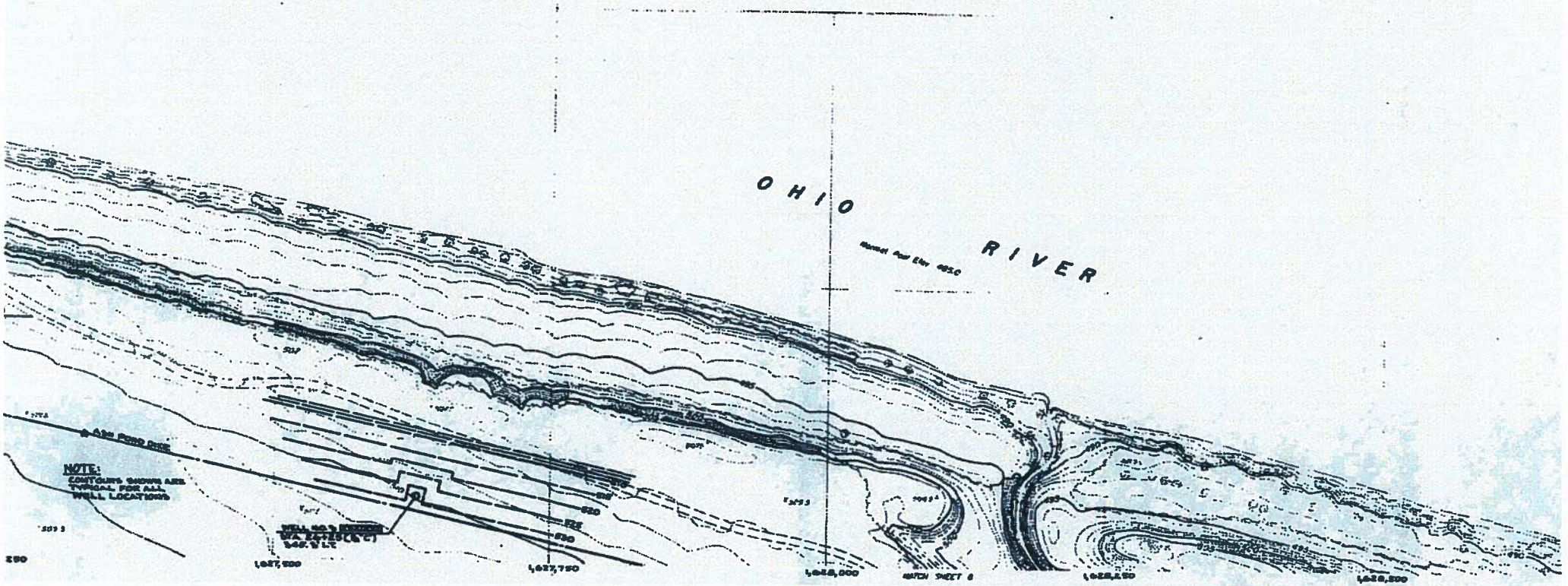
PROFILES	C25
TYPICAL SECTIONS	C30
CULVERT DETAILS	C33
GENERAL NOTES AND LEGEND	C11
▲ ASH POND LAYOUT	C14



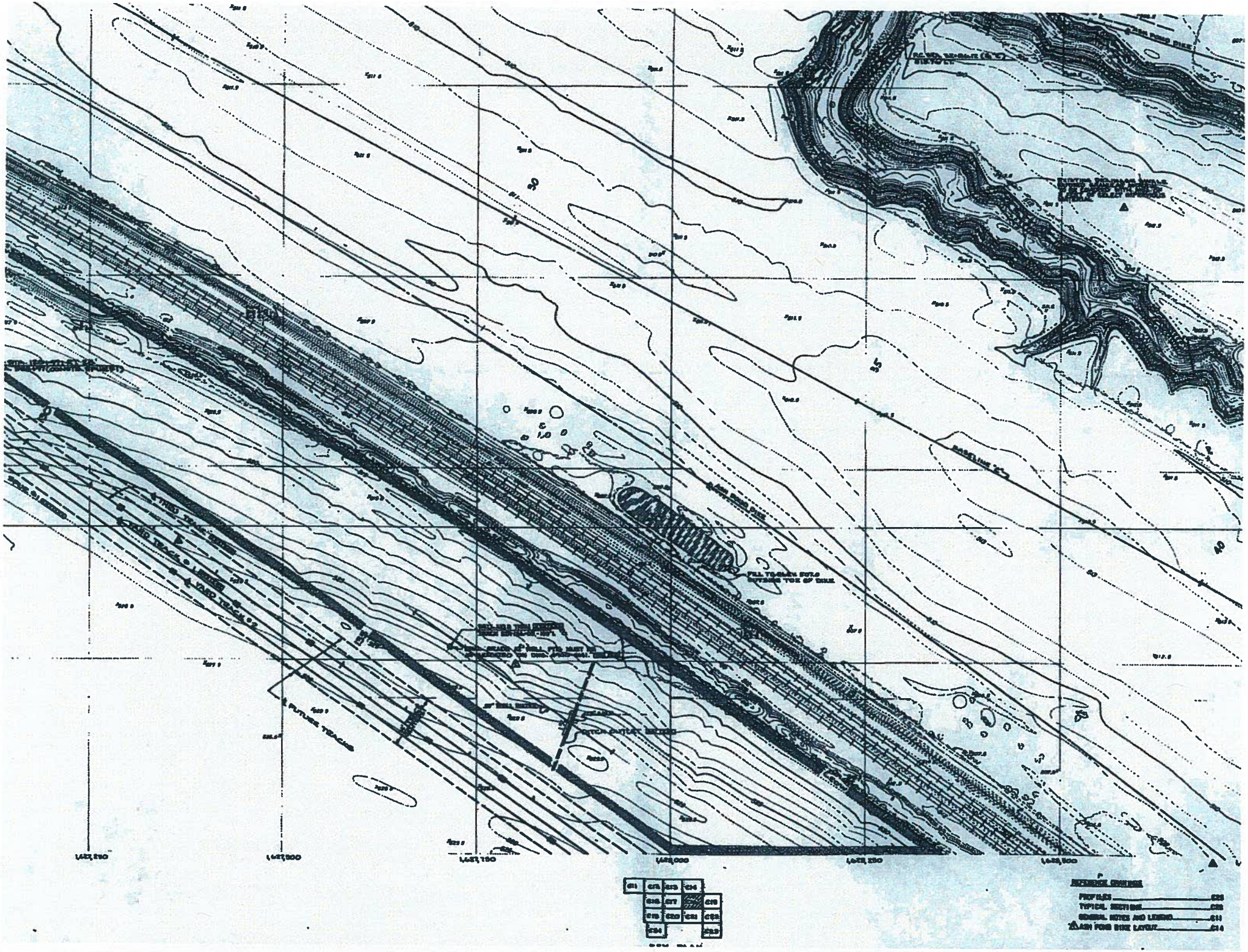
ASH POND DIKE LAYOUT
SCALE: 1" = 200'

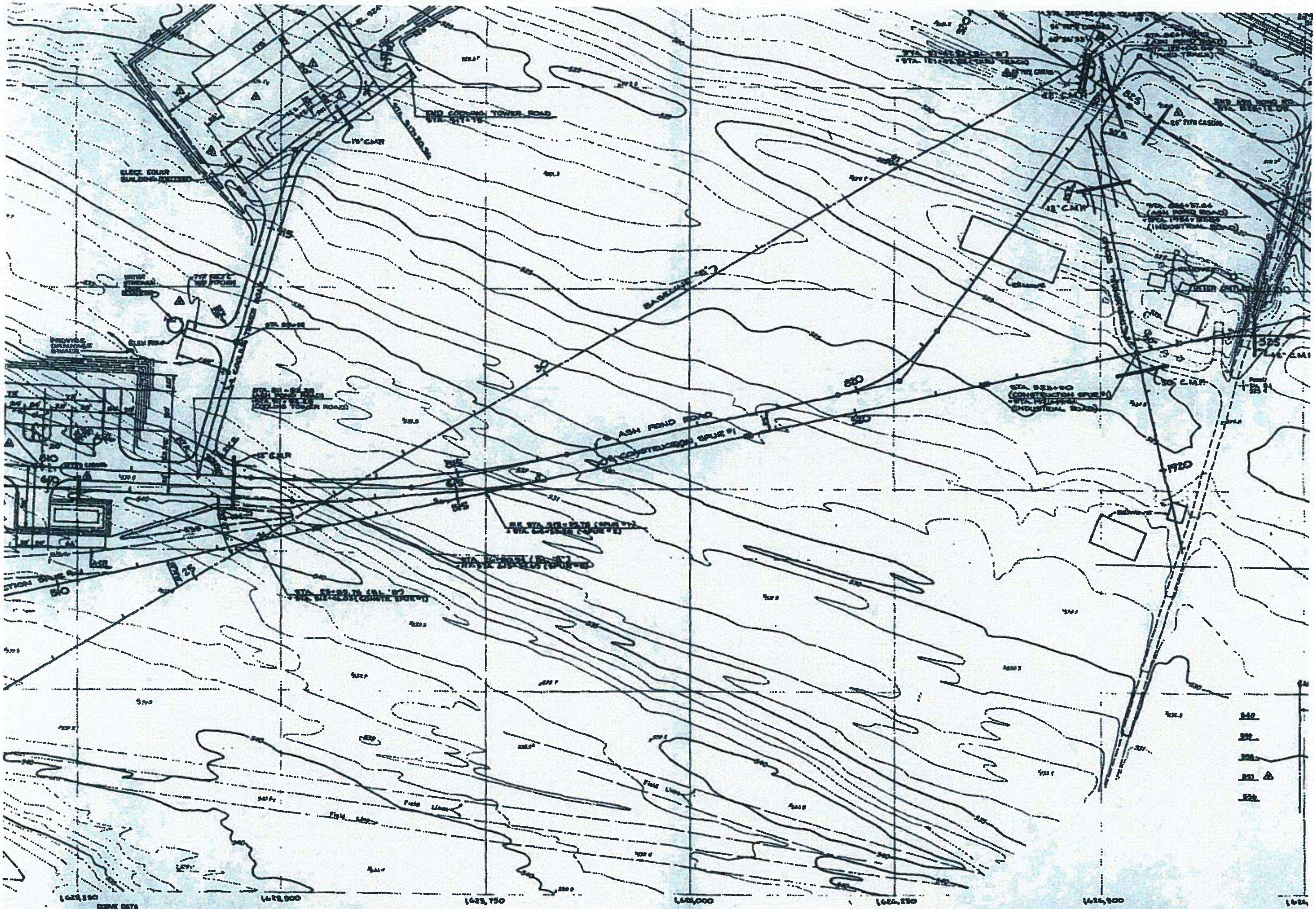


TYPICAL SECTION
ASH POND DIKE
NO SCALE



OHIO RIVER
PROFILE - SPECIAL DITCH "D"
TYPICAL SPECIAL DITCH


FILL TO MATCH EXISTING TOE OF DIKE
FUTURE TRACK
REFERENCE DRAWINGS
PROFILES
TYPICAL SECTIONS
GENERAL NOTES AND LEGEND
DIKE FOOD SITE LAYOUT



P.I. STA.	Δ	D	R	T	L	E
	7°08'10"	12°	477.46'	29.84'	59.61'	0.93'
1+05.08	11°47'23"	2°	2864.79'	295.79'	589.46'	15.23'
2+79.85	42°33'11"	12°	477.46'	175.39'	337.94'	31.54'
3+34.85	8°24'13"	12°	477.46'	35.08'	70.03'	1.29'
4+42.34	13°23'25"	4°	1432.50'	168.06'	336.91'	13.31'
5+63.58	42°17'26"		200.0'	77.36'	147.63'	14.44'
6+47.57	90°00'00"		50.0'	50.0'	78.54'	20.71'
7+08.51	103°48'36"		50.0'	63.66'	94.08'	34.67'
8+05.82	29°04'46"		100.0'	26.16'	57.62'	8.00'

CURVE DATA

REMARKS

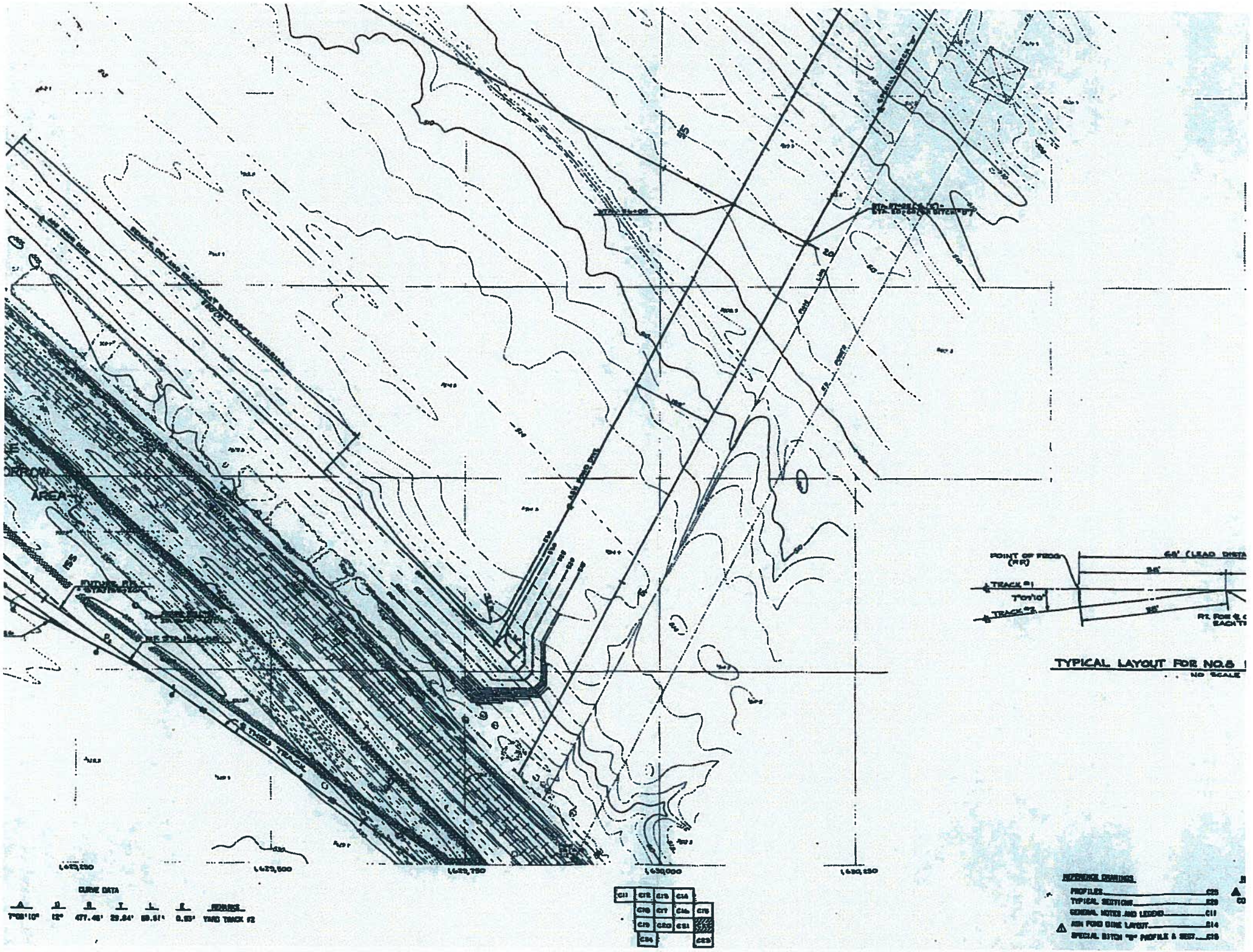
P.I. = 28' RT. - STA. 128+20 (THRU TRACK)

△ NOTES:

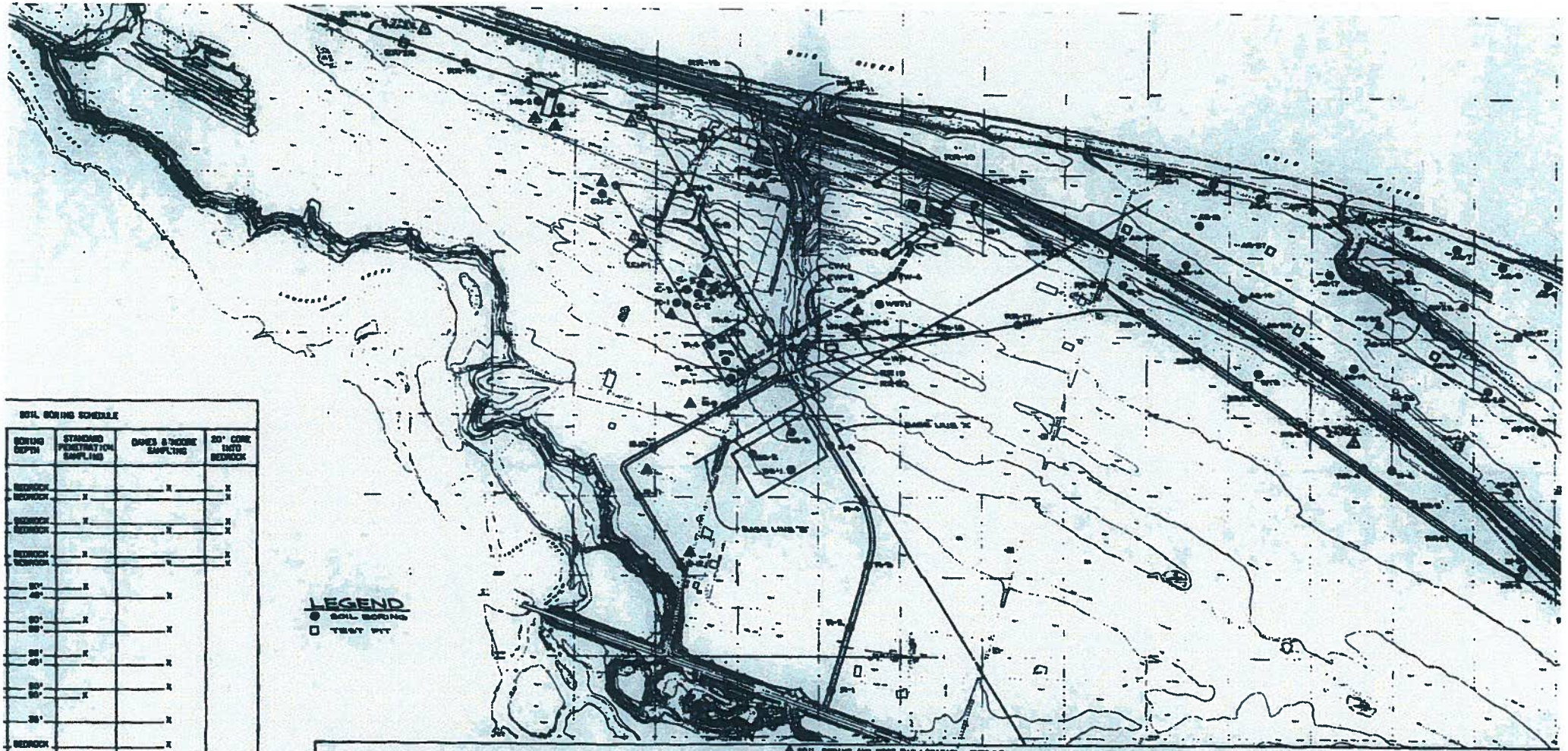
ALL WORK ON THIS DRAWING BY CONTRACTS 241 & 242 EXCEPT AS NOTED.

REFERENCE DRAWINGS:

- PROFILES ______ C21, C26 & C27
- TYPICAL SECTIONS ______ C8
- CULVERT DETAILS ______ C8
- STRUCTURE REMOVAL ______ C19
- GENERAL NOTES AND LEGEND ______ C11
- △ ASH POND DIKE LAYOUT ______ C14


TYPICAL LAYOUT FOR NO.8
NO SCALE
CURVE DATA
REFERENCE DRAWINGS
PROFILES
TYPICAL SECTIONS
GENERAL NOTES AND LEGEND
ASH POND DIKE LAYOUT
SPECIAL DITCH "B" PROFILE & SECT.


OHIO RIVER
PHOTO REDUCED COPY
STANLEY CONSULTANTS
EAST KENTUCKY RURAL ELECTRIC COOPERATIVE CORPORATION
CHARLESTON BOTTOMS STATION
PLANT SITE ARRANGE

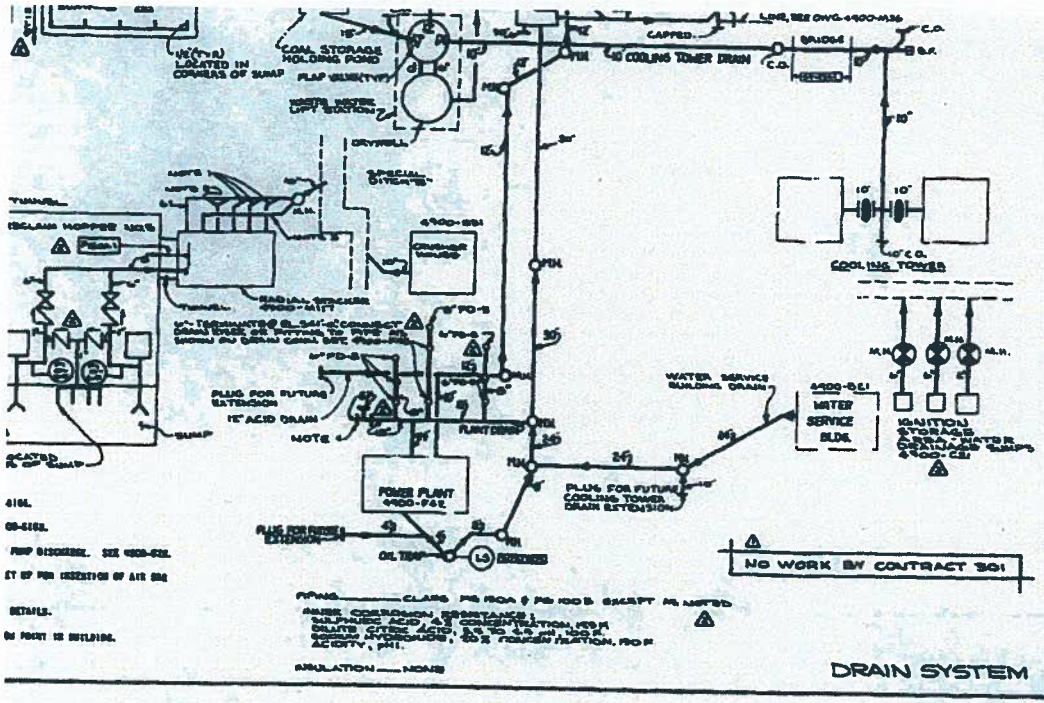


SOIL BORING SCHEDULE

BORING DEPTH	STANDARD PENETRATION SAMPLING	DAVIS & MOORE SAMPLING	20' CORE INTO BEDROCK
BEDROCK		X	X
BEDROCK	X		X
BEDROCK			
BEDROCK	X	X	X
BEDROCK			
BEDROCK	X		X
BEDROCK		X	X
80'	X		
85'		X	
90'	X		
95'		X	
95'	X		
100'		X	
100'	X		
105'		X	
110'		X	
BEDROCK		X	
90'	X		
95'		X	
95'		X	
100'		X	
100'		X	
105'		X	
110'		X	
115'		X	
120'		X	
125'		X	
130'		X	
135'		X	
140'		X	
145'		X	
150'		X	
155'		X	
160'		X	
165'		X	
170'		X	
175'		X	
180'		X	
185'		X	
190'		X	
195'		X	
200'		X	
205'		X	
210'		X	
215'		X	
220'		X	
225'		X	
230'		X	
235'		X	
240'		X	
245'		X	
250'		X	
255'		X	
260'		X	
265'		X	
270'		X	
275'		X	
280'		X	
285'		X	
290'		X	
295'		X	
300'		X	
305'		X	
310'		X	
315'		X	
320'		X	
325'		X	
330'		X	
335'		X	
340'		X	
345'		X	
350'		X	
355'		X	
360'		X	
365'		X	
370'		X	
375'		X	
380'		X	
385'		X	
390'		X	
395'		X	
400'		X	
405'		X	
410'		X	
415'		X	
420'		X	
425'		X	
430'		X	
435'		X	
440'		X	
445'		X	
450'		X	
455'		X	
460'		X	
465'		X	
470'		X	
475'		X	
480'		X	
485'		X	
490'		X	
495'		X	
500'		X	
505'		X	
510'		X	
515'		X	
520'		X	
525'		X	
530'		X	
535'		X	
540'		X	
545'		X	
550'		X	
555'		X	
560'		X	
565'		X	
570'		X	
575'		X	
580'		X	
585'		X	
590'		X	
595'		X	
600'		X	
605'		X	
610'		X	
615'		X	
620'		X	
625'		X	
630'		X	
635'		X	
640'		X	
645'		X	
650'		X	
655'		X	
660'		X	
665'		X	
670'		X	
675'		X	
680'		X	
685'		X	
690'		X	
695'		X	
700'		X	
705'		X	
710'		X	
715'		X	
720'		X	
725'		X	
730'		X	
735'		X	
740'		X	
745'		X	
750'		X	
755'		X	
760'		X	
765'		X	
770'		X	
775'		X	
780'		X	
785'		X	
790'		X	
795'		X	
800'		X	
805'		X	
810'		X	
815'		X	
820'		X	
825'		X	
830'		X	
835'		X	
840'		X	
845'		X	
850'		X	
855'		X	
860'		X	
865'		X	
870'		X	
875'		X	
880'		X	
885'		X	
890'		X	
895'		X	
900'		X	
905'		X	
910'		X	
915'		X	
920'		X	
925'		X	
930'		X	
935'		X	
940'		X	
945'		X	
950'		X	
955'		X	
960'		X	
965'		X	
970'		X	
975'		X	
980'		X	
985'		X	
990'		X	
995'		X	
1000'		X	

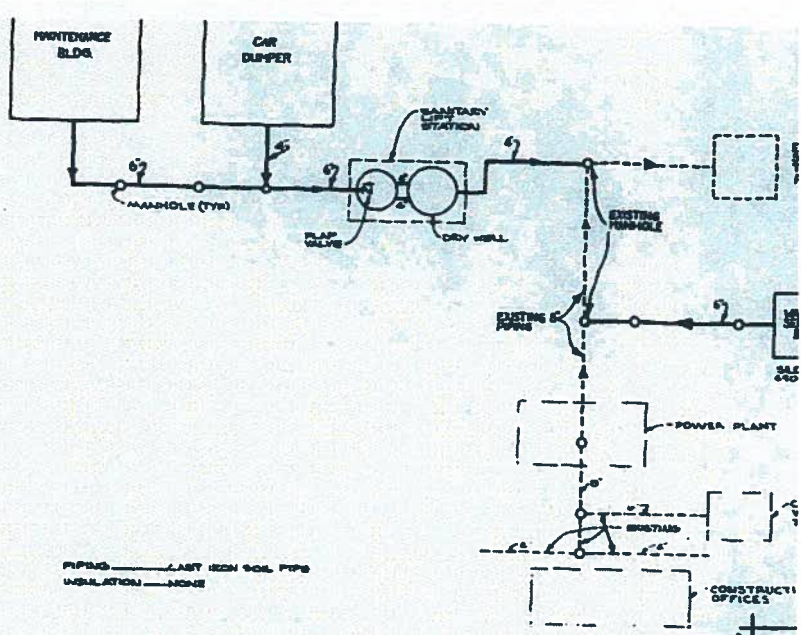
SOIL BORING AND TEST PIT LOCATION SCHEDULE

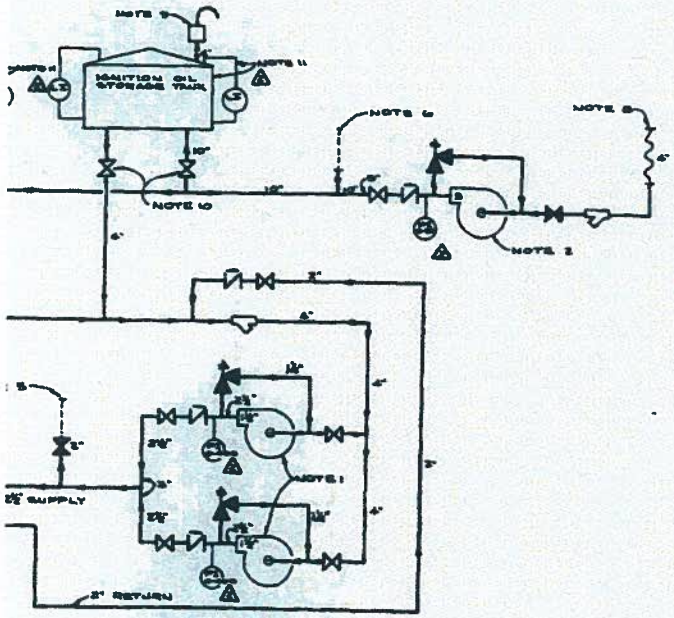
BORING NO.	BASELINE	STATION	OFFSET LEFT OR RIGHT (FEET)	BORING NO.	BASELINE	STATION	OFFSET LEFT OR RIGHT (FEET)	BORING NO.	BASELINE	STATION	OFFSET LEFT OR RIGHT (FEET)	TEST PIT NO.	BASELINE	STATION	OFFSET LEFT OR RIGHT (FEET)
B-1	TAIL TRACK	1+00	0	B-1	TAIL TRACK	1+00	0	B-1	TAIL TRACK	1+00	0	TP-1	TAIL TRACK	1+00	0
B-2	TAIL TRACK	2+00	0	B-2	TAIL TRACK	2+00	0	B-2	TAIL TRACK	2+00	0	TP-2	TAIL TRACK	2+00	0
B-3	TAIL TRACK	3+00	0	B-3	TAIL TRACK	3+00	0	B-3	TAIL TRACK	3+00	0	TP-3	TAIL TRACK	3+00	0
B-4	TAIL TRACK	4+00	0	B-4	TAIL TRACK	4+00	0	B-4	TAIL TRACK	4+00	0	TP-4	TAIL TRACK	4+00	0
B-5	TAIL TRACK	5+00	0	B-5	TAIL TRACK	5+00	0	B-5	TAIL TRACK	5+00	0	TP-5	TAIL TRACK	5+00	0
B-6	TAIL TRACK	6+00	0	B-6	TAIL TRACK	6+00	0	B-6	TAIL TRACK	6+00	0	TP-6	TAIL TRACK	6+00	0
B-7	TAIL TRACK	7+00	0	B-7	TAIL TRACK	7+00	0	B-7	TAIL TRACK	7+00	0	TP-7	TAIL TRACK	7+00	0
B-8	TAIL TRACK	8+00	0	B-8	TAIL TRACK	8+00	0	B-8	TAIL TRACK	8+00	0	TP-8	TAIL TRACK	8+00	0
B-9	TAIL TRACK	9+00	0	B-9	TAIL TRACK	9+00	0	B-9	TAIL TRACK	9+00	0	TP-9	TAIL TRACK	9+00	0
B-10	TAIL TRACK	10+00	0	B-10	TAIL TRACK	10+00	0	B-10	TAIL TRACK	10+00	0	TP-10	TAIL TRACK	10+00	0
B-11	TAIL TRACK	11+00	0	B-11	TAIL TRACK	11+00	0	B-11	TAIL TRACK	11+00	0	TP-11	TAIL TRACK	11+00	0
B-12	TAIL TRACK	12+00	0	B-12	TAIL TRACK	12+00	0	B-12	TAIL TRACK	12+00	0	TP-12	TAIL TRACK	12+00	0
B-13	TAIL TRACK	13+00	0	B-13	TAIL TRACK	13+00	0	B-13	TAIL TRACK	13+00	0	TP-13	TAIL TRACK	13+00	0
B-14	TAIL TRACK	14+00	0	B-14	TAIL TRACK	14+00	0	B-14	TAIL TRACK	14+00	0	TP-14	TAIL TRACK	14+00	0
B-15	TAIL TRACK	15+00	0	B-15	TAIL TRACK	15+00	0	B-15	TAIL TRACK	15+00	0	TP-15	TAIL TRACK	15+00	0
B-16	TAIL TRACK	16+00	0	B-16	TAIL TRACK	16+00	0	B-16	TAIL TRACK	16+00	0	TP-16	TAIL TRACK	16+00	0
B-17	TAIL TRACK	17+00	0	B-17	TAIL TRACK	17+00	0	B-17	TAIL TRACK	17+00	0	TP-17	TAIL TRACK	17+00	0
B-18	TAIL TRACK	18+00	0	B-18	TAIL TRACK	18+00	0	B-18	TAIL TRACK	18+00	0	TP-18	TAIL TRACK	18+00	0
B-19	TAIL TRACK	19+00	0	B-19	TAIL TRACK	19+00	0	B-19	TAIL TRACK	19+00	0	TP-19	TAIL TRACK	19+00	0
B-20	TAIL TRACK	20+00	0	B-20	TAIL TRACK	20+00	0	B-20	TAIL TRACK	20+00	0	TP-20	TAIL TRACK	20+00	0
B-21	TAIL TRACK	21+00	0	B-21	TAIL TRACK	21+00	0	B-21	TAIL TRACK	21+00	0	TP-21	TAIL TRACK	21+00	0
B-22	TAIL TRACK	22+00	0	B-22	TAIL TRACK	22+00	0	B-22	TAIL TRACK	22+00	0	TP-22	TAIL TRACK	22+00	0
B-23	TAIL TRACK	23+00	0	B-23	TAIL TRACK	23+00	0	B-23	TAIL TRACK	23+00	0	TP-23	TAIL TRACK	23+00	0
B-24	TAIL TRACK	24+00	0	B-24	TAIL TRACK	24+00	0	B-24	TAIL TRACK	24+00	0	TP-24	TAIL TRACK	24+00	0
B-25	TAIL TRACK	25+00	0	B-25	TAIL TRACK	25+00	0	B-25	TAIL TRACK	25+00	0	TP-25	TAIL TRACK	25+00	0
B-26	TAIL TRACK	26+00	0	B-26	TAIL TRACK	26+00	0	B-26	TAIL TRACK	26+00	0	TP-26	TAIL TRACK	26+00	0
B-27	TAIL TRACK	27+00	0	B-27	TAIL TRACK	27+00	0	B-27	TAIL TRACK	27+00	0	TP-27	TAIL TRACK	27+00	0
B-28	TAIL TRACK	28+00	0	B-28	TAIL TRACK	28+00	0	B-28	TAIL TRACK	28+00	0	TP-28	TAIL TRACK	28+00	0
B-29	TAIL TRACK	29+00	0	B-29	TAIL TRACK	29+00	0	B-29	TAIL TRACK	29+00	0	TP-29	TAIL TRACK	29+00	0
B-30	TAIL TRACK	30+00	0	B-30	TAIL TRACK	30+00	0	B-30	TAIL TRACK	30+00	0	TP-30	TAIL TRACK	30+00	0
B-31	TAIL TRACK	31+00	0	B-31	TAIL TRACK	31+00	0	B-31	TAIL TRACK	31+00	0	TP-31	TAIL TRACK	31+00	0
B-32	TAIL TRACK	32+00	0	B-32	TAIL TRACK	32+00	0	B-32	TAIL TRACK	32+00	0	TP-32	TAIL TRACK	32+00	0
B-33	TAIL TRACK	33+00	0	B-33	TAIL TRACK	33+00	0	B-33	TAIL TRACK	33+00	0	TP-33	TAIL TRACK	33+00	0
B-34	TAIL TRACK	34+00	0	B-34	TAIL TRACK	34+00	0	B-34	TAIL TRACK	34+00	0	TP-34	TAIL TRACK	34+00	0
B-35	TAIL TRACK	35+00	0	B-35	TAIL TRACK	35+00	0	B-35	TAIL TRACK	35+00	0	TP-35	TAIL TRACK	35+00	0
B-36	TAIL TRACK	36+00	0	B-36	TAIL TRACK	36+00	0	B-36	TAIL TRACK	36+00	0	TP-36	TAIL TRACK	36+00	0
B-37	TAIL TRACK	37+00	0	B-37	TAIL TRACK	37+00	0	B-37	TAIL TRACK	37+00	0	TP-37	TAIL TRACK	37+00	0
B-38	TAIL TRACK	38+00	0	B-38	TAIL TRACK	38+00	0	B-38	TAIL TRACK	38+00	0	TP-38	TAIL TRACK	38+00	0
B-39	TAIL TRACK	39+00	0	B-39	TAIL TRACK	39+00	0	B-39	TAIL TRACK	39+00	0	TP-39	TAIL TRACK	39+00	0
B-40	TAIL TRACK	40+00	0	B-40	TAIL TRACK	40+00	0	B-40	TAIL TRACK	40+00	0	TP-40	TAIL TRACK	40+00	0
B-41	TAIL TRACK	41+00	0	B-41	TAIL TRACK	41+00	0	B-41	TAIL TRACK	41+00	0	TP-41	TAIL TRACK	41+00	0
B-42	TAIL TRACK	42+00	0	B-42	TAIL TRACK	42+00	0	B-42	TAIL TRACK	42+00	0	TP-42	TAIL TRACK	42+00	0
B-43	TAIL TRACK	43+00	0	B-43	TAIL TRACK	43+00	0	B-43	TAIL TRACK	43+00	0	TP-43	TAIL TRACK	43+00	0
B-44	TAIL TRACK	44+00	0	B-44	TAIL TRACK	44+00	0	B-44	TAIL TRACK	44+00	0	TP-44	TAIL TRACK	44+00	0
B-45	TAIL TRACK	45+00	0	B-45	TAIL TRACK	45+00	0	B-45	TAIL TRACK	45+00	0	TP-45	TAIL TRACK	45+00	0
B-46	TAIL TRACK	46+00	0	B-46	TAIL TRACK	46+00	0	B-46	TAIL TRACK	46+00	0	TP-46	TAIL TRACK	46+00	0
B-47	TAIL TRACK	47+00	0	B-47	TAIL TRACK	47+00	0	B-47	TAIL TRACK	47+00	0	TP-47	TAIL TRACK	47+00	0
B-48	TAIL TRACK	48+00	0	B-48	TAIL TRACK	48+00	0	B-48	TAIL TRACK	48+00	0	TP-48	TAIL TRACK	48+00	0
B-49	TAIL TRACK	49+00	0	B-49	TAIL TRACK	49+00	0	B-49	TAIL TRACK	49+00	0	TP-49	TAIL TRACK	49+00	0
B-50	TAIL TRACK	50+00	0	B-50	TAIL TRACK	50+00	0	B-50	TAIL TRACK	50+00	0	TP-50	TAIL TRACK	50+00	0



DRAIN SYSTEM

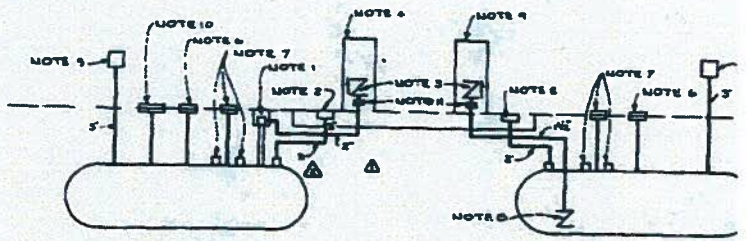
A





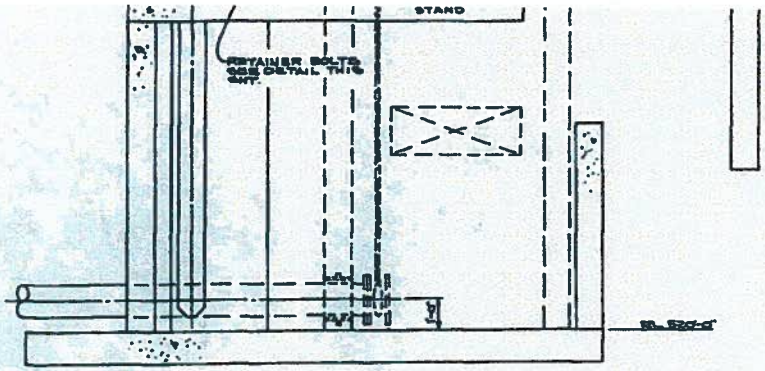
NOTES

1. IGNITION OIL PUMPS.
2. FUEL OIL TRANSFER PUMP.
3. COOL SPACE 4000-M.
4. TERMINATE WITH 2 1/2" HOSE, END AND 2" FLASH END AT EL. 241'-0".
5. TO ASH WATER PUMP HOUSE FUEL OIL STORAGE TANK SEE 4000-M.
6. BLIND FLANGE FOR FUTURE CONNECT TO SAMPLE SPLASHING.
7.
8. TANK CAR UNLOADING RACK.
9. FLAME ARRESTER.
10. LOCKING VALVE.
11. FURNISHED AND INSTALLED BY OWNER

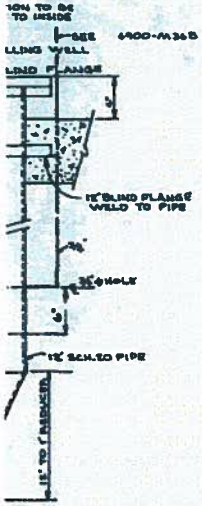


PIPING ——— CLASS P-RO AS
INSULATION ——— NONE

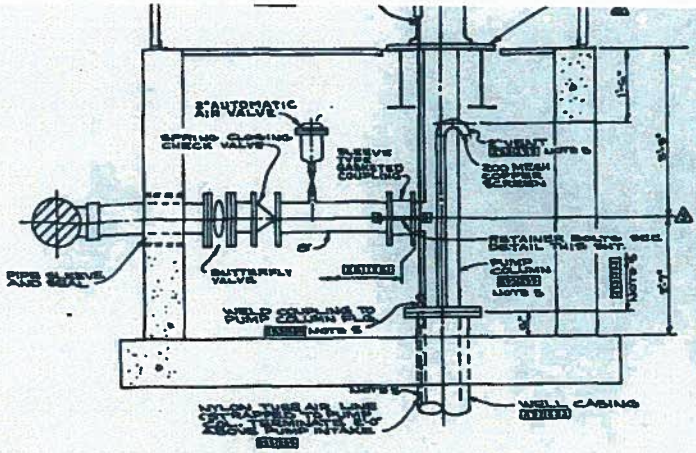
NO WORK BY CONTRACT 301

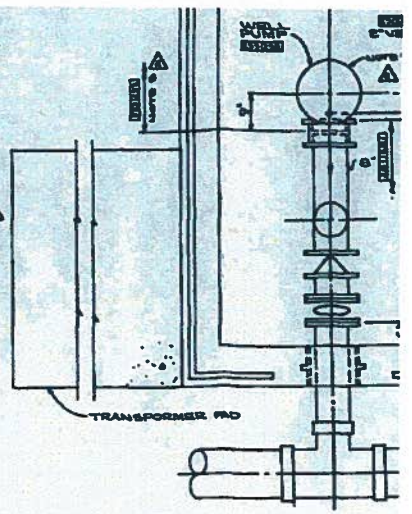


SECTION B-M112
M112
SCALE: 1/2"=1'-0"



L DETAIL
NONE

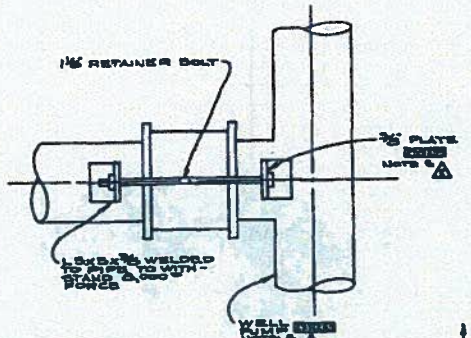




CONTRACT 225 WORK:
1. INSTALL 12"X10" 150# FLAT FACE GALV. CI REDUCING FLANGE WITH LOOSE FIT ON PUMP COLUMN.
2. INSTALL GASKET ON WELL CASING FLANGE AND INSTALL PUMP COLUMN IN WELL CASINGS.
3. AFTER WELL PUMP BASE IS BOLTED IN PLACE, BOLT LOOSE FLANGE ON PUMP COLUMN TO WELL CASING FLANGE.
4. CONTINUOUS SEAL WELD PUMP COLUMN TO LOOSE FLANGE.
5. WELL PUMP NO.1, MOTOR AND ACCESSORIES

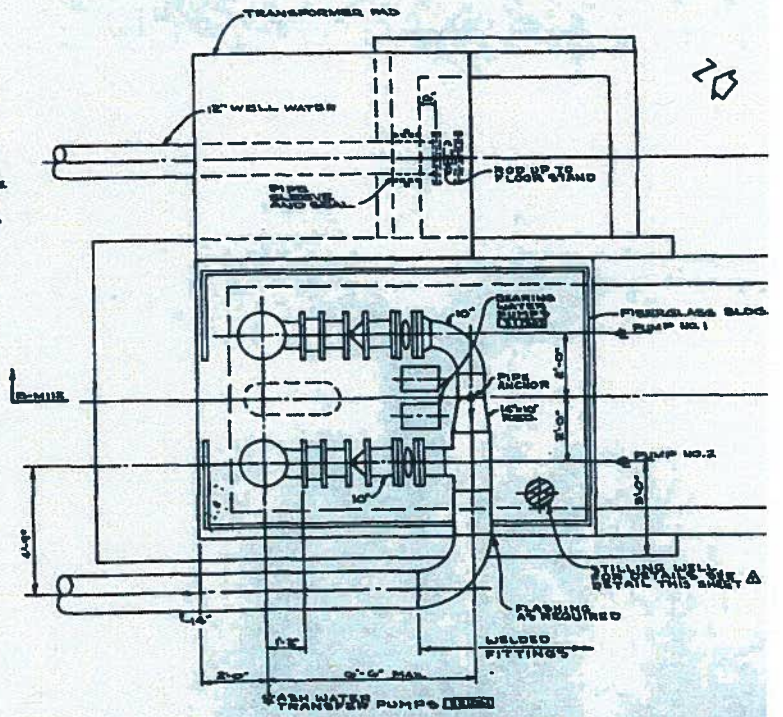
SECTION A-M112
M112
SCALE: 1/2"=1'-0"

PLAN - WELL PUM
SCALE: 1/2"=1'-0"

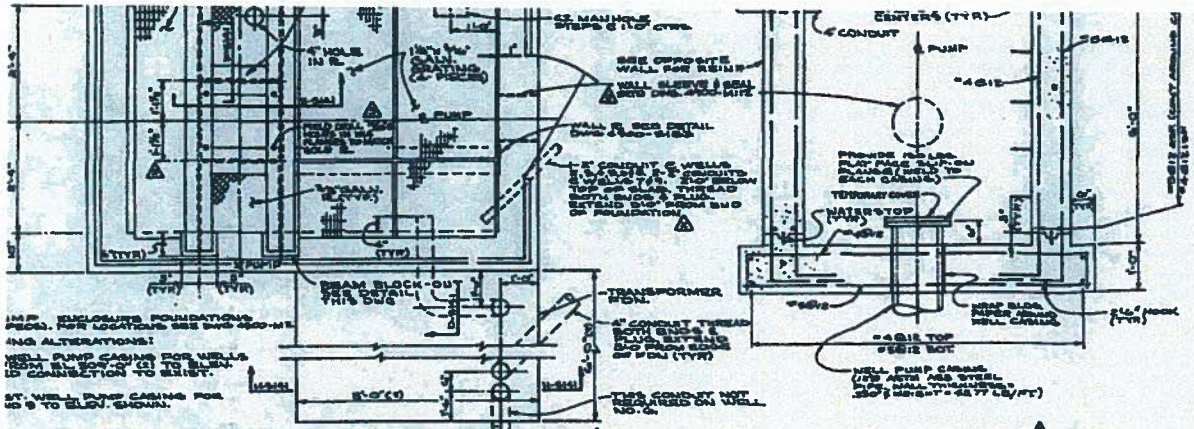


NOTE: TWO RETAINER BOLTS REQ'D.

RETAINER BOLT DETAIL
SCALE: NONE

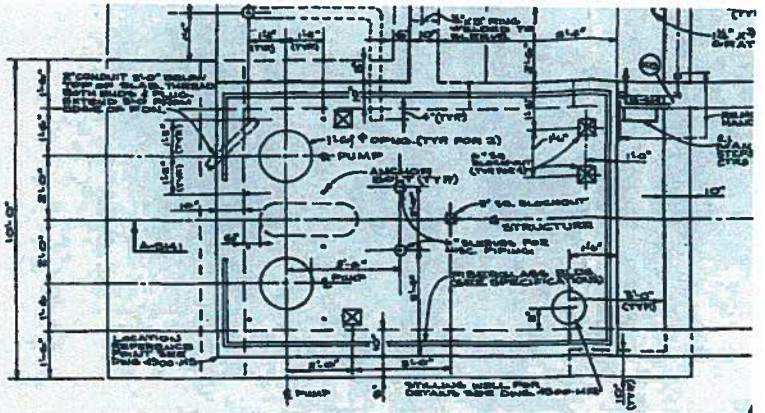


PLAN - ASH WATER TRANSFER STRUCTUR
SCALE: 1/2"=1'-0"

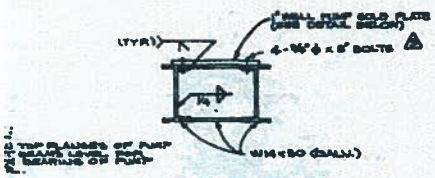


J - WELL PUMP ENCLOSURE FOUNDATION

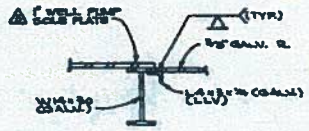
SECTION D-S141



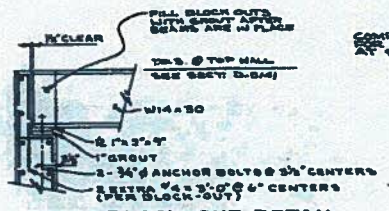
PLAN - ASH WATER TRANSFER STRUCTURE



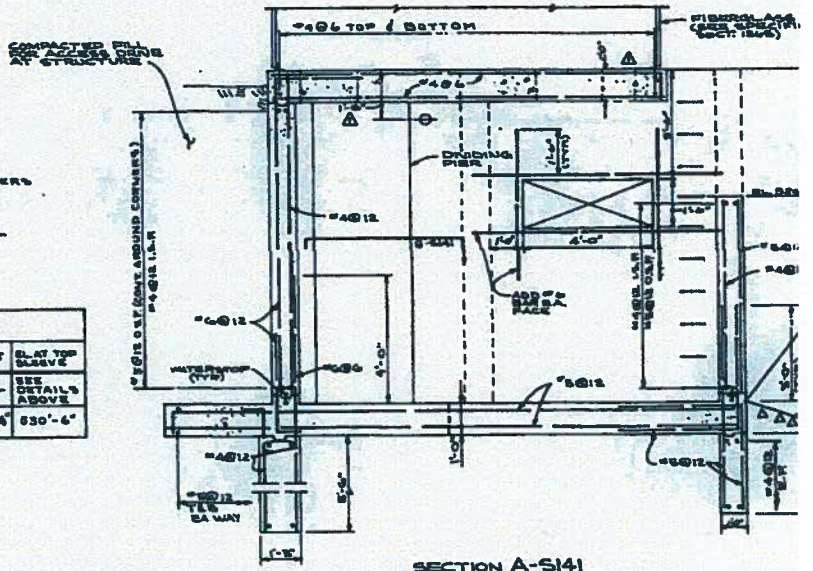
SECTION E-S141



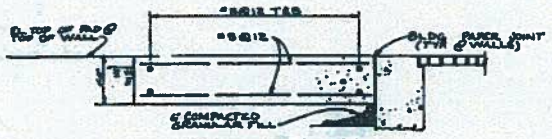
SECTION F-S141



BEAM BLOCK-OUT DETAIL



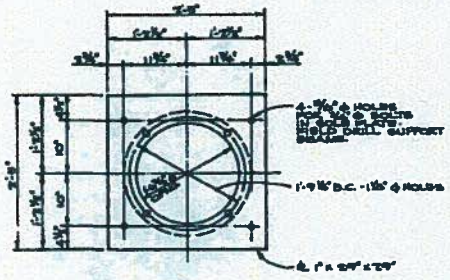
SECTION A-S141



SECTION H-S141

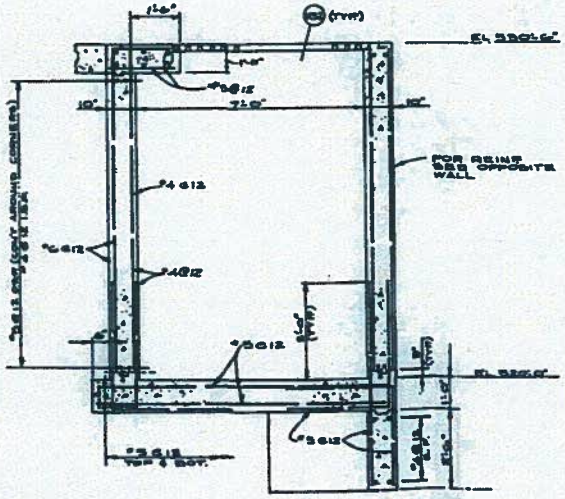
ANCHOR BOLT SCHEDULE

LOCATION	TYPE	NO. REQ'D.	A	B	C	D	E	F	G	J	K	T	EL. AT TOP SLEEVE
BEAM BLOCK-OUTS WELL PUMP	D	80	2'-4"	—	4"	3/4"	3"	—	—	—	—	—	SEE DETAILS ABOVE
ASH WATER PUMPS	M	8	1'-5"	9"	4"	3/4"	—	1 1/2"	8"	—	3"	3/4"	830'-6"

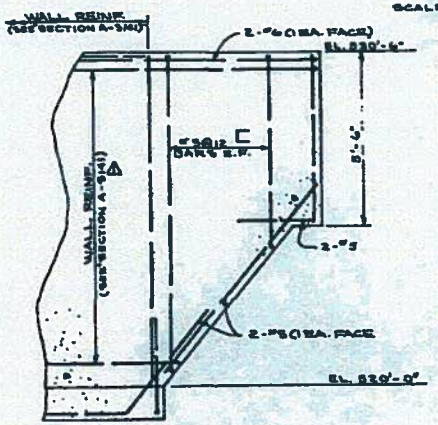


WELL PUMP SOLE PLATE

(4 REQUIRED)



SECTION C-S141



SECTION B-S141

SECTION G-S

Appendix B

EPA Checklist

Site Name:	H.L. Spurlock	Date:	2/15/11
Unit Name:	Ash Pond	Operator's Name:	East Kentucky Power Cooperative
Unit I.D.:		Hazard Potential Classification:	High ☐ Significant ☐ Low ☒
	Inspector's Name:	Robert Edwards, PE and Lauren Ohotzke	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	X		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	X		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	X		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		N/A	Is water entering inlet, but not exiting outlet?		N/A
5. Lowest dam crest elevation (operator records)?	X		Is water exiting outlet, but not entering inlet?		N/A
6. If instrumentation is present, are readings recorded (operator records)?	X		Is water exiting outlet flowing clear?		N/A
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	X		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		N/A	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		N/A	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Issue #	Comments
1	There are 2 daily inspections (1 during each 12 hour shift) done by plant personnel; Records of these daily inspections are kept for the day until reviewed by a supervisor. If there are no abnormalities found, then the inspection document(s) are discarded. To date, there have not been any abnormalities found during these daily inspections. In 2009, annual inspections began, using a 3rd party geotechnical engineering company.
4	This impoundment does not have an open channel spillway.
5	Crest is surveyed annually and restored to 28 foot height if necessary. Crest is observed twice during daily inspections for abnormal settlement, low spots, etc., and maintained as required.
12,16,20	Water from the impoundment is pumped to a series of treatment lagoons, therefore no decant pipe(s) exist.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit N/A

INSPECTOR Robert Edwards, PE and Lauren Ohotzke

Date 2/15/11

Impoundment Name Ash Pond

Impoundment Company East Kentucky Power Cooperative

EPA Region Region 4

State Agency (Field Office) Address Kentucky Department For Environmental Protection
Dam Safety and Floodplain Compliance, Kentucky Division of Water
14 Reilly Road, Frankfort, KY 40601-1189

Name of Impoundment Ash Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☒ **Update** ☐

	Yes	No
Is impoundment currently under construction?	☐	☒
Is water or ccw currently being pumped into the impoundment?	☒	☐

IMPOUNDMENT FUNCTION: Store CCR, specifically the bottom ash, from power generation at the H.L. Spurlock Power Plant. Fly ash is collected and stored dry in the hopper and trucked to the plant's landfill.

Nearest Downstream Town Name: Ripley, Ohio

Distance from the impoundment: 3.5 miles downstream

Location:

Latitude	38	Degrees	42	Minutes	1.6158	Seconds	**N**
Longitude	-83	Degrees	48	Minutes	6.0978	Seconds	**W**

State Kentucky **County** Mason

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency? Kentucky Division of Water (Inspections are performed based on the hazard classification of the impoundment. Ranked as a Low hazard classification, impoundment is inspected every 5 years).

HAZARD POTENTIAL *(In the event the impoundment should fail, the following would occur):*

☐ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

☒ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. **Losses are principally limited to the owner's property.**

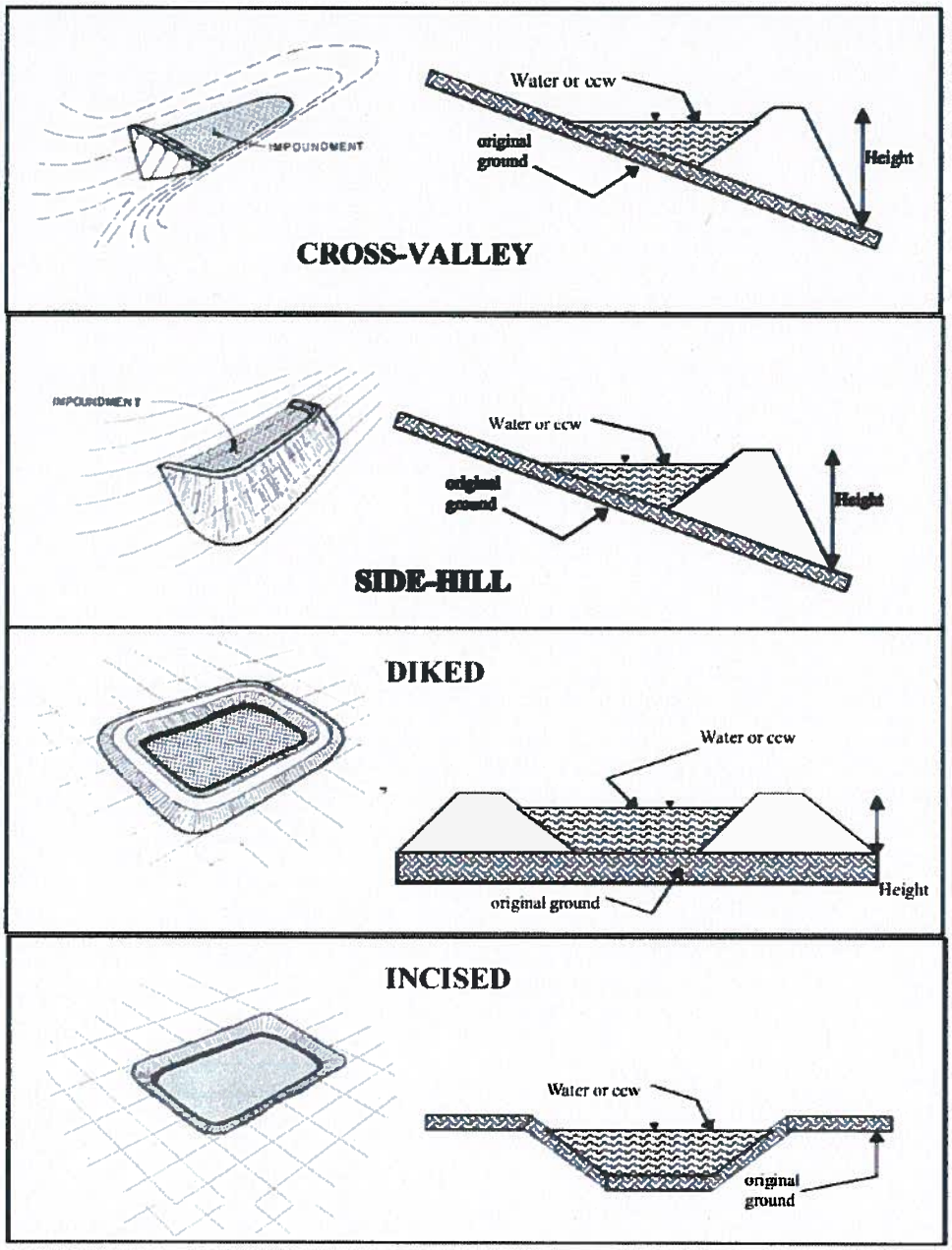
☐ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Economic losses as a result of a failure or misoperation would primarily effect the H.L. Spurlock Power Plant's property, only.

CONFIGURATION:



☐ Cross-Valley ☐ Side-Hill ☒ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft)	28	**Embankment Material**	Silty Clay/ Sandy Clay Materials
Pool Area (ac)	57	**Liner**	**Clay Liner; 15" deep or 18"** deep where material was left in place
Current Freeboard (ft)	Maintains 2.5 (Design 1.5)	**Liner Permeability**	Relatively low seepage: 91 gal/min +/- 20% (Estimated rate at time of construction).

TYPE OF OUTLET (Mark all that apply

☐ **Open Channel Spillway**

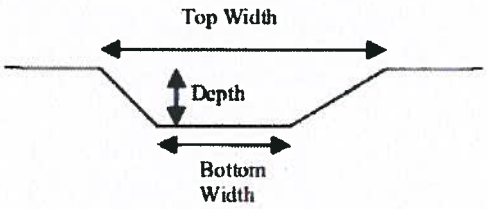
- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

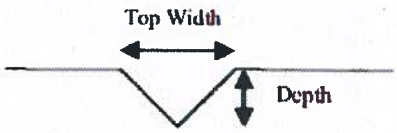
average bottom width (ft)

top width (ft)

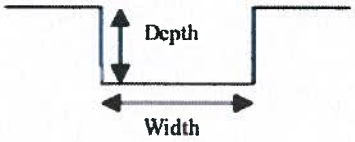
TRAPEZOIDAL



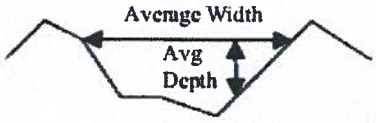
TRIANGULAR



RECTANGULAR

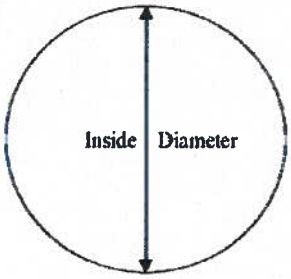


IRREGULAR



☐ **Outlet**

18" inside diameter
(SDR 17 – smooth lined – 19.5" OD)



Material

- ☐ corrugated metal
- ☐ welded steel
- ☐ concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☐	☐

☐ **No Outlet**

☒ **Other Type of Outlet** (specify): Water leaving the impoundment is pumped with a capacity of 2 pumps at rate of 2400 gpm each. Generally operates with one pump at 2400 gpm to the series of treatment lagoons (primary and secondary, respectively).

The Impoundment was Designed By Stanley

	Yes	No
Has there ever been a failure at this site?	☐	☒

If So When?

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	☒
If So When?		

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☒
If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No, this was not the case.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

Yes. Information prepared by the Utility was reviewed during the assessment and has been given to the assessors (Robert Edwards, PE and Lauren Ohotzke), temporarily, while an in depth report of the assessment is written, to be submitted to the EPA.

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

No such evidence was visible.

APPENDIX C

PHOTOGRAPHS

Photo 01: Ash Water Transfer Pump Station
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 02: Phragmites Along Inside perimeter of Ash Pond (1 of 2)
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 03: Phragmites Along Inside perimeter of Ash Pond (2 of 2)
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 04: Observed Area at Toe of Exterior Slope of North Dike
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 05: Area Observed Near Toe of SE Corner of Outside Embankment
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 06: Primary Lagoon
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 07: Secondary Lagoon
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 08: Area Observed Just West of Toe of SE Corner of Outside Embankment
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 09: Structural Bridging System Containing Pipes Carrying CCR (Bottom Ash) from Plant to Pond (1 of 2)

H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 10: Structural Bridging System Containing Pipes Carrying CCR (Bottom Ash) from Plant to Pond (2 of 2)

H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 11: Looking SW Toward Plant from South Crest; Pipes Carrying CCR (Bottom Ash) on the Right

H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 12: Looking NE from Toe of SW Corner of Outside Embankment; Portal Entry of Pipes Carrying CCR (Bottom Ash)

H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 13: HDPE (Black) Pipes Transporting CCR (Bottom Ash) from the Plant to the Pond; Fiberglass Pipe (Lower) and Metal Pipe (top) are Abandoned
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 14: Pipe Floaters Within Ash Pond (1 of 2)
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 15: Pipe Floaters within Ash Pond (2 of 2)
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 16: Inlet Pipe Releasing CCR (Bottom Ash) from Plant
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 17: Bottom Ash Stockpiles and Surface Water within Ash Pond
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 18: Bottom Ash Stockpiles within Ash Pond
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 19: Looking SW Toward Plant from Staging Area of Stockpiled Bottom Ash
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 20: Water Within the Spurlock Ash Pond
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 21: Ohio River, Running Parallel to the Northern Embankment of the Ash Pond
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 22: Looking NE from Western Crest at Northern Crest Typical Conditions (See Top Left Corner of Photo)
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 23: Looking down South Crest; Typical Conditions
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 24: Looking down East Crest from NE Corner; Typical Conditions
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 25: Looking down West Crest from NW Corner; Typical Conditions
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 26: Layer of 18" Thick Riprap Surrounding Inside Perimeter of Ash Pond
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 27: Layer of 18" Thick Riprap Combined with Phragmites Surrounding Inside Perimeter of Ash Pond

H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 28: Northern Exterior Embankment

H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 29: Southern Exterior Embankment
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 30: Eastern Exterior Embankment
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Photo 31: Western Exterior Embankment
H.L. Spurlock Power Station Ash Pond; February 15, 2011

Appendix D

EKPC Response Letter to EPA's Request for Information (March 2009)

EAST KENTUCKY POWER COOPERATIVE

March 24, 2009

Mr. Richard Kinch
US Environmental Protection Agency
Two Potomac Yard
2733 S. Crystal Dr.
5th Floor; N-5783
Arlington, VA 22202-2733

Dear Mr. Kinch:

Re: Request for Information under Section 104 (e) of Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9604(e)

Please find enclosed East Kentucky Power Cooperative's (EKPC) response to questions issued by the EPA pursuant to CERCLA, 42 U.S.C. 9604(e). EKPC's responses include all EKPC surface impoundments or diked or bermed management units that receive liquid-borne material for the storage or disposal of residuals or by-products from the combustion of coal at the Dale Power Station and the H.L. Spurlock Power Station.

EKPC received two letters of request for information concerning the Dale Power Station and H. L. Spurlock Power Station. A response for each plant is attached followed by a signed certification.

Please contact EKPC representative, Jerry Purvis, Environmental Affairs Manager, at 859-745-9244 if you have any questions.

Sincerely,

Jerry Purvis

Jerry Purvis, Manager
Environmental Affairs

JP:jkr

Attachments

c: Bob Marshall, EKPC
David Smart, EKPC-Legal
John Twitchell, EKPC
Craig Johnson, EKPC
David Elkins, Spurlock Station Plant Mgr.
Ron Thomas, Dale Station Plant Mgr.

(h:Environ/EPA-request 3-09ltr.doc)

4775 Lexington Road 40391
P.O. Box 707, Winchester,
Kentucky 40392-0707
Tel. (859) 744-4812
Fax: (859) 744-6008
http://www.ekpc.coop

East Kentucky Power Cooperative, Inc.
Dale Power Station

1. Relative to the National Inventory of Dams criteria for High, Significant, Low or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the units(s). If the unit(s) does not have a rating, please note that fact.

   EKPC Response: *Dale Ash Pond #2 – Not rated and regulated by the Kentucky Division of Water.*

   Dale Ash Pond #4 – Class A (low hazard), rated and regulated by the Kentucky Division of Water.

2. What year was each management unit commissioned and expanded?

   EKPC Response: *Dale Ash Pond #2 – Original in-service date was December 1, 1954, modified in 1999 by removing dike between Ponds 1 & 2 and improving watershed ditches.*
   Dale Ash Pond #4 – Built 1977

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   EKPC Response: *Dale Station temporarily stores fly ash and bottom ash in Ash Ponds #2 and #4. The ponds are used alternately; Ash Pond #2 will be in service while Pond #4 is out of service being cleaned. Or Ash Pond #4 is in service while Ash Pond #2 is out of service or being cleaned.*

   The ratio of the mixture of ash to the ponds is approximately 20% bottom ash to 80% fly ash. Boiler slag and other constituents make up less than one percent of the volume of the coal combustion byproducts (CCB) stored in the ponds. The ash is sluiced to the respective ponds in service using raw service water from the Kentucky River. Ash sluicing water decants in the pond, the ash particles separate from the water before discharging through respective KPDES permitted outfalls.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   EKPC Response: *Dale Ash Pond #2 – Monitored by a Registered PE*
   Dale Ash Pond #4 – Designed, constructed and monitored by a Registered PE

5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management units(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   EKPC Response: *Dale Ash Pond #2 & #4 – Evaluated on a periodic basis by the Vice-President of Production, a Registered Professional Engineer with a BS & MS in Mining Engineering and 20 years+ of extensive work in the civil and geotechnical engineering.*

   During routine monitoring as part of normal operating procedures, on August 20, 2008 a small leak was detected on Ash Pond #4. The pond was immediately taken out of service and dewatered. The Kentucky Division of Water was promptly contacted. This pond is in the process of being bid in April 2009 for investigation, engineering review and repair of the leak. This project will be completed prior to placing this pond back in service.

   As a result of the TVA incident, EKPC, along with normal routine visual monitoring, has decided to take a proactive stance to have these ash pond dams assessed by an outside engineering firm. The bid specification for this project is expected to be issued in April 2009. The assessments should be complete and documented by the winter of 2009.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

4775 Lexington Road 40391
P.O. Box 707, Winchester,
Kentucky 40392-0707
Tel. (859) 744-4812
Fax: (859) 744-6008
http://www.ekpc.coop

EKPC Response: *The Kentucky Division of Water inspected Dale Station's Ash Pond #4 dam in 1998. (See Attachment 1, 20090316160432759.pdf, KDOW, State Inspection Report)*

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   EKPC Response: *There have been no assessments, evaluations, or inspections conducted by State or Federal regulatory officials on Dale Station's dams within the last year. See response to Question No. 5 above.*

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   EKPC Response: *Dale Ash Pond #2 – Eight acres with 180,000 yds^3 capacity, current storage approximately 40,000 yds^3 as of March 15, 2008, Dam height of 20 ft.*
   Dale Ash Pond #4 – 10.7 acres with 230,000 yds^3 capacity, approximately 180,000 yds^3 current storage as of August 22, 2008, when this pond was taken out of service. Dam height is 26 ft.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   EKPC Response: *In August 2008, a small leak to land was detected on Ash Pond #4. As a part of normal operating procedures, the plant personnel took the pond out of service. The Kentucky Division of Water was promptly contacted. Visual inspections of the dam were conducted and documented. The pond was nearing its capacity in ash and water level. The plant followed normal procedures and placed Ash Pond #2 in service. Ash Pond #4 was taken out-of-service and dewatered.*

   As discussed in the response to Question No. 5, this pond is in the process of being bid in April 2009 for investigation, engineering review and repair of the leak.

10. Please identify all current legal owner(s) and operators(s) at the facility.

EKPC Response: *Dale Power Station is owned and operated by East Kentucky Power Cooperative.*

East Kentucky Power Cooperative
P.O. Box 707
4775 Lexington Road
Winchester, KY 40392

East Kentucky Power Cooperative, Inc.
Spurlock Power Station

1. Relative to the National Inventory of Dams criteria for High, Significant, Low or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the units(s). If the unit(s) does not have a rating, please note that fact.

   EKPC Response: *Spurlock Ash Pond – rated and regulated by the Kentucky Division of Water as Class A (low hazard). Area and height for this pond as noted in the Kentucky Division of Water's inventory is not correct. The correct information is provided in the response to Question No. 8 below.*

2. What year was each management unit commissioned and expanded?

   EKPC Response: *Spurlock Ash Pond – Built in 1976*

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag (4) flue gas emission control residuals (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   EKPC Response: *Spurlock Station only sluices bottom ash to this storage unit. Fly ash and gypsum are land filled dry in a special waste landfill at the site.*

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   EKPC Response: *Spurlock Ash Pond - Designed, constructed and monitored by a registered PE.*

5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management units(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the

company plans an assessment or evaluation in the future, when is it expected to occur?

EKPC Response: *Spurlock Station's Ash Pond is inspected during mowing operations for leaks or other irregularities under the direction of a registered PE.*

As a result of the TVA incident, EKPC, along with normal routine visual inspections, has decided to take a proactive stance to have this ash pond dam assessed by an outside engineering firm. The bid specification for this project is expected to be issued in April 2009. The assessment should be complete and documented by the winter of 2009.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   EKPC Response: *The Kentucky Division of Water inspected Spurlock Station's dam in 1983 (See attachment No. 2, 20090316160450453.pdf, KDOW State inspection report, Hugh L. Spurlock Station) and February 19, 2009. The most recent inspection report has not been received.*

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   EKPC Response: *During the recent inspection at Spurlock Station's dam by Scott Phelps and Mortaza Rabiee of the Kentucky Division of Water, Mr. Phelps commented on the good overall condition of the dam. He did request the removal of any cattails that were not protecting the shoreline from wave action and removal of one shrub that is present near the toe of the dam slope. This work is pending and should be completed within 30 days.*

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

10. Please identify all current legal owner(s) and operators(s) at the facility.

EKPC Response: *Dale Power Station is owned and operated by East Kentucky Power Cooperative.*

East Kentucky Power Cooperative
P.O. Box 707
4775 Lexington Road
Winchester, KY 40392

See Attachment 3 for Signature Page – Dale Station
See Attachment 4 for Signature Page – Spurlock Station

4775 Lexington Road 40391
P.O. Box 707, Winchester,
Kentucky 40392-0707

Tel. (859) 744-4812
Fax: (859) 744-6008
http://www.ekpc.coop

EAST KENTUCKY POWER COOPERATIVE, INC.

ATTACHMENT 1 –
KDOW STATE INSPECTION REPORT
WILLIAM C. DALE STATION

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER
14 REILLY ROAD
FRANKFORT, KENTUCKY 40601

CERTIFICATE OF INSPECTION
FOR
DAM AND APPURTENANT WORKS

ATTENTION: The Division of Water does not intend this report to be taken as an assurance that no other problems exist at this site or that this dam is safe. The reports sole intent is to provide you a factual account of the conditions observed at the site during the inspection. If you have questions, write this office at above listed address or call (502) 564-3410.

Inventory Number: 0660
Hazard Class: LOW
Name of Dam: EAST KY POWER-ASH STORAGE DAM (CLARK CO.)
County: CLARK
Owner: EAST KY POWER CO
Inspection Date: 10/29/98
Address: BOX 707
City: WINCHESTER
State: KY Zip Code: 40391
Phone Number: 606/561-6859

PERSONS PRESENT AT INSPECTION:
STEWART CORTER, GEORGE CHILDERS,DOW
LARRY BOWLING, EAST KY. POWER

Weather: 55 DEG CLDY.
Normal Pool Elevation: 602 MSL
Dam Height(feet): .
Current Pool Elevation: 602 MSL
Dam Type:
THE DAM IS A 2200 FT LONG CIRCULAR EMBANKMENT, 25 FT HIGH AND WITH A TOP WIDTH OF 15 FT. ALL SLOPES ARE RIPRAPPED AND THE INSIDE SLOPE IS 2.5:1 AND OUTSIDE IS 3:1.

1. UPSTREAM SLOPE OF DAM:
RIPRAP IN GOOD CONDITION;

2. CROWN OF DAM:
GRAVEL ROAD IN GOOD CONDITION

CERTIFICATE OF INSPECTION
FOR
DAM AND APPURTENANT WORKS
KY ID: 0660

3. DOWNSTREAM SLOPE OF DAM:
RIPRAP IN GOOD CONDITION

A. Seepage (describe below, locate on last page):
NONE NOTED

B. Toe Drains (size, condition, flowing, etc.):
NONE NOTED

4. PRINCIPAL SPILLWAY ELEVATION: 602 MSL
THE OUTLET CONSISTS OF A 5 FT DIAMETER PERFORATED RISER (TOP ELEV. 602.0) AND FILTER SYSTEM WITH A 12" C.M. PIPE 116 FT LONG AND A CONCRETE EXIT FLUME.

A. Inlet:
GOOD CONDITION

B. Outlet:
GOOD CONDITION

C. Stilling basin:
NONE

5. EMERGENCY SPILLWAY ELEVATION: . MSL
LISTED UNDER OUTLET WORKS

6. DRAWDOWN FACILITIES:
YES

a. Valved: UPSTREAM Last Operated: UNKNOWN .

CERTIFICATE OF INSPECTION
FOR
DAM AND APPURTENANT WORKS
KY ID: 0660

7. DOES HAZARD CLASSIFICATION NEED TO BE REEVALUATED? NO
   a. If yes, explain:

   b. Distance checked downstream in miles:
      TO KENTUCKY RIVER

8. WERE PHOTOGRAPHS TAKEN? YES

9. GENERAL COMMENTS AND RECOMMENDATIONS:
   STRUCTURE IS WELL MAINTAINED

10. SKETCH OF DAM (Locate alterations or problem areas):

Inspector: STEWART CARTER

Reviewer: GEORGE CHILDERS Date: .

EAST KENTUCKY POWER COOPERATIVE

ATTACHMENT 2 -
KDOW STATE INSPECTION REPORT
HUGH L. SPURLOCK STATION

(H:Environ/EPA-request 3-09ltr.doc)

Inventory No. 758

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES & ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER
FRANKFORT, KENTUCKY 40601

INSPECTION REPORT
DAM AND APPURTENANT WORKS

Name of Structure East Ky. Power Lookout Owner East Ky Power

County Wayne Address East Ky. Power Lookout

Date April 25 1983 P.O. Box 707
Williamson, Ky 70791

PERSONS PRESENT AT INSPECTION (Name and Title):

Jim Littlefield Lot Supervisor

Any structural modifications, problem areas, or additional information should be sketched on a copy of the Lakes Inventory drawings, and the revised drawings made a part of this report. If additional sheets are needed for further sketches or notes, these should also be noted and made a part of this report.

1. UPSTREAM (LAKESIDE) SLOPE OF DAM:

a. Vegetative Cover Satisfactory

	Yes	No
Trees	___	✓
Brush or bushes	___	✓
Needs mowing	___	✓
Needs fertilizing	___	✓
Needs herbicide	___	✓

RECEIVED JUN 1983

WHITE – Inventory File; CANARY – District Office; PINK – Owner

b. Erosion Nor

c. Slope Protection Good

	Yes	No
Completely rip-rapped?	✓	

Area(s) needing additional rip-rap None

d. Slumps, slides, cracks None

	Yes	No
Sketch of location attached?		✓

e. Animal burrows Nor

	Yes	No
Water coming from hole?		✓
Running water sounds heard?		✓

f. Drift and debris Nor

	Yes	No
Blocking trash rack or riser inlet?		✓

g. Remarks

2. CROWN (TOP OF DAM)

a. Vegetative Cover Grass

	Yes	No
Trees	___	✓
Brush or bushes	___	✓
Needs mowing	___	✓
Needs fertilizing	___	✓
Needs herbicide	___	✓
Ruts from vehicle or foot traffic	___	✓

b. Erosion None

c. Slumps, slides, cracks None

	Yes	No
Sketch of location attached?	___	✓

d. Remarks

3. DOWNSTREAM SLOPE OF DAM

a. Vegetative Cover Sand

	Yes	No
Trees	___	✓
Brush or bushes	___	✓
Needs mowing	___	✓
Needs reseeding	___	✓
Needs fertilizing	___	✓
Needs herbicide	___	✓

b. Erosion No

c. Seepage No

	Yes	No
Left Abutment (Looking Downstream)		✓
Right Abutment (Looking Downstream)		✓
Toe of dam		✓
Sketch of location attached		✓
Soil particles or discoloration of water in seepage		✓

Estimated volume of seepage N/A

d. Slumps, slides, cracks No

	Yes	No
Sketch of location attached?		✓

e. Animal burrows

	Yes	No
Water coming from hole?		✓
Running water sounds heard?		✓

f. Remarks

4. PRINCIPAL SPILLWAY

a. Inlet
1. Type (concrete, metal, etc.) N/A

2. Shape

3. Condition _____

_____

b. Outlet

1. Type (concrete, metal, etc.) _____

_____

2. Shape _____

_____

3. Condition _____

_____

	Yes	No
Is stilling basin rip-rapped?	____	____

c. Remarks _____

_____

_____

5. EMERGENCY SPILLWAY:

a. Type (rock, earth, etc.) None

_____

b. Condition _____

_____

_____

	Yes	No
Inlet blocked by debris?	____	____
Trees or brush growing in channel?	____	____

c. Remarks N/A

_____

_____

6. DRAWDOWN FACILITIES None

When is last known time operated? _____

Valved on upstream or downstream side? _____

Remarks _____

	Yes	No
7. WERE PHOTOGRAPHS TAKEN?	✓	
Does the hazard classification need to be re-evaluated?		✓

If Yes explain why _____

	Yes	No
8. DO PLANS AND SPECIFICATIONS EXIST?	✓	

If so where? On file at Div. of Water

9. GENERAL COMMENTS AND RECOMMENDATIONS Dam appears to be in good condition.

10. REVIEWER COMMENTS _____

Are plans on file with Division of Water? Yes ✓ No ____

Inspected by _____

Reviewed by _____

EAST KENTUCKY POWER COOPERATIVE

ATTACHMENT 3 -
SIGNATURE PAGE – DALE STATION

(H:Environ/EPA-request 3-09ltr.doc)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

March 9, 2009

OFFICE OF
THE ADMINISTRATOR

Plant Manager
Dale Power Station
1925 Ford Road
Winchester, Kentucky 40391

Dear Sir or Madam:

The release of over 5 million cubic yards (1.1 billion gallons) of coal ash from the Tennessee Valley Authority's Kingston, Tennessee, facility in December 2008 serves as an important reminder of the need for our continued diligence on disposal units where coal combustion wastes are managed. The coal ash from the facility flooded more than 300 acres of land, damaging homes and property.

It is critical that we all work to the best of our abilities to prevent a similar catastrophic failure and the resultant environmental damage. One of the first steps in this effort is to assess the stability of the impoundments and similar units that contain coal combustion residuals and by-products to determine if and where corrective measures may be needed and then to carry out those measures as expeditiously as possible. I am asking that you assist us in this endeavor by giving your personal attention to the enclosed information request issued under the authority of Section 104(e) of the Comprehensive Environmental Response, Compensation, and Liability Act and that you work with us throughout the process. By exercising the utmost care and diligence in examining whether there are any safety concerns at the units and then taking appropriate actions to address these concerns, you will be ensuring the protection of public health, safety, and the environment.

Thank you for making this a priority at the highest levels of your organization.

Sincerely,

Lisa P. Jackson

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR [illegible] 2009

Via CERTIFIED MAIL/RETURN RECEIPT REQUESTED

OFFICE OF
SOLID WASTE AND
EMERGENCY RESPONSE

Plant Manager
Dale Power Station
1925 Ford Rd
Winchester, Kentucky 40391

RE: Request for Information Under Section 104 (e) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9604(e)

Dear Sir or Madam:

The United States Environmental Protection Agency is requesting information relating to the surface impoundments or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material from a surface impoundment used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. EPA is requesting this information pursuant to the authority granted to it under Section 104 (e) of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. 9604(e) which provides in relevant part that whenever the Agency has reason to believe that there may be a release or a threat of a release of a pollutant or contaminant, they may require any person who has or may have information to furnish information or documents relating to the matter, including the identification, nature, and quantity of materials which have been or are generated, treated, stored or disposed at the facility and the nature or extent of a release or a threatened release. EPA believes that the information requested is essential to an evaluation of the threat of releases of pollutants or contaminants from these units. **EPA hereby requires that you furnish to EPA, within ten (10) business days of receipt of this letter a response to each request for information set forth in the Enclosure, including all documents responsive to such request.**

Please provide a full and complete response to each request for information set forth in Enclosure A. The provisions of Section 104 of CERCLA authorize EPA to pursue penalties for failure to comply with or respond adequately to an information request under Section 104(e). In addition, providing false, fictitious or fraudulent statements or representations may subject you to criminal penalties under 18 U.S.C. 1001.

Your response must include the following certification signed and dated by an authorized representative of the Dale Power Station.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: Craig Johnson
Name: Craig Johnson, PE
Title: VP Production

This request has been reviewed and approved by the Office of Management and Budget pursuant to the Paperwork Reduction Act, 44 U.S.C., 3501-3520.

Please send your reply to:

Mr. Richard Kinch
US Environmental Protection Agency (5306P)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

If you are using overnight or hand delivery mail, please use the following address:

Mr. Richard Kinch
US Environmental Protection Agency
Two Potomac Yard
2733 S. Crystal Dr.
5th Floor; N-5783
Arlington, VA 22202 2733

EPA expects the owners and operators of these units to exercise the utmost care and diligence in examining whether there are any potential concerns at the units and to take appropriate actions to address them. We ask that this effort be a priority at the highest levels of your organization to ensure the protection of public health, safety, and the environment.

If you have any questions concerning this matter, please contact Mr. Kinch in the Office of Solid Waste and Emergency Response at (703) 308-8214. I appreciate your attention to this critical matter.

Sincerely,

Barry N. Breen
Acting Assistant Administrator

Enclosure