HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

12 October 2016
File No. 40373-445

SUBJECT: CCR History of Construction
Killen Ash Pond
Dayton Power & Light Company
Killen Electric Generating Station
Manchester, Ohio

Haley & Aldrich, Inc. (Haley & Aldrich) has assisted Dayton Power & Light Company (DP&L) with compiling the history of construction for the Killen Ash Pond at the Killen Electric Generating Station. This work was performed in accordance with the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities, 40 CFR Part 257, specifically §257.73(c)(1).

The Killen Ash Pond is comprised of the Bottom Ash Pond and Fly Ash Pond which together are referred to as the "Ash Pond." The Ohio Department of Natural Resources (ODNR) considers the Bottom Ash Pond and Fly Ash Pond to be a single unit.

To the extent feasible, Dayton Power & Light Co. has provided documentation supporting the history of construction. Information concerning the history of construction of the Killen Ash Pond is presented in the following sections.

§257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

Owner: Dayton Power & Light Company
745 US Route 52
P.O. Box 468
Aberdeen, OH 45101

Name of CCR Unit: Killen Ash Pond

NID[1] ID/ODNR Number: OH01127/8533-001

[1] National Inventory of Dams is a database which documents dams in the United States and is maintained by the USACE.

<u>§257.73(c)(1)(ii)</u>: The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 ½ minute or 15 minute topographic quadrangle map or a topographic map of equivalent scale if a USGS map is not available.

Latitude: 38°41'06"
Longitude: 83°28'02"
The general facility location map is provided in **Appendix 1**.

<u>§257.73(c)(1)(iii):</u> A statement of the purpose for which the CCR unit is being used.

Killen Ash Pond is a CCR impoundment that receives, settles and stores bottom ash and fly ash sluice water, cooling tower blow-down, coal pile runoff and other wastewaters from the plant.

<u>§257.73(c)(1)(iv):</u> The name and size, in acres, of the watershed within which the CCR unit is located.

Watershed Name: DP&L Killen Ash Pond
Watershed Area: 234 acres

Watershed delineation and associated area are provided in the figure in **Appendix 2**, from a memorandum titled, "Killen Pond Inflow Design Flood Control System Plan," by Haley & Aldrich dated October 2016. Since the Ash Pond berms are above-grade, the watershed area corresponds to the pond boundaries shown in the figure.

<u>§257.73(c)(1)(v)</u>: A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

A description of the physical and engineering properties of the foundation and abutment materials on which the Killen Ash Pond is constructed was included in a report entitled, "Killen Electric Generating Station Units No. 1 and No. 2, Ash Disposal Pond Dike and Foundation Studies, (Volume 1A of 2)" by Ebasco Services Inc., dated August 1979. Pertinent pages from this report providing the required information are provided in **Appendix 3**.

A subsurface exploration program, including work around the Killen Ash Pond, was performed as part of the CCR Rule compliance Safety Factor Assessment. The final report, entitled "Initial Safety Factor Assessment, Killen Electric Generating Station, Ash Pond" by Haley & Aldrich, Inc., dated October 2016 details test borings and cone penetrometer soundings performed adjacent to the unit (see pages 3-5 and Appendix A). This report in its entirety is available to the public via the DP&L CCR Rule compliance website.

<u>§257.73(c)(1)(vi)</u>: A statement of the type, size, range, and physical engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

The Killen Ash Pond was constructed in one stage between approximately 1979 and 1982. The Ash Pond is surrounded on all sides by above-grade earthen embankments with a low-permeability fill core and random fill zones on either side of the core. Clay material was used in the construction of the embankment's impervious core. The two portions of the Killen Ash Pond (Bottom Ash Pond and Fly Ash Pond) are separated by an interior dike constructed of random fill material borrowed from within the impoundment. Additionally, a 2 to 6-foot thick low-permeability earth blanket was installed to limit seepage. Maximum embankment height is 58 feet for the bottom ash portion of the pond and 77 feet for the fly ash portion of the pond.

The type, size, range, and physical engineering properties of the impoundment materials, as well as specifications for the method of site preparation and construction of are presented in a report entitled, "Killen Electric Generating Station Units No. 1 and No. 2, Ash Disposal Pond Dike and Foundation Studies, (Volume 1A of 2)" by Ebasco Services Inc., dated August 1979. Pertinent pages from this report are provided in **Appendix 4**.

§257.73(c)(1)(vii): At a scale that details engineering structures and appurtenances relevant to the design, construction, operation and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

Design drawings providing available information from the list above, have been provided in **Appendix 5**. Information identified in 257.73(c)(1)(vii) not included in the design drawings is assumed to be unavailable.

§257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.

The following instrumentation exists at the Killen Ash Pond:

- Settlement monuments SM1, SM2, SM3, SM4, SM5, SM6, SM7, SM8, SM9 and SM10
- Piezometers W-1, W-2, W-3, W-4, W-5, W-6, W-7, and W-8

Settlement monuments were installed around the perimeter of the impoundment dikes at the end of construction to monitor movement of the dikes during pond filling and during long-term operation of the impoundment.

Piezometers were initially installed to monitor the effectiveness of the low-permeability earth blanket installed during construction. The piezometers can also be utilized for monitoring long-term groundwater levels and to monitor water quality. The existing piezometers and settlement monuments at the Killen Ash Pond are shown on Figure 3 of a report entitled, "Round 10 Dam Assessment, Dayton Power and Light Company, Killen Electric Generating Station, Bottom Ash Pond and Fly Ash Pond," by

GZA GeoEnvironmental dated August 2012. The purpose of the settlement monuments and piezometers is also discussed in the above-referenced Ebasco report dated August 1979. Pertinent pages from the above referenced reports are provided in **Appendix 6**.

§257.73(c)(1)(ix): Area- capacity curves for the CCR unit.

The area-capacity curves for the Killen Ash Pond are contained in DP&L's "Operation Maintenance and Inspection Manual" dated April 2014. Copies of the curves are presented in **Appendix 7**.

§257.73(c)(1)(x): A description of each spillway and diversion design features and capacity calculations used in their determination.

The Killen Ash Pond includes two spillways and one recycle conveyance structure.

Internal Spillway between Bottom Ash Pond and Fly Ash Pond - Flow from the bottom ash portion of the pond is conveyed to the fly ash portion through a concrete channel equipped with removable steel channel stop logs.

Recycle Structure – An outlet conveys flow from the bottom ash portion back to the plant for use as recycled make-up water for plant process. This water enters a 58-foot high concrete pump station intake tower. Water entering the intake tower is conveyed back to the plant by gravity through a 36-inch diameter ductile iron pipe (DIP) which is installed inside of a 72-inch corrugated metal pipe (CMP) with open annulus. A 36-inch stainless steel sluice gate is provided in the pump station tower to shut off flow from the impoundment to the plant as needed.

Ash Pond Discharge - The fly ash portion of the Ash Pond has a single discharge point. A decant structure consisting of a 17-foot by 18-foot rectangular concrete overflow structure exists near the southwest corner of the impoundment. Water enters the overflow structure via dual weirs located on opposite sides of the structure. After entering the structure, water is conveyed through a 42-inch reinforced concrete pipe (RCP) to a 4-foot square x 61-foot high vertical concrete standpipe (blow out drain). Water is conveyed from the standpipe by a 36-inch DIP which is installed through a 72-inch RCP with open annulus. The 36-inch DIP outlets into a concrete energy dissipater structure and Parshall Flume. Flow from the flume enters a drainage ditch that discharges to the Ohio River.

A description of each spillway and diversion design feature for the Killen Ash Pond is included in DP&L's "Operation Maintenance and Inspection Manual" dated April 2014. Pertinent pages from the manual providing the required information are provided in **Appendix 8**. Design drawings for the above structures are included in **Appendix 5**. No historical capacity calculations were identified and are assumed to be unavailable.

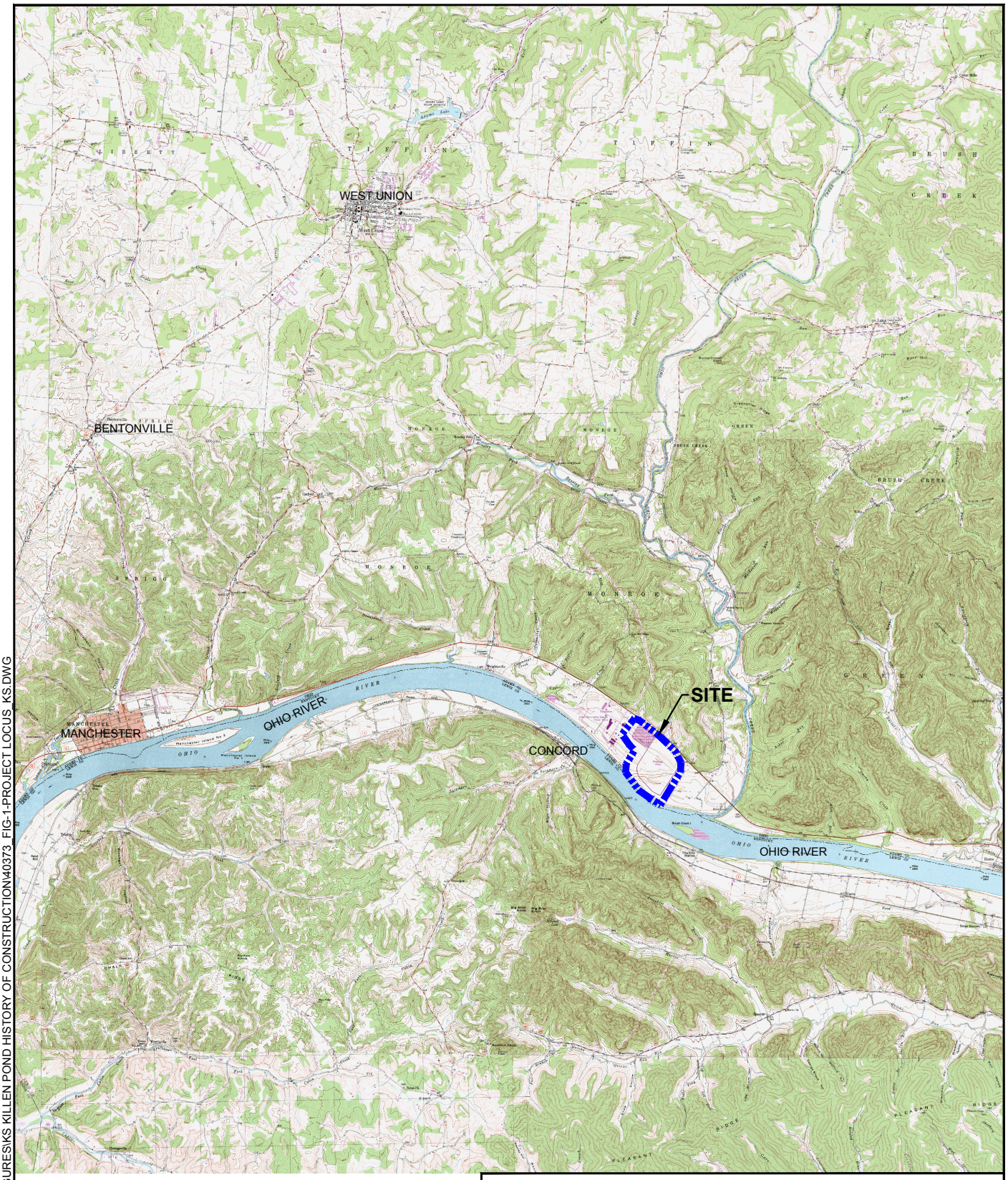
§257.73(c)(1)(xi): The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

The construction specifications are included in **Appendix 4**. Provisions for surveillance, maintenance, and repair of the Killen Ash Pond are discussed in the above referenced DP&L's "Operation Maintenance and Inspection Manual" dated April 2014. Pertinent pages from this manual providing the required information are provided in **Appendix 9**.

§257.73(c)(1)(xii): Any record or knowledge of structural instability of the CCR unit.

There are no records or knowledge of structural instability associated with the Killen Ash Pond as indicated in DP&L's "Killen Station Ash Pond Annual Inspection" report dated December 21, 2015 (performed in accordance with 40 CFR §257.83), or previous impoundment inspection reports by others. Pertinent pages from DP&L's 2015 report are provided in **Appendix 10**.

APPENDIX 1
Site Locus



TOPO SOURCE: USGS TOPOGRAPHIC MAPS, DECATUR, WEST UNION, LYNX, MAYSVILLE EAST, MACHESTER ISLANDS, CONCORDE - OHIO ORANGEBURG, TOLLESBORO, CHARTERS - KENTUCKY QUADRANGLES (2013)

HALEY ALDRICH

DAYTON POWER & LIGHT COMPANY
KILLEN GENERATING STATION
14869 U. S. 52
MANCHESTER, OHIO

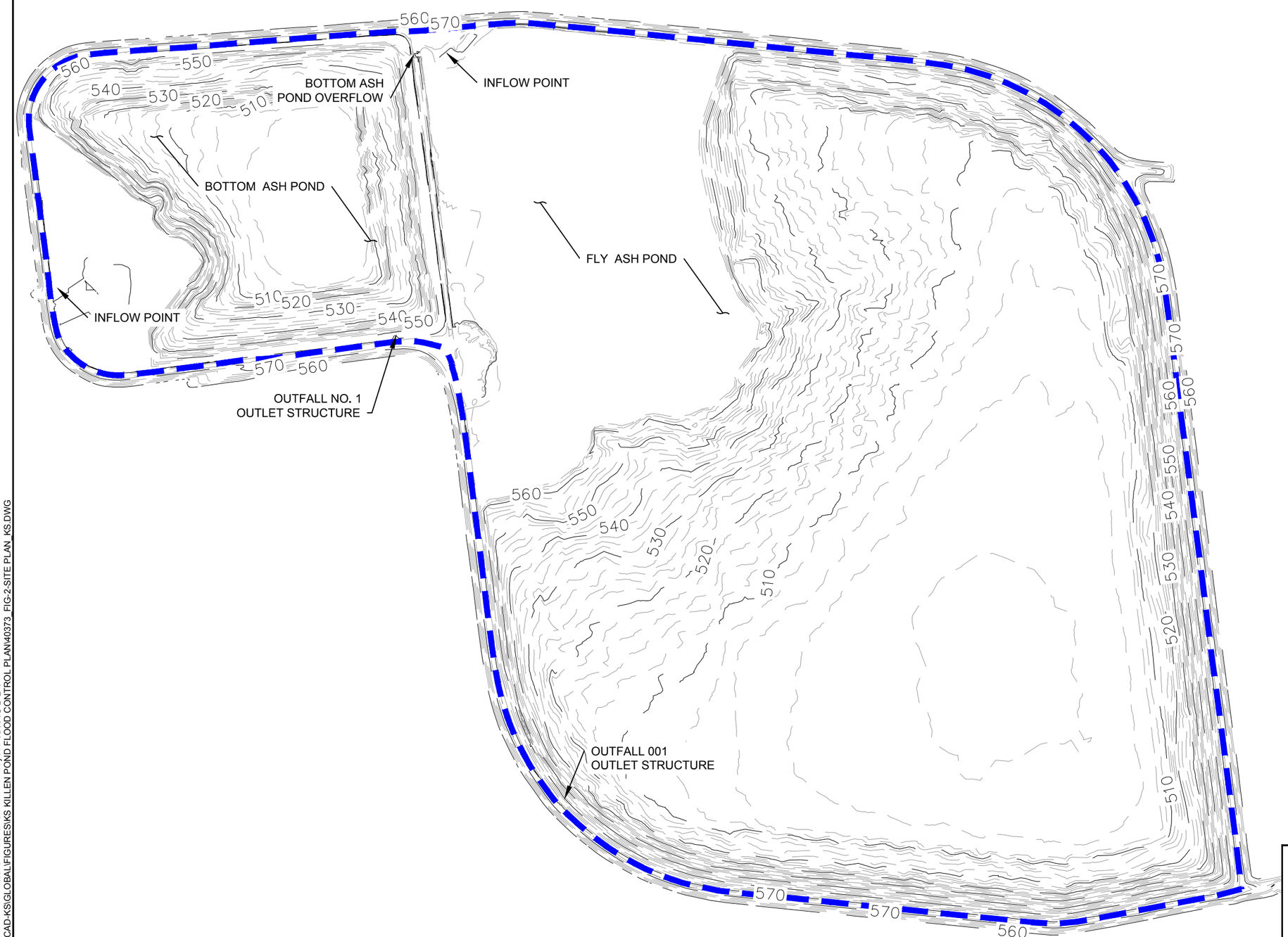
PROJECT LOCUS

APPROXIMATE SCALE: 1" = 10 000'
OCTOBER 2016

FIGURE 1

LUCAS, ANDY Printed: 6/13/2016 8:08 AM Layout: PROJECT LOCUS
G:\40373_DP&L\CAD-KS\GLOBAL\FIGURES\KS KILLEN POND HISTORY OF CONSTRUCTION\40373_FIG-1-PROJECT LOCUS_KS.DWG

APPENDIX 2
Figure 2 and Appendix from:
Killen Pond Inflow Design Flood Control System Plan
By Haley & Aldrich, Dated October 2016



LEGEND

APPROXIMATE KILLEN POND BOUNDARY

–520– EXISTING 10' CONTOUR

EXISTING 2' CONTOUR

NOTES

1. EXISTING TOPOGRAPHY CREATED USING COMPOSITE 2005 AND 2011 SURVEYS PROVIDED BY DP&L.
2. BATHYMETRIC SURVEY PERFORMED BY SOUTHERN OHIO DREDGING ON 30 JUNE 2011.
3. TRIBUTARY DRAINAGE AREA LIMITED TO PRECIPITATION FALLING WITHIN THE IMPOUNDMENT PERIMETER.
4. DEVELOPED IN CONJUNCTION WITH CORRESPONDING HYDROCAD FLOOD CONTROL PLAN MODEL.

0 400 800

SCALE IN FEET

HALEY ALDRICH

DAYTON POWER & LIGHT COMPANY
KILLEN ELECTRIC GENERATING STATION
MANCHESTER/WRIGHTSVILLE, OHIO

KILLEN POND
SITE PLAN

SCALE: AS SHOWN
MARCH 2016

FIGURE 2

LUCAS, ANDY Printed: 3/14/2016 10:21 AM Layout: HA-FIG-B-L-V
G:\40373_DP&L\CAD-KS\GLOBAL\FIGURES\KS KILLEN POND FLOOD CONTROL PLAN\40373_FIG-2-SITE PLAN_KS.DWG

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	122.687	0.000	0.000	0.000	122.687	Pasture/grassland/range, Fair	BAPS, FAPS
0.000	111.028	0.000	0.000	0.000	111.028	Water Surface	BAPS, FAPS
0.000	**233.715**	**0.000**	**0.000**	**0.000**	**233.715**	**TOTAL AREA**	

APPENDIX 3
Excerpt from:
Killen Electric Generating Station Units No. 1 and No. 2, Ash Disposal Pond Dike and Foundation Studies, (Volume 1A of 2)
By Ebasco Services, Inc., Dated August 1979
Pages 2, 18-20

II. SUMMARY

A. SITE CONDITIONS

The proposed ash disposal pond for the Killen Electric Generating Station covers approximately 285 acres in the area east of the plant site between U.S. Highway 52 and the Ohio River. The ash pond location lies on a large alluvial deposit in the flood plain of the Ohio River.

The subsurface profile consists of three (3) basic zones or layers of material. Silts and clays exist at the ground surface in varying thicknesses (5 to over 20 feet) over most of the site. A transition zone of silty sand and sandy silt material generally exists beneath the upper zone throughout the proposed ash disposal area but is more prominent near the river. Underlying the transition zone is a foundation of relatively clean sand which extends to bedrock. Occasional pockets of gravel exist throughout the subsurface profile.

Bedrock at the site exists within 20 feet of the ground surface in the northeast corner of the pond near U.S. Highway 52 and deepens to approximately 80 to 90 feet beneath the ground surface along the Ohio River. Bedrock beneath the site consists of calcareous shale interbedded with thin layers of limestone.

The groundwater level varies over the site due to local topographical influences, but generally averages Elevation 491.0. The groundwater level is slightly higher near the highway and drops near the river where it is influenced by concurrent water levels in the river.

A study of site and regional geology and seismology indicates the maximum seismic event likely to occur at the site would not exceed Intensity VI or VII on the Modified Mercalli scale. This would correspond to a peak horizontal ground acceleration of 0.10g at the site.

B. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on the field and laboratory investigation. Detailed conclusions and recommendations are provided in Section VI of this report.

1 - Fly ash and bottom ash disposal ponds of the required storage volumes can be constructed at the proposed plant site by utilizing the site materials to construct earth embankments.

2 - The ash disposal pond dike slopes are stable at 2.5 horizontal to 1.0 vertical under static and dynamic loading conditions. All slopes were analyzed for both the construction and the long-term cases. The long-term case was also analyzed for high water level conditions in the Ohio River.

B. LABORATORY INVESTIGATION

1. General

Laboratory tests were conducted on representative undisturbed and recompacted samples to determine the physical properties of the soils for strength and settlement evaluation. Typical compressibility characteristics were determined from the results of a total of twelve (12) consolidation tests. The results of eight (8) consolidated undrained (CU) triaxial tests, four (4) unconsolidated-undrained triaxial tests, and twenty-five (25) unconfined compression tests were used to develop typical strength parameters of the dike fill and foundation materials. The results of these tests are included in Appendix D.

Grain size and Atterberg limits tests were performed to determine soil classification. Standard Proctor moisture-density tests were performed to develop typical compaction characteristics and for correlation with soil strength parameters. Laboratory permeability tests were performed to determine permeability coefficients for the dike core materials. The results of the laboratory permeability tests are summarized in Table 2.

The laboratory tests performed during the detailed plant subsurface investigation were conducted in laboratories at the University of Illinois, Champaign, Illinois, and at Columbus Testing Laboratories, Columbus, Ohio. All other laboratory testing was conducted at Bowser-Morner Laboratories, Dayton, Ohio. All tests were performed in accordance with the relevant ASTM standards. The laboratory testing program was initiated and supervised by Ebasco Services Incorporated.

2. Design Strength Parameters

The selection of soil properties and shear strength design parameters is strongly influenced by the complexity of the soil profile and the manner in which samples are selected for testing. Graphical representations of shear strength were studied along with published values to select design strength values.

The perimeter and interior dikes (see Typical Sections, Figure 4) will be constructed from borrow materials excavated from within the ash pond. The dike fill materials consist of select impervious fill and random fill material. The select

impervious fill (silt and clay) will be used to construct an impervious core in the perimeter dike and to blanket the bottom and sides of the ash pond excavation, where required, to prevent leaching of the ash sluice water into the groundwater. The random fill will be used primarily for stability purposes in the perimeter dike; however, the interior dikes will be constructed entirely of random fill. Typical properties of the dike fill and foundation materials are summarized on Tables 3 and 4.

Triaxial shear tests were conducted on samples of impervious fill material at various moisture contents and densities to determine the effect of moisture content on drained and undrained shear strength. These tests were run on both field and laboratory compacted samples. The results of the triaxial tests are presented in Appendix D in the form of Mohr's Diagrams.

Figures 15 and 16 present a summary of triaxial data for effective and total strength parameters, respectively. A range of values and design strength envelopes were selected for use in design of the perimeter dike. An average cohesion (C) of 0.25 kips per square foot (ksf) and an internal angle of friction ($\emptyset$) of 25° were selected for effective stress analyses, and an average "C" of 1.40 ksf and $\emptyset = 14^{\circ}$ were selected for total stress analyses of select impervious fill.

A range of design values for random fill was conservatively assumed based on tests performed on the various materials at the site. Cohesion was varied from 0.0 to 1.2 ksf and $\emptyset$ from 16° to 38° for undrained analyses. For drained analyses, "C" was assumed to be 0.0 ksf and $\emptyset = 38^{\circ}$. These values will be verified during the first stages of construction by additional strength tests on field compacted samples.

The foundation materials consist of surface silts and clays, a transition zone of sandy silts and silty sands, and a thick underlying layer of sand and gravel. The surface silts and clays that characterize the site vary in thickness but average approximately 15 feet deep beneath the perimeter dike.

A cohesion of 0.50 ksf and $\emptyset = 8^{\circ}$ was conservatively selected for total stress analyses (undrained case) of the dike foundation materials based on the results of triaxial shear and unconfined compression tests performed on relatively undisturbed samples. For effective stress analysis (drained case) of the dike foundation materials, cohesion was assumed to be 0.0 ksf and $\emptyset = 35^{\circ}$.

B. LABORATORY INVESTIGATION (Continued)

For slope stability analyses it was assumed that the surface materials were underlain by sand with a cohesion of 0.0 ksf and $\emptyset = 35^{\circ}$.

APPENDIX 4
Excerpt from:
Killen Electric Generating Station Units No. 1 and No. 2, Ash Disposal Pond Dike and Foundation Studies, (Volume 1A of 2)
By Ebasco Services, Inc., Dated August 1979
Pages 4-19, Tables 1-4, Appendix B & D

III. ASH DISPOSAL POND OPERATION AND DESIGN REQUIREMENTS

A. ASH DISPOSAL POND OPERATION

1 - Bottom Ash Disposal Area

The bottom ash disposal area (referred to as bottom ash pond) will be a separate compartment located in the northwest corner of the ash pond. Bottom ash, consisting of vitrified particles from flour up to a few inches in diameter, and pyrites will be sluiced on an intermittant basis to the disposal area. Each generating unit will produce an average sluice water volume of 84,500 cubic feet per day for bottom ash and pyrites. In addition to inflow from the ash sluicing operations, a maximum flow of up to 1,150,000 cubic feet per day will come from the contaminated waste water basins (including storm runoff from the coal storage pile and plant area), and a maximum flow of up to 3,490,000 cubic feet per day will come from blowdown from the Unit No. 1 and No. 2 cooling towers.

The bottom ash pond will be initially filled with sluice water using make-up from the Ohio River. It will take approximately 24 months to fill the bottom ash pond to normal operating level at elevation 569.5. During initial filling one (1) sluice pipe will extend down the dike slope to the bottom of the ash pond to prevent washing and erosion of the dike slope. The bottom ash sluice pipes will be moved along the length of the dike, as required, to minimize excess buildup of ash at the point of discharge.

An intake structure for the ash sluice water recirculation system will be located in the southeast corner of the bottom ash pond. After the ash pond is filled initially, water will be recirculated to the plant and reused for subsequent sluicing operations. The ash sluice water recirculation structure is discussed in detail in Section III.B.2.

The water level in the bottom ash pond will be maintained at least 1 foot higher than the water level in the fly ash pond. An overflow structure into the fly ash pond will be provided to evacuate storm water and "blow down" the pond, as required.

2 - Fly Ash Disposal Area

The larger volume of the ash disposal pond will be for storage of fly ash. Fly ash will be sluiced to the fly ash disposal area on an intermittent basis. Each generating unit will produce an average sluice water volume of 295,000 cubic feet per day.

A. ASH DISPOSAL POND OPERATION (Continued)

The fly ash pond will be filled initially to elevation 568.5 using make-up water from the Ohio River. Initially, one (1) sluice pipe will extend down the dike slope and discharge at the bottom of the pond to prevent washing and erosion of the slope. It will take approximately 30 months to fill the fly ash pond to normal operating level. Once the pond is filled, the water will be recirculated. The point of discharge of the fly ash will be stationary, as the fly ash will flow and settle out over a large area of the pond.

A blowdown structure will be provided in the southwest corner of the fly ash pond to "blow down" the pond, as required during plant and pond operation, and to drain storm water from the pond. The blowdown structure will discharge to Ditch B and then to the Ohio River. The blowdown structure is discussed in detail in Sections III.A.3 and III.B.2.

3 - Spillway Requirements

Administrative Rule 1501:21-13-03, Spillway Design, General Requirements, states that every "dam shall have a spillway system which will safely pass the design flood without endangering the safety of the dam." The rule also states that the capacity of the spillway system shall be equal to the peak inflow of the design flood, unless the applicant demonstrates by flood routing procedures that the spillway system will not endanger the safety of the dam.

The primary purpose of the proposed ash pond is to provide a suitable and environmentally acceptable means to dispose of bottom ash and fly ash accumulated as a result of operation of the Killen Electric Generating Station. The ash disposal pond will be constructed in such a manner that runoff from "upstream" areas will be diverted around the pond (Section III.B.3). The only storm water which must be drained from the pond is direct rainfall on the pond. Thus, the ash pond does not fall entirely within the general classification of "dikes and dams" for which the Administrative Rules were intended and a variance from Rule 1501:21-13-03 was requested.

The blowdown structure will, in general, be designed in accordance with Rules 1501:21-13-04 (Pipe Conduit Spillways, General Requirements) and 1501:21-13-05 (Pipe Conduit Spillways, Specific Requirements). The blowdown structure will be specifically designed to meet the requirements of Part G, Rule 1501:21-13-04, which states that the pipe conduit shall be of sufficient size as "to remove from the reservoir within 10 days following passage of the design flood peak at least 80 percent of the water temporarily detained above the elevation

A. ASH DISPOSAL POND OPERATION (Continued)

of the primary spillway", or in this case, the blowdown structure. A detailed description of the blowdown structure is given in Section III.B.2. Flood routing through the blowdown structure is discussed in detail in Section V.C.2.

Part F, Rule 1501:21-13-04, states that "a secondary (emergency) overflow spillway shall be required except where specifically exempted by the Chief." Adequate freeboard would exist within the pond to store the PMS, without discharge through the blowdown structure. Due to the nature and purpose of the pond and the fact that the blowdown structure will be designed to route the PMS from the pond as stated above, a secondary spillway was considered unnecessary and a variance from Part F, Rule 1501:21-13-04 was requested. The blowdown structure will be provided with a hood to prevent floating material from entering the drain and clogging the discharge pipe. Access will be provided to the structure for removal of any debris which may build up around the outside of the structure.

4 - Drain Requirements

Administrative Rule 1501:21-13-06 required all "dams in Class I to include a device to permit draining the reservoir within a reasonable period of time as approved by the Chief." Upstream storm runoff will be diverted around the ash pond and the dikes will not impound any flood water other than that water which rains directly into the pond (see Section III.B.3). The storm water which rains directly in the pond will be routed through the blowdown structure as described in Section V.C.2. Thus, the ash disposal pond will not be endangered by any storm water which would require the reservoir to be drained.

Also, as previously stated, the primary purpose of the ash pond will be to dispose of bottom ash and fly ash accumulated during operation of the Killen Electric Generating Station. If this pond were to be drained, the water discharge would not meet the current State and Federal water quality standards.

In conclusion, the pond will not impound "upstream" runoff, and any large discharge from the pond lowering the operating water level would result in a violation of water quality standards. Therefore, a drain was not included in the design of the pond and a variance from Rule 1501:21-13-06 was requested.

B. ASH DISPOSAL POND DESIGN REQUIREMENTS

1. Ash Pond Dikes and Earth Blanket

Construction of the ash disposal pond will involve building an earth perimeter impoundment dike and an earth interior dividing dike. The perimeter dike will impound approximately 1903 acre-feet of bottom ash storage capacity and 11,004 acre-feet of fly ash storage capacity.

The interior dividing dike will separate the bottom ash from the fly ash within the pond. A description of the ash disposal operation pond is given in Section III.A.

The perimeter dike will be approximately 13,957 feet long and will average approximately 50 feet in height. The perimeter dike will attain a maximum height of 87 feet as it crosses Spring Run in the southwest corner of the ash pond. The crest of the perimeter dike will be 15 feet wide and will be maintained at Elevation 573.0. Both the inside and outside slopes of the dike will be constructed 2.5 horizontal to 1.0 vertical from crest down to natural grade. A 15 foot wide berm will be maintained on the outside face of the perimeter dike at Elevation 540.0. An approximate 50 foot wide berm will be held at natural grade at the inside toe of the dike. Existing grade will be cut back at 2.5 horizontal to 1.0 vertical down to the bottom of the ash pond (Elevation 492.0 in the bottom ash pond and 498.0 in the fly ash pond) to provide borrow material for construction of the dikes.

The perimeter dike will be a zoned embankment consisting of an impervious core and random fill zones on either side of the core. The central core will be 15 feet wide at an elevation 4 feet below the crest of the dike and will slope at 1.0 horizontal to 1.0 vertical down to existing grade.

A trench key will be used to tie the core into the foundation materials, where required. The trench key will be used wherever the perimeter dike crosses existing stream beds and in areas where the existing grade transverse to the direction of the dike is sufficiently steep so as to require a trench key.

Impervious fill material will be used to cap the top 4 feet of the dike for ease of construction. The embankment fill zones are shown on a typical cross section of the perimeter dike on Figure 4.

B. ASH DISPOSAL POND DESIGN REQUIREMENTS (Continued)

Drainage ditches will collect runoff from the outside face of the perimeter dike. The details of these ditches are discussed in Section III.B.3.

To facilitate construction of the dike in the southwest corner of the ash pond in the area of Spring Run, a temporary drain will be installed through the dike foundation. The drain will consist of a 24-inch diameter corrugated metal pipe with a silting basin at the upstream end of the pipe and a flap gate at the downstream end. The pipe will drain the interior of the ash pond during construction and will be pressure grouted full with a lean cement-sand grout upon completion of the dikes. The pipe will be offset from the bottom of the existing channel, thus allowing for the pipe to be founded in the original foundation material. Anti-seep collars will be installed and the pipe will be encased along its entire length with lean concrete. The normal intake will consist of a metal riser pipe with a skimmer for trash and debris, while a 24-inch slide gate with a trash rack will be provided for a low water inlet. The flap gate will keep trash and debris in the river from backing up inside the pipe. Also, the flap gate will prevent the Ohio River from backing up inside the dike and flooding the excavation during construction.

The interior dike separating the bottom ash from the fly ash will be approximately 1160 feet long and will average 45 feet in height. The crest of the interior dike will also be 15 feet wide and will be maintained at Elevation 573.0. The interior dike slopes will be 2.5 horizontal to 1.0 vertical from the crest down to natural grade and a 50 foot wide berm will be held at natural grade at the toe of the dike. The interior dike will be homogeneous embankment constructed of random fill material borrowed from within the pond. A typical cross-section of the interior dividing dike is shown on Figure 4.

A gravel road will be constructed on top of the perimeter and interior dikes. The road will protect the top of the dikes from erosion due to rainfall runoff, wave spray, etc., and provide all-weather access and protection against traffic wear.

All dike slopes will be grass seeded to protect against erosion. A six (6) inch cover of topsoil will be placed on all dike slopes prior to seeding to aid the growth of vegetation.

B. ASH DISPOSAL POND DESIGN REQUIREMENTS (Continued)

An impervious earth blanket will be installed to protect the ash pond against seepage, where the existing material is insufficient or the sand and gravel strata have been exposed by excavation. In general, the earth blanket will consist of compacted select impervious fill tapered from 6 feet thick at the toe of the slope of the excavation down to 2 feet thick some distance toward the center of the ash pond (extent of blanket depends on length of seepage path to Ohio River). The impervious earth blanket will be maintained a constant 6 feet thick in the bottom ash pond. A 6 foot thickness measured normal to the slope will be put on the side slopes of the excavation. Excess topsoil stripped during excavation of the ash pond will be spoiled in the unblanketed central portion of the fly ash pond.

2. Appurtenant Dike Structures

Appurtenant structures associated with construction of the ash disposal pond include the ash sluicing pipes and supports, the sluice pipe dike crossing structures, the sluice water recirculating structure, the bottom ash pond overflow structure, and the blowdown structure from the fly ash disposal area. These structures are generally designed in accordance with the Administrative Rules.

Sluice Pipes and Supports - Bottom ash and pyrites will be sluiced to the disposal area in two (2) 10-inch diameter pipes (1 per unit). Fly ash will be sluiced to the fly ash disposal area in two (2) 8-inch diameter pipes (1 per unit). A common standby pipe will be provided at each location.

The bottom ash pipes will be elevated to the crest of the dike by an earth ramp constructed on the outside face of the west dike of the bottom ash pond. After crossing the dike crest the sluice pipes will run along the inside crest of the perimeter dike. Pipe supports (cradles) will be precast concrete founded in the upper dike fill. Riprap will be placed at the discharge points to prevent washing and erosion of the slopes. One (1) pipe will extend to the bottom of the slope at each discharge location to prevent washing and erosion of the slopes during initial filling.

Two other pipes will also discharge into the bottom ash pond. A 20-inch pipe will carry the combined blowdown from the Unit 1 and 2 cooling towers, and a 18-inch pipe will convey effluent from the waste water collection basins. Both pipes will be buried in the bottom ash pipe ramp and will cross the

dike crest beneath the road and the bottom ash pipes. These two pipes will discharge initially into corrugated metal pipes which will extend down the inside slope during initial filling of the pond to prevent washing and erosion. Rip rap will be placed around the discharge points.

Sluice Pipe Dike Crossing Structures - Sluice pipes will cross the dike crest in concrete box culverts. The service road on the crest of dikes will be raised over the culverts. The bottom ash pipes will cross the bottom ash dike near the southern end of the west dike. The fly ash pipes will first cross the south perimeter dike of the bottom ash pond, and then cross the southern end of the interior dike.

Bottom Ash Pond Overflow Structure - The bottom ash pond overflow structure will be located in the crest at the north end of the interior dike. The overflow structure will be a rectangular concrete box culvert with steel stop logs to control flow from the bottom ash to the fly ash pond and to maintain the normal operating level of the bottom ash pond at Elevation 569.5. The stop logs will act as a rectangular wier to control the flow, with an outlet capacity sufficient to safely pass the design flood in accordance with the Administrative Rules.

Riprap, placed on a sand filter, will be provided around the structure to prevent erosion or undermining of the structure. Special slope protection will be required below the structure on the fly ash side of the interior dike during initial filling of the pond. This is required due to the fact that the bottom ash pond will fill up with sluice water at a faster rate than the fly ash pond, and the overflow will run down the slope.

Sluice Water Recirculating Structure - Sluice water from the bottom ash pond will be recirculated and reused. The intake structure for the recirculating sytem will be located in the southeast corner of the bottom ash pond. The intake structure consists of a vertical circular concrete standpipe located in the inside slope of the perimeter dike. The intake pipe will extend from Elevation 565.0 to down below existing grade where one (1) 36-inch diameter ductile iron pipe will carry the water beneath the dike (through the foundation materials) and back to the plant. A protective hood will be installed to prevent floating debris from entering the intake pipe. A splitter will be installed in the top of the standpipe to prevent vortexing.

B. ASH DISPOSAL POND DESIGN REQUIREMENTS (Continued)

Beneath the dike, the ductile iron pipe will be enclosed in a 72-inch diameter corrugated metal pipe. Anti-seep collars will be installed on the corrugated metal pipe beneath the dike core. A 36-inch sluice gate will be installed in the vertical standpipe at the mouth of the ductile iron pipe to isolate the pipe if required. A footbridge will be constructed from the dike crest to the top of the intake standpipe to provide access for operating the sluice gate and to clear floating debris away from the intake area. The sluice water will be recirculated to the Killen Station plant area in a pipe located along the south dike of the bottom ash pond.

Blowdown Structure - The ash pond blowdown structure will be located in the southwest corner of the fly ash pond. The blowdown structure will be used to "blow down" the pond, as required, during plant and ash pond operation and to drain storm water from the ash pond. The blowdown structure will discharge into Ditch B. Sufficient land area adjacent to the dike will be provided for the possible future addition of a pH neutralization facility to treat blowdown water from the ash pond before it is discharged into Ditch B. In accordance with Administrative Rule 1501:21-13-04, Part G, the blowdown structure will be designed to remove from the reservoir within 10 days at least 80 percent of the water from the PMS temporarily detained in the reservoir above the elevation of the primary spillway, or in this case the inlet weir of the blowdown structure.

The blowdown intake structure will consist of a concrete box equipped with a weir at Elevation 568.30. The intake will be founded in the random fill on the inside slope of the perimeter dike just below the crest. A horizontal 42-inch diameter reinforced concrete pipe with a flow control gate will convey the water to a vertical concrete standpipe (located in the dike core) which will drop the water below the dike. A 36-inch diameter ductile iron pipe will carry the water beneath the dike, discharging into an open ditch. Expansion joints will be provided, where required, to compensate for potential differential settlement and horizontal spreading of the dike fill. The ductile iron pipe will be enclosed in a 72-inch diameter corrugated metal pipe. Anti-seep collars will be installed on the corrugated metal pipe beneath the dike core. Due to the configuration of the blowdown pipe system, it will not be subjected to negative pressures. Cathodic protection will be provided for all metal pipes.

B. ASH DISPOSAL POND DESIGN REQUIREMENTS (Continued)

An energy dissipating structure will be provided at the discharge end of the 36-inch diameter ductile iron pipe to slow the flow and prevent erosion of the ditch. Water from the ash pond will be directed through a Parshall flume (to monitor discharge) and then empty into Ditch B. A blind flange will be installed in the wall of the energy dissipating structure to allow for the possible future addition of the pH neutralization facility.

A protective hood will be installed around the intake to prevent floating debris from entering the intake. A footbridge will be constructed from the dike crest to the intake to provide access to the control gate and to clear floating debris away from the intake structure.

3. Site Drainage

Construction of the ash disposal pond dikes will alter the natural drainage patterns existing in the immediate vicinity of the pond. Two (2) ditches, both starting near the northwest corner of the ash pond, will be constructed outside the perimeter dike to divert runoff from "upstream" areas around the pond and into the Ohio River. These ditches will be designed based on a storm with a 50 year recurrence interval.

(Spring Run) One (1) ditch (Ditch A) will be constructed parallel to the north perimeter dike (between the dike and U.S. Highway 52) and then curve south, parallelling the east perimeter dike to the river (see Construction Drawings, Ash Pond Area General Plan). This ditch will collect runoff from approximately 833 acres north of the highway and from the area east of the pond. Two drop structures will be constructed near culvert locations under U.S. Highway 52. All "upstream" water which presently drains through the ash pond site via Spring Run or its tributaries will be diverted through the new ditch. Any low areas remaining between Ditch A and the dike will be filled and graded to drain. A concrete drop structure will be required to dissipate the velocity of the water from the higher ground near the highway down to the lower area where Ditch A will intercept Spring Run. The ditch will be designed to carry a maximum flow of 950 cubic feet per second at a velocity of 3.7 feet per second near the outfall to the river. A concrete outfall structure will be constructed at the Ohio River. Riprap or other special protective measures against erosion will be installed as required. The ditch slopes will also be seeded to protect against erosion. The center line of Ditch A will be located approximately 100 feet from the toe of the north dike and 500 feet from the toe of the east dike so as not to pose any erosional problems for the ash pond perimeter dike.

B. ASH DISPOSAL POND DESIGN REQUIREMENTS (Continued)

The other main ditch (Ditch B) will parallel the west perimeter dike, approximately 50 to 75 feet from the toe, draining the area west of the ash disposal pond between the pond and the power plant. Several low areas will require filling and grading to drain. Ditch B will be designed to carry a maximum flow of 198 cubic feet per second (167 cfs due to the design storm plus 31 cfs from ash pond blowdown structure during the design storm) at a velocity of 3.5 feet per second.

The water will pass through culverts beneath the ash disposal area entrance roads and follow the perimeter dike alignment to the river. A concrete outfall structure will be required at the Ohio River. Riprap will be placed along this ditch, where required, to protect the toe of the dike and the ditch from possible erosion. The remainder of the ditch will be seeded to protect the slopes.

Small ditches and downfall gutters will be constructed along the berm at Elevation 540.0 on the outside face of the perimeter dike to protect the face of the dike from erosion. Downfall gutters placed at regular intervals along the berm will convey water directly to the perimeter ditches, or to small "collector ditches" along the toe of the dike and then to the perimeter ditches.

IV. INVESTIGATIVE TECHNIQUES

A. FIELD INVESTIGATION

1. General

The subsurface investigation at the Killen Station ash disposal pond site was conducted in several phases from November, 1973, to December, 1975. A total of 170 soil test borings and 16 test pits were used to evaluate the subsurface profile throughout the proposed ash pond location. Static falling head field permeability tests were performed in 13 of the borings. Twenty-two (22) piezometers were installed to determine existing groundwater elevations.

All field investigative work was performed under the guidance of Ebasco Services Incorporated. The locations of all borings and test pits are shown on Figure 2.

The borings and test pits in the ash pond area were identified, as follows:

P - Preliminary investigation and detailed plant investigation borings.

A - Detailed investigation borings in ash pond area

D - Borings along proposed docking line

TP - Test pits

The results of all boring and sampling procedures are presented on Boring and Test Pit Logs in Appendices E and F, respectively. The Perimeter and Interior Dike Center Line Profiles, included in the construction drawings (Appendix C), show all borings located within 200 feet of the dike center lines.

The preliminary investigation at the Killen Station site was conducted in November and December, 1973. Six (6) borings were located in or very near the area selected for the ash disposal pond for Units No. 1 and No. 2. The initial drilling and sampling was performed by Bowser-Morner Testing Laboratories, Inc., Dayton, Ohio. All borings were extended approximately 10 feet into bedrock. Standard penetration tests were performed at 5 foot intervals from the ground surface to refusal. Ax size cores were obtained to investigate the refusal materials. Five (5) piezometers were installed to monitor groundwater levels.

A. FIELD INVESTIGATION (Continued)

The detailed subsurface investigation was conducted between January and May, 1974. The boring contractor was Buckeye Drilling Corporation, Columbus, Ohio. During this phase of the investigation, a total of 107 borings were made in the ash pond area. A large number of borings were concentrated in the bottom ash disposal area and in the northern half of the fly ash disposal area to locate borrow areas for select sand backfill material to support the main plant structures.

Continuous split-spoon sampling was specified in most of the "A" borings during this phase of investigation to be certain that the recovered sample was representative of in situ soil and free from contamination of auger cuttings and other materials falling back into the hole. Seventeen (17) piezometers were installed to determine groundwater elevations, particularly in the proposed borrow areas.

In September and October, 1974, and November and December, 1975, fifty-three (53) additional borings were drilled and sixteen (16) test pits were excavated. The borings were drilled by Bowser-Morner Testing Laboratories, Inc., Dayton, Ohio, and the test pits were excavated by UCON Construction Company, a subsidiary of DP&L. The test pits are discussed in detail in Section IV.A.4. Split-spoon samples were generally specified at 5 foot intervals. Thirty-two (32) relatively undisturbed samples were obtained during the course of drilling for qualitative laboratory testing. Field permeability tests were performed at thirteen (13) boring locations. The procedures and results of these permeability tests are discussed in Section III.A.3.

In addition to the "A" and "P" series borings, four (4) "D" series borings were utilized to provide continuity along the river front. These borings were drilled along the docking line in the Ohio River for the plant barge unloading facilities and extend to near the southwest corner of the ash pond.

2. Boring and Sampling Procedures

The soil test borings were made using a truck-mounted boring rig. Generally, all borings were advanced using hollow stem augers, however, some of the "A" borings drilled during the detailed plant subsurface investigation were advanced using either "drilling mud" or as "cased borings." Standard penetration tests were performed, as specified, and samples were

retrieved, visually classified, sealed in moisture tight jars and transported to the laboratory for inspection. The depths at which these samples were obtained are indicated on the Boring Logs in Appendix E.

Relatively undisturbed samples were obtained at specified depths by hydraulically pressing, at a constant rate, 3-inch OD thin-walled steel tubes. Once the samples were obtained, the ends of the tube were sealed and the samples were transported to the laboratory for possible tests and inspection. The locations and depths of the undisturbed samples obtained are shown on the Boring Logs in Appendix E.

Rock coring procedures were used to determine the character and continuity of the refusal materials. Ax size core was taken using a hollow double-tube core barrel fitted with a diamond-studded bit. The core samples retrieved were stored in wooden core boxes and transported to the laboratory, where they were classified, and the recovery and rock quality designation (RQD) were determined. The recovery is the ratio of the sample length to the depth drilled expressed as a percent. The RQD is the percentage of the length of hard, sound core recovered which has core segments 4 or more inches long compared to the total length of the run. Generalized rock descriptions, percent recovery, RQD values and bit sizes used are shown on the appropriate boring logs.

3. Field Permeability Tests

Thirteen (13) field permeability tests were conducted to determine the permeability of the upper foundation soils (primarily silts and clays) beneath the perimeter dike. These tests were performed in boreholes using the static falling head method. The borehole was first advanced to the desired depth using a hollow stem auger. A 2-inch diameter PVC pipe was inserted into the borehole, seated at the bottom, and the inside of the pipe flushed out. The pipe was filled with water and the rate of inflow (or fall of water in the pipe) was measured. The permeability of the upper foundation materials was estimated on the basis of the flow data from these tests. Permeabilities calculated are in the range of 10^{-6} centimeters per second. The results of these tests are summarized in Table 1.

A. FIELD INVESTIGATION (Continued)

4. Test Pits

A total of sixteen (16) test pits were excavated in the ash pond area in October through December, 1975. Test pits TP-1 through TP-4 were excavated to obtain 50 pound bag samples for laboratory permeability tests. These test pits were excavated to a depth of 5 to 6 feet with a bulldozer, the samples were obtained, and then transported to the laboratory for testing.

Test Pits TP-5 through TP-16 were excavated at various locations to verify material types and locations. Test Pits TP-5 through TP-15 were excavated using a bulldozer. The test pits ranged in size from 75 to 100 feet in length, up to 50 feet wide, and were from 12 to 15 feet deep. One (1) side was benched at approximately 5 foot intervals for safety and one (1) side was maintained vertical. TP-16, located in the soft bottom of Spring Run Creek, required the use of a backhoe and was excavated to a depth of 14 to 15 feet. Each test pit was logged by an Ebasco soils engineer and selected samples were obtained for grain size analysis. All test pits were backfilled upon completion of logging and sampling operations. The test pit locations are shown on Figure 2. The logs for each test pit are presented in Appendix F.

5. Clay Test Fill

A clay test fill was constructed prior to the placement of miscellaneous clay fill material in the Killen Station plant area. The test fill was used to establish an efficient method of construction of all clay fill materials to be used on the Killen Project, including the select impervious fill material to be used in the perimeter dike core and the impervious earth blanket.

In addition to developing compaction procedures, the test fill was used to determine strength and consolidation characteristics of the fill material. Eighteen (18) relatively undisturbed samples were obtained from nine (9) borings made in the test fill. Three (3) triaxial shear tests and eight (8) unconfined compression tests were performed to develop strength characteristics of the compacted fill material. Six (6) consolidation tests were performed to determine consolidation characteristics. The results of these tests are included in Appendix D. The appropriate strength values selected are discussed in Section IV.B.2.

B. LABORATORY INVESTIGATION

1. General

Laboratory tests were conducted on representative undisturbed and recompacted samples to determine the physical properties of the soils for strength and settlement evaluation. Typical compressibility characteristics were determined from the results of a total of twelve (12) consolidation tests. The results of eight (8) consolidated undrained (CU) triaxial tests, four (4) unconsolidated-undrained triaxial tests, and twenty-five (25) unconfined compression tests were used to develop typical strength parameters of the dike fill and foundation materials. The results of these tests are included in Appendix D.

Grain size and Atterberg limits tests were performed to determine soil classification. Standard Proctor moisture-density tests were performed to develop typical compaction characteristics and for correlation with soil strength parameters. Laboratory permeability tests were performed to determine permeability coefficients for the dike core materials. The results of the laboratory permeability tests are summarized in Table 2.

The laboratory tests performed during the detailed plant subsurface investigation were conducted in laboratories at the University of Illinois, Champaign, Illinois, and at Columbus Testing Laboratories, Columbus, Ohio. All other laboratory testing was conducted at Bowser-Morner Laboratories, Dayton, Ohio. All tests were performed in accordance with the relevant ASTM standards. The laboratory testing program was initiated and supervised by Ebasco Services Incorporated.

2. Design Strength Parameters

The selection of soil properties and shear strength design parameters is strongly influenced by the complexity of the soil profile and the manner in which samples are selected for testing. Graphical representations of shear strength were studied along with published values to select design strength values.

The perimeter and interior dikes (see Typical Sections, Figure 4) will be constructed from borrow materials excavated from within the ash pond. The dike fill materials consist of select impervious fill and random fill material. The select

B. LABORATORY INVESTIGATION (Continued)

impervious fill (silt and clay) will be used to construct an impervious core in the perimeter dike and to blanket the bottom and sides of the ash pond excavation, where required, to prevent leaching of the ash sluice water into the groundwater. The random fill will be used primarily for stability purposes in the perimeter dike; however, the interior dikes will be constructed entirely of random fill. Typical properties of the dike fill and foundation materials are summarized on Tables 3 and 4.

Triaxial shear tests were conducted on samples of impervious fill material at various moisture contents and densities to determine the effect of moisture content on drained and undrained shear strength. These tests were run on both field and laboratory compacted samples. The results of the triaxial tests are presented in Appendix D in the form of Mohr's Diagrams.

Figures 15 and 16 present a summary of triaxial data for effective and total strength parameters, respectively. A range of values and design strength envelopes were selected for use in design of the perimeter dike. An average cohesion (C) of 0.25 kips per square foot (ksf) and an internal angle of friction (ϕ) of 25° were selected for effective stress analyses, and an average "C" of 1.40 ksf and $\phi = 14^{\circ}$ were selected for total stress analyses of select impervious fill.

A range of design values for random fill was conservatively assumed based on tests performed on the various materials at the site. Cohesion was varied from 0.0 to 1.2 ksf and ϕ from 16° to 38° for undrained analyses. For drained analyses, "C" was assumed to be 0.0 ksf and $\phi = 38^{\circ}$. These values will be verified during the first stages of construction by additional strength tests on field compacted samples.

The foundation materials consist of surface silts and clays, a transition zone of sandy silts and silty sands, and a thick underlying layer of sand and gravel. The surface silts and clays that characterize the site vary in thickness but average approximately 15 feet deep beneath the perimeter dike.

A cohesion of 0.50 ksf and $\phi = 8^{\circ}$ was conservatively selected for total stress analyses (undrained case) of the dike foundation materials based on the results of triaxial shear and unconfined compression tests performed on relatively undisturbed samples. For effective stress analysis (drained case) of the dike foundation materials, cohesion was assumed to be 0.0 ksf and $\phi = 35^{\circ}$.

TABLE 1

FIELD PERMEABILITY TESTS

Boring Number	Depth of Test (ft)	Permeability (cm/sec)	
A-131	10	*	
A-131	20	*	
A-132	5	*	
A-132	15	1.8×10^{-6}	
A-132	20	6.0×10^{-7}	
A-134	5	*	
A-134	15	*	
A-134	25	2.4×10^{-6}	
A-136	5	*	
A-136	15	*	
A-136	25	5.5×10^{-6}	
A-138	5	*	
A-138	15	*	
A-138	25	3.9×10^{-6}	
A-140	5	*	
A-140	20	*	
A-141	5	*	
A-141	35	1.4×10^{-7}	lowest
A-143	5	*	
A-143	10	*	
A-143	20	*	
A-143	28.5	7.8×10^{-6}	
A-144	5	*	
A-144	2	3.1×10^{-3}	highest
A-144A	17	2.6×10^{-5}	
A-144B	14	2.9×10^{-3}	
A-144C	15	1.2×10^{-3}	
A-146	5	*	
A-146	15	6.0×10^{-7}	
A-146	20	1.5×10^{-6}	

* Permeability too small to measure.

TABLE 2

SUMMARY OF LABORATORY PERMEABILITY TESTS

Location	Material	Maximum Dry Density (PCF)	Optimum Moisture Content (%)	% Compaction of Sample	Moisture Content of Sample (%)	Permeability (cm/sec)
TP-1	Brown silt, some sand, some clay	116.2	14.3	90.0	18.3	3.3×10^{-6}
TP-1	Brown silt, some sand, some clay	116.2	14.3	95.0	16.3	3.3×10^{-6}
TP-2	Brown silt, some sand, some clay	112.9	16.4	90.0	20.4	7.4×10^{-6}
TP-2	Brown silt, some sand, some clay	112.9	16.4	95.0	18.4	3.0×10^{-6}
TP-3	Gray silt and clay, trace of sand	110.3	17.6	90.0	21.6	2.5×10^{-6}
TP-3	Gray silt and clay, trace of sand	110.3	17.6	95.0	19.6	2.6×10^{-6}
TP-4	Brown silt, some clay, some sand	110.4	18.2	90.0	22.2	2.1×10^{-6}
TP-4	Brown silt, some clay, some sand	110.4	18.2	95.0	20.2	1.7×10^{-6}

TABLE 3

TYPICAL PROPERTIES OF IMPERVIOUS MATERIAL

A. In Situ Silt and Clay

1.	Saturated Unit Weight	126 PCF
2.	Submerged Unit Weight	64 PCF
3.	Dry Unit Weight	105 $\pm$ 8 PCF
4.	Natural Moisture Content	20 $\pm$ 5 percent
5.	Liquid Limit	36 $\pm$ 5
6.	Plasticity Index	14 $\pm$ 7
7.	Unconfined Compressive Strength	3.2 $\pm$ 1.7 TSF
8.	Cohesion = $\frac{Qu}{2}$ = $\frac{1.5 \text{ TSF}}{2}$ (Min.)	1.5 KSF
9.	Angle of Internal Shear Resistance	8° (assumed)
10.	Coefficient of Permeability	10^{-6} cm/sec

B. Compacted Select Impervious Fill

1.	Saturated Unit Weight	133 PCF
2.	Submerged Unit Weight	71 PCF
3.	Dry Unit Weight	112 $\pm$ 6 PCF
4.	Natural Moisture Content	18.5 $\pm$ 4.5 percent
5.	Unconfined Compressive Strength	6.5 $\pm$ 2 KSF
6.	Cohesion (from Triaxial Tests)	1.4 KSF
7.	Angle of Internal Friction	14°
8.	Coefficient of Permeability	10^{-6} cm/sec

TABLE 4

TYPICAL PROPERTIES OF RANDOM MATERIAL

A. In Situ Sand

1. Average Relative Density	65 to 70 percent
2. Saturated Unit Weight	120 PCF
3. Submerged Unit Weight	107 PCF
4. Moisture Content	12 $\pm$ 6 percent
5. Angle of Internal Fraction	35°
6. Cohesion	0 KSF
7. Coefficient of Permeability	10^{-3} cm/sec

B. Compacted Random Fill Material

1. Saturated Unit Weight	130 PCF
2. Submerged Unit Weight	68 PCF
3. Dry Unit Weight	116 PCF
4. Natural Moisture Content	12 $\pm$ 6 percent
5. Cohesion	0 to 1.2 KSF
6. Angle of Internal Friction	16° to 38°
7. Coefficient of Permeability (assumed)	10^{-3} + cm/sec

APPENDIX B

EXCAVATION, BACKFILL, FILLING AND GRADING SPECIFICATION

Project Identification

No. DAY-3848-CH-3

EBASCO SERVICES INCORPORATED

EBASCO SPECIFICATION

EXCAVATION, BACKFILL, FILLING AND GRADING

PURCHASER: THE DAYTON POWER AND LIGHT COMPANY
CINCINNATI GAS AND ELECTRIC COMPANY

OWNER: THE DAYTON POWER AND LIGHT COMPANY
CINCINNATI GAS AND ELECTRIC COMPANY

OPERATING COMPANY: THE DAYTON POWER AND LIGHT COMPANY

PROJECT: KILLEN ELECTRIC GENERATING STATION

UNIT NO.: 1 & 2 NOMINAL KW 600 MW PER UNIT

LOCATION: ADAMS COUNTY, OHIO

SELLER:

CONSTRUCTION MANAGER: DANIEL CONSTRUCTION COMPANY

STATE OF OHIO JAMES S. SEMPLE, JR. No. 38774 REGISTERED PROFESSIONAL ENGINEER

GEORGIA REGISTERED No. 9506 PROFESSIONAL ENGINEER JAMES S. SEMPLE, JR.

"Prepared under the supervision of

James S. Semple, Jr., Ohio - PE License No. E-38774

James S. Semple, Jr.

Spec. Status	Date	Prepared By:	Reviewed By:	Pages Affected
Original	5-14-74	K Ramachandra KR 5/14/74	J L Ehasz JLE	
R1	6-7-74	K Ramachandra KR 6/10/74	J L Ehasz JLE	i,3,4,5,6,7,8,9, 10,11,12,13,14,15 16 and deleted 17
R2	6-28-74	K Ramachandra KR/JGJ. 7/1/74	J L Ehasz JLE 7/1/74	1 to 18 Inclusive
R3	11-3-75	K A Kessler KAK 11/3/75	J L Ehasz JLE	5,6,7,8,11 to 17 Inclusiv
R4	2-27-76	G Goodheart GJG 2/27/76	J L Ehasz JLE	i,1,10,11,13 to 18 Inclusive
R5	4-28-76	G Goodheart GJG 4/26/76	J L Ehasz JLE 4/5	Addendum No. 1
R6	9-7-76	G Goodheart GJG/KAK	J L Ehasz JLE	Addendum No. 2
R7	8-13-79	G Goodheart GJG 8/13/79	J. D. Sykes JDS	All except Pages 14 and 1

EBASCO SERVICES INCORPORATED
EBASCO SPECIFICATION

EXCAVATION, BACKFILL, FILLING AND GRADING

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TWO RECTOR STREET
NEW YORK

Ebasco Specification
Excavation, Backfill, Filling and Grading

Project Identification
No. DAY-3848-CH-3

1. SCOPE

This specification covers excavation, foundation preparation for plant area buildings and in the ash disposal area, backfilling for plant area buildings, construction of the ash pond embankments and filling and grading in the plant and ash disposal areas as shown on the drawings. R7

In addition, the work under this specification shall also include:

a - Grubbing, removal and disposal of stumps, roots and organic material.

b - Storage or disposal of all earth, sand, gravel, rock, boulder, debris and/or other materials at the locations as directed by the Owner.

c - Erecting and maintaining substantial barricades around excavations where required for safety.

d - Backfilling of all unauthorized over-excavations.

e - Care and removal of all surface water, rainwater or ground water seeping and flowing into the excavations by means of ditching, damming, pumping or other suitable means approved by the Owner.

f - The foundation preparation in advance of concrete placement under the plant buildings.

2. STANDARDS AND DEFINITIONS

.01 Standards

Equipment and/or services furnished in accordance with this specification shall comply with all Federal and State laws and local ordinances of the place of installation and with the following codes to the extent referenced herein. Unless otherwise noted, the document with addenda, amendments and revisions in effect on the date of Contract will apply. Later editions may be used by mutual consent in writing between the Contractor and the Engineer. R2

2. STANDARDS AND DEFINITIONS (Continued)

.01 Standards (Continued)

This specification includes references to or requirements for meeting or adhering to certain "Standard Specifications" or "Tentative Specifications" of the American Society for Testing and Materials. In those specifications, the letters "ASTM" or "ASTM Standards" shall mean the latest revision of those Standard Specifications or Tentative Specifications of the American Society for Testing and Materials.

a - ASTM D 1140, "Amount of Material in Soils Finer than the No. 200 Sieve"

b - ASTM D 698 (Method A), "Moisture-Density Relations of Soils, Using 5.5-lb Rammer and 12-inch Drop"

c - ASTM D 1557 (Method C), "Moisture-Density Relations of Soils, Using 10-lb Rammer and 18-inch Drop"

d - ASTM D 2216, "Laboratory Determination of Moisture Content of Soil"

e - ASTM D 2167, "Density of Soil in Place by the Rubber-Balloon Method" R7

f - ASTM D 1556, "Density of Soil in Place by the Sand-Cone Method"

g - ASTM D 2922, "Determining the Density of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth)" R7

h - Ebasco Specification DAY 3848-CH-2, "Clearing and Grubbing"

.02 Definitions

a - Owner

In these specifications, the word "Owner" shall mean The Dayton Power and Light Company.

2. STANDARDS AND DEFINITIONS (Continued)

.02 Definitions (Continued)

b - Engineer

In these specifications, the word "Engineer" shall mean Ebasco Services Incorporated. R7

c - Construction Manager

In these specifications, the word "Construction Manager" shall mean Daniel Construction Company. R7

d - Contractor

In these specifications, the word "Contractor" shall mean the person(s), partnership, company or corporation under contract to the Construction Manager to perform work covered by this specification. R7

3. EXCAVATION

During the course of all excavation work, extreme care shall be exercised by the Contractor to preserve and avoid damage to trees, shrubs and all other vegetation which does not directly hamper work progress. The Contractor's plans for the dimensions and routes of required access roads shall be subject to the approval of the Owner and he shall not enter any designated picnic, camping or recreational areas, except with written permission of the Owner. The discharge into natural streams or ponds of gasoline, oil or any other waste material is prohibited.

Adequate barricades shall be erected and maintained around excavations where required for safety.

Excavation shall consist of the removal, storage and/or disposal of all Materials required to be removed such as topsoil, clay, sand, gravel, rock fragments, boulders, soft and disintegrated rock or any other material that can be effectively removed by normal excavating machinery like scrapers or bulldozers and if necessary by a D 9 Caterpillar Tractor or equal equipped with a single tooth ripper.

4. DISPOSITION OF EXCAVATED MATERIAL

.01 Topsoil

Immediately after grubbing and stump removal operations and before general excavation commences, topsoil shall be removed where and to such a depth as may be directed by the Engineer. Topsoil is defined as the loamy dark surface or top layer of soil including fine roots, the herbaceous vegetation and overlying grass and is characterized by the presence of organic matter. R2

The topsoil to be reused shall be stockpiled at convenient Owner approved locations. Compaction of this soil shall be accomplished by two or three passes of hauling and spreading equipment. Stockpiles shall be smoothed to a measurable outline and shall be constructed as directed and approved by the Owner. R1

.02 Suitable Excavated Material

Insofar as it is practicable, all suitable materials resulting from open cut excavations shall be used for permanent construction. Where practicable, materials suitable for use for construction shall be excavated separately from materials to be wasted. Suitable material shall be segregated by loads during the excavation and shall be placed directly in final locations or in temporary stockpiles and later placed in the designated final locations in accordance with the appropriate drawings. R1

.03 Unsuitable Excavated Material

Excavated materials which are unsuitable for use in accordance with this specification and the appropriate drawings or which are waste or excess material not required for construction of dikes, diversion and separating dikes or fill for the plant area shall be disposed of in waste disposal areas shown on the drawings or designated by the Owner. R1

All waste or excess material shall be disposed of in a manner which will avoid the necessity of rehandling or the interference with other work. It shall be spread and graded in uniform layers and compacted by two passes of crawler-type tractors, smooth rollers or other equipment approved by the Owner. If disposed of in benches, precautions shall be taken, to the Owner's satisfaction, to prevent material from rolling downhill. Waste piles shall be shaped to insure drainage. R1

5. FILL MATERIAL

Material to be excavated from the plant area and the ash pond borrow areas and from the stockpile areas that is to be used as compacted fill shall be as follows.

.01 Select Sand Fill

The sand shall be free of muddy material, organic matter, rubbish, debris, or other unsuitable materials. It shall have no more than 15 percent of the material passing the No. 200 sieve. The allowable maximum size of material shall be 6 inches. The source of this material is from excavation at borrow area locations in the ash storage area. The select sand fill shall be primarily used in the main plant area. The actual locations where the select sand fill is to be used, shall be according to the drawings. R1 R7

a - The moisture content at time of compaction shall not vary more than plus or minus 3 percent from the optimum moisture content specified based on modified Proctor tests. R7 R1

b - Material with a higher moisture content than required for the specified compaction shall be spread on a dry area and disc-harrowed to reduce the moisture content by evaporation. Material with a lower moisture content than that required for the specified compaction shall be spread and sprinkled with water, then disc-harrowed until the required moisture content is attained. R7 R1 R2

c - The area to be backfilled shall be prepared by compacting the material in-place at the bottom of the excavation to a minimum density of 95 percent of the maximum obtained in the modified Proctor Compaction Test (ASTM D 1557 - Method C). Compaction shall be by means of the same equipment used for the final compacted fill. R7

d - The initial lift of the select sand fill material shall serve as test fill sections where the best combination of equipment, number of passes and in situ testing methods will be established by the Engineer to yield the required in-place densities. R2 R7

5. FILL MATERIAL (Continued)

.01 Select Sand Fill (Continued)

e - The select sand material to be used as fill shall be spread and leveled in layers not to exceed 24 inches thickness before compaction. Compaction shall be effected by means of a vibratory drum roller imparting a minimum dynamic force of 72,000 lb, or by other means as approved by the Engineer to obtain required results. The speed of the rolling equipment shall not exceed 1.5 miles per hour unless the test fill shows effective compaction at high speeds as determined by the Engineer. The rolling and compaction shall be effected by rolling only in the forward direction unless the equipment is capable of reversing the rotation of the dynamic force when travelling in the reverse direction. R3 | R7 R2

f - Any material which fails to meet the specified minimum density shall be compacted. If the material is too dry to be compacted to minimum required density, it shall be sprinkled with water before compacting. Material too wet to be compacted to minimum required density shall be removed and replaced with new fill.

g - Any placed material which has become too wet or in any other way has become unsuitable, shall be disc-harrowed and dried or at the Engineer's option, removed and replaced with new fill. Any area from which compacted fill has been stripped shall be recompacted before new fill is placed. All layers within the width selected for placing shall be compacted to their full width. No fill shall be placed within 20 feet of the boundary between material being compacted and the uncompacted material being placed. | R7

h - Compaction shall be uniform within any one layer over the entire area. The surface of each lift shall be kept reasonably smooth and free of ridges or ruts, which might affect the compaction of later lifts. Equipment used for hauling shall follow paths different from each other, to aid compaction, over the entire area. Placement of new fill on fill compacted more than 48 hours previously will be treated as placing fill on the original excavated area. The surface of the area shall be first cleaned of all loose debris.

5. FILL MATERIAL (Continued)

.01 (Continued)

i - In small areas where it is not possible to reach with large scale mobile compaction equipment, the fill shall not contain material larger than 3 inches in size. It shall be compacted with a mechanical tamper, small vibratory roller, vibratory plate, or other suitable means to attain required compaction. These areas shall be compacted to the same minimum compaction as the rest of the fill and shall be brought up in not greater than 6 inch lifts. Care shall be taken to insure that the fill in these areas is integral with the rest of the fill.

j - Slopes of the sections of fill shall be one vertical to two and one-half horizontal in the excavation proper only. All permanent exposed slopes shall be one vertical to three horizontal, unless as noted on the drawings. Where two sections of fill join, that fill placed earlier shall be cut back a minimum of 3 feet to a minimum slope of one vertical to two and one-half horizontal (1:2.5) to expose undisturbed compacted material. R1

k - In-Place Density and Testing

i - All backfill shall be compacted to a minimum of 95 percent of the maximum density obtained on the Modified Proctor Compaction Test (ASTM D 1557 - Method C). R7

ii - Control tests of densities and moisture contents will be made by the Engineer as the work progresses, to assure that required densities and moisture contents are being achieved.

iii - The in-place density shall be tested in accordance with any of the following: ASTM D 2922, ASTM D 1556 or ASTM D 2167, to insure that the backfill has been properly compacted. The Engineer shall allow the use of speedy moisture tester or equivalent for moisture control in the field. The decision to allow in situ testing by nuclear methods shall be made by the Engineer during construction of the test fill sections. The nuclear method shall be R7

5. FILL MATERIAL (Continued)

.01 (Continued)

k - (Continued)

correlated to results obtained by methods in accordance with ASTM D 1556 or ASTM D 2167. The Engineer shall, at his discretion, allow the nuclear method to control further compaction activities. Initially, for every ten (10) field tests performed by the nuclear method, there shall be one check test by either the sand cone or rubber balloon method, ASTM D 1556 or ASTM D 2167 respectively. Once the reliability of the nuclear test method has been clearly established, the ratio of check tests required may be decreased to one check test for every 40 tests performed by the nuclear method. The difference between the results shall not exceed tolerances set by the Engineer. If the tolerances allowed are exceeded, the Engineer shall either order more check tests or disallow the use of nuclear method of testing. There shall be a minimum of one inplace density test on any day of compaction activity. A test shall be made in each layer for every 10,000 square feet of compacted fill area and one test for every area of less than 10,000 square feet placed in one day. More tests may be run at the discretion of the Engineer. R7

iv - When the weather is of such a nature as to endanger the quality of the fill material being placed, whether this be due to rain, or any other element of the weather, the placement of fill shall be halted until the weather conditions are satisfactory. Under no conditions shall fill be placed during heavy rains.

v - Any and all questions regarding the borrowing, preparation, placement and protection of the compacted fill shall be referred to the Engineer. All decisions by the Engineer regarding the approval of compacted fill, in any aspect, shall be final. R2 R7

5. FILL MATERIALS (Continued)

.01 (Continued)

k - (Continued)

vi - For select sand fill, 90 percent of the tests performed in each lift shall have in-place densities equal to or greater than 95 percent of the maximum density obtained in the Modified Proctor Compaction Test (ASTM D 1557 - Method C). The remaining 10 percent of the tests shall have in-place density in a random distribution throughout the area not lower than 90 percent of the maximum density obtained in the laboratory test. The section in any lift of material of select sand fill not meeting these requirements shall be recompacted and retested for compliance. No new material shall be placed until the underlying lift has been properly compacted and tested. R7

The frequency of testing as presented in this section represents the minimum required. At the discretion of the Engineer, additional tests will be performed in any suspicious area of any lift of select sand fill. R2

.02 Select Impervious Fill

The impervious material shall be free of muddy material, organic matter, rubbish, debris or other unsuitable materials. The gradation of the impervious material shall consist of soil particles with a minimum of 95 percent passing through No. 4 sieve and a minimum of 25 percent fines passing No. 200 sieve. The source of this material is from the plant island excavation and excavation in ash storage area. The select impervious fill shall be primarily used for the central core in the perimeter dikes and in the impervious blanket in the ash storage area. The actual locations where this fill shall be used, shall be according to the drawings. R1 R4

a - The moisture content at the time of compaction shall generally not vary more than plus 4 to minus 2 percent from optimum moisture content, based on Standard Proctor Tests. Moisture content may vary occasionally up to as high as 8 percent above optimum, provided a minimum 95 percent compaction is achieved R3

5. FILL MATERIAL (Continued)

.02 Select Impervious Fill (Continued)

a - (Continued)

based on Standard Proctor Tests. However, at least 90 percent of the moisture content tests shall be within the established range of plus 4 to minus 2 percent from optimum, and in no case shall the moisture content exceed 8 percent above optimum. Moisture contents between 4 and 8 percent shall be randomly distributed throughout the fill. R3

b - Material with a higher moisture content than required for the specified compaction shall be spread on a dry area and dried by harrowing or by discing and aerated prior to placement. R1 Material with a lower moisture content than that required for the specified compaction shall have moisture added at the stockpiles, supplemented as required either by sprinkling the preceding layer prior to placing new material thereon or by sprinkling and mixing the new material in place prior to rolling or by a combination of the two (2) methods.

c - The area to be backfilled shall be prepared for select impervious material by discing or scarifying so as to loosen the R1 entire surface to a depth of 2 inches. Water shall be added, if necessary, to the material at the time of scarifying so that it shall be within plus or minus 2 percent of optimum water content for compaction. Immediately after such scarifying the next layer of material shall be placed over the base and compacted as specified. The top surface of freshly placed and rolled layers ordinarily will require no preparation other than moistening ahead of the new layer when the new material is drier than optimum water content.

d - The initial lift of the select impervious fill material shall serve as test sections where the best combination of equipment, number of passes, and in situ testing method will be established by the Engineer to yield the required in-place densities. R1 R2 R7

5. FILL MATERIAL (Continued)

.02 Select Impervious Fill (Continued)

e - The select impervious material to be used as a fill shall be spread and levelled in layers not to exceed 9 inches thickness before compaction. The rollers to be used for compacting the select impervious material shall be of the sheepsfoot or wedgefoot type. Other types of rollers which the Contractor proposes to use shall be subject to the approval of the Engineer. In any event the fill shall be so constructed as to be uniformly dense and to the minimum density requirement. R1 R7 R4

f - The dikes shall be constructed to the lines and grades shown on the drawings and shall be built up in continuous, nearly horizontal layers. The level of the select impervious fill shall be maintained at least one (1) lift thickness but no more than six (6) lift thicknesses (approximately four and one-half feet) above the level of the adjacent random fill at all times. Where necessary for construction purposes, longitudinal end slopes not steeper than 25 percent will be permitted. Transverse construction slopes on any lift shall not be steeper than 5 percent. The top of any lift during construction shall be kept slightly crowned transversely for drainage. The select impervious fill core shall be slightly overbuilt transversely during construction to ensure complete compaction of all dike core materials. Prior to the placement of random fill, the overbuilt core shall be cut back to the required grade. If the embankment is constructed in stages, immediately before a later stage of construction is begun, the fill placed earlier shall be cut back a minimum of three (3) feet measured normal to the surface and into the previous stage to expose material that has not been affected by wetting, drying, erosion, relaxation or frost action. R5 R5

g - No material shall be placed in any zone of the dikes that does not conform to the provisions of this specification without the permission of the Engineer. Any haul roads constructed on any zone of the dikes of the Contractor, containing material that does not conform to the provisions of this specification shall be removed by the Contractor at his own expense, and shall be replaced with the material specified for that zone. R2

5. FILL MATERIAL (Continued)

.02 Select Impervious Fill (Continued)

h - Any placed material which has become too wet or in any other way has become unsuitable, as determined by tests, shall be disc-harrowed and dried or at the Engineer's option, removed and replaced with new fill. Any area from which compacted fill has been stripped shall be recompacted before new fill is placed. All layers within the width selected for placing shall be placed within 20 feet of the boundary between material being compacted and the uncompacted material being placed. R7

i - In-Place Density and Testing R7

i - The select impervious fill shall be compacted to a minimum of 95 percent of the maximum density obtained in the Standard Proctor Compaction Test (ASTM D 698 - Method A). Optimum conditions for moisture and density shall be determined by the Engineer for the various impervious material excavated. The results of tests made during construction shall be made available to the Contractor. R1 R2

ii - Control tests of densities and moisture contents will be made by the Engineer as the work progresses, to assure that the required densities and moisture contents are being achieved.

iii - The in-place density shall be tested in accordance with any of the following: ASTM D 2922, ASTM D 1556, ASTM D 2167, to assure that the backfill has been properly compacted. The Engineer shall allow the use of speedy moisture tester or equivalent for moisture control in the field. The decision to allow in situ testing by nuclear methods shall be made by the Engineer during construction of the test fill section. The nuclear method shall be correlated to results obtained by methods in accordance with ASTM D 1556 or ASTM D 2167. The Engineer shall, at his discretion, allow the nuclear method to control further compaction activities. Initially, for every 10 field tests performed by the nuclear method, there shall R7

5. FILL MATERIAL (Continued)

.02 Select Impervious Fill (Continued)

i - (Continued)

be one check test by either the sand cone or rubber balloon method, ASTM D 1556 or ASTM D 2167, respectively. Once the reliability of the nuclear test method has been clearly established, the ratio of check tests required may be decreased to one check test for every 40 tests performed by the nuclear method. The difference between the results shall not exceed tolerances set by the Engineer. If the tolerances allowed are exceeded, the Engineer shall either order more check tests or disallow the use of nuclear method of testing. There shall be a minimum of one in-place density test on any day of compaction activity. A test shall be made in each layer for every 20,000 square feet of compacted fill area and one test for every area less than 20,000 square feet placed in one day. More tests may be run at the discretion of the Engineer. R7

iv - Sections 5.01k-iv and 5.01k-v shall be applicable.

v - For select impervious fill, 90 percent of the tests performed in each lift shall have in-place densities equal to or greater than 95 percent of the maximum density obtained in the Standard Proctor Compaction Test (ASTM D 698 - Method A). The remaining 10 percent of the tests shall have in-place densities in a random distribution throughout the area not lower than 90 percent of the maximum density obtained in the laboratory test. The section in any lift of material of select impervious fill not meeting these requirements shall be recompacted and retested for compliance. No new material shall be placed until the underlying lift has been properly compacted and tested. The frequency of testing as presented in this section represents the minimum required. At the discretion of the Engineer, additional tests will be performed in any suspicious area of any lift of select impervious fill. R1 R2 R1

5. FILL MATERIAL (Continued)

.03 Random Fill

The random fill material shall be free of muddy material, organic matter, rubbish, debris, or other unsuitable materials. The random material shall have no specific gradation requirements, however, the maximum allowable size of material shall be 6 inches. Random fill shall generally consist of either existing silty sand or sandy silt material excavated and used without modification, or a blended mixture of clay and sand disced together to form a homogeneous fill. Random fill shall be used primarily in the ash pond embankments and for general raising of plant grade. Random fill shall be placed as shown on the drawings or where directed by the Engineer. R4 R7

a - The moisture content at the time of compaction shall generally not vary more than plus 4 to minus 2 percent from optimum moisture content, based on Standard Proctor Tests. Moisture content may vary occasionally up to as high as 8 percent above optimum, provided a minimum 95 percent compaction is achieved based on Standard Proctor Tests. At least 90 percent of the moisture content tests shall be within the established range of plus 4 to minus 2 percent from optimum, and in no case shall the moisture content exceed 8 percent above optimum. Moisture contents between 4 and 8 percent shall be randomly distributed throughout the fill. R4

b - Material with a higher moisture content than required for the specified compaction shall be spread on a dry area and dried by harrowing or discing and aerated prior to placement. Material with a lower moisture content than that required for the specified compaction shall be spread and sprinkled with water, supplemented as required by sprinkling the preceding layer prior to placing new material, then disc-harrowed until the required moisture content is attained. R4

c - Prior to the placement of random fill material, the foundation shall be prepared by discing and scarifying so as to loosen the entire surface to a depth of 2 inches. Water shall be added to the foundation material, if required, so that it shall be within plus or minus 2 percent of optimum moisture content at the time of compaction. Immediately after such scarifying the next layer of material shall be placed and compacted as specified. R4

5. FILL MATERIAL (Continued)

.03 Random Fill (Continued)

d - The initial lift of the random fill material shall serve as test sections where the best combination of equipment, number of passes, and in situ testing methods will be established by the Engineer to yield the required in-place densities. R4 R7

e - The random material to be used as fill shall be spread and levelled in layers not to exceed 9 inches thickness before compaction. The rollers to be used for compaction shall be the wedgefoot or vibratory steel wheel type. The vibratory roller, if used, shall impart a minimum dynamic force of 40,000 ft-lb. Other types of rollers which the contractor may propose to use shall be subject to the approval of the Engineer. Compaction shall be accomplished with a minimum of eight (8) roller passes at a speed not to exceed four (4) miles per hour. The fill shall be constructed so as to be uniformly dense and to the minimum density requirements. R6 R4 R7 R6

f - Any material which fails to meet the specified minimum density shall be recompacted. If the material is too dry to be compacted to the minimum required density, it shall be sprinkled with water before recompacting. Material too wet to be compacted to the minimum required density shall be removed and replaced with new fill. R4

g - Any material previously placed which has become too wet or in any other way has become unsuitable shall be disc-harrowed and dried, or at the Engineer's option, removed and replaced with new fill. Any area from which compacted fill has been stripped shall be recompacted before new fill is placed. All layers within the width selected for placing shall be compacted to their full width. R7 R4

h - The dikes shall be constructed to the lines and grades shown on the drawings and shall be built up in continuous, nearly horizontal layers. The level of the random fill shall be maintained at least one (1) but no more than six (6) lift thicknesses (approximately four and one-half feet) below the adjacent select impervious fill at all times. Where necessary R4 R7

5. FILL MATERIAL (Continued)

.03 Random Fill (Continued)

h - (Continued)

for construction purposes, longitudinal end slopes not steeper than 25 percent will be permitted. Transverse construction slopes on any lift shall not be steeper than 5 percent. The top of any lift during construction shall be graded transversely for drainage. If the embankment is constructed in stages, in the longitudinal direction, immediately before a later stage of construction is begun, the fill placed earlier shall be cut back a minimum of 3 feet measured normal to the surface and into the previous stage to expose material that has not been affected by wetting, drying, erosion, relaxation, or frost action. R4

i - In-Place Density and Testing

i - The random fill shall be compacted to a minimum of 95 percent of the maximum density obtained in the Standard Proctor Compaction Test (ASTM D 698 - Method A). Optimum conditions for moisture and density shall be determined by the Engineer for the various random materials excavated. The results of tests made during construction shall be made available to the Contractor. R4

ii - Control tests of densities and moisture content will be made by the Engineer as the work progresses, to assure that required densities and moisture contents are being achieved. R4

iii - The in-place density shall be tested in accordance with any of the folowing: ASTM D 2922, ASTM D 1556, or ASTM D 2167 to assure that the backfill has been properly compacted. The Engineer shall allow the use of speedy moisture tester or equivalent for moistue content in the field. The decision to allow in situ testing by nuclear methods shall be made by the Engineer during construction of the test fill sections. The nuclear method shall be correlated to results obtained by methods in accordance with R7

5. FILL MATERIAL (Continued)

.03 Random Fill (Continued)

i - (Continued)

iii - (Continued)

ASTM D 1956 or ASTM D 2167. The Engineer shall, at his discretion, allow the nuclear method to control further compaction activities. Initially, for every 10 field tests performed by the nuclear method, there shall be one check test by either the sand cone or rubber balloon method, ASTM D 1556 or ASTM D 2167, respectively. Once the reliability of the nuclear test method has been established, the ratio of check tests required may be increased to one check test for every 40 tests performed by the nuclear method. The difference between the results shall not exceed tolerances set by the Engineer. If the tolerances allowed are exceeded, the Engineer shall either order more check tests or disallow the use of nuclear method of testing. There shall be a minimum of one in-place density test on any day of compaction activity. A test shall be made in each layer for every 20,000 square feet of compacted fill area and one test for every area of less than 20,000 square feet placed in one day. More tess may be run at the discretion of the Engineer. R7

iv - The requirements of Section 5.01k-iv and 5.01k-v shall also apply for random fill material. R7

v - When blended random fill is tested in the laboratory, samples shall be prepared by compacting material exactly as it was obtained from the field, without further blending as specified in ASTM D 698-70. Care shall be exercised in preparing samples for moisture content determination to ensure that large clay balls of high moisture content are not tested with disproportionate amounts of dryer sand, thus resulting in incorrect total moisture values for the entire sample and false correlations with the in-place density tests. R6

5. FILL MATERIAL (Continued)

.04 Miscellaneous Clay Fill

The required properties and source of this material shall be same as for select impervious fill. The miscellaneous clay fill shall be primarily used in coal storage areas, and for general raising of the plant grade. R1
The final location of this fill to be used shall be according to the drawings.

a - The average moisture content for the miscellaneous clay fill material may vary from an average of plus 6 to minus 2 percent from optimum. The absolute maximum measured moisture content for this material shall not exceed 8 percent above optimum. R3

b - The requirements of sections 5.02b through 5.02e and 5.02h-i through 5.02h-iv shall also apply for miscellaneous clay fill. R3

c - For miscellaneous clay fill, 80 percent of the tests performed in each lift shall have in-place densities equal to or greater than 95 percent of the maximum density obtained in the Standard Proctor Compaction Test (ASTM D 698 - Method A). The remaining 20 percent of the tests shall have in-place densities in a random distribution throughout the area not lower than 90 percent of the maximum density obtained in the laboratory test. Any section in any lift of material of miscellaneous clay fill not meeting these requirements shall be recompacted and retested for compliance. No new material shall be placed until the underlying lift has been properly compacted and tested. R3

A test shall be made in each layer for every 20,000 square feet of compacted fill area and one test for every area less than 20,000 square feet placed in one day. R1

The frequency of testing as presented in this section represents the minimum required. At the discretion of the Engineer, additional tests will be performed in any suspicious area of any lift of miscellaneous clay fill. R2

5. FILL MATERIAL (Continued)

.05 Spoil Fill (Topsoil)

Spoil fill shall consist of the topsoil stripped according to Section 4.01 of this specification, and wasted material obtained during select sand or select impervious fill excavation operations and any other material directed to be used by the Engineer. R4

a - Topsoil shall be placed on all dike slopes as shown on the drawings upon completion of grading operations of the dike fill. All excess topsoil stripped in the ash disposal area shall be spoiled in the unblanketed central portion of the fly ash disposal area. R4

b - Compaction of topsoil shall be accomplished by two (2) or three (3) passes of the hauling and spreading equipment. Compaction shall be sufficient to maintain the material in place on the slopes, but at the same time allow vegetation to take root. R4

6. QUALITY PROGRAM - SOILS CONTROL

.01 This section establishes a program and methods for soils control to assure that controlled compacted backfill and miscellaneous backfills comply with design requirements and this specification, and to assure that appropriate records and current reports on technical aspects of this work are prepared.

The soils control activities will be performed primarily in five areas of the project. The five major areas will be the borrow area, stockpile area, the plant area compacted backfill, the ash disposal area, and the soils laboratory. The activities performed in each of these areas will be integrated, and records will be maintained to make the program of soils control complete. Reports of this work will be issued periodically. R7

The Soils Control Personnel of the project will consist of a Quality Control Engineer-Soils and Laboratory Technicians working as a unit to form the Field Inspection and Quality Control Force. R7

6. QUALITY PROGRAM - SOILS CONTROL (Continued)

.02 The activities of the Soils Control Personnel shall include;

a - Borrow-Stockpile Areas

i - Inspection of the preparation of stockpile areas, and the disposal of borrow area spoil.

ii - Inspect, sample and test the designated borrow area materials to assure a constant source of suitable materials as defined by the specifications.

b - Plant Area Compacted Backfill

i - Inspect all of the prepared foundations to be sure of proper compaction and that the contact surfaces have been properly prepared.

ii - Inspect to ensure that oversize rocks are removed from the fill in compliance with the specifications for the various areas.

iii - Inspect, sample, and test to ensure that the backfill material is compacted at the established optimum moisture content.

iv - Inspect to ensure that the coverage and the number of passes made with the compactor are consistent with the number established during the test fills to obtain the maximum density.

v - Inspect and test the density of the compacted backfill with field density tests.

vi - Make daily inspection logs.

c - Ash Disposal Area

i - Inspect all of the prepared embankment foundations to be sure of proper compaction and that the contact surfaces have been properly prepared. R7

6. QUALITY PROGRAM - SOILS CONTROL (Continued)

.02 (Continued)

c - (Continued)

ii - Inspect to ensure the fill material is placed in lifts in compliance with the specifications and that no unsuitable material is placed in fill areas.

iii - Inspect to ensure that oversize rocks are removed from the embankment fill in compliance with the specifications for the various areas.

iv - Inspect, sample, and test to ensure that the fill material is compacted at the established optimum moisture content. R7

v - Inspect to ensure that the coverage and the number of passes made with the compactor are consistent with the number established during the test fills to obtain the maximum density.

vi - Inspect and test the density of the compacted backfill with field density tests.

vii - Make daily inspection logs.

d - Soils Laboratory

i - Test the materials to be used as backfill to determine their suitability; materials shall be sampled from both the stockpile and the excavation areas. Mechanical Analysis and Compaction Tests shall be performed to determine the moisture-density relationships with respect to the Modified or Standard Compaction Tests as specified.

ii - Perform Mechanical Analysis Tests (including Moisture Content Determinations) on the materials from the work points in the borrow and stockpile areas to determine their suitability for use in the compacted backfill.

6. QUALITY PROGRAM - SOILS CONTROL (Continued)

.02 (Continued)

d - (Continued)

iii - Test the materials being placed as the "test fill" in the backfill areas to establish the optimum number of passes of the compactor to obtain the required density.

iv - Perform Field Density and Mechanical Analysis Tests on materials from the compacted backfill to assure the suitability of the materials and their compaction.

v - Keep records of all the field and laboratory tests performed and prepare summaries of the test results.

vi - Make the necessary reports for the Construction Superintendent, Engineer and Quality Control as defined by this specification.

.03 Duties and responsibilities of field personnel shall be as follows:

a - The Quality Control Engineer-Soils shall spend a major portion of his time observing the actual backfilling operations and ascertain that all work is performed in accordance with the plans and specifications, and to see that such field tests are performed as are necessary for reports and guidance of the Contractor's forces. The Quality Control Engineer-Soils does not have the authority nor will he be permitted to qualify the specifications in any way. R7 R7

i - He shall be familiar with the plans, specifications, and contents of this program and shall be governed by them.

ii - He shall examine equipment to ascertain compliance with specifications. If this manual is in conflict with the specifications, the specification requirement shall govern.

6. QUALITY PROGRAM - SOILS CONTROL (Continued)

.03 (Continued)

a - (Continued)

iii - He shall be on duty during his entire working shift and shall observe all construction operations within his province.

iv - He shall see that all the work is executed in full accordance with the plans and specifications and shall have authority to stop construction that is not. If defective materials have been placed, he shall require their removal.

v - He shall have the Soils Laboratory perform any field or laboratory tests necessary to assure compliance with specifications.

vi - He shall transmit to those persons relieving him all current instructions received and other information pertinent to the work.

vii - He shall prepare and render daily reports of all work performed to the Engineer.

viii - He shall maintain a diary with each daily entry signed or initialed by him. The diary shall be marked, numbered and filed as part of the permanent records of the project. The diary shall show the following information:

(1) Data and weather conditions.

(2) Work of the Quality Control Engineer-Soils R7

(3) Construction work accomplished.

(4) Construction crew and equipment.

(5) Instructions given to the Contractor and important conversations with the Contractor relative to progress or other details of the project.

6. QUALITY PROGRAM - SOILS CONTROL (Continued)

.03 (Continued)

a - (Continued)

viii- (Continued)

(6) Examinations, discussions, and decisions.

(7) Other matters of importance.

ix - He shall inspect the foundation of the compacted backfill to insure that the moisture content of the foundation areas is consistent with the optimum criteria, and that the foundation has been compacted to the required density.

x - He shall see that only materials meeting the specifications of the compacted backfill are taken from the borrow areas and stockpiled, if required, or if at the optimum moisture content used directly in the fill area.

xi - The compacted backfill will be constructed in accordance with the specifications and controlled by the compaction criteria established. It shall be the duty of the Quality Control Engineer-Soils to check and/or direct the following: R7

(1) That the moisture content is consistent with the established optimum.

(2) That all oversize rocks are removed from the fill material in compliance with the requirements of this specification.

(3) That the number of passes made with the compactor is consistent with the number of passes and coverage established for required density during the construction of the test fills.

6. QUALITY PROGRAM - SOILS CONTROL (Continued)

.03 (Continued)

a - (Continued)

xi - (Continued)

(4) That the Contractor generally performs in a workmanlike manner:

(a) Foundations reasonably level prior to placement of backfill.

(b) Place backfill in the proper sequence.

(c) That the lift thickness is in accordance with specifications and that the top of each lift is reasonably level before compaction.

(d) That compaction equipment conforms with the specifications or equivalent, established during early placements as test fills.

(5) He shall have the soils laboratory under jurisdiction.

(6) He shall designate the location at which tests will be run.

b - The purpose of the soils laboratory is to perform the actual field density tests and to conduct routine tests on the material in the compacted backfill and borrow areas to be certain of compliance with the contract specifications.

It shall be the function of the laboratory staff under the jurisdiction of the Quality Control Engineer-Soils to perform all the required tests in a competent and accurate manner, to keet accurate records, to assemble and summarize daily logs and records, and to compile all field laboratory data for a weekly report. R7

6. QUALITY PROGRAM - SOILS CONTROL (Continued)

.03 (Continued)

b - (Continued)

The soils laboratory will perform all tests required by the Quality Control Engineer-Soils. All test locations will be selected by the laboratory personnel, as directed by the Quality Control Engineer-Soils. R7

R7

i - Compacted Backfill And Ash Disposal Areas R7

The frequency of sampling for field density tests will be based on this specification. Additional laboratory testing relative to field density testing shall include Mechanical Grain Size Analysis, and Modified and Standard Proctor Compaction Tests. These tests shall be used to establish criteria for percent compaction. During construction of the test fills and during borrow area testing prior to and concurrent with fill placement, a family of curves should be derived for the various materials encountered in order to minimize compaction tests. Initially, one set of laboratory tests (grain size and compaction) shall be performed for every ten field tests. As familiarity is gained with the borrow materials, this ratio may be increased to one set of laboratory tests (grain size and compaction) for every 40 field tests. Sand cone, rubber balloon, and nuclear test methods shall be used as previously specified to determine in-place densities. R5

ii - Borrow Stockpile Areas

During the construction period it shall be the duty of the laboratory personnel to sample and perform laboratory tests on materials from the borrow and stockpile areas as directed by the Quality Control Engineer-Soils. This will be necessary to assure a constant supply of suitable materials for the backfill at all times. R7

APPENDIX D

LABORATORY TEST RESULTS

KILLEN ELECTRIC GENERATING STATION
SUMMARY OF LABORATORY TESTING DATA
DIKE FILL MATERIALS

LOCATION*	SAMPLE OR TEST NUMBER	MATERIAL	UNIFIED SOIL CLASS.	LIQUID LIMIT	PLASTICITY INDEX	DRY UNIT WEIGHT (PCF)	MOISTURE CONTENT (%)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	COHESION "C" TRIAXIAL (KSF)	INTERNAL ANGLE OF SHEAR RESISTANCE, "O" (DEGREES)
MF	1	Sandy Clayey Silt	ML-CL	25	6	108.1	18.2	-	0.00	30.0
MF	2	Sandy Clayey Silt	ML-CL	25	6	104.5	20.3	-	0.70	22.0
MF	3	Sandy Clayey Silt	ML-CL	25	6	112.8	17.6	-	1.00	11.5
MF	4	Sandy Clayey Silt	ML-CL	25	6	113.6	19.0	-	1.25	11.0
MF	5	Sandy Clayey Silt	ML-CL	25	6	107.7	23.0	-	1.70	3.5
MF	6	Sandy Clayey Silt	ML-CL	25	6	111.0	19.4	-	0.55	3.0
TF (A1)	7 (1C)	Brown Silt, Some Clay, Some Sand	ML	36	11	106.8	15.7	-	0.30	24.0
TF (A1)	8 (2C)	Brown Silt, Some Clay, Some Sand	CL	30	10	107.8	16.8	-	2.40	9.0
TF (A2)	1C	Brown Silt, Some Clay Some Sand	ML	33	7	105.9	15.9	6360	-	-
TF (A2)	2C	Brown Silt, Some Clay, Some Sand	ML-CL	29	7	112.3	17.7	-	-	-
TF (A3)	1C	Brown Silt, Some Clay, Some Sand	-	-	-	105.2	15.9	5670	-	-
TF (A3)	2C	Brown Silt, Some Clay, Some Sand	CL	36	15	-	16.8	-	-	-
TF (B1)	1C	Brown Silt, Some Clay, Some Sand	ML	33	7	-	16.8	-	-	-

KILLEN ELECTRIC GENERATING STATION
SUMMARY OF LABORATORY TESTING DATA
DIKE FILL MATERIALS

LOCATION*	SAMPLE OR TEST NUMBER	MATERIAL	UNIFIED SOIL CLASS.	LIQUID LIMIT	PLASTICITY INDEX	DRY UNIT WEIGHT (PCF)	MOISTURE CONTENT (%)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	COHESION "C" TRIAXIAL (KSF)	INTERNAL ANGLE OF SHEAR RESISTANCE, "ø" (DEGREES)
TF (B1)	2C	Brown Silt, Some Clay, Some Sand	CL	31	10	109.2	18.6	-	-	-
TF (B2)	1C	Brown Silt, Some Clay, Some Sand	ML	37	10	107.3	17.1	8140	-	-
TF (B2)	1C	Brown Silt, Some Clay, Some Sand	-	-	-	105.9	17.5	3820	-	-
TF (B2)	2C	Brown Silt, Some Clay, Some Sand	CL	33	11	109.5	17.4	7180	-	-
TF (B-3)	9 (1C)	Sandy Silty Clay	-	-	-	106.1	15.9	-	1.30	38.0
TF (B3)	2C	Brown Silt, Some Clay, Some Sand	CL	32	11	111.4	17.6	-	-	-
TF (C1)	1C	Brown Silt, Some Clay, Some Sand	CL	34	12	101.2	16.6	6580	-	-
TF (C1)	1C	Brown Silt, Some Clay, Some Sand	CL	34	12	105.3	15.1	7920	-	-
TF (C1)	2C	Brown Silt, Some Clay, Some Sand	CL	32	13	-	17.6	-	-	-
TF (C2)	1C	Brown Silt, Some Clay, Some Sand	CL	32	10	106.2	16.0	8250	-	-
TF (C2)	2C	Brown Silt, Some Clay, Some Sand	ML	32	8	107.9	17.6	-	-	-

KILLEN ELECTRIC GENERATING STATION
SUMMARY OF LABORATORY TESTING DATA
DIKE FILL MATERIALS

LOCATION*	SAMPLE OR TEST NUMBER	MATERIAL	UNIFIED SOIL CLASS.	LIQUID LIMIT	PLASTICITY INDEX	DRY UNIT WEIGHT (PCF)	MOISTURE CONTENT (%)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	COHESION "C" TRIAXIAL (KSF)	INTERNAL ANGLE OF SHEAR RESISTANCE, "ø" (DEGREES)
TF (C3)	2C	Brown Silt, Some Clay, Some Sand	CL	36	13	111.5	17.1	-	-	-

* MF - Sample from miscellaneous clay fill area

TF - Sample from clay test fill (number in parenthesis is boring number in test fill)

KILLEN ELECTRIC GENERATING STATION
SUMMARY OF LABORATORY TESTING DATA
DIKE FOUNDATION MATERIALS

LOCATION	SAMPLE DEPTH (FT)	MATERIAL	UNIFIED SOIL CLASS.	LIQUID LIMIT	PLASTICITY INDEX	DAY UNIT WEIGHT (PCF)	MOISTURE CONTENT (%)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	COHESION "C" TRIAXIAL (KSF)	INTERNAL ANGLE OF SHEAR RESISTANCE, "ø"(DEGREES)
A-129	0-2	Brown Silt, Some Clay, Some Sand	-	-	-	98.7	19.1	11350	-	-
A-129	5-7* (Test 10)	Brown Silt and Clay, Some Sand	CL	44	24	-	-	-	1.50	13.0
A-129	10-12	Brown Silt, Some Clay, Trace of Sand	-	-	-	101.1	22.6	3130	-	-
A-129	15-17	Brown Silt, Some Clay, Trace of Sand	-	-	-	103.8	21.2	2370	-	-
A-129	20-22	Brown Silt and Sand, Trace of Clay	-	-	-	97.5	25.7	1150	-	-
A-133	3-5	Brown Silt, Some Clay, Trace of Sand	ML	40	14	105.4	20.3	6710	-	-
A-133	8-10	Brown Sand, Some Silt, Some Clay	SM-SC	26	6	106.5	20.0	850	-	-
A-133	13-15	Brown Sand, Some Silt, Some Clay	SM	-	NP	101.3	20.2	-	-	-
A-133	18-20	Brown Sand, Some Silt, Some Clay	SM	-	NP	96.9	22.0	680	-	-
A-133	23-25	Brown Sand, Some Silt, Some Clay	SM	-	NP	94.6	15.8	-	-	-

KILLEN ELECTRIC GENERATING STATION
SUMMARY OF LABORATORY TESTING DATA
DIKE FOUNDATION MATERIALS

LOCATION	SAMPLE DEPTH (FT)	MATERIAL	UNIFIED SOIL CLASS.	LIQUID LIMIT	PLASTICITY INDEX	DAY UNIT WEIGHT (PCF)	MOISTURE CONTENT (%)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	COHESION "C" TRIAXIAL (KSF)	INTERNAL ANGLE OF SHEAR RESISTANCE, "Ø" (DEGREES)
A-133	28-29	Brown Sand, Some Silt, Some Clay	SM	-	NP	107.5	17.9	540	-	-
A-135	3-5	Brown Silt, Some Clay, Some Sand	CL	36	16	110.1	18.9	7740	-	-
A-135	13-15	Brown Silt and Sand, Trace of Clay	-	-	-	101.7	21.7	-	-	-
A-135	18-20* (Test 11)	Brown Silt and Sand, Trace of Clay	-	-	-	105.9	20.7	-	0.50	17.5
A-135	23-25	Brown Silt and Sand, Trace of Clay	-	-	-	106.2	20.5	5440	-	-
A-135	28-30	Brown Silt and Sand, Trace of Clay	-	-	-	104.7	16.4	-	-	-
A-137	3-5	Brown Silt, Some Sand, Some Clay	CL	31	9	113.4	17.1	5050	-	-
A-137	8-10	Brown Sand, Some Silt, Some Clay	ML-CL	26	6	108.8	19.3	1200	-	-
A-137	18-20	Brown Silt and Sand, Some Clay	ML	23	2	107.1	22.5	1650	-	-
A-137	23-25	Brown Sand and Silt, Trace of Clay	CL	26	8	100.2	22.4	-	-	-

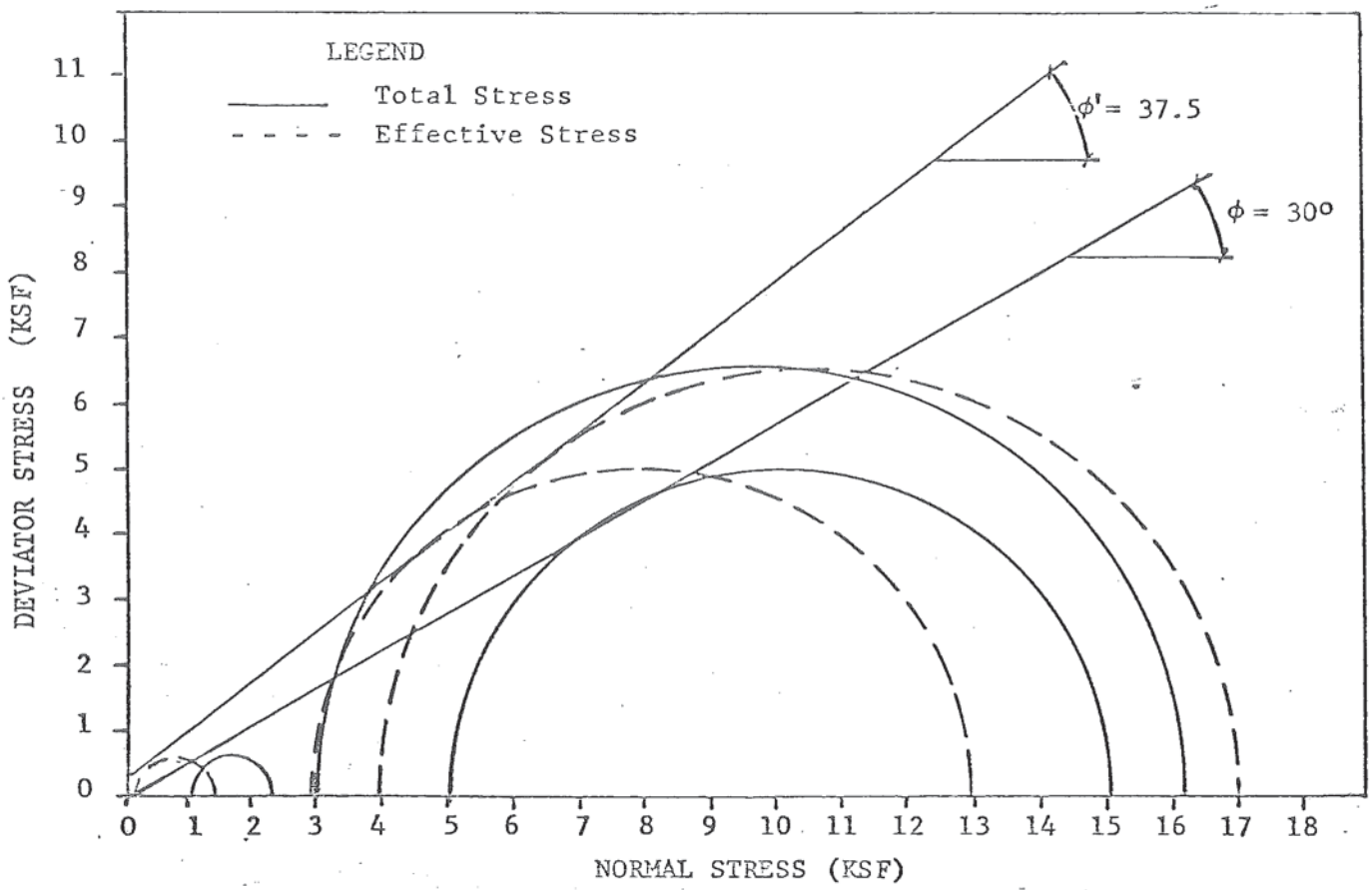
KILLEN ELECTRIC GENERATING STATION
SUMMARY OF LABORATORY TESTING DATA
DIKE FOUNDATION MATERIALS

LOCATION	SAMPLE DEPTH (FT)	MATERIAL	UNIFIED SOIL CLASS.	LIQUID LIMIT	PLASTICITY INDEX	DAY UNIT WEIGHT (PCF)	MOISTURE CONTENT (%)	UNCONFINED COMPRESSIVE STRENGTH (PSF)	COHESION "C" TRIAXIAL (KSF)	INTERNAL ANGLE OF SHEAR RESISTANCE, "ø" (DEGREES)
A-139	3-5	Brown Silt and Clay, Trace of Sand	CL	38	14	114.0	22.1	11390	-	-
A-139	8-10	Brown Silt, Some Clay, Some Sand	CL	35	15	107.5	20.7	3210	-	-
A-139	13-15	Brown Sand, Some Silt, Some Clay	SM	22	2	-	-	-	-	-
A-139	23-25	Brown Silt, Some Sand, Some Clay	ML-CL	25	7	112.4	42.1	-	-	-
A-142	3-5	Brown and Gray Clay and Silt, Trace Sand	-	-	-	97.4	26.1	5390	-	-
A-142	10-12	Brown and Gray Clay and Silt, Trace Sand	CL	48	24	97.8	22.5	7660	-	-
A-142	14.5-16.5	Brown and Gray Clay, Some Silt, Trace Sand	-	-	-	106.3	14.7	-	-	-
A-142	18.5-20.5* (Test 12)	Brown and Gray Clay, Some Silt, Trace Sand	-	-	-	91.5	30.1	-	0.80	1.5

* Triaxial test number in parenthesis

TRIAXIAL TEST RESULTS

MOHR DIAGRAM



CONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST

WITH PORE PRESSURE MEASUREMENTS

TOTAL STRESS PARAMETERS:
"Cohesion", C 0 ksf
Angle of Shear Resistance, ϕ 30°

EFFECTIVE STRESS PARAMETERS:
"Cohesion", C' 0.26 ksf
Angle of Shear Resistance, ϕ' 37.5°

UNIT WEIGHT, γ 108.1 PCF (Dry)

INITIAL MOISTURE CONTENT, ω 18.2%

SAMPLE TYPE UD

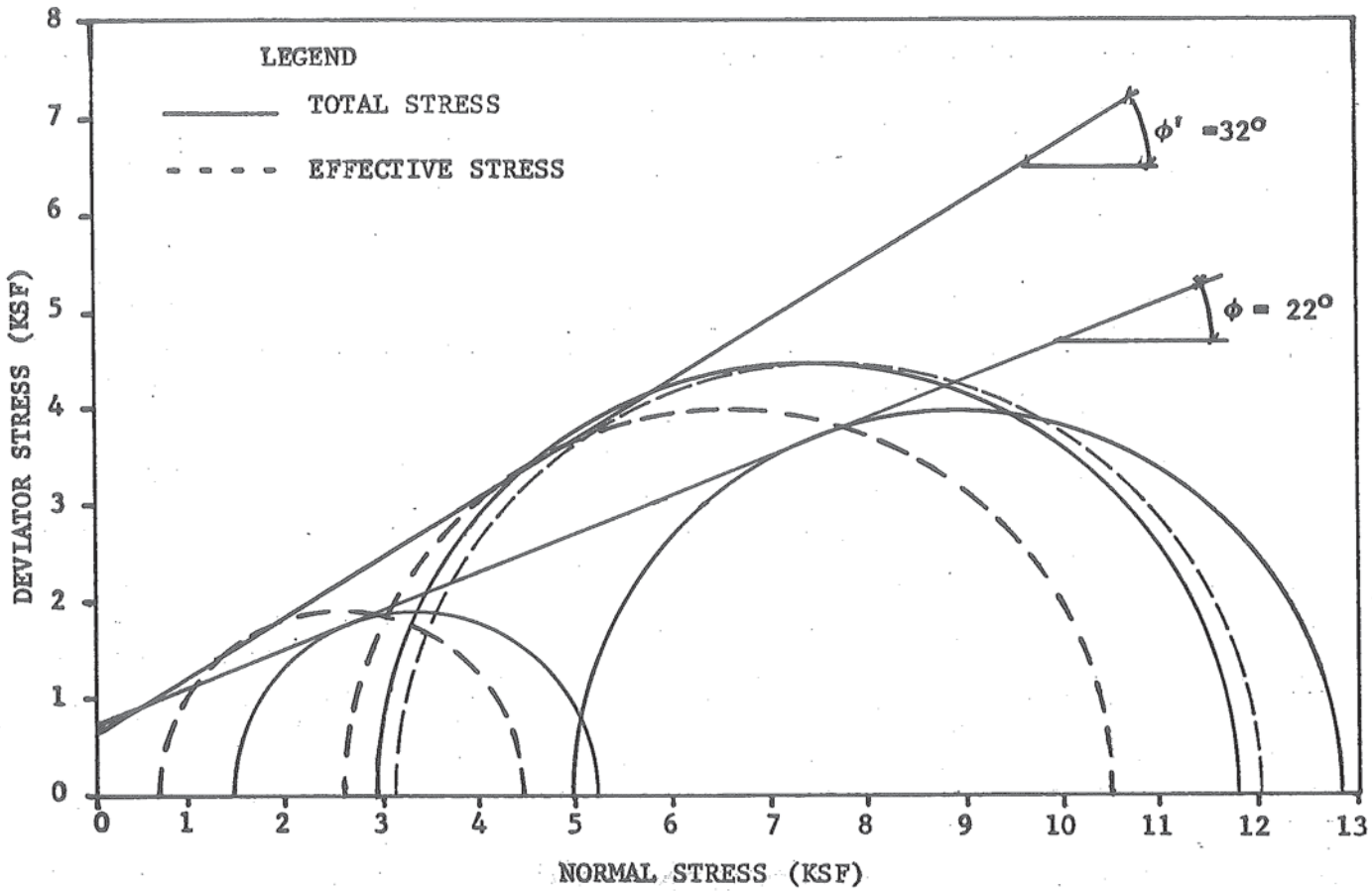
DEPTH 0-2 Ft.

MATERIAL SANDY CLAYEY SILT

LOCATION MISC. CLAY FILL

TEST 1

MOHR DIAGRAM



CONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST

WITH PORE PRESSURE MEASUREMENTS

TOTAL STRESS PARAMETERS:

"Cohesion", C 0.70 KSF

Angle of Shear Resistance, ϕ 22°

EFFECTIVE STRESS PARAMETERS

"Cohesion", C' 0.60 KSF

Angle of Shear Resistance, ϕ' 32°

Unit Weight, γ 104.5 PCF (Dry)

Initial Moisture Content, ω 20.3%

SAMPLE TYPE UD

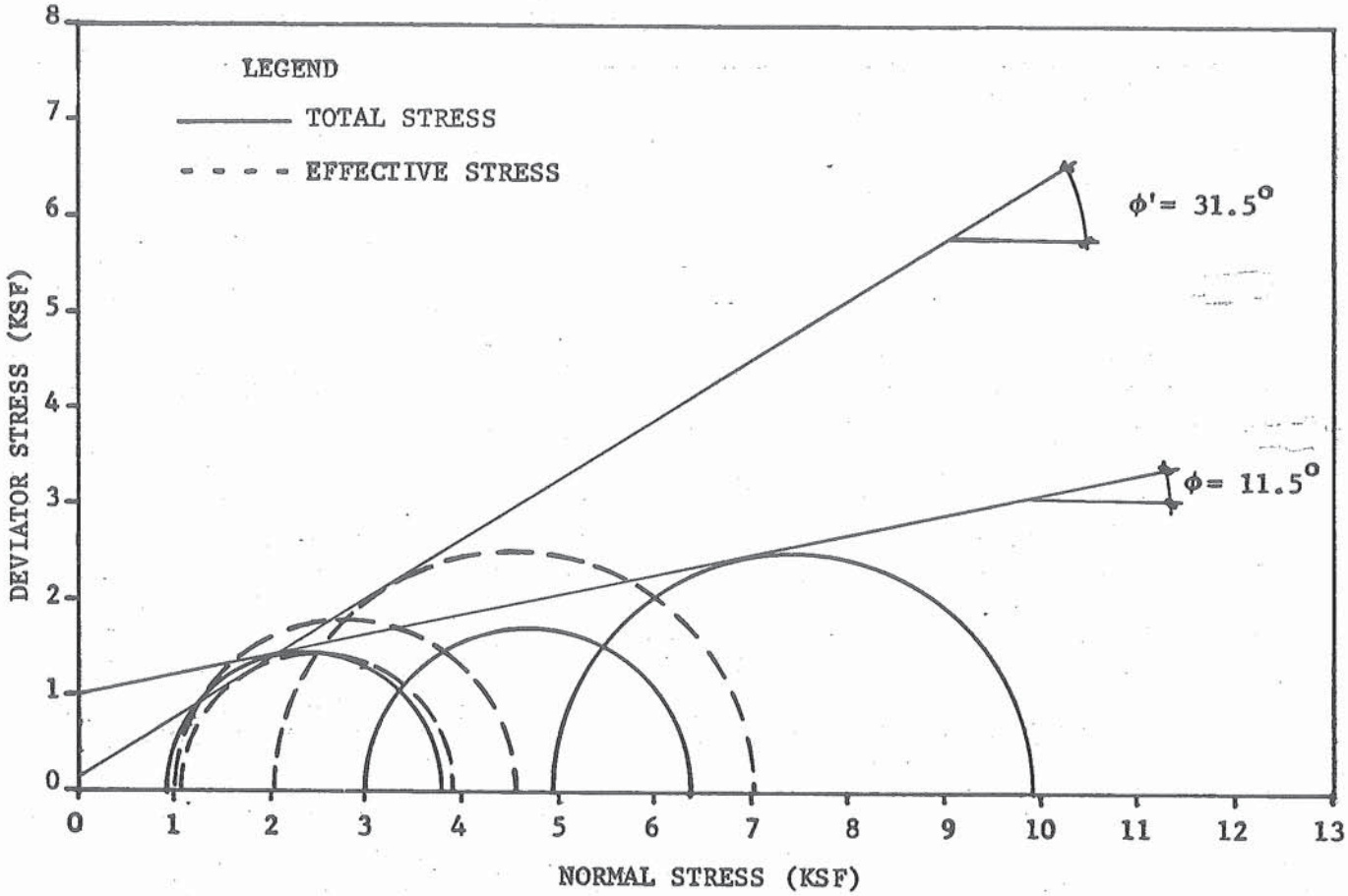
DEPTH 0-2 ft.

MATERIAL SANDY CLAYEY SILT

LOCATION MISC. CLAY FILL

TEST 2

MOHR DIAGRAM



CONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST WITH PORE PRESSURE MEASUREMENTS

TOTAL STRESS PARAMETERS:
"Cohesion", C 1.00 KSF
Angle of Shear Resistance, ϕ 11.5°

EFFECTIVE STRESS PARAMETERS:
"Cohesion", C' 0.10 KSF
Angle of Shear Resistance, ϕ' 31.5°

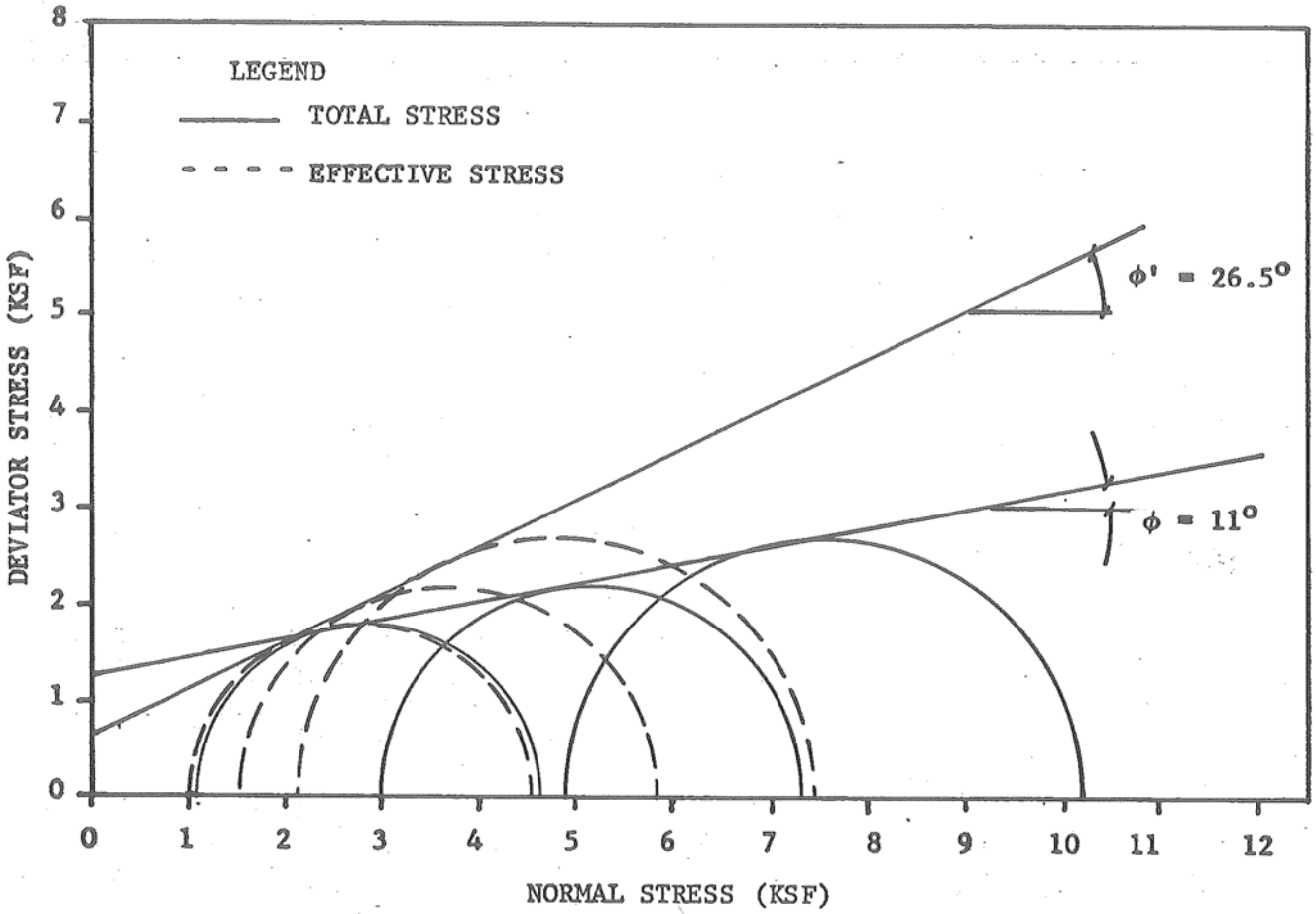
Unit Weight, γ 112.8 PCF (Dry)

Initial Moisture Content, ω 17.6%

SAMPLE TYPE	LAB COMPACTED
DEPTH	—
MATERIAL	SANDY CLAYEY SILT
LOCATION	MISC. CLAY FILL

TEST 3

MOHR DIAGRAM



CONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST

WITH PORE PRESSURE MEASUREMENTS

TOTAL STRESS PARAMETERS:
"Cohesion", C 1.25 KSF
Angle of Shear Resistance, ϕ 11°

EFFECTIVE STRESS PARAMETERS:
"Cohesion", C' 0.60 KSF
Angle of Shear Resistance, ϕ' 26.5°

Unit Weight, γ 113.6 PCF (Dry)

Initial Moisture Content, ω 19.0%

SAMPLE TYPE LAB COMPACTED

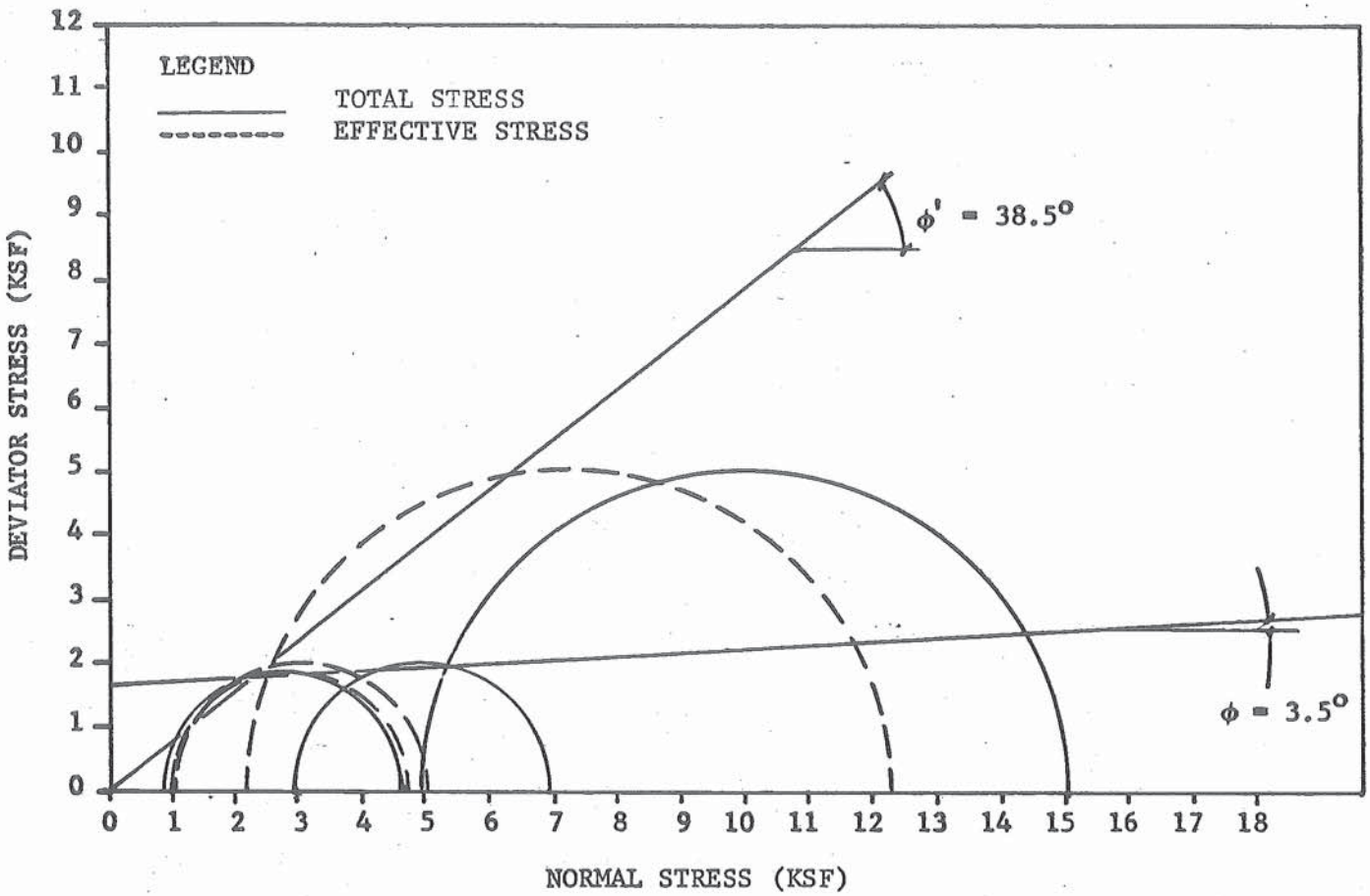
DEPTH ——

MATERIAL SANDY CLAYEY SILT

LOCATION MISC. CLAY FILL

TEST 4

MOHR DIAGRAM



CONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST

WITH PORE PRESSURE MEASUREMENTS

TOTAL STRESS PARAMETERS:
"Cohesion", C 1.70 KSF
Angle of Shear Resistance, ϕ 3.5°

EFFECTIVE STRESS PARAMETERS:
"Cohesion", C' 0.0 KSF
Angle of Shear Resistance, ϕ' 38.5°

Unit Weight, γ 107.7 PCF (Dry)

Initial Moisture Content, ω 23.0%

SAMPLE TYPE LAB COMPACTED

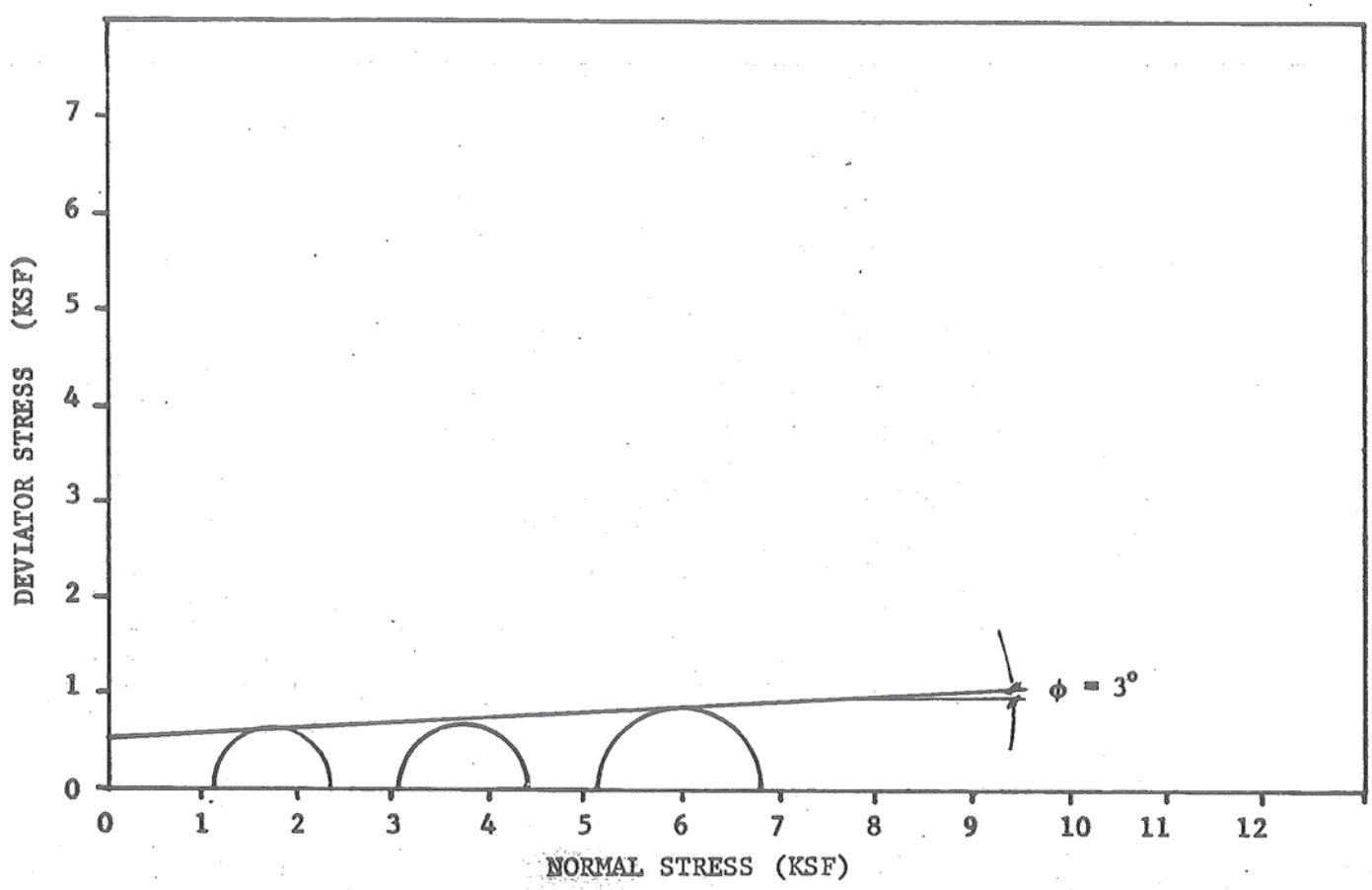
DEPTH —

MATERIAL SANDY CLAYEY SILT

LOCATION MISC. CLAY FILL

TEST 5

MOHR DIAGRAM



UNCONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST

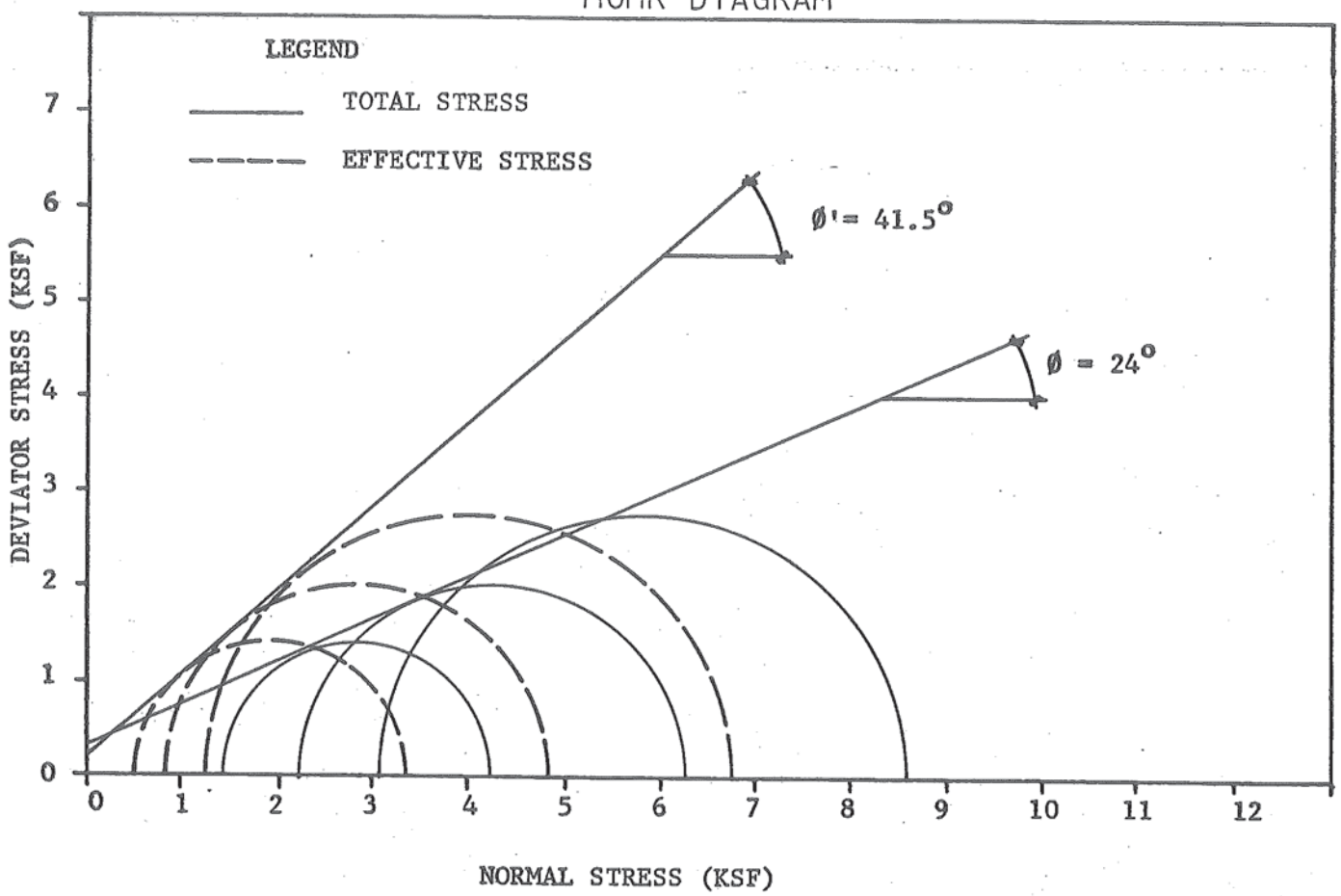
TOTAL STRESS PARAMETERS:
"Cohesion", C 0.55 KSF
Angle of Shear Resistance, ϕ 3°

Unit Weight, γ 111.0 PCF (Dry)
Initial Moisture Content, ω 19.4%

SAMPLE TYPE	LAB COMPACTED
DEPTH	—
MATERIAL	SANDY CLAYEY SILT
LOCATION	MISC. CLAY FILL

TEST 6

MOHR DIAGRAM



CONSOLIDATED - UNDRAINED TRIAXIAL SHEAR TEST WITH PORE PRESSURE MEASUREMENTS

TOTAL STRESS PARAMETERS:
"Cohesion", C 0.30 KSF
Angle of Shear Resistance, Ø 24°

EFFECTIVE STRESS PARAMETERS:
"Cohesion", C' 0.20 KSF
Angle of Shear Resistance, Ø' 41.5°

Unit Weight, γ 106.8 PCF (DRY)

Initial Moisture Content, ω 15.7%

SAMPLE TYPE UD

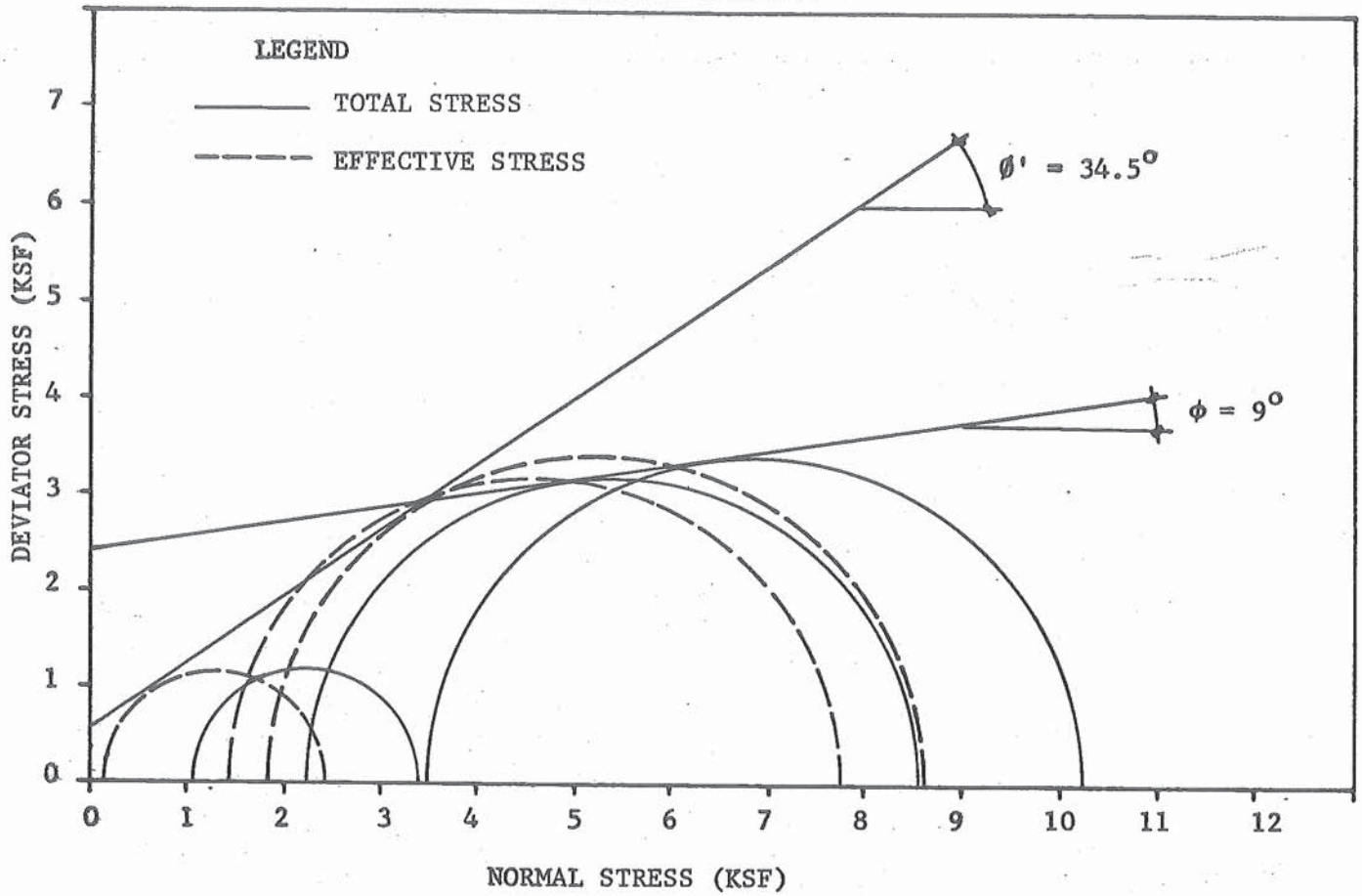
DEPTH 0-2 Ft

MATERIAL Sandy Clayey Silt

LOCATION CLAY TEST FILL

TEST 7

MOHR DIAGRAM



CONSOLIDATED - UNDRAINED TRIAXIAL SHEAR TEST
WITH PORE PRESSURE MEASUREMENTS

TOTAL STRESS PARAMETERS:
"Cohesion", C 2.40 KSF
Angle of Shear Resistance, Ø 9°

EFFECTIVE STRESS PARAMETERS:
"Cohesion", C' 0.55 KSF
Angle of Shear Resistance, Ø' 34.5°

Unit Weight, γ 107.8 PCF (DRY)

INITIAL MOISTURE CONTENT, ω 16.8%

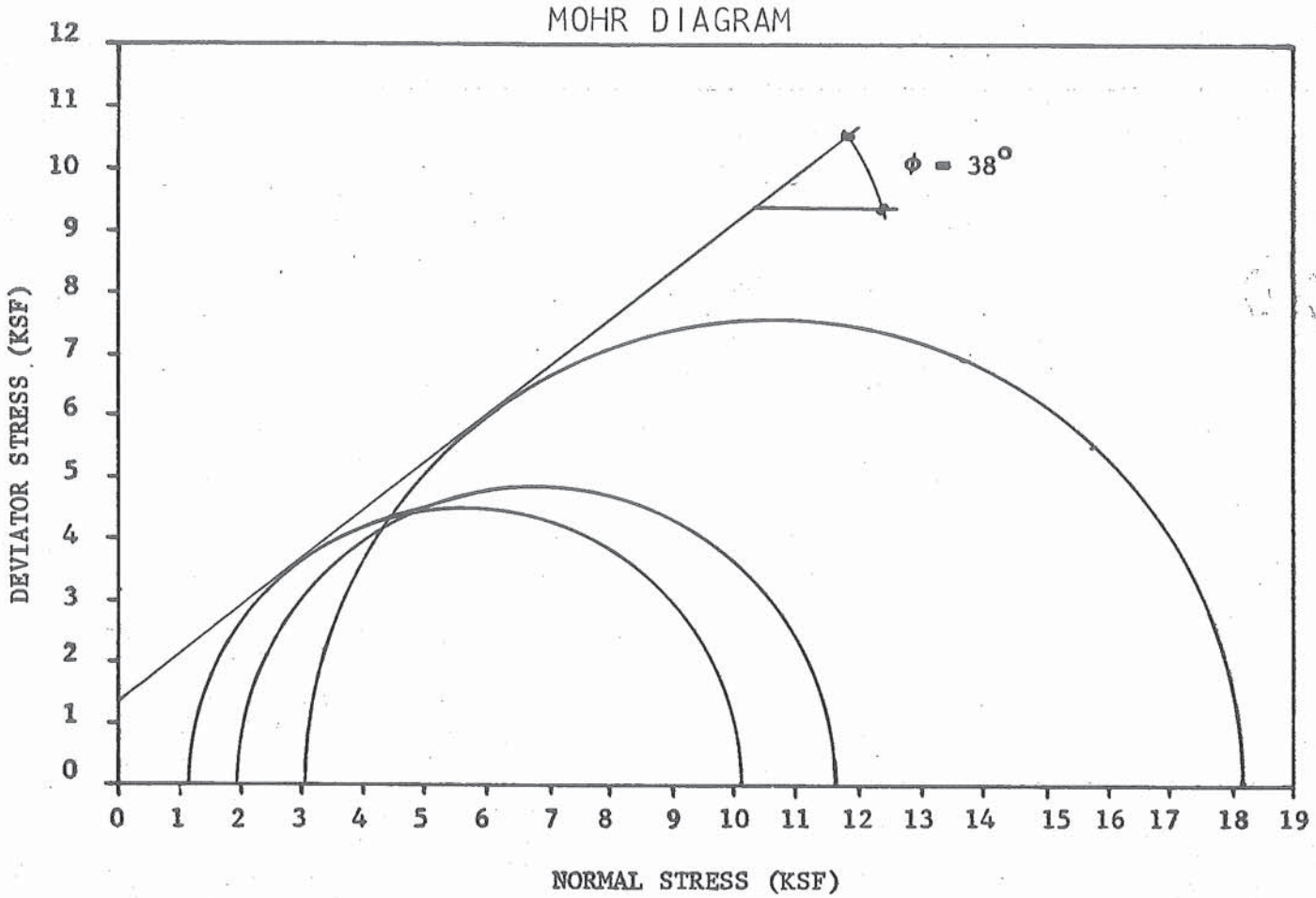
SAMPLE TYPE UD

DEPTH 2-4 Ft

MATERIAL Sandy Silty Clay

LOCATION CLAY TEST FILL

TEST 8



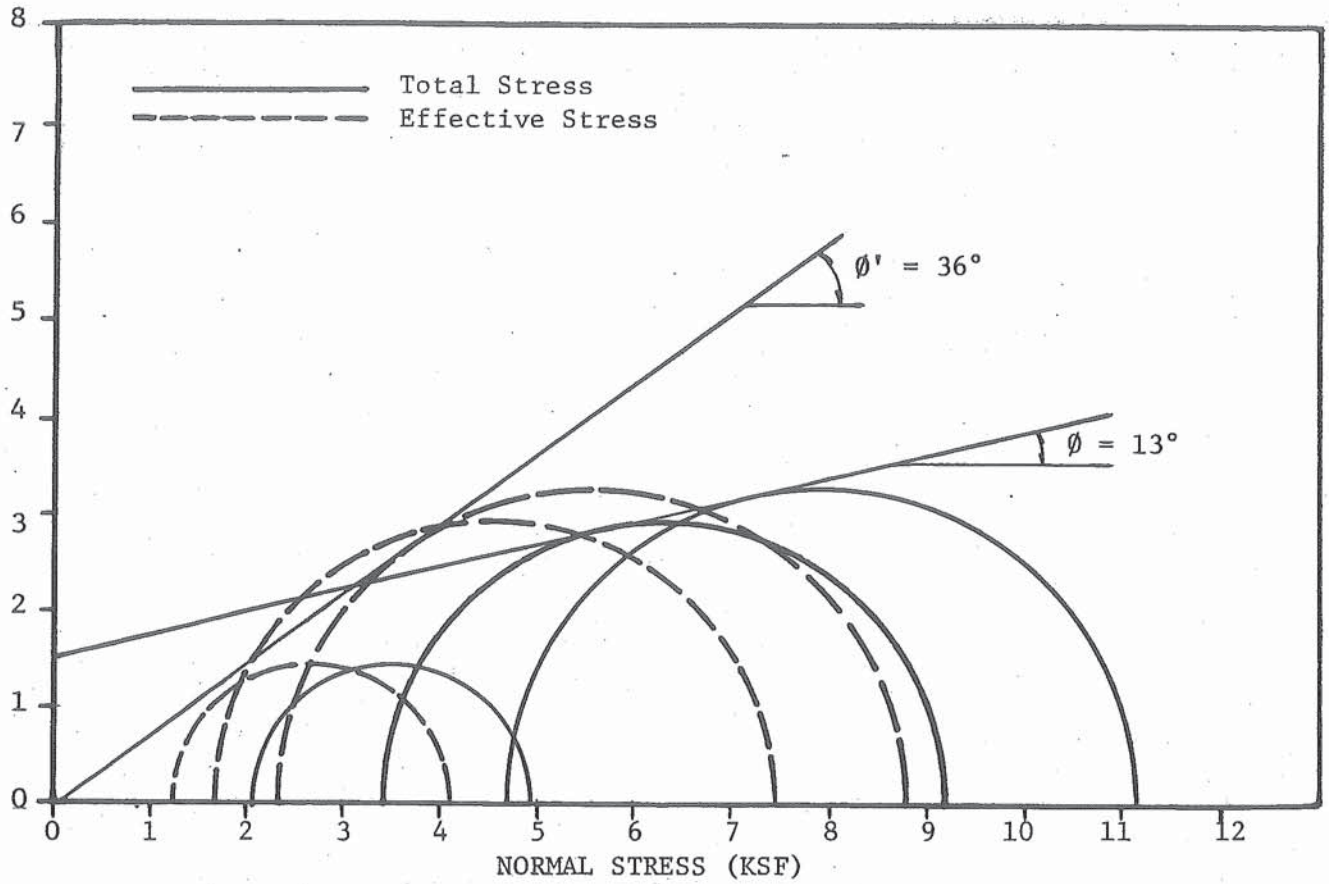
UNCONSOLIDATED - UNDRAINED TRIAXIAL SHEAR TEST

TOTAL STRESS PARAMETERS:
"Cohesion", C 1.30 KSF
Angle of Shear Resistance, Ø 38°
Unit Weight, 106.1 PCF(DRY)
INITIAL MOISTURE CONTENT, ω 15.9%

SAMPLE TYPE LAB COMPACTED
DEPTH -
MATERIAL Sandy Silty Clay
LOCATION CLAY TEST FILL

TEST 9

MOHR DIAGRAM



CONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST
WITH PORE PRESSURE MEASUREMENTS

TOTAL STRESS PARAMETERS:
"Cohesion", C 1.50 KSF
Angle of Shear Resistance, Ø 13°

EFFECTIVE STRESS PARAMETERS:
"Cohesion", C' 0.0 KSF
Angle of Shear Resistance, Ø' 36°

UNIT WEIGHT, γ 105.9 PCF (Dry)

INITIAL MOISTURE CONTENT, ω 17.5%

SAMPLE TYPE UD

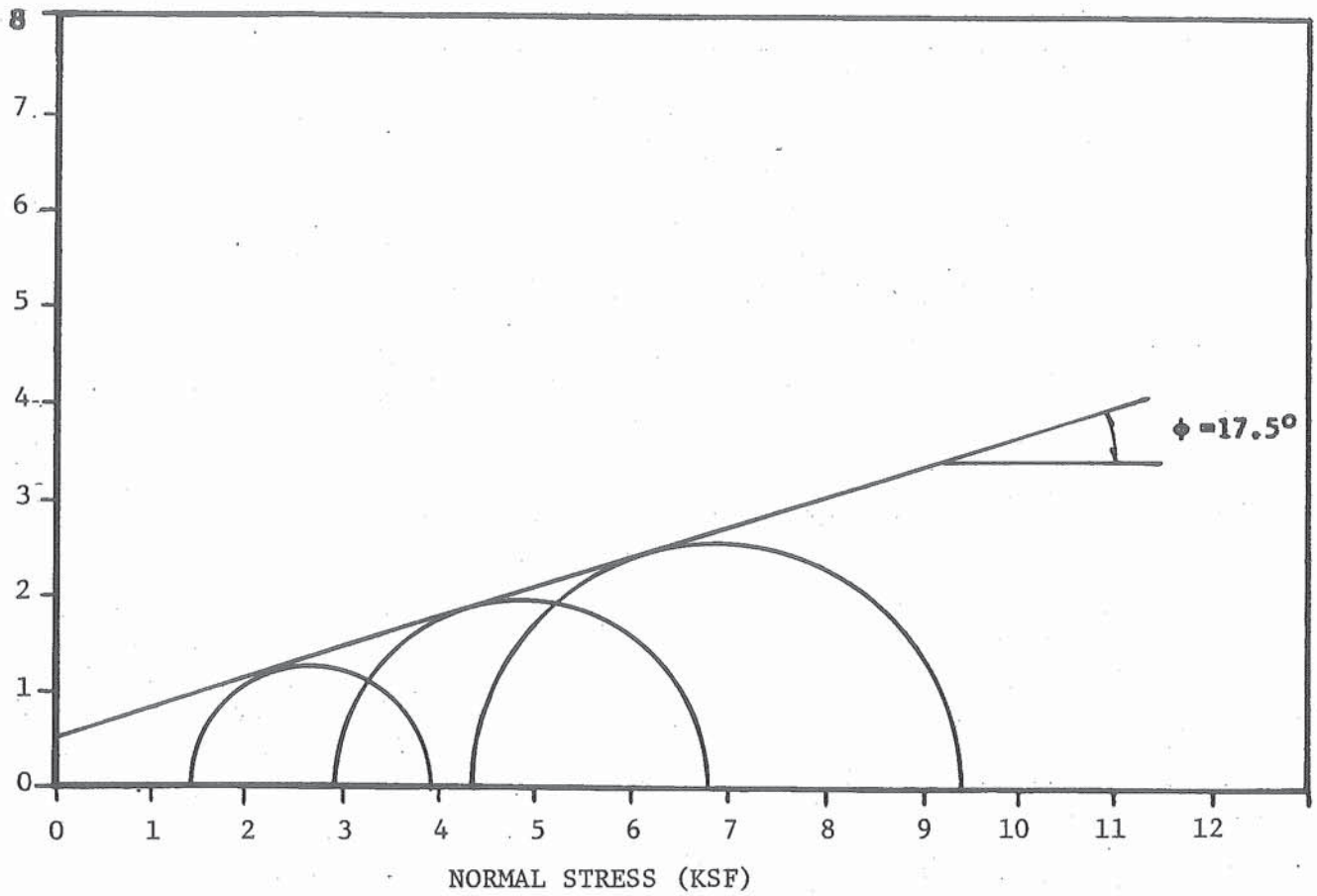
DEPTH 5-7 Ft.

MATERIAL Brown Silt, Some Clay Some Sand

LOCATION Boring A-129

TEST 10

MOHR DIAGRAM



UNCONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST

TOTAL STRESS PARAMETERS:
"Cohesion", C 0.50 KSF
Angle of Shear Resistance, Ø 17.5°

UNIT WEIGHT, γ 105.9 PCF (Dry)

INITIAL MOISTURE CONTENT, ω 20.7%

SAMPLE TYPE UD

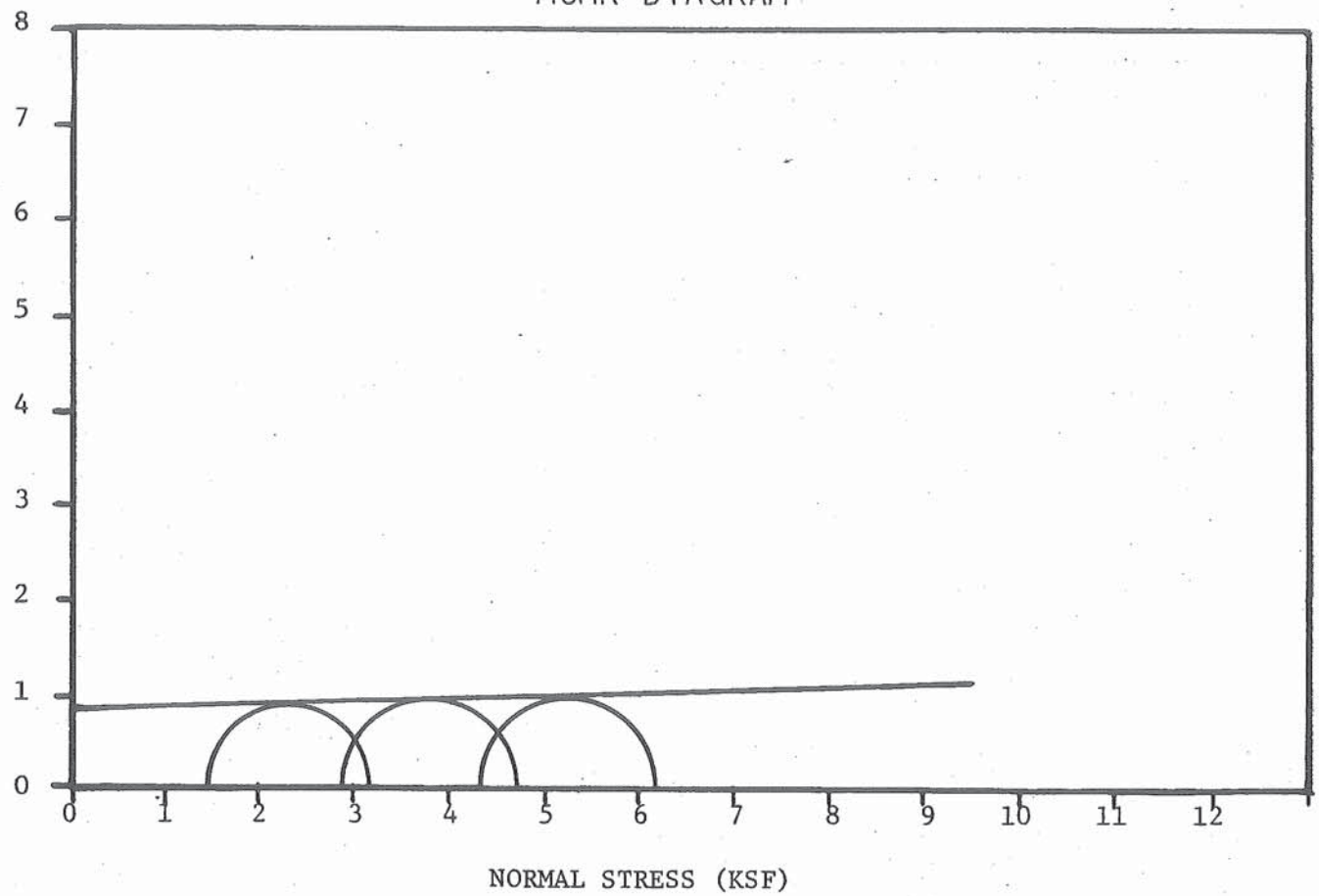
DEPTH 18-20 Ft.

MATERIAL Brown Silt and Sand, Trace of Clay

LOCATION Boring A-135

TEST 11

MOHR DIAGRAM



UNCONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST

TOTAL STRESS PARAMETERS
"Cohesion", C 0.80 KSF
Angle of Shear Resistance, Ø 1.5°

UNIT WEIGHT, γ 91.5 PCF (Dry)

INITIAL MOISTURE CONTENT, ω 30.0%

SAMPLE TYPE UD

DEPTH 18.5-20.5

MATERIAL Brown and Gray Clay, Some Silt, Trace of Sand

LOCATION Boring A-142

TEST 12

UNCONFINED COMPRESSIVE STRENGTH

TEST RESULTS

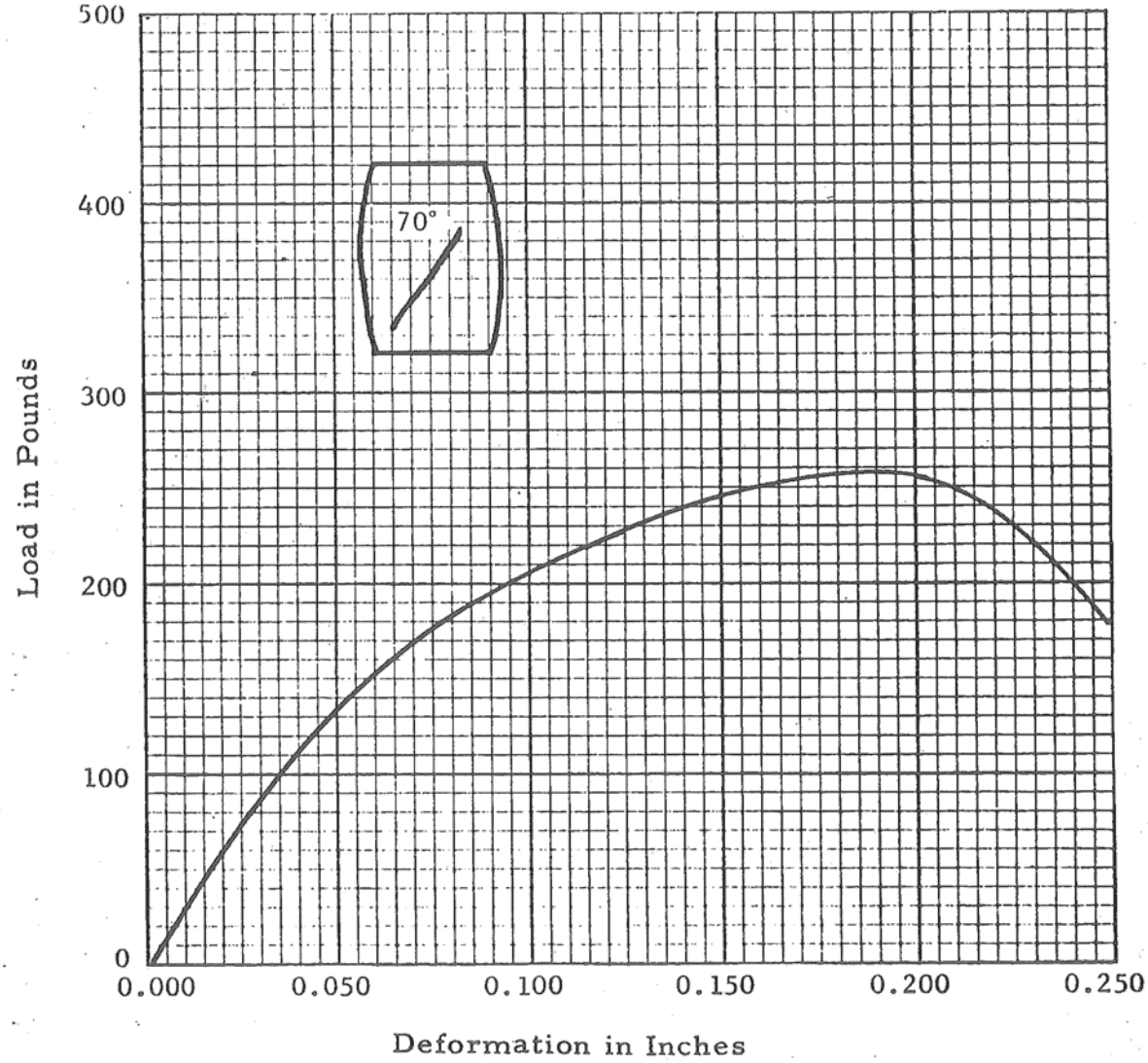
UNCONFINED COMPRESSION TEST

Project:	KILLEN STATION - TEST FILL
Boring No:	A3
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	0.0 - 2.0'
Depth Interval of Strata:	0.0 - 2.8'
Depth of Interval of Test Sample:	0.5 - 1.0'
Sample Recovery:	17"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.188"
Test Specimen Weight	2.32 lbs.
Moisture Content	15.9%
Wet Unit Weight	121.9 pcf
Dry Unit Weight	105.2 pcf
Unconfined Compression Strength	5670 psf
Load Increment at Failure	258.8 lbs.
Height at Failure	5.013"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand, trace of Gravel

FAILURE SKETCH



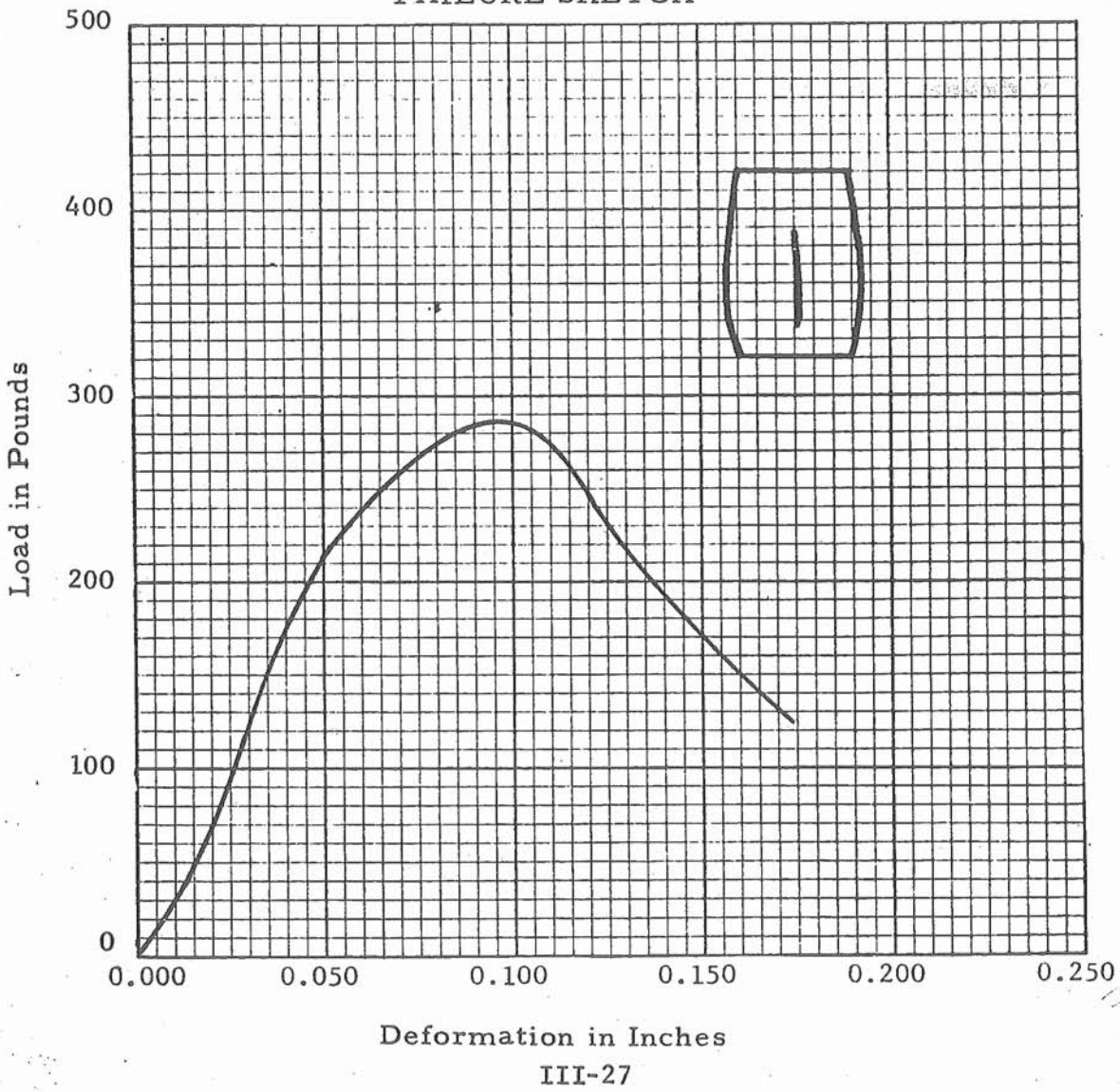
UNCONFINED COMPRESSION TEST

Project:	KILLEN STATION - TEST FILL
Boring No:	A2
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	0.0 - 2.0'
Depth Interval of Strata:	0.0 - 3.2'
Depth of Interval of Test Sample:	0.5 - 0.9'
Sample Recovery:	17"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.062"
Test Specimen Weight	2.27 lbs.
Moisture Content	15.9%
Wet Unit Weight	122.7 pcf
Dry Unit Weight	105.9 pcf
Unconfined Compression Strength	6360 psf
Load Increment at Failure	286.2 lbs.
Height at Failure	4.962"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand

FAILURE SKETCH



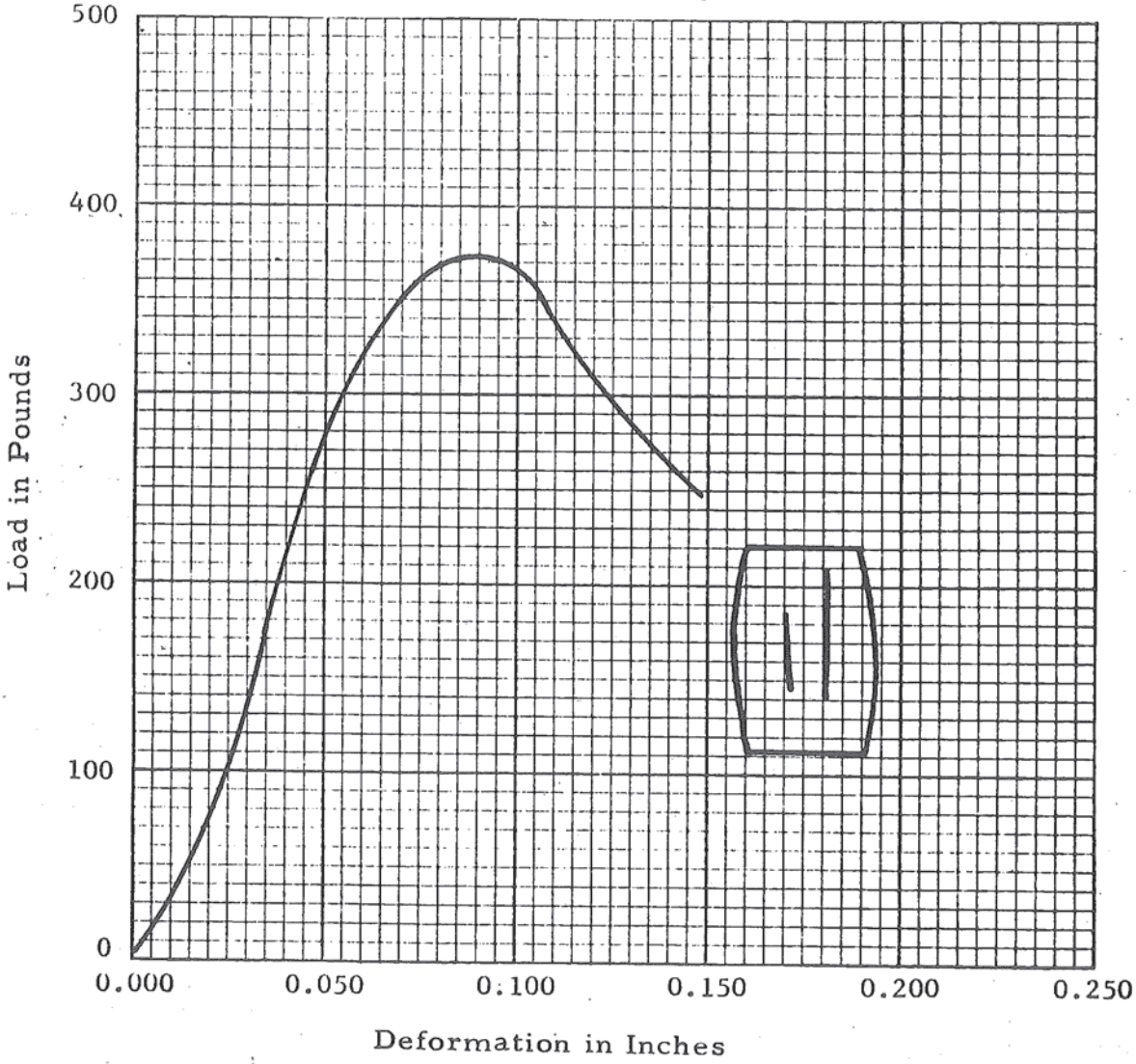
UNCONFINED COMPRESSION TEST

Project:	KILLEN STATION - TEST FILL
Boring No:	B2
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	0.0 - 2.0'
Depth Interval of Strata:	0.0 - 3.3'
Depth of Interval of Test Sample:	0.8 - 1.3'
Sample Recovery:	27"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.531"
Test Specimen Weight	2.55 lbs.
Moisture Content	17.1%
Wet Unit Weight	125.6 pcf
Dry Unit Weight	107.3 pcf
Unconfined Compression Strength	8140 psf
Load Increment at Failure	365.4 lbs.
Height at Failure	5.431"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand

FAILURE SKETCH



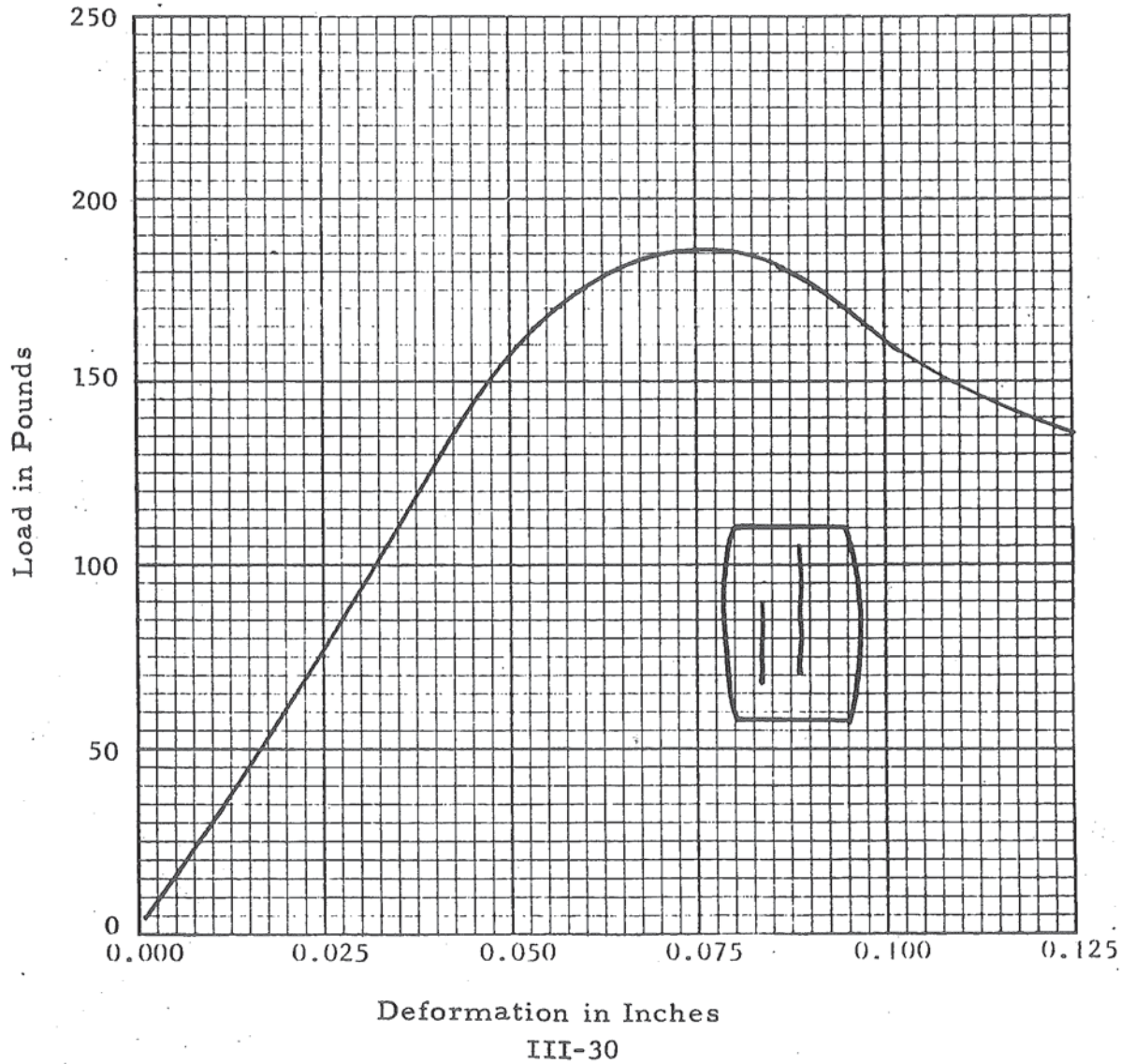
UNCONFINED COMPRESSION TEST

Project:	KILLEN STATION - TEST FILL
Boring No:	B2
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	0.0 - 2.0'
Depth Interval of Strata:	0.0 - 3.3'
Depth of Interval of Test Sample:	1.7 - 2.2'
Sample Recovery:	27"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.72 lbs.
Moisture Content	17.5%
Wet Unit Weight	124.4 pcf
Dry Unit Weight	105.9 pcf
Unconfined Compression Strength	3820 psf
Load Increment at Failure	170.5 lbs.
Height at Failure	5.200"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand

FAILURE SKETCH



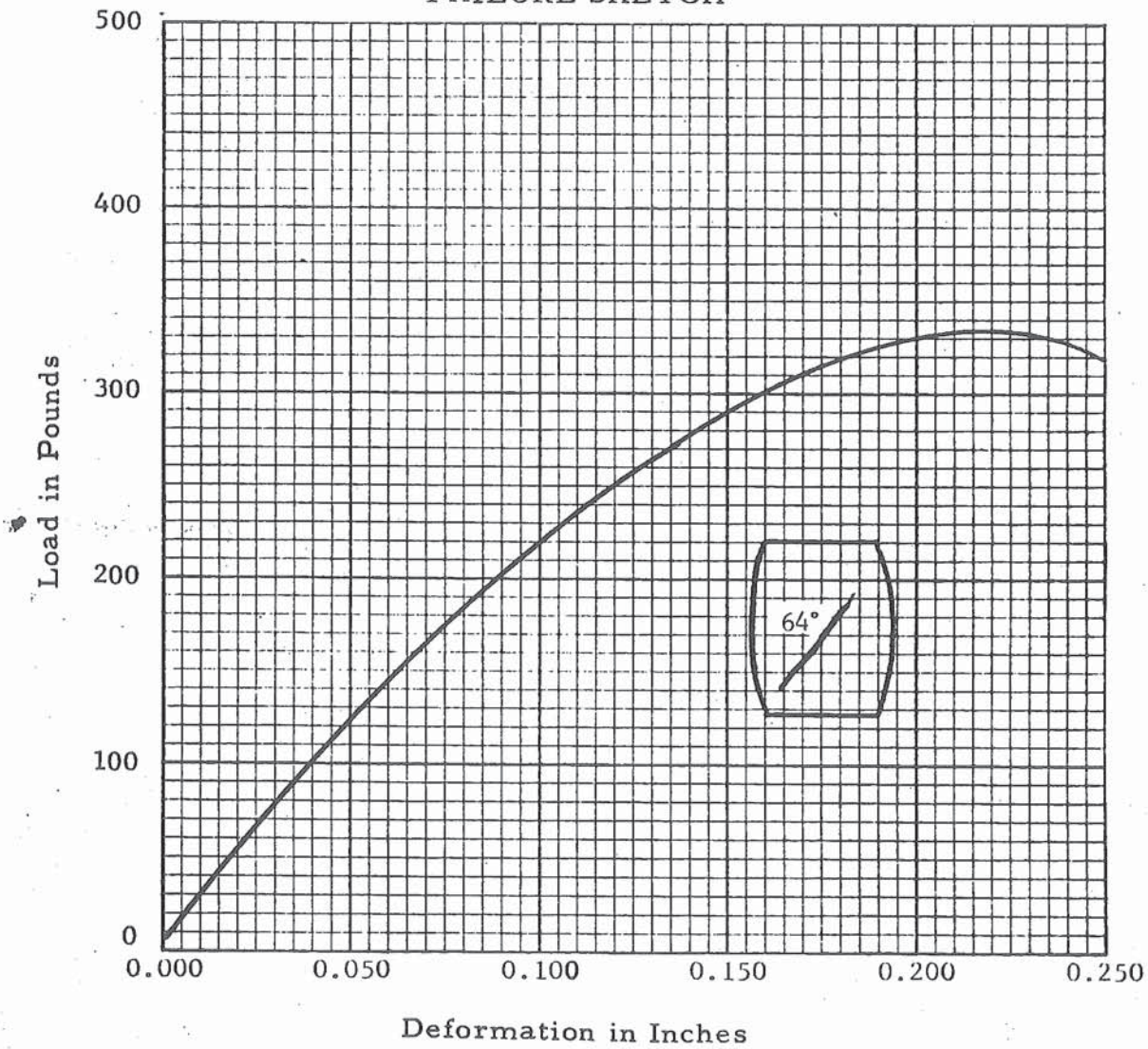
UNCONFINED COMPRESSION TEST

Project:	KILLEN STATION - TEST FILL
Boring No:	B2
Sample No:	2C
Surface Elevation:	Not Taken
Depth Interval of Sample:	2.0 - 4.0'
Depth Interval of Strata:	0.0 - 3.3'
Depth of Interval of Test Sample:	2.0 - 2.4'
Sample Recovery:	24"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	4.875"
Test Specimen Weight	2.30 lbs.
Moisture Content	17.4%
Wet Unit Weight	128.6 pcf
Dry Unit Weight	109.5 pcf
Unconfined Compression Strength	7180 psf
Load Increment at Failure	331.9 lbs.
Height at Failure	4.650"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand

FAILURE SKETCH



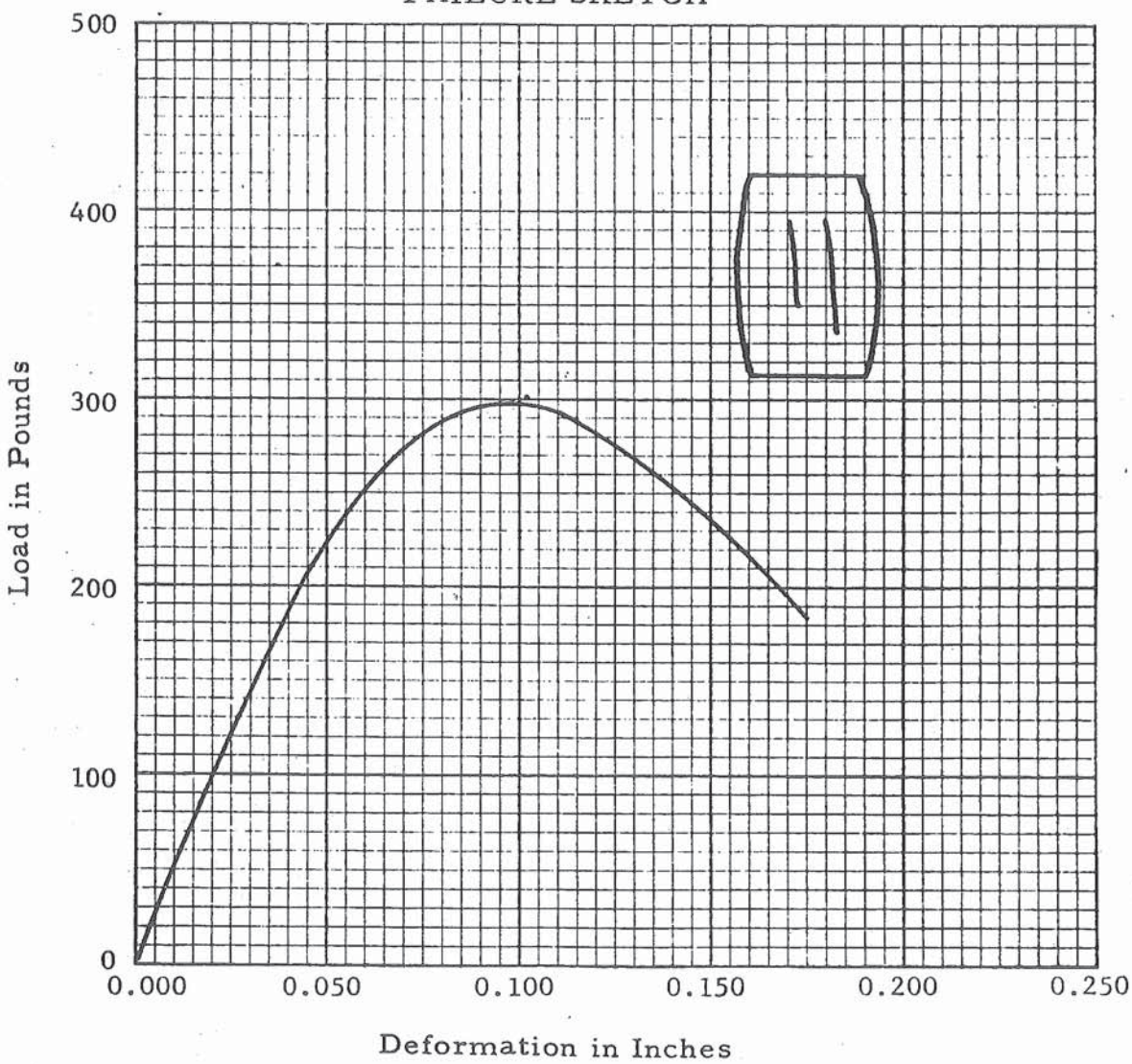
UNCONFINED COMPRESSION TEST

Project:	KILLEN STATION - TEST FILL
Boring No:	C1
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	0.0 - 2.0'
Depth Interval of Strata:	0.0 - 3.5'
Depth of Interval of Test Sample:	0.4 - 0.8'
Sample Recovery:	26"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.500"
Test Specimen Weight	2.38 lbs.
Moisture Content	16.6%
Wet Unit Weight	117.9 pcf
Dry Unit Weight	101.2 pcf
Unconfined Compression Strength	6580 psf
Load Increment at Failure	295.4 lbs.
Height at Failure	5.400"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand

FAILURE SKETCH



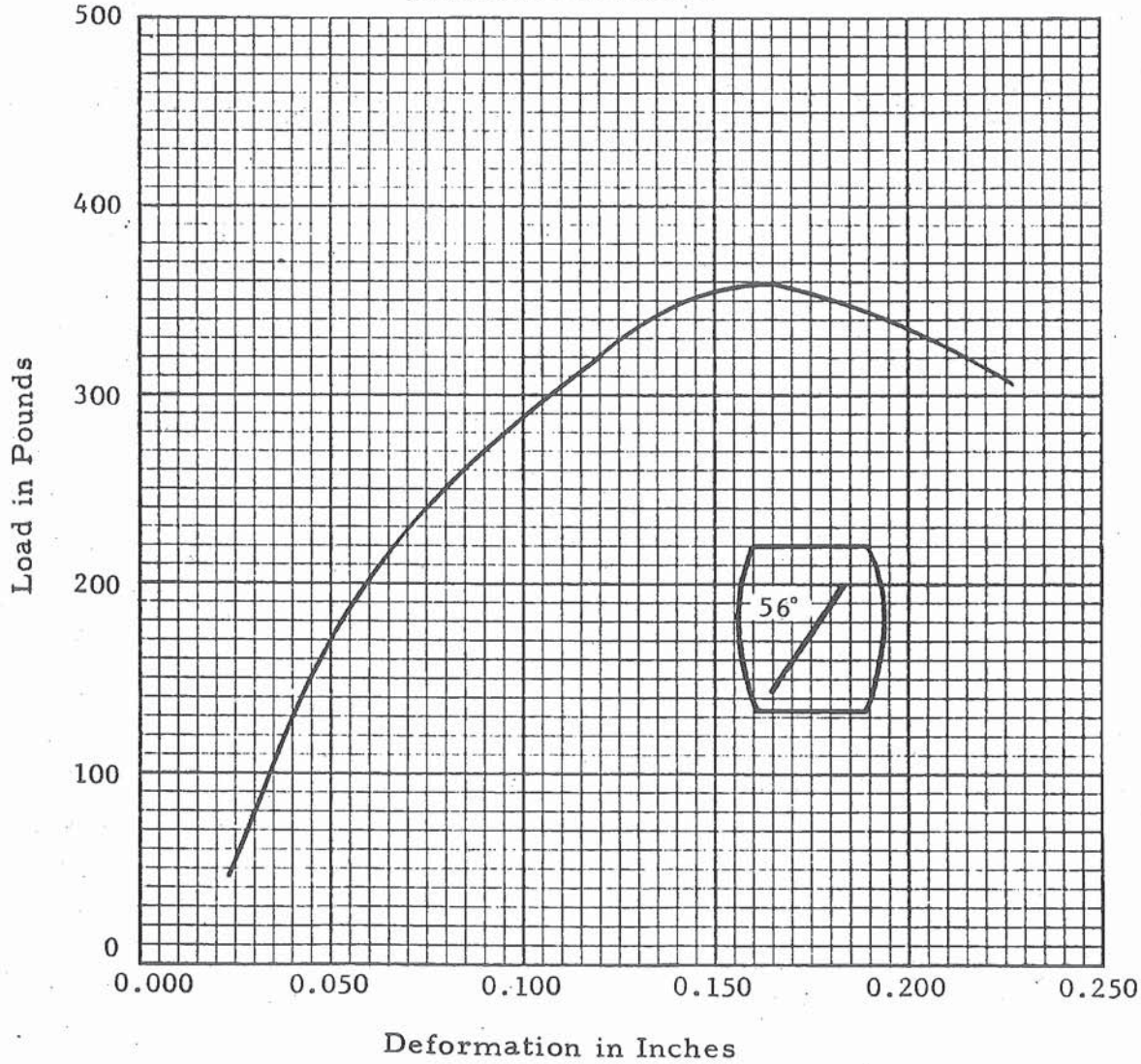
UNCONFINED COMPRESSION TEST

Project:	KILLEN STATION - TEST FILL
Boring No:	C1
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	0.0 - 2.0'
Depth Interval of Strata:	0.0 - 3.5'
Depth of Interval of Test Sample:	1.1 - 1.5'
Sample Recovery:	26"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	4.500"
Test Specimen Weight	2.0 lbs.
Moisture Content	15.1%
Wet Unit Weight	121.1 pcf
Dry Unit Weight	105.3 pcf
Unconfined Compression Strength	7920 psf
Load Increment at Failure	362.4 lbs.
Height at Failure	4.335"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand

FAILURE SKETCH



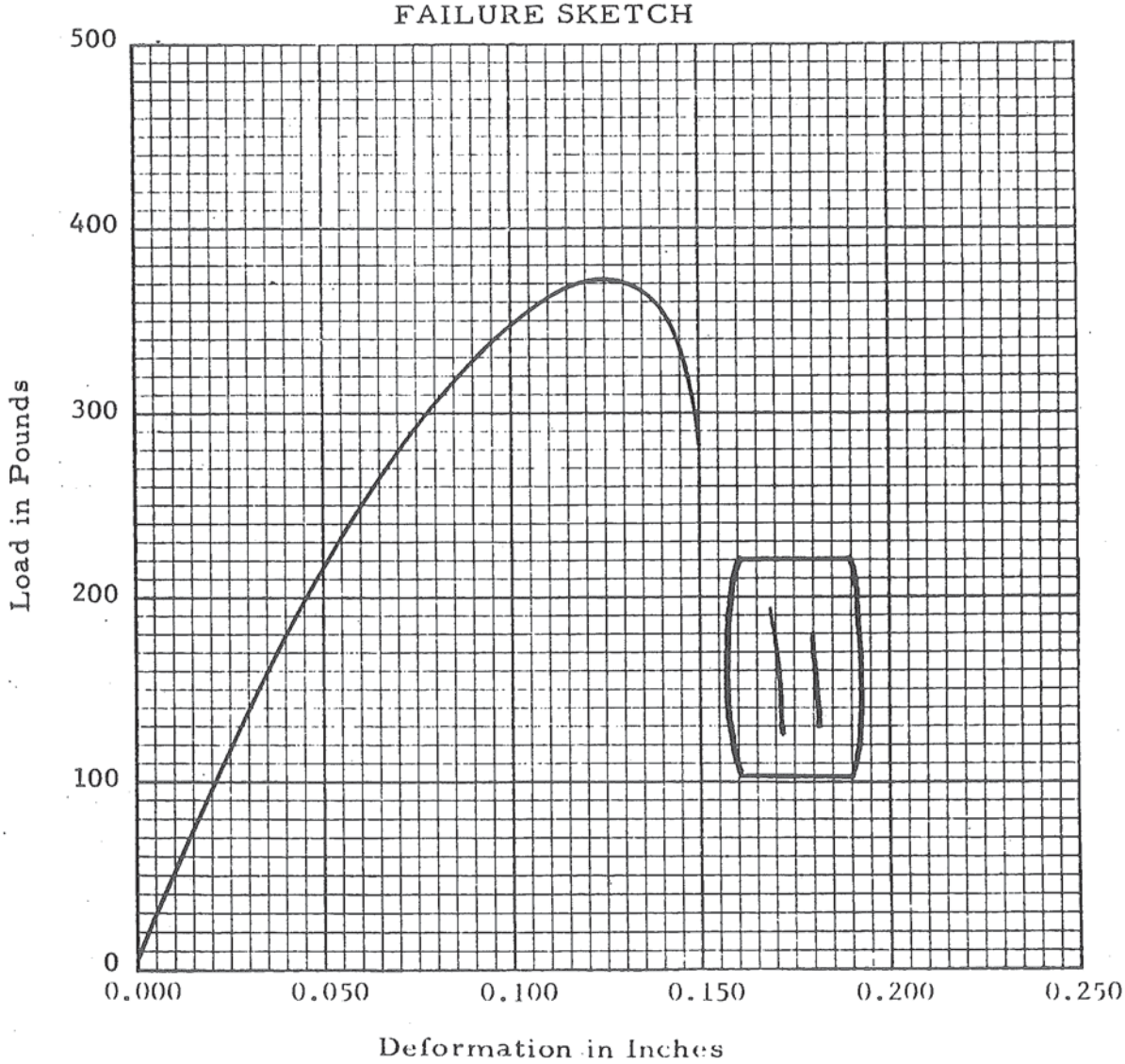
UNCONFINED COMPRESSION TEST

Project:	KILLEN STATION - TEST FILL
Boring No:	C2
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	0.0 - 2.0'
Depth Interval of Strata:	0.0 - 3.3'
Depth of Interval of Test Sample:	0.9 - 1.4'
Sample Recovery:	20"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.69 lbs.
Moisture Content	16.0%
Wet Unit Weight	123.2 pcf
Dry Unit Weight	106.2 pcf
Unconfined Compression Strength	8250 psf
Load Increment at Failure	371.5 lbs.
Height at Failure	5.825"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand

FAILURE SKETCH



UNCONFINED COMPRESSION TEST

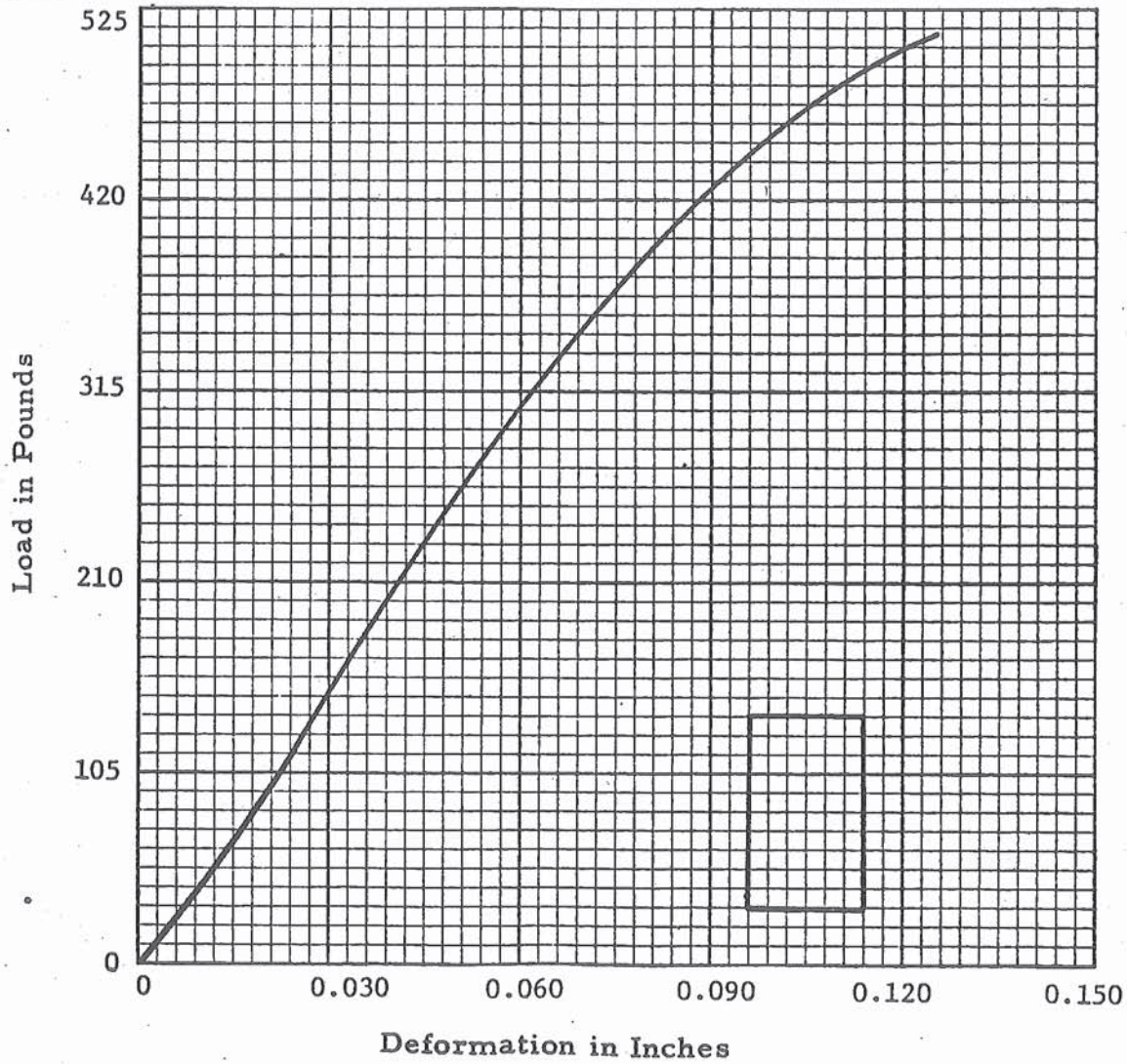
Project:	KILLEN ELECTRIC GENERATING STATION - ADAMS COUNTY, OHIO
Boring No:	A-129
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	0.0'-2.0'
Depth Interval of Strata:	0.0'-7.0'
Depth of Interval of Test Sample:	0.1'-0.6'
Sample Recovery:	10"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.531"
Test Specimen Weight	2.39 lbs.
Moisture Content	19.1%
Wet Unit Weight	117.6 pcf
Dry Unit Weight	98.7 pcf
Unconfined Compression Strength	11350 psf*
Load Increment at Failure	511.4 lbs.
Height at Failure	5.825"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand, trace of Organic

* Capacity of Testing Machine

FAILURE SKETCH



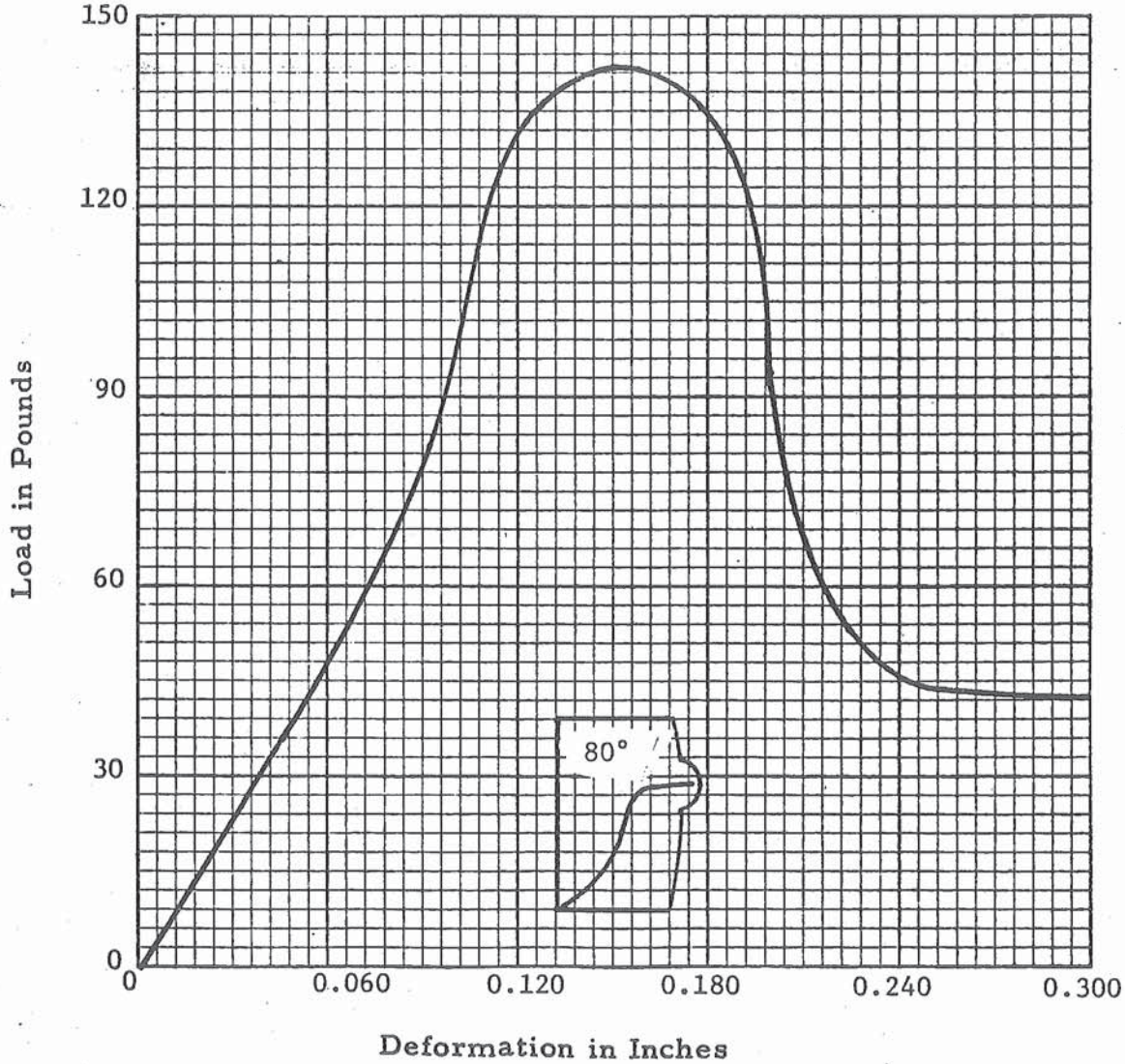
UNCONFINED COMPRESSION TEST

Project: KILLEN ELECTRIC GENERATING STATION - ADAMS COUNTY, OHIO	
Boring No:	A-129
Sample No:	3C
Surface Elevation:	Not Taken
Depth Interval of Sample:	10.0'-12.0'
Depth Interval of Strata:	7.0'-17.0'
Depth of Interval of Test Sample:	11.0'-11.5'
Sample Recovery:	24"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.71 lbs.
Moisture Content	22.6%
Wet Unit Weight	124.0 pcf
Dry Unit Weight	101.1 pcf
Unconfined Compression Strength	3130 psf
Load Increment at Failure	141.2 lbs.
Height at Failure	5.800"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, trace of Sand

FAILURE SKETCH



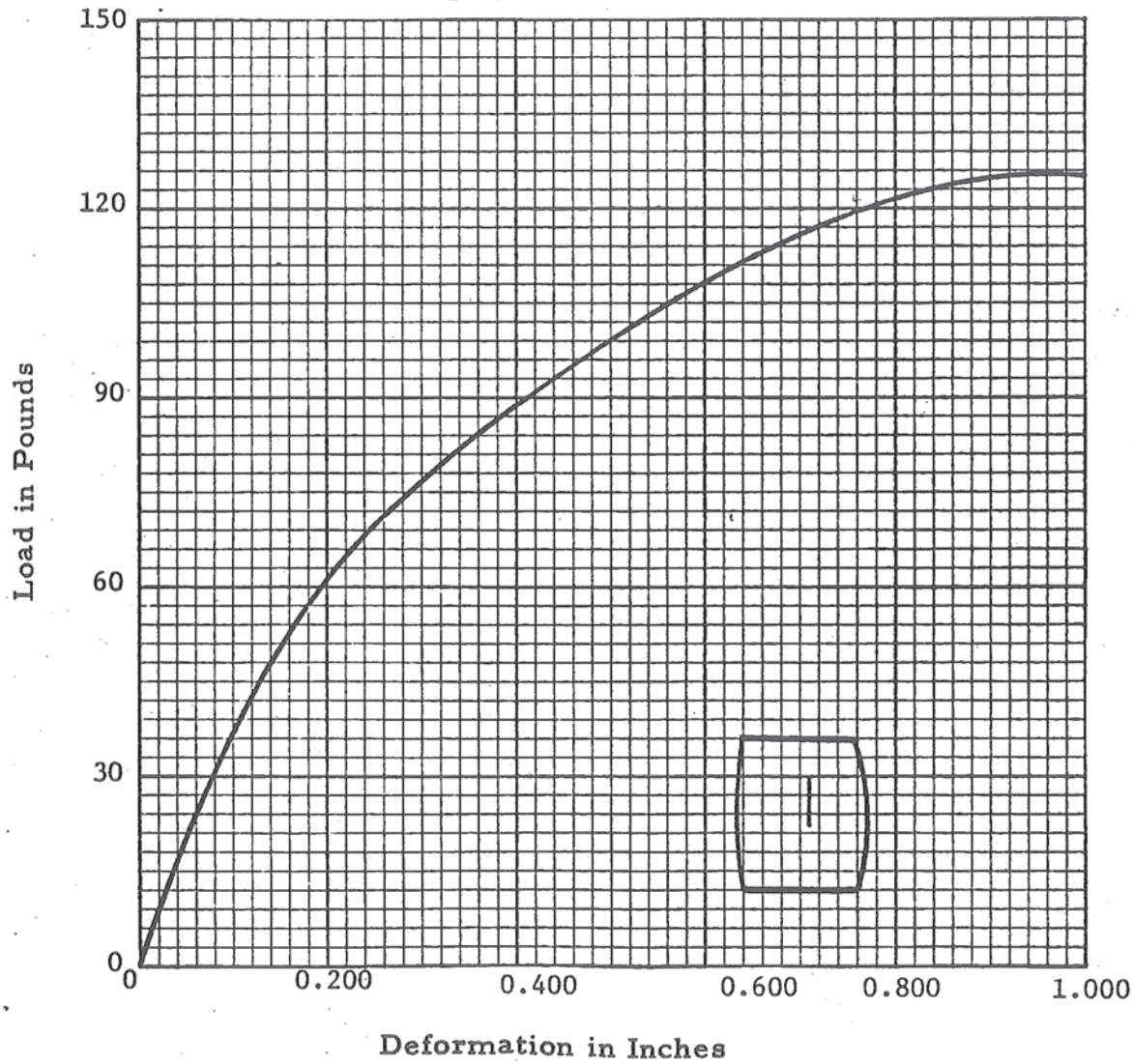
UNCONFINED COMPRESSION TEST

Project: KILLEN ELECTRIC GENERATING STATION - ADAMS COUNTY, OHIO	
Boring No:	A-129
Sample No:	4C
Surface Elevation:	Not Taken
Depth Interval of Sample:	15.0'-17.0'
Depth Interval of Strata:	7.0'-17.0'
Depth of Interval of Test Sample:	16.5'-17.0'
Sample Recovery:	22"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.75 lbs.
Moisture Content	21.2%
Wet Unit Weight	125.8 pcf
Dry Unit Weight	103.8 pcf
Unconfined Compression Strength	2370 psf
Load Increment at Failure	125.5 lbs.
Height at Failure	4.950"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, trace of Sand

FAILURE SKETCH



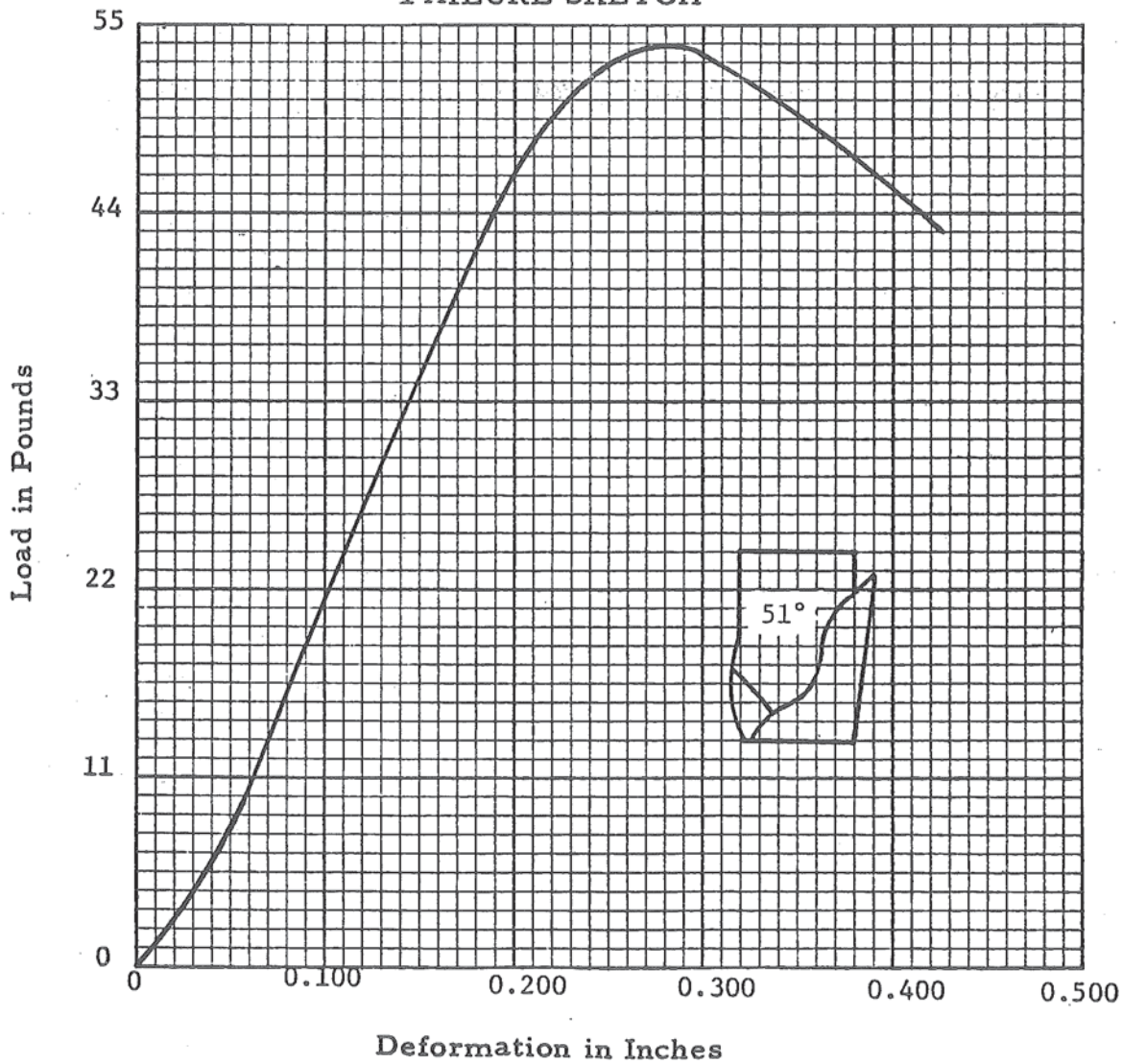
UNCONFINED COMPRESSION TEST

Project:	KILLEN ELECTRIC GENERATING STATION - ADAMS COUNTY, OHIO
Boring No:	A-129
Sample No:	5C
Surface Elevation:	Not Taken
Depth Interval of Sample:	20.0'-22.0'
Depth Interval of Strata:	17.0'-27.0'
Depth of Interval of Test Sample:	21.0'-21.5'
Sample Recovery:	20"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.68 lbs.
Moisture Content	25.7%
Wet Unit Weight	122.6 pcf
Dry Unit Weight	97.5 pcf
Unconfined Compression Strength	1150 psf
Load Increment at Failure	53.0 lbs.
Height at Failure	5.675"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt and Sand, trace of Clay

FAILURE SKETCH



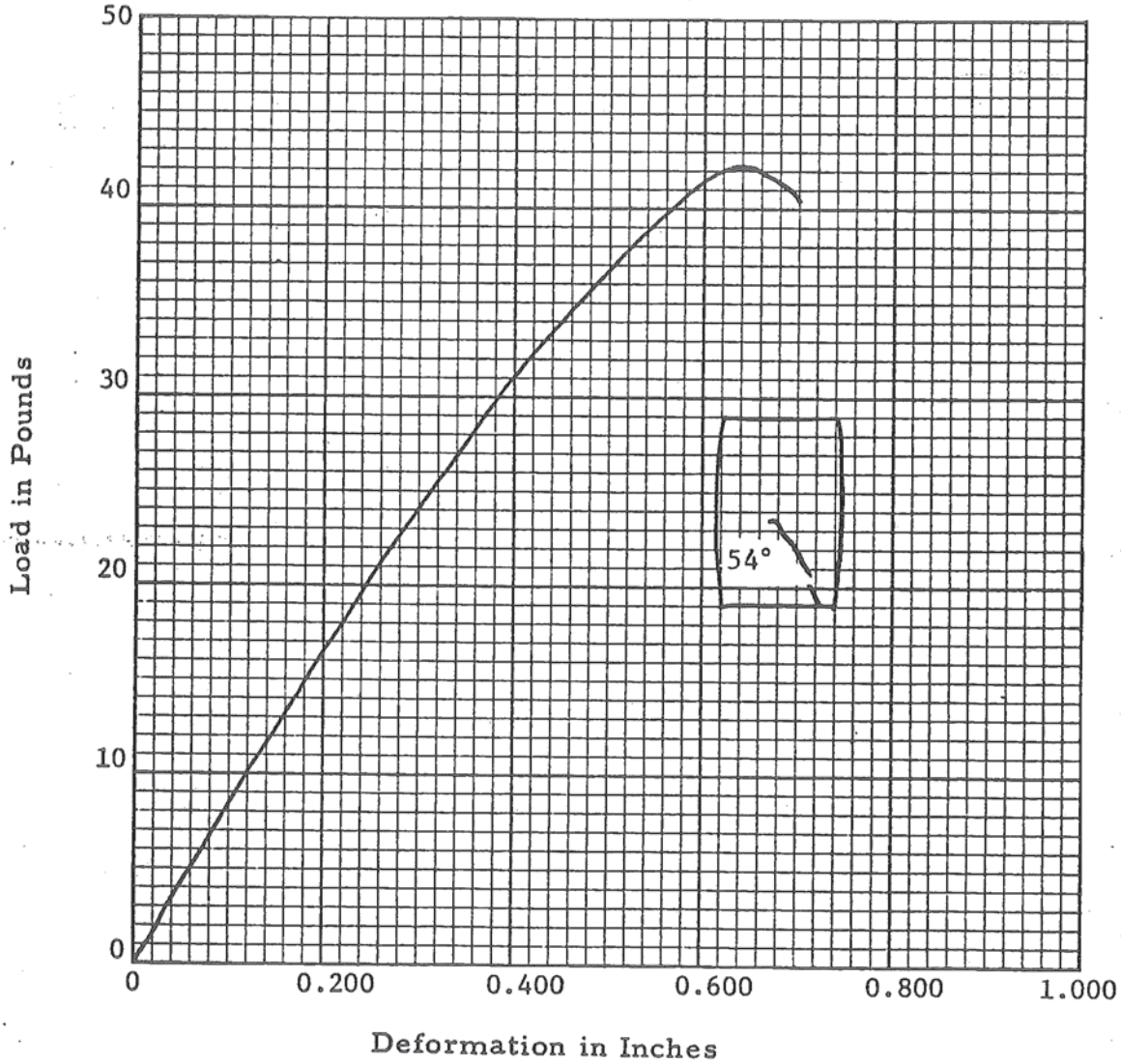
UNCONFINED COMPRESSION TEST

Project: PROPOSED ASH DISPOSAL AREA - KILLEN STATION	
Boring No:	A-133
Sample No:	2C
Surface Elevation:	512.0'
Depth Interval of Sample:	8.0' - 10.0'
Depth Interval of Strata:	5.0' - 29.0'
Depth of Interval of Test Sample:	8.8' - 9.3'
Sample Recovery:	23"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.79 lbs.
Moisture Content	20.0%
Wet Unit Weight	127.8 pcf
Dry Unit Weight	106.5 pcf
Unconfined Compression Strength	850 psf
Load Increment at Failure	42.1 lbs.
Height at Failure	5.325"
Test Method	ASTM-D2166-66
Soil Classification	Brown silt and sand, trace clay

FAILURE SKETCH



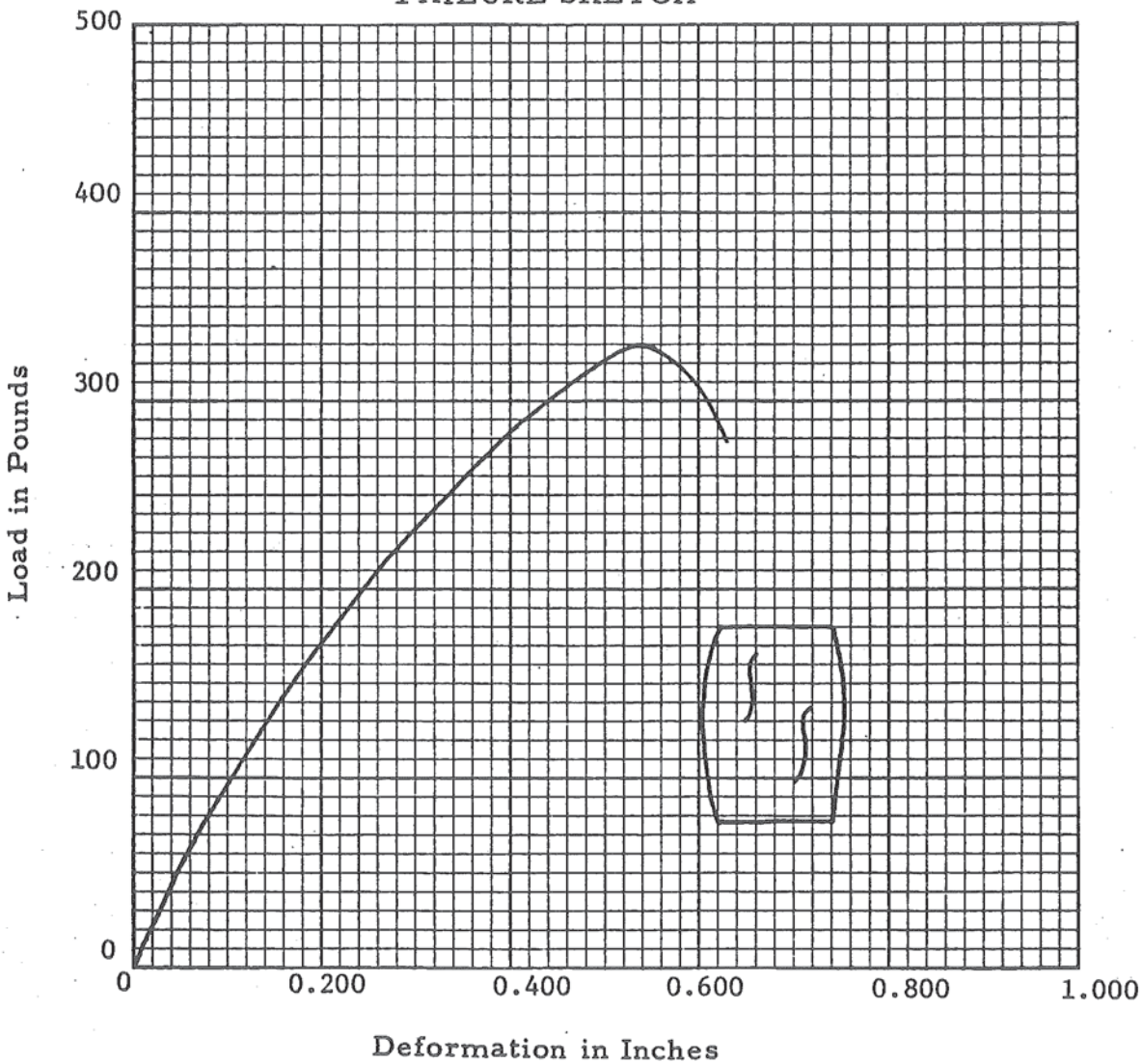
UNCONFINED COMPRESSION TEST

Project: PROPOSED ASH DISPOSAL AREA - KILLEN STATION	
Boring No:	A-133
Sample No:	1C
Surface Elevation:	512.0'
Depth Interval of Sample:	3.0' - 5.0'
Depth Interval of Strata:	1.0' - 5.0'
Depth of Interval of Test Sample:	4.0' - 4.5'
Sample Recovery:	19"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.77 lbs.
Moisture Content	20.3%
Wet Unit Weight	126.9 pcf
Dry Unit Weight	105.4 pcf
Unconfined Compression Strength	6710 pcf
Load Increment at Failure	325.8 lbs.
Height at Failure	5.400"
Test Method	ASTM-D2166-66
Soil Classification	Brown clay, some silt, trace sand

FAILURE SKETCH



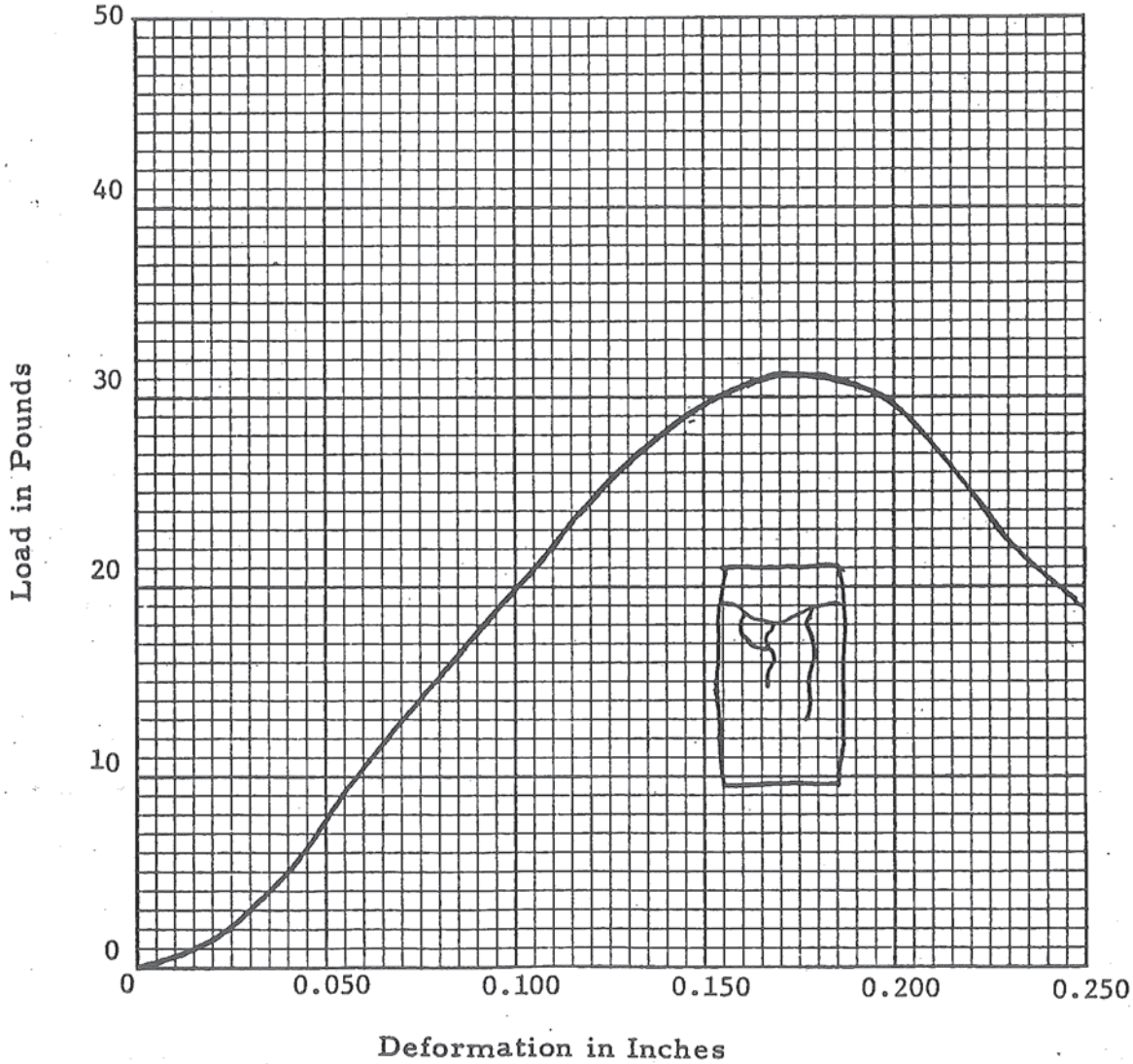
UNCONFINED COMPRESSION TEST

Project: PROPOSED ASH DISPOSAL AREA - KILLEN STATION	
Boring No:	A-133
Sample No:	4C
Surface Elevation:	512.0'
Depth Interval of Sample:	18.0' - 20.0'
Depth Interval of Strata:	5.0' - 29.0'
Depth of Interval of Test Sample:	19.3' - 19.8'
Sample Recovery:	24"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.58 lbs.
Moisture Content	22.0%
Wet Unit Weight	118.1 pcf
Dry Unit Weight	96.9 pcf
Unconfined Compression Strength	680 psf
Load Increment at Failure	31.1 lbs.
Height at Failure	5.775"
Test Method	ASTM-D2166-66
Soil Classification	Brown silt and sand, trace clay

FAILURE SKETCH



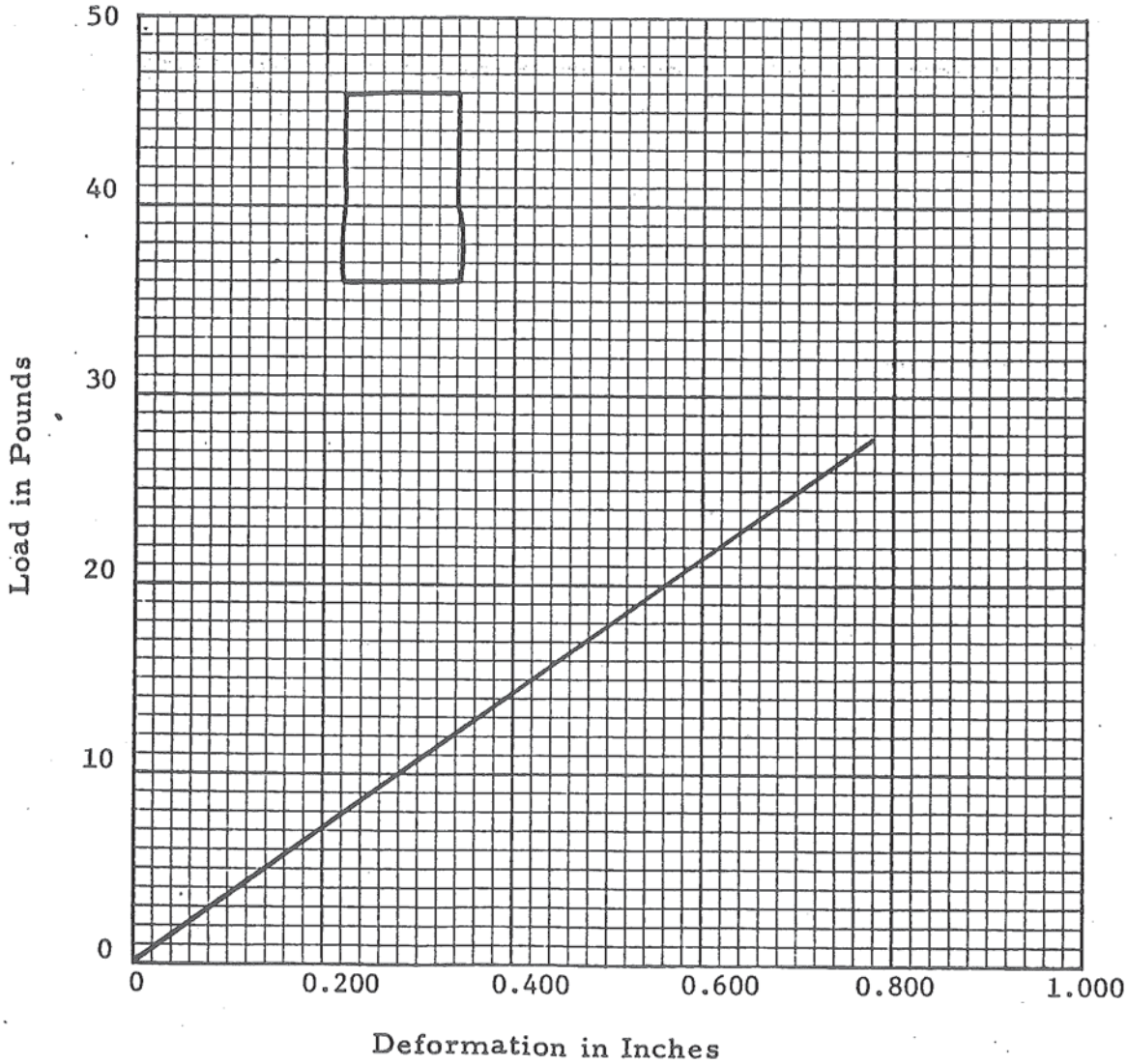
UNCONFINED COMPRESSION TEST

Project: PROPOSED ASH DISPOSAL AREA - KILLEN STATION	
Boring No:	A-133
Sample No:	6C
Surface Elevation:	512.0'
Depth Interval of Sample:	28.0' - 29.0'
Depth Interval of Strata:	5.0' - 29.0'
Depth of Interval of Test Sample:	28.2' - 28.7'
Sample Recovery:	12"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.77 lbs.
Moisture Content	17.9%
Wet Unit Weight	126.7 pcf
Dry Unit Weight	107.5 pcf
Unconfined Compression Strength	540 psf
Load Increment at Failure	27.3 lbs.
Height at Failure	5.175"
Test Method	ASTM-D2166-66
Soil Classification	Brown silt and sand, trace clay

FAILURE SKETCH



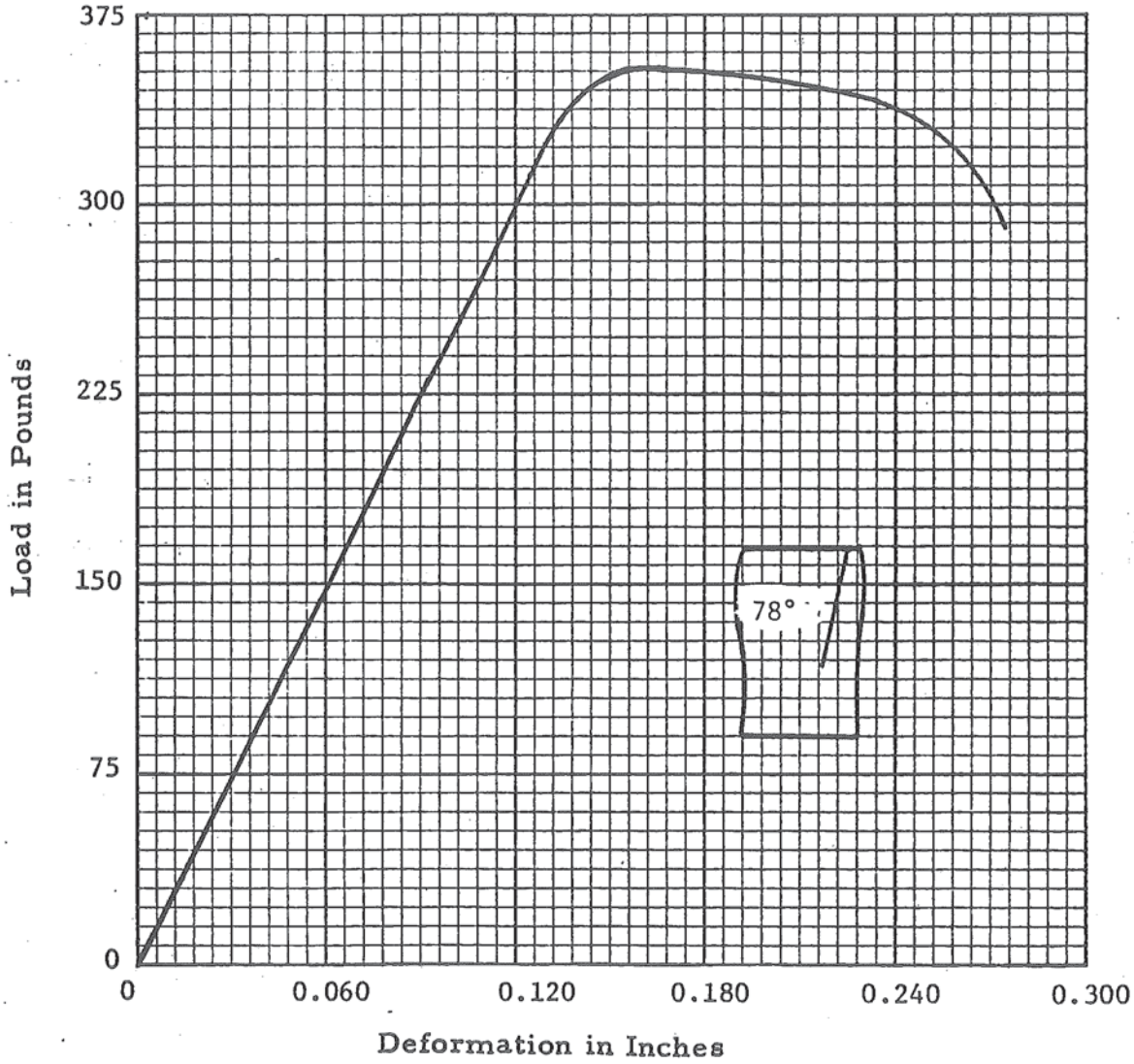
UNCONFINED COMPRESSION TEST

Project: KILLEN ELECTRIC GENERATING STATION - ADAMS COUNTY, OHIO	
Boring No:	A-135
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	3.0'-5.0'
Depth Interval of Strata:	1.0'-10.0'
Depth of Interval of Test Sample:	4.0'-4.5'
Sample Recovery:	24"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.90 lbs.
Moisture Content	18.9%
Wet Unit Weight	130.8 pcf
Dry Unit Weight	110.1 pcf
Unconfined Compression Strength	7740 psf
Load Increment at Failure	350.7 lbs.
Height at Failure	5.800"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt, some Clay, some Sand, trace of Organic

FAILURE SKETCH



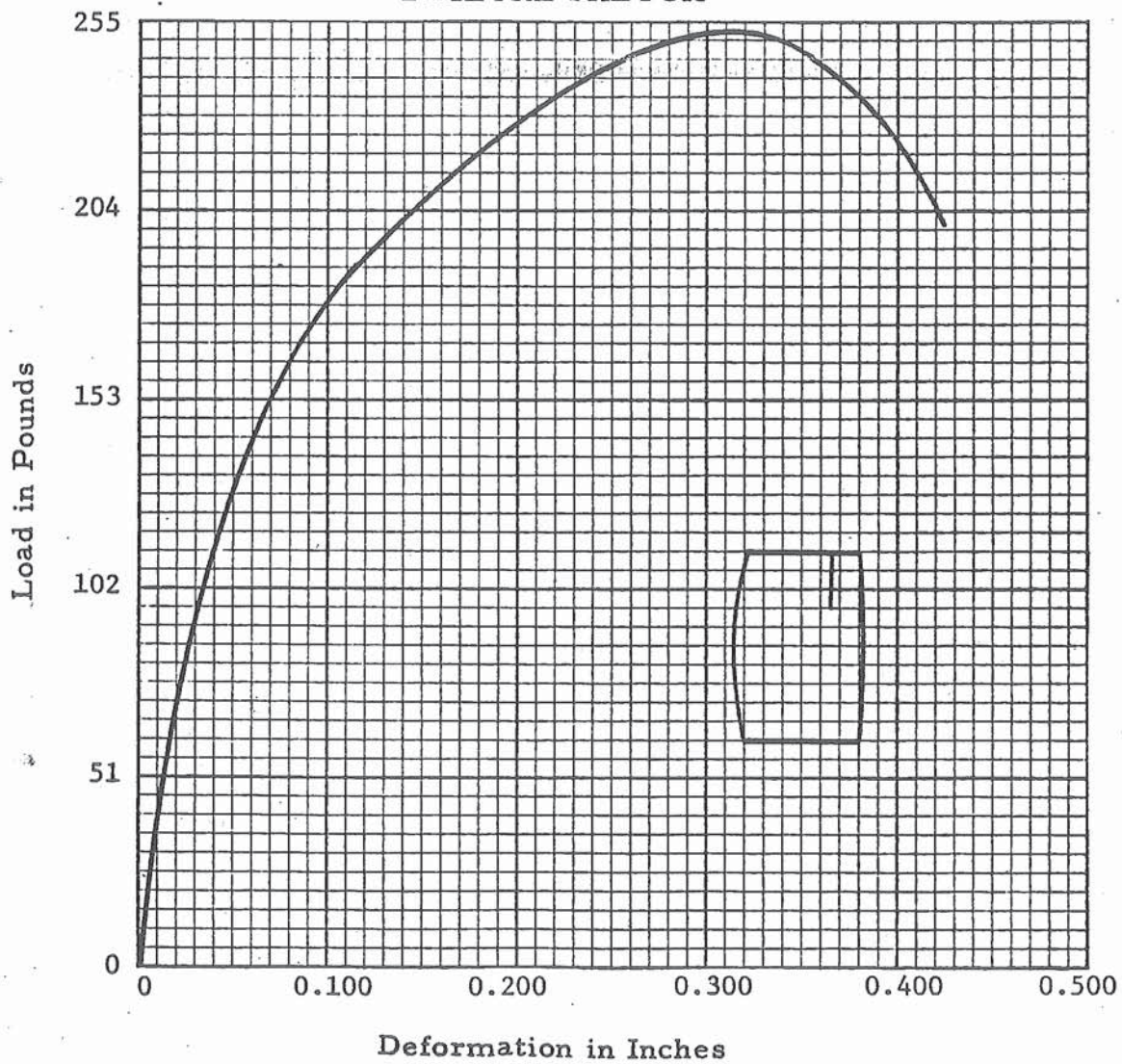
UNCONFINED COMPRESSION TEST

Project: KILLEN ELECTRIC GENERATING STATION - ADAMS COUNTY, OHIO	
Boring No:	A-135
Sample No:	5C
Surface Elevation:	Not Taken
Depth Interval of Sample:	23.0'-25.0'
Depth Interval of Strata:	10.0'-29.0'
Depth of Interval of Test Sample:	24.0'-24.5'
Sample Recovery:	20"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.80 lbs.
Moisture Content	20.5%
Wet Unit Weight	128.0 pcf
Dry Unit Weight	106.2 pcf
Unconfined Compression Strength	5440 psf
Load Increment at Failure	252.70 lbs.
Height at Failure	5.650"
Test Method	ASTM-D2166-66
Soil Classification	Brown Silt and Sand, trace of Clay

FAILURE SKETCH



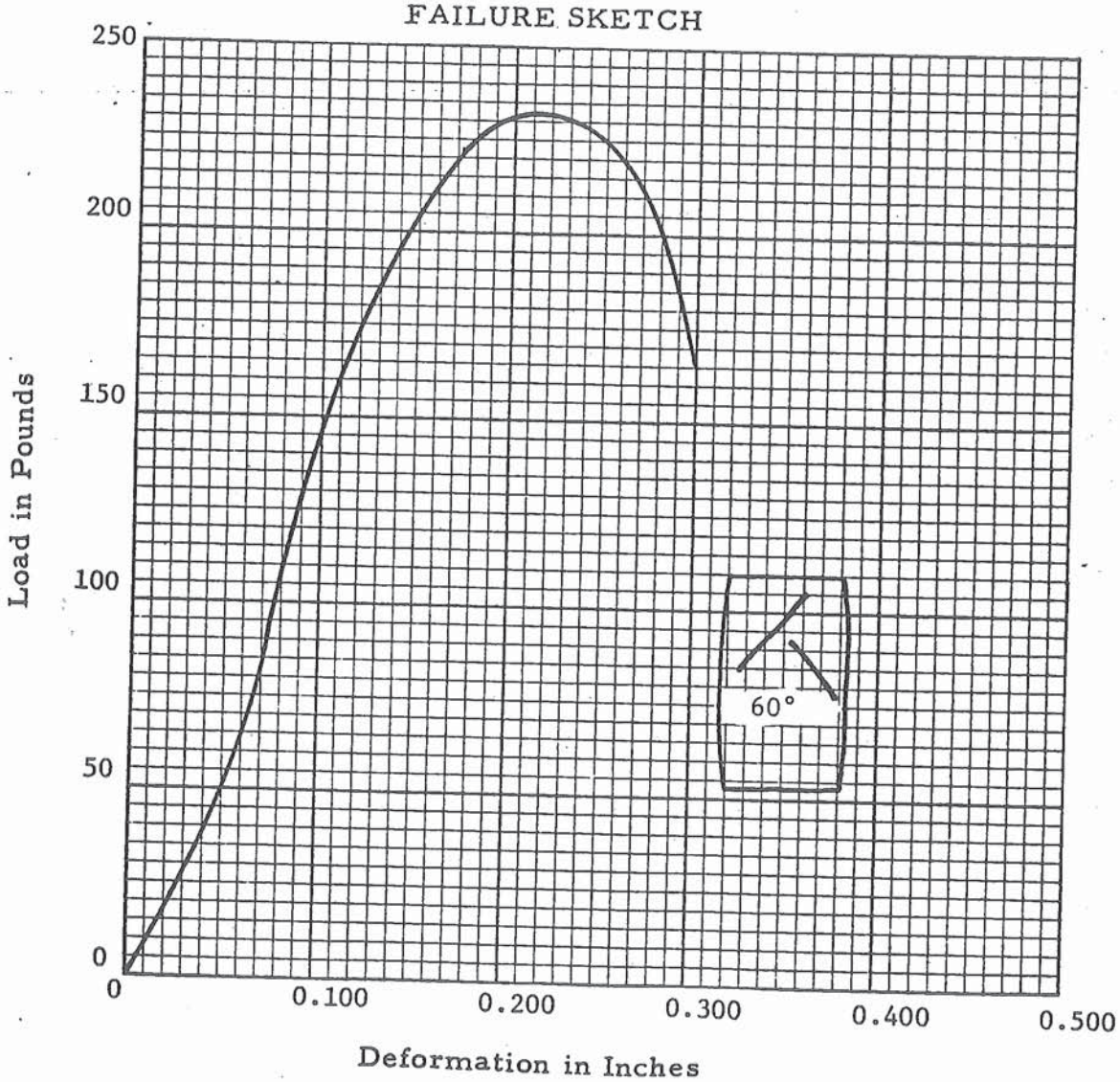
UNCONFINED COMPRESSION TEST

Project:	PROPOSED ASH DISPOSAL AREA - KILLEN STATION
Boring No:	A-137
Sample No:	1C
Surface Elevation:	518.5'
Depth Interval of Sample:	3.0' - 5.0'
Depth Interval of Strata:	1.5' - 10.0'
Depth of Interval of Test Sample:	4.3' - 4.8'
Sample Recovery:	18"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.90 lbs.
Moisture Content	17.1%
Wet Unit Weight	132.8 pcf
Dry Unit Weight	113.4 pcf
Unconfined Compression Strength	5050 psf
Load Increment at Failure	231.4 lbs.
Height at Failure	5.725"
Test Method	ASTM-D2166-66
Soil Classification	Brown silt, some sand, some clay

FAILURE SKETCH



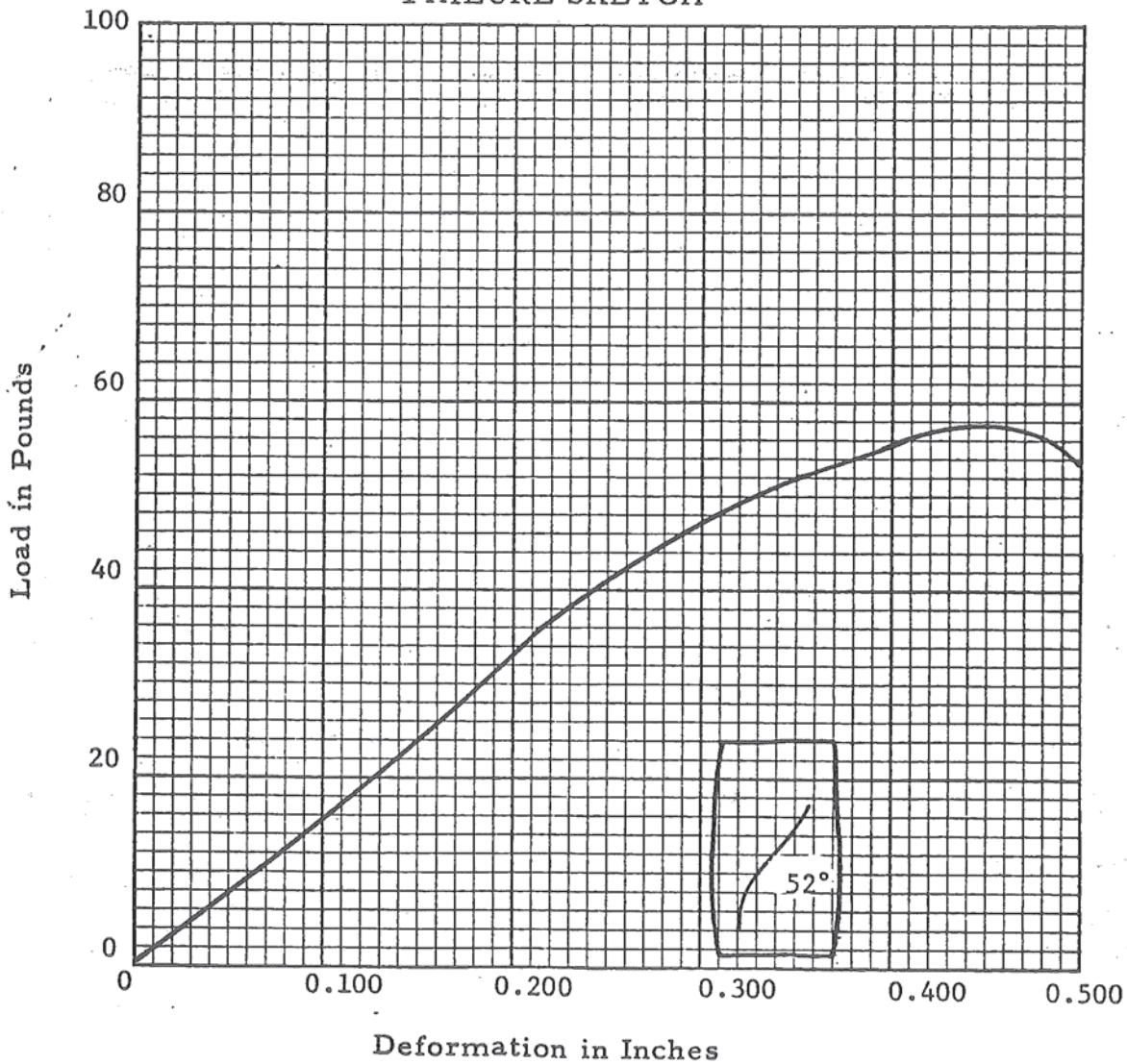
UNCONFINED COMPRESSION TEST

Project:	PROPOSED ASH DISPOSAL AREA - KILLEN STATION
Boring No:	A-137
Sample No:	2C
Surface Elevation:	518.5'
Depth Interval of Sample:	8.0' - 10.0'
Depth Interval of Strata:	1.5' - 10.0'
Depth of Interval of Test Sample:	8.1' - 8.6'
Sample Recovery:	24"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.84 lbs.
Moisture Content	19.3%
Wet Unit Weight	129.8 pcf
Dry Unit Weight	108.8 pcf
Unconfined Compression Strength	1200 psf
Load Increment at Failure	57.1 lbs.
Height at Failure	5.500"
Test Method	ASTM-D2166-66
Soil Classification	Brown silt, some sand, some clay

FAILURE SKETCH



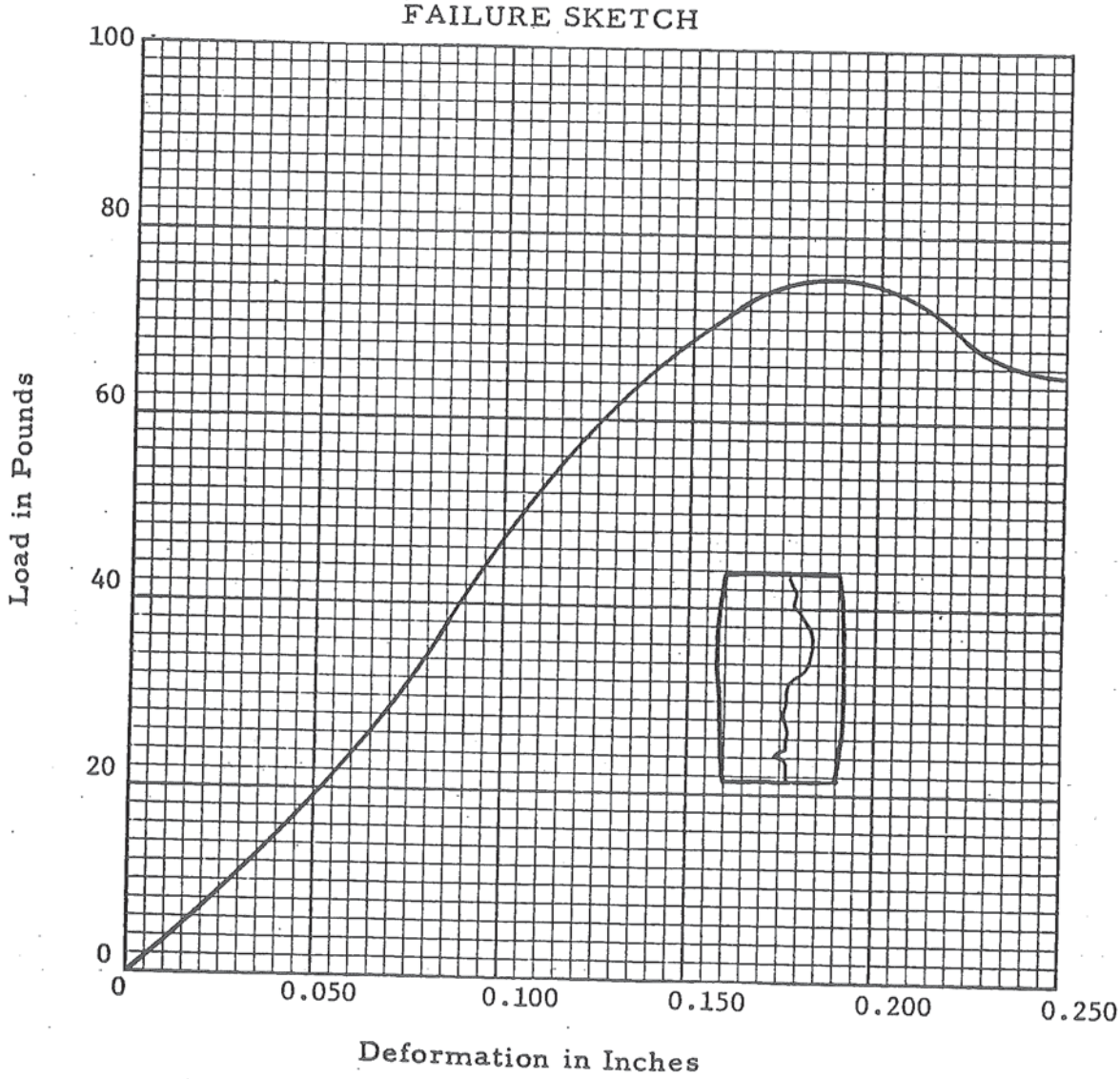
UNCONFINED COMPRESSION TEST

Project: PROPOSED ASH DISPOSAL AREA - KILLEN STATION	
Boring No:	A137
Sample No:	4C
Surface Elevation:	518.5'
Depth Interval of Sample:	18.0' - 20.0'
Depth Interval of Strata:	10.0' - 25.5'
Depth of Interval of Test Sample:	19.1' - 19.6'
Sample Recovery:	24"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.76 lbs.
Moisture Content	22.5%
Wet Unit Weight	126.3 pcf
Dry Unit Weight	107.1 pcf
Unconfined Compression Strength	1650 psf
Load Increment at Failure	74.8 lbs.
Height at Failure	5.775"
Test Method	ASTM-D2166-66
Soil Classification	Brown silt and sand, trace clay

FAILURE SKETCH



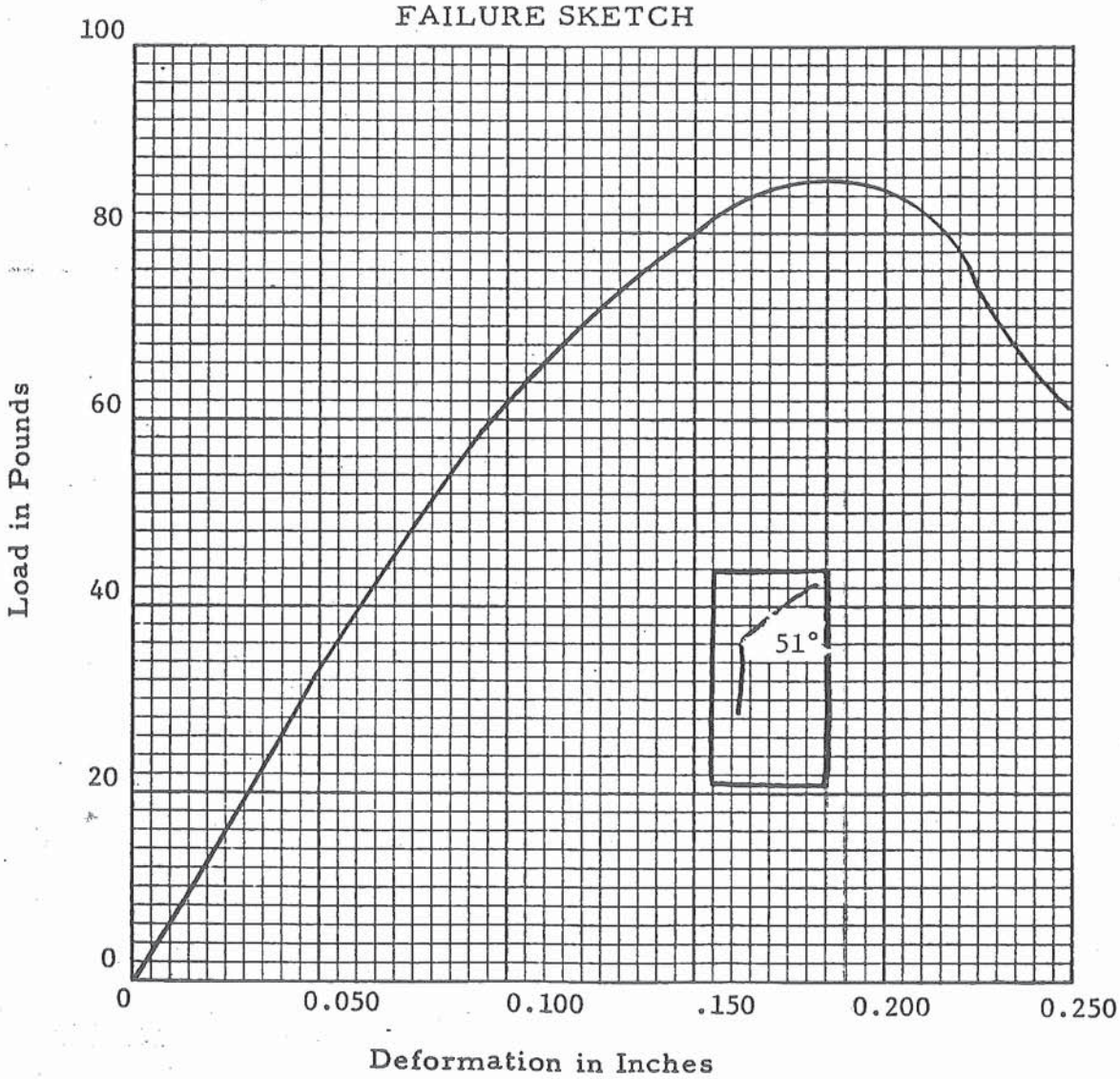
UNCONFINED COMPRESSION TEST

Project: PROPOSED ASH DISPOSAL AREA -	KILLEN STATION
Boring No:	A139
Sample No:	1C
Surface Elevation:	521.8'
Depth Interval of Sample:	3.0' - 5.0'
Depth Interval of Strata:	1.5' - 10.0'
Depth of Interval of Test Sample:	4.2' - 4.7'
Sample Recovery:	24"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950
Test Specimen Weight	2.94 lbs.
Moisture Content	18.1%
Wet Unit Weight	134.6 pcf
Dry Unit Weight	114.0 pcf
Unconfined Compression Strength	11,390 psf
Load Increment at Failure	517.7 lbs.
Height at Failure	5.775"
Test Method	ASTM-D2166-66
Soil Classification	Brown clay, some silt, some sand

FAILURE SKETCH



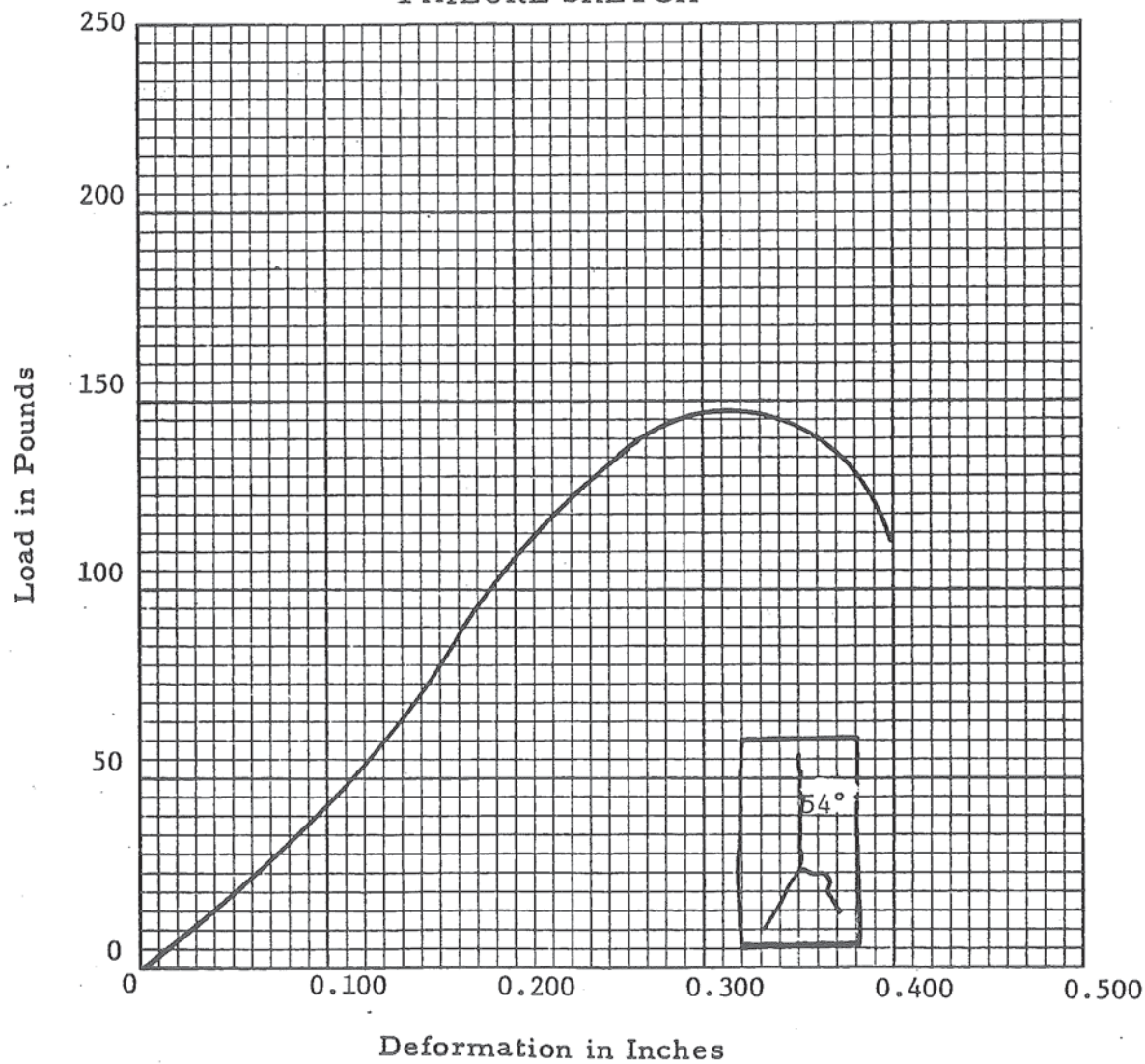
UNCONFINED COMPRESSION TEST

Project:	PROPOSED ASH DISPOSAL AREA - KILLEN STATION
Boring No:	A-139
Sample No:	2C
Surface Elevation:	521.8'
Depth Interval of Sample:	8.0' - 10.0'
Depth Interval of Strata:	1.5' - 10.1'
Depth of Interval of Test Sample:	9.1' - 9.7'
Sample Recovery:	24"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.84 lbs.
Moisture Content	20.7%
Wet Unit Weight	129.8 pcf
Dry Unit Weight	107.5 pcf
Unconfined Compression Strength	3210 psf
Load Increment at Failure	149.6 lbs.
Height at Failure	5.625"
Test Method	ASTM-D2166-66
Soil Classification	Brown clay, some silt, some sand

FAILURE SKETCH



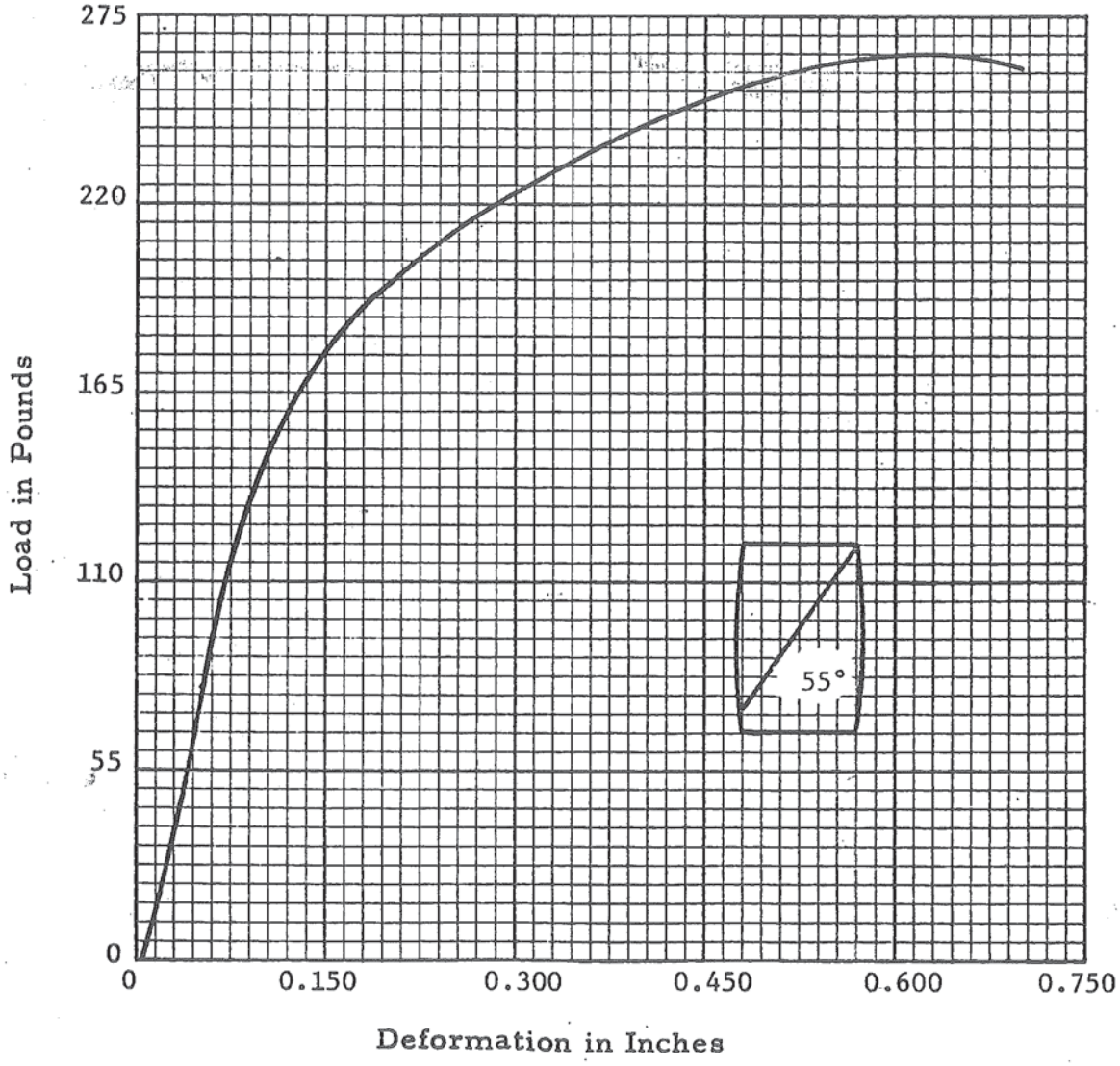
UNCONFINED COMPRESSION TEST

Project: KILLEN ELECTRIC GENERATING STATION - ADAMS COUNTY, OHIO	
Boring No:	A-142
Sample No:	1C
Surface Elevation:	Not Taken
Depth Interval of Sample:	3.0'-5.0'
Depth Interval of Strata:	2.0'-20.5'
Depth of Interval of Test Sample:	3.7'-4.2'
Sample Recovery:	18"

SPECIMEN DATA

Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.68 lbs.
Moisture Content	26.1%
Wet Unit Weight	122.9 pcf
Dry Unit Weight	97.4 pcf
Unconfined Compression Strength	5390 psf
Load Increment at Failure	263.1 lbs.
Height at Failure	5.375"
Test Method	ASTM-D2166-66
Soil Classification	Brown and Gray Clay, some Silt, trace of Sand

FAILURE SKETCH



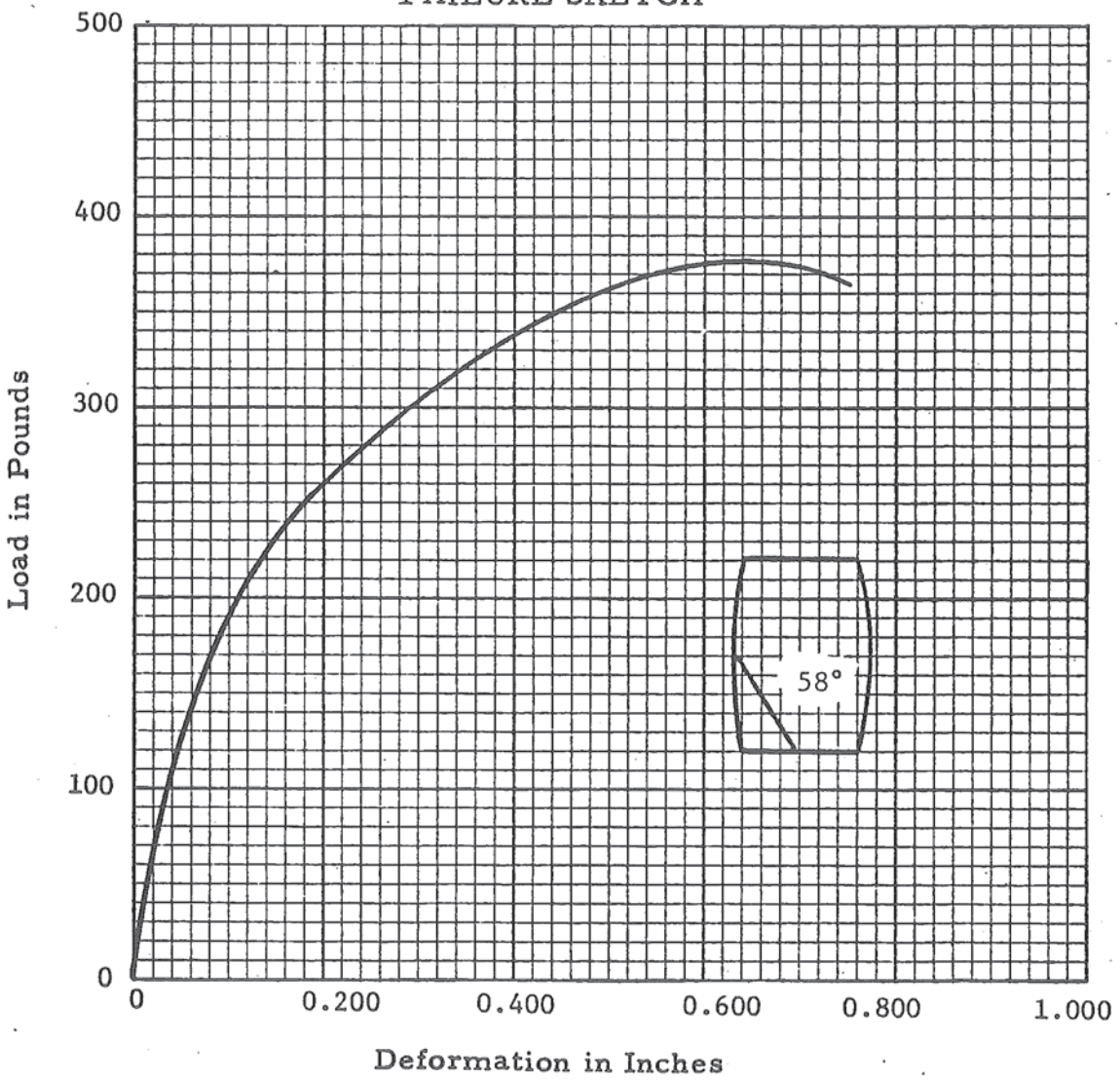
UNCONFINED COMPRESSION TEST

Project: KILLEN ELECTRIC GENERATING STATION - ADAMS COUNTY, OHIO	
Boring No:	A-142
Sample No:	3C
Surface Elevation:	Not Taken
Depth Interval of Sample:	10.0'-12.0'
Depth Interval of Strata:	2.0'-20.5'
Depth of Interval of Test Sample:	10.8'-11.3'
Sample Recovery:	19"

SPECIMEN DATA

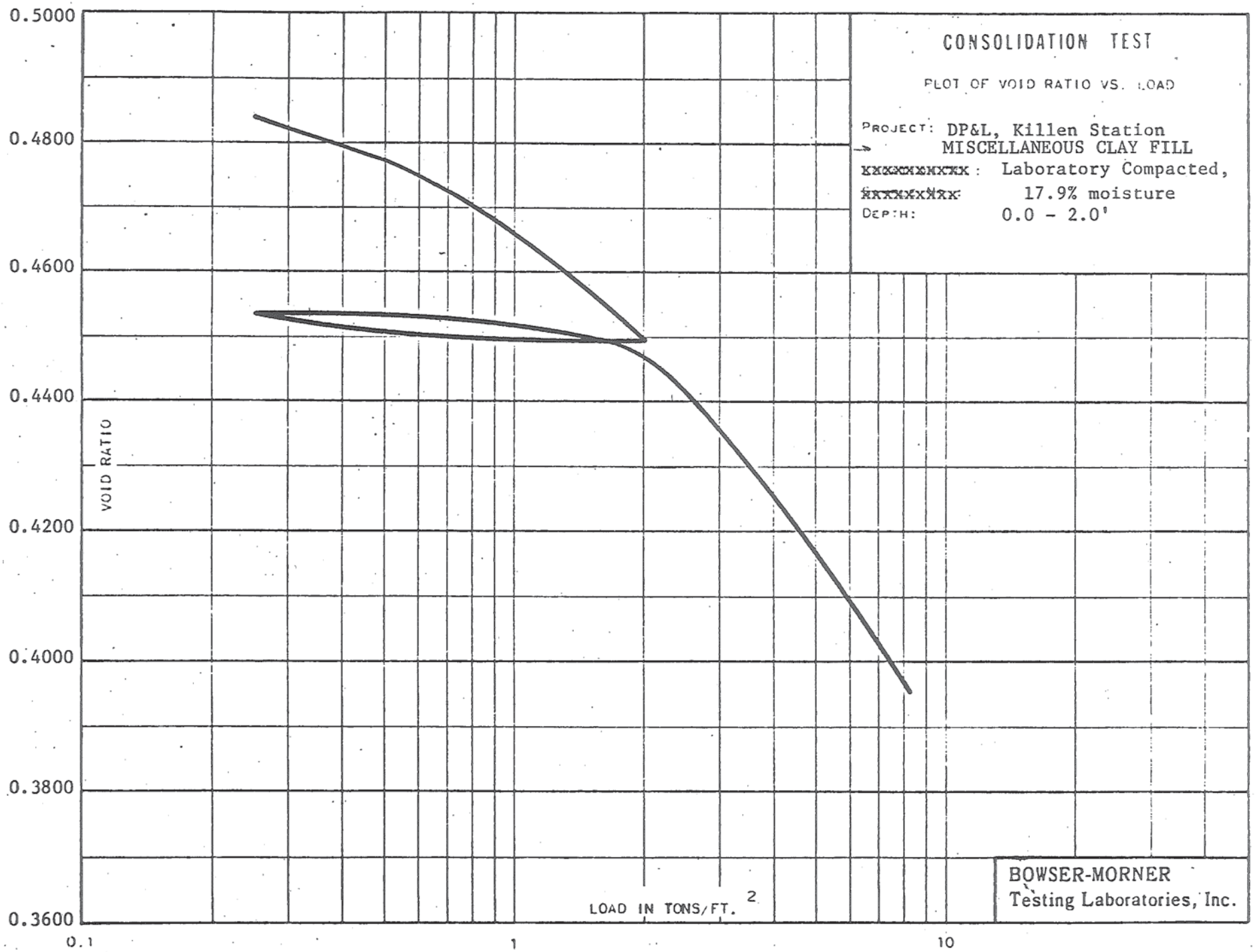
Initial Diameter	2.843"
Initial Height	5.950"
Test Specimen Weight	2.62 lbs.
Moisture Content	22.5%
Wet Unit Weight	119.8 pcf
Dry Unit Weight	97.8 pcf
Unconfined Compression Strength	7660 psf
Load Increment at Failure	377.6 lbs.
Height at Failure	5.325"
Test Method	ASTM-D2166-66
Soil Classification	Brown and Gray Clay, some Silt, trace of Sand

FAILURE SKETCH

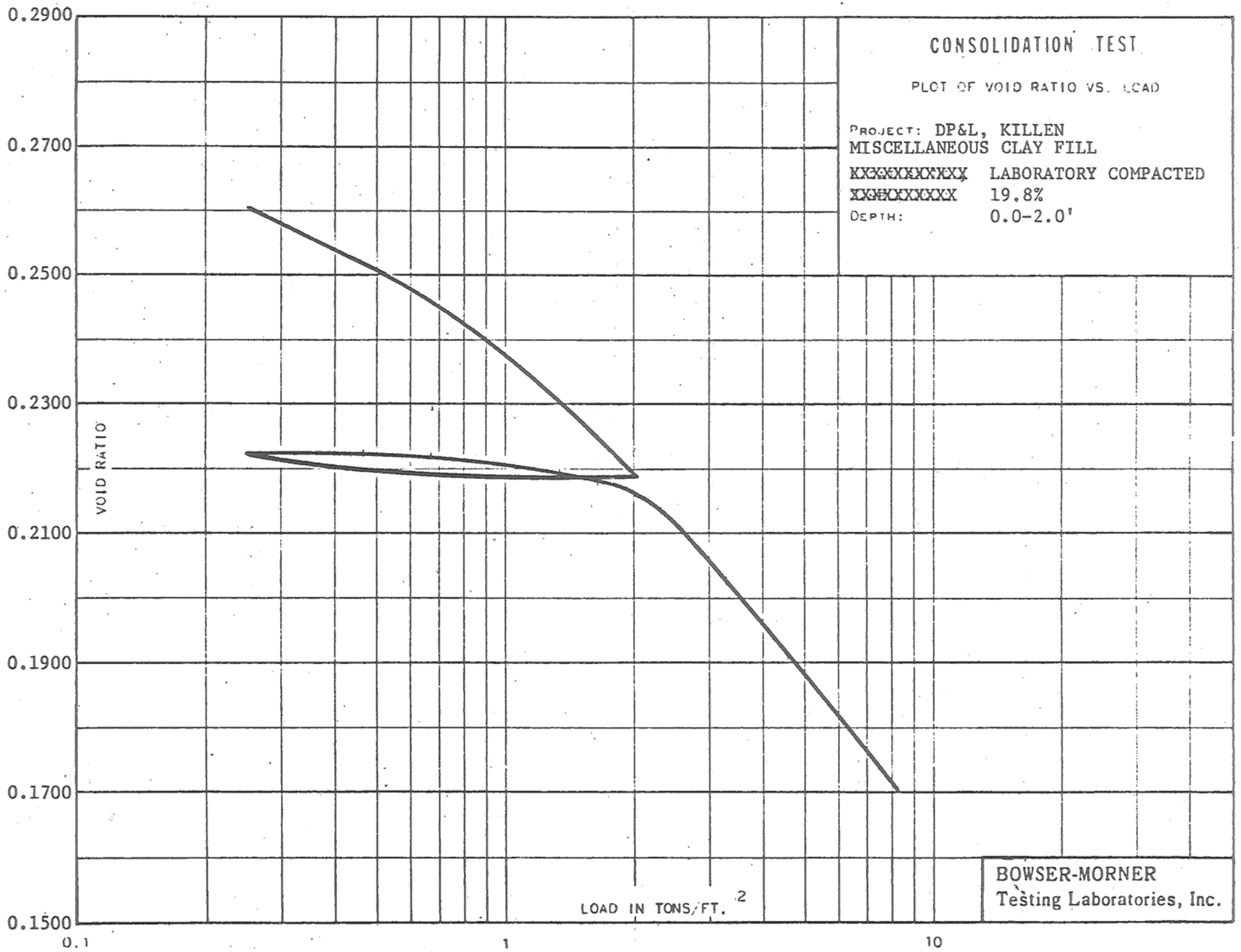


CONSOLIDATION TEST RESULTS

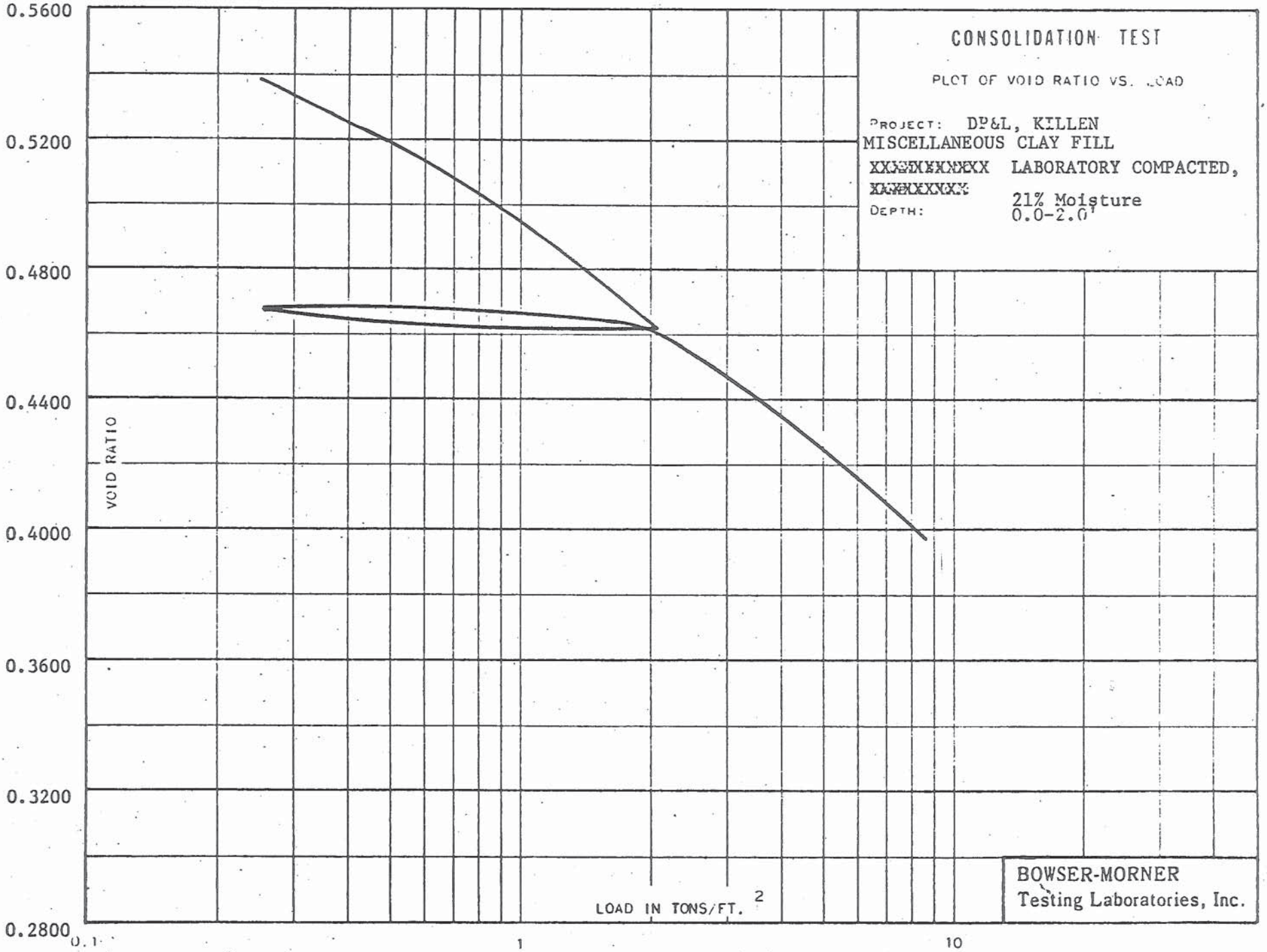
FORM 2A86


CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: DP&L, Killen Station
MISCELLANEOUS CLAY FILL
Laboratory Compacted,
17.9% moisture
DEPTH: 0.0 - 2.0'
VOID RATIO
0.5000
0.4800
0.4600
0.4400
0.4200
0.4000
0.3800
0.3600
0.1
1
10
LOAD IN TONS/FT.2
BOWSER-MORNER
Testing Laboratories, Inc.

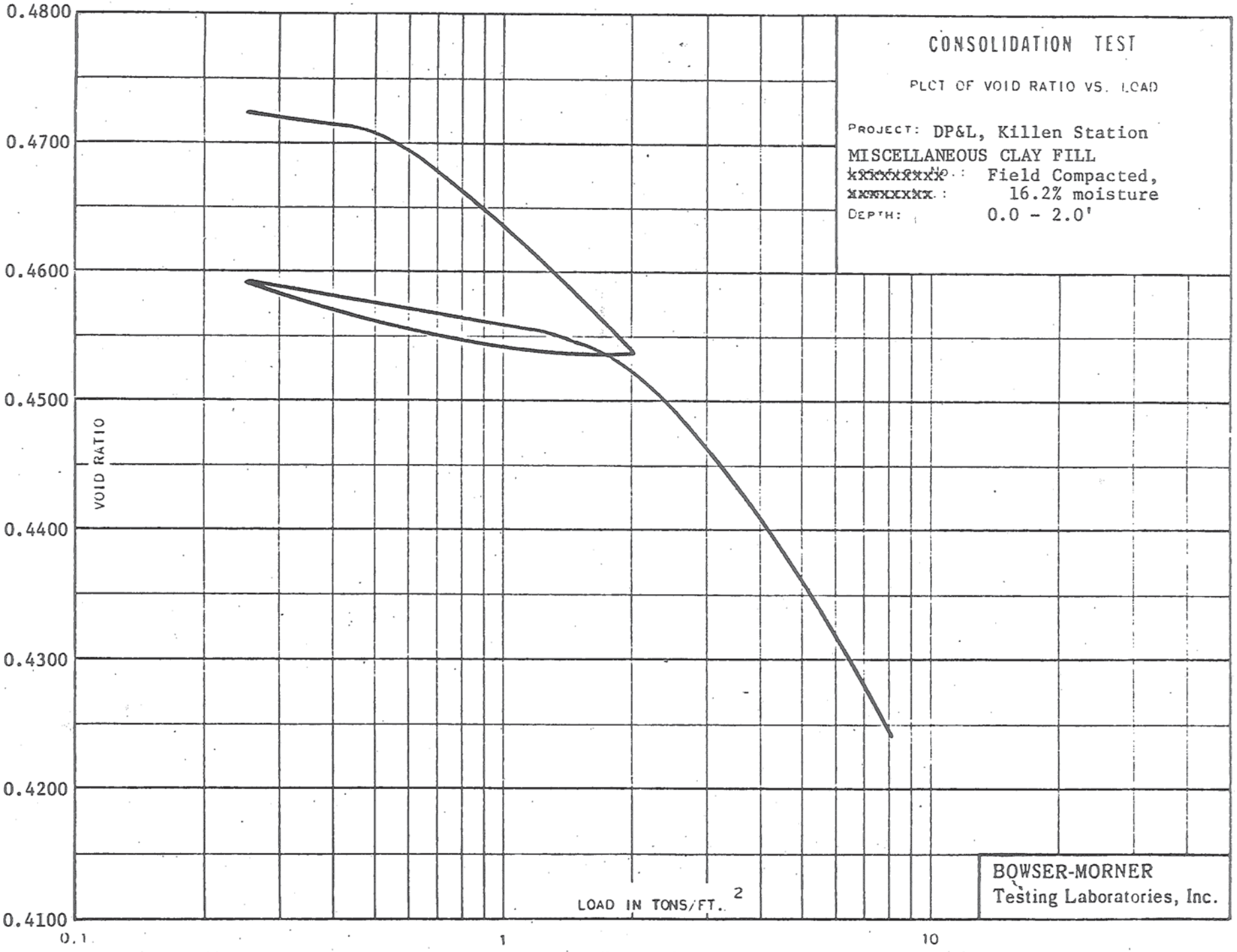
FORM 2A86


CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: DP&L, KILLEN
MISCELLANEOUS CLAY FILL
XXXXXXXXXXX LABORATORY COMPACTED
XXXXXXXXXXX 19.8%
DEPTH: 0.0-2.0'
VOID RATIO
0.2900
0.2700
0.2500
0.2300
0.2100
0.1900
0.1700
0.1500
0.1
1
10
LOAD IN TONS/FT.2
BOWSER-MORNER
Testing Laboratories, Inc.

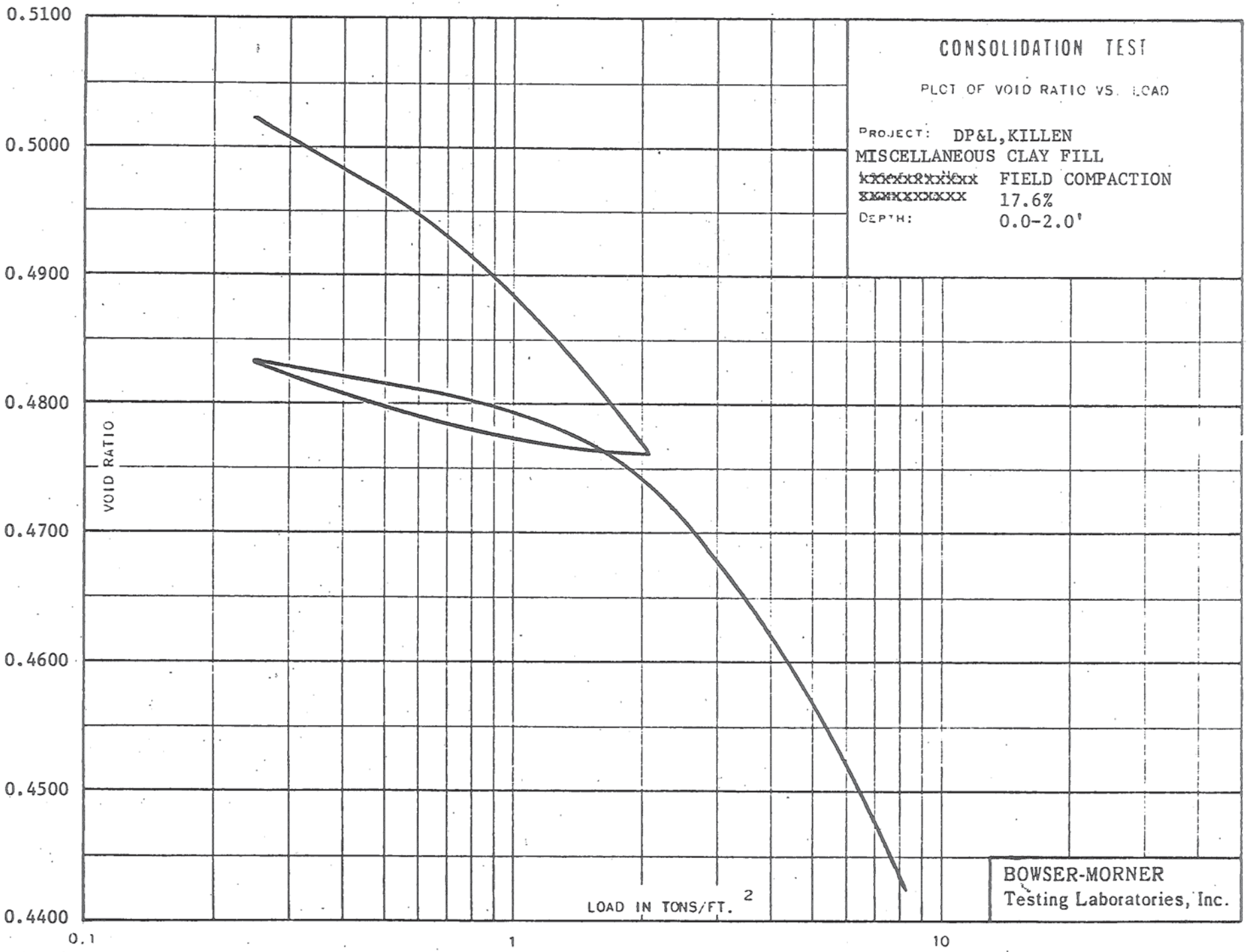
FORM 2A86


CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: DP&L, KILLEN
MISCELLANEOUS CLAY FILL
LABORATORY COMPACTED,
21% Moisture
DEPTH: 0.0-2.0'
VOID RATIO
0.5600
0.5200
0.4800
0.4400
0.4000
0.3600
0.3200
0.2800
LOAD IN TONS/FT.2
0.1
1
10
BOWSER-MORNER
Testing Laboratories, Inc.

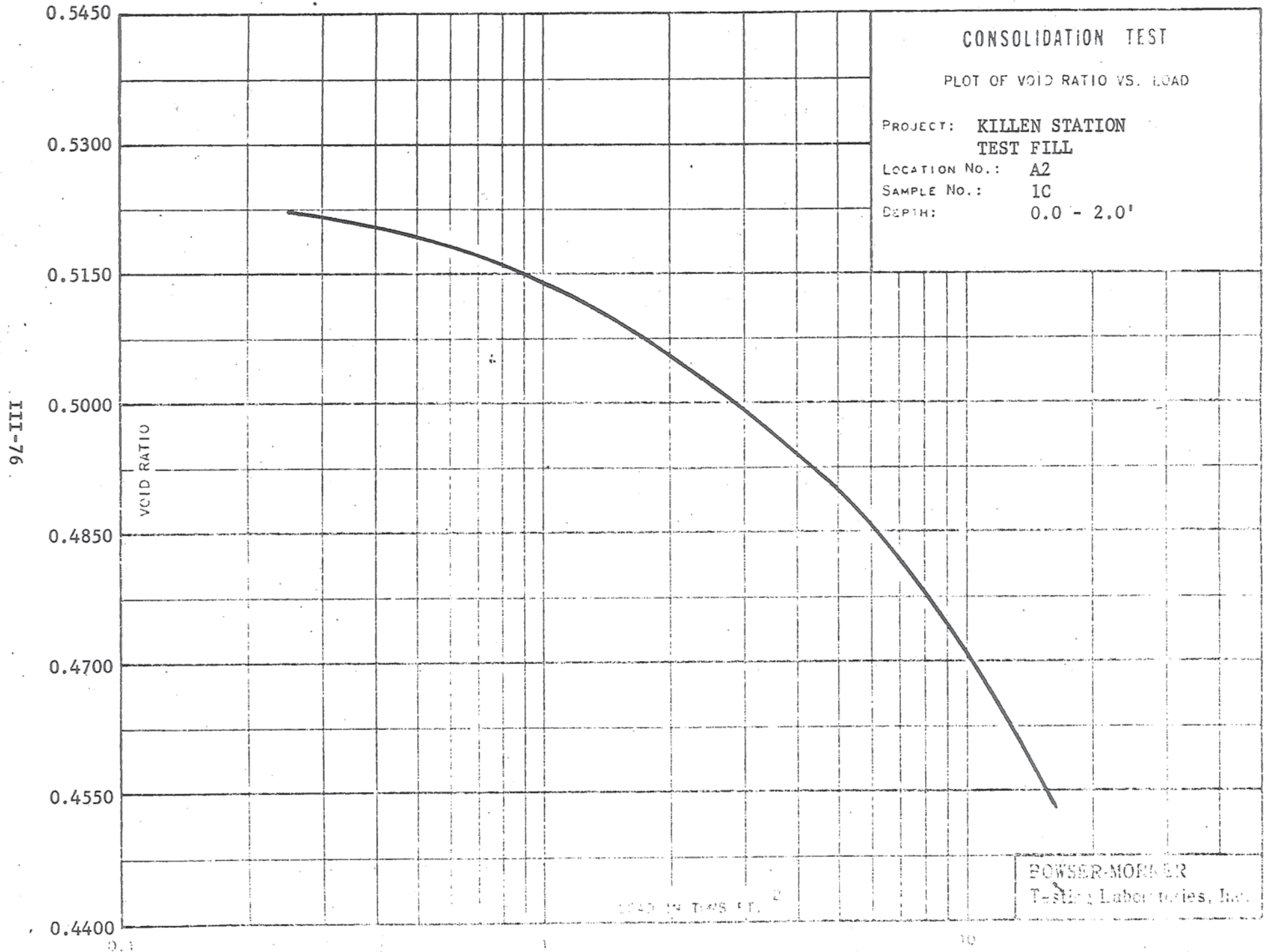
FORM 2A86


CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: DP&L, Killen Station
MISCELLANEOUS CLAY FILL
Field Compacted,
16.2% moisture
DEPTH: 0.0 - 2.0'
VOID RATIO
0.4800
0.4700
0.4600
0.4500
0.4400
0.4300
0.4200
0.4100
0.1
1
10
LOAD IN TONS/FT.2
BOWSER-MORNER
Testing Laboratories, Inc.

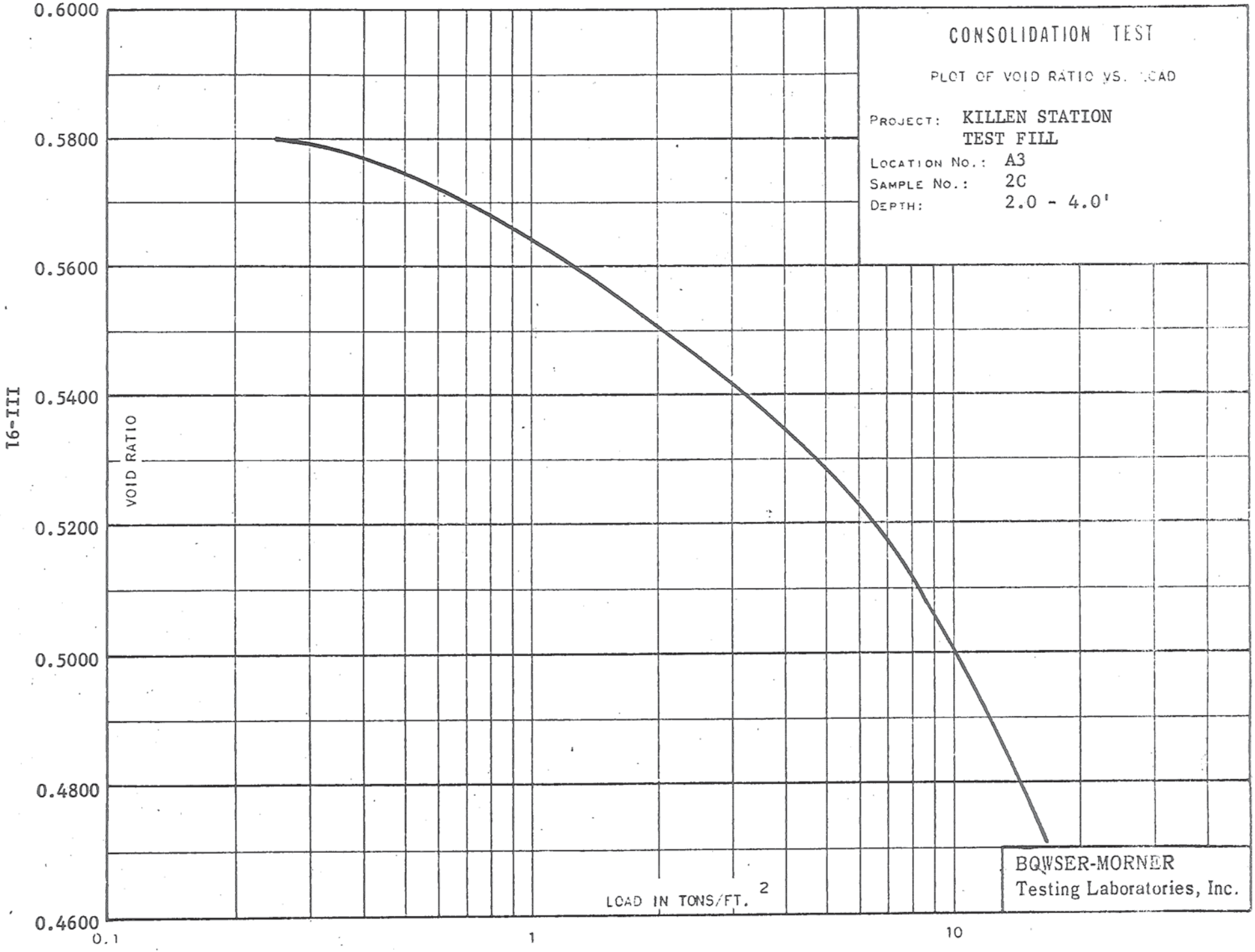
FORM 2A86


CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: DP&L, KILLEN
MISCELLANEOUS CLAY FILL
FIELD COMPACTION
17.6%
DEPTH: 0.0-2.0'
VOID RATIO
0.5100
0.5000
0.4900
0.4800
0.4700
0.4600
0.4500
0.4400
LOAD IN TONS/FT.2
0.1
1
10
BOWSER-MORNER
Testing Laboratories, Inc.

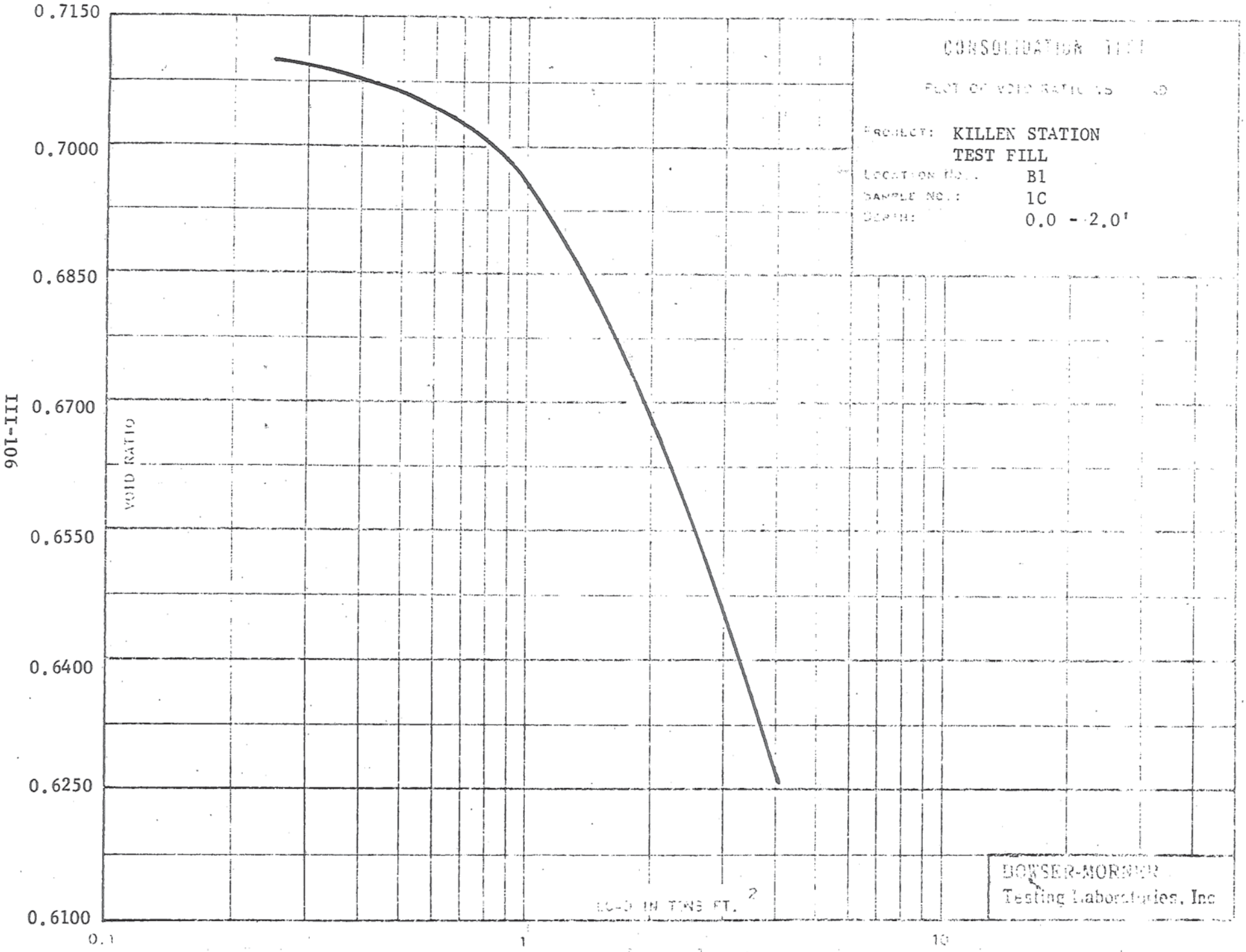
FORM 2A86

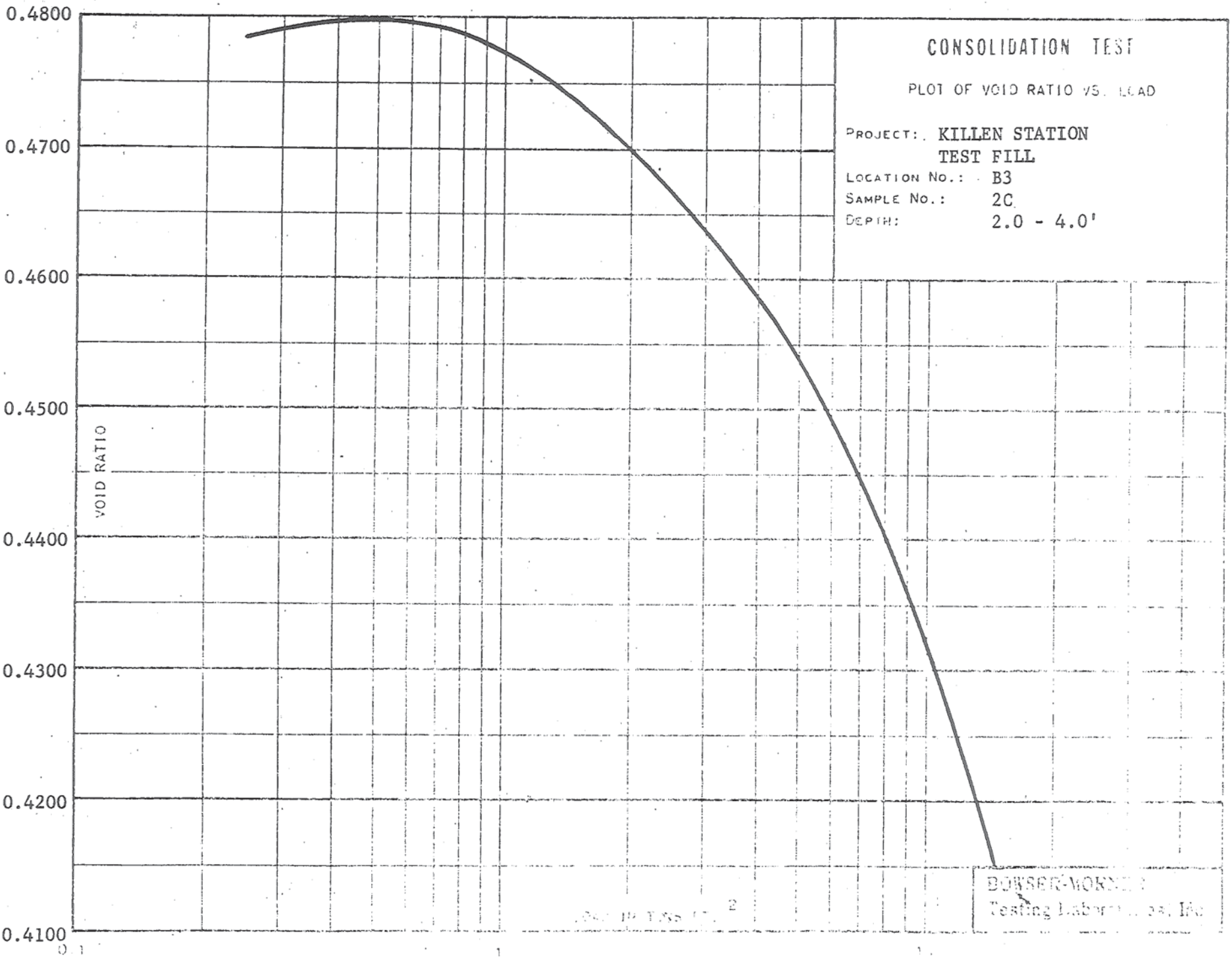

CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: KILLEN STATION TEST FILL
LOCATION NO.: A2
SAMPLE NO.: 1C
DEPTH: 0.0 - 2.0'
VOID RATIO
0.5450
0.5300
0.5150
0.5000
0.4850
0.4700
0.4550
0.4400
0.1
1
10
LOAD IN TONS PER SQ. FT.
BOWSER-MORNER
Testing Laboratories, Inc.

FORM 2A36

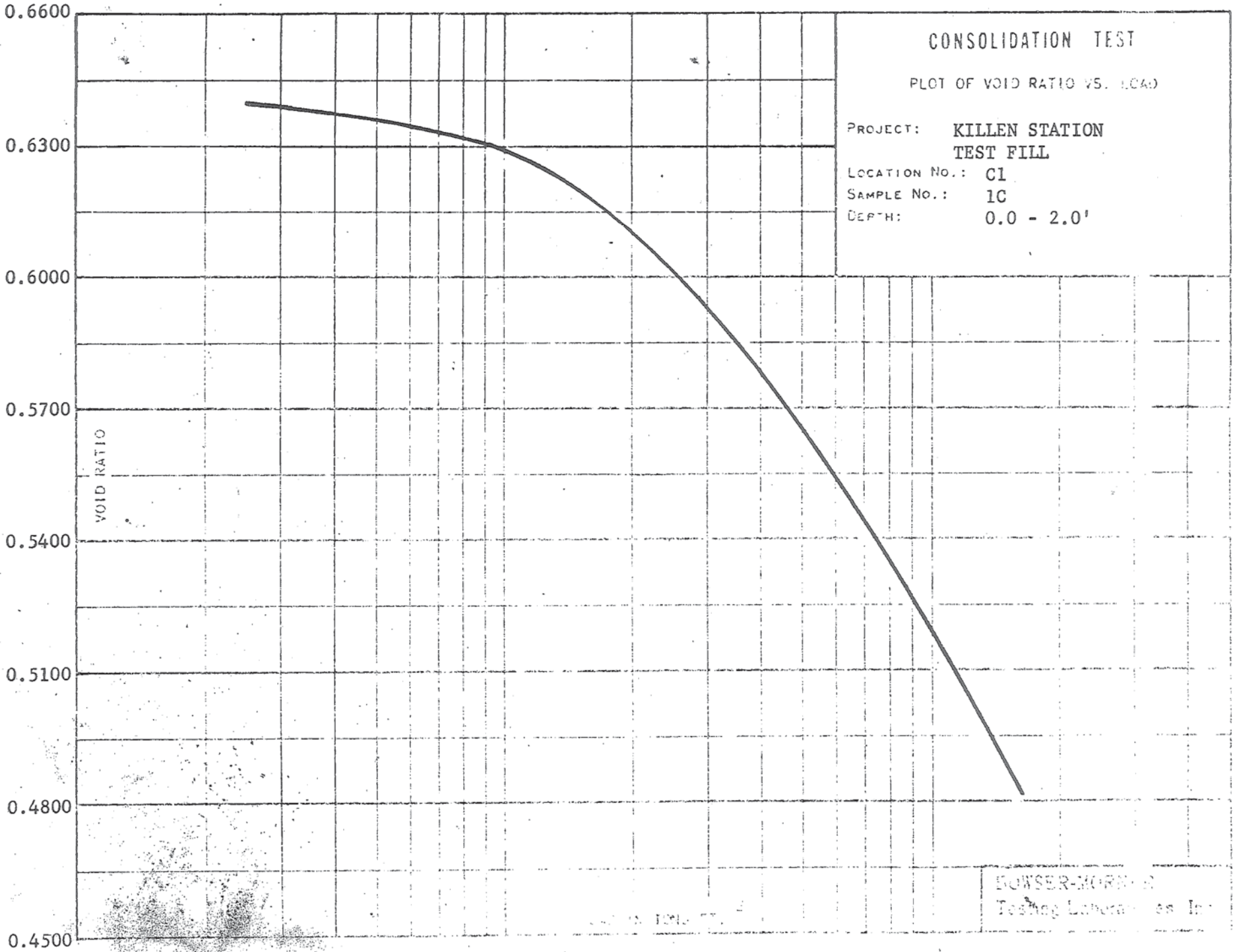

CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: KILLEN STATION TEST FILL
LOCATION NO.: A3
SAMPLE NO.: 2C
DEPTH: 2.0 - 4.0'
VOID RATIO
0.6000
0.5800
0.5600
0.5400
0.5200
0.5000
0.4800
0.4600
0.1
1
10
LOAD IN TONS/FT.2
BOWSER-MORNER
Testing Laboratories, Inc.

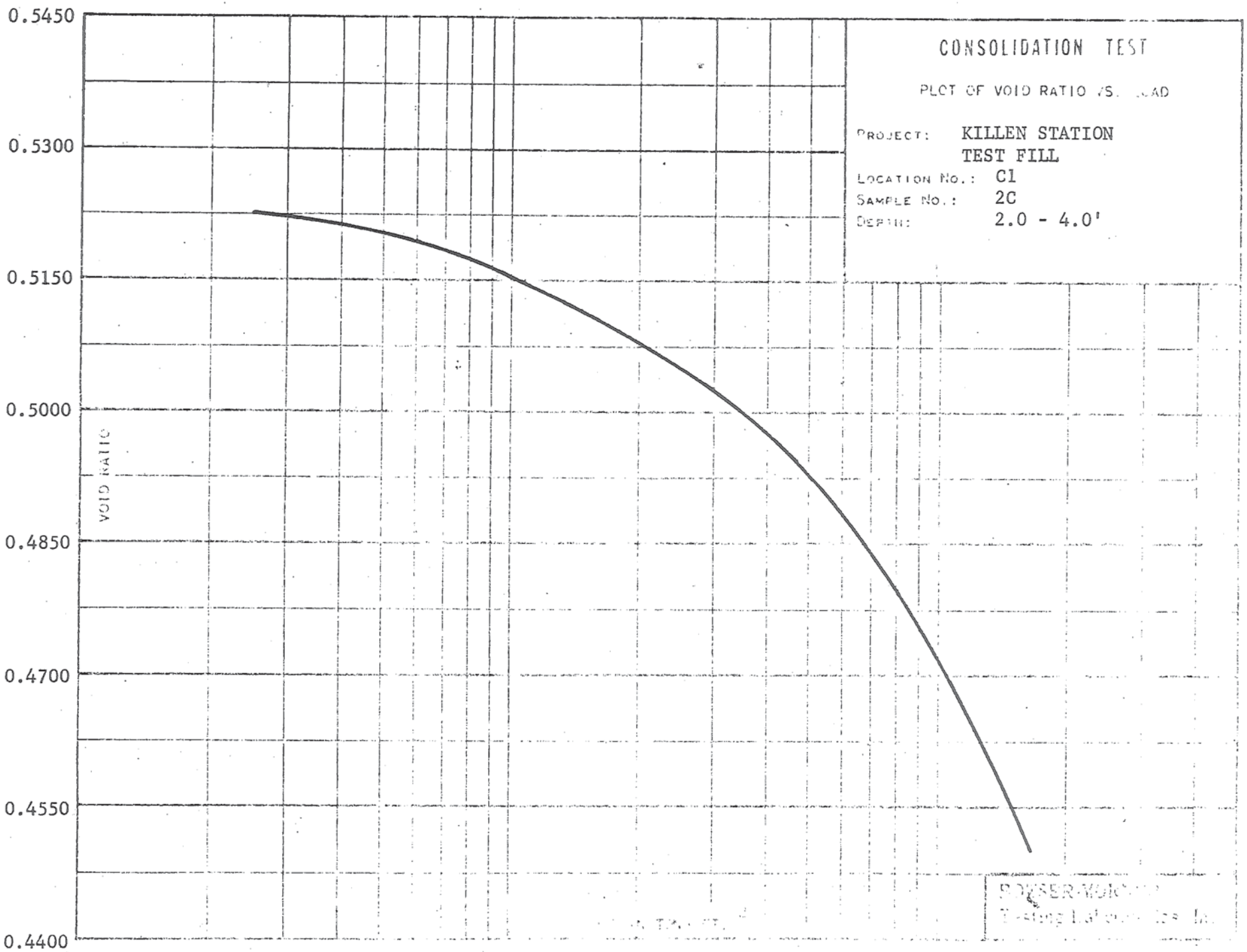
FORM LAB


CONSOLIDATION TEST
PLOT OF VOID RATIO VS LOAD
PROJECT: KILLEN STATION
TEST FILL
LOCATION NO.: B1
SAMPLE NO.: 1C
DEPTH: 0.0 - 2.0'
VOID RATIO
0.7150
0.7000
0.6850
0.6700
0.6550
0.6400
0.6250
0.6100
0.1
1
10
LOAD IN TONS FT.2
BOWSER-MORNER
Testing Laboratories, Inc

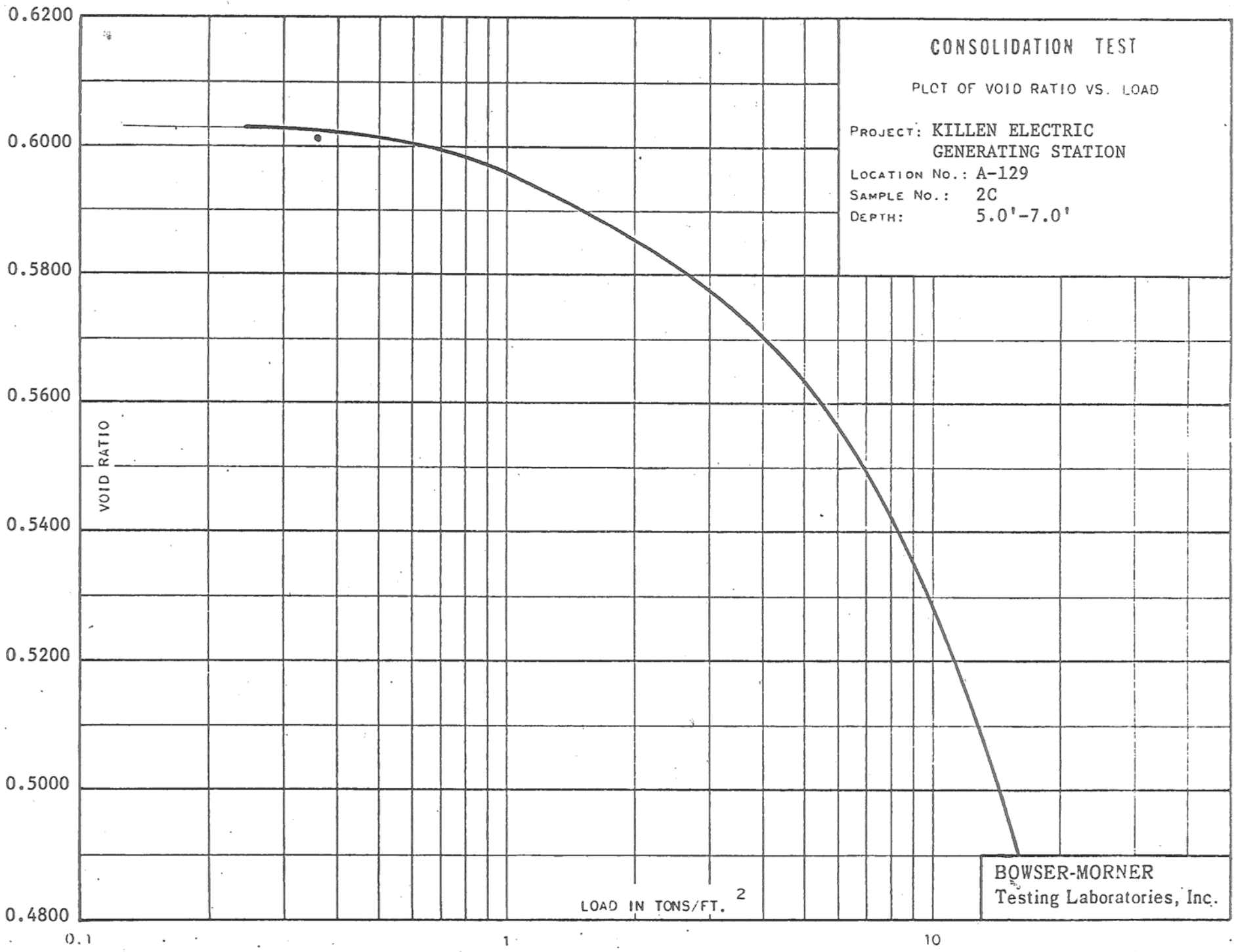

CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: KILLEN STATION
TEST FILL
LOCATION NO.: B3
SAMPLE NO.: 2C
DEPTH: 2.0 - 4.0'
VOID RATIO
0.4800
0.4700
0.4600
0.4500
0.4400
0.4300
0.4200
0.4100
BOWSER-MORNER
Testing Laboratories, Inc.

FORM 2A86


CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: KILLEN STATION TEST FILL
LOCATION No.: C1
SAMPLE No.: 1C
DEPTH: 0.0 - 2.0'
VOID RATIO
0.6600
0.6300
0.6000
0.5700
0.5400
0.5100
0.4800
0.4500

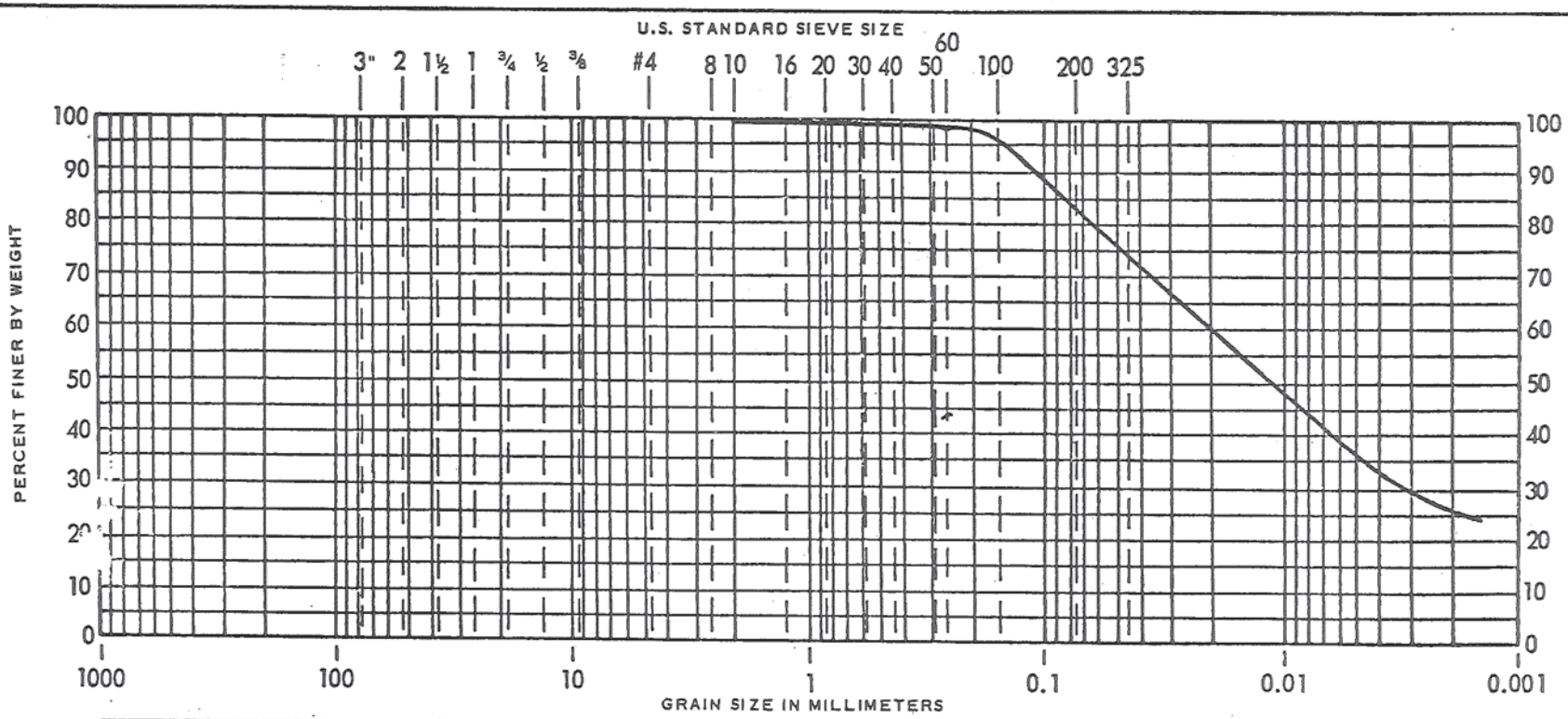

CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: KILLEN STATION TEST FILL
LOCATION NO.: C1
SAMPLE NO.: 2C
DEPTH: 2.0 - 4.0'
VOID RATIO
0.5450
0.5300
0.5150
0.5000
0.4850
0.4700
0.4550
0.4400

FORM 2A86


CONSOLIDATION TEST
PLOT OF VOID RATIO VS. LOAD
PROJECT: KILLEN ELECTRIC GENERATING STATION
LOCATION NO.: A-129
SAMPLE NO.: 2C
DEPTH: 5.0'-7.0'
VOID RATIO
0.6200
0.6000
0.5800
0.5600
0.5400
0.5200
0.5000
0.4800
LOAD IN TONS/FT.2
0.1
1
10
BOWSER-MORNER
Testing Laboratories, Inc.

GRAIN SIZE ANALYSIS CURVES

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 17%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	46%	37%

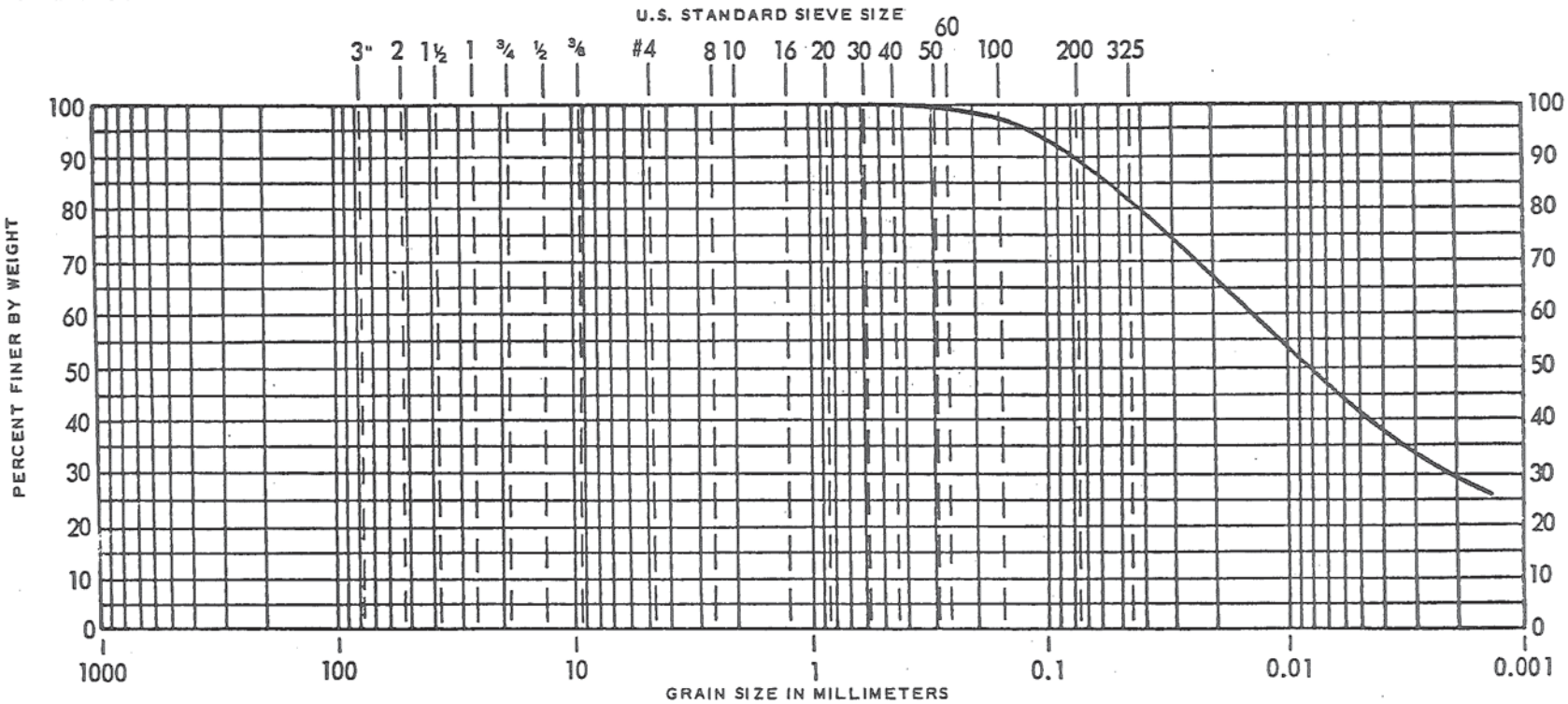
PROJECT KILLEN ELECTRIC GENERATING STATION
BORING NO. A-129
SAMPLE NO. 2-C
DEPTH 5.0'-7.0'
CLASSIFICATION "CL" Silty CLAY

NATURAL % MOISTURE
LIQUID LIMIT 44
PLASTIC LIMIT 20
PLASTICITY INDEX 24
COLOR Brown
REMARKS "U.S.C.S."

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 10%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	49%	41%

PROJECT ASH DISPOSAL AREA

BORING NO. A133
SAMPLE NO. 1C
DEPTH 3.0'-5.0'
CLASSIFICATION "ML"

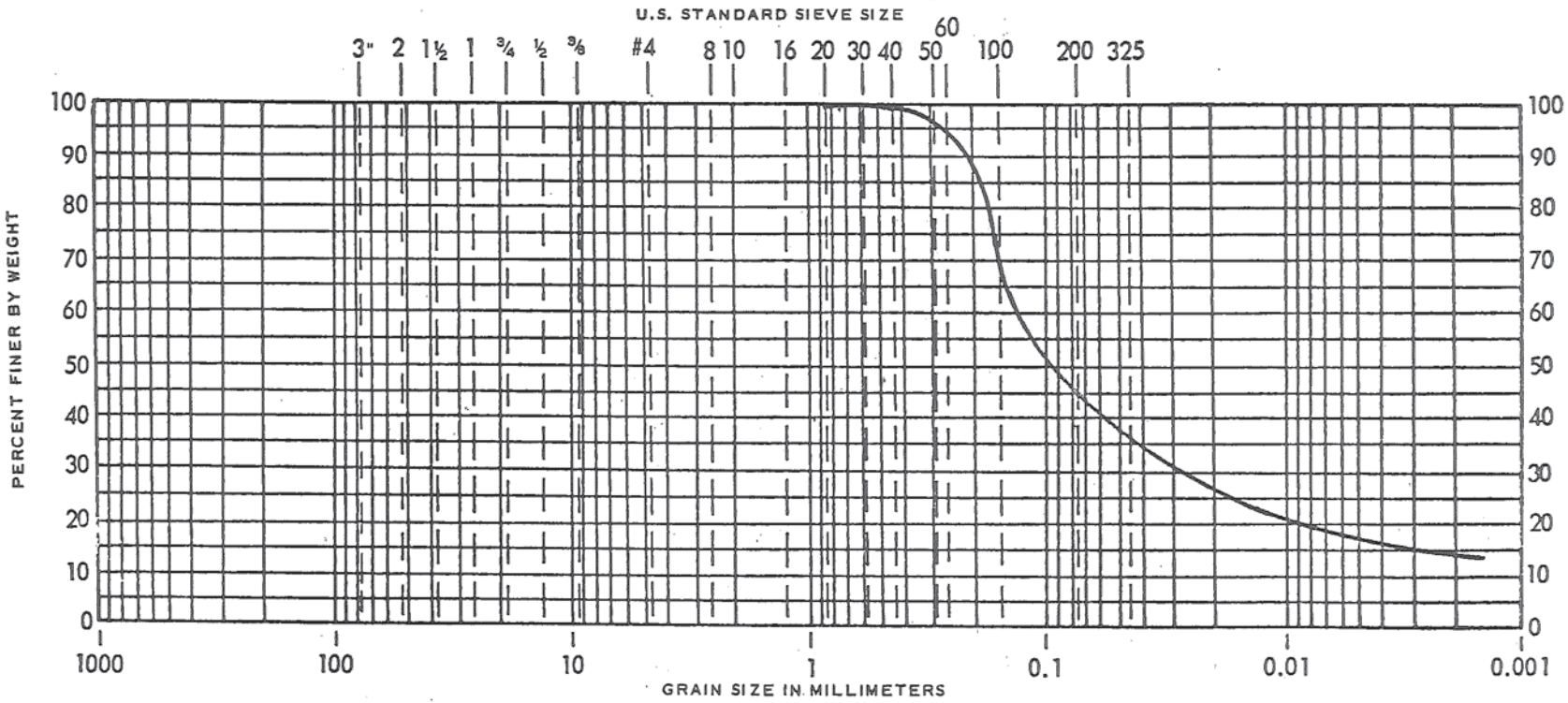
Clayey SILT

NATURAL % MOISTURE 20.3
LIQUID LIMIT 40
PLASTIC LIMIT 26
PLASTICITY INDEX 14
COLOR Brown
REMARKS "USCS"

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET

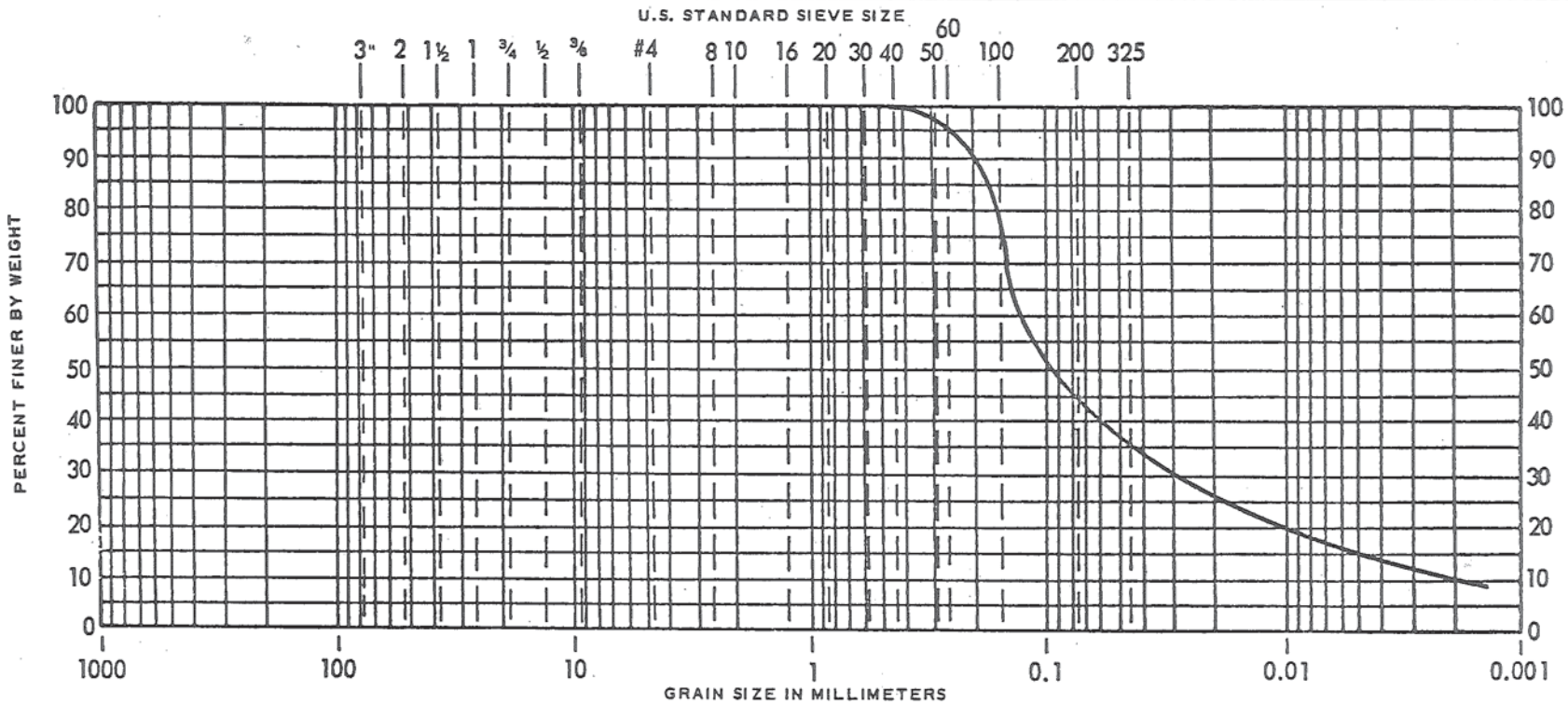


COBBLES	GRAVEL		SAND 56%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	26%	18%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 20.0	BOWSER-MORNER
BORING NO. A133	LIQUID LIMIT 26	TESTING LABORATORIES, INC.
SAMPLE NO. 2C	PLASTIC LIMIT 20	
DEPTH 8.0'-10.0'	PLASTICITY INDEX 6	
CLASSIFICATION "SM-SC"	COLOR Brown	
Silty, Clayey SAND	REMARKS "USCS"	

2B-1A

SOIL CLASSIFICATION SHEET



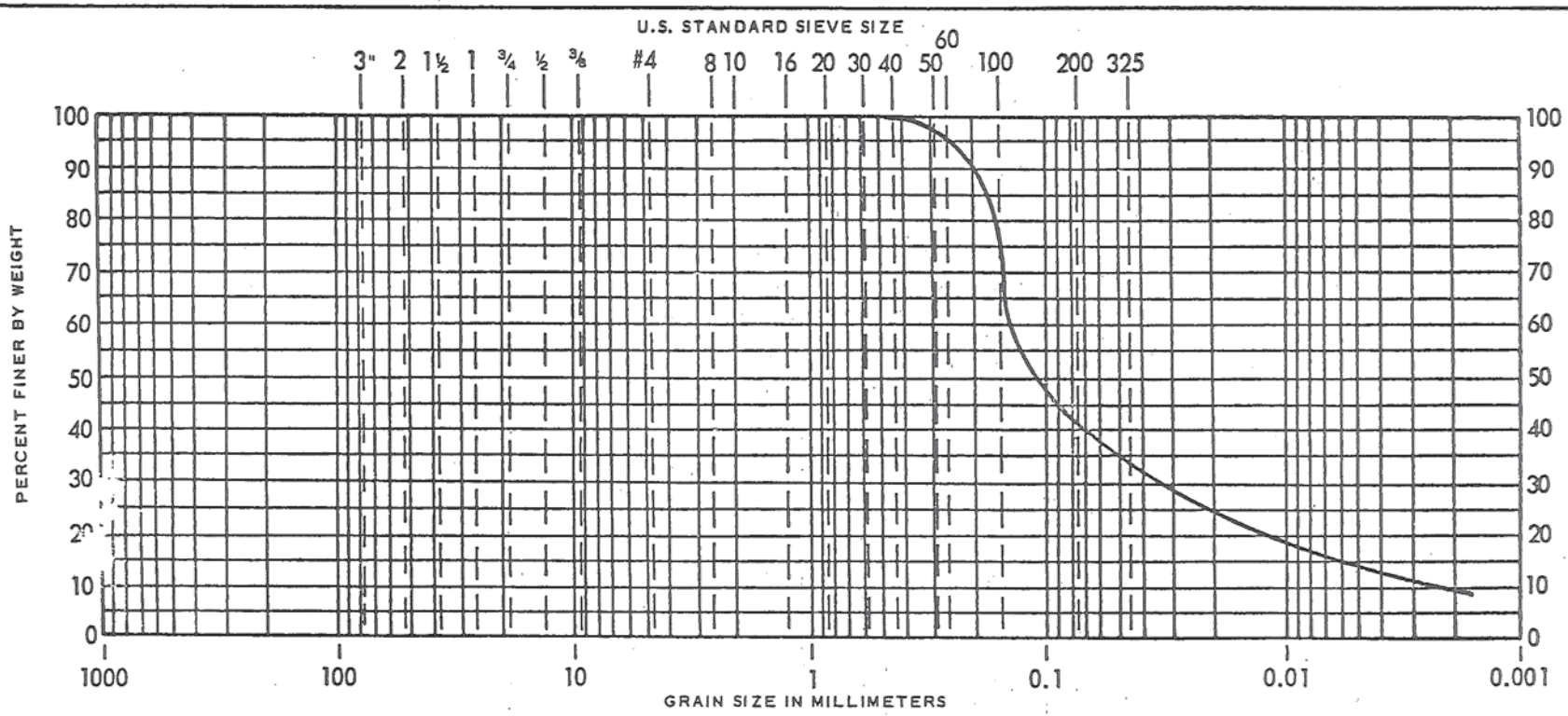
COBBLES	GRAVEL		SAND 57%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	28%	15%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 20.2	
	LIQUID LIMIT Tested	
BORING NO. A133	PLASTIC LIMIT Non-plastic	
SAMPLE NO. 3C	PLASTICITY INDEX	
DEPTH 13.0'-15.0'	COLOR Brown	
CLASSIFICATION "SM"	REMARKS "USCS"	
Silty SAND		

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET

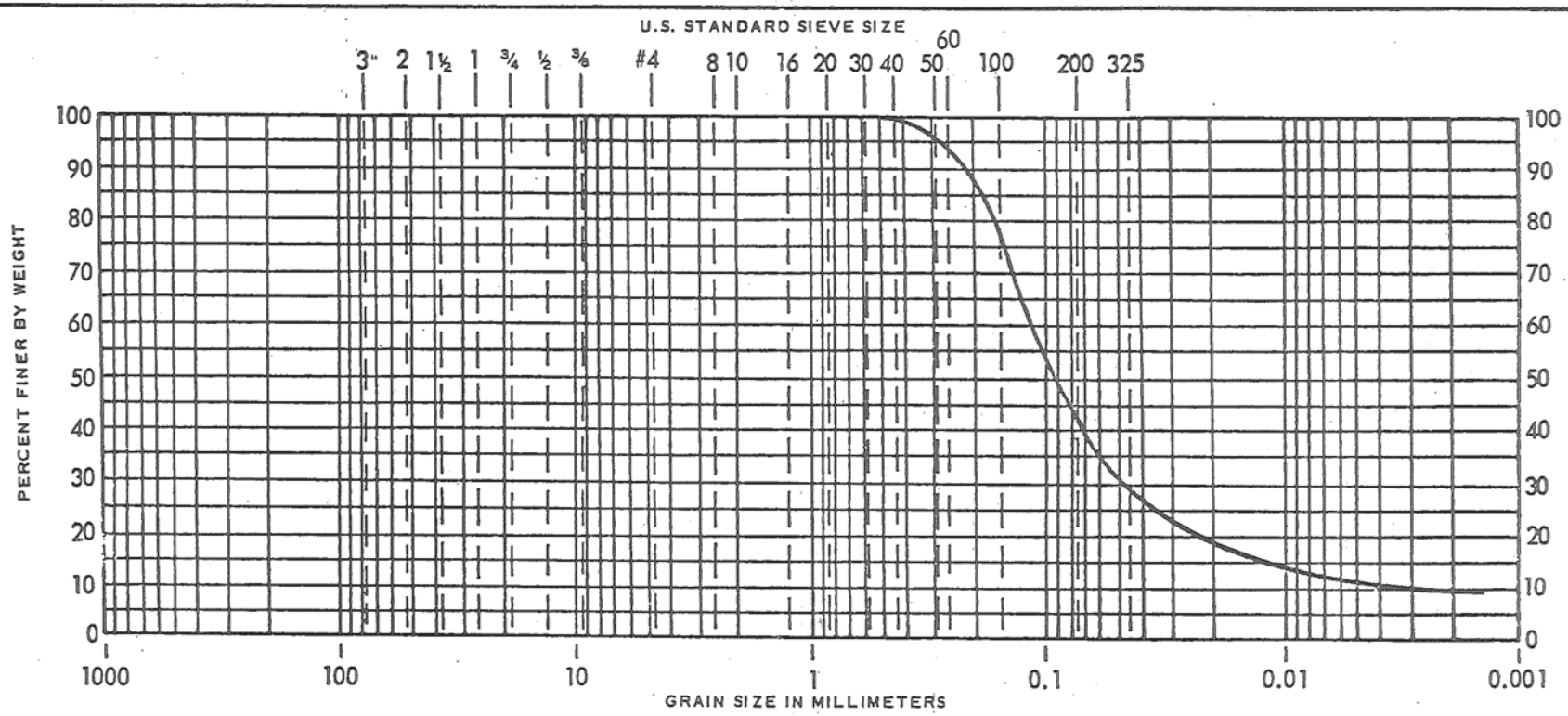


COBBLES	GRAVEL		SAND 60%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	22%	18%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 22.0%	BOWSER-MORNER
BORING NO. A133	LIQUID LIMIT Tested	TESTING LABORATORIES, INC.
SAMPLE NO. 4C	PLASTIC LIMIT Non-Plastic	
DEPTH 18.0' - 20.0'	PLASTICITY INDEX	
CLASSIFICATION "SM"	COLOR Brown	
Silty, SAND	REMARKS "USCS"	

2B-1A

SOIL CLASSIFICATION SHEET

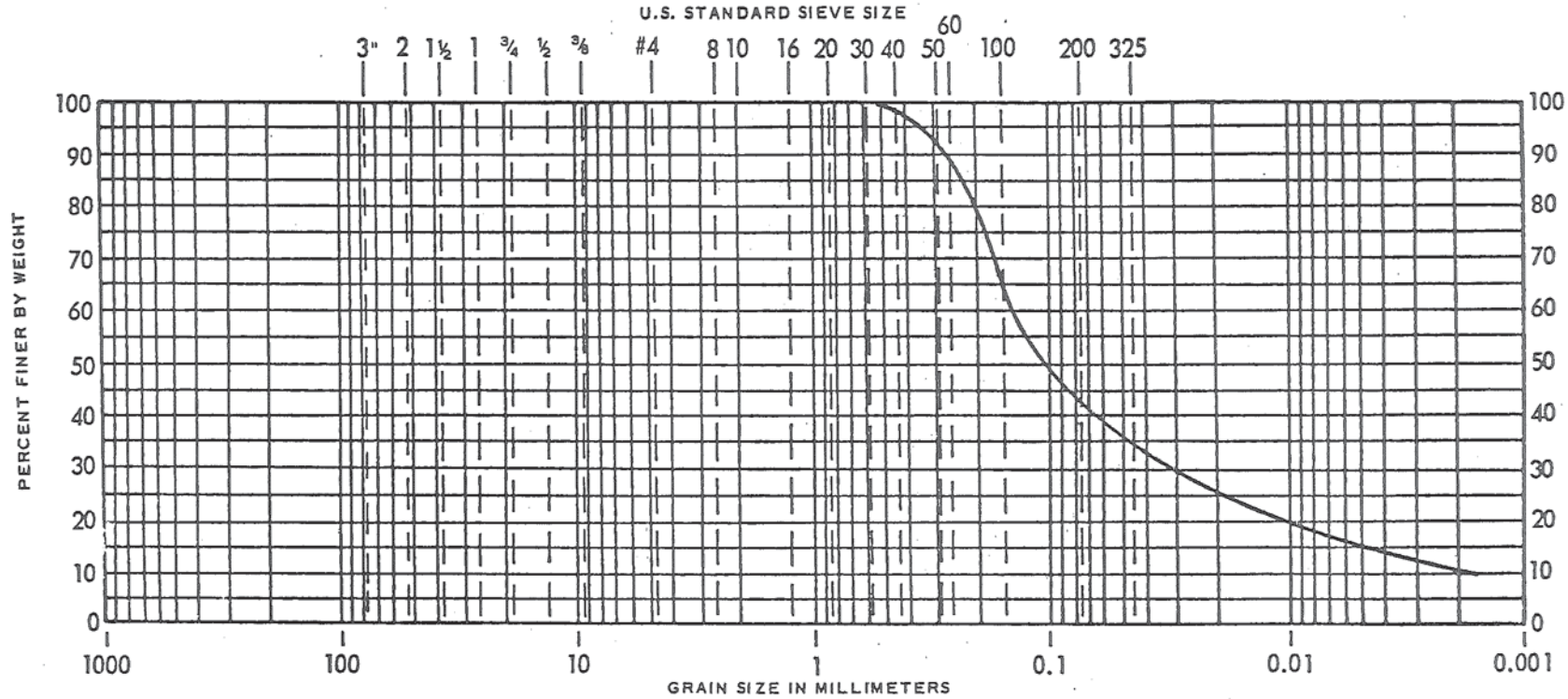


COBBLES	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE 56%	32%	12%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 15.8%	BOWSER-MORNER
BORING NO. A133	LIQUID LIMIT Tested	TESTING LABORATORIES, INC.
SAMPLE NO. 5C	PLASTIC LIMIT Non-plastic	
DEPTH 23.0' - 25.0'	PLASTICITY INDEX	
CLASSIFICATION "SM"	COLOR Brown	
Silty SAND	REMARKS "USCS"	

2B-1A

SOIL CLASSIFICATION SHEET

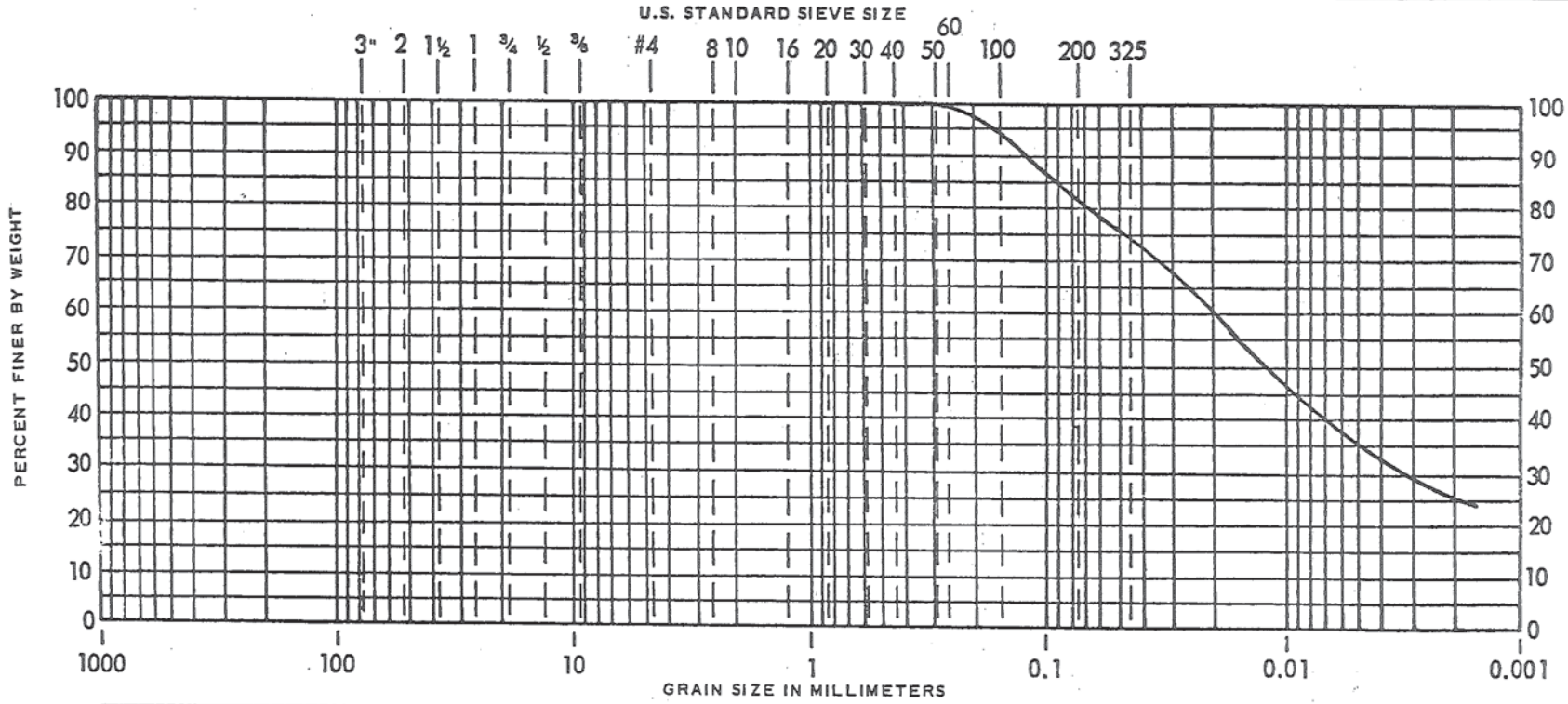


COBBLES	GRAVEL		SAND 59%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	26%	15%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 17.9%	BOWSER-MORNER
BORING NO. A133	LIQUID LIMIT Tested	TESTING LABORATORIES, INC.
SAMPLE NO. 6C	PLASTIC LIMIT Non-Plastic	
DEPTH 28.0' - 29.0'	PLASTICITY INDEX	
CLASSIFICATION "SM"	COLOR Brown	
Silty SAND	REMARKS "USCS"	

2B-1A

SOIL CLASSIFICATION SHEET

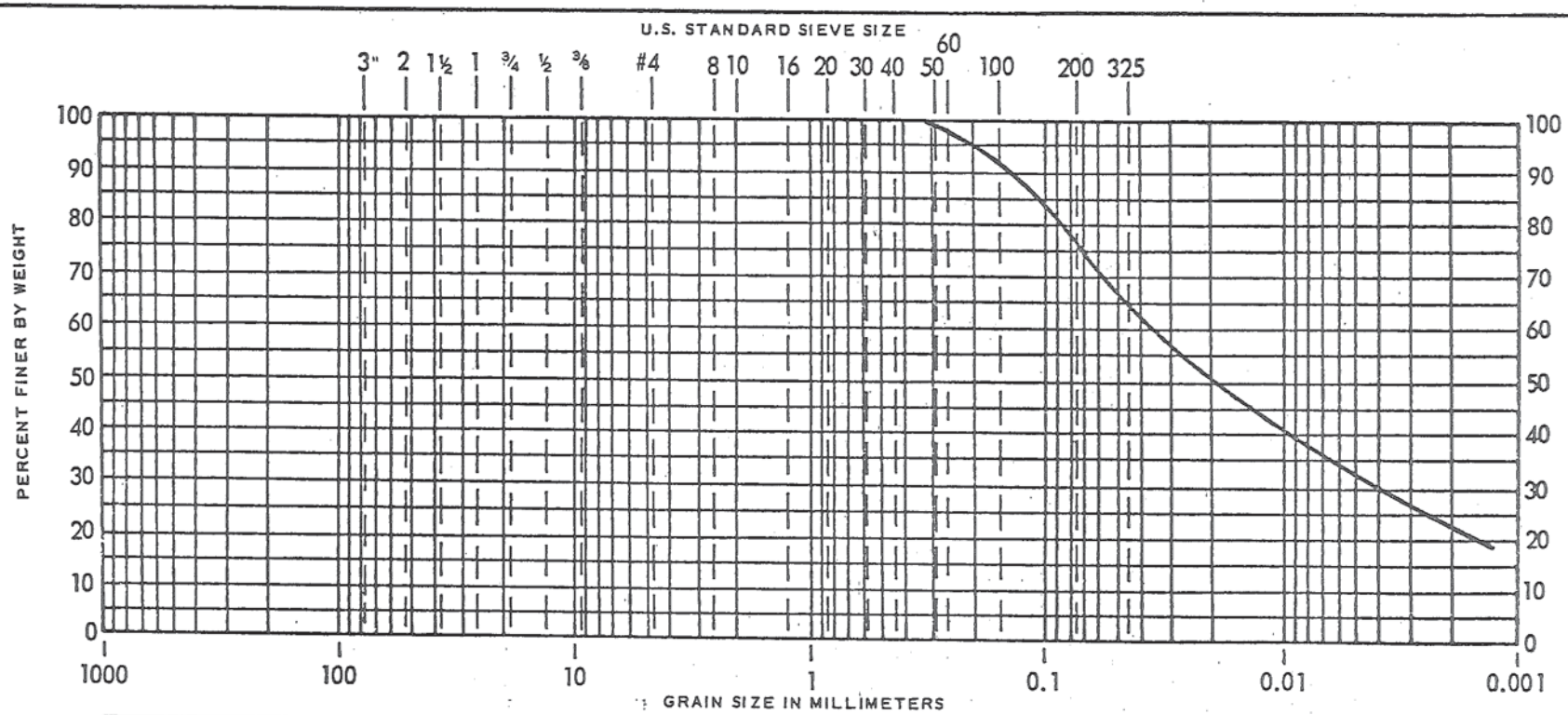


COBBLES	GRAVEL		SAND 18%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	47%	35%

PROJECT KILLEN ELECTRIC GENERATING STATION BORING NO. A-135 SAMPLE NO. 1-C DEPTH 3.0'-5.0' CLASSIFICATION "CL" Silty CLAY	NATURAL % MOISTURE LIQUID LIMIT 36 PLASTIC LIMIT 20 PLASTICITY INDEX 16 COLOR Brown REMARKS "U.S.C.S."	BOWSER-MORNER TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET

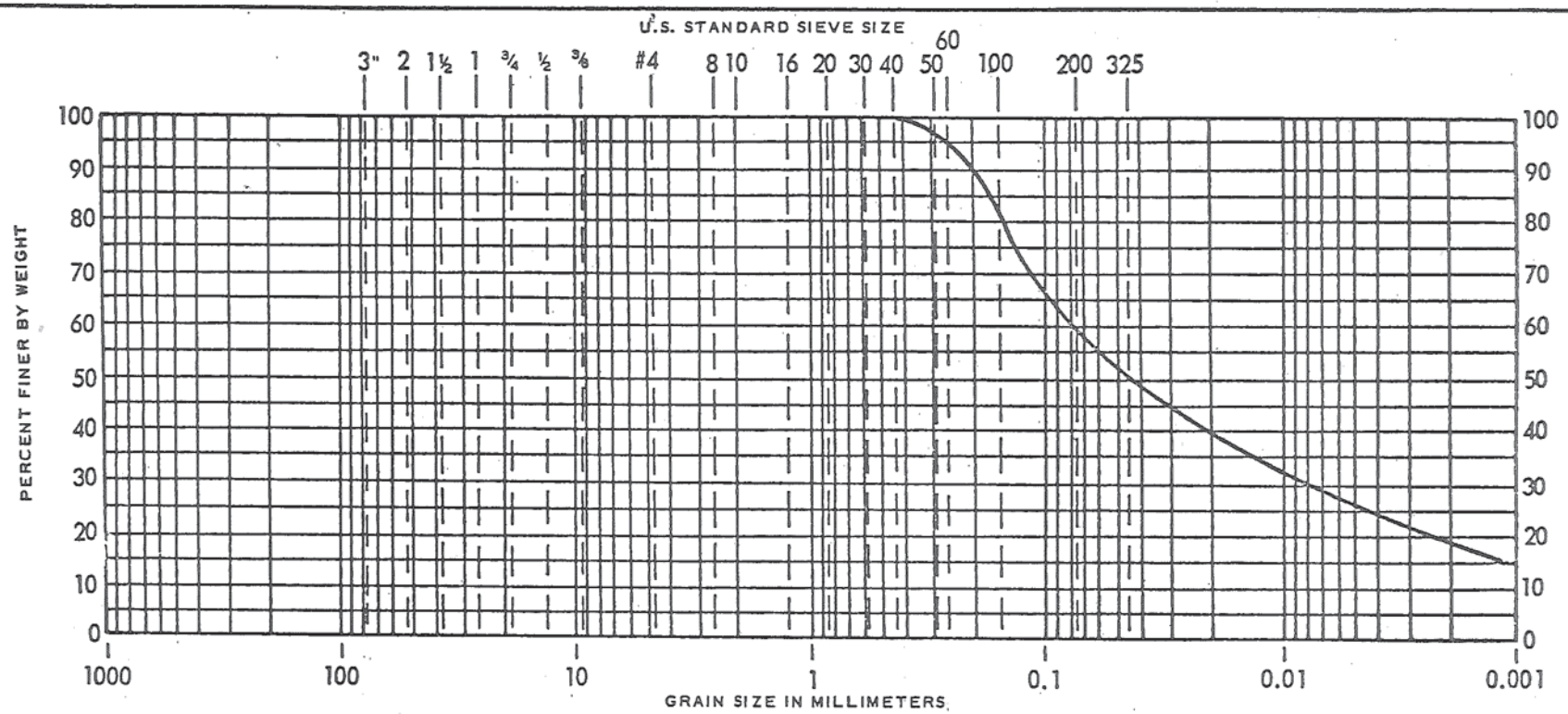


COBBLES	GRAVEL		SAND 23%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	45%	32%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 17.1%	BOWSER-MORNER
BORING NO. A137	LIQUID LIMIT 31	TESTING LABORATORIES, INC.
SAMPLE NO. 1C	PLASTIC LIMIT 22	
DEPTH 3.0' - 5.0'	PLASTICITY INDEX 9	
CLASSIFICATION "CL"	COLOR Brown	
Silty Sandy CLAY	REMARKS "USCS"	

2B-1A

SOIL CLASSIFICATION SHEET

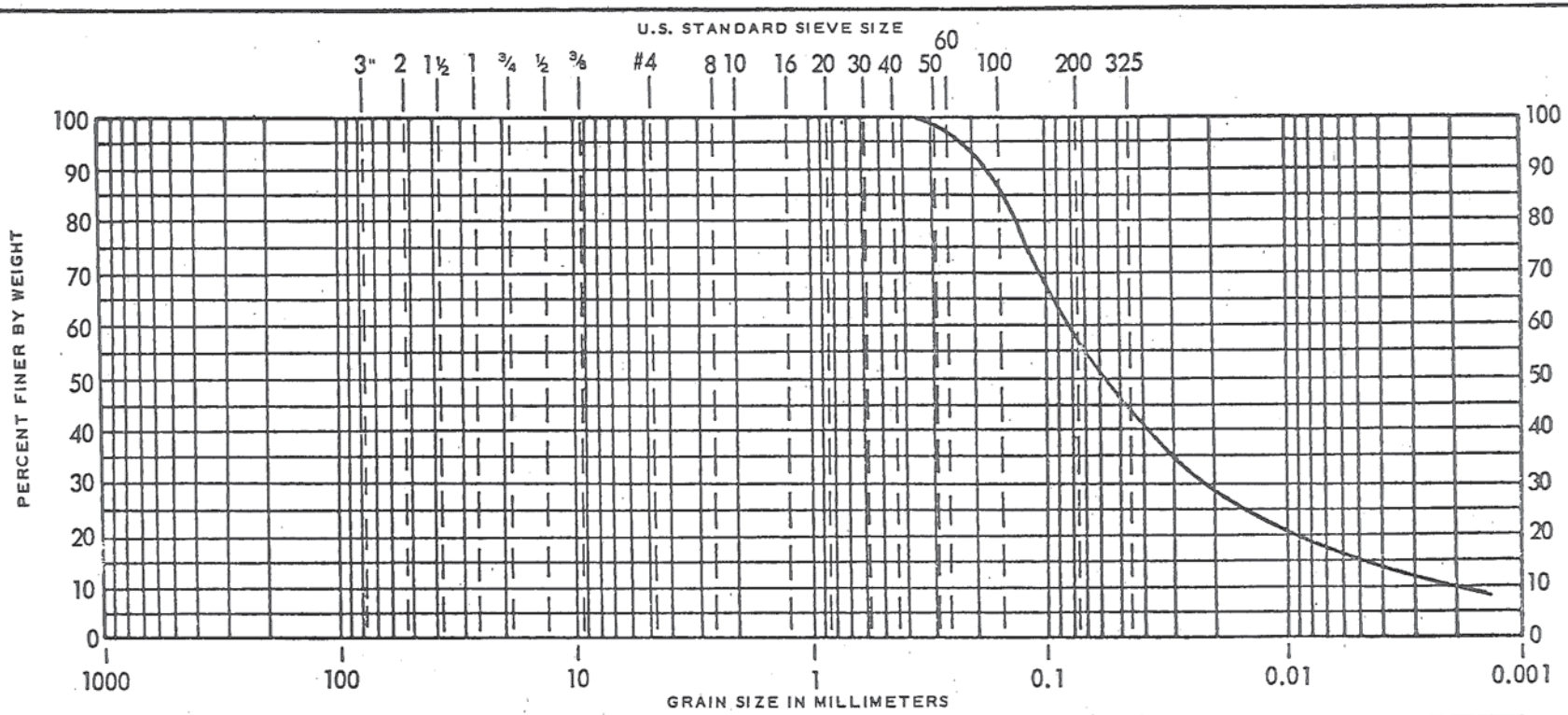


COBBLES	GRAVEL		SAND 40%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	34%	26%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 19.3%	BOWSER-MORNER
BORING NO. A137	LIQUID LIMIT 26	TESTING LABORATORIES, INC.
SAMPLE NO. 2C	PLASTIC LIMIT 20	
DEPTH 8.0' - 10.0'	PLASTICITY INDEX 6	
CLASSIFICATION "ML - CL"	COLOR Brown	
	REMARKS "USCS"	
Sandy, Clayey, SILT		

28-1A

SOIL CLASSIFICATION SHEET

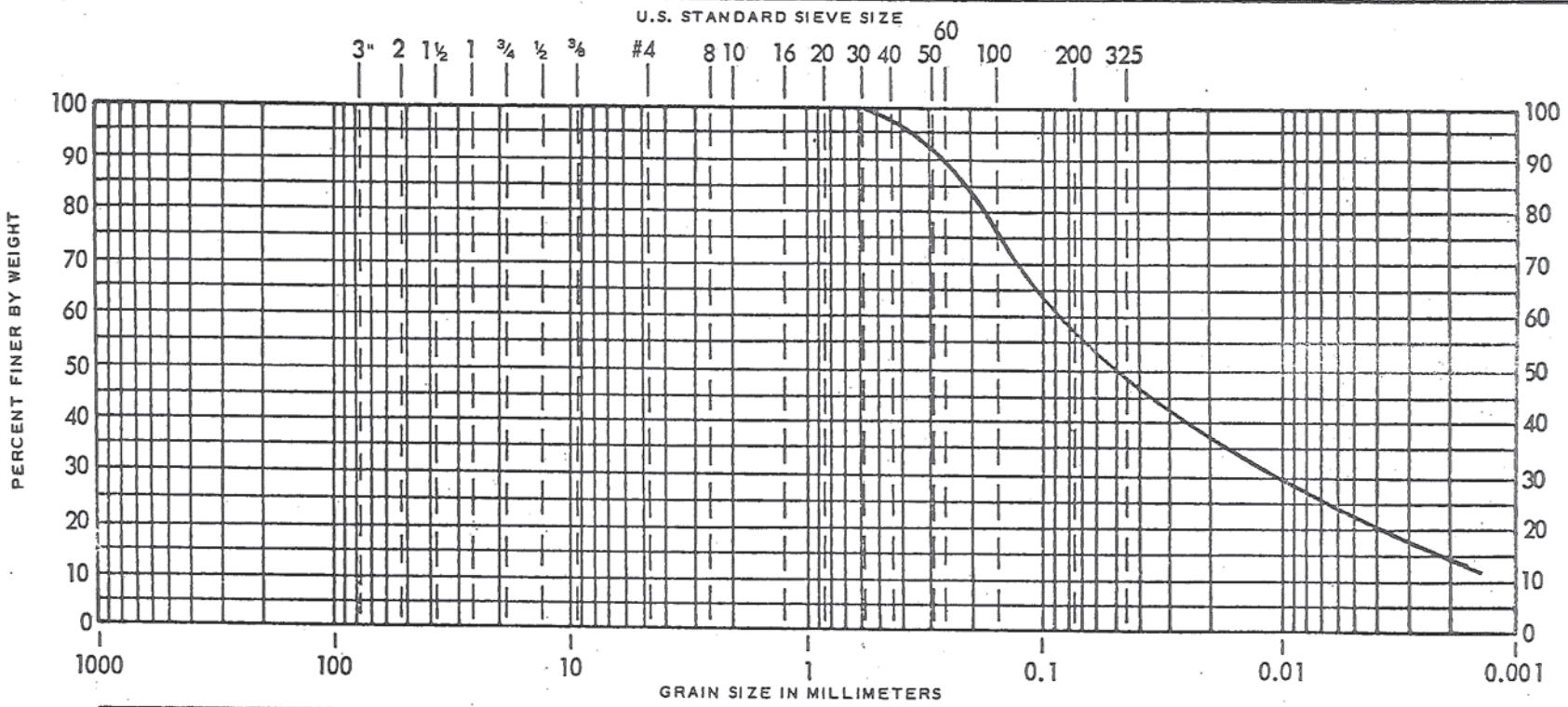


COBBLES	GRAVEL		SAND 40%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	46%	14%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 22.5%	BOWSER-MORNER
BORING NO. A137	LIQUID LIMIT 23	TESTING LABORATORIES, INC.
SAMPLE NO. 4C	PLASTIC LIMIT 21	
DEPTH 18.0' - 20.0'	PLASTICITY INDEX 2	
CLASSIFICATION "ML"	COLOR Brown	
Clayey, Sandy SILT	REMARKS "USCS"	

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 40%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	39%	21%

PROJECT ASH DISPOSAL AREA

BORING NO. A137
SAMPLE NO. 5C
DEPTH 23.0' - 25.0'
CLASSIFICATION "CL"

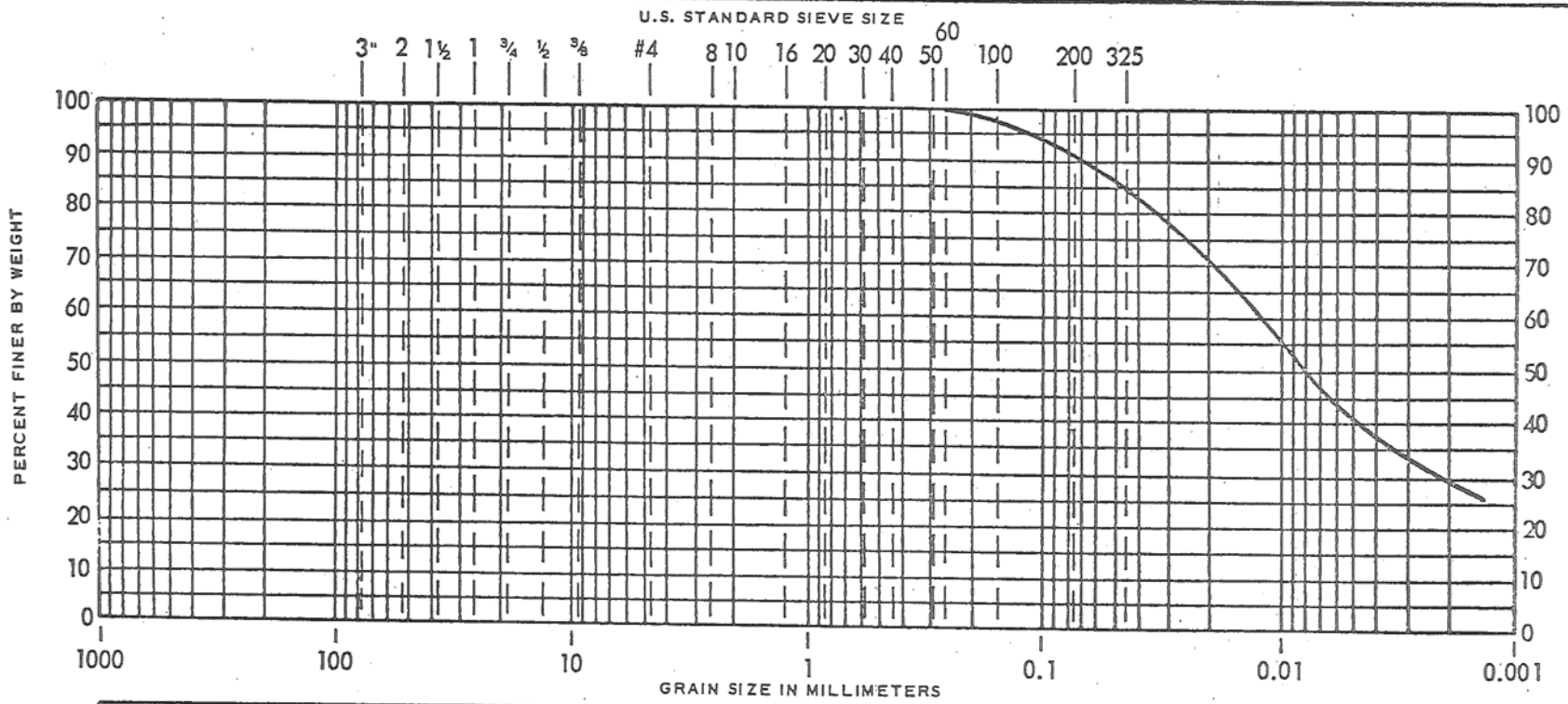
Silty Sandy CLAY

NATURAL % MOISTURE 22.4%
LIQUID LIMIT 26
PLASTIC LIMIT 18
PLASTICITY INDEX 8
COLOR Brown
REMARKS "USCS"

BOWSER-MORNER
TESTING LABORATORIES, INC.

28-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 7%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	53%	40%

PROJECT ASH DISPOSAL AREA

BORING NO. A139
SAMPLE NO. 1C
DEPTH 3.0' - 5.0'
CLASSIFICATION "CL"

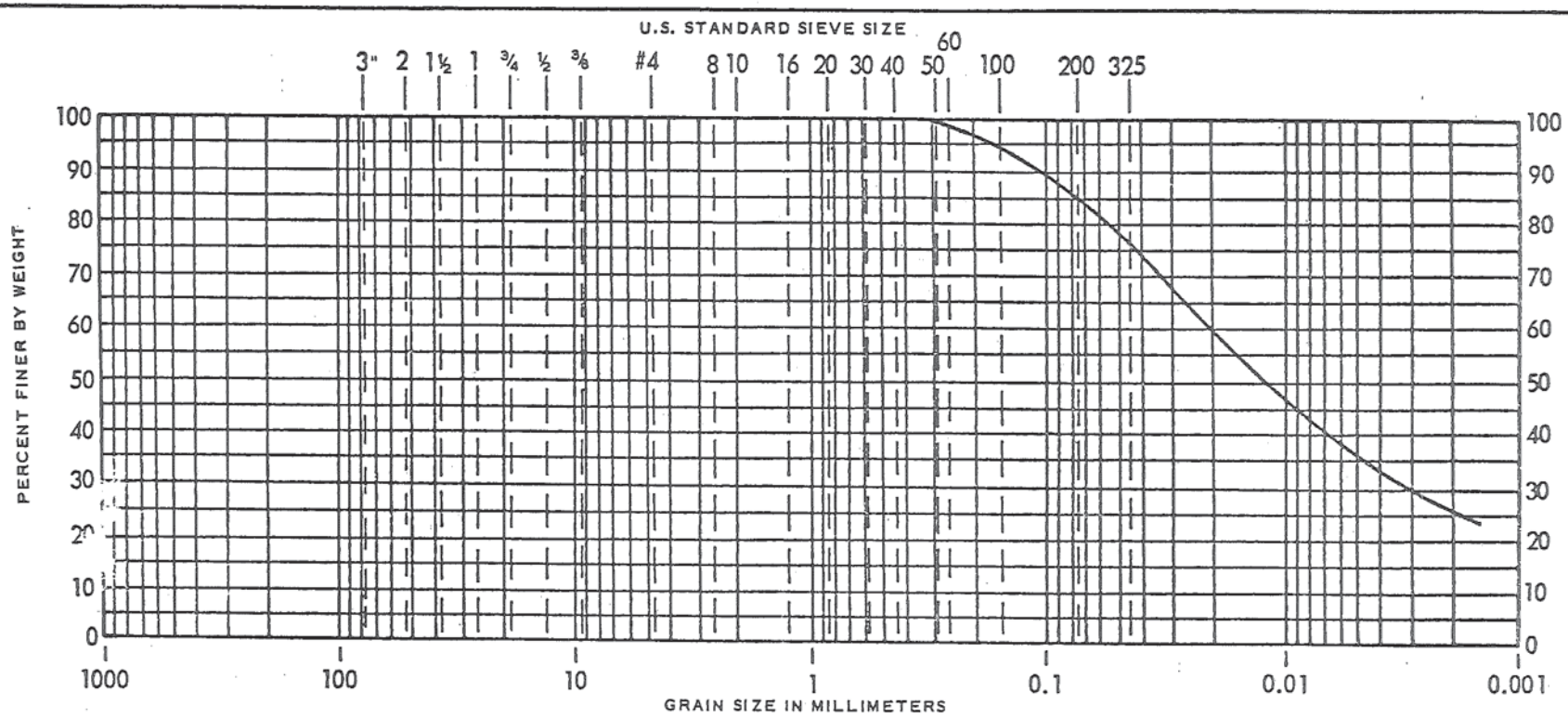
Silty CLAY

NATURAL % MOISTURE	22.1%
LIQUID LIMIT	38
PLASTIC LIMIT	24
PLASTICITY INDEX	14
COLOR	Brown
REMARKS	"USCS"

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET

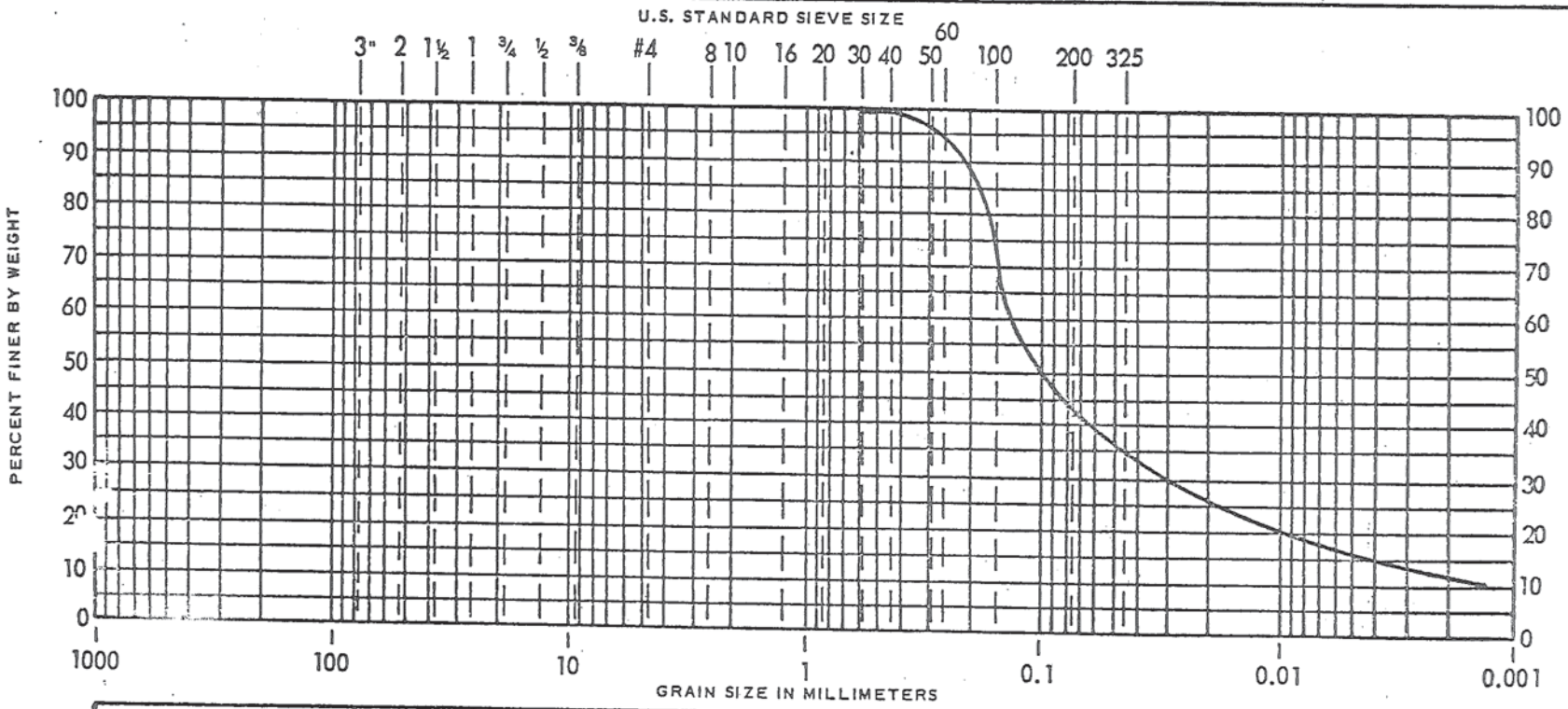


COBBLES	GRAVEL		SAND 14%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	51%	35%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 20.7%	BOWSER-MORNER
BORING NO. A139	LIQUID LIMIT 35	TESTING LABORATORIES, INC.
SAMPLE NO. 2C	PLASTIC LIMIT 20	
DEPTH 8.0' - 10.0'	PLASTICITY INDEX 15	
CLASSIFICATION "CL"	COLOR Brown	
Lean CLAY	REMARKS "USCS"	

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 57%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	27%	16%

PROJECT ASH DISPOSAL AREA

BORING NO. A139
SAMPLE NO. 3C
DEPTH 13.0' - 15.0'
CLASSIFICATION "SM"

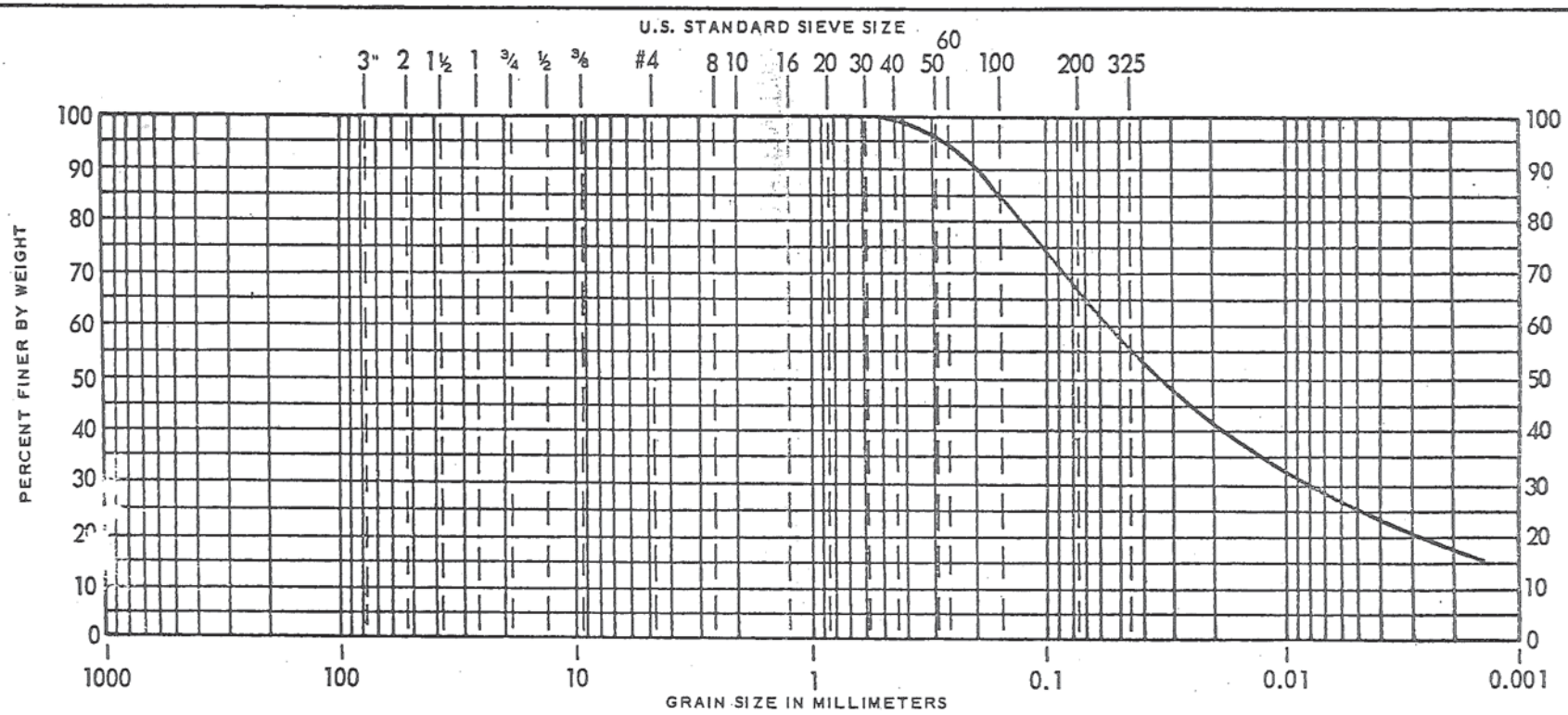
Silty SAND

NATURAL % MOISTURE
LIQUID LIMIT 22
PLASTIC LIMIT 20
PLASTICITY INDEX 2
COLOR Brown
REMARKS "USCS"

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET

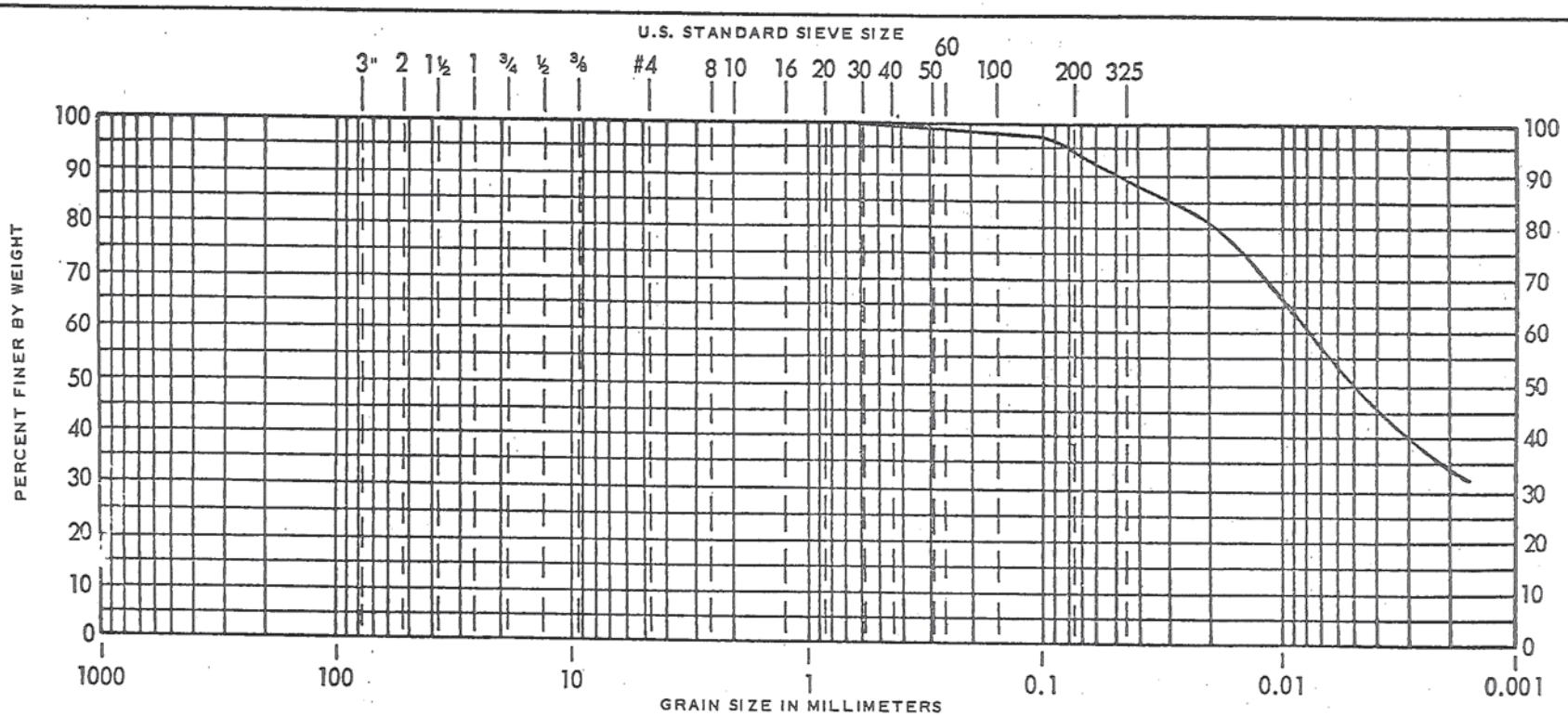


COBBLES	GRAVEL		SAND 32%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	43%	25%

PROJECT ASH DISPOSAL AREA	NATURAL % MOISTURE 42.1%	BOWSER-MORNER
BORING NO. A139	LIQUID LIMIT 25	TESTING LABORATORIES, INC.
SAMPLE NO. 5C	PLASTIC LIMIT 18	
DEPTH 23.0' - 25.0'	PLASTICITY INDEX 7	
CLASSIFICATION "ML-CL"	COLOR Brown	
Sandy Clayey SILT	REMARKS "USCS"	

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 5%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	44%	51%

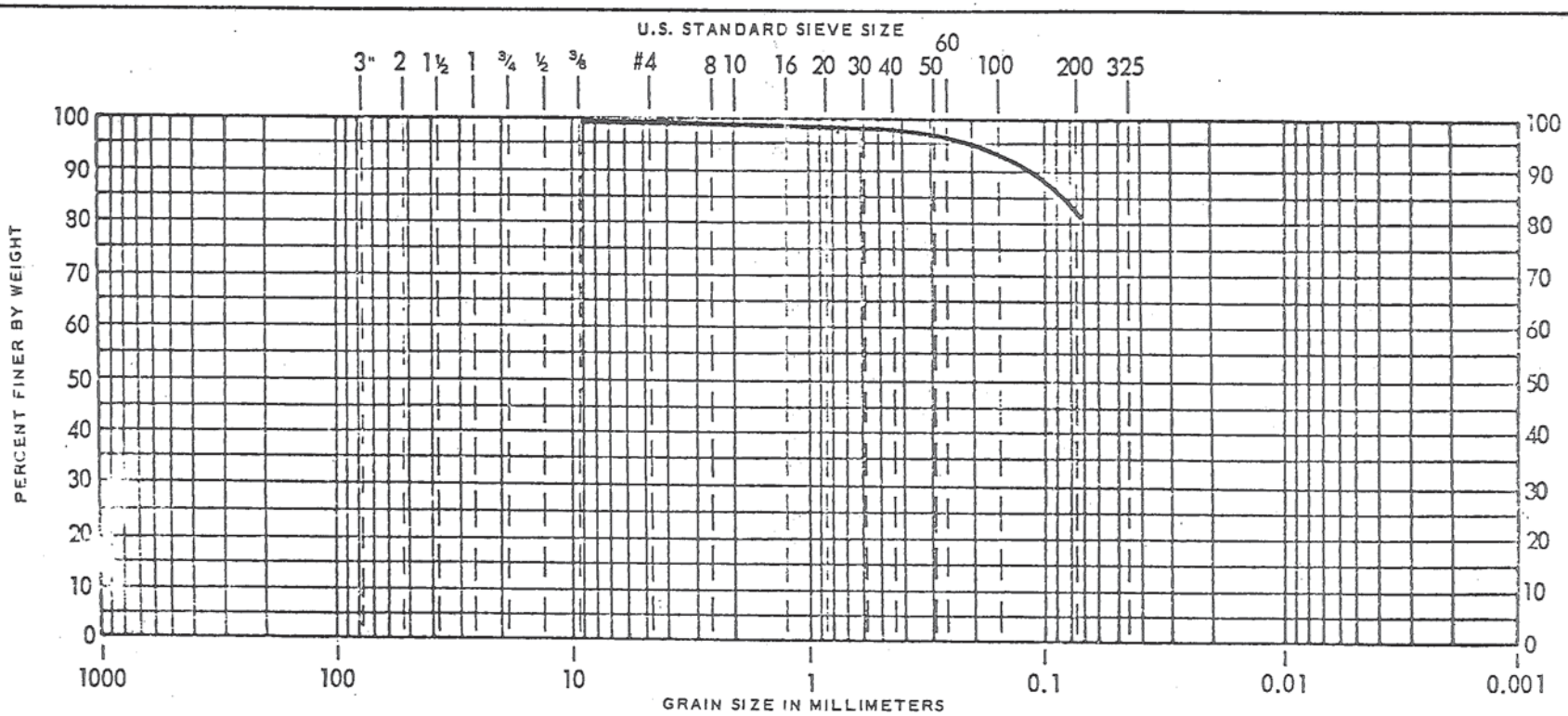
PROJECT KILLEN ELECTRIC GENERATING STATION
BORING NO. A-142
SAMPLE NO. 3-C
DEPTH 10.0'-12.0'
CLASSIFICATION "CL" Silty CLAY

NATURAL % MOISTURE
LIQUID LIMIT 48
PLASTIC LIMIT 24
PLASTICITY INDEX 24
COLOR Brown
REMARKS "U.S.C.S."

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL 1%		SAND 17%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-82	%-

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION

BORING NO. A-155

SAMPLE NO. 3A

DEPTH 9.0-10.5'

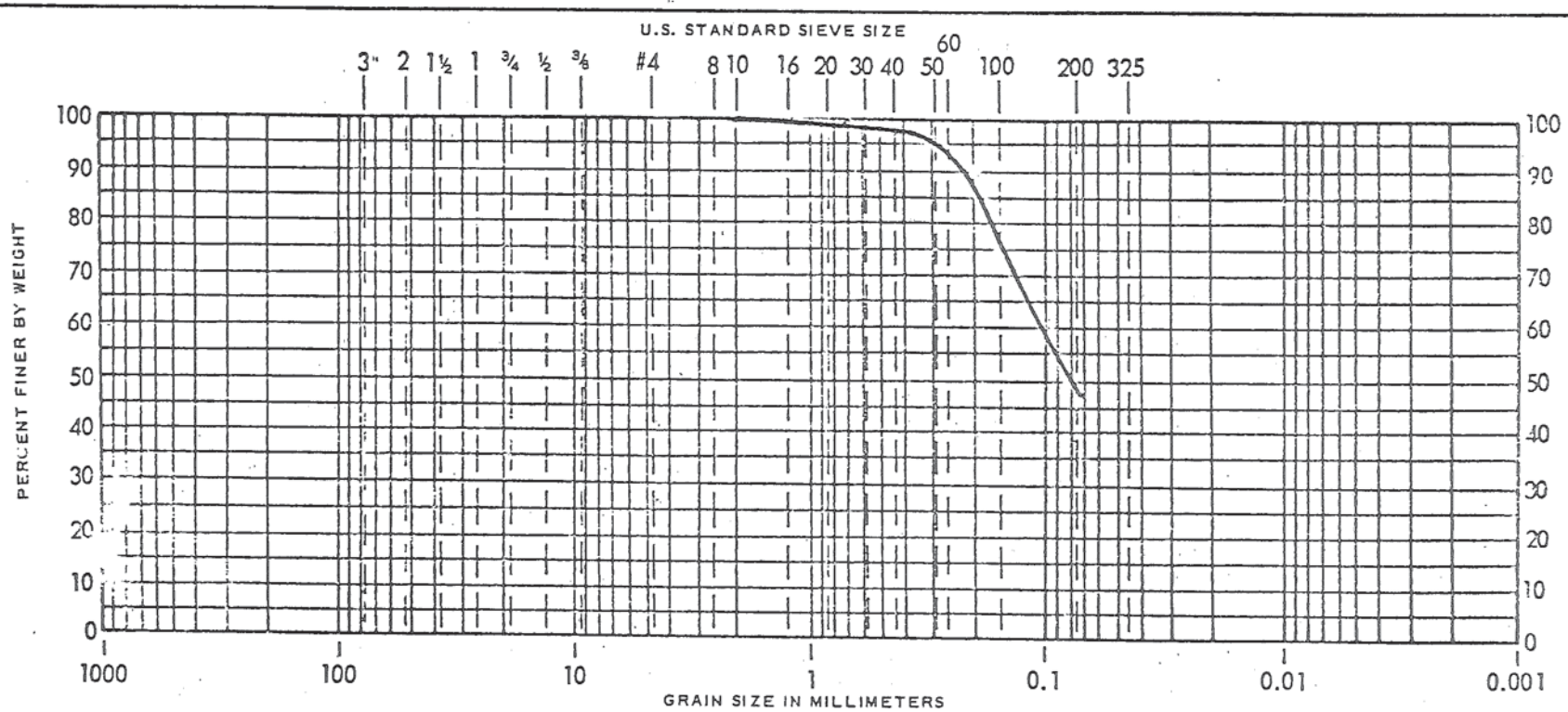
Color: Brown

BOWSER-MORNER

TESTING LABORATORIES, INC.

28-1A

SOIL CLASSIFICATION SHEET



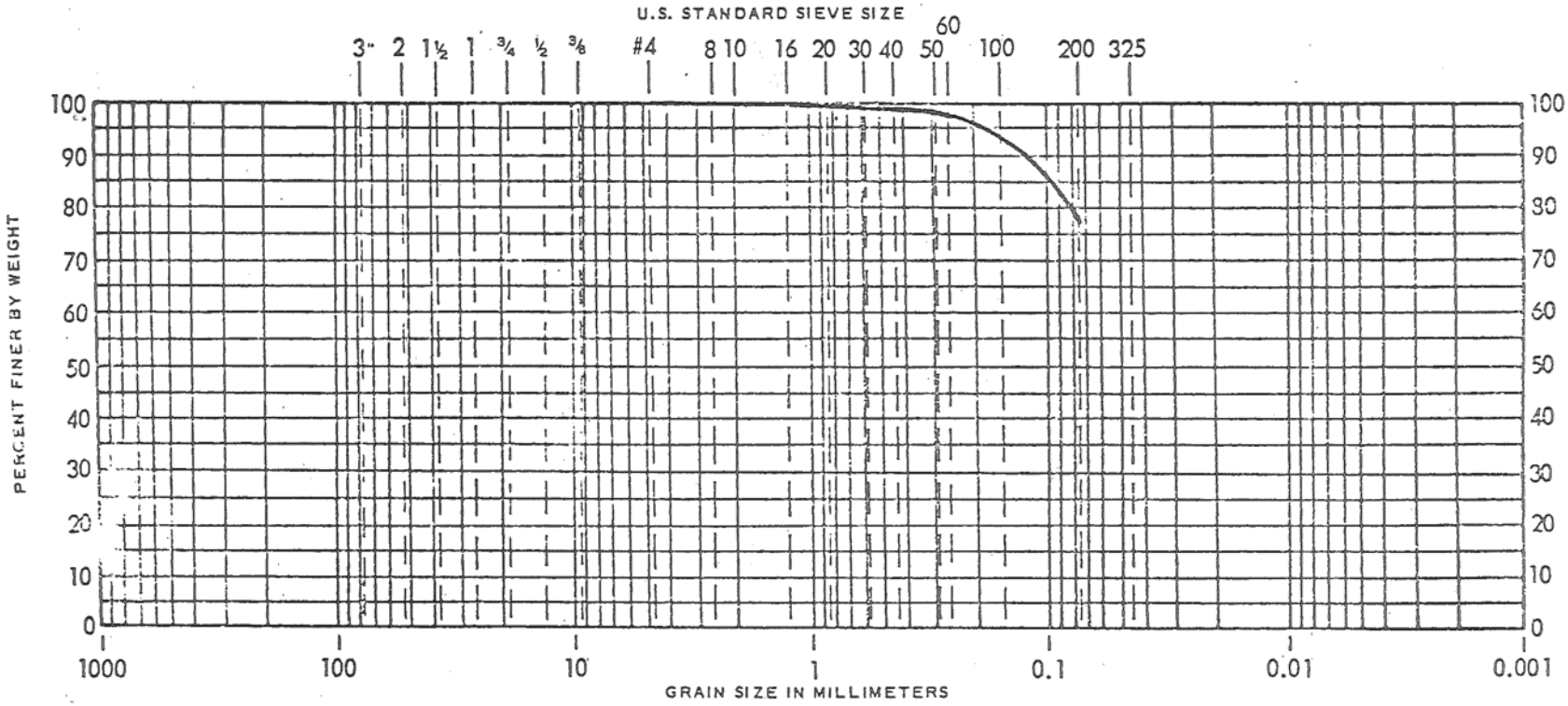
COBBLES	GRAVEL		SAND 54%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-46	%-

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION
BORING NO. A-157
SAMPLE NO. 7A
DEPTH 29.5-31.0'
Color: Brown

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 25%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	– 75%	–

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION

BORING NO. A-158

SAMPLE NO. 3A

DEPTH 9.5-11.0'

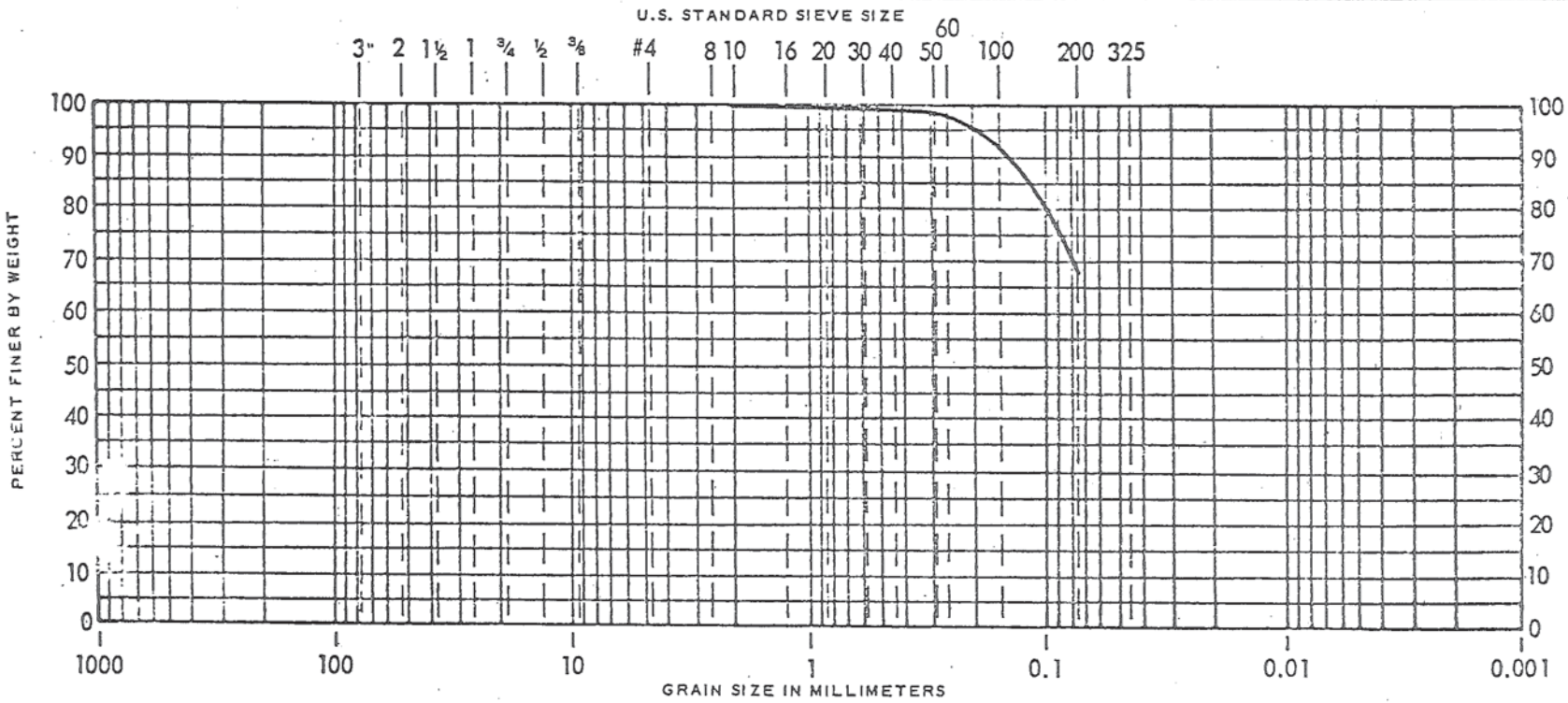
Color: Brown

BOWSER-MORNER

TESTING LABORATORIES, INC.

28-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 34%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-66	%-

PROJECT PROPOSED ASH DISPOSAL POND-KILLEN STATION

BORING NO. A-158

SAMPLE NO. 6A

DEPTH 24.5-26.0'

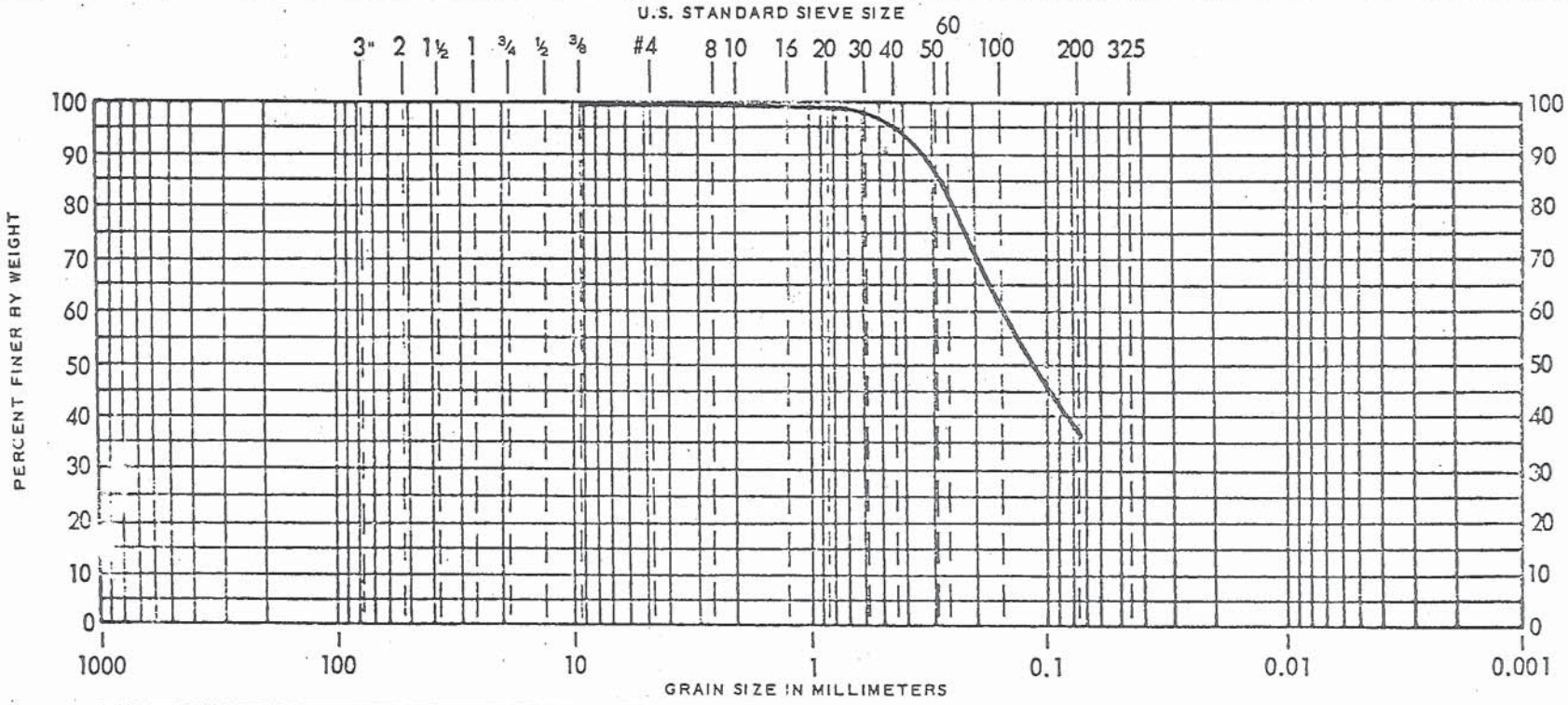
Color: Brown

BOWSER-MORNER

TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



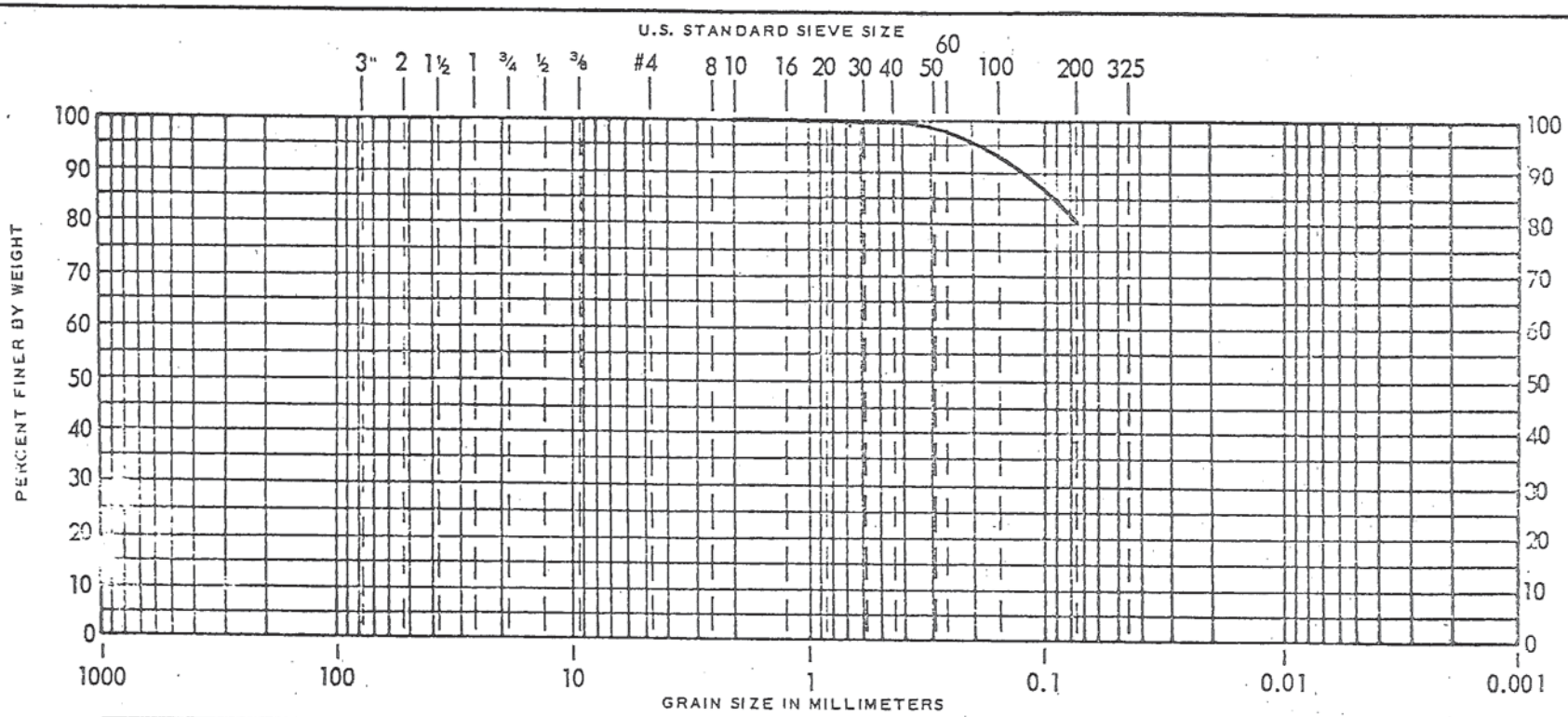
COBBLES	GRAVEL 1%		SAND 64%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-35	%-

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION
BORING NO. A-158
SAMPLE NO. 7A
DEPTH 29.5-31.0'
Color: Brown

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 20%			SILT -80%	CLAY -
	COARSE	FINE	COARSE	MEDIUM	FINE		

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION

BORING NO. A-159

SAMPLE NO. 4A

DEPTH 14.5-16.0'

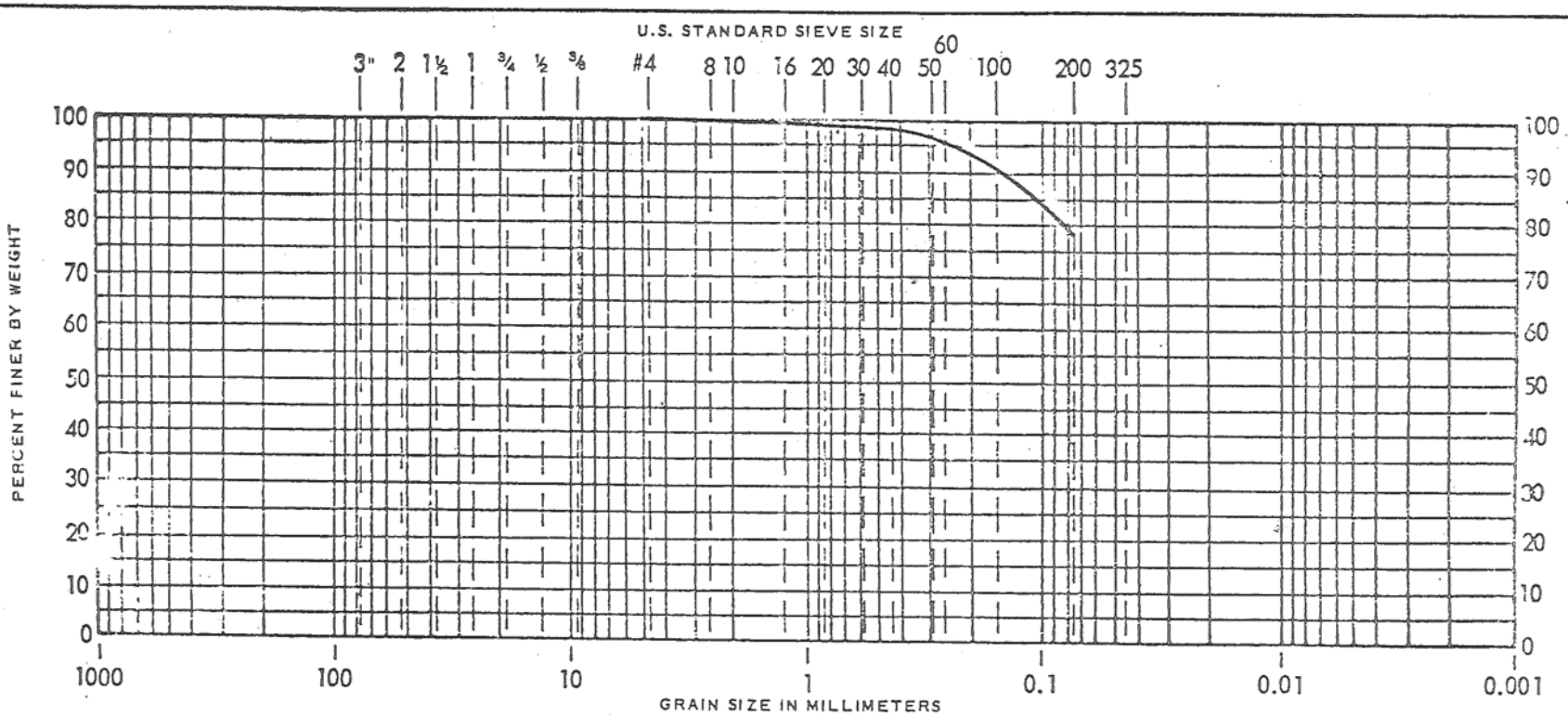
Color: Brown

BOWSER-MORNER

TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



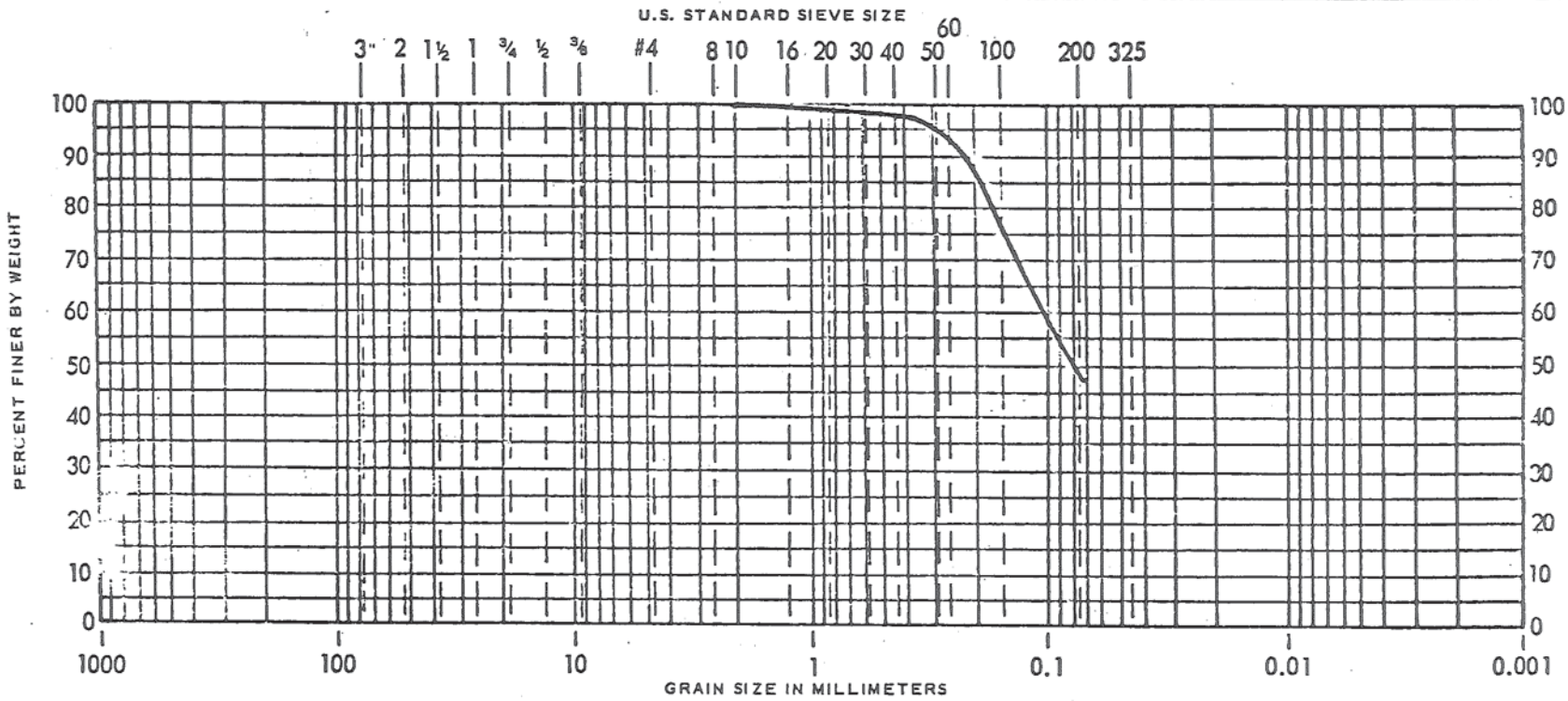
COBBLES	GRAVEL		SAND 22%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-78%	-

PROJECT: PROPOSED ASH DISPOSAL POND - KILLEN STATION
BORING NO.: A-160
SAMPLE NO.: 2A
DEPTH: 4.5-6.0'
COLOR: Brown

BOWSER-MORNER
TESTING LABORATORIES, INC.

28-1A

SOIL CLASSIFICATION SHEET



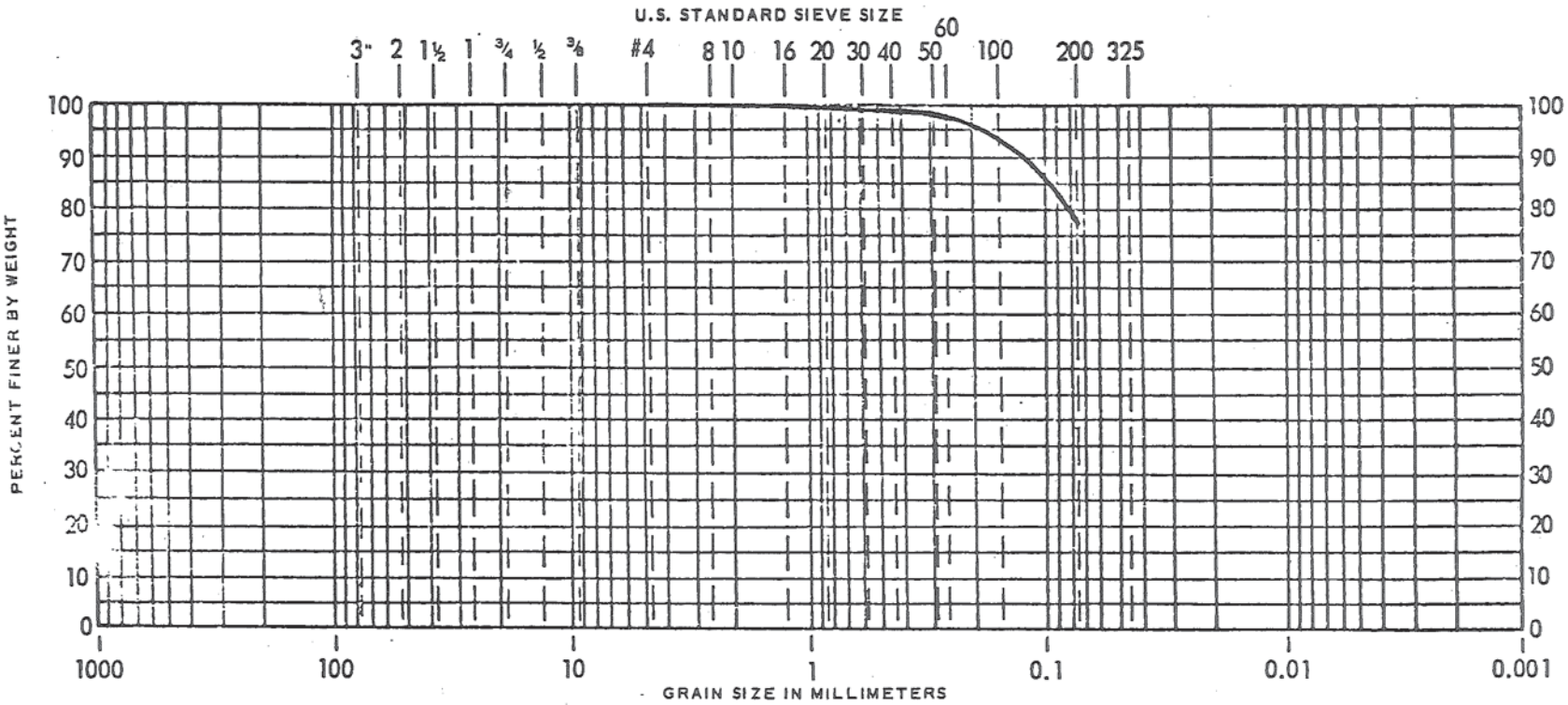
COBBLES	GRAVEL		SAND 54%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-46	%-

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION
BORING NO. A-157
SAMPLE NO. 7A
DEPTH 29.5-31.0'
Color: Brown

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 25%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	- 75%	-

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION

BORING NO. A-158

SAMPLE NO. 3A

DEPTH 9.5-11.0'

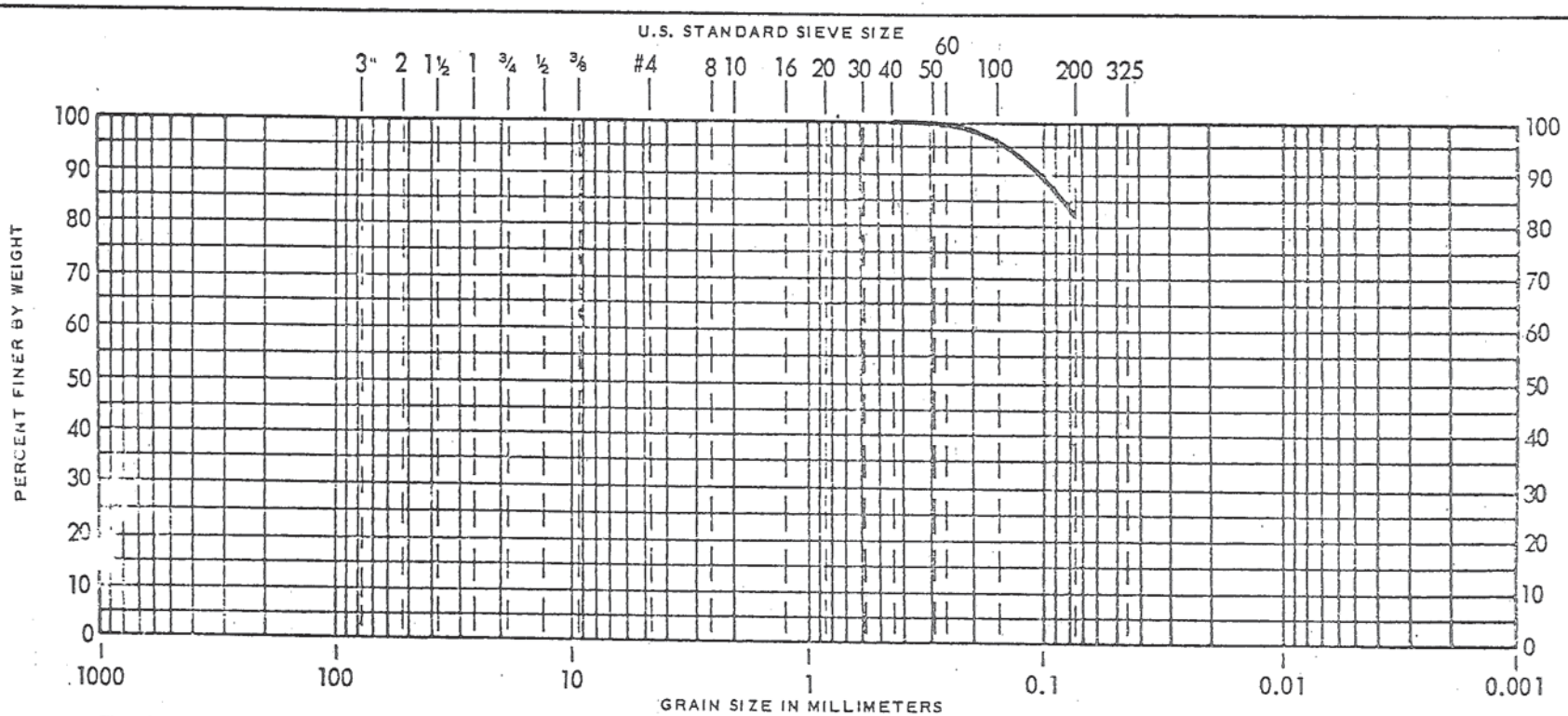
Color: Brown

BOWSER-MORNER

TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 18%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-82%	-

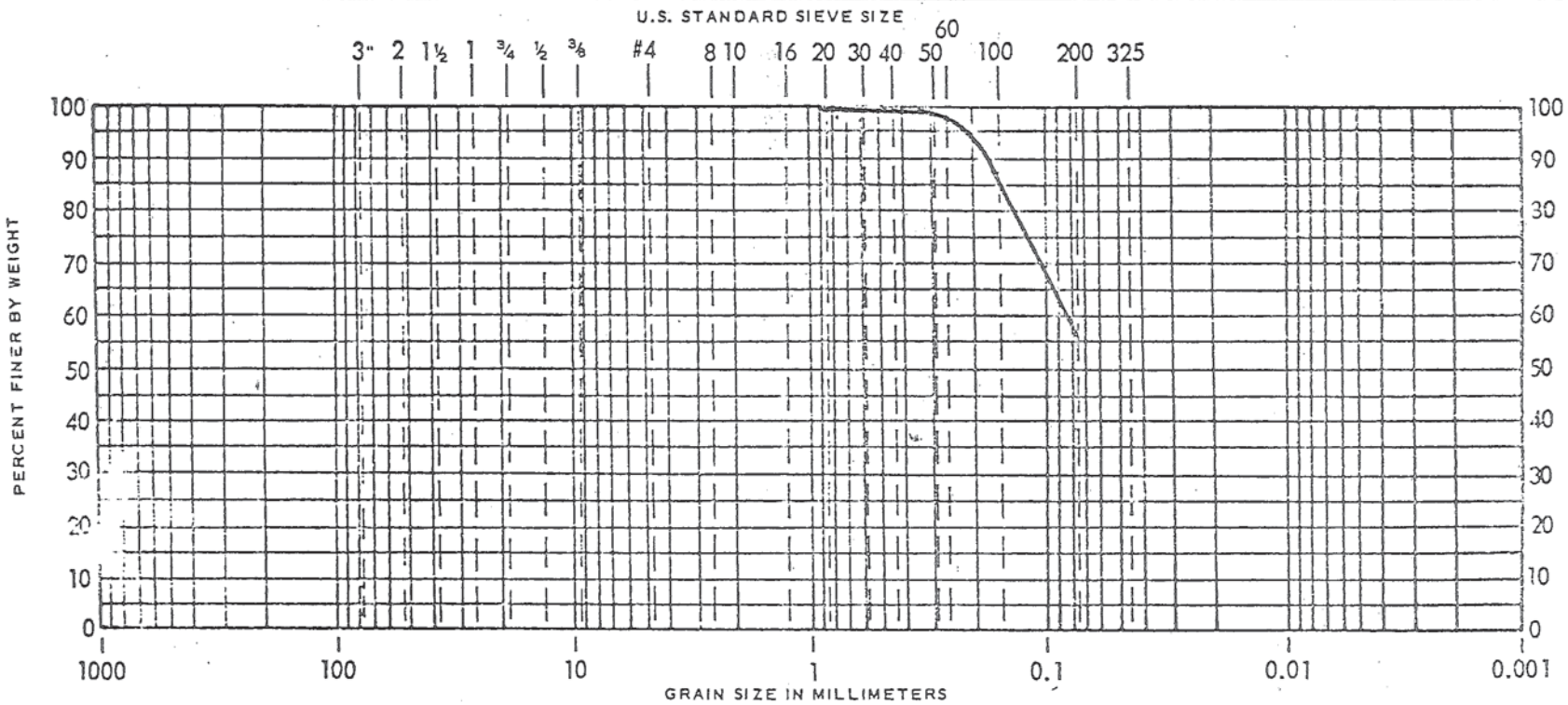
PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION

BORING NO. A-161
SAMPLE NO. 2A
DEPTH 4.5-6.0'
Color: Brown

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



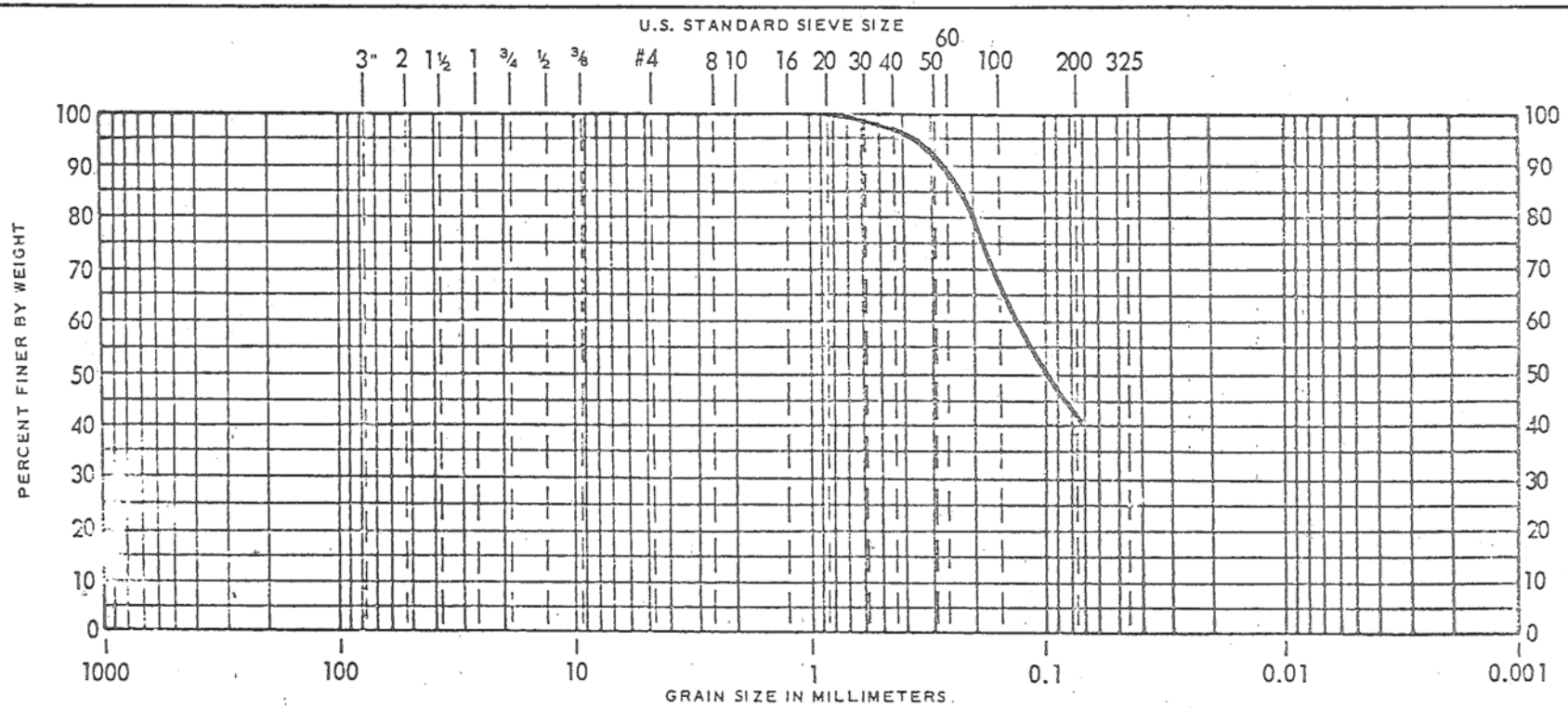
COBBLES	GRAVEL		SAND 45%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-55	%-

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION
Location: TP-5
Color: Brown
DEPTH 10.0'

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION

Location: TP-7

Color: Brown

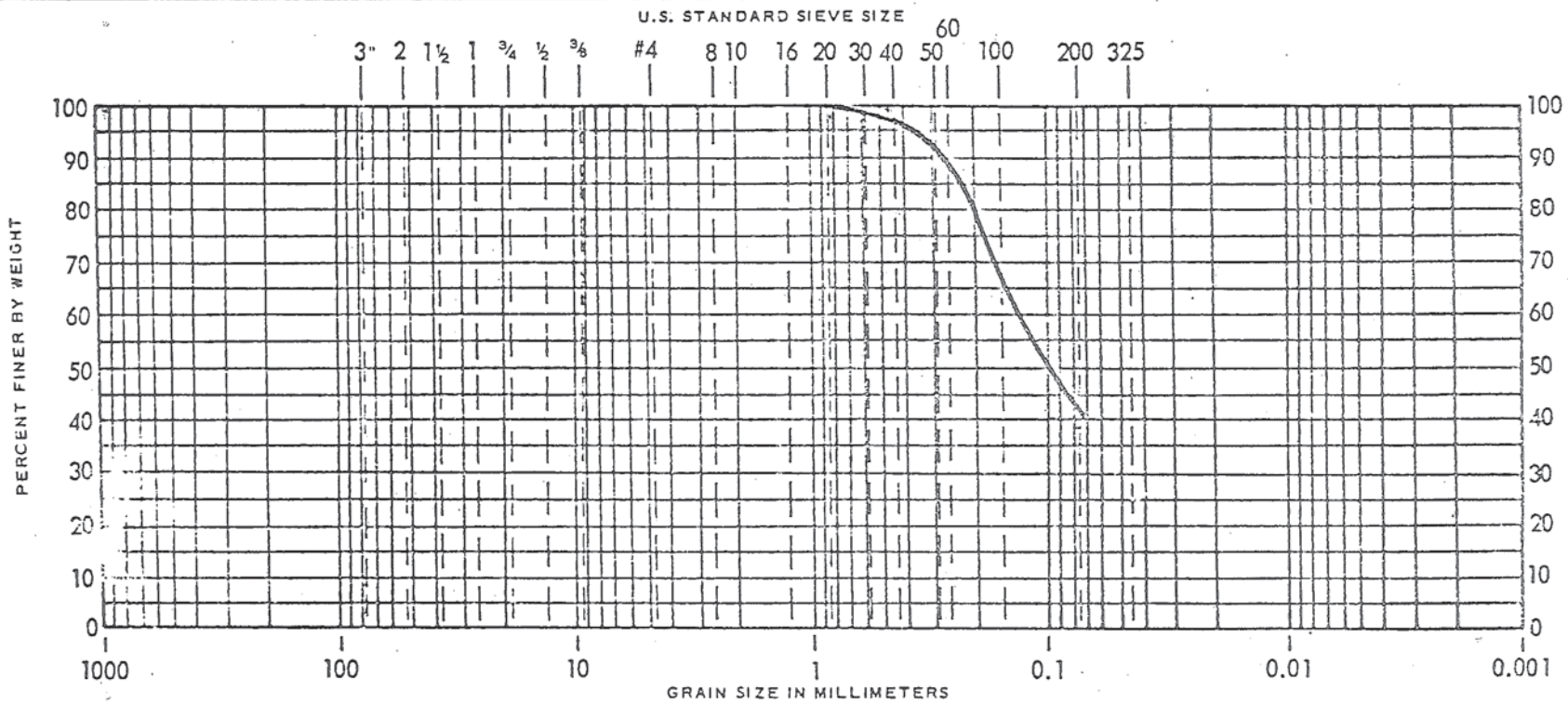
DEPTH 5.0'

BOWSER-MORNER

TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



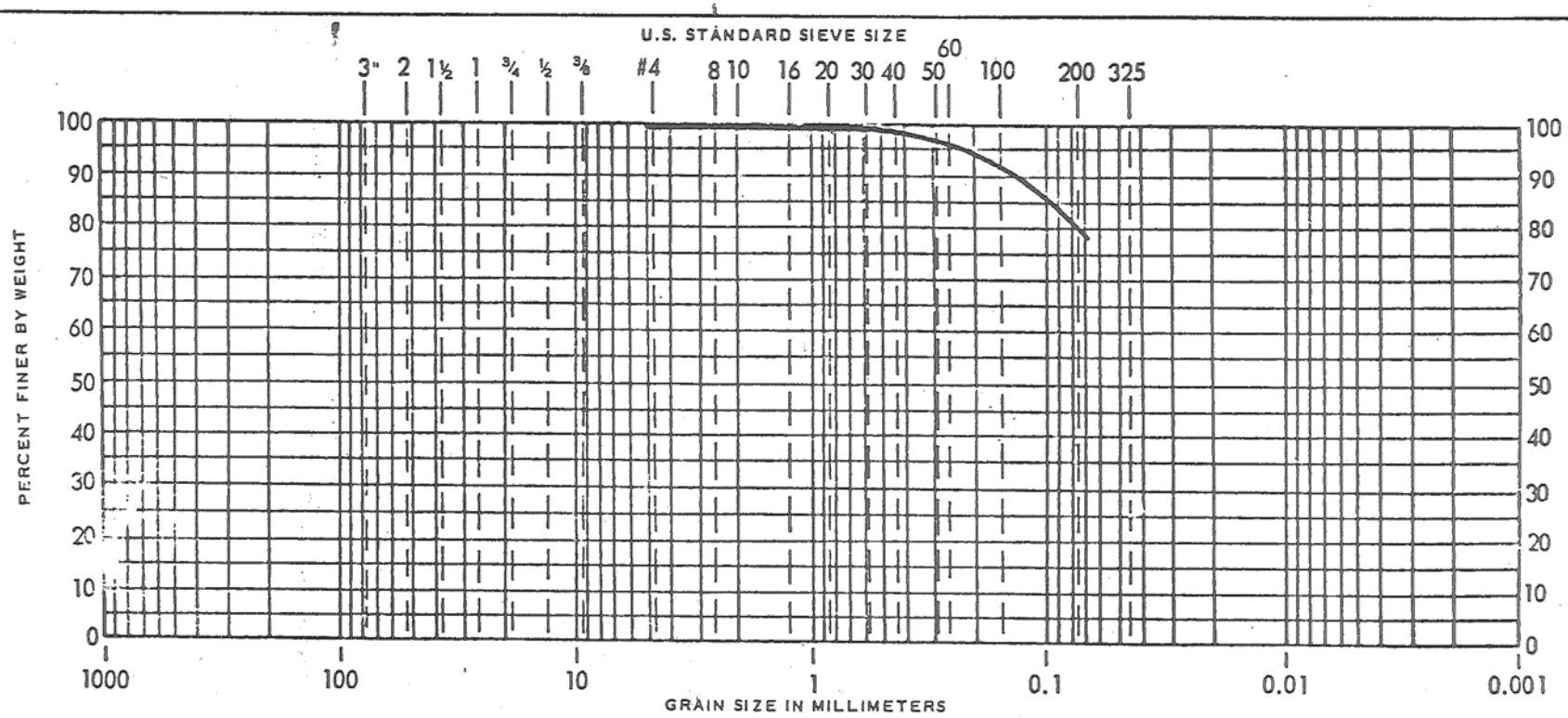
COBBLES	GRAVEL		SAND 60%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-40	%-

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION
Location: TP-7
Color: Brown
DEPTH 5.0'

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL 1%		SAND 20%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-79	%-

PROJECT PROPOSED ASH DISPOSAL POND KILLEN STATION

Location: TP-8

Color: Brown

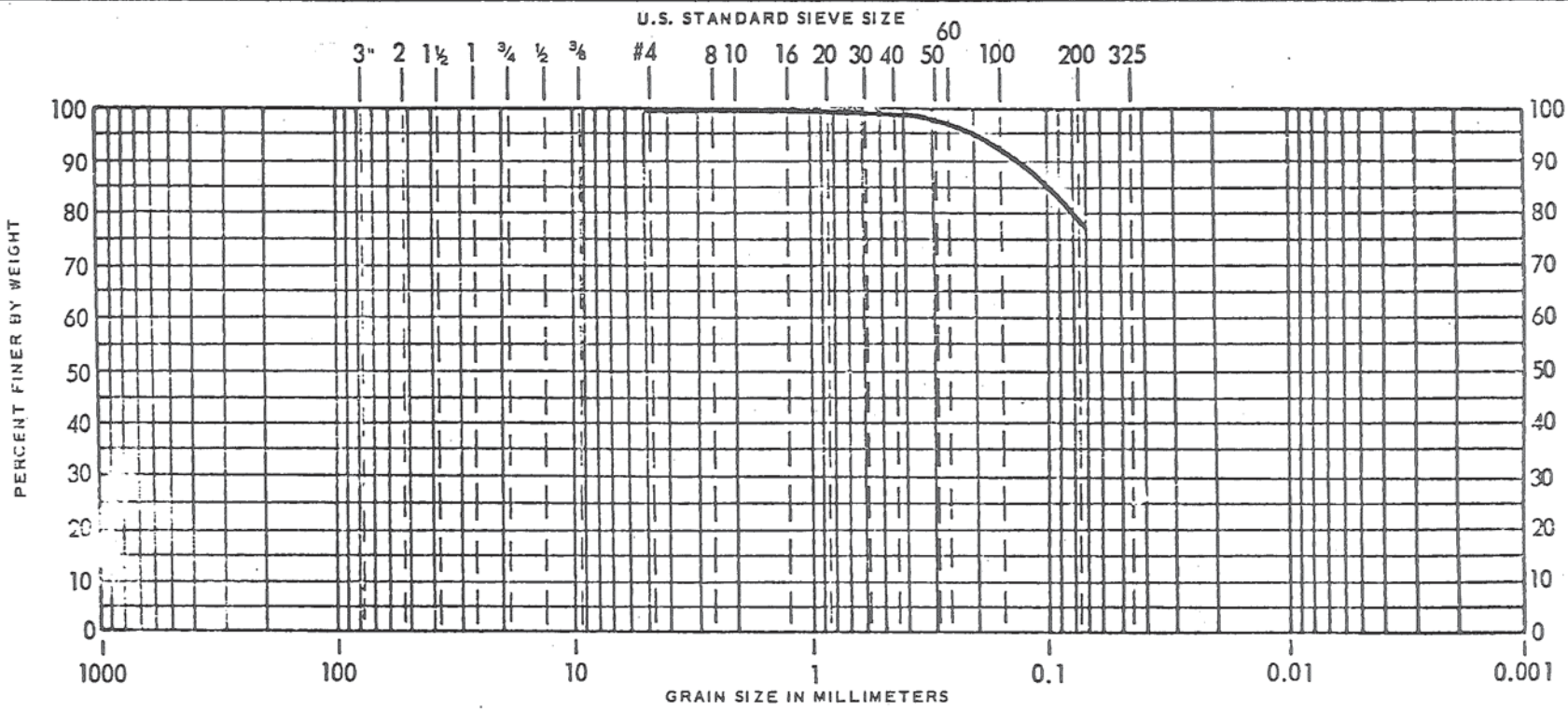
DEPTH 12.5'

BOWSER-MORNER

TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 20%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-80%	-

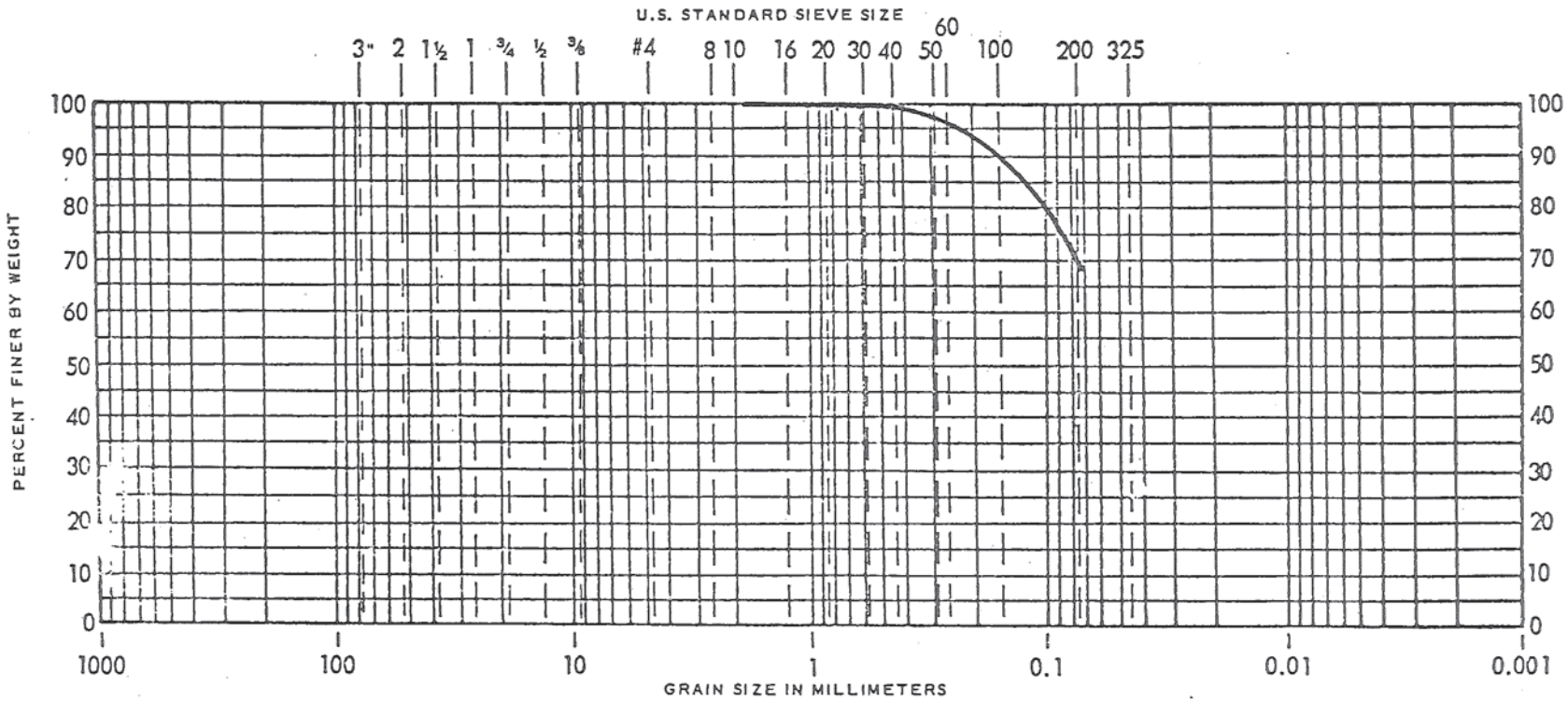
PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION
Location: TP-9
Color: Brown

DEPTH 11.5'

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 31%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-69	%-

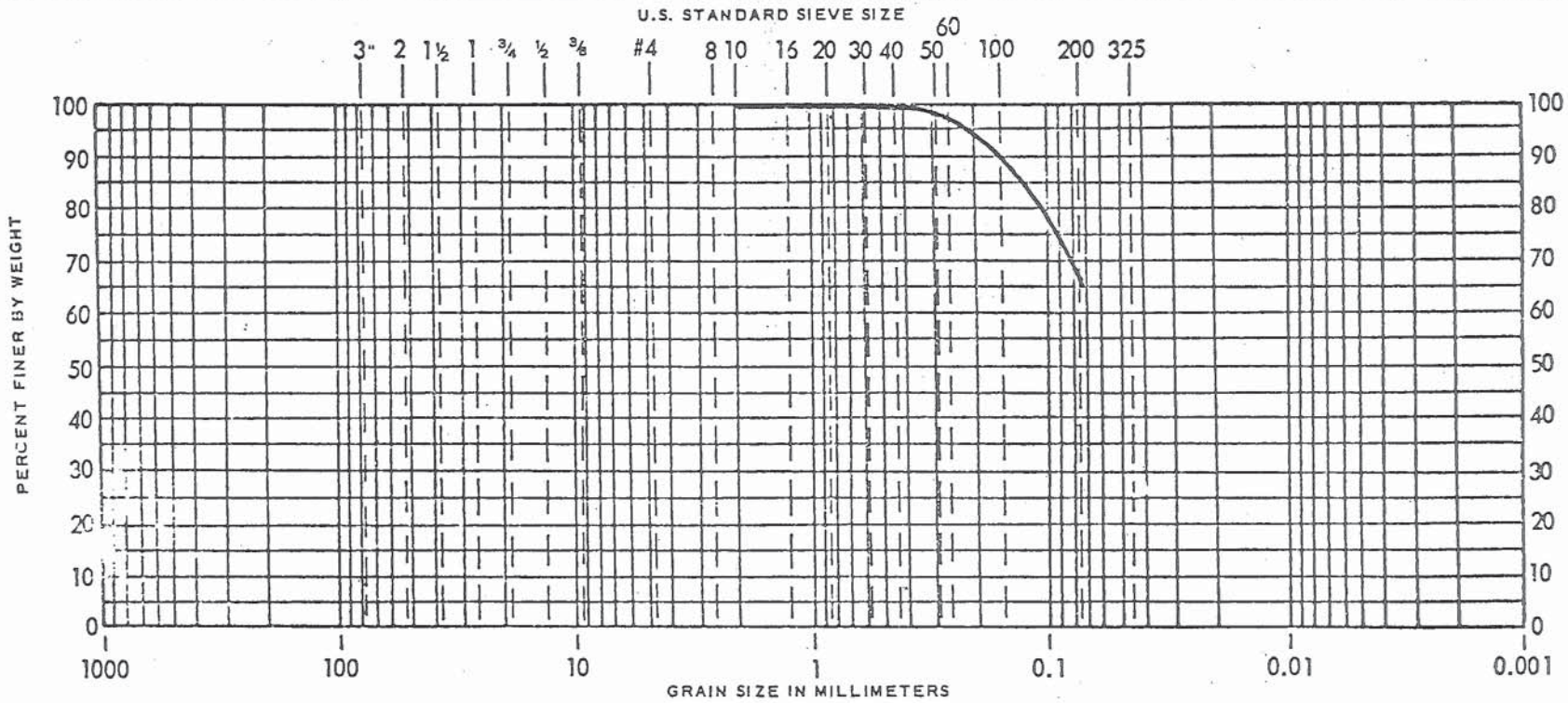
PROJECT KILLEN STATION
Location: TP-10
Color: Brown

DEPTH 10.0'

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 35%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-65	%-

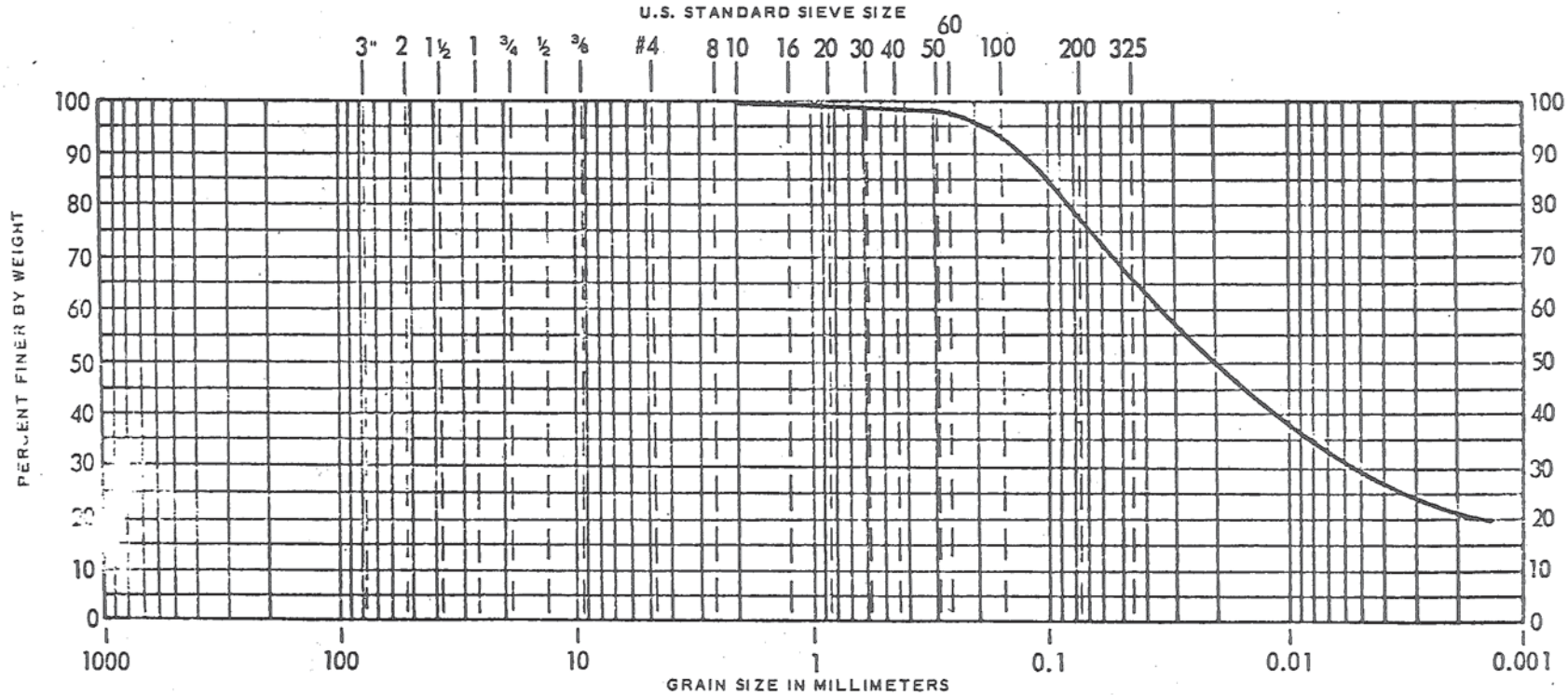
PROJECT KILLEN STATION
Location: TP-10
Color: Brown

DEPTH 13.5'

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL		SAND 20%			SILT 52%	CLAY 28%
	COARSE	FINE	COARSE	MEDIUM	FINE		

PROJECT PROPOSED ASH DISPOSAL POND - KILLEN STATION

BORING NO. TP-14

DEPTH 13.0'

CLASSIFICATION "CL"

silty, sandy CLAY

LIQUID LIMIT 36

PLASTIC LIMIT 23

PLASTICITY INDEX 13

COLOR Brown

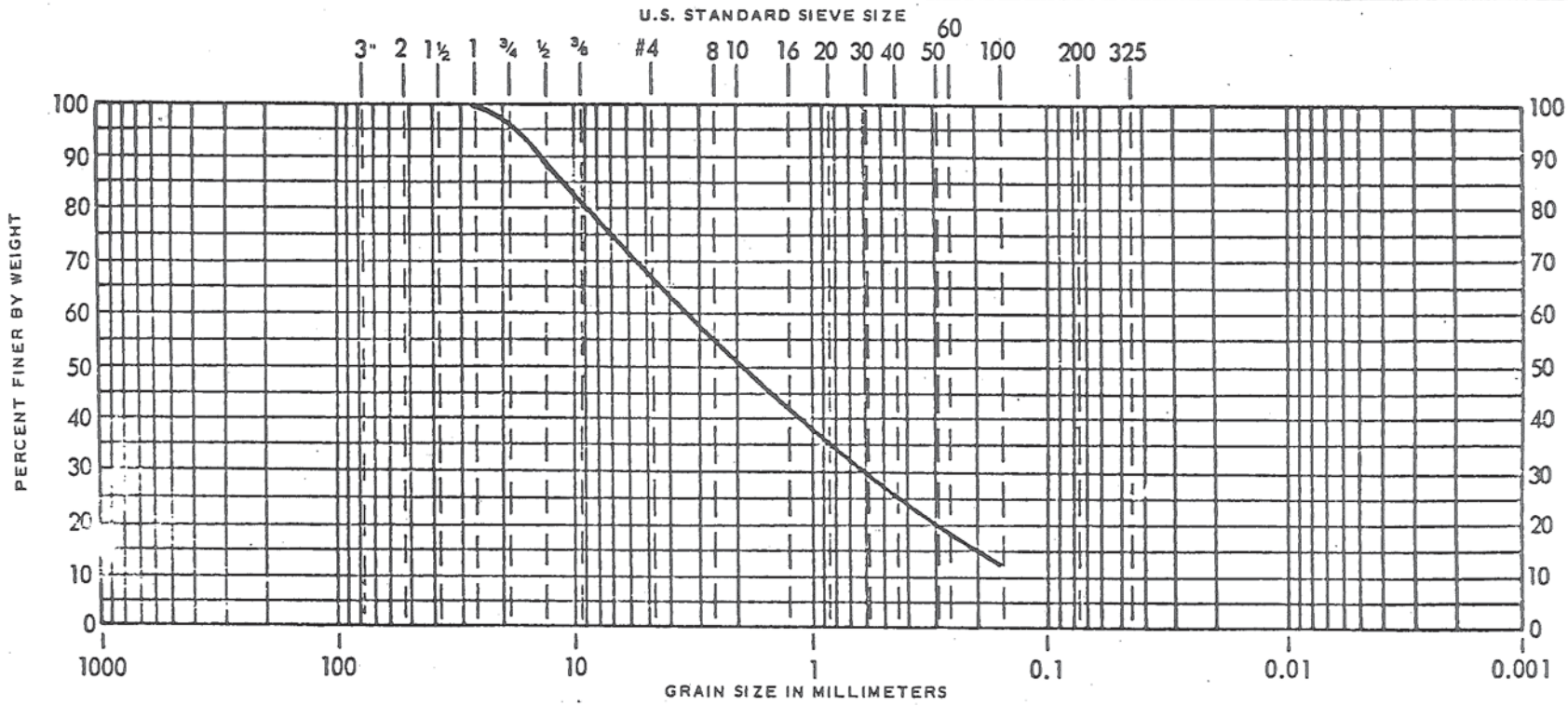
REMARKS "U.S.C.S."

BOWSER-MORNER

TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL 34%		SAND 54%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-12	%-

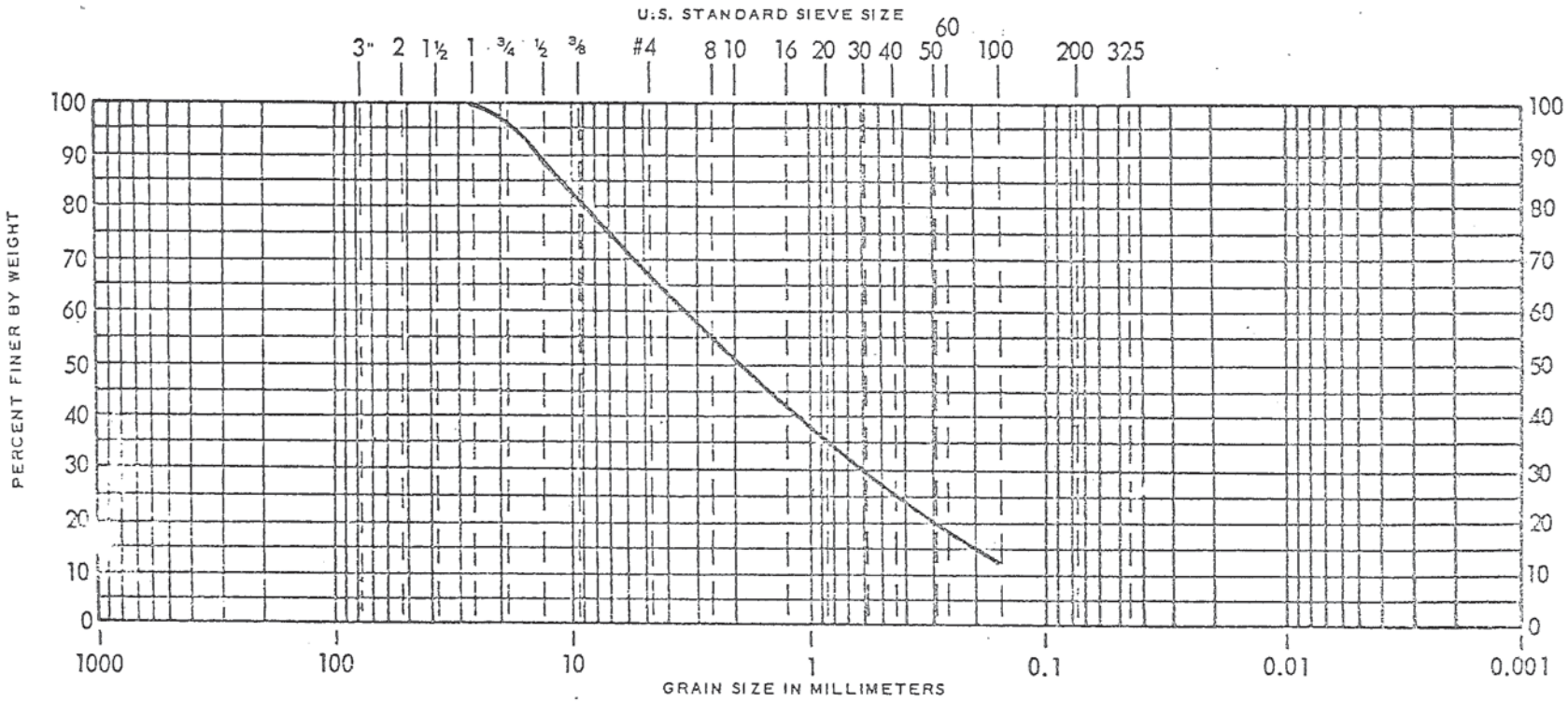
PROJECT KILLEN STATION
Location: TP-15
Color: Brown

DEPTH 12.5'

BOWSER-MORNER
TESTING LABORATORIES, INC.

28-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL 34%		SAND 54%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-12	%-

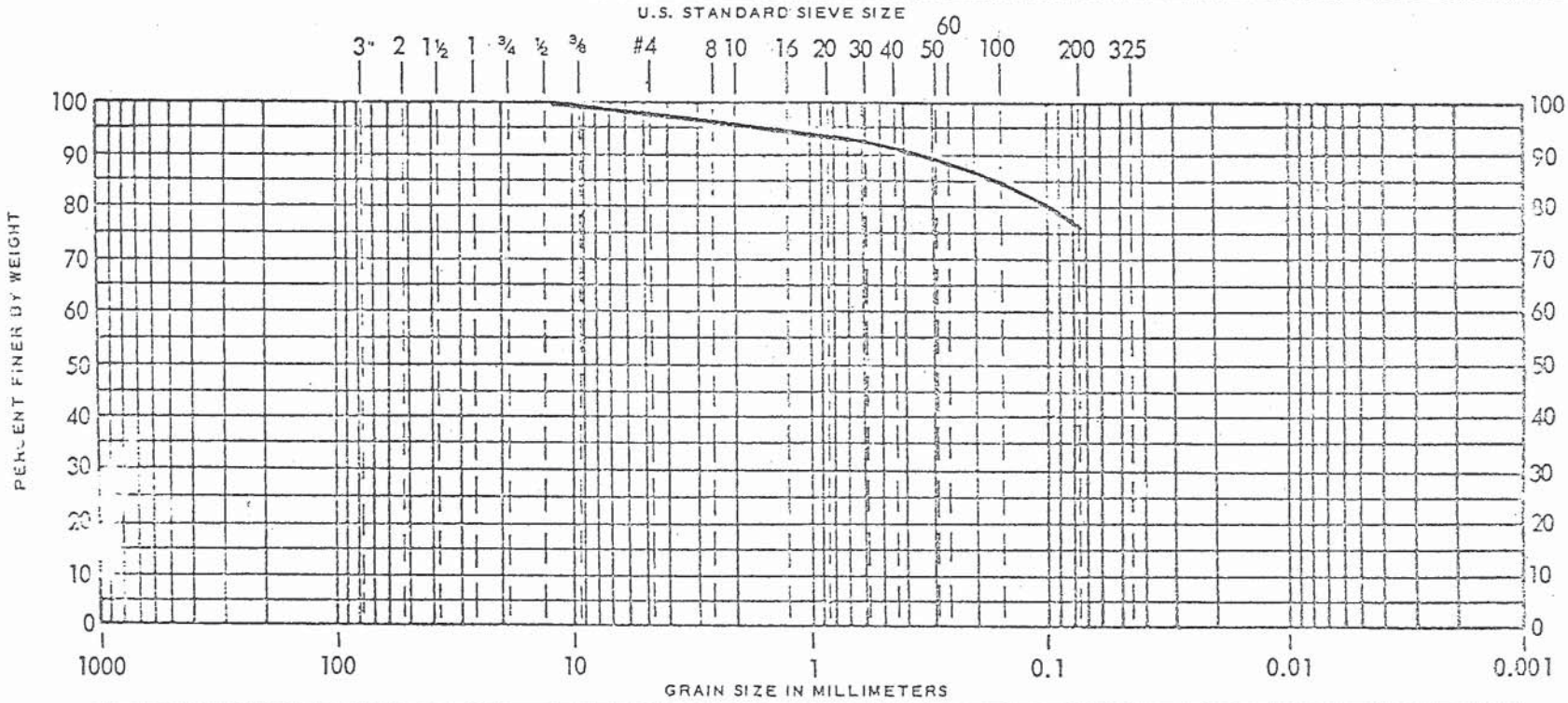
PROJECT KILLEN STATION
Location: TP-15
Color: Brown

DEPTH 12.5'

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

SOIL CLASSIFICATION SHEET



COBBLES	GRAVEL 2%		SAND 22%			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	-76	%-

PROJECT KILLEN STATION
Location: TP-16
Color: Brown

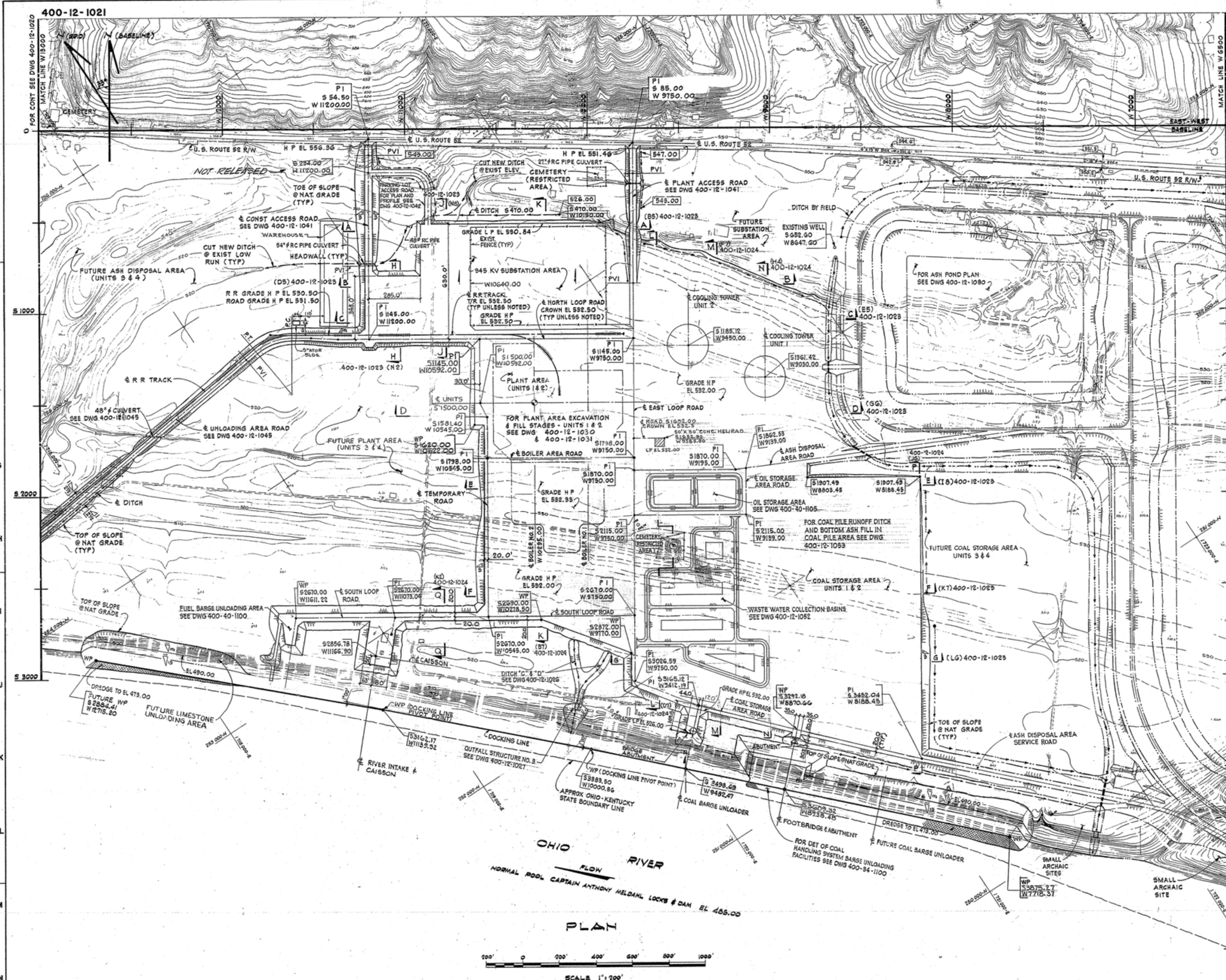
DEPTH 12.0'

BOWSER-MORNER
TESTING LABORATORIES, INC.

2B-1A

APPENDIX 5
Design Drawings
By Ebasco Services, Inc.

400-12-1021



PLAN

SCALE 1" = 200'

PLAN LEGEND

- ⟵ DENOTES DITCH & FLOW DIRECTION
- [000.00] DENOTES ELEV BOTTOM OF DITCH
- [hatched] DENOTES DREDGED AREAS IN OHIO RIVER
- [000.00] DENOTES EXISTING CULVERT INVERT EL
- R/W DENOTES RIGHT OF WAY
- T/R DENOTES TOP OF RAIL

QUANTITIES (NET BY FIELD UNLESS NOTED)

ITEM	0.5' STRIPPING CU YD	DREDGING CU YD	EXCAVATION CU YD	SELECT IMPERVIOUS FILL - CU YD *	SELECT SAND FILL - CU YD	FILL FOR GENERAL GRADING - CU YD *
PLANT AREA ISLAND	12,000	-	691,400	-	845,000	-
PLANT AREA PERIMETER	29,200	-	-	-	-	527,600
COAL STORAGE AREA - UNITS 1 & 2	27,800	-	-	-	-	620,000
STACKER/RECLAIMER	2,400	-	-	-	-	20,800
WASTE WATER COLLECTION BASINS	7,900	-	10,200	99,000	-	8,300
PLANT ACCESS ROADS	17,700	-	20	-	-	299,200
SUBSTATION AREA	12,400	-	-	-	-	185,400
UNLOADING AREA ROAD	8,000	-	169,600	-	-	19,000
CONST UNLOADING FACILITY	-	14,900	4,500	-	4,000	-
OIL STORAGE AREA	2,800	-	-	-	-	39,600
RIVER INTAKE ACCESS AREA	2,600	-	-	-	-	54,900
FUEL BARGE UNLOADING AREA	1,700	-	2,000	-	-	26,000
COAL BARGE UNLOADING AREA	-	31,700 **	84,000	-	-	-
STORM DRAINAGE OUTFALL DITCH "C" & "D"	-	-	9,000	-	-	-
TOTALS	124,500	46,600	970,720	99,000	849,000	1,800,800

~~FILL FOR GENERAL GRADING MAY BE EITHER MISC CLAY FILL OR RANDOM FILL~~

* ~~FILL QUANTITIES INCLUDE FILLING 0.5' STRIPPING VOID~~

** ~~DREDGING QUANTITY INCLUDES 4,800 CUYD SAND~~

NOTES

GRID COORDINATE LOCATIONS ARE BASED UPON OHIO STATE GRID SYSTEM

ALL COORDINATE LOCATIONS ARE REFERRED TO THE NORTH - SOUTH & EAST - WEST COORDINATES OF THE PLANT

MINIMUM DITCH SLOPE SHALL BE .002'/FT UNLESS NOTED

MINIMUM DITCH RADIUS SHALL BE 50.0' UNLESS NOTED

ALL CULVERTS EXCEPT THOSE UNDER PLANT ACCESS ROAD & CONSTRUCTION ACCESS ROAD SHALL BE CORRUGATED METAL PIPE, ASBESTOS BONDED (100% OF PERIPHERY)

~~ALL SITE CLEARING, EXCAVATION, BACKFILL, DRAINAGE FOR PLANT AREA AND DIKES SHALL BE IN ACCORDANCE WITH SPECIFICATIONS DAY-3848-CH2 & CH3 LATEST REVISION~~

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
SITE GENERAL GRADING PLAN - SH 1	400-12-1020
SITE GENERAL GRADING PLAN - SH 3	400-12-1022
SITE GENERAL GRADING SECT. - SH 1	400-12-1023
SITE GENERAL GRADING SECT. - SH 2	400-12-1024
SITE GENERAL GRADING DETAILS - SH 1	400-12-1026
COLLECTION BASINS 1, 2 & 3 - CLEANING WASTE RETENTION BASIN PLAN	400-12-1052
PLANT AREA EXCAVATION & FILL STAGES - UNITS 1 & 2 - SH 1	400-12-1030
PLANT AREA EXCAVATION & FILL STAGES - UNITS 1 & 2 - SH 2	400-12-1031
SITE BORROW AREAS - SH 2	400-12-1033
PLANT AREA GRADING & DRAINAGE - SH 1	400-12-1034
PLANT ACCESS ROADS	400-12-1041
PLANT AREA ROADS - SH 1	400-12-1042
SITE GENERAL GRADING DETAILS - SH 2	400-12-1027
UNLOADING AREA ACCESS RAILROADS & ROADS	400-12-1045
ROADS & RAILROADS SECTIONS & DETAILS	400-12-1046
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
COAL HANDLING SYSTEM BARGE UNLOADERS - GENERAL PLAN	400-34-1100
COAL HANDLING SYSTEM GENERAL LOCATION PLAN	400-35-1100
CONSTRUCTION UNLOADING FACILITIES - SH 1	400-37-1100
FUEL BARGE UNLOADING FACILITY GENERAL PLAN, SECT & DET	400-40-1100
FUEL BARGE UNLOADING FACILITY - SH 4	400-40-1105
COAL PILE RUNOFF DITCH PLAN	400-12-1053
SITE PLAN (MECH)	400-12-7200
PLOT PLAN (MECH)	400-12-7201

GEORGIA REGISTERED No. 9506 PROFESSIONAL ENGINEER JAMES S. SEMPLE, JR.

STATE OF OHIO JAMES S. SEMPLE, JR. No. 38774 REGISTERED PROFESSIONAL ENGINEER

WORK THIS DWG WITH DWG 400-12-1020, 400-12-1022, 400-12-1023 & 400-12-1024

EBASCO REFERENCE NUMBER DAY3848G-12-1021 R-6

REVISIONS

1. ADDED: (K5) ℄ RIVER INTAKE, (K9) ℄ BLOWDOWN OUTFALL, (J10) COAL BARGE UNLOADER FILL, (K14) ASH DISPOSAL AREA SERVICE ROAD. REVISED: CONTAMINATED WASTE WATER COLLECTION BASIN, (K9) DOCKING LINE LOCATION, EXCAVATION, DREDGING, DITCHES & CONC FLUMES, (L19) DWG NO. DELETED: (E13, E16 & H17) BORROW AREAS — DATE 3-14-75, BY DN, CHK KKF, APPROVED JES
2. REVISED: (F10) GRADING, (C12, C15) CULVERT DATA, (E15) ASH POND LAYOUT & DRAINAGE, (C19) QUANTITIES (B18, D19) STRIPPING DIM., (L11) NOTE, (C3, D4) CULV NOTATION (K13, L18) REF DWG, (G18) NOTES, RELEASED: (J3) RIVERFRONT GRADING. ADDED: (J8) FILL LIMITS, (H15, J18) DITCH, (I6) RIVER INTAKE ACCESS RD, (D11) EXISTING WELL & COORD, (J10, J11) CULVERTS, (D12) DITCH, (J1, K5, K8, K9, L13) DOCKING LINE COORD. DELETED: (I5) LIMESTONE UNLOADING AREA ROAD, (I8) LIMESTONE STORAGE AREA FILL, (E11) DITCH "C", (N15) INFO REQD APPLIQUE, (H12) CULVERT DATA, (K18, M18) REF DWG — DATE 5-5-76, BY DN, CHK MWB, APPROVED JES
3. REVISED: (J6, J8, K9, K11) GRADING, (H8) LIM. OF EXCAVATION, (K12, M15) COOR., (B18) QUANTITIES. ADDED: (E9, F5, G9, H9, I3, J7, M15) NOT RELEASED (J1, M14) NOTE. DELETED: (I12) DRAINAGE DITCH (I14) CEMETERY (K9) BLOW-DOWN (M11) REF.
4. REVISED: (C18) QTY TABLE; (E5) FILL & FENCE LOC; (H9) FENCE. ADDED: (I4) GRADING; (J10, K18) EL; (J18, K18) REF DWG; (H11, N17) NOTE. DELETED: (E7, G18, I5, K6) NOTE; (E9, F4, G9, H4, H8, J7, L15) NOT RELEASED — BY RG/RDA, CHK KKF, APPROVED MS/JDS
5. REVISED: (G19) QTY. ADDED: (F19) QTY; (C18) DITCHES & OUTFALL STR; (K18) REF DWG. — BY DN, CH RDA/GSR, APPROVED MS
6. REVISED: (D7) FENCE LOC; (E5) DIM. ADDED: (C13) INFO REQD — DATE 6-13-80, BY DN, CH RDA/GSR/SKT, APPROVED JDS
7. BY ES ENGR, APP'D 3/23/83. ADDED HELICOPTER PAD/CE MR CO 193 — DATE 3-27-81, BY GH, CH LC, APPROVED MS

INFO REQD TO COMPLETE THIS DRAWING
PARKING LOT ACCESS ROAD (DP & L)

NOTE: KILLEN STATION WAS INITIALLY DESIGNED FOR TWO UNITS. IN SEPTEMBER 1980, UNIT 1 WAS CANCELLED. REFERENCES TO UNIT 1 ARE TO BE CONSIDERED AS NOT RELEASED FOR CONSTRUCTION.

EBASCO SERVICES INCORPORATED

TITLE: SITE GENERAL GRADING PLAN SH.-2

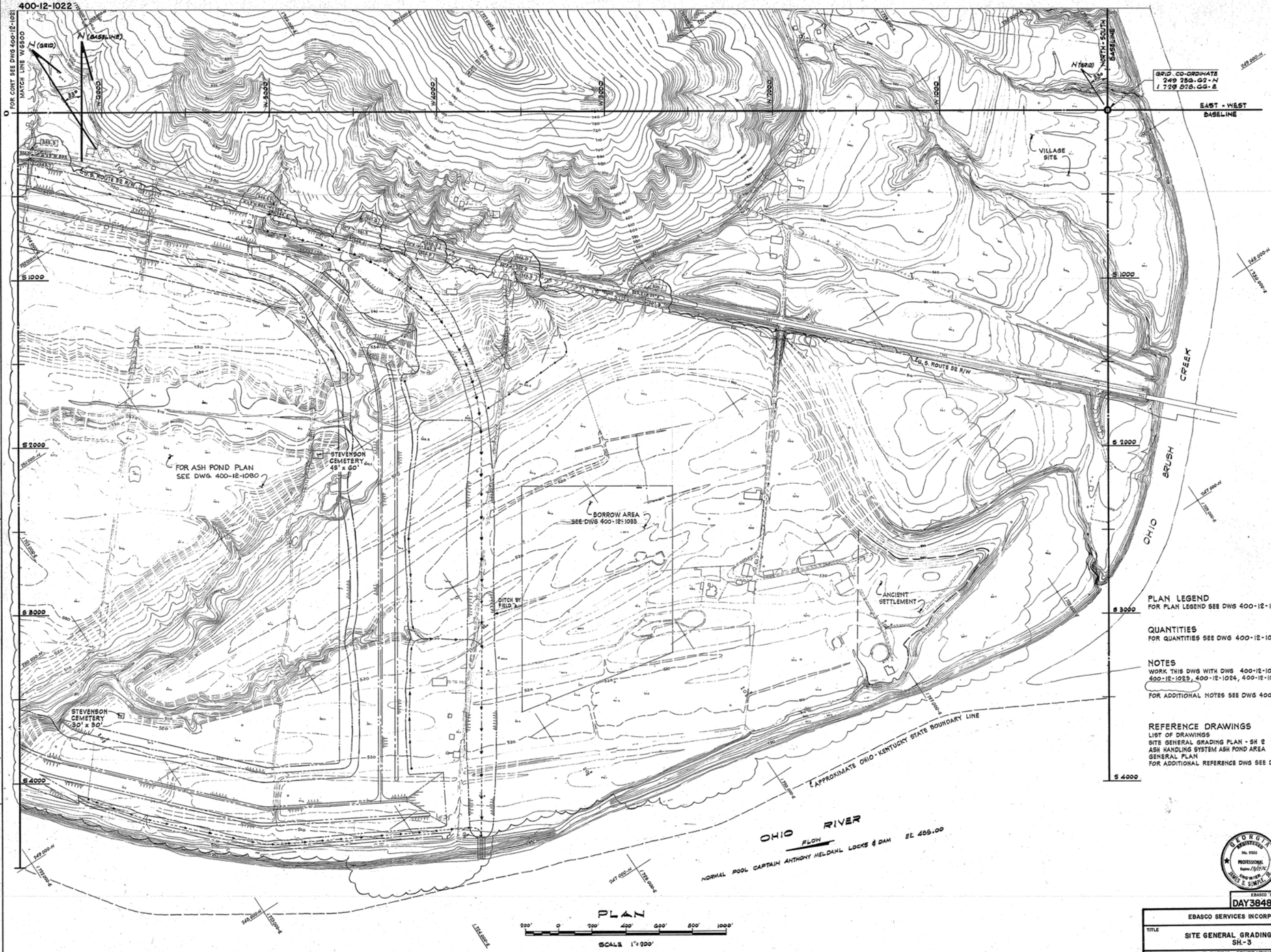
FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO. 2
606,025 KW INSTALLATION UNIT NO. 1

SCALE 1" = 200'	DIV. CIVIL		PROJECT
DRAWN D. NORRIS		9-26-74	APPROVED James S. Semple Jr. 10/1/74
CHECKED T. HSU	R. HOLT	9-26-74	APPROVED
ENGINEER			APPROVED

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1021 SHEET OF SHEETS

400-12-1022



PLAN LEGEND

FOR PLAN LEGEND SEE DWG 400-12-1021

QUANTITIES

FOR QUANTITIES SEE DWG 400-12-1021

NOTES

WORK THIS DWG WITH DWG 400-12-1020, 400-12-1021, 400-12-1023, 400-12-1024, 400-12-1026

FOR ADDITIONAL NOTES SEE DWG 400-12-1021

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
SITE GENERAL GRADING PLAN - SH 2	400-12-1021
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080

FOR ADDITIONAL REFERENCE DWG SEE DWG 400-12-1021

GEORGIA REGISTERED No. 9305 PROFESSIONAL ENGINEER Expires 12/31/94 JAMES R. SIMPKINS, JR.

STATE OF OHIO JAMES S. SEARLE, JR. No. 38174 REGISTERED PROFESSIONAL ENGINEER

EBASCO REFERENCE NUMBER: DAY3848G-12-1022 R-2

EBASCO SERVICES INCORPORATED

TITLE: SITE GENERAL GRADING PLAN SH.-3

FOR: KILLEN ELECTRIC GENERATING STATION
606,028 KW INSTALLATION UNIT NO.2
606,028 KW INSTALLATION UNIT NO.1

SCALE 1" = 200'	DIV. CIVIL	PROJECT	
DRAWN D. NORRIS	9-26-74	APPROVED	10/16/74
CHECKED W. FAEAU	9-26-74	APPROVED	
ENGINEER		APPROVED	

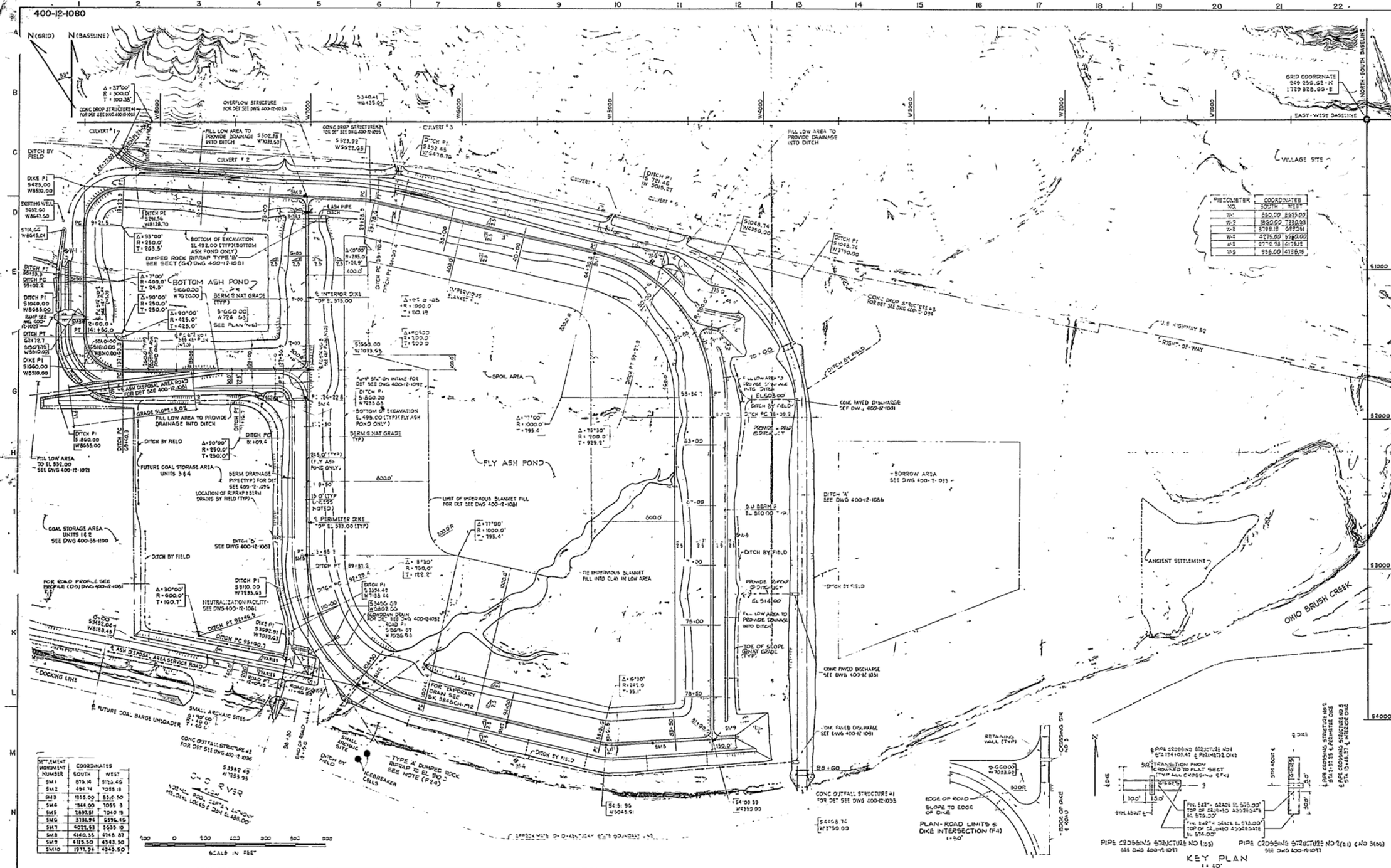
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1022
SHEET OF SHEETS

REVISIONS

	DATE	BY	CHK	APPROVED
1 ADDED (1) ASH DISPOSAL AREA (2) ROAD (3) ALIGNMENT (4) SEWERS FROM ALLISON TISO NOTE (5) ANCIENT SETTLEMENT (6) STEVENSON CEMETERY (7) SITE GENERAL GRADING AREAS	4/4/75	DN	KEF	
2 REVISED (6&7) ASH POND LAYOUT & DRAINAGE (CONTOURS) (8) ADDED CO. DR. DS, SG, KS, (10) CULVERT DATA ADDED (11) ROAD (12) ANCIENT SETTLEMENT (13) NORTH AREA	10/16/74	DN		

400-12-1080



SETTLEMENT MONUMENT NUMBER	COORDINATES SOUTH	WEST
SM1	519.16	5159.46
SM2	494.74	7055.13
SM3	1355.00	8516.50
SM4	1844.00	1055.3
SM5	2892.51	7040.79
SM6	3381.94	5596.15
SM7	4022.53	5635.10
SM8	4140.35	4148.87
SM9	4715.50	4343.50
SM10	4971.74	4343.50

PIEZOMETER NO.	COORDINATES SOUTH	WEST
W-1	550.00	5503.00
W-2	1850.00	7250.00
W-3	5799.18	5992.91
W-4	5275.00	5592.00
W-5	5774.73	4179.15
W-6	936.00	4156.18

QUANTITIES (NET BY FIELD UNLESS NOTED)

AREA	1.0' STRIPPING CU YD	SELECT & IMPERVIOUS FILL CU YD	MISC CLAY FILL CU YD	RANDOM* FILL CU YD
ASH POND PERIMETER DIKE INCL ROADS	138,800	1,524,100	83,800	2,153,400
ASH POND INTERIOR DIKE	7,500	—	—	188,800
ASH POND IMPERVIOUS BLANKET	—	803,100	—	—

* ALL FILL QUANTITIES INCLUDE FILLING 1.0' STRIPPING VOID

TOPSOIL FILL ON DIKE SLOPES 71,900 CU YD

AREA	0.35' STRIPPING CU YD	SAND EXCAVATION CU YD	SILT & CLAY EXCAVATION CU YD	RANDOM EXCAVATION CU YD
ASH POND	209,700	820,000	3,200,000	2,711,100

MAXIMUM BOTTOM ASH POND STORAGE CAPACITY 3,069,400 CU YD

MAXIMUM FLY ASH POND STORAGE CAPACITY 17,749,800 CU YD

DUMPED ROCK RIPRAP TYPE "A" 1,400 CU YD

DUMPED ROCK RIPRAP TYPE "B" 450 CU YD

SELECT SAND FILTER 90 CU YD

LEGEND

* SM DENOTES SETTLEMENT MONUMENT
* ◇ DENOTES PIEZOMETER LOCATION

NOTES

DUMPED ROCK RIPRAP SHALL CONFORM TO STATE OF OHIO DEPT OF TRANSPORTATION CONSTRUCTION AND MATERIAL SPECIFICATION ITEM 601.07

ALL CLEARING, EXCAVATION, BACKFILL, DRAINAGE AND DIKES SHALL BE IN ACCORDANCE WITH SPECIFICATIONS DAY 3848-CH-2 & CH-3 LATEST REVISION

FOR DETAILS SEE DWG 400-12-1081, 400-12-1082, 400-12-1083 & 400-12-1092 THRU 400-12-1096

FIELD TO VERIFY DIKE COORDINATES & TOE OF DIKE WITH EXISTING CONTOURS

FOR ADDITIONAL NOTES SEE DWG 400-12-1020

CULVERT'S DRAINAGE # 2, #3, #4 & #5 TO BE BLENDED WITH DITCH "A" AND DRESSED WITH RIPRAP SIM TO TYPICAL SECTION ON DWG 400-12-1083 FROM EXIST R/W TO DITCH A

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
SITE GENERAL GRADING PLAN SH 1	400-12-1020
SITE GENERAL GRADING PLAN SH 2	400-12-1021
SITE GENERAL GRADING PLAN SH 3	400-12-1022
SITE GENERAL GRADING SECT SH 1	400-12-1023
SITE GENERAL GRADING SECT SH 2	400-12-1024
SITE GENERAL GRADING DETAILS SH 1	400-12-1025
MISC RAMPS SECT & DET	400-12-1029
ASH HANDLING SYSTEM DIKES, SECT & DETAILS-M & R	400-12-1081
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS-M & R-SH1	400-12-1082
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS-M & R-SH2	400-12-1083
ASH HANDLING SYSTEM PERIMETER DIKE & PROFILE SH 1	400-12-1084
ASH HANDLING SYSTEM PERIMETER DIKE & INTERIOR DIKE & PROFILES SH 2	400-12-1085
ASH HANDLING SYSTEM ASH POND DITCH "A" & PROFILE SH 3	400-12-1086
ASH HANDLING SYSTEM ASH POND DITCH "B" & PROFILE SH 6	400-12-1087
ASH HANDLING SYSTEM ASH POND PERIMETER DIKE SECT SH 1	400-12-1088
ASH HANDLING SYSTEM ASH POND PERIMETER DIKE SECT SH 2	400-12-1089
ASH HANDLING SYSTEM ASH POND PERIMETER DIKE SECT SH 3	400-12-1090
ASH HANDLING SYSTEM ASH POND PERIMETER DIKE & INTERIOR DIKE SECT SH 4	400-12-1091
SITE BORROW AREAS SH 2	400-12-1033
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS-M & R-SH 3	400-12-1092
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS-M & R-SH 4	400-12-1093
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS-M & R-SH 5	400-12-1094
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS-M & R-SH 6	400-12-1095
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS-M & R-SH 7	400-12-1096
TEMPORARY DRAIN AT SPRING RUN	SK 3848CH-M2
NEUTRALIZATION FACILITY-SH1	400-12-1061
ASH HANDLING SYSTEM MISC STRUCTURES SECT & DETAILS-M & R-SH 7	400-12-1097

WORK THIS DRAWING WITH DWG 400-12-1021 & 400-12-1081 THRU 400-12-1096

EBASCO REFERENCE NUMBER DAY 3848G-12-1080 R-12

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN

FOR: KILLEN ELECTRIC GENERATING STATION 800,000 KW INSTALLATION UNIT NO.1 800,000 KW INSTALLATION UNIT NO.2

SCALE 1"=200' BY CIVIL

DRAWN D. NORRIS — 2-26-76 APPROVED

CHECKED D. BUTALLA — 2-26-76 APPROVED

CHECKED — 2-26-76 APPROVED

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

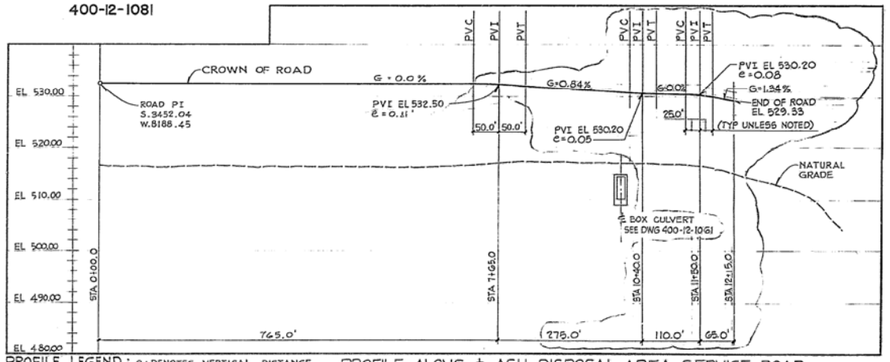
400-12-1080

KFD-611-82

REVISIONS

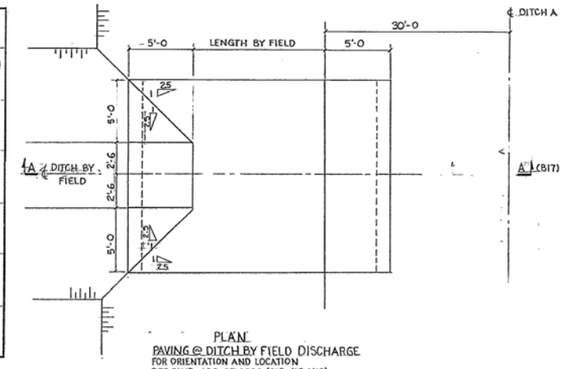
1	REVISED (LEG) & STATION (SUM & MA A-CAPP (C2) DITCH & CAPP (C2) DITCH & DIKE		
2	REVISED (T18) BORROW AREA, ADDED (DITCH WALL (CONC PG) ADDED (DITCH WALL (CONC PG) SMALL DRAINAGE DITCH, (T4) DITCH (T5) DITCH, (T6) DITCH, (T7) DITCH, (T8) DITCH, (T9) DITCH, (T10) DITCH, (T11) DITCH, (T12) DITCH, (T13) DITCH, (T14) DITCH, (T15) DITCH, (T16) DITCH, (T17) DITCH, (T18) DITCH, (T19) DITCH, (T20) DITCH, (T21) DITCH, (T22) DITCH, (T23) DITCH, (T24) DITCH,

400-12-1081

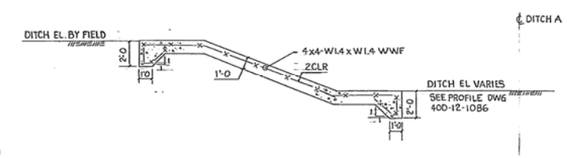


PROFILE LEGEND: e: DENOTES VERTICAL DISTANCE FROM CROWN OF ROAD TO A POINT OF VERTICAL INTERSECTION (PVI) OF TANGENTS TO PARABOLIC CURVE
G: DENOTES GRADE PERCENT SLOPE

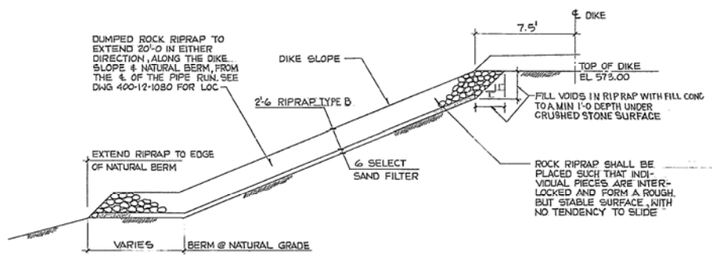
PROFILE ALONG ℄ ASH DISPOSAL AREA SERVICE ROAD
(FOR ORIENTATION & LOCATION SEE DWG 400-12-1080)
1 = 10' VERT
1 = 100' HORIZ



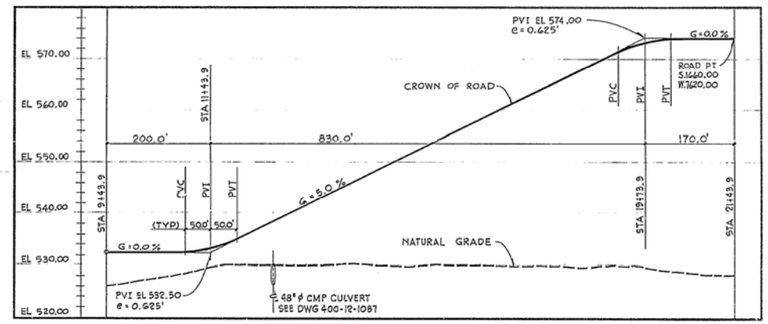
PLAN
PAVING @ DITCH BY FIELD DISCHARGE
FOR ORIENTATION AND LOCATION
SEE DWG 400-12-1080 (G13, J13, M13)
¼"=1'-0



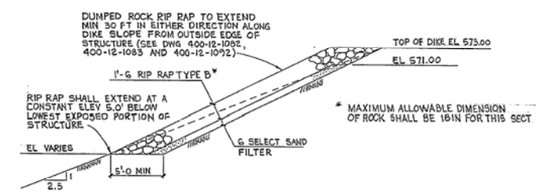
SECT A (B14)
¼"=1'-0



TYP SECT - RIPRAP AT ASH SLUICE PIPE DISCHARGE
NTS



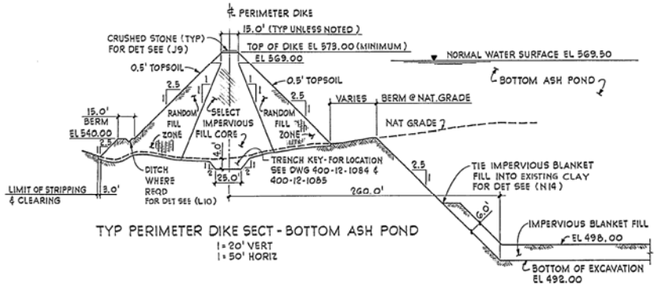
PROFILE ALONG ℄ ASH DISPOSAL AREA ROAD
(FOR ORIENTATION & LOCATION SEE DWG 400-12-1080)
1 = 10' VERT
1 = 100' HORIZ



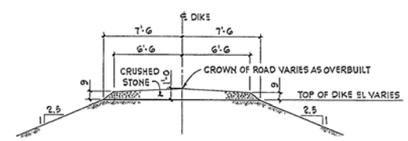
TYP SECT - RIP RAP AROUND DIKE STRUCTURES
NTS

QUANTITIES (NET BY FIELD UNLESS NOTED)

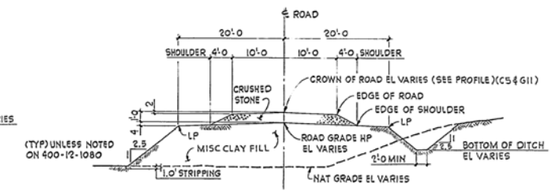
CRUSHED AGGREGATE (ITEM 411)	10,250 CU YD
CONCRETE CLASS A (3500 PSI)	72 CU YD
¼x4-W1.4 x W1.4 WELDED WIRE FABRIC	2260 SQ FT



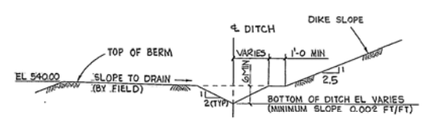
TYP PERIMETER DIKE SECT - BOTTOM ASH POND
1 = 20' VERT
1 = 50' HORIZ



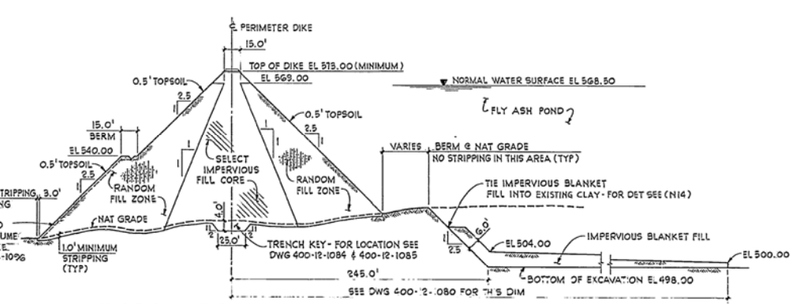
TYP DET - CRUSHED STONE ON TOP OF DIKES
1 = 5'



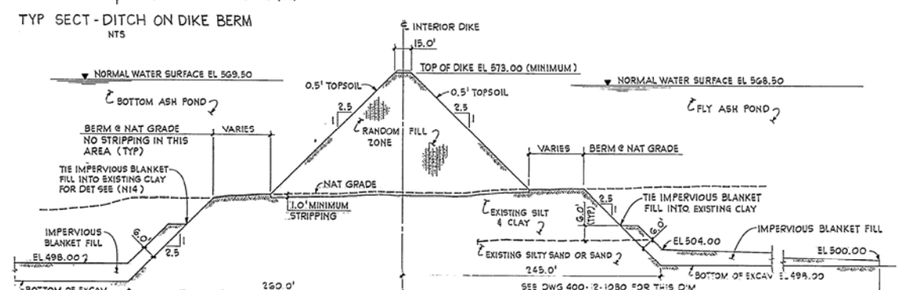
TYP DET - ASH DISPOSAL AREA ROAD & ASH DISPOSAL AREA SERVICE ROAD
1 = 5' VERT
1 = 10' HORIZ



TYP SECT - DITCH ON DIKE BERM
NTS



TYP PERIMETER DIKE SECT - FLY ASH POND
1 = 20' VERT
1 = 50' HORIZ



TYP INTERIOR DIKE SECT
1 = 20' VERT
1 = 50' HORIZ

NOTES
FOR GENERAL NOTES SEE DWG 400-12-1080
ALL VERTICAL CURVES SHALL BE PARABOLIC CURVES
CRUSHED AGGREGATE SHALL CONFORM TO STATE OF OHIO DEPT OF TRANS CONSTRUCTION AND MATERIAL SPECIFICATION ITEM 411

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM PERIMETER DIKE & PROFILE SH 1	400-12-1084
ASH HANDLING SYSTEM PERIMETER DIKE & INTERIOR DIKE & PROFILE SH 2	400-12-1085
ASH HANDLING SYSTEM ASH POND DITCH "A" & PROFILE SH 3	400-12-1086
ASH HANDLING SYSTEM ASH POND DITCH "B" & PROFILE SH 4	400-12-1087
ASH HANDLING SYSTEM MISC STRUCTURES SECTS & DETS M&R SH 1	400-12-1082
ASH HANDLING SYSTEM MISC STRUCTURES SECTS & DETS M&R SH 2	400-12-1083
ASH HANDLING SYSTEM MISC STRUCTURES SECTS & DETS M&R SH 3	400-12-1092
ASH HANDLING SYSTEM MISC STRUCTURES SECTS & DETS M&R SH 7	400-12-1096
NEUTRALIZATION FACILITY SH 1	400-12-1061

STATE OF OHIO — JAMES S. SHAFER, JR. — No. 20774 — REGISTERED PROFESSIONAL ENGINEER

LONG'S REGISTERED — No. 9906 — PROFESSIONAL ENGINEER — STATE OF OHIO

WORK THIS DWG WITH DAS 400-12-1080

EBASCO REFERENCE NUMBER: DAY3848G — 12 — 1081 R-4

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
DIKES, SECTIONS & DETAILS - SH 1

FOR: KILLEN ELECTRIC GENERATING STATION
608,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

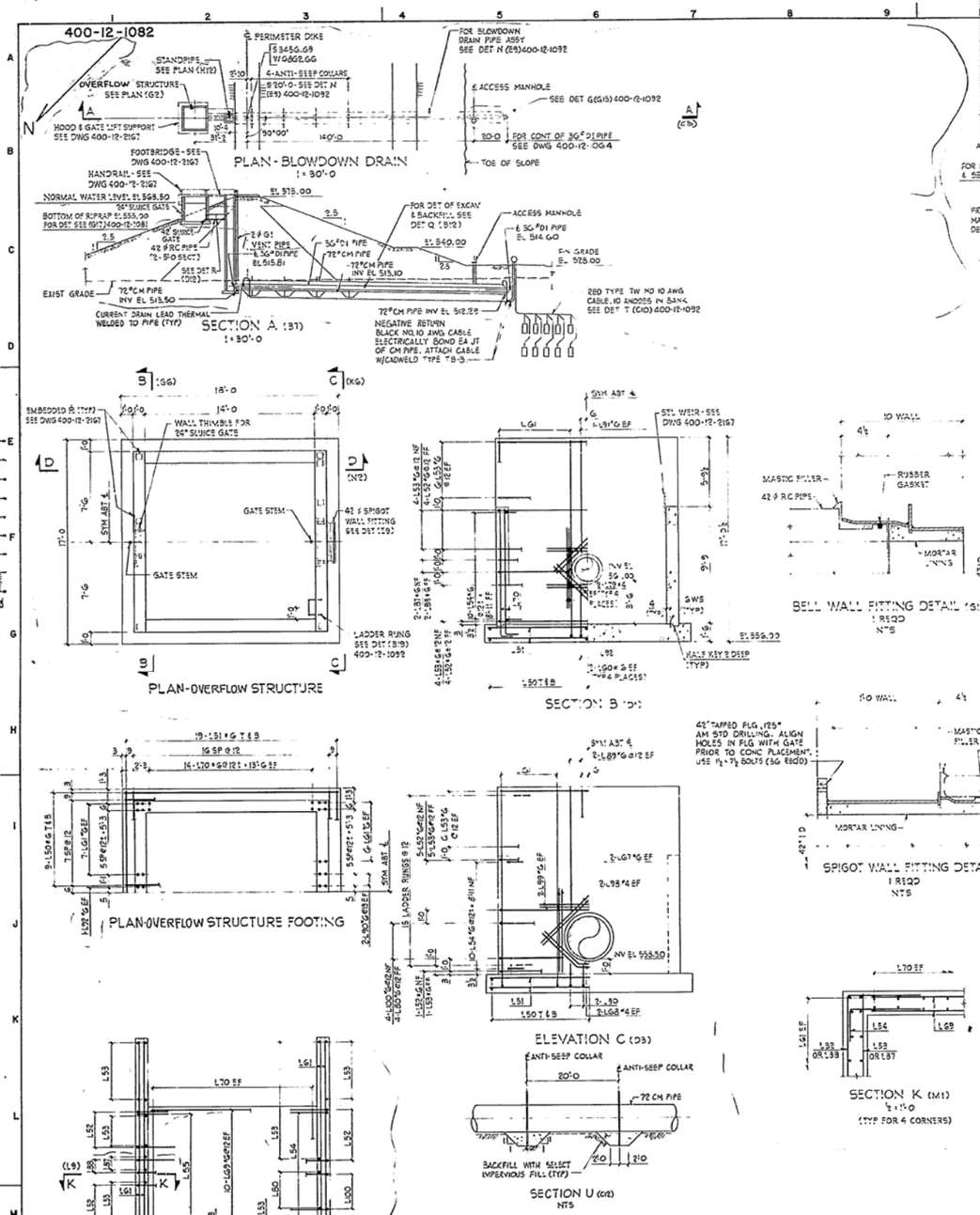
SCALE AS NOTED	DR. C. J. L.	ROADSET	
DRAWN D. NORRIS	12-27-76	APPROVED	12-29-76
CHECKED K. EATEHPURIA	12-28-76	APPROVED	
ENGINEER	12-28-76	APPROVED	

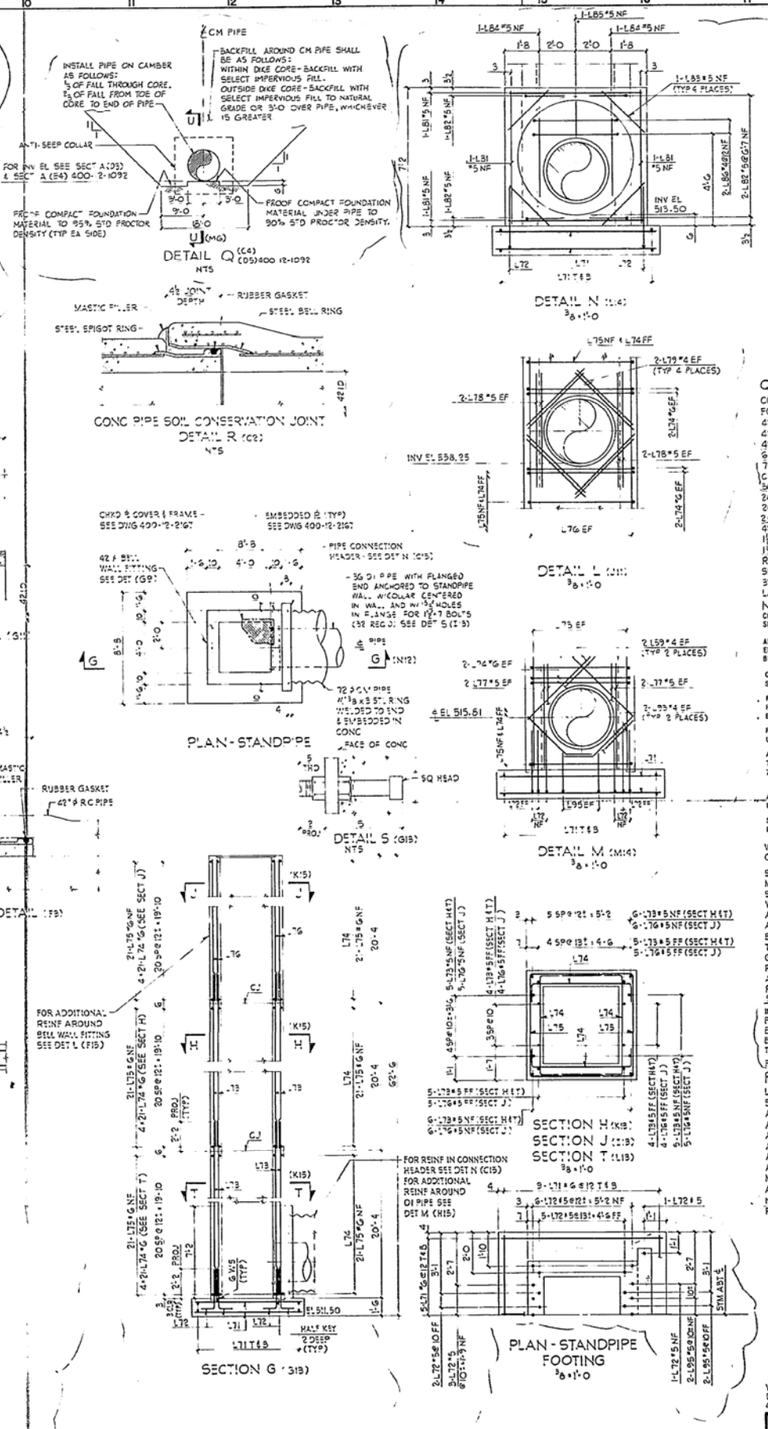
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1081
SHEET OF SHEETS

REVISIONS

	DATE	BY	CHK	APPROVED
1	REV(P)50 (K-4) SECT ADDED (10 FT) SECT, (P4,N4) MISC (G4,H4)			
2	REV (P4) MISC (G4,H4)			
3	ADDED (B17) PLAN, SECT (B14) QUANTITIES - AS PER DCN 503-C27 8/21/80			
4	REVISED (B7) PROFILE			





QUANTITIES (NET BY FIELD UNLESS NOTED)

CONCRETE CLASS "A" (3500 PSI)	93 CU YD
FOR REINF STEEL SEE BAR BENDING SCHEDULE 400-12-1300-14	
42 ϕ BELL WALL FITTING	1 REQD
42 ϕ SPIGOT WALL FITTING	1 REQD
42 ϕ R C PIPE	11 LIN FT
6"x3/8 PVC WATERSTOP	80 LIN FT
72 ϕ CM PIPE (12 GAGE)(CSH CORRUGATIONS)	16.0 LIN FT
CM ANTI-SEEP COLLAR	4 REQD
36" ϕ DI PIPE	16.0 LIN FT
24" SLUICE GATE & LIFT	1 REQD
24 ϕ WALL THIMBLE	1 REQD
2 ϕ GI PIPE	60 LIN FT
42" SLUICE GATE & LIFT	1 REQD
1"x 7" BOLT (A-307 STEEL) W/2 HEX NUTS	32 REQD
1"x 7½" BOLT (A-307 STEEL) W/HEX NUT	56 REQD
RIPRAP	200 CU YD
SELECT SAND FILTER & BEDDING	85 CU YD
32 LB MAGNESIUM ANODE - 48 PER DET (C10) 400-12-1092	10 REQD
LADDER RUNG - 48 PER DET (B19) 400-12-1092	15 REQD

NOTES

CONCRETE SHALL BE CLASS "A" (3500 PSI)
SEE SPECIFICATION EBASCO DAY 3848-CH 5

ALL ANCHOR BOLTS, DRAIN PIPES, PIPE SLEEVES, ELECTRICAL CONDUITS AND EMBEDDED PARTS SHALL BE IN POSITION BEFORE CONCRETE IS PLACED.

CURRENT ACI STANDARDS SHALL GOVERN FOR ALL DESIGN AND CONSTRUCTION UNLESS OTHERWISE NOTED.

FOR SPECIFICATIONS FOR STEEL FOR CONCRETE REINFORCING BARS AND FOR BAR DETAILS SEE BAR BENDING SCHEDULE.

PLACING DIMENSIONS ARE GIVEN TO CENTER OF BARS UNLESS NOTED.

ALL SPLICES IN REINFORCEMENT SHALL COMPLY WITH THE REQUIREMENTS OF ACI 318 71 CODE SECTIONS 7.5 TO 7.12 INCLUSIVE.

ALL BARS SHALL HAVE 2" MINIMUM CONCRETE COVER UNLESS OTHERWISE NOTED.

SHIFT OR BEND BARS TO CLEAR ANCHOR BOLTS, DRAINS, PIPE SLEEVES AND EMBEDDED PARTS.

WATERSTOPS "TO BE 6"x3/8 PVC (UNLESS NOTED) PLACED CONTINUOUSLY SPLICES TO BE LAPPED AND WELDED.

SLUICE GATES SHALL BE HEAVY DUTY SLUICE GATES, ARMCO MODEL 55-10 OR EQUAL, WITH ROUND OPENING, RISING STEM, STANDARD BOTTOM, FLANGE BACK AND ADJUSTABLE SIDE WEDGES. PEDESTAL BASE HANDWHEEL LIFTS SHALL BE ARMCO MODEL WPB-8 WITH 1" DIA STAINLESS STEEL STEM AND BRONZE LIFT NUT OR EQUAL. WALL THIMBLE SHALL BE ARMCO ROUND FLANGE ROUND OPENING, NO LONG WALL THIMBLE OR EQUAL WITH STAINLESS STEEL ANCHOR BOLTS. GATES SHALL NOT BE REMOVED FROM FRAMES FOR ANY REASON PRIOR TO INSTALLATION. STEM GUIDES SHALL BE ATTACHED TO WALLS AS PER MANUFACTURER'S RECOMMENDATION. FOR LOCATIONS AND DETAILS OF EMBEDDED PLATES SEE DWG 400-12-2167

IN SMALL AREAS AROUND PIPES AND STRUCTURES WHERE IT IS NOT POSSIBLE TO COMPACT USING LARGE SCALE MOBILE COMPACTION EQUIPMENT, FILL MATERIAL SHALL BE BROUGHT UP IN LIFTS NOT TO EXCEED 6 INCHES AND COMPACTED BY HAND, SMALL MECHANICAL TAMPERS, OR OTHER SUITABLE MEANS TO ATTAIN MINIMUM REQUIRED DENSITY

FOR DUCTILE IRON PIPE SPECIFICATION SEE NOTE (118) 400-12-1092

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
BAR BENDING SCHEDULE	400-12-1300-14
ASH HANDLING SYSTEM -	
ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM DIKES, SECT & DET	400-12-1081
ASH HANDLING SYSTEM -	
ASH POND DITCH "B" & PROFILE	400-12-1087
ASH HANDLING SYSTEM -	
MISC STRUCTURES, SECT & DET-M&R-SH 3	400-12-1092
ASH POND MISC STEEL	400-12-2167
NEUTRALIZATION FACILITY SH 4	400-12-1004
FOR ADDITIONAL REF DWG SEE DWG 400-2-1080	

8/24/79

STATE OF OHIO — JAMES S. SIMPLE JR. No. 34774 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA — No. 9904 — REGISTERED PROFESSIONAL ENGINEER — JAMES S. SIMPLE JR.

WORK THIS DWG WITH DWG 400-12-1080, 400-12-1092 & 400-12-2167

EBASCO REFERENCE NUMBER: DAY3848G 12-1082 R-4

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
MISC STRUCTURES, SECT & DET-M&R-SH 1

FOR: KILLEN ELECTRIC GENERATING STATION
506,025 KW INSTALLATION UNIT NO.2
506,025 KW INSTALLATION UNIT NO.1

SCALE 1"=1'-0 UNLESS NOTED	MK. CIVIL	PROJECT	
DRAWN D. NORRIS / GOODMANN	6-15-76	APPROVED	7-12-76
CHECKED A. MIKHAIL / T. HSU	6-16-76	APPROVED J.D. SYKES, Sr.	6-29-76
ENGINEER	6-24-76	APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1082
SHEET OF SHEETS

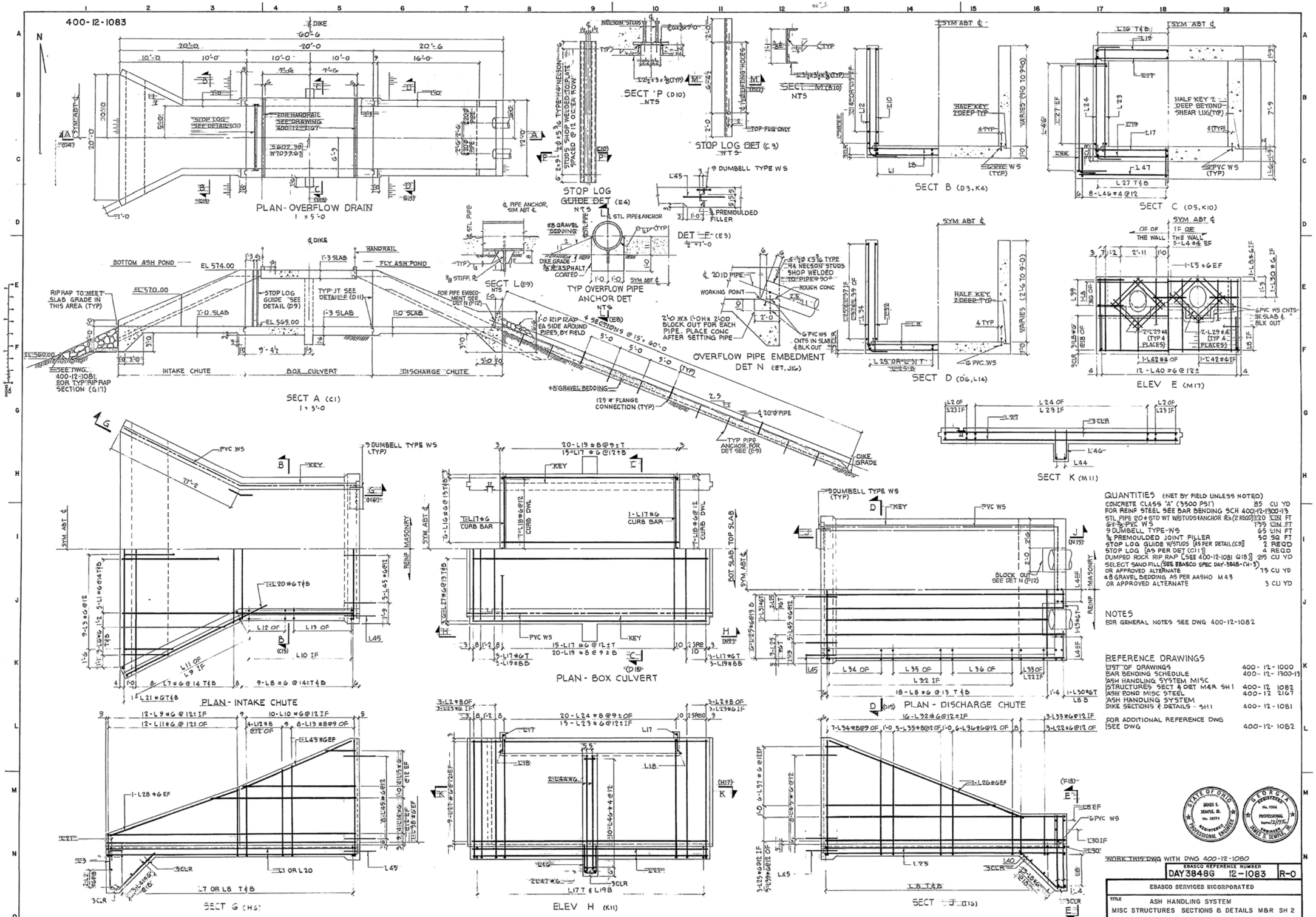
REVISIONS

1	REVISED: (106 SECT A); (110 SECT D); (113 SECT E); (103 PLAN - MISC STRUCT); (99 QUANT); (4 SECT C); ADDED (L, G) NOTE.	DRN BY CG	APPROVED KK/JS
2	REVISED (A) NOTE IN (106 SECT A); (110 SECT D); (113 SECT E); (99 QUANT); (4 SECT C); ADDED (L, G) NOTE.	DRN BY CG	APPROVED KK/JS
3	REVISED (A) NOTE IN (106 SECT A); (110 SECT D); (113 SECT E); (99 QUANT); (4 SECT C); ADDED (L, G) NOTE.	DRN BY CG	APPROVED KK/JS
4	REVISED: (A) NOTE IN (106 SECT A); (110 SECT D); (113 SECT E); (99 QUANT); (4 SECT C); ADDED (L, G) NOTE.	DRN BY CG	APPROVED KK/JS
5	REVISED (B&G LIT)		

DWG NO. 400-12-1082 — DRN BY CG — APPROVED JT/DB WW/GR JW/JV

BY K.L.S. 3-4-86 CHANGED INTAKE STR. TO DOWNSTREAM SHAPE (AL 04.1) PRP

400-12-1083



QUANTITIES (NET BY FIELD UNLESS NOTED)

CONCRETE CLASS "A" (3500 PSI)	85 CU YD
FOR REINF STEEL SEE BAR BENDING SCH 400-12-1300-13	
STL PIPE 20 ϕ STD WT W/STUDS ANCHOR RIGS (2 REQD)	120 LIN FT
6 x 3/8 PVC WS	135 LIN FT
9 DUMBELL TYPE-WS	65 LIN FT
3/4 PREMOULDED JOINT FILLER	50 SQ FT
STOP LOG GUIDE W/STUDS [AS PER DETAIL (C9)]	2 REQD
STOP LOG [AS PER DET (C11)]	4 REQD
DUMPED ROCK RIP RAP [SEE 400-12-1081 G18]	215 CU YD
SELECT SAND FILL (SEE EBASCO SPEC DAY-3848-CH-3) OR APPROVED ALTERNATE	75 CU YD
#8 GRAVEL BEDDING AS PER AASHO M 43 OR APPROVED ALTERNATE	3 CU YD

NOTES

FOR GENERAL NOTES SEE DWG 400-12-1082

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
BAR BENDING SCHEDULE	400-12-1300-13
ASH HANDLING SYSTEM MISC STRUCTURES SECT & DET M&R SH 1	400-12-1082
ASH POND MISC STEEL	400-12-2167
ASH HANDLING SYSTEM DIKE SECTIONS & DETAILS - SH 1	400-12-1081

FOR ADDITIONAL REFERENCE DWG SEE DWG 400-12-1082

WORK THIS DWG WITH DWG 400-12-1080

STATE OF OHIO — JAMES S. SEMPLE, JR. No. 38274 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA REGISTERED No. 15504 PROFESSIONAL ENGINEER JAMES S. SEMPLE, JR. Expires 12/31/76

EBASCO REFERENCE NUMBER DAY3848G 12-1083 R-0

EBASCO SERVICES INCORPORATED

TITLE ASH HANDLING SYSTEM
MISC STRUCTURES SECTIONS & DETAILS M&R SH 2

FOR KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

SCALE 1/2" = 1'-0 (U.N.) DIV. CIVIL CONDUCT

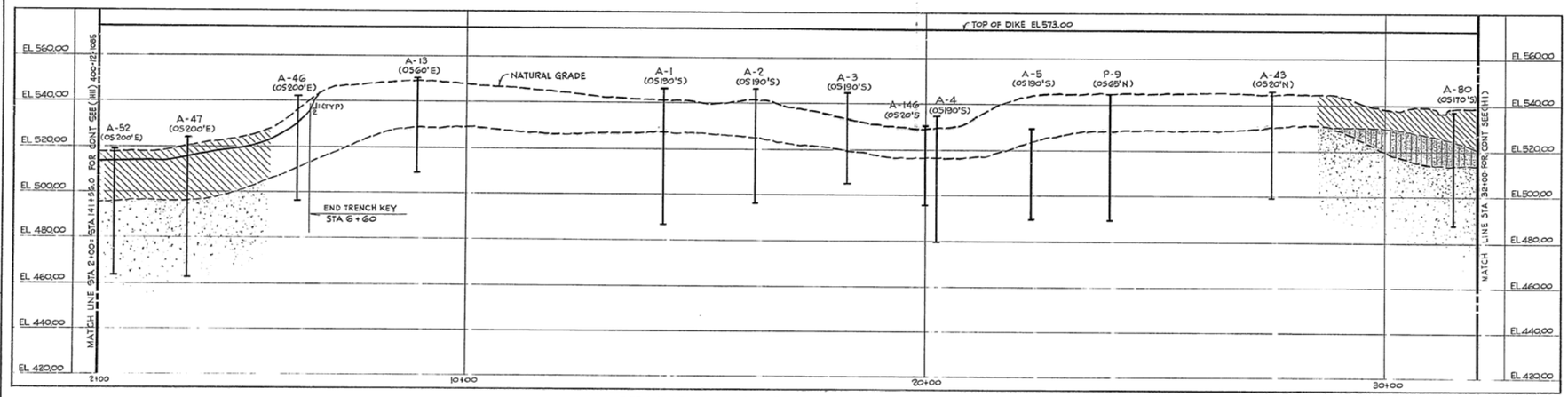
DRAWN	7-23-76	APPROVED	7-29-76
CHECKED A. MICHAIL T. HSU	8-2-76	APPROVED J. D. SYKES	8-2-76
ENGINEER	8-9-76	APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

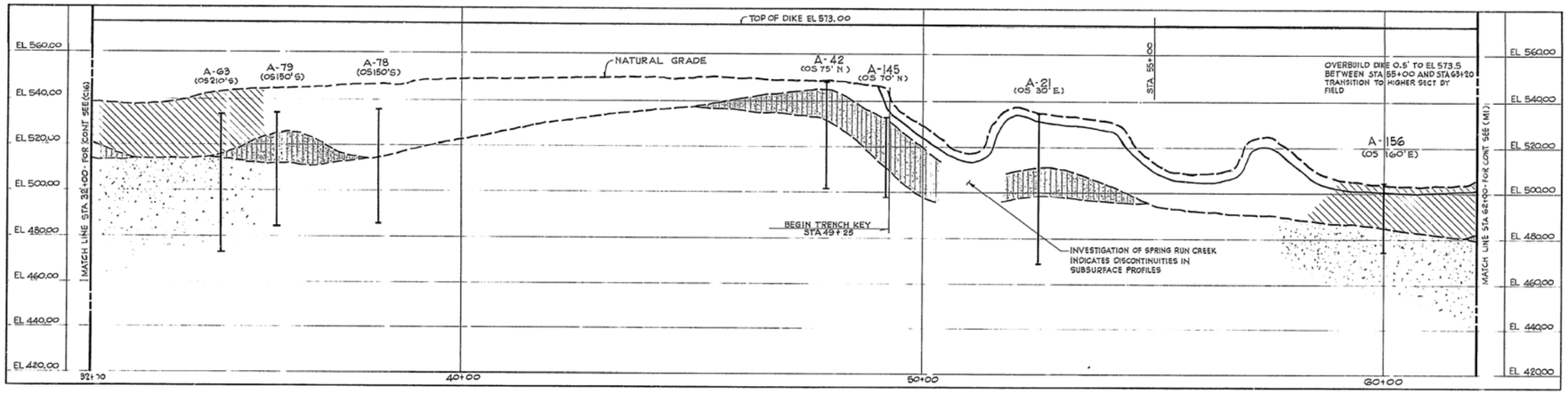
400-12-1083 SHEET 67 SHEETS

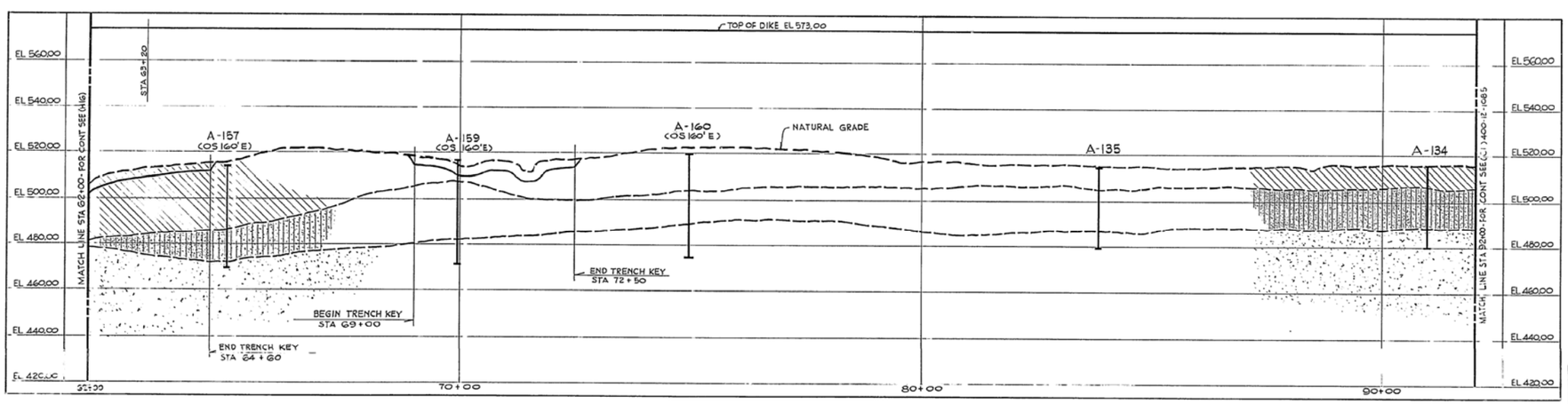
REVISIONS

400-12-1084



PERIMETER DIKE ℄ PROFILE





LEGEND

- DENOTES SILT & CLAY (IMPERVIOUS MATERIAL)
- DENOTES SILT, CLAY & SAND (RANDOM MATERIAL)
- DENOTES SAND (RANDOM MATERIAL)
- DENOTES SOIL BORING LOCATION
- OS DENOTES OFFSET

QUANTITIES (NET BY FIELD UNLESS NOTED)

FOR QUANTITIES SEE DWG 400-12-1080

NOTES

FOR GENERAL NOTES SEE DWG 400-12-1080

THIS DRAWING HAS BEEN PREPARED FOR THE USE OF DESIGN PERSONNEL OF EBASCO SERVICES INCORPORATED ONLY. INFORMATION CONTAINED HEREON IS AN INTERPRETATION OF THE ORIGINAL LOGS OF BORINGS FOR DESIGN PURPOSES ONLY AND MAY OR MAY NOT BE COMPLETE. DATA NOT PERTINENT TO DESIGN PURPOSES OR AVAILABLE IN OTHER REPORTS OR DATA SHEETS MAY NOT BE INDICATED HEREON.

ANY PERSON USING THIS DRAWING FOR ANY PURPOSE OTHER THAN THE ABOVE SHOULD REQUEST TO EXAMINE AND REFER TO THE ORIGINAL LOGS AND DATA SHEETS PREPARED BY BUCKEYE DRILLING CORPORATION AND BOWSER-MORNER TESTING LABORATORIES, INC.

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM DIKES, SECT'S & DETAILS SH 1	400-12-1081
ASH HANDLING SYSTEM PERIMETER DIKE & INTERIOR DIKE & PROFILES SH2	400-12-1085
ASH HANDLING SYSTEM ASH POND PERIMETER DIKE SECT'S SH 1	400-12-1088
ASH HANDLING SYSTEM ASH POND PERIMETER DIKE SECT'S SH 2	400-12-1089
ASH HANDLING SYSTEM ASH POND PERIMETER DIKE SECT'S SH 3	400-12-1090
ASH HANDLING SYSTEM ASH POND PERIMETER DIKE & INTERIOR DIKE SECT'S SH 4	400-12-1091

FOR ADDITIONAL REFERENCE DWG SEE DWG 400-12-1080

STATE OF OHIO — JAMES S. SAMPLE, JR. — No. 36774 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA — REGISTERED — No. 9304 — PROFESSIONAL ENGINEER — JAMES S. SAMPLE, JR.

WORK THIS DWG WITH DWGS - 400-12-1080 & 400-12-1085

EBASCO REFERENCE NUMBER: DAY 38486-12-1084 R-0

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM PERIMETER DIKE & PROFILE SH 1

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

SCALE 1" = 20' VERT 1" = 100' HORIZ	DIV. CONC - HYD	PROJECT	
DRAWN S. KIM		APPROVED	
CHECKED		APPROVED	
ENGINEER	2-28-76	APPROVED	

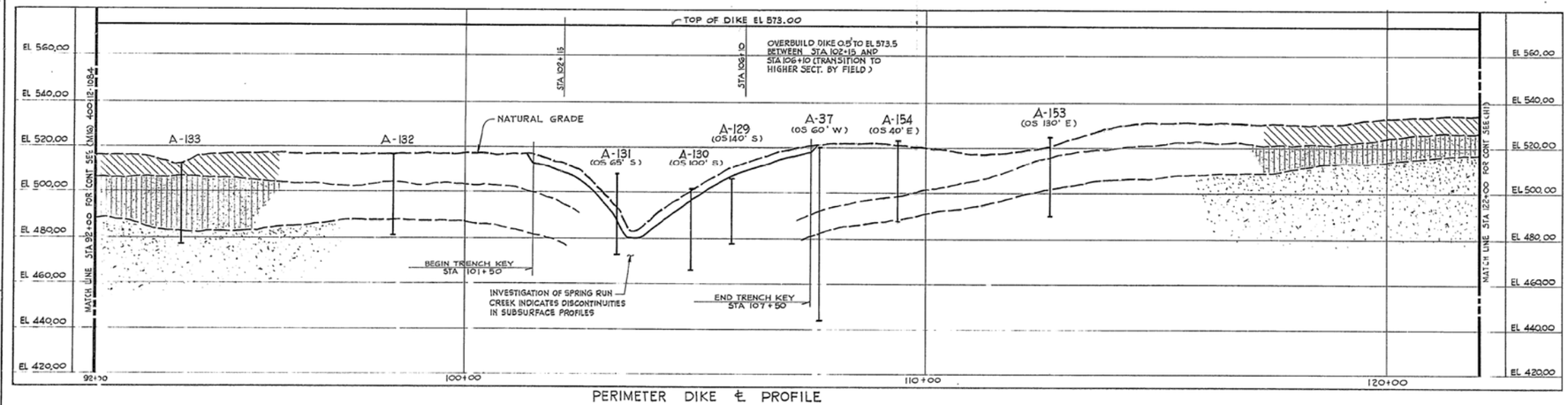
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1084 — SHEET OF SHEETS

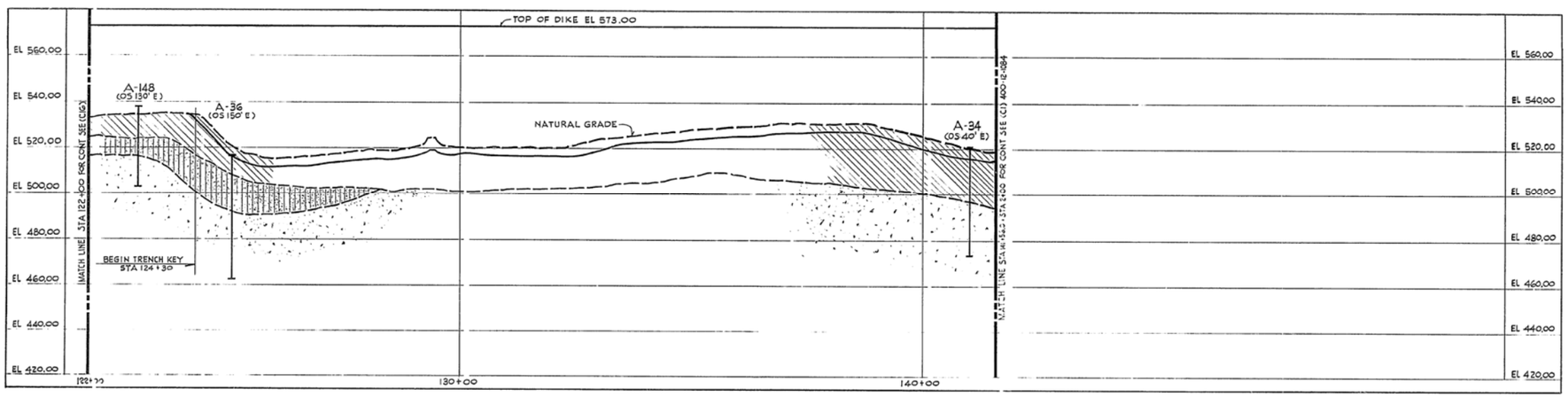
REVISIONS

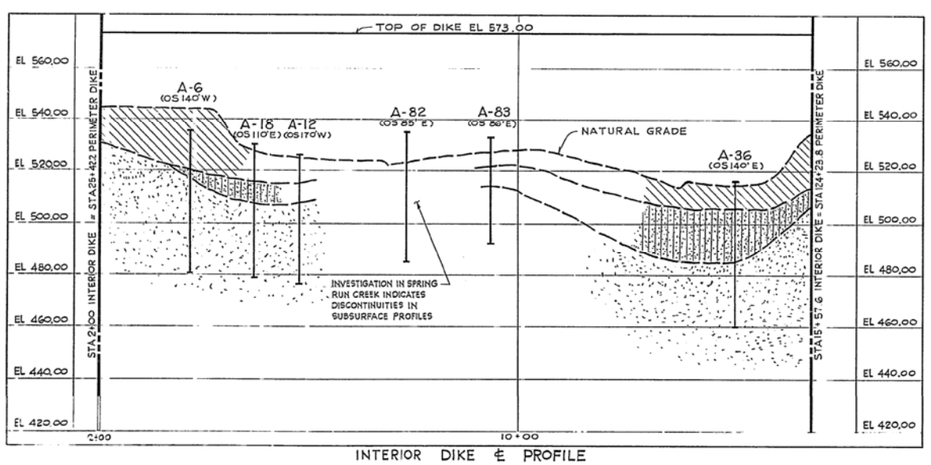
FILE

400-12-1085



PERIMETER DIKE ℄ PROFILE





INTERIOR DIKE ℄ PROFILE

LEGEND

- DENOTES SILT & CLAY (IMPERVIOUS MATERIAL)
- DENOTES SILT, CLAY & SAND (RANDOM MATERIAL)
- DENOTES SAND (RANDOM MATERIAL)
- DENOTES SOIL BORING LOCATION
- OS DENOTES OFFSET

QUANTITIES (NET BY FIELD UNLESS NOTED)

FOR QUANTITIES SEE DWG 400-12-1080

NOTES

FOR GENERAL NOTES SEE DWG 400-12-1080

THIS DRAWING HAS BEEN PREPARED FOR THE USE OF DESIGN PERSONNEL OF EBASCO SERVICES INCORPORATED ONLY. INFORMATION CONTAINED HEREON IS AN INTERPRETATION OF THE ORIGINAL LOGS OF BORINGS FOR DESIGN PURPOSES ONLY AND MAY OR MAY NOT BE COMPLETE. DATA NOT PERTINENT TO DESIGN PURPOSES OR AVAILABLE IN OTHER REPORTS OR DATA SHEETS MAY NOT BE INDICATED HEREON.
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REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DWG 400-12-1084

STATE OF OHIO — JAMES S. SAMPLE, JR. No. 34774 — REGISTERED PROFESSIONAL ENGINEER

GEORGE A. No. 9304 — REGISTERED PROFESSIONAL ENGINEER

WORK THIS DWG WITH DWG 400-12-080 & 400-12-1084

EBASCO REFERENCE NUMBER: DAY3848G-12-1085 R-0

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
PERIMETER DIKE & INTERIOR DIKE ℄ PROFILE SH2

FOR: KILLEN ELECTRIC GENERATING STATION
608,025 KW INSTALLATION UNIT NO.2
608,025 KW INSTALLATION UNIT NO.1

SCALE 1"=20' VERT 1"=100' HORIZ | DIV. CONC-HYD | PROJECT

DRAWN S. K-M | APPROVED

CHECKED S. T-A | APPROVED

ENGINEER DAY H.E. 2-28-76 | APPROVED

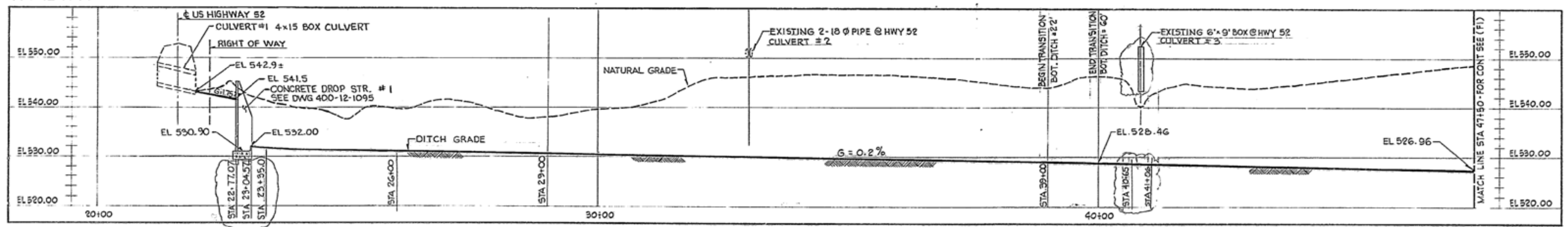
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1085
SHEET OF SHEETS

REVISIONS

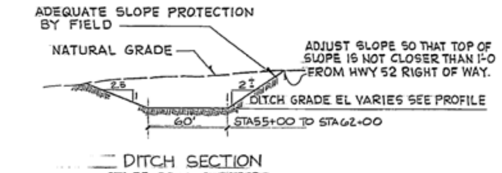
FILE

400-12-1086



PROFILE LEGEND
G - DENOTES GRADE PERCENT SLOPE

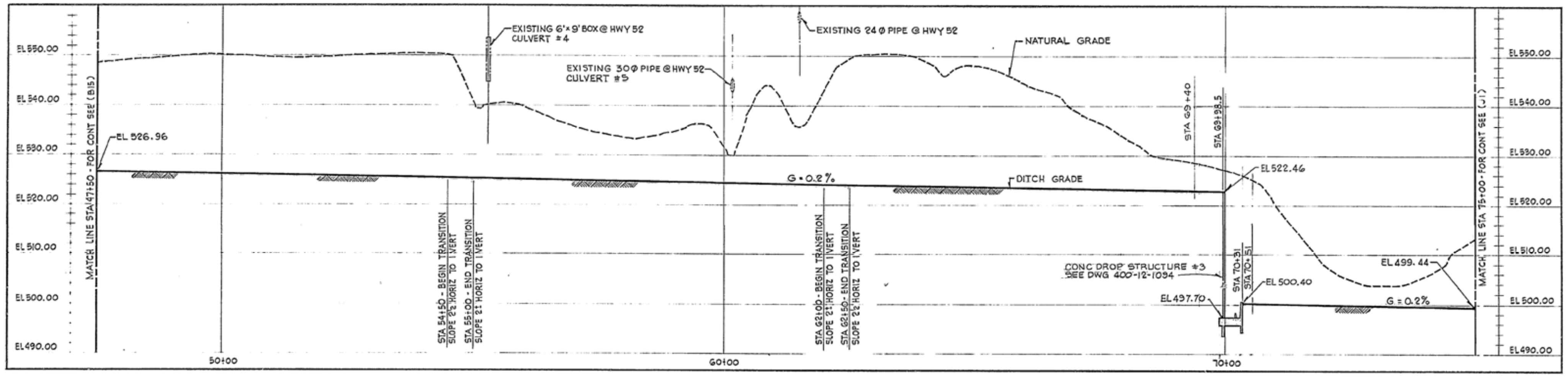
PROFILE ALONG ¢ DITCH "A" (FOR ORIENTATION & LOCATION SEE DWG 400-12-1080)
HORIZ 1 = 100'
VERT 1 = 10'



DITCH SECTION
STA 55+00 TO STA 62+00
NTS

QUANTITIES (NET BY FIELD UNLESS NOTED)

SILT & CLAY EXCAVATION	298,400 CU YD
RANDOM EXCAVATION	183,200 CU YD
CRUSHED STONE	910 CU YD
ROCK CHANNEL PROTECTION TYPE "B"	3,580 CU YD



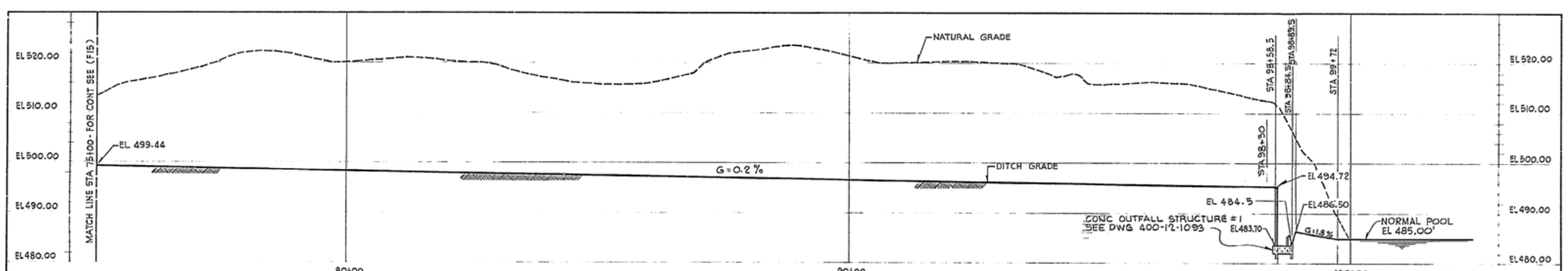
NOTES

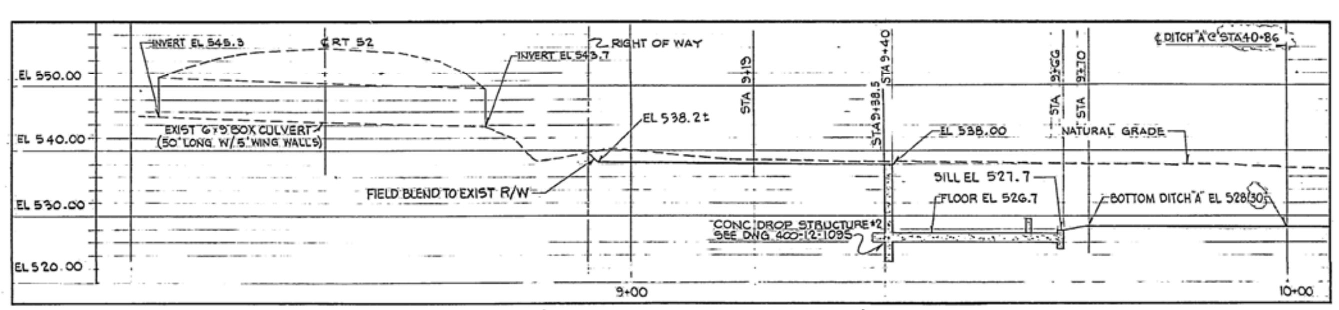
DRAINAGE COMPUTATIONS ARE BASED ON AN AVERAGE RAINFALL OF 4.5 IN/HR FOR A 50 YR EXPECTANCY

ROCK CHANNEL PROTECTION SHALL CONFORM TO STATE OF OHIO SPEC. 601.07 (TYPE "B") AND 601.08. ALL ROCK SHALL WEIGH 165 lb/CU. FT. MINIMUM, EXCEPT THAT THE MAXIMUM ROCK SIZE IS NOT MORE THAN 2'-0.

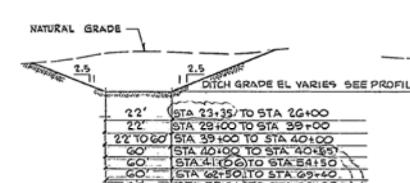
REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM MISC STRUCTURES SECT & DET M&R SH 4	400-12-1093
ASH HANDLING SYSTEM MISC STRUCTURES SECT & DET M&R SH 5	400-12-1094
ASH HANDLING SYSTEM MISC STRUCTURES SECT & DET M&R SH 6	400-12-1095
FOR ADDITIONAL REF DWG SEE DWG	400-12-1080

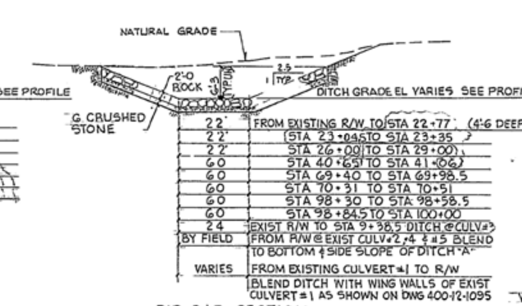




PROFILE ¢ DITCH @ CULVERT #3 (FOR ORIENTATION & LOCATION SEE DWG 400-12-1080)
1:10' VERT & HORIZ



NORMAL SECTION



RIP RAP SECTION

TYPICAL DITCH SECTIONS
NOT TO SCALE

STATE OF OHIO — JAMES S. SEMPLE, JR. — No. 38774 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA — REGISTERED — No. 9506 — PROFESSIONAL — Expires 12/31/76 — ENGINEER — JAMES S. SEMPLE, JR.

WORK THIS DWG. WITH DWG 400-12-1080

EBASCO REFERENCE NUMBER: DAY 3848 G-12-1086 R-2

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
ASH POND DITCH 'A' ¢ PROFILE SH 3

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

SCALE NOTED	DIV. CIVIL	PROJECT	
DRAWN D.M. HERINGTON	2-24-76	APPROVED [signature]	6-29-76
CHECKED [signature]	2-26-76	APPROVED J.D. SYKES, Jr.	6-29-76
ENGINEER [signature]	6-29-76	APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1086
SHEET OF SHEETS
FILE

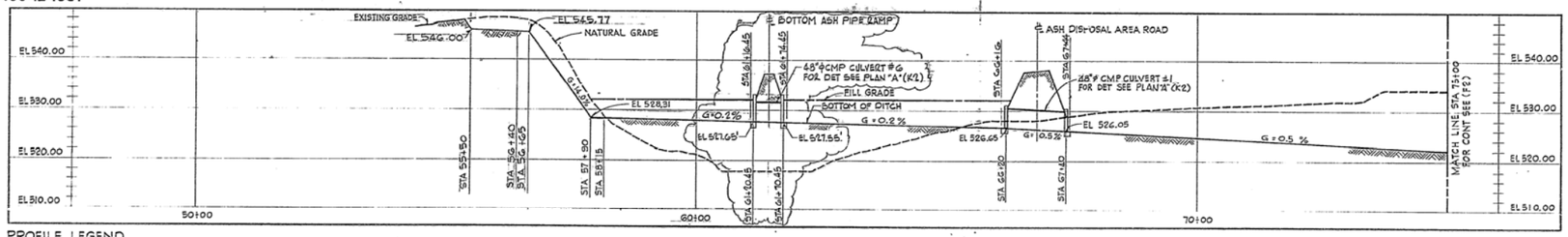
INFORMATION REQUIRED TO COMPLETE THIS DRAWING
WORK PERMIT FOR WORK INSIDE RIGHT OF WAY US 52 — DP&L

REVISIONS

1	REVISED D9, QUAN (G12, K12) DWG NO (M12, M16, N16) SECT. (C2 - 3, M12, N12) STA. ADDED (B4, G13, K13, N7) STR. NO (B18, SECT. B2, E2) & GRADE (G5, G9) NOTE DELETED (F12, K13) APPR'N (N15) NOT RELEASED	2-8-77	RP / DMH	AN / KKF
2	[illegible] STATIONS [illegible]	11-7-79	DA	KKF

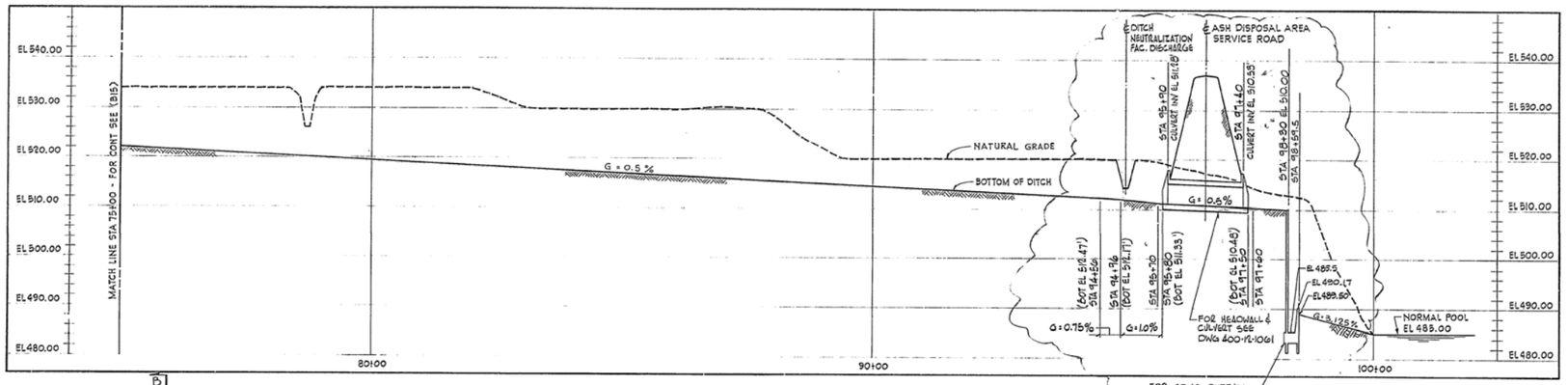
DATE | BY | CH | APPROVED

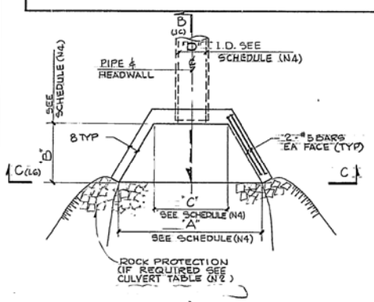
400-12-1087



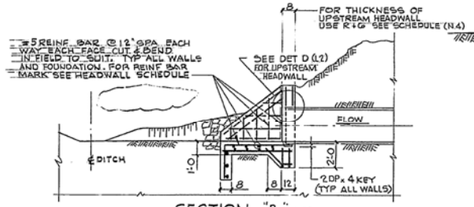
PROFILE LEGEND
G - DENOTES GRADE PERCENT SLOPE

PROFILE ALONG ℄ DITCH "B" (FOR ORIENTATION & LOCATION SEE DWG 400-12-1080)
HORIZ 1"=100'
VERT 1"=10'

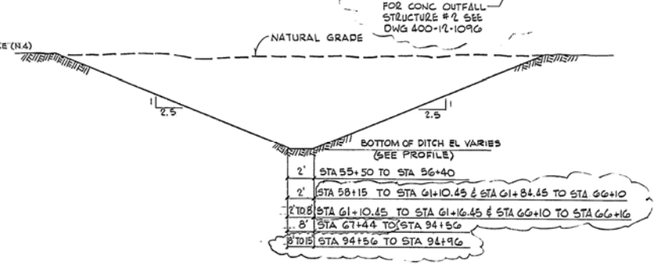




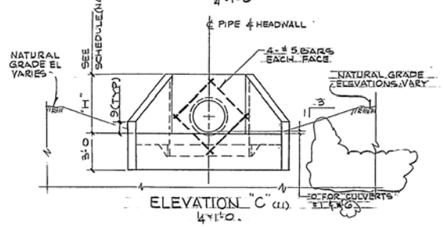
PLAN A
TYP REINF CONC HEADWALL
1/4"=1'-0



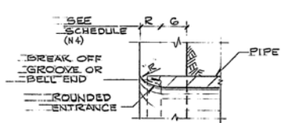
SECTION "B" (H2)
1/4"=1'-0



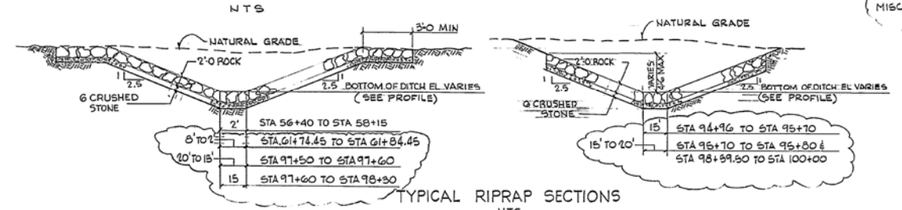
TYPICAL SECTION
NTS



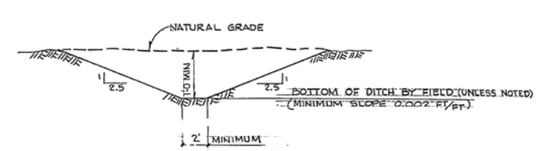
ELEVATION "C" (L1)
1/4"=1'-0



DETAIL "D" (L6)
ROUNDED ENTRANCE FOR UPSTREAM HEADWALL ONLY. SEE SECT D (L6) FOR DOWNSTREAM HEADWALL



TYPICAL RIPRAP SECTIONS
NTS



TYPICAL SECTION - DITCH BY FIELD
NTS

ITEM #	ROCK PROTECTION IF REQUIRED
CULVERT #1	NOT REQUIRED
CULVERT #6	SEE TYP RIPRAP SECT (M11)

CULVERT TABLE

ALL SLOPES				SLOPE 2½:1		REINF MARK	CONC QUAN (CU YDS)
D	H	R	C	A	B		
48	5'-6	6	5'-0	8'-0	4'-0	F104	8
48	5'-6	6	5'-0	8'-0	4'-0	F106	8

HEADWALL SCHEDULE

QUANTITIES (NET BY FIELD UNLESS NOTED)

SILT & CLAY EXCAVATION	37,200	CU YD
RANDOM EXCAVATION	10,300	CU YD
CRUSHED STONE	350	CU YD
ROCK CHANNEL PROTECTION TYPE "B"	1400	CU YD
48"ϕ CMP, 14 GA	170	LF

FOR REINFORCED CONCRETE SEE HEADWALL SCHEDULE (N5)
FOR CONC REINFORCING STEEL SEE BAR BENDING SCHEDULE 400-12-1300-4

NOTES

DRAINAGE COMPUTATIONS ARE BASED ON AN AVERAGE RAINFALL OF 4.5 IN/HR FOR A 50 YR EXPECTANCY PERIOD CULVERTS ARE DESIGNED TO FLOW 75% FULL

ALL CULVERTS SHALL BE CORRUGATED METAL PIPE, ASBESTOS BONDED, BITUMINOUS COATED (5x1 CORRUGATIONS)

ROCK CHANNEL PROTECTION SHALL CONFORM TO STATE OF OHIO SPEC 601.07 (TYPE "B") & 601.08. ALL ROCK SHALL WEIGH 165 LB/CU FT MINIMUM, EXCEPT THAT THE MAXIMUM ROCK SIZE IS NOT MORE THAN 2'-0.

CONCRETE SHALL BE CLASS "A" (3500 PSI) SEE SPECIFICATION EBASCO DAY-3848-CH5

CURRENT ACI STANDARDS SHALL GOVERN FOR ALL DESIGN AND CONSTRUCTION UNLESS OTHERWISE NOTED.

FOR SPECIFICATIONS FOR STEEL FOR CONCRETE REINFORCING BARS AND FOR BAR DETAILS SEE BAR BENDING SCHEDULE.

PLACING DIMENSIONS ARE GIVEN TO CENTER OF BARS UNLESS NOTED.

ALL SPLICES IN REINFORCEMENT SHALL COMPLY WITH THE REQUIREMENTS OF ACI 318-71 CODE SECTIONS 7.5 TO 7.12 INCLUSIVE.

ALL BARS SHALL HAVE 2" MINIMUM CONCRETE COVER UNLESS OTHERWISE NOTED.

REFERENCE DRAWINGS

BAR BENDING SCHEDULE	400-12-1300-4
LIST OF DRAWINGS	400-12-1000
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM MISC STRUCTURES SECT & DET SH 1	400-12-1082
ASH HANDLING SYSTEM MISC STRUCTURES SECT & DET M & R SH 7	400-12-1096
NEUTRALIZATION FACILITY GEN PLAN SECT & DET M & R	400-12-1061
MISC RAMPS SECT & DET	400-12-1029

STATE OF OHIO — JAMES S. SEMPLE, JR. No. 28374 REGISTERED PROFESSIONAL ENGINEER

GEORGIA REGISTERED No. 9504 PROFESSIONAL ENGINEER JAMES S. SEMPLE, JR. Expires 12/31/76

WORK THIS DRAWING WITH DWG 400-12-1080

EBASCO REFERENCE NUMBER: DAY 3848G-12-1087 R-2

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
ASH POND DITCH 'B' ℄ PROFILE SH 4

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

SCALE AS NOTED	DIV. CIVIL	PROJECT	
DRAWN D. NORRIS / D.M.H	2-24-76	APPROVED	6-28-76
CHECKED	2-26-76	APPROVED J.D.S. VEES	6-28-76
ENGINEER	6-24-76	APPROVED	

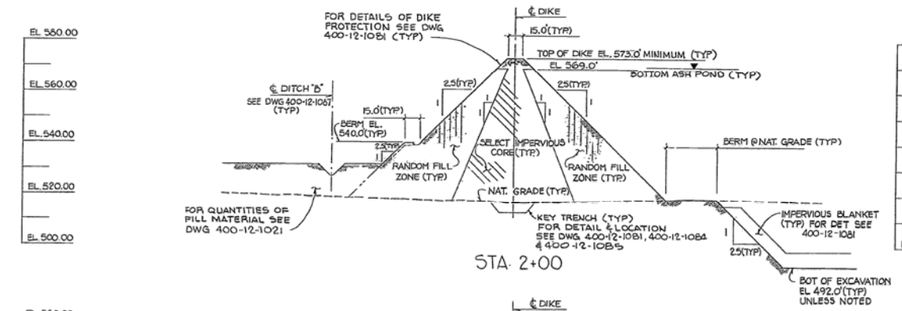
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1087
SHEET OF SHEETS

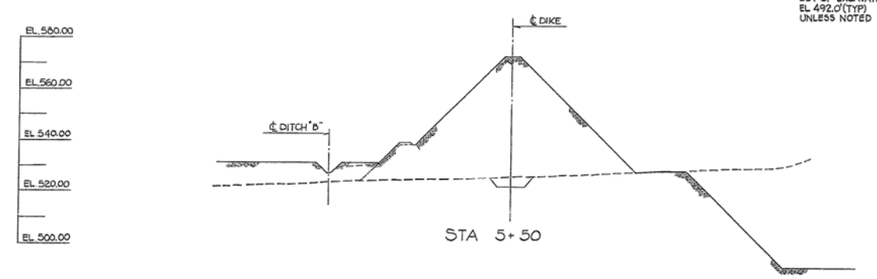
REVISIONS

1	REVISED (B-3) QUANT ADDED (B-3) STA 57+90, DELETED # 3 BARKAN	DRN	APPROVED
DATE	BY	CH	APPROVED
8-27-80	JM	WK	JDS
2	REVISED (B-1) TO NO. 5 ROCK CHANNEL PROTECTION (B-1) QUANT (N1) TO 2-5 CULVERT NO. 5 (B-1) NOTE ADDED (A8 TO 2-5) CULVERT DELETED (T-1, A-2, 3) (B-1) QUANT.	DRN	APPROVED
DATE	BY	CH	APPROVED
8-27-80	JM	ROBINS	JDS

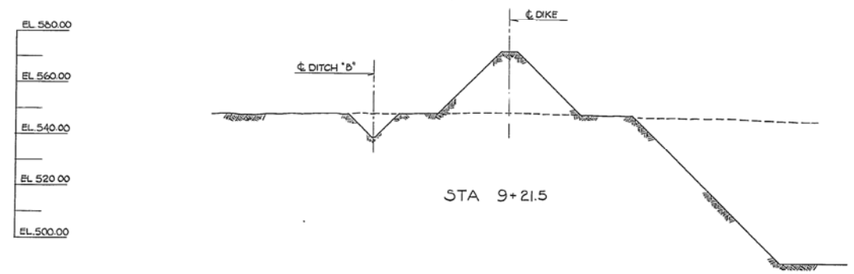
400-12-1088



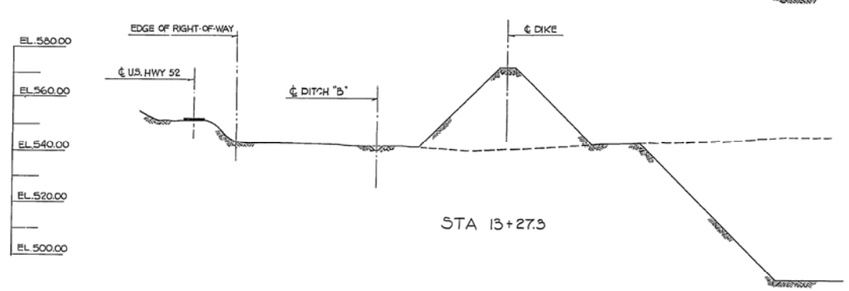
STA 2+00



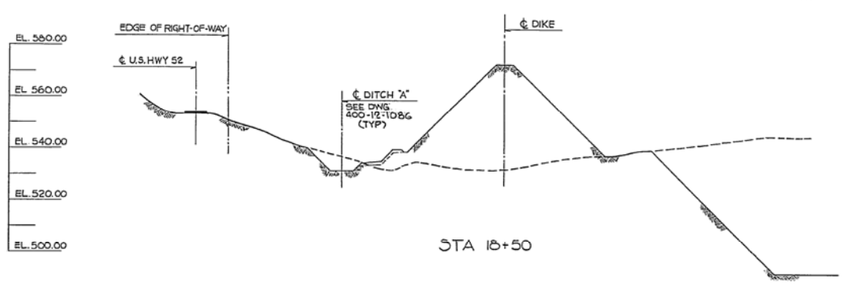
STA 5+50



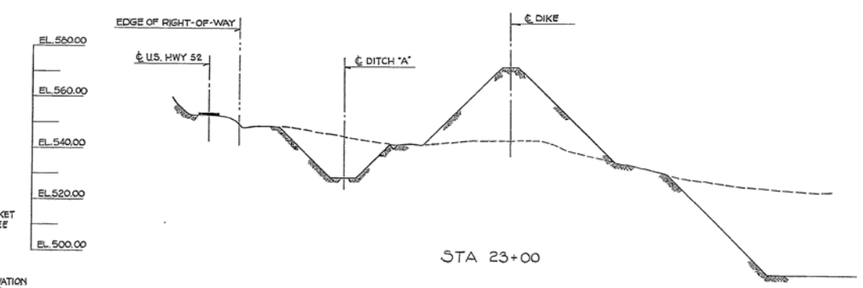
STA 9+21.5



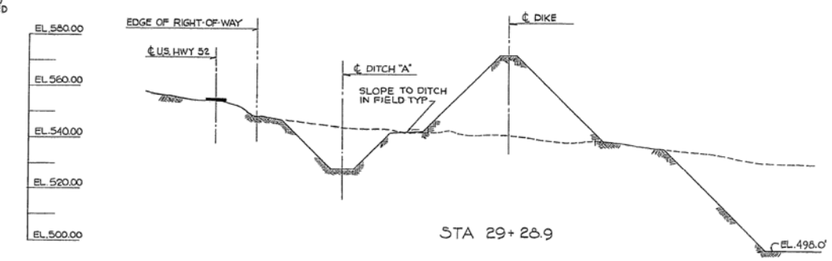
STA 13+27.3



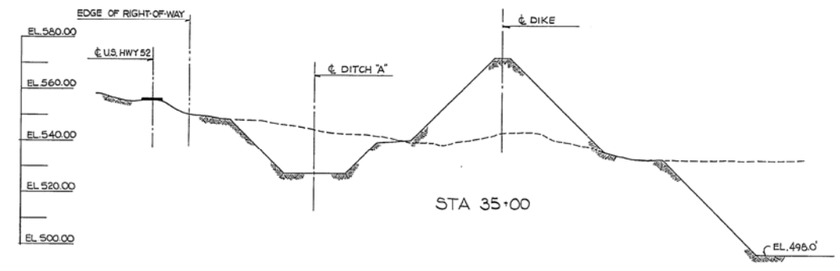
STA 18+50



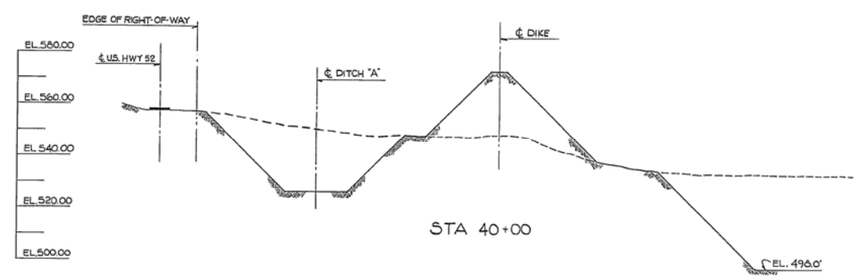
STA 23+00



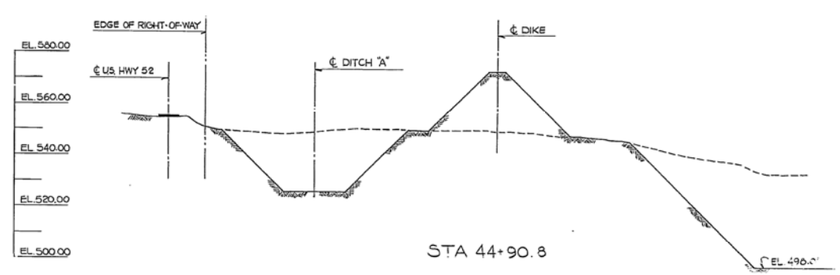
STA 29+28.9



STA 35+00



STA 40+00



STA 44+90.8

PERIMETER DIKE SECTIONS
STA 2+00 TO 44+90.8

QUANTITIES (NET BY FIELD UNLESS NOTED)
FOR QUANTITIES SEE DWG 400-12-1080

NOTES
FOR GENERAL NOTES SEE DWG. 400-12-1080
SLUICE PIPES NOT SHOWN

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM DIKE SECTIONS & DETAILS	400-12-1081
ASH HANDLING SYSTEM PERIMETER DIKE & PROFILE SH. 1	400-12-1084

FOR ADDL. REF. DWG. SEE DWG. 400-12-1080

STATE OF OHIO — JAMES S. SEMPLE, JR. — No. 34374 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA — REGISTERED — No. 9204 — PROFESSIONAL ENGINEER

WORK THIS DWG WITH DWG 400-12-080

EBASCO REFERENCE NUMBER: DAY3848G-12-1088 R-0

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
ASH POND PERIMETER DIKE SECTS SH 1

FOR: KILLEN ELECTRIC GENERATING STATION
506,025 KW INSTALLATION UNIT NO. 2
506,025 KW INSTALLATION UNIT NO. 1

SCALE 1"=20' VERT. 1"=50' HORIZ.	DIV CONC.-HYD	PROJECT	
DRAWN WAYCLILIS	2-12-76	APPROVED	2-27-76
CHECKED SUTALLA	2-12-76	APPROVED	
ENGINEER	2-24-76	APPROVED	

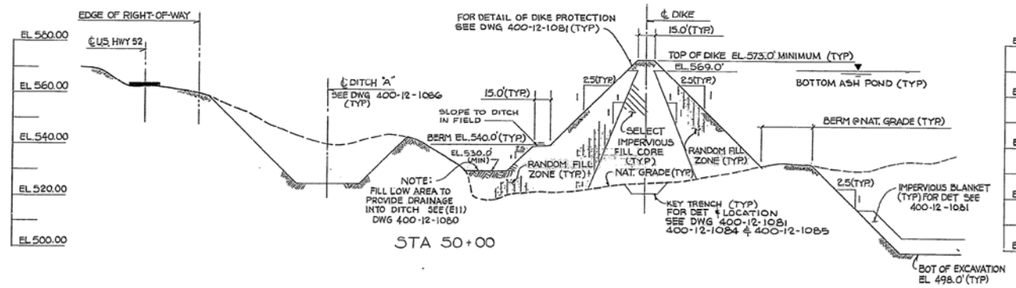
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1088
SHEET OF SHEETS

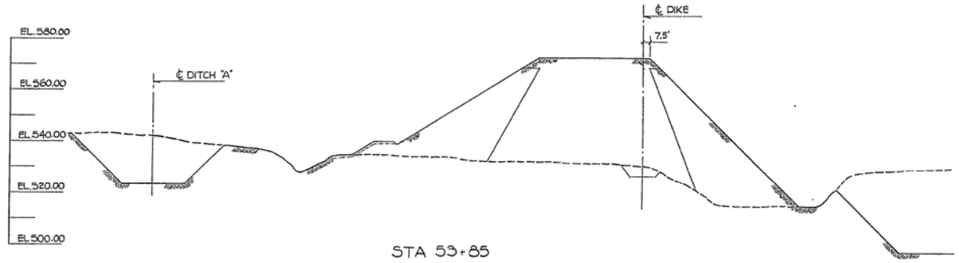
REVISIONS

FILE

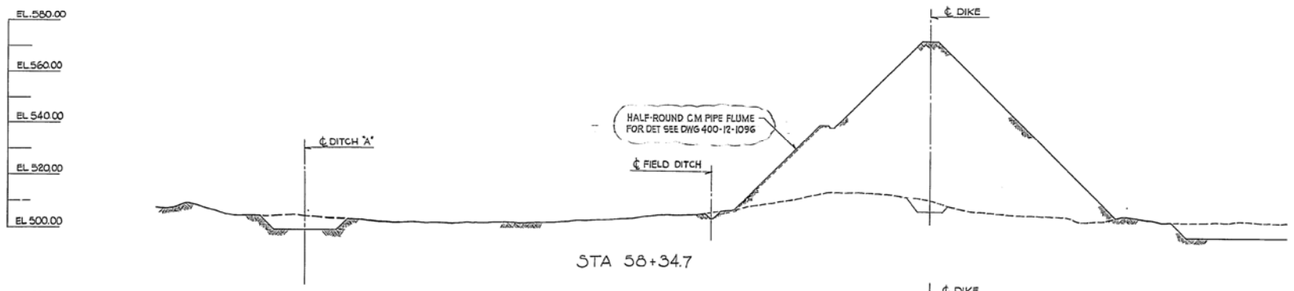
400-12-1089



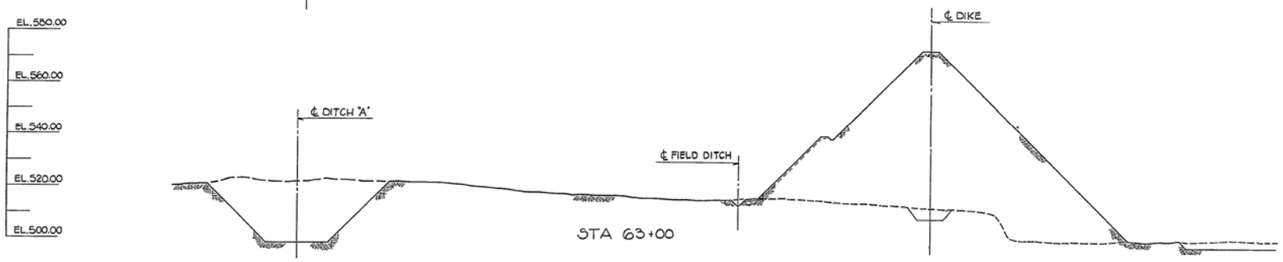
STA 50+00



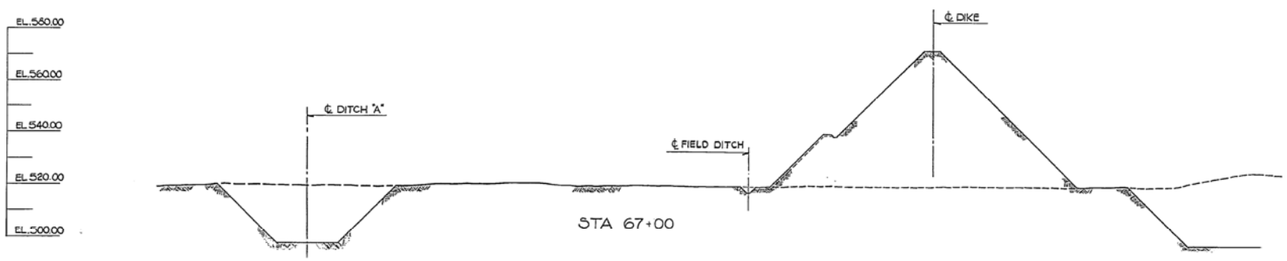
STA 53+85



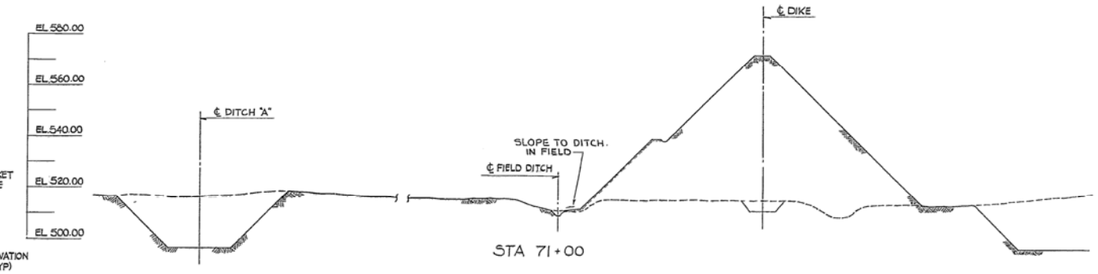
STA 58+34.7



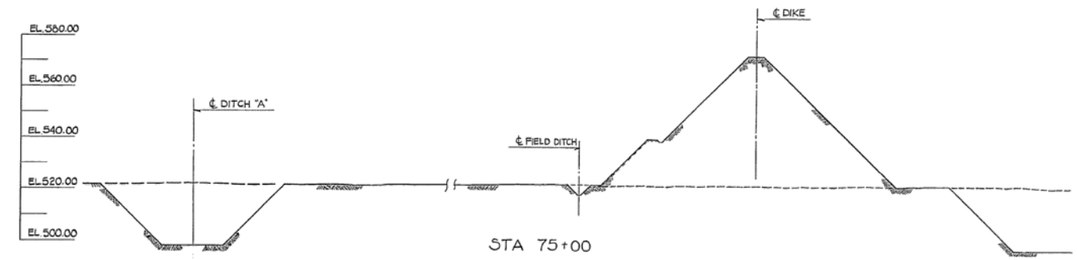
STA 63+00



STA 67+00



STA 71+00



STA 75+00

PERIMETER DIKE SECTIONS
STA 50+00 TO 75+00

QUANTITIES (NET BY FIELD UNLESS NOTED)
FOR QUANTITIES SEE DWG. 400-12-1080

NOTES
FOR GENERAL NOTES SEE DWG 400-12-1080

REFERENCE DRAWINGS
FOR REFERENCE DRAWINGS SEE DWG 400-12-1088

STATE OF OHIO — JAMES S. SEMPLE, JR. No. 28274 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA REGISTERED No. 9144 PROFESSIONAL ENGINEER JAMES S. SEMPLE, JR.

WORK THIS DWG WITH DWG 400-12-1080

EBASCO REFERENCE MASTER: DAY 3848 G-12-1089 | R-1

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
ASH POND PERIMETER DIKE SECTS SH 2

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

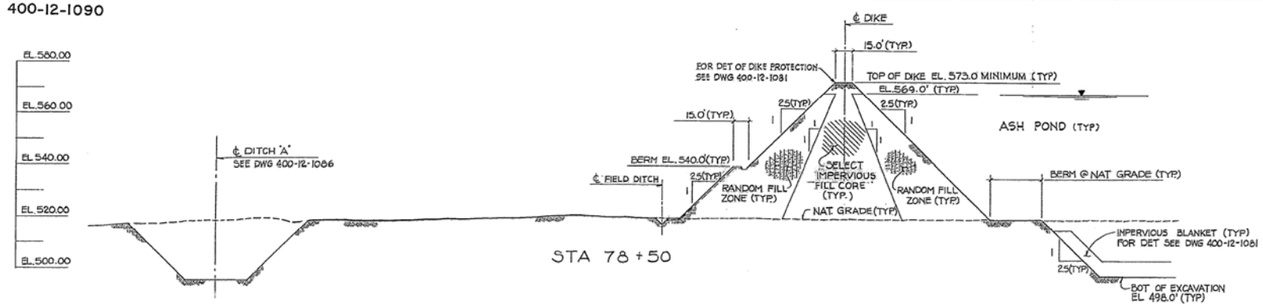
SCALE 1" = 20' VERT. 1" = 50' HORIZ.	DIV. CONC - HYD	PROJECT	
DRAWN WAYDULIS	2-24-76	APPROVED	
CHECKED	2-25-76	APPROVED	
ENGINEER	2-28-76	APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

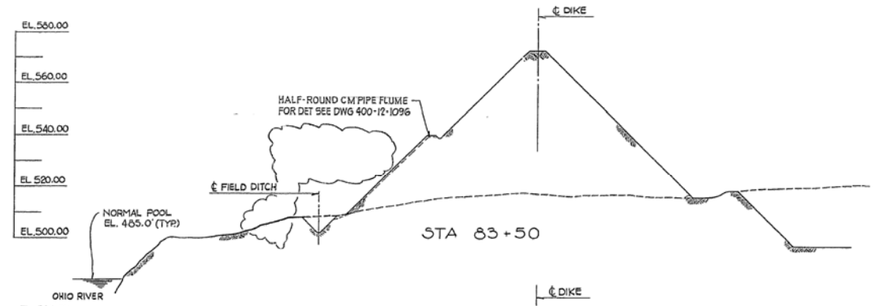
400-12-1089
SHEET OF SHEETS
FILE

REVISIONS
1 REVISED PER CHANGE NOTE 2-24-76 WAYDULIS
2 REVISED PER CHANGE NOTE 2-25-76 WAYDULIS
3 REVISED PER CHANGE NOTE 2-28-76 WAYDULIS

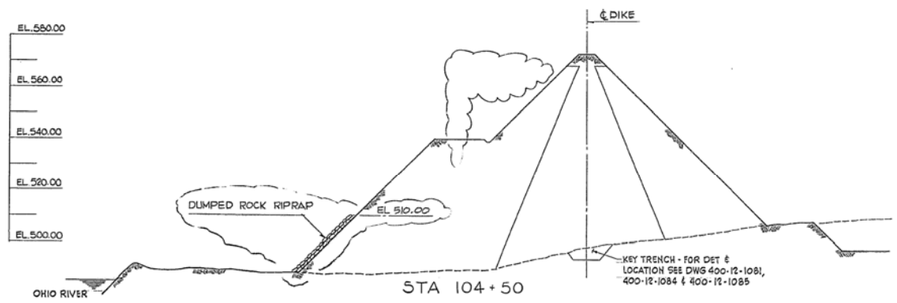
400-12-1090



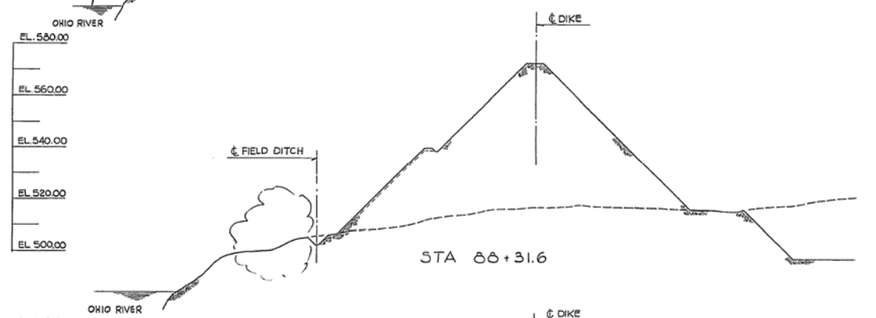
STA 78+50



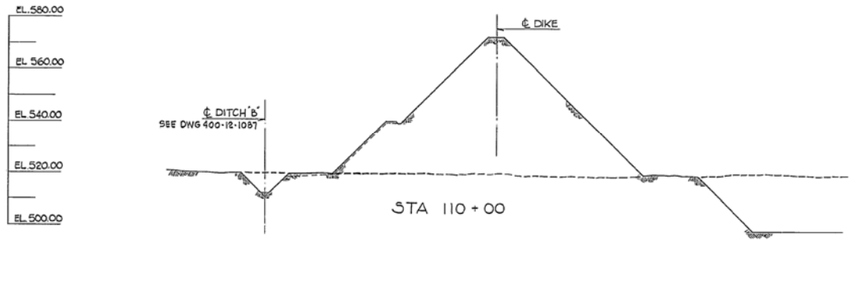
STA 83+50



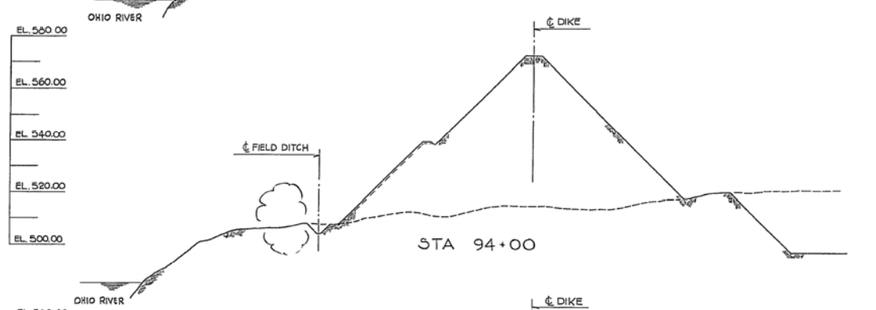
STA 104+50



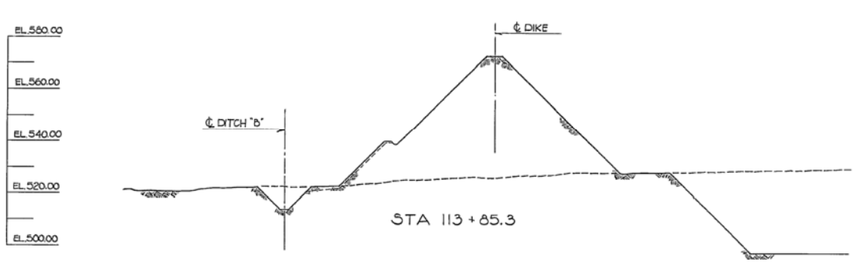
STA 88+31.6



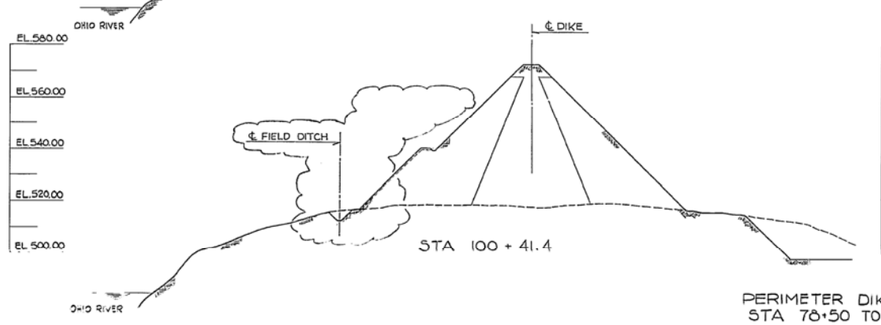
STA 110+00



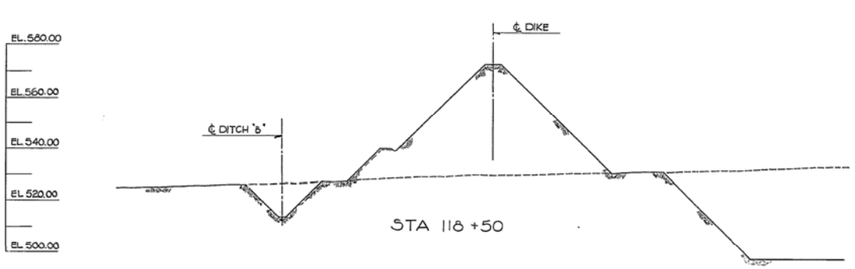
STA 94+00



STA 113+85.3



STA 100+41.4



STA 118+50

PERIMETER DIKE SECTIONS
STA 78+50 TO 118+50

QUANTITIES (NET BY FIELD UNLESS NOTED)
FOR QUANTITES SEE DWG. 400-12-1080

NOTES
FOR GENERAL NOTES SEE DWG 400-12-1080

REFERENCE DRAWINGS
FOR REFERENCE DRAWINGS SEE DWG 400-12-1088

STATE OF OHIO — JAMES S. SIMPLE, JR. — No. 36774 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA — No. PE 9506 — PROFESSIONAL ENGINEER — JAMES S. SIMPLE, JR.

WORK THIS DWG WITH DWG 400-12-1080

EBASCO REFERENCE NUMBER: DAY 3846G-12-1090 | R-2

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
ASH POND PERIMETER DIKE SECTS SH 3

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

SCALE 1"=20' VERT. 1"=50' HORZ	BW. CONC - HYD	PROJECT	
DRAWN WAYCUILIS	2-28-76	APPROVED	3-29-76
CHECKED	2-28-76	APPROVED	
ENGINEER	2-28-76	APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

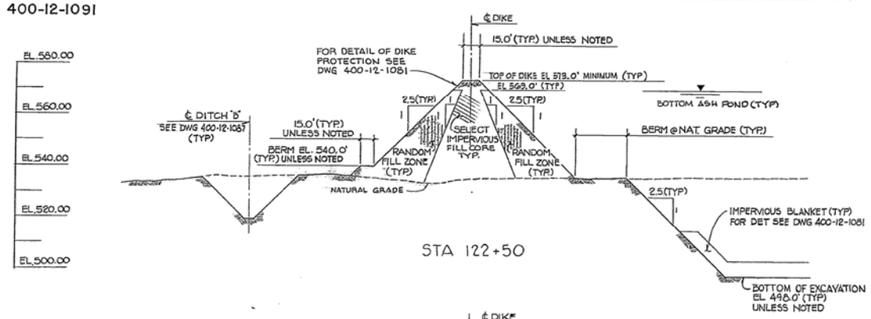
400-12-1090
SHEET OF SHEETS

FILE

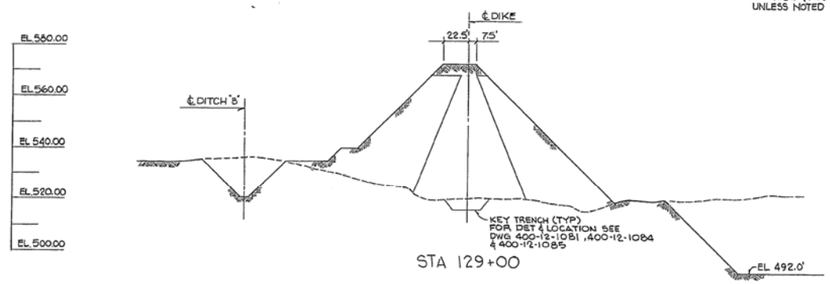
REVISIONS

1	REVISED ESTIMATE	
DATE	BY	CH APPROVED
6-19-78	JCH	KKF/SSR 7-19-78
2	ADDED (N3) FIELD DITCH (F1) RIPRAP (N3) SERVICE ROAD	
DATE	BY	CH APPROVED
7/3/80	JMT	R.A. GAMESKI JMT

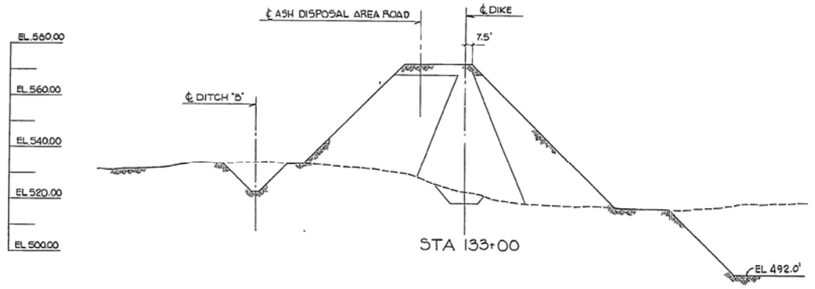
400-12-1091



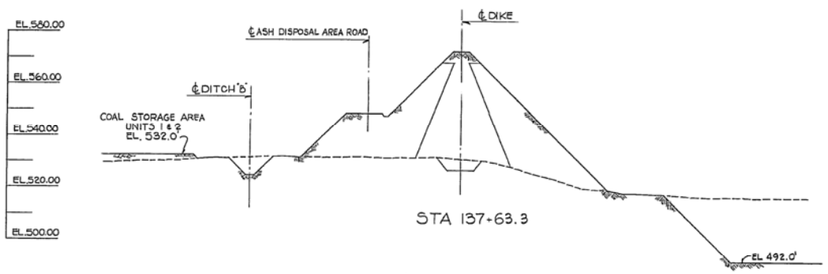
STA 122+50



STA 129+00

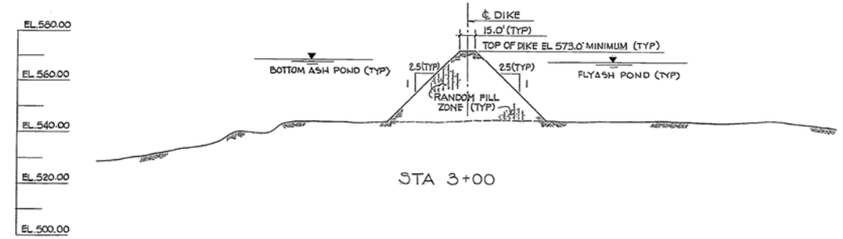


STA 133+00

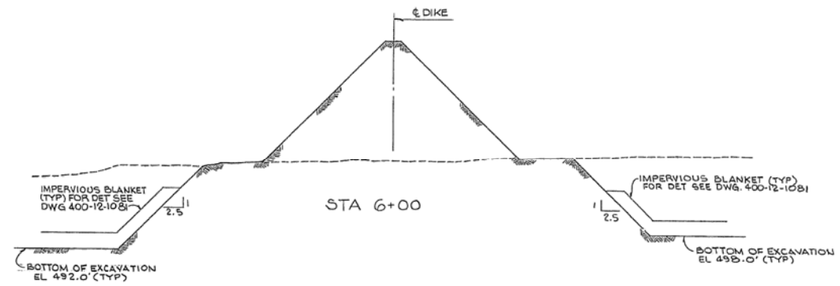


STA 137+63.3

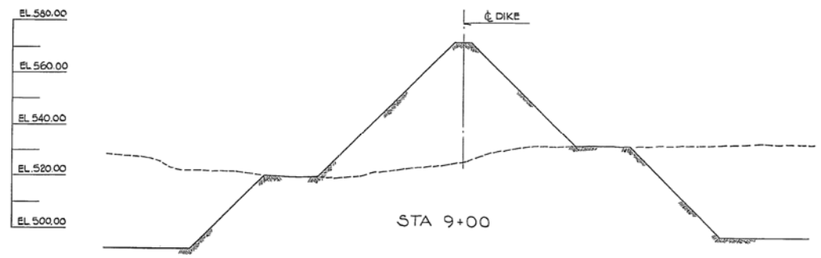
PERIMETER DIKE SECTIONS
STA 122+50 TO 137+63.3



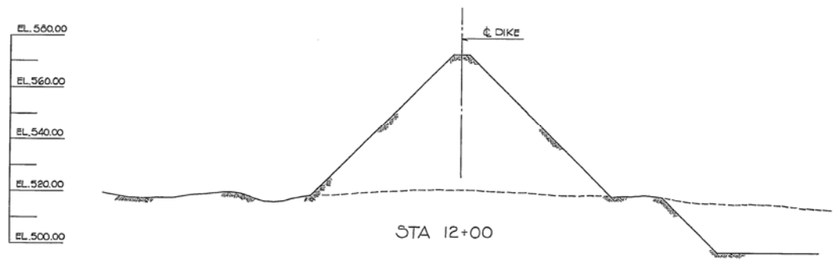
STA 3+00



STA 6+00



STA 9+00



STA 12+00

INTERIOR DIKE SECTIONS
STA 3+00 TO 12+00

QUANTITIES (NET BY FIELD UNLESS NOTED)
FOR QUANTITIES SEE DWG. 400-12-1080

NOTES
FOR GENERAL NOTES SEE DWG 400-12-1080

REFERENCE DRAWINGS
FOR REFERENCE DRAWINGS SEE DWG 400-12-1088

STATE OF OHIO — JAMES S. SHAPIRO, JR. — No. 38774 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA — REGISTERED — No. 9304 — PROFESSIONAL ENGINEER

WORK THIS DWG. WITH DWG 400-12-1080

EBASCO REFERENCE NUMBER: DAY 3848G-12-1091 R-0

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
ASH POND PERIMETER DIKE & INTERIOR DIKE SECTS SH 4

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

SCALE 1"=20' VERT. 1"=50' HORIZ.	BIN. CONC. - HYD	PROJECT	
DRAWN WAYCUILIS		APPROVED	
CHECKED		APPROVED	
ENGINEER		APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1091
SHEET OF SHEETS

REVISIONS

FILE

400-12-1092

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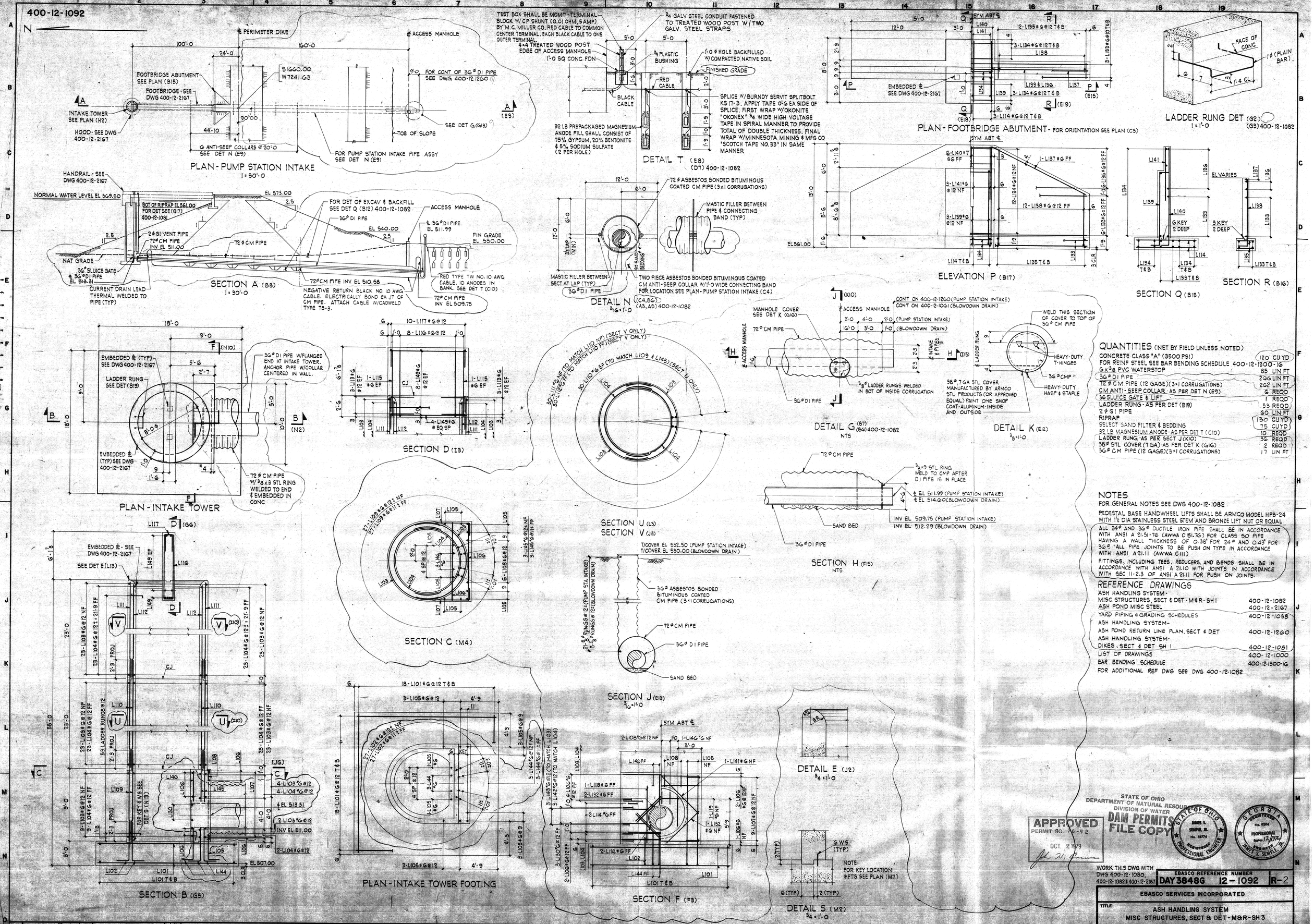

QUANTITIES (NET BY FIELD UNLESS NOTED)

CONCRETE CLASS "A" (3500 PSI)	120 CU YD
FOR REINF STEEL SEE BAR BENDING SCHEDULE 400-12-1300-16	
6 x 3/8 PVC WATERSTOP	85 LIN FT
36" DI PIPE	266 LIN FT
72" CM PIPE (12 GAGE)(3x1 CORRUGATIONS)	262 LIN FT
CM ANTI-SEEP COLLAR - AS PER DET N (E9)	6 REQD
36 SLUICE GATE & LIFT	1 REQD
LADDER RUNG - AS PER DET (B19)	53 REQD
2" GI PIPE	60 LIN FT
RIPRAP	130 CU YD
SELECT SAND FILTER & BEDDING	75 CU YD
32 LB MAGNESIUM ANODE - AS PER DET T (C10)	10 REQD
LADDER RUNG - AS PER SECT J (K10)	36 REQD
38" STL COVER (7 GA) - AS PER DET K (G16)	2 REQD
36" CM PIPE (12 GAGE)(3x1 CORRUGATIONS)	17 LIN FT

NOTES

FOR GENERAL NOTES SEE DWG 400-12-1082

PEDESTAL BASE HANDWHEEL LIFTS SHALL BE ARMCO MODEL HPB-24 WITH 1½ DIA STAINLESS STEEL STEM AND BRONZE LIFT NUT OR EQUAL

ALL 24" AND 36" DUCTILE IRON PIPE SHALL BE IN ACCORDANCE WITH ANSI A 21.51-76 (AWWA C151-76) FOR CLASS 50 PIPE HAVING A WALL THICKNESS OF 0.38" FOR 24" AND 0.43" FOR 36". ALL PIPE JOINTS TO BE PUSH ON TYPE IN ACCORDANCE WITH ANSI A21.11 (AWWA C111)

FITTINGS, INCLUDING TEES, REDUCERS, AND BENDS SHALL BE IN ACCORDANCE WITH ANSI A 21.10 WITH JOINTS IN ACCORDANCE WITH SEC 11-2.3 OF ANSI A 21.11 FOR PUSH ON JOINTS.

REFERENCE DRAWINGS

ASH HANDLING SYSTEM- MISC STRUCTURES, SECT & DET - M&R - SH 1	400-12-1082
ASH POND MISC STEEL	400-12-2167
YARD PIPING & GRADING SCHEDULES	400-12-1058
ASH HANDLING SYSTEM- ASH POND RETURN LINE PLAN, SECT & DET	400-12-1260
ASH HANDLING SYSTEM- DIKES, SECT & DET SH 1	400-12-1081
LIST OF DRAWINGS	400-12-1000
BAR BENDING SCHEDULE	400-12-1300-16

FOR ADDITIONAL REF DWG SEE DWG 400-12-1082

STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
DAM PERMITS
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APPROVED
PERMIT NO. 75-92
OCT. 2 1979

STATE OF OHIO — JAMES S. SEMPLE, JR. — No. 28774 — REGISTERED PROFESSIONAL ENGINEER

GEORGIA REGISTERED PROFESSIONAL ENGINEER No. 9504 — JAMES S. SEMPLE, JR.

WORK THIS DWG WITH DWG 400-12-1080, 400-12-1082 & 400-12-2167

EBASCO REFERENCE NUMBER DAY38486 12-1092 R-2

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
MISC STRUCTURES, SECT & DET - M&R - SH 3

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO. 2
606,025 KW INSTALLATION UNIT NO. 1

SCALE 4"=1'-0 UNLESS NOTED	DIV. CIVIL	PROJECT	
DRAWN D. NORRIS / N. BANDI	6-30-76	APPROVED James S Semple Jr	7-30-76
CHECKED M. DIBELLA	7-28-76	APPROVED J. D. SYKES, JR.	7-29-76
ENGINEER	7-29-76	APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1092
SHEET OF SHEETS

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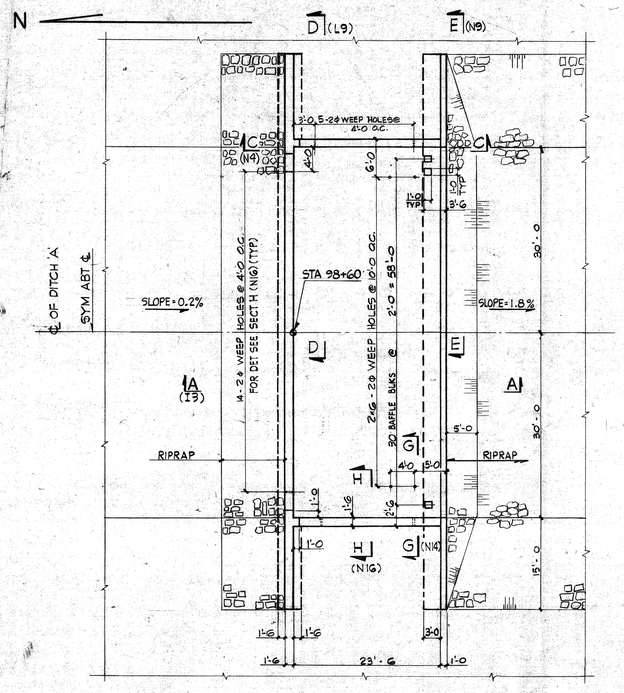
DIVISION OF WATER
DAM PERMITS AND INSPECTION

REVISIONS

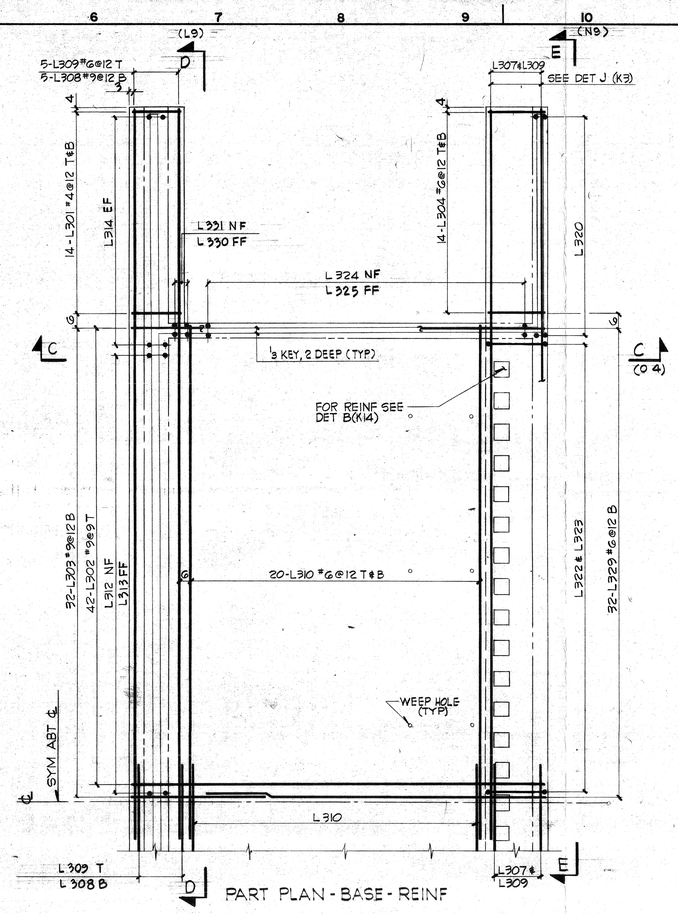
NO.	DESCRIPTION	BY	CH	APPROVED
1	REVISED (C8) NOTE, (B6) SECT A, (C7) & (J6), (J9) (E8) (L1) (L3) (L6) (L9) (L11) (L13) (L15) (L17) QUANT, LADDER RUNG DET (B19) ADDED, (C10) DET T (B18) COORDINATE	RG	WF	JSS
2	REVISED (B6, G4, M1) PLAN (E6, J7, M4, M10) SECTIONS (C1, C3, E1, E4, E9, L1, L3, L6, L9) DET'S (B19) QUANTITIES (C1, C3, K10) SECTION (C1, C3) NOTE (C8) REF DWG NOTE (C8) REF DWG DET (E4, L1, M3) DET (E6, L1, M3) NOTE (K3, L1, M3) SECTION	RG	WF	JSS

SYMBOL	DESCRIPTION

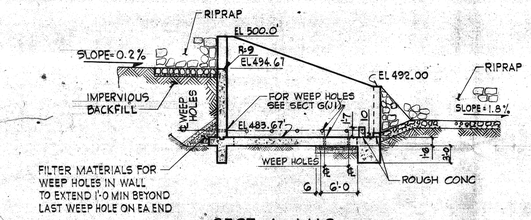
400-12-1093



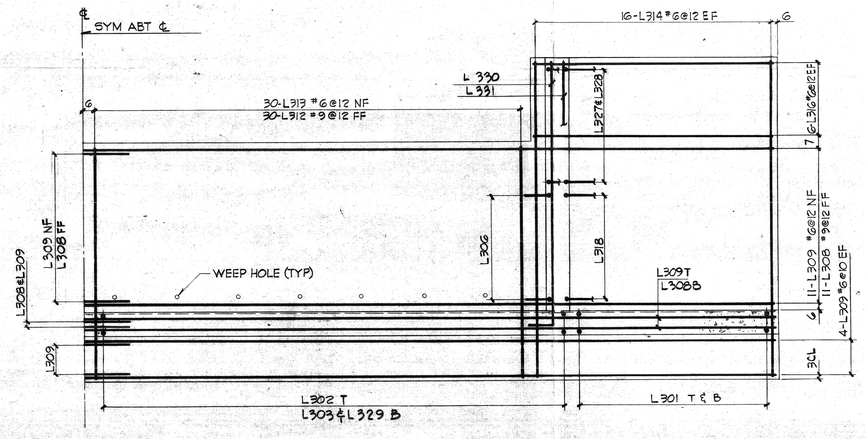
PLAN - MAS — CONC OUTFALL STRUCTURE NO. 1
SCALE 1" = 10'-0



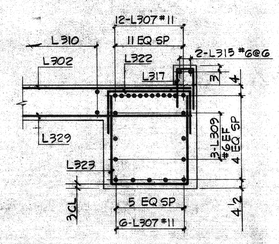
PART PLAN - BASE - REINF



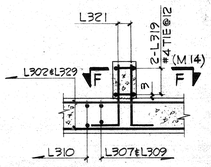
SECT A - MAS (D2)
1" = 10'-0



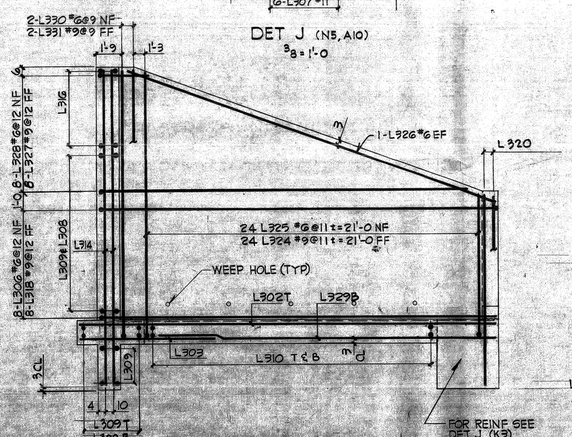
SECT D (A3, A7)



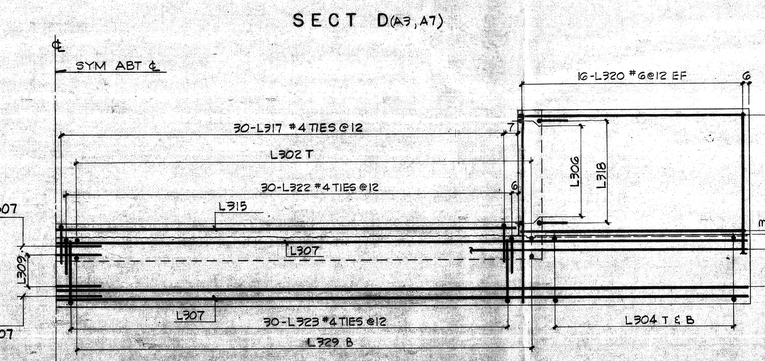
DET J (N5, A10)
3/8" = 1'-0



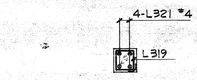
DET B (D8)
(30 REQD)
3/8" = 1'-0



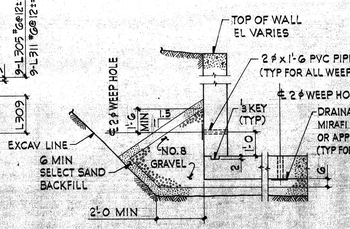
SECT C (C10)



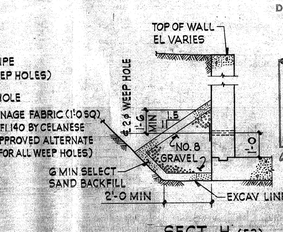
SECT E (A4, A10)



SECT F (K14)
3/8" = 1'-0



SECT G (E8)
NTS



SECT H (E8)
NTS

QUANTITIES (NET BY FIELD UNLESS NOTED)

CONCRETE CLASS "A" (3500 PSI)	275 CU YD
FOR REINF BARS SEE BAR BENDING SCH 400-12-1300-20	
MIRAFI 140 BY CELANESE OR APPROVED ALTERNATE	36 SQ FT
SELECT SAND BACKFILL (PER EBASCO SPEC DAY 3848-CH3) OR APPROVED ALTERNATE	30 CU YD
NO. 8 GRAVEL (PER AASHO M43) OR APPROVED ALTERNATE	45 CU YD
PVC PIPE - 2ø x 1'-6	36 REQD

NOTES

FOR RIPRAP DETAILS SEE DWG 400-12-1086 (N15)
FOR ADDITIONAL NOTES SEE DWG 400-12-1082

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
BAR BENDING SCHEDULE	400-12-1300-20
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS M&R SH 1	400-12-1082
ASH HANDLING SYSTEM ASH POND DITCH 'A' ℄ PROFILE SH 3	400-12-1086

STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
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OCT 2 1979

GEORGIA REGISTERED No. 9504 PROFESSIONAL ENGINEER JAMES S. SEMPLE

STATE OF OHIO JAMES S. SEMPLE, JR. No. 36774 REGISTERED PROFESSIONAL ENGINEER

WORK THIS DWG WITH 400-12-1080 & 400-12-1086

EBASCO REFERENCE NUMBER DAY3848G - 12 - 1093 R-0

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
MISC STRUCTURES, SECT & DET - M&R - SH 4

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO. 2
606,025 KW INSTALLATION UNIT NO. 1

SCALE 1/4"=1'-0 UNLESS NOTED	DIV. CIVIL	PROJECT	
DRAWN KIM / STOKES / RAP	8-17-76	APPROVED	7-8-76
CHECKED N. Bandi	8-18-76	APPROVED J.D. SYKES, JR.	8-27-76
ENGINEER	8-25-76	APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1093
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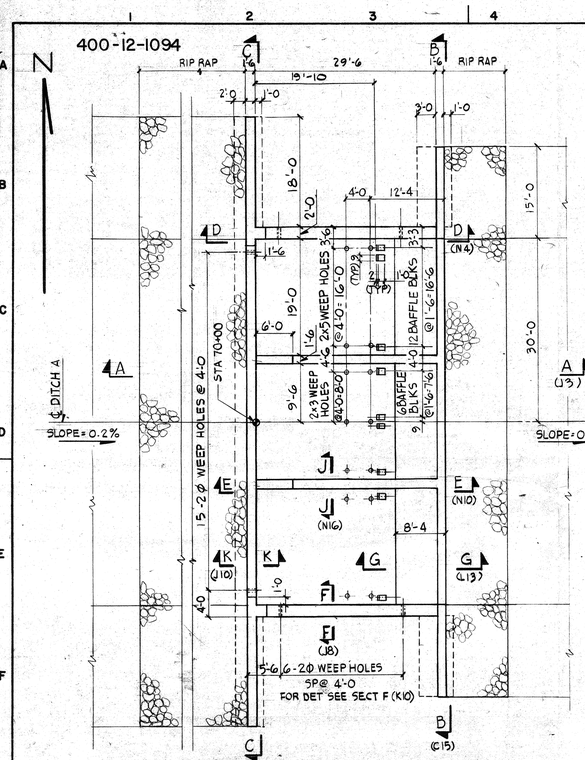
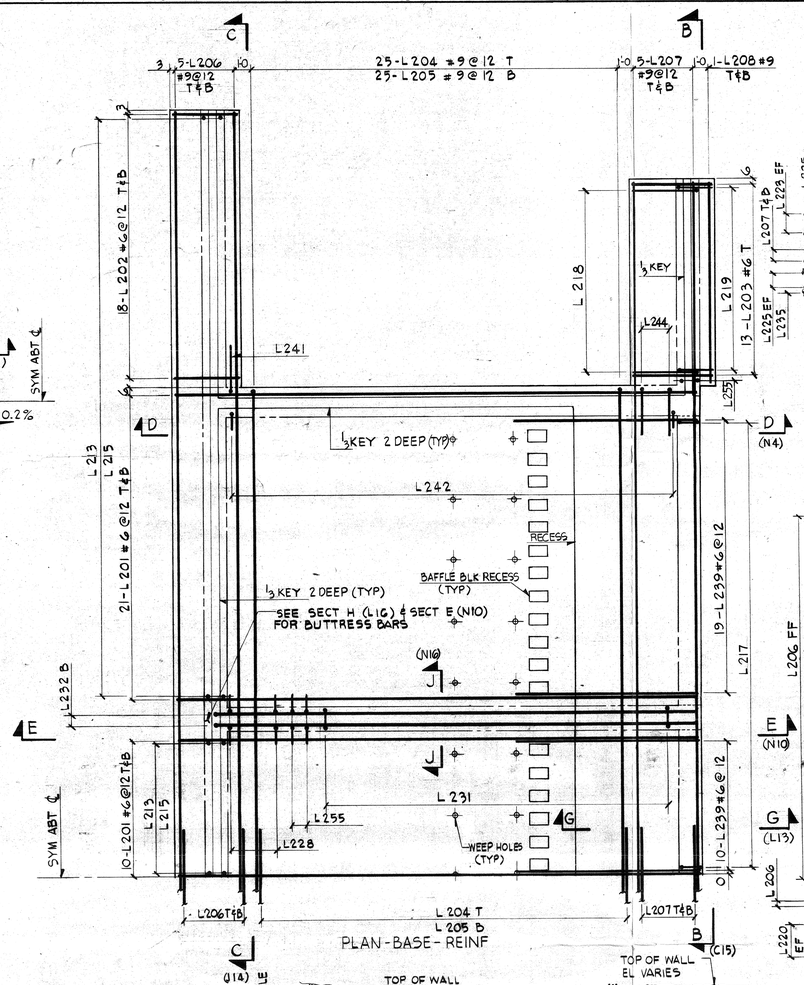
DAM PERMITS AND INSPECTION

REVISIONS

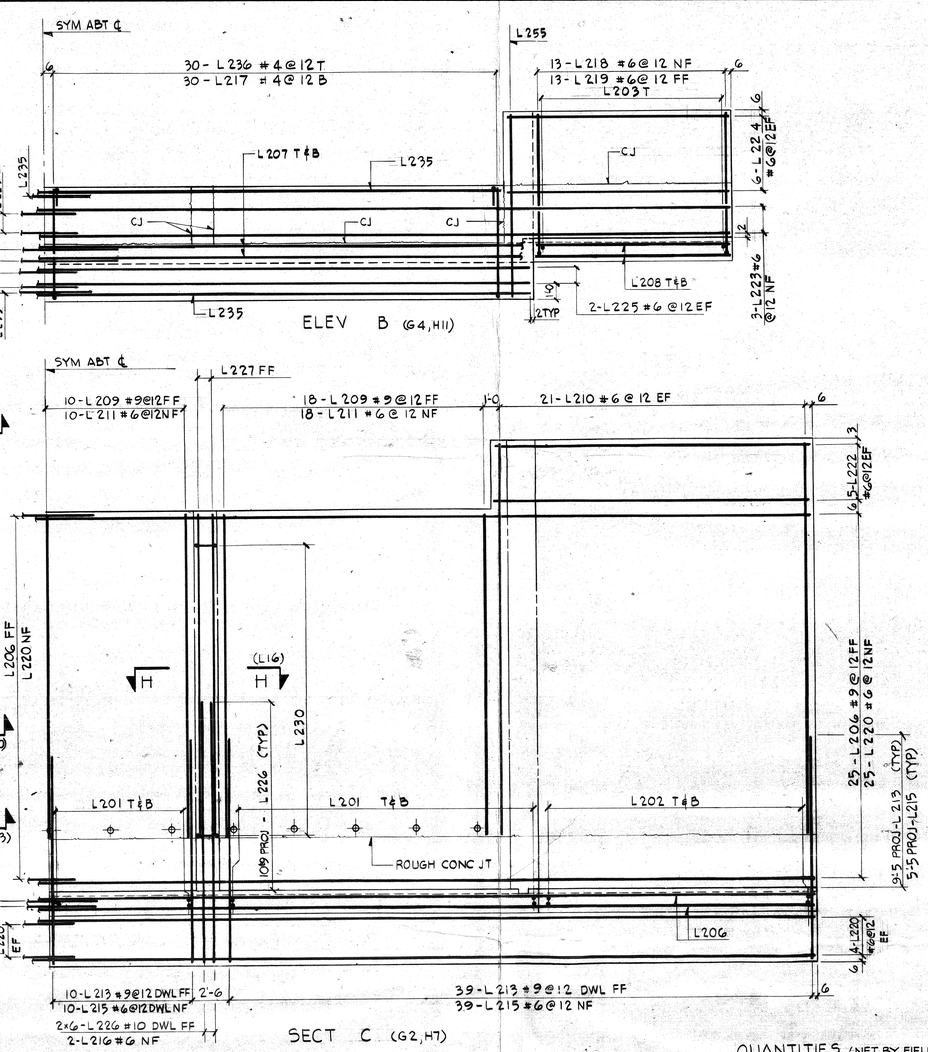
400-12-1094

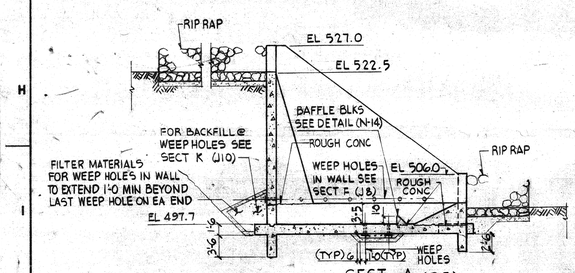


PLAN - DROP STR #3-MAS
SCALE 1 = 10'-0

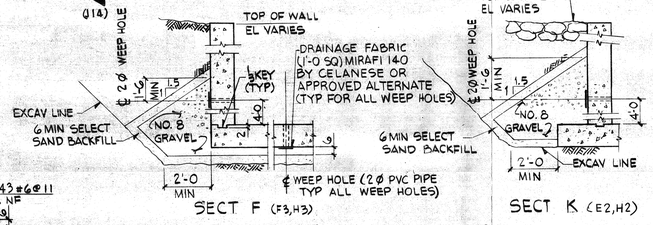


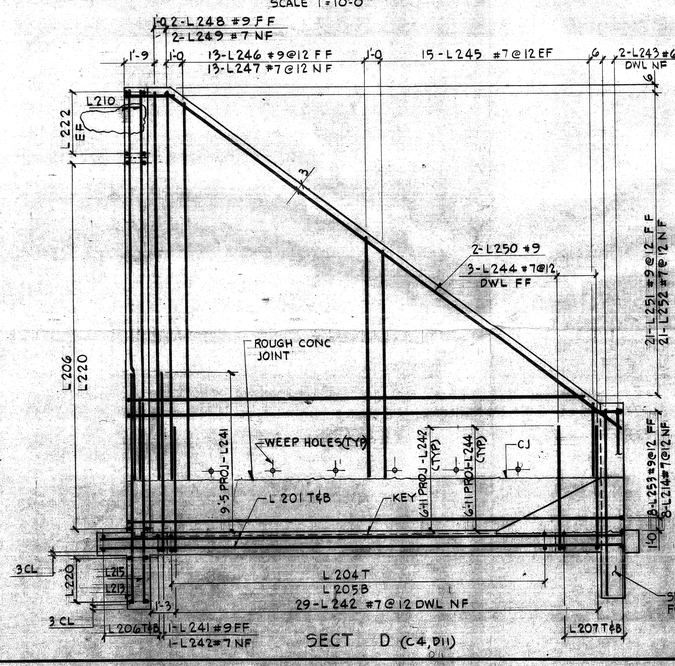
PLAN - BASE - REINF

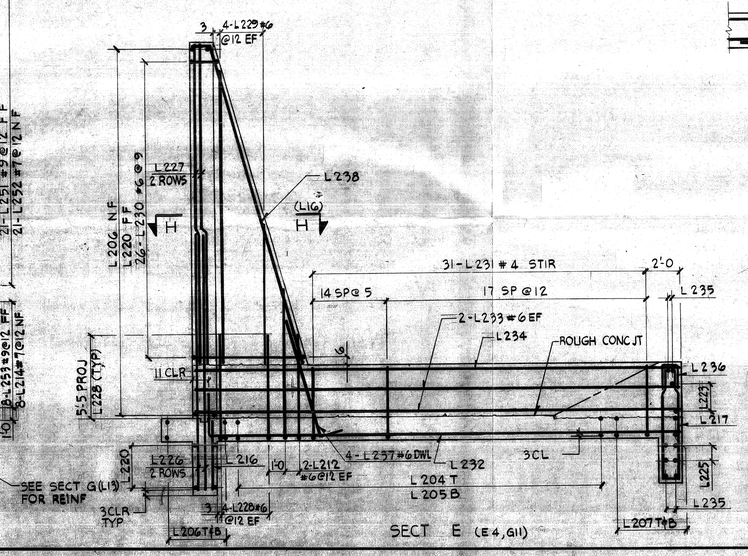


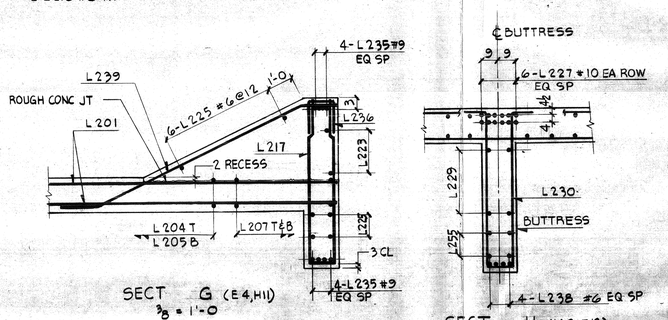


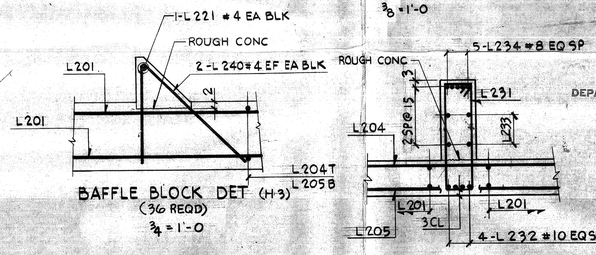
SECT A (D5)
SCALE 1 = 10'-0











SECT J (E3,F8)

QUANTITIES (NET BY FIELD UNLESS NOTED)

CONCRETE CLASS "A" (3500 PSI)	411 CY
FOR REINF BARS SEE BAR BENDING SCH 400-12-1300-19	
MIRAFI 140 (OR APPROVED ALTERNATE)	60 SQ FT
SELECT SAND BACKFILL-SEE EBASCO SPEC DAY-3848-CH-3 (OR APPROVED ALTERNATE)	58 CY
#8 GRAVEL BEDDING AS PER AASHO M 43 (OR APPROVED ALTERNATE)	157 CY
PVC PIPE 2Ø x 1'-6 LG	45 REQD
PVC PIPE 2Ø x 2'-0 LG	12 REQD

NOTES:

FOR RIP RAP DETAILS SEE DWG 400-12-1086 (N15)
FOR ADDITIONAL NOTES SEE DWG 400-12-1082

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
BAR BENDING SCHEDULE	400-12-1300-19
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DETAILS M&R SH 1	400-12-1082
ASH HANDLING SYSTEM ASH POND DITCH "A" & PROFILE SH 3	400-12-1086

STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
DAM PERMITS
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APPROVED
PERMIT NO.
OCT 2 1979

WORK THIS DWG WITH 400-12-1080 & 400-12-1086

APPROVED
PERMIT NO. 76-92
OCT 2 1979

RECEIVED
AUG 16 1979
DIVISION OF WATER
DAM PERMITS AND INSPECTION

EBASCO REFERENCE NUMBER		
DAY 3848G	12-1094	R-0

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM
MISC STRUCTURES, SECT & DET - M&R-SH 5

FOR: KILLEN ELECTRIC GENERATING STATION
606,025 KW INSTALLATION UNIT NO.2
606,025 KW INSTALLATION UNIT NO.1

SCALE 1"=1'-0 UNLESS NOTED	DIV. CIVIL	PROJECT	
DRAWN	8-6-76	APPROVED	9-20-76
CHECKED	9-1-76	APPROVED J.D. SYKES, Jr.	9-20-76
ENGINEER	5-20-76	APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1094
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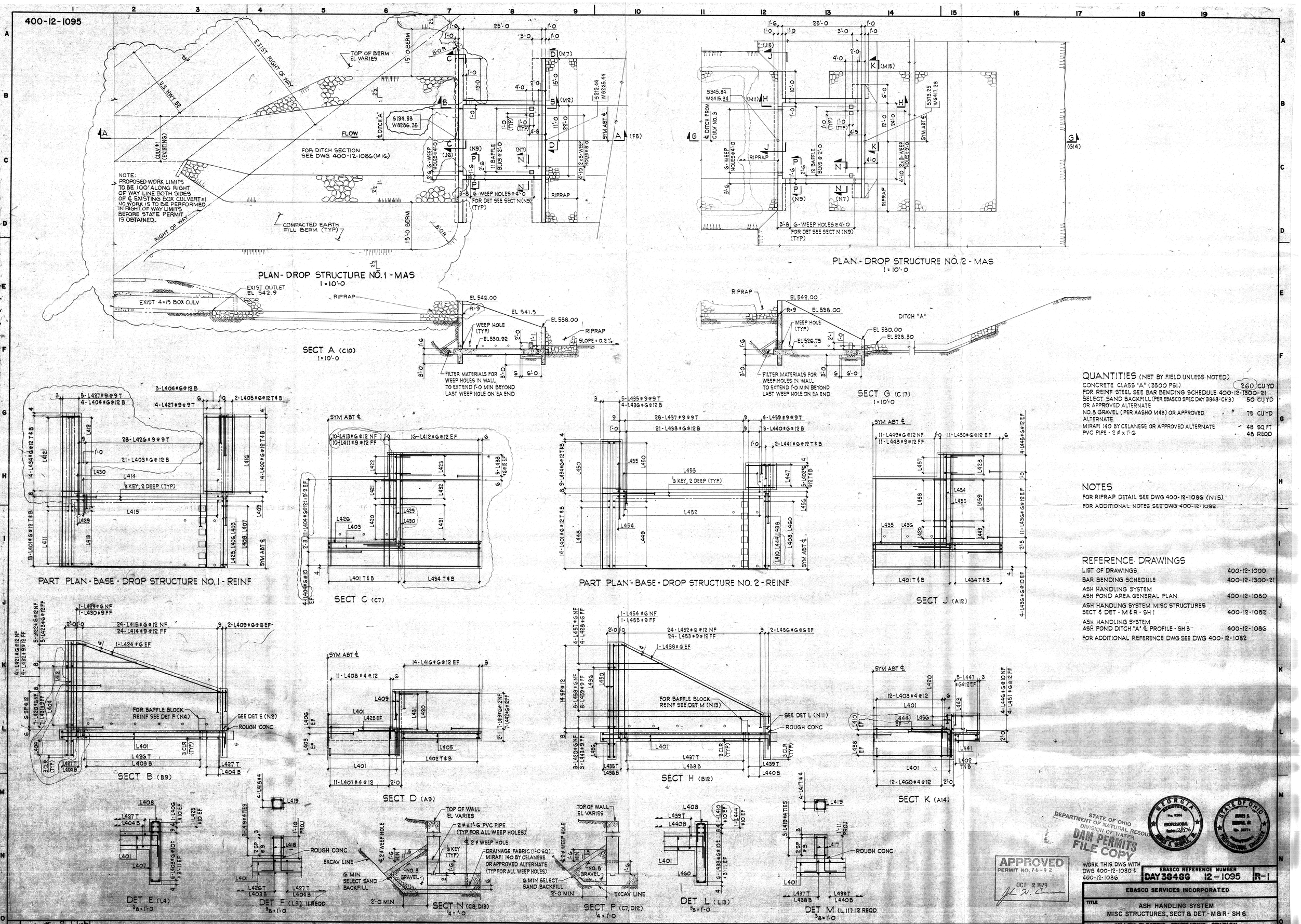
REVISIONS

OPEN DOLLIE (F1) BAR MARK LW

400-12-1095



QUANTITIES (NET BY FIELD UNLESS NOTED)

CONCRETE CLASS "A" (3500 PSI)	260 CU YD
FOR REINF STEEL SEE BAR BENDING SCHEDULE 400-12-1300-21	
SELECT SAND BACKFILL (PER EBASCO SPEC DAY 3848-CH3) OR APPROVED ALTERNATE	50 CU YD
NO. 8 GRAVEL (PER AASHO M43) OR APPROVED ALTERNATE	75 CU YD
MIRAFI 140 BY CELANESE OR APPROVED ALTERNATE	48 SQ FT
PVC PIPE - 2 ø x 1'-6	48 REQD

NOTES

FOR RIPRAP DETAIL SEE DWG 400-12-1086 (N15)

FOR ADDITIONAL NOTES SEE DWG 400-12-1082

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
BAR BENDING SCHEDULE	400-12-1300-21
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM MISC STRUCTURES SECT & DET - M & R - SH 1	400-12-1082
ASH HANDLING SYSTEM ASH POND DITCH "A" & PROFILE - SH 3	400-12-1086

FOR ADDITIONAL REFERENCE DWG SEE DWG 400-12-1082

STATE OF OHIO DEPARTMENT OF NATURAL RESOURCES DIVISION OF WATER DAM PERMITS FILE COPY

APPROVED PERMIT NO. 76-92 OCT 2 1979

RECEIVED AUG 16 1979 DIVISION OF WATER DAM PERMITS AND INSPECTION

WORK THIS DWG WITH DWG 400-12-1080 & 400-12-1086

EBASCO REFERENCE NUMBER DAY 3848G 12-1095 R-1

EBASCO SERVICES INCORPORATED

TITLE: ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DET - M&R - SH 6

FOR: KILLEN ELECTRIC GENERATING STATION 606,025 KW INSTALLATION UNIT NO. 2 606,025 KW INSTALLATION UNIT NO. 1

SCALE 3/8 = 1'-0 UNLESS NOTED	DIV. CIVIL	PROJECT	
DRAWN D. NORRIS	8-6-76	APPROVED	7-8-76
CHECKED N. Bagnall	8-16-76	APPROVED J.D. SYKES Jr.	8-27-76
ENGINEER		APPROVED	

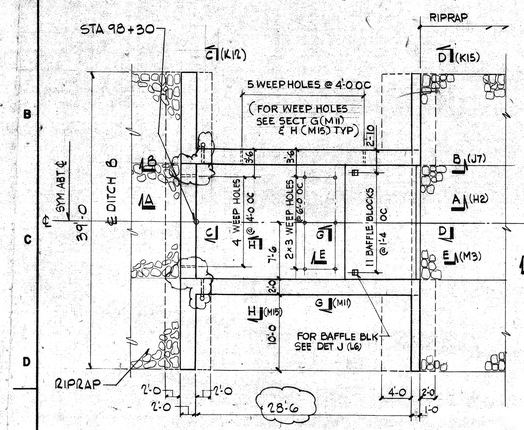
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1095 SHEET OF SHEETS

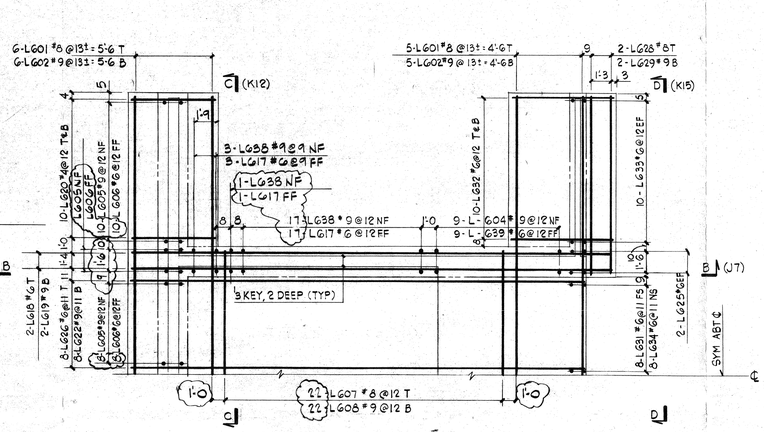
REVISIONS

1	REVISED (F19) QUAN (HI, H7, I15, I12, L1, L14, N11) REINF (C12, F12) RIPRAP ADDED (E5) RIPRAP DITCH (NW) (W4-L5, TO PLAN 4 DELETED (E1) NOT REQ'D (M15) INFO REQUIRED	2477 D.H. KKP
	DATE BY	CH APPROVED

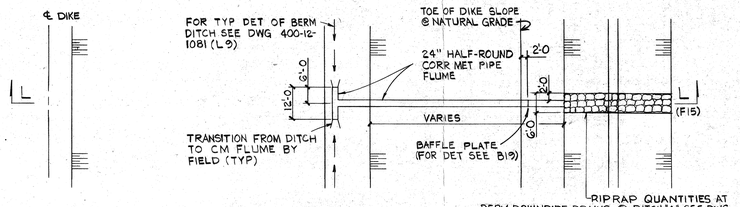
400-12-1096



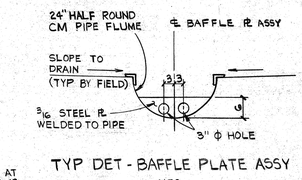
MAS PLAN - CONC OUTFALL STRUCTURE - STA 98+30



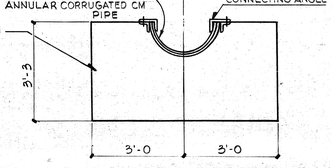
PART PLAN - BASE - REINF



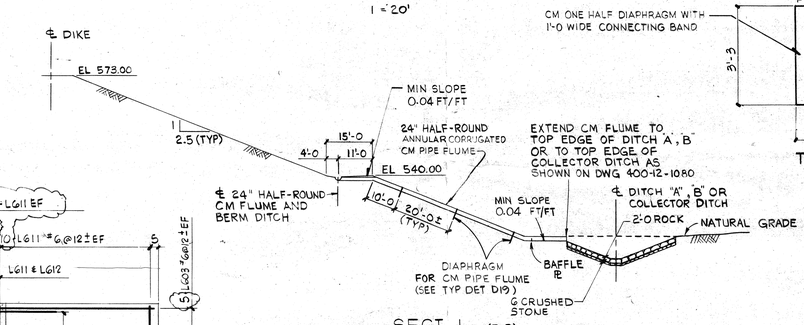
TYP PLAN - BERM DOWNPIPE DRAIN
(20 REQD)
1 = 20'



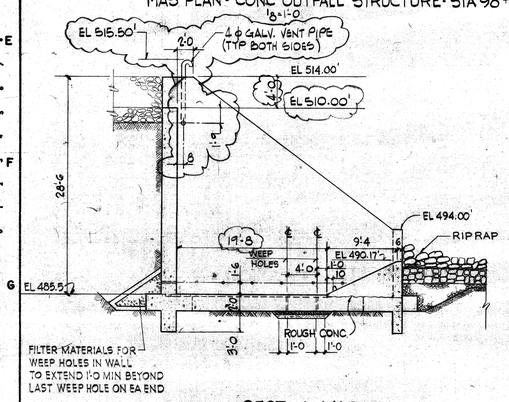
TYP DET - BAFFLE PLATE ASSY
NTS



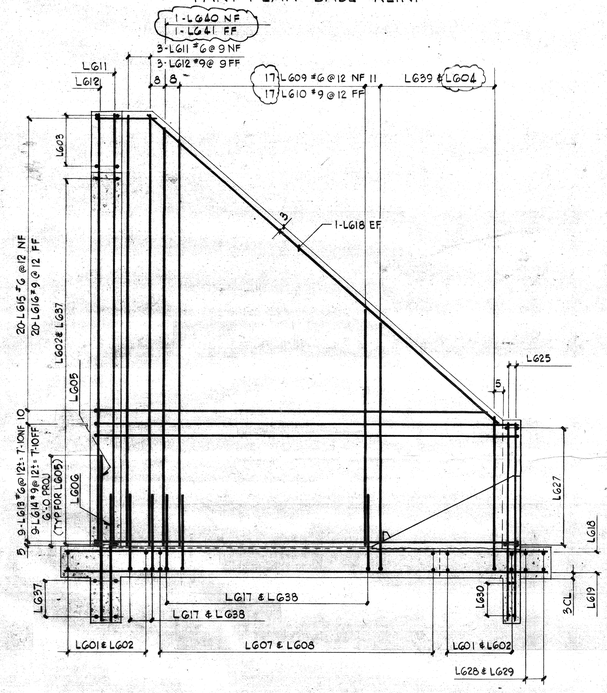
TYP DET - DIAPHRAGM
1 = 2'-0



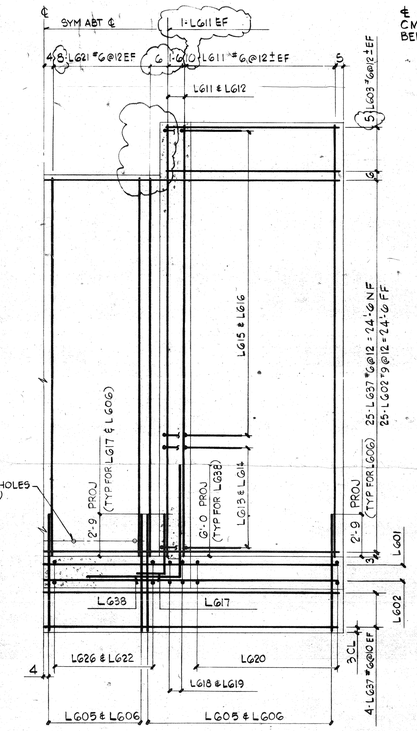
SECT L (B17)
1 = 20



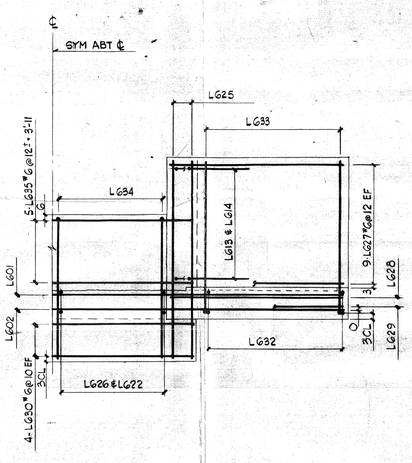
SECT A-MAS (C4)
3/8 = 1'-0



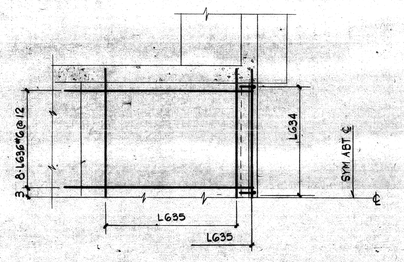
SECT B (B4, C10)



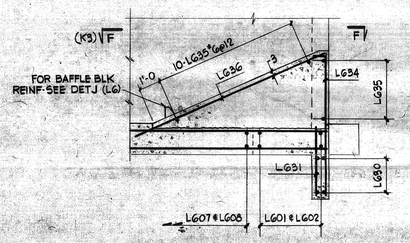
SECT C (B2, B6)



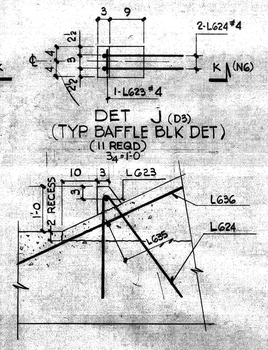
SECT D (B4, B10)



SECT F (K1)

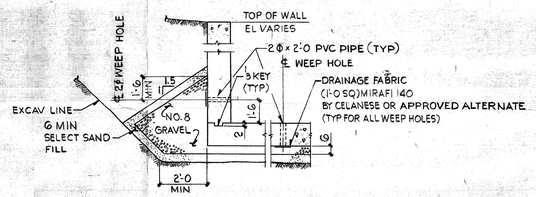


SECT E (C4)

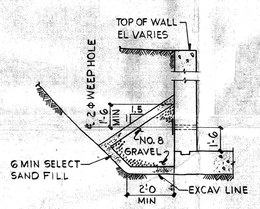


DET J (D3)
(TYP BAFFLE BLK DET)
(11 REQD)
3/4 = 1'-0

SECT K (L6)
3/4 = 1'-0



SECT G (D3)



SECT H (D2)

QUANTITIES (NET BY FIELD UNLESS NOTED)

CONCRETE CLASS "A" (3500 PSI)	240 CU YD
FOR REINF BARS SEE BAR BENDING SCHEDULE	400-12-1300-23
MIRAFI 140 OR APPROVED ALTERNATE	20 SQ FT
SELECT SAND FILL (PER EBASCO SPEC DAY 3848-CH3) OR APPROVED ALTERNATE	81 CU YD
NO 8 GRAVEL BEDDING AS PER AASHO M43 OR APPROVED ALTERNATE	51 CU YD
BERM DOWNPIPE DRAINS - PER TYP PLAN (C15)	20 REQD
2 Φ x 2'-0 PVC PIPE	20 REQD
4 Φ GALV. VENT PIPE	20 LF

NOTES

SEE DWG 400-12-1080 FOR APPROXIMATE LOCATIONS OF BERM DOWNPIPE DRAINS AS PER TYP PLAN (C15). EXACT LOCATIONS BY FIELD.
FOR RIPRAP DETAILS SEE DWG 400-12-1087 (M13)
FOR ADDITIONAL NOTES SEE DWG 400-12-1082

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
BAR BENDING SCHEDULE	400-12-1300-23
ASH HANDLING SYSTEM ASH POND AREA GENERAL PLAN	400-12-1080
ASH HANDLING SYSTEM DIKES, SECTS & DET - SH 1	400-12-1081
ASH HANDLING SYSTEM MISC STRUCTURES, SECT & DET - M&R SH 1	400-12-1082
ASH HANDLING SYSTEM ASH POND DITCH "B" & PROFILE SH 4	400-12-1087

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GEORGIA REGISTERED No. 9504 PROFESSIONAL ENGINEER JAMES S. SEMPLE, JR.

STATE OF OHIO JAMES S. SEMPLE, JR. No. 38774 REGISTERED PROFESSIONAL ENGINEER

APPROVED
PERMIT NO. 76-92
OCT 2 1979

RECEIVED
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WORK THIS DWG WITH DWGS 400-12-1080 & 400-12-1087

EBASCO REFERENCE NUMBER DAY 3848G 12-1096 R-1

EBASCO SERVICES INCORPORATED

TITLE ASH HANDLING SYSTEM
MISC STRUCTURES, SECT & DET, M&R-SH7

FOR KILLEN ELECTRIC GENERATING STATION
608,025 KW INSTALLATION UNIT NO.2
608,025 KW INSTALLATION UNIT NO.1

SCALE 4"=1'-0 UNLESS NOTED	DIV. CIVIL	PROJECT	
DRAWN L.WAYCUILIG / D.SHAH	8-25-76	APPROVED J.D.SYKES, JR.	9-11-76
CHECKED K.K. FATEHPURIA	8-26-76	APPROVED J.D.SYKES, JR.	9-3-76
ENGINEER M.K. KOPLIN		APPROVED	

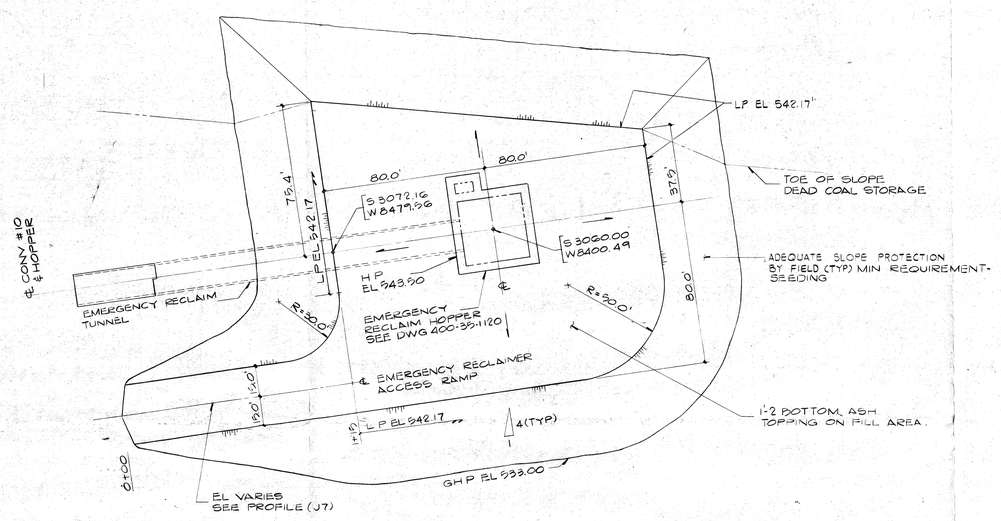
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1096
SHEET OF SHEETS

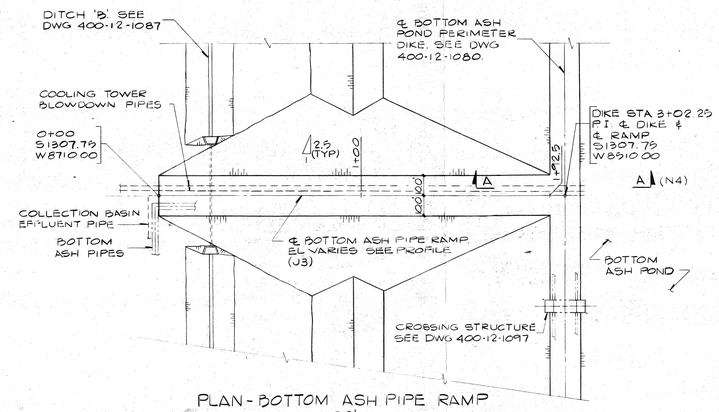
REVISIONS

1	(E1) ISSD (B1, C1, E1, F1) OUTFALL STRUCT; (E4) BILL NO: (D1, D2, D3, E1, G1) DIM; (E5) EL; (C5, C6, D5) DIM; E1, E10, E11, F5, H10, J1, K1 ADDED (D4, C5, E4, J1) & BM (C3, C4) D1, M1; (B1, C1, E1) VENT PIPES (H17) QUANT; (E1, K1) NOTE		
DATE	BY	CK	APPROVED
8-27-79	BD	MMS	RSK

400-12-1029



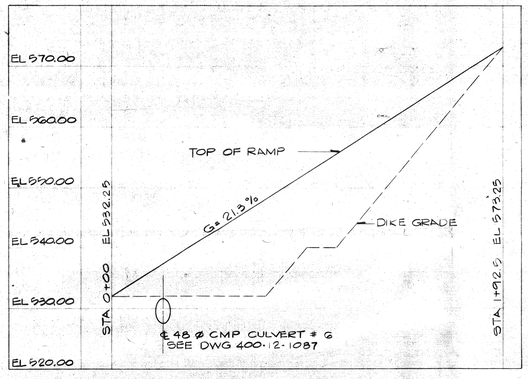
PLAN- EMERGENCY RECLAIMER ACCESS AREA
1=30'



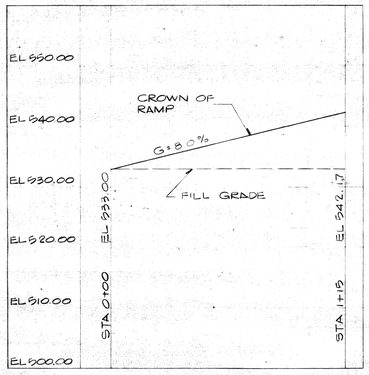
PLAN- BOTTOM ASH PIPE RAMP
1=30'

QUANTITIES (NET BY FIELD UNLESS NOTED)

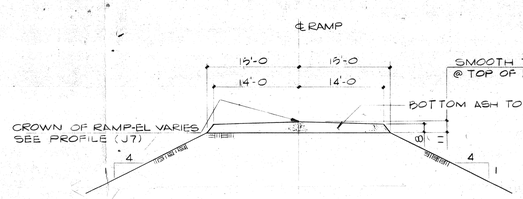
EARTH FILL	15,500 CU YD
BOTTOM ASH TOPPING	1050 CU YD



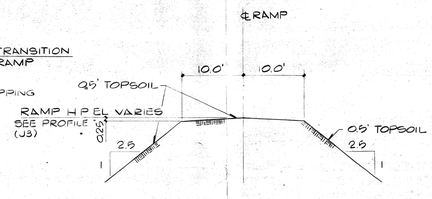
PROFILE ALONG ℄ BOTTOM ASH PIPE RAMP (E14)
1=10' VERT
1=50 HORIZ



PROFILE ALONG ℄ EMERGENCY RECLAIMER ACCESS RAMP (D3)
1=10' VERT
1=50 HORIZ



TYP SECT - EMERGENCY RECLAIMER ACCESS RAMP (D3)
1=5' VERT
1=10' HORIZ



TYP SECT- BOTTOM ASH PIPE RAMP (E14)
1=5' VERT
1=10' HORIZ

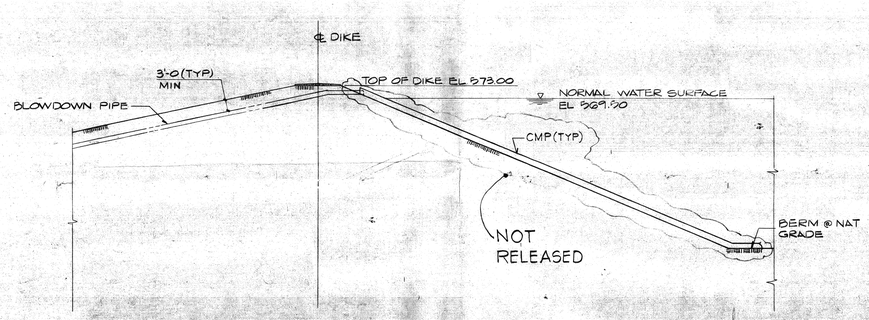
NOTES

FOR GENERAL NOTES SEE DWG 400-12-1080 & 400-12-1021.

FOR COOLING TOWER BLOWDOWN PIPES, COLLECTION BASIN EFFLUENT PIPES AND BOTTOM ASH PIPES SEE DWG 400-12-7574.

REFERENCE DRAWINGS

LIST OF DRAWINGS	400-12-1000
SITE GENERAL GRADING PLAN SH 2	400-12-1021
ASH POND AREA GENERAL PLAN	400-12-1080
ASH POND DITCH 'B' & PROFILE SH 4	400-12-1087
AHS-MISC STRUCT SECT & DET SH 8	400-12-1097
CHS-EMERG RECLAIM HOPPER & TUNNEL-MAS SH 1	400-35-1120
YARD PIPING SH 5 (MECH)	400-12-7574



SECT A (D17)
1=20'

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OCT 2 1979

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DIVISION OF WATER
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STATE OF OHIO JAMES S. SEMPLE, JR. No. 38774 REGISTERED PROFESSIONAL ENGINEER

GEORGIA REGISTERED No. 9504 PROFESSIONAL ENGINEER JAMES S. SEMPLE, JR.

INFORMATION REQUIRED TO COMPLETE THIS DRAWING.
"ATLANTA RELEASE REQUIRED FOR CONSTRUCTION".
CMP SIZE AND SUPPORT DETAILS

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EBASCO REFERENCE NUMBER
DAY3848G 12-1029 R-0

EBASCO SERVICES INCORPORATED

TITLE MISC RAMPS SECT & DET

FOR KILLEN ELECTRIC GENERATING STATION
608,025 KW INSTALLATION UNIT NO.2
608,025 KW INSTALLATION UNIT NO.1

SCALE NOTED	DIV. CIVIL	PROJECT	
DRAWN L. COX	4-6-79	APPROVED James S. Semple	6-5-79
CHECKED W. WEIKEL	4-13-79	APPROVED J.D. SYKES	6-2-79
ENGINEER G S REDDY	5-22-79	APPROVED	

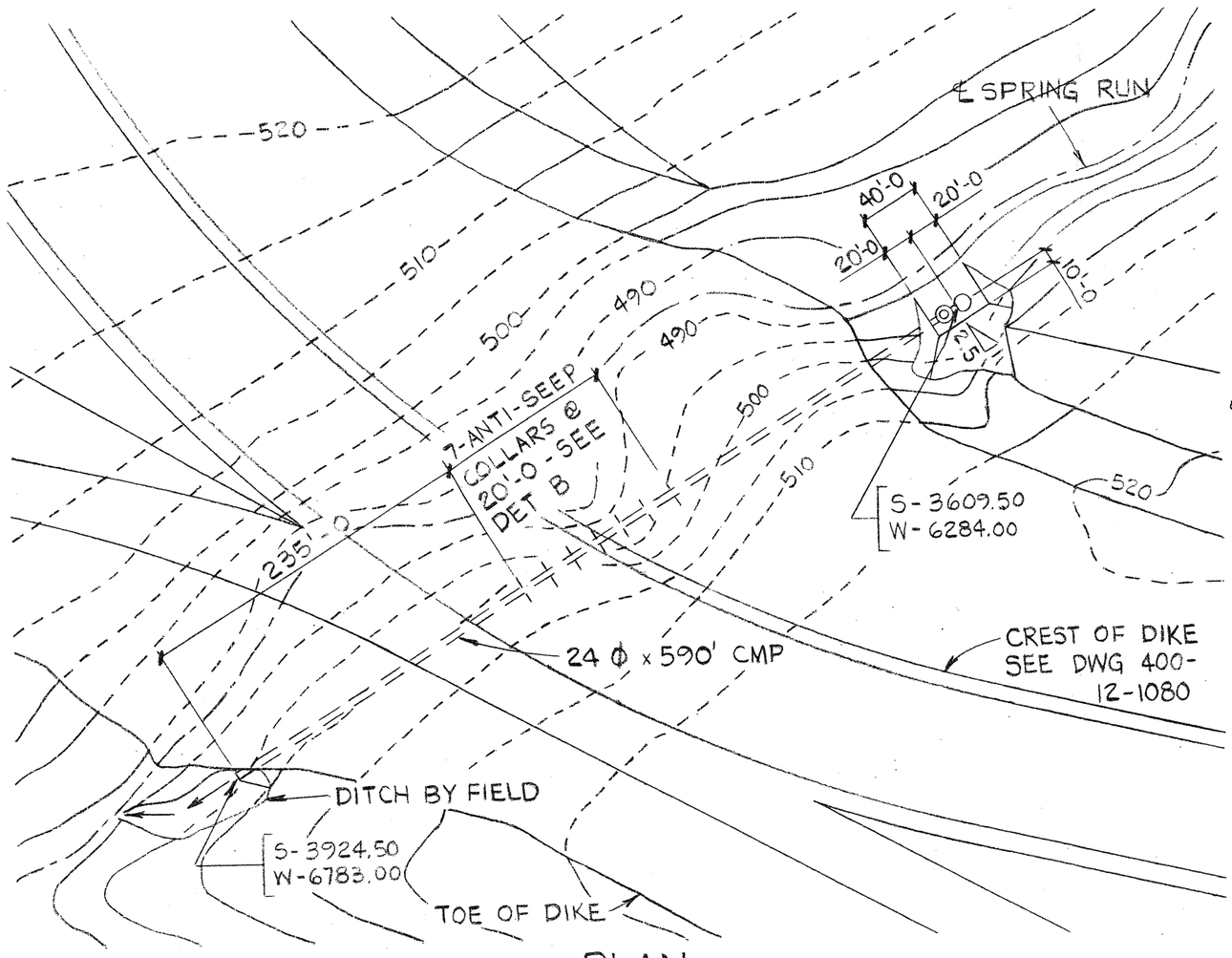
THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-1029
SHEET OF SHEETS

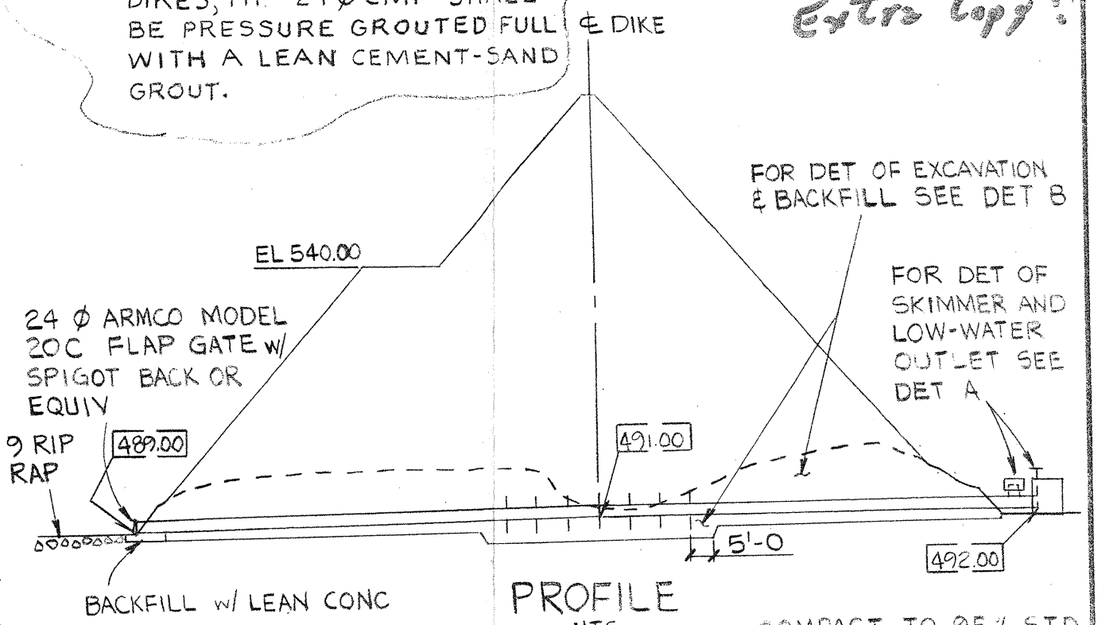
REVISIONS

NOTE: AFTER COMPLETION OF THE DIKES, TH 24 Ø CMP SHALL BE PRESSURE GROUTED FULL WITH A LEAN CEMENT-SAND GROUT.

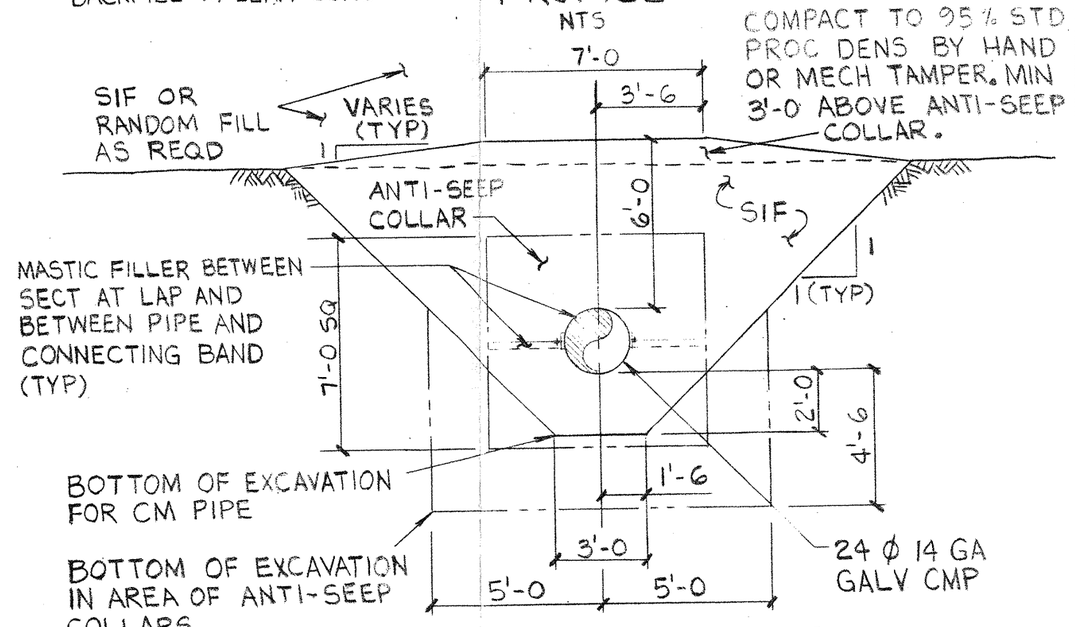
Extra Copy?



PLAN
1 = 100'

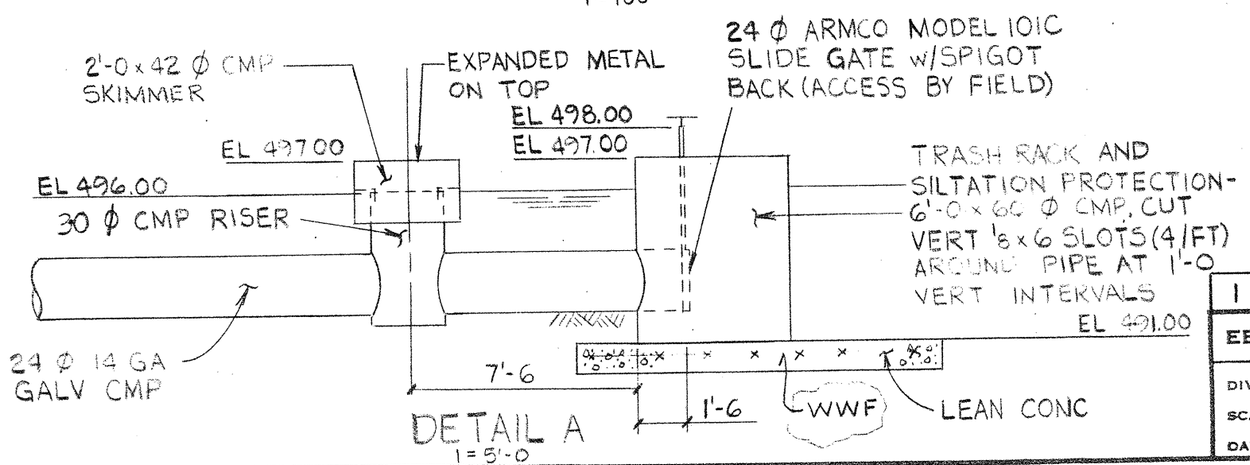


PROFILE
NTS



DETAIL B
1 = 5'-0

NOTE
SIF = SELECT IMPERVIOUS FILL (SEE SPEC DAY 3848 CH-3)



DETAIL A
1 = 5'-0

1	6-7-77	MHforsea	JDSykes Jr	

EBASCO SERVICES INCORPORATED

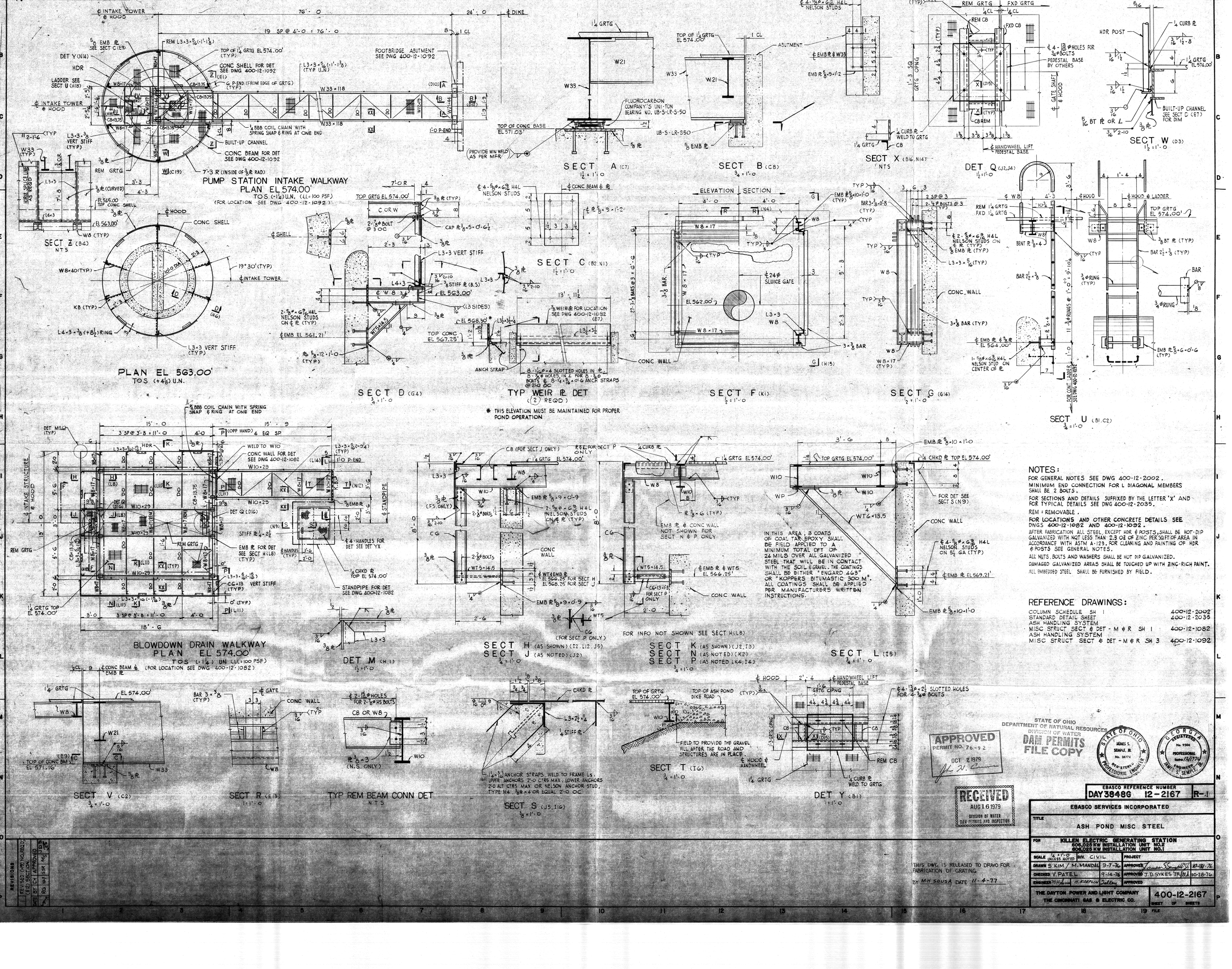
DIV. CIVIL DR. GFG
SCALE A.N. CH. P.I.B.
DATE 7-23-76
APPROVED MHforsea JDSykes Jr

KILLEN STATION
UNITS 1 & 2
TEMPORARY DRAIN AT SPRING RUN

SK 3848
CH-192

400-12-2167

N



NOTES:

FOR GENERAL NOTES SEE DWG 400-12-2002.

MINIMUM END CONNECTION FOR L DIAGONAL MEMBERS SHALL BE 2 BOLTS.

FOR SECTIONS AND DETAILS SUFFIXED BY THE LETTER 'X' AND FOR TYPICAL DETAILS SEE DWG 400-12-2035.

REM = REMOVABLE.

FOR LOCATIONS AND OTHER CONCRETE DETAILS SEE DWGS 400-12-1082 AND 400-12-1092.

AFTER FABRICATION ALL STEEL, EXCEPT HDR & POSTS, SHALL BE HOT-DIP GALVANIZED WITH NOT LESS THAN 2.3 OZ OF ZINC PER SQ FT OF AREA IN ACCORDANCE WITH ASTM A-123. FOR CLEANING AND PAINTING OF HDR & POSTS SEE GENERAL NOTES.

ALL NUTS, BOLTS AND WASHERS SHALL BE HOT DIP GALVANIZED.

DAMAGED GALVANIZED AREAS SHALL BE TOUCHED UP WITH ZINC-RICH PAINT.

ALL EMBEDDED STEEL SHALL BE FURNISHED BY FIELD.

IN THIS AREA, 3 COATS OF COAL TAR EPOXY SHALL BE FIELD APPLIED TO A MINIMUM TOTAL DFT OF 24 MILS OVER ALL GALVANIZED STEEL THAT WILL BE IN CONTACT WITH THE SOIL & GRAVEL. THE COATINGS SHALL BE EITHER "ENGARD 463" OR "KOPPERS BITUMASTIC 300-M". ALL COATINGS SHALL BE APPLIED PER MANUFACTURERS WRITTEN INSTRUCTIONS.

REFERENCE DRAWINGS:

COLUMN SCHEDULE SH 1	400-12-2002
STANDARD DETAIL SHEET	400-12-2035
ASH HANDLING SYSTEM MISC STRUCT SECT & DET - M & R SH 1	400-12-1082
ASH HANDLING SYSTEM MISC STRUCT SECT & DET - M & R SH 3	400-12-1092

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DAM PERMITS AND INSPECTION

THIS DWG IS RELEASED TO DRAWO FOR FABRICATION OF GRATING
BY MH SOUSA DATE 11-4-77

REVISIONS				
1	REVISED (MP) NO REQD (E12) SECTION	RG	MK	10-28-76

EBASCO REFERENCE NUMBER DAY3848G 12-2167 R-1

EBASCO SERVICES INCORPORATED

TITLE: ASH POND MISC STEEL

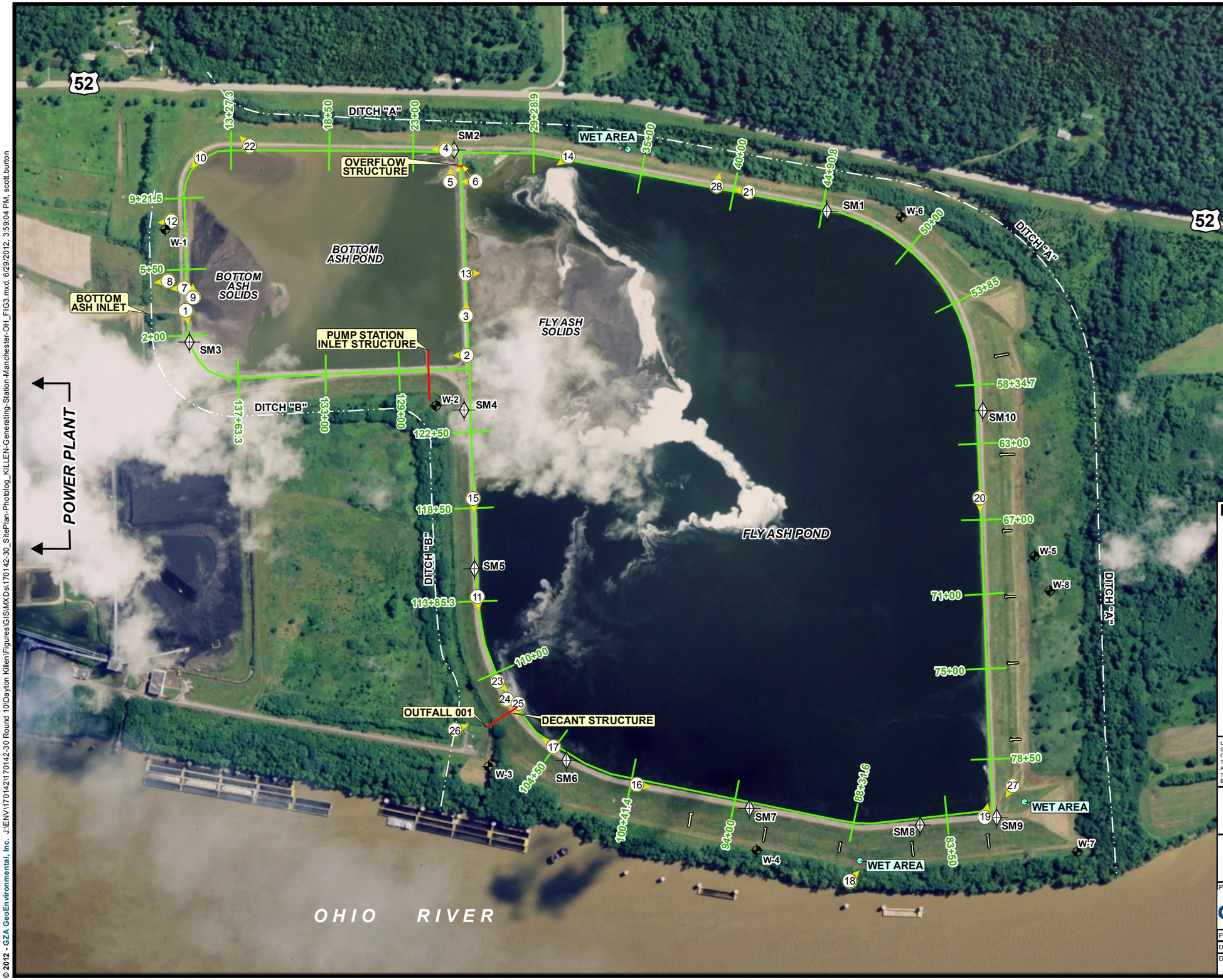
FOR: KILLEN ELECTRIC GENERATING STATION
608,025 KW INSTALLATION UNIT NO.2
605,025 KW INSTALLATION UNIT NO.1

SCALE ¼"=1'-0 UNLESS NOTED	DIV. CIVIL	PROJECT	
DRAWN S. KIM / M. MANDAL	9-7-76	APPROVED James S. Semple Jr.	10-31-76
CHECKED V. PATEL	9-14-76	APPROVED J.D. SYKES JR.	10-28-76
ENGINEER H. KOEPLIN		APPROVED	

THE DAYTON POWER AND LIGHT COMPANY
THE CINCINNATI GAS & ELECTRIC CO.

400-12-2167
SHEET OF SHEETS

APPENDIX 6.1
Figure 3 from:
Round 10 Dam Assessment, Dayton Power and Light Company, Killen Electric Generating Station, Bottom Ash Pond and Fly Ash Pond
By GZA GeoEnvironmental, Dated August 2012



LEGEND

- APPROXIMATE LOCATION OF PIEZOMETERS
- 27 PHOTO LOCATION / DIRECTION
- APPROXIMATE LOCATION OF SURVEY MONUMENTS
- WET AREA
- T-DRAIN

SOURCE: This map contains the ESRI ArcGIS Online World Imagery Map service, published February 2011 by ESRI ARCIMS Services. The service was compiled to uniform cartography using a variety of best available sources from several data providers.

Data Supplied by : esri

0 150 300 600
SCALE IN FEET

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KILLEN ELECTRIC GENERATING STATION
14869 U.S. 52
MANCHESTER, OHIO

SITE PLAN AND PHOTOLOG

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com

PREPARED FOR: United States Environmental Protection Agency

PROJ MGR: TRB	REVIEWED BY: PHB	CHECKED BY: TRB	FIGURE 3
DESIGNED BY: MVE	DRAWN BY: EMD / SBB	SCALE: 1 in = 499 ft	
DATE: 06/29/2012	PROJECT NO. 01.0170142.30	REVISION NO.	

© 2012 - GZA GeoEnvironmental, Inc. J:\ENV\170142\170142-30 Round 10\Dayton Killen\Figures\GIS\MXDs\170142-30_SitePlan-Photolog_KILLEN-Generating-Station-Manchester-OH_FIG3.mxd, 6/29/2012, 3:59:04 PM, scott.burton

APPENDIX 6.2
Excerpt from:
Killen Electric Generating Station Units No. 1 and No. 2, Ash Disposal Pond Dike and Foundation Studies, (Volume 1A of 2)
By Ebasco Services, Inc., Dated August 1979
Pages 35-36

C. SEEPAGE ANALYSES (Continued)

Seepage was estimated for the east and west perimeter dikes using the flow net developed in Section B (Figure 13B). The seepage for these areas was calculated to be on the order of .021 gpm/lin foot of dike.

The north perimeter dike is an area where the longest flow paths to the Ohio River exist. Due to the hills north of the pond, where bedrock underlying the alluvial deposits daylights, any seepage north from the pond is forced around the pond and towards the river. This situation is illustrated on the horizontal flow net. Estimated seepage for this area is approximately .0101 gpm/lin foot of dike (see Section C, Figure 13C).

Seepage from the bottom ash pond was calculated using the flow net developed in Section D (Figure 13D). From the horizontal flow net, it can be seen that the flow paths for seepage from the bottom ash pond to the river extend through the plant area. The magnitude of seepage from the bottom ash pond was calculated to be .021 gpm/lin foot of dike.

The total seepage from the pond is determined by multiplying the various seepage rates per unit length by the dike section which they represent. The resultant quantity is slightly less than 1.5 gallons per minute per acre. The overlapping effect of the flow net where the dike curves were taken into consideration. The projected seepage losses are insignificant compared to the area and volume of the pond. Therefore, it was concluded the design is adequate and no additional measures to reduced seepage are required.

D. MONITORING PROGRAM

1. During Construction

Piezometers will be installed during the initial stages of construction of the dikes to establish a base record of the existing groundwater conditions. These piezometers will be monitored on a regular basis throughout construction to provide information on the magnitude and distribution of pore pressures within the foundation materials. Additional piezometers may be installed within the embankment during construction, if required on the basis of the regular monitoring program.

D. MONITORING PROGRAM (Continued)

2. After Construction

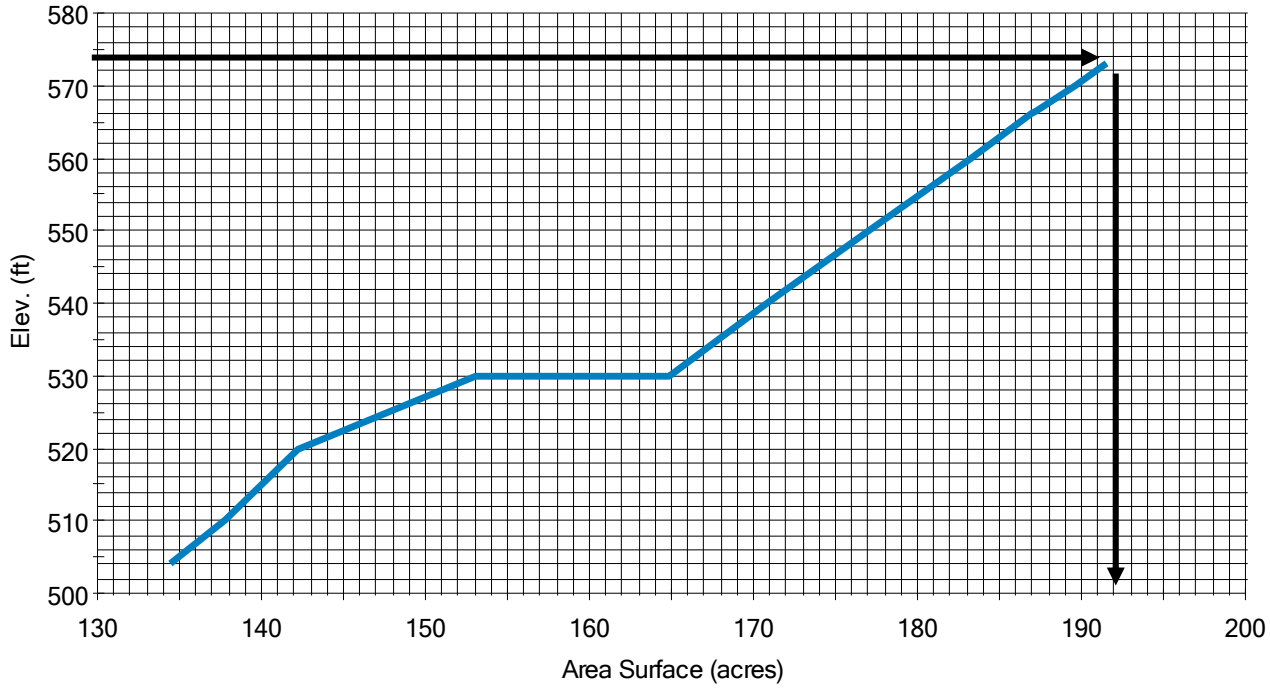
An additional series of piezometers will be installed near the downstream toe during the latter part of construction of the dikes. These piezometers will measure the performance of the impervious earth blanket which will be used to seal the bottom of the pond and will record any rise in groundwater should it occur. These piezometers will be read on a weekly basis until a consistant trend is established for each piezometer; then, the readings will gradually be extended to monthly intervals for the life of the pond. Should any of the piezometers become active, the reading frequency will be shortened accordingly to study the detail of activity.

Selected piezometers will be used for water quality sampling in order to record any influence of the disposal areas on the existing groundwater. The selection of sampling locations will involve randomly spaced piezometers along the downstream toe of the perimeter dike. Should any piezometers become active, water quality samples will be taken in addition to the regular monitoring. The piezometer readings and water quality characteristics taken after construction and during pond operation will be compared to the base information.

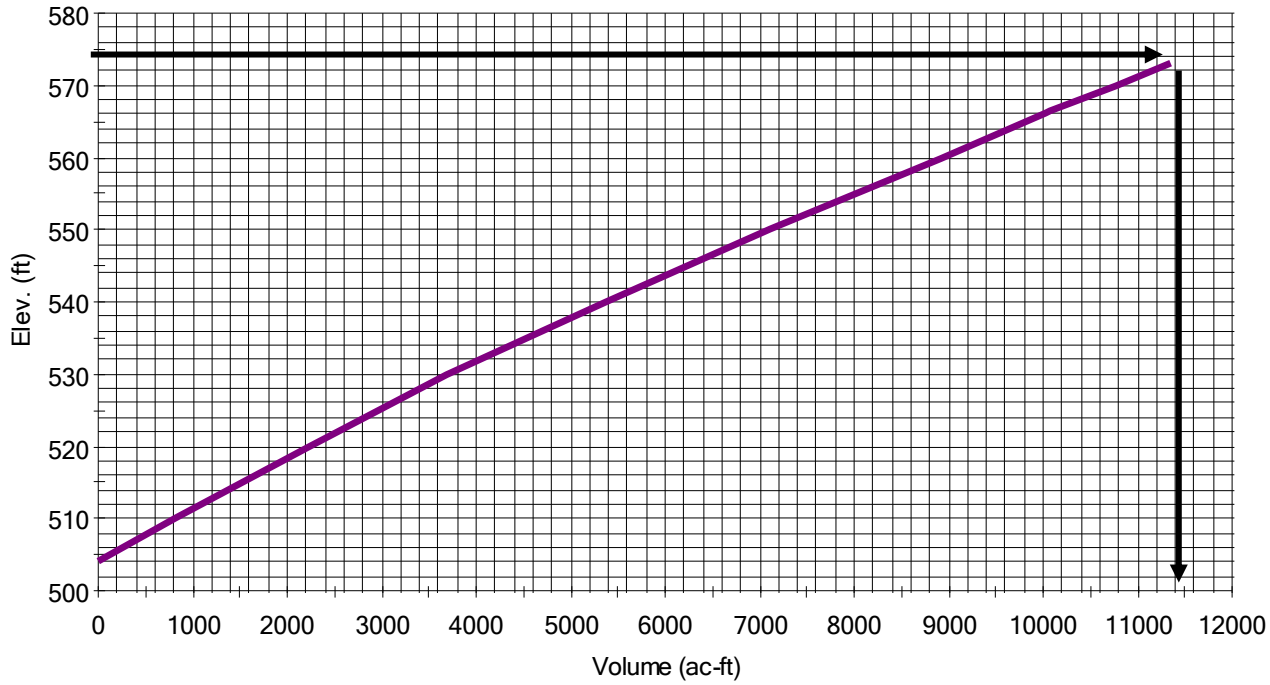
Surface monuments will be placed at the maximum section of the perimeter dike (where the dike crosses Spring Run) and at several other locations upon completion of construction to monitor settlement and possible horizontal movements of the dike. These monuments will be surveyed periodically to monitor any movement within the dikes which might cause detrimental effects to the dikes or any of the appurtenant structures associated with the dikes.

APPENDIX 7
Excerpt from:
Operation Maintenance and Inspection Manual
By DP&L, Dated April 2014
Pages 16-17

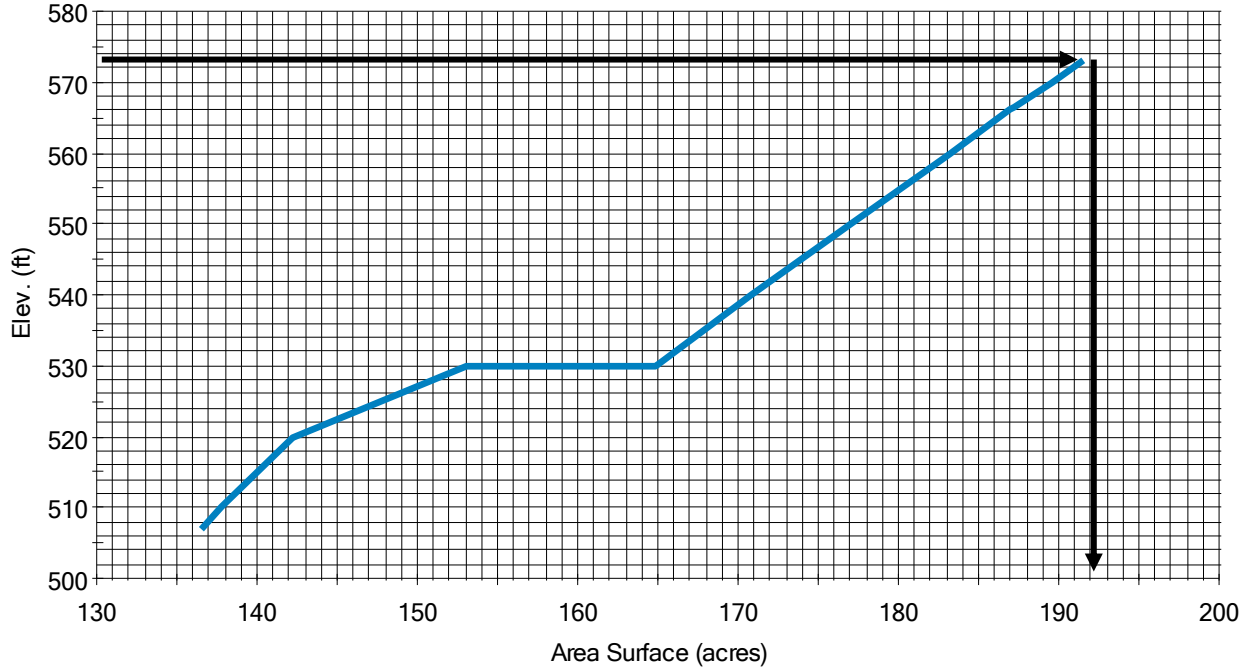
Total Storage Capacity of Impoundment (Elevation vs Area Surface)



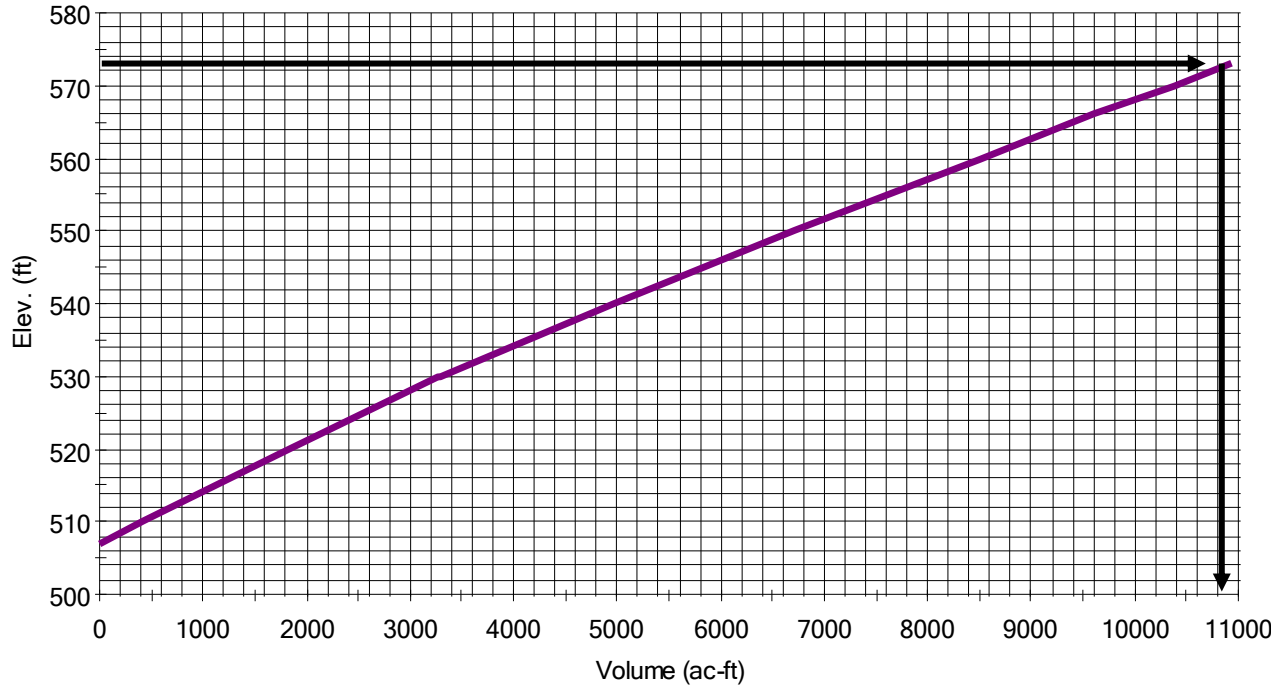
Storage Capacity of Impoundment (Elevation vs Volume)



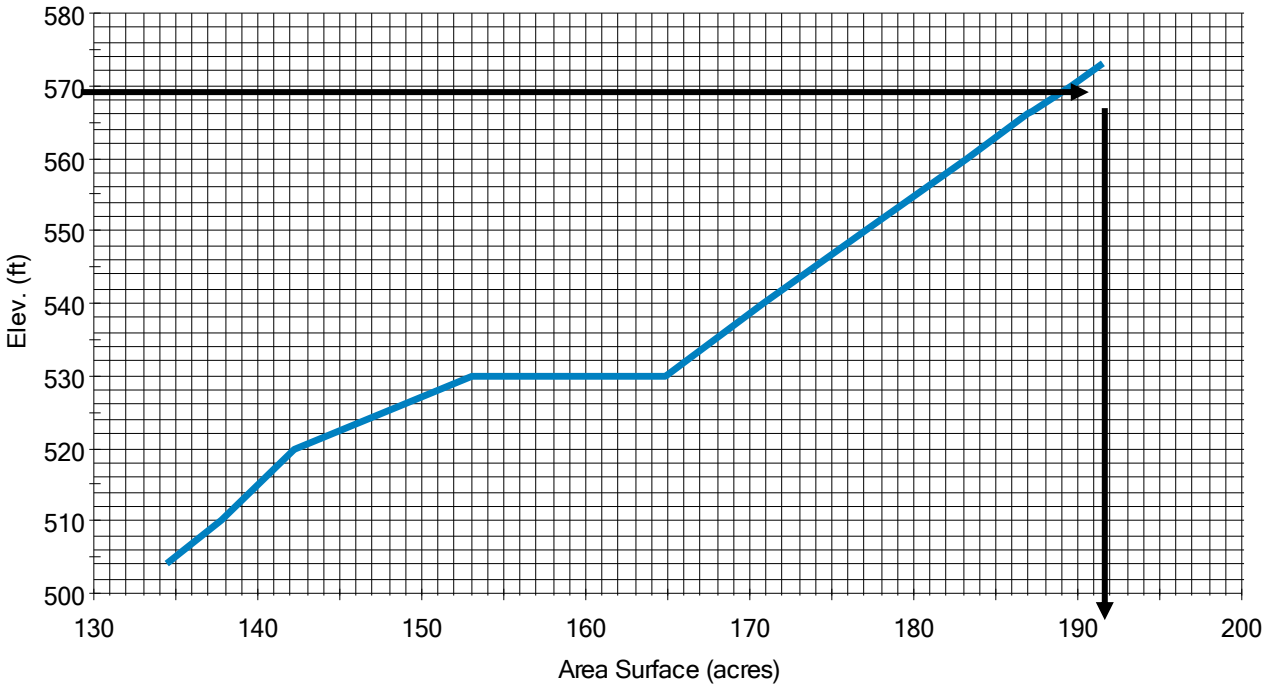
Total Storage Capacity Behind Dam (Elevation vs Area Surface)



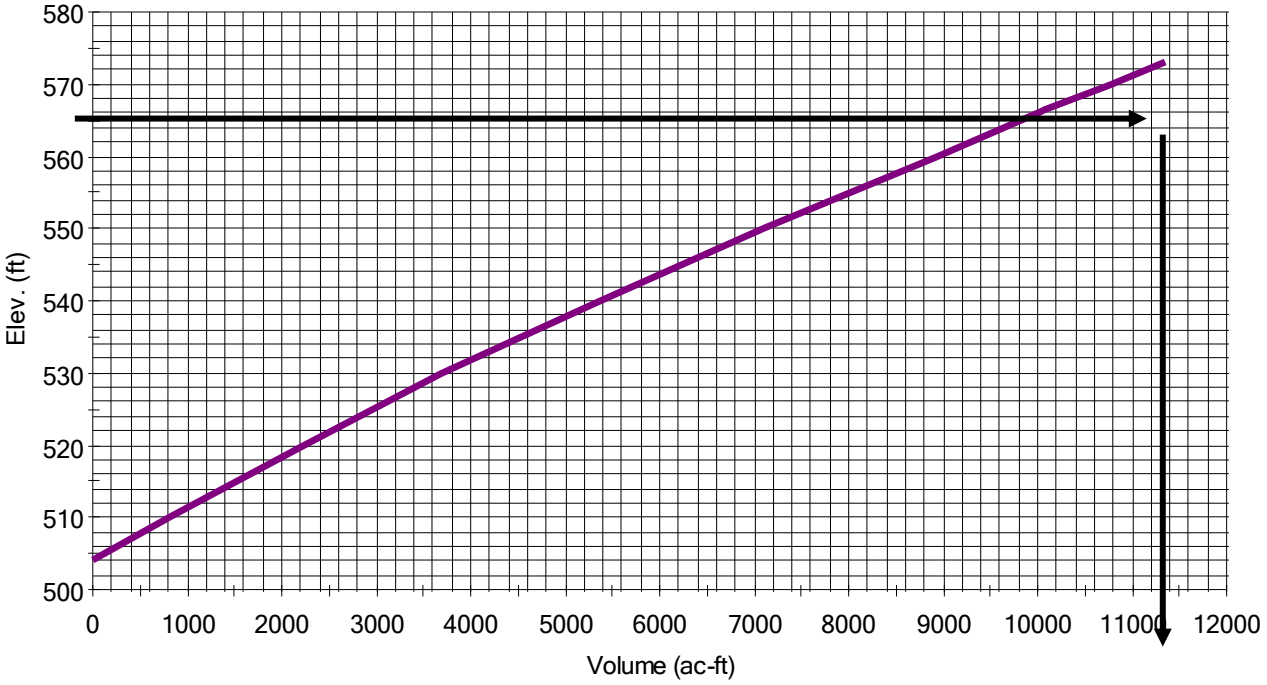
Storage Capacity behind Dam (Elevation vs Volume)



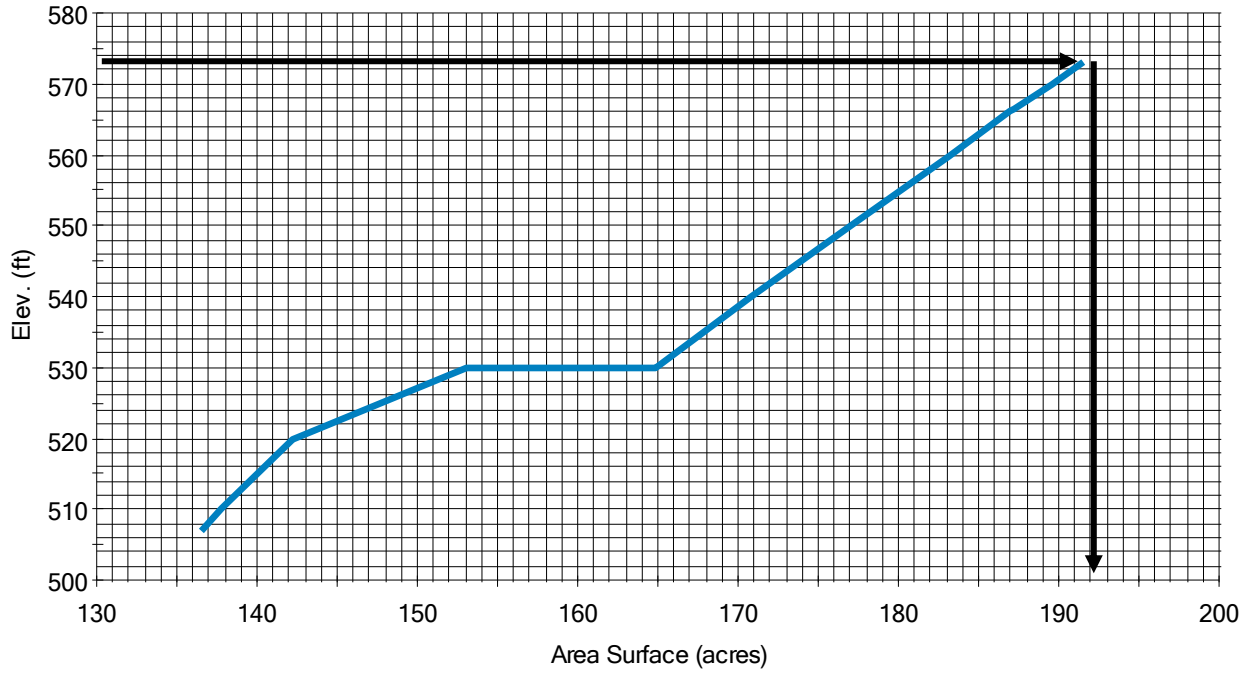
Total Storage Capacity of Impoundment (Elevation vs Area Surface)



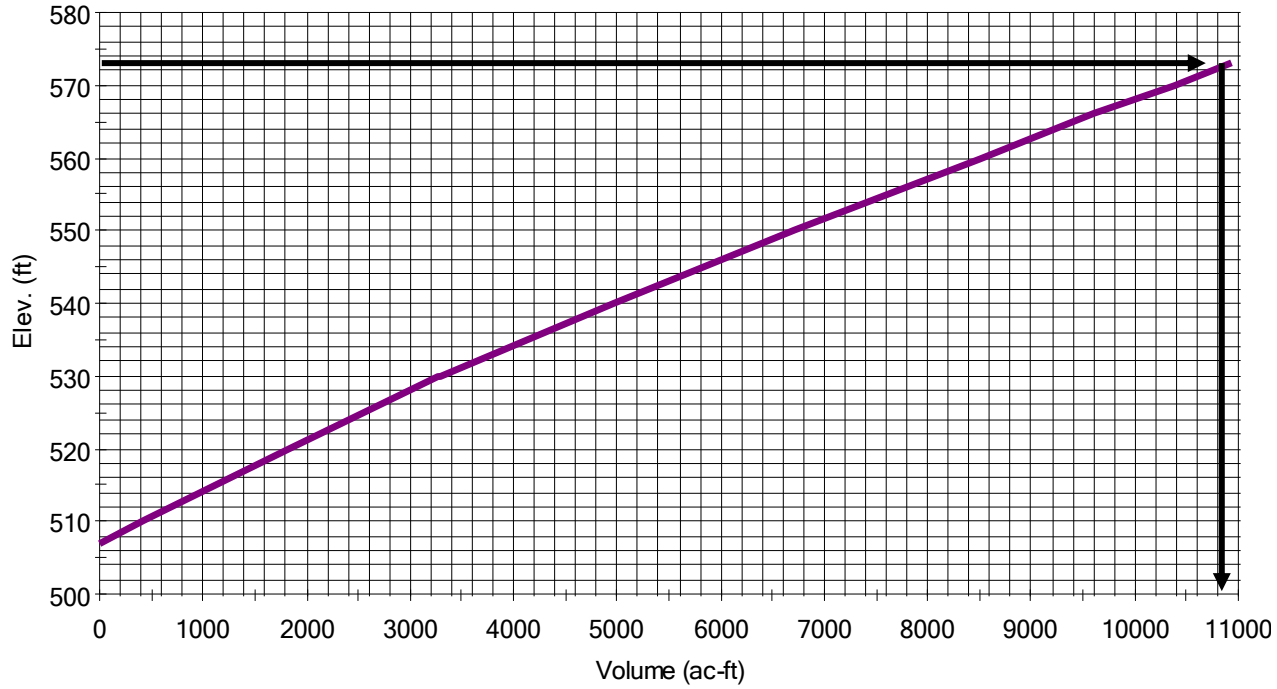
Storage Capacity of Impoundment (Elevation vs Volume)



Total Storage Capacity Behind Dam (Elevation vs Area Surface)



Storage Capacity behind Dam (Elevation vs Volume)



APPENDIX 8
Excerpt from:
Operation Maintenance and Inspection Manual
By DP&L, Dated April 2014
Pages 3-7, 11-15

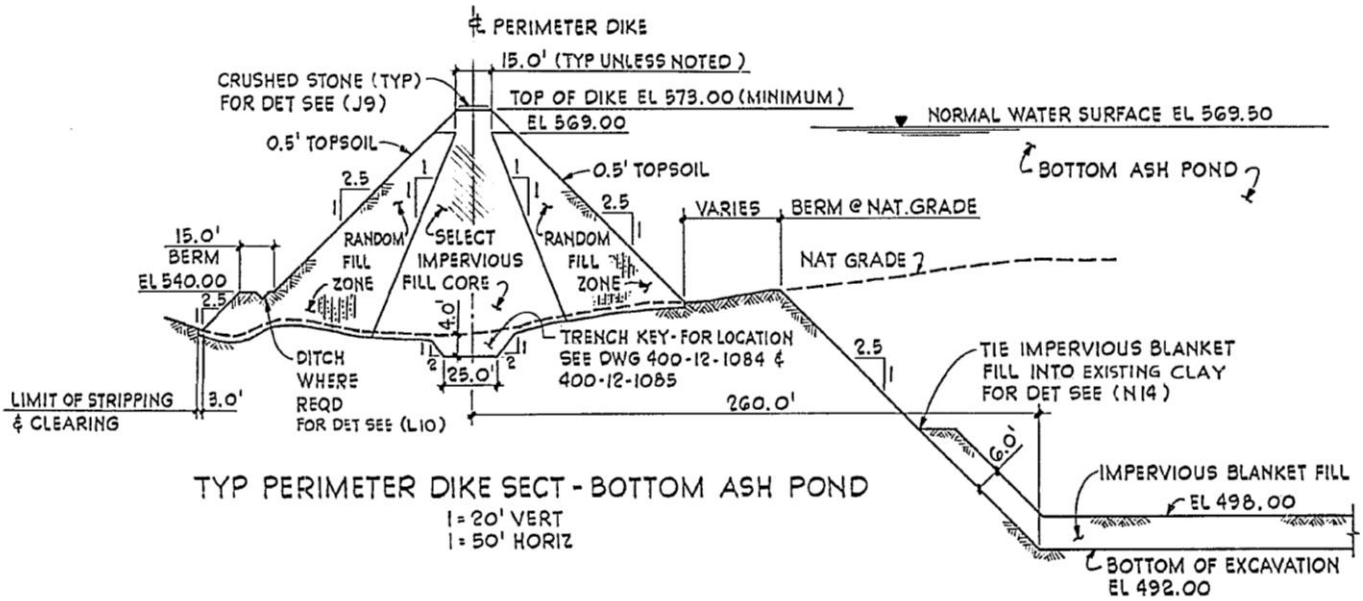
2.0 DESCRIPTION OF PROJECT

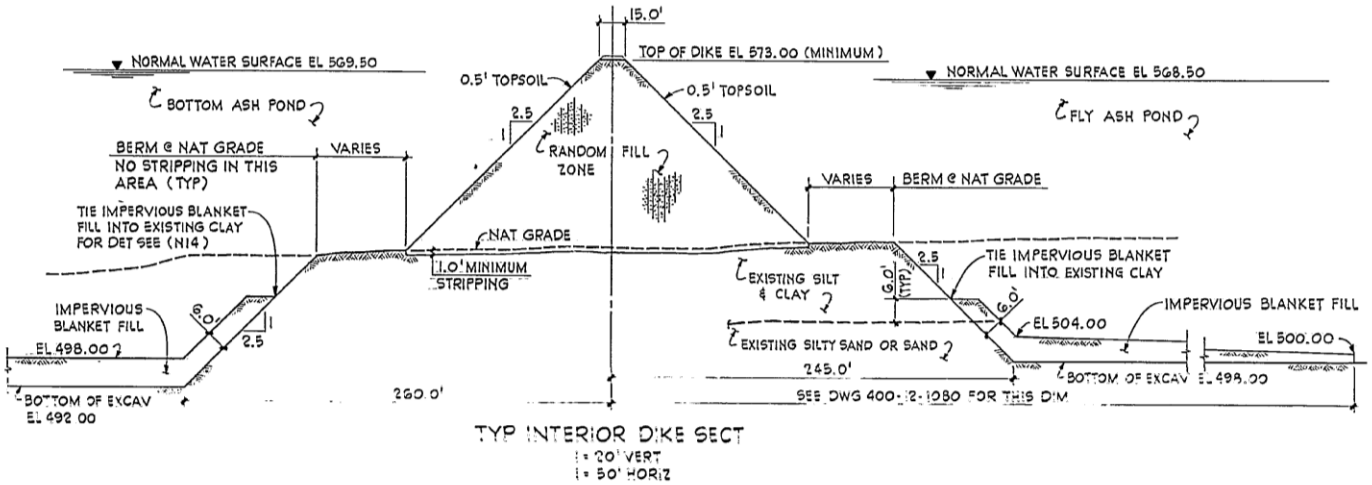
This section describes the structures' general arrangement and reservoir storage capacity. Refer to Figure 7.1 for a site plan. The impoundment is one large structure divided with an earthen interior dike, consisting of a smaller bottom ash pond (northwest side) and larger fly ash pond (east side).

2.1 Ash Impoundment Dike, Bottom Ash Pond

2.1.1 General Arrangement

Ash Impoundment Dike, Bottom Ash Pond is an off-stream upground reservoir for the storage of coal combustion bottom ash from the Killen Station generating unit. It is surrounded on the north by U.S. Route 52, west by the cooling tower and switchyard, south by the Ohio River and east by the fly ash pond. As shown in Table 2.1.2, the dam has an overall length of 5,075 feet that includes the north (1,390 feet), west (1,190 feet), south (1,350 feet) and east (1,145 feet). The height of earthen dam ranges from 21.0 to 43.0 feet, based on the lowest elevation point on the downstream toe. The crest is 10 feet along the north dam, west and south dams. Both upstream and downstream slopes are 2.5 horizontal to 1 vertical (2.5H:1V). The original design bottom of pond is at elevation 498 feet or 32 feet below the surrounding existing ground surface. [Reference: Figure 7.1 and DP&L Drawing 400-12-1081]. There is record survey topography of the original or existing pond bottom on DP&L Drawings 400-12-1021 and 400-12-1022. From the original design drawing detail shown below obtained from DP&L Drawing 400-12-1081, the bottom of pond and portion of side slope below original grade has 6 feet thick impervious fill that is tied into existing clay stratum. The perimeter dam on the north, west and south sides of the pond has a clay core. The east dam is an interior structure with only random fill material from the design drawing detail. Refer to Appendix B for site photos of this pond.





There are two outfalls for this pond. The primary **Outfall No. 1** is located on the south dam that is recycled make-up water back to the plant. **Outfall No. 1** is an 8-foot diameter riser (pump station intake tower) by 58.5 foot high reinforced concrete overflow structure with a 72-inch corrugated metal pipe (CMP) outlet with invert at elevation 511.0 feet. [Reference: DP&L Drawing 400-12-1260]. The structure decants water from the ash slurry and conveys more than 3,060 feet to the ash water pumps and FGD make-up water storage tank. [Reference: DP&L Drawing 400-12-1060]. The elevation of the overflow section cannot be adjusted and remains at 569.5 feet. A pipe at the bottom of riser is a 36-inch ductile iron pipe (DIP). [Reference: DP&L Drawing 400-12-1092]. A 36-inch stainless steel sluice gate at the concrete overflow structure is provided to shut off flow from this impoundment to the plant when necessary.

The secondary **Outfall No. 2** is located on the east interior dam that discharges water to the adjacent fly ash pond. **Outfall No. 2** is a 10-foot wide reinforced concrete channel with a bridge. This channel is equipped with stop logs to control water level starting at an invert elevation 565.0 feet. [Reference: DP&L Drawing 400-12-1093].

There is no emergency spillway for the pond since there is no drainage basin flowing into it. Runoff during storms consists entirely of precipitation which falls directly on the pond's footprint.

Table 2.1.1, Bottom Ash Pond

Item	Description
ODNR File Number	N8533-001
National Number	OH01127
USGS Basin	05090201
Community Distance from Dam	0.98 miles, Concord, KY Lewis County
Location:	
Outfall Point #1 (To recirculation water back to the plant)	Latitude = 38° 41’ 15” N Longitude = 83° 28’ 14” W
	North = 251,922 East = 1,691,437 Top of Structure Elev = 572.0 ft Crest Elev = 569.5 ft
Outfall Point #2 (Direct water to fly ash pond over the interior dike)	Latitude = 38° 41’ 22” N Longitude = 83° 28’ 5” W
	North = 252,622 East = 1,692,122 Crest Elev = 565.0 ft, bottom of stop logs
State	Ohio
County	Adams
Township	Monroe
Stream	Ohio River
USGS Quadrangle Map	Concord, KY-Ohio

Note 1: The grid coordinates were obtained from mapping provided by DP&L, Flown April 2005, DIL8State Plane&NAVD88 Datum.dwg, prepared by LR Kimball & Associates.

Table 2.1.2, Bottom Ash Pond

Item	Description
Design/Construction Information:	
Original Designer	Ebasco Services, Inc, Atlanta, GA
Date Completed	1982
Contractor	Hol-acc & Daniel
Structure Information:	
Purpose of Dam	Industrial
Type of Impoundment	Upground
Type of Structure	Earthfill
Drainage Area	39.2 acres
Entire Length of Dam	**5,075 ft**
Bottom of Pond [1, 2]	El 498 ft.
North Embankment Data:	
Dam Length	1,390 ft
Maximum Height	39.0 ft; based on toe of dam El 534 ft.
Top Berm Width	10.0 ft
Top of Dam	El 572.5 to 573.0 ft, Design was 573.0
Upstream Slope [1. 2]	2.5H:1V
Downstream Slope [1. 2]	2.5H:1V
West Embankment Data:	
Dam Length	1,190 ft
Maximum Height	42.0 ft; based on toe of dam El 531 ft.
Top Berm Width	10.0 ft
Top of Dam	El 572.3 to 572.7 ft, Design was 573.0
Upstream Slope [1. 2]	2.5H:1V
Downstream Slope [1. 2]	2.5H:1V

Table 2.1.2, Bottom Ash Pond (cont.)

South Embankment Data:	
Dam Length	1,350 ft
Maximum Height	43.0 ft; based on toe of dam El 530 ft.
Top Berm Width	10.0 ft
Top of Dam	El 572.1 to 572.6 ft, Design was 573.0
Upstream Slope [1, 2]	2.5H:1V
Downstream Slope [1, 2]	2.5H:1V
East Embankment Data (Interior):	
Dam Length	1,145 ft
Maximum Height	58 ft; based on toe of dam El 515 ft.
Top Berm Width	10.0 ft
Top of Dam	El 573.0 ft, Design was 573.0 There are no spot elevations from flyover along the crest.
Upstream Slope [1, 2]	2.5H:1V
Downstream Slope [1, 2]	2.5H:1V

Reference 1: DP&L Drawing 400-12-1080

Reference 2: DP&L Drawing 400-12-1081

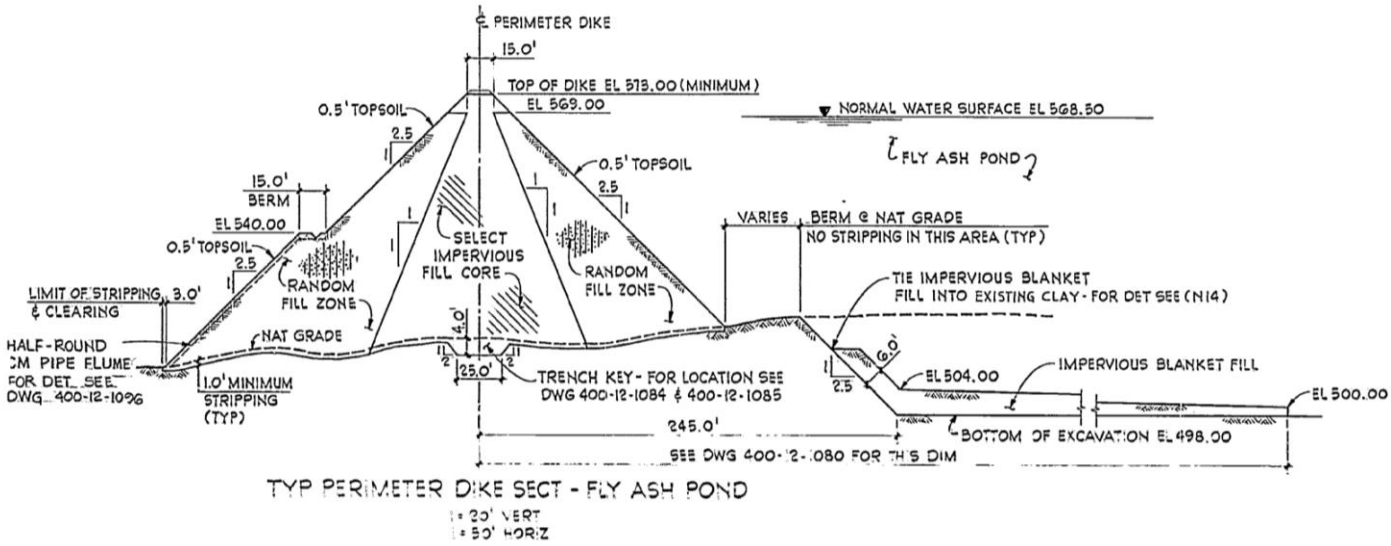
Table 2.1.3, Bottom Ash Pond

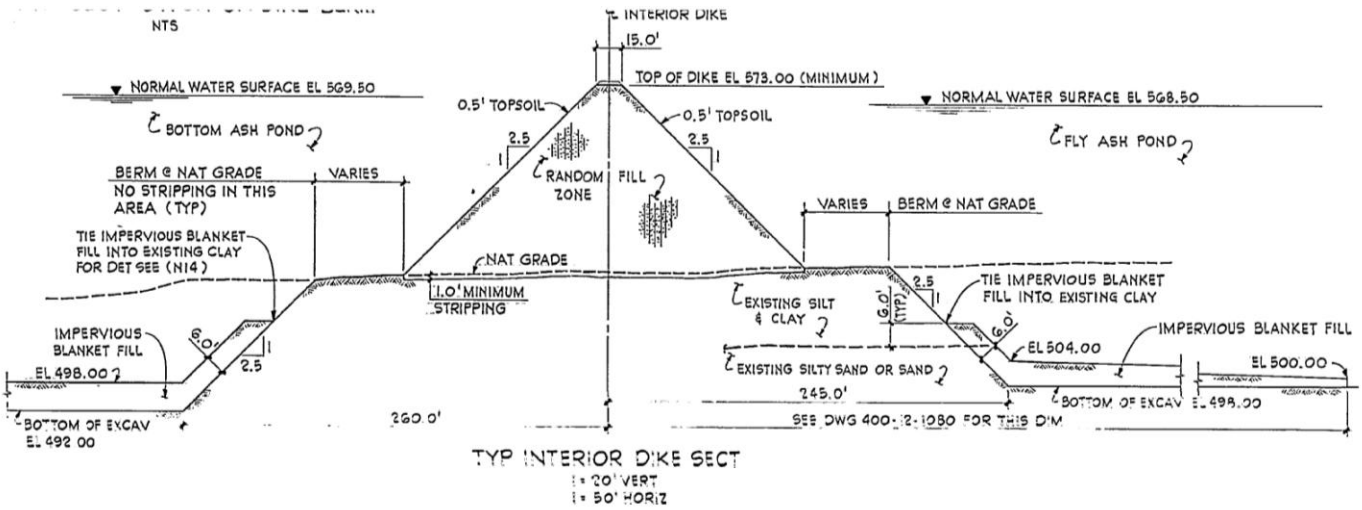
Item	Description
Spillway and Outlet Works Data:	
Pond Drain [3]	36-inch sluice gate and 36-inch DIP
Principal Spillway [3]	An 8-foot diameter riser (pump station intake tower) by 58.5 foot high reinforced concrete overflow structure with a 6-foot CMP outlet
Emergency Spillway	None

Reference 3: DP&L Drawing 400-12-1092

2.2 Ash Impoundment Dike, Fly Ash Pond

Ash Impoundment Dike, Fly Ash Pond is an off-stream upground reservoir for the storage of coal combustion fly ash from the Killen Station generating unit. It is surrounded on the north by U.S. Route 52, west by the bottom ash pond and the coal pile, south by the Ohio River and east by open space. As shown in Table 2.2.2, the dam has an overall length of 11,200 feet that includes the north (2,790 feet), west (2,980 feet), south (2,680 feet) and east (2,750 feet). The height of earthen dam ranges from 24.0 to 77.0 feet, based on the lowest elevation point on the downstream toe. The crest width ranges from 8.9 to 10.1 feet along the west dam. The crest width is 10.0 feet along the north, east and south dams. Both upstream and downstream slopes are 2.5H:1V. The original design bottom of pond is at elevation 504 feet or 3 to 26 feet below the surrounding existing ground surface. [Reference: Figures 7.2, 7.3 and DP&L Drawing 400-12-1081, 1088, 1089, 1090 and 1091]. There is record survey topography of the original or existing pond bottom on DP&L Drawings 400-12-1021 and 400-12-1022. From the design drawing detail shown below that was obtained from DP&L Drawing 400-12-1081, the bottom of pond and portion of side slope below original grade has 6 feet thick impervious fill tied into existing clay stratum. The perimeter dam on the north, east, south and approximately half of the west sides of the pond has a clay core. The remainder of the west dam separating the fly ash pond from the bottom ash pond is an interior structure with only random fill material from the DP&L Drawing 400-12-1081. Refer to Appendix B for site photos of this pond.





The outfall is located in the southwest corner of the impoundment and discharges to the Ohio River after pH adjustment. The discharge consists of a 4-foot by 4-foot by 61.0-foot high concrete overflow structure with a 72-inch CMP outlet pipe with invert at elevation 507.5 feet. The structure decants water from the ash slurry. The outlet pipe runs below grade. A 26-inch stainless steel sluice gate at the concrete overflow structure is provided to shut off flow from this impoundment when necessary. [Reference: DP&L Drawing 400-12-1082]. There is no emergency spillway for the pond since there is no drainage basin flowing into it. Runoff during storms consists entirely of precipitation which falls directly on the pond's footprint.

Table 2.2.1, Fly Ash Pond

Item	Description
ODNR File Number	N8533-001
National Number	OH01127
USGS Basin	05090201
Community Distance from Dam	0.98 miles, Concord, KY Lewis County
Location:	
Outlet Point	Latitude = 38° 40' 57" N Longitude = 83° 28' 22" W
	North = 250,126 East = 1,690,755 Top of Structure Elev = 571.74 ft Normal Pool Elev = 568.50 ft
State	Ohio
County	Adams
Township	Monroe
Stream	Ohio River
USGS Quadrangle Map	Concord, KY-Ohio

Note 1: The grid coordinates were obtained from mapping provided by DP&L, Flown April 2005, DIL15State Plane&NAVD88 Datum.dwg, prepared by LR Kimball & Associates.

Table 2.2.2, Fly Ash Pond

Item	Description
Design/Construction Information:	
Original Designer	Ebasco Services, Inc, Atlanta, GA
Date Completed	1982
Contractor	Hol-acc & Daniel
Structure Information:	
Purpose of Dam	Industrial
Type of Impoundment	Upground
Type of Structure	Earthfill
Drainage Area	230.7 acres
Entire Length of Dam	11,200 ft
Bottom of Pond [1, 2]	El 500 to 504 ft.
North Embankment Data:	
Dam Length	2,790 ft
Maximum Height	33.0 ft; based on toe of dam El 540 ft.
Top Berm Width	10.0 ft
Top of Dam	El 572.3 to El 572.9, Design was 573.0
Upstream Slope [1, 2]	2.5H:1V
Downstream Slope[1, 2]	2.5H:1V
West Embankment Data:	
Dam Length	1,835 ft and 1,145 ft, interior berm
Maximum Height	53.0 ft; based on toe of dam El 520 ft.
Top Berm Width	10.0 ft
Top of Dam	El 572.0 to 572.5 ft, Design was 573.0
Upstream Slope [1, 2]	2.5H:1V
Downstream Slope [1, 2]	2.5H:1V

Table 2.2.2, Fly Ash Pond (cont.)

South Embankment Data:	
Dam Length	2,680 ft
Maximum Height	77.0 ft; based on toe of dam El 496 ft.
Top Berm Width	10.0 ft
Top of Dam	El 572.1 to El 572.5, Design was 573.0
Upstream Slope	2.5H:1V
Downstream Slope	2.5H:1V
East Embankment Data:	
Dam Length	2,750 ft
Maximum Height	61 ft; based on toe of dam El 512 ft.
Top Berm Width	10.0 ft
Top of Dam	El 572.3 to El 573.0, Design was 573.0
Upstream Slope [1, 2]	2.5H:1V
Downstream Slope [1, 2]	2.5H:1V

Reference 1: DP&L Drawing 400-12-1080

Reference 2: DP&L Drawing 400-12-1081

Table 2.2.3, Fly Ash Pond

Item	Description
Spillway and Outlet Works Data:	
Pond Drain	26-inch sluice gate to 14 ft x 15 ft reinforced concrete overflow structure, then 42-inch sluice gate to 42-inch RCP to principal spillway
Principal Spillway	A 4-foot x 4-foot by x 61.0 foot high reinforced concrete overflow structure (blow out drain) with a 6-foot CMP outlet
Emergency Spillway	None

Reference 4: DP&L Drawing 400-12-1082

2.2.2 Reservoir Storage Capacity

The fly ash settles, the excess slurry water is decanted through the overflow structure and is adjusted for pH and discharged to the Ohio River. A weir gate was installed at the overflow structure to raise the operation pool elevation. The pond is designed for the life of the plant. When the pond has reaches its full capacity of ash it will be abandoned. The disposition of the ash at the time of plant closure is not yet determined.

As shown in Table 2.2.2, the dam's crest elevation ranges from 572.0 to 572.5 feet (West Dam), 572.3 to 572.9 feet (North Dam), 572.3 to 573.0 feet (East Dam) and 572.1 to 572.5 feet (South Dam). The original design grade for this structure is 573.0 feet, which is approximately 6 to 12-inches more than existing conditions. The maximum storage capacity will be based the design elevation.

Total Storage Capacity of Impoundment

The storage capacity of the fly ash pond at normal pool elevation 568.5 feet is 10,500 acre-feet and the surface area is 188.7 acres. This includes the excavated below grade volume from elevation 520 to 504 feet. The maximum storage capacity at design crest elevation 573.0 feet is 11,350 acre-feet and surface area is 191.4 acres. Refer to Figure 7.1 or graphs below for the stage storage data of this impoundment.

Storage Capacity behind Dam

The storage capacity of the fly ash pond at normal pool elevation 568.5 feet is 10,100 acre-feet and the surface area is 188.7 acres. The maximum storage capacity at design crest elevation 573.0 feet is 10,944 acre-feet and surface area is 191.4 acres. These values exclude the volume below grade within the impoundment from elevation 504 to 507 feet. Refer to Figure 7.3 near the blowdown drain.

APPENDIX 9
Excerpt from:
Operation Maintenance and Inspection Manual
By DP&L, Dated April 2014
Pages 19-22

3.0 INSPECTION

DP&L shall perform four types of inspections. Three periodic inspections include monthly, annual and five year inspections. The fourth type is monitoring as needed during and after heavy rainfall events. Table 3.1 lists the type and frequency of the inspection activities to be performed at the dam. Inspection forms are included under Appendix A. DP&L's representative should complete the annual or semiannual (every 6 months) inspections in the spring or fall. It is recommended DP&L contracts a Registered Professional Engineer **(qualified in Dam Safety)** to perform the five-year inspections in the spring or fall; DP&L should document their inspection in a report described in Forms 2, 3 and 4 including photographs. DP&L or Engineer should document the inspection in a report as described in Form 5 including photographs.

Table 3.1

Frequency	Personnel	Inspection Item	Form No. or Reference
As Needed (After heavy rainfall event such as 2" in a 24 hour period)	Owner's Representative	Monitor the rainfall at NOAA, National Weather Service	www.nws.noaa.gov Form No. 1
		Flow though overflow pipe	
		Water level of the impoundment	
Monthly *(Visual Observation)*	Owner's Representative	Seepage and/or wet areas	Form No. 2
		Flow through spillway culvert	
		Water level of the impoundment	
		Slides and cracks	
		Rodent activity	
		Vandalism	
Annually *(Visual Observation)*	Owner's Representative	Slope protection	Form No. 3
		Condition of earthen dam	
		Outfall discharge area	
		Entire area around dam for erosion	
		Condition of vertical riser and culvert *(visual)*	
Semiannually *(Operational)*	Owner's Representative	Pond drain and valve *(operational)*	Form No. 4
		Dam maintenance record	
Periodic 5 years *(Visual Observation)*	Owner's Representative	Slope protection	Form No. 5
		Condition of earthen dam	
		Outfall discharge to plunge pool area	
		Entire area around dam for erosion	
		Condition of vertical riser and culvert *(visual)*	
Periodic 5 years *(Visual Observation)*	ODNR/Division of Soil & Water	Engineer's Safety Inspection Checklist	Form No. 6

	Resources/Dam Safety Engineering Program		

4.0 MAINTENANCE

Table 4.1 lists the type and frequency of the maintenance activities to be performed at the dam.

Table 4.1

Frequency (Min.)	Personnel	Maintenance Item
Semi Annually	Owner's Representative	All vegetative cover on the dam shall be cut. This includes trees, shrubs and all woody growth. Mow the grass.
		Lubricate and inspect the pond drain valve mechanism.
Annually	Owner's Representative	All vegetative cover on the dam shall be cut. This includes trees, shrubs and all woody growth. Mow the grass.
As Needed	Owner's Representative	Repair erosion and re-establish proper vegetative cover. Reseeding of bare or eroded areas should be performed immediately to allow re-vegetation.
		All rodent damage shall be repaired immediately by filling the burrows or holes utilizing the mud packing method. To backfill a burrow, place a length of metal stovepipe in a vertical position over the entrance to the burrow and fill with slurry clay and cement. After the burrow is filled, the pipe should be removed and dry earth tamped into the burrow entrance and the vegetation re-established.

5.0 OPERATION

Specific procedures for operation of mechanical equipment are as follows:

Table 5.1

Frequency (Min.)	Personnel	Maintenance Item
Semiannually	Owner's Representative	Open and close the pond drain valve to ensure proper operation.

Maintain a permanent record of all maintenance actions.

6.0 SAFE RATE DRAWDOWN PLAN

The following section includes the method to be used for drawing the impoundment down under emergency conditions. For the bottom ash pond, the water level can be gradually reduced to elevation 565.0 feet (4.5 feet) by removal of stop logs in Outfall No. 2. The water would flow through the channel at the interior dike towards the fly ash pond. Outfall No. 1 does not have a drain in the riser.

For the fly ash pond, the water level can be gradually reduced to elevation 561.0 feet (7.5 feet) by opening the 24-inch sluice gate.

In emergency situations, the pool level can be drawn down by ½ -foot per day.

In non-emergency situations, the pool level should be drawn down by 1-foot per week or less. Rapid lowering of the pool level does not allow the embankment soil to drain and can cause earth slides and cracks on the upstream slope of the dam.

APPENDIX 10
Excerpt from:
Killen Station Ash Pond Annual Inspection
By DP&L, Dated 21 December 2015

The ash pond dam is in good structural condition based on the visual inspection. Maintenance items were noted during the field inspection. Rodent holes were found near station 110 along the fence on the bench. The protective erosion blanket was damaged where the bench drain at station 132+50 crosses under the fence. Some erosion was also noted along bench drains at station 1 and station 4+50. Noted seep areas were monitored but have not shown any change from previous inspections.

Changes in Geometry [§ 257.83(b)(2)(i)]

There were no changes to the upstream face of the dam. Rock erosion protection is in place and in good condition around the perimeter of the pond. There were no changes to the geometry of the downstream face of the dam pond or other indications of structural weakness. Slopes have no indication of deformation or other indicators of instability.

Instrumentation [§ 257.83(b)(2)(ii)]

These ponds are equipped with a staff gauge mounted on the primary outlet and eight piezometers around the perimeter. Review of data collected from piezometers does not indicate any problems.

Structural Weakness [§ 257.83(b)(2)(vi)]

No indication was found of an actual or potential structural weakness of the CCR unit or any existing condition that was disrupting or had the potential to disrupt the operation and safety of the CCR unit and appurtenant structures.

Other Changes [§ 257.83(b)(2)(vii)]

No changes were found to the CCR unit which could affect the stability or operation of the impounding structure since the previous annual inspection.

Visual Inspection of Hydraulic Structures [§ 257.83(b)(1)(iii)]

This pond contains three hydraulic structures. All three structures were found to be in good condition with no indication of deterioration. Outlet pipes for the two structures which discharge water show no signs of leaking or problems.

Design drawings indicate that there was a temporary drain from the impoundment during construction which was grouted closed. No seepage or soft ground was discovered at or around the discharge point for this pipe.

Water and Material Depths and Volumes

[§ 257.83(b)(2)(iii), § 257.83(b)(2)(iv), § 257.83(b)(2)(v)]

Physical Parameters of Impoundment		
Depth of water	70.5	Feet
Minimum depth of water	63.0	Feet
Maximum depth of water	570.0	Feet
Elevation of water	568.5	Feet (review of weekly inspection reports show normal fluctuation of the depth/water level)
Storage Capacity	21,600,000	Cubic Yards ,Crest Full Volume
Volume of water	13,200,000	Cubic Yards
Volume of CCR	6,800,000	Cubic Yards