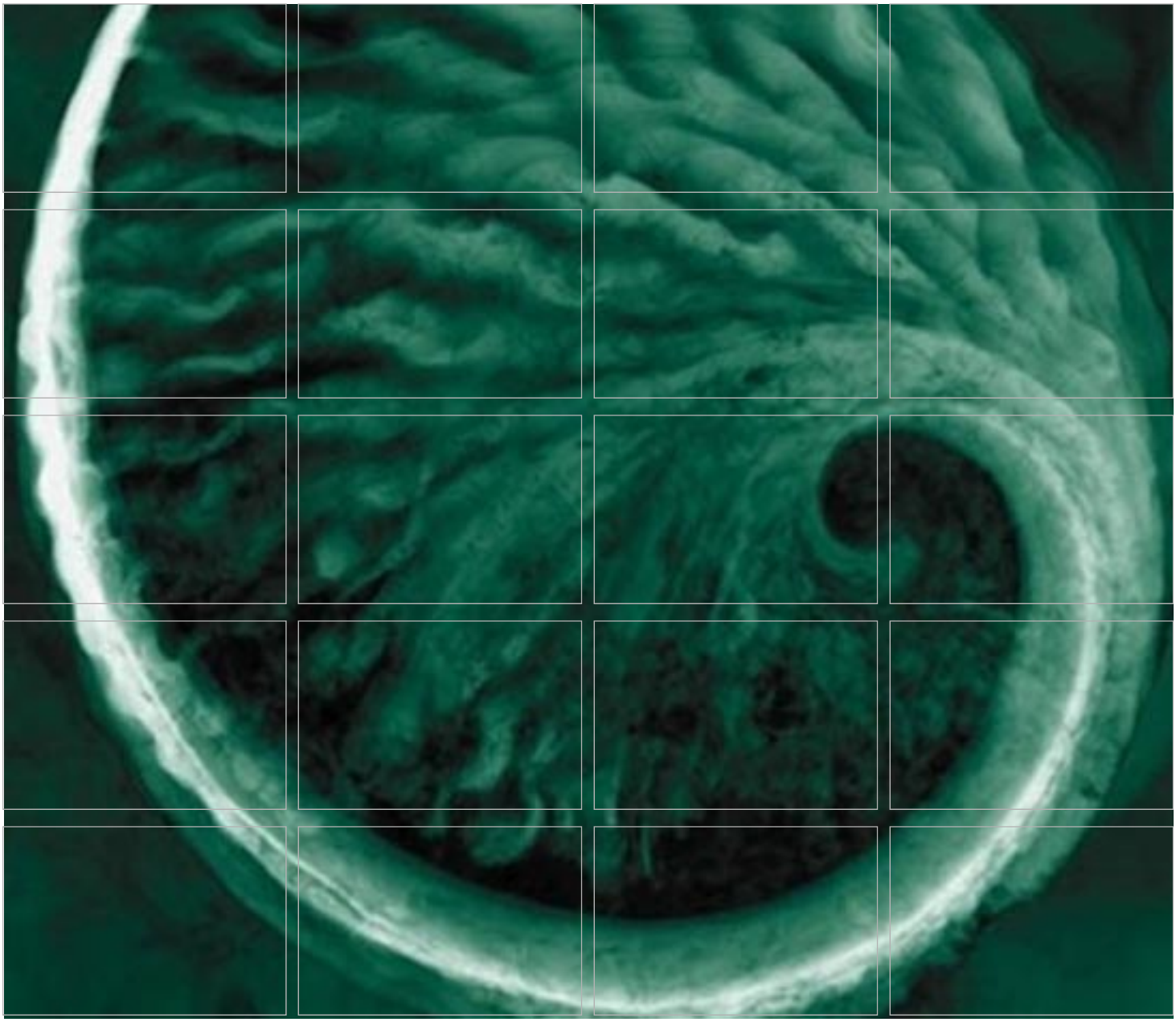

CCR Surface Impoundment History of Construction Documentation

Texas Municipal Power Agency
Gibbons Creek Steam Electric Station

Grimes County, Texas

October 12, 2016

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Texas Municipal Power Agency

CCR Surface Impoundment History of Construction Documentation: *Gibbons Creek Steam Electric Station*

October 12, 2016

Project No. 0336706
Grimes County, Texas

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APPENDICES

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1.0 INTRODUCTION

The Texas Municipal Power Agency (TMPA) owns and operates the Gibbons Creek Steam Electric Station (GCSES) facility located in unincorporated Grimes County, Texas. The GCSES generates coal combustion residuals (CCR) that are regulated under Title 40, Code of Federal Regulations, Part 257 (40 CFR Part 257)(CCR Rule).

TMPA operates two CCR surface impoundments at the GCSES:

(1) the Ash Ponds (APs); and

(2) the Scrubber Sludge Pond (SSP).

This report is a compilation of the available history of construction documentation for the two CCR surface impoundments at the GCSES.

1.1 REQUIREMENTS

Regulations in 40 CFR §257.73, Structural Integrity Criteria for Existing CCR Surface Impoundments, requires that owners and operators of existing CCR Surface Impoundments compile a history of construction of CCR surface impoundments and post the documentation on an internet site accessible by the public. The documentation must include the following, to the extent feasible in accordance with 40 CFR §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.

(ii) The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 1/2 minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

(iii) A statement of the purpose for which the CCR unit is being used.

(iv) The name and size in acres of the watershed within which the CCR unit is located.

(v) A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; 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.

(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.

(viii) A description of the type, purpose, and location of existing instrumentation.

(ix) Area-capacity curves for the CCR unit.

(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.

(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

(xii) Any record or knowledge of structural instability of the CCR unit.

This report summarizes the available information regarding the APs and SSP CCR surface impoundments history of construction at the TMPA GCSES. Documentation referenced herein is included in Appendix A.

According to 40 CFR 257.73, TMPA **must** update the relevant information if there is a significant change to any information compiled regarding the APs or SSP history of construction.

2.0 CCR SURFACE IMPOUNDMENT DESCRIPTION

The TMPA GCSES is a coal fired steam electric plant capable of generating approximately 470 MW. Construction of the GCSES began in 1977. The GCSES began generating electric power in 1982.

TMPA currently operates two CCR surface impoundments at the GCSES which are subject to requirements in 40 CFR §257:

- the Ash Ponds (APs); and
- the Scrubber Sludge Pond (SSP).

The location of each of those CCR units is shown on Figure 1.

TMPA also operates an existing CCR landfill however; the history of construction requirement only applies to the CCR surface impoundments at the site. The CCR surface impoundments and their history of construction are described below.

2.1 ASH PONDS

The APs are three adjoining and connected CCR surface impoundments separated by earthen dikes and hydraulic gates, constructed by TMPA between 1977 and 1978 as part of the original GCSES plant construction.

The APs are a surface impoundment that was constructed and received CCR before October 14, 2015. In addition, the APs currently receive CCR. Hence, in accordance with 40 CFR §257.53, the APs are classified as an active existing CCR surface impoundment.

2.1.1 Ownership and Unit Identification

The APs are owned and operated by the TMPA GCSES. The full name and address for the TMPA GCSES is as follows:

Texas Municipal Power Agency
Gibbons Creek Steam Electric Station
12824 FM 244 Rd
Anderson, TX 77830-5642

In addition, the APs are listed as Solid Waste Management Unit (SWMU) 006 on the Notice of Registration (NOR) for Solid Waste Registration (SWR) 32271 issued to TMPA by the TCEQ (TCEQ 2016). The NOR states that the APs are an active surface impoundment. A copy of the NOR as of August 8, 2016 is included in Appendix A (TCEQ 2016). A current copy of the NOR can be found on the TCEQ's central registry internet site.

2.1.2 *Unit Location and Watershed*

The APs are located on the GCSES site generally southeast of the GCSES electric power generation plant and west of Gibbons Creek Reservoir; see Figure 1. Based on the Texas Natural Resource Conservation Service (NRCS) the APs are located in the Navasota watershed (Hydrologic Unit Code 12070103) which is approximately 1.44 MM acres (NRCS 2008). However, the APS are elevated from the surrounding drainage area and there is no natural drainage into the APs other than direct precipitation. According to the facility's water balance diagram, the APs receive direct precipitation and stormwater runoff from a drainage area of approximately 35 acres and pumped stormwater drainage from approximately 22 acres (TMPA 2013).

2.1.3 *Unit Purpose*

The APs receive the following wastewater streams as shown on the facility NOR, TPDES Permit No. WQ0002120000 (TCEQ 2015), and water balance diagram (TMPA 2013):

1) bottom ash transport water overflow from hydrobins used to dewater the bottom ash CCR;
2) coal pile stormwater and dust suppression runoff;
3) boiler blowdown;
4) water purification wastewater;
5) treated sewage wastewater;
6) Flue Gas Desulfurization (FGD) scrubber wastewater;
7) Air preheater basket washing wastewater;
8) boiler tube cleaning wastewater;
9) CCR landfill collected leachate;
10) Plant area stormwater drainage;
11) Once through cooling water; and
12) Non-contact auxiliary cooling water.

Under the facility's TPDES Permit No. WQ0002120000, TMPA is authorized to discharge excess water in the APs to Gibbons Creek Reservoir as necessary subject to the effluent limitations in the permit (TCEQ 2015).

2.1.4 *Unit Construction*

The APs are three adjoining and connected CCR surface impoundments, designed by Tippett & Gee, Inc. and constructed by R. N. Adams Construction Company. According to dates of the original contract documents, construction of the APs began in 1977 (TMPA 1977a). The completion date of the AP construction is unknown but was likely in 1981 based on the date of the NSS "Summary of Testing of Ash Ponds" report dated March 2, 1981 (NSS 1981).

According to the NOR, operation of the APs began in April, 1982 (TCEQ 2016). The APs were constructed by a combination of excavation and fill to lines and grades in accordance with technical specifications and drawings for the facility (T&G 1977a, T&G 1977b, T&G 1978, T&G 1979a, T&G 1979b).

A soils investigation was conducted National Soil Services (NSS) prior to plant construction to characterize the physical and engineering properties of the subsurface. Boring Nos. 4 through 7 and 13 through 18 were installed in the area of the proposed APs from 100 feet to 200 feet below ground surface. Soil samples collected were analyzed for the following properties (NSS 1976):

- moisture content;
- Atterberg limits;
- grain size distribution;
- unconfined compressive strength;
- unconsolidated-undrained compressive strength; and
- consolidated-undrained compressive strength.

The NSS investigation report also presents a description of the general site geologic formations as well as more detailed discussion of strata encountered in the soil borings. The strata that make up the foundations and abutments on which the APs were constructed include, from the ground surface (NSS 1976):

- a thin mantle of silty sand;
- an upper clay;
- an upper silty sand to sandy silt;
- a middle clay;
- a lower silty sand;
- a lower silt; and
- a lower clay.

2.1.5 Site Preparation

Prior to AP construction, areas that would receive fill were stripped of topsoil and other organic material to a depth of one foot below ground surface. Areas that would receive fill were then scarified to a depth of one foot, moisture content of soils were adjusted if necessary, and the ground surface was compacted to achieve 95% of the maximum dry density as determined by the Standard Compaction Test (ASTM 698) for highly plastic clays or Texas Highway Department method (Tex-113-E) for sandy clays (T&G 1977a).

During construction of the APs, five-foot deep inspection trenches were installed along the interior toe of the embankments to observe the soil strata below the toe and dike foundations and ensure pervious soils did not underlie the embankment foundations. The locations of the inspection trenches are shown in Tippett & Gee Drawing No. C-230-003, included in Appendix A (T&G 1977b). The exposed soil was examined to identify, and where found replace, pervious soils. Pervious soils, where encountered during trench installation and general pond excavation, were over-excavated and replaced with three feet of compacted clay (T&G 1977a, T&G 1977b, T&G 1978).

2.1.6 Pond Construction

The APs was constructed by a combination of excavation and fill. Soils that were excavated and suitable for pond construction were used as fill. The excavated surface and compacted fill portions of the APs are comprised of clay, silty clay, and sandy clay (T&G 1977a).

Fill soils were placed in maximum nine inch-thick loose lifts, moisture content was adjusted as necessary to within 2% dry to 4% wet of optimum, and compacted to achieve 95% of the maximum dry density as determined by the Standard Compaction Test (ASTM 698) for highly plastic clays or Texas Highway Department method (Tex-113-E) for sandy clays (T&G 1977a).

Prior to plant operation, several soil tests were conducted to evaluate the characteristics of the natural soil liner and were compared to the Texas Department of Water Resources (TDWR, predecessor to the TCEQ) guidelines for surface impoundment liners. The guidelines recommended impoundment liners consist of either four feet of natural soil or three feet of compacted clay with the following properties:

- at least 30% soil particles passing the No. 200 sieve;
- a Liquid Limit of at least 30;
- a Plasticity Index of at least 15; and
- a permeability less than or equal to 1 x 10-7 cm/sec.

Portions of the APs liner that did not achieve those criteria were excavated, replaced with three or more feet of clay compacted in eight to nine inch lifts, and retested to confirm conformance with the TDWR guidelines stated above (NSS 1981). Tippet & Gee subsequently provided a certification letter that the APs met the TDWR guidelines (T&G 1981).

Each of the three APs is approximately 1820 feet long and 245 feet wide at the dike crest interior top of bank, and 20 feet deep from the dike crest to the pond bottom. Based on those dimensions, the total area inside the interior top of bank of the three APs is approximately 30.7 acres (T&G 1977b). Available design drawings of the APs as required under 40 CFR §257.73(c)(vii) are included in Appendix A.

2.1.7 Instrumentation

According to TMPA personnel, instrumentation at the APs currently consists of a staff gauge that is used to monitor the water level in the APs.

2.1.8 Area-Capacity Relationship

Each of the three APs is shown to be approximately 1820 feet long and 245 feet wide at the dike crest interior top of bank. Each of the APs is shown to have a common dike crest elevation. Each of the APs is shown to be approximately 20 feet deep from the dike crest to the pond bottom with 3H:1V side slopes. Based on those dimensions, the total area inside the three APs dike crests is approximately 30.7 acres (T&G 1977b). An area capacity curve of the APs is included in Figure 2.

2.1.9 Diversion Design

The APs have a single outfall (Outfall 001) constructed of two pipes that drain to a drainage channel and then to the Gibbons Creek Reservoir. Outfall 001 pipes consist of one, 4-inch diameter steel pipe and one, 12-inch diameter Fiberglass Reinforced Plastic pipe. Discharge of Outfall 001 is controlled by valves. The maximum discharge capacity of Outfall 001 is unknown however, according to the facility's TPDES permit application (ERM 2010) for TPDES Permit No. WQ0002120000 the maximum recorded daily flow was 3.44 million gallons (TCEQ 2015). A copy of the TPDES permit application is available from the TCEQ by making an Open Records Request.

2.1.10 Structural Instability

There is no available record or knowledge of structural instability of the APs. A structural stability assessment is currently being conducted under separate contract for the AP.

2.1.11 Construction Specifications

Specifications for the construction of the APs are included in Appendix A (T&G 1977a).

2.1.12 Surveillance Maintenance and Repair

The APs are inspected at least weekly according to 40 CFR §257.83(a)(i-ii) for the following:

- any appearances of actual or potential structural weakness and other conditions which are disrupting or have the potential to disrupt the operation or safety of the APs; and
- abnormal discoloration, flow or discharge of debris or sediment through Outfall 001.

The APs instrumentation (staff gauge) is monitored at least monthly according to 40 CFR §257.83(a)(1)(iii).

Under 40 CFR §257.83(b) the APs are inspected annually by a qualified professional engineer to ensure the design, construction, operation, and maintenance of the APs is consistent with recognized and generally accepted good engineering standards.

Weekly, monthly, and annual inspections are maintained in TMPA's operating record for a minimum of five years. Annual inspections are also posted on TMPA's publically available internet site.

The APs are maintained and repaired as necessary and as soon as practical following discovery of deterioration that will affect the APs structural integrity and/or operation.

2.2 SCRUBBER SLUDGE POND

The SSP is a CCR surface impoundment constructed by TMPA between 1977 and 1978 as part of the original GCSES plant construction.

The SSP is a surface impoundment that was constructed and received CCR before October 14, 2015. In addition, the SSP currently receives CCR. Hence, in accordance with 40 CFR §257.53, the SSP is classified as an active existing CCR surface impoundment.

2.2.1 Ownership and Unit Identification

The SSP is owned and operated by the TMPA GCSES. The full name and address for the TMPA GCSES is as follows:

Texas Municipal Power Agency
Gibbons Creek Steam Electric Station
12824 FM 244 RD
Anderson, TX 77830-5642

In addition, the SSP is listed as Solid Waste Management Unit (SWMU) 004 on the Notice of Registration (NOR) for Solid Waste Registration (SWR) 32271 issued to TMPA by the TCEQ (TCEQ 2016). The NOR states that the SSP is an active surface impoundment. A copy of the NOR as of August 8, 2016 is included in Appendix A (TCEQ 2016). A current copy of the NOR can be found on the TCEQ's central registry internet site.

2.2.2 *Unit Location and Watershed*

The SSP is located on the GCSES site generally south of the GCSES electric power generation plant, southwest of the SSP and west of Gibbons Creek Reservoir; see Figure 1. Based on the Texas Natural Resource Conservation Service (NRCS) the SSP is located in the Navasota watershed (Hydrologic Unit Code 12070103) which is approximately 1.44 MM acres (NRCS 2008). However, the SSP is elevated from the surrounding drainage area and there is no natural drainage into the SSP other than direct precipitation. The SSP receives direct precipitation and stormwater runoff from a drainage area of approximately 8 acres (TMPA 2000).

2.2.3 *Unit Purpose*

The SSP receives FGD scrubber wastewater as shown on the facility NOR, TPDES Permit No. WQ0002120000 (TCEQ 2015), and water balance diagram (TMPA 2013).

Under the facility's TPDES Permit No. WQ0002120000, TMPA is authorized to transfer SSP water to the APs for eventual discharge to Gibbons Creek Reservoir as necessary subject to the effluent limitations in the permit (TCEQ 2015).

2.2.4 *Unit Construction*

The SSP was designed by Tippett & Gee, Inc. and constructed by R. N. Adams According to dates of the original contract documents, construction of the SSP began in 1977 (TMPA 1977a). The completion date of the SSP construction is unknown. According to the NOR, operation of the SSP began in April, 1982 (TCEQ 2016).

A soils investigation was conducted prior to plant construction to characterize the physical and engineering properties of the subsurface. Boring Nos. 4 through 7 and 13 through 18 were installed in the area of the proposed SSP from 100 feet to 200 feet below ground surface. Soil samples collected were analyzed for the following properties (NSS 1976):

- moisture content;
- Atterberg limits;
- grain size distribution;
- unconfined compressive strength;
- unconsolidated-undrained compressive strength; and
- consolidated-undrained compressive strength.

The NSS investigation report also presents a description of the general site geologic formations as well as more detailed discussion of strata encountered in the soil borings. The strata that make up the foundations and abutments on which the SSP was constructed include, from the ground surface (NSS 1976):

- a thin mantle of silty sand;
- an upper clay;
- an upper silty sand to sandy silt;
- a middle clay;
- a lower silty sand;
- a lower silt; and
- a lower clay.

2.2.5 Site Preparation

Prior to SSP construction, areas that would receive fill were stripped of topsoil and other organic material to a depth of one foot below ground surface. Areas that would receive fill were then scarified to a depth of one foot, moisture content of soils were adjusted if necessary, and the ground surface was compacted to achieve 95% of the maximum dry density as determined by the Standard Compaction Test (ASTM 698) for highly plastic clays or Texas Highway Department method (Tex-113-E) for sandy clays (T&G 1977a).

During construction of the SSP, five-foot deep inspection trenches were installed along the interior toe of the embankments to observe the soil strata below the toe and dike foundations and ensure pervious soils did not underlie the embankment foundations. The exposed soil was examined to identify, and where found replace, pervious soils. Pervious soils, where encountered during trench installation and general pond excavation, were over-excavated and replaced with three feet of compacted clay (T&G 1977a).

2.2.6 Pond Construction

The SSP was constructed by a combination of excavation and fill. Soils that were excavated and suitable for pond construction were used as fill. The excavated surface and compacted fill portions of the SSP are comprised of clay, silty clay, and sandy clay (T&G 1977a).

Fill soils were placed in maximum nine inch-thick loose lifts, moisture content was adjusted as necessary to within 2% dry to 4% wet of optimum, and compacted to achieve 95% of the maximum dry density as determined by the Standard Compaction Test (ASTM 698) for highly plastic clays or Texas Highway Department method (Tex-113-E) for sandy clays (T&G 1977a).

According to the Tippet & Gee transmission letter of NSS soil test reports of the APs natural and compacted clay liner dated March 13, 1981, (T&G 1981) Tippett & Gee also transmitted NSS soil test reports of the SSP natural and compacted clay liner. Presumably the SSP was also tested for the following TDWR guideline criteria:

- at least 30% soil particles passing the No. 200 sieve;
- a Liquid Limit of at least 30;

- a Plasticity Index of at least 15; and
- a permeability less than or equal to 1 x 10-7 cm/sec.

Although the APs and SSP were constructed at the same time, under the same contract and specifications, and the same construction quality assurance contractor (NSS) sampled and analyzed both CCR unit liners, the AP and SSP test reports were transmitted separately and a copy of the T&G transmission letter and accompanying NSS reports have not been identified for the SSP.

Shortly after first receipt of FGD scrubber wastewater the SSP developed a seep in one of the dikes. On May 20, 1983 TMPA notified the United States Environmental Protection Agency (EPA) of the seep (TMPA 1983). In September, 1983 TMPA contracted with NSS to conduct a study of the SSP seep and to develop options to provide additional containment of the SSP which included construction of a slurry wall or installation of an artificial liner (NSS 1983). Ultimately the pond was dewatered and FGD material was removed according to specifications "Site Preparation of Sludge Pond Prior to Installation of Liner"; a copy of the undated specifications are included in Appendix A (--- unknown). The date and author of the site preparation specifications are unknown but presumably were prepared by TMPA for the project in conjunction with "Specifications For Material and Installation of a Flexible Membrane Liner for a Sludge Disposal Pond" (TMPA 1983). TMPA contracted with Staff Industries, Inc. to install a Hypalon® flexible membrane liner (FML); the installation was completed in early 1985 (SII 1985).

The SSP is approximately 750 feet long and 380 feet wide at north end and 470 feet wide at the south end of the dike crest interior top of bank, and 20 feet deep from the dike crest to the pond bottom. Based on those dimensions, the total area inside the interior top of bank of the three SSP is approximately 7.3 acres (T&G 2000). Available design drawings of the SSP as required under 40 CFR §257.73(c)(vii) are included in Appendix A.

2.2.7 Instrumentation

According to TMPA personnel, instrumentation at the SSP currently consists of a staff gauge that is used to monitor the water level in the SSP (TMPA 1985).

2.2.8 Area-Capacity Relationship

The SSP is approximately 750 feet long and 380 feet wide at north end and 470 feet wide at the south end of the dike crest interior top of bank, and 20 feet deep from the dike crest to the pond bottom. The SSP is shown to be approximately 20 feet deep from the dike crest to the pond bottom with 3H:1V side slopes. Based on those dimensions, the total area inside the three SSP dike crests is approximately 7.3 acres (TMPA 2000). An area capacity curve of the SSP is included in Figure 3.

2.2.9 Diversion Design

The SSP was not constructed with an emergency outfall or spillway. Water is pumped from the SSP to the APs as determined necessary by TMPA to control freeboard at the SSP.

2.2.10 Structural Instability

There is no available record or knowledge of structural instability of the SSP. A structural stability assessment is currently being conducted under separate contract for the SSP

2.2.11 Construction Specifications

Specifications for the construction of the SSP and subsequent installation of the Hypalon® FML are included in Appendix A (T&G 1977a, TMPA 1983b, TMPA ----).

2.2.12 Surveillance Maintenance and Repair

The SSP is inspected at least weekly according to 40 CFR §257.83(a)(i-ii) for the following:

- any appearances of actual or potential structural weakness and other conditions which are disrupting or have the potential to disrupt the operation or safety of the SSP; and
- abnormal discoloration, flow or discharge of debris or sediment through Outfall 001.

The SSP instrumentation (staff gauge) is monitored at least monthly according to 40 CFR §257.83(a)(1)(iii).

Under 40 CFR §257.83(b) the SSP is inspected annually by a qualified professional engineer to ensure the design, construction, operation, and maintenance of the SSP is consistent with recognized and generally accepted good engineering standards.

Weekly, monthly, and annual inspections are maintained in TMPA's operating record for a minimum of five years. Annual inspections are also posted on TMPA's publically available internet site.

The SSP is maintained and repaired as necessary and as soon as practical following discovery of deterioration that will affect the SSP structural integrity and/or operation.

3.0 NOTIFICATION AND RECORD KEEPING

TMPA will issue notifications and implement recordkeeping in accordance with 40 CFR §257.105 and 40 CFR §257.106.

3.1 NOTIFICATION

TMPA will notify the Executive Director of the TCEQ, the State Director as defined in 40 CFR §257,105(d), and in accordance with 40 CFR §257.106(f)(8) when the History of Construction Documentation Report is available in the TMPA operating record and when placed on the publically accessible TMPA internet site.

In accordance with TCEQ instructions related to CCR units in Texas, TMPA will send each notification to the TCEQ via internet electronic mail to:

CCRNotify@tceq.texas.gov

3.2 RECORDKEEPING

TMPA will maintain the History of Construction Documentation Report and associated documentation in the TMPA operating record starting no later than October 17, 2016 and for a period of five years thereafter.

3.3 INTERNET POSTING

TMPA will maintain the History of Construction Documentation Report and associated documentation and on the publically accessible TMPA internet site within 30 days of placement in the TMPA operating record and for a period of five years thereafter.

3.4 HISTORY OF CONSTRUCTION UPDATE

According to 40 CFR 257.73, TMPA **must** update the relevant information if there is a significant change to any information compiled regarding the APs or SSP history of construction.

4.0 REFERENCED DOCUMENTS

The following documents were used as sources of information for this report.

4.1 TMPA DOCUMENTS

The following documents were used as sources of information for this report. These documents are posted on the facility operating record.

ERM 2010 — *Industrial Wastewater Permit Renewal and Major Amendment Application*, TPDES Permit No. 02120, Texas Municipal Power Agency, Gibbons Creek Steam Electric Station, Carlos, Texas, Environmental Resources Management, September, 2010.

NSS 1976 — *Preliminary Soils Investigation, Proposed Steam Electric Station,* NFS/National Soil Services, Inc., Report No. 76602, August, 1976.

NSS 1981 — *Summary of Testing of Ash Ponds, Gibbons Creek Steam Electric Station, Grimes County, Texas*, Report No. D-76602-4, NFS/National Soil Services, Inc. March 2, 1981.

NSS 1983 — *Sludge Pond Study, Gibbons Creek Steam Electric Station, Grimes County, Texas*, Job No. D-76602-52, NFS/National Soil Services, Inc. October 21, 1983.

SII 1985 — *Sludge Pond Liner Certification and Warranty,* Staff Industries, Inc., Edward C. Staff, April, 1985.

T&G 1977a — *Specifications and Contract Documents for Site Preparation, Gibbons Creek Steam Electric Station, Unit No. 1, Texas Municipal Power Agency, Specification No. GC-1022*, Tippet & Gee, Inc. March, 1977.

T&G 1977b — *Sections, Site-Grading, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Drawing No. C-230-003*, Tippet & Gee, Inc. April 21, 1977, revised October 28, 1977.

T&G 1978 — *Plant Site Layout, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Drawing No. C-230-001*, Tippet & Gee, Inc. April 21, 1977, revised August 28, 1978.

T&G 1979a — *Ash Ponds – Drop Inlets & Culvert Plans & Sections, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Drawing No. 15-C-235*, Tippet & Gee, Inc. January 16, 1979, revised August 16, 1979.

T&G 1979b — *Ash Ponds – Drop Inlets & Culvert Sections & Details, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Drawing No. 15-C-236*, Tippet & Gee, Inc. June 1, 1979, revised June 25, 1981.

T&G 1981 — *Ash Pond Lining Certification, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency,* Tippet & Gee, Inc., March 13, 1981.

TMPA 1983a — *GCSES, C-5610 Seepage from GCSES Sludge Pond,* Ed Wagoner, TMPA, May 20, 1983.

TMPA 1983b — *Specifications For Material and Installation of a Flexible Membrane Liner for a Sludge Disposal Pond, Gibbons Creek Steam Electric Station, Unit No. 1, Texas Municipal Power Agency, Specification No. SPPE-84001*, J. Shoults, TMPA, December, 1983.

TMPA 1985 — *Sludge Pond Gauge*, JMS, TMPA, Sketch, February 20, 1985.

TMPA 2000 — *Sludge Pond for Survey Information, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Dwg. No. 11-C-19.1*, TMPA, February 15, 2000.

TMPA 2013 — *TMPA Water Balance Diagram*, ERM Drawing No 10-C-301, September 24, 2010, Revised by Texas Municipal Power Agency, August 15, 2013.

TMPA ----- — *Specifications, Site Preparation of Sludge Pond Prior to Installation of Liner*, unknown author, unknown date.

4.2 PUBLIC SOURCE DOCUMENTS

The following public source documents were used as sources of information used for this report. Copies of these public documents are available from the respective public source publishers.

NRCS 2008 — *TX_HU12_Geo83 - The 8, 10, and 12 hydrologic unit boundaries for Texas,* Texas Natural Resources Conservation Service, Hydrologic Unit Code 12070103, 2008.

TCEQ 2015 — *Texas Pollutant Discharge Elimination System Permit No. WQ0002120000,* Texas Commission on Environmental Quality, issued April 29, 2009, renewal issued December 15, 2015.

TCEQ 2016 — *Notice of Registration, Industrial and Hazardous Waste*, Texas Municipal Power Agency, Solid Waste Registration No. 32271, EPA Id. TXD000751073, Texas Commission on Environmental Quality, August 8, 2016.

Figures

October 2016
Project No. 0336706

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(512) 459-4700

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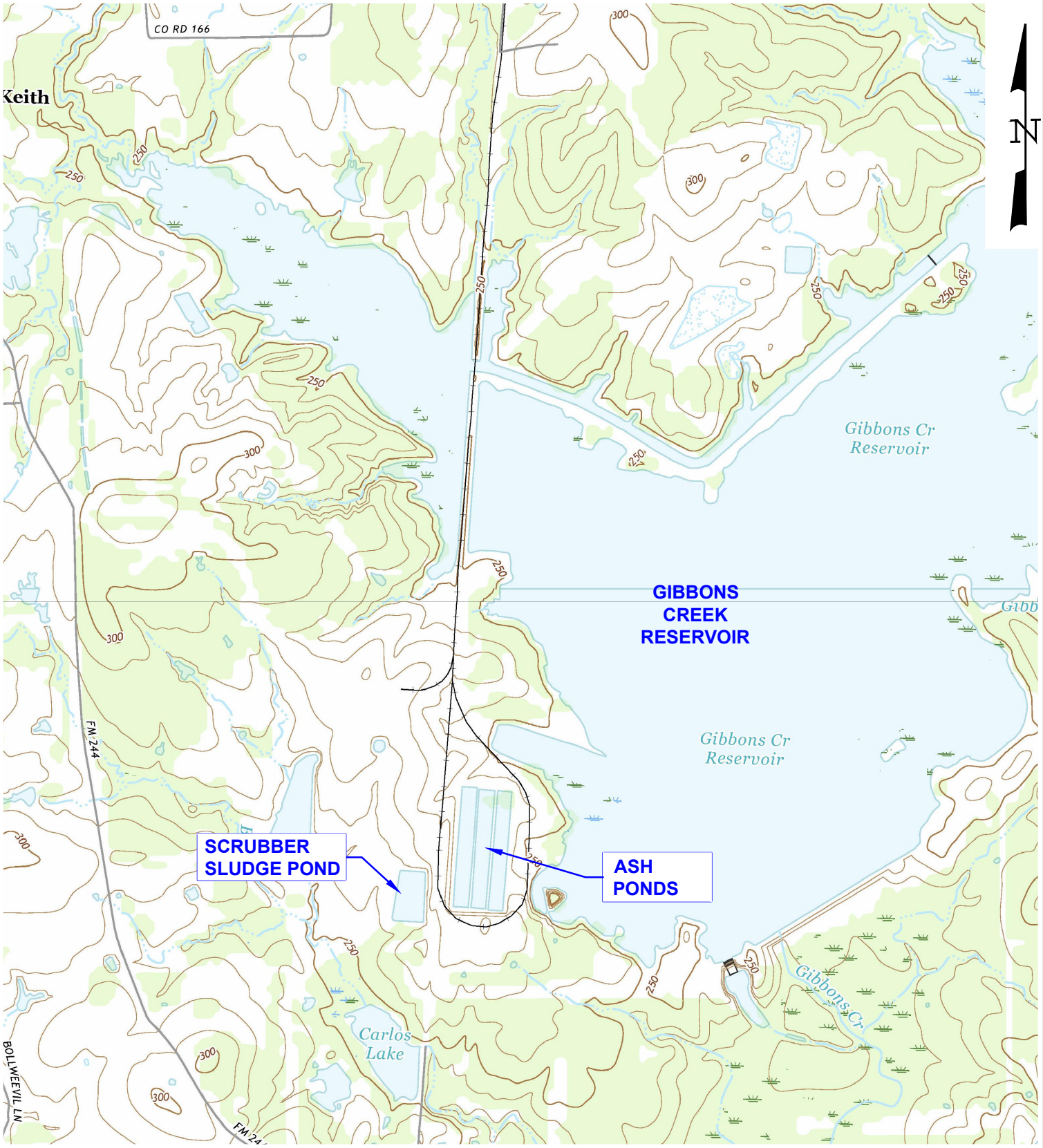

SOURCE: USGS TOPOGRAPHIC QUADRANGLES, 7.5 MINUTE SERIES, CARLOS, TEXAS, 2016 AND KEITH, TEXAS, 2016.

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SCALE FEET

Environmental Resources Management

DESIGN: CJ	DRAWN: CAK	CHKD.:
DATE: 9/2/2016	SCALE: AS SHOWN	REV.:

FIGURE 1
SITE LOCATION MAP
Texas Municipal Power Agency
Gibbons Creek Steam Electric Station
Carlos, Texas

ERM

ERM-Southwest, Inc. TX PE Firm No. 2393

Figure 2 - Ash Ponds Stage - Storage Curve

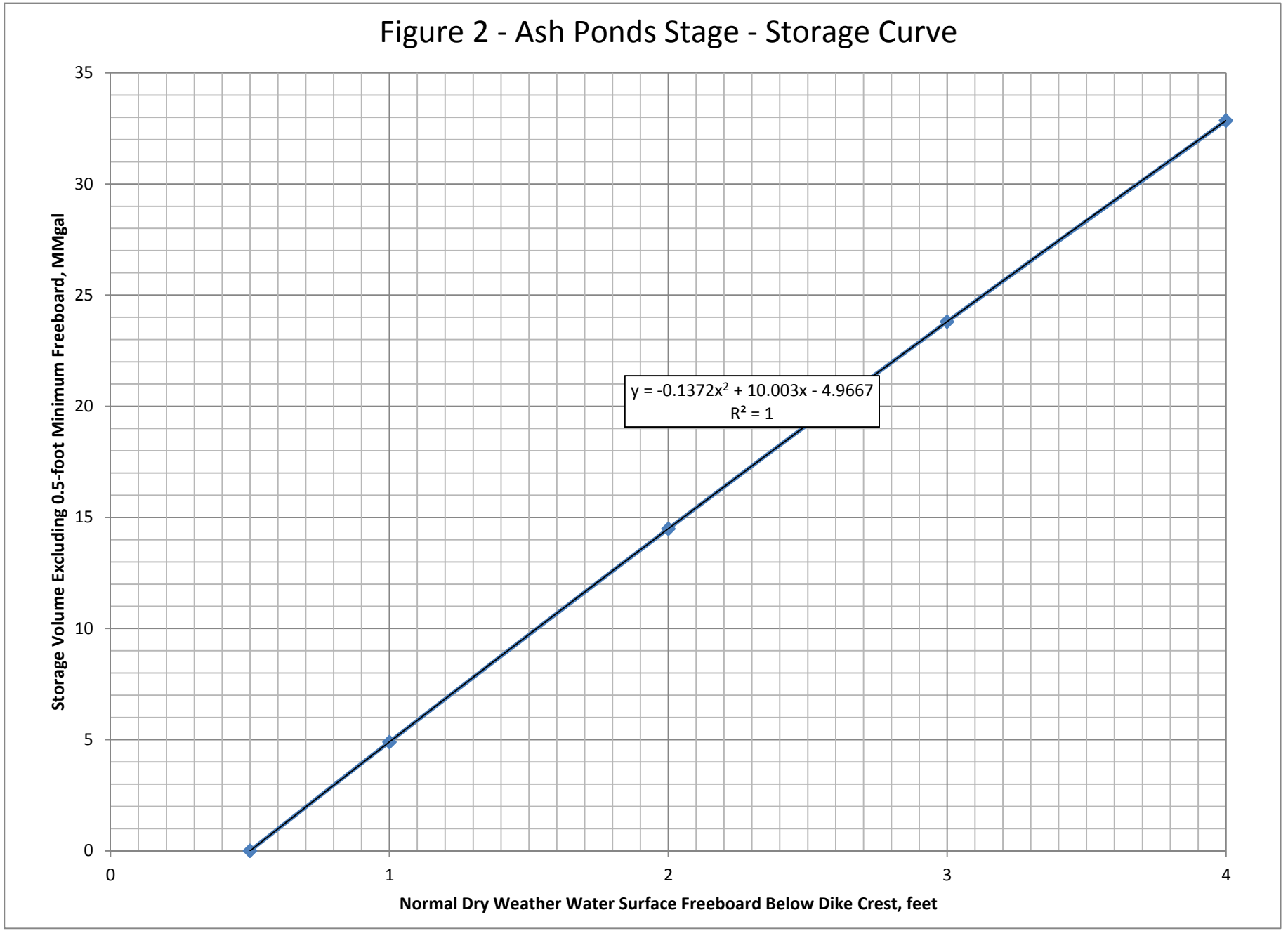
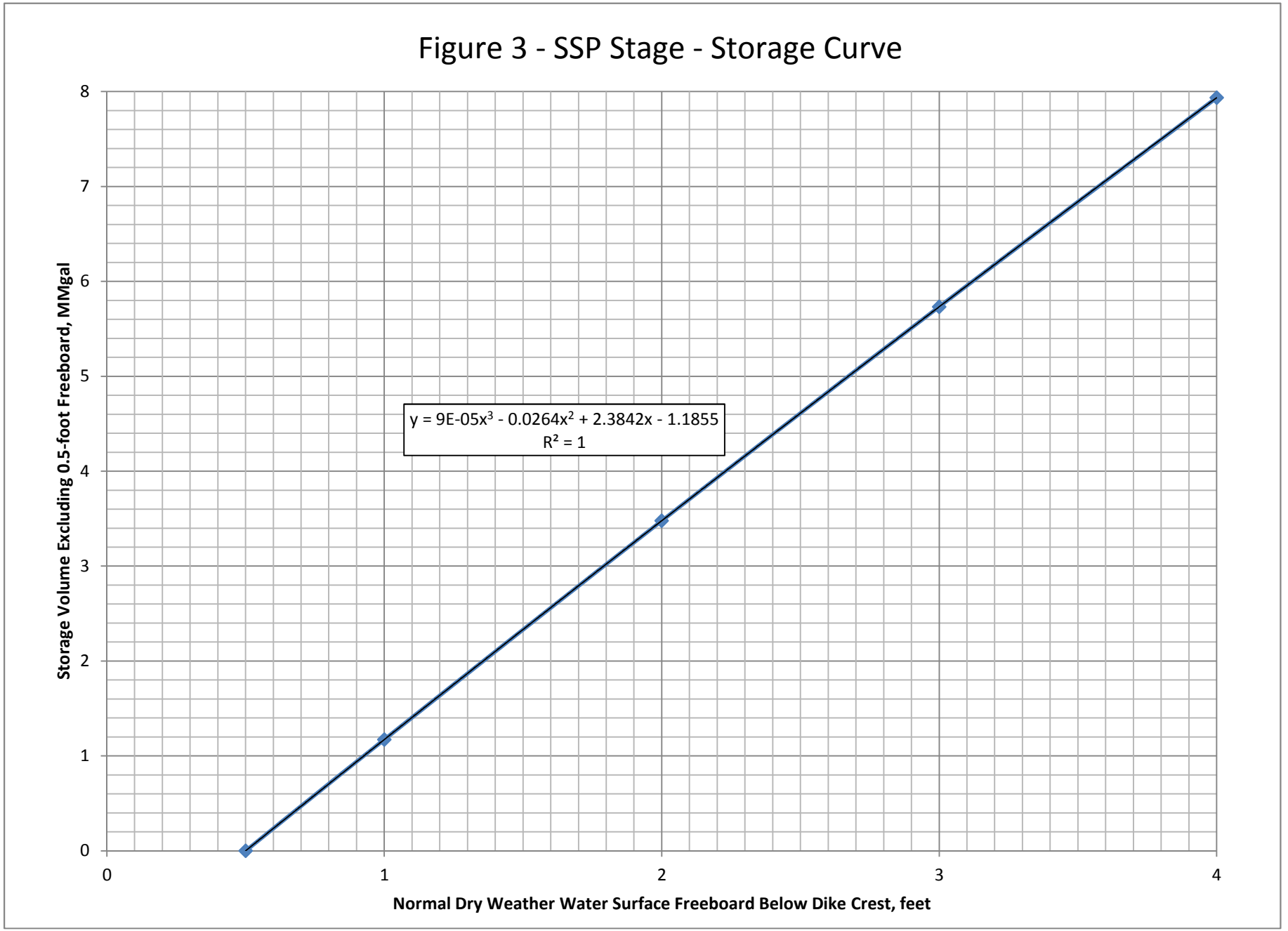


Figure 3 - SSP Stage - Storage Curve



Appendix A

October 2016
Project No. 0336706

Environmental Resources Management
206 East 9th Street, Suite 1700
Austin, Texas 78701
(512) 459-4700

TMPA DOCUMENTS

Environmental Resources Management
206 East 9th Street, Suite 1700
Austin, Texas 78701
(512) 459-4700

NSS 1976 *Preliminary Soils Investigation, Proposed Steam Electric Station,* NFS/National Soil Services, Inc., Report No. 76602, August, 1976.

NFS / NATIONAL SOIL SERVICES, INC. *CONSULTING ENGINEERS*
214-330-9211
P. O. BOX 24596
4087 SHILLING WAY
DALLAS, TEXAS 75224

August 31, 1976
Report No. 76602

Texas Power Pool, Inc.
Forest Park Center
7111 Bosque Blvd.
Waco, Texas 76710

Attention: Mr. F. K. Smith, P. E.
Project Director

PRELIMINARY SOILS INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
BRYAN LIGNITE PROJECT
GRIMES COUNTY, TEXAS

Gentlemen:

Submitted here is our preliminary report on the subsurface conditions at the above project site. These studies were performed in accordance with our contract for geotechnical engineering services dated April 16, 1976.

We trust that the results presented herein are in sufficient detail to permit preliminary designs sufficient for cost estimates and general arrangement of the foundation systems. Final studies may be initiated after more detailed information relative to the location and size of plant structures and foundation loads is developed.

If you have any questions, please call us.

Very truly yours,

NFS/NATIONAL SOIL SERVICES, INC.

Robert S. Junkrowski

Robert S. Junkrowski, P. E.

Tillman A. Riewe

Tillman A. Riewe, P. E.

RSJ/JKP/jb/dg
Copies submitted: 20

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BRYAN LIGNITE PROJECT
GRIMES COUNTY, TEXAS

PRELIMINARY SOILS INVESTIGATION
PROPOSED STEAM ELECTRIC STATION

Report to

TEXAS POWER POOL, INC.
Waco, Texas

By

NFS/NATIONAL SOIL SERVICES, INC.
Consulting Engineers
Dallas, Texas

August, 1976

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ILLUSTRATIONS

APPENDIX A

PART I - INTRODUCTION

PROJECT DESCRIPTION

This investigation was made at the proposed site of the steam electric station planned by the Texas Power Pool, Inc., to be located approximately 1.5 miles north of Carlos in Grimes County, Texas. One 400 MW generating unit is currently planned. Structure locations and final plant grade have not yet been determined. A cooling pond is tentatively planned on Gibbon's Creek to the east of the proposed plant site. The location of the plant site is approximately as shown on the Plan of Borings, Plate 1, in the report's illustrations.

Two additional sites were investigated during the preliminary stages of this study. The locations of these two sites and the borings made in the areas are also shown on the boring plan. All other information on these two sites, including boring logs and laboratory test results, are included in Appendix A.

PURPOSE AND SCOPE OF STUDY

This study was made to provide preliminary foundation design information for the steam electric station and related facilities and to determine the potential impact upon the terrain and groundwater resources. Specifically, the study was planned to define:

a. general and site geology of the area;

b. the general topography of the site;

c. soil stratigraphy in the plant island area;

d. general seismology of the area;

e. classification, strength, and compressibility characteristics of the foundation soils;

f. suitable foundation types;

g. location, depth, and usage of any groundwater resources in the area;

h. general characteristics and metals content of the groundwater resources; and

i. the potential impact on the groundwater from plant seepage.

SOILS INVESTIGATION

FIELD STUDIES

Soil conditions were defined by undisturbed sample borings, located as shown on the Plan of Borings, Plate 1. Samples were obtained at approximately five-foot intervals and at changes of strata. Thin-walled Shelby tube and Pitcher barrel type samplers were used to obtain undisturbed samples. Disturbed samples were also obtained using a conventional split-spoon sampler. The surface elevation, sample depth, description, and soil classification (based on the Unified Soil Classification System) are shown on the logs of borings, Plates 2 throug' 32. Logs of piezometer installations are presented on Plates 33 and 34. Keys to descriptive terms and symbols used on the logs are presented on Plates 35 and 36.

The Shelby tube sampler is a three-inch I.D. thin-walled tube which is pushed into the undisturbed soils at the bottom of the borehole by hydraulic rams on the drill rig. The Shelby tube is limited to cohesive soils into which the tube can be pushed by the weight of the drill rig. Where the Shelby tube could not penetrate the soils, a Pitcher barrel sampler was used to obtain undisturbed samples. The Pitcher barrel sampler is a double tube core barrel in which the inner tube leads the cutting bit. The amount of lead by the inner tube is variable, depending on the strata, but is generally less than one inch. The Pitcher barrel sampler is also ideally adapted for obtaining undisturbed samples in silt and sand strata by coring procedures where samples with the Shelby tube sampler cannot be obtained.

The consistency of each undisturbed cohesive sample was evaluated in the field by using a calibrated hand penetrometer. This device measures the pressure necessary to push a 0.25-inch diameter piston into the undisturbed specimen. The pressure at 0.25-inch

penetration has been correlated with the laboratory unconfined compressive strength; thus a representative estimate of soil consistency is obtained. The results, expressed in terms of shear strength (one-half the compressive strength) are plotted as open circles in the strength plot on the boring logs. Numerous samples exhibited strengths in excess of 1.5 tons per square foot, the maximum capacity of the penetrometer. When the sample strength exceeded this capacity, a plotted value of 1.5+ is shown on the logs. Values influenced by sand and silt lenses were not recorded.

A standard two-inch diameter O.D. split-spoon sampler was used in cohesionless strata in order to define the relative density of the sand strata and where recovery with a thin-walled Shelby tube or Pitcher barrel sampler could not be obtained. The standard penetration sampler was driven into the bottom of the borehole by a 140-pound hammer falling 30 inches. Each observation of driving resistance, expressed as blows per foot, is tabulated on the appropriate boring log at the depth the sampler was used.

Water levels were observed in borings within several days after completion of drilling. These water levels are noted in the lower right on the boring logs and are also shown on the Generalized Soils Profiles, Plates 37 through 39. Piezometers were installed in two locations near borings B-15 and B-17 to determine the variation in groundwater elevation with time. Details of their installation are shown on Plates 33 and 34.

LABORATORY STUDIES

Classification

Classification of soils was verified by natural moisture content determinations, liquid and plastic limit determinations, and grain size analyses. The natural moisture content, liquid and plastic limits, and percent passing the No. 200 sieve are tabulated at respective sample depths on the boring logs and on the Generalized Soils Profiles; the gradation test results are presented graphically on Plates 44 through 52.

Unconfined Compression

The shear strength of selected clay samples was determined by unconfined compression tests. In the unconfined test, a cylindrical specimen of an undisturbed sample is subjected to axial compression without lateral confinement. The ultimate pressure at failure, divided by two, is termed the shear strength or cohesion of the sample. Cohesion values from unconfined tests are plotted as solid circles in the strength plot. The natural moisture content and dry density of each specimen are also recorded opposite the strength values.

Triaxial Compression

Strength characteristics of the foundation soils were also defined by unconsolidated-undrained and consolidated-undrained triaxial compression tests performed on undisturbed specimens. These tests provide a quantitative indication of the response of the foundation media to variations in normal (confining) pressures. They are used to define strength parameters corresponding to stress conditions during loading and unloading of soils at various stages during construction.

Unconsolidated-undrained tests define soil strength, as a function of normal pressure, during initial application of foundation loads and consolidated-undrained tests define soil strength at an intermediate construction stage, assuming complete consolidation (drainage) due to initial loads; consolidation due to final loads has not developed.

In these tests, selected samples are enclosed in a membrane and confined laterally. Compressive strength is determined for a minimum of three confining pressures using a single specimen. This is termed multi-stage loading. In the consolidated-undrained test, the equilibrium moisture content (consolidation or drainage) is developed for each confining pressure applied. Drainage is not permitted, however, during axial compression.

To approximate in-situ conditions during construction, specimens selected for evaluation of foundation strength were permitted to absorb moisture prior to performing the tests. Cohesionless specimens were essentially saturated when tested.

A plot of shear strength, as a function of normal pressure, defines the angle of internal shear, $\emptyset$, and cohesion, c (shear strength at zero confining pressure). The angle of shear expresses the variation in strength as a function of confining or consolidation pressure. Results of these tests, together with the pertinent classification properties for each sample, are shown graphically on Plates 53 through 78. Several test specimens failed under the initial confining pressure, thus prohibiting development of the strength envelope. Appropriate notations are made on the respective illustrations.

PART II- GEOLOGY, TOPOGRAPHY, GENERALIZED SOIL CONDITIONS, AND SEISMOLOGY

GENERAL GEOLOGY

Physiography

The proposed plant site is located in the central portion of the West Gulf Coastal Plain section of the Gulf Coastal Plain physiographic province of the United States. The West Gulf Coastal Plain rims the Gulf of Mexico from just east of the Mississippi River to south of the Rio Grande River. Within Texas it exists as a belted coastal plain, 150 to 300 miles wide. The topography of the West Gulf Coastal Plain is related to the depositional and erosional processes associated with the Gulf Coast geosyncline. Relatively few features are of tectonic origin; however, tectonic activity in adjoining provinces has influenced topographic development within the coastal plain. The Coastal Plain is drained by the Sabine, Trinity, Brazos, Colorado, Guadalupe, Nueces, and Rio Grande Rivers. The project area is drained by tributaries of the Navasota River, which is part of the Brazos River watershed.

The Coastal Plain has evolved to its present condition mainly by erosion, deposition, and compaction of sediments; and by slow gulfward subsidence of the Gulf Coast geosyncline. The Gulf Coast geosyncline comprises a series of poorly consolidated sedimentary formations composed chiefly of fine sands, sandstones, siltstones, indurated clays, marl, limestone, and chalk with subordinate amounts of volcanic tuff, lignite, and gravel. The West Gulf Coastal Plain has developed during the Cenozoic Era of geologic time as a result of sediment filling a subsiding continental geosynclinal trough. A series of transgressions and regressions of the sea over the continental mass coupled with alternating uplift and subsidence of the geosyncline has produced a wedge of clastic sediments which thicken considerably toward the Gulf.

The Cenozoic rocks in Texas have been divided into eight groups which are subdivided into numerous formations and members. These formations have outcrops which roughly parallel the Gulf Coast, and the formations dip toward the Gulf at an angle just slightly greater than the land surface. Therefore, traveling away from the Gulf toward the interior of Texas, one encounters progressively older formations. Differential erosion of alternating formations has produced a topography of low dissected cuestas and intervening lowlands.

The soil formations in the project area are of Eocene and Miocene Age and are frequently overlain by Recent and Pleistocene deposits associated with stream deposits and residual soils. Formations exposed in the site area include the Eocene Yegua Formation of the Claiborne Group, the Eocene Caddell, Wellborn, Manning, and Whitsett Formations of the Jackson Group, and the Miocene Catahoula Formation. These formations are classified and divided as shown on the Generalized Geologic Timetable, Figure 1. A Generalized Geologic Map of the area is presented on Plate 40.

Stratigraphy

Yegua Formation - The Yegua Formation, which is the uppermost formation of the Claiborne Group and conformably underlies the Jackson Group, consists of sand, sandy shale, clay, and lignite. The Yegua strata records a time of terrestrial deposition during which a number of streams flowed across the present area depositing crossbedded sand, silt, and clay, some of which were derived from a volcanic source. The fluviatile deposits coalesce and interfinger with lignitic sands, clays, and lignites which were deposited in coastal swamps. Deposits of deltaic origin also comprise a considerable portion of the Yegua Formation and at a number of places these are steeply dipping foreset beds.

Caddell Formation - The Caddell Formation is the basal formation of the Jackson Group and conformably overlies the Yegua Formation. The Caddell consists mostly of gray and tan crossbedded sands and gray and chocolate-colored clays in the area of study. Some of the sands and clays contain lignitic material so that in many places the Caddell

Formation is not readily separable from the underlying Yegua Formation. The Caddell strata were deposited under fluviatile, palustrine, littoral, and marine conditions. The area of the present outcrop was very close to the strand line level, and there were oscillations and retreats of the sea causing shallow water marine layers to be interbedded with the continental deposits.

Wellborn Formation - The Wellborn Formation is the second oldest formation of the Jackson Group and is divisible into three mappable units: 1) the Bedias sandstone at the base; 2) an unnamed middle member consisting of shale, sands, clay, and sandy shale; and 3) the Carlos sandstone at the top. Total thickness of the Wellborn Formation is approximately 200 feet.

The Bedias sandstone is the basal member of the Wellborn Formation and consists of gray fine sand, often with a cemented upper layer of hard sandstone. The Bedias sandstone represents a beach or littoral deposit of a transgressive sea with marine beds at the top.

Between the Bedias sandstone and the Carlos sandstone there is a member which consists largely of brown shales interbedded with sand, sandstone, and sandy shale. The sands, clays, and sandy shales comprising the middle part of the Wellborn Formation indicates that these beds were deposited under a combination of palustrine, fluviatile, and probably littoral conditions.

The Carlos sandstone is the upper sandstone member of the Wellborn Formation, and consists of gray and white sand which in some areas is well cemented into sandstone. The Carlos sandstone was probably deposited in a very shallow marine, or possibly lagoonal, environment.

Manning Formation - The Manning Formation is the second youngest formation of the Jackson Group. It is composed of light gray, fine-grained sands and tan, brown and gray clays with minor amounts of lignite. Total thickness of the Manning Formation in this area is approximately 250 feet. The basal 100 feet or so of the Manning contains a

greater percentage of lignite than is normal for the rest of the formation. The top of this lower lignitic zone is overlain by the Goodbread sandstone member. It consists of massive, fine-grained, tan and gray sand, often capped by a cemented zone.

At the top of the Manning are two sandstone units which form prominent escarpments. The shaley zone between these sandstones is 30 to 60 feet in thickness and each sandstone unit varies from 5 to 50 feet in thickness. In some areas, the two sandstone units combine to make a single prominent escarpment. This is the most prominent escarpment produced by any member of the Jackson series in the area of study. The lower of the two sandstones is named Tuttle, while the upper sandstone is named the Yuma. Several other sandstones exist in the Manning, but they are non-persistent and are not mapped or named.

The lower strata of the Manning Formation are essentially non-marine and shallow lagoonal origin. The thin beds of lignite indicate a swamp environment in some places. The Goodbread sand member is interpreted as being deposited in small, localized deltas between shallow lagoons. The Tuttle sandstone member appears to have been deposited in shallow bays. The lower portion of the Yuma member appears to have been deposited in shallow, quiet bays, while the upper portion of the Yuma probably represents a beach or littoral deposit.

The contact between the Manning Formation and the underlying Wellborn Formation is conformable, and the Manning Formation is conformably overlain by the Whitsett Formation.

Whitsett Formation - The Whitsett Formation is the youngest formation in the Jackson Group. In this area, the Whitsett is approximately 50 feet in thickness, most of which is not well exposed. The lower portion is composed predominately of brown and gray fine-grained, slightly indurated sandstone with lesser amounts of soft tan and reddish-tan clay. Changes of lithologies along the strike are common. The upper portion of the Whitsett is generally covered by a deep sandy soil, but where it is exposed it is composed of light-tan shale, brown lignitic clay, and gray sand.

The Whitsett Formation in this area appears to be non-marine in origin. The lower strata indicates deposition by fast moving streams, while the upper strata are probably of deltaic and lagoonal origin.

The Whitsett Formation conformably overlies the Manning Formation and is unconformably overlain by the Chita member of the Catahoula Formation.

Catahoula Formation - The Catahoula Formation forms the base of the Miocene Series in this area and is generally composed of tan and white sandy clays, tan sandstones, and dark gray tuffaceous sandstones. Members of the Catahoula which have been mapped in adjacent areas are, in ascending order, the Chita member, Catahoula non-calcareous member, Dunlap sandstone member, Catahoula non-calcareous member, and Catahoula calcareous member. The Catahoula is approximately 250 feet thick in this area.

The Chita member and the lower portion of the lower non-calcareous member are present in the area represented on the accompanying geologic map. The Chita member is generally composed of tan fine to medium grained, indurated sandstone, and is approximately 40 feet thick. The Chita forms a well-defined cuesta marking the base of the Catahoula Formation. The Chita member is believed to have been deposited by a number of coalescing streams on a relatively flat plain. The Chita sandstone member is unconformably underlain by the Whitsett Formation of the Jackson Group.

GENERALIZED GEOLOGIC TIMETABLE

ERA	SYSTEM	SERIES	GROUP	FORMATION	MEMBER
Cenozoic	Quaternary	Holocene		Flood Plain Alluvium	
	Tertiary	Miocene		Catahoula	
		Eocene	Jackson	Manning	Yuma Sandstone
					Tuttle Sandstone
					Goodbread Ss.
				Wellborn	Carlos Sandstone
					Middle Wellborn Sandstone
					Bedias Sandstone
				Caddell	
					Basal Sandstone
			Claiborne	Yegua	

FIGURE 1

SITE GEOLOGY

The project site lies on the outcrop of the Wellborn Formation of the Jackson Group. The strata underlying the plant site belongs to the middle Wellborn member, which has been described in the stratigraphy section. The Wellborn Formation in this area strikes approximately N 45° E and dips to the southeast at about 85 feet per mile.

TOPOGRAPHY

The project area lies within the drainage basin of Gibbons Creek, a tributary of the Navasota River. Gibbons Creek flows through a nearby flat and featureless plain that is, in places, over one mile in width. Gibbons Creek and its tributaries form a dendritic drainage pattern. This system is complex and mature and was probably formed concurrently with the development of the present topography. With the exception of Gibbons Creek, all of the streams in the area are intermittent.

Most of the site area is covered with thick forest growth and heavy underbrush. The principal forest trees include several species of oak, yellow pine, pecan, gum and cedar. Small, local areas have been cleared for farming on the outcrops of the Caddell and Wellborn formations.

The topography of the site area is controlled by the underlying formations. The Yegua formation forms gently rolling hills and valleys of low relief. The Jackson group and Catahoula formation are composed of alternating clay and sand beds whose regional dip is to the southeast. These beds vary in their resistance to weathering and have been eroded into a series of low dissected cuestas. These cuestas trend to the northeast, parallel to the strike of the beds. The mature topography of the area is characteristic of a belted coastal plain.

The principal cuesta-forming members are the Bedias, Middle Wellborn, Carlos, Tuttle, and Yuma sandstones. All of these sandstone members vary considerably in thickness and degree of induration and the cuestas they form are not continuous and are

poorly defined. The cuestas formed by the Carlos and Middle Wellborn sandstone members are best developed adjacent to the flood plain of Gibbons Creek where tributary streams have deeply eroded the clay strata and have thus developed steep scarp slopes on the cuestas.

Impact of plant construction on the topography cannot be fully defined until the proposed plant grade and size and location of proposed structures is finally known. Considerable cut and fill will be made to level the site under the major structures. Grading in other areas will be required to construct level pads for minor structures and other pertinent facilities. Natural drainage of the plant site will also be altered.

GENERALIZED SOIL CONDITIONS

Subsurface conditions at the proposed Bryan Power Plant site are illustrated graphically on the Generalized Soils Profiles A-A' through F-F', Plates 37 through 39. Seven general soil units underlie the site. These soil zones include, in descending order, a thin mantle of silty sand, an upper clay, an upper silty sand to sandy silt, a middle clay, a lower silty sand, a lower silt, and a lower clay. These strata are listed and described on Plate 38.

Loose tan and gray silty fine sand comprised the uppermost soil unit. This sand varies in thickness from one foot in boring B-5 to 7.5 feet in boring B-13, but is generally less than two feet thick.

The upper clay, shown as strata No. 2 on the Generalized Soils Profiles, consists of very stiff to hard tan and brown clay and sandy clay. It extends to depths varying between 7.0 feet in boring B-15 to 27.5 feet in boring B-17. This strata is weathered in its upper zones, and is also a weathered version of the middle clay. Iron stains are prevalent in all borings except borings B-15 and B-18. The clay general has moderate plasiticity, with plasticity indices ranging from 14 to 35; however, some clays encountered in borings B-13, B-16, and B-18 had plasticity indices as high as 47.

The upper sand, shown as strata No. 3 on the Generalized Soils Profiles, is a very dense tan and gray silty fine sand and sandy silt. Clay laminations are prominent with the stratum. The stratum occurs in two layers in borings B-5, B-13, and B-16 and in one zone in the remaining borings. The individual layers vary in thickness from 5.0 feet in boring B-16 to 25.0 feet in boring B-4. A seven foot strata of soft sandstone was encountered in boring B-15 and a 3.0 foot lense of hard sandy siltstone was encountered in boring B-14. Interbedded clay and clayey sand occurs within this unit in boring B-5 and silt strata occurred in borings B-4 and B-14.

Slight amounts of bentonitic clay are present within the sand and silt and lend plasticity to the formation in borings B-13 and B-16. The minus 200 sieve content of the sand varies from 11 percent in B-14 to over 50 percent in B-16, but usually averages greater than 40 percent.

The middle clay unit, shown as strata No. 4 on the Generalized Soils Profiles, generally consists of hard gray or brown clay with occasional silty clay. The thickness of the middle clay varies greatly due to the occurrence of a seam of the upper sand unit within the clay zone. From its upper contact to its lower contact, the middle clay varies in thickness between 44.0 and 115.0 feet. Occasional silt and sandy silt seams are interbedded within the clay in the upper part of the unit. Some seams and inclusions of lignite and lignitic clay were encountered in borings B-5, B-13, B-14, and B-17. The middle clay generally exhibits high plasticity, with plasticity indices greater than 30. The lower part of the stratum in borings B-5, B-4, and B-14 is extremely active with plasticity indices greater than 80 and it contains occasional slickensided zones.

The lower silty sand, shown as strata No. 5 on the Generalized Soils Profiles, varies in thickness from 15 feet in boring B-14 to 40 feet in boring B-5 and consists predominately of very dense gray silty fine sand. In borings B-14, B-15, B-16, and B-17 the sand is cemented and occurs as moderately hard to hard gray sandstone seams varying from two feet in thickness in boring B-16 to 17 feet in boring B-15. As in the upper sand,

traces of bentonitic clay result in the silty sand exhibiting some plasticity. The minus 200 sieve content ranges from 10 percent in boring B-16 to 37 percent in boring B-5, but is generally greater than 30 percent. Clay laminations are present within this sand but are not as prevalent as those in the upper sand.

The sixth soil unit is a very dense gray sandy and clayey silt varying in thickness from 18 feet in boring B-17 to 22 feet in boring B-4. The silt was encountered only in borings B-4, B-14, and B-17. The silt may be distinguished from the overlying sand stratum by the lack of sandstone seams and the differing amounts of sand and clay within the strata. Traces of bentonitic clay influence the plasticity characteristics of the silt.

The lower clay unit, shown as strata No. 7 on the Generalized Soils Profiles, is predominately hard greenish-gray to gray clay. This stratum extends to the completion depth of the borings, but was not encountered in boring B-13. Sandy clay, 13 feet thick, was encountered within this unit in boring B-16 and silty clay occurs in seams in borings B-4, B-15, and B-18. The clay has very high plasticity due to the occurrence of bentonite minerals within the clay. Plasticity indices range from 79 in boring B-14 to 128 in boring B-15.

SEISMOLOGY

The Grimes County project is located in a region of low seismicity that extends from Florida to Texas. Most earthquakes in the Coastal Plain have occurred near the Mississippi Valley area, several hundred miles from the site.

Pertinent earthquakes whose epicenters are near the project site are listed on Table I and shown on Figure 2.

The strongest shocks historically known in the Gulf Coastal Plain Region were the 1811-1812 New Madrid, Missouri shocks, with a Modified Mercalli Intensity of XI. The epicenter of these shocks were over 500 miles northeast of the project area.

The largest event recorded in the area was the Mexia-Wortham earthquake of 1932 (about 90 miles north of the site) listed by "Earthquake History of the United States", (1973), as Modified Mercalli Intensity V-VI with a felt effect area of 1,000 square miles. This shock was probably not felt at the project site.

In March, 1957, a series of four earthquakes occurred in the East Texas oil field area, north of the Mt. Enterprise fault system, about 150 miles northeast of the project site. Evaluation of the felt-effect reports suggest a roughly circular area of maximum Intensity V in the Diana-Gladewater-Longview area which produced a felt-effect area of 19,075 square miles. These quakes were probably lightly felt at the site area.

The Hemphill, Texas event of 1964 (about 150 miles northeast of the site), was of high frequency and short duration and generally had small felt-effect areas, except for one shock which reportedly was felt in Shreveport, some 85 miles from the epicenter (Shreveport Times, March 25, 1964, pg. 18A). This series of shocks had a Modified Mercalli Intensity of IV-V and were probably not felt at the site.

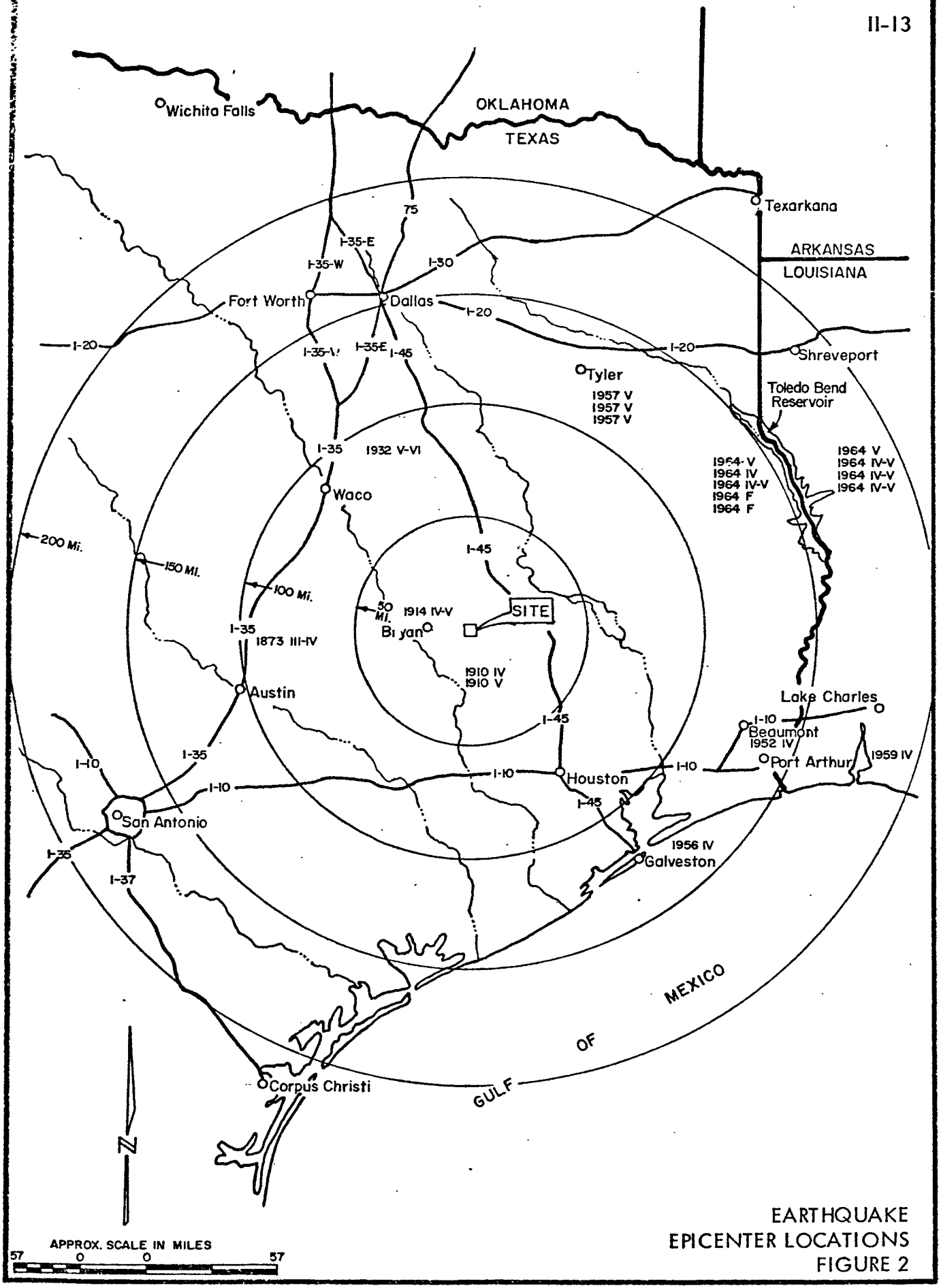
In American National Standard A58, Appendix A8, "Earthquake Loads", a map of risk zones and damaging earthquakes of the United States is shown. The project site lies within risk Zone 1. Accordingly, it is recommended that major structures should be designed using an acceleration of 0.05g.

TABLE I

LOCATION OF EARTHQUAKES

Date	Location	°N	°W	Epicentral Intensity *
1811, Dec. 16	New Madrid, Missouri	36°3'	89°3'	XII
1873, April 30	Manor, Texas	30°15'	97°42'	III-IV
1910, May 11	Waller and Washington Counties, Texas	30°8'	96°2'	IV
1914, Dec. 29	Anderson, Texas	30°31'	95°55'	IV-V
1932, April 19	Mexia-Wortham, Texas	31°42'	96°24'	V-VI
1952, Oct. 17	Orange, Texas	30°	94°	IV
1956, Jan. 7	Galveston Island, Texas	29°3'	95°	IV
1957, March 19	Diana-Gladewater-Longview, Texas	32°	95°	V
1964, May 7	Pineland, Texas	31°15'	94°	Felt
1964, June 2	Toledo Bend Area, Texas	31°15'	94°	IV

*Modified Mercalli Scale



EARTHQUAKE
EPICENTER LOCATIONS
FIGURE 2

PART III - FOUNDATION ANALYSES AND RECOMMENDATIONS

FOUNDATION TYPES

General

Final plant grade and structure locations are currently unknown. Since the existing ground surface varies widely across the site and the results of the borings and geologic study have indicated a substantial dip to the southeast of suitable bearing strata, a single foundation type and depth cannot be recommended nor can a single desirable bearing-stratum be identified. It appears from our preliminary investigation that the very dense silty sand stratum, whose upper contact varies between Elev 255 in the northern part of the site, to Elev 220 in the southern part, will provide the most desirable foundation bearing. The variation in depth to this strata and the lack of definite structure locations indicates several alternative foundation systems may be considered. The foundation types which may be studied include:

a. spread footings and mats;

b. drilled and underreamed piers; and

c. driven piles.

One single foundation type or a combination of the above may be selected based on more detailed studies.

Spread Footings and Mats

Spread footings or mat foundations may be considered for all structures except those located in the southeast corner of the plant site defined by boring B-13. Extensive lignitic clay and lignite deposits, unsuitable for shallow footing support, were encountered to an approximate depth of 35 feet. Structures located in this area will require a deep foundation system unless additional borings indicate the extent of the lignitic deposits is limited.

In the other areas of the proposed plant site, available boring information indicates that, although final plant grade is unknown, footings or mats founded in the shallow silty sand stratum between Elev 220 and Elev 255 will perform satisfactorily. Footings should be located below the zone of seasonal volume change which is anticipated to be between ten and twelve feet in the area. Spread footings and mats may not be suitable in some areas because of low allowable bearing values, or extensive shallow clay deposits.

The individual characteristics of each major structure must be evaluated in order to determine specific foundation requirements. In general, spread footings or mat-type foundations founded in the silty sands will experience settlement; however, settlement should occur immediately upon application of loads and differential settlement should be negligible after completion of construction. Extensive shallow clay deposits will preclude the use of shallow foundation systems as differential settlement will occur over a period of many years. Construction should be scheduled to delay rigid connections between structures, thus reducing differential movements to a small portion of the total settlement. In-situ load tests should be performed prior to construction to confirm anticipated soil behavior.

Drilled and Underreamed Piers

Drilled and underreamed piers should also be considered for all structures. It is anticipated that piers can generally be founded at the upper contact of the very dense silty fine sand/sandy silt strata that were encountered beneath the site. As the borings are widely separated and the strata exhibit a dip of between 70 and 100 feet across the site, a single bearing stratum cannot be identified at this time. The individual location of the major structures must be evaluated in order to determine specific foundation depth requirements.

Piers founded in silty sand may experience some settlement. However, settlement will occur in the sand immediately upon application of the loads and differential settlement should be negligible after completion of the structure. Extensive clay

deposits may preclude the use of drilled footings due to the possibility of differential movement over the design life of the structure. As with spread footings, construction should be scheduled to delay rigid connections between structures, thus reducing differential movements to a small portion of the total settlement. Final design will require in-situ load tests to verify subsurface soil behavior.

Driven Piles

High pile capacities can be developed in these geologic formations. Pile capacity will be developed by a combination of skin friction (and/or adhesion) and point bearing. The maximum pile capacity can generally be developed by driving the piles into silty sand formations. A detailed investigation will be required beneath each structure to determine the pile tip elevation.

All piles driven into these formations will require pre-drilling to within a few feet of the design tip elevation. The required depth of pre-drilling will vary from pile to pile. However, pre-drilling does not have significant influence on pile capacity provided that the piles are driven to the required resistance after pre-drilling. Previous studies in formations of this type have shown that nominal length (40 feet) Raymond Step-Tapered piles with an "O" tip can be designed to carry loads on the order of 100-to-125 tons provided the allowable stresses in concrete are not exceeded. Final design should be checked by full scale pile load tests which could be performed in advance of construction.

SPREAD FOOTINGS AND MATS

Allowable Bearing Capacity

Based on field and laboratory strength data, bearing capacity analyses indicate allowable bearing loads for footings and mats would be in the order of 4,000 to 6,000 pounds per square foot for dead plus live loads with a 30 percent increase permitted for wind loads. Foundations proportioned in accordance with these values would have a factor of safety in excess of two with respect to shear failure.

Settlement

Detailed settlement analyses have not been performed since any settlement analyses for structures of this type require the knowledge of foundation size, loading, and depth in order to predict the settlement. Also important from the analysis point of view is the relative stress influence between adjacent footings. However, upon comparison of the preliminary data obtained from this investigation with other projects, it may be concluded that excessive differential settlements can be controlled. Detailed settlement analyses can only be made after the determination of foundation dimensions and loadings.

DRILLED AND UNDERREAMED PIERS

Allowable Bearing Capacity

Based on field and laboratory strength data, bearing capacity analyses indicate allowable bearing values for the piers founded between Elev 220 and Elev 255 at the upper contact top of the silty sand/sandy silt strata will be on the order of 12,000 to 14,000 pounds per square foot for dead load plus live load with a 30 percent increase permitted for wind loads. Foundations proportioned in accordance with these values would have a factor of safety in excess of two with respect to shear failure.

Settlement

As with shallow footings, detailed settlement analyses can only be performed after foundation size, depth, and loading is determined. Excessive differential settlements can be controlled. A detailed settlement analysis will be made after determination of foundation dimensions and loadings.

PILE SUPPORTED STRUCTURES

Pile Capacity

The compression load capacity of piles is developed by friction and end bearing in the sands, silts, or clays. The specific components of pile capacity are as follows:

Friction, Q_{FS} - in the cohesionless sands and silts will be a function of tip elevation, lateral earth pressure, pile perimeter, and the coefficient of friction between the pile and soil expressed as:

$$Q_{FS} = P_s \, p_o \, H_s \, k \tan \emptyset$$

where: P_s = the pile perimeter in sand;

p_o = the effective overburden pressure at mid-height of the sand stratum;

H_s = embedded length in sand;

k = the coefficient of lateral earth pressure; and

$\emptyset$ = the angle of friction between the pile and soil.

Preliminary design parameters recommended for the design and economic analyses of Raymond Step-Taper piles are as follows:

Dense to very dense silty sands and sandy silts, $k \tan \emptyset = 1.6$

Medium dense clayey sands, silty sands, and sandy silts, $k \tan \emptyset = 1.2$

End Bearing, Q_{ES} - for piles in cohesionless soils is a function of embedded length and soil characteristics defined by:

$$Q_{ES} = p_{ot} \, N'_q \, A$$

where: p_{ot} = the effective overburden pressure at the pile tip;

N'_q = a dimensionless factor related to the angle of internal friction and shape of the failure plane; and

A = pile tip area.

For Raymond Step-Taper piles preliminary design parameters recommended for the design and economic studies are:

Dense to very dense silty sands and sandy silts, $N'_q = 50$

Medium dense clayey sands, silty sands, and sandy silts, $N'_q = 30$

Friction, Q_{FC} - in the cohesive soils will be a function of the soil-pile adhesion and the pile perimeter as given by the following:

$$Q_{FC} = P_c \, c_a \, H_c$$

where: P_c = pile perimeter in clay;

c_a = pile-soil adhesion; and

H_c = embedded length in the clay stratum.

The pile-soil adhesion, c_a, may be assumed to approach the cohesion value as defined by the laboratory tests.

End Bearing, Q_{EC} - in the cohesive strata is a function of the shear strength c, and a dimensionless bearing capacity factor, N_c, related by:

$$Q_{EC} = cN_c \, A$$

The bearing capacity factor, N_c, for deeply embedded piles is 9.0. The cohesion, c, may be assumed equal to the results of laboratory shear strength.

Ultimate Compression Capacity, Q_C - for a pile penetrating into sands and clays is as follows:

$$Q_C = \underbrace{\overbrace{P_s \, p_o \, H_s \, k \tan \phi}^{\text{Sand}} + \overbrace{P_c \, c_a \, H_c}^{\text{Clay}}}_{\text{Skin Friction}} + \underbrace{\overbrace{p_{ot} \, N'_q \, A}^{\text{Sand}} \text{ or } \overbrace{cN_c A}^{\text{Clay}}}_{\text{End Bearing}}$$

where the terms are as previously defined.

Ultimate tension capacity, Q_T, will be developed by skin friction in the sands and clays. Skin friction under tension conditions will normally be in the order of 70 percent of that developed by compression loading.

Settlement

Based on the results of these studies and settlement observation at other structures in similar formations, it may be concluded that settlement will occur immediately upon application of loads and that the amount of settlement will be negligible.

ADDITIONAL STUDIES

Additional studies required for selection of foundation type must include settlement analyses of typical footing or pier sizes due to static and vibratory loads and pile capacity curves for evaluation of foundation types and selection of pile capacities (or lengths) in various areas. Additional field, laboratory, and engineering studies are also required for major units to more adequately define subsurface conditions for final design and construction plans.

PART IV - GROUNDWATER ANALYSES

IDENTIFICATION OF GROUNDWATER RESOURCES

Within the site area, the formations which are likely to contain groundwater resources are the Eocene Yegua Formation of the Claiborne Group, the Eocene Jackson Group, the Miocene Catahoula Formation and the flood plain alluvium of Holocene age. The Yegua Formation yields small to moderate amounts (0-500 gpm) of fresh to moderately saline water to public-supply, rural-domestic, and livestock wells on the outcrop of the aquifer and a few miles southeast of the outcrop. No wells tapping the Yegua were noted in the site area.

The Caddell and Wellborn Formations of the Jackson Group yield small to moderate amounts of fresh to moderately saline water to irrigation, rural-domestic, and livestock wells on the outcrops of the aquifers and a few miles southeast of the outcrops.

Several water wells exist in the site area. Information on some of these wells is lacking as no written records of those wells could be located. The Texas Water Development Board maintains files on water wells drilled in the state; however, their records did not include data on several of the wells located in the site area. A tabulation of the wells in the site area describing the location, depth, usage, and other details is shown on Plate 42. It is believed that the wells listed pump from either the Caddell Formation or the Wellborn Formation.

The Catahoula Formation yields small to moderate amounts of fresh to slightly saline water to public-supply, irrigation, rural-domestic, and livestock wells on the outcrop of the aquifer and a few miles southeast of the outcrop. The Catahoula crops out in a small area in the far southeast corner of the site area. No wells were noted on the outcrop of the Catahoula within the project area.

DETERMINATION OF AQUIFER RECHARGE AND DISCHARGE AREA

Groundwater recharge areas within the project area are the outcrops of the unmapped sandy members of the Yegua Formation, the basal sandstone of the Caddell Formation, the Bedias sandstone, the middle Wellborn sand, the Carlos sandstone of the Wellborn Formation, and the sandstone members of the Manning and Catahoula Formation. Locations of these outcrops are shown on the Geologic Map, Plate 40. The principal source of groundwater in the site area is rainfall. Only a small amount of the average rainfall (approximately 41 inches) reaches the water table. This small amount replenishes the aquifers and replaces the water that is removed by pumping and natural discharge. The general direction of movement of groundwater in the site area is southeastward toward the Gulf of Mexico.

The aquifers in the project area are believed to discharge by seepage into streams springflow, evaporation, and by pumping from wells. Although no seeps or springs are noted near the site, it is believed that some may exist along Gibbons Creek. Landowners south of the site area noted that several springs once existed along Gibbons Creek, but the springs quit running several years ago.

ANALYSIS OF GROUNDWATER SAMPLES

Samples of water from three existing water wells in the vicinity of the site area were taken. Locations of these wells are shown on Plate 41. Descriptions of the wells are presented on Plate 42. In addition a sample of water from Gibbons Creek at the bridge where Highway 30 crosses the creek was also taken. These four samples were sent to Calgon Corporation, Pittsburg, Pennsylvania, for chemical analyses. Items tested for included:

alkilinity	aluminum
pH	arsenic
total dissolved solids	barium
cation-anion balance	calcium
color	chronium
turbidity	copper
bicarbonate	iron
sulfate	lead
chloride	magnesium
fluoride	manganese
nitrate	mercury
carbonate	molybdenum
phosphate	nickel
silica	potassium
	selenium
	sodium
	zinc

In addition, temperature of each water sample was measured at the time the sample was taken. Results of these analyses completed to date are presented on Plate 43.

IMPACT OF PLANT CONSTRUCTION

The impact of plant construction upon the groundwater resources cannot be completely evaluated until the final layout of the facilities is made. However, by careful site grading contaminated runoff can be directed into a retention pond and prevented from entering the normal drainage channels or the cooling water reservoir. Through the use of an impervious clay lining or proper siting of the drainage retention pond and the settling pond, any contamination of the groundwater can be controlled. It should be economically feasible to prevent polluted runoff or seepage from entering the subsurface water table at this site.

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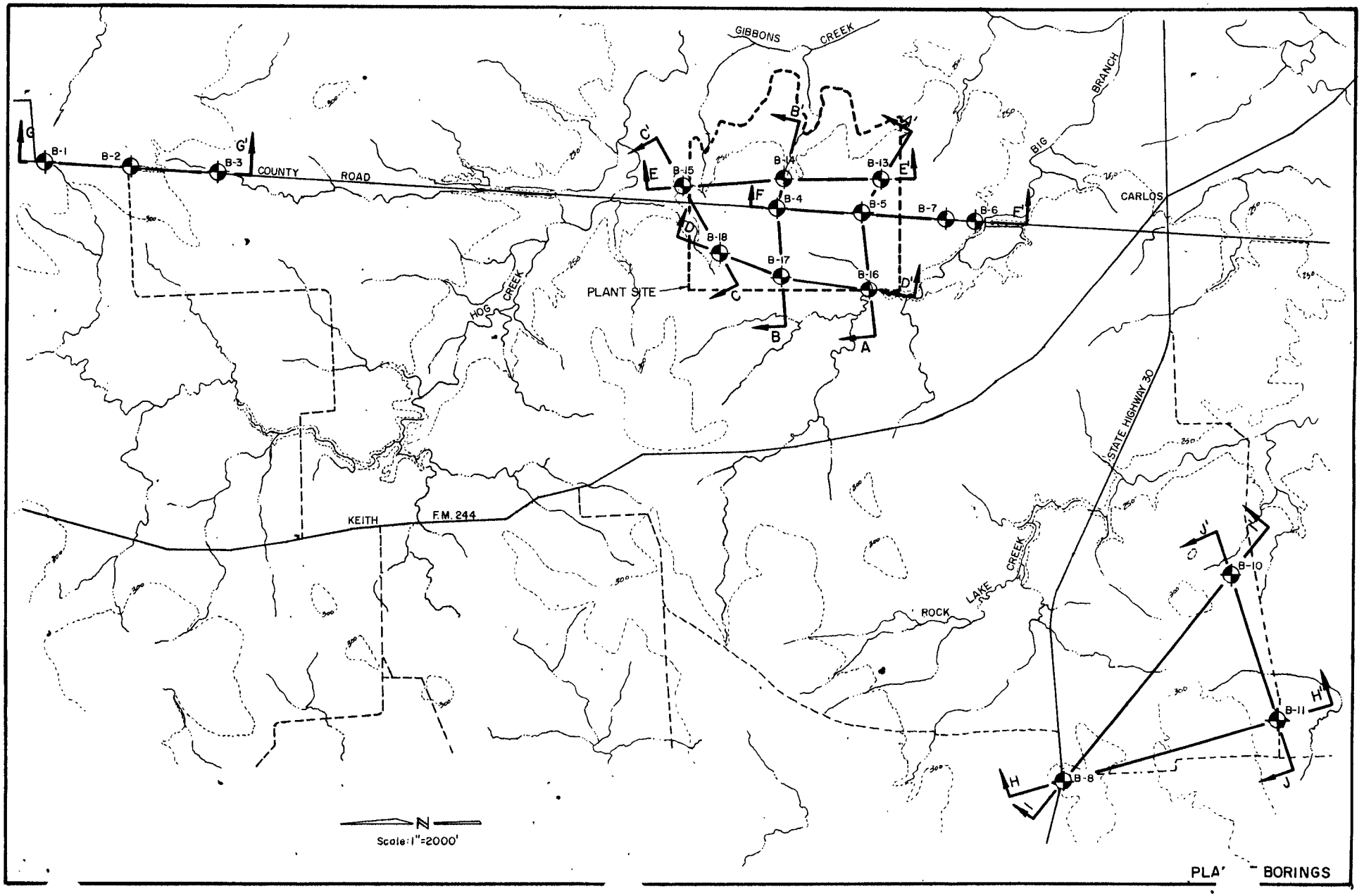
ILLUSTRATIONS


GIBBONS CREEK
BIG BRANCH
CARLOS
COUNTY ROAD
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-10
B-11
B-13
B-14
B-15
B-16
B-17
B-18
PLANT SITE
HOG CREEK
KEITH
F.M. 244
STATE HIGHWAY 30
ROCK LAKE CREEK
Scale: 1"=2000'
PLA BORINGS

LOG OF BORING NO. B-4

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 267 ±	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Very stiff brown silty clay (CL)							
5			Medium dense light tan to light brown sandy silt -dense		69	44	30			
10										
15			-w/occasional light brown silty sand seams and occasional brown clay balls and seams							
20			-very dense below 18.5' (ML)	82						
25			Very dense gray silty fine sand -w/carbonaceous seams					31		87
30					39	38	29			
35										
40			-w/carbonaceous laminations							
45			(SM)		40					
50			Very dense gray silt -w/6.0" clay seam at 49.5' -w/occasional gray clay laminations							

(Continued)

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PLATE 2

LOG OF BORING NO. B-4 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(ML)		84	46	22			
60			Hard gray clay, w/silt seams			64	22	27		
65										
70			-w/8.0" silty sand seam at 69.0' (CH)					25		
75			Hard greenish-gray clay, w/occasional silt laminations -w/occasional pyrite or marcasite nodules			82	24	31		91
80										
85								33		
90			-w/numerous silty sand and silt seams below 88.0' -ironstone seam at 91.0-93.0' (CH)							
95			Hard gray clay, w/occasional sandy silt seams (CH)	84/10"				32		
100			Very dense gray silty fine sand -indurated to 103.0'							

(Continued)

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PLATE 3

LOG OF BORING NO. B-4 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105										
110			-w/carbonaceous seams -w/occasional indurated sandy silt laminations (SM)	50/4" seat						
115			Very dense gray clayey sand, indurated, w/silt seams -w/clay laminations (SC)		25	42	20			
120										
125			Very dense gray sandy silt, w/clay laminations (ML)							
130										
135			Hard gray clay, slightly sandy (CH)			63	28		6+	
140			Hard gray clay, slickensided			114	32	32	6+	
145									6+	
150						119	40	36	6+	

(Continued)

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PLATE 4

LOG OF BORING NO. B-4 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
155									
160			(CH)						
165									
			Hard gray clay, w/numerous silty sand seams and pockets		58	17	24		100
170									
175			(CH)						
180			Hard gray and greenish-gray clay, w/occasional silt laminations						
185									
190							32		
195									
200			-slickensided (CH)						

COMPLETION DEPTH: 200.0' DEPTH TO WATER: 20.0'
DATE: 5/20/76 DATE: 5/21/76

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PLATE 5

LOG OF BORING NO. B-5

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

ELEVATION: 273±

DEPTH, FT.	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
	Loose gray and tan silty fine sand, w/clay inclusions (SM)		32	18	16		
	Very stiff light tan sandy clay, w/sand inclusions (CL)						
5	Loose tan silty fine sand (SM)		44	19	26		90
	Hard light tan sandy clay, w/yellow clay and sand inclusions -w/occasional clay laminations and inclusions (CL)		62	28	33	(2.22)	84
10	Hard tan clay, w/sandy clay inclusions and iron stains (CH)						
	Hard dark reddish-brown lignitic clay, w/lignitic material seams (OL)				58		49
15	Hard brown silty clay (CL)						
	Hard green clay, moderately slickensided (CH)		92	37	34		85
20	Hard dark reddish-brown lignitic clay, w/clay seams (OH)		53	32	28		
	Soft dark reddish-brown lignitic material, w/clay seams (Pt)					(1.)	
25	Hard gray clayey silt (ML)		46	33	31		90
	Hard gray clay, w/occasional claystone laminations (CH)						
30	Hard gray sandy clay, w/numerous sand inclusions (CL)		33	18	22	(1.70)	101
	Very dense gray silty fine sand, w/occasional clay laminations						
35							
40							
45							
50							

(Continued)

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PLATE 6

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SM)	57						
55			Hard gray sandy clay, w/numerous sand inclusions -w/lignitic clay seam at 56.0' (CL)			48	19	24	(2.73)	97
60			Hard gray clay, w/numerous silt laminations (CH)			73	32	30	(1.7)	88
65			Hard gray clay			76	32	33	(2.32)	86
70										
75			-w/sand laminations and inclusions (CH)							
80			Hard brown silty clay -1.0" thick lignitic material seam at 81.0'							
85			-w/numerous silty fine sand laminations and inclusions and occasional clay laminations (CL)			43	22	27		93
			Hard brown silty clay, w/lignitic material inclusions (CL)							
90			Hard gray clay, w/sandy clay laminations (CH)							
			Very dense gray silty fine sand, w/ numerous clay balls, laminations (SM)							
95			Hard gray clay, w/numerous thin silt laminations (CH)			81	28	29	(1.81)	90
			Hard brown silty clay, w/lignitic clay inclusions (CL)							
100										

(Continued)

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PLATE 7

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			Very dense gray clayey fine sand, w/sand inclusions -silty fine sand at 103.5-103.7' (SC)		33					
105			Hard gray sandy clay, -silty clay seam, w/lignitic laminations at 104.0-104.3'	50/3.5"						
			-silty fine sand seam at 105.3-105.5'	seat						
110			-silty fine sand seam at 108.0-108.5' (CL)							
115			Hard gray clay, w/numerous sandy clay seams and laminations							
			-slickensided			49	22	26		96
120										
125			-w/numerous clay and silt laminations							
130			(CH)			65	21	28	(2.1+)	94
			Hard greenish-gray clay, w/occasional silt laminations							
135										
									(3.1+)	
140						109	32	34		85
								31		90
145										
150										

(Continued)

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PLATE 8

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155			(CH)							
160			Very dense gray clayey fine sand, w/clay balls and inclusions and fossil fragments (SC)		37	41	20	20		10
165			Very dense gray silty fine sand, w/occasional thin sandstone laminations							
170			-w/occasional sandstone and claystone laminations		34			24		9
175			(SM)							
180			Very dense gray silty fine sand							
185										
190			-w/numerous clay laminations	50/3" seat	90					
195			(SM)							
200			Hard gray clay, w/sandy clay inclusions (CH)			92	33	26		9

COMPLETION DEPTH: 200.0'
DATE: 5/1/76

DEPTH TO WATER: 20.5'
DATE: 5/2/76

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PLATE 9

LOG OF BORING NO. B-6

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 260 ±	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			Medium dense tan clayey sand, w/coarse gravel (SC)						
5			Stiff grayish-red clay (CH)		60	20	27		94
10			Dense light tan clayey silt	89	48	27	29		89
15			-w/reddish-tan clay laminations -w/silty fine sand pockets (ML)						
20			Hard reddish-tan clay (CH)		52	29	31		89
25			Hard dark gray clay, w/silty fine sand laminations -w/dark brown carbonaceous clay (CH)		65	28	29	(2.89)	90
30			Hard reddish-brown lignitic clay, w/clay laminations -w/light tan silty clay laminations (OH)		72	36	40	(1.32)	72
35			Hard brownish-gray clay, w/silty fine sand laminations (CH)						
40			Hard dark brown lignitic clay, w/slickensides -w/organic material increasing below 38.8' (OL)						
45			Soft black lignite, friable (Pt)						
50			Hard gray clayey silt		48	31			

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 10

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			(ML)							
55			Hard gray clay, w/sand pockets (CH)							
60			Moderately hard gray sandstone, w/occasional carbonaceous material					16	(20.19)	112
65								8		
70			Moderately hard gray clayey sandstone -high angle fracture 67.5-69.0' -w/pyrite filled fractures -w/carbonaceous seams at 71.5-72.0' -w/moderately hard greenish-gray siltstone pockets at 73.0-75.0'	100 78				22	(10.05)	103
75			Very dense gray sandy silt, w/ dark gray clay seams -w/gray sandstone seams (ML)	33						
80			Very hard gray to greenish-gray clay -w/occasional pyrite nodules	100						
85			-w/light gray silt seams below 87.0'			120	35	33		
90			(CH)							
95			Hard gray clay, w/occasional greenish-gray clay seams -w/carbonaceous seams at 95.0-96.0'			93 71	22 26			
100					97			29		

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 11

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105			-1/2 to 2" carbonaceous seams at 103.0-104.0' (CH)							
110			Very dense gray silty fine sand, w/gray sandy clay pockets -w/carbonaceous seams		36	46	19	24		
115			(SM)							
120			Hard gray clay -w/occasional silt laminations (CL-CH)							
125										
130			Very dense gray sandy silt -w/occasional gray clay laminations		89	66	22	26		
135			(ML)							
140			Hard gray clay, slightly slickensided -w/silt and sand seams					29		
145						96	24	28		
150			(CH)							

COMPLETION DEPTH: 150.0'
DATE: 5/18/76

DEPTH TO WATER: 10.5' Caved at 35.0'
DATE: 5/19/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 12

LOG OF BORING NO. B-7

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Wash **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 268 ±		LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
0			Tan clay						
5									
10									
15				(CH)					
20			Gray clay						
25				(CH)					
30			Black lignitic material	(Pt)					
			Gray clay	(CH)					
			Gray clay	(CH)					
35			Gray clay						
40				(CH)					
45			Gray clayey sand						
50									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 13

LOG OF BORING NO. B-7 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5, 1.0, 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SC) Gray clay					
55								
			(CH)					
60			Green and gray silty clay					
65								
70								
75								
			(CL)					
80			Gray clay					
85								
90								
95								
			(CH)					
100								

COMPLETION DEPTH: 100.0'
DATE: 5/20/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 14

LOG OF BORING NO. B-13

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 260.15	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
5			Medium dense light tan silty fine sand -w/clay laminations and iron staining (SM)	77					
10			Hard tan clay, w/iron stains (CH)						
15			Stiff dark brown clay, w/lignitic material seams -slickensided -w/lignitic pockets and inclusions (CH)		74	36	39		78
25			Hard dark brown lignitic clay (OL)				42		71
35			Hard green sandy clay (CL)						
40			Dense gray silty fine sand -very dense	33	44	20	23		103
45							29		
50									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 15

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(SM)						
60			Hard gray clay						
65			-w/occasional silty clay laminations		76	38	32	(3.5)	89
70			-sandy clay seam at 69.8-70.0'						
75			(CH)						
80			Hard gray sandy clay, w/occasional clay laminations						
85				58	51	29	28		92
90			-very stiff below 88.0', w/numerous sand pockets						
95			(CL)						
100			Very dense gray silty fine sand						
			-w/thin clay laminations and pockets	30	43	18	28		9[illegible]

(Continued)

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
105			(SM)						
110			Very stiff gray silty clay, w/thin clay and sand laminations (CL)						
115			Hard gray clay (CH)						
120			Hard gray clay, slightly silty	96					
125			-w/occasional silt laminations (CH)						
130			Hard gray clay, slightly slickensided						
135									
140									
145									
150			w/occasional thin silt laminations (CH)						

COMPLETION DEPTH: 150.0'
DATE: 8/6/76

DEPTH TO WATER: 8.3' Caved at 9.9'
DATE: 8/10/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 17

LOG OF BORING NO. B-14

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

ELEVATION: 251.87

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose tan silty fine sand (SM)			54	38	18			
5			Hard gray sandy clay (CL)								
10			Hard tan clay, w/iron stains and sand laminations (CL) Hard tan sandy siltstone	64							
15			Very dense tan silty fine sand, w/occasional lignitic laminations and iron stains (SM)		50/3"						
			Very dense gray silty fine sand, w/numerous clay and lignitic laminations and lignitic inclusions (SM)			11			24		97
20			Hard gray clay, w/ numerous silty fine sand laminations				59	26	28		94
25											
30									36		83
35			(CH-CL)				58	23	29		94
			Hard brown clay, w/ numerous sand laminations and occasional lignitic laminations (CL-CH)			51	50	19	22		102
40											
45			Very dense gray silty fine sand (SM)		50/2" seat						
			Very dense gray sandy silt			57	Non-Plastic		31		
50											

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 18

LOG OF BORING NO. B-14 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			(ML)						
55			Hard gray clay, w/silty sand laminations (CL)						
60			Hard gray clay, w/numerous silty fine sand laminations and silt laminations		60	22	30	(1.50)	92
65									
70			(CH-CL)						
75			Hard gray clay, w/ sandy silt laminations to 78.5'	93	79	19	30		92
80			(CH)						
85			Hard gray clay						
90			-very stiff at 88.5'		112	31	32	(1.83)	91
95			-w/slickensides						
100									

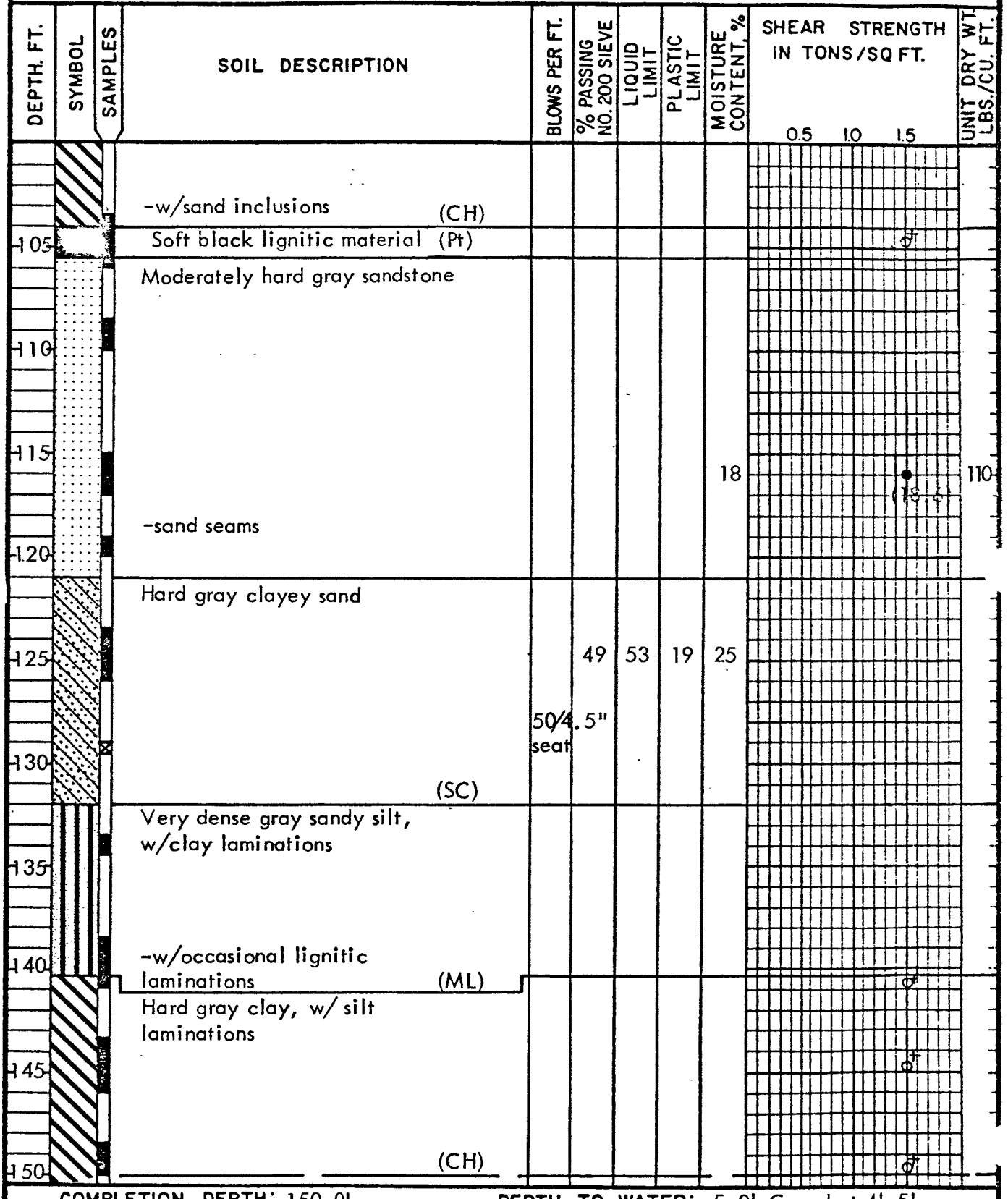
(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 19

LOG OF BORING NO. B-14 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS



COMPLETION DEPTH: 150.0'
DATE: 7/23/76

DEPTH TO WATER: 5.0'-Caved at 41.5'
DATE: 7/27/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 20

LOG OF BORING NO. B-15

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

ELEVATION: 255.36

DEPTH, FT.	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
	Loose tan silty fine sand (SM)							
5	Very stiff tan sandy clay (CL)							
10	Soft tan fine grained sandstone, w/iron stains and numerous silt laminations	29						
15	Very dense tan silty fine sand, slightly indurated (SM)							
	Very dense red silt, w/iron laminations (ML)							
20	Very hard gray sandy clay, w/ numerous clay laminations and seams -w/numerous silty sand and sandy silt seams		94	55	20	34		90
25								
30	-w/occasional slickensided clay seams							
35	(ML)							
	Hard gray clay, w/silt laminations (CH)							
40	Very dense gray sandy clay, w/occasional clay laminations (CL)		93			30		92
45	Hard gray clay, w/occasional slickensides							
50				112	28	36		

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 21

LOG OF BORING NO. B-15 (Cont'd)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-grayish - green						
60							34		88
65			(CH)						
70			Moderately hard gray fine grained sandstone, w/lignitic material inclusions and clay laminations						
75			Very dense gray silty fine sand (SM)	16					
80			Moderately hard gray sandstone						
85									
90									
95			Hard greenish - gray clay						
100			-brown						

(Continued).

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 22

LOG OF BORING NO. B-15 (Cont'd)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105									
110					163	35	33	2.2	85
115									
120									
125									
130			-w/silty fine sand laminations -w/numerous small sand pockets and laminations (CH)						
135			Hard grayish - green silty clay, w/numerous clay and silt pockets						
140			-w/numerous sand laminations and pockets (CL)						
145			Hard grayish - green clay						
150			(CH)						

COMPLETION DEPTH: 150.0'
DATE: 7/29/76

DEPTH TO WATER: Dry-Caved at 15.0'
DATE: 7/29/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 23

LOG OF BORING NO. B-16

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 260.52						
			Medium dense tan silty fine sand (SM)						
5			Hard tan and gray sandy clay (CL)						
10			Very stiff tan clay, w/iron laminations (CH)		81	38	39		
15			Dense tan silty fine sand, w/iron laminations (SM)	53					
20			Hard reddish-tan clay, slightly slickensided, w/iron laminations (CH)						
			Hard gray sandy clay (CL)		56	28	31	(3.22)	92
25			Hard gray clay, slightly slickensided (CH)						
30			Hard brown clay						
35			-gray, w/silty sand laminations (CH)	91	68	25	27 37		93 82
40			Very dense gray silty fine sand				28		97
45									
50				52	64	20	25		1(

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 24

LOG OF BORING NO. B-16 (Cont'd)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(SM)						
60			Hard gray silty clay, w/siltstone lenses (CL)						
65			Hard gray clay, w/clay laminations -w/occasional silty fine sand laminations	90	67	22	29		92
70									
75							32		90
80			-sand inclusions (CL-CH)						
85			Very stiff green clay						
90					98	30	35	(1.9)	89
95									
100			-w/silt laminations						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 25

LOG OF BORING NO. B-16 (Cont'd)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
105			-slightly slickensided - hard (CH)							
110			Very dense gray silty fine sand, w/lignitic inclusions to 110.0' (SM)		10					
125			Moderately hard gray calcareous sandstone w/argonite crystals	25						
130			Very dense gray silty fine sand (SM)							
135			Hard gray sandy clay							
140			(CL)							
145			Hard gray clay							
150			(CH)							

COMPLETION DEPTH: 150.0'
DATE: 8/11/76

DEPTH TO WATER: Caved at 12.2'
DATE: 8/13/76

NATIONAL SOIL SERVICES, INC.

PLATE 26

LOG OF BORING NO. B-17

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 283.63	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT LBS./CU. FT.
			Loose tan silty fine sand (SM) Hard tan sandy clay (CL)						
5			Very stiff light tan clay						
10			-hard below 8.5' -w/iron stains, sand laminations, and claystone laminations at 8.5' (CL-CH)		60	27	28		
15			Hard light tan sandy clay (CL)						
20			Very stiff light tan clay, w/ numerous iron stains (CH)		63	30			
25			Very stiff reddish-brown sandy clay, w/numerous iron stains (CL)						
30			Hard gray clay, w/numerous silt laminations		79	30	31	(2.9)	90
35			-w/numerous fractures and slickensides (CH)						
40			Hard gray and brown clay, w/occasional lignitic inclusions (CH)		60	22	30	(2.2)	93
45			Hard gray and brown sandy clay -w/occasional lignitic laminations (CL)						
50			Very dense gray silty fine sand	37	30	23	25		98

(Continued)

LOG OF BORING NO. B-17 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(SM)				29		95
60			Hard gray silty clay, w/numerous silt laminations						
65			-sandy silt seam at 64.5'		33	19	27		95
70			(CL)						
75			Hard gray clay, w/occasional silty fine sand laminations						
80			(CH)						
85			Very stiff gray clay, w/silt laminations		36	25	31		91
90			-stiff at 88.5-90.0'						
95			-hard below 93.5'				32	(2.0)	90
100									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 28

LOG OF BORING NO. B-17 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT LBS./CU. FT.
105			-w/sandy silt laminations (CL-CH)							
110			Hard gray sandstone, w/vertical fracture	43						
			-soft below 113.0'							
115			-w/numerous horizontal fractures and occasional lignitic laminations							
120			-w/occasional claystone laminations and lignitic laminations							
125			Very dense gray silty fine sand		30					
130			(SM)							
135			Very dense gray silt, slightly clayey		89					
140			(ML)							
145			Hard gray clay						0+ 0+	
150			(CH)							

COMPLETION DEPTH: 150.0'
DATE: 8/5/76

DEPTH TO WATER: 40.9'
DATE: 8/13/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 29

LOG OF BORING NO. B-18

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 274.58							
			Very stiff tan clay, w/iron laminations							
			-w/numerous thin sand pockets			76	29	34		
5										
			-w/numerous sand pockets and laminations							
10			(CH)							
			Hard tan sandy clay			39	20	24		
15			(CL)							
			Very dense light tan silty fine sand							
20										
			-w/occasional to numerous thin clay laminations		50/3.6" 95					
25						53	22	33		89
30			(SM)							
			Hard gray clay							
35										
			-w/occasional silty sand laminations below 39.0'							
40			-slightly slickensided							
						55	23	32		92
45										
50										

Approx 25'

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

PLATE 30

LOG OF BORING NO. B-18 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55								32		90
60										
65						92	25	35		88
70										
75			(CH)							
80			Very dense gray silty fine sand -highly indurated -w/numerous sandstone seams	80				19	(19.7)	109
85				66						
90										
95			(SM)							
100			Hard gray sandy clay		73	48	34	35		

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 31

LOG OF BORING NO. B-18 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
105			(CL)						
			Hard gray clay						
110									
115			-w/occasional thin silt laminations						
					113	31	33	(4.7)	88
120									
125									
130									
135			-w/occasional to numerous sand pockets						
140			(CH)						
145			Hard gray silty clay, w/numerous sand and clay pockets below 144.0'						
150			(CL)						

COMPLETION DEPTH: 150.0'
DATE: 8/4/76

DEPTH TO WATER: 24.2' Caved at 28.8'
DATE: 8/6/76

LOG OF BORING NO. P-15

PIEZOMETER INSTALLATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Wash **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH, TSF	ANGLE OF SHEAR	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 255.4±						
			Tan silty fine sand (SM)						
			Tan sandy clay (CL)						
10			Tan sandstone						
			Red silt (ML)						
20			Gray sandy silt, w/occasional clay seams						
30			(ML)						
			Gray clay (CH)						
40									
50									
60									
70									
80									
90									
100									

P-15 Riser
Elev. 257.4±

Seal

P-15

P-15

Date:	Time:	Depth of Water Below Ground Surface
8-13	10:30	+2.0'
	10:31	1.0'
	10:32	0.1'
	10:34	0.8'
	10:38	1.7'
	10:45	2.1'
	11:00	2.8'
	11:30	3.8'

COMPLETION DEPTH: 36.0'
DATE: 8/13/76

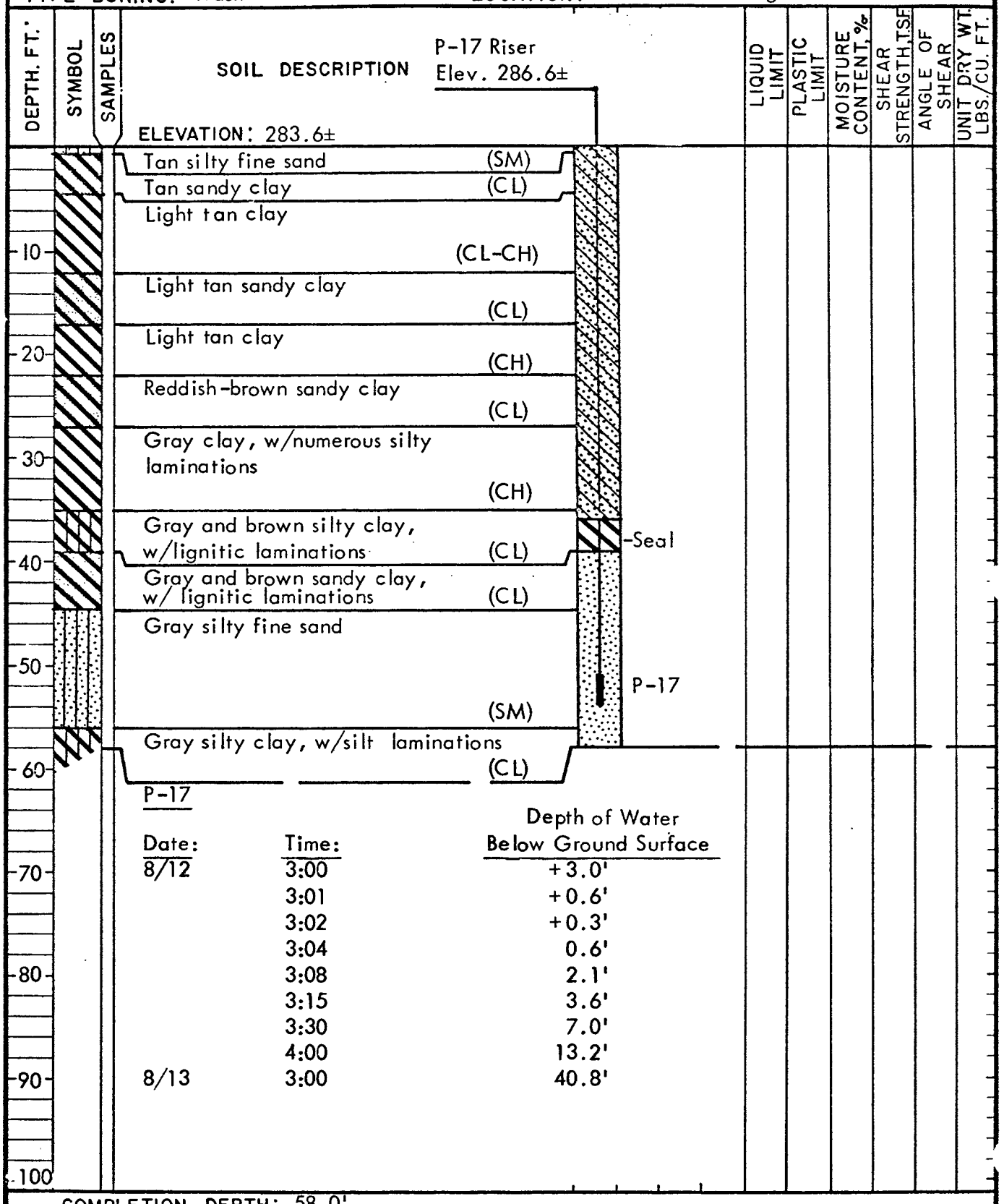
NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 33

LOG OF BORING NO. P-17

PIEZOMETER INSTALLATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Wash **LOCATION:** See Plan of Borings



P-17

Date:	Time:	Depth of Water Below Ground Surface
8/12	3:00	+3.0'
	3:01	+0.6'
	3:02	+0.3'
	3:04	0.6'
	3:08	2.1'
	3:15	3.6'
	3:30	7.0'
	4:00	13.2'
8/13	3:00	40.8'

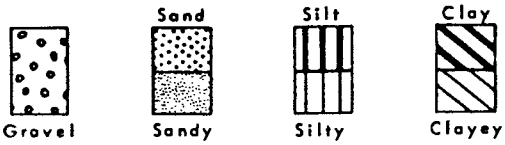
COMPLETION DEPTH: 58.0'
DATE: 8/12/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 34

KEY TO SOIL CLASSIFICATIONS AND SYMBOLS

SOIL TYPE



Predominant type shown heavy

SAMPLE TYPE

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS
(Major portion retained on No. 200 sieve)

Includes (1) clean gravels and sands described as fine, medium or coarse, depending on distribution of grain sizes and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by lotaratory tests or estimated from resistance to sampler penetration.

Penetration Resistance Blows/Foot **	Descriptive Term	Relative Density *
0 - 10	Loose	0 to 40%
10 - 30	Medium dense	40 to 70%
30 - 50	Dense	70 to 90%
Over 50	Very dense	90 to 100%

* From tests on undisturbed sand sample
** 140# hammer, 30-inch drop

Relative density is also used to describe condition of low plasticity (P I ≤ 10) fine grained soils such as sandy silts.

FINE GRAINED SOILS
(Major portion passing No. 200 sieve)

Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests for soils with plasticity indices ≥ 10.

Descriptive Term	Compressive Strength Tons/sq. Ft.
Very soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very stiff	2.00 to 4.00
Hard	4.00 and higher

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

TERMS CHARACTERIZING SOIL STRUCTURE

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

Sensitive - pertaining to cohesive soils that are subject to appreciable loss of strength when remolded

Laminated - composed of thin layers of varying color and texture

Interbedded - composed of alternate layers of different soil types

Calcareous - containing appreciable quantities of calcium carbonate

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

Poorly graded - predominately of one grain size, or having a range of sizes with some intermediate size missing

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

Degree of slickenside development:

Slightly slickensided - slickensides are present at intervals of 1-2 feet and soil does not easily break along these planes.

Moderately slickensided - slickensides are spaced at intervals of 1-2 feet and soil breaks easily along these planes.

Extremely slickensided - slickensides are spaced at intervals 4-12 inches, are continuous and interconnected. Soil breaks easily along the slickensides. Resulting size of broken pieces three to six inches.

Intensely slickensided - slickensides are spaced at intervals of less than four inches and are continuous in all directions. Soil breaks down along planes into nodules 0.25 - 2 inch in size.

KEY TO ROCK CLASSIFICATIONS AND SYMBOLS

ROCK TYPE


Limestone


Dolomite


Chalk


Marl


Shale


Sandstone


Conglomerate


Granite


Quartz


Anhydrite

SAMPLE TYPE


Undisturbed


Rock Core


Split Spoon


No Recovery

TERMS CHARACTERIZING PHYSICAL PROPERTIES OF ROCK

Bedding Characteristics:

Massive	–	occurring in thick beds, free from minor joints and laminations, more than 100 mm. in thickness
Thin to med.	–	occurring in relatively thin layers or laminae, 2 mm. to 100 mm. bedding planes
Fissile	–	bedding which consists of laminae less than 2 mm. in thickness, splits easily along closely spaced parallel planes
Cross-bedded	–	arrangement of laminations of strata transverse or oblique to the main planes of stratification of the strata concerned
Foliated	–	the laminated structure resulting from segregation of granular and fine minerals into layers parallel to the schistosity (result of the parallel arrangement of platy and ellipsoidal mineral grains)
Platy	–	parallel arrangement of broad or flat minerals (giving a foliation) by slablike inclusions, by schlieren, or by bands of different mineralogy or texture
Fragmental	–	consisting of broken material, particularly that which has been moved from its place of origin

Lithologic Characteristics:

Clayey, Shaly, Calcareous (limy) Siliceous Sandy, Silty, Plastic Seams Carbonaceous	–	The lithology is used describing the parent rock such as a shaly limestone or carbonaceous shale

Hardness and Degree of Cementation:

Very soft or plastic	–	can be remolded in hand, corresponds in consistency up to very stiff in soils
Soft	–	can be scratched with fingernail
Moderately hard	–	can be scratched easily with knife; cannot be scratched with fingernail
Hard	–	difficult to scratch with knife
Very hard	–	cannot be scratched with knife
Poorly cemented or friable	–	easily crumbled
Cemented	–	bound together by chemically precipitated material occurring in the interstices between allogenic particles of rock – quartz, calcite, dolomite, siderite and iron oxide are common cementing materials

Swelling Properties:

Swelling and Non-Swelling

Slaking Properties:

Non-Slaking

Slakes slowly on exposure

Slakes readily on exposure

Texture:

Dense	–	fine-grained aphanitic rocks in which the grain size generally averages less than 0.05 to 0.1 mm.
Fine	–	more than 50% by weight smaller than 0.074 mm. in diameter (seen only with a strong hand lens or a microscope)
Medium	–	majority of grain sizes between 0.074 mm. and 0.5 mm.
Coarse	–	grain sizes range from 0.5 mm. to 1.0 mm. (crystals are visible to the unaided eye)

Structure:

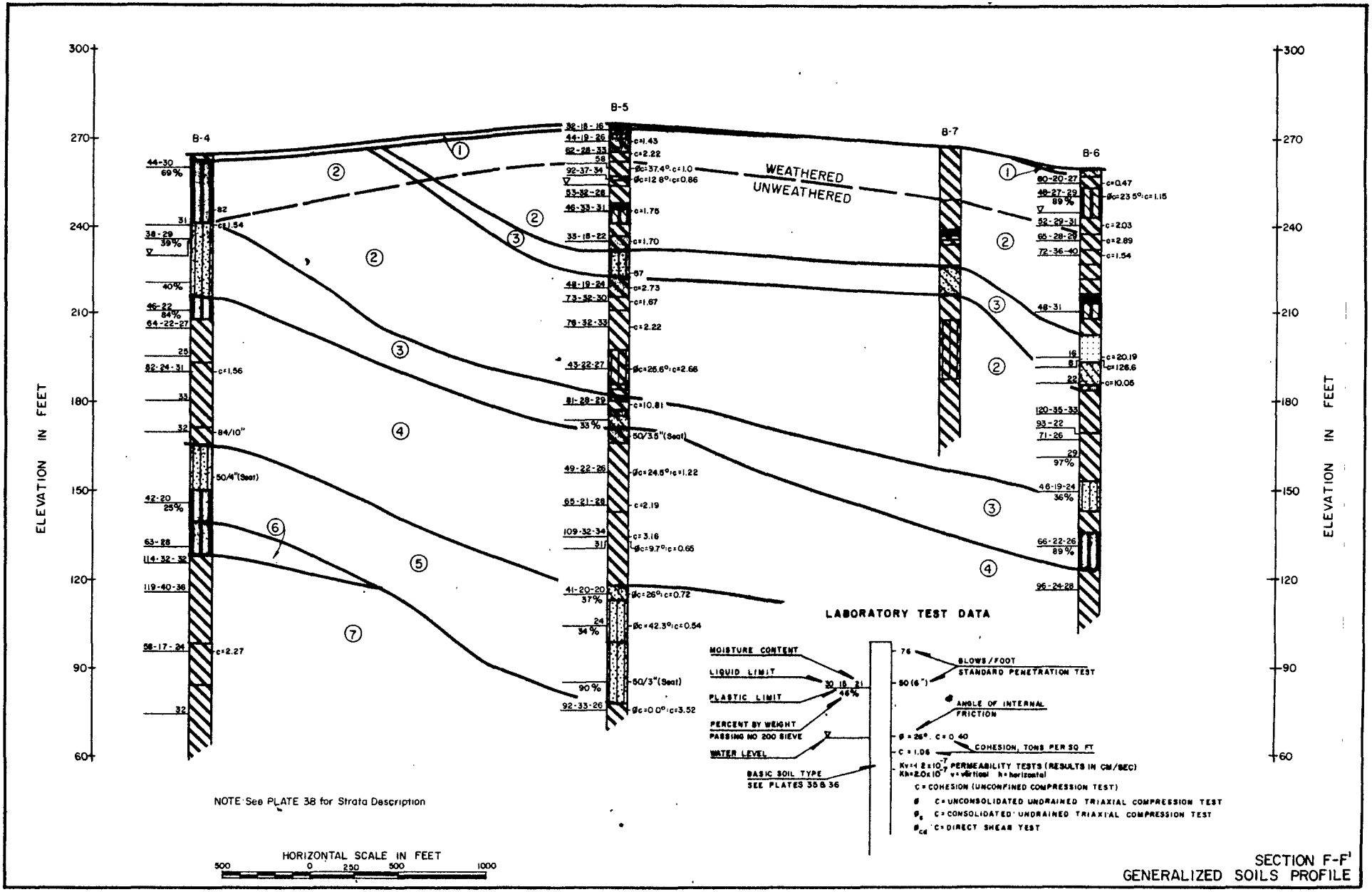
Bedding	–	Flat (0° to 15°); Gently dipping (15° to 30°) Steeply dipping (30° to vertical)
Fractures, scattered or open	–	broken surface of minerals or rock which does not exhibit cleavage or bedding planes
Fractures, closely spaced	–	shows signs of broken minerals but now is cemented
Brecciated (sheared & fragmented)	–	rock made up of highly angular coarse fragments – may be sedimentary or formed by crushing or grinding along faults
Joints	–	fractures in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.
Faulted	–	fracture or fracture zone along which there has been displacement of the sides relative to one another parallel to the fracture – the displacement may be a few inches or many miles
Slickensides	–	polished and striated (scratched) surface that results from friction along a fault plane

Degree of Weathering:

Unweathered	–	rock in its natural state before being exposed to atmospheric agents
Slightly weathered	–	noted predominantly by color change with no disintegrated zones
Weathered	–	complete color change with zones of slightly decomposed rock
Extremely weathered	–	complete color change with consistency, texture, and general appearance approaching soil

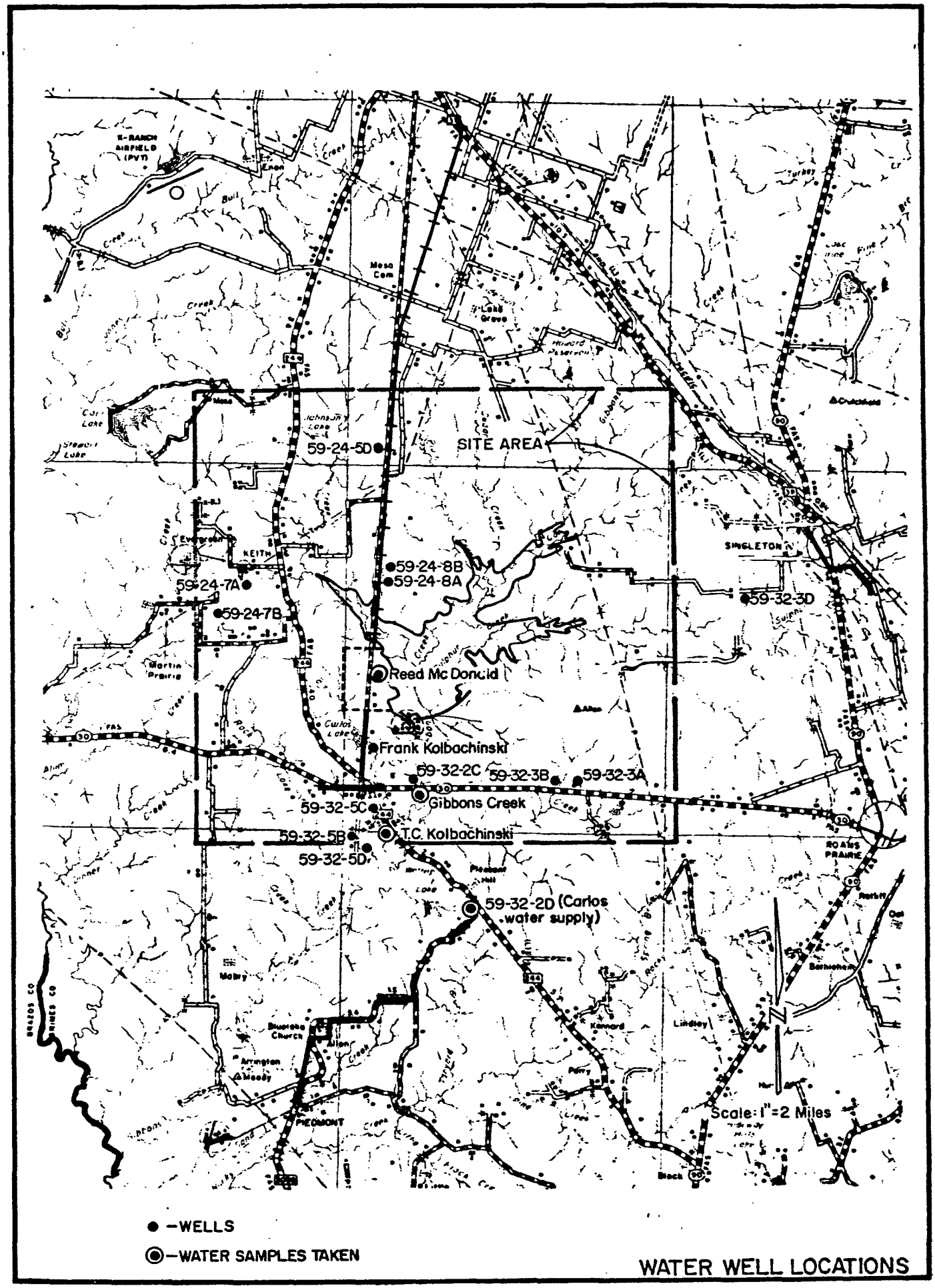
Solution and Void Conditions:

Solid	–	contains no voids
Vuggy (pitted)	–	cavities in rock
Vesicular	–	containing many small cavities
Porous	–	containing voids, pores, interstices, or other openings which may or may not interconnect
Cavities	–	solutional concavity in limestone caves, the outline of which is determined by a joint or joints – also applied to small hollows in cavernous lava
Cavernous	–	containing cavities or caverns, sometimes quite large – most frequent in limestones and dolomites



SECTION F-F'
GENERALIZED SOILS PROFILE

PLATE 40



WATER WELL LOCATIONS

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 41

Texas Water Development Board Well No.	Owner	Water Level Depth	Water Level Date	Method of Lift	Use of Water
59-32-2D	Carlos Supply	45'	2/2/72	Submersible Pump	Public Water Supply
59-32-5B	T. J. C	5'	10/30/71		
59-24-7B	J. C.	0'	8/25/70		Domestic
-	Frank I			Jet Pump	No longer used
-	T. C.			Jet Pump	Livestock
59-32-2C	Tony K	2'			Domestic
59-24-7A	R. L.	wing gpm	8/31/70		Domestic
-	Reed M			Jet Pump	Domestic
59-24-5D	Munci	30'		Jet Pump	Domestic
59-24-8B	Herbe	4'	9/28/72		Domestic
59-32-5D	Tommy	32'	3/3/75		Domestic
59-32-3A	Tod P	30'	12/67	Submersible Pump	Domestic
59-32-3D	Loyd	12'	3/29/75	Submersible Pump	Domestic
59-32-5C	Carrie				Domestic
59-24-8A	H. P.	42'	4/3/70		Domestic
59-32-3B	R. L.	50'	4/30/72		Irrigation

Location	Temperature (°)	A ›nate /l)	Phosphate (mg/l)	Silica (mg/l)	Aluminum (mg/l)	Arsenic (mg/l)	Barium (mg/l)
Reed McDonald	71°		0.80		0.45	<0.010	0.7
T.C. Kolbachinski	75°		0.13	44	0.05	<0.010	1.1
Carlos Water Supply	77°		0.42	75	<0.05	<0.010	0.7
Gibbons Creek	82°						

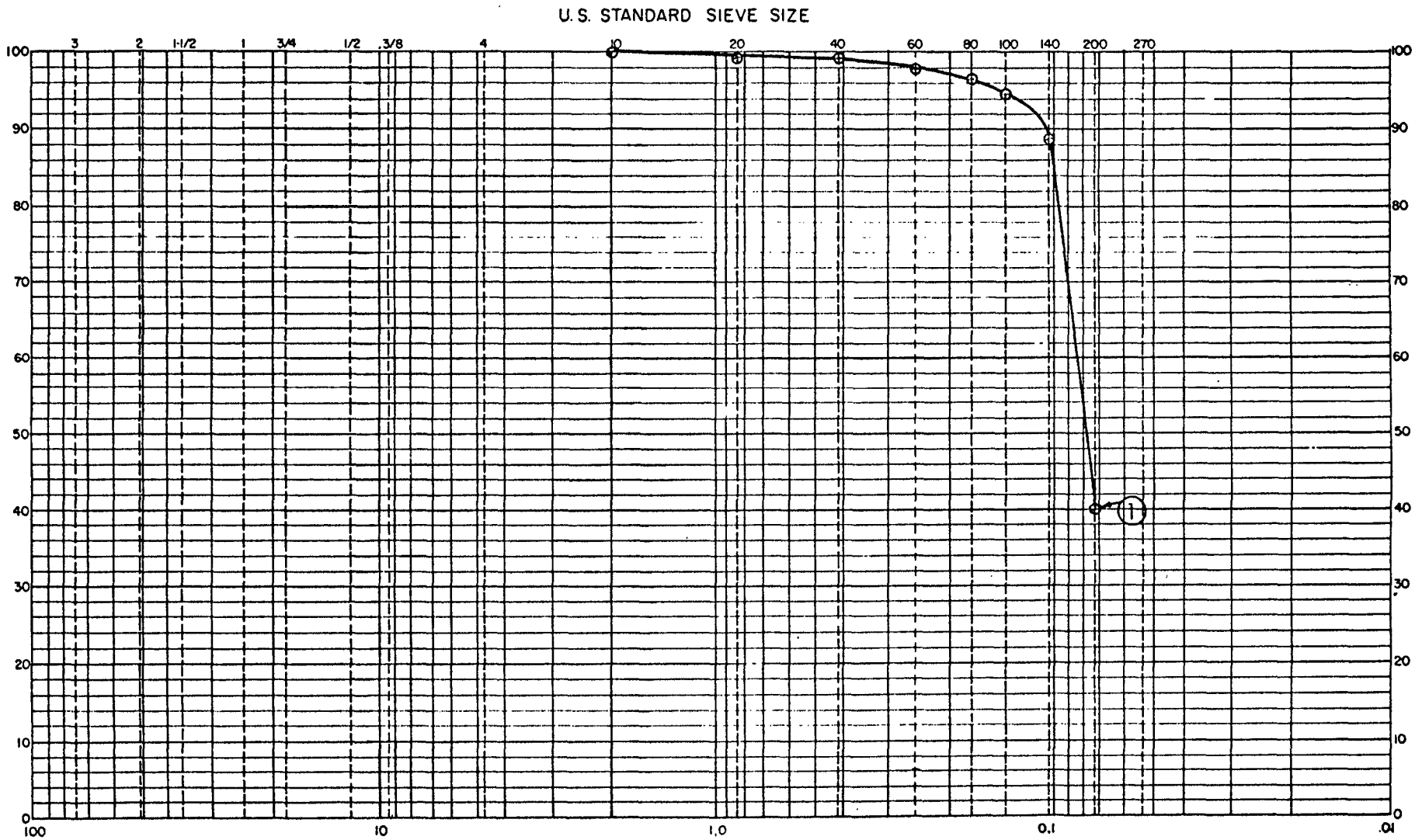
Location	Cadmium (mg/l)	Nickel (mg/l)	Potassium (mg/l)	Selenium (mg/l)	Sodium (mg/l)	Zinc (mg/l)
Reed McDonald	0.01	0.05	34		58	0.5C
T.C. Kolbachinski	0.01	0.05	26		490	0.05
Carlos Water Supply	<0.01	0.05	10		200	0.05
Gibbons Creek						

WATER ANALYSES

PLATE 43

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

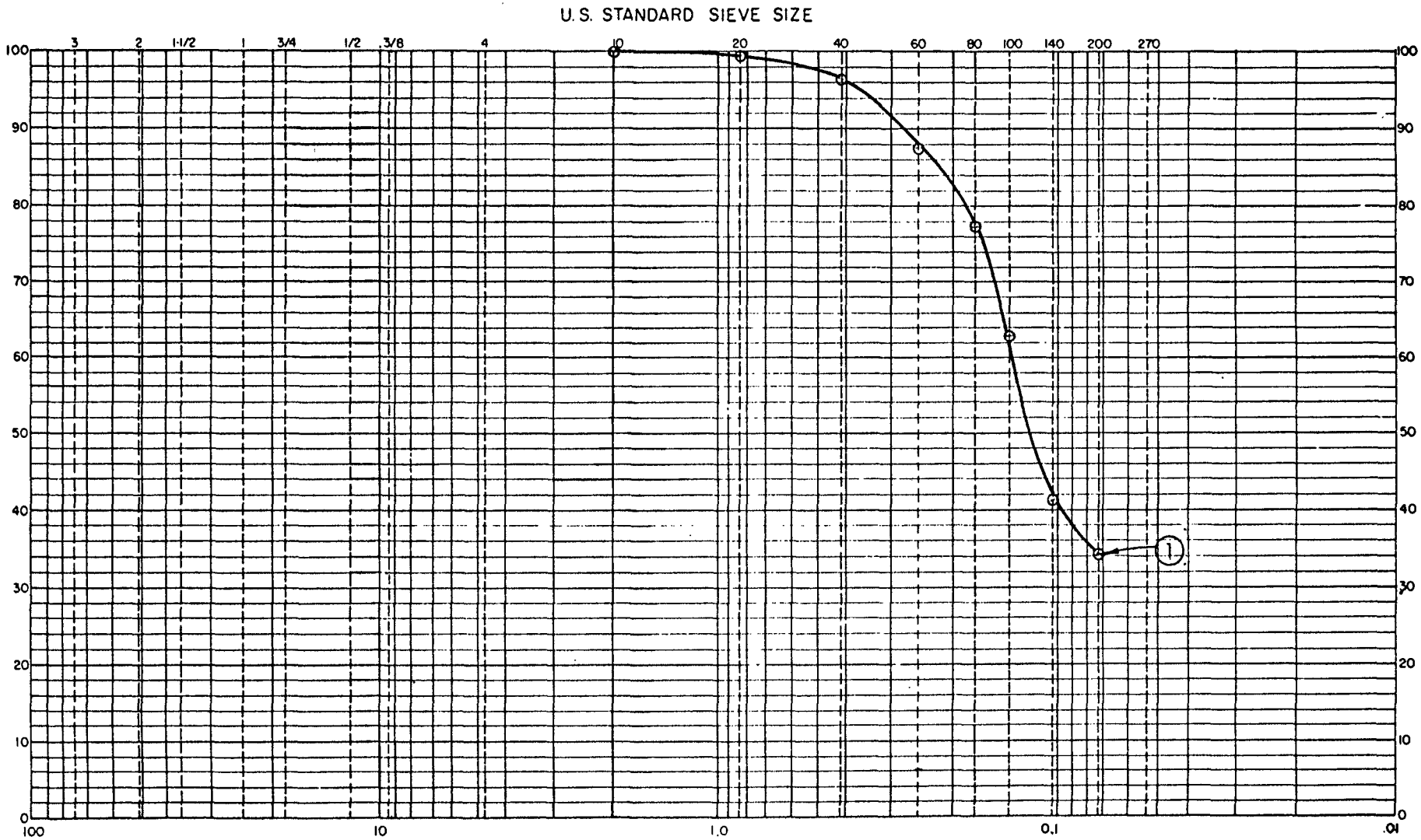
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-4	44.2-44.5'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 44

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAIN SIZE IN MILLIMETERS

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

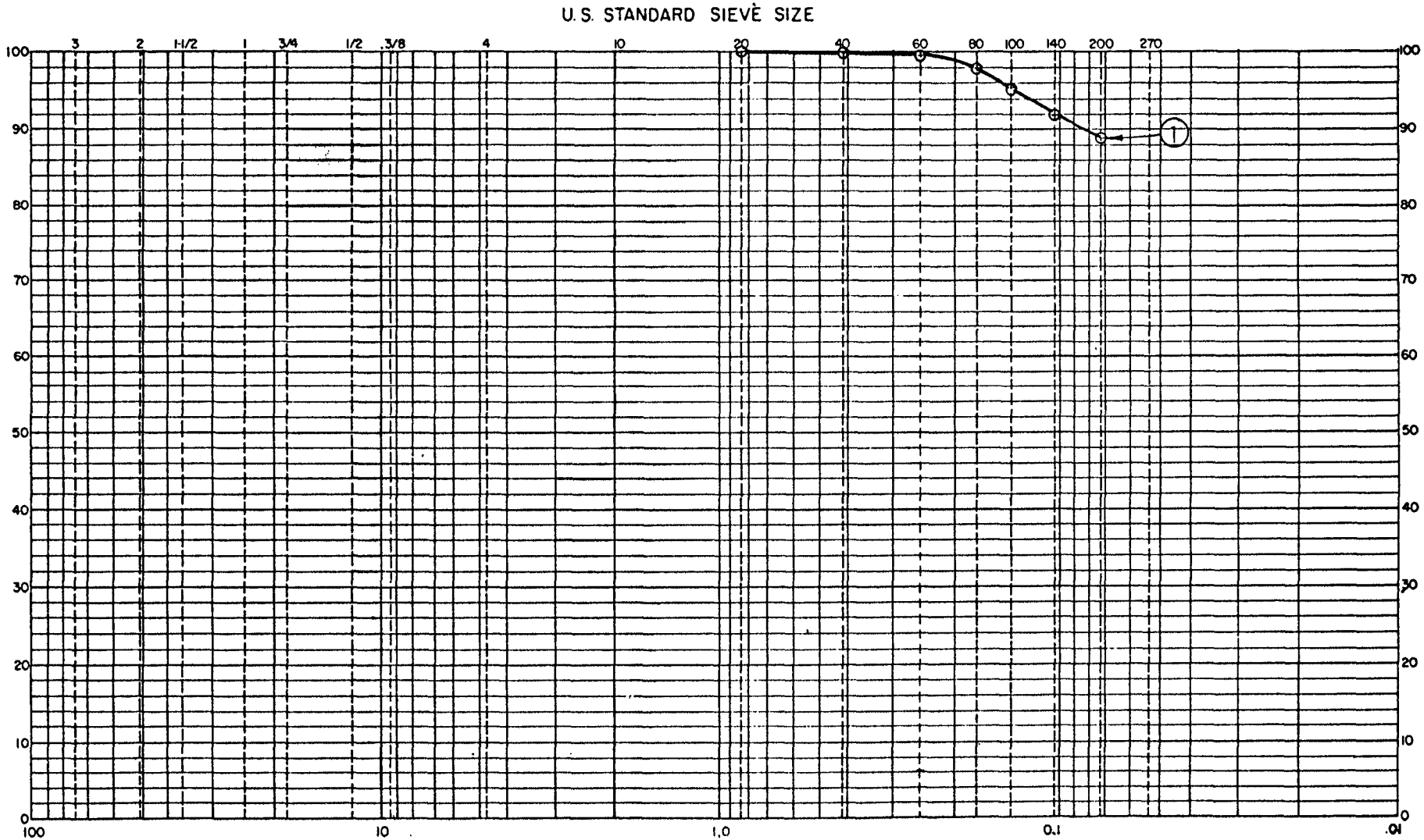
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-5	169.3-170.0'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 45

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

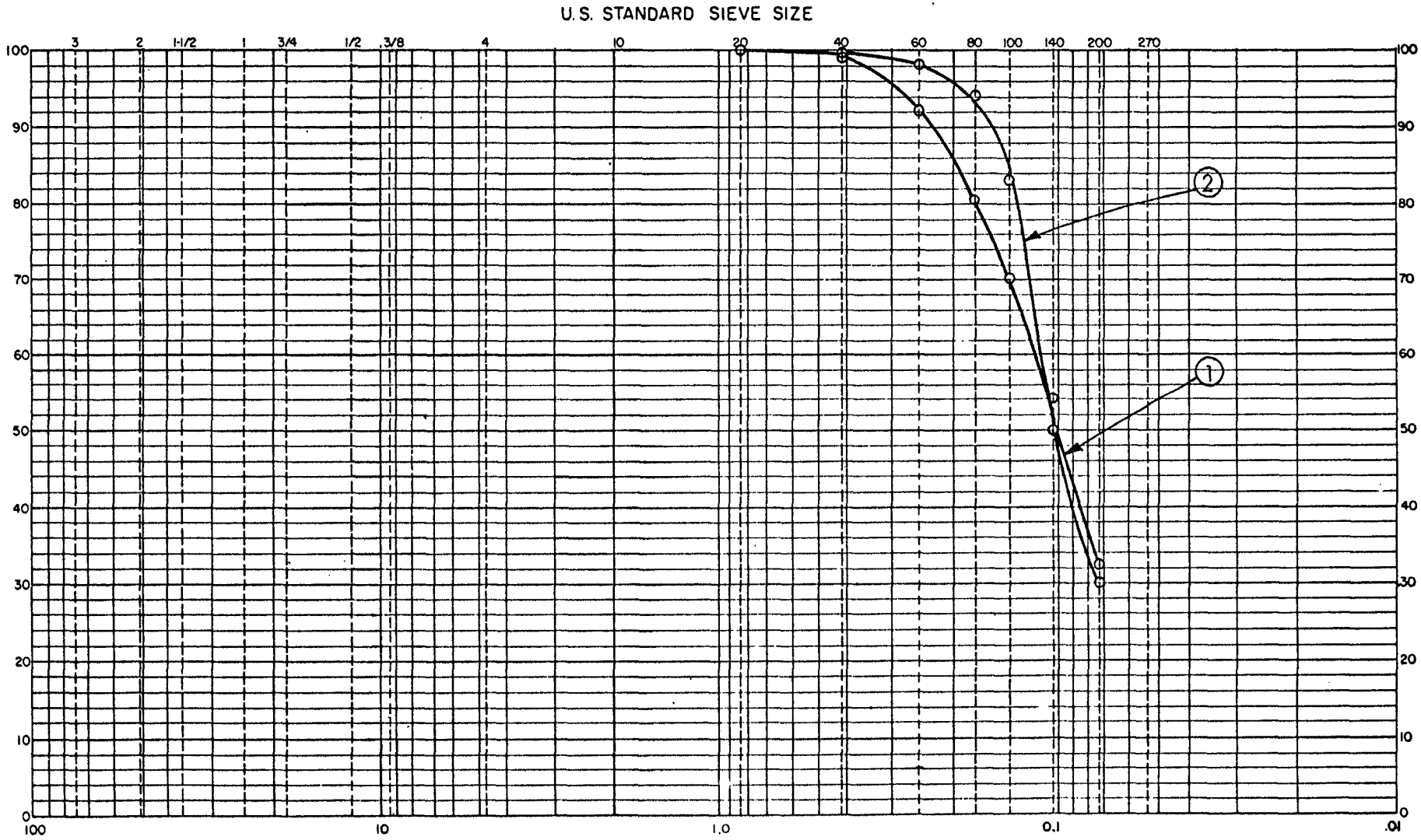
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-6	9.5-10.0'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 46

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

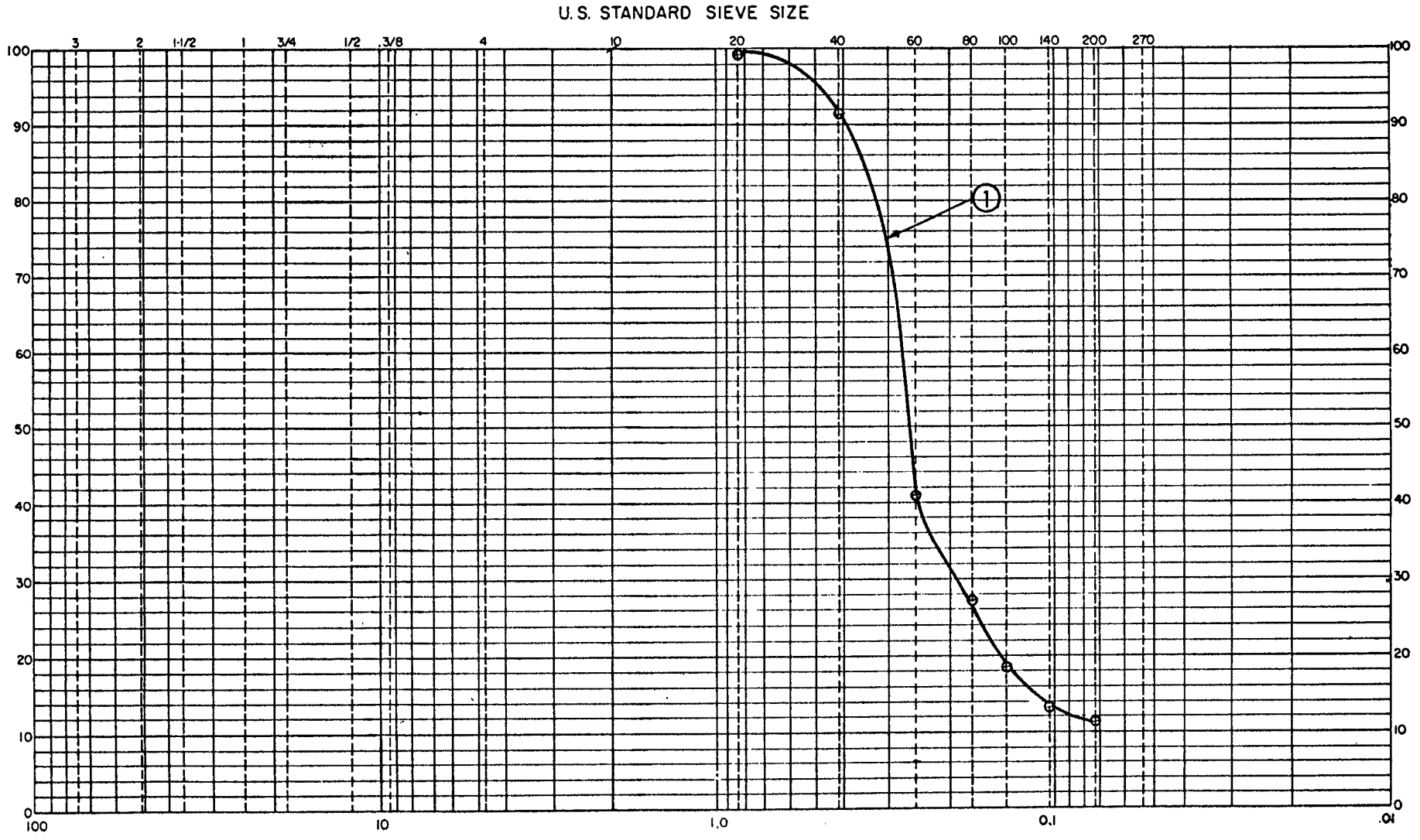
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-13	43.0-43.8'	1
B-13	98.0-98.5'	2

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 47

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

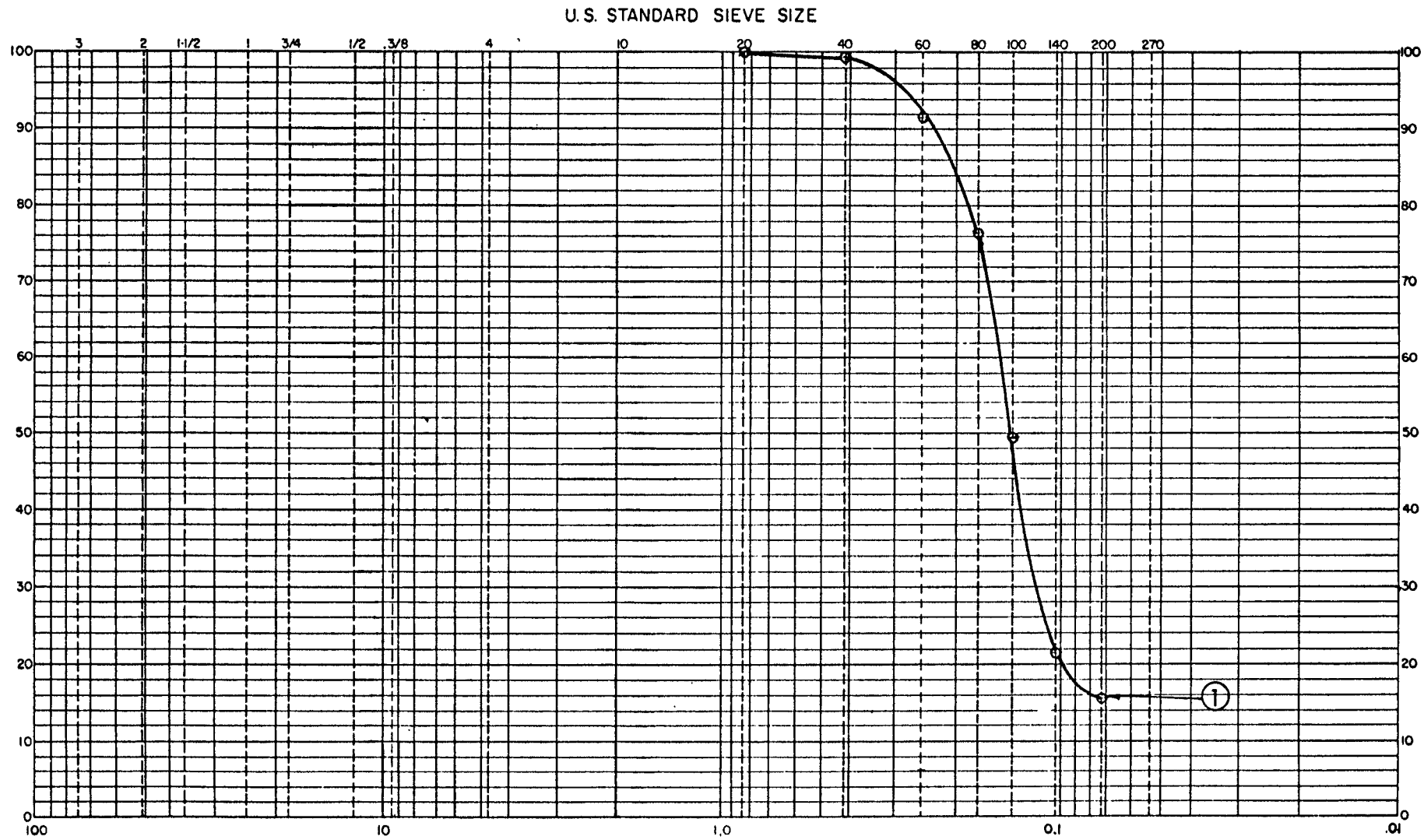
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-14	17.5-18.2'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 48

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



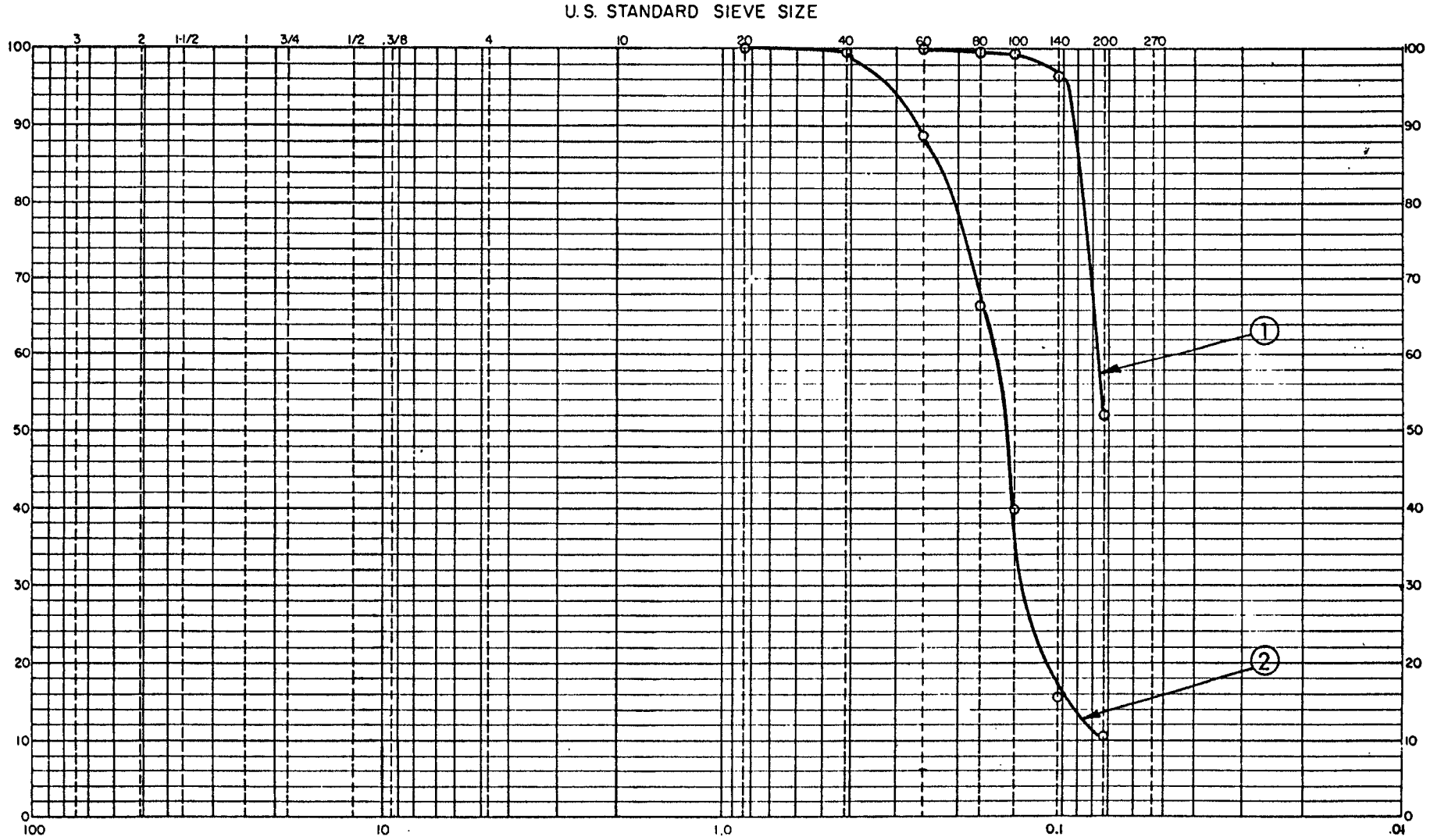
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-15	73.5-73.8'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 49

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

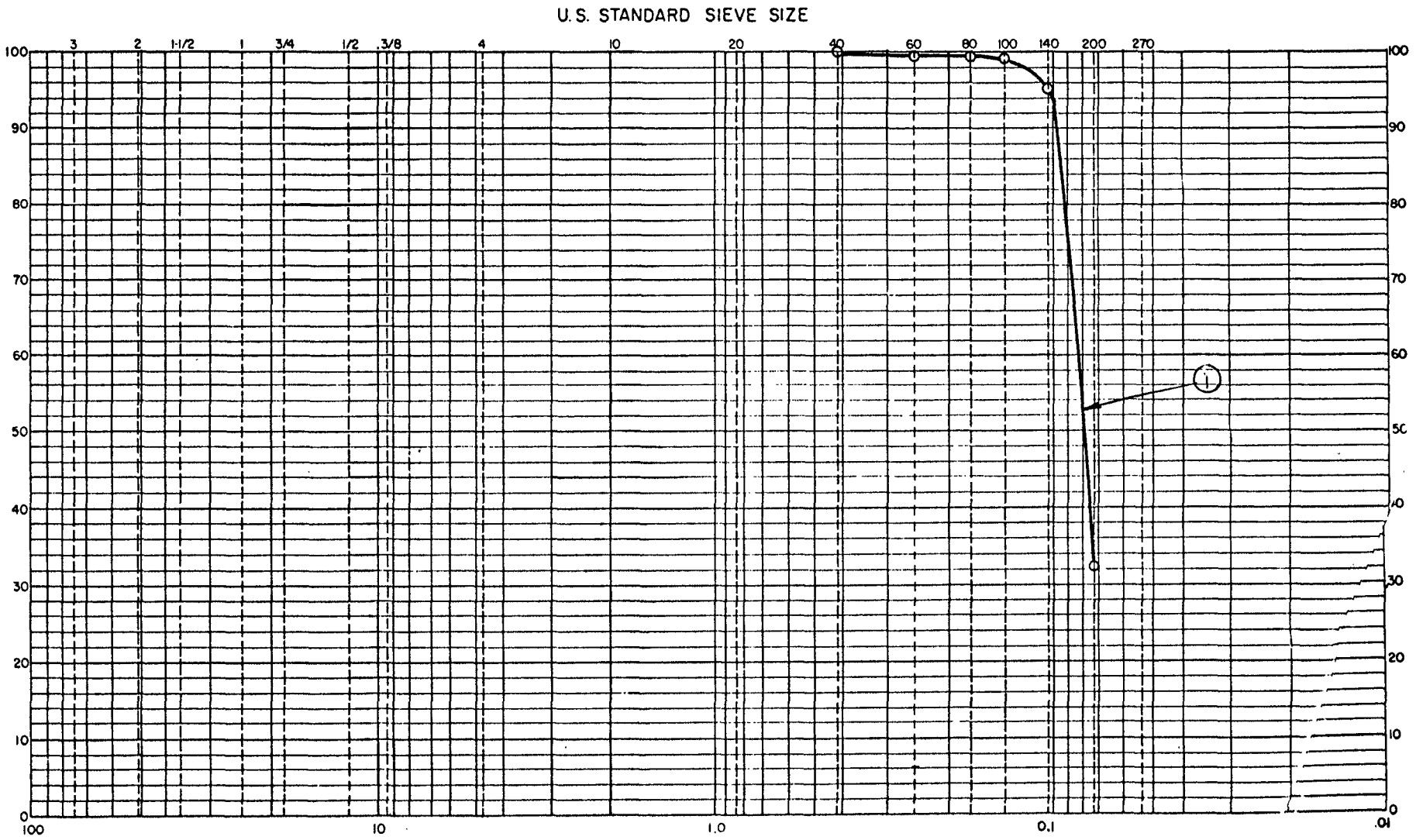
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-16	48.0-48.8'	1
B-16	114.8-115.0'	2

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 50

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAIN SIZE IN MILLIMETERS

	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

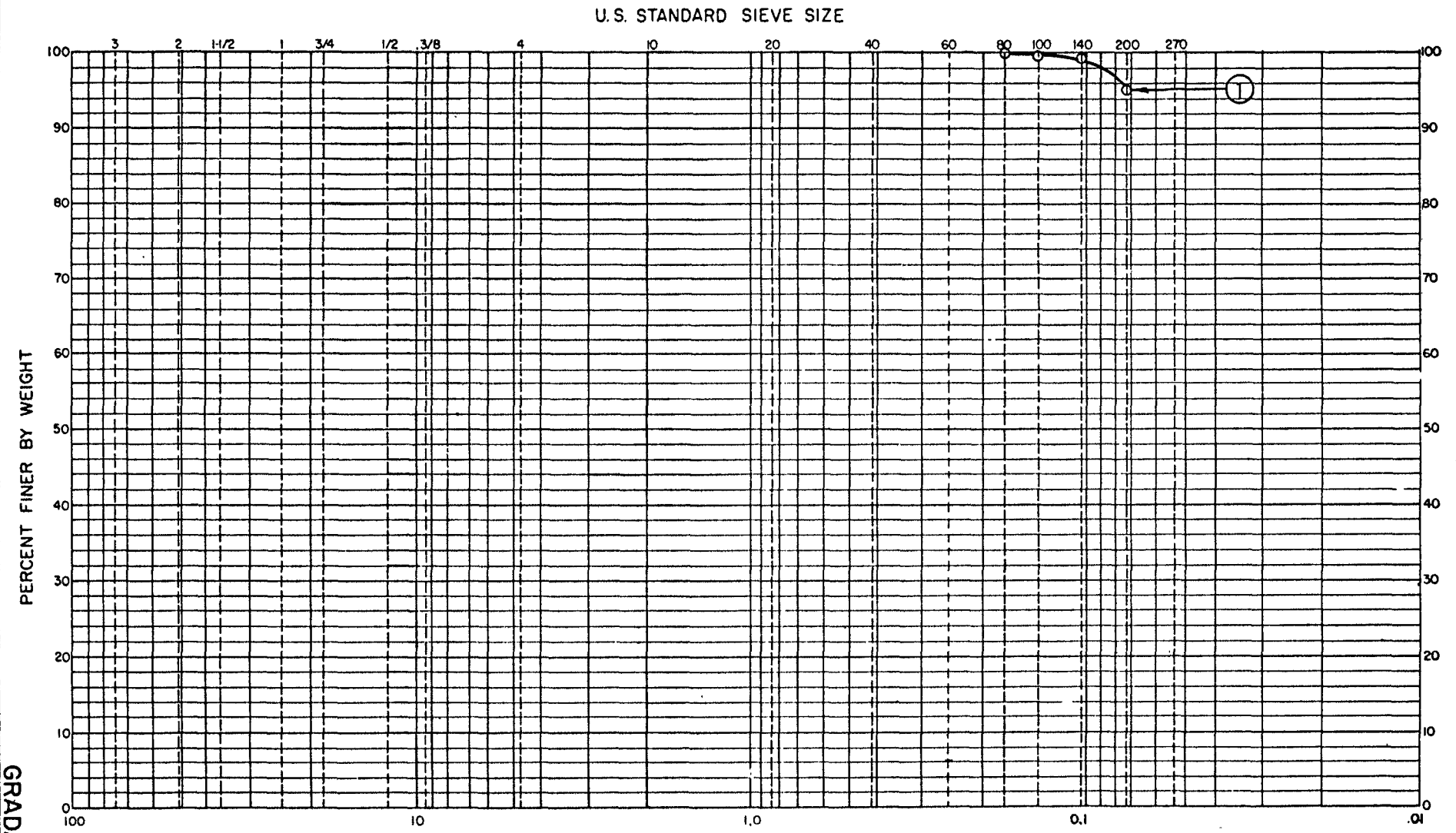
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-17	49.4-50.1'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 51

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-18	24.0-24.8'	1

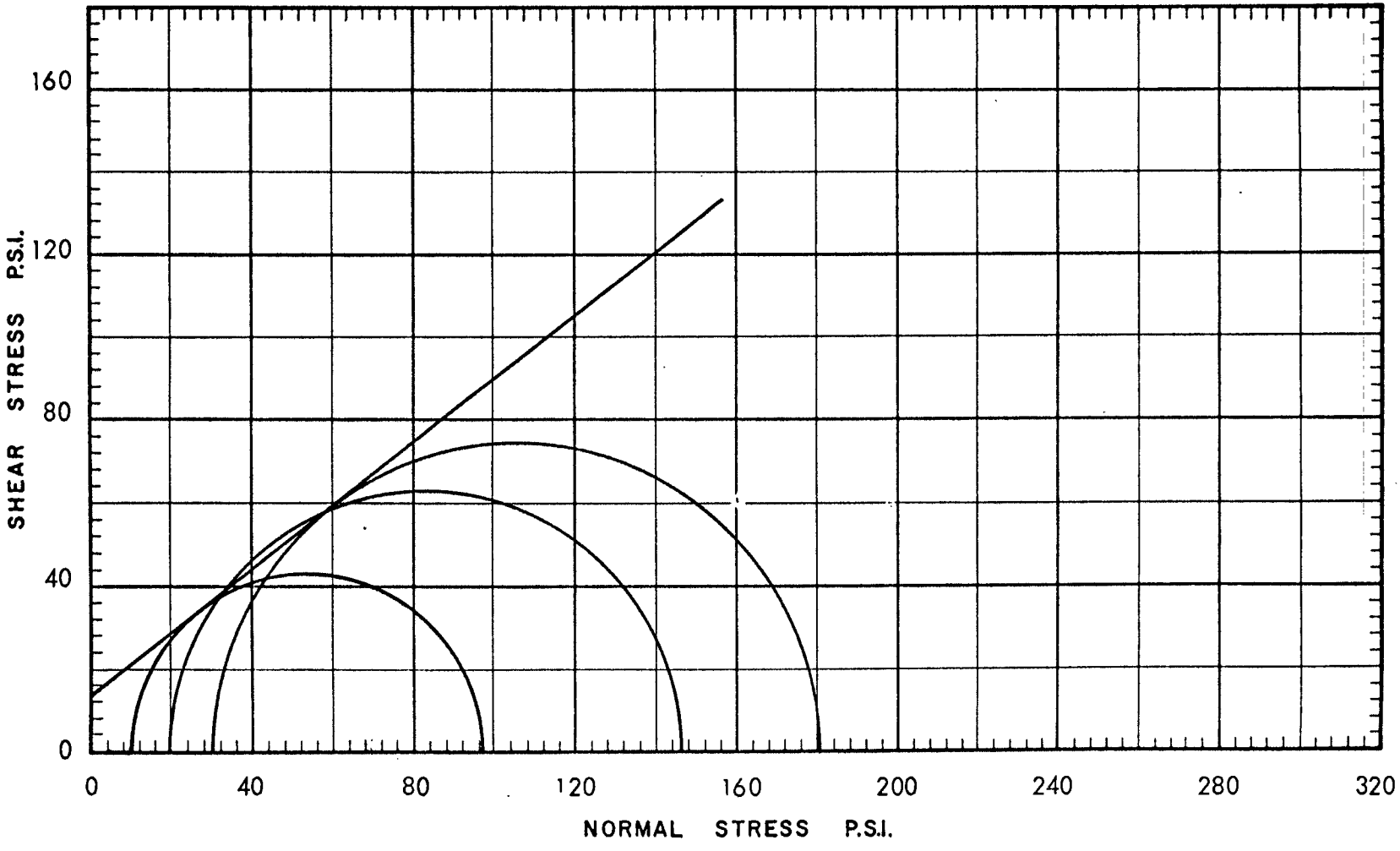
LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE 52

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-5 DEPTH: 14.2-15.0'
DESCRIPTION: Dark reddish-brown lignitic clay, w/lignitic material seams
ANGLE OF SHEAR: 37.4°
COHESION: c = 13.9 psi = 1.0 tsf

MOISTURE CONTENT:
BEFORE: 57.7 %, AFTER: 79.4 %
UNIT DRY WT: 48.9 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

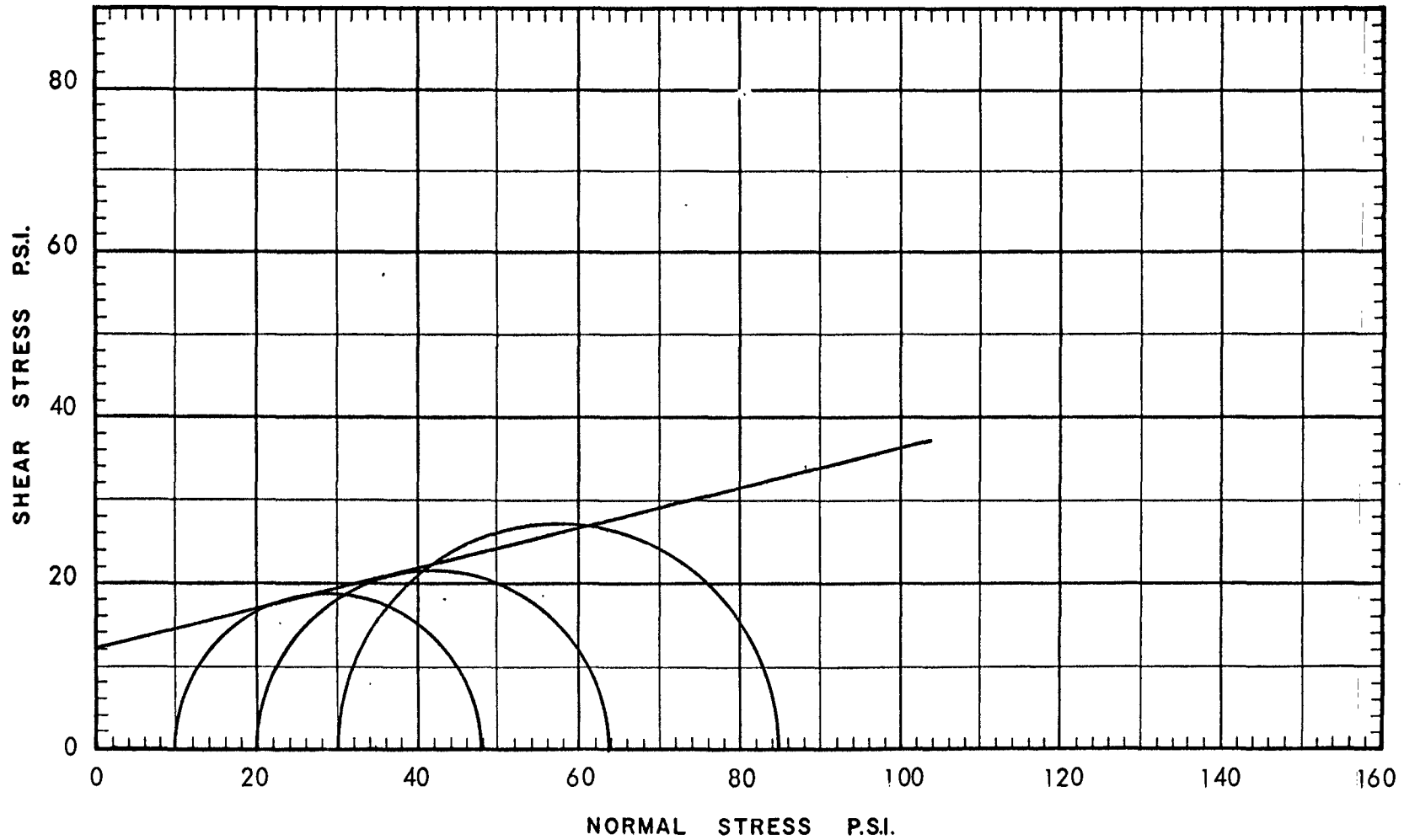
PLATE 53

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-5 DEPTH: 19.4-20.0'
DESCRIPTION: Green clay

ANGLE OF SHEAR: 12.8°
COHESION: c = 12.0 psi = 0.86 tsf

MOISTURE CONTENT:
BEFORE: 34.2 %, AFTER: 38.0 %
UNIT DRY WT: 85.0 LBS./CU.FT.
LIQUID LIMIT: 91.5
PLASTICITY INDEX: 54.9



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

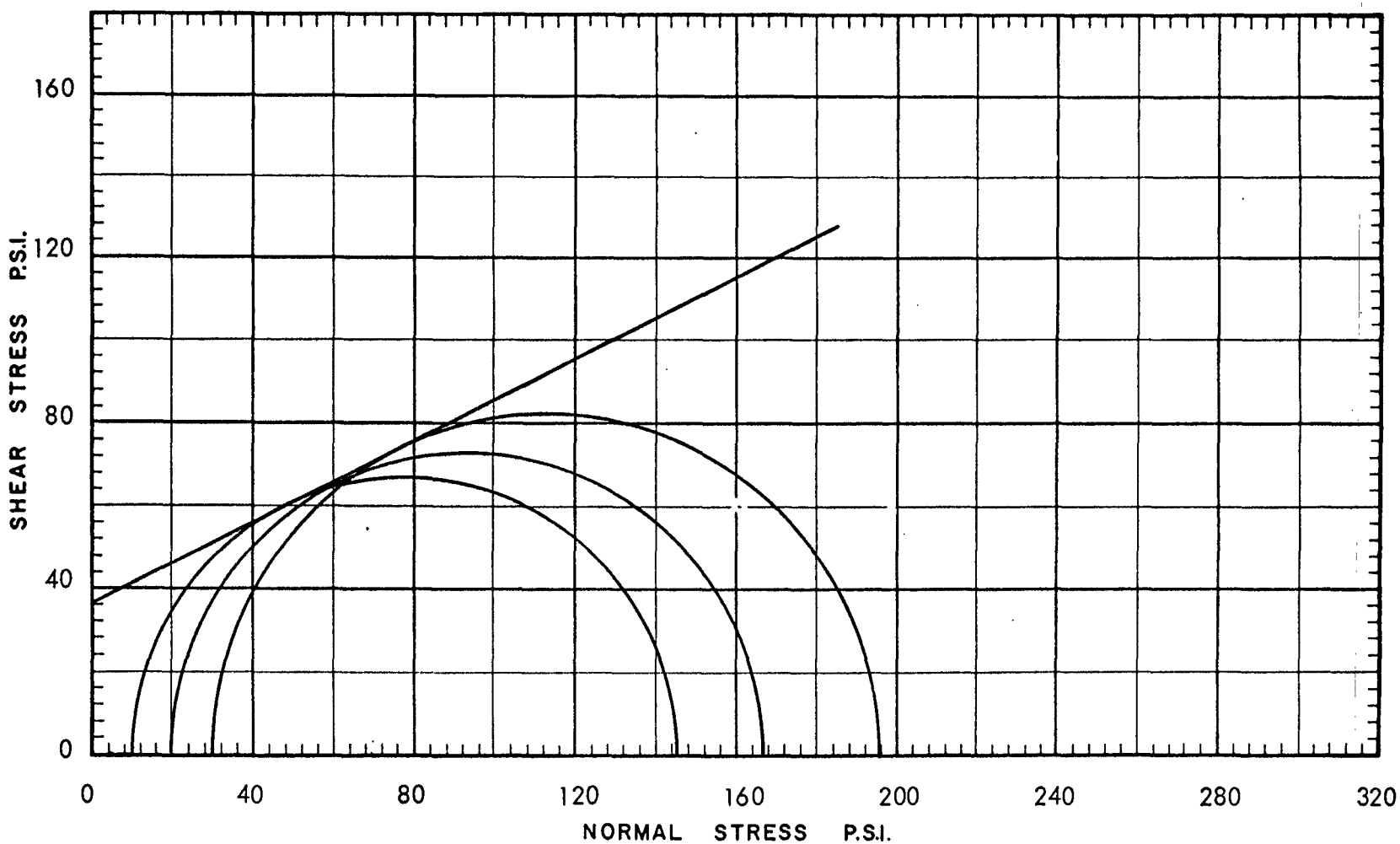
PLATE 54

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-5 DEPTH: 84.7-85.3'
DESCRIPTION: Brown silty clay

ANGLE OF SHEAR: 25.6°
COHESION: c = 37.0 psi = 2.66 tsf

MOISTURE CONTENT:
BEFORE: 27.4 %, AFTER: 29.3 %
UNIT DRY WT: 92.6 LBS./CU.FT.
LIQUID LIMIT: 43.2
PLASTICITY INDEX: 20.6



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

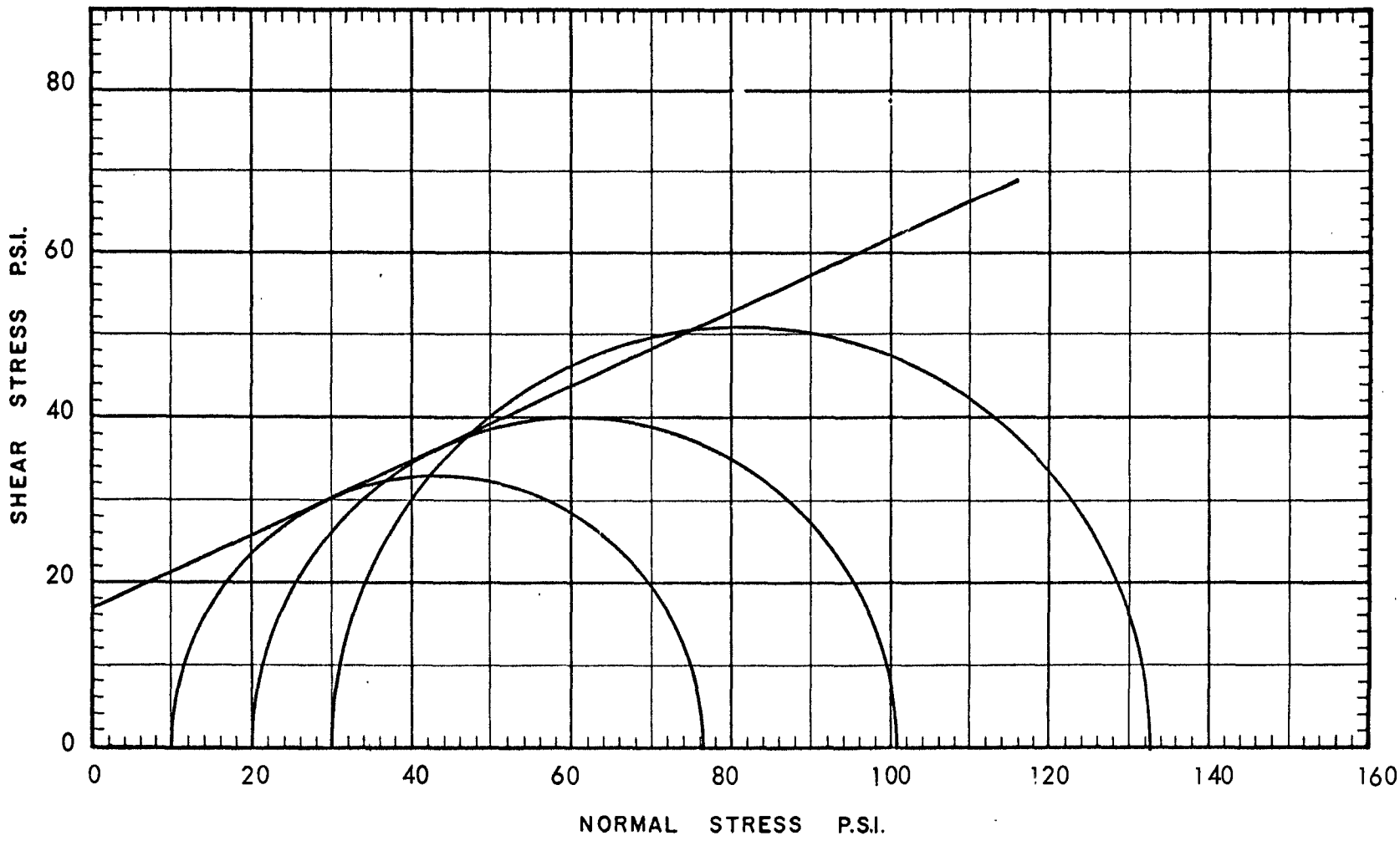
PLATE 55

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-5 DEPTH: 119.4-120.0'
DESCRIPTION: Gray clay

ANGLE OF SHEAR: 24.5°
COHESION: c = 17.0 psi = 1.22 tsf

MOISTURE CONTENT:
BEFORE: 25.7 %, AFTER: 29.3 %
UNIT DRY WT: 96.3 LBS./CU.FT.
LIQUID LIMIT: 48.7
PLASTICITY INDEX: 27.2



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

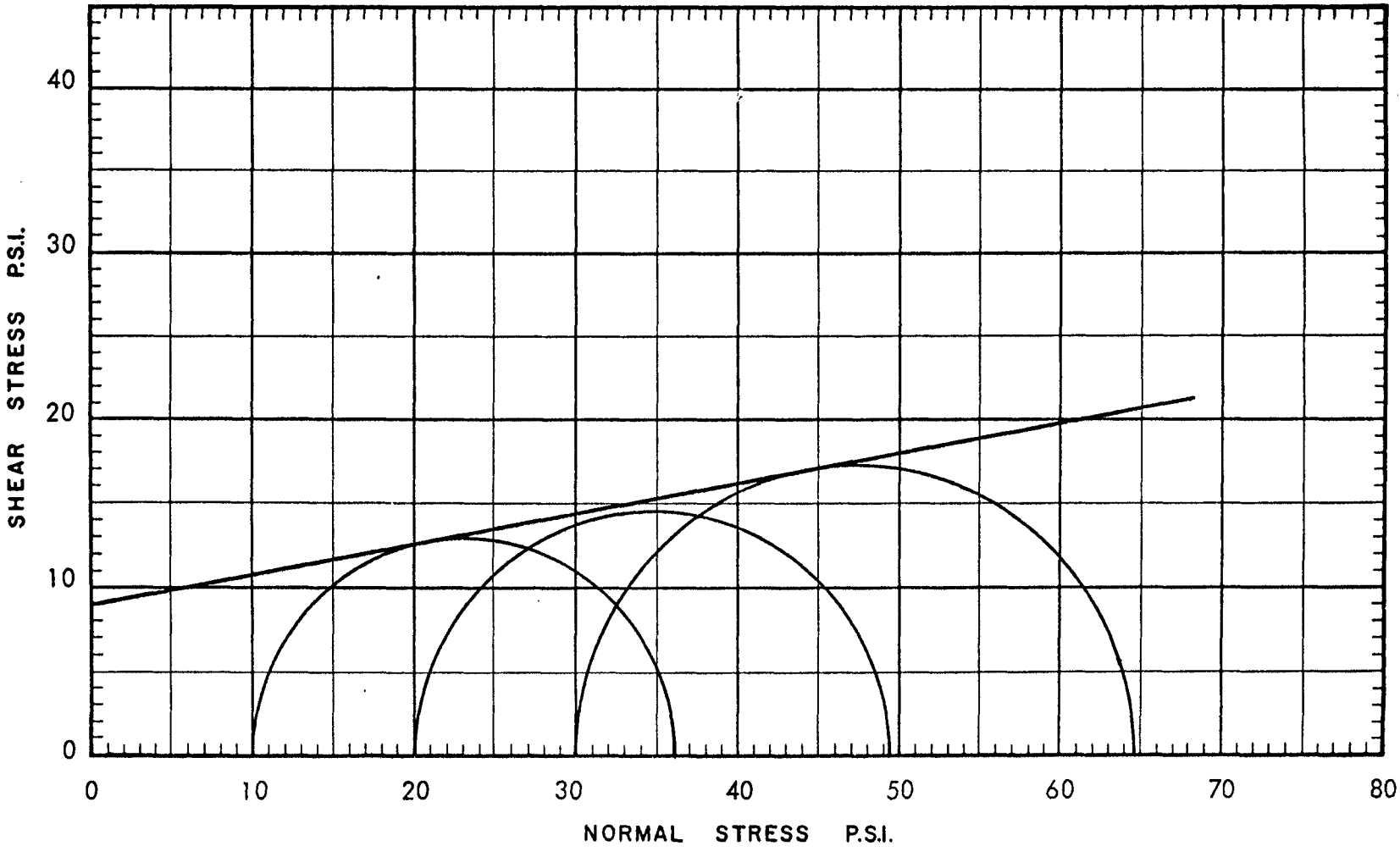
PLATE 56

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-5 DEPTH: 139.3-140.0'
DESCRIPTION: Greenish-gray clay

ANGLE OF SHEAR: 9.7°
COHESION: c = 9.0 psi = 0.65 tsf

MOISTURE CONTENT:
BEFORE: 31.1 %, AFTER: 38.8 %
UNIT DRY WT: 90.5 LBS./CU.FT.
LIQUID LIMIT: 108.6
PLASTICITY INDEX: 77.1



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

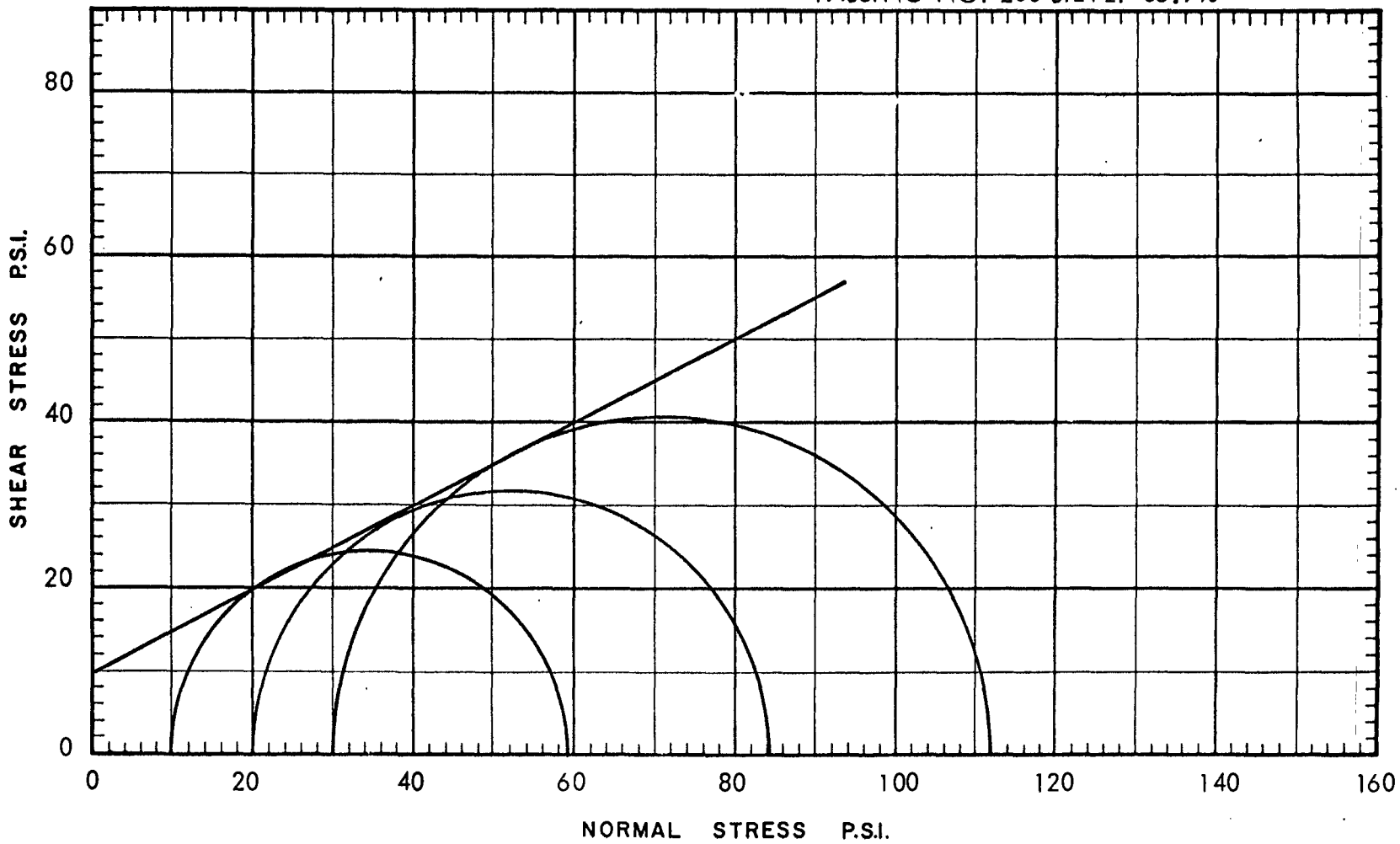
PLATE 57

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-5 DEPTH: 159.3-160.0'
DESCRIPTION: Gray clayey fine sand

ANGLE OF SHEAR: 26.0°
COHESION: c = 10.0 psi = 0.72 tsf

MOISTURE CONTENT:
BEFORE: 19.9 %, AFTER: 21.1 %
UNIT DRY WT: 105.8 LBS./CU.FT.
LIQUID LIMIT: 41
PLASTICITY INDEX: 21
PASSING NO. 200 SIEVE: 36.7%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

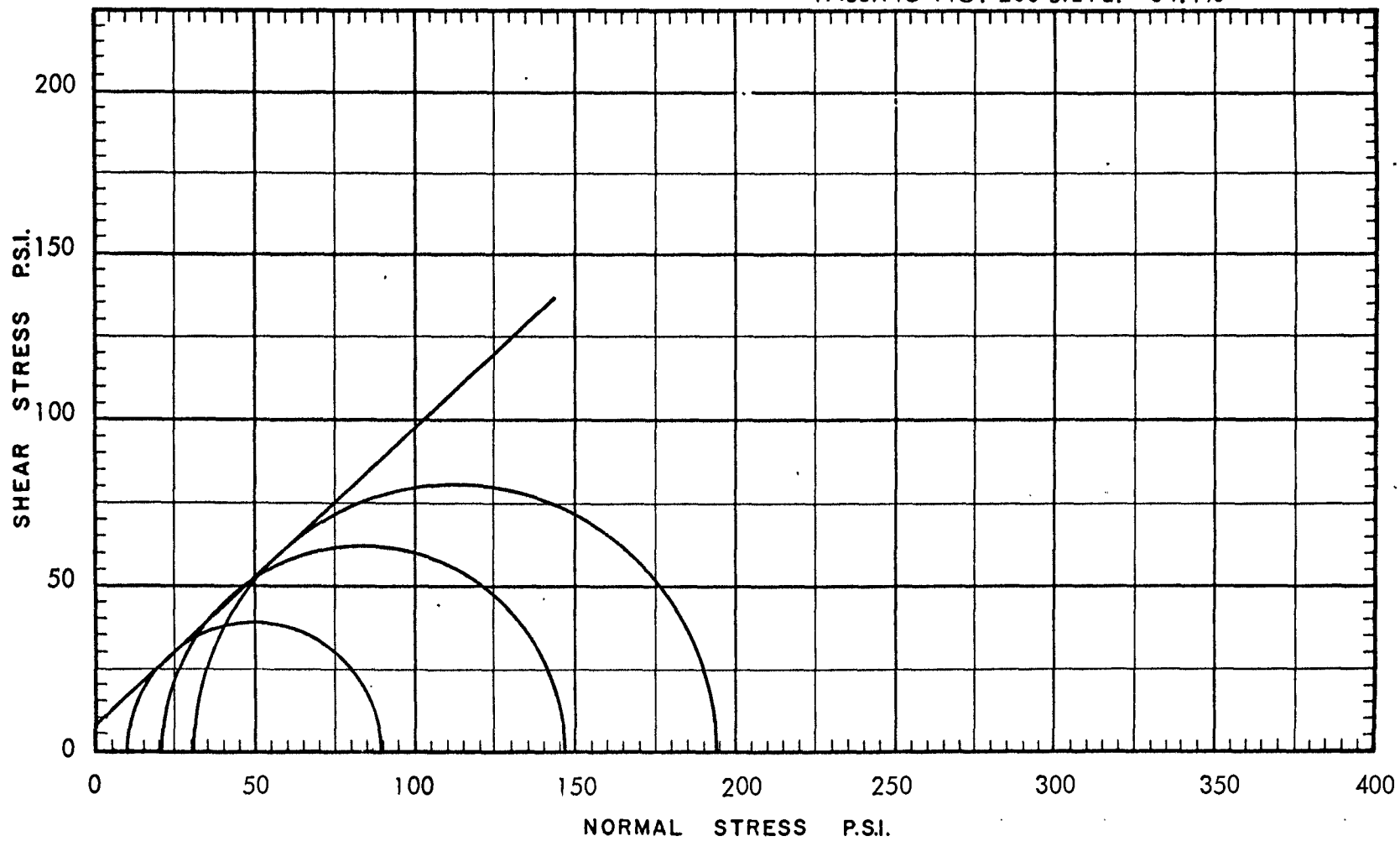
PLATE 58

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-5 DEPTH: 169.3-170.0'
DESCRIPTION: Gray silty fine sand

ANGLE OF SHEAR: 42.3°
COHESION: c = 7.5 psi = 0.54 tsf

MOISTURE CONTENT:
BEFORE: 23.6 %, AFTER: 18.3 %
UNIT DRY WT: 98.4 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:
PASSING NO. 200 SIEVE: 34.1%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

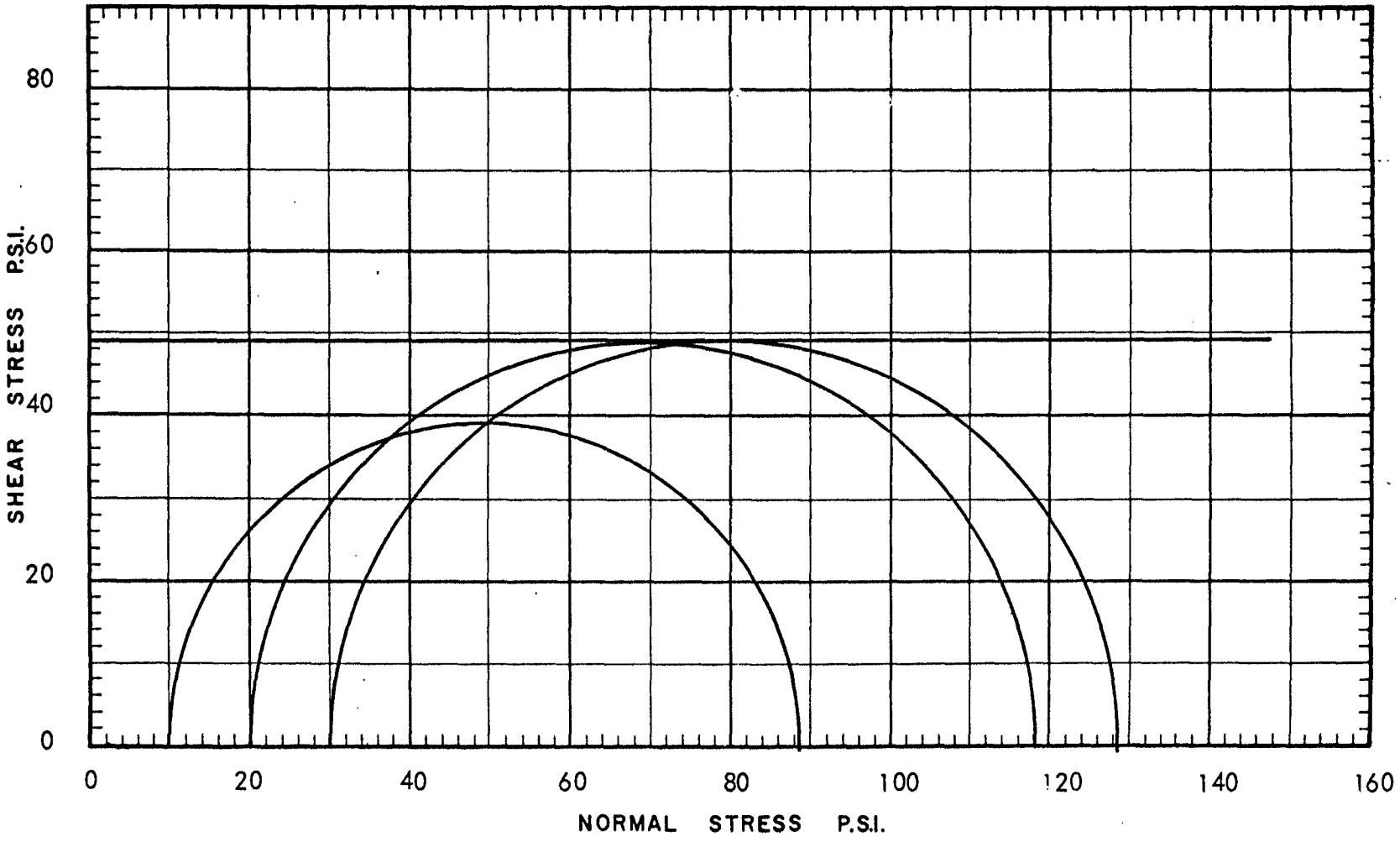
PLATE 59

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-5 DEPTH: 199.2-199.8'
DESCRIPTION: Gray clay, w/sandy clay inclusions

ANGLE OF SHEAR: 0.0°
COHESION: c = 48.9 psi = 3.52 tsf

MOISTURE CONTENT:
BEFORE: 25.7 %, AFTER: 36.5 %
UNIT DRY WT: 92.5 LBS./CU.FT.
LIQUID LIMIT: 92.4
PLASTICITY INDEX: 59.1



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

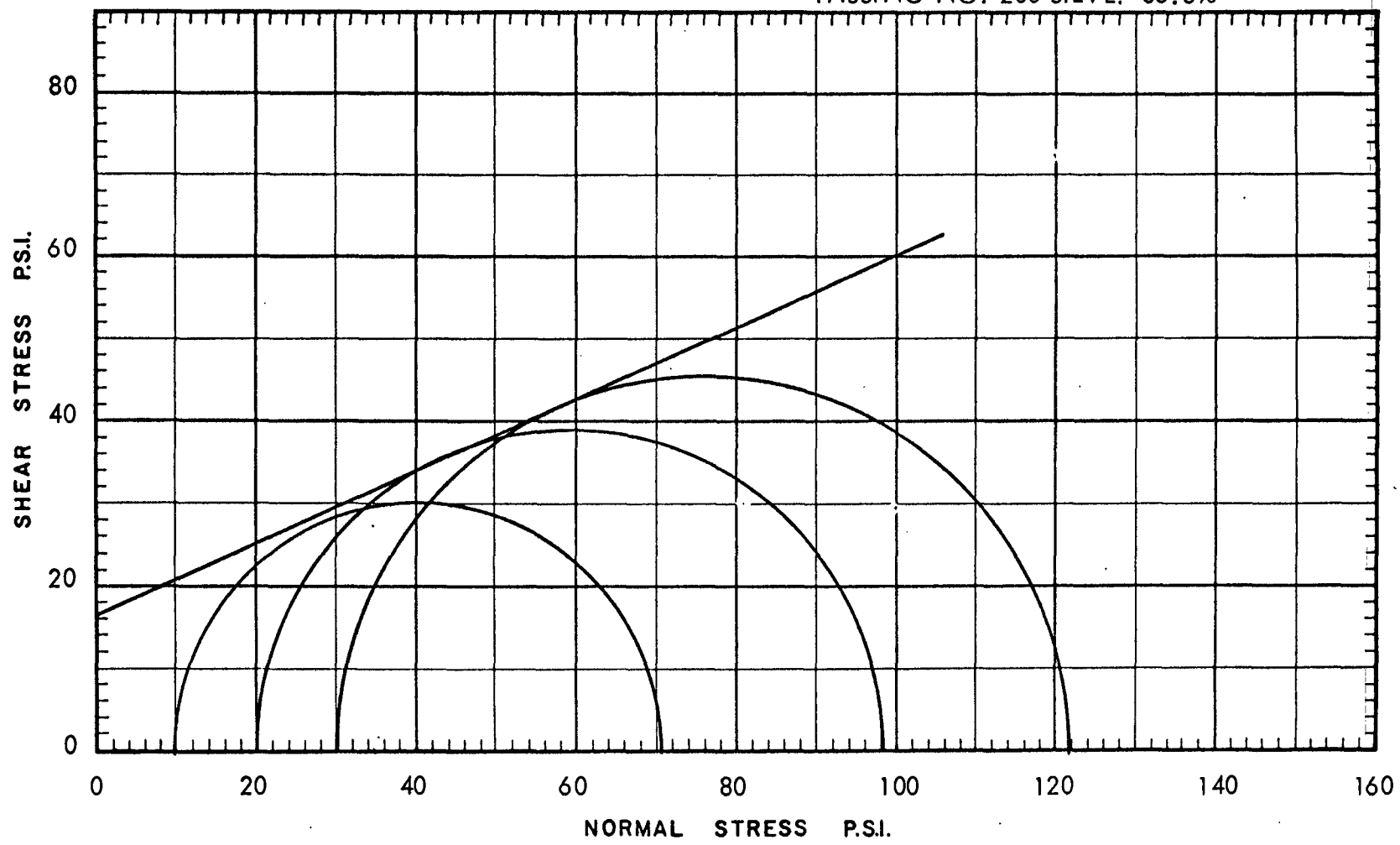
PLATE 60

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-6 DEPTH: 9.5-10.0'
DESCRIPTION: Light tan clayey silt

ANGLE OF SHEAR: 23.5°
COHESION: c = 16.0 psi = 1.15 tsf

MOISTURE CONTENT:
BEFORE: 29.3 %, AFTER: 30.8 %
UNIT DRY WT: 88.7 LBS./CU.FT.
LIQUID LIMIT: 48.0
PLASTICITY INDEX: 20.6
PASSING NO. 200 SIEVE: 88.8%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

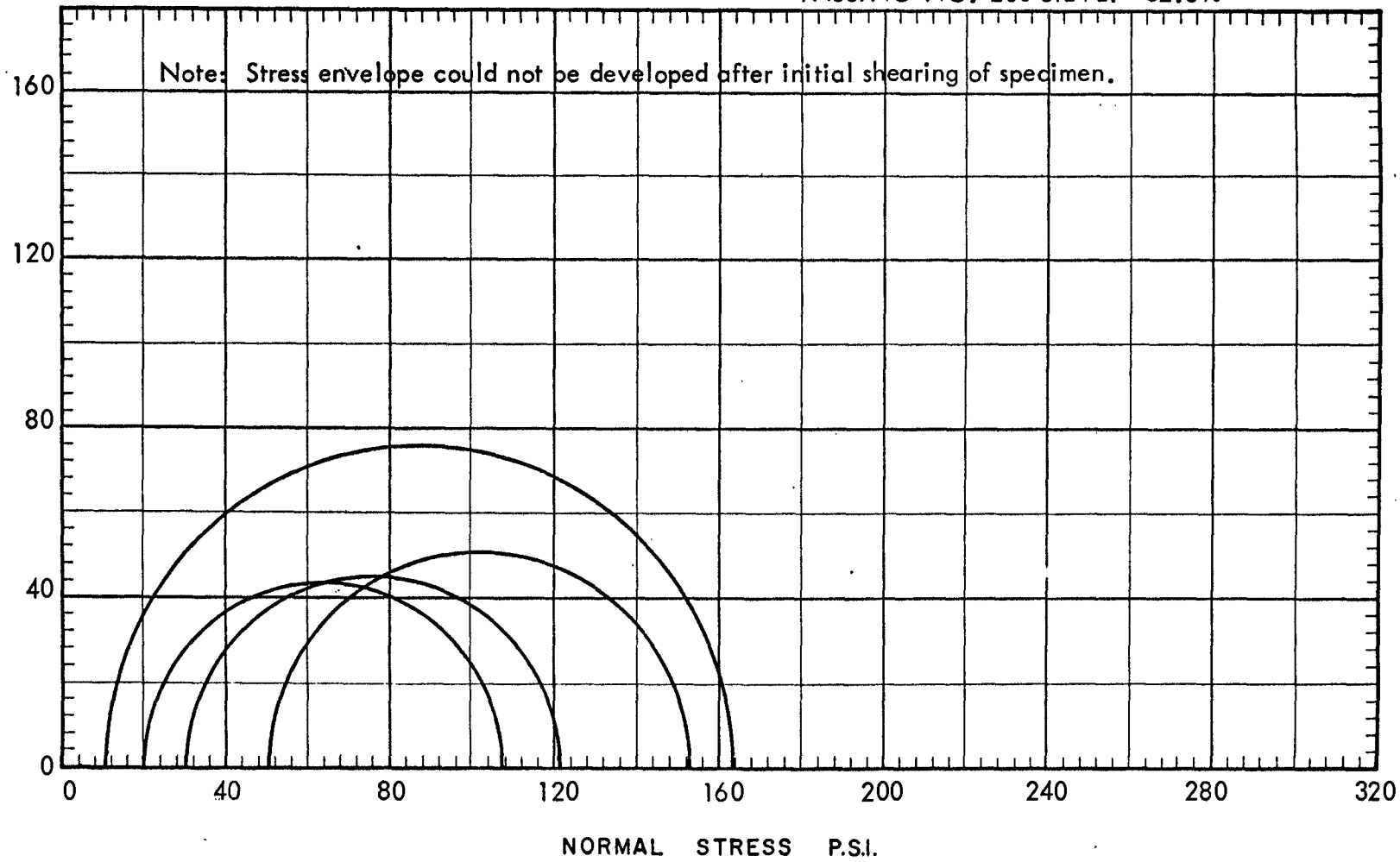
PLATE 61

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-13 DEPTH: 43.0-43.8'
DESCRIPTION: Gray silty fine sand

ANGLE OF SHEAR:
COHESION: c =

MOISTURE CONTENT:
BEFORE: 22.6 %, AFTER: %
UNIT DRY WT: 103.2 LBS./CU.FT.
LIQUID LIMIT: 44.2
PLASTICITY INDEX: 24.0
PASSING NO. 200 SIEVE: 32.6%



UNCONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

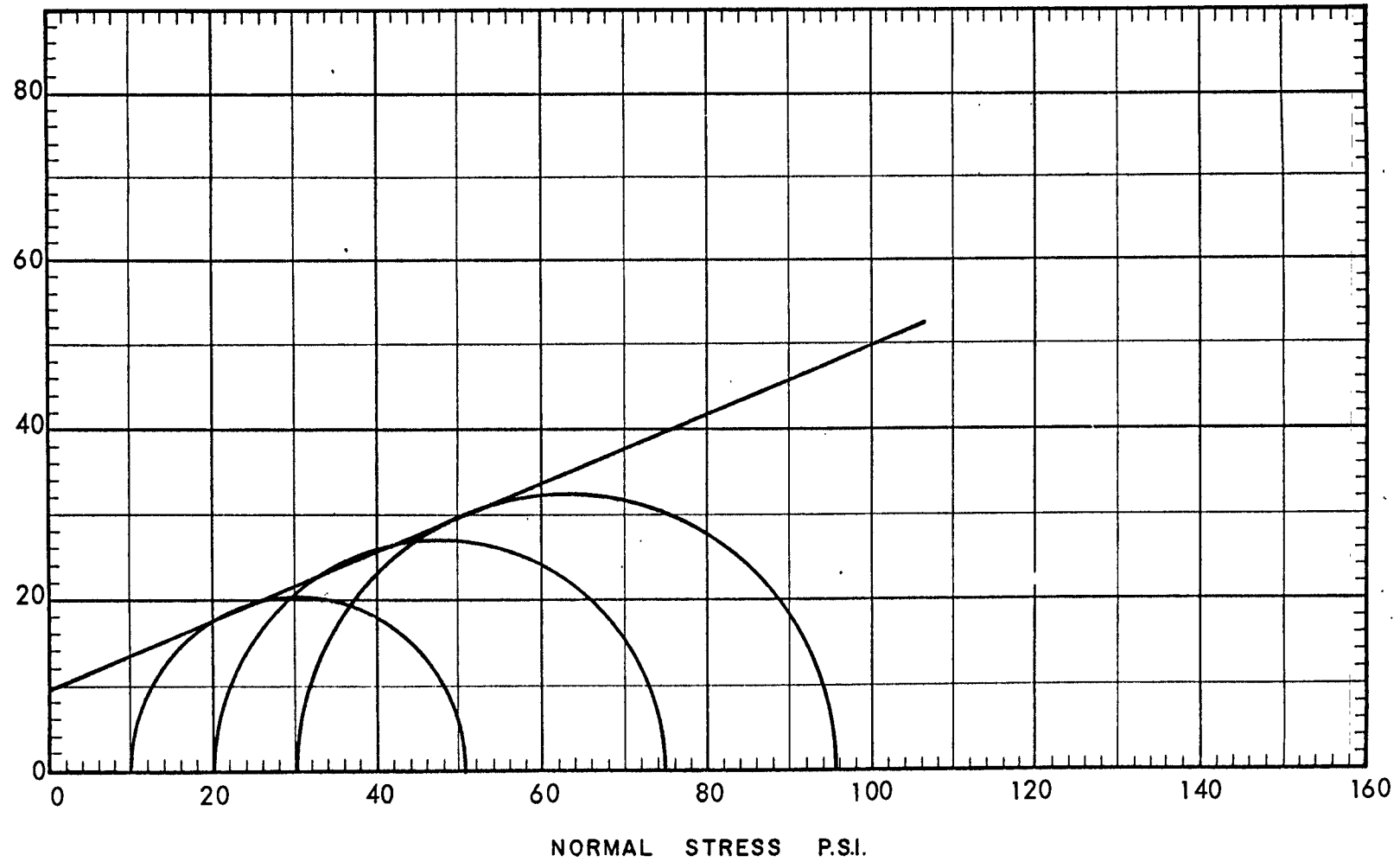
PLATE 62

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-13 DEPTH: 48.0-48.8'
DESCRIPTION: Gray silty fine sand

ANGLE OF SHEAR: 22.3°
COHESION: c = 9.5 psi = 0.68 tsf

MOISTURE CONTENT:
BEFORE: 29.4 %, AFTER: 25.0 %
UNIT DRY WT: 94.4 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

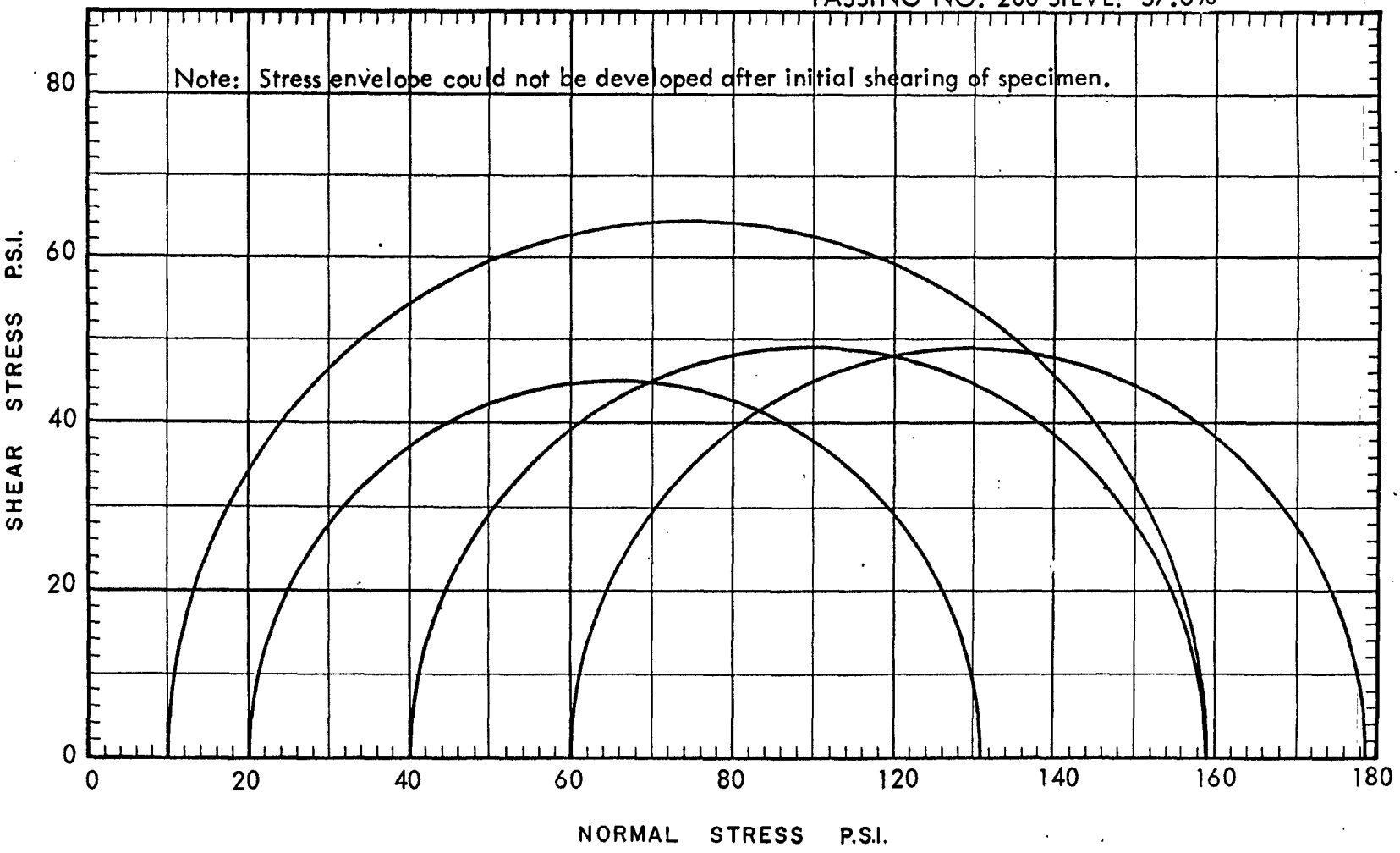
PLATE 63

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-13 DEPTH: 83.0-83.8'
DESCRIPTION: Gray sandy clay

ANGLE OF SHEAR:
COHESION: c =

MOISTURE CONTENT:
BEFORE: 28.4 %, AFTER: %
UNIT DRY WT: 92.3 LBS./CU.FT.
LIQUID LIMIT: 51.1
PLASTICITY INDEX: 22.2
PASSING NO. 200 SIEVE: 57.6%



UNCONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

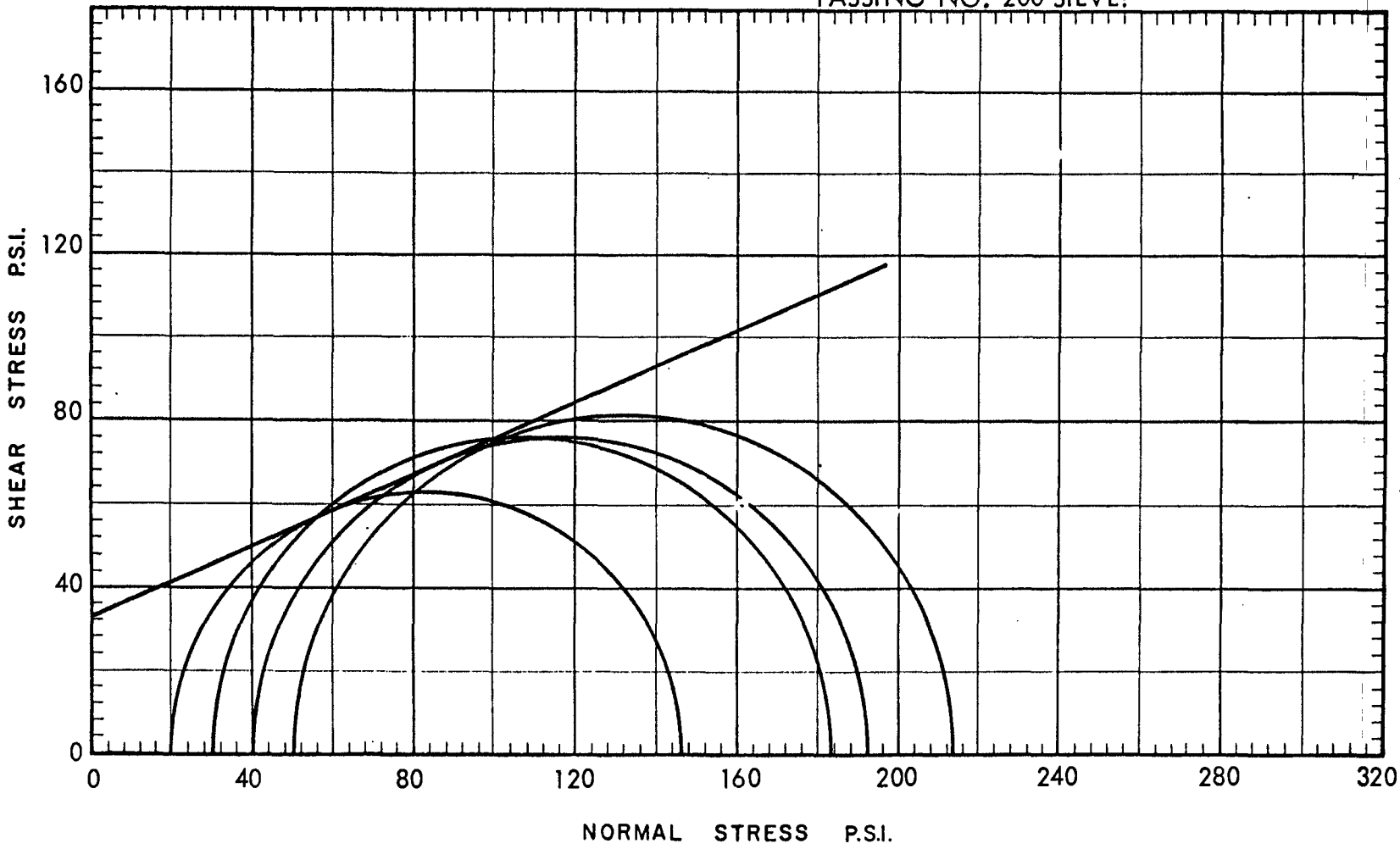
PLATE 64

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-13 DEPTH: 98.0-98.8'
DESCRIPTION: Gray silty fine sand, w/clay laminations

ANGLE OF SHEAR: 22.0°
COHESION: c = 33.5 psi - 2.41 tsf

MOISTURE CONTENT:
BEFORE: 27.6 %, AFTER: 27.7 %
UNIT DRY WT: 93.3 LBS./CU.FT.
LIQUID LIMIT: 43.1
PLASTICITY INDEX: 25.0
PASSING NO. 200 SIEVE:



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

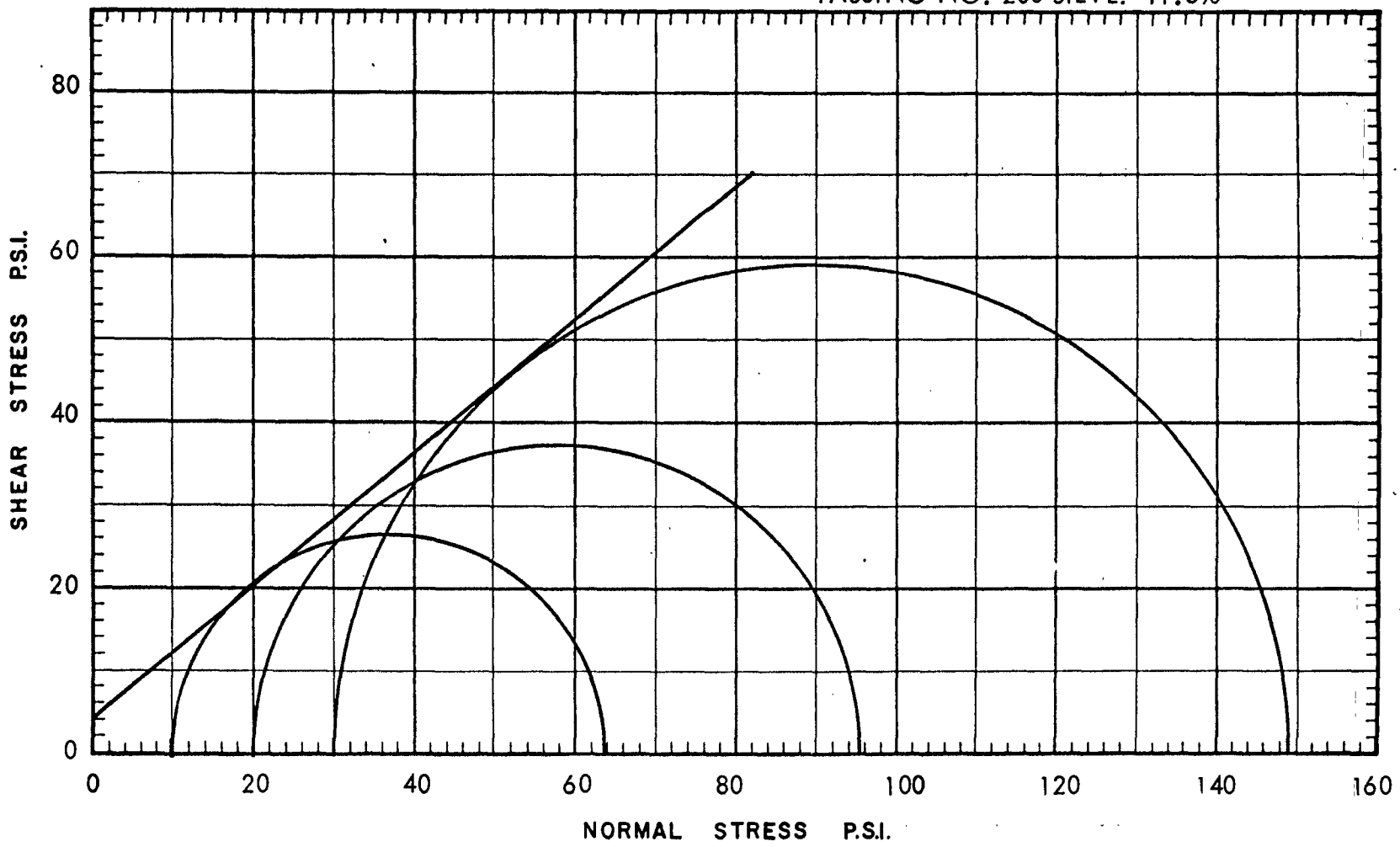
PLATE 65

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-14 DEPTH: 17.5-18.2'
DESCRIPTION: Gray silty fine sand, w/lignitic laminations

ANGLE OF SHEAR: 39.0°
COHESION: c = 4.0 psi - 0.29 tsf

MOISTURE CONTENT:
BEFORE: 23.6 %, AFTER: 17.3 %
UNIT DRY WT: 97.4 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:
PASSING NO. 200 SIEVE: 11.3%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

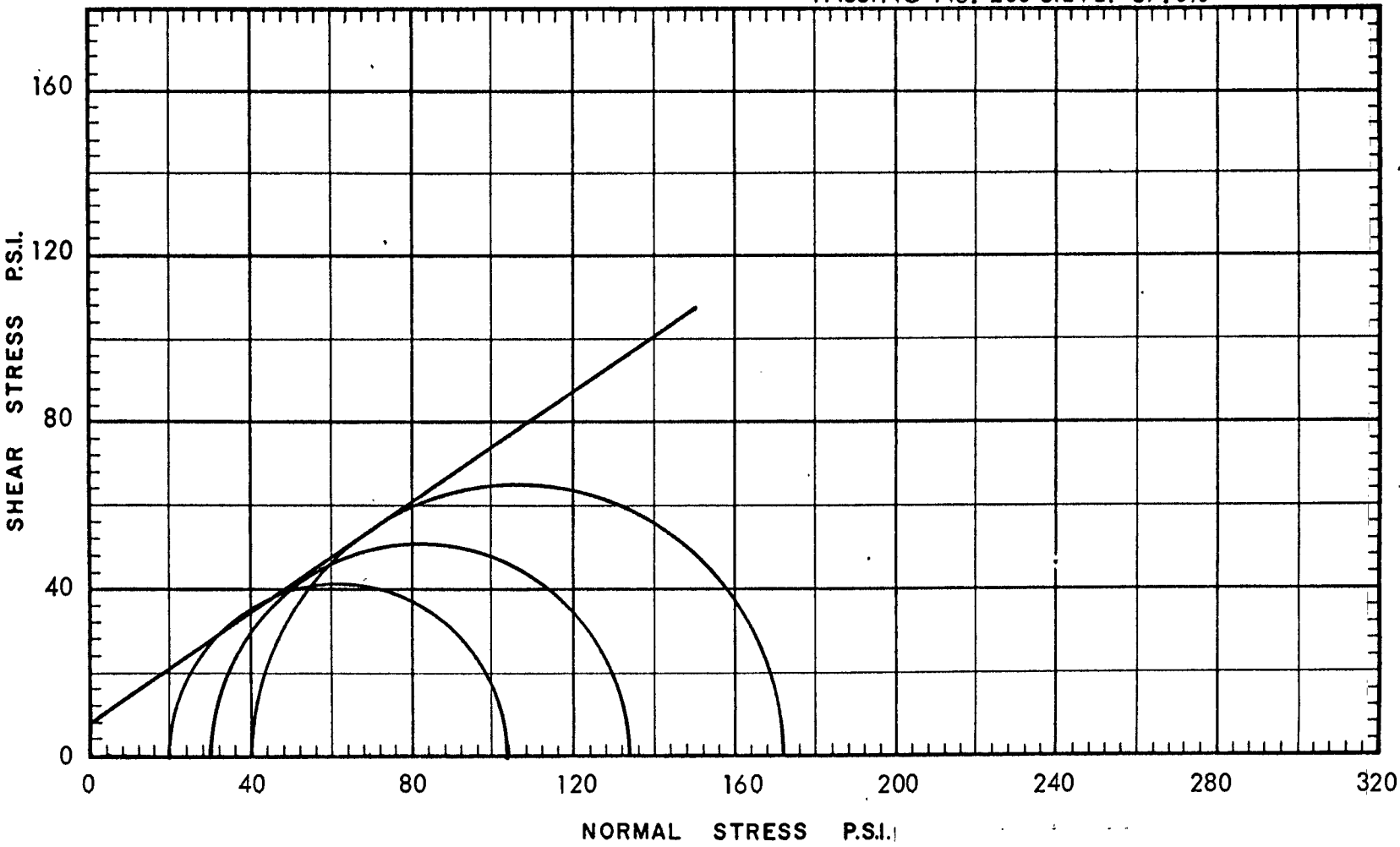
PLATE 66

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-14 DEPTH: 48.1-48.8'
DESCRIPTION: Gray sandy silt

ANGLE OF SHEAR: 33.7°
COHESION: c = 8.0 psi = 0.58 tsf

MOISTURE CONTENT:
BEFORE: 30.9 %, AFTER: 27.6 %
UNIT DRY WT: 92.5 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX: Non Plastic
PASSING No. 200 SIEVE: 57.0%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

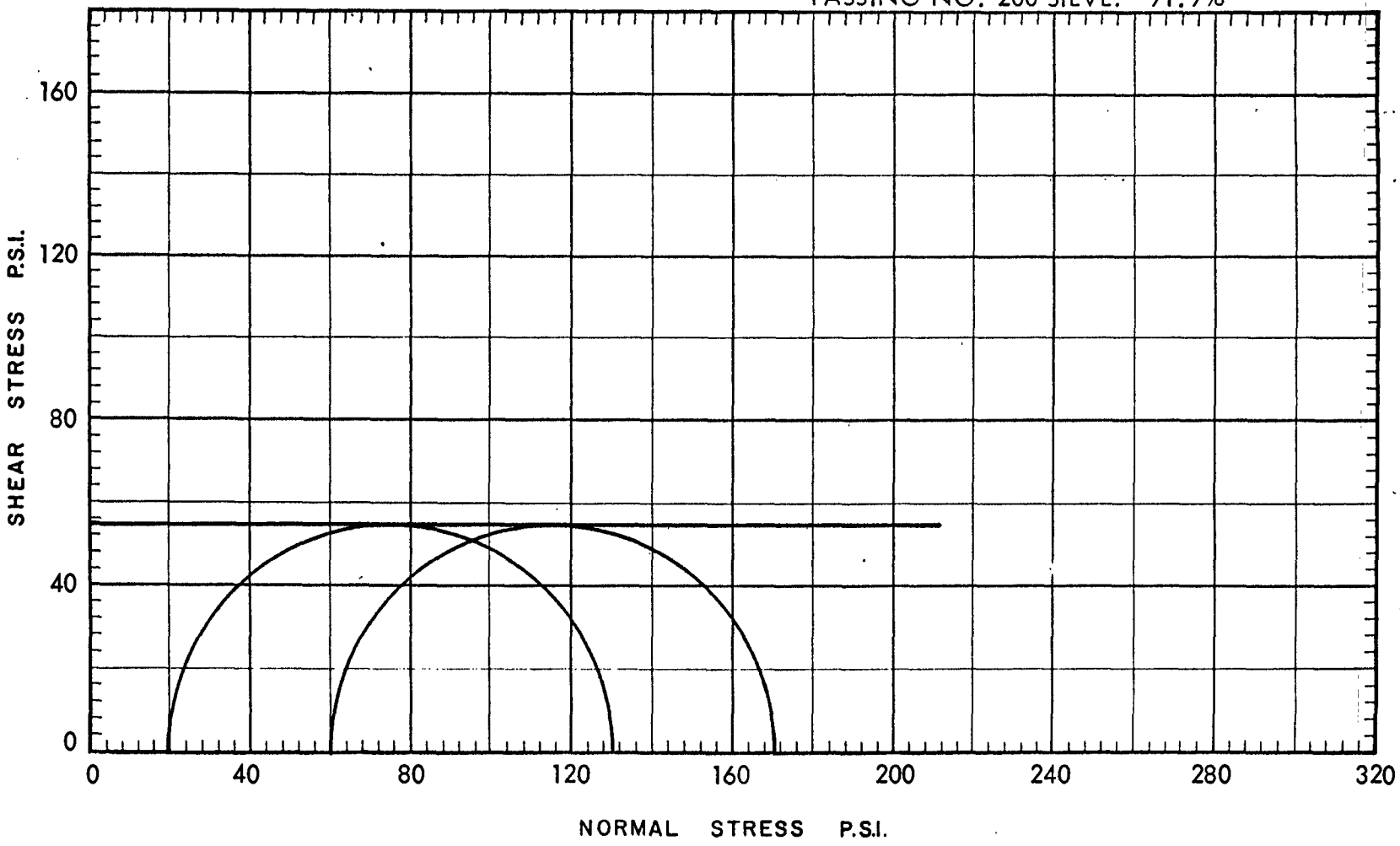
PLATE 67

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-14 DEPTH: 73.9-74.6'
DESCRIPTION: Gray clay, w/sandy silt laminations

ANGLE OF SHEAR: 0.0°
COHESION: c = 54.9 psi=3.95tsf

MOISTURE CONTENT:
BEFORE: 30.0 %, AFTER: 29.9 %
UNIT DRY WT: 92.0 LBS./CU.FT.
LIQUID LIMIT: 78.6
PLASTICITY INDEX: 59.7
PASSING NO. 200 SIEVE: 91.9%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

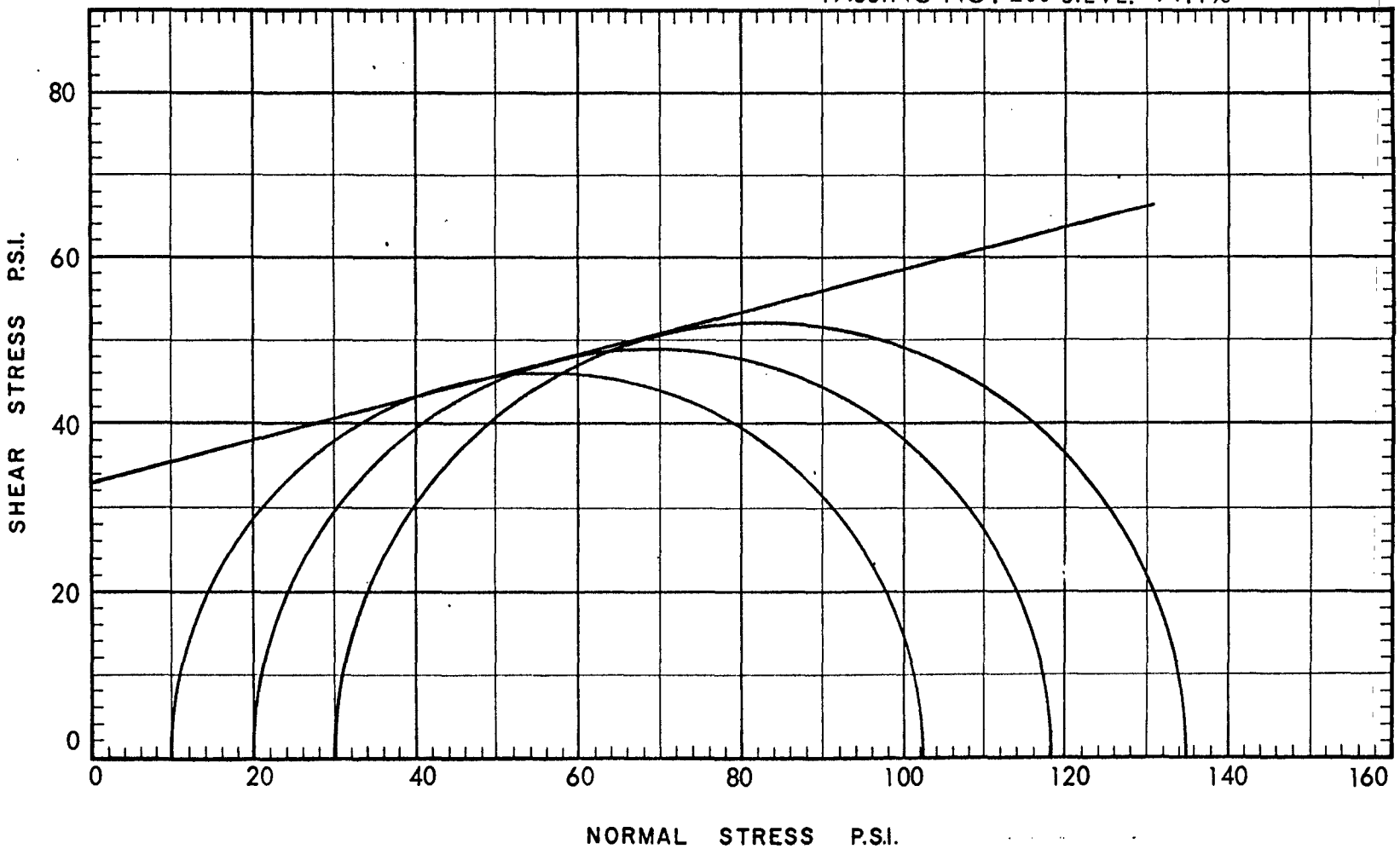
PLATE 68

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-15 DEPTH: 22.7 - 23.5'
DESCRIPTION: Gray sandy clay

ANGLE OF SHEAR: 14.4°
COHESION: c = 32.7 psi = 2.35 tsf

MOISTURE CONTENT:
BEFORE: 34.4 %, AFTER: 29.5 %
UNIT DRY WT: 90.1 LBS./CU.FT.
LIQUID LIMIT: 55.2
PLASTICITY INDEX: 35.2
PASSING NO. 200 SIEVE: 94.1%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

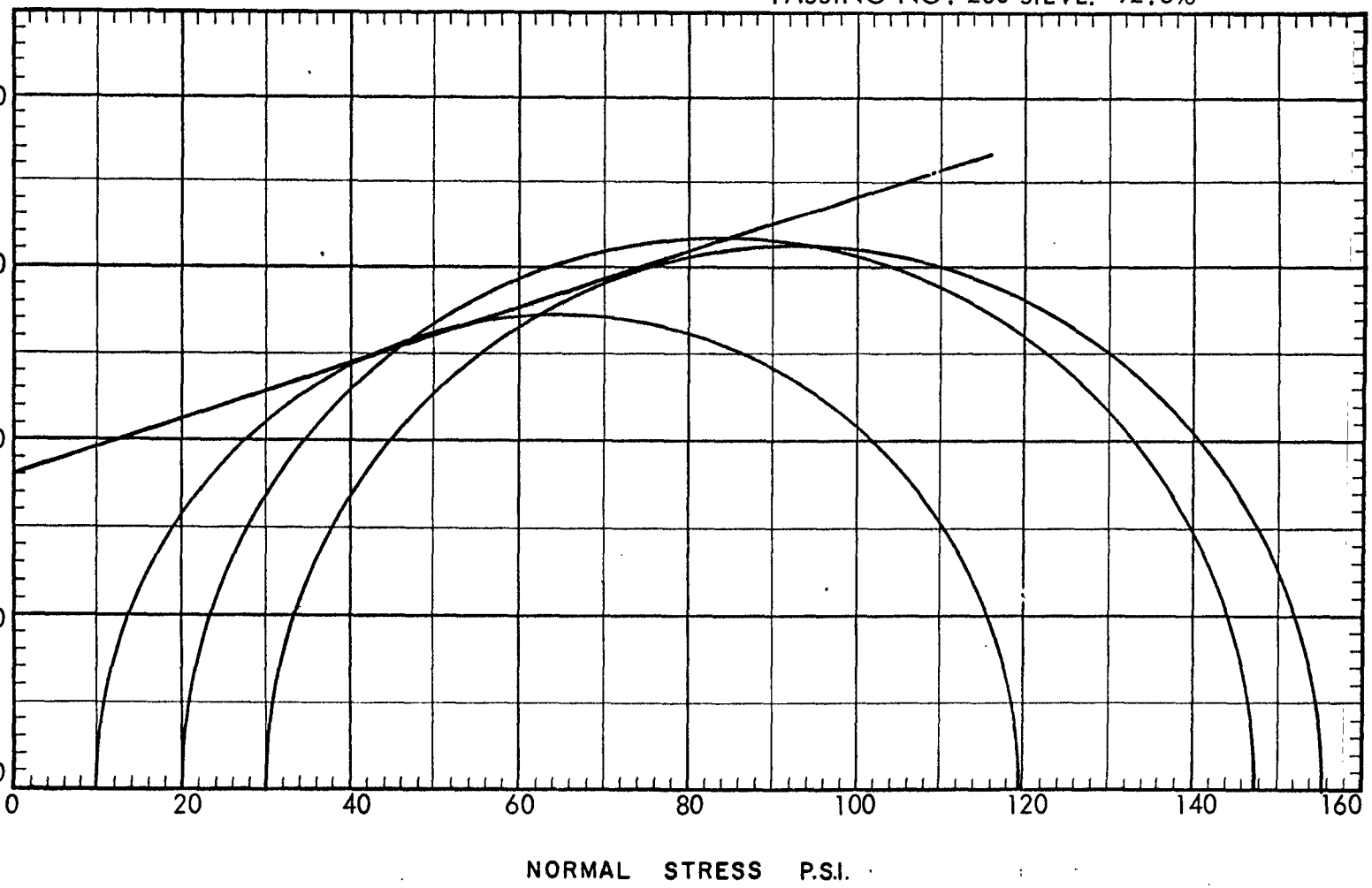
PLATE 69

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-15 DEPTH: 39.0 - 39.7'
DESCRIPTION: Gray sandy silt

ANGLE OF SHEAR: 17.2°
COHESION: c = 36.0 psi = 2.59 tsf

MOISTURE CONTENT:
BEFORE: 29.6 %, AFTER: 31.0 %
UNIT DRY WT: 91.5 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:
PASSING NO. 200 SIEVE: 92.8%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

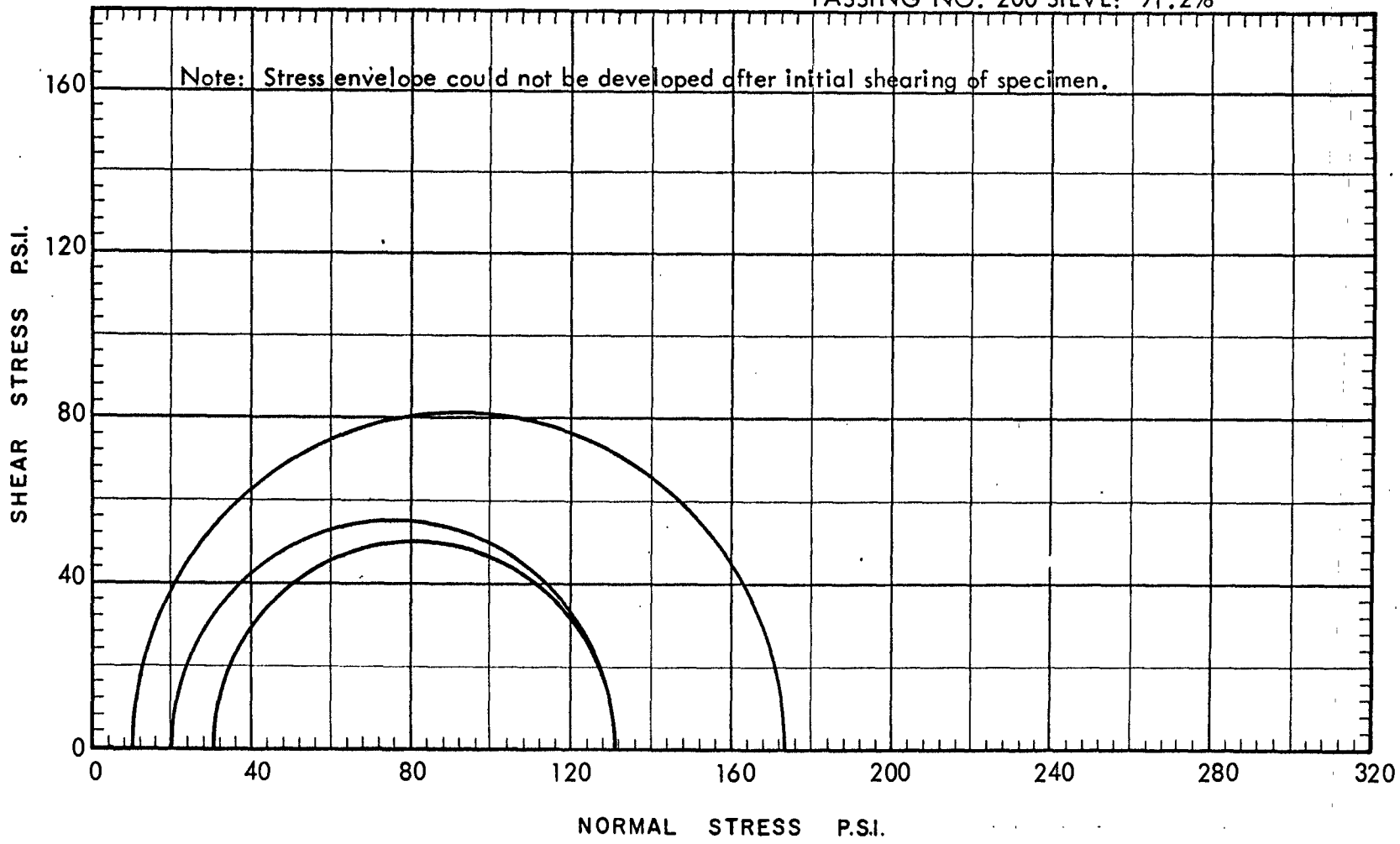
PLATE 70

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-16 DEPTH: 33.0-33.8'
DESCRIPTION: Brown sandy clay

ANGLE OF SHEAR:
COHESION: c =

MOISTURE CONTENT:
BEFORE: 26.7 %, AFTER: 29.6 %
UNIT DRY WT: 92.6 LBS./CU.FT.
LIQUID LIMIT: 68.2
PLASTICITY INDEX: 42.9
PASSING NO. 200 SIEVE: 91.2%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

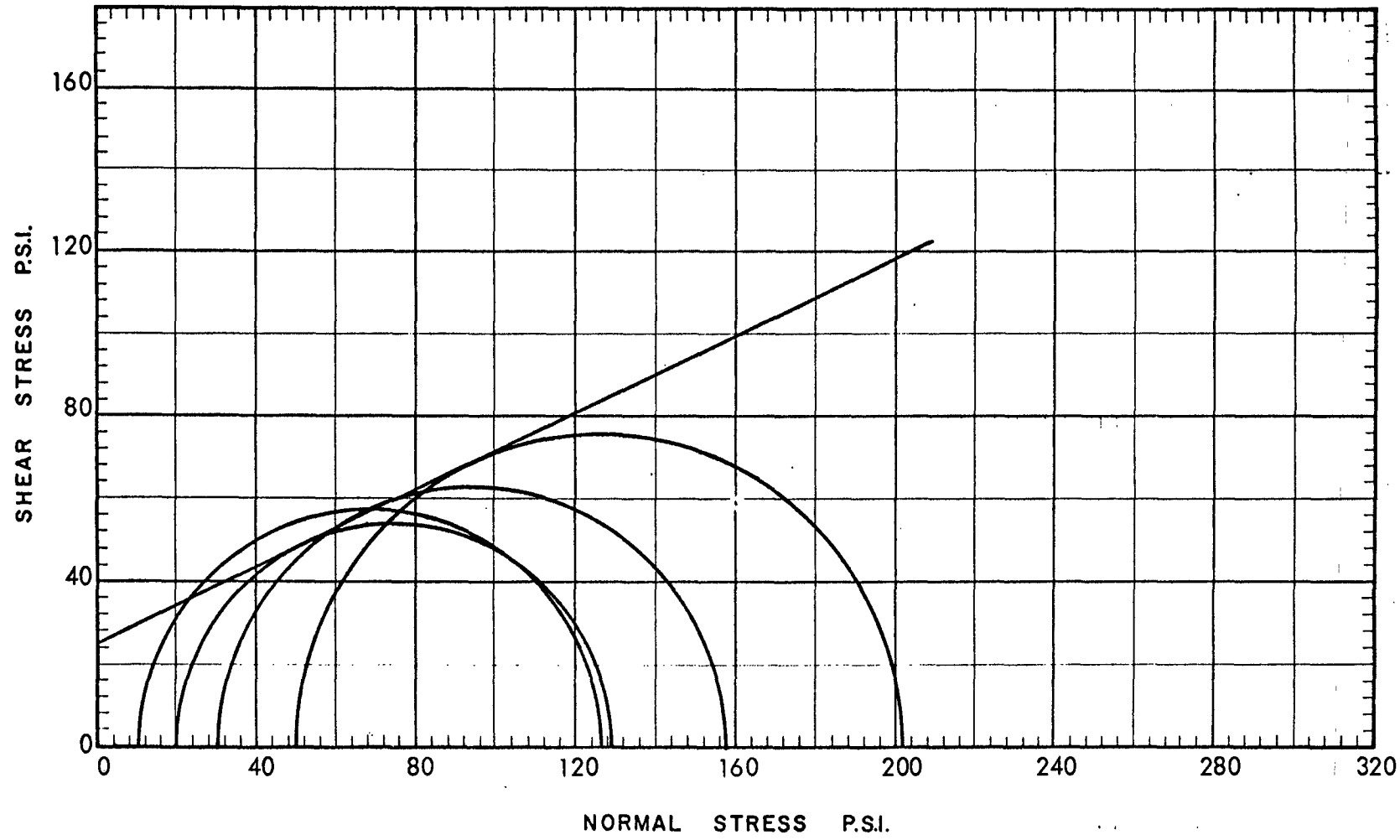
PLATE 71

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-16 DEPTH: 43.0-43.8'
DESCRIPTION: Gray silty fine sand

ANGLE OF SHEAR: 22.8°
COHESION: c = 29.0 psi = 2.09 tsf

MOISTURE CONTENT:
BEFORE: 27.7 %, AFTER: 26.7 %
UNIT DRY WT: 97.3 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

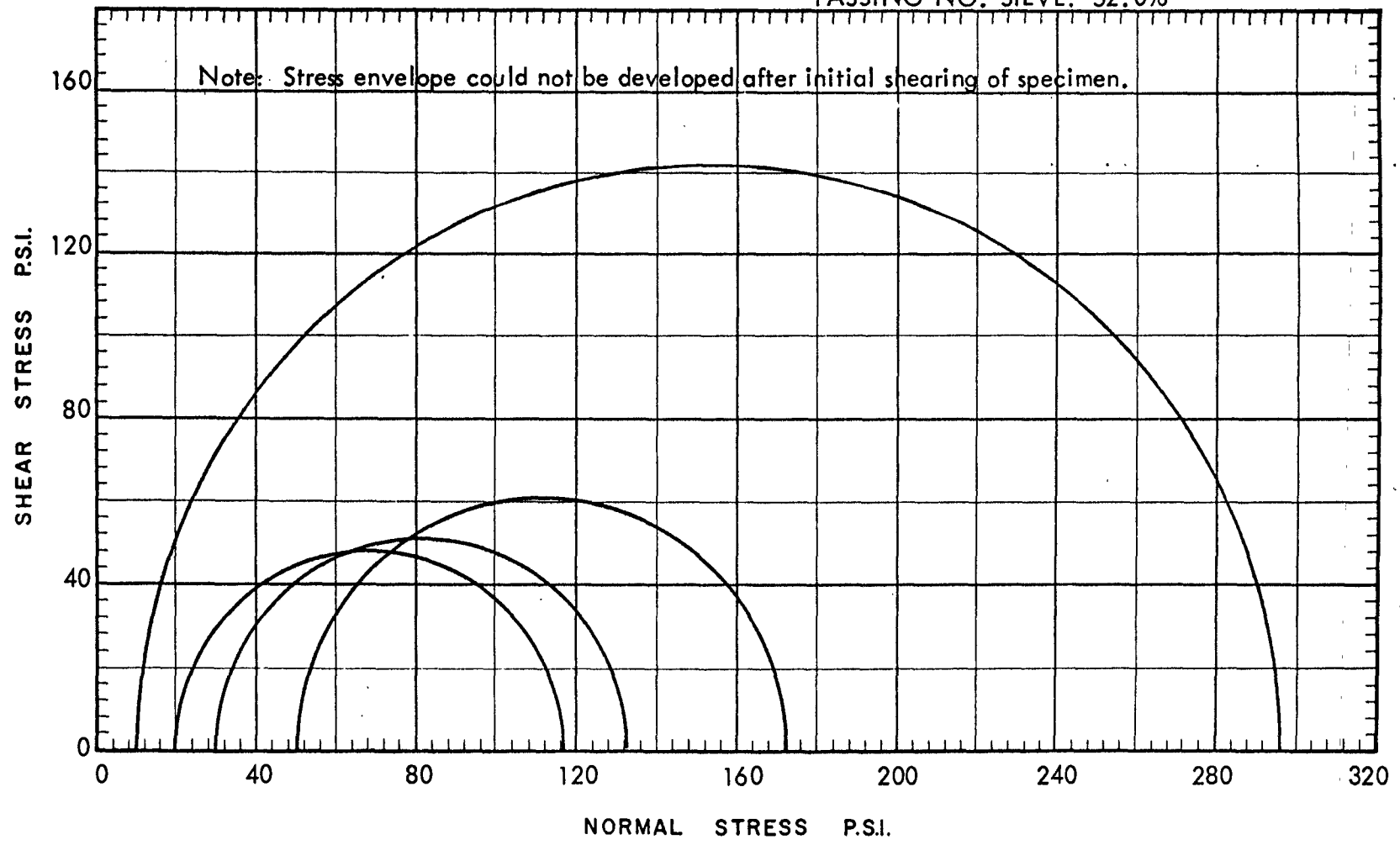
PLATE 72

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-16 DEPTH: 48.0-48.5'
DESCRIPTION: Gray silty fine sand

ANGLE OF SHEAR:
COHESION: c =

MOISTURE CONTENT:
BEFORE: 24.8 %, AFTER: %
UNIT DRY WT: 99.5 LBS./CU.FT.
LIQUID LIMIT: 64.4
PLASTICITY INDEX: 44.8
PASSING NO. SIEVE: 52.0%



UNCONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

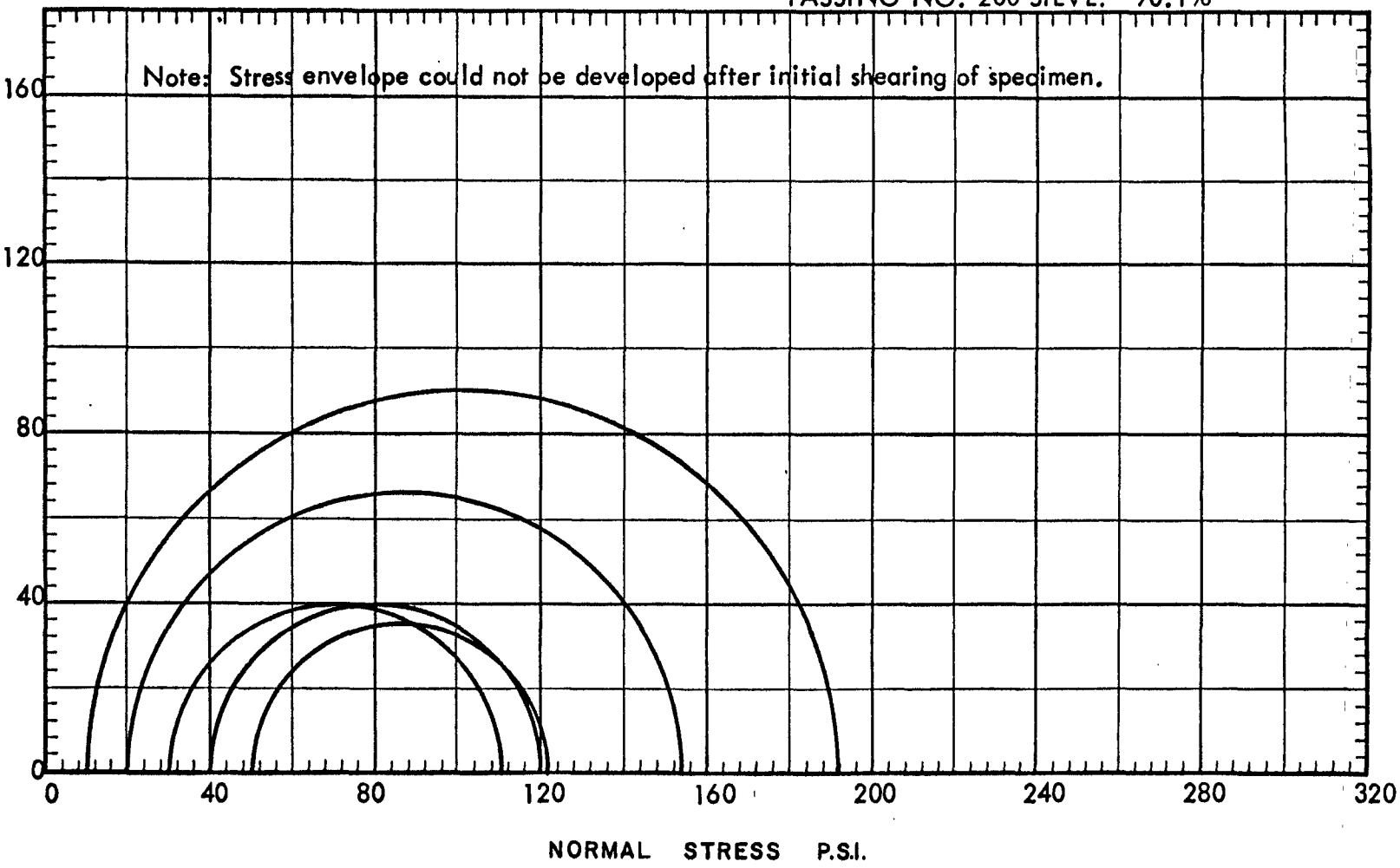
PLATE 73

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-16 DEPTH: 63.0-63.8'
DESCRIPTION: Gray sandy caly

ANGLE OF SHEAR:
COHESION: c =

MOISTURE CONTENT:
BEFORE: 29.3 %, AFTER: %
UNIT DRY WT: 92.3 LBS./CU.FT.
LIQUID LIMIT: 66.8
PLASTICITY INDEX: 44.4
PASSING NO. 200 SIEVE: 90.1%



UNCONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

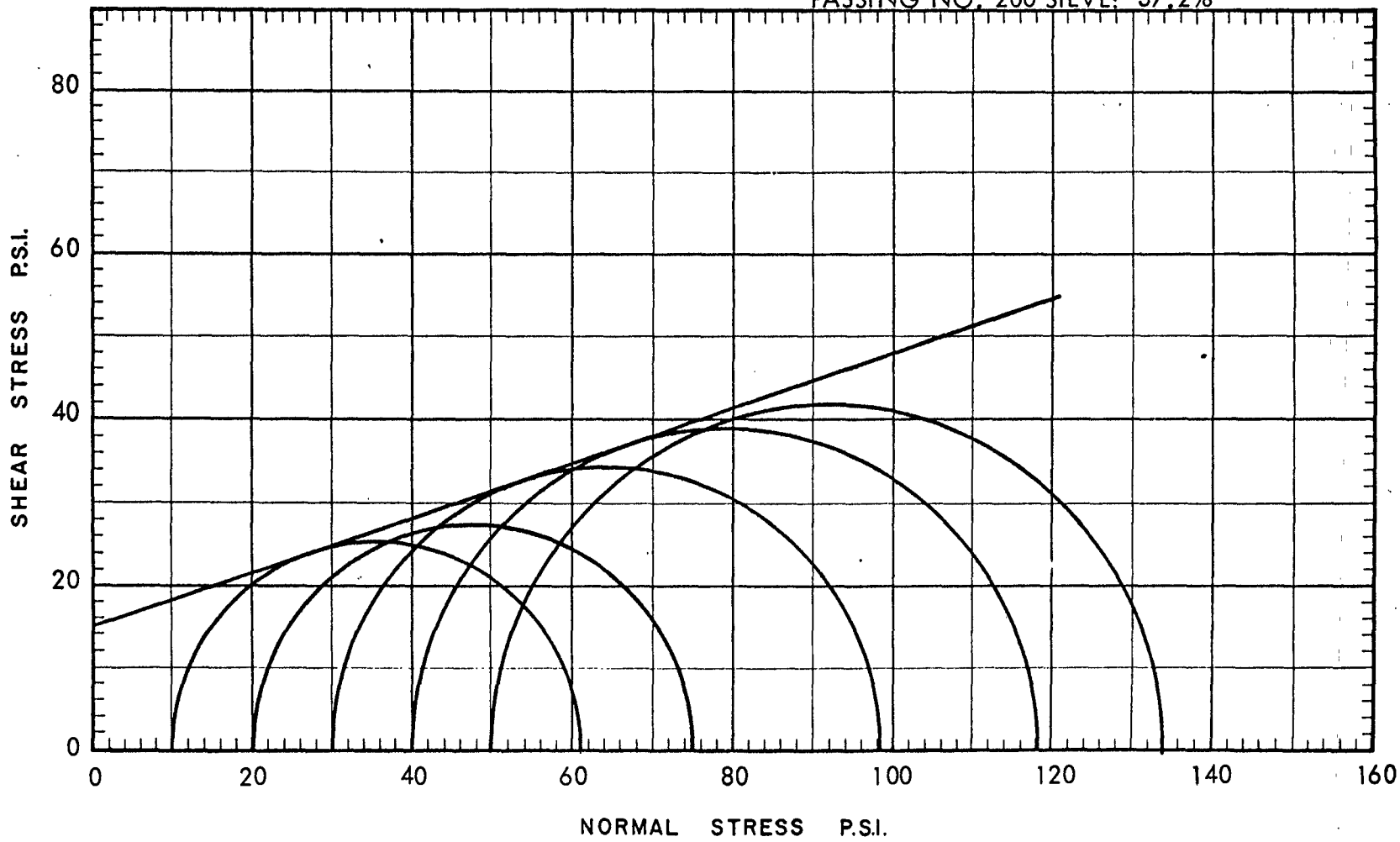
PLATE 74

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-17 DEPTH: 49.4-50.1'
DESCRIPTION: Gray silty fine sand

ANGLE OF SHEAR: 17.6°
COHESION: c = 15.0 psi - 1.08 tsf

MOISTURE CONTENT:
BEFORE: 25.2 %, AFTER: %
UNIT DRY WT: 97.7 LBS./CU.FT.
LIQUID LIMIT: 29.9
PLASTICITY INDEX: 6.9
PASSING NO. 200 SIEVE: 37.2%



UNCONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

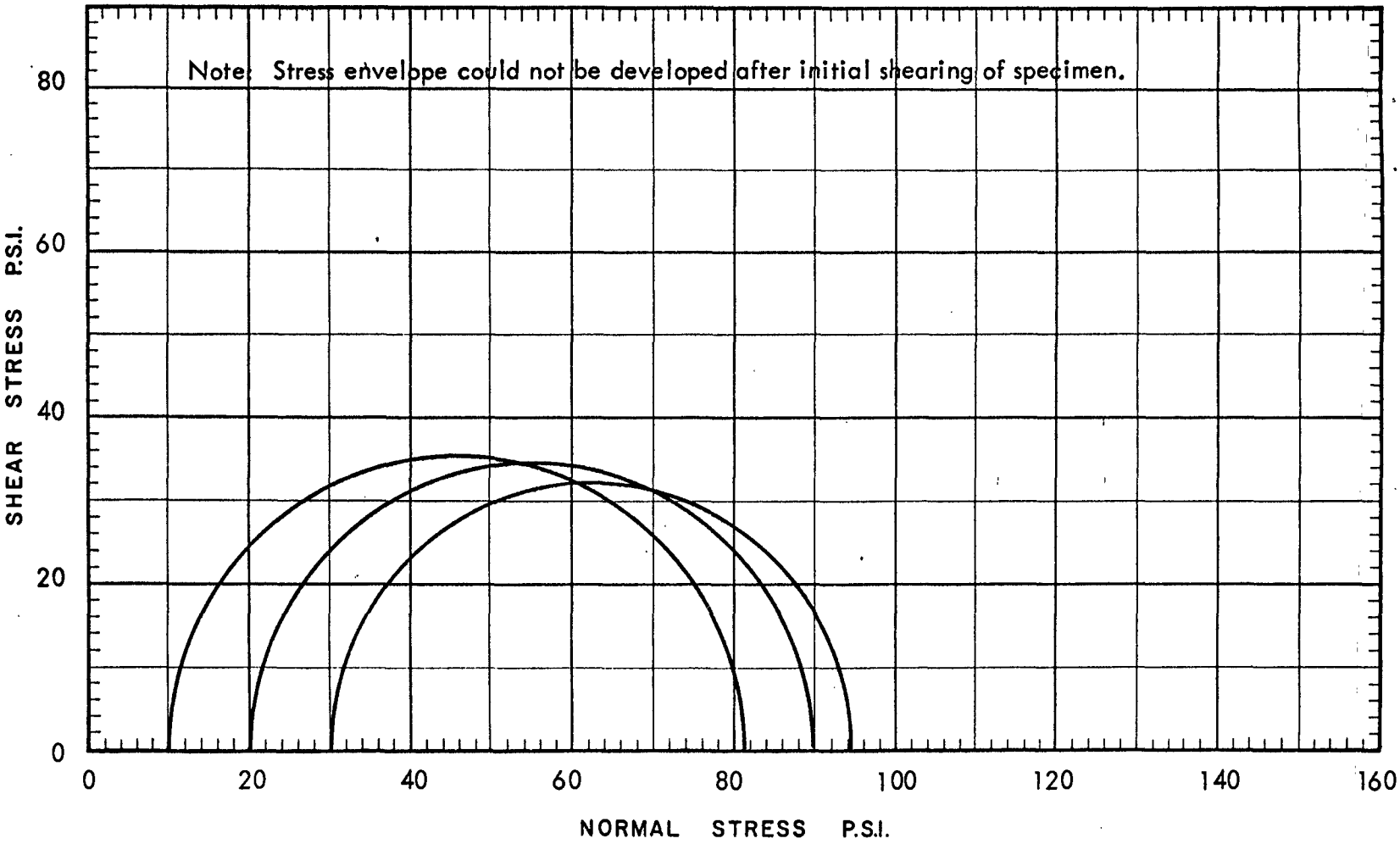
PLATE 75

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-17 DEPTH: 53.6 - 54.3'
DESCRIPTION: Gray silty fine sand

ANGLE OF SHEAR:
COHESION: c =

MOISTURE CONTENT:
BEFORE: 29.0 %, AFTER: 27.3 %
UNIT DRY WT: 95.3 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

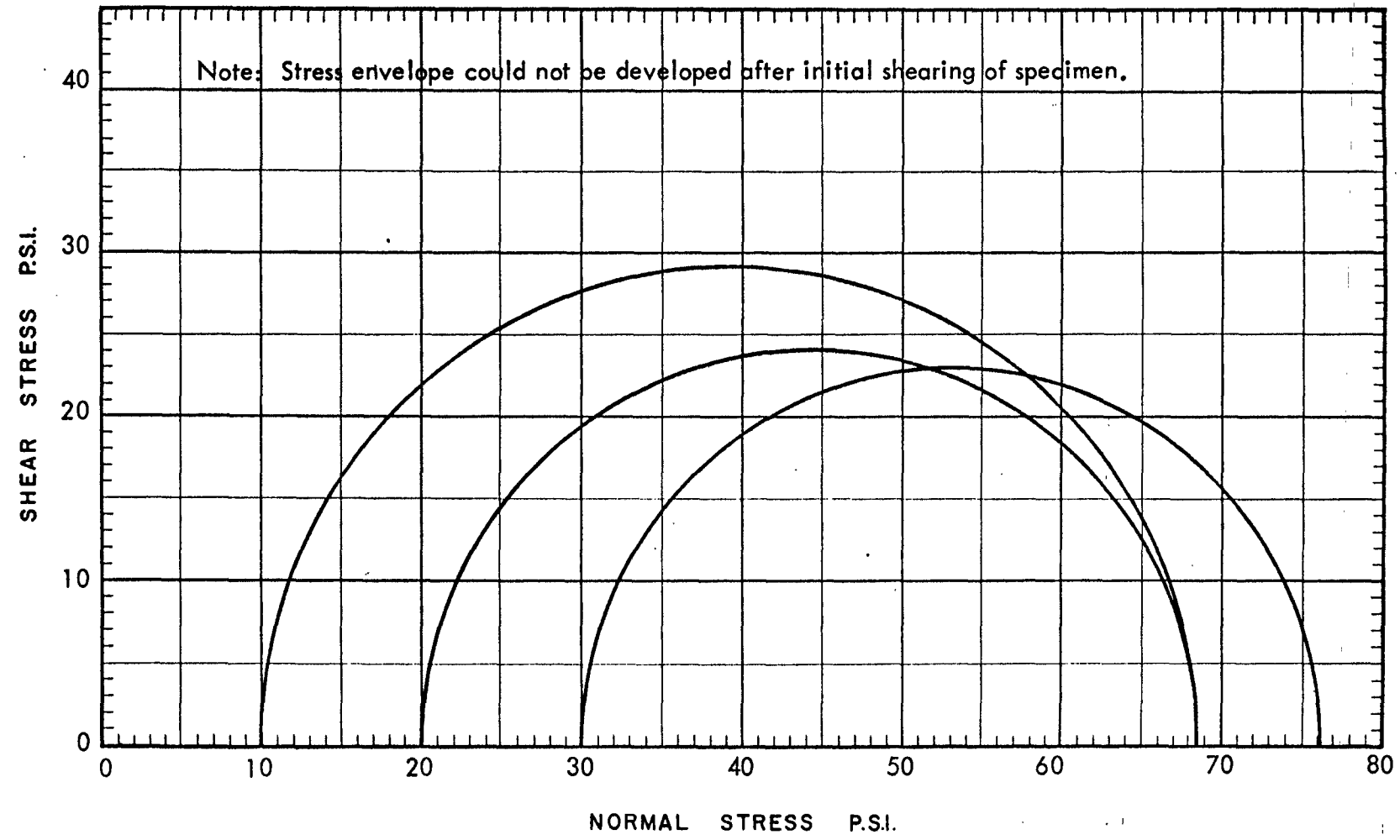
PLATE 76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-18 DEPTH: 53.0-53.5'
DESCRIPTION: Gray clay

ANGLE OF SHEAR:
COHESION: c =

MOISTURE CONTENT:
BEFORE: 31.5%, AFTER: %
UNIT DRY WT: 90.3 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:



UNCONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

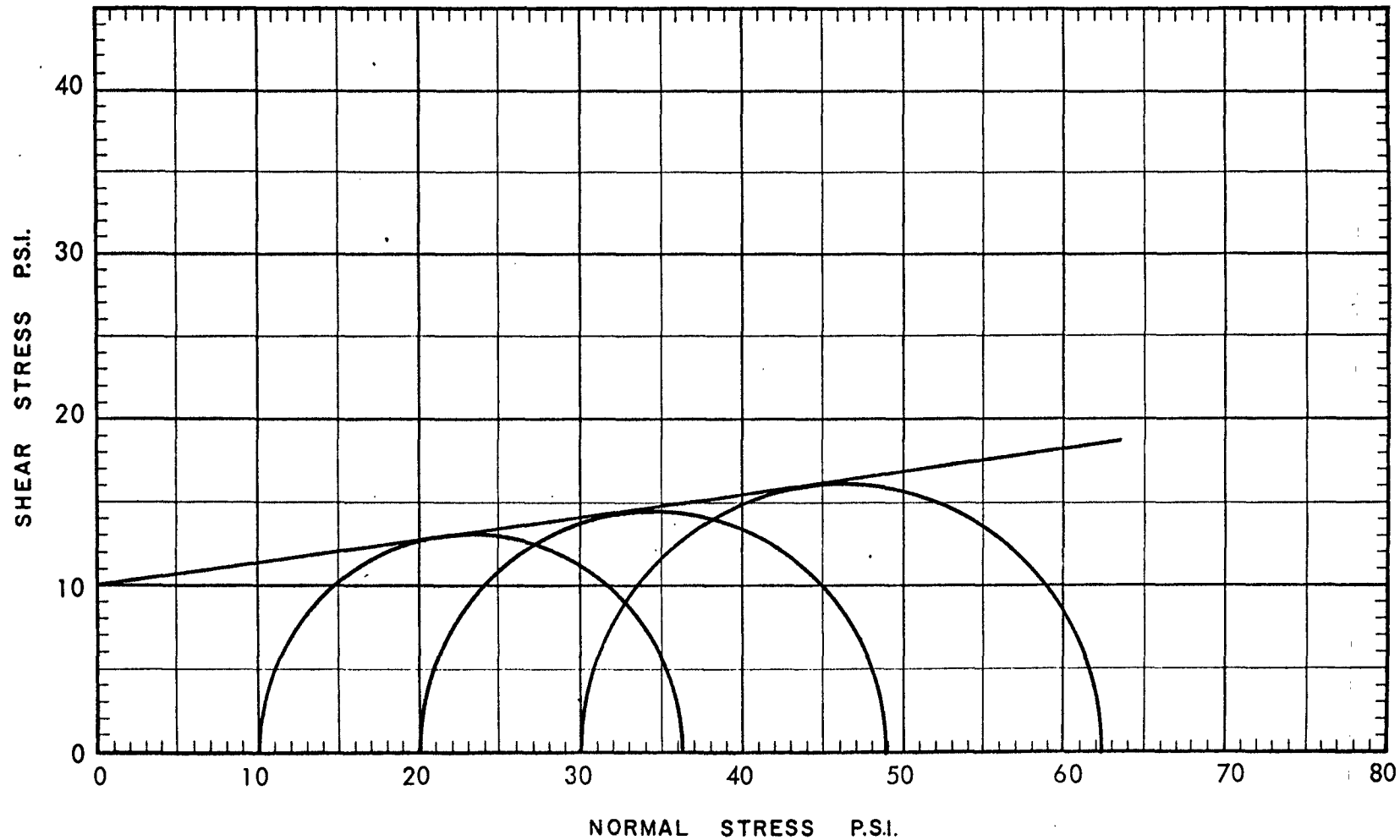
PLATE 77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-18 DEPTH: 63.0-63.4'
DESCRIPTION: Gray clay

ANGLE OF SHEAR: 7.5°
COHESION: c = 10.0 psi = 0.72 tsf

MOISTURE CONTENT:
BEFORE: 34.8%, AFTER: 36.0%
UNIT DRY WT: 87.7 LBS./CU.FT.
LIQUID LIMIT: 92.0
PLASTICITY INDEX: 67.4



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

PLATE 78

APPENDIX A

LOG OF BORING NO. B-1
SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 316 ±	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose tan sandy silt (ML)							
			Hard tannish-gray clay, jointed w/numerous silty sand inclusions (CH)							
5			Very stiff light tan clay -hard (CH)			62	12	35		92
			Hard brown clay -sand seam at 8.0-8.4' (CH)							
10			Hard light gray clay, w/ numerous clay laminations and iron staining					32		95
15			-w/occasional sand laminations and inclusions			64				
20			-w/numerous sand laminations and inclusions (CH)							
25			Hard gray clay, w/numerous silt and sand laminations -sand seam at 23.6-23.9'			66	32	33		93
30			(CH)	50/5.0" seat						
35			Very dense gray silty sand (SM)							
40			Very stiff gray clay, w/ occasional sand laminations (CH)							
			Very dense gray silty fine sand, slightly indurated (SM)							
45			Hard gray sandy clay, w/occasional silty fine sand laminations and inclusions		50	42	23			
50			-silty sand seam at 48.5-48.9'							

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CL)						
55			Hard gray clay, w/numerous silt laminations		79	28	32		91
			-silt seam						
60									
			-carbonaceous seam						
65									
70					75	31	31		91
			(CH)						
75			Hard green and gray clay, w/numerous silt laminations						
			-very stiff brown at 79.0-80.0'						
80					80	29	36		
85									
90			-w/slickensides						
95			-w/occasional silty sand seams				29		
100									

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
105								29		
110			-w/bentonitic pockets and occasional silty fine sand laminations					33		
115										
120						85	18	29		9
125			-w/numerous silty fine sand laminations					25		
130			-w/silty fine sand laminations at 129.2-129.3' (CH)					30		
135			Hard gray clay, w/ numerous silt laminations (CH)		96	51	19	27		
140			Hard gray clay	70				29		
145			-w/occasional siltstone seam (CH)							
150			Very dense gray silty fine sand, w/occasional clay laminations and clay balls							

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-3

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155			(SM)	50/5" seat	46					
160			Hard gray sandy clay, w/numerous silt laminations -w/lignitic clay pockets							
165			(CL)							
170			Very dense gray silty fine sand, w/numerous clay laminations		49					
175										
180			-w/clay pockets	50/4.5" seat	70					
185			(SM)							
190			Hard gray clay, w/ numerous silty sand laminations and pockets							
195										
200			(CL)			49	18	29		

COMPLETION DEPTH: 200.0'
DATE: 5/20/76

DEPTH TO WATER: 26.0'
DATE: 5/21/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-4

LOG OF BORING NO. B-2

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: [illegible]	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose light tan silty fine sand (SM)		63	54	24	22		97
5			Very stiff light tan clay -w/medium to coarse sand seam at 0.5' -w/vertical fissures -w/lignitic material seam at 5.5'		86	51	32	29		92
10				49						
15			(CH)		94	56	30	38		89
20			Hard dark tan and brown clay (CH)	50/5"		79	31	31		
25			Hard greenish-gray clay, shaley	seat						
30			-w/numerous sand and thin sandstone laminations -w/45° slickenside (CH)			83	34	33		87
35			Very dense greenish-gray fine sand (SM)	50/4"						
40			Hard greenish-gray clay, w/occasional sand laminations	seat						
45			-w/occasional to numerous sand laminations and slight slickensides			44	23	28		87
50										

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-5

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-w/clayey fine sand pockets		69	34			
60			-w/occasional to numerous sandstone laminations below 58.5'						
65					55	23	27		97
70									
75							34		90
80			-w/numerous sandy silt inclusions						
85					77	30	32		89
90			-w/occasional sandy silt laminations						
95					86	29	27		99
100			-slightly slickensided						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-6

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105			-slightly slickensided -w/occasional sandy silt laminations		60	21	26		95
110			-w/numerous sandy silt and silty fine sand inclusions						
115					78	25	27		97
120			-w/bentonitic clay inclusions at 119.5 - 119.9' -w/numerous sandy silt inclusions and slight slickensides						
125									
130					80	23	28		96
135			-w/numerous silty fine sand laminations and inclusions below 134.0'						
140			-slickensided -siltstone seam at 140.3 - 140.5'		58	19	30		94
145			-fractured						
150			-slightly slickensided						

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155			(CH)							
160			Very dense greenish-gray silty fine sand -w/siltstone laminations at 158.5' -w/occasional to numerous clay laminations		50			26		97
165										
170			-siltstone laminations	50/5.5" seat	67					
175			(SM)							
180			Hard brown clay, slickensided -w/numerous thin silty fine sand laminations			43	21	26		91
185			(CL)							
190			Very dense gray silty fine sand		40			21		105
195			(SM)							
200			-w/occasional clay laminations	50/5" seat	56					

COMPLETION DEPTH: 199.0'
DATE: 5/11/76

DEPTH TO WATER: 21.5'
DATE: 5/12/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-8

LOG OF BORING NO. B-3

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 287 ±						
			Loose tan silty fine sand (SM)						
			Very stiff tan sandy clay (CL)	59			14		
5			Hard gray clay, w/occasional sand inclusions (CH)		52	26	26		
10			Hard gray clay, w/numerous clay and silt laminations and iron stains -very stiff		64	29	31		88
15			-w/numerous sand inclusions		46	17	28		94
20			(CH)	80					
			Dense tan silty fine sand, w/numerous clay laminations (SM)				34		85
25									
30			Hard light green and gray clay (CH)		72	28	31		88
35			Hard gray clay, w/numerous silt laminations		69	33	35		84
40					58	29	30		90
45			-w/sandy clay seams at 44.4 - 44.7'						
50			-slickensided						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-9

LOG OF BORING NO. B-3 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
55					75	32	33		88
60			-slightly slickensided -w/occasional thin silt laminations						
65			-w/fractured siltstone inclusions				14		
70			-slickensided						
75			-slightly slickensided				27		
80			-w/silty fine sand seam at 79.4 - 79.6 '						
85					79	26	32		
90									
95			-w/bentonitic seam at 93.8-94.0'				36		
100									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-10

LOG OF BORING NO. B-3 (Cont'd.)

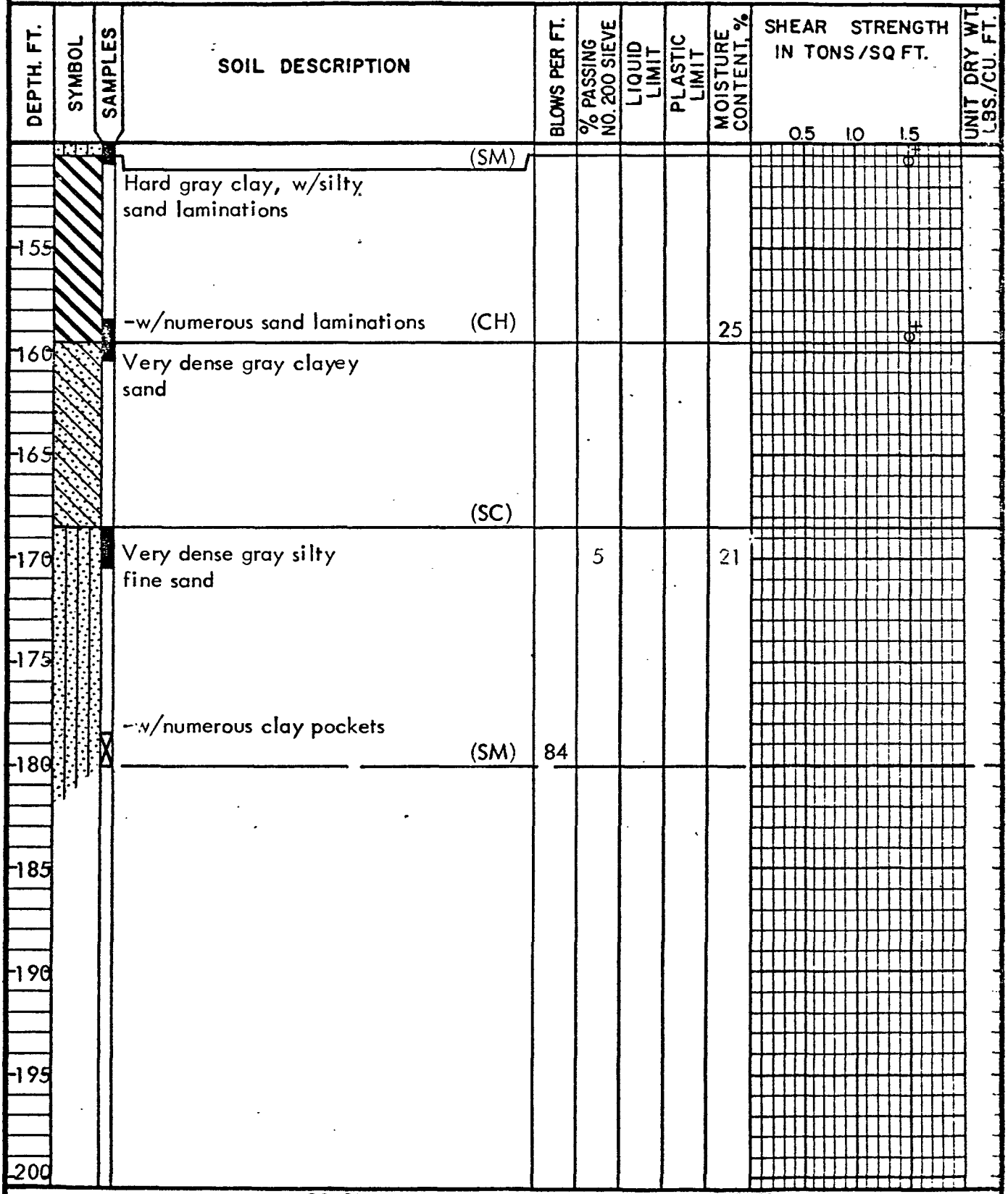
SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CH)							
105			Hard gray clay, w/ occasional sand laminations (CH)							
110			Very dense gray sandy silt -siltstone seam at 110.0-110.2' -w/numerous clay laminations (ML)					25		
115			Hard gray clay -w/clayey sand seams and numerous silt laminations							
120										
125			(CH)							
130			Very dense gray silty fine sand, w/occasional clay laminations	50/4" seat	49			28		
135										
140										
145			-w/numerous clay seams and occasional lignitic inclusions		48			30		
150										

(Continued)

LOG OF BORING NO. B-3 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS



COMPLETION DEPTH: 180.0'
DATE: 5/17/76

DEPTH TO WATER: 15.0'
DATE: 5/18/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-12

LOG OF BORING NO. B-8

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

ELEVATION: 305+

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose tan silty fine sand (SM)							
5			Very stiff gray sandy clay, w/numerous clay laminations (CL)	100						
			Hard gray fine grained siliceous sandstone w/ numerous iron stains and fractures	99						
10				100						
			Very stiff tan sandy clay (CL)							
15			Moderately hard dark gray and reddish-tan fine-grained sandstone, w/numerous iron stains and shale inclusions -high angle fracture at 9.5' -6.0" shale seam at 11.7'		36			23		95
20						70	18	29	(2.+)	94
			Very dense tan clayey fine sand, w/numerous clay laminations (SC)							
25			Hard gray clay, w/numerous silty fine sand laminations (CH)							
30			Hard gray sandy clay -w/numerous sand laminations						6+	
35			(CL)			45	31	31	6+ (3.0)	89
40			Very dense gray sandy silt, w/numerous clay laminations (ML)							
45			Hard gray and brown clay w/numerous silt laminations						6+	
50						56	37	42	(4.+) 6+	74

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55									
60			-lignitic material seam at 59.8' (CH)				29		85
65			Very dense brown sandy silt w/clay-filled fractures (ML)						
			Very dense light gray sandy silt (ML)						
70			Soft black lignitic material, w/ lignitic clay seams (Pt)						
75			Hard gray clay, intensely slickensided at 74.0'		69	27	28		94
80			(CH)						
85			Very dense gray sandy silt (ML)	57	49	39			
90			Hard light gray clay, w/ silt laminations (CH)		65	24	23		102
95			Hard light gray sandy clay, w/numerous clay laminations	35	44	21			
100									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-14

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CL)							
105			Hard gray clay (CH)							
110			Very dense gray silty fine sand, w/occasional clay laminations (SM)	50/5" seat						
115			Hard gray clay							
120										
125						66	22	29		90
130			-w/numerous silt laminations (CH)							
135			Very dense gray silty fine sand, w/occasional clay laminations (SM)	50/3" seat						
140										
145			Very dense gray and brown silt, w/numerous clay laminations (ML)							
			Very dense tannish-brown and gray clayey sand (SC)							
150										

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
155			Soft tan, gray, and brown sandstone							
160			Very dense gray silty fine sand							
165										
				50/2" seat						
170										
175			--clay seam at 179.0 and 179.5' (SM)							
180			Hard gray clay, w/ occasional silty fine sand laminations						6+	
185										
190									6+	
195										
200			(CH)							

COMPLETION DEPTH: 200.0'
DATE: 6/4/76

DEPTH TO WATER: 4.0
DATE: 6/5/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-16

LOG OF BORING NO. B-10

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 280 ±							
			Loose tan silty sand (SM)							
			Stiff tan sandy clay (CL)							
5			Dense tan silty fine sand -w/clayey sand laminations and gravel							
10			-iron stained	85	28	29	22	14		
			-very dense below 8.5'							
15										
20										
					26					
25			(SM)							
			Very stiff tan sandy clay, iron stained	30	c2	44	19	25		
30			(CL)							
35			Very stiff gray sandy clay							
40			-stiff, w/lignitic laminations and sand seams							
45			-hard							
			(CL)							
			Hard black lignitic clay w/ lignitic material laminations (OH)							
50										

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-17

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			Very dense gray silty fine sand -w/occasional lignitic material and clay laminations (SM)						
60			Hard gray clay -w/silt laminations and seams (CH)						
70			Soft black lignitic material (Pt)						
75			Hard dark brown lignitic clay -w/lignitic material laminations (OH)						
80			Hard gray clay (CH)		79	30	24		
85			Very dense gray silt (ML)	59	49	23	33		
90			Soft gray siltstone, w/ numerous sand laminations						
95									
100									

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105			Very dense gray silty fine sand, w/occasional clay laminations	78						
110			(SM)							
115			Hard gray clay, w/silt laminations to 115.5'							
			-brown							
120										
125										
130			-slickensided fracture							
			(CH)							
135			Moderately hard gray sandy silt-stone, w/occasional sand laminations							
140			Very dense gray sandy silt							
			(ML)							
145			Very dense gray silt, w/ occasional sand laminations							
			-numerous clay laminations							
150										

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155									
160			-brown, w/numerous lignite laminations (ML)	43	50	32			
165			Very dense gray silt						
170									
175									
			-w/occasional clay laminations						
180									
185									
190									
195									
			(ML)						
200			Hard gray clay (CH)						

COMPLETION DEPTH: 200.0'
DATE: 6/9/76

DEPTH TO WATER: Caved at 21.5'
DATE: 6/10/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-20

LOG OF BORING NO. B-11

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT LBS./CU. FT.
			ELEVATION: 291 ±								
			Loose tan silty fine sand (SM)								
			Very stiff tan sandy clay (CL)								
5			Soft to moderately hard light gray weathered fine-grained sandstone, w/iron staining and healed fractures	93							
10			Very dense tan silty fine sand, w/occasional silt laminations	7							
15											
20					50/4.25"						
25						6					
			-w/occasional iron stains								
30											
35											
40											
45			(SM) Hard gray clay, w/ numerous silt laminations -lignitic clay seam at 48.6'								
50											

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-21

LOG OF BORING NO. B-11 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CH)			[illegible]	22	[illegible]		
55			Hard gray silty clay (CL)						4+	
60			Hard dark gray sandy clay (CL)	50/4.5" seat	44	37	26	24	4+	
65			Hard dark brown lignitic clay (OH)							
70			Very dense gray silt, w/numerous silty fine sand laminations (ML)							
75			Moderately hard gray claystone, w/numerous silty fine sand laminations							
			Hard gray clay		86	54	27	23		
80									4+	
85			-slightly sandy (CL-CH)						4+	
90			Hard dark brown lignitic clay, slickensided, w/lignitic material seams (CH)						4+	
95			Soft black lignitic material (Pt)							
			Hard gray clay -w/numerous silty fine sand laminations to 100.5'							
100									4+	

(Continued)

LOG OF BORING NO. B-11 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
105			-lignitic material seam at 103.5'						4+	
110			(CH)						4+	
115			Hard gray sandy clay, w/occasional lignitic inclusions						4+	
120			-w/numerous sand laminations (CL)						4+	
125			Very dense gray and green silty fine sand, w/occasional lignitic clay laminations (SM)							
130			Very dense gray sandy silt, w/brown clay laminations (ML)	50/5"						
135			Hard gray sandy clay, w/numerous silty fine sand laminations (CL)						4+	
140			Moderately hard gray siltstone, w/clay laminations							
145			Hard gray clay (CH)						4+	
150			Very dense gray sandy silt							

(Continued)

LOG OF BORING NO. B-11 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

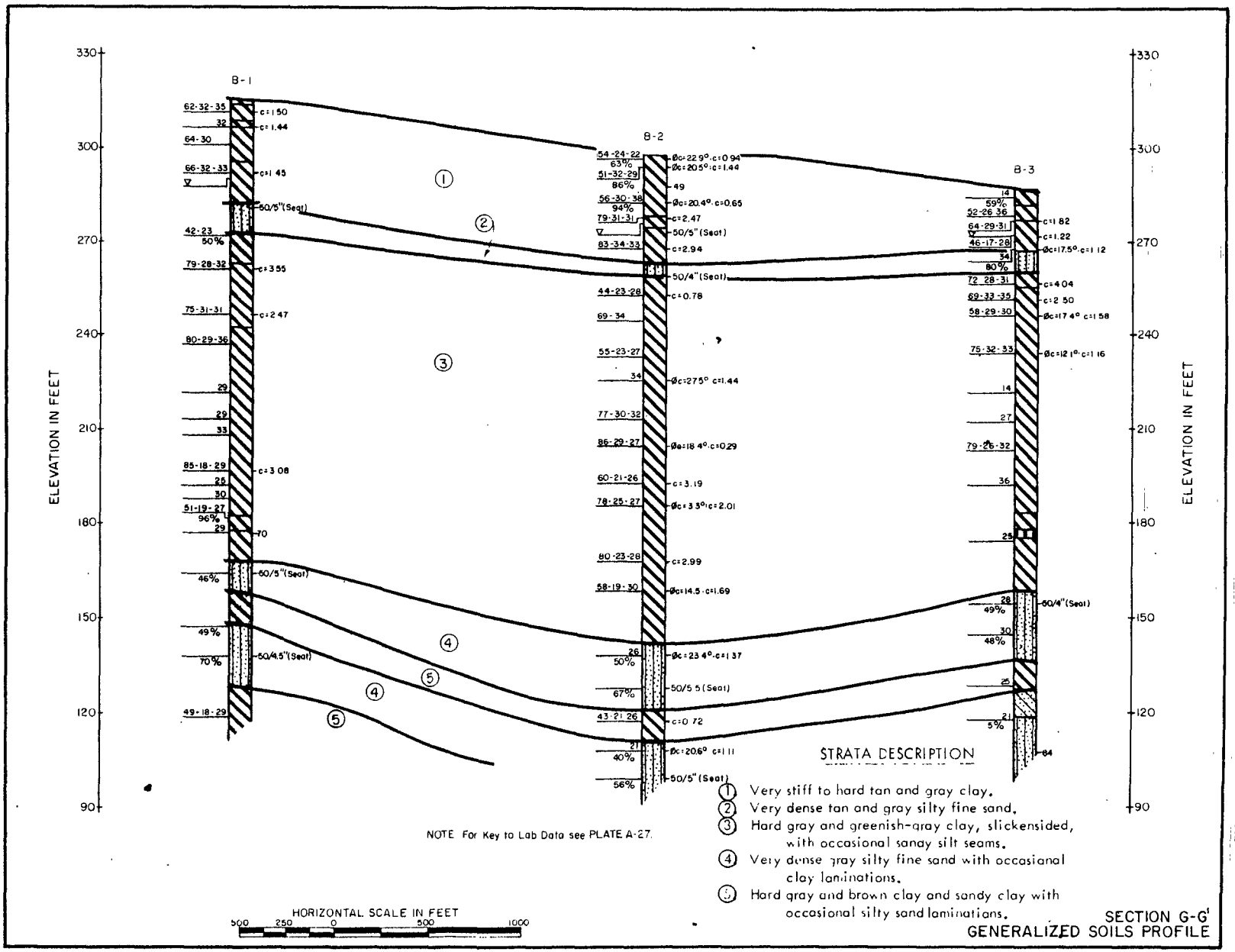
DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			(CL)						
205									
210									
215									
220									
225									
230									
235									
240									
245									
250									

COMPLETION DEPTH: 201.0'
DATE: 6/7/76

DEPTH TO WATER: 34.0'
DATE: 6/8/76

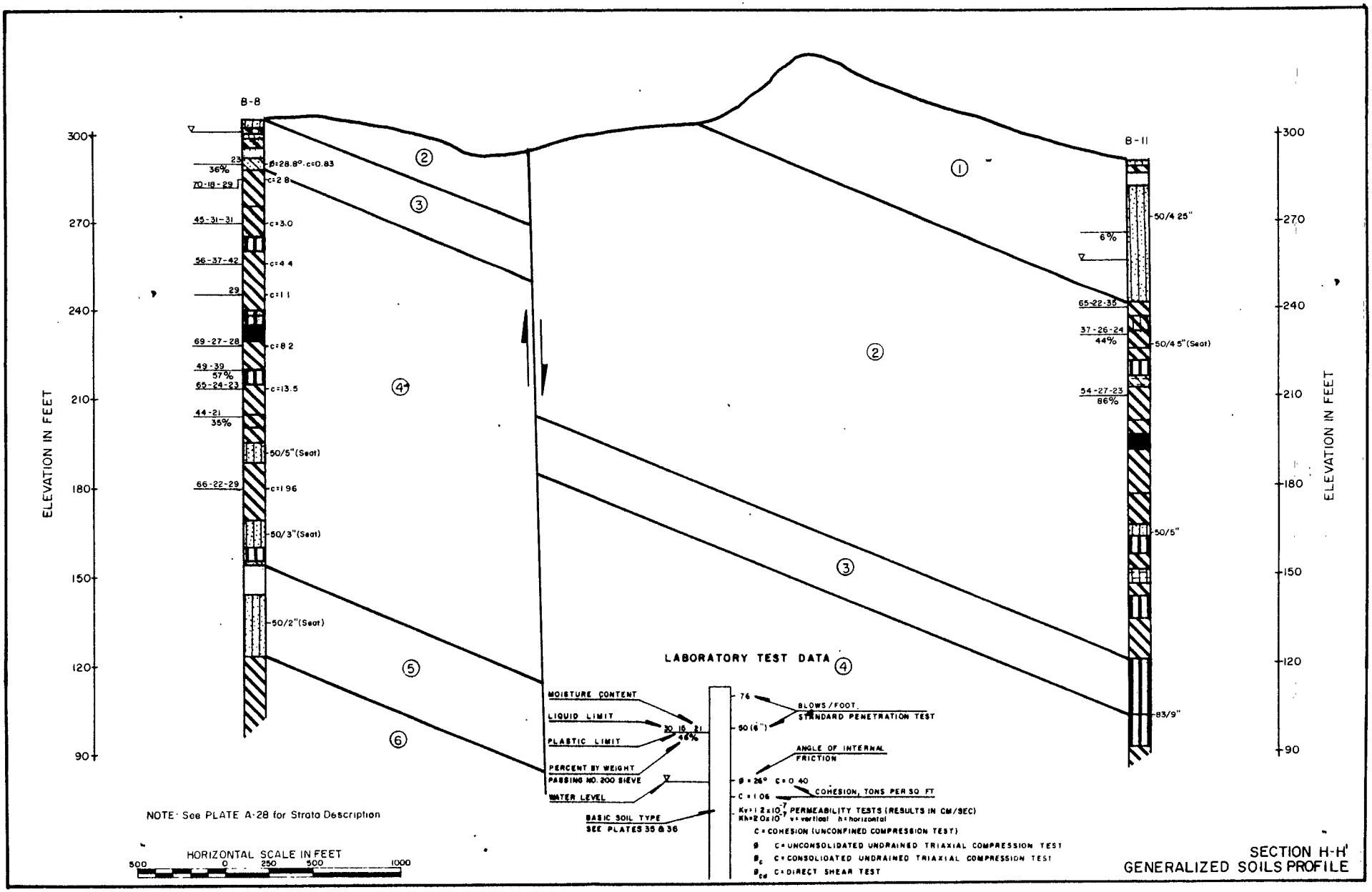
NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-25

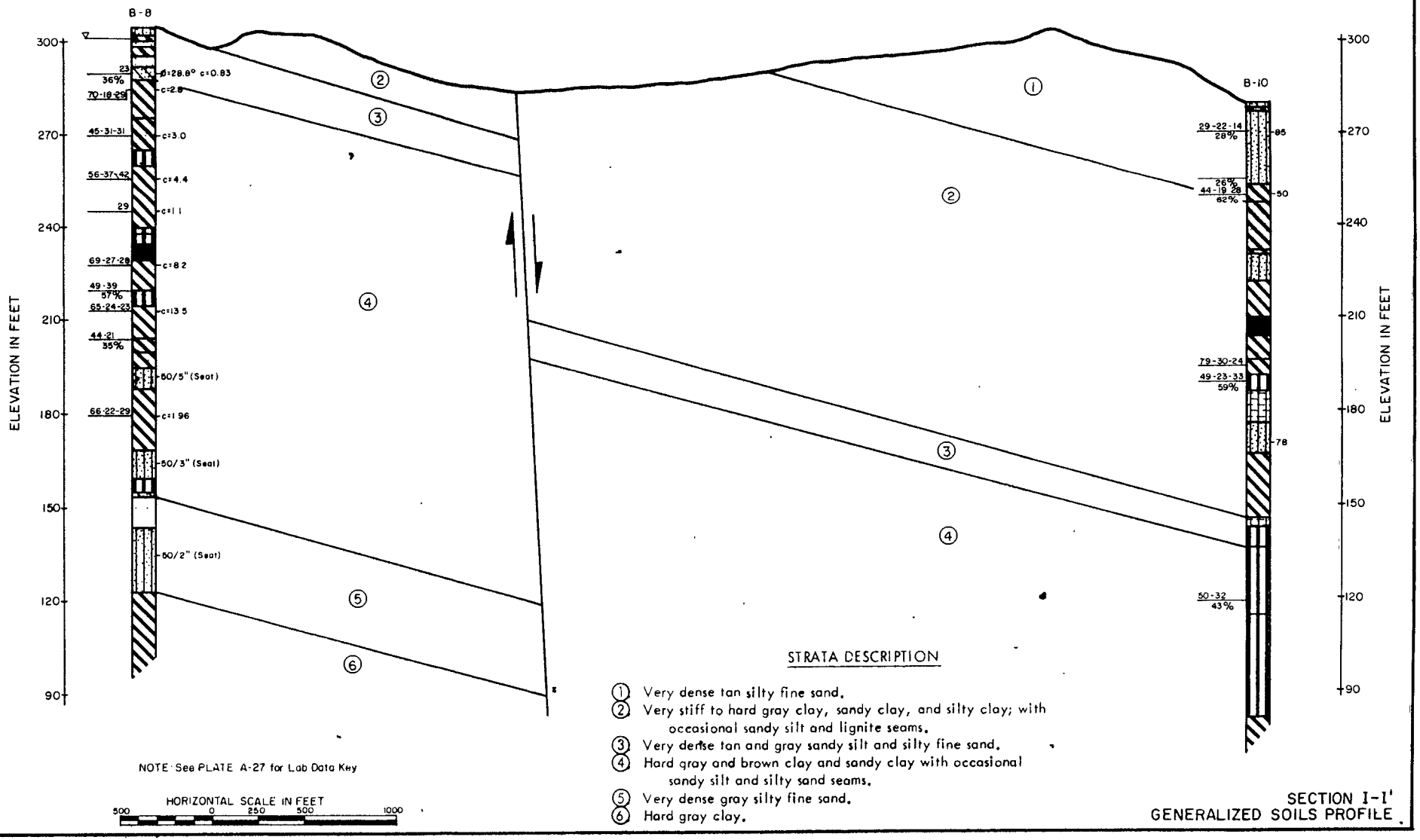


SECTION G-G'
GENERALIZED SOILS PROFILE

PLATE A-26



SECTION H-H'
GENERALIZED SOILS PROFILE



NOTE: See PLATE A-27 for Lab Data Key

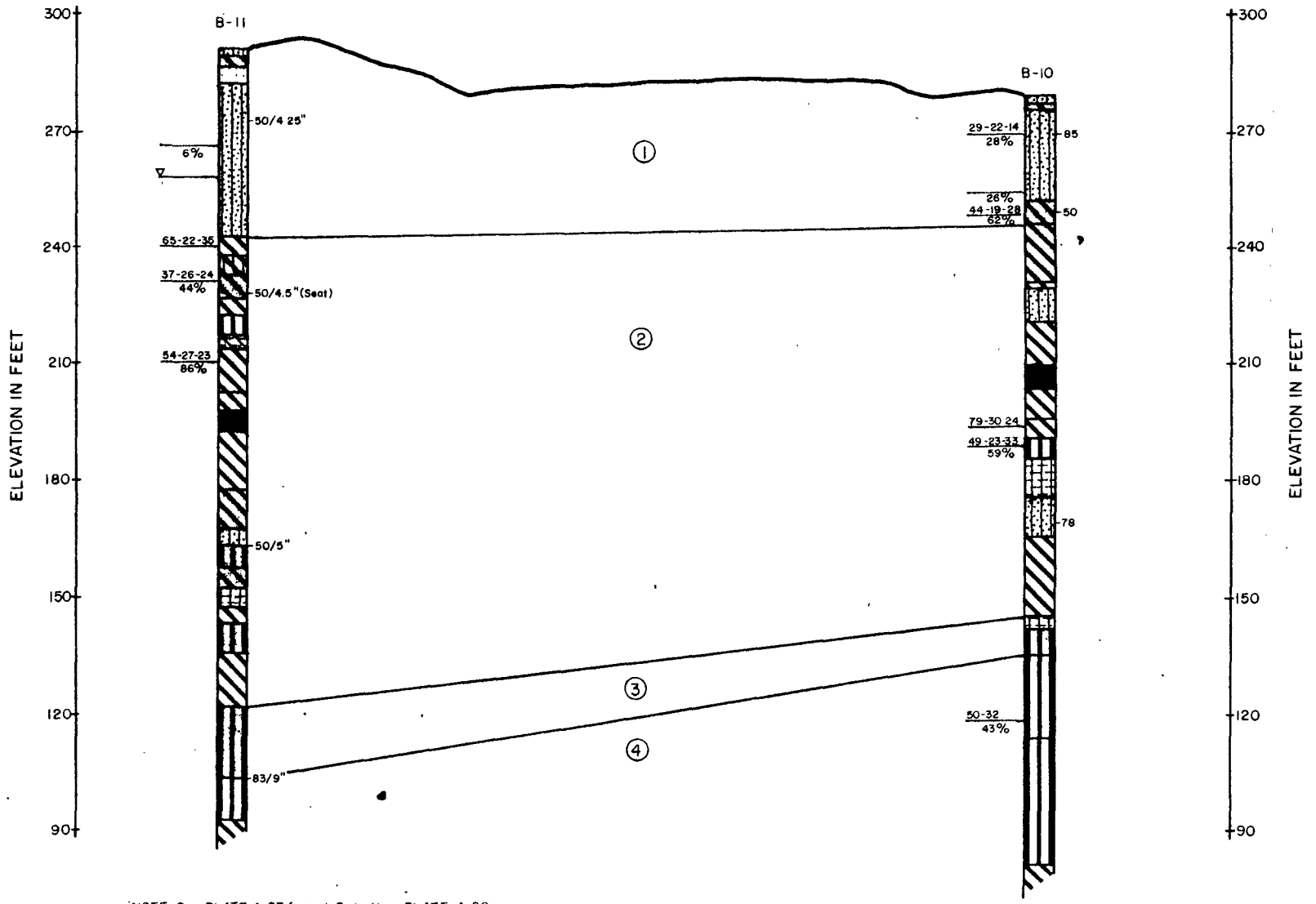
HORIZONTAL SCALE IN FEET
500 0 250 500 1000

STRATA DESCRIPTION

① Very dense tan silty fine sand.
② Very stiff to hard gray clay, sandy clay, and silty clay; with occasional sandy silt and lignite seams.
③ Very dense tan and gray sandy silt and silty fine sand.
④ Hard gray and brown clay and sandy clay with occasional sandy silt and silty sand seams.
⑤ Very dense gray silty fine sand.
⑥ Hard gray clay.

SECTION I-I'
GENERALIZED SOILS PROFILE

PLATE A-28



NOTE: See PLATE A-27 for Lab Data Key, PLATE A-28 for Strata Description.

HORIZONTAL SCALE IN FEET

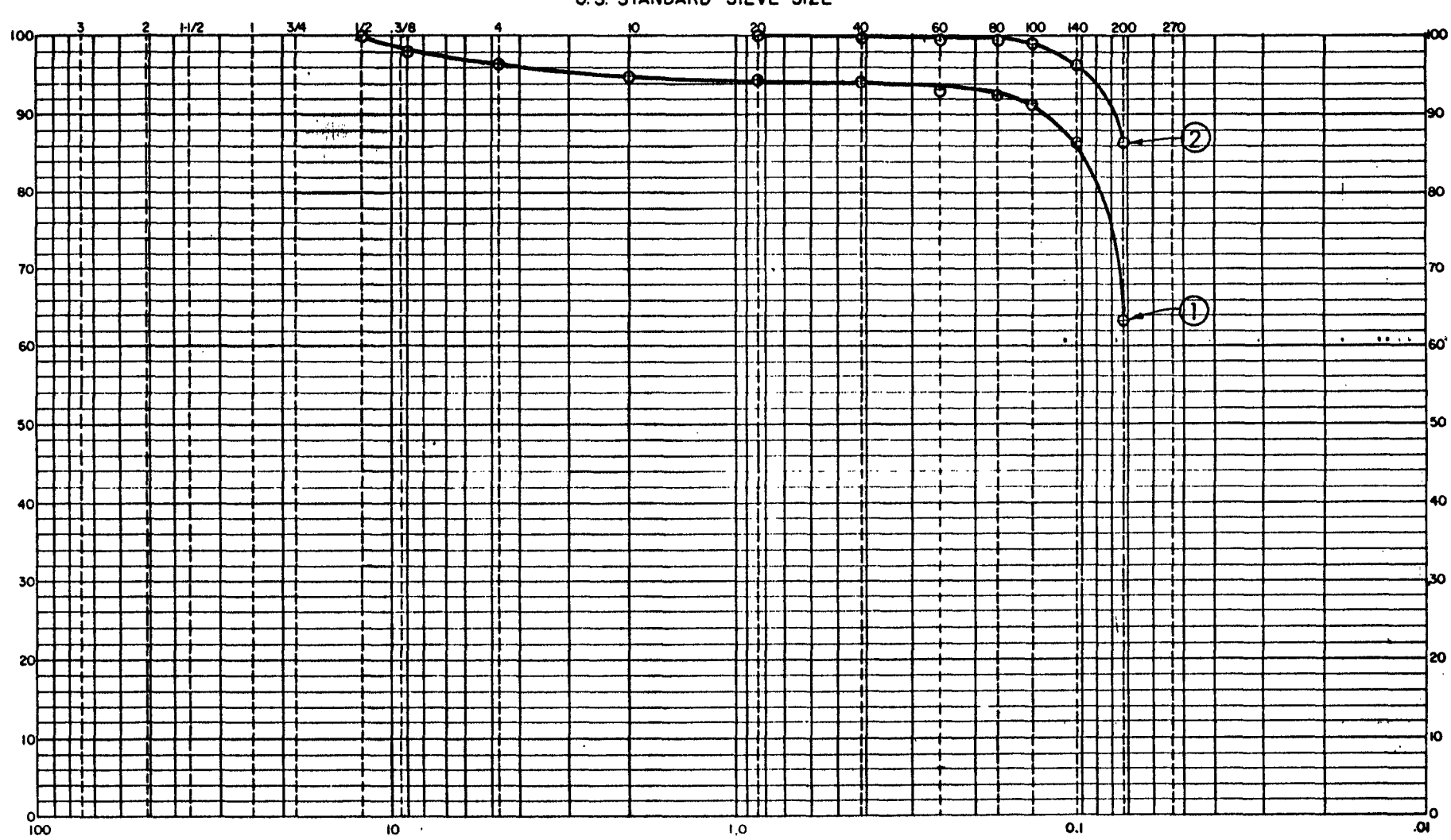
500 0 250 500 1000

SECTION J-J'
GENERALIZED SOILS PROFILE

PLATE A-29

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

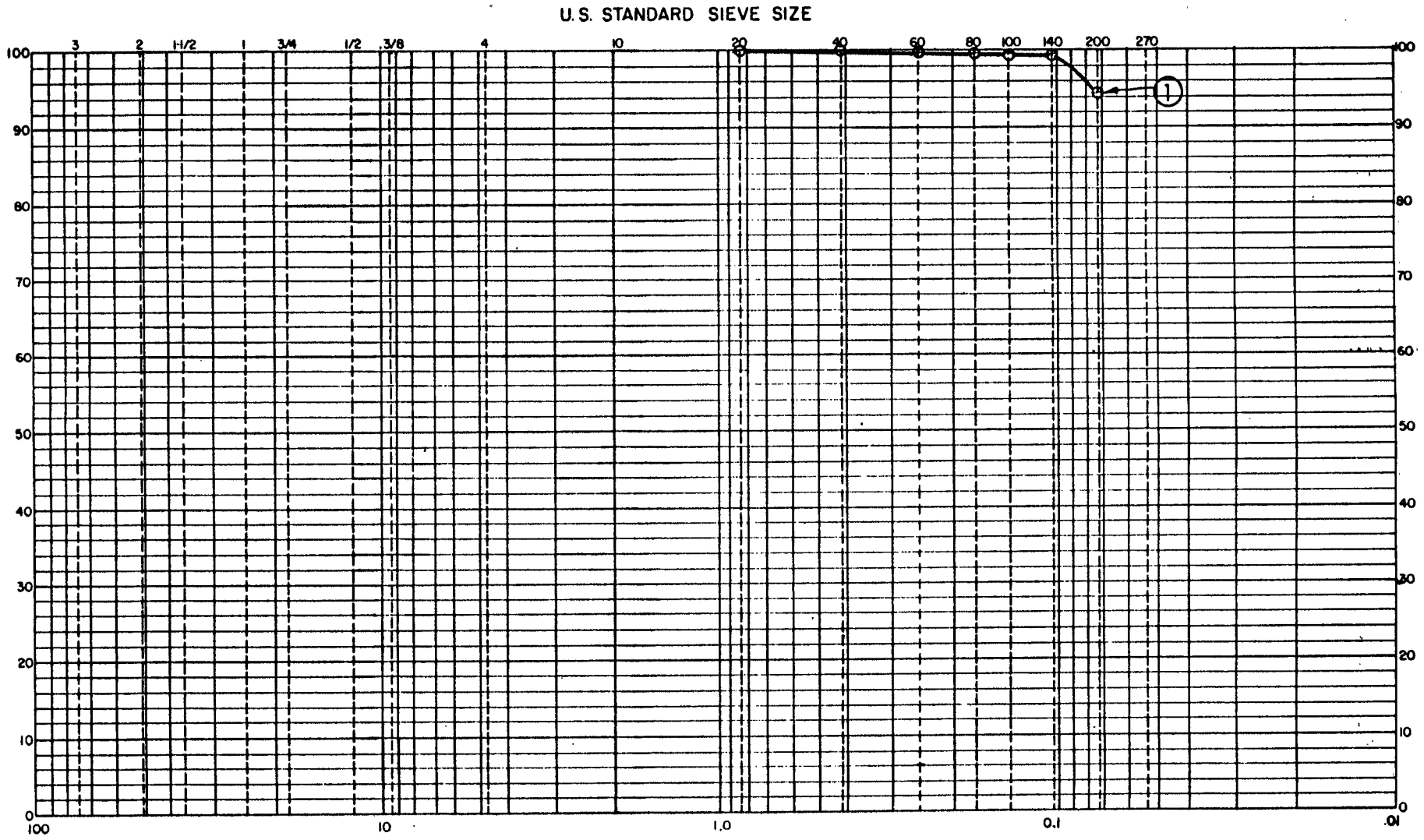
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-2	0.7-1.5'	1
B-2	3.7-4.5'	2

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE A-30

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAIN SIZE IN MILLIMETERS

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

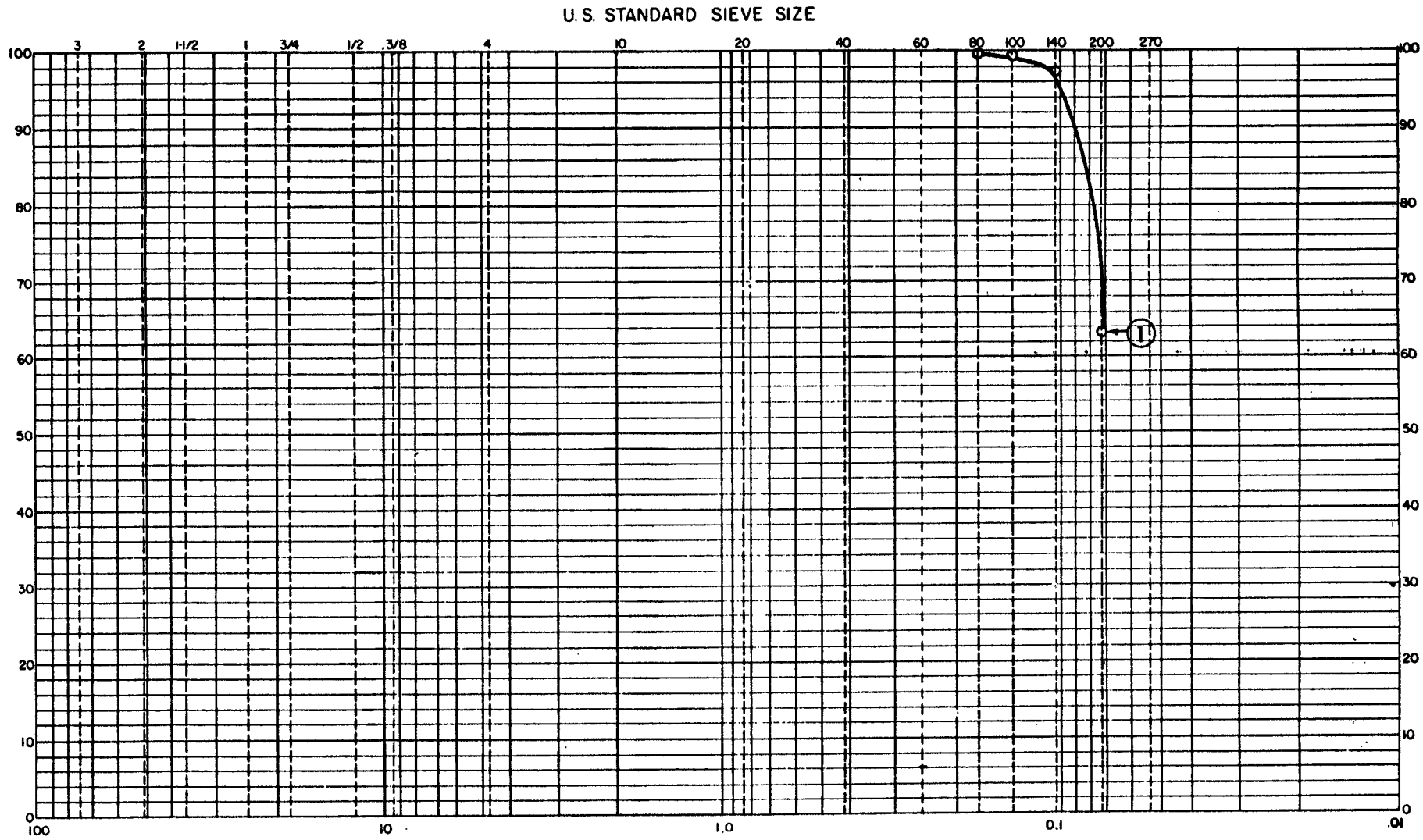
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-2	14.2-15.0'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE A-31

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

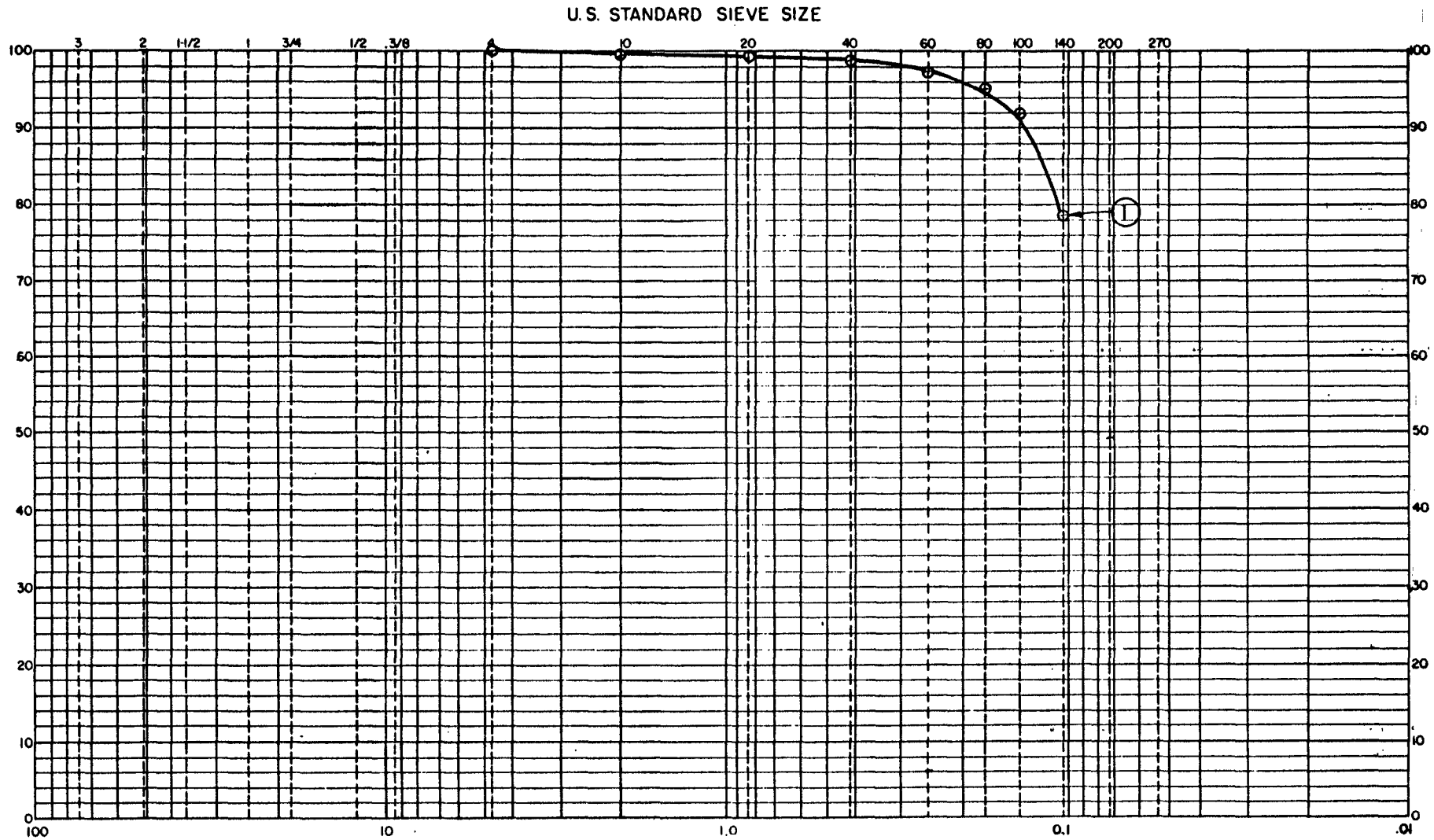
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-2	35.2-35.5'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE A-32

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAIN SIZE IN MILLIMETERS

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

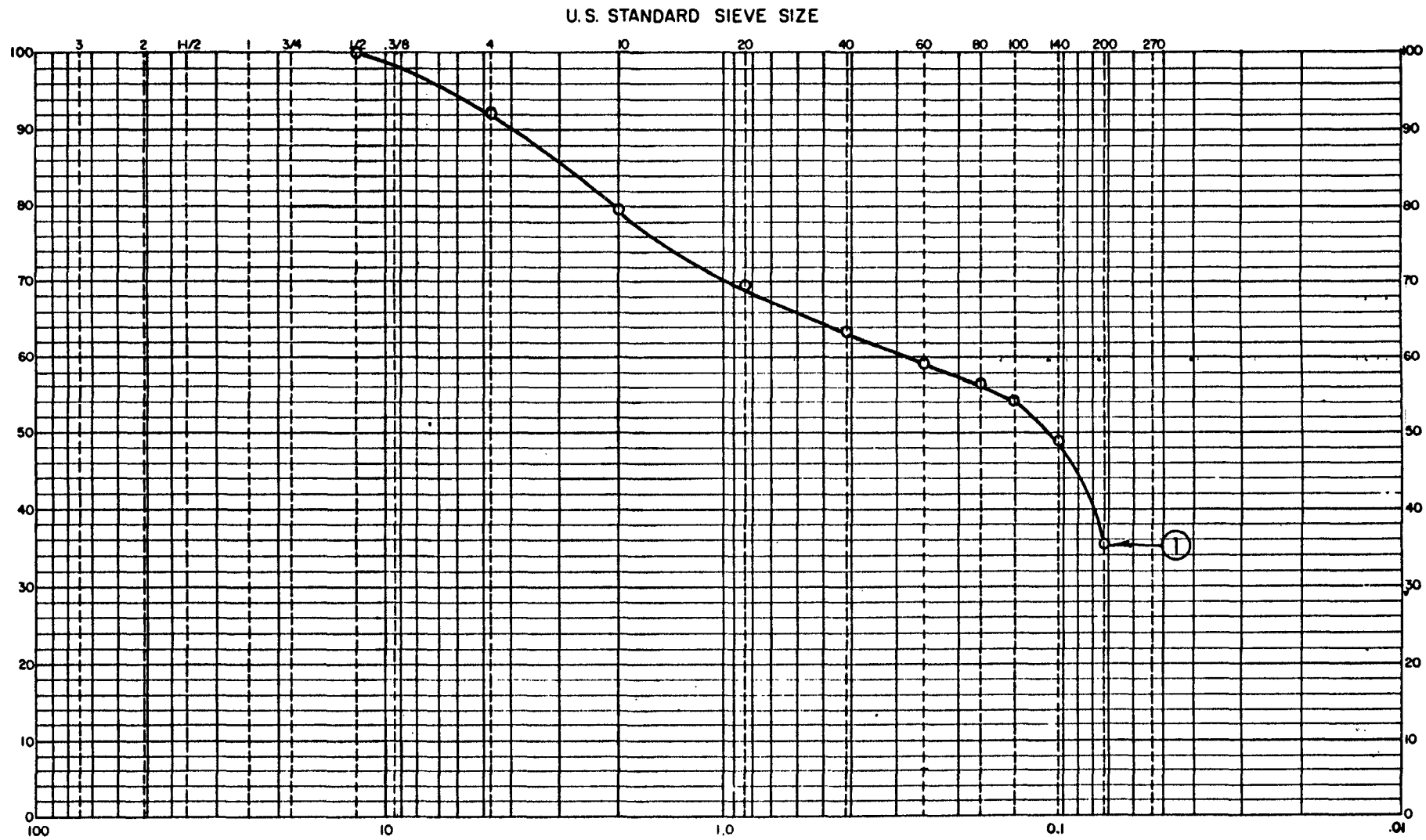
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-2	160.0-160.7'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE A-33

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



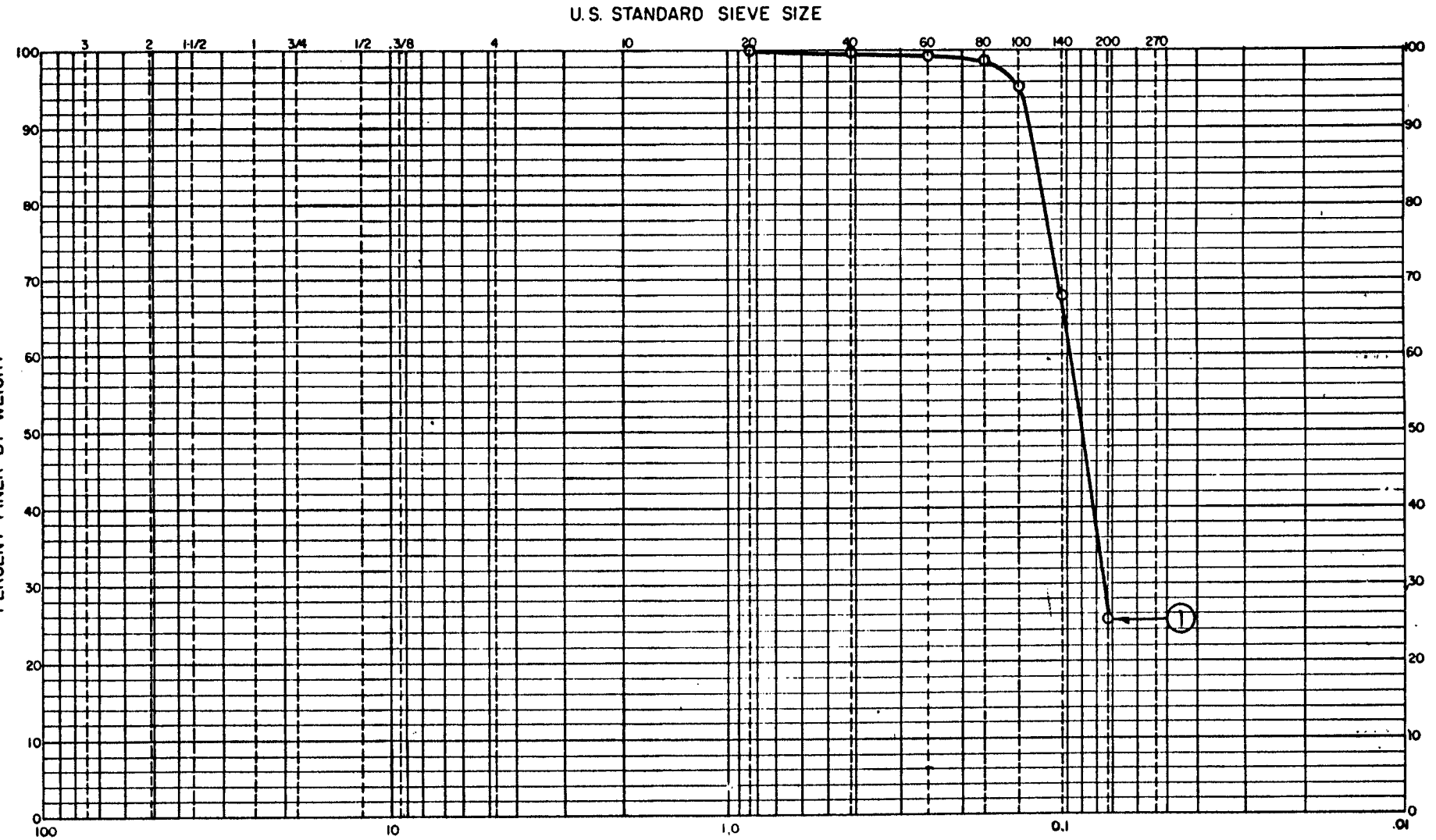
GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-8	14.3-15.0'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



GRAIN SIZE IN MILLIMETERS

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

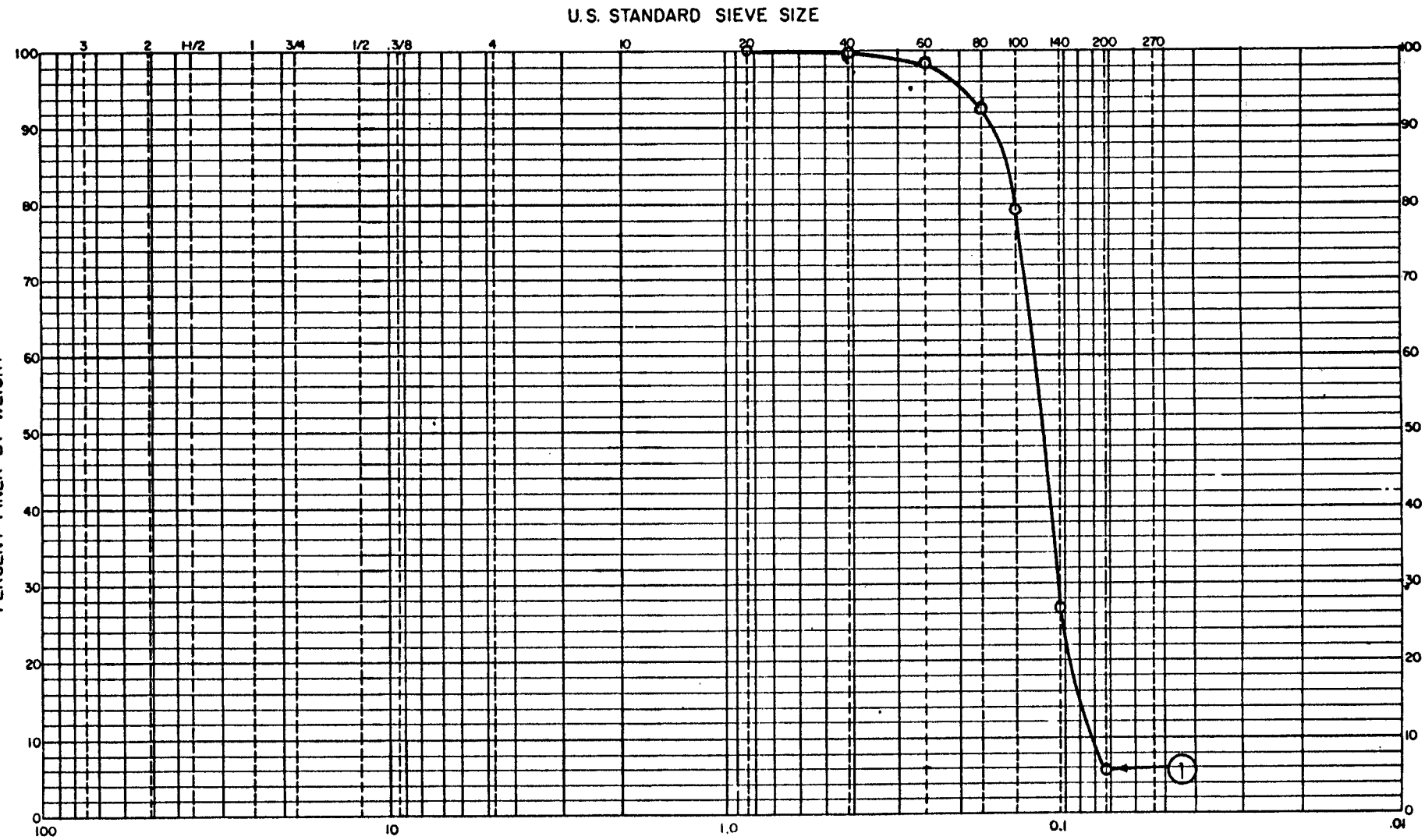
LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-10	24.2-24.5'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

PLATE A-35

NFS/NATIONAL SOIL SERVICES
CONSULTING ENGINEERS

GRADATION CURVES



	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LOCATION	DEPTH OR ELEVATION	CURVE NO.
B-11	23.8-24.1'	1

LOCATION	DEPTH OR ELEVATION	CURVE NO.

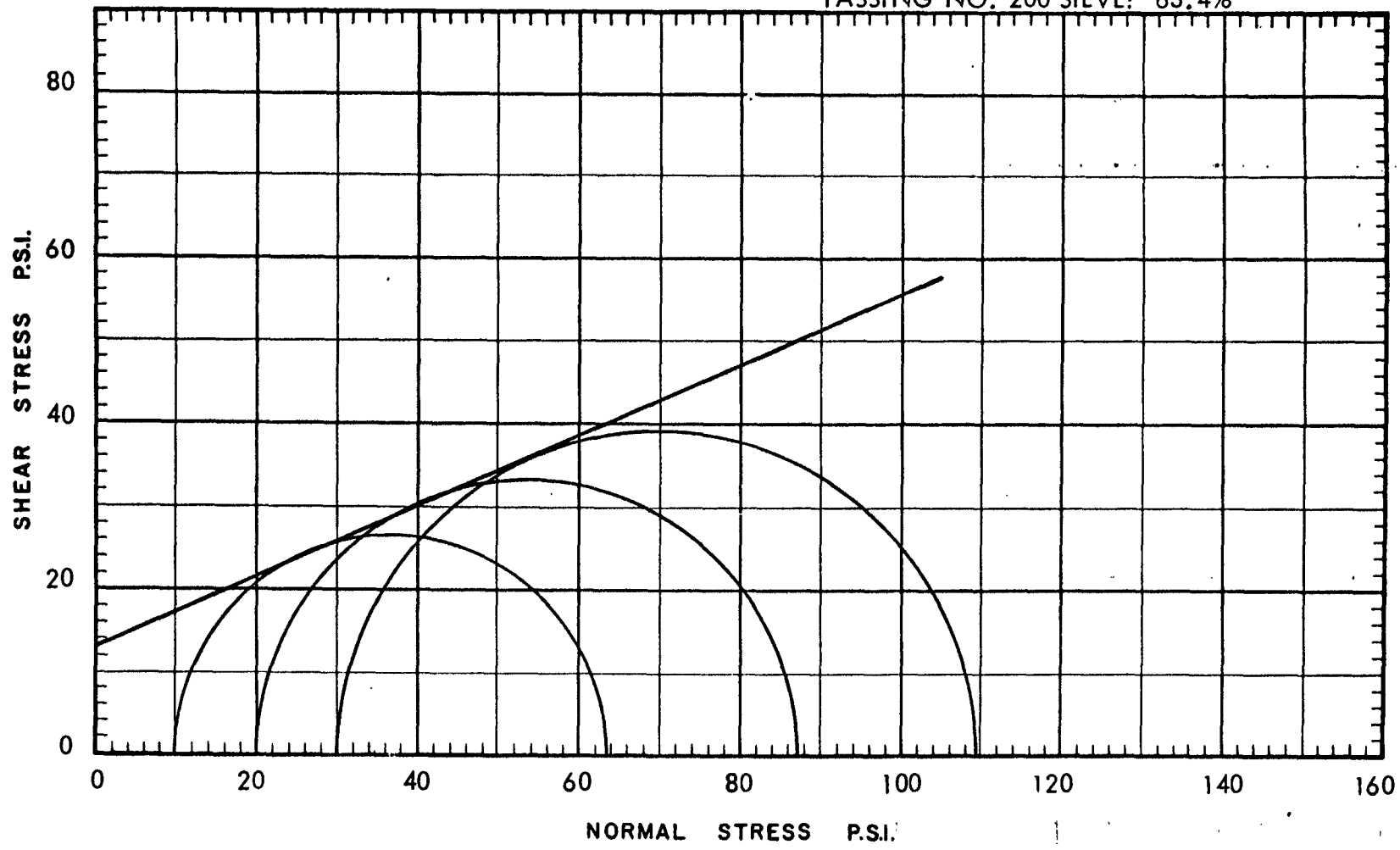
PLATE A-36

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-2 DEPTH: 0.7-1.5'
DESCRIPTION: Light tan clay

ANGLE OF SHEAR: 22.9°
COHESION: c = 13.0 psi = 0.94 tsf

MOISTURE CONTENT:
BEFORE: 22.4 %, AFTER: 28.6 %
UNIT DRY WT: 97.0 LBS./CU.FT.
LIQUID LIMIT: 54.3
PLASTICITY INDEX: 30.4
PASSING NO. 200 SIEVE: 63.4%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

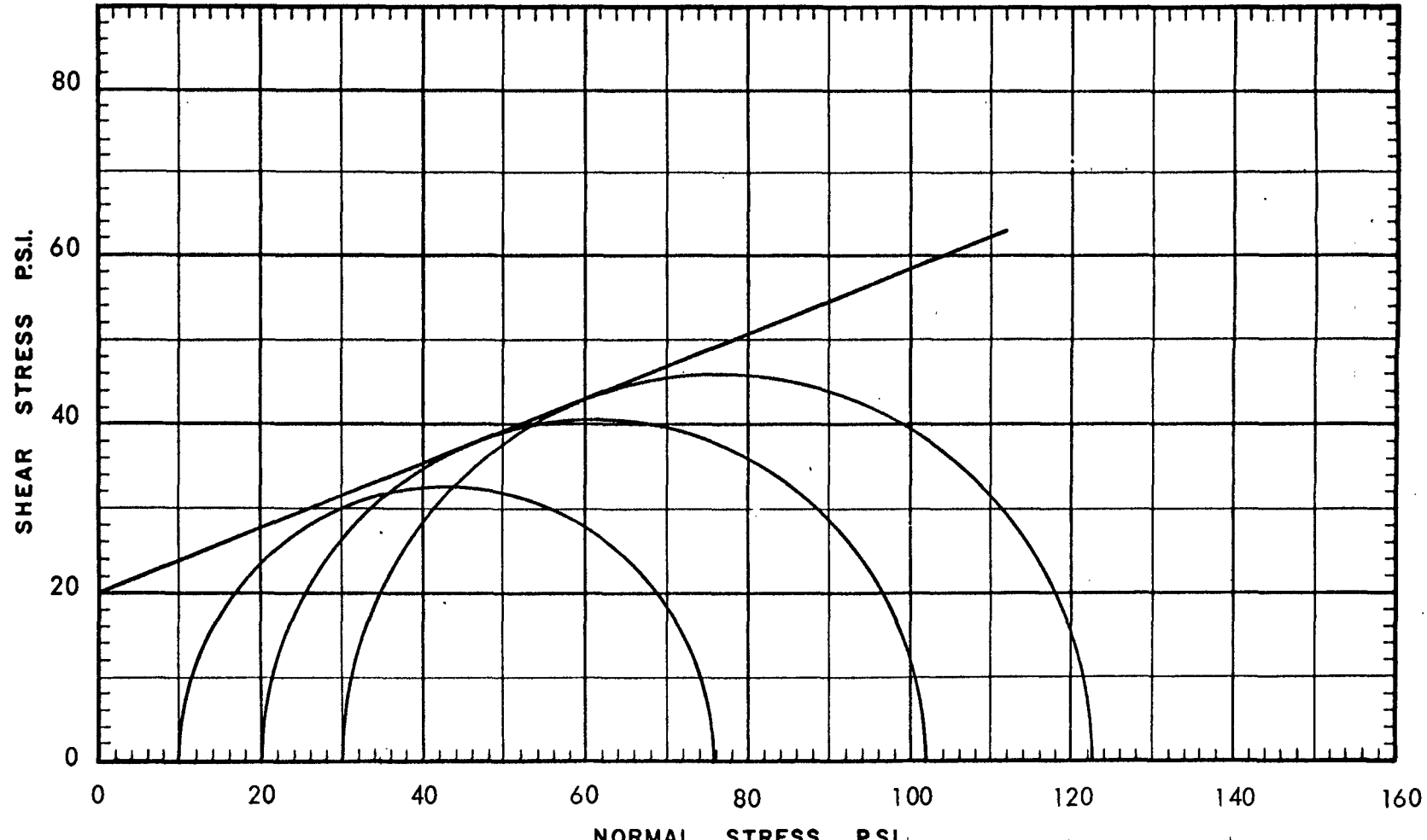
PLATE A-37

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-2 DEPTH: 3.7-4.5'
DESCRIPTION: Light tan clay

ANGLE OF SHEAR: 20.5°
COHESION: c = 20.0 psi = 1.44 tsf

MOISTURE CONTENT:
BEFORE: 29.3 %, AFTER: 28.4 %
UNIT DRY WT: 91.5 LBS./CU.FT.
LIQUID LIMIT: 51.1
PLASTICITY INDEX: 19.2
PASSING NO. 200 SIEVE: 86.4%



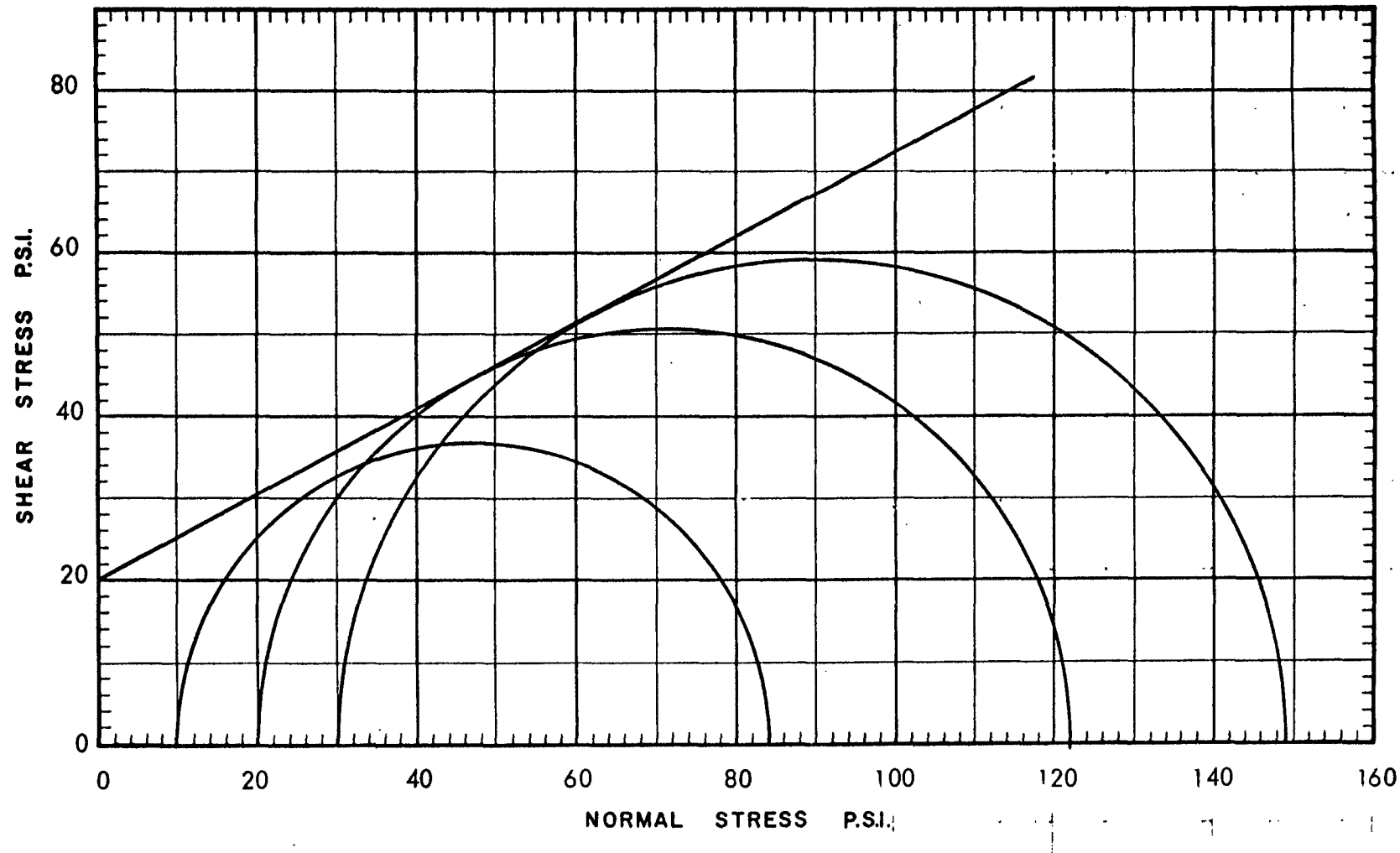
CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

PLATE A-38

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-2 DEPTH: 74.2-75.0'
DESCRIPTION: Greenish-gray clay, w/silty fine sand seam
ANGLE OF SHEAR: 27.5°
COHESION: c = 20.0 psi = 1.44 tsf

MOISTURE CONTENT:
BEFORE: 34.3 %, AFTER: 29.3 %
UNIT DRY WT: 90.1 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

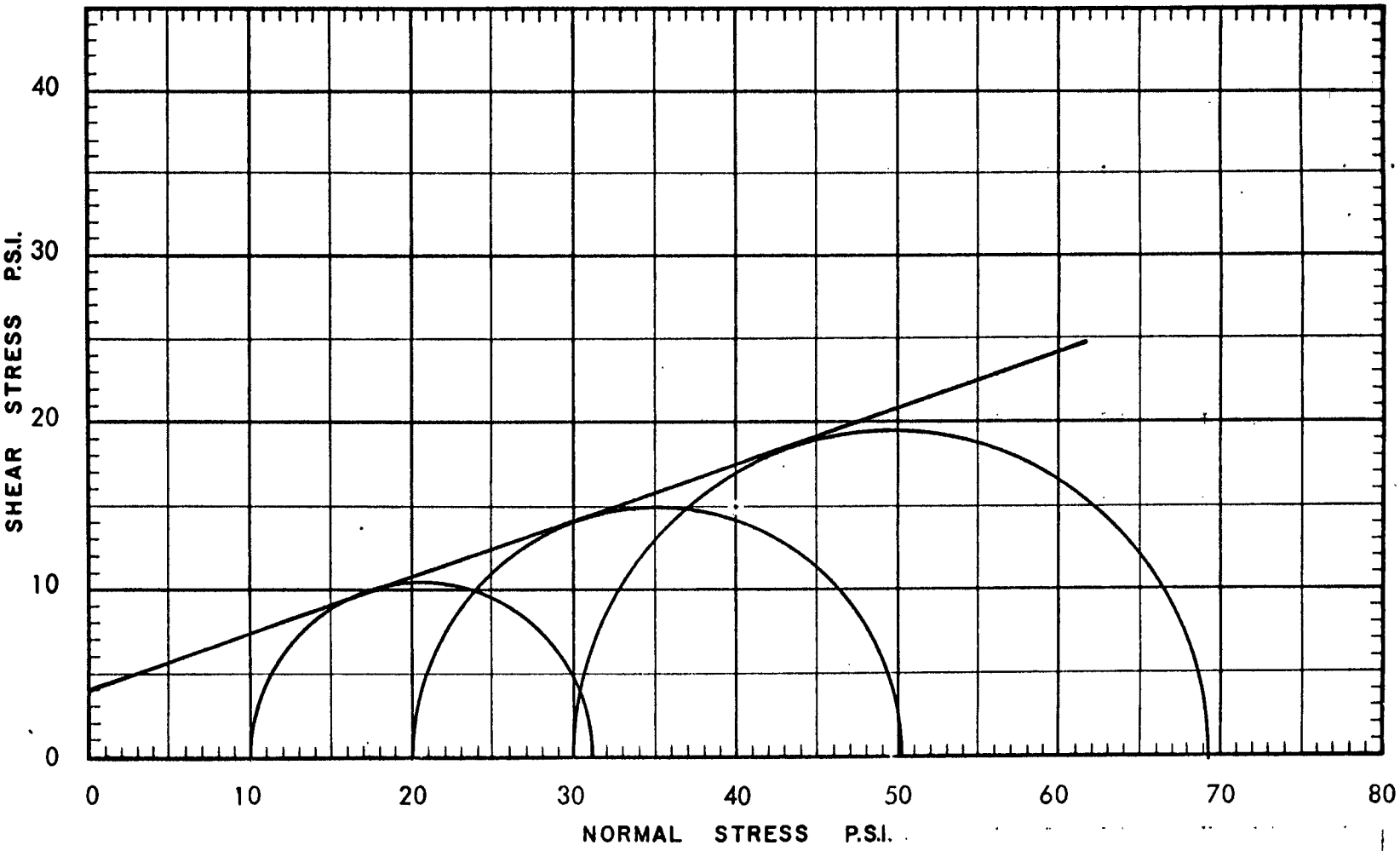
PLATE A-40

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-2 DEPTH: 94.2-95.0'
DESCRIPTION: Greenish-gray clay w/silt laminations

ANGLE OF SHEAR: 18.4°
COHESION: c = 4.0 psi = 0.29 tsf

MOISTURE CONTENT:
BEFORE: 26.8 %, AFTER: 31.0 %
UNIT DRY WT: 99.2 LBS./CU.FT.
LIQUID LIMIT: 85.8
PLASTICITY INDEX: 56.7



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

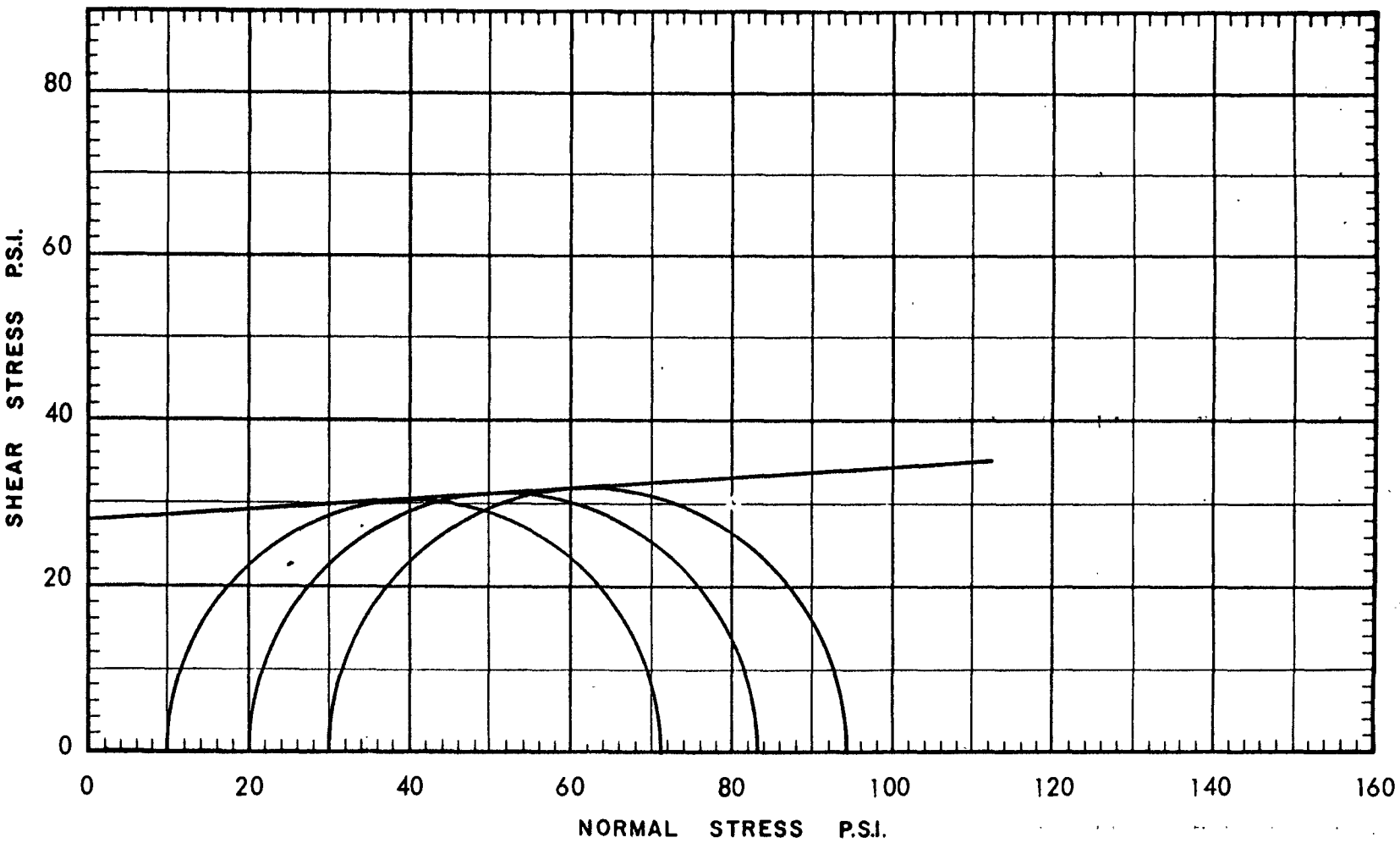
PLATE A-41

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-2 DEPTH: 114.2-115.0'
DESCRIPTION: Greenish-gray clay w/silt laminations

ANGLE OF SHEAR: 3.3°
COHESION: c = 28.0 psi = 2.01 tsf

MOISTURE CONTENT:
BEFORE: 26.9 %, AFTER: 31.0 %
UNIT DRY WT: 97.3 LBS./CU.FT.
LIQUID LIMIT: 78.0
PLASTICITY INDEX: 52.9



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

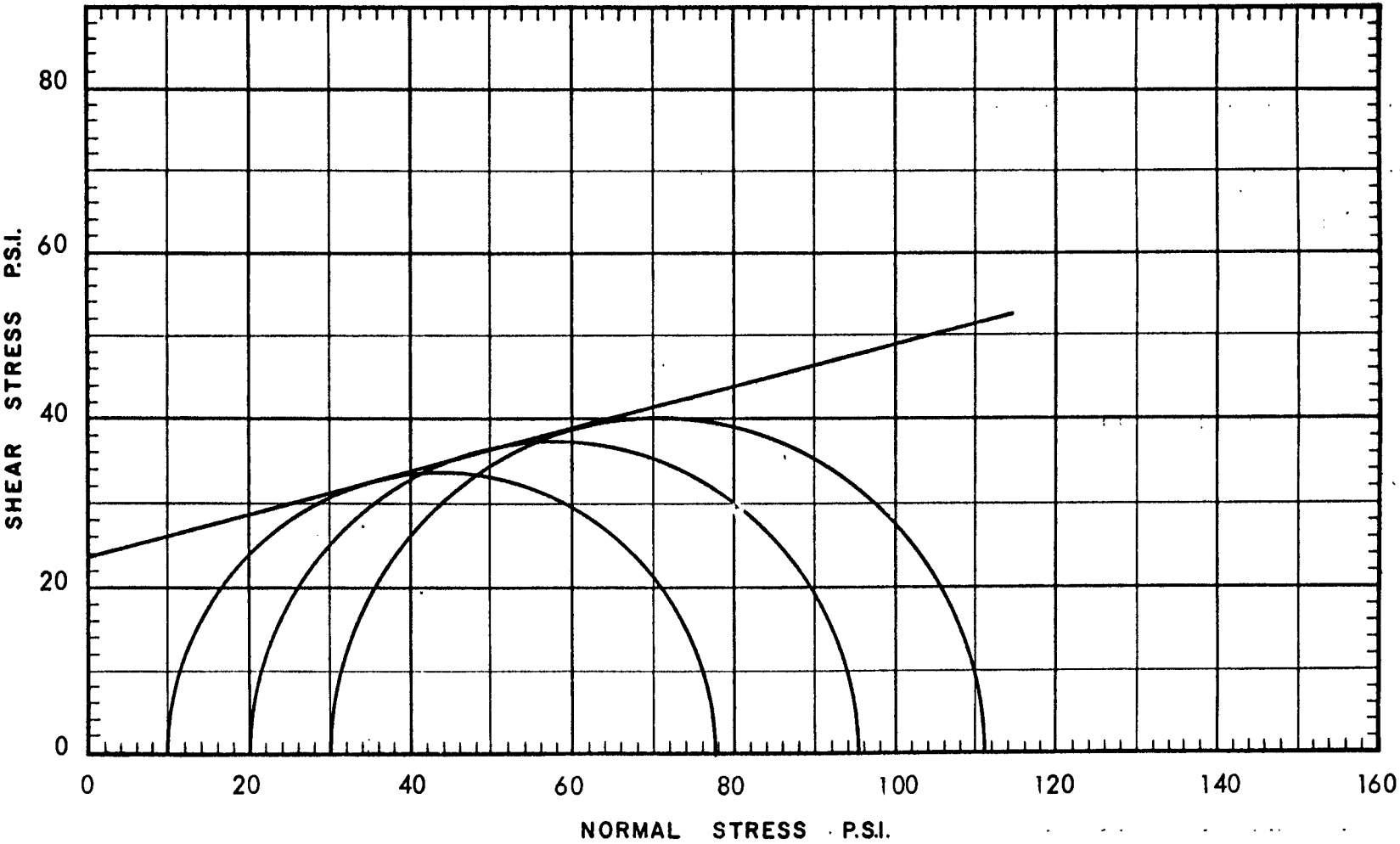
PLATE A-42

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-2 DEPTH: 139.6-140.3'
DESCRIPTION: Greenish-gray clay w/sand laminations

ANGLE OF SHEAR: 14.5°
COHESION: c = 23.5 psi - 1.69 tsf

MOISTURE CONTENT:
BEFORE: 29.5 %, AFTER: 30.6 %
UNIT DRY WT: 93.8 LBS./CU.FT.
LIQUID LIMIT: 58
PLASTICITY INDEX: 39



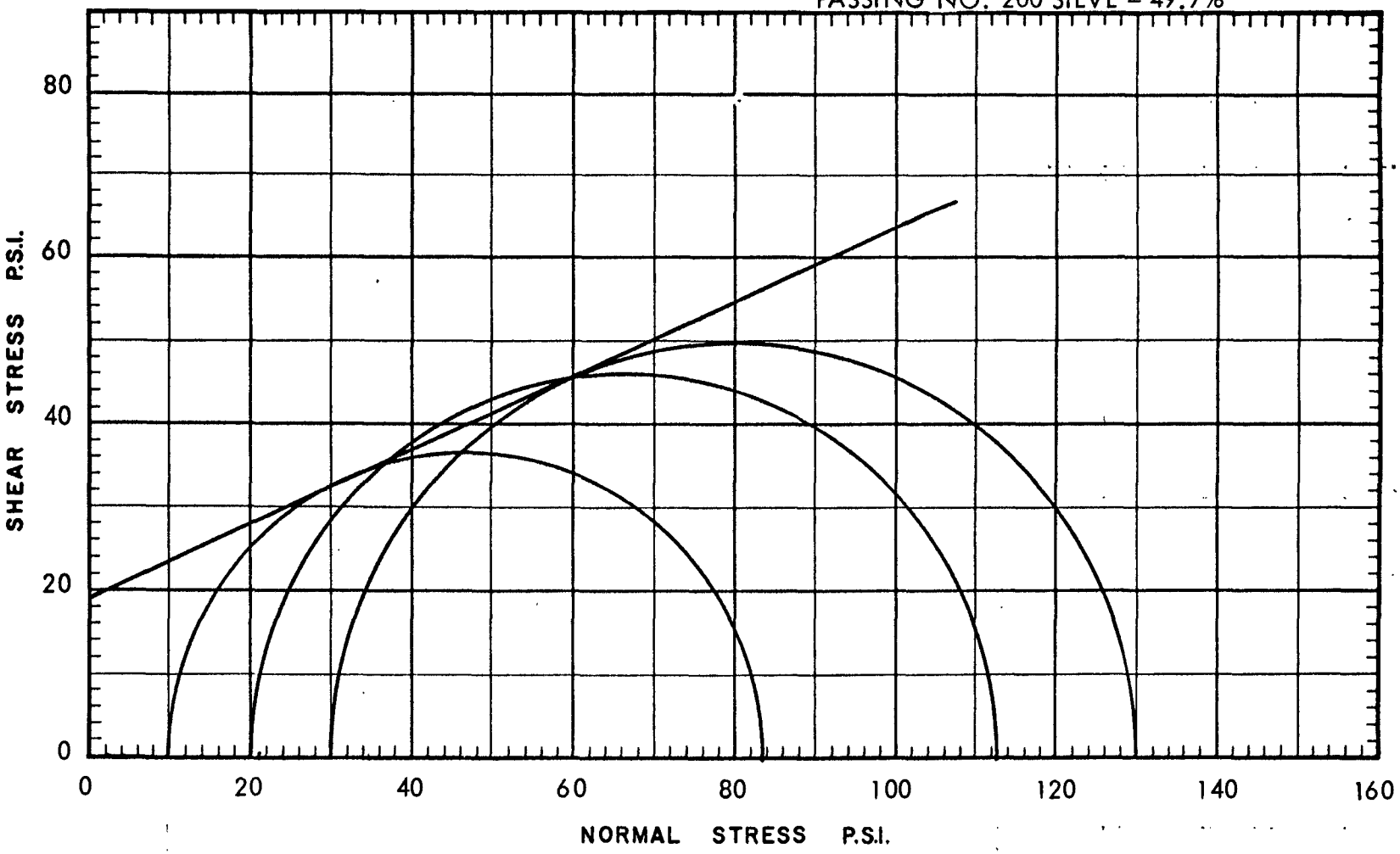
CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

PLATE A-43

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-2 DEPTH: 160.0-160.7'
DESCRIPTION: Greenish-gray silty fine sand, w/ numerous clay laminations
ANGLE OF SHEAR: 23.4°
COHESION: c = 19.1 psi = 1.37 tsf

MOISTURE CONTENT:
BEFORE: 25.8 %, AFTER: 26.1 %
UNIT DRY WT: 97.1 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:
PASSING NO. 200 SIEVE = 49.7%



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

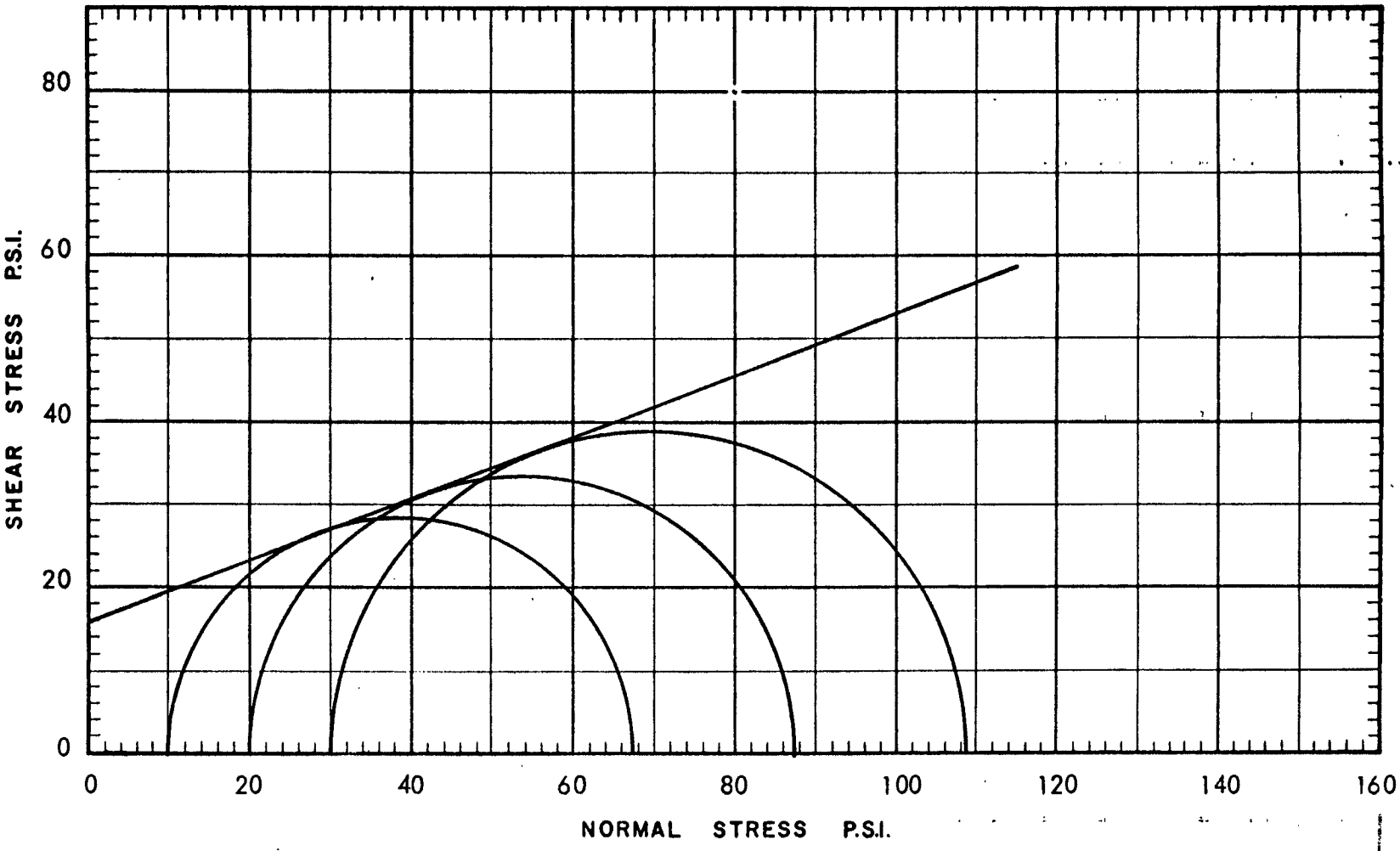
PLATE A-44

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-2 DEPTH: 189.0-189.7'
DESCRIPTION: Gray silty fine sand

ANGLE OF SHEAR: 20.6°
COHESION: c = 15.4 psi = 1.11 tsf

MOISTURE CONTENT:
BEFORE: 21.3 %, AFTER: 23.3 %
UNIT DRY WT: 104.8 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:
PASSING NO. 200 SIEVE: 39.8%



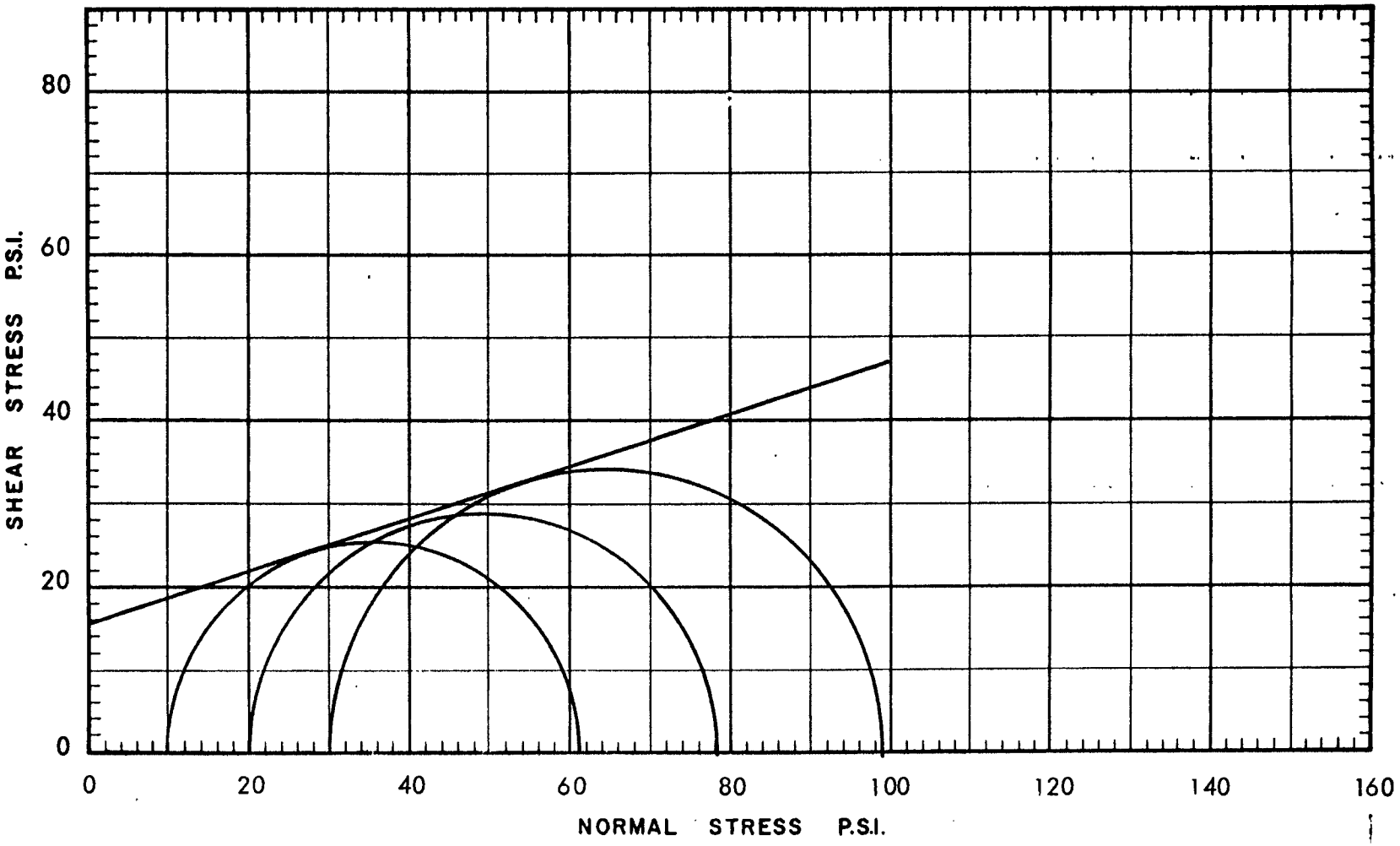
CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

PLATE A-45

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-3 DEPTH: 19.6-20.2'
DESCRIPTION: Tan silty fine sand w/numerous clay laminations
ANGLE OF SHEAR: 17.5°
COHESION: c = 15.5 psi = 1.12 tsf

MOISTURE CONTENT:
BEFORE: 33.7%, AFTER: 32.7 %
UNIT DRY WT: 85.4 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

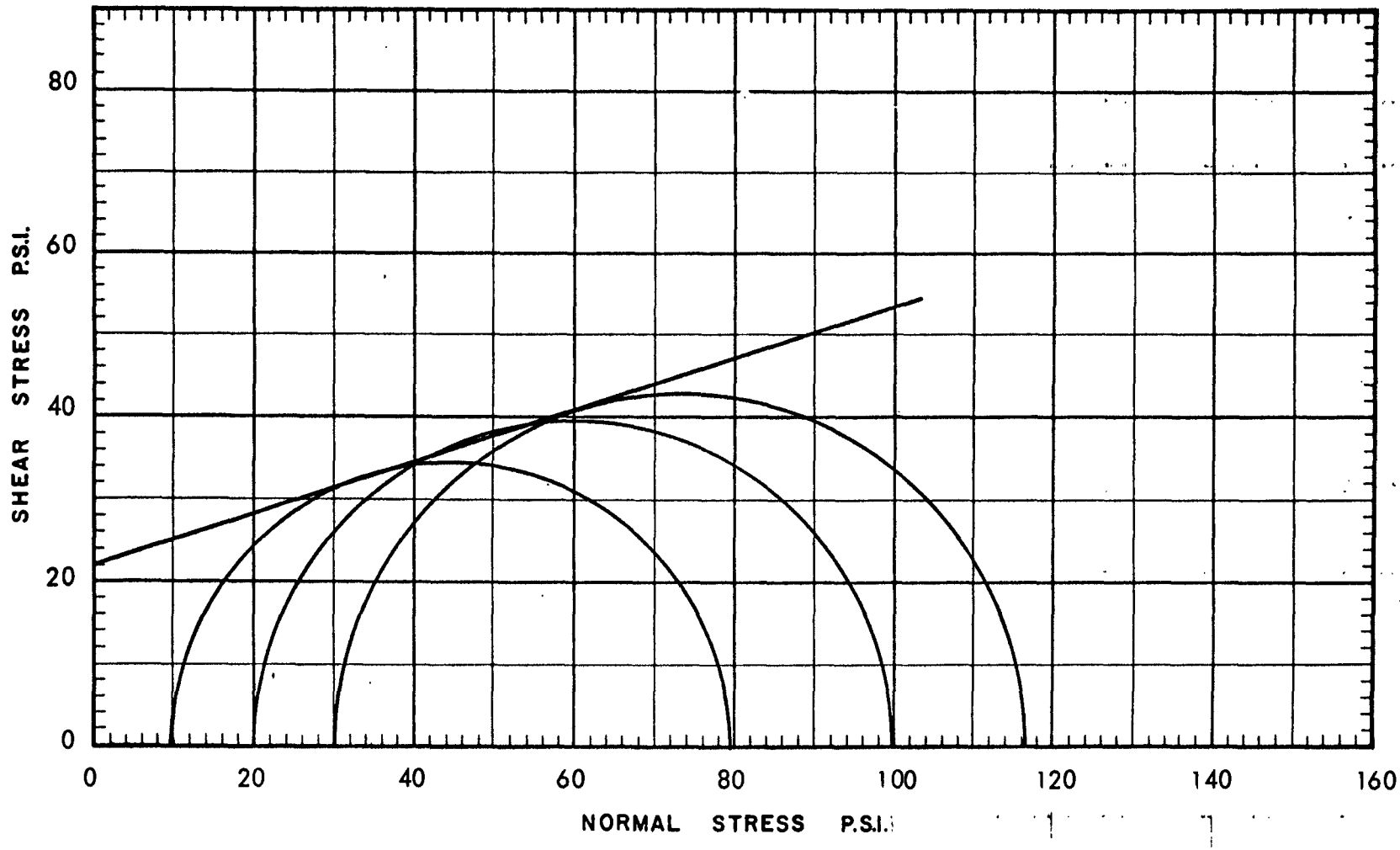
PLATE A-46

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-3 DEPTH: 33.9-40.0'
DESCRIPTION: Gray clay w/silt laminations

ANGLE OF SHEAR: 17.4°
COHESION: c = 22.0 psi = 1.58 tsf

MOISTURE CONTENT:
BEFORE: 30.0 %, AFTER: 35.9 %
UNIT DRY WT: 89.9 LBS./CU.FT.
LIQUID LIMIT: 57.8
PLASTICITY INDEX: 28.4



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

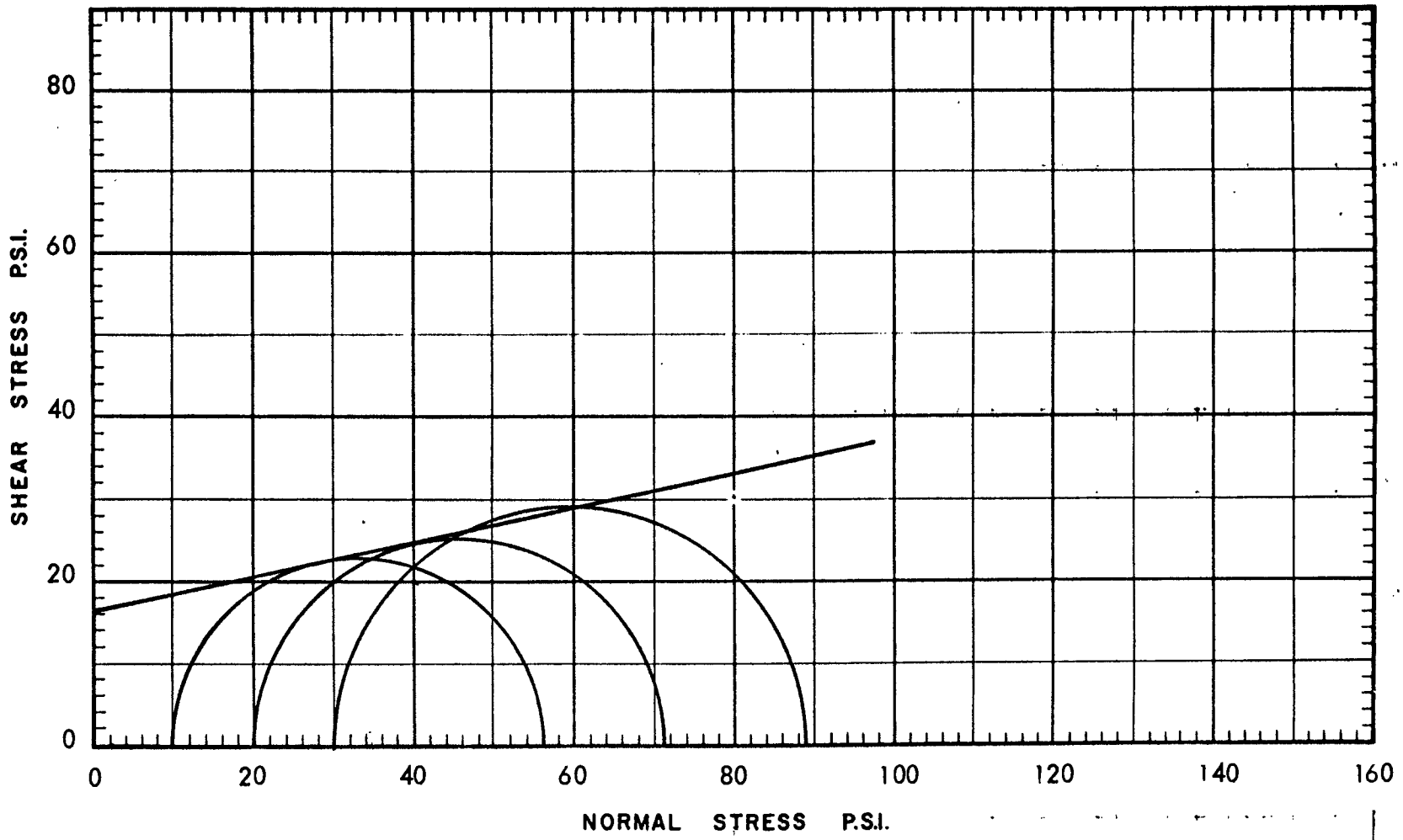
PLATE A-47

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

BORING NO: B-3 DEPTH: 53.5-54.2'
DESCRIPTION: Gray clay

ANGLE OF SHEAR: 12.1°
COHESION: c = 16.2 psi = 1.16 tsf

MOISTURE CONTENT:
BEFORE: 33.2 %, AFTER: 39.6 %
UNIT DRY WT: 85.8 LBS./CU.FT.
LIQUID LIMIT: 74.7
PLASTICITY INDEX: 43.0



CONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

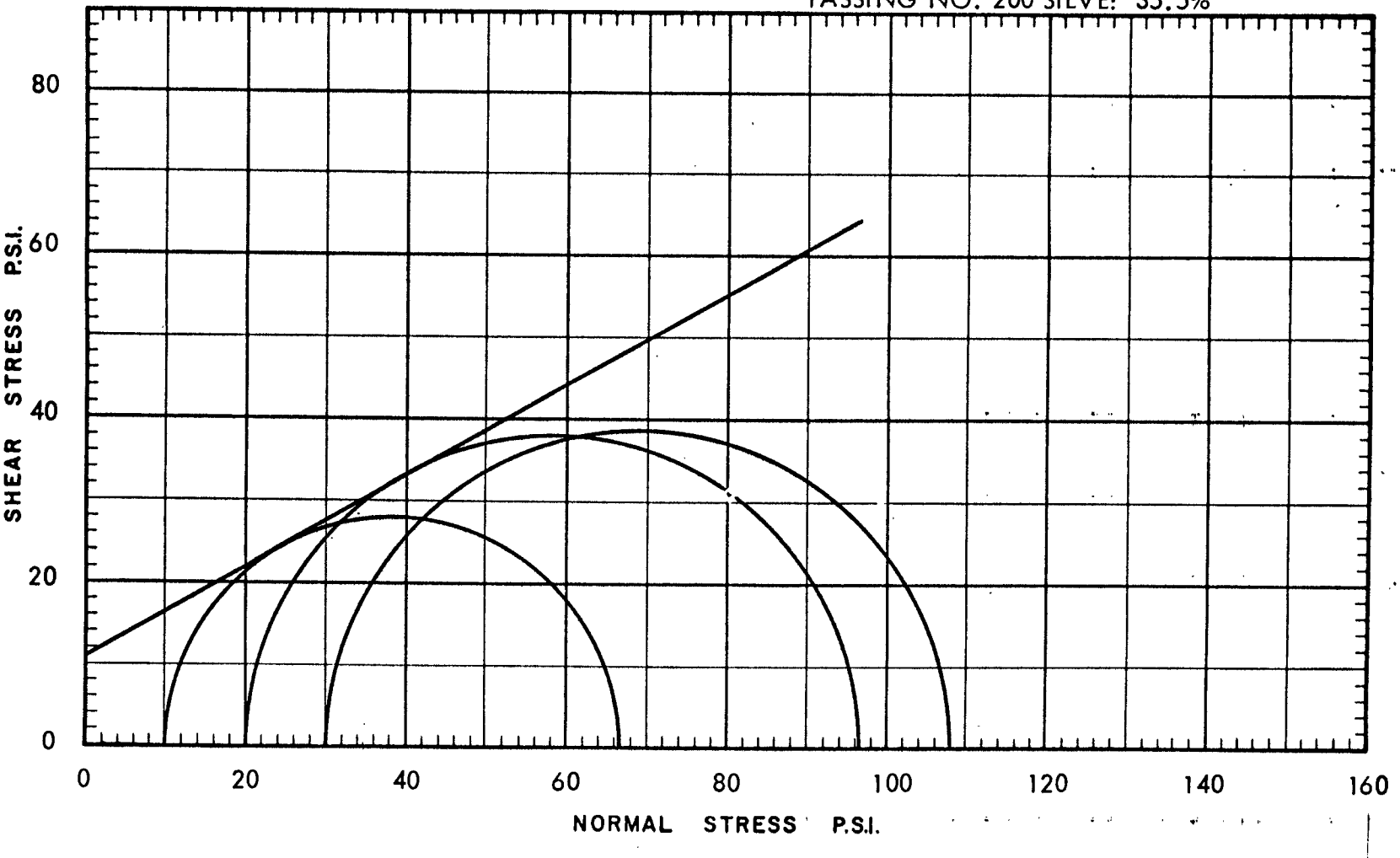
PLATE A-48

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

BORING NO: B-8 DEPTH: 14.3-15.0'
DESCRIPTION: Tan clayey fine sand

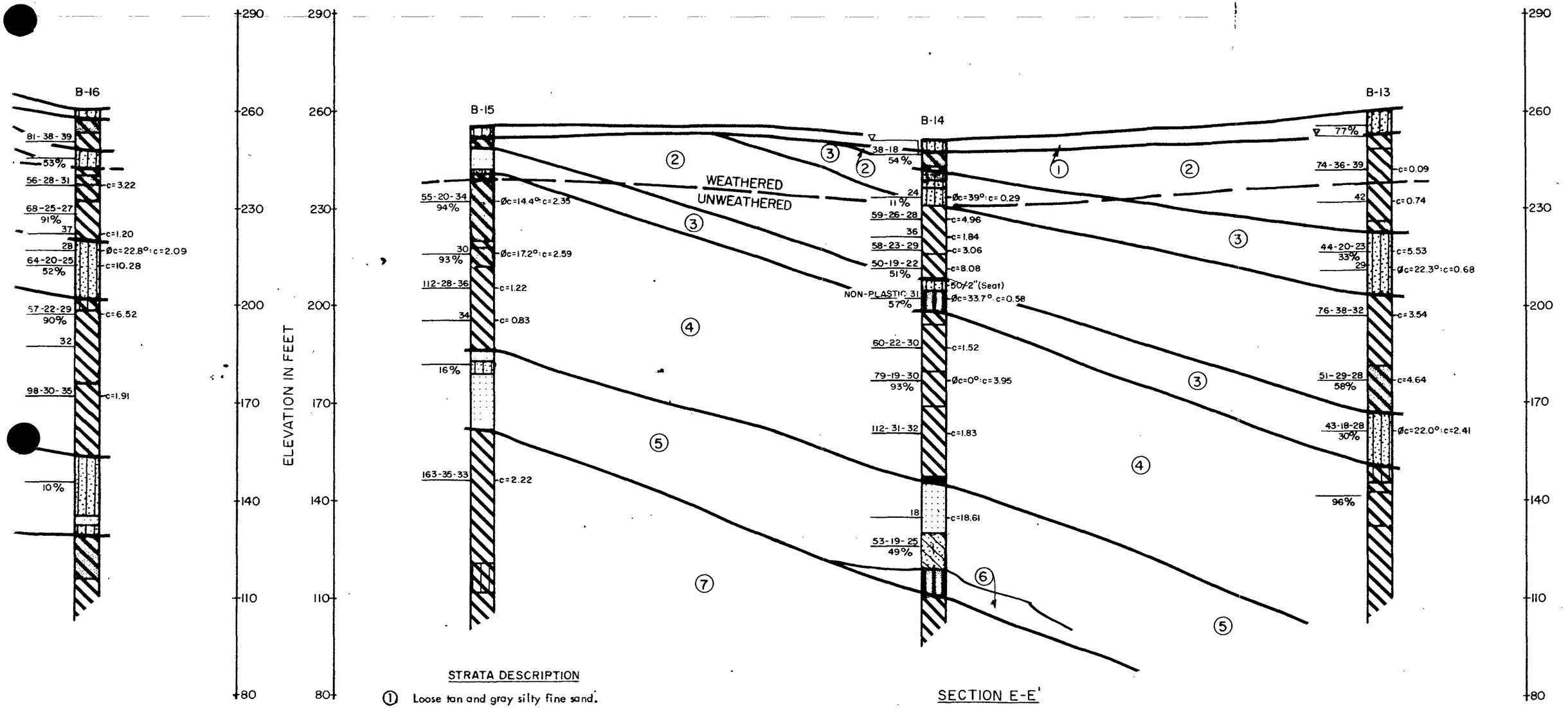
ANGLE OF SHEAR: 28.8°
COHESION: c = 11.5 psi = 0.83 tsf

MOISTURE CONTENT:
BEFORE: 22.6 %, AFTER: %
UNIT DRY WT: 98.0 LBS./CU.FT.
LIQUID LIMIT:
PLASTICITY INDEX:
PASSING NO. 200 SIEVE: 35.5%



UNCONSOLIDATED-UNDRAINED
SHEAR TEST RESULTS

PLATE A-49



SECTION E-E'

NOTE: See PLATE 37 for Lab Data Key.

STRATA DESCRIPTION

① Loose tan and gray silty fine sand.

② Very stiff to hard tan, brown and gray clay, sandy clay, and silty clay.

③ Very dense tan and gray silty fine sand and sandy silt.

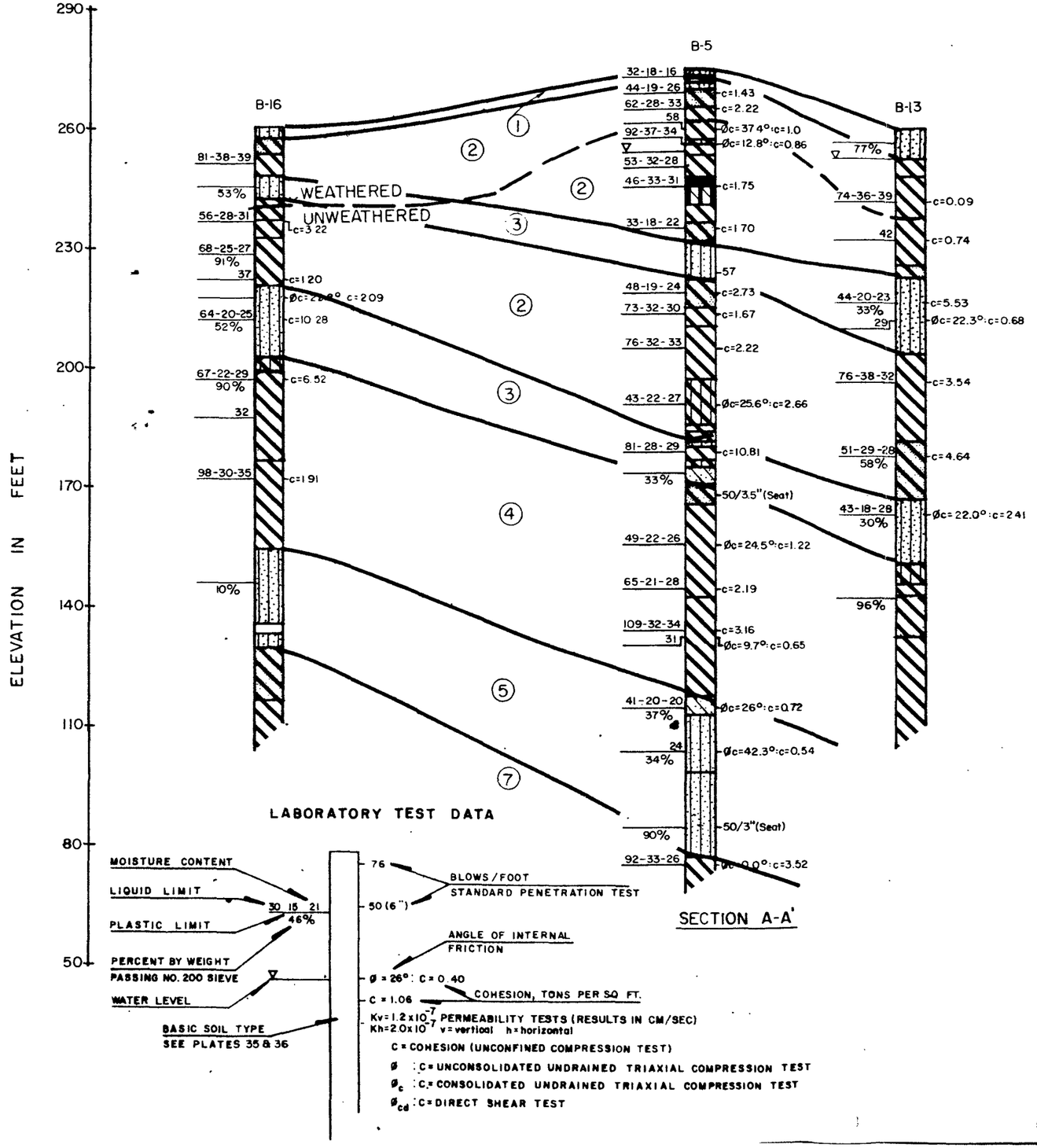
④ Hard gray and brown clay, sandy clay, and silty clay, with occasional interbedded sandy silt seams and occasional lignite lenses.

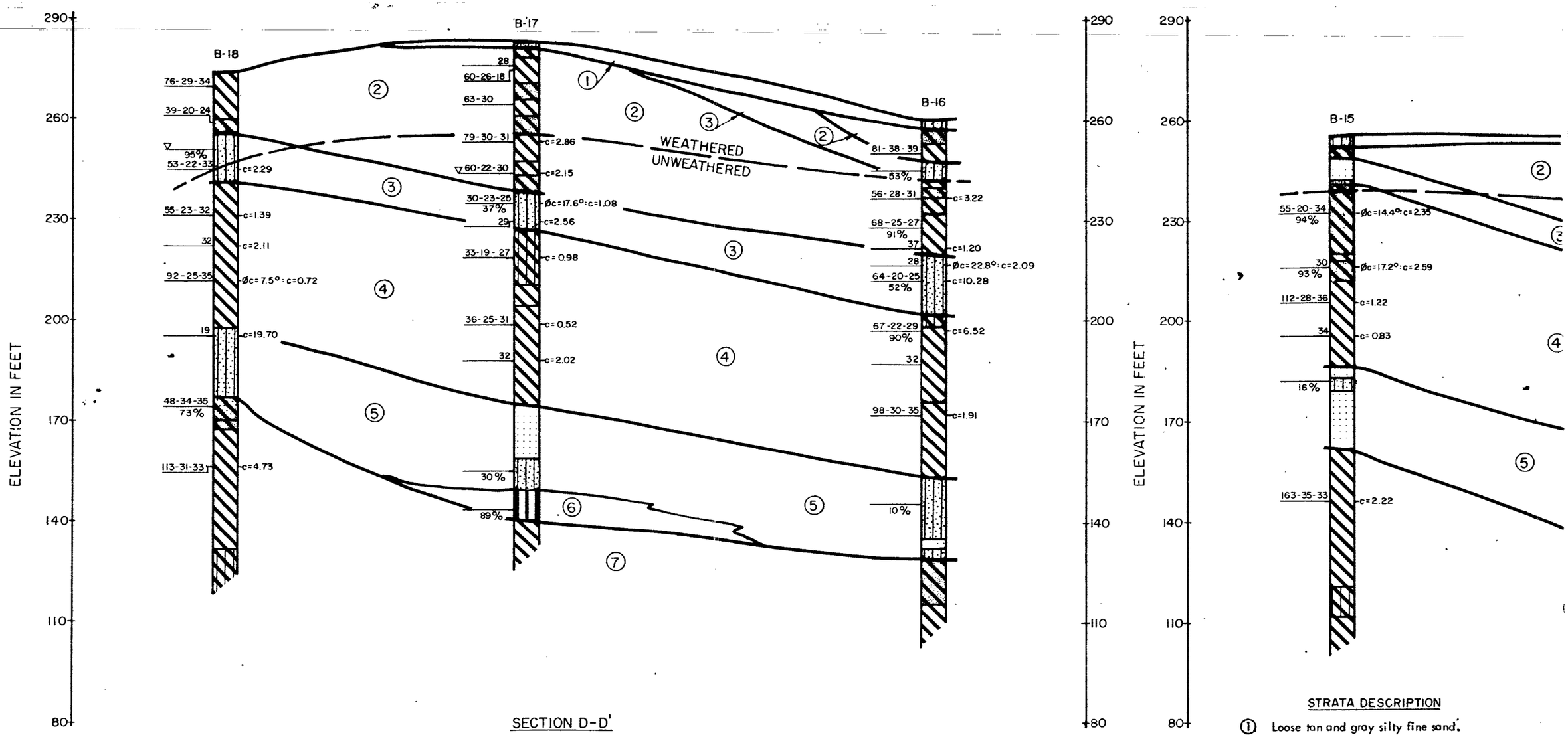
⑤ Very dense gray silty fine sand, sandy silt, and occasional hard gray sandstone lenses.

⑥ Very dense gray sandy or clayey silt

⑦ Hard gray and greenish gray clay and silty clay.

SECTIONS D-D', E-E'
GENERALIZED SOILS PROFILES


ELEVATION IN FEET
290
260
230
200
170
140
110
80
50
B-16
B-5
B-13
WEATHERED
UNWEATHERED
81-38-39
53%
56-28-31
c=3.22
68-25-27
91%
37
c=1.20
Øc=28.0°: c=2.09
64-20-25
52%
c=10.28
67-22-29
90%
c=6.52
32
98-30-35
c=1.91
10%
32-18-16
44-19-26
c=1.43
62-28-33
c=2.22
58
92-37-34
Øc=37.4°: c=1.0
Øc=12.8°: c=0.86
53-32-28
46-33-31
c=1.75
33-18-22
c=1.70
57
48-19-24
c=2.73
73-32-30
c=1.67
76-32-33
c=2.22
43-22-27
Øc=25.6°: c=2.66
81-28-29
33%
c=10.81
50/3.5"(Seat)
49-22-26
Øc=24.5°: c=1.22
65-21-28
c=2.19
109-32-34
31
c=3.16
Øc=9.7°: c=0.65
41-20-20
37%
Øc=26°: c=0.72
24
34%
Øc=42.3°: c=0.54
90%
50/3"(Seat)
92-33-26
Øc=0.0°: c=3.52
77%
74-36-39
c=0.09
42
c=0.74
44-20-23
33%
29
c=5.53
Øc=22.3°: c=0.68
76-38-32
c=3.54
51-29-28
58%
c=4.64
43-18-28
30%
Øc=22.0°: c=2.41
96%
SECTION A-A'
LABORATORY TEST DATA
MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT
PERCENT BY WEIGHT PASSING NO. 200 SIEVE
WATER LEVEL
BASIC SOIL TYPE SEE PLATES 35 & 36
30 15 21
46%
76
50(6")
BLOWS/FOOT STANDARD PENETRATION TEST
ANGLE OF INTERNAL FRICTION
Ø = 26°: C = 0.40
C = 1.06
COHESION, TONS PER SQ FT.
Kv=1.2x10⁻⁷ PERMEABILITY TESTS (RESULTS IN CM/SEC)
Kh=2.0x10⁻⁷ v=vertical h=horizontal
C = COHESION (UNCONFINED COMPRESSION TEST)
Ø : C = UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
Øc : C = CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
Øcd : C = DIRECT SHEAR TEST
B-17
B-4
28
60-26-18
63-30
79-30-31
c=2.86
60-22-30
c=2.15
30-23-25
37%
29
Øc=17.6°, c=1.08
c=2.56
33-19-27
c=0.98
36-25-31
c=0.52
32
c=2.02
30%
89%
44-30
69%
82
c=1.54
38-29
39%
31
40%
46-22
84%
64-22-27
25
82-24-31
33
32
84/10"
42-20
25%
63-28
114-32-32
119-40-36
58-17-24
c=2.27
32
50/4"(Seat)
SECTION B-B'
NOTE: See PLATE 38 for Strata Descript
HORIZONTAL SCALE IN FEET
500 0 250 500 1000



SECTION D-D'

HORIZONTAL SCALE IN FEET
500 0 250 500 1000

NOTE: See PLATE 37 for Lab Data Key.

STRATA DESCRIPTION

① Loose tan and gray silty fine sand.

② Very stiff to hard tan, brown and gray clay, sandy c and silty clay.

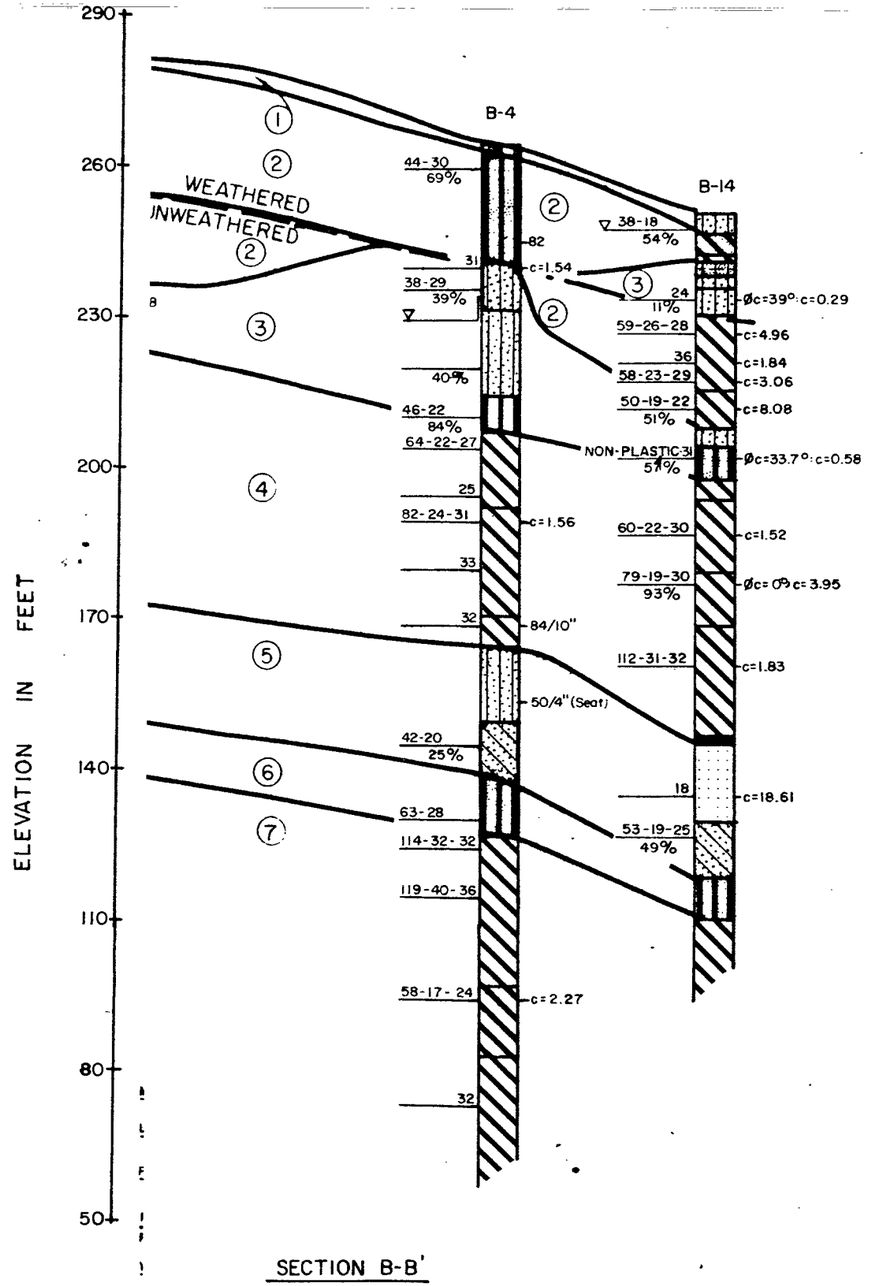
③ Very dense tan and gray silty fine sand and sandy sil

④ Hard gray and brown clay, sandy clay, and silty cla interbedded sandy silt seams and occasional lignite

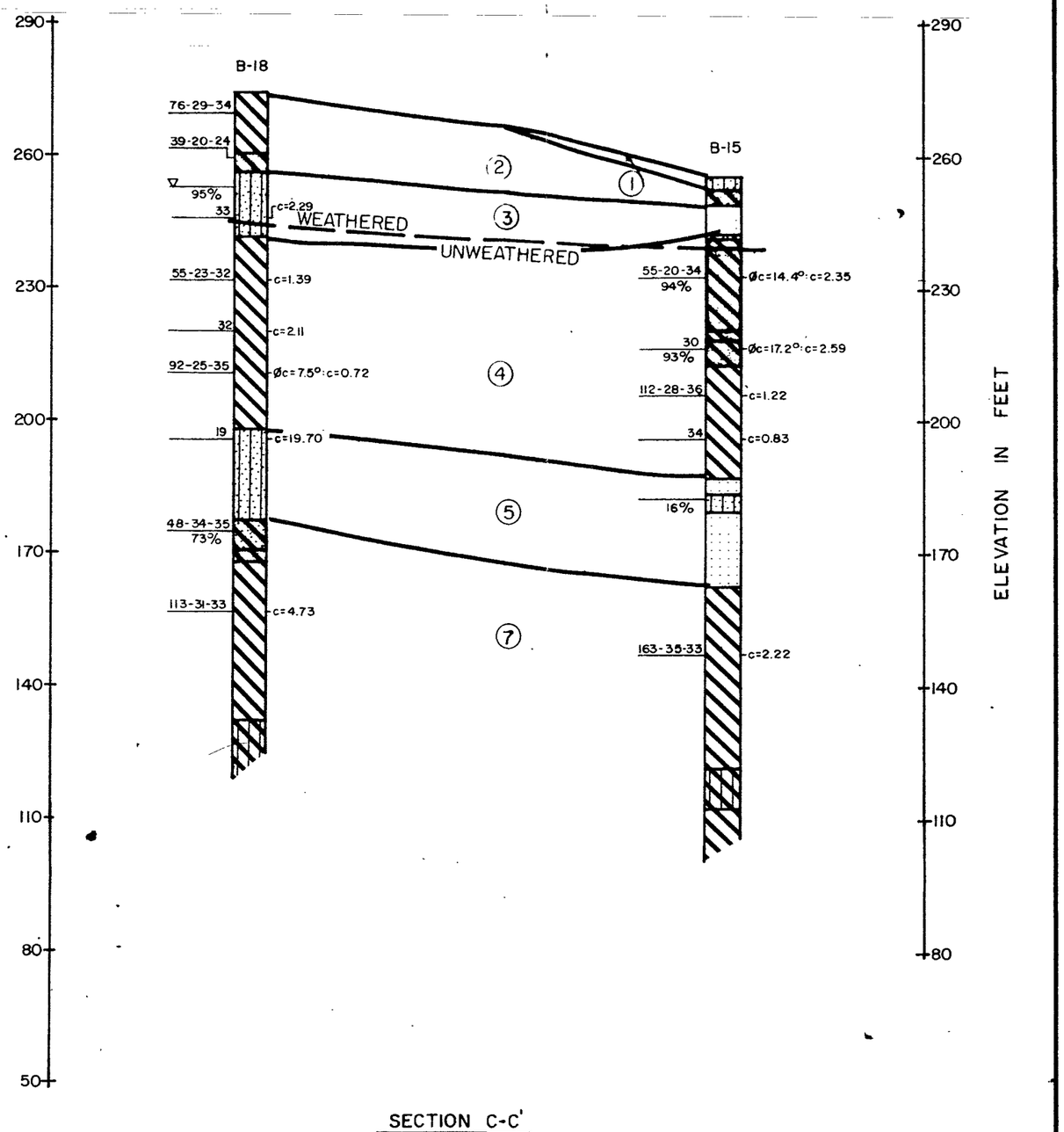
⑤ Very dense gray silty fine sand, sandy silt, and occa gray sandstone lenses.

⑥ Very dense gray sandy or clayey silt

⑦ Hard gray and greenish gray clay and silty clay.



SECTION B-B'



SECTION C-C'

NOTE: See PLATE 38 for Strata Description.

SECTIONS A-A', B-B', C-C'
GENERALIZED SOILS PROFILES

(OFF SHEET)

MON. A-37
N 364 170.44
E 3 341 707.49
ELEV. 857.45

WM. B-14
264.25
N 369 342.71
E 3 339 723.27

MON. A-38
261.71
N 373 091.35
E 3 338 036.91

B-77 B-76 B-79 B-80 B-81 B-82 B-83 B-84 B-85 B-86 B-25 B-26

MON. A-1
N 373 574.52
E 3 336 876.15
ELEV. 824.91

WCM. W-19
N 370 165.01
E 3 335 746.67
ELEV. 774.64

(OFF SHEET)

(OFF SHEET)

N

REVISIONS BY	DESCRIPTION
1. 9-11-79 MW	ADDED BORINGS B-77 THRU B-88
2. 9-11-79 NY	"ACCEPTED FOR CONSTRUCTION"; NO CHANGE FROM DIVISION 1.

SCALE 1" = 200'
DRAWN R. BLE J.L.W.
DATE 6-1-79
CHECKED W.G.W.
APPROVED W.G.W. J.L.W.

LOUIS T. GEE 9916 REGISTERED PROFESSIONAL ENGINEER
William G. Hollowell 19137 REGISTERED PROFESSIONAL ENGINEER
JAMES L. WEBB 36861 REGISTERED PROFESSIONAL ENGINEER

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

GIBBONS CREEK S.E.S.
UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

PLANT SITE
SOIL BORINGS

JOB NO. GC-7300 REV. 2
DRAWING NO. II-C-003

DRAWING NUMBER

DRAWING NUMBER

DRAWING NUMBER

GC 7300
II-C-003 R 2

NSS 1981 *Summary of Testing of Ash Ponds, Gibbons Creek Steam Electric Station, Grimes County, Texas*, Report No. D-76602-4, NFS/National Soil Services, Inc. March 2, 1981.

SUMMARY OF TESTING OF ASH PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

Report to

TEXAS MUNICIPAL POWER AGENCY
Anderson, Texas

By

NFS/NATIONAL SOIL SERVICES, INC.
Consulting Engineers
Dallas, Texas

March, 1981

NFS / NATIONAL SOIL SERVICES, INC. CONSULTING ENGINEERS
DALLAS/FORT WORTH • HOUSTON • LONGVIEW • TAMPA/CLEARWATER
4087 SHILLING WAY • DALLAS, TEXAS 75224 • 330-9211

SOILS ENGINEERING REPORT

SUMMARY OF TESTING OF ASH PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

March 2, 1981
Report No. D-76602-4

Texas Municipal Power Agency
Post Office Box 229
Anderson, Texas 77830

Attention: Mr. Stan Primus

Gentlemen:

Included herein is the summary of all testing performed on the three ash ponds at the Gibbons Creek Steam Electric Station. The purpose of this testing was to verify that the natural soils or clay liner meets the requirements outlined by the Texas Department of Water Resources. The following sections describe the testing procedures and give our opinion regarding the pond construction.

BACKGROUND INFORMATION

The three equal-size and adjacent ponds are located northwest of the generating unit. The pond bottoms are approximately 1,700 feet long and 130 feet wide. The top elevation is approximately 280 and the bottom elevation is approximately 250. Interior slopes are all 3(H) to 1(V). The purpose of the pond is to contain sludge and ash waste. Such wastes typically contain trace elements of heavy metals and other material considered hazardous. Therefore, it was planned that the pond construction meet the requirements

outlined by the Texas Department of Water Resources for a Class I hazardous waste disposal. These requirements specify that at least four feet of natural soil exist below the bottom of the pond or three feet of recompacted clay be provided to serve as a barrier to seepage. The soil also has to have at least 30 percent passing the No. 200 sieve, have a liquid limit and plasticity index of at least 30 and 15, respectively, and exhibit a permeability of no more than 1×10^{-7} cm/sec.

INSPECTION AND TESTING PROCEDURES

After the ponds were excavated to the required grade, several tests were made on the bottom and slopes to determine the characteristics of the natural soils. It was determined that the bottom of the middle and west ponds and the approximately northern half of the east pond should be excavated and replaced with a three-foot-thick soil liner. Also, lignite seams were exposed in several areas on the slopes of the east and west ponds and these were also undercut and replaced with at least three feet of clay.

Soils proposed for use as a clay liner were tested to verify that they were satisfactory and then were brought in and compacted in approximately eight to nine-inch layers to a total thickness of at least three feet. In most cases, the compaction exceeded 95 percent of the maximum density determined by Test Method Tex 113-E. Field density tests were performed to verify the compaction and samples were obtained for laboratory permeability testing and liquid and plastic limit tests. Several percent passing the No. 200 sieve tests were also performed. All testing procedures were in accordance with ASTM standards or with accepted laboratory practices.

All test locations are shown on Plate 1 and the test results corresponding to the sample numbers are shown on Plates 2 through 6. Some of these tests have been reported previously under different sample numbers, but have been renumbered here sequentially. The crosshatched areas shown on Plate 1 indicate the approximate zones that were undercut and replaced with three feet of clay.

CONCLUSIONS

Based on the inspection and test data which are attached, it is the writer's opinion that these ponds are constructed in accordance with good engineering practice and should meet the guidelines outlined by the Texas Department of Water Resources for waste disposal ponds.

If you should have any questions or comments regarding this work, please call.

Very truly yours,

NFS/NATIONAL SOIL SERVICES, INC.

Stephen S. Foose

Stephen S. Foose, P. E.
Senior Project Engineer

SSF/ga

Distribution:

Texas Municipal Power Agency - 4

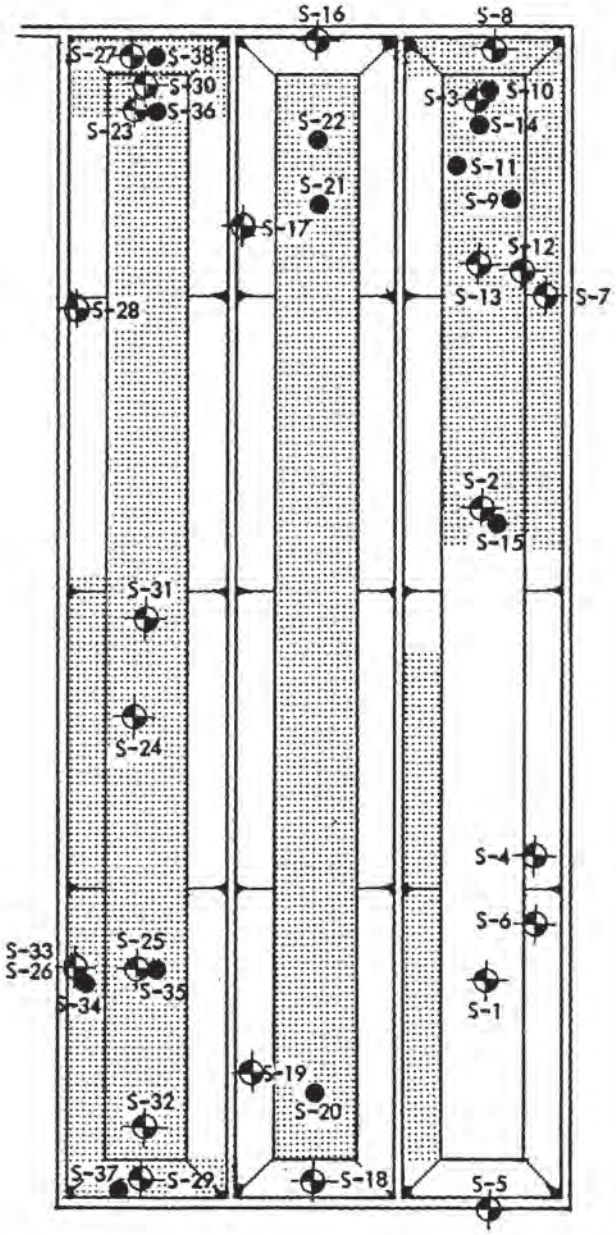
Tippet & Gee, Inc. - 2
Mr. Larry Webb

NFS/National Soil Services, Inc. - 1
Mr. Tim Wooley

76602-4

Scale 1" = 300'

N



LEGEND

Test samples on natural soils

Test samples on clay liner

Approx. areas which were lined with 3 feet of clay

Note: Sample locations are approx.

GIBBONS CREEK ASH PONDS
PLAN OF SAMPLES

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 1

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

SUMMARY OF TEST DATA
EAST ASH POND
GIBBONS CREEK STEAM ELECTRIC STATION

Sample No.	Location*	Unified Soil Classification System	Percent Passing No. 200 Sieve	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity Index	Dry Density (pcf)	Percent of Optimum Density	Coefficient of Permeability (cm/sec)
1	N369580 E3338937	CH		30	54	31	90		8.4×10^{-8}
2	N370320 E3338960	CL		40	48	28	80		2.4×10^{-7}**
3	N370958 E3338980	SC		26	36	13**	79		1.7×10^{-5}**
4	N369770 E3339015	SC	46	21	42	24	103	99	8.0×10^{-9}
5	N369220 E3338920	CH		25	53	30	92		3.4×10^{-8}
6	N369670 E3339010	CH		29	74	52	88		4.8×10^{-8}
7	N370650 E3339065	CH		27	55	33	84		6.9×10^{-8}
8	N371030 E3339000	SM		20	34	8**	89		1.1×10^{-5}**
9	Bottom - North End	SM	41		37	5			

* See Plate 1.
** Does not meet requirements of TDWR.

PLATE 2

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

SUMMARY OF TEST DATA (Contd.)
EAST ASH POND
GIBBONS CREEK STEAM ELECTRIC STATION

Sample No.	Location *	Unified Soil Classification System	Percent Passing No. 200 Sieve	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity Index	Dry Density (pcf)	Percent of Optimum Density	Coefficient of Permeability (cm/sec)
10	Bottom - North End	SM	13		Non-plastic				
11	Bottom - North End	SM	28		Non-plastic				
12	N370685 E3339030	CL	55	18	39	23	97	96	8.2×10^{-8}
13	N370700 E3338963	CH	64	26	55	30	86	98	2.6×10^{-7} **
14	Bottom - North End	CH	75	31	62	39	92	100	9.0×10^{-10}
15	Bottom - Middle	CH	71	29	65	40	92	101	2.5×10^{-9}

* See Plate 1.
** Does not meet requirements of TDWR.

PLATE 3

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

SUMMARY OF TEST DATA
MIDDLE ASH POND
GIBBONS CREEK STEAM ELECTRIC STATION

Sample No.	Location *	Unified Soil Classification System	Percent Passing No. 200 Sieve	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity Index	Dry Density (pcf)	Percent of Optimum Density	Coefficient of Permeability (cm/sec)
16	N371057 E3338725	SC		30	36	10**	80		2.9×10^{-8}
17	N369770 E3338600	CL	74	26	48	28	99	100	5.4×10^{-8}
18	N369275 E3338650	CH		40	59	32	71		9.7×10^{-8}
19	West Slope - South End	CH	77		58	35			
20	Bottom - South End	CH	86	35	57	29	82	95	3.2×10^{-8}
21	Bottom - North End	CH	93	32	68	44	87	96	2.5×10^{-9}
22	Bottom - North End	CH	85	28	71	47	91	101	2.0×10^{-9}

* See Plate 1.
** Does not meet requirements of TDWR.

PLATE 4

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

SUMMARY OF TEST DATA
WEST ASH POND
GIBBONS CREEK STEAM ELECTRIC STATION

Sample No.	Location *	Unified Soil Classification System	Percent Passing No. 200 Sieve	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity Index	Dry Density (pcf)	Percent of Optimum Density	Coefficient of Permeability (cm/sec)
23	N370960 E3338435	SM			31	8**			
24	N370020 E3338400	Lignite Samples - No Tests							
25	N369620 E3338390	Lignite Samples - No Tests							
26	N369630 E3338297	Lignite Samples - No Tests							
27	N371049 E3338435	SM			32	9**			
28	N370660 E3338330	CL		22	40	18	92		3.6×10^{-8}
29	N369290 E3338380	CH		26	53	27	91		1.2×10^{-7} **
30	N371000 E3338450	CH	77	29	69	46	92	92	4.2×10^{-9}
31	N370170 E3338425	CH	88	34	61	38	85	98	2.3×10^{-9}

* See Plate 1.
** Does not meet requirements of TDWR.

PLATE 5

SUMMARY OF TEST DATA (Contd.)
WEST ASH POND
GIBBONS CREEK STEAM ELECTRIC STATION

Sample No.	Location *	Unified Soil Classification System	Percent Passing No. 200 Sieve	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity Index	Dry Density (pcf)	Percent of Optimum Density	Coefficient of Permeability (cm/sec)
32	N369370 E3338390	CH	70	28	54	34	92	100	5.6×10^{-9}
33	N369630 E3338290	CH		33	64	40	82		1.7×10^{-8}
34	West Slope - South End	CH	73	26	67	45	94	103	9.8×10^{-9}
35	Bottom - South End	CH	77	28	54	34	92	100	9.9×10^{-10}
36	Bottom - North End	CH	82	34	70	46	86	98	2.5×10^{-9}
37	South Slope	CH	75	26	60	39	93	100	1.1×10^{-9}
38	North Slope	CH	77	32	59	36	80	93	3.0×10^{-8}

* See Plate 1.
** Does not meet requirements of TDWR.

NSS 1983 *Sludge Pond Study, Gibbons Creek Steam Electric Station, Grimes County, Texas*, Job No. D-76602-52, NFS/National Soil Services, Inc. October 21, 1983.

NFS SERVICES, INC.
CONSULTING ENGINEERS
(Formerly National Soil Services)

P.O. BOX 24596
DALLAS, TEXAS 75224
4087 SHILLING WAY
214-330-9211 (Office) 214-330-8953 (Telecopy)

October 21, 1983
Job No. D-76602-52

REC'D TMPA
OCT - 2 1983
AM 7|8|9|10|11|12|1|2|3|4|5|6 PM

Texas Municipal Power Agency
P. O. Box 7000
Bryan, Texas 77805

Attention: Mr. John Turlak

SLUDGE POND STUDY
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

Gentlemen:

This letter presents the results of our detailed evaluation of the requirements for slurry wall containment of the above-noted pond. Our initial cost estimates and recommendations, as related to both a slurry wall and an artificial liner, were submitted in our September 16, 1983 letter.

Field and Laboratory Investigations

Subsurface exploration along the proposed slurry wall alignment consisted of seven undisturbed sample borings drilled at 200 to 250-foot intervals to a depth of 50 feet. Continuous samples were obtained in the upper 30 feet. The borings were drilled by Soil Mechanics Incorporated during the period September 27-29, 1983.

The soil samples were reviewed by Mr. Darryl Carlson, Senior Geologist for NFS Services, Inc. Samples were classified visually by Mr. Carlson with notations made as to degree of fissuring and moisture conditions. Fracture surfaces were tested with litmus paper to determine pH. Additionally, pH determinations were made in the laboratory by Soil Mechanics Incorporated to provide data regarding the natural pH of the soils. In general, the pH testing proved to be inconclusive with respect to tracking movements of contaminants.

Geologic Assessment

A boring plan (Plate 1) and a soil profile (Plate 2) are attached to this letter. As indicated on Plate 2, the fill portion of the dike embankment, ranging from about one foot to 12 feet, is made up of clays and sandy clays.

A Recent/Pleistocene-aged terrace deposit is present beneath the fill and overlies the Eocene-aged Jackson Group. Soils in the former deposit consist of sandy clay and clayey sand with gravel. Thickness of the deposit ranges from a minimum of four feet at boring location SDP-2 to a maximum of approximately 15 feet at boring location SDP-5. The contact with the underlying Jackson Group is an undulating surface.

Soils of the Eocene-aged Jackson Group underlie the Recent/Pleistocene terrace deposit and are present to below completion depths of the borings. Grade on the undulating upper surface ranges from Elev 261 to Elev 270. Soil types consist of clay, sandy clay, silty clay, clayey silt, clayey sand, silty sand, lignite and occasional thin seams of sandstone.

Clays, sandy clays and lignites in the Jackson Group are extensively fractured throughout the depths penetrated by the borings. Free moisture was observed on some fracture surfaces in the lignite stratum. Fracture surfaces within the upper 20 feet are all generally stained by iron oxide which has been deposited from groundwater. The area of staining represents a zone of water table fluctuation.

Apparent dip of strata in the Jackson Group is on the order of 260 feet per mile in a southwesterly direction, and is based on correlation of the persistent lignite stratum shown on Plate 2. Clays are generally present above the lignite except in the vicinity of boring SDP-7. At this location, approximately 25 feet of clayey sand and silty sand overlie the lignite.

Seepage Conditions

Approximate grade of the pond bottom (Elev 260) is shown on Plate 2 by a dashed line. Soils present along the dike slopes and in the bottom of the pond consist of clay fill, Recent/Pleistocene-aged sandy clay and clayey sand and Eocene-aged clay, sandy clay, and clayey sand.

Soils with the greatest potential for seepage would be clayey sands in the Recent/Pleistocene-aged deposit and the fractured clays in the Eocene aged-Jackson Group. Based on the available subsurface data and visual observations, the seepage has a nearly horizontal flow pattern through the lower part of the dike in the Recent/Pleistocene and Eocene formations. Seepage from the pond bottom is not considered a problem inasmuch as the reworked and recompacted clay bottom has been protected by accumulated surface water runoff during the approximate four-year interval between the pond completion and commencement of operation.

As outlined in our September 16, 1983 letter, the two available methods for providing containment of the pond are the installation of an artificial liner and construction of a slurry wall. Findings from this detailed evaluation of the requirements for slurry wall construction indicate the general absence of an identifiable, continuous aquitard into which the slurry wall may be tied. Nonetheless, it is our judgment that a 40-foot-deep slurry wall installed along the top of the dike would effectively contain the pond by elimination of the present horizontal flow pattern and by creation of vertical flow gradients in the foundation clay strata. Based on our findings, the slurry wall should be constructed around the entire perimeter of the pond.

Updated Cost Estimates

As reported in our September 16, 1983 letter, the cost of an artificial liner is estimated to range from $246,000 to $283,000, depending upon the type of liner material installed and exclusive of the costs of dewatering the pond, removing accumulated sludges, and placing a protective soil cover over the installed liner.

The revised cost estimate for a 40-foot-deep slurry wall around the pond perimeter is $310,000, based on perimeter distance of 2,500 feet and the use of bottom ash for backfilling the trenches. The bottom ash backfill was initially suggested by Mr. Pradeep Tipnis of TMPA. Results of a sieve analysis performed on a representative sample of bottom ash in our on-site laboratory showed 90 percent passing the one-half-inch sieve and 4.6 percent passing the No. 200 sieve. While this gradation is somewhat coarse for use as slurry trench backfill, the bottom ash is brittle and could be broken down to produce additional fines through movement of a tracked construction vehicle prior to placement in the trench.

Conclusions and Recommendations

Based on the findings from this study, the estimated cost for the slurry wall construction is $310,000 as compared to the range of $246,000 to 283,000 estimated for installation of an artificial liner. Assuming that costs associated with transferring the contents of the sludge pond to another pond, removing accumulated sludges from the pond bottom and placing any desired soil cover over the artificial liner (Note: part or all of this work may be accomplished by plant personnel and it is assumed that these costs will be determined by TMPA) do not exceed the cost difference between above-stated estimated costs for the slurry wall and artificial liner, we recommend that an artificial liner be used to provide containment of the sludge pond.

In our judgment, the composite 36-mil Hypalon/30-mil PVC liner, which is normally less expensive than an all Hypalon liner and is estimated to have an installed cost of $246,000, will be satisfactory for this installation. We will be pleased to furnish you with any additional data that you may request regarding liner material, installation procedures, etc.

Please call us if there are any questions or if we may be of additional assistance.

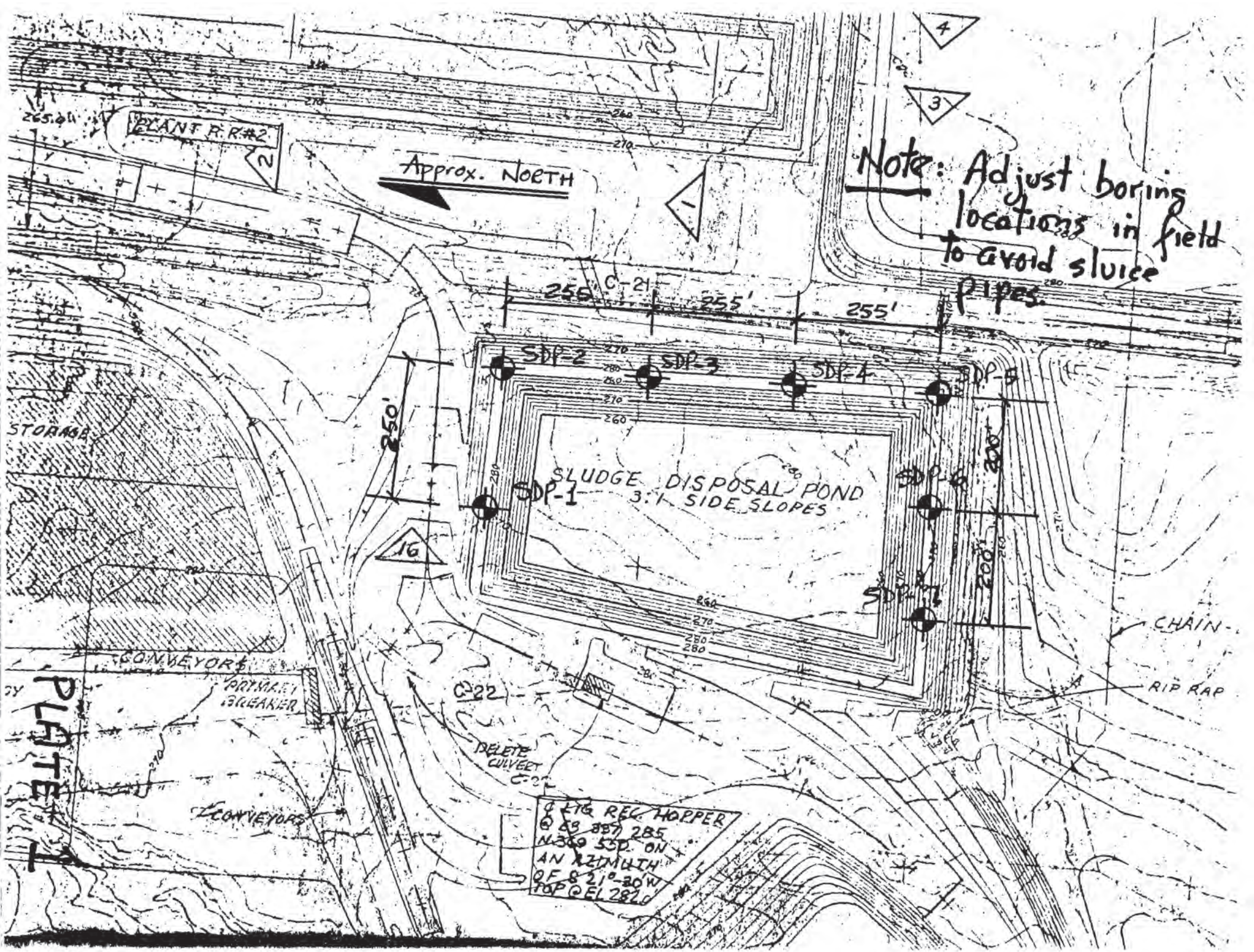
Very truly yours,

NFS SERVICES, INC.

Gary G. LaFrance, P. E.
Manager of Engineering

GGL/lcr
Encl.

cc: Tippett & Gee, Inc.
Attention: Mr. Larry Webb, P. E.


Note: Adjust boring locations in field to avoid sluice pipes.
Approx. NORTH
PLANT R.R.#2
265.0
C-21
250'
255'
255'
SDP-2
SDP-3
SDP-4
SDP-5
SDP-6
SDP-7
SDP-1
250'
200'
200'
SLUDGE DISPOSAL POND
3:1 SIDE SLOPES
STORAGE
CONVEYORS
PRIMARY BREAKER
CONVEYORS
C-22
DELETE CULVERT C-22
CHAIN-
RIP RAP
PLOTTER
16
4
3
2
1

NORTH SIDE — EAST SIDE — SOUTH SIDE

SDP-1 SDP-2 SDP-3 SDP-4 SDP-5 SDP-6 SDP-7

ELEVATION IN FEET (MSL)

280 270 260 250 240 230

FILL

RECENT/PLEISTOCENE

EOCENE JACKSON GROUP

APPROX. POND BOTTOM

SDP-1: w/lignite seams w/jts; 3.9; w/jts stained; 5.0; 3.9

SDP-2: w/jts; w/jts lignitic

SDP-3: w/jts; w/jts stained; lignitic; lignitic w/jts; wet; 5.3

SDP-4: w/jts; open jts; jts stained; 4.1; lignitic; 3.8; 8.2

SDP-5: 4.5; w/stained jts; w/jts; w/jts No staining; w/jts; w/jts No staining; 8.5

SDP-6: 3.9; w/stained jts; 4.3; w/stained jts; lignitic w/jts

SDP-7: w/stained jts; 4.3; 4.3

SOIL TYPE

Gravel	Sand	Silt	Clay
Gravelly	Sandy	Silty	Clayey

Predominant type shown heavy

◇3.9 pH of Soil Sample determined in Lab

Scale: 1" = 100' Hor
1" = 10' Vert

SLUDGE POND
GENERALIZED SOILS
CONDITIONS

PLATE 2
D-76602-S2

Jim Shoulta

NFS SERVICES, INC.
CONSULTING ENGINEERS

P.O. BOX 24596
DALLAS, TEXAS 75224
4087 SHILLING WAY
214-330-9211 (Office) 214-330-8953 (Telecopy)

(Formerly National Soil Services)

September 16, 1983
Job No. D-76602-52

REC'D TMPA
SEP 20 1983
AM 7 8 9 10 11 12 1 2 3 4 5 6 PM

Texas Municipal Power Agency
P. O. Box 7000
Bryan, Texas 77805

Attention: Mr. John Turlak

SLUDGE POND STUDY
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

Gentlemen:

This letter will provide confirmation of the cost estimates and recommendations presented to you on September 12, 1983 via the telephone conference call between Messrs. John Turlak of TMPA, Larry Webb of Tippett & Gee, and Gary LaFrance of NFS Services, Inc. These cost estimates and recommendations pertain to remedial work required for containment of the existing sludge pond. A preliminary assessment of the pond leakage was made at the September 6, 1983 meeting held at the plant site. At that time, it was concurred that NFS and T & G would jointly develop cost estimates and recommendations for alternate containment methods using an artificial liner and a slurry wall.

Cost estimates for installation of an artificial liner and a slurry wall are presented as follows:

A. Artificial Liner

1. Assumptions

a.) The liner will be required over the entire pond area (total area of bottom and slopes is about 350,000 square feet).

b.) The liner installation will require pumping the contents of the pond to a nearby ash pond, removing and disposing of accumulated sludge solids in the bottom of the pond, stripping sludge-contaminated soils, backfilling irregularities over the pond bottom, scarifying and sterilizing the subgrade, and installing a gas vent system. This cost estimate does not include provisions for pumping and removing sludge nor for the cost of any protective soil cover that may be required for cleaning out the pond at a later date.

c.) Two liner types were evaluated: (1) 36-mil Hypalon; and (2) a composite liner consisting of 36-mil Hypalon on the slopes and 30-mil PVC over the bottom area. Based on recent experience, material costs are estimated to be $0.55 per square foot for the Hypalon and $0.35 per square foot for the PVC. Installation costs for either the 36-mil all Hypalon liner or the composite Hypalon/PVC liner is estimated to be $0.10 per square foot.

2. Estimated Total Cost for 36-Mil Hypalon Liner

a.)	Subgrade Preparation (includes stripping, backfilling, scarifying and sterilizing, and installing gas vents)	$ 58,000.00
b.)	Material Cost (36-Mil Hypalon)	190,000.00
c.)	Installation Cost	35,000.00
	Estimated Total Cost	$ 283,000.00

3. Estimated Total Cost of Composite 36-Mil Hypalon and 30-Mil PVC Liner

a.)	Subgrade Preparation	$ 58,000.00

b.) Material Cost

36-Mil Hypalon	86,000.00
30-Mil PVC	67,000.00
c.) Installation Cost	35,000.00
Estimated Total Cost	$ 246,000.00

B. Slurry Wall

1. Assumptions

a.) The slurry wall will extend around three sides of the pond with an estimated total length of 1,300 lineal feet. Required depth of the slurry wall is expected to range from 30 to 40 feet. Average thickness of the slurry wall is estimated to be 2.5 feet. Estimated unit cost for slurry wall construction is $3.00 per square foot.

b.) Sand backfill will be required for the trenches. In-place cost of the sand is estimated to be $3.75 per cubic yard.

c.) A geotechnical investigation, consisting of about seven 50-foot-deep borings, laboratory soil tests and engineering analyses will be required and can be expected to cost about $10,000.00. A similar study will not be needed for the artificial liner alternate. The cost of the geotechnical investigation has not been included in the cost estimate for the slurry wall construction.

2. Estimated Total Cost for 40-Foot-Deep Slurry Wall

a.)	Basic Slurry Wall Construction	$ 156,000.00
b.)	Sand Backfill	19,000.00
c.)	Reshape and Revegetate Slopes	5,000.00
	Estimated Total Cost	$ 180,000.00

3. Estimated Total Cost for 30-Foot-Deep Slurry Wall

a.)	Basic Slurry Wall Construction	$ 117,000.00
b.)	Sand Backfill	14,000.00
c.)	Reshape and Revegetate Slopes	5,000.00
	Estimated Total Cost	$ 136,000.00

With respect to the slurry wall construction, Mr. Larry Webb noted that the contractor may prefer to remove and then later replace the upper one to two feet of the top of the dike in order to increase the width of the work area from the present 20 feet to about 30 feet. If this is not done, the more restricted work space may result in an increase in unit cost of slurry wall construction from about $3.00 per square foot to $4.00 per square foot.

Based on the foregoing construction cost estimates, it is apparent that an artificial liner, whether all Hypalon or a composite liner of 36-mil Hypalon and 30-mil PVC, should be considerably more expensive than construction of a slurry wall for containment of the sludge pond. It is recommended that the sludge pond study proceed by obtaining the necessary subsurface exploration to permit detailed evaluation of the requirements for the slurry wall construction. Enclosed with this letter are Plates 1 and 2 which present a recommended plan of borings and a listing of subsurface data needed from the borings.

Please call us if there are any questions.

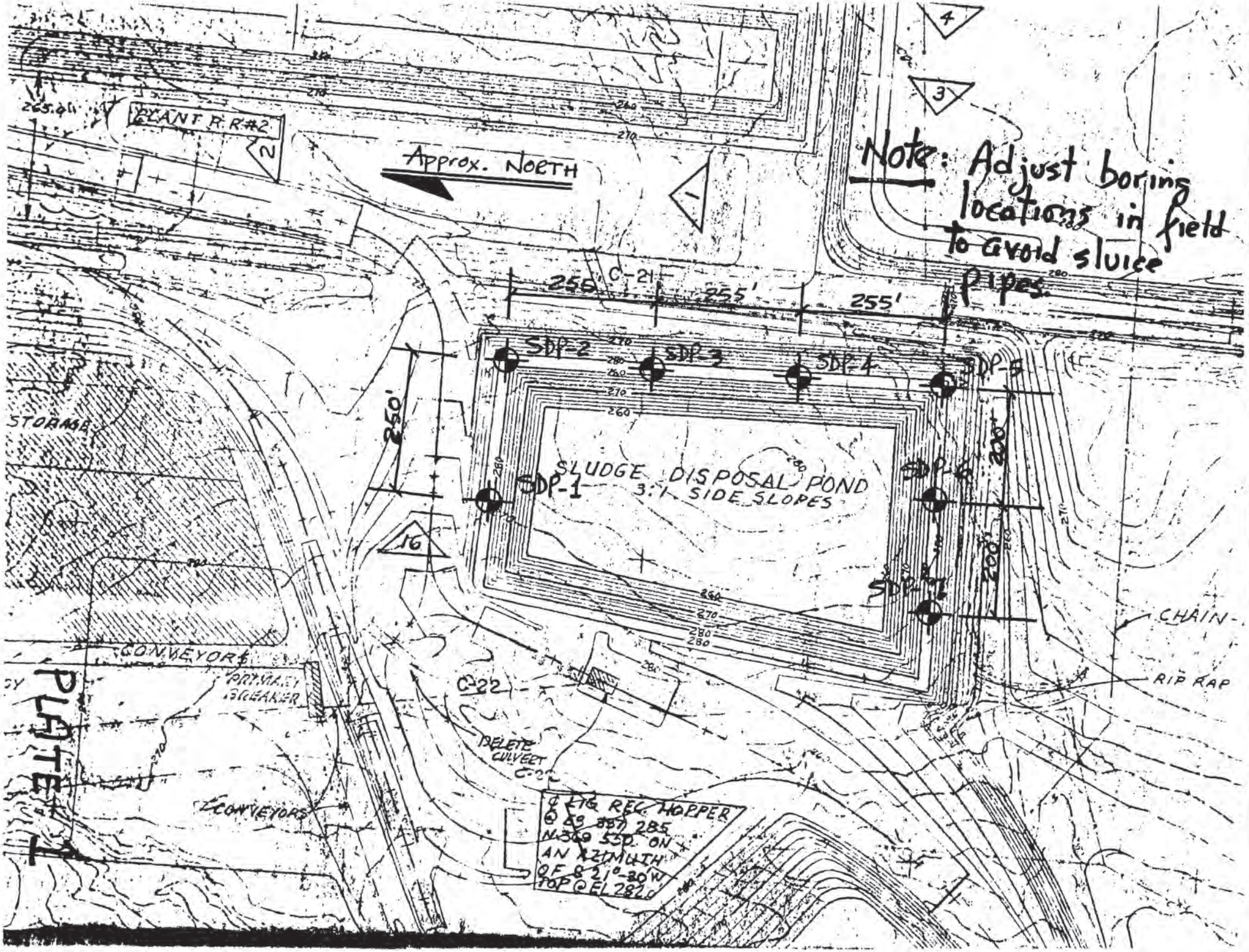
Very truly yours,

NFS SERVICES, INC.

Gary G. LaFrance, P. E.
Manager of Engineering

GGL/sf
Encl.

cc: Tippett & Gee, Inc.
Attention: Mr. Larry Webb, P. E.


Note: Adjust boring locations in field to avoid sluice pipes.
Approx. NORTH
PLANT R.R.#2
SDP-1
SDP-2
SDP-3
SDP-4
SDP-5
SDP-6
SDP-7
SLUDGE DISPOSAL POND
3:1 SIDE SLOPES
250'
255'
255'
200'
C-21
C-22
STORAGE
CONVEYORS
PRIMARY BREAKER
CONVEYORS
DELETE CULVERT C-22
CHAIN-
RIP RAP
PLETE

SLUDGE POND STUDY

GIBBONS CR. SES

1. Drill seven borings, SDP-1 thru SDP-7, to a depth of 50 feet.
2. Take continuous 3" diameter Shelby tube or Pitcher barrel samples in upper 30 feet. Take Shelby tube or Pitcher barrel samples @ 5' intervals below a depth of 30 feet.
3. A soils engineer or geologist should log all samples in the field and should be present at the drill rig during the drilling and sampling work.
4. In addition to the usual data appearing on a boring log, the soils engineer or geologist should record details concerning loss of drill water, in-situ fissures in clay (depth and orientation, stained surfaces, etc.), and depth and thickness of sand seams.
5. Preserve representative undisturbed samples from each sampling interval in a waxed container. Also, obtain a pint-sized jar sample from the same sampling interval.
6. Grout completed boreholes with a cement-bentonite grout mixture.

PLATE 2

John Turtak
Jim Shoults

SOIL MECHANICS INCORPORATED

FOUNDATION EXPLORATION AND TESTING SERVICES
206 NORTH SIMS • P. O. BOX 672 • BRYAN, TEXAS • 77806-0672

TELEPHONE (409) 822-6810 / 822-3767

LETTER OF TRANSMITTAL

TO: Texas Municipal Power Agency
Attn: Mr. Pradeep Tipnis
P.O. Box 7000
Bryan, TX 77805

REC'D TMPA
OCT 5 1983
AM 7 8 9 10 11 12 1 2 3 4 5 6 PM
A

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

SMI PROJECT NO. 283-202

We are sending you 2 copies of the following:

Pages	Dated	Item	Pages	Dated	Item
		Concrete Compressive Strength			Summary of Laboratory Test Data
		Concrete Batch Plant Report	6	9-27-83	Boring Logs
		Concrete Field Report	8	9-28-83	Boring Logs
		In-place Density Test Report	1	9-30-83	Boring Log
		Mechanical Analysis	3		Boring Logs - Monitor Wells
		Optimum Moisture/Density Relationship	1		Monitor Well Location Sketch

Signed: Leigh Ann Capps
Leigh Ann Capps

Date: October 3, 1983

REMARKS:

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-1

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-27-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ⊘ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
	2468			Topsoil, tan silty fine sand with roots
				2'
	2469	4+		Hard tan and gray clay, fill
5	2470	4+		Hard tan and gray clay with red clay streaks, fill
	2471	4+		Hard tan clay
	2472	4+		Hard brown clay to 8'2"
		2.75		Very stiff gray sandy clay with gravel and sand pockets
10	2473	2.0		Stiff to very stiff tan sandy clay with gravel and sand pockets
	2474	1.75		Stiff tan and gray sandy clay
15	2475	4.0		Hard gray sandy clay with tan clay layer at 15.75'
				16'
	2476	3.5		Very stiff brown clay with lignite seams, laminated and jointed
		2.5		
	2477	2.5		Very stiff brown silty clay with organic clay layer and cemented sand nodules
20				20'
	2478	4+		Hard tan silty clay
	2479	4+		Hard gray clay with iron stains and sand pockets
25	2480	4+		Hard gray clay with iron stains, laminated and jointed
	2481	4+		Hard gray clay with iron stains, laminated and jointed
	2482	4+		Hard gray silty clay with iron stains and gypsum seams
30				
	2483	4+		Hard gray clay with gypsum seam at 33'3", laminated and jointed
35				
				37'±
	2484	2.0		Stiff gray sandy clay-clayey sand
40				
				42'±
	2485	2.0		Alternating layers of gray sandy clay and clayey sand
45				

SOIL MECHANICS INCORPORATED BRYAN, TEXAS

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-1

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-27-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ☐ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
				Alternating layers of gray sandy clay and clayey sand — 47.5'
50	⊠ 2486		58	Very dense gray sand
				Bottom at 50'
55				
60				
65				

Boring filled with cement-bentonite grout upon completion of drilling.

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-2

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-27-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ⊘ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
	2448			Topsoil, tan silty fine sand with roots — 2'
	2449	4+		Hard tan and gray clay with sand streaks, fill
5	2450	4+		Hard tan and gray clay and sandy clay with sand streaks, fill
	2451	4+		Hard gray clay with sand and clay pockets, fill
	2452	2.25		Very stiff red and gray sandy clay with tan sand pockets
10	2453	2.75 4+		Very stiff to hard red and gray sandy clay
	2454	4+		Hard gray sandy clay, jointed
15	2455	4+		Hard gray clay — 15.5'
	2456	2.0		Brown lignitic clay, jointed Very stiff brown clay with trace of lignite, laminated and jointed
	2457	3.0		Very stiff reddish brown silty clay, laminated and jointed
20	2458	4+		Hard reddish brown silty clay with iron ore layer at 21'10"
	2459	4+		Hard brown clay — 22'7" Hard black lignite
	2460	4+		Hard black lignite — 25'
25	2461	4+		Hard gray silty clay, laminated
	2462	4+		Hard gray silty clay, laminated
	2463	4+		Hard gray silty clay, laminated
30				
	2464	4+		Hard gray sandy clay with 2" sandstone layer at 33', laminated
35				
	2465	4+		Cemented sand seam at 38' Hard gray clay with cemented sand seams — 38.75' Sand — 40.5'
40				
	2466	4+		Hard gray sandy clay with trace of lignite
45				

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-2

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-27-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ⊘ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
				47.5'
50	⊠ 2467		50/8"	Very dense gray sand
				Bottom at 50'
55				
60				
65				

Boring filled with cement-bentonite grout upon completion of drilling

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-3

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-27-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ⊘ - No Recovery J-Jar

Depth in Feet	Sample Type & No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
	2487			Topsoil, tan silty fine sand with roots — 2'
	2488	4+		Hard gray clay with tan clay streaks and calcareous nodules
5	2489	4+		Hard tan and gray sandy clay with sand pockets and gravel, fill
	2490	4+		Hard tan and gray sandy clay with trace of gravel
	2491	4+		Hard tan and gray sandy clay with occasional sand pockets and gravel
10	2492	4+		Hard tan and gray sandy clay with organic material, jointed Hard tan clay with organic material at 11'8", jointed
	2493	4+		Hard tan clay with iron stains and lignite streaks, laminated and jointed — 14'
15	2494	2.0 4+		Stiff to hard brown silty clay with trace of lignite, laminated and jointed
	2495	1.5 4+		Stiff brown silty clay with trace of lignite — 17' Hard tan clay
	2496	4+		Hard tan clay with iron ore seams, jointed — 20'
20	2497	2.5 4+		Stiff brown lignitic clay, laminated and jointed — 21' Hard tan clay with iron ore seams, laminated and jointed — 22'
	2498	4+ 3.5		Hard brown lignitic clay, laminated and jointed Very stiff dark brown lignitic clay at 23', laminated, jointed
25	2499	4+		Hard brown lignitic clay, laminated and jointed
	2500	4+		Hard brown lignitic clay, laminated and jointed — 28'
	2501	4+		Hard black lignite
30				— 32'
				Gray sandy clay
	2502	4+		Hard gray sandy clay
35				
	2503	4+		Hard gray sandy clay, laminated
40				
				Cemented sand seam at 43'
	2504	2.0		Stiff gray sandy clay with sand pockets and cemented sand nodules
45				

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-3

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-27-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Dean

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ⊘ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
50	■ 2505	4+		Hard gray sandy clay
				Bottom at 50'
55				
60				
65				

Boring filled with cement-bentonite grout upon completion of drilling

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-4
LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-28-83 PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ⊘ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
	2506	3.0		Topsoil, tan silty fine sand 10"
				Very stiff tan clay
	2507	4.0		Hard tan sandy clay with trace of lignite and gravel, fill
5	2508	2.0		Stiff tan and gray sandy clay with gravel and 1" sand layer at 5'
	2509	4+		Hard red and gray sandy clay
	2510	2.5		Very stiff tan and gray sandy clay with clayey sand pockets
10	2511	2.0		Very stiff tan and gray sandy clay with clayey sand pockets and trace of organic
	2512	2.5		Very stiff tan and gray sandy clay with gravel, cemented sand nodules and tan sand pockets
15	2513	2.5		Very stiff tan and gray sandy clay
		4+		Hard tan clay with sand nodules at 15'
	2514	4+		Hard tan clay with iron stains 17'10"
				Hard brown clay
	2515	2.5		Very stiff brown clay
20		4+		Hard brown lignitic clay at 19', laminated and jointed 20'
	2516	4+		Hard tan clay with iron stain streaks, jointed
	2517	4+		Hard tan clay with iron stain streaks, jointed
25	2518	4+		Hard tan clay with iron stain streaks, jointed 25'8"
				Hard brown lignitic clay, jointed
	2519	4+		Alternating 4-in. layers of brown lignitic clay and tan clay with iron stains, jointed
	2520	4+		Hard tan clay
30				Hard brown lignitic clay at 28.5', laminated and jointed
	2521	4+		Hard brown lignitic clay, laminated and jointed 35'
35				Lignite 38'
40	2522	4+		Hard gray silty clay with trace of lignite
	2523	4+		Hard gray sandy clay with cemented sand seams
45				

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-4

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-28-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ☐ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
50	■ 2524	4+		Hard gray sandy clay
				Bottom at 50'
55				
60				
65				
				Boring filled with cement-bentonite grout upon completion of drilling

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-5

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-28-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ⊘ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
	2525			Topsoil, tan silty fine sand 1"
				Tan, red and gray sandy clay with sand nodules and pockets
	2526	3.5		Very stiff tan and gray sandy clay with cemented sand pockets 4'±
5	2527J			Sandstone layers 6'±
	2528	2.5		Very stiff tan and gray sandy clay with sand nodules
	2529	1.0		Plastic tan, red and gray sandy clay
10	2530	2.5		Very stiff gray sandy clay
	2531	3.75		Very stiff gray sandy clay with sand nodules and decayed organic material
		3.0		Very stiff gray sandy clay with sand nodules
15	2532	4+		Hard tan sandy clay with iron stains at 15'
	2533	4+		Hard tan and gray clay with iron nodules and streaks, jointed
	2534	4+		Hard tan and gray clay with iron nodules and streaks, laminated and jointed
20	2535	4+		Hard tan sandy clay with iron stains
	2536	4+		Hard tan clay, laminated and jointed 23.5'
				Hard brown clay, laminated and jointed 24'
25	2537	4+		Hard black lignite, laminated and jointed
	2538	4+		Hard black lignite, laminated and jointed
	2539	4+		Hard black lignite, laminated and jointed 29.5'
30				Clay
35	2540	4+		Hard green clay, jointed 37'±
	2541	4+		Hard black lignite, laminated and jointed 39.5'±
40				
	2542	4+		Hard gray silty clay, laminated and jointed
45				

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-5

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-28-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ☐ - No Recovery J-Jar DESCRIPTION OF STRATUM
				Lignite from 48 to 49'
				49'
50				Sandstone layer
				Bottom at 50'
55				
60				
65				

Boring filled with cement-bentonite grout upon completion of drilling

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-6
LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY
DATE: 9-28-83 PROJECT NO: 283-202
BORING TYPE: 4 1/2" Rotary
DRILLER: Anderson SOIL TECHNICIAN: Huff
GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ☒ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
	2544	4+		Topsoil, tan silty fine sand — 4"
				Hard tan sandy clay
	2545	2.5		Very stiff tan sandy clay with sand pockets and iron stains
5	2546	2.5		Very stiff tan sandy clay with sand pockets and iron stains
	2547	3.75		Very stiff tan sandy clay to clay
	2548	2.5		Very stiff tan sandy clay to clay
10				Tan and red sandy clay with gravel and sand pockets at 9'
	2549	1.5		Stiff tan and red sandy clay with gravel and sand pockets
		4+		Hard gray clay with iron ore pockets, jointed at 10'8"
	2550	4+		Hard tan and gray clay with iron stains, jointed
15	2551	4+		Hard tan clay with iron stains and decayed vegetation, jointed
	2552	4+		Hard tan clay with iron stains and decayed vegetation, jointed — 18'
	2553	4+		Alternating 5-in. layers of brown lignitic clay, laminated and jointed and brown sandy clay
20	2554	4+		Hard brown lignitic clay, laminated and jointed — 20.5'
				Hard tan clay, jointed
	2555	4+		Hard tan clay, jointed
				Hard gray clay with small sand seams, jointed at 22.5'
25	2556	4+		Hard gray clay with yellow seams, jointed
	2557	4+		Hard gray clay, jointed with 3" layer of brown lignitic clay at 25'
	2558	4+		Hard gray clay, jointed with 6" brown lignitic clay layer at 28'
30				— 32.5'
				Lignitic clay
	2559	4+		Hard brown lignitic clay, laminated and jointed with 3" gray sandy clay layer at 34'
35				— 37'±
	2560	4+		Hard gray clay with cemented sand seams, laminated
40				
	2561	4+		Hard dark gray lignitic clay — 43'3"
45				Black lignite — 44.5'

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-6

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-28-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ☒ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
50	■ 2562	4+		Hard gray silty clay, laminated
				Bottom at 50'
55				
60				
65				
				Boring filled with cement-bentonite grout upon completion of drilling

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-7

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-28,29-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ☒ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
	2563	3.75		Topsoil, tan silty fine sand — 6"
				Very stiff gray sandy clay
	2564	3.5		Very stiff tan and gray sandy clay with gray sand pocket at 3.5', fill
5	2565	1.5 3.75		Stiff to very stiff tan and gray sandy clay
	2566	3.5		Very stiff tan and gray sandy clay with sand nodules and organic material
	2567	4.0		Hard tan and gray clay with gray clay pockets, fill
10	2568	4+		Hard tan and gray clay with gravel and sand pockets
	2569	4+		Hard tan clay with sandstone nodules
15	2570	3.0		Very stiff tan and gray sandy clay — 15'
				Gray clayey sand
	2571	3.0		Gray and red clayey sand — 16.5'
				Very stiff gray clay
	2572	4+		Hard tan sandy clay — 18.5'
20				Hard brown clay — 20'
	2573	4+		Hard gray sandy clay
	2574	4+		Hard gray sandy clay with organic streaks, jointed
25	2575	2.25		Very stiff gray sandy clay
	2576	2.25		Very stiff gray sandy clay — 28'
	2577			Gray sandy clay-clayey sand
30				
	2578	3.5		Very stiff gray sandy clay-clayey sand
35				
	2579			Gray clayey sand with 1/2" layer of brown clayey sand at 39.5'
40				
	2580	2.0		Gray clayey sand — 44.5'
45				Very stiff gray sandy clay layer with tan sand layer at 45' and 4" layers of brown organic material

BORING LOG

PROJECT: Gibbons Creek S.E.S. Facility Sludge Disposal Pond, Carlos, Texas

BORING NO: SDP-7

LOCATION: As directed by Client

CLIENT: TEXAS MUNICIPAL POWER AGENCY

DATE: 9-28,29-83

PROJECT NO: 283-202

BORING TYPE: 4 1/2" Rotary

DRILLER: Anderson

SOIL TECHNICIAN: Huff

GROUND ELEV: 280'±

■ - Shelby Tube Sample ⊠ - Standard Penetration Test Sample ☐ - No Recovery J-Jar

Depth in Feet	Sample Type & Sample No.	Penetrometer Reading, tsf	Blows / Foot	DESCRIPTION OF STRATUM
50	■ 2581			Alternating layers of sandstone and gray sandy clay
				Bottom at 50'
55				
60				
65				
				Boring filled with cement-bentonite grout upon completion of drilling

SII 1985 *Sludge Pond Liner Certification and Warranty,* Staff Industries, Inc., Edward C. Staff, April, 1985.

STAFF INDUSTRIES INC. 240 Chene Street · Detroit, Michigan 48207 · Telephone (313) 259-1820

March 14, 1985

RECEIVED
JMS
MAR 18 1985
Eng., Constr & Systems Operation

Mr. J.M. Shoults, P.E.
Texas Municipal Power Agency
P.O. Box 7000
Bryan, Texas 77805

RE: Sludge Disposal Pond TMPA P.O. #B-9027, G.C.S.E.S. Unit 1, Carlos, Texas

Dear Mr. Shoults:

This is to certify Staff Industries furnished and installed the Hypalon liner for the referenced project according to the approved plans and specifications.

The installation was accomplished during the period of February 6, 1985 through February 19, 1985.

The certificate for the Hypalon material from manufacturer and the material warranty will be sent to you as soon as we receive same from the material supplier.

If you have any questions, please feel free to call.

Sincerely yours,

STAFF INDUSTRIES, INC.

Thomas A. Ruwart

Thomas A. Ruwart, P.E.

TAR/smf

attach.

cc: Fred Long
Ben Huffman

B9027

STAFF INDUSTRIES INC. 240 Chene Street · Detroit, Michigan 48207 · Telephone (313) 259-1820

April 11, 1985

Ms. Carole Lanyon
Texas Municipal Power Agency
P.O. Box 7000
Bryan, Texas 77805

Dear Ms. Lanyon:

Enclosed is a 20-Year Material Warranty from J.P.Stevens for the supply of Hypalon lining material shipped to Texas Municipal Power Co., at Carlos, Texas.

If we can be of further assistance, please let me know.

Sincerely,

STAFF INDUSTRIES, INC.

Edward C. Staff
Vice President

ECS*kr

Encl
cc: J-5732

J.P. Stevens & Co., Inc.
ELASTOMERIC PRODUCTS DEPARTMENT
EASTHAMPTON, MA 01027 (413) 527-0700

WARRANTY NO. 490 DATE 3-25-85

J.P. STEVENS & CO., INC.
LIMITED 20 YEAR WARRANTY FOR POND/PIT LINERS AND COVERS

J.P. Stevens & Co., Inc., as manufacturer, warrants each J.P. Stevens & Co., Inc. liner which is manufactured, sold as first quality and installed under Staff Industries supervision and/or control (1) to be free of any defects in materials and/or workmanship at the time of sale and (2) to have a useful life from the date of sale for a period of 20 twenty years under the normal uses and service for which it is designed and manufactured in any customary weather which may be encountered and which is not customarily considered to be in the nature of an act of God, casualty or catastrophe such as (but not limited to) earthquake, flood, piercing hail, tornado, etc. Normal use and service excludes, among other things, the exposure of the liner to harmful chemicals, mechanical abuse by machinery, equipment or people or excessive pressures or stresses from any source.

Should defects or premature loss of use within the scope of the above warranty occur, J.P. Stevens & Co., Inc. will supply repair or replacement materials on a pro rata basis at the then current price in such manner as to charge the customer only for that portion of the warranted 20 twenty year life which has elapsed since he purchased the material. To enable J.P. Stevens & Co., Inc.'s technical staff to properly determine the cause of any alleged defect and to take appropriate steps to effect timely corrective measures if such defect is within the warranty, any claim for alleged breach of warranty must be made and presented to J.P. Stevens & Co., Inc. within thirty (30) days after the alleged defect was first noticed or the defect and all warranties will be deemed to have been waived by the purchaser.

J.P. Stevens & Co., Inc.'s liability under this warranty shall in no event exceed the amount of the sale price of the material sold to the purchaser for the particular installation in which it failed, and under no circumstances shall J.P. Stevens & Co., Inc. have any liability for any special, direct, indirect or consequential damages arising from loss of production or any other losses owing to failure of the material or installation, and no allowance will be made for repairs, replacements or alterations made by the purchaser unless with J.P. Stevens & Co., Inc.'s consent in writing. J.P. Stevens & Co., Inc. neither assumes nor authorizes any person other than an officer of the Company to assume for it any other or additional liability in connection with the J.P. Stevens & Co., Inc.'s liner. All damages to parties other than the purchaser-user are specifically disclaimed.

If J.P. Stevens & Co., Inc.'s liner is installed by other than Staff Industries or a contractor under supervision and/or control, neither this warranty nor any other warranty shall be in effect or enforceable.

Any materials sold, other than as first quality, are sold as is and without warranty of any kind or nature.

Included in this warranty are reservoir cover products provided by J.P. Stevens & Co., Inc. provided these cover products are specifically made and installed for cover applications.

All warranties are given for individual installations and to become effective J.P. Stevens & Co., Inc. must have a certificate of installation stating, date installed, supervisor of installation, location, and identification code of J.P. Stevens & Co., Inc.'s product.

The warranties herein are given in lieu of all other possible warranties, express, implied, statutory or otherwise, and by accepting delivery of the materials, the purchaser expressly waives all other such possible warranties except those specifically given herein and purchaser acknowledges thereby that the warranties given herein are accepted in preference to any all such other possible warranties.

This warranty is limited to installations for commercial and/or industrial uses only and does not apply to consumer uses as defined by the Magnuson-Moss Warranty Act or any similar State consumer warranty statute. The parties expressly agree that the sale hereunder is for commercial or industrial use only.

Leon M Coco
J.P. Stevens & Co., Inc.

President, Stevens Elastomerics
Title

(Please cut off and return lower portion to J.P. Stevens & Co., Inc., Easthampton, Mass. 01027)

Staff - Texas Municipal

WARRANTY NO. 490

This J.P. STEVENS & CO., INC. LIMITED WARRANTY FOR HYPALON® LININGS AND COVERS is accepted by the below signed Purchaser-User:

_____
(Signature, Purchaser-User)

_____
(Name—Please Print)

_____
(Address)

_____
(City, State, Zip Code)

J.P. Stevens & Co., Inc.
ELASTOMERIC PRODUCTS DEPARTMENT
EASTHAMPTON, MA 01027 (413) 527-0700

J. P. Stevens & Co., Inc.
ELASTOMERIC PRODUCTS DEPARTMENT
EASTHAMPTON, MA 01027 (413) 527-0700

RECEIVED
APR 15 1985
T.M.P.A.-Document Control

WARRANTY NO. 490

DATE 3-25-85

J.P. STEVENS & CO., INC.
LIMITED 20 YEAR WARRANTY FOR POND/PIT LINERS AND COVERS

J.P. Stevens & Co., Inc., as manufacturer, warrants each J.P. Stevens & Co., Inc. liner which is manufactured, sold as first quality and installed under Staff Industries supervision and/or control (1) to be free of any defects in materials and/or workmanship at the time of sale and (2) to have a useful life from the date of sale for a period of 20 twenty years under the normal uses and service for which it is designed and manufactured in any customary weather which may be encountered and which is not customarily considered to be in the nature of an act of God, casualty or catastrophe such as (but not limited to) earthquake, flood, piercing hail, tornado, etc. Normal use and service excludes, among other things, the exposure of the liner to harmful chemicals, mechanical abuse by machinery, equipment or people or excessive pressures or stresses from any source.

Should defects or premature loss of use within the scope of the above warranty occur, J.P. Stevens & Co., Inc. will supply repair or replacement materials on a pro rata basis at the then current price in such manner as to charge the customer only for that portion of the warranted 20 twenty year life which has elapsed since he purchased the material. To enable J.P. Stevens & Co., Inc.'s technical staff to properly determine the cause of any alleged defect and to take appropriate steps to effect timely corrective measures if such defect is within the warranty, any claim for alleged breach of warranty must be made and presented to J.P. Stevens & Co., Inc. within thirty (30) days after the alleged defect was first noticed or the defect and all warranties will be deemed to have been waived by the purchaser.

J.P. Stevens & Co., Inc.'s liability under this warranty shall in no event exceed the amount of the sale price of the material sold to the purchaser for the particular installation in which it failed, and under no circumstances shall J.P. Stevens & Co., Inc. have any liability for any special, direct, indirect or consequential damages arising from loss of production or any other losses owing to failure of the material or installation, and no allowance will be made for repairs, replacements or alterations made by the purchaser unless with J.P. Stevens & Co., Inc.'s consent in writing. J.P. Stevens & Co., Inc. neither assumes nor authorizes any person other than an officer of the Company to assume for it any other or additional liability in connection with the J.P. Stevens & Co., Inc.'s liner. All damages to parties other than the purchaser-user are specifically disclaimed.

If J.P. Stevens & Co., Inc.'s liner is installed by other than Staff Industries or a contractor under supervision and/or control, neither this warranty nor any other warranty shall be in effect or enforceable.

Any materials sold, other than as first quality, are sold as is and without warranty of any kind or nature.

Included in this warranty are reservoir cover products provided by J.P. Stevens & Co., Inc. provided these cover products are specifically made and installed for cover applications.

All warranties are given for individual installations and to become effective J.P. Stevens & Co., Inc. must have a certificate of installation stating, date installed, supervisor of installation, location, and identification code of J.P. Stevens & Co., Inc.'s product.

The warranties herein are given in lieu of all other possible warranties, express, implied, statutory or otherwise, and by accepting delivery of the materials, the purchaser expressly waives all other such possible warranties except those specifically given herein and purchaser acknowledges thereby that the warranties given herein are accepted in preference to any all such other possible warranties.

This warranty is limited to installations for commercial and/or industrial uses only and does not apply to consumer uses as defined by the Magnuson-Moss Warranty Act or any similar State consumer warranty statute. The parties expressly agree that the sale hereunder is for commercial or industrial use only.

Louis M Coco
J.P. Stevens & Co., Inc.

President, Stevens Elastomerics
Title

(Please cut off and return lower portion to J.P. Stevens & Co., Inc., Easthampton, Mass. 01027)

Staff - Texas Municipal

WARRANTY NO. 490

This J.P. STEVENS & CO., INC. LIMITED WARRANTY FOR HYPALON® LININGS AND COVERS is accepted by the below signed Purchaser-User.

C.E. Mahaffey (T.M.P.A.)
(Signature, Purchaser-User)

C.E. Mahaffey
(Name—Please Print)

P.O. Box 7000
(Address)

Bryan Texas 77805
(City, State, Zip Code)

J. P. Stevens & Co., Inc.
ELASTOMERIC PRODUCTS DEPARTMENT
EASTHAMPTON, MA 01027 (413) 527-0700

P.O#B 9027

STAFF INDUSTRIES INC. 240 Chene Street · Detroit, Michigan 48207 · Telephone (313) 259-1820

March 27, 1985

Ms. Carole Lanyon
Texas Municipal Power Agency
P.O. Box 7000
Bryan, Texas 77805

Dear Ms. Lanyon:

Attached is the Hypalon Material Certification from J. P. Stevens, our roll goods supplier.

Staff Industries certifies that the material supplied to Tampa at Carlos, Texas was purchased under our P.O.#5036 as referred to in the attached certification.

If we can be of further assistance, please let me know.

Sincerely,

STAFF INDUSTRIES, INC.

Edward C. Staff
Vice President

ECS*kr
cc: J-5732

STEVENSELASTOMERICS

J.P. Stevens & Co., Inc.
26 Payson Avenue
Easthampton, MA 01027
413 527 0700

March 25, 1985

Mr. Ed Staff
Staff Industries
240 Chene Street
Detroit, MI 48207

MATERIAL CERTIFICATION

RE: MATERIAL CERTIFICATION FOR TEXAS
MUNICIPAL POWER AUTHORITY - CARLOS, TX.

We hereby certify that Stevens Hypalon lining material, purchased by Staff Industries P. O. #5036 and used on the above referenced project meets or exceeds the requirements as set fourth in the specification.

Sincerely,

J. P. STEVENS & CO., INC.
Stevens Elastomerics

Arnold G. Peterson

Arnold G. Peterson
Technical Director
Membrane Lining

AGP/dtp

T&G 1977a *Specifications and Contract Documents for Site Preparation, Gibbons Creek Steam Electric Station, Unit No. 1, Texas Municipal Power Agency, Specification No. GC-1022*, Tippet & Gee, Inc. March, 1977.

TIPPETT & GEE, INC.

CONSULTING ENGINEERS

ABILENE, TEXAS

SPECIFICATIONS

AND

CONTRACT DOCUMENTS

FOR

SITE PREPARATION

GIBBONS CREEK STEAM ELECTRIC STATION

UNIT NO. 1

TEXAS MUNICIPAL POWER AGENCY

SPECIFICATION NO. GC-1022

March, 1977

TIPPETT & GEE, INC.

CONSULTING ENGINEERS

ABILENE, TEXAS

SPECIFICATIONS

AND

CONTRACT DOCUMENTS

FOR

SITE PREPARATION

GIBBONS CREEK STEAM ELECTRIC STATION

UNIT NO. 1

TEXAS MUNICIPAL POWER AGENCY

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NOTICE OF BIDS

Sealed bids will be received by the TEXAS MUNICIPAL POWER AGENCY (TMPA) for:

SITE PREPARATION

on or before 10:00 o'clock, a.m., May 24, 1977, at the Project Manager's office, Texas Municipal Power Agency (TMPA), Forest Park Center, 7111 Bosque Blvd., Waco, Texas 76710, at which time and place the proposals will be publicly opened and read. Specifications may be obtained upon request from the Consulting Engineers, Tippett & Gee, Inc., 502 North Willis Street, Abilene, Texas 79603.

Texas Municipal Power Agency (TMPA) reserves the right to reject any or all bids.

Each bid must be accompanied either by an acceptable bidder's bond, a certified check, or a cashier's check, payable to the Texas Municipal Power Agency (TMPA), in an amount not less than ten percent of the total amount bid.

Paul R. Cunningham, P.E.
General Manager

NOTICE AND INSTRUCTIONS TO BIDDERS
CONSTRUCTION CONTRACT

1. Sealed proposals for the furnishing, delivery and installation of equipment and materials for the electric generating plant of Texas Municipal Power Agency (hereinafter called the "Owner") which is to be part of the Project known as Gibbons Creek Steam Electric Station, Unit No. 1 will be received by the Owner on or before 10:00 o'clock A. M., May 24, 19 77, at Texas Municipal Power Agency, Forest Park Center, Waco, TX. at which time and place the proposals will be publicly opened and read. Any proposal received subsequent to the time specified will be promptly returned to the Bidder unopened.

2. The Plans and Specifications, together with all necessary forms and other documents for bidders may be obtained from the Owner or from the Engineer, **Tippett & Gee, Inc.** at the latter's office at 502 North Willis, Abilene, Texas, 79603. The Plans and Specifications may be examined at the office of the Engineer.

3. **Manner of Submitting Proposals.** Proposals and all supporting instruments must be submitted on the forms furnished by the Owner and must be delivered in a sealed envelope addressed to the Owner. The name and address of the Bidder, its license number, if a license is required by the State, and the date and hour of the opening of bids must appear on the envelope in which the Proposal is submitted. Proposals must be filled in in ink or typewritten. No alterations or interlineations will be permitted, unless made before submission and initialed and dated.

4. **Familiarity with Conditions.** Prior to the submission of the Proposal, the Bidder shall make and shall be deemed to have made a careful examination of the site of the Project and of the Plans and Specifications, Construction Drawings and forms of Contractor's Proposal and Acceptance, and Contractor's Bond on file with the Owner and with the Engineer, and shall become informed as to the location and nature of the proposed construction, the ecological and environmental criteria to be followed, the transportation facilities, the kind and character of soil and terrain to be encountered, the kind of facilities required before and during the construction of the Project, general local conditions and all other matters that may affect the cost and the time of completion of the Project.

5. **Bidder's Qualifications.**

Bids will not be considered under the specifications unless:

a. The Contractor has constructed installations of power stations and/or similar heavy industrial installations.

b. The bidder has submitted to the Owner and Engineers, not less than fifteen days prior to the date for receiving bids, two copies of the list of installations which bidder intends to use to establish his qualifications.

c. Bidder must submit satisfactory evidence that he:

1) Maintains a permanent place of business

2) Has suitable financial status to meet obligations incidental to the work.

3) Has no just or proper claims pending against him on other similar work.

4) Has adequate plant equipment available to do the work properly and expeditiously.

5) Has adequate technical knowledge and practical experience.

6. **The Time for Completion** of the Project shall be as specified by the Engineer in the Proposal.

7. **Bid Bond.** Each Proposal must be accompanied by a Bid Bond or a certified check on a bank that is a member of the Federal Deposit Insurance Corporation, payable to the order of the Owner, in an amount equal to ten per cent (10%) of the maximum bid price. Each Bidder agrees, provided its Proposal is one of the three low Proposals, that, by filing its Proposal together with such Bid Bond or check in consideration of the Owner's receiving and considering such Proposal, said Proposal shall be firm and binding upon each such Bidder and such Bid Bond or check shall be held by the Owner until a Proposal is accepted and a satisfactory Contractor's Bond is furnished by the successful Bidder or for a period not to exceed sixty (60) days from the date hereinbefore set for the opening of Proposals, whichever period shall be the shorter. If such Proposal is not one of the three low Proposals, the Bid Bond or check will be returned in each instance within a period of ten (10) days to the Bidder furnishing same.

8. **Contractor's Bonds.** Performance bond and payment bond shall be executed in five (5) counterparts by the successful contractor on the forms attached hereto, signed by a surety company authorized to do business in the State of Texas, and acceptable as surety to the Owner. Additional copies shall be prepared if so directed by the Owner and/or the Engineers.

The performance and payment bonds each shall be in the amount equal to 100% of the contract amount. With each bond there shall be filed with the Purchaser one copy of "Power of Attorney", certified, and including the date the bond.

9. **Failure to Furnish Contractor's Bonds.** Should the successful Bidder fail or refuse to execute such counterparts of the Proposal or to furnish Contractor's Bonds within ten (10) days after written notification of the acceptance of the Proposal by the Owner, the Bidder will be considered to have abandoned the Proposal. In such event, the Owner shall be entitled (a) to enforce the Bid Bond in accordance with its terms, or (b) if a certified check has been delivered with the Proposal, to retain from the proceeds of the certified check the difference (not exceeding the amount of the certified check) between the amount of the Proposal and such larger amount for which the Owner may in good faith contract with another party to construct the Project. The term "successful Bidder" shall be deemed to include any Bidder whose proposal is accepted after another Bidder has previously refused or has been unable to execute the counterparts of the proposal or to furnish satisfactory Contractor's Bonds.

10. Factors in Deciding the Award of the Contract. In estimating the lowest cost to the Owner as one of the factors in deciding the award of the Contract, the Owner will consider, in addition to the prices quoted in the Proposals, the following:

a. Financial Capability
b. D&B report
c. Previous experience which can be verified by reference
d. Performance history which can be verified by reference
e. Personnel available
f. Local offices
g. Construction plant available
h. Contractor's work load.
i. Interest in the Owner
j. Experience in the state where project is located.
k. Time of completion.

11. Contract is Entire Agreement. The Contract to be effected by the acceptance of the Proposal shall be deemed to include the entire agreement between the parties thereto, and the Bidder shall not claim any modification thereof resulting from any representation or promise made at any time by any officer, agent or employee of the Owner or by any other person. Contractor's proposal and Engineers' specifications shall be attached to and form a part of the contract.

12. Minor Irregularities. The Owner reserves the right to waive minor irregularities or minor errors in any Proposal, if it appears to the Owner that such irregularities or errors were made through inadvertence. Any such irregularities or errors so waived must be corrected on the Proposal prior to the acceptance thereof by the Owner.

13. Bid Rejection. The Owner reserves the right to reject any or all Proposals.

14. Summary of Proposal. Proposals shall include Summary of Proposal, consisting of the accompanying form properly filled out. Five (5) extra copies of this form are enclosed for Contractor's use. Proposal shall be submitted in quadruplicate.

15. Interpretation of Contract Documents. If Contractor contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the specifications or other proposed contract documents, he may submit to the Engineers a written request for an interpretation thereof. The Contractor submitting the request will be responsible for its prompt and actual delivery. Any interpretation of such documents will be made only by Addendum duly issued, and a copy of such Addendum will be mailed or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanations or interpretations of such documents which anyone presumes to make on behalf of the Owner before expiration of the ultimate time set for the receipt of bids.

GC-1022

SUMMARY OF PROPOSAL

FOR

SITE PREPARATION

GIBBONS CREEK STEAM ELECTRIC STATION

UNIT NO. 1

TEXAS MUNICIPAL POWER AGENCY

CONTRACTOR R.N.Adams Construction Co.

	(Insert all data in this column)
A. LUMP SUM PRICE	
Price for the WORK complete as specified and/or shown on the drawings.	
a. Material and Equipment	$ 3,006,929.71
b. Labor.....	$ 2,863,061.83
TOTAL LUMP SUM PRICE.....	$ 5,869,991.54
B. DATES	
1. Date which bidder can start construction work..	June 15, 1977
2. Date which bidder can complete earthwork and grading in Power House and Boiler Area.....	November 1, 1977 ✓
3. Date which bidder can complete access road work	December 1, 1977
4. Date which bidder can complete all work.....	March 1, 1978 ✓ August 31, 1978
5. Latest date bidder can start construction and meet specified completion dates.....	July 1, 1977
C. BIDDER SHALL STATE the amount included in the above LUMP SUM PRICE for the following:	
1. Clearing, grubbing and removal and stockpiling of topsoil.....	$ 263,255.18
2. Excavating, backfilling and grading on the plant site.....	$ 2,177,225.95
3. Ash pond construction.....	$ 502,063.95
4. Sludge disposal pond.....	$ 126,415.70
5. Collection pond.....	$ 462,288.60
6. Broadcast sprigging.....	$ 24,806.25
* 7. Riprap.....	$ 1,126,974.00 *
8. Soil cement as a substitute for riprap.....	$ 1,020,328.10
9. Plant Roads.....	$ 262,855.45
10. Plant railroad earthwork.....	$ 357,053.10
11. Plant access haul road.....	$ 145,722.40

*Based on acceptance of material from Texas Crushed Stone meeting 40% wear specs.

CONTRACTOR R. N. Adams Construction Co.

		(Insert all data in this column)	
	12. Culverts in plant area.....	$ 81,808.50	
	13. Lime treatment and base course work on plant access road.....	$ 30,333.25	
	14. Reinforced plastic pipe at ash ponds.....	$ 199,432.83	
	15. Seeding.....	$ 10,840.00	
	16. Miscellaneous Items.....	$ 205,562.27	
	D. UNIT PRICES as follows for work in place for the net amount that may be added to or deducted from the amounts shown on the drawings and/or called for in the specifications.....	ADDITIONS	DEDUCTIONS
*	1. Price per cubic yard for general earth excavation (machine)	$ 0.65	$ 0.65
	2. Price per cubic yard for backfill compacted to 95% maximum density.....	$ 0.30	$ 0.30
	3. Price per square yard for broadcast sprigging of Coastal Bermudagrass.....	$ 0.108	$ 0.108
	4. Price per cubic yard for riprap in place....	$ 20.75	$ 20.75 **
	5. Price per cubic yard for soil cement protection as a substitute for riprap.....	$ 18.70	$ 18.70
	6. Price per square yard for lime treatment of subgrade to a depth of 9" (Item 260).....	$ 1.79	$ 1.79
	7. Price per cubic yard of flexible base material Type A, Grade 2, (Item 248) in place.....	$ 16.60	$ 16.60
	8. Price per acre for seeding.....	$ 400.00	$ 400.00
*	9. Price per cubic yard for restricted excavation, such as over-excavation in the inspection trenches (machine).....	$ 1.00	$ 1.00
	10. Price per cubic yard for backfill compacted to 90% maximum density.....	$ 0.30	$ 0.30
***	11. Price per cubic yard, per mile transported for transporting surplus fill material for stockpiling to areas not yet designated.....	$ 0.44	$ 0.44

CANCELLATION SCHEDULE:

July 1, 1977	-0-
August 1, 1977	$ 10,000.00
September 1, 1977	20,000.00
October 1, 1977	30,000.00
November 1, 1977	40,000.00
December 1, 1977	50,000.00
January 1, 1978	60,000.00

** Based on acceptance of material from Texas Crushed Stone meeting 40% wear specs.

*(REVISED BY ADDENDUM NO. 1)
***(REVISED BY ADDENDUM NO. 3)

E. COST PLUS: It may be necessary to do extra work as the job progresses which is not covered by unit prices.

Contractor agrees to do work on a "Cost Plus" basis if authorized by Owner. Owner shall pay Contractor an amount equal to the net cost of the work plus a percentage. Net cost of work includes equipment, labor and labor foreman, material, and insurance and taxes on labor. The percentage shall include the cost of service of superintendent, field office force, all overhead including taxes and insurance generally considered as overhead, and the use of small tools and profit. Percentage is set out herein and is..... 15 %

F. Contractor shall attach to his proposal a list of equipment and respective rental rates. Rates shall not include insurance, overhead, taxes and profit.

EQUIPMENT RENTAL RATES

621 Scraper	27.00 per hour
632 Scraper	38.00 per hour
660 Scraper	38.00 per hour
D-9 Dozer	40.50 per hour
D-8 Dozer	30.50 per hour
No. 14 Motor Grader	20.50 per hour
977 or 950 Loader	20.00 per hour
Plow and Tractor	29.50 per hour
Roller and Tractor	29.50 per hour
Water wagon	25.00 per hour
Service Truck	4.20 per hour
30-T Motor Crane	30.00 per hour
95 Dragline	40.00 per hour
Pulvi-Mixer	21.50 per hour
Pneumatic Roller	13.00 per hour

SUMMARY OF PROPOSAL
SITE PREPARATION
GIBBONS CREEK S.E.S.
UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

GC-1022

CONTRACTOR R.N. Adams Contracution Co.

Bidder's signature below shall indicate receipt of addenda by him and their incorporation in his proposal.

SPECIFICATIONS GC-1022 ADDENDUM NO.	DATE RECEIVED	SIGNATURE OF CONTRACTOR
1	May 4, 1977	Arbatt
2	May 13, 1977	Arbatt
3	May 19, 1977	Arbatt
4		
5		
6		

Dated at Kaufman, Texas this 28th day of June 1977.

R. N. ADAMS CONSTRUCTION CO.
Contractor

Arbatt
Signature of Contractor

Vice - President
Title

Business Address of Contractor:

R. N. Adams Construction Co.

P. O. Box 340

Kaufman, Texas 75142

Attn: R. N. Adams

Phone: 214-932-2124

GENERAL CONDITIONS

(Form 200-A, Rev. 12-68)

INDEX

GENERAL CONDITIONS

(Form 200-A, Rev. 12-68)

EXHIBIT "A"

1. SCOPE: The Contract consists of the Agreement, these General Conditions, the Drawings and Specifications, Notice to Contractors, Instruction to Bidders, Proposal, Performance Bond, Addenda to Drawings and Specifications, all supplementary and/or Special Conditions, duly authorized Change Orders, engineering data furnished by the CONTRACTOR (when and as approved by the OWNER or ENGINEER), and instructions furnished by manufacturers of equipment for the installation thereof, and any other exhibits specified in the Agreement.

Any provision of these General Conditions that follows which pertains to a nonexistant condition, or which conflicts with any provision of the *Special Conditions* and/or *Job Specifications* shall have no meaning in the Contract and shall be disregarded.

2. DEFINITIONS: The Contract consists of all of the Documents and Drawings enumerated in Article 1 "Scope" above.

OWNER and CONTRACTOR are those mentioned in the Agreement. They are treated throughout as if each were of masculine gender and singular number.

Wherever in the Contract the term ENGINEER, ENGINEERS, or CONSULTING ENGINEERS is used, it refers to Tippett and Gee, Consulting Engineers.

The term *Work* includes such equipment, labor, material, methods and transportation or other facilities as may be necessary to complete the Contract.

The term Subcontractor includes only those having a direct contract with the CONTRACTOR and it includes one who furnishes material worked to a special design according to the plans and Specifications of this *Work*, but does not include one who merely furnishes material not so worked.

The term "date of Contract" shall be the date of the Contract Agreement.

The term "day" and/or "days" shall mean a calendar day or days of twenty-four hours each.

The term "Drawings" includes all Drawings prepared by the OWNER and/or ENGINEER, Drawings submitted by the successful Bidder with his Proposal and by the CONTRACTOR to the OWNER, when and as approved by the ENGINEER and all Drawings submitted by the OWNER and/or ENGINEER to the CONTRACTOR during the progress of the *Work* as provided herein.

The terms "approved", "as approved", "acceptable", "suitable", "properly", "satisfactory", shall mean "approved", "as approved", etc., by the OWNER and/or ENGINEER.

3. COPIES OF CONTRACT: A minimum of five copies of the CONTRACTOR's Proposal as submitted, Performance-Payment Bond, and the Contract Agreement shall be prepared. Additional copies shall be prepared if so directed by the OWNER and/or ENGINEER. Two of these copies, each containing the Bond properly executed and the Contract Agreement signed by the CONTRACTOR, shall be submitted to and signed by the OWNER; one of the second copies shall be delivered to the CONTRACTOR. A third copy of the above shall be delivered to the ENGINEER. The fourth copy of the above is to be retained by the surety company. The original copies of the above documents are to be retained by the OWNER in addition to the copy thereof in the OWNER's copy of the executed documents.

4. VERBAL STATEMENTS: Verbal statements are not binding. Verbal statements do not form a part of, or alter in any way, the written agreement.

5. SCOPE, NATURE, AND INTENT OF SPECIFICATIONS AND DRAWINGS: Specifications and Drawings supplement each other and together constitute one complete set of Specifications and Plans so that any *Work* exhibited in one and not in the other shall be executed just as if it had been set forth in both, in order that the *Work* shall be completed to the complete design or designs as decided and determined by the ENGINEER.

It is understood and agreed that the *Work* shall be performed and completed according to the true spirit, meaning, and intent of the Contract, Specifications and Drawings. It is incumbent on the CONTRACTOR that the CONTRACTOR shall furnish the *Work* complete and that the *Work* be satisfactory in all respects and fulfills the guarantees of the *Job Specifications*.

Should anything be omitted from the Specifications and Drawings which is necessary to a clear understanding of the *Work*, or should it appear that various instructions are in conflict, then the CONTRACTOR shall secure written instructions from the OWNER and/or ENGINEER before proceeding with the construction affected by such omissions and/or discrepancies.

6. EXAMINATION OF SITE: CONTRACTOR shall carefully examine the site of *Work* and the adjacent premises. CONTRACTOR shall conduct the necessary investigations to inform himself thoroughly as to the facilities for delivering and handling his equipment and material at the site, and investigation of all difficulties involved in the completion of the *Work* in accordance with the Specifications and Drawings.

CONTRACTOR shall make thorough investigation of the measures that may be required for protection of his *Work* from water hazards which may be encountered.

CONTRACTOR shall also investigate other potential interference and difficulties he may encounter in the proper and complete execution of all *Work* specified herein and/or shown on the Drawings.

Submission of a proposal or bid and/or execution of the Contract by the CONTRACTOR shall constitute a representation by CONTRACTOR that he has made a full and complete investigation of the site of the *Work* and all property and facilities adjacent or contiguous thereto with respect to both surface and subsurface conditions; and that CONTRACTOR is willing to assume full and complete responsibility for the effect of any and all such conditions upon the *Work* and the progress thereof.

7. SHOP DRAWINGS AND SAMPLES: After checking and verifying all field measurements, the CONTRACTOR will submit to the ENGINEER for approval, in accordance with the accepted schedule of Shop Drawing submissions, five copies (or at the ENGINEER's option, one reproducible copy) of all Shop Drawings, which shall have been checked by and stamped with the approval of the CONTRACTOR and identified as the ENGINEER may require. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable the ENGINEER to review the information as required.

The CONTRACTOR will also submit to the ENGINEER for approval, with such promptness as to cause no delay in *Work*, all samples required by the Contract Documents and/or requested by the ENGINEER. All samples will have been checked by and stamped with the approval of the CONTRACTOR, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.

At the time of each submission, the CONTRACTOR will in writing call the ENGINEER's attention to any deviations that the Shop Drawing or sample may have from the requirements of the Contract Documents.

The ENGINEER will check and approve (or otherwise act on) with reasonable promptness Shop Drawings and samples, but his checking and approval shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. The approval of a sep-

arate item as such will not indicate approval of the assembly in which the item functions. The CONTRACTOR will make any corrections required by the ENGINEER and will return the required number of corrected copies of Shop Drawings and resubmit new samples until approved. Submission of Shop Drawings by or through the CONTRACTOR shall constitute a representation of their accuracy, and all deviations or revisions in any drawing being resubmitted by or through the CONTRACTOR shall be specifically called to the attention of the ENGINEER by written document separate and apart from the Drawing itself.

No *Work* requiring a Shop Drawing or sample submission shall be commenced until the submission has been approved by the ENGINEER.

The ENGINEER's approval of Shop Drawings or samples shall not relieve the CONTRACTOR from his responsibility for any deviations from the requirements of the Contract Documents unless the CONTRACTOR has in writing called the ENGINEER's attention to such deviations at the time of submission and the ENGINEER has given written approval to the specific deviation, nor shall any approval by the ENGINEER relieve the CONTRACTOR from responsibility for errors or omissions in the Shop Drawings.

8. ENGINEER'S STATUS DURING CONSTRUCTION: The ENGINEER shall be the OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of the ENGINEER as the OWNER's representative during construction are set forth in these General Conditions and shall not be extended without written consent of the OWNER and the ENGINEER.

The ENGINEER may make periodic visits to the site to observe the progress and quality of the executed *Work* and to determine, in general, if the *Work* is proceeding in accordance with the Contract Documents. He will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the *Work* nor will he be responsible for the construction means, methods, techniques, sequences or procedures, or the safety precautions incident thereto. His efforts will be directed toward providing assurance for the OWNER that the completed Project will conform to the requirements of the Contract Documents, but he will not be responsible for the CONTRACTOR's failure to perform the *Work* in accordance with the Contract Documents. On the basis of his on-site observations, he will keep the OWNER informed of the progress of the *Work* and will endeavor to guard the OWNER against defects and deficiencies in the *Work* of CONTRACTORS.

The ENGINEER will have authority to disapprove of or reject *Work* which, in his opinion, is defective; i.e., it is unsatisfactory, faulty or defective, or does not conform to the requirements of the Contract Documents or does not meet the requirements of any inspection, test or approval referred to in Article 24. Failure on the part of the ENGINEER to disapprove of or reject *Work*, methods, or acts or omissions of any kind shall never at any time be deemed to constitute acceptance or approval of the same.

If the OWNER and ENGINEER agree, the ENGINEER will provide one or more Resident Project Representatives to assist the ENGINEER in carrying out his responsibilities at the site.

9. CONTRACTOR'S SUPERVISION AND SUPERINTENDENCE: The *Work*, from its commencement to completion, shall be under the exclusive charge and control of the CONTRACTOR, and all risks in connection therewith shall be borne by the CONTRACTOR.

The CONTRACTOR will supervise and direct the *Work* efficiently and with his best skill and attention. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. Before undertaking the *Work* he will carefully study and compare the Contract Documents and check and verify all figures shown thereon and all field measurements. He will at once report in writing to the ENGINEER any conflict, error or discrepancy which he may discover. The CONTRACTOR will be responsible to see that the finished *Work* complies accurately with the Contract Documents.

The CONTRACTOR will keep on the *Work* at all times during its progress a resident superintendent sat-

isfactory to the ENGINEER. The superintendent shall not be replaced without the consent of the ENGINEER except under extraordinary circumstances. The superintendent will be the CONTRACTOR's representative at the site and shall have authority to act on behalf of the CONTRACTOR. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR.

The CONTRACTOR will provide competent, suitably qualified personnel to survey and lay out the *Work* and perform construction as required by the Contract Documents. He will at all times maintain good discipline and order among his employees at the site.

The ENGINEER will not be responsible for the acts or omissions of the CONTRACTOR, or any Subcontractors, or any of his or their agents or employees, or any other persons performing any of the *Work*.

10. CONTRACTOR'S OFFICE AT SITE OF WORK: CONTRACTOR shall maintain a suitable office at or near the site of the *Work* which shall be the headquarters of his superintendent. Any communications delivered at the CONTRACTOR's office at the site of the *Work* shall be deemed to have been given to the CONTRACTOR. CONTRACTOR shall install his own telephone and pay for all of his telephone and telegram charges.

11. LEGAL ADDRESS OF CONTRACTOR: The business address of the CONTRACTOR given in the bid Proposal upon which this Contract is founded and the CONTRACTOR's office in the vicinity of the *Work* are hereby designated as the places to which all letters, notices, and other communications to the CONTRACTOR may be mailed or delivered. Any notice to the CONTRACTOR required, permitted or given hereunder shall be deemed sufficient if the notice, letter or other communication is delivered to CONTRACTOR at either of the above named addresses or if the same, properly addressed to the CONTRACTOR at either of such addresses, is deposited in the United States mail; and the date of any notice deposited in the mail shall be the date of such mailing.

12. ERECTION: CONTRACTOR shall provide all labor, tools, materials, hoists, false work, scaffolding, etc., which may be necessary for the *Work*, and shall take out and pay for any required permits. At the request of either the OWNER or the ENGINEER, CONTRACTOR agrees to remove any designated employee from the *Work*.

CONTRACTOR shall employ a competent engineer to determine lines and elevations. CONTRACTOR shall lay out the *Work* and shall be responsible for its correctness. He shall correct at his own expense all errors in the *Work* arising from his inaccuracy.

CONTRACTOR shall schedule, arrange, and carry on the *Work* so as not to interfere with the delivery and erection of the *Work* of others. In coordinating *Work* with other contractors, this CONTRACTOR shall cease *Work* at any point and transfer his men to other portions of the *Work*, without cost to the OWNER, to facilitate the erection of such other *Work*, returning them thereafter to complete the unfinished *Work*.

CONTRACTOR shall do such fitting, cutting, and patching as may be required to install the *Work* and shall properly fit it to existing *Work*. CONTRACTOR shall not endanger any *Work* by digging, cutting, or otherwise, and shall not alter or cut the *Work* of any other Contractor except with the written authorization of OWNER or the ENGINEER.

Commercial operation of all equipment incorporated in the *Work* shall be demonstrated to the ENGINEER's satisfaction. CONTRACTOR shall give OWNER all instructions and information as may be necessary for the proper care and/or operation of the equipment.

Where connections are made to existing *Work* or to *Work* installed by others, they shall be made at such times as may be mutually agreed upon between the OWNER and the CONTRACTOR.

Any existing work that may be removed by CONTRACTOR shall be either stored on the premises and shall remain OWNER's property, or shall be removed from the premises and disposed of, as may be requested by OWNER.

13. USE OF PREMISES: The CONTRACTOR shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or approved by the OWNER and/or ENGINEER and shall not unreasonably encumber the premises with his materials.

If OWNER makes available to the CONTRACTOR any store rooms, storage space, offices, or other accommodations, the CONTRACTOR shall inspect these and arrange with the OWNER for their use. In case of dispute between Contractors as to the use of such accommodations, OWNER or the ENGINEER will make the final allotment.

CONTRACTOR's personnel shall not enter any of OWNER's existing buildings and other facilities unless authorized to do so. No one other than the personnel of the CONTRACTOR engaged in actual performance of the *Work* in any existing buildings and other facilities shall receive authorization to enter the same. All of CONTRACTOR's *Work* on existing facilities shall be coordinated with the schedule of OWNER's plant operations. While working in existing facilities, CONTRACTOR shall comply with all plant rules OWNER may have in effect.

The CONTRACTOR shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.

The CONTRACTOR shall be responsible for maintaining the premises during the *Work* with due regard to the safety of workmen and others as well as for the protection of the *Work*.

14. STORAGE: If suitable space is available outside of the Project area, on property owned by the OWNER, this space as mutually agreed upon by OWNER and CONTRACTOR for the location of CONTRACTOR's office, shops, or warehouses, or for the storage of materials will be provided by OWNER free of charge.

Office space inside of Project buildings will not be available to CONTRACTOR unless specific approval has been given by OWNER.

All temporary buildings required by CONTRACTOR shall be erected by him at his own expense and only with OWNER's consent and shall be removed at the termination of their usefulness, or termination of the job, without cost to OWNER.

Prior to erection of any temporary buildings, CONTRACTOR shall submit plans to OWNER for general approval of materials and appearance before building may be erected.

15. PUBLIC REGULATIONS: Building permits and all other necessary permits, licenses, etc., shall be taken out by the CONTRACTOR at his own expense. CONTRACTOR shall also secure at his own expense all Certificates of Inspection and of Occupancy that may be required by authorities having jurisdiction over the *Work*. CONTRACTOR shall give all required notices and shall comply with all applicable laws, ordinances, and regulations of any public authorities having jurisdiction. If CONTRACTOR discovers that any Drawing or Specification forming a part of the Contract is at variance with such legal requirements, he shall promptly notify the ENGINEER in writing. If CONTRACTOR performs any *Work* which is contrary to any such ordinances, regulations, or laws, he shall bear all penalties and costs arising therefrom. The *Work* shall also comply with the regulations of the latest revision of National Board of Fire Underwriters.

The CONTRACTOR shall pay all sales, consumer, use and other similar taxes required by the law of the place where the *Work* is to be performed, unless specified otherwise in the Contract Documents.

16. RELATIONS WITH OTHER CONTRACTORS: CONTRACTOR shall cooperate with all other Contractors who may be performing *Work* in behalf of the OWNER. He shall promptly make good at his own expense any injury or damage that may be sustained by other Contractors or employees of the OWNER at his hands.

17. LOCAL LABOR: Local labor, when available, shall be given preference.

18. MATERIALS AND WORKMANSHIP: Unless otherwise specifically provided for in the Specifications, all equipment, materials, and articles incorporated in the *Work* covered by this Contract are to be new and of the most suitable grade of their respective kinds for the purpose and all workmanship shall be first class.

Approval of the OWNER and/or ENGINEER shall be obtained prior to the utilization of any material, fixture or apparatus which is not definitely specified or which is offered as substitution for any material, fixture or apparatus which has been specified.

19. SAFETY AND PROTECTION; EMERGENCIES: The CONTRACTOR will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the *Work*. He will take all necessary precautions for the safety of and will provide the necessary protection to prevent damage, injury or loss to:

A. All employees on the *Work* and other persons who may be affected thereby,

B. All the *Work* and all materials or equipment (including equipment and materials being furnished by the OWNER and to be installed by CONTRACTOR) to be incorporated therein, whether in storage on or off the site, and

C. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

* D. All work will be performed in accordance with the latest edition of Occupational Safety and Health, General Industry Standards and Interpretations, published by the U. S. Department of Labor.

The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He will erect and maintain, as required by the conditions and progress of the *Work*, all necessary safeguards for safety and protection, including posting danger signs and other warnings against hazards and promulgating safety regulations. He will notify owners of adjacent utilities when prosecution of the *Work* may affect them. When the use or storage of explosives or other hazardous materials is necessary for the prosecution of the *Work*, the CONTRACTOR will exercise the utmost care and will carry on such activities under the supervision of properly qualified personnel. All damage, injury or loss to any person or property caused, directly or indirectly, in whole or in part, by the CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, will be remedied by the CONTRACTOR, except damage or loss attributable to the fault of Drawings or Specifications or to the acts of the OWNER or the ENGINEER or anyone employed by either of them or for whose acts either of them may be liable, and not attributable to the fault or negligence of the CONTRACTOR.

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The CONTRACTOR will designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the CONTRACTOR's superintendent unless otherwise designated in writing by the CONTRACTOR to the OWNER and the ENGINEER.

In emergencies affecting the safety of persons or the *Work* or property at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the ENGINEER or OWNER, is obligated to act, at his discretion, to prevent threatened damage, injury or loss. He will give the ENGINEER prompt written notice of any significant changes in the *Work* or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the changes and deviations involved. If the CONTRACTOR believes that additional *Work* done by him in an emergency which arose from causes beyond his control entitles him to an increase in the Contract Price or an extension of the Contract Time, he may make a claim therefor as provided in Article 26.

20. SANITARY REGULATIONS: CONTRACTOR shall conform with all rules and regulations of boards and bodies having jurisdiction with respect to sanitation. CONTRACTOR shall furnish toilet facilities and drinking water to all of his employees.

21. CLEANING UP: The CONTRACTOR shall at all times keep the premises free from accumulations of debris caused by the *Work*, and at the completion of the *Work* he shall remove all such debris, and also his tools, scaffolding, and surplus materials and shall leave his *Work* 'broom clean' or its equivalent. The *Work* shall be left in good order and condition. In case of dispute, OWNER may remove the debris and charge the cost to the Contractors concerned, in proportions determined by OWNER or the ENGINEER.

22. SUGGESTIONS TO CONTRACTOR ADOPTED AT HIS OWN RISK: Any suggestion by the ENGINEER, his representative, or other representative of the OWNER, of any plan or method of work, but not specified if adopted or followed by the CONTRACTOR in whole or in part, shall be used at the exclusive risk and responsibility of the CONTRACTOR. The OWNER and the ENGINEER will assume no responsibility in such cases.

23. INDEPENDENT CONTRACTOR: CONTRACTOR is and shall remain an independent CONTRACTOR with full, complete and exclusive power and authority to direct, supervise and control his own employees and to determine the method of the performance of the *Work* covered hereby. The fact that the OWNER and/or the ENGINEER shall have the right to observe CONTRACTOR's *Work* during its performance and to carry out the other prerogatives which are expressly reserved to and vested in the OWNER or the ENGINEER hereunder is not intended to and shall not at any time change or affect the status of the CONTRACTOR as an independent CONTRACTOR with respect either to the OWNER or the ENGINEER or to the CONTRACTOR's own employees or to any other person, firm or corporation.

24. OBSERVATION AND TESTING: The OWNER, ENGINEER, and/or their representatives shall have the right at all reasonable times to observe and test the *Work*. CONTRACTOR shall make necessary arrangements and provide proper facilities and access for such observation and testing, either at CONTRACTOR's shop or at the mills or shops of any manufacturer where any part of the *Work* is being fabricated or manufactured, or at any location wherever the *Work* is in preparation or progress. CONTRACTOR shall ascertain the scope of any observation which may be contemplated, and shall give ample notice as to the time each part of the *Work* will be ready for such observation. OWNER may reject any *Work* found to be defective or not in accordance with the Contract, regardless of the stage of its completion or the time or place of discovery of such errors, and regardless of whether OWNER's observer has previously accepted the *Work* through oversight or otherwise. If any *Work* should be covered up without approval or consent of the OWNER, it must, if requested by the OWNER and/or ENGINEER or their representatives, be uncovered for examination at the CONTRACTOR's expense.

If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any *Work* to specifically be inspected, tested, or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the ENGINEER timely notice of readiness therefor. The CONTRACTOR will furnish the ENGINEER the required certificates of inspection, testing or approval. All such tests will be in accordance with the methods prescribed by the American Society for Testing and Materials or such other applicable organization as may be required by law or the Contract Documents. If any such *Work* required so to be inspected, tested or approved is covered up without written approval or consent of the ENGINEER, it must, if requested by the ENGINEER, be uncovered for observation at the CONTRACTOR's expense. The cost of all such inspections, tests and approvals shall be borne by the CONTRACTOR unless otherwise provided. Any *Work* which fails to meet the requirements of any such test, inspection or approval and any *Work* which meets the requirements of any such test or approval but does not meet the requirements of the Contract Documents shall be considered defective. Such defective *Work* shall be corrected at the CONTRACTOR's expense.

Neither observations by the ENGINEER nor inspections, tests or approvals by persons other than the CONTRACTOR shall relieve the CONTRACTOR from his obligations to perform the *Work* in accordance with the requirements of the Contract Documents.

25. VERIFICATION OF DIMENSIONS: The exactness of dimensions given on any Drawings issued by the ENGINEER is not guaranteed by him or the OWNER. CONTRACTOR shall verify and satisfy himself as to the accuracy of all dimensions. In all cases of interconnection of the *Work* with other *Work*, he shall verify at the site any dimensions relating to such other *Work*. Any errors due to CONTRACTOR's failure so to verify any such dimensions shall be promptly rectified by CONTRACTOR without cost to OWNER.

26. CHANGES IN THE WORK: OWNER shall have the right to make any changes or altering in the *Work*, the Contract Sum being adjusted accordingly. Except in an emergency endangering life or property, no claim for *Work* involving additional cost shall be allowed unless it shall have been ordered in writing by OWNER or his representatives.

27. LOSS OR DAMAGE: Until accepted in its entirety by OWNER, the *Work* shall be at CONTRACTOR's risk. If any damage to or loss of any part of the *Work* occurs prior to acceptance, CONTRACTOR shall promptly repair or replace the part or parts so lost or damaged without cost to the OWNER. CONTRACTOR shall bear all loss or damage to CONTRACTOR's property. The CONTRACTOR shall protect OWNER's property from and shall be responsible for any loss or damage arising out of the erection of the *Work*. However, CONTRACTOR shall not be responsible for any loss or damage caused solely by OWNER's negligence and without CONTRACTOR's contributory negligence, except that CONTRACTOR shall be solely responsible for any damage or loss due to the use of any facilities or service furnished by OWNER, such as hoisting, switching, etc., regardless of OWNER's negligence. The CONTRACTOR shall pay for any injury or damages in the *Work* of any other Contractor which may be done by him or his workmen.

28. RIGHT OF OWNER TO TERMINATE CONTRACT:

A. If the CONTRACTOR refuses or fails to prosecute the *Work*, or any separable part thereof, with such diligence as will insure its completion within the time specified in this Contract, or any extension thereof, or fails to complete said *Work* within such time, OWNER may, by written notice to the CONTRACTOR, terminate his right to proceed with the *Work* or such part of the *Work* as to which there has been delay. In such event OWNER may take over the *Work* and prosecute the same to completion, by Contract or otherwise, and the CONTRACTOR and his sureties

shall be liable to OWNER for any excess cost occasioned the OWNER thereby, and for liquidated damages for delay as fixed in the Specifications or accompanying papers, until such reasonable time as may be required for the final completion of the *Work*, or if liquidated damages are not so fixed, any actual damages occasioned by such delay. If the CONTRACTOR's right to proceed is so terminated, the OWNER may take possession of and utilize in completing the *Work* such materials, appliances, and plant as may be on the site of the *Work* and necessary therefor.

B. If the OWNER does not terminate the right of the CONTRACTOR to proceed, as provided in the foregoing Paragraph A, the CONTRACTOR shall continue the *Work* in which event he and his sureties shall be liable to the OWNER, in the amount set forth in the Specifications or accompanying papers, for fixed, agreed, and liquidated damages for each calendar day of delay until the *Work* is completed or accepted, or if liquidated damages are not so fixed, any actual damages occasioned by such delay.

C. The right of the CONTRACTOR to proceed shall not be terminated, as provided in the foregoing Paragraph A hereof, nor the CONTRACTOR charged with liquidated or actual damages, as provided in the foregoing Paragraph B hereof, because of any delays in the completion of the *Work* due to unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including, but not restricted to, acts of God, or of the public enemy, acts of the Government, in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or delays of Subcontractors or suppliers due to such causes: Provided, that the CONTRACTOR shall within ten days from the beginning of any such delay, unless the OWNER shall grant a further period of time prior to the date of final settlement of the Contract, notify the OWNER in writing of the causes of the delay. The OWNER shall ascertain the facts and the extent of the delay and extend the time for completing the *Work* when in its judgment the findings justify such an extension.

29. SUSPENSION OF WORK ON NOTICE: The OWNER may order the CONTRACTOR to suspend all or any part of the *Work* for such periods of time as may be determined by him to be necessary or desirable for the convenience of the OWNER. Unless such suspension unreasonably delays the progress of the *Work* and causes additional expense or loss to the CONTRACTOR, no increase in Contract price will be allowed. In the case of suspension of all or any part of the *Work* for an unreasonable length of time, causing additional expense or loss in the opinion and judgment of the ENGINEER, not due to the fault or negligence of the CONTRACTOR, the OWNER shall make an equitable adjustment in the Contract price and modify the Contract accordingly.

An equitable extension of time for the completion of the *Work* in the event of any such suspension will be allowed the CONTRACTOR, provided, however, that the suspension was not due to the fault or negligence of the CONTRACTOR.

30. PAYMENTS: No payments made or certificates given shall be considered as conclusive evidence of the performance of the Contract, either wholly or in part, nor shall any certificate or payment be construed as acceptance of defective *Work*. CONTRACTOR shall at any time requested during the progress of the *Work* furnish the OWNER or the ENGINEER with a verified certificate showing the CONTRACTOR's total outstanding indebtedness in connection with the *Work*. Before final payment is made, CONTRACTOR shall satisfy OWNER, by affidavits or otherwise, that there are no outstanding liens against OWNER's premises by reason of any *Work* under the Contract. Acceptance by CONTRACTOR of final payment on the Contract price shall constitute a waiver of all claims against OWNER.

31. PROGRESS CHARTS, SUNDAY, HOLIDAY, AND NIGHT WORK: Within five days after commencement of the *Work* hereunder or within such additional time as may be determined by the OWNER and

the ENGINEER, the CONTRACTOR shall prepare and submit to OWNER and ENGINEER for approval a practicable and feasible schedule, showing the order in which the CONTRACTOR proposes to carry on the *Work*, the date on which he will start the several salient features (including procurement of materials, plant, and equipment) and the contemplated dates for completing them. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of *Work* scheduled for completion at any time. The CONTRACTOR shall on the chart show the actual progress at the end of each week or at such intervals as directed by the OWNER and the ENGINEER, and shall immediately deliver to the OWNER and the ENGINEER three copies thereof.

The CONTRACTOR shall furnish sufficient forces, construction plant, and equipment and shall work such hours including night shifts, overtime operations, and Sunday and holiday work, as may be necessary to insure the prosecution of the *Work* in accordance with the approved progress schedule. If, in the opinion of the OWNER, the CONTRACTOR falls behind the progress schedule, the CONTRACTOR shall take such steps as may be necessary to improve his progress and the OWNER may require him to increase the number of shifts and/or overtime operations, days of work and/or the amount of construction plant, all without additional cost to the OWNER.

Failure of the CONTRACTOR to comply with the requirements of the OWNER under this provision shall be grounds for determination by the OWNER that the CONTRACTOR is not prosecuting the *Work* with such diligence as will insure completion within the time specified. Upon such determination the OWNER may terminate the CONTRACTOR's right to proceed with the *Work*, or any separable part thereof. The OWNER may also hold up progress payments until in the opinion of the OWNER satisfactory progress is resumed. It shall be understood by the CONTRACTOR that the schedule or actual progress of other Contractors is not to be used as a basis for comparison with or modification of this CONTRACTOR's schedule except as approved by the ENGINEERS. The fact that other Contractors are not proceeding in accordance with their schedule shall not relieve this CONTRACTOR from expediting the *Work* under these Specifications.

32. PROGRESS PAYMENTS: Upon execution of the Contract by the OWNER and the CONTRACTOR, CONTRACTOR shall submit an itemized breakdown of the Contract price as to the various classifications of the *Work* by crafts, subcontracts, lump sum of materials and labor, which breakdown, subject to the approval of the ENGINEER, shall be used as the basis for progress payments of the Contract.

The CONTRACTOR shall submit to the OWNER on or about the first day of each month an application for partial payment.

Payments to the CONTRACTOR will be made for the *Work* done and materials in place plus an allowance of ninety percent of invoice cost for materials properly stored at the site but not incorporated in the *Work*. From the total amount so ascertained ten percent will be retained until completion and final acceptance.

33. CORRECTION OF WORK BEFORE FINAL PAYMENT FOR WORK: CONTRACTOR shall promptly remove from OWNER's premises all materials condemned by the ENGINEER on account of failure to conform to the Contract, whether actually incorporated in the *Work* or not, and CONTRACTOR shall at his own expense, promptly replace such condemned materials with other materials conforming to the requirements of the Contract. CONTRACTOR shall also bear the expense of restoring all work of other Contractors damaged by any such removal or replacement. If CONTRACTOR does not remove and replace any such condemned work within a reasonable time after a written notice by the OWNER or the ENGINEER, OWNER may remove and replace it at CONTRACTOR's expense.

34. CORRECTION OF WORK AFTER FINAL PAYMENT: Neither the final payment nor certificate nor any provision in the Contract shall relieve the CONTRACTOR of responsibility for faulty ma-

terials or workmanship, and he shall remedy any defects due thereto and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of substantial completion. The OWNER shall give notice of observed defects with reasonable promptness.

35. OWNER'S RIGHT TO DO WORK: If the CONTRACTOR fails to prosecute the *Work* properly, to perform any provision of the Contract, or to carry on the erection with the diligence necessary to insure the prompt completion of the *Work*, OWNER may request him to employ more men, machinery, tools, etc., specifying the additional requirements. If CONTRACTOR fails to comply with such request within seven days from the receipt thereof, OWNER may employ such additional men, machinery, tools, etc., as shall be necessary to complete the *Work* promptly, and the cost thereof to the OWNER shall be deducted from any sums then or thereafter due CONTRACTOR under the Contract; or OWNER may elect to take over the *Work*, and may use at his option any of the CONTRACTOR's tools, plant, equipment, and materials which are on or about the premises, the amount due CONTRACTOR for any such plant rental or materials to be determined by the ENGINEER.

36. PROTECTION OF MATERIAL AND WORK: The CONTRACTOR shall at all times take care to protect and preserve all materials, supplies, and equipment of every description (including property which may be OWNER furnished or owned) and all *Work* performed. All reasonable requests of OWNER to enclose or specially protect such property shall be complied with. If, as determined by OWNER, material, equipment, supplies, and *Work* performed are not adequately protected by the CONTRACTOR such property may be protected by the OWNER and the cost thereof may be charged to the CONTRACTOR or deducted from any payments due to him.

37. HINDRANCE AND DELAYS: In executing the Contract Agreement, the CONTRACTOR agrees that in undertaking to complete the *Work* within the time therein fixed, he has taken into consideration and made allowances for all hindrances and delays incident to such *Work*, whether growing out of delays in securing material or workmen or otherwise. No charge shall be made by the CONTRACTOR for hindrance or delays from any cause during the progress of any part of the *Work* embraced in this Contract except those expenses referred to in Article 29 entitled "Suspension of Work on Notice".

38. ROYALTIES AND PATENTS: CONTRACTOR shall pay all royalties and license fees which may be payable on account of the *Work* or any part thereof. He shall defend all suits or claims instituted against OWNER for the infringement of any patent rights, and shall pay all awards of damages assessed and all costs of suit adjudged against OWNER in such suits or proceedings, provided OWNER gives CONTRACTOR reasonable notice in writing of the institution of any such suit or proceeding, permits him to defend it, and gives him all such information, assistance, and authority as shall be necessary to enable him to do so. In case any part of the *Work* is held in any such suit to constitute infringement and its use is enjoined, CONTRACTOR shall within a reasonable time (a) replace at CONTRACTOR's own expense such part of the *Work* with a non-infringing part or modify it so that it becomes non-infringing, or (b) secure for OWNER the right to continue the use of such part of the *Work* by procuring for OWNER a license or such other permission as will enable CONTRACTOR to secure the suspension of the injunction. If the CONTRACTOR is unable, after reasonable effort, to secure such a license or permission, or to make replacement or modification, he shall remove the part so enjoined from OWNER's premises and refund that portion of the Contract price which represents any part affected by the injunction.

39. ASSIGNMENT OR SUBLEASE: CONTRACTOR shall not sub-let or assign the Contract for any part of the *Work* without first obtaining OWNER's written approval. Approval of a Subcontractor will not be given unless OWNER has been furnished with satisfactory evidence that the proposed Subcontrac-

tor is carrying ample public liability insurance and workmen's compensation to the extent and in the same manner as is herein provided to be furnished by CONTRACTOR, if such approval is given the CONTRACTOR is not relieved from full responsibility for the *Work* or the fulfillment of all obligations under the Contract.

40. CONTRACTOR'S INDEBTEDNESS: If during the progress of the *Work* CONTRACTOR shall allow any indebtedness to accrue for work furnished by others or by Subcontractors and shall fail to pay and discharge such indebtedness, within five days after demand made, then OWNER may, during the period for which such indebtedness shall remain unpaid, withhold from the unpaid portion of the Contract price a sum equal to the amount of such unpaid indebtedness or may apply the sum so withheld to the discharge of such indebtedness.

41. INDEMNIFICATION: The CONTRACTOR shall defend, indemnify and hold harmless the OWNER and the ENGINEER and their respective officers, agents and employees from and against all claims, damages, demands, suits, judgments, losses, expenses and costs, including attorney's fees and expenses, arising out of, resulting from or in connection with the performance of the *Work* or any failure to perform the *Work*, or any part thereof, provided that any such claim, damage, demand, suit, judgment, loss, expense or cost (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom and (b) is caused in whole or in part or claimed to have been caused in whole or in part by or in connection with any negligent act or omission of the CONTRACTOR, any Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

In any and all claims against the OWNER or the ENGINEER or any of their agents or employees by any employee of the CONTRACTOR, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Article 41 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or any Subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

42. LIABILITY INSURANCE:

A. CONTRACTOR's Liability Insurance: The CONTRACTOR will purchase and maintain such insurance as will protect him from claims under workmen's compensation laws, disability benefit laws or other similar employee benefit laws; from claims for damages because of bodily injury, occupational sickness or disease, or death of his employees, and claims insured by usual personal injury liability coverage; from claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees including claims insured by usual personal injury liability coverage; and from claims for injury to or destruction of tangible property, including loss of use resulting therefrom – any or all of which may arise out of or result from the CONTRACTOR's operations under the Contract Documents, whether such operations be by himself or by any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be legally liable. This insurance shall be written for not less than any limits of liability specified in the Contract Documents or required by law, whichever is greater, and shall include contractual liability insurance. Before starting the *Work*, the CONTRACTOR will file with the OWNER and ENGINEER certificates of such insurance, acceptable to the OWNER;

these certificates shall contain a provision that the coverage afforded under the policies will not be cancelled or materially changed until at least 30 days prior written notice has been given to the OWNER and ENGINEER.

B. OWNER's Liability Insurance: CONTRACTOR shall provide and maintain OWNERS' Protective Liability Insurance in amounts and limits set forth in Article 43 which insurance shall name OWNER as the insured and which shall name the ENGINEER as additional insured therein and which insurance shall protect OWNER and the ENGINEER against any and all claims that may arise as a result of the operations of the CONTRACTOR, his Subcontractors or either of their employees or agents in fulfilling this Contract. This policy shall be deposited with the ENGINEER at their offices in Abilene, Taylor County, Texas, prior to commencement of the *Work*.

43. LIABILITY INSURANCE LIMITS: The insurance provided for in Article 42 shall meet the following minimum requirements and evidence of compliance therewith in the form of approved certificates, or certified copies of policies shall be filed with the OWNER and the ENGINEER prior to commencement of the *Work*. Insurance shall be effected with companies satisfactory to OWNER and/or ENGINEER and shall be subject to the provision that cancellation or substantive changes shall not be made effective without giving 30 days advance notice thereof to the OWNER and/or ENGINEER.

A. Workmen's Compensation – Statutory as respects employees subject to the applicable Acts and voluntary with respect to employees not so subject.

B. Employer's Liability – Minimum $100,000. as respects Statutory employees and $100,000./100,000. as respects others.

C. Comprehensive General Liability – Limits of Liability: Bodily Injury – $100,000. each person, $300,000. each occurrence; Property Damage – $100,000. each occurrence, $500,000. aggregate.

The policy shall provide:

(1) Personal Injury coverage as customarily defined.

(2) Broad form property damage coverage.

(3) Coverage for hazards of blasting – explosion, collapse and underground facilities generally identified as the "x", "c" and "u" hazards.

(4) Contractual Liability coverage including the Indemnification agreement in Article 41.

(5) Completed Operations Coverage: This insurance shall be furnished and maintained by CONTRACTOR for a period not less than one year from and beyond the date of final payment under the Contract.

D. Comprehensive Automobile Liability – Limits of Liability: Bodily Injury – $100,000. each person, $300,000. each occurrence; Property Damage – $100,000. each occurrence.

NOTE: If CONTRACTOR prefers to maintain single limit of liability coverage, the limits applicable to (2) and (3) above shall be not less than $500,000.

E. Catastrophe Liability Insurance (Umbrella) applicable to the Project in an amount not less than five million.

F. OWNER's Protective Liability – Limits of Liability: Bodily Injury – $300,000. each person, $1,000,000. each accident; Property Damage – $1,000,000. each accident.

44. PROPERTY INSURANCE: CONTRACTOR shall effect and maintain Builder's Risk hazard insurance covering all risks of loss (subject to a deductible amount of not more than $5,000.00) in an amount equal to 100% of the Contract Price hereof. In addition, the CONTRACTOR shall effect and maintain all Builder's Risk insurance on equipment and/or materials furnished by the OWNER and stored and/or installed by the CONTRACTOR in an amount equal to 100% of the value of the equipment and/or materials. Such insurance shall include OWNER's Loss, if any, under such policy or policies and shall be adjustable with CONTRACTOR and OWNER and shall be payable to the OWNER as trustee for the interested parties.

In the event separate policies are issued, they shall be deposited with the ENGINEER at their offices in Abilene, Texas. If CONTRACTOR effects Blanket or Reporting Form Builder's Risk Insurance, he shall deposit an abstract or the equivalent thereof of such policy in the manner provided, which evidence shall provide that as respects OWNER's interest, such insurance shall not be cancelled or changed without at least 30 days prior written notice to the OWNER and the ENGINEER. If, in the event of cancellation or change, CONTRACTOR fails to replace such insurance prior to the effective date of such cancellation or change, OWNER may effect such insurance as is necessary to protect his interest at the sole expense of the CONTRACTOR. The CONTRACTOR shall be responsible for and shall pay the deductible portion in the event of a loss.

45. PERFORMANCE BOND: The Performance Bond executed by the CONTRACTOR shall be a guarantee that the *Work* will be completed as required by the Contract. The Performance Bond shall also be a guarantee that all repair, or replacement where required, or the cost thereof, of all *Work* performed under the terms of the Contract, where such repair or replacement is required because of defective workmanship or material, or both, and for the replacement of defective equipment of parts thereof, within a period of one year after date of acceptance by the OWNER of the *Work*.

The OWNER agrees to mail a notice to the CONTRACTOR, calling his attention to any failure to comply with the requirements of the Bond, not less than ten days before notifying his surety of such failure.

46. LIQUIDATED DAMAGES: Time is of essence of this Contract and the time of completion is a part of the consideration in the Agreement, and in the event that the CONTRACTOR shall fail in the performance of the *Work* specified and required to be performed within the period of time stipulated therefor in the Agreement, the CONTRACTOR shall pay unto the OWNER, as stipulated liquidated damages and not as a penalty, the sum stipulated therefor in the *Special Conditions* or other Contract Documents for each and every day that the CONTRACTOR shall be in default.

For purposes of computation, the CONTRACTOR's time or period of time for completion of the *Work* shall be deemed to have commenced 15 days after the written authorization to begin *Work* has been issued by the OWNER and/or the ENGINEER.

The OWNER will furnish the CONTRACTOR a monthly statement on prescribed forms, showing number of days charged during the month, total number of days allowed in Contract, and the days remaining under the Contract. The CONTRACTOR will be allowed ten days in which to protest the correctness of the statement, otherwise the statement will stand.

If the CONTRACTOR fails to complete the Contract in the days specified, the time charge will be made for each day thereafter.

Extensions of time will not be granted for delays caused by unsuitable ground conditions, inadequate construction force, the failure of the CONTRACTOR to place orders for equipment or materials in sufficient time to insure delivery as needed or for any rain, snow or other unfavorable weather conditions. Ap-

plication for time extensions due to weather will be considered only as to extraordinary or unusual conditions which could not reasonably have been anticipated.

The OWNER shall have the right to deduct said liquidated damages from any monies in its hands, otherwise due, or to become due, to said CONTRACTOR, or to sue for and recover compensation for damages for nonperformance of this Contract at the time stipulated herein and provided for.

47. ENGINEER'S INTERPRETATIONS AND DECISIONS: The ENGINEER will issue with reasonable promptness such written clarifications or interpretations (in the form of Drawings or otherwise) as he may determine necessary for the proper execution of the *Work*, such clarifications and interpretations to be consistent with or reasonably inferable from the overall intent of the Contract Documents. If the CONTRACTOR believes that a written clarification and interpretation entitles him to an increase in the Contract Price, he may make a claim therefor as provided in Article 26.

The ENGINEER will be the initial interpreter of the terms and conditions of the Contract Documents and the judge of the performance thereunder. In his capacity as interpreter and judge he will exercise his best efforts to insure faithful performance by both the OWNER and the CONTRACTOR. He will not show partiality to either and shall not be liable for the result of any interpretation or decision rendered in good faith. Claims, disputes and other matters relating to the execution and progress of the *Work* or the interpretation of or performance under the Contract Documents shall be referred initially to the ENGINEER for decision, which he shall render in writing within a reasonable time.

Either the OWNER or the CONTRACTOR may demand arbitration with respect to any such claim, dispute or other matter that has been referred to the ENGINEER, except any which have been waived by the making or acceptance of final payment as provided in Article 30, such arbitration to be in accordance with Article 48. However, no demand for arbitration of any such claim, dispute or other matter shall be made until the earlier of (a) the date on which the ENGINEER has rendered his decision or (b) the tenth day after the parties have presented their evidence to the ENGINEER if he has not rendered his written decision before that date. No demand for arbitration shall be made later than thirty days after the date on which the ENGINEER rendered his written decision in respect of the claim, dispute or other matter as to which arbitration is sought; and the failure to demand arbitration within said thirty days' period shall result in the ENGINEER's decision being final and binding upon the OWNER and the CONTRACTOR. If the ENGINEER renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but shall not supersede the arbitration proceedings, except where the decision is acceptable to the parties concerned.

48. ARBITRATION: All claims, disputes and other matters in question arising out of, or relating to, this Agreement or the breach thereof except for claims which have been waived by the making or acceptance of final payment as provided by Article 30, shall on the demand of either the OWNER or the CONTRACTOR, be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then obtaining. This Agreement so to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

Notice of the demand for arbitration shall be filed in writing with the other party to the Agreement and with the American Arbitration Association, and a copy shall be filed with the ENGINEER. The demand for arbitration shall be made within the 30 day period specified in Article 47 where applicable, and in all other cases within a reasonable time after the claim, dispute or other matter in question has arisen, and in no event shall it be made after institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

The CONTRACTOR will carry on the *Work* and maintain the progress schedule during any arbitration proceedings, unless otherwise agreed by him and the OWNER in writing.

SUPPLEMENT
TO
TIPPETT & GEE FORM 200-A
GENERAL CONDITIONS

These conditions are applicable to all specifications issued with the above named Tippett & Gee forms.

I. Intent

These conditions apply specifically to Site Preparation GC-1022, Gibbons Creek S.E.S. Texas Municipal Power Agency

described in the Specifications.

II. Location of Plant

The site of the generating plant is as follows:

a. Fort Worth and Denver (NEAREST RAILROAD) b. Iola (RAILROAD STATION)

c. State #30/#244 (HIGHWAY NO.) d. paved (PAVED, IMPROVED, ETC.) e. 15 (MILES FROM NEAREST RAILROAD STATION)

at an elevation of 260 feet above sea level.

III. Auxiliary Services

Water necessary for construction purposes will be available to the Contractor, at or near the job site.

IV. Storage and Office Space

a. Storage

The Contractor must provide his own protected storage space at a location on the plant site as directed by the Owner or his representative. The materials or equipment to be used for this Specification must be so stored that they will not deteriorate by external causes.

b. Office

Office space within the plant building will not be available to the Contractor. Location for an office will be provided by the Owner as directed by the Owner or his engineer. Contractor must provide a suitable building with light, heat and telephone service.

c. Toilets

Sanitary facilities must be provided by the Contractor for his employees in a location approved by the Owner or his engineer. They must be in accordance with the rules and regulations of the locality of the plant (state, county or city). Use of the plant facilities will not be permitted.

d. Removal

The facilities described above under a, b, and c, must be removed after the Contractor has completed the contract or at such earlier time as requested by the Owner or his engineer unless, by mutual agreement between the Contractor and the Owner, the latter decides to take over any or all of these facilities.

V. Cooperation

The Contractor shall cooperate with all other contractors and with the Owner's plant personnel.

VI. Construction Drawings

The Owner will furnish to the Contractor 6 (QUANTITY) sets of construction prints without charge; additional sets will be available to the Contractor at $0.07 per sq. ft. or $1.00 per sheet, whichever is less. These are not Contractor's drawings.

VII. Informative Material

Unless otherwise stipulated in the Specification, the Contractor must submit to the Owner or his engineer, the following materal:

a. Drawings

1. During construction: 3 (QUANTITY) sets of prints as outlined in the Specifications and 4 (QUANTITY) sets of manufacturer's prints, certified for the job. One print of each drawing will be returned to the Contractor either approved or annotated. A corrected drawing must then be submitted until the design is finally approved. Of the finally approved drawing, 4 (QUANTITY) prints shall be submitted to the Owner or his engineer.

2. After completion: as requested (QUANTITY) sets of all prints; 2 (QUANTITY) sets of Contractor's prints to be reproducible.

VIII. Breakdown of Prices and Costs

a. Within 10 days after receipt of notice of award, the Contractor shall submit to the Owner or his engineer for approval a detailed breakdown of the bid price and a detailed construction schedule. The breakdown shall contain an itemized list of all component parts of the Project complete with quantities, unit prices and total costs, the sum of which shall equal the bid price. This, upon approval, shall constitute the basis on which partial payment will be made.

b. Within 30 days after Completion of the Project, the Contractor shall submit to the Owner or his engineer a complete breakdown of costs by accounts, in accordance with the FPC Uniform System of Accounts prescribed for Public Utilities and Licensees, Class A and B.

CONTRACT AGREEMENT

THIS AGREEMENT, made and entered into this 20th day of June, 19 77, by and between the TEXAS MUNICIPAL POWER AGENCY acting through its BOARD OF DIRECTORS thereunto duly authorized so to do, Party of the First Part, and hereinafter called the Purchaser, and R. N. ADAMS CONSTRUCTION COMPANY , Kaufman, Texas a CORPORATION of DELAWARE, Party of the Second Part, and hereinafter called the Contractor.

WITNESSETH:

THAT WHEREAS, the Purchaser has caused to be prepared, in accordance with law, specifications, plans, and other contract documents for the work herein described, and has approved and adopted said documents, and has caused to be published, in the manner and for the time required by law, an advertisement for and in connection with SITE PREPARATION in accordance with the terms of this Contract; and

WHEREAS, the said Contractor, in response to such advertisement, has submitted to the Purchaser, in the manner and at the time specified, a sealed proposal in accordance with the terms of said advertisement; and

WHEREAS, the Purchaser, in the manner prescribed by law, has publicly opened, examined, and canvassed the proposals submitted in response to the published invitation therefor, and as a result of such canvass has determined and declared the aforesaid Contractor to be the best bidder for the said work and has duly awarded to the said Contractor a contract therefor, for the sum or sums named in the Contractor's proposal, a copy therefor being attached to and made a part of this Contract.

NOW, THERFORE, in consideration of the compensation to be paid to the Contractor and of the mutual agreements herein contained, the Parties to these presents have agreed and hereby agree, the Puchaser for itself and its successors, and the Contractor for itself, himself, or themselves, or its, his, or their successors and assigns, or its, his, or their executors and administrators, as follows:

ARTICLE I. That the Contractor shall (a) furnish all tools, equipment, supplies, superintendence, transportation, and other construction accessories, services, and facilities; (b) furnish all materials, supplies, and equipment specified and required to be incorporated in and form a permanent part of the completed work; (c) provide and perform all necessary labor; and, in a good, substantial, and workmanlike manner and in accordance with the provisions of the General Conditions and the Special Conditions of this Contract, which are attached hereto and made a part hereof, and in conformity with the Contract Plans and Specifications designated and identified therein) (d) execute, construct, and complete all work included in and covered by the Purchaser's official award of this Contract to the said Contractor, such award being based on the acceptance by the Purchaser of the Contractor's proposal, or part thereof, as follows:

FURNISH, DELIVER AND UNLOAD MATERIALS FOR AND SHALL CONSTRUCT,

ERECT, AND FINISH IN A WORKMANLIKE MANNER AT THE PLANT SITE AREA

THE CONSTRUCTION ITEMS AS SET OUT IN AND IN COMPLETE ACCORDANCE

WITH SPECIFICATION GC-1022

ARTICLE II. That the Purchaser shall pay to the Contractor for the performance of the work embraced in this Contract, and the Contractor will accept as full compensation therefor, the sum (subject to adjustment as provided by the Contract) of FIVE MILLION EIGHT HUNDRED SIXTY-NINE THOUSAND, NINE HUNDRED NINETY-ONE DOLLARS and Fifty-four cents ($5,869,991.54)

for all work covered by and included in the Contract award and designated in the foregoing Article I; payment thereof to be made in cash or its equivalent, in the manner provided in the General Conditions hereto attached.

ARTICLE III. That the Contractor shall start work on, or within ten (10) days following, the date of a written order from the Purchaser to the Contractor to proceed with the work to be performed under the provisions of this Contract or on a subsequent date designated and authorized by the Purchaser in said order, and that the Contractor shall complete said work within eight (8) months consecutive calendar days from and after the date of, or subsequent date authorized in, the said order by the Purchaser to proceed.

IN WITNESS WHEREOF, the Parties hereto have executed this Contract as of day and year first written.

TEXAS MUNICIPAL POWER AGENCY
Purchaser

By: _____
Signature of Officer

ATTEST:

_____
Secretary

_____
Title

(Seal)

R. N. ADAMS CONSTRUCTION COMPANY
Party of the Second Part (Contractor)

By: _____
Signature of Officer

ATTEST:

Audrey Graham
Ass't Secretary

Vice-President
Title

(Seal)

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

The foregoing Contract and Bond are in due form according to law and are hereby approved.

_____
Attorney

NOTE: This Contract must be signed by the President or Vice President of the Contractor's firm and attested by the Secretary of the firm. If the Contract is to be signed by any person other than the President or Vice President, then a Board Resolution authorizing said person to sign and bind the firm must be included with each copy of the Contract.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that we, the undersigned _____

R. N. ADAMS CONSTRUCTION COMPANY

_____, hereinafter referred to as "Contractor", and

AMERICAN GENERAL INSURANCE COMPANY,

a Corporation organized and existing under the laws of the State of

TEXAS and duly authorized to transact business in the State of Texas, as Surety, are held and firmly bound unto the TEXAS MUNICIPAL POWER AGENCY, hereinafter referred to as "Purchaser", in the sum of
FIVE MILLION EIGHT HUNDRED SIXTY-NINE THOUSAND,
NINE HUNDRED NINETY-ONE DOLLARS AND Fifty-four cents DOLLARS

($ 5,869,991.54) lawful money of the United States of America, for the payment of which sum, well and truly to be made to the aforesaid Purchaser, Contractor and Surety bind themselves and their heirs, executors, administrators, successors, and assigns, jointly and severally, by these presents.

WHEREAS, on the 20th day of June, 19 77, the above named Contractor entered into a written "Contract" with the aforesaid Purchaser for furnishing materials, supplies, construction tools, equipment, and plant, and the performance of all necessary labor, for and in connection with the construction of certain improvements designated, defined, and described in the said Contract and the conditions thereof, and in accordance with the Contract drawings and specifications therefore, all of which are made a part of this instrument as fully and completely as if set out in full herein; and

WHEREAS, it was a condition of the Contract awarded by the Purchaser to Contractor that these presents be executed by the Contractor and Surety;

NOW, THEREFORE, if the said Contractor shall and will, in all particulars, well, duly, and faithfully observe, perform and abide by each and every covenant, condition, and part of the said Contract, and the conditions, specifications, drawings, and other Contract documents thereto attached or, by reference, made a part thereof, according to the true intent and meaning in each case, then this obligation shall be null and void; otherwise, it shall remain in full force and effect, and the above sum shall be payable to Purchaser on demand.

PROVIDED, FURTHER, that this bond shall bind Contractor and Surety to Purchaser for one year after the date of acceptance by Purchaser of the work done under the Contract to guarantee payment for all repairs or replacement required to correct defective workmanship or materials, and

PROVIDED, FURTHER, that this bond is executed pursuant to the provisions of Article 5160 of the Revised Civil Statutes of Texas, as amended, and all liabilities on this bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copies at length herein, and

PROVIDED, FURTHER, that if the said Contractor shall fail to pay all just claims and demands by, or in behalf of, any employee or other person, or any firm, association, or corporation, for labor performed or materials, supplies, or equipment furnished, used, or consumed by said Contractor or his, their, or its subcontractor or subcontractors in the performance of the said work contracted to be done, then and in that event the aforesaid Surety will pay the full value of any and all such claims or demands in any total amount not exceeding the amount of this obligation, together with interest as provided by law.

THE UNDERSIGNED SURETY, for value received, hereby stipulates and agrees that no extension of time, change in, addition to, or other modification whatsoever of the terms of the Contract or work to be performed thereunder, or of the specifications or other Contract document or Contract documents, shall in any wise effect its obligation on this bond and said Surety does hereby waive notice of any such extension of time, change, addition, or modification. Surety further waives notice of any default, delay, or defect by Contractor in the performance of the Contract, and agrees that Surety shall be bound to take notice of and shall be held to have knowledge of all acts or omissions of the said Contractor in all matters pertaining to said Contract.

IT IS THE INTENTION OF SURETY fully and completely to indemnify and in all things save harmless the Purchaser against loss, expense, and/or damage arising from any failure or failures on the part of Contractor, Principal herein, in faithfully and fully carrying out the terms of the Contract between Contractor and Purchaser, as the said Contract may be amended, modified, or changed from time to time, and in faithfully and fully carrying out the work to be done under the Contract.

This bond and all obligations created hereunder shall be governed by the laws of the State of Texas.

ANY RETENTION to be withheld by Purchaser and otherwise to have been paid to Contractor is not intended for Surety's benefit and shall not inure thereto.

IN TESTIMONY WHEREOF, the said Contractor has hereunto set his hand and the said Surety has caused these presents to be executed in its name, and its corporate seal to be hereunto affixed, by its attorney-in-fact thereunto duly authorized so to do, at KAUFMAN, TEXAS

on this the 28th day of JUNE, 1977.

R. N. ADAMS CONSTRUCTION COMPANY
Contractor

By: [signature]
Signature of Officer

Vice - President
Title (Seal)

ATTEST:

[signature]
Assistant Secretary

AMERICAN GENERAL INSURANCE COMPANY
Surety Company

By: [signature]
Attorney-in-Fact (Seal)

ATTEST:

[signature]

Accompany this bond with Attorney-in-Fact's authority from the Surety company certified to include the date of the bond.

NOTE: This Bond must be signed by the President or Vice-President of the Contractor's firm and attested by the Secretary of the firm. If the Bond is to be signed by any person other than the President or Vice-President, then the Board Resolution authorizing said person to sign and bind the firm must be included with each copy of the Bond.

CERTIFIED COPY

AMERICAN GENERAL INSURANCE COMPANY
HOUSTON, TEXAS

No. _____

GENERAL POWER OF ATTORNEY

(BONDS FOR UNLIMITED AMOUNTS)

Know All Men by these Presents:

That the AMERICAN GENERAL INSURANCE COMPANY, a corporation, duly incorporated under the laws of the State of Texas, doth hereby constitute and appoint Connie J. Jones, Paul J. Jones and Connie J. Jones, Jr., jointly or severally, of the City of Waco, State of Texas, to be its true and lawful attorney-in-fact for the following purposes, to-wit:

To sign its name as surety, and to execute, seal and acknowledge any and all bonds, recognizances, obligations, stipulations, undertakings or anything in the nature of the same, and to respectively do and perform any and all acts and things set forth in the appended resolution of the Board of Directors of the said AMERICAN GENERAL INSURANCE COMPANY; provided, that the penal sum of no single one of such bonds, recognizances, obligations, stipulations or undertakings shall exceed the sum of Unlimited Dollars ($); the Company hereby ratifying and confirming all and whatsoever the said attorney-in-fact may lawfully do in the premises by virtue of these presents, but reserving to itself full power of substitution and revocation.

In Witness Whereof, The said AMERICAN GENERAL INSURANCE COMPANY, pursuant to a resolution passed by its Board of Directors, at a meeting held on the 11th day of September, A.D. 1930, a certified copy of which is hereto annexed, has caused these presents to be sealed with its corporate seal, duly attested by the signature of its President, Vice-Presidents and Secretary this 5th day of May, A. D. 19 65.

American General Insurance Company

(SEAL)
ATTEST: (Signed) George W. Fleet
Secretary.

By (Signed) T. F. Smith
Vice President.

STATE OF TEXAS
COUNTY OF HARRIS, } ss:
CITY OF HOUSTON.

On this 5th day of May in the year 19 65 before me personally came T. F. Smith to me known, who, being by me duly sworn, did depose and say: That he resides in Houston, Texas; that he is Vice President of the AMERICAN GENERAL INSURANCE COMPANY, the corporation described in and which executed the above instrument; that he knows the Seal of said corporation; that the Seal affixed to said instrument is such corporation Seal; that it was affixed to such instrument by and under authority conferred by the Board of Directors of said corporation; and that he signed his name thereto by like authority.

(SEAL)

(Signed) Harriet Stewart
Notary Public, Harris County, Texas

A-76-1

PAYMENT BOND

STATUTORY PAYMENT BOND PURSUANT TO ARTICLE 5160 OF THE REVISED CIVIL STATUTES OF TEXAS, AS AMENDED

KNOW ALL MEN BY THESE PRESENTS, that

R. N. ADAMS CONSTRUCTION COMPANY

(hereinafter called the principal(s), as Principal(s) and

AMERICAN GENERAL INSURANCE COMPANY

(hereinafter called the Surety(s), being a Corporate Surety licensed to do business in the State of Texas as Surety(s), are held and firmly bound unto the TEXAS MUNICIPAL POWER AGENCY (hereinafter called the Obligee), in the amount of FIVE MILLION EIGHT HUNDRED SIXTY-NINE THOUSAND NINE HUNDRED NINETY-ONE DOLLARS AND Fifty-four cents Dollars ($5,869,991.54)

for the payment whereof, the said Principal and Surety binds themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract ("Contract") with the Obligee, dated the 20th day of June, 1977, to supply certain labor and/or materials for the Gibbons Creek Steam Electric Station, Unit No. 1, located near Carlos, Texas, all of such work to be done as set out in said Contract and in the Contract documents, all of which are hereby referred to and made a part hereof as fully and to the same extent as if copies at length herein, and

WHEREAS, it was a condition of such Contract that Principal execute this bond,

NOW, THEREFORE, in consideration of the sums paid in Principal and Surety by Obligee, the condition of this obligation is such, that if the said Principal shall timely pay all claimants supplying labor and/or material to said Principal or a subcontractor in the prosecution of the work provided for in such Contract, then, this obligation shall be void; otherwise to remain in full force and effect. It is also understood and agreed that the provisions of this bond shall inure to the benefit of any person, firm or corporation who may furnish to Principal any machinery or equipment and/or other material or both, for or in connection with the performance of the Contract.

PROVIDED, HOWEVER, that his bond is executed pursuant to the provisions of Article 5160 of the Revised Civil Statutes of Texas, as amended, and all liabilities of this bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copies at length herein, and

PROVIDED FURTHER, that in consideration of the sums paid to Surety in exchange for Surety's agreement hereunder, Surety relieves Obligee of any obligation whatsoever to notify Surety (1) of any default, delay or other failure by Principal in complying with the terms of the Contract between Principal and Obligee, including, but not limited to, terms relating to the payment by Principal of all consideration owed to claimants supplying labor and materials for the performance of said Contract, or (2) of any change, modification, extension, or alteration whatsoever in the Contract between Obligee and Principal or the work to be done pursuant to said Contract. Surety agrees that Surety shall be bound to take notice of and shall be held to have knowledge of all acts or omissions of Principal in relation to the Contract, and

PROVIDED FURTHER, that Obligee shall have the right to apply any retention withheld from Principal pursuant to their Contract in any manner Obligee determines to be appropriate. It is the express intent of Obligee, and Surety so agrees, that no such retention shall inure to the benefit of Surety or lessen Surety's obligation hereunder.

IN WITNESS WHEREOF, the said Principal(s) and Surety(s) have signed and sealed this instrument this 28th day of JUNE, 1977.

R. N. ADAMS CONSTRUCTION COMPANY
Principal

By: [signature]
Signature of Officer

ATTEST:
[signature]
Ass't Secretary

Vice - President
Title (Seal)

AMERICAN GENERAL INSURANCE COMPANY
Surety Company

By: [signature]
Attorney-in-Fact (Seal)

ATTEST:
[signature]

Accompany this bond with Attorney-in-Fact's authority from the surety company certified to include the date of the bond.

NOTE: This Bond must be signed by the President or Vice-President of the Contractor's firm and attested by the Secretary of the firm. If the Bond is to be signed by any person other than the President or Vice-President, then a Board Resolution authorizing said person to sign and bind the firm must be included in each copy of the Bond.

CERTIFIED COPY

AMERICAN GENERAL INSURANCE COMPANY
HOUSTON, TEXAS

No. _____

GENERAL POWER OF ATTORNEY

(BONDS FOR UNLIMITED AMOUNTS)

Know All Men by these Presents:

That the AMERICAN GENERAL INSURANCE COMPANY, a corporation, duly incorporated under the laws of the State of Texas, doth hereby constitute and appoint Connie J. Jones, Paul J. Jones and Connie J. Jones, Jr., jointly or severally, of the City of Waco, State of Texas, to be its true and lawful attorney-in-fact for the following purposes, to-wit:

To sign its name as surety, and to execute, seal and acknowledge any and all bonds, recognizances, obligations, stipulations, undertakings or anything in the nature of the same, and to respectively do and perform any and all acts and things set forth in the appended resolution of the Board of Directors of the said AMERICAN GENERAL INSURANCE COMPANY; provided, that the penal sum of no single one of such bonds, recognizances, obligations, stipulations or undertakings shall exceed the sum of Unlimited Dollars ($); the Company hereby ratifying and confirming all and whatsoever the said attorney-in-fact may lawfully do in the premises by virtue of these presents, but reserving to itself full power of substitution and revocation.

In Witness Whereof, The said AMERICAN GENERAL INSURANCE COMPANY, pursuant to a resolution passed by its Board of Directors, at a meeting held on the 11th day of September, A.D. 1930, a certified copy of which is hereto annexed, has caused these presents to be sealed with its corporate seal, duly attested by the signature of its President, Vice-Presidents and Secretary this 5th day of May, A. D. 19 65.

American General Insurance Company

(SEAL)
ATTEST: (Signed) George W. Fleet
Secretary.

By (Signed) T. F. Smith
Vice President.

STATE OF TEXAS
COUNTY OF HARRIS,
CITY OF HOUSTON. } ss:

On this 5th day of May in the year 19 65 before me personally came T. F. Smith to me known, who, being by me duly sworn, did depose and say: That he resides in Houston, Texas; that he is Vice President of the AMERICAN GENERAL INSURANCE COMPANY, the corporation described in and which executed the above instrument; that he knows the Seal of said corporation; that the Seal affixed to said instrument is such corporation Seal; that it was affixed to such instrument by and under authority conferred by the Board of Directors of said corporation; and that he signed his name thereto by like authority.

(SEAL)

(Signed) Harriet Stewart
Notary Public, Harris County, Texas

A-76-1

SPECIFICATIONS

FOR

SITE PREPARATION

GIBBONS CREEK STEAM ELECTRIC STATION

UNIT NO. 1

TEXAS MUNICIPAL POWER AGENCY

I. GENERAL

A. SCOPE OF WORK

The Texas Muncicpal Power Agency will construct a steam electric power station using Grimes County, Texas, lignite as the boiler fuel. Texas Municipal Power Agency, has been designated as the agent and as such, will enter into contracts as Purchaser for all materials, equipment and construction necessary for the power project.

The plant will be located in Grimes County, approximately 1.5 miles north of Carlos, Texas. The site will be served by a spur from the Fort Worth and Denver Railroad and the Chicago Rock Island and Pacific Railroad. The plant site may be reached by all-weather roads.

Contractor shall furnish, deliver and unload materials for, and shall construct, erect, and finish in a workmanlike manner at the plant site area the construction items as set out in these specifications and/or shown on the drawings.

B. SUPPLEMENTARY DOCUMENTS

The following are attached hereto and form a part hereof:

1. General Conditions. (Form 200-A, Rev. 12-68).
2. Contract Documents. (Form 210, Rev. 1-10-75).
3. Technical Specifications.
4. The "Summary of Proposal" consisting of the accompanying forms.

C. TEXAS USE TAX

The Texas Municipal Power Agency is exempt from any Federal excise and transportation taxes and Texas State sales tax. Successful Contractor shall contact the Owner for a copy of their exemption certificate.

D. DEFINITIONS

Wherever the terms "Tippett & Gee, Consulting Engineers" and "Engineers" are used, they refer to Tippett & Gee, Inc.

Where specific brand names or manufacturers are used, they are used as a measure of quality, and equipment approved equal by the Purchaser or Engineers may be substituted.

E. PROPOSAL INFORMATION

Proposal shall include the following:

1. The Summary of Proposal, seven (7) copies, consisting of the accompanying form, properly completed.

2. Bid Bond properly completed and attached to the original proposal.

F. INTERPRETATIONS OF PLANS AND SPECIFICATIONS

1. Oral interpretations are not binding. Verbal statements do not form a part of or alter in any way the Plans, Specifications or Contract Documents.

2. It is understood and agreed that the work shall be performed and completed according to the true spirit, meaning and intent of the Plans, Specifications and Contract. It is incumbent upon the Contractor that he shall furnish the work complete and that the work be satisfactory in all respects and fulfill the guarantee of the specifications.

   Should any information be omitted from the specifications which is necessary to clear understanding of the work, or should it appear that various instructions are in conflict, the Contractor shall request in writing written instructions from the Engineers before proceeding with the work affected by such omissions and/or discrepancies.

3. Questions concerning interpretation or intent of the Plans, Specifications or Contract Documents should be directed to:

   Mr. W. G. Hollowell, P.E.
   Tippett & Gee, Inc.
   502 North Willis Street
   Abilene, Texas 79603

   Any interpretation will be made only by addendum to the Specifications or Contract Documents.

4. Copies of such addenda as may be issued will be furnished to all holders of specifications.

5. Each bidder is required to acknowledge receipt of all addenda by listing all such addenda in his proposal.

G. SITE INSPECTION

Arrangements for Bidders to inspect the site shall be made by contacting John Hill, Texas Municipal Power Agency, 1706 Texas Avenue, Bryan, Texas 77801, phone 713-779-0616.

H. CANCELLATION SCHEDULE

Since final approval to proceed with construction on this project cannot be made until approval of Environmental Assesment Report and reasonable assurance that certain other permits and leases can be obtained, there exists a possibility that the start of work may be delayed. Contractors shall include in their proposals a cancellation schedule by months from July 1, 1977 through January 1, 1978, stating charges, if any, to be added to their proposal for each month's delay in notice to proceed.

I. CONSTRUCTION SHACK

Contractor shall provide temporary office facilities at the site of the work for the Owner's Engineers. The facilities shall be provided from the beginning of construction until completion of Contractor's work. The structure shall be weatherproof, adequately heated, insulated, lighted and air conditioned. The building shall be approximately 15' X 20' and shall have a 4' X 10' table along one wall. A suitable mobile trailer may be furnished in lieu of the 15' X 20' building. Furnishings shall include two office desks with swivel chairs and a four section metal filing cabinet.

J. LINES AND ELEVATIONS

Contractor shall employ a competent engineer or land surveyor to determine lines and elevations. Contractor shall lay out the work and shall be responsible for its correctness. He shall correct at his own expense all errors in the work arising from his inaccuracy.

K. DRAWINGS (CONTRACTOR'S)

1. Shop Drawings:

Submit shop drawings in triplicate to the Engineers for approval. After shop drawings have been checked and corrections made, four (4) copies shall be furnished to the Engineers.

Manufacturing or fabrication of any material or the performing of any work prior to approval of shop drawings will not be permitted.

The approval of shop drawings will be for size and arrangement of materials and appurtenances. Any errors in dimensions shown on shop drawings shall be the responsibility of the Contractor.

2. Drawing Addressing:

Unless notified otherwise, drawings shall be addressed as follows:

Tippett & Gee, Inc.
502 North Willis Street
Abilene, Texas 79603

Attention: Site Preparation, GC-1022
Gibbons Creek S.E.S.
Unit No. 1

L. PRIORITIES AND COMPLETION DATES

Contractor shall give special priority to the following items of work and shall adhere to completion periods specified:

1. Earthwork and grading in the Turbine Room and Boiler areas: four months after notice to proceed.

2. Plant access road: five months after notice to proceed.

3. Railroad No. 1 and Railroad No. 2: five months after notice to proceed.

4. All remaining work: eight months after notice to proceed.

M. WORK DESCRIPTION

A list of the work as hereinafter specified and/or shown on the drawings, includes in general, but is not limited to the following:

1. Clearing, grubbing and removal and stockpiling of topsoil.

2. Excavating, backfilling and grading on the plant site.

3. Construction of Ash Disposal Ponds, Sludge Disposal Pond and Yard Collection Pond.

4. Broadcast sprigging of pond slopes with Coastal Bermudagrass.

5. Riprap of selected areas.

6. Plant roads.

7. Culverts in plant area.

8. Lime treatment and base course work on plant access road.

9. Reinforced plastic pipe at ash disposal ponds.

10. Project sign.

11. Furnishing Engineer's temporary office.

12. Establishing profile grade for plant railroads.

N. DRAWINGS (CONSULTING ENGINEER'S)

The following drawings by Tippett & Gee, Inc., dated or revised as noted, are included herewith and hereby made a part hereof. All work shown on these drawings or covered in the specifications shall be done by this Contractor unless specifically noted otherwise.

C-230-001-1	Plant Site Layout
C-230-002-1	Soil Boring Plot Plan
C-230-003	Sections, Site-Grading
C-230-004-1	Sections, Site-Grading
C-230-005	Plant Railroads
C-230-006	Plant Access Road
C-230-007-1	Culvert Details
C-230-008	Miscellaneous Details
C-230-009	Plant Access Haul Road

O. PROPOSAL PERIOD

Contractor's proposal shall remain valid for acceptance by the Texas Municipal Power Agency for a period of 90 days from the date of bid opening.

P. CLARIFICATION

Drawing C-230-001 indicates chain-link security fence. This fence will not be installed by this Contract. Drawing C-230-001 also indicates contours joining the C. W. Intake structure. Contours for the C. W. structure will be in accordance with drawing C-230-004, Sections, site-grading. Plant facilities such as buildings, boiler, receiving hoppers, etc., shown on the drawings are for information only and their construction is not a part of this Contract.

* The only pipes to be installed under this contract are the two reinforced plastic pipes in the ash ponds, all concrete pipes in culverts, the C.I. drain pipe in the F.O. Facility dike and the C.I. drain pipe in the Pump Complex dike. The water lines from the Turbine Room to the C. W. Intake Structure and the C. W. Discharge Seal Well and the sewer lines are shown for information purposes only and are not a part of this contract.

*(REVISED BY ADDENDUM NO. 2)

A. APPLICABLE CODES AND STANDARDS

All references to the following publications are to be latest issue of each, together with the latest additions and/or amendments thereto, as of the date of contract. References to the sponsoring agencies will be made in accordance with the abbreviations indicated.

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

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

AASHTO . . . . American Association of State Highway and Transportation Officials Standard Specifications

THD . . . . . Texas State Department of Highways and Public Transportation.

B. GEOTECHNICAL DATA

At the end of the specifications there is a Data Section which includes logs of the borings made at the site. The location of the borings are shown on the drawings. This information is furnished for Contractor's convenience; in using it Contractor assumes the risk, as Purchaser and the Consulting Engineers assume no responsibility for accuracy of information shown thereon. Contractor will be permitted to make his own soil investigations, but same shall be made at no cost to Purchaser and type and location shall be as approved by Owner.

C. LINES AND GRADES

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

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

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

D. CLEARING

Prior to performing excavation or fill work, areas in which such work is to be done shall be cleared, grubbed and the top soil removed.

1. Clearing:

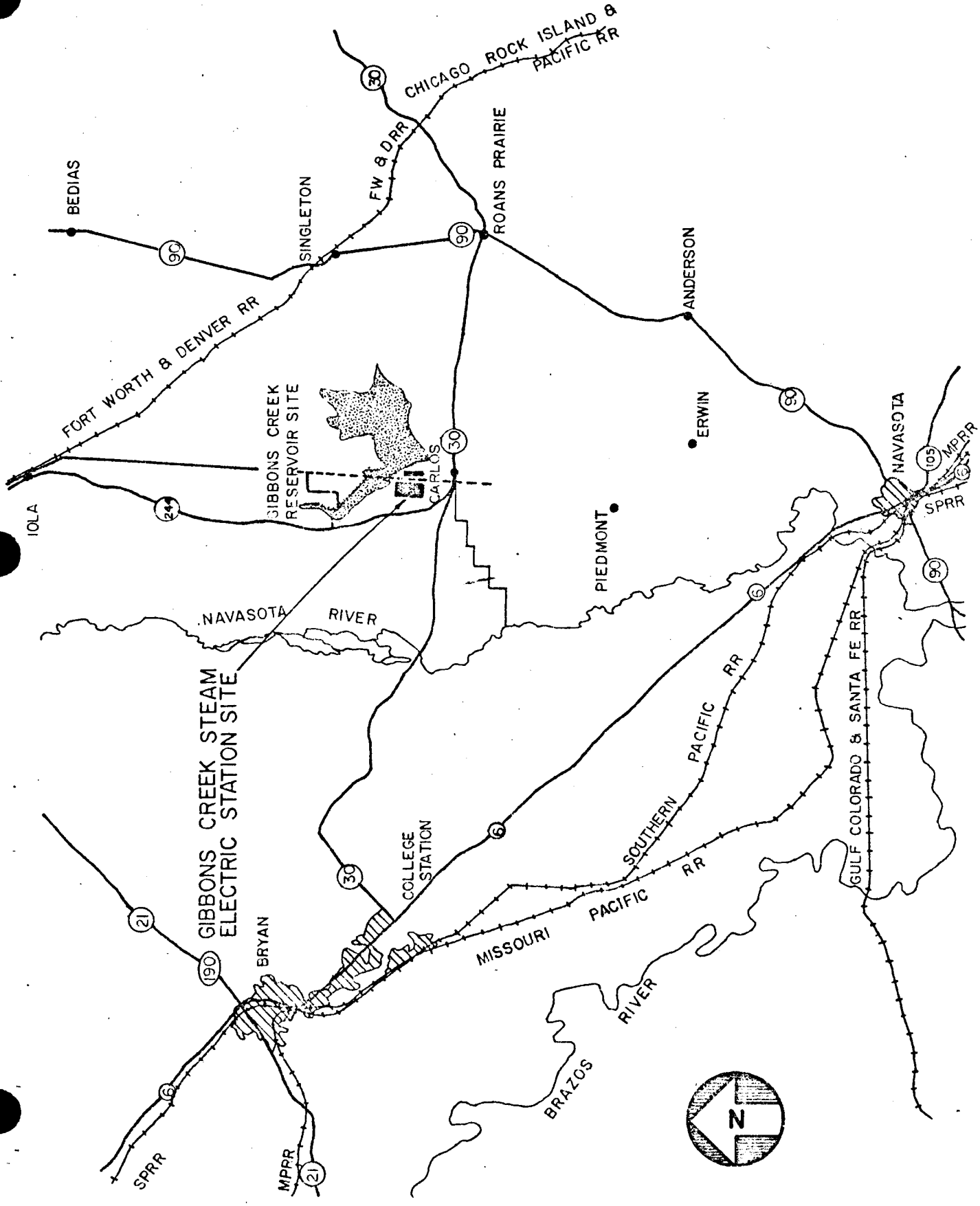
   Clearing is defined as removal and disposal of all trees, down timber, snags, brush, hedges, bushes and all other vegetation or organic materials, and also all rubbish, debris or other foreign or objectionable materials above ground surface, except removal of sod and topsoil.

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

2. Grubbing:

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

GIBBONS CREEK STEAM ELECTRIC STATION VICINITY MAP



3. Disposal:

All materials from clearing and grubbing operations shall be Contractor's property and shall be promptly disposed of off the site. Accumulation of such materials on premises is not permitted. If Contractor desires to burn materials, the obtaining of a burning permit shall be Contractor's responsibility.

4. Removal of Topsoil:

Topsoil in areas to be excavated or filled shall be removed, stockpiled and saved at various locations on the site nearby where it is to be reused. Stockpile locations shall be as approved by Engineer. Topsoil shall be carefully stripped off, stored in a stockpile and kept clean and free of all foreign material. Sod and other vegetation shall be removed from the topsoil before it is stockpiled. Topsoil, in a 12 inch thickness shall be placed on the outside and top of the ash disposal pond berms, on the outside and inside face of the yard collection pond, on the south slope of switchyard area, on the north, east and west slopes of Lignite Handling area, and on the outside and top of the sludge disposal pond berm. No topsoil will be placed in areas specified for riprap.

E. EXCAVATION

Excavation is defined to include all incidental clearing, all excavation and disposal of excavated materials, all protection, sheeting, shoring, bracing, all dewatering, and preparation of bearing areas as required to properly install and complete the WORK, regardless of portions of WORK for which required, and regardless of nature of materials encountered in excavating.

1. Protection and Support:

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

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

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

d. Protection and support shall be arranged for minimum interference with pipe laying and similar work.

2. Formwork:

Earth excavations shall be of sufficient size to allow for placing of formwork for concrete, for inspection of formwork and surfaces of completed concrete, and for dampproofing, waterproofing, pipework, etc.

3. Bearing Areas:

a. Bearing areas for all Foundations shall be inspected and approved by the Consulting Engineers before any concrete is placed. If bearing areas are not suitable, as determined by the Consulting Engineers, Contractor may be requested to carry the excavations deeper to more suitable bearing material; such additional excavation will be paid for on the unit price basis set forth for the WORK.

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

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

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

4. Excavation for Pipework:

a. Make excavation for this work true to grade, profile and alignment, and so as to provide full, even and continuous bedding.

5. Disposal of Excavated Materials:

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

F. FILL

Fill includes the following two classes, the use of each shall be as indicated.

Class 1: Regular compacted fill, RCF. Regular compacted fill will be placed in all fill areas that are not designated controlled compacted fill.

Class 2: Controlled compacted fill, CCF. Controlled compacted fill will be placed in the following fill areas:

1. Embankments
2. Road beds
3. Railroad beds
4. All slopes steeper than 5 horizontal to 1 vertical (5:1)
5. At all future structure locations, the dimensions obtained from drawing C-230-001 will be increased 20' for purposes of placing the CCF. For example, the maintenance building which is 300' X 150' would have a CCF pad 320' X 170'.
6. Switchyard area
7. Ash silo area (all the area that will drain into culvert #20)

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

Soils available for compaction from cuts in the plant area include clays, silty clays, sandy clays, clayey sands, and various mixtures of these soils. The moisture content data indicates that these soils will be excavated, if in their present condition, at a moisture content slightly below the optimum value. Comparison of dry unit weight test results with results of compaction tests indicate that embankment shrinkage factors will range from 10 to 15 percent, excluding loss from the Contractor's operation.

Some highly plastic clays may be encountered. These clays with liquid limits in excess of 50 and plasticity indexes greater than 30 will not be permitted in the top two feet of any embankment.

* The following Sections, Class 1, Regular Compacted Fill and Class 2, Controlled Compacted Fill specify 90% and 95%, respectively, of the maximum denisty obtained by the Texas Highway Department Method (TEX-113 E). However, when highly plastic clays are encountered, the Standard Compaction Test (ASTM D-698) shall be used. For highly plastic clays, Class 1 and Class 2 fill shall be compacted to 90% and 95% respectively, of the maximum density obtained by the Standard Compaction Test (ASTM D-698).

1. Class 1, Regular Compacted Fill:

a. Material: This material will consist of the upper layers of clay material which overlay the very dense fine sand material. All material used shall be as approved by Engineer.

*(REVISED BY ADDENDUM NO. 3)

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

c. Compaction Densities: Build up fill to grade elevations indicated or required, with suitable moisture control and compaction throughout placing, as specified in d. following, to produce a completed fill capable of supporting trucks and other heavy construction equipment. All Class 1 fill shall be compacted to a minimum of 90% of the maximum density obtained using Test Method Tex 113-E. The moisture content may vary from a minimum of two percent below to four percent above the optimum value as defined by the THD compaction Test Procedure, Test Method Tex 113-E.

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

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

2) For Type RCF cohesive fill, compact by use of sheeps foot roller or with other ramming type equipment, as approved.

3) In places inaccessible to large equipment, obtain required compaction with mechanical rammers for Type RCF cohesive fill.

2. Class 2, Controlled Compacted Fill:

a. Material: Same as described for Class 1 regular compacted fill.

b. Preparation of Subgrade:

1) Subgrade to receive controlled compacted fill shall be inspected by the Consulting Engineers to determine if it is suitable and has sufficient bearing capacity for the fill material and loads to be placed over it.

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

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

c. Compaction Densities:

During the compaction process the soil moisture content should be near the optimum value to obtain desired fill characteristics. The water content may vary from a minimum of two percent below, to four percent above the optimum value as defined by the Texas Highway Department Compaction Test Procedure, Test Method Tex 113-E, varying the compaction effort in accordance with the plasticity characteristics of the soil. All Class 2 fill shall be compacted to a minimum of 95 percent of the maximum density obtained using Test Method Tex 113-E.

d. Placing of Fill:

Place as follows, unless otherwise approved or requested:

1) Place fill, with optimum moisture content, in uniform horizontal layers not over 9" deep before compaction. Add water, or dry out fill, to maintain optimum moisture content throughout placing and compaction.

2) For Type CCF cohesive fill, compact by use of sheeps foot roller or with other ramming type equipment, as approved.

3) In places inaccessible to large equipment, obtain required compaction with mechanical rammers for Type CCF cohesive fill.

3. Surplus Fill Material:

The dirt balance will result in a considerable surplus of fill material. This material shall be stockpiled west of the plant (bounded by Highway 244, Plant Access Road, Railroad No. 3 and the Plant Access Haul Road) and in other areas as approved by the Engineer. The stockpiled material shall be placed in a manner that would not obstruct existing drainage flows nor be placed in a manner that could be easily washed down stream.

G. BACKFILL

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

1. Material:

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

2. Compaction:

Backfill shall be built up to the grade elevations indicated or required, with suitable moisture control and compaction throughout placing, in the same manner as specified in F.1., for Regular Compacted Fill.

3. Backfill Around Underground Piping:

Place backfill around underground piping, drain lines, etc., only after piping, drain lines, etc., have been tested and/or inspected and approved. Use special care in backfilling to see that backfill is free of cinders or other materials which may be injurious, in opinion of Consulting Engineers, to such piping, drain lines, etc. Provide backfill free from rocks, hard lumps or clods larger than 3 inches. Do not use sod. Place backfill below top of piping, drain lines, etc., in alternate layers on each side of piping, drain lines, etc.

H. GRADING

Consists of rough grading and finish grading as follows:

1. Rough Grading:

Cut, fill, spread and level during course of WORK to elevations indicated.

2. Finish Grading:

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

I. POND CONSTRUCTION

Pond construction includes the Ash Disposal Ponds, Sludge Disposal Pond and Yard Collection Pond. Their construction shall conform to the shapes, locations and dimensions as shown on the drawings, to the specifications herein and the items described as follows:

1. Ash Disposal Ponds and the Sludge Disposal Pond:

The clays, silty clays and sandy clays in the vicinity of the ash disposal ponds and the sludge disposal pond are sufficiently impervious that it is not necessary to blanket the ash disposal ponds and the sludge disposal pond where these clays are exposed. However, where silty sands, lignite, or any substance possessing a permeability greater than 1.0×10^{-7} CM/SEC are exposed, these materials will be over-excavated to a depth of three feet and will be replaced with three feet of compacted medium to highly plastic clay (coefficient of permeability less than 1.0×10^{-7} CM/SEC) to prevent water loss. Foundation preparation for the embankments will include a five foot inspection trench backfilled with impervious clay at the inside toe of the embankment to assure that pervious

*(REVISED BY ADDENDUM NO. 3)

layers do not underlie the embankment. Any pervious layers must be penetrated by the inspection trench and backfilled with impervious clay. The embankments will be constructed in the following manner:

a. All organic matter and topsoil should be excavated to a depth of at least one foot and stockpiled.

b. Provide inspection trenches as indicated on drawing C-230-001 for the ash disposal pond and similarly for the sludge disposal pond. The trenches will be a minimum of eight feet wide and five feet deep for inspection of the foundation. Any pervious layers encountered must be penetrated by deepening the inspection trench. The inspection trench must be backfilled with impervious clays and compacted as prescribed in Item d.

c. Scarify the foundation soils to a depth of 12 inches, adjust the moisture content, and recompact to a density of at least 95 percent of the maximum dry unit weight as determined by the Standard Compaction Test (ASTM D-698) for highly plastic clays and the Texas Highway Department Method (TEX 113E) for sandy clays, clayey sands, silty sands, and soils. The moisture content can vary from a minimum of two percent below to a maximum of four percent above the optimum value.

d. Place embankment soils in thin loose lifts not exceeding nine inches in thickness, adjust moisture, and compact to a density of at least 95 percent of the maximum as defined by the Standard Compaction Test (ASTM D-698) for highly plastic clays and the Texas Highway Department Method (TEX-113E) for sandy clays, clayey sands, silty sands, and sands. The moisture content should vary from a minimum of two percent below to a maximum of four percent above the optimum value.

e. Special zoning of the embankments are not required; however, the center portion of the embankments will be constructed of clays having a permeability less than 1.0×10^{-7} CM/SEC with sands and other relatively pervious materials being eliminated from use in construction of this center zone. All excavated materials will be suitable for fill material excluding organic topsoil, lignitic clays, and lignites.

f. Use minimum slopes of 3.0 horizontal to 1.0 for the embankments.

g. The outside slopes and top of the embankments will be covered with topsoil and then sprigged to provide a good turf of Coastal Bermudagrass.

h. The bottom of the ponds will be inspected for areas where silty sands and lignite are exposed. In these areas the ponds will be over-excavated an additional three feet and backfilled with impervious clay. Placement and compaction requirements as specified in Item d will be followed.

2. Plant Collection Pond:

The clays, silty clays, and sandy clays from required plant grading may be used for construction of the embankment. Zoning of the embankment is not necessary; however, provision should be made to use only clays in the center third of the structure with the more pervious materials such as sands, silty sands, and clayey sands being placed in the outer shell of the earthen structure. The embankment will be constructed in the following manner:

a. All organic material and topsoil should be excavated to a depth of 1 foot and stockpiled. A greater depth of stripping may be required in some areas due to sloughs, small stream beds, uneven topography, and excessively wet soils.

b. Provide an inspection trench under the center of the embankment, eight feet wide at the bottom and ten feet deep, for purposes of inspection of the foundation. All pervious strata must be penetrated by the inspection trench. Backfill the inspection trench with impervious clays and compact as specified in Item d.

c. Scarify the foundation soils to a depth of 12 inches, adjust the moisture content, and recompact to a density of at least 95 percent of the maximum dry unit weight as determined by Standard Compaction Test (ASTM D-698) for highly plastic clays and the Texas Highway Department Test Method (TEX-113E) for other soils types. The moisture content may vary from a minimum of two percent below to a maximum of four percent above the optimum value.

d. Place embankment soils in thin loose lifts not exceeding nine inches in thickness, adjust moisture, and compact to 95 percent of Standard Compaction Test (ASTM D-698) for highly plastic clays and the Texas Highway Department Test Method (TEX-113E) for other soil types, and at a moisture content ranging from two percent below the optimum value to four percent above the optimum value.

e. Use minimum slope ratios of 3 horizontal to one vertical.

f. The downstream slope of the embankment will be covered with topsoil and then sprigged to provide a good turf of Coastal Bermudagrass cover.

g. Upstream slope protection will be provided by stone riprap placed on sand and gravel bedding. Riprap will be placed from elevation 254.0' to elevation 244.0' at the bottom of the slope.

h. Soils at this site are generally plastic and impermeable (permeability coefficient equal to 1×10^{-7} CM/SEC). However, if silty sands are encountered in any areas within the pond, over-excavated to a depth of three feet and replaced with a compacted clay blanket. Placement and compaction requirements will be as specified in Item d.

J. BROADCAST SPRIGGING

* Broadcast sprigging of Coastal Bermudagrass shall consist of placing 12 inches of top soil (free from noxious weeds or other matter deleterious to the growth of Coastal Bermudagrass), preparing the top soil, fertilizing the area, placing of Coastal Bermudagrass sprigs, disking, rolling and watering as directed by the Engineer.

Areas to be sprigged are listed as follows:

a. Top and outside slopes of the outer ash disposal dikes.

b. Top and outside slopes of the sludge disposal dike.

c. Top and slopes (outside and inside) of the yard collection pond dam.

d. South slope of switchyard area.

e. North, east and west slopes of the lignite storage area.

f. Railroad No. 3

1. Planting Season:

All sprigging shall be done between the average date of the last freeze in the Spring (March 1) and six weeks prior to the average date for the first freeze in the Fall (December 4).

*(REVISED BY ADDENDUM NO. 3)

2. Materials:

Coastal Bermudagrass sprigs shall be obtained from a live growing source having a healthy virile root system of dense, thickly matted roots throughout the soil. Sprigs which have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted shall be rejected.

The sprigs shall be free from noxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. The sprigs shall come from a source that has been closely pastured, burned, or closely mowed and raked to remove all weeds and long standing stems. Sources from which sprigs are taken shall be approved by the Engineer.

Care shall be taken at all times to keep the sprigs moist and protected from the sun and wind from the time they are dug until planted. When so directed by the Engineer, the sprig source shall be watered to the extent required prior to digging. The time between digging and planting shall not exceed 24 hours.

Sprigs shall be delivered to the planting site in a loose condition, or may be baled if desired by the contractor. Sprigs shall be free of native soil.

3. Soil Preparation:

The top soil on which sprigging is to be placed shall be loosened by disking or other approved method to a depth of not less than 4 inches. All large clods shall be pulverized and boulders, rocks or other debris shall be removed until in the opinion of the Engineer, a friable, firm seedbed is prepared. The contractor shall take full advantage of weather conditions, but the work may be suspended when in the judgment of the Engineer, the continuation of the same may result in unfavorable planting conditions. When so directed by the Engineer, the planting site shall be watered to the extent required prior to planting. After the planting site has been prepared for sprigging, fertilization shall be uniformly distributed over the area in accordance with the provisions of Item 5., Fertilizer.

4. Sprigging:

The sprigs shall be broadcast by hand or mechanically spread over the prepared area at a minimum rate of 75 cubic feet of baled, live springs per acre.

The sprigs shall be immediately disked under to a depth of 2 to 3 inches.

The sprigged area shall then be rolled with a corrugated roller of the 'cultipacker' type. All rolling of slope areas shall be on the contour.

The area shall then be thoroughly watered and kept in a moist condition as directed by the Engineer.

5. Fertilizer:

Fertilizer shall be applied at planting time and after growth is established to insure a satisfactory cover. Fertilizer types and rates of application are as follows:

a. Planting time	Rates of Application (lbs/acre)		
	$\frac{N}{40}$	$\frac{P_2O_5}{40}$	$\frac{K_2O}{0}$

*(REVISED BY ADDENDUM NO. 3)

* Mixture of: Ammonium Nitrate (33.5-0-0) 120 lbs per acre
Superphosphate, triple (0-46-0) 87 lbs. per acre

b. Growth Established

Rates of Application (lbs/acre)		
$\frac{N}{40}$	$\frac{P_2O_5}{0}$	$\frac{K_2O}{0}$

6. Watering:

The sprigged area shall be watered at such times and in the manner and quantity as directed by the Engineer.

K. SEEDING

1. Application:

When specified on drawings, all seeding will be accomplished in accordance with current THD specifications, Item 164.

2. Planting Dates:

All seed will be planted during January 1 to May 15.

3. Seed Mixture:

The mixture will consist of 4 pounds per acre of Green Sprangletop, 8 pounds per acre of common Bermudagrass and 10 pounds per acre of K. R. Bluestem.

4. Fertilization:

Fertilizer rates, seed purity, and seed germination rates will be in accordance with current THD specifications, Item 164 and Item 166.

* L. RIPRAP

Riprap shall be placed as indicated on the drawings and as specified below. The riprap indicated for the outfall pipe of culvert No. 20 shall be placed in a strip 10 feet wide with the outfall pipe being in the center of the stip. The strip shall start at the end of the outfall pipe and shall extend across the adjacent ditch and two feet up the dike (measured vertically) at the pump complex.

18 inches of riprap shall be placed in the following areas:

1. Plant Collection Pond.
2. C. W. Intake Canal.
3. In areas specified for riprap that join the lake.

12 inches of riprap shall be placed in the following areas:

1. At the discharge of Culvert No. 20.
2. Southwest of the sludge disposal pond (Drwg. C-230-001).
3. In the future coal receiving area (Drwg. C-230-001).

1. Material:

a. Stone for riprap shall be durable and of a suitable quality to insure permanence in the structure and in the climate in which it is to be used. It shall be free from cracks, seams and other defects which would tend to unduly increase its deterioration from natural causes and it shall be reasonably well graded between the prescribed limits as specified. Material will be rejected when failing to meet the following specification requirements.

*(REVISED BY ADDENDUM NO. 3)

* b. The riprap shall meet the following tests:

1. Soundness in magnesium sulfate

The riprap stone shall have a maximum loss of 20% on a weighted average at 5 cycles when tested for soundness in magnesium sulfate in accordance with ASTM Standard C-88. The test for soundness of aggregate by use of sodium sulfate shall be run using particles passing a 2-1/2 inch sieve and retained on a 1-1/2 inch sieve. After final drying the material will be screened over the 1-1/4 inch sieve.

2. Resistance to Abrasion

The riprap shall have maximum percent of wear of 35% after 1,000 rev. as determined by ASTM designation C-535, Grading 1.

c. The riprap shall meet the following gradation requirements:

18 inch Riprap		12 Inch Riprap	
U.S. Stand. Sieve Size	Specification Limits % Passing	U.S Stand. Sieve Size	Specification Limits % Passing
18 in.	100	12 in.	90-100
12 in.	30-50	8 in.	40-60
8 in.	0-15	6 in.	10-30
6 in.	0-5	3 in.	0-20

d. Place in manner to insure that largest rock fragments are uniformly distributed and that smaller rock fragments serve to fill spaces between larger rock fragments in such manner as will result in dense uniform course of riprap.

e. Riprap may be placed by dumping and shall be placed to its full course thickness in one operation. Hand placing to limited extent may be used only to extent necessary to secure specified results.

f. Average Thickness Riprap Courses:

Not less than full thickness indicated, except tolerances of 4 in. from slope lines and grades will be allowed to finish surfaces, provided extremes of such tolerance shall not occur within areas less than 10 feet square.

2. Placing:

The riprap shall be placed on a 6 inch layer of blanket material which shall meet the following gradation requirements:

6 Inch Blanket Material

U.S. Standard Sieve Size	Specification Limits % Passing
3 in.	95-100
1-1/2 in.	80-100
3/4 in.	65-84
3/8 in.	54-68
#4	43-58
#40	5-24
#100	0-10

*(REVISED BY ADDENDUM NO. 3)

a. The blanket material shall meet the following tests:

1. Soundness in magnesium sulfate

The blanket material shall have a maximum loss of 25% on a weighted average at 5 cycles when tested for soundness in magnesium sulfate in accordance with ASTM Standard C-88. The 'Test for Soundness of Aggregate by use of Sodium Sulfate' shall be run using particles passing a 2-1/2 inch sieve and retained on a 1-1/2 inch sieve. After final drying, the material shall be screened over the 1-1/4 inch sieve.

2. Resistance to Abrasion

The blanket material shall have a maximum percentage of wear of 35% after 1,000 rev. as determined by ASTM designation C-535, 'Method of Test for Resistance to Abrasion of Large Size Coarse Aggregate by Use of the Los Angeles Abrasion Machine,' Grading 1.

b. The blanket material shall be durable and of a suitable quality to insure permanence in the structure. It shall contain no organic matter and meet the above gradation requirements."

M. SOIL CEMENT OPTION

1. As an option to the Contractor, soil cement protection may be substituted in all areas specified for riprap. If this option is selected, the soil cement will be two feet in thickness measured perpendicular to the slope.

2. The soil cement mixture will be mixed, placed, finished and cured in accordance with current THD specifications Item 274. The mixture may be placed in 9 inch lifts. For estimating purposes, 12 percent cement (13 pounds per cubic foot of treated soil) may be considered.

3. Sands for soil cement base will generally be uniformly graded with less than 25 percent passing the No. 200 sieve, and with a plasticity index less than six. The results of studies in the area have not revealed any suitable sand sources on the site.

4. Soil cement will be compacted as near to the optimum value as possible, and limited to a moisture content from 2.0 percent dry of optimum to optimum and will have a minimum density of 95 percent of the maximum as defined by the AASHTO T134-70 procedure.

5. Quality control testing will include density tests and molding of specimens for laboratory strength tests. The reference compaction test for comparison of density tests will be performed using materials taken from the field mix just prior to field compaction as the time interval of the laboratory compaction test will correspond to field operations. The laboratory specimens for strength tests will be molded at the same time the mixture is compacted in the field. An alternate method of checking the strengths would be to core the cured soil cement. A minimum curing time of seven days is required prior to coring. Unconfined compression strength of soil cement specimens should be a minimum of 500 psi in seven days.

6. Where soil cement slope protection is adjacent to a road bed, the soil cement will be terminated below the top of subgrade shoulder elevation to insure proper drainage of the road bed section.

*(REVISED BY ADDENDUM NO. 3)

LOG OF BORING NO. B-1
SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 316 ±	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT LBS./CU. FT.
			Loose tan sandy silt (ML)							
			Hard tannish-gray clay, jointed w/numerous silty sand inclusions (CH)							
5			Very stiff light tan clay -hard (CH)			62	32	35		92
			Hard brown clay -sand seam at 8.0-8.4' (CH)							
10			Hard light gray clay, w/ numerous clay laminations and iron staining					32		96
15			-w/occasional sand laminations and inclusions			64				
20			-w/numerous sand laminations and inclusions (CH)							
25			Hard gray clay, w/numerous silt and sand laminations -sand seam at 23.6-23.9' (CH)	50/5.0" seat		66	32	33		93
30										
35			Very dense gray silty sand (SM)							
40			Very stiff gray clay, w/ occasional sand laminations (CH)							
			Very dense gray silty fine sand, slightly indurated (SM)							
45			Hard gray sandy clay, w/occasional silty fine sand laminations and inclusions		50	42	23			
50			-silty sand seam at 48.5-48.9'							

(Continued)

NATIONAL SOIL SERVICES, INC.
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PLATE A-1

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CL)						
55			Hard gray clay, w/numerous silt laminations		79	28	32		91
60			-silt seam						
65			-carbonaceous seam						
70			(CH)		75	31	31		91
75			Hard green and gray clay, w/numerous silt laminations -very stiff brown at 79.0-80.0'						
80					80	29	36		
85									
90			-w/slickensides						
95			-w/occasional silty sand seams				29		
100									

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105								29		
110			-w/bentonitic pockets and occasional silty fine sand laminations					33		
115										
120						85	18	29		9
125			-w/numerous silty fine sand laminations					25		
130			-w/silty fine sand laminations at 129.2-129.3' (CH)					30		
135			Hard gray clay, w/ numerous silt laminations (CH)		96	51	19	27		
140			Hard gray clay	70				29		
145			-w/occasional siltstone seam (CH)							
150			Very dense gray silty fine sand, w/occasional clay laminations and clay balls							

(Continued)

NATIONAL SOIL SERVICES, INC.
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PLATE A-3

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

SITE SELECTION STUDY-
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155			(SM)	50/5" seat	46					
160			Hard gray sandy clay, w/numerous silt laminations -w/lignitic clay pockets							
165			(CL)							
170			Very dense gray silty fine sand, w/numerous clay laminations		49					
175			-w/clay pockets	50/4.5" seat	70					
180										
185			(SM)							
190			Hard gray clay, w/ numerous silty sand laminations and pockets							
195										
200			(CL)			49	18	29		

COMPLETION DEPTH: 200.0' DEPTH TO WATER: 26.0'
DATE: 5/20/76 DATE: 5/21/76

NATIONAL SOIL SERVICES, INC.
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PLATE A-4

LOG OF BORING NO. B-2

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 399 ±	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose light tan silty fine sand (SM)		63	54	24	22		97
5			Very stiff light tan clay -w/medium to coarse sand seam at 0.5' -w/vertical fissures -w/lignitic material seam at 5.5'	49	86	51	32	29		92
10										
15			(CH)		94	56	30	38		83
20			Hard dark tan and brown clay (CH)	50/5"		79	31	31		
25			Hard greenish-gray clay, shaley	seat						
30			-w/numerous sand and thin sandstone laminations -w/45° slickenside (CH)			83	34	33		87
35			Very dense greenish-gray fine sand (SM)	50/4"						
40			Hard greenish-gray clay, w/occasional sand laminations	seat						
45			-w/occasional to numerous sand laminations and slight slickensides			44	23	28		87
50										

(Continued)

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PLATE A-5

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-w/clayey fine sand pockets		69	34		4+	
60			-w/occasional to numerous sandstone laminations below 58.5'					4+	
65					55	23	27	4+	97
70								4+	
75							34	4+	90
80			-w/numerous sandy silt inclusions					4+	
85					77	30	32	4+	89
90			-w/occasional sandy silt laminations					4+	
95					86	29	27	4+	99
100			-slightly slickensided					4+	

(Continued)

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PLATE A-6

LOG OF BORING NO. B-2 (Cont'd.)
SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105			-slightly slickensided -w/occasional sandy silt laminations		60	21	26		95
110			-w/numerous sandy silt and silty fine sand inclusions						
115					78	25	27		97
120			-w/bentonitic clay inclusions at 119.5 - 119.9' -w/numerous sandy silt inclusions and slight slickensides						
125									
130					80	23	28		96
135			-w/numerous silty fine sand laminations and inclusions below 134.0'						
140			-slickensided -siltstone seam at 140.3 - 140.5'		58	19	30		94
145			-fractured						
150			-slightly slickensided						

(Continued)

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PLATE A-7

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155			(CH)							
160			Very dense greenish-gray silty fine sand -w/siltstone laminations at 158.5' -w/occasional to numerous clay laminations		50			26		97
165				50/5.5"						
170			-siltstone laminations	seat	67					
175			(SM)							
180			Hard brown clay, slickensided -w/numerous thin silty fine sand laminations			43	21	26		91
185			(CL)							
190			Very dense gray silty fine sand		40			21		105
195			(SM)							
200			-w/occasional clay laminations	50/5"	seat 56					

COMPLETION DEPTH: 199.0'
DATE: 5/11/76

DEPTH TO WATER: 21.5'
DATE: 5/12/76

NATIONAL SOIL SERVICES, INC.
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PLATE A-8

LOG OF BORING NO. B-3

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 287 ±	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT LBS./CU. FT.
			Loose tan silty fine sand (SM)						
			Very stiff tan sandy clay (CL)	59			14		
5			Hard gray clay, w/occasional sand inclusions (CH)		52	26	26		
10			Hard gray clay, w/numerous clay and silt laminations and iron stains		64	29	31		85
15			-very stiff -w/numerous sand inclusions		46	17	28		94
20			(CH)	80					
			Dense tan silty fine sand, w/numerous clay laminations (SM)				34		95
25									
30			Hard light green and gray clay (CH)		72	28	31		88
35			Hard gray clay, w/numerous silt laminations		69	33	35		84
40					58	29	30		90
45			-w/sandy clay seams at 44.4 - 44.7' -slickensided						
50									

(Continued)

NATIONAL SOIL SERVICES, INC.
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PLATE A-9

LOG OF BORING NO. B-3 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55					75	32	33		
60			-slightly slickensided -w/occasional thin silt laminations						
65			-w/fractured siltstone inclusions				14		
70			-slickensided						
75			-slightly slickensided				27		
80			-w/silty fine sand seam at 79.4 - 79.6 '						
85					79	26	32		
90									
95			-w/bentonitic seam at 93.8-94.0'				36		
100									

(Continued)

LOG OF BORING NO. B-3 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CH)							
105			Hard gray clay, w/ occasional sand laminations (CH)							
110			Very dense gray sandy silt -siltstone seam at 110.0-110.2' -w/numerous clay laminations (ML)					25	+	
115			Hard gray clay -w/clayey sand seams and numerous silt laminations						+	
120										
125			(CH)						+	
130			Very dense gray silty fine sand, w/occasional clay laminations	50/4" seat	49			28		
135										
140										
145			-w/numerous clay seams and occasional lignitic inclusions		48			30		
150										

(Continued)

LOG OF BORING NO. B-3 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155			Hard gray clay, w/silty sand laminations (SM)							
			-w/numerous sand laminations (CH)					25		
160			Very dense gray clayey sand							
165			(SC)							
170			Very dense gray silty fine sand		5			21		
175			-w/numerous clay pockets (SM)	84						
180										
185										
190										
195										
200										

COMPLETION DEPTH: 180.0' DATE: 5/17/76

DEPTH TO WATER: 15.0' DATE: 5/18/76

NATIONAL SOIL SERVICES, INC.
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PLATE A-12

LOG OF BORING NO. B-4

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 267 ±	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Very stiff brown silty clay (CL)							
5			Medium dense light tan to light brown sandy silt -dense		69	44	30			
10										
15			-w/occasional light brown silty sand seams and occasional brown clay balls and seams							
20			-very dense below 18.5' (ML)	82						
25			Very dense gray silty fine sand -w/carbonaceous seams					31		92
30					39	38	29			
35										
40			-w/carbonaceous laminations							
45			(SM)		40					
50			Very dense gray silt -w/6.0" clay seam at 49.5' -w/occasional gray clay laminations							

(Continued)

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PLATE 2

LOG OF BORING NO. B-4 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(ML)		84	46	22			
60			Hard gray clay, w/silt seams			64	22	27		
65										
70			-w/8.0" silty sand seam at 69.0' (CH)					25		
75			Hard greenish-gray clay, w/occasional silt laminations -w/occasional pyrite or marcasite nodules			82	24	31		91
80										
85								33		
90			-w/numerous silty sand and silt seams below 88.0' -ironstone seam at 91.0-93.0' (CH)							
95			Hard gray clay, w/occasional sandy silt seams (CH)	84/10"				32		
100			Very dense gray silty fine sand -indurated to 103.0'							

(Continued)

LOG OF BORING NO. B-4 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105										
110			-w/carbonaceous seams -w/occasional indurated sandy silt laminations (SM)	50/4" seat						
115			Very dense gray clayey sand, indurated, w/silt seams -w/clay laminations (SC)		25	42	20			
120										
125			Very dense gray sandy silt, w/clay laminations (ML)							
130										
135			Hard gray clay, slightly sandy (CH)			63	28			
140			Hard gray clay, slickensided			114	32	32		
145										
150						119	40	36		

(Continued)

NATIONAL SOIL SERVICES, INC.
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PLATE 4

LOG OF BORING NO. B-4 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155									
160									
165			(CH)						
			Hard gray clay, w/numerous silty sand seams and pockets		58	17	24		109
170									
175			(CH)						
180			Hard gray and greenish-gray clay, w/occasional silt laminations						
185									
190							32		
195									
200			-slickensided (CH)						

COMPLETION DEPTH: 200.0' DEPTH TO WATER: 20.0'
DATE: 5/20/76 DATE: 5/21/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 5

LOG OF BORING NO. B-5

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 273±	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose gray and tan silty fine sand, w/clay inclusions (SM)		32	18	16		
			Very stiff light tan sandy clay, w/sand inclusions (CL)						
5			Loose tan silty fine sand (SM)		44	19	26		90
			Hard light tan sandy clay, w/yellow clay and sand inclusions -w/occasional clay laminations and inclusions (CL)		62	28	33		84
			Hard tan clay, w/sandy clay inclusions and iron stains (CH)				58		49
15			Hard dark reddish-brown lignitic clay, w/lignitic material seams (OL)						
			Hard brown silty clay (CL)		92	37	34		85
20			Hard green clay, moderately slickensided (CH)						
			Hard dark reddish-brown lignitic clay, w/clay seams (OH)		53	32	28		
25			Soft dark reddish-brown lignitic material, w/clay seams (Pt)						
30			Hard gray clayey silt (ML)		46	33	31		90
35			Hard gray clay, w/occasional claystone laminations (CH)						
40			Hard gray sandy clay, w/numerous sand inclusions (CL)		33	18	22		101
45			Very dense gray silty fine sand, w/occasional clay laminations						
50									

(Continued)

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY LBS./CU. FT.
			(SM)	57						
55			Hard gray sandy clay, w/numerous sand inclusions -w/lignitic clay seam at 56.0' (CL)			48	19	24		97
60			Hard gray clay, w/numerous silt laminations (CH)			73	32	30		88
65			Hard gray clay			76	32	33		86
70										
75			-w/sand laminations and inclusions (CH)							
80			Hard brown silty clay -1.0" thick lignitic material seam at 81.0'							
85			-w/numerous silty fine sand laminations and inclusions and occasional clay laminations (CL)			43	22	27		93
			Hard brown silty clay, w/lignitic material inclusions (CL)							
90			Hard gray clay, w/sandy clay laminations (CH)							
			Very dense gray silty fine sand, w/ numerous clay balls, laminations (SM)							
95			Hard gray clay, w/numerous thin silt laminations (CH)			81	28	29		90
			Hard brown silty clay, w/lignitic clay inclusions (CL)							
100										

(Continued)

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			Very dense gray clayey fine sand, w/sand inclusions -silty fine sand at 103.5-103.7' (SC)		33					
105			Hard gray sandy clay, -silty clay seam, w/lignitic laminations at 104.0-104.3'	50/3.5"						
110			-silty fine sand seam at 105.3-105.5' -silty fine sand seam at 108.0-108.5' (CL)	seat						
115			Hard gray clay, w/numerous sandy clay seams and laminations							
120			-slickensided			49	22	26		96
125			-w/numerous clay and silt laminations							
130			(CH)			65	21	28		94
135			Hard greenish-gray clay, w/occasional silt laminations							
140						109	32	34 31		85 90
145										
150										

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 8

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
155			(CH)							
160			Very dense gray clayey fine sand, w/clay balls and inclusions and fossil fragments (SC)		37	41	20	20		10[illegible]
165			Very dense gray silty fine sand, w/occasional thin sandstone laminations							
170			-w/occasional sandstone and claystone laminations		34			24		9[illegible]
175			(SM)							
180			Very dense gray silty fine sand							
185										
190			-w/numerous clay laminations	50/3" seat	90					
195			(SM)							
200			Hard gray clay, w/sandy clay inclusions (CH)			92	33	26		92

COMPLETION DEPTH: 200.0' DEPTH TO WATER: 20.5'
DATE: 5/1/76 DATE: 5/2/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

PLATE 8

LOG OF BORING NO. B-6

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 260 ±	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Medium dense tan clayey sand, w/coarse gravel (SC)						
5			Stiff grayish-red clay (CH)		60	26	27		94
10			Dense light tan clayey silt	89	48	27	29		89
15			-w/reddish-tan clay laminations -w/silty fine sand pockets (ML)						
20			Hard reddish-tan clay (CH)		52	29	31		89
25			Hard dark gray clay, w/silty fine sand laminations -w/dark brown carbonaceous clay (CH)		65	28	29		90
30			Hard reddish-brown lignitic clay, w/clay laminations -w/light tan silty clay laminations (OH)		72	36	40		72
35			Hard brownish-gray clay, w/silty fine sand laminations (CH)						
40			Hard dark brown lignitic clay, w/slickensides -w/organic material increasing below 38.8' (OL)						
45			Soft black lignite, friable (Pt)						
50			Hard gray clayey silt		48	31			

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 10

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(ML)							
55			Hard gray clay, w/sand pockets (CH)							
60			Moderately hard gray sandstone, w/occasional carbonaceous material							
65								16 8	(20+)	112
70			Moderately hard gray clayey sandstone -high angle fracture 67.5-69.0' -w/pyrite filled fractures -w/carbonaceous seams at 71.5-72.0' -w/moderately hard greenish-gray siltstone pockets at 73.0-75.0'	100 78				22	(10.0)	109
75			Very dense gray sandy silt, w/ dark gray clay seams -w/gray sandstone seams (ML)	33						
80			Very hard gray to greenish-gray clay -w/occasional pyrite nodules	100						
85			-w/light gray silt seams below 87.0'			120	35	33		
90			(CH)							
95			Hard gray clay, w/occasional greenish-gray clay seams -w/carbonaceous seams at 95.0-96.0'			93 71	22 26			
100					97			29		

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 11

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105			-1/2 to 2" carbonaceous seams at 103.0-104.0' (CH)							
110			Very dense gray silty fine sand, w/gray sandy clay pockets -w/carbonaceous seams		36	46	19	24		
115			(SM)							
120			Hard gray clay -w/occasional silt laminations (CL-CH)						4+	
125										
130			Very dense gray sandy silt -w/occasional gray clay laminations		89	66	22	26		
135			(ML)							
140			Hard gray clay, slightly slickensided -w/silt and sand seams					29	4+	
145						96	24	28	4+	
150			(CH)						4+	

COMPLETION DEPTH: 150.0'
DATE: 5/18/76

DEPTH TO WATER: 10.5' Caved at 35.0'
DATE: 5/19/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 12

LOG OF BORING NO. B-7

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Wash LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 268 ±	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
0			Tan clay					
5								
10								
15			(CH)					
20			Gray clay					
25			(CH)					
30			Black lignitic material (Pt) Gray clay (CH) Gray clay (CH)					
35			Gray clay					
40			(CH)					
45			Gray clayey sand					
50								

(Continued)

LOG OF BORING NO. B-7 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SC) Gray clay					
55								
			(CH)					
60			Green and gray silty clay					
65								
70								
75								
			(CL)					
80			Gray clay					
85								
90								
95								
100			(CH)					

COMPLETION DEPTH: 100.0'
DATE: 5/20/76

LOG OF BORING NO. B-8

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 305±							
			Loose tan silty fine sand (SM)							
			Very stiff gray sandy clay, w/numerous clay laminations (CL)	100						
5			Hard gray fine grained siliceous sandstone w/ numerous iron stains and fractures	99						
10				100						
			Very stiff tan sandy clay (CL)							
15			Moderately hard dark gray and reddish-tan fine-grained sandstone, w/numerous iron stains and shale inclusions -high angle fracture at 9.5' -6.0" shale seam at 11.7'		36			23		95
20						70	18	29		94
			Very dense tan clayey fine sand, w/numerous clay laminations (SC)							
25			Hard gray clay, w/numerous silty fine sand laminations (CH)							
30			Hard gray sandy clay -w/numerous sand laminations							
35			(CL)			45	31	31		85
40			Very dense gray sandy silt, w/numerous clay laminations (ML)							
45			Hard gray and brown clay w/numerous silt laminations							
50						56	37	42		70

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-lignitic material seam at 59.8' (CH)				29		85
60									
65			Very dense brown sandy silt w/clay-filled fractures (ML)						
			Very dense light gray sandy silt (ML)						
70			Soft black lignitic material, w/ lignitic clay seams (Pt)						
75			Hard gray clay, intensely slickensided at 74.0'		69	27	28		94
80			(CH)						
85			Very dense gray sandy silt (ML)	57	49	39			
90			Hard light gray clay, w/ silt laminations (CH)		65	24	23		102
95			Hard light gray sandy clay, w/numerous clay laminations	35	44	21			
100									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-14

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			(CL)							
105			Hard gray clay (CH)							
110			Very dense gray silty fine sand, w/occasional clay laminations (SM)	50/3" seat						
115			Hard gray clay							
120										
125						66	22	29		90
130			-w/numerous silt laminations (CH)							
135			Very dense gray silty fine sand, w/occasional clay laminations (SM)	50/3" seat						
140										
145			Very dense gray and brown silt, w/numerous clay laminations (ML)							
150			Very dense tannish-brown and gray clayey sand (SC)							

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-15

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
155			Soft tan, gray, and brown sandstone							
160			Very dense gray silty fine sand							
165				50/2" seat						
170										
175			-clay seam at 179.0 and 179.5' (SM)							
180			Hard gray clay, w/ occasional silty fine sand laminations						6+	
185										
190									6+	
195										
200			(CH)							

COMPLETION DEPTH: 200.0'
DATE: 6/4/76

DEPTH TO WATER: 4.0'
DATE: 6/5/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-16

LOG OF BORING NO. B-10

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 280 ±	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose tan silty sand (SM)							
			Stiff tan sandy clay (CL)							
5			Dense tan silty fine sand -w/clayey sand laminations and gravel -iron stained	85	28	29	22	14		
10			-very dense below 8.5'							
15										
20										
25			(SM)		26					
30			Very stiff tan sandy clay, iron stained (CL)	50	62	44	19	29		
35			Very stiff gray sandy clay							
40			-stiff, w/lignitic laminations and sand seams							
45			-hard (CL)							
50			Hard black lignitic clay w/ lignitic material laminations (OH)							

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			Very dense gray silty fine sand -w/occasional lignitic material and clay laminations (SM)						
60			Hard gray clay -w/silt laminations and seams (CH)						
70			Soft black lignitic material (Pt)						
75			Hard dark brown lignitic clay -w/lignitic material laminations (OH)						
80			Hard gray clay (CH)		79	30	24		
85			Very dense gray silt (ML)	59	49	23	33		
90			Soft gray siltstone, w/ numerous sand laminations						
95									
100									

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105			Very dense gray silty fine sand, w/occasional clay laminations	78						
110			(SM)							
115			Hard gray clay, w/silt laminations to 115.5'							
			-brown							
120										
125										
130			-slickensided fracture							
			(CH)							
135			Moderately hard gray sandy silt-stone, w/occasional sand laminations							
140			Very dense gray sandy silt							
			(ML)							
145			Very dense gray silt, w/ occasional sand laminations							
			-numerous clay laminations							
150										

(Continued)

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

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
155									
160			-brown, w/numerous lignite laminations (ML)	43	50	32			
165			Very dense gray silt						
170									
175									
			-w/occasional clay laminations						
180									
185									
190									
195			(ML)						
200			Hard gray clay (CH)						

COMPLETION DEPTH: 200.0'
DATE: 6/9/76

DEPTH TO WATER: Caved at 21.5'
DATE: 6/10/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-20

LOG OF BORING NO. B-11

SITE SELECTION STUDY-
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

ELEVATION: 291 +

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			Loose tan silty fine sand (SM)								
			Very stiff tan sandy clay (CL)								
5			Soft to moderately hard light gray weathered fine-grained sandstone, w/iron staining and healed fractures	93							
10			Very dense tan silty fine sand, w/occasional silt laminations	7							
15											
20		X			50/4.5"						
25						6					
30			-w/occasional iron stains								
35											
40											
45			(SM) Hard gray clay, w/ numerous silt laminations -lignitic clay seam at 48.6'								
50											

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-21

LOG OF BORING NO. B-11 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CH)			[illegible]	[illegible]	[illegible]		
55			Hard gray silty clay (CL)							
60			Hard dark gray sandy clay (CL)	50/4"	44	[illegible]	26	24		
				seam						
65			Hard dark brown lignitic clay (OH)							
70			Very dense gray silt, w/numerous silty fine sand laminations (ML)							
75			Moderately hard gray claystone, w/numerous silty fine sand laminations							
			Hard gray clay		86	54	27	[illegible]		
80										
85			-slightly sandy (CL-CH)							
90			Hard dark brown lignitic clay, slickensided, w/lignitic material seams (CH)							
95			Soft black lignitic material (Pt)							
			Hard gray clay -w/numerous silty fine sand laminations to 100.5'							
100										

(Continued)

LOG OF BORING NO. B-11 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105			-lignitic material seam at 103.5'							
110			(CH)							
115			Hard gray sandy clay, w/occasional lignitic inclusions							
120			-w/numerous sand laminations (CL)							
125			Very dense gray and green silty fine sand, w/occasional lignitic clay laminations (SM)							
130			Very dense gray sandy silt, w/brown clay laminations (ML)	50/5"						
135			Hard gray sandy clay, w/numerous silty fine sand laminations (CL)							
140			Moderately hard gray siltstone, w/clay laminations							
145			Hard gray clay (CH)							
150			Very dense gray sandy silt							

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-23

LOG OF BORING NO. B-11 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(ML)							
155			Hard green clay							
160										
165			(CH)							
170			Very dense gray and tan sandy silt							
175										
180										
185			(ML)							
190			Very dense green silt	83/9"						
195			(ML)							
200			Hard gray clay, w/silt laminations							

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-24

LOG OF BORING NO. B-11 (Cont'd.)

SITE SELECTION STUDY
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CL)						
205									
210									
215									
220									
225									
230									
235									
240									
245									
250									

COMPLETION DEPTH: 201.0'
DATE: 6/7/76

DEPTH TO WATER: 34.0'
DATE: 6/8/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE A-25

LOG OF BORING NO. B-13

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 260.15	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
0			Medium dense light tan silty fine sand						
5			-w/clay laminations and iron staining (SM)	77					
10			Hard tan clay, w/iron stains (CH)						
15			Stiff dark brown clay, w/lignitic material seams						
20			-slickensided -w/lignitic pockets and inclusions (CH)		74	36	39		78
25			Hard dark brown lignitic clay						
30			(OL)				42		71
35			Hard green sandy clay (CL)						
40			Dense gray silty fine sand						
45			-very dense	33	44	20	23		103
50							29		94

(Continued)

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(SM)						
60			Hard gray clay						
65			-w/occasional silty clay laminations		76	38	32	(3.5)	89
70			-sandy clay seam at 69.8-70.0'						
75			(CH)						
80			Hard gray sandy clay, w/occasional clay laminations						
85				58	51	29	28		92
90			-very stiff below 88.0', w/numerous sand pockets						
95			(CL) Very dense gray silty fine sand						
100			-w/thin clay laminations and pockets	30	43	18	28		96

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 16

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

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
105			(SM)						
110			Very stiff gray silty clay, w/thin clay and sand laminations (CL)						
115			Hard gray clay (CH)						
120			Hard gray clay, slightly silty	96					
125			-w/occasional silt laminations (CH)						
130			Hard gray clay, slightly slickensided						
135									
140									
145									
150			w/occasional thin silt laminations (CH)						

COMPLETION DEPTH: 150.0' DEPTH TO WATER: 8.3' Caved at 9.9'
DATE: 8/9/76 DATE: 8/10/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 17

LOG OF BORING NO. B-14

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 251.87	CORE RECOVERY %	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose tan silty fine sand (SM)			54	38	18			
5			Hard gray sandy clay (CL)								
10			Hard tan clay, w/iron stains and sand laminations (CL) Hard tan sandy siltstone	64							
			Very dense tan silty fine sand, w/occasional lignitic laminations and iron stains (SM)		50/3"						
15			Very dense gray silty fine sand, w/numerous clay and lignitic laminations and lignitic inclusions (SM)			11			24		97
20			Hard gray clay, w/ numerous silty fine sand laminations				59	26	28		94
25											
30									36		93
35			(CH-CL)				58	23	29		94
			Hard brown clay, w/ numerous sand laminations and occasional lignitic laminations (CL-CH)			51	50	19	22		102
40											
45			Very dense gray silty fine sand (SM)		50/2" seat						
			Very dense gray sandy silt			57	Non-Plastic		31		92
50											

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 18

LOG OF BORING NO. B-14 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(ML)						
55			Hard gray clay, w/silty sand laminations (CL)						
60			Hard gray clay, w/numerous silty fine sand laminations and silt laminations		60	22	30		92
65									
70			(CH-CL)						
75			Hard gray clay, w/ sandy silt laminations to 78.5'	93	79	19	30		92
80			(CH)						
85			Hard gray clay						
90			-very stiff at 88.5'		112	31	32	(1.83)	91
95			-w/slickensides						
100									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 19

LOG OF BORING NO. B-14 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			-w/sand inclusions (CH)							
105			Soft black lignitic material (Pt)							
			Moderately hard gray sandstone							
110										
115								18		110
			-sand seams							
120										
			Hard gray clayey sand							
125					49	53	19	25		
				50/4.5" seat						
130			(SC)							
			Very dense gray sandy silt, w/clay laminations							
135										
140			-w/occasional lignitic laminations (ML)							
			Hard gray clay, w/ silt laminations							
145										
150			(CH)							

COMPLETION DEPTH: 150.0'
DATE: 7/23/76

DEPTH TO WATER: 5.0'-Caved at 41.5'
DATE: 7/27/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 20

LOG OF BORING NO. B-15

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 255.36	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose tan silty fine sand (SM)							
5			Very stiff tan sandy clay (CL)						C	
10			Soft tan fine grained sandstone, w/iron stains and numerous silt laminations	29						
15			Very dense tan silty fine sand, slightly indurated (SM)							
			Very dense red silt, w/iron laminations (ML)							
20			Very hard gray sandy clay, w/ numerous clay laminations and seams -w/numerous silty sand and sandy silt seams		94	55	20	34		90
25										
30			-w/occasional slickensided clay seams							
35			(ML)							
			Hard gray clay, w/silt laminations (CH)						C+T	
40			Very dense gray sandy clay, w/occasional clay laminations (CL)		93			30		92
45			Hard gray clay, w/occasional slickensides						C+	
50						112	28	36	C+ C	86

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

PLATE 21

LOG OF BORING NO. B-15 (Cont'd)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-grayish - green						
60							34		88
65			(CH)						
70			Moderately hard gray fine grained sandstone, w/lignitic material inclusions and clay laminations						
				16					
75			Very dense gray silty fine sand (SM)						
80			Moderately hard gray sandstone						
85									
90									
95			Hard greenish - gray clay						
100			-brown						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 22

LOG OF BORING NO. B-15 (Cont'd)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105									
110					163	35	33		85
115									
120									
125									
130			-w/silty fine sand laminations -w/numerous small sand pockets and laminations (CH)						
135			Hard grayish - green silty clay, w/numerous clay and silt pockets -w/numerous sand laminations and pockets (CL)						
140									
145			Hard grayish - green clay (CH)						
150									

COMPLETION DEPTH: 150.0'
DATE: 7/29/76

DEPTH TO WATER: Dry-Caved at 15.0'
DATE: 7/29/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 23

LOG OF BORING NO. P-15

PIEZOMETER INSTALLATION -
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Wash LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION		LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH, TSF	ANGLE OF SHEAR	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 255.4±	P-15 Riser Elev. 257.4±						
			Tan silty fine sand	(SM)						
			Tan sandy clay	(CL)						
10			Tan sandstone							
			Red silt	(ML)						
20			Gray sandy silt, w/occasional clay seams	Seal						
30				(ML) P-15						
			Gray clay	(CH)						
40										
50										
60										
70										
80										
90										
100										

P-15

Date:	Time:	Depth of Water Below Ground Surface
8-13	10:30	+2.0'
	10:31	1.0'
	10:32	0.1'
	10:34	0.8'
	10:38	1.7'
	10:45	2.1'
	11:00	2.8'
	11:30	3.8'

COMPLETION DEPTH: 36.0'
DATE: 8/13/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 33

LOG OF BORING NO. B-16

'PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 260.52						
			Medium dense tan silty fine sand (SM)						
5			Hard tan and gray sandy clay (CL)						
10			Very stiff tan clay, w/iron laminations (CH)		81	38	39		
15			Dense tan silty fine sand, w/iron laminations (SM)	53					
20			Hard reddish-tan clay, slightly slickensided, w/iron laminations (CH)					(3.22)	
			Hard gray sandy clay (CL)		56	28	31		92
25			Hard gray clay, slightly slickensided (CH)						
30			Hard brown clay						
35			-gray, w/silty sand laminations (CH)	91	68	25	27 37		93 82
40			Very dense gray silty fine sand				28		97
45									
50				52	64	20	25		100

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 24

LOG OF BORING NO. B-16 (Cont'd)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(SM)						
60			Hard gray silty clay, w/siltstone lenses (CL)						
65			Hard gray clay, w/clay laminations -w/occasional silty fine sand laminations	90	67	22	29		92
70									
75							32		90
80			-sand inclusions (CL-CH)						
85			Very stiff green clay						
90					98	30	35	(1.9)	89
95									
100			-w/silt laminations						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 25

LOG OF BORING NO. B-16 (Cont'd)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
105			-slightly slickensided - hard (CH)							
110			Very dense gray silty fine sand, w/lignitic inclusions to 110.0' (SM)		10					
125			Moderately hard gray calcareous sandstone w/argonite crystals	25						
130			Very dense gray silty fine sand (SM)							
135			Hard gray sandy clay (CL)							
145			Hard gray clay (CH)							
150										

COMPLETION DEPTH: 150.0'
DATE: 8/11/76

DEPTH TO WATER: Caved at 12.2'
DATE: 8/13/76

LOG OF BORING NO. B-17

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 283.63	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose tan silty fine sand (SM) Hard tan sandy clay (CL)					4+ 4+	
5			Very stiff light tan clay -hard below 8.5' -w/iron stains, sand laminations, and claystone laminations at 8.5' (CL-CH)		60	27	28	4+	
15			Hard light tan sandy clay (CL)					4+	
20			Very stiff light tan clay, w/ numerous iron stains (CH)		63	30		2	
25			Very stiff reddish-brown sandy clay, w/numerous iron stains (CL)					2 4+	
30			Hard gray clay, w/numerous silt laminations -w/numerous fractures and slickensides (CH)		79	30	31	4+ 4+ (2.9)	90
35			Hard gray and brown clay, w/occasional lignitic inclusions (CH)		60	22	30	4+ (2.2) 4+ 4+	93
40			Hard gray and brown sandy clay -w/occasional lignitic laminations (CL)					4+	
45			Very dense gray silty fine sand						
50				37	30	23	25		98

(Continued)

LOG OF BORING NO. B-17 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(SM)				29		95
60			Hard gray silty clay, w/numerous silt laminations						
65			-sandy silt seam at 64.5'		33	19	27		95
70			(CL)						
75			Hard gray clay, w/occasional silty fine sand laminations						
			(CH)						
80			Very stiff gray clay, w/silt laminations						
85					36	25	31		91
90			-stiff at 88.5-90.0'						
95			-hard below 93.5'				32	(2.0)	96
100									

(Continued)

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PLATE 28

LOG OF BORING NO. B-17 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
105			-w/sandy silt laminations (CL-CH)							
110			Hard gray sandstone, w/vertical fracture	43						
			-soft below 113.0'							
115			-w/numerous horizontal fractures and occasional lignitic laminations							
120			-w/occasional claystone laminations and lignitic laminations							
125			Very dense gray silty fine sand		30					
130			(SM)							
135			Very dense gray silt, slightly clayey		89					
140			(ML)							
145			Hard gray clay						ϕ^+	
150			(CH)						ϕ^+	

COMPLETION DEPTH: 150.0' DEPTH TO WATER: 40.9'
DATE: 8/5/76 DATE: 8/13/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 29

LOG OF BORING NO. P-17

PIEZOMETER INSTALLATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Wash LOCATION: See Plan of Borings

DEPTH, FT.	SOIL DESCRIPTION		LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH, TSF	ANGLE OF SHEAR	UNIT DRY WT. LBS./CU. FT.
	ELEVATION: 283.6±							
	Tan silty fine sand	(SM)						
	Tan sandy clay	(CL)						
10	Light tan clay	(CL-CH)						
	Light tan sandy clay	(CL)						
20	Light tan clay	(CH)						
	Reddish-brown sandy clay	(CL)						
30	Gray clay, w/numerous silty laminations	(CH)						
	Gray and brown silty clay, w/lignitic laminations	(CL)						
40	Gray and brown sandy clay, w/ lignitic laminations	(CL)						
	Gray silty fine sand	(SM)						
50								
	Gray silty clay, w/silt laminations	(CL)						
60								

P-17 Riser
Elev. 286.6±

-Seal

P-17

P-17

Date:	Time:	Depth of Water Below Ground Surface
8/12	3:00	+3.0'
	3:01	+0.6'
	3:02	+0.3'
	3:04	0.6'
	3:08	2.1'
	3:15	3.6'
	3:30	7.0'
	4:00	13.2'
8/13	3:00	40.8'

70
80
90
100

COMPLETION DEPTH: 59.0'
DATE: 8/12/76

LOG OF BORING NO. B-18

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: See Plan of Borings

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 274.58	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Very stiff tan clay, w/iron laminations							
			-w/numerous thin sand pockets			76	29	34		
5										
			-w/numerous sand pockets and laminations							
10			(CH)							
			Hard tan sandy clay			39	20	24		
15			(CL)							
			Very dense light tan silty fine sand							
20										
			-w/occasional to numerous thin clay laminations	50/3.6"	95					
25										
						53	22	33		89
30			(SM)							
			Hard gray clay							
35										
			-w/occasional silty sand laminations below 39.0'							
40			-slightly slickensided							
						55	23	32		92
45										
50										

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

PLATE 30

LOG OF BORING NO. B-18 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	CORE RECOVERY %	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55								32		90
60										
65						92	25	35		88
70										
75			(CH)							
80			Very dense gray silty fine sand -highly indurated -w/numerous sandstone seams	80				19	1.7	109
85				66						
90										
95			(SM)							
100			Hard gray sandy clay		73	48	34	35		

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE 31

LOG OF BORING NO. B-18 (Cont'd.)

PRELIMINARY SITE INVESTIGATION
PROPOSED STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT LBS./CU. FT.
105			(CL)						
			Hard gray clay						
110									
115			-w/occasional thin silt laminations						
					113	31	33		88
120									
125									
130									
135			-w/occasional to numerous sand pockets						
140			(CH)						
			Hard gray silty clay, w/numerous sand and clay pockets below 144.0'						
145									
150			(CL)						

COMPLETION DEPTH: 150.0'
DATE: 8/4/76

DEPTH TO WATER: 24.2' Caved at 28.0'
DATE: 8/5/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

PLATE 32

LOG OF BORING NO. B-19

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371550 E3339830

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 242.8						
			Stiff brown sandy clay (CL)					o	
			Medium dense light brown clayey fine sand (SC)	46					
5			Very dense tan clayey fine sand (SC)						
10			Very dense tan silty fine sand, iron stained w/numerous clay laminations,						
			-free water at 14.0'						
15				35					
20			-w/silt laminations						
			-gray, w/lignitic laminations (SM)						
25									
30									
35									
40									
45									
50									

COMPLETION DEPTH: 25.0'
DATE: 12/19/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-20

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371730 E3339260

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 241.9						
			Loose green clayey fine sand -sandy clay seam at 1.5-2.0' (SC)						
5			Medium dense light green silty fine sand (SM)						
			Dense light brown silty fine sand, iron stained w/clay laminations	25	28	17			
10									
			-occasional lignitic laminations						
15			(SM)						
			Very dense light gray silty fine sand (SM)						
20									
25									
30									
35									
40									
45									
50									

COMPLETION DEPTH: 20.0'
DATE: 12/19/76

LOG OF BORING NO. B-21

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371730 E3338865

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 251.1	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Medium dense brown silty fine sand (SM)							
5			Medium dense tan and light tan clayey fine sand, w/ clay and iron pockets	21						
10			(SC)		34	27	16	26		82
15			Dense tan silty fine sand, iron stained -0.1' dark tan clay seam at 14.5'							
20			-very dense below 20.5' (SM)	82						
25			Very dense tan clayey fine sand (SC)		25	26	13	24		97
30			Very dense dark gray silty fine sand, w/light tan clay pockets (SM)	50/6"						
35			Hard dark gray silty clay, w/ lignitic lenses (CL)						0.4	
40			Soft dark gray and gray siltstone -0.2" lignitic seam at 40.0'							
45			Hard gray clay, w/lignitic laminations and numerous silt laminations (CH)			56	23			
50			Hard dark brown and black sandy clay, w/lignitic seams						0.4	

(Continued)

LOG OF BORING NO. B-21 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			(CL)							
55			Very dense gray silty fine sand, w/lignitic lenses							
60			-clay seam (SM)	50/6" seat						
			Note: Caved at 10.0' at completion							
65										
70										
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 61.0'
DATE: 12/9/76

DEPTH TO WATER: Caved at 10.0'
DATE: 12/9/76

NATIONAL SOIL SERVICES, INC.

LOG OF BORING NO. B-22

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371750; E3338400

ELEVATION: 258.1

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)							
			Firm brown sandy clay (CL)							
5			Very stiff light tan clay, w/sandy clay filled fissures and silty clay laminations -w/numerous thin sand and silty clay seams to 24.7' -w/occasional iron stains			75	27	32	(3.22)	85
10										
15										
20			-w/selenite crystal pockets at 20.2'							
25			-w/organic clay laminations at 25.0' (CH)					30	(3.40)	92
30			Very dense gray, brown, and reddish-tan silty fine sand, w/iron stains -w/lignitic laminations -gray (SM)	50/6"						
35			Hard dark reddish-brown clay, slickensided (OH)							
40			Very stiff gray silty clay, w/numerous sand and clay laminations (CL)							
45			Very dense dark brown clayey sand, w/numerous clay and silt pockets (SC)							
			Soft black lignitic material (Pt)							
50			Very dense gray silty fine sand		28					

(Continued)

LOG OF BORING NO. B-22 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			w/occasional thin clay laminations	95/10"						
			(SM)							
60			Hard gray clay							
65			-w/sandy silt seams							
			-w/sandy clay seams							
70			(CL-CH)							
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 70.0' DEPTH TO WATER: 20.0'
DATE: 12/7/76 DATE: 12/8/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-23

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371665; E3338400

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 261.3							
			Loose brown silty fine sand (SM)							
			Soft tan silty clay (CL)							
5			Very dense light tan clayey fine sand -w/iron stains (SC)							
10			Hard light tan clay, w/ iron stains (CH)		80	59	32			
15			Hard dark tan and light tan clay (CH)			78	28	35	(2.99)	83
			Hard dark gray silty clay (CL)							
20			Hard gray clay w/numerous sand pockets							
25			(CH)		67	59	25	33		86
30			Hard gray sandy clay, w/lignitic laminations (CL)							
			Very dense gray silty fine sand, w/clay seams (SM)	50/5"						
35			Hard brownish-gray sandy clay, w/lignitic material seams (CL)							
40										
45			Very dense gray clayey fine sand, slightly indurated -w/lignitic pockets							
50										

(Continued)

LOG OF BORING NO. B-23 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SC)	50/3" Seat						
55			Very dense gray sandy silt -w/indurated seams (ML)							
60			Hard dark brown clay, w/numerous silt seams (CL-CH)							
70										
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 70.5'
DATE: 12/7/76

DEPTH TO WATER: 17.0'
DATE: 12/8/76

LOG OF BORING NO. B-24

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371480 E3338392

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 263.5							
			Medium dense dark brown silty fine sand (SM)							
			Hard tan and yellow clayey silt (ML)							
-5			Hard tan and light reddish-tan sandy clay, w/sand and silt seams (CL)	86	60	44	27			
-10			Hard light tan clay, w/sand and siltstone seams and iron pockets (CH)			55	30			
-15			Very dense light tan silty fine sand, w/iron stains (SM)							
-20			Hard light tan, red and yellow sandy clay, w/sand pockets and iron stains		52	47	26	29	(2.92)	90
-25			-light tan (CL)							
-30			Dense tan silty fine sand, w/clay seams	39						
			-w/iron concretions (SM)		78	51	29	36		86
-35			Very dense gray clayey fine sand (SC)							
-40			Hard gray and green clay, w/sandy silt seams							
-45			-w/pyrite crystals and organic laminations (ML)							
-50			Very dense brown and dark brown silty fine sand, w/clay seams							

(Continued)

LOG OF BORING NO. B-24 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SM)						
55			Very dense gray silty fine sand, w/clay seams (CL)						
			Very dense gray silty fine sand, w/clay seams (SM)						
60			Hard tan and gray silty clay, w/sand seams (CL)						
			Moderately hard gray and light gray siltstone, w/clay laminations						
65									
			Very dense gray and dark green sandy silt, w/fine sand and clay seams (ML)						
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 70.5' DEPTH TO WATER: 20.0'
DATE: 12/8/76 DATE: 12/9/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-25

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371495 ; E3338060

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 269.0	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose tan clayey fine sand, w/silty sand seams -w/occasional gravel -medium dense gray (SC)							
5			Hard tan sandy clay (CL)							
			Hard tan clay, w/silt filled fissures (CH)			54	27	30	(1.82)	84
10										
			Hard tan clay, w/ironstained fractures and occasional sand seams (CH)							
15										
			Hard tan clay, ironstained, w/occasional sand seams			54	35	37		82
20										
			-w/organic material (CH)							
25										
			Dense tan clayey fine sand, ironstained, w/occasional clay laminations and numerous organic leaf impressions -w/1/8" selenite lamination at 29.0' (SC)		40	38	21	33		88
30										
35			Dense tan and gray sandy silt, w/occasional clay seams and organic material laminations (ML)	43	46	43	22			
			Dense gray clayey fine sand, w/organic material laminations, -w/occasional silty fine sand seams (SC)							
40										
45			Soft gray sandstone							
			Soft gray shale, slickensided							
			Hard gray clay, w/occasional sand laminations			56	23			
50										

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

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

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			-w/organic material (CH)							
55			Hard brown sandy clay, w/ occasional bentonite pockets (CL)						5+	
60			Very dense gray silty fine sand, w/occasional lignitic clay laminations	50/3"						
65			-w/occasional sandstone laminations -w/occasional lignitic laminations -w/occasional clay seams (SM)							
70			Hard gray silty clay, w/ occasional silty sand seams (CL)						5+	
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 70.0'
DATE: 11/16/76

DEPTH TO WATER: 29.0'
DATE: 11/17/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-26

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371625; E3337960

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 268.1						
			Stiff brown sandy clay (CL)						
5			Medium dense light tan clayey fine sand		43	24			
10			(SC)	39					
15			Hard brown clay		53	25	29	(3.1)	85
20			-w/sand pockets						
25			(CL-CH)						
30			Very dense gray silty sand, w/lignitic seams and clay laminations (SM)				29		91
35			Very dense gray sandy silt (ML)						
40			Hard gray clay						
45			-w/numerous silt laminations						
50			-dark brown (CL)						

COMPLETION DEPTH: 50.0' DEPTH TO WATER: 22.0' Caved at 45.0'
DATE: 11/20/76 DATE: 11/21/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-27

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371620; E3337810

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 272.4							
			Firm brown sandy clay (CL)							
5			Hard light tan clay, w/ sand pockets (CL)							
15			Very dense tan clayey sand, w/clay pockets		33	43	19	19		102
25				50/6"						
30			(SC)		34	37	19			
35			Very dense tan silty fine sand, w/clay seams (SM)							
40			Hard gray clay w/sandy clay seams			35	20	22		101
45										
50			(CL-CH)							

COMPLETION DEPTH: 50.0' DEPTH TO WATER: 25.0' Caved at 47.0'
DATE: 11/20/76 DATE: 11/21/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-28

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371620; E3337665

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 275.6							
			Soft gray sandy clay, w/ 3" silty sand seam at 0.0' (CL)						0	
5			Hard light brown and tan clay, w/clayey sand filled fissures			37	26	24	4+	
10			-w/numerous sand and clayey sand pockets						4+	
15			-w/inclined organic laminations (CL-CH)							
20			Very dense light tan silty fine sand, slightly clayey (SM)	71	29	32	26	26	4+	90
25			Hard brown tan and gray clay, w/clay stone lenses (CH)						4+	
30			Very dense light tan silty fine sand, slightly clayey (SM)						4+	
35			Hard brown and tan clay, indurated, w/sand pockets			63	26	31	(2.36) 4+	89
			-gray (CH)							
40			Hard gray silty clay (CL)						4+	
45			Hard gray clay (CH)						4+	
50			Dense gray sandy silt, w/ occasional clay laminations (ML)							

COMPLETION DEPTH: 50.0' DEPTH TO WATER: 23.0' Caved at 48.0
DATE: 11/20/76 DATE: 11/21/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-29

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371510; E3337630

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 279.7							
			Loose gray silty sand (SM)							
			Soft gray silty clay (CL)						o	
5			Very stiff light brown and tan clayey silt, slightly sandy (ML)							
10		X	Hard light brown and tan silty clay, w/numerous sand seams	44						
15			-w/sand seam at 15.0-16.0' (CL)						o+	
20			Dense light gray clayey fine sand, w/numerous clay pockets (SC)							
25			Very dense light brown and gray clayey sand, w/numerous clay pockets (SC)			43	26	24	(8.80) o+	118
30			Hard red and brown clay, indurated (CH)							
			Dense light gray clayey fine sand, w/2" lignitic material seam at 30.0' (SC)						o+	
35			Hard light brown and gray silty clay -w/1" sand seam at 33.8' (CL)							
40			Hard gray clay, w/occasional lignitic seams and pockets at 40.0' - 40.5' -slickensided -w/occasional silty and sandy clay laminations and seams -w/indurated seams -w/lignitic material seams at 49.0-50.2'		96	77	28	30	o+ (1.82) o+	90
45										
50										

(Continued)

LOG OF BORING NO. B-29 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			w/bentonite pocket at 49.5' (CH)							
			Hard gray silty clay (CL)							
55			Very dense gray and brown silty fine sand, w/organic material	63						
			-w/occasional sand, sandy clay, and clay seams		26		27			94
60			-w/indurated seams							
			-w/lignitic laminations							
65				50/1" Seat						
			(SM)							
70										
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 70.0'
DATE: 11/20/76

DEPTH TO WATER: 25.0' Caved at 65.0'
DATE: 11/21/76

LOG OF BORING NO. B-30

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371225;E3337630

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 279.7							
			Loose brown silty sand (SM)							
5			Firm brown sandy clay, ironstained, -hard below 3.5', w/sand pockets (CL)							
			Hard tan clay, ironstained w/silt laminations			72	38	39		
10										
15			(CH)							
			Very dense tan silty fine sand, w/clay laminations		36					
20										
25			(SM)							
			Hard gray clay							
30			(CH)							
			Very dense gray and tan clayey sand, w/clay laminations and indurated seams	50/6"						
35			(SC)							
			Hard gray silty clay, w/ lignitic material seams							
40										
45									(6, 80)	
50					92	53	32	31		91

(Continued)

LOG OF BORING NO. B-30 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CL-CH)						
55			Hard gray clay, w/occasional silt laminations (CH)						
			Hard gray silty clay (CL)						
60			Very dense gray clayey fine sand (SC)						
			Hard brown sandy clay, w/ lignitic laminations (CL)						
65			Hard gray silty clay (CL)						
			Very dense gray sandy silt (ML)						
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 70.0' DEPTH TO WATER: 4.0' Caved at 28.0'
DATE: 11/18/76 DATE: 11/21/76

LOG OF BORING NO. B-31

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371370; E3337550

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 282.0	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)							
5			Very stiff gray sandy clay, w/ ironstained pockets (CL)							
			Very stiff tan silty clay (CL)							
10			Very dense light gray clayey sand, w/occasional silty sand and silty clay seams (SC)							
			Hard tan silty clay (CL)							
15			Hard tan sandy clay (CL)	54						
20			Very dense tan silty fine sand, w/occasional clay seams			36	20			
25										
30			-w/lignitic material laminations and clay pockets -w/indurated seams -w/clayey sand seams	50/5.5" Seat						
35			-3" lignitic material seam at 37.5' (SM)							
40			Hard greenish gray clay, slickensided (CH)							
45			Hard gray clay, w/ occasional sand pockets -w/lignitic material seams at 45.0-45.4' (CL)							
50			Hard gray clay -w/occasional silt laminations					27	(6.59)	93

(Continued)

LOG OF BORING NO. B-31 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
55			-w/occasional lignitic material pockets							
			-w/lignitic material laminations (CH)							
60			Very dense gray and grayish brown silty fine sand, slightly clayev (SM)	89/10"						
			Hard gray and brown sandy clay, w/numerous lignitic material laminations (CL)							
65			Very dense gray and brown silty fine sand, lignitic -w/clay seams at 69.0' (SM)							
70										
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 70.0'
DATE: 11/21/76

DEPTH TO WATER: 1.0' Caved at 35.0'
DATE: 11/22/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-32

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371510; E3337465

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 281.1	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)							
5			Firm tan silty clay (CL)							
10			Hard light tan clay, w/ silt laminations (CL-CH)						2+	
15			Very dense tan clayey fine sand, ironstained, w/clay pockets							
20										
25					31	25	18			
30			(SC)	50/6" Seat						
35			Hard tan and brown clay (CL)						0+	
40			Hard gray clay, w/silt laminations to 45.0'							
45										
50			-indurated						2+	

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-32 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CH)						
55			Hard gray silty clay					+	
			(CL)						
60			Very dense brown clayey fine sand -w/lignitic clay seam at 59.5' -gray	29	40	32	25		96
65									
			(SC)						
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 70.0'
DATE: 11/21/76

DEPTH TO WATER:
DATE:

Caved at Surface at Completion

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-33

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371225; E3337465

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 281.5	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)							
5			Stiff gray and red sandy clay -gray -w/silty sand seams (CL)		50	36	12	17		
10										
15			Dense light gray sandy silt, w/clay laminations (ML)							
20			Hard light gray clay -w/silt laminations							
25			(CH)							
30			Dense light gray silty fine sand -w/clay laminations -w/indurated seams (SM)	39						
35			Hard light brownish tan clay, jointed -w/occasional silty seams -w/occasional selenite laminations (CH)							
40			Hard gray clay, w/occasional silty seams (CH)							
45			Hard brownish gray clay, w/silt pockets -w/numerous lignitic material pockets at 45.0-45.5' (CH)			67	26	31	(4.31)	90
50			Hard gray silty clay, w/occasional lignitic material seams							

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-33 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (.05 .10 .15)	UNIT DRY WT. LBS./CU. FT.
55			-w/lignitic material and lignitic clay seams below 54.5' (CL)							
60			Very dense gray silty fine sand (SM).							
65			Very dense gray and brown clayey fine sand -w/bentonitic sand pockets at 61.5' -lignitic -w/sandy silt seams at 65.1' (SC)	92/10"	24					
70										
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 70.0' DATE: 11/22/76

DEPTH TO WATER: 31.0' Caved at 65.0' DATE: 11/23/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-34

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371990;E3337500

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 279.9							
			Loose brown silty fine sand (SM)							
			Soft tan silty clay (CL)							
			Medium dense brown silty sand (SM)							
5			Very stiff brown sandy clay (CL)							
			Dense tan clayey sand, w/ clay seams (SC)		29	34	14			
10			Very stiff tan clay, w/ ironstains and numerous sand pockets (CL)							
			Very dense tan silty fine sand		19					
15										
20		X		95/11"						
			-gray		16	26	12			
25										
								24		93
30										
			-w/sandstone and claystone seams (SM)							
35			Hard brown clay (CH)							
			Dense gray clayey fine sand, w/lignitic material seams					31		87
40										
			-siltstone seam							
45										
			-w/clay seams		33	45	26	22		104
50										

(Continued)

LOG OF BORING NO. B-34 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55				46						
60										
65			(SC)							
70			Hard gray clay, w/ silt seams							
75			-w/siltstone seams			47	23	24		99
80			-w/sand seams							
85			-greenish-gray							
90			(CL-CH)							
95			Hard greenish-gray clay, w/occasional silt laminations							
100			(CH)							

COMPLETION DEPTH: 100.0' DEPTH TO WATER: 24.9' Caved at 25.0'
DATE: 12/1/76 DATE: 12/2/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-35

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370920; E3337910

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 273.2	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT LBS./CU. FT.
			Loose light brown silty fine sand (SM)						
			Soft tan sandy clay, ironstained, w/sand laminations - hard below 2.5' (CL)						
5									
			Hard tan silty clay, ironstained and jointed -very stiff below 9.0' (CL)		48	26			
10									
			Very stiff tan clayey silt, ironstained	87	45	24	30		84
15									
			-w/silt seams at 19.5'						
			-w/numerous clay laminations below 20.0'						
20									
							26		88
25			(ML)						
			Hard gray clay, indurated		86	27	26	(23.3)	94
30			-lignitic below 31.0' (CH)						
			Hard gray sandy clay, w/indurated seams (CL)						
35									
			Hard gray clay, -w/0.5' sandstone seam at 37.0' -w/slickensides at 39.0' -w/sandstone seams at 40.0-41.0' -w/sandy clay seam at 43.5-44.5' (CH)		62	38			
40									
45									
			Hard gray clay, w/ silt pockets -w/organic material						
50									

(Continued)

LOG OF BORING NO. B-35 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			-lignitic below 50.0'						
			(CL)						
55			Hard gray silty clay						
			(CL)						
			Hard gray clay -w/occasional silt laminations						
60			-slightly sandy, w/lignitic laminations at 60.0'						
			(CL-CH)						
65									
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 60.0'
DATE: 11/17/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-36

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N369560; E3337210

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 261.8							
			Loose brown clayey sand (SC)							
			Soft brown clay (CH)							
5			Very stiff light tan sandy clay (CL)							
10			Medium dense light tan clayey fine sand (SC)							
15			Medium dense light tan silty fine sand (SM)							
20			Hard brown clay, iron stained, w/silty fine sand laminations -dark gray -w/silty fine sand seams w/lignitic laminations and seams (CH)							
25			Hard dark gray sandy clay (CL)							
30			Very dense gray silty fine sand, w/organic laminations (SM)							
35			Hard gray clay -w/silty fine sand laminations -carbonaceous laminations							
40										
45			(CH)							
			Very dense grayish-green silty fine sand (SM)							
50			Hard grayish-green silty clay							

(Continued)

LOG OF BORING NO. B-36 (Cont'd.)
FINAL-PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CL)							
			Very dense grayish-green silty fine sand (SM)							
55			Hard gray clay w/silt and organic laminations and silty fine sand seams (CL)							
60			Hard gray clay, w/silt and organic laminations			82	28	32	(1.73)	89
65			-w/lignitic laminations and seams (CH)							
70			Soft gray clayey sandstone							
			Hard black lignitic clay (OH)							
			Soft black lignitic material (Pt)							
75			Hard gray clay, w/ silty fine sand laminations (CH)							
			Very dense gray silty fine sand (SM)							
80			Hard gray clay, w/ silty fine sand seams and siltstone seams (CL-CH)			47	26	17	(3.8)	114
			Hard gray silty clay, w/grayish-green fine sand seams (CL)							
85			Hard gray clay, w/occasional carbonaceous material							
90			-w/occasional silty clay laminations							
95			-w/occasional silty fine sand laminations							
100			(CH)							

COMPLETION DEPTH: 100.5'
DATE: 1/31/77

DEPTH TO WATER: 13.0'
DATE: 2/1/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-37
FINAL PLANT SITE-INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370100; E3337175

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 266.5	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Medium dense tan and brown clayey fine sand (SC)						
			Medium dense tan and gray silt, w/iron laminations (ML)						
5			Very stiff light tan sandy clay, iron stained, w/sand filled fissures (CL)		66	27			
10			Hard light gray and tan clay, w/iron and siltstone laminations (CH)						
15			Hard light brown sandy clay, w/organic and iron laminations (CL)						
20			Dense brown silty fine sand, w/organic laminations (SM)	33	36	24	27		93
25			Dense gray silty fine sand -w/5.0' clay seam at 28.0' (SM)						
30			Hard gray clay, w/lignitic laminations and silt seams (CH)		70	38	32	(3.58)	87
35			Dense gray sandy silt (ML)						
40			Hard gray clay, w/ siltstone laminations (CH)						
45			Very dense gray silty fine sand, w/clay pockets (SM)						
50			Hard dark gray silty clay w/lignitic clay laminations						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-37 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(CL)							
			Hard gray clay, w/lignitic and silty clay laminations (CH)							
60			Hard gray sandy clay, w/ lignitic material seams							
65			(CL)							
70		X	Very dense brown silty fine sand, w/lignitic laminations	50/5"						
75			-w/numerous clay laminations and lignitic material seams. (SM)							
			Hard gray sandy clay, w/ silty sand laminations (CL)							
80			Hard gray and brown silty clay, w/silt laminations (CL)							
			Very dense gray silty fine sand (SM)							
85			Very dense gray clayey sand, w/clay seams							
90			-w/siltstone seams							
95			(SC)							
			Hard gray and green clay							
100			(CH)							

COMPLETION DEPTH: 100.0'
DATE: 12/17/76

DEPTH TO WATER: 12.0'
DATE: 12/18/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-38

FINAL PLANT SITE-INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370435;E3336989

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 268.3						
			Medium dense brown silty fine sand (SM)						
5			Dense light tan clayey fine sand, w/iron and silt laminations (SC)						
			Stiff light tan silty clay (CL)						
10			Hard light tan sandy clay, w/silt and iron laminations (CL)	27	28	23			
			Dense tan clayey fine sand, w/silt and iron laminations (SC)						
20			Hard tan and brown clay, w/clayey silt seams -w/iron laminations						
25			(CL-CH)		57	33	32	(3.09)	87
30									
35			Hard gray clay, w/silt and lignitic material laminations	72	54	25			
40									
45			(CH)		53	35	30	(7.92)	91
50			Hard gray clay, slightly indurated, w/lignitic laminations						

(Continued)

LOG OF BORING NO. B-38 (Cont'd)
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CH)						
55			Hard gray clay, w/lignite laminations		52	29	29	(7 89)	93
			(CH)						
60			Very dense gray silty fine sand, w/lignitic laminations (SM)						
65			Hard gray clayey silt, w/lignitic laminations -w/0.3' siltstone seam at 63.5'	90	48	28			
70			-w/4.0' silty fine sand seam at 73.5' (ML)						
75			Hard gray clay, w/silty fine sand seams and siltstone laminations						
80									
85									
90									
95									
100			(CL-CH)						

COMPLETION DEPTH: 100.0' DATE: 12/16/76

DEPTH TO WATER: 20.0' Caved at 40.0' DATE: 12/17/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-39

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370850; E3337140

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 272.7	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)							
5			Medium dense tan and brown clayey fine sand (SC)		44	44	17			
			Medium dense light tan clayey sand, w/iron and silt laminations -very stiff (SC)							
10			Dense tan silty fine sand, w/iron and silt laminations							
15			-numerous clay seams (SM)	36	47					
20			Very stiff tan and brown clay, w/siltstone and silt seams							
25			(CL-CH)			25	23	24	(1.58)	92
30			Hard gray clay							
35			-lignitic material laminations (CH)			58	22	24	(5.16)	96
40			Hard brown clay, w/lignitic laminations and sand laminations							
45			(CH)			57	24	30	(8.00)	92
50			Hard gray clay, w/ lignitic laminations							

(Continued)

LOG OF BORING NO. B-39 (Cont'd)
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-numerous silt laminations (CH)						
60			Very dense dark brown clayey sand w/lignitic material seams and clay pockets (SC)						
65			Very dense gray silty fine sand, w/lignitic laminations and clay pockets (SM)						
70			Hard gray clay, w/lignitic, silt, and siltstone laminations						
75									
80									
85									
90			(CL-CH)						
95			Hard greenish-gray clay						
100			(CH)						

COMPLETION DEPTH: 100.0' DEPTH TO WATER: 0.0'
DATE: 12/15/76 DATE: 12/16/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-40

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Samples LOCATION: N370850; E3337065

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 270.7							
			Medium dense dark brown silty fine sand -w/sandy clay seams (SM)							
5			Medium dense tan and light tan clayey fine sand (SC)							
			Medium dense tan silty fine sand, w/iron stains (SM)	31						
10			Hard brown clay, w/ silt laminations (CL)							
			Hard tan, green, and light tan clay, w/silt and sand seams			57	22	28		91
15										
20				43						
			(CH)							
25			Medium dense tan and light tan sandy silt, w/iron stains (ML)		61	40	20			
30			Hard gray silty clay (CL)							
35			Hard gray clay (CH)			68	39	34	(3.62)	87
40			Hard gray and dark green silty clay (CL)							
45			Soft green and light green siltstone							
			Hard gray clay, w/ numerous silt laminations			49	28	27	(5.5)	95
50										

(Continued)

LOG OF BORING NO. B-40 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CL)						
55			Very dense dark brown and green clayey sand, w/clay pockets						
60			-gray (SC)						
65			Very dense gray silty fine sand, w/dark tan clay and siltstone seams (SM)						
70			Hard gray clay, w/siltstone seams (CH)						
75			Very dense gray silty fine sand, w/clay laminations (SM)						
80			Very dense gray clayey fine sand (SC)						
85			Hard greenish-gray clay						
90			-slickensided -w/silt lenses						
95									
100			(CH)						

COMPLETION DEPTH: 100.5'
DATE: 12/13/76

DEPTH TO WATER: 6.0'
DATE: 12/14/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-41

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370850; E3336960

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 270.7							
			Loose dark brown and red silty fine sand (SM)							
			Soft dark brown and red sandy clay (CL)							
5			Very stiff gray sandy clay, w/iron pockets (CL)							
10			Medium dense light tan and and tan silty fine sand, w/gravel (SM)	36						
15			Very stiff brown sandy clay, w/clayey sand seams -w/silty sand seams at 14.0' (CL)		79	48	25	36		82
20			Hard light tan silty clay (CL)							
25			Hard tan and red clay (CH)							
30			Hard gray and light green clay						(6.18)	
35						64	31	39		78
40			-w/lignitic laminations -w/lignitic clay pockets (CH)							
45			Hard green and light green silty clay, w/lignitic seams (CL)							
50			Very dense gray clayey fine sand		24	35	25	25		99

(Continued)

LOG OF BORING NO. B-41 (Cont'd)
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			-gray, dark green and brown (SC)							
55			Hard brown sandy clay (CL)	86/10.5"						
60			Very dense green silty fine sand (SM)							
65										
70			Hard gray clay, slickensided, w/sand seams (CH)							
			Moderately hard gray and light gray siltstone, w/clay seams							
75			Very dense gray silty fine sand, w/clay seams (SM)							
			Hard brown, gray, and dark gray clay, w/silt seams							
80										
85			(CH)							
90			Hard greenish-gray clay, w/occasional sand seams							
95										
100			(CH)							

COMPLETION DEPTH: 100.5'
DATE: 12/16/76

DEPTH TO WATER: 12.0'
DATE: 12/17/76

LOG OF BORING NO. B-42

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371500; E3337180

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 276.5						
			Firm dark brown clay (CH)						
5			Dense tan sandy silt, w/ occasional clay laminations (ML)	76					
10									
			Stiff gray silty clay (CL)						
15									
			Hard gray clay		60	32			
20			-1.5" selenite seam at 24.0' (CH)						
25			Hard gray clay						
30			-dark gray, w/occasional silt pockets		78	29	28	(7.3)	93
35			-0.8" lignitic material seam at 34.0'						
			-w/siltstone seams						
40			-w/lignitic clay pockets (CH)						
45			Hard gray and tan silty clay, w/sand seams and lignitic material laminations (CL)		30	26	23	(7.8)	10[illegible]
50									

(Continued)

LOG OF BORING NO. B-42 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 05 10 15	UNIT DRY WT. LBS./CU. FT.
55			Very dense brown clayey fine sand, w/clay and lignitic material laminations (CL)	50/5"						
60			Hard gray and green clay, w/silt and siltstone seams							
65										
70										
75										
80										
85										
90			(CL-CH)							
95			Hard greenish-gray clay, w/siltstone laminations							
100										

COMPLETION DEPTH: 100.0'
DATE: 12/13/76

DEPTH TO WATER: 0.0' Caved at 70.0'
DATE: 12/14/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-43

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372285; E33337140

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 283.7						
			Soft brown sandy clay (CL)						
			Firm brown clay, ironstained (CH)						
5			Medium dense gray clayey sand, w/sandy clay pockets, iron stained -light tan	45	53	31	30		
10									
15									
20			-light gray (SC)						
25			Hard brown clay, ironstained, w/sand seams (CH)					4.0+	
30			Hard gray clay, w/silt laminations					4.0+	
35									
40			(CL)		50	24	26	4.0+	92
45			Very dense gray silty fine sand, w/clay seams						
50				38	45	28	25		96

(Continued)

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

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SM)						
55			Soft gray siltstone						
			Very dense gray sandy silt						
60			(ML)						
			Hard tannish-brown clay, w/silt seams		49	24	33	+	95
65									
70									
75			(CL-CH)						
			Hard gray clay					+	
80			-greenish-gray, w/occasional silt laminations				32	+	90
85									
90								+	
95									
100			(CH)					+	

COMPLETION DEPTH: 100.0' DATE: 11/29/76

DEPTH TO WATER: Caved at Surface DATE: 11/30/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-44

FINAL PLANT SITE INVESTIGATION

GIBBONS CREEK STEAM ELECTRIC STATION

GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372555 E 3337175

DEPTH. FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 282.4							
			Loose light brown clayey fine sand (SC)							
5			Very dense light tan silty fine sand		20	31	25			
10			(SM)	50/5"						
15			Hard light brown clay, slightly silty, w/occasional sand pockets						⊙+	
20			(CL-CH)							
25			Hard grayish-brown clay, w/silt laminations and seams			60	31	30		81
30			-w/occasional pyrite nodules (CH)							
35			Hard brown silty clay, w/silt laminations, occasional sand pockets and lignitic laminations (CL)						⊙+	
40			Very dense brown clayey sand, w/numerous sandy clay pockets and occasional clay seams (CL)							
45			Very dense gray silty fine sand							
			-sandy silt seam at 46.0'	95/9"						
50					47	27	23	26		97

(Continued)

LOG OF BORING NO. B-44 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			(SM)						
55			Hard brown sandy clay, w/silty clay laminations and numerous sand pockets (CL)						
60			Hard grayish-brown clay, w/occasional silt laminations		53	24	25		96
65									
70			-silty sand seam at 68.5-69.3'						
75									
80			-w/silt seams and laminations (CH)						
85			Hard brownish-green clay						
90					110	28	32		90
95									
100			(CH)						

COMPLETION DEPTH: 100.0'
DATE: 11/12/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-45

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372555; E3336905

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 285.4	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 10 15)	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)							
			Medium dense light brown clayey fine sand (SC)							
5			Hard light brown and gray silty clay, w/iron laminations (CL)						0+	
			Hard light gray silty clay, w/occasional sand pockets (CL)						0+	
10			Hard light grayish-brown clay, w/sand pockets and occasional silt laminations						0+	
15			-w/iron stains -fractured, w/occasional silt pockets and selenite pockets at 15.0'			81	40	42	0+	
20			-w/occasional iron nodules and silty clay seams at 20.0-21.0'						0+	
25			(CH)						0+	
30			Hard gray sandy clay, w/ lignitic material pockets (CL-CH)		67	55	23	28	2+	95
35			Very dense gray clayey sand w/ occasional sandy clay pockets (SC)							
40			Very dense gray silty fine sand, w/indurated seams	55						
45			(SM)		35	Non-Plastic		27		92
50			Hard gray sandy clay, w/indurated seams						2+	

(Continued)

LOG OF BORING NO. B-45 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			-w/occasional sand seams (CL)							
55			Hard gray clay, w/sand and clay seams -w/indurated seams (CL)						0+	
			Very dense gray silty fine sand (SM)							
60			Hard gray clay, w/sand seams -gray and brown, w/6.0" silty fine sand seam at 64.0'-64.5' (CL-CH)			78	32	32	0+	88
70			Very dense gray silty fine sand, w/silt seams (SM)	85/9"						
75			Hard gray silty clay -w/siltstone seam at 79.0' -/0.1' lignitic material seam at 79.5' (CL)						0+	
80			Hard gray clay (CH)						0+	
85			Very dense gray sandy silt -w/occasional clay seams (ML)	50/2"	60			28		96
90			Hard gray clay (CH)						0+	
95										
100										

COMPLETION DEPTH: 100.0'
DATE: 11/17/76

DEPTH TO WATER: 30.5' Caved at 31.0'
DATE: 11/21/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-46

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372310; E3336905

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 284.3							
			Loose brown silty fine sand (SM)							
			Firm gray and tan clay (CH)						0	
			Hard brown sandy clay							
5			-light gray (CL)							
			Dense tan clayey sand, w/clay laminations (SC)		36					
			Hard light brown clay, indurated, jointed, and ironstained (CH)							
10										
			Dense light gray clayey fine sand, w/occasional clay seams (SC)							
15										
			Hard light brown clay	69						
			-jointed and ironstained							
20			-w/lignitic material seam at 23.7'							
			-w/occasional selenite seams (CH)							
25			Hard gray clay, w/ occasional silt pockets			62	30	22		86
30										
35			(CH)							
			Very dense gray clayey sand, w/occasional gray clay pockets		45					
40			-w/organic laminations and seams (SC)							
			Very dense gray silty fine sand	50/3"	21			24		96
45			-w/siltstone							
50										

(Continued)

LOG OF BORING NO. B-46 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SM)							
55			Hard gray clay, w/ silt seams							
60										
65						56	22	32		89
70			(CL-CH)							
75			Hard gray silty clay, w/occasional sand seams -w/iron nodules (CL)							
80			Hard gray clay -w/1.0' silt seam at 80.0'							
85			-w/silt-filled fractures on bedding planes					33	(2.19)	89
90						101	27	33		86
95			-w/iron nodules -w/occasional silt seams							
100			(CH)							

COMPLETION DEPTH: 100.0'
DATE: 11/30/76

DEPTH TO WATER: 11.0' Caved at 35.0'
DATE: 12/1/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-47

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372075; E3336905

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 284.6							
			Loose brown silty fine sand (SM)							
5			Hard gray and tan sandy clay -light gray (CL)						+ +	
			Very dense ligh gray sandy silt, w/clay laminations (ML)							
10		X	Very dense light gray silty fine sand, w/ clayey seams	65						
15			-w/numerous iron laminations (SM)			57	29		+	
			Hard light brown clay, jointed, w/slickensides (CH)							
20			Hard light gray and tan silty clay (CL)							
			Hard brown clay (CH)						+	
25										
30			Hard gray clay -w/two 1" lignitic material seams at 29.0'							
35			-w/lignitic clay seam at 39.0' (CH)			61	30	35	+ (2.73)	84
40			Hard brown sandy clay -gray -w/silty clay seams to 44.0' (CL)							
45			Very dense brownish-gray silty fine sand, slightly clayey							
50					27					

(Continued)

LOG OF BORING NO. B-47 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-indurated to 53.0' (SM)		43	28	24	27		98
60		X	Very dense gray sandy silt, w/occasional clay seams (ML)	50/4"						
65										
70			Hard gray clay, w/sandy silt seams (CL-CH)			59	30	31		91
75			Very dense gray sandy silt, w/occasional clay laminations -w/occasional silty fine sand seams (ML)							
80			Hard gray clay, w/ occasional silty sand seams -slickensided (CL-CH)							
85			Hard greenish-gray clay, w/occasional silt laminations -slickensided, w/0.5' displacement -w/pyrite			86	29	36		85
90										
95										
100			(CH)							

COMPLETION DEPTH: 100.0'
DATE: 11/29/76

DEPTH TO WATER: 25.0' Caved at 40.0'
DATE: 11/30/76

NATIONAL SOIL SERVICES, INC.

LOG OF BORING NO. B-48

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371850; E3336915

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 282.1							
			Loose brown silty fine sand, slightly clayey (SM)							
			Hard light brown and tan sandy clay, iron-stained (CL)							
5			Medium dense gray clayey fine sand (SC)							
			Hard light gray clay, w/ numerous sand pockets (CL)	50						
10			Dense light tan silty fine sand, w/occasional clay laminations (SM)							
15			Dense light gray silty sand, w/ occasional clay seams		41	48	20			
20			(SM)							
			Hard light brown clay (CH)							
25			Hard dark gray and brown clay, w/silt pockets (CH)							
30			Hard gray clay, w/silt laminations (CL)							
			Hard gray clay, w/occ-asional organic material			84	36	37	(4.5+)	81
35			-w/sand seam at 42.5'-44.0' (CH)							
40			Hard gray clay, w/silt laminations							
			-w/sand seams at 45.5' (CL)							
45			Very dense brown and gray clayey sand, w/lignitic material							
50										

(Continued)

LOG OF BORING NO. B-48 (Cont'd)
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			-w/numerous lignitic clay laminations (SC)							
55			Very dense gray silty fine sand (SM)		14			31		89
			Hard gray clay, slickensided (CH)							
60			Very dense gray silty fine sand -w/occasional clay seams -slightly clayey below 60.5' (SM)	50/5.5"						
65			Hard gray silty clay, indurated (CL)							
70			Hard gray clay -w/silt laminations							
75			-slickensided			64	22	28		90
80										
85			(CH)							
90			Hard gray and green clay -w/occasional sand laminations			100	28	34		88
95										
100			(CH)							

COMPLETION DEPTH: 100.0 DEPTH TO WATER: 25.0' Caved at 46.0'
DATE: 11/23/76 DATE: 12/1/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-49

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371850; E3337100

ELEVATION: 279.5

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)							
			Stiff brown sandy clay (CL)							
5			Hard light tan silty clay (CL)							
			Dense light brown sandy silt (ML)							
10			Dense tan clayey sand, ironstained, w/clay seams		24	30	16	14		
15		X		91						
20			(SC)			40	23	23		100
25			Hard brown clay, w/siltstone seams -ironstained (CH)							
30			Hard gray clay, w/ lignitic material seams and sand pockets (CL-CH)							
35			Hard gray clay, w/ silt laminations							
40						72	42	36		79
45			(CH)							
50			Very dense dark brown clayey sand		40	46	20			

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-49 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SC)							
55			Very dense gray silty fine sand (SM)	50/4" Seat						
60			Very dense gray clayey fine sand (SC)		47	33	23	27		93
65			Hard gray clay, indurated to 65.0' -w/silt laminations			50	24	26		97
75			(CL-CH)							
80			Hard grayish-green clay -w/occasional silt laminations			80	30	30		88
90										
95										
100			(CH)							

COMPLETION DEPTH: 100.0' DEPTH TO WATER: 27.0'
DATE: 11/22/76 DATE: 11/23/76

NATIONAL SOIL SERVICES, INC.

LOG OF BORING NO. B-50

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372075; E3337100

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 281.5						
			Soft brown silty clay -hard tan (CL)					0+	
5			Dense light tan clayey sand	38	37	21	19		
10									
15									
20			-w/iron stains (SC)						
25			Hard brown clay, ironstained (CH)					0+	
30			Hard gray clay, slickensided, w/ lignitic material laminations (CH)		69	33		0+	
35									
40			Hard gray sandy clay, w/ brown clay seams (CL-CH)	76			27	0+	96
45			Very dense gray clayey sand, w/occasional sandy clay seams (SC)		52	30	28		89
50			Very dense gray silty fine sand, w/lignitic material seams	28					

(Continued)

LOG OF BORING NO. B-50 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SM)						
55			Hard gray clay, indurated to 60.0'		36	21	31		90
60			-w/silt laminations				32		90
65									
70									
75									
80			(CL-CH)						
85			Hard grayish-green clay						
90					99	30	35		84
95									
100			(CH)						

COMPLETION DEPTH: 100.0' DATE: 11/23/76

DEPTH TO WATER: 30.0' DATE: 11/24/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-51
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372290; E3336765

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5, 1.0, 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 286.0						
			Loose brown silty fine sand -tan (SM)						
5			Stiff tan sandy clay -hard and gray (CL)						
10			Dense tan silty sand, iron stained (SM)	48	37	14			
20			Hard brown clay, iron-stained, w/silt seams		55	31	32		87
30			Hard gray clay, w/silt pockets (CH)		69	35	33		84
40			Very dense brown and gray clayey fine sand (SC)						
50			Very dense gray silty fine sand (SM)						

COMPLETION DEPTH: 50.0' DEPTH TO WATER: 24.9' Caved at 25.0'
DATE: 12/1/76 DATE: 12/2/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-52

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371990; E3336765

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION (ELEVATION: 286.2)	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)							
5			Stiff reddish-brown sandy clay (CL)							
			Medium dense tan silty fine sand (SM)							
10			Very dense light gray silty fine sand	58	25	27	15			
15			(ML)							
			Hard brown clay (CH)			54	19	30		91
20										
			Very dense light gray sandy silt, w/clay seams (ML-MH)		71	60	28	27		91
25										
30										
			Hard gray and brown clay, w/silt pockets (CH)			66	30	22	(1.79)	94
35										
40										
			Hard grayish-brown clay -numerous silt laminations (CL-CH)			71	34			
45										
50										

COMPLETION DEPTH: 50.0' DEPTH TO WATER: Caved at 3.0'
DATE: 12/1/76 DATE: 12/2/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-53

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372555; E3336375

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 288.6						
			Loose brown silty fine sand (SM)						
5			Stiff brown silty clay -hard below 4.0' -w/ironstained below 5.0'		44	21			
10			(CL)						
15			Hard tan clay, ironstained						
20			-brown		58	31	33		86
25			(CH)						
30			Hard gray clayey silt w/lignitic material seams	98	51	36	32		86
35			(MH)						
40			Very dense gray clayey fine sand	44	33	21	18		100
45			(ML)						
50			Hard gray clay, slightly indurated (CH)						

COMPLETION DEPTH: 50.0' DEPTH TO WATER: 19.9' Caved at 20.0'
DATE: 12/2/76 DATE: 12/3/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-54

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372260; E333520

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 286.3						
			Soft brown sandy clay (CL)						
5			Very stiff light gray silty clay (CL)						
10			Very dense light tan silty fine sand	40	36	21			
15			-w/clay seams -w/ironstain (SM)						
20			Hard brown clay, ironstained -w/occasional silt laminations		84	34	40		80
25			(CH)						
30			Hard gray clay, w/ occasional silt laminations		71	32	31		86
35			-brown and gray (CH)						
40			Very dense gray clayey sand, w/bentonite pockets (SC)						
45			Very dense gray silty fine sand, w/clay pockets (SM)						
50			Very dense gray sandy silt, w/indurated clay laminations (ML)						

COMPLETION DEPTH: 50.0' DEPTH TO WATER: 20.9' Caved at 21.0'
DATE: 12/2/76 DATE: 12/3/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-55

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372080; E3336365

ELEVATION: 284.2

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose brown sandy clay (CL)						
			Hard tan silty clay (CL)						
5									
			Very stiff brown clay, iron-stained, w/silt laminations						
10			-silt seams						
			-hard at 13.0' - 20.0'						
15									
			-lignitic at 18.5'		65	30			
20									
			-very stiff						
25			(CH)						
			Hard gray clay, w/silt laminations		62	39	32		84
30									
35			(CH)						
			Very dense gray silty fine sand, w/ clay and lignitic material laminations	62			22	(5, 36)	104
40									
45									
50			(SM)						

COMPLETION DEPTH: 50.0' DEPTH TO WATER: 20.9' Caved at 21.0'
DATE: 12/2/76 DATE: 12/3/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-56

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N373150; E3337500

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 272.2						
			Stiff brown sandy clay (CL)						
			Very stiff light tan clayey silt (ML)						
5			Hard tan silty clay (CL)						
10			Hard tan clay, w/silt laminations		55	27	31		86
15									
20			(CL-CH)						
25			Very dense tan sandy silt, w/siltstone seams	54	42	18			
30			(ML)						
35			Hard light gray clay, w/ numerous sand laminations (CL)						
40			Very dense gray sandy silt -w/2.0" siltstone seam at 38.0'						
45			-w/clay laminations (ML)						
50									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-56 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			Hard dark brown clay, w/ silt seams						
			(CH)						
60			Hard gray silty clay (CL)						
65									
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 60.0'
DATE: 12/8/76

DEPTH TO WATER: Caved at 10.0'
DATE: 12/8/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-57

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372850; E3337500

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 281.4	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty sand (SM)						
5			Medium dense gray silty fine sand, ironstained						
				22	Non-Plastic				
10			-w/ironstained laminations						
15			-w/siltstone laminations						
20									
25			-w/clay laminations.	84			33		84
30			-w/silt laminations (SM)						
35			Very dense gray sandy silt, w/ numerous clay laminations						
40			-w/siltstone seam						
				66	49	29	26		95
45			(ML)						
50			Hard gray clay, w/ silt laminations.						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-57 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CL)						
55			Hard dark brown clay (CH)						
60			Very dense gray sandy silt (ML)						
65			Hard dark brown clay, w/ silt laminations (CL-CH)						
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 65.0'
DATE: 12/3/76

DEPTH TO WATER: 22.9' Caved at 23.0
DATE: 12/4/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-58
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N373150; E3337200

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 273.1							
			Loose brown silty fine sand, slightly clayey (SM)							
			Very stiff brown silty clay, w/iron stains and clay pockets (CL)							
5			Hard tan clay, w/iron stains and silt pockets			78	26			
10			-w/numerous thin silt laminations (CH)							
15			Hard gray sandy clay, w/numerous clay and silt pockets (CL)			46	22	26		92
20			Very dense tan silty fine sand, w/occasional clay pockets	50/4"						
25			-w/lignitic material seam							
30			-w/numerous thin silt and clay laminations (SM)		26			25		96
35			Hard gray clay						(8.78)	
40			-w/clay and silt seams			52	25	27		97
45			(CL-CH)							
50			Hard greenish-gray clay, w/occasional to numerous sand and silt laminations							

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-58 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55									
			(CH)						
60									
65									
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 60.0'
DATE: 12/7/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-59

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372850; E3337200

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 275.4	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose brown silty fine sand (SM)						
5			Hard brown silty clay -tan -w/numerous silt laminations						
10			(CL)						
15			Very stiff tan clay, ironstained (CH)	97	60	26			
20			Hard gray clay, w/ occasional silt laminations -shaley						
25			(CH)		66	36	34		86
30			Very dense brown clayey sand (SC)	21	35	21			
35			Very dense gray silty fine sand						
40			(SM)	52					
45			Hard gray clay, w/sandy silt seams						
50									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-59 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55									
60			(CL-CH)						
65									
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 60.0'
DATE: 12/3/76

DEPTH TO WATER: 20.9' Caved at 21.0'
DATE: 12/4/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-60

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N373150; E3336900

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 279.5	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Loose gray silty fine sand (SM)						
5			Hard brown clay, iron stained -occasional silt laminations (CH)		72	22	28		
10									
15			Hard brown clay (CH)		67	31	41		
20			Very dense gray silty sand, w/lignitic material seams and clay pockets						
25			(SM)	50	43	26			
30			Very dense gray silty fine sand -siltstone seam at 33.5'						
35			(SM)	30			26		96
40			Very dense gray sandy silt, w/clay seams and laminations						
45			(ML)	97					
50			Hard gray clay, w/ occasional siltstone seams						

(Continued)

LOG OF BORING NO. B-60 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-slickensided, w/silt laminations						
60			-greenish-gray						
65			(CH)						
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 65.0'
DATE: 12/7/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-61

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372850; E3336900

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 285.7						
			Loose brown clayey fine sand (SC)						
			Dense tan sandy silt, w/ clay seams (ML)						
5			Very stiff tan silty clay, ironstained (CL)						
			Hard brown clay, slickensided						
10					60	29	30		
			-w/lignitic material seams						
15									
20									
			-very stiff, w/silt pockets (CH)						
25									
			Very dense gray sandy silt, w/clay laminations						
30									
			-dark brown						
35			-w/lignitic material seam						
				57	43	24	24		98
40			(ML)						
			Hard gray clay, w/siltstone seams						
45									
					39	22			
50									

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-61 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55									
60			(CL-CH)						
			Hard dark brown clay						
65									
			(CH)						
70									
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 70.0'
DATE: 12/4/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-62

WATER RETENTION POND
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371160; E3335661

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 261.2							
			Medium dense brown and tan silty fine sand (SM)							
5			Medium dense brown, tan, and light tan clayey fine sand, w/iron pockets (SC)							
10			Hard tan, light tan, and dark tan clay, iron stained, -very stiff below 6.0' -w/iron pockets -w/silt seams (CH)							
15			Hard tan and light tan silty clay (CL)							
20			Dense gray and brown clayey fine sand -lignitic material seam at 22.5' (SC)	47						
25			Very dense gray silty fine sand, w/siltstone seams and lignitic laminations (SM)							
30										
35			Soft gray siltstone, w/ vertical fracture							
40			Hard gray clayey silt, w/ clay and sand seams (ML)							
45										
50										

COMPLETION DEPTH: 40.5'
DATE: 12/16/76

LOG OF BORING NO. B-63

WATER RETENTION POND.
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370600; E3335515

ELEVATION: 257.7

DEPTH, FT.	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5, 1.0, 1.5)	UNIT DRY WT. LBS./CU. FT.
0	Medium dense brown silty fine sand, w/iron pockets and gravel (SM)							
5	Very stiff light brown clay, w/iron, silt, and silty clay pockets -w/silt and silty clay laminations to 14.0' -w/silt seams -w/occasional thin laminations of selenite crystals below 8.0' (CH)							
15	Hard brown and dark brown sandy clay, w/ occasional sand and silt pockets (CL)							
20	Very dense gray silty fine sand -w/lignitic laminations at 21.5'	89						
30	(SM)							
35	Very stiff gray sandy clay, w/numerous thin sand and silt laminations (CL)							
40	Hard gray clay (CH)							
45								
50								

COMPLETION DEPTH: 40.5' DEPTH TO WATER: 12.0'
DATE: 12/17/76 DATE: 12/17/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-64

WATER RETENTION POND
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370000; E3335380

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 255.5							
			Loose brown silty fine sand, slightly clayey (SM)							
5			Stiff brown clay, w/siltstone fragments to 3.0' -hard below 3.0' -iron stained (CL)							
10			Medium dense light tan silty fine sand, w/iron and clay laminations (SM)					37	$K_v = 4.93 \times 10^{-8}$ cm/sec	80
15			Hard tan clay, w/iron stained laminations and inclined fractures (CH)			65	26			
			Hard gray clay, w/siltstone seams -w/reddish-tan seams -w/heavily iron stained seams and selenite filled fractures (CL)							
20			Dense gray silty fine sand, w/large clay balls (SM)							
25			Hard gray clay, w/ silty fine sand laminations -occasional carbonaceous material (CH)							
30			Hard gray silty clay w/silty fine sand laminations -carbonaceous material -occasional siltstone laminations (CL)							
35			Very dense brown sandy clay, w/carbonaceous inclusions (CL)							
40			Very dense clayey fine sand w/occasional carbonaceous inclusions (SC)							
45										
50										

COMPLETION DEPTH: 40.5' DEPTH TO WATER: 6.0'
DATE: 2/1/77 DATE: 2/2/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-65

WATER RETENTION POND
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N369540; E3335509

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 260.3							
			Soft brown sandy clay (CL)							
5			Stiff light brown sandy clay, w/iron staining			33	18	22	$K_v = 8.83 \times 10^{-6}$ cm/sec	97
10								22		98
15			-very stiff below 13.0' -iron and organic laminations -w/clay laminations -occasional carbonaceous laminations (CL)							
20			Hard gray silty clay, w/silty fine sand laminations							
25			-dark gray (CL)							
30			Hard dark gray clay, w/silt and organic laminations -w/silty fine sand pockets							
35			(CH)							
40			Hard brown lignitic clay, w/lignitic laminations (OH)							
45			Hard gray clay -carbonaceous laminations (CH)							
50										

COMPLETION DEPTH: 40.5' DEPTH TO WATER: 20.0'
DATE: 2/1/77 DATE: 2/2/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-66

WATER RETENTION POND
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N369500; E3336015

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 250.5							
			Stiff brown clay, w/silty fine sand pockets (CH)							
5			Medium dense brown silty fine sand (SM)		42			16	$K_v = 7.26 \times 10^{-7}$ cm/sec	106
10			Hard light tan clay, w/sandy clay laminations and seams -w/silty fine sand laminations			56	24	35		82
15			-w/iron stained laminations (CH)							
20			Hard gray clay, w/occasional organic laminations			66	34			
25			(CH)							
30			Very dense gray clayey fine sand (SC)	77						
35			Hard dark gray clay, w/silty fine sand laminations (CL)							
40										
45										
50										

COMPLETION DEPTH: 30.5' DEPTH TO WATER: 1.0'
DATE: 2/11/77 DATE: 2/2/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-67

WATER RETENTION POND
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370247 ; E3335795

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 258.2						
			Medium dense brown, red, and tan silty fine sand (SM)						
5			Medium dense brown, red, and tan clayey fine sand -w/clay pockets (SC)						
			Hard light tan, tan, brown, and red clay, w/sand seams and iron laminations (CH)						
10			Dense tan silty fine sand (SM)						
			Hard tan and light tan clay, w/sand seams -w/silt seams and iron (CL-CH)						
15									
20			Hard tan, brown, and light tan silty clay, w/iron pockets -w/silt seams at 19.0' (CL)						
25									
30									
35									
40									
45									
50									

COMPLETION DEPTH: 20.5 DEPTH TO WATER: Caved at Surface
DATE: 12/17/76 DATE: 12/17/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

LOG OF BORING NO. B-68

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371080; E3338850

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 260.8							
			Stiff brown silty clay (CL)							
5			Very dense light tan silty fine sand (SM)		27	32	14	12	$K_v = 1.5 \times 10^{-7}$ cm/sec	92
10			Very dense light tan silty fine sand (SM)		14	Non-Plastic		20	$K_v = 2.2 \times 10^{-6}$ cm/sec	88
15				82/11"						
20			Very dense tan silty fine sand, w/numerous clay balls (SM)							
25										
30										
35										
40										
45										
50										

COMPLETION DEPTH: 25.5' DEPTH TO WATER: 7.5'
DATE: 12/2/76 DATE: 12/3/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-69

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370430; E3338830

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 258.9							
			Hard dark brown clay (CH)							
5			Hard reddish-brown sandy clay, w/light tan clay seams (CL)							
			Hard dark brown lignitic clay, w/lignitic material seams (OH)			51	23			
10			Hard light tan clay, indurated, w/iron seams (CL-CH)							
15			Very dense light green sandy silt, w/clay laminations (ML)		67	43	24	30	$K_v = 1.0 \times 10^{-6}$ cm/sec	94
20			Very dense greenish-gray sandy silt							
25										
			(ML)	76/1"						
30										
35										
40										
45										
50										

COMPLETION DEPTH: 29.5' DEPTH TO WATER: 14.5'
DATE: 12/2/76 DATE: 12/3/76

NATIONAL SOIL SERVICES, INC.

LOG OF BORING NO. B-70

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N369240; E3338790

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 281.5							
			Loose dark brown sandy silt (ML)							
			Hard red clay, w/ tan pockets (CH)							
5			Hard tan clay, ironstained (CH)							
			Hard tan and yellow weathered siltstone, ironstained							
10			Hard tan and yellow clay, w/silt laminations							
15			(CL)							
			Hard green clay, w/silt pockets			62	28	27	K_v=4.1X10^{-6} cm/sec	96
20			-w/0.2' lignitic material seam at 23.5' (CH)							
			Very dense gray silty fine sand		48	38	32	25		94
25				82/11.5"					K_v=4.9X10^{-6} cm/sec	
			-siltstone seam							
30			(SM)							
			Hard brownish-gray clay, indurated			52	25			
35										
40			(CH)							
			Soft dark reddish-brown lignitic material (Pt)							
45										
50										

COMPLETION DEPTH: 45.5' DEPTH TO WATER: 6.5'
DATE: 12/3/76 DATE: 12/4/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-71

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N369785; E3338690

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 256.8						
			Very stiff tan clay, w/silt laminations (CL)						
5			Hard tan and dark red clay, ironstained (CH)		69	32			
10			Soft dark reddish-brown weathered lignitic material, w/clay seams (Pt)						
15			Hard dark green clay, w/ lignitic material seams (CH)						
			Hard dark red lignitic clay (OH)						
20			Hard dark green clay, w/ sandstone seams -lignitic (CH)						
25									
30									
35									
40									
45									
50									

COMPLETION DEPTH: 25.5' DEPTH TO WATER: 6.5'
DATE: 12/3/76 DATE: 12/4/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-72

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370150; E3338545

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 265.9						
			Loose brown clayey sand -0.1' reddish-brown lignitic material seam at 3.5' (SC)						
5			Very stiff reddish-brown silty clay (CL)					0+	
			Hard tan clay -reddish-brown below 9.5'					0+	
10									
			-ironstained, w/sand seams (CH)		39	29		0+	
15									
			Hard reddish-brown lignitic silt w/tan seams (ML)	32	45	32	27	$K_v = 7.9 \times 10^{-5}$ cm/sec 0+	92
20									
			Hard dark reddish-brown lignitic clay, w/lignitic material seams (OH)					0+	
25									
			Hard green clay, w/silt pockets (CH)					0+	
30									
35									
40									
45									
50									

COMPLETION DEPTH: 30.5' DEPTH TO WATER: 20.5'
DATE: 12/1/76 DATE: 12/2/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-73

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370660; E3338420

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 275.7						
			Loose brown silty fine sand (SM)						
			Stiff red clay, w/ pockets of sand (CH)						
5			Hard reddish-tan silty clay		58	24	29		
			-w/occasional iron pockets jointed at 8.0'						
10									
15									
20			-w/occasional sand and clay laminations						
25			-tan and gray, w/occasional sand seams		48	23	30	$K_v = 4.7 \times 10^{-7}$ cm/sec	91
			(CL-CH)						
30			Hard green silty clay, w/silt seams						
35									
			(CL)						
40									
45									
50									

COMPLETION DEPTH: 40.0' DEPTH TO WATER: 17.0'
DATE: 12/1/76 DATE: 12/2/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-74

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371200; E3338370

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 259.2							
			Very stiff dark red sandy clay (CL)							
5			Dense red and tan silty fine sand		35	40	23	24	$K_v = 3.4 \times 10^{-8}$ cm/sec	99
			-w/clay laminations (SM)							
10			Very dense tan silty fine sand, ironstained	66						
15					22	26	24	26	$K_v = 1.8 \times 10^{-7}$ cm/sec	94
20				94/1.5'	21					
25			(SM)							
30										
35										
40										
45										
50										

COMPLETION DEPTH: 25.5' DEPTH TO WATER: 10.5'
DATE: 12/4/76 DATE: 12/5/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-75

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N370150; E3338275

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 277.8							
			Loose brown and tan silty fine sand -w/red clay seam at 0.5' -w/occasional gravel (SM)							
5			Hard tan silty clay, jointed, w/indurated zones and iron-laminations -reddish-tan -w/organic laminations (CL)							
10			Very stiff tan clay (CH)							
15			Hard tannish-red lignitic clay, w/lignitic material seams at 9.0'-10.0' (OH)			92	37			
			Hard brown clay, w/ lignitic material seams (CH)		47	74	60	44	$K_v = 1.1 \times 10^{-7}$ cm/sec	62
20			Stiff dark green clay, w/ occasional dark reddish-brown lignitic material seams (CH)							
25			Hard dark brown sandy clay, indurated -lignitic material seam		38	85	65	50	$K_v = 6.7 \times 10^{-4}$ cm/sec	61
30			(CL)							
35			Hard dark gray sandy clay, indurated (CL)							
40			Very dense green clayey fine sand (SC)	50/4"						
45			Hard green sandy clay (CL)							
50										

COMPLETION DEPTH: 45.0' DEPTH TO WATER: Caved at 3.0'
DATE: 12/1/76 DATE: 12/2/76

NATIONAL SOIL RERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-76

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N369260; E3338250

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 277.5						
			Loose dark reddish-brown clayey fine sand (SC)						
5			Stiff tan silty clay (CL)						
10			Stiff tan and dark red clay, ironstained and jointed (CH)						
15			Hard light tan and light gray clay, w/silt laminations (CL-CH)	93	38	20	24	$K_v = 1.7 \times 10^{-7}$ cm/sec	96
20			Hard dark tan clay (CH)						
25			Very dense dark gray silty fine sand, w/light gray clay pockets (SM)	48	49	24	25	$K_v = 4.6 \times 10^{-5}$ cm/sec	102
30			Soft dark brown lignitic material, w/clay seams (Pt)						
35			Hard greenish-gray clay, slickensided (CH)						
40			Soft dark brown lignitic material (Pt)						
45									
50									

COMPLETION DEPTH: 45.5' DEPTH TO WATER: 6.5'
DATE: 12/3/76 DATE: 12/4/76

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-77

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** N370723; E3339097

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 259.0						
			Loose brown silty fine sand (SM)						
			Firm brown sandy clay, w/iron stained laminations and numerous sand pockets						
5			-stiff below 2.0' (CL)						
			Stiff light tan silty clay, w/numerous sand laminations						
10									
15			(CL)						
			Medium dense gray silty fine sand, w/clay balls						
20									
25									
30									
			(SM)						
35									
40									
45									
50									

COMPLETION DEPTH: 35.0' DEPTH TO WATER: 10.0' - Caved at 31.0'
DATE: 4/2/77 DATE: 4/3/77

LOG OF BORING NO. B-78

ASH STORAGE PONDS
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N369513; E3339064

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 266.3						
			Loose reddish-brown silty fine sand w/iron stains and occasional clay laminations (SM)						
5			Stiff light tan silty clay, w/clay laminations and iron stains (CL)						
10			Very stiff light tan clay, w/iron stained lenses (CH)						
15			Hard grayish-green silty clay, w/clay and sand laminations						
20			-w/lignitic material laminations (CL)						
25			Soft reddish-brown lignitic material -w/lignitic clay seams (Pt)						
30			Hard gray silty clay, w/lignitic clay seams (CL)						
35			Hard dark brown lignitic clay, w/silty clay and lignitic material seams (OL)						
40									
45									
50									

COMPLETION DEPTH: 40.0'
DATE: 4/4/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS

PLATE

LOG OF BORING NO. B-79

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371246; E3338035

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 270.9							
			Firm light tan sandy clay, w/gravel (CL)						o	
5			Medium dense light tan silty fine sand, slightly clayey							
10										
15			-w/iron stained laminations -dense below 13 5'	41						
20										
25										
30				36						
35			-w/brown siltstone laminations and seams (SM)							
40			Hard brown siltstone, w/iron stained laminations						o+	
45			Hard grayish-green clay, w/occasional silt laminations -w/lignitic material						o+ o+ o+	
50										

(Continued)

NATIONAL SOIL SERVICES, INC.

PLATE

LOG OF BORING NO. B-79 (Cont'd)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. 0.5 1.0 1.5	UNIT DRY WT. LBS./CU. FT.
55			-w/clayey silt seams (CL-CH)							
60			Very dense grayish-brown silty fine sand, w/organic laminations (SM)							
65										
70										
75			Hard gray sandy clay, w/occasional sand seams -indurated -w/clay laminations	50/4" seat						
80			-w/clay seams -crossbedded							
85										
90			(CL)							
95			Hard dark brown clay, w/silty fine sand laminations and seams -greenish-gray and dark brown (CH)							
100										

COMPLETION DEPTH: 100.0'
DATE: 4/20/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-80

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371949; E3337946

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION ELEVATION: 264.4	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			Firm brown sandy clay (CL)							
			Hard tan silty clay (CL)							
5			Very dense light tan clayey fine sand, occasionally indurated -w/silty clay laminations, and organic and iron stained pockets							
10				50/3.5" seat						
15			-w/siltstone seams (SC)							
			Very stiff tan sandy clay, w/selenite crystals (CL)							
20			Hard grayish-green fine sandy clay, w/tan silty clay and organic laminations -w/silty fine sand and clay laminations (CL)							
25			Very dense grayish-green clayey sand (SC)							
30										
35			Hard grayish-green sandy clay, w/organic and clay laminations							
40			-w/silty fine sand seams (CL)							
			Very dense grayish-green silty fine sand, w/clay and organic laminations (SM)							
45										
50			Very stiff dark brown clay, w/sand and silt seams							

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-80 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55		X		50/5.5" seat						
			(CH)							
60			Hard grayish-green clay, w/fine sand laminations and pockets							
65										
70			-w/iron pyrite crystals (CL-CH)							
			Very stiff grayish-green clay, w/silty clay laminations							
75			-hard							
			-w/iron pyrite crystals							
80										
85										
			-w/slickensided fractures							
90										
95			(CH)							
			Very dense gray clayey fine sand, w/organic pockets and laminations							
100			(SC)							

COMPLETION DEPTH: 100.0'
DATE: 4/18/77

DEPTH TO WATER: 22.0' - Caved at 24.0'
DATE: 4/19/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-81

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371801; E3337940

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5, 1.0, 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 265.2							
			Loose brown silty fine sand (SM)							
			Soft brown clay, w/selenite crystals (CH)							
5			Hard tan silty clay, w/iron iron stained pockets and laminations -w/silty fine sand seams							
10										
15										
			-w/tan clay laminations							
20				42						
			-w/selenite crystals and iron stained laminations (SM)							
25			Very dense grayish-green clayey fine sand							
30										
			-w/clay laminations	69						
35										
40			(SC)							
			Very dense grayish-green clayey fine sand, w/clay laminations and seams (SC)							
45										
			Hard grayish-green clay, w/silty fine sandy laminations -w/organic laminations							
50										

(Continued)

LOG OF BORING NO. B-81 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 / 1.0 / 1.5)	UNIT DRY WT. LBS./CU. FT.
			(CH)						
55			Very dense grayish-green clayey fine sand, w/clay laminations and seams						
60			(SC)					0+	
65			Hard grayish-green silty clay, w/silty fine sand laminations and seams						
			-w/clay laminations					0+	
70			-w/organic laminations and seams					0+	
75			(CL)						
			Hard grayish-green clay, w/silty clay and iron pyrite seams					0+	
80			-slickensided					0+	
85								0+	
90								0+	
95								0+	
100			-w/iron pyrite crystals (CH)						

COMPLETION DEPTH: 100.0'
DATE: 4/18/77

DEPTH TO WATER: 20.0'
DATE: 4/19/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-82

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N374156; E3337791

DEPTH FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 248.6						
			Loose brown silty fine sand (SM)						
5			Stiff light brown sandy clay, w/tan clay pockets and silty fine sand laminations and pockets (CL)					o	
10			Medium dense light tan silty fine sand, w/iron stained laminations, tan clay laminations, and selenite crystals (SM)						
15			Hard grayish-green sandy clay, w/grayish-green clay seams and pockets (CL)					o+	
20			Hard grayish-green clay, w/silty clay laminations					o+	
25			-very stiff at 23.0-33.0', w/occasional sand laminations					o	
30								o	
35			-slightly slickensided, w/iron pyrite crystal pockets					o+	
40			-w/occasional silt laminations					o+	
45			-w/sand pockets and selenite crystals (CH)					o+	
50			Moderately hard grayish-green sandstone, w/iron stained laminations						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-82 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			Very dense grayish-green silty fine sand, occasionally indurated						
60			-w/brown clay seams						
65									
70			(SM)						
75									
80									
85									
90									
95									
100									

COMPLETION DEPTH: 70.0'
DATE: 4/4/77

DEPTH TO WATER: 5.5' - Caved at 46.0'
DATE: 4/5/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-83

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372472; E3337017

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 283.8						
			Medium dense brown silty fine sand (SM)						
5			Hard light brown and light tan silty clay, iron stained, w/occasional silt and sand laminations						
10			(CL)						
15			Hard tan silty clay, w/iron stains and occasional clay laminations						
20									
25			(CL)						
30			Hard grayish-green silty clay, w/numerous small silt pockets						
35			-w/organic clay seams and laminations (CL)						
40			Very dense silty fine sand, w/clay gray laminations -w/light gray clay seams -w/numerous organic laminations to 45.0'						
45									
50									

(Continued)

LOG OF BORING NO. B-83 (Cont'd)
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
				50/5"						
			(SM)							
55			Hard grayish-green silty clay, w/silty fine sand laminations							
60			-w/lignitic clay seam							
65										
			-w/clay and sand laminations							
70			-w/increased clay laminations							
75			(CL)							
			Hard grayish-green clay, w/silty clay laminations							
80										
			-w/occasional small silt pockets							
85										
			-w/occasional pyrite crystals							
90										
95										
			-w/numerous silt laminations							
100			(CH)							

COMPLETION DEPTH: 100.0'
DATE: 4/5/77

DEPTH TO WATER: Dry - Caved at 27.0'
DATE: 4/6/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-84

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** N372273; E3336986

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 283.3						
			Medium dense brown silty fine sand (SM)						
5			Hard gray sandy clay, w/silt laminations (CL)						
10			Hard tan silty clay, w/fine sand and iron stained laminations						
15			-light brown, w/light tan silty fine sand seams (CL)						
20			Hard light tan silty clay, w/numerous sand laminations and pockets -tan, w/tan clay laminations and iron stains						
25			(CL)						
30			Hard grayish-green silty clay, w/clay and sand pockets						
35			-w/clay seams (CL)						
40			Hard brown sandy clay, w/clay, sand, and lignitic clay laminations (CL)						
			Hard gray silty clay, w/gray clay laminations (CL)						
45			Very dense grayish-green silty fine sand, w/iron pyrite crystals and clay pockets						
50									

(Continued)

LOG OF BORING NO. B-84 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-w/occasional clay laminations (SM)	50/1"						
60			Hard grayish-green silty clay, w/gray clay laminations						o+	
65			-w/silty fine sand seams						o+	
70			(CL)						o+	
75			Hard gray clay, w/occasional silt laminations (CH)						o+	
80			Very dense grayish-green silty fine sand, w/organic laminations (SM)						o+	
85			Hard grayish-green clay, w/silty clay laminations						o+	
90										
95										
100			-slightly slickensided (CH)							

COMPLETION DEPTH: 100.0'
DATE: 4/7/77

DEPTH TO WATER: Dry - Caved at 21.0'
DATE: 4/8/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

LOG OF BORING NO. B-85

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N372153; E3336982

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 283.3						
5			Loose brown silty fine sand -w/tan clay seams (SM)						
10			Hard light tan silty clay, w/clay and sand laminations, iron stains and selenite crystals						
15			-w/light tan clay laminations (CL)						
20			Hard tan clay, w/iron stains and silty clay laminations -w/selenite crystals (CH)						
25			Hard grayish-green clay, w/silty clay inclusions						
30			-w/numerous silt and silty clay laminations (CH)						
35			Hard grayish-green silty clay, w/organic clay and sand pockets (CL)						
40			Very dense gray silty fine sand, w/slightly clayey pockets						
45			-w/silty clay laminations						
50									

(Continued)

LOG OF BORING NO. B-85 (Cont'd.)
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			(SM)						
55			Very dense gray sandy silt, w/numerous clay laminations and seams						
60			(ML)						
65			Hard gray silty clay, w/gray clay laminations -w/silty fine sand laminations and seams -increasing silty fine sand seams						
70									
75									
80			(CL)						
85			Hard grayish-green clay, w/silty clay and silty fine sand seams and laminations						
90			-w/iron pyrite crystals						
95									
100			(CH)						

COMPLETION DEPTH: 100.0'
DATE: 4/8/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-86

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** N371954; E3336976

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 282.6						
5			Loose light brown silty fine sand (SM)						
10			Very stiff light tan clay, w/iron stained and silt laminations						
			-hard						
15			-w/increasing fine sand laminations below 15.0'						
20			(CH)						
25			Hard tan clay, w/silt and iron laminations						
			-w/selenite crystals (CH)						
30			Hard gray clay, w/lignitic laminations						
			-w/fine sand laminations						
35			-w/lignitic clay laminations						
40			-w/fine sand laminations						
45			(CH)						
50			Very dense dark grayish-brown clayey fine sand, w/gray clay laminations						

(Continued)

LOG OF BORING NO. B-86 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-grayish-green							
60			-w/lignitic laminations (SM)	82						
65			Hard gray clay, slickensided, w/silty fine sand laminations							
70										
75										
80			-w/silty fine sand seams (CL)							
85			Hard grayish-green clay, w/silty clay laminations							
90										
95										
100			-w/iron pyrite crystals (CH)							

COMPLETION DEPTH: 100.0'
DATE: 4/12/77

DEPTH TO WATER: Dry - Caved at 27.0'
DATE: 4/13/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-87

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample **LOCATION:** N370721; E3337226

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 275.0						
			Medium dense brown silty fine sand (SM)						
5			Stiff tan clay, w/silty fine sand and iron stained laminations -hard, w/gravel (CL-CH)						
10			Hard light tan silty clay, w/ iron stained laminations (CL)						
15			Hard light tan sandy clay -w/tan sand and iron stained laminations (CL)						
20			Very dense tan clayey sand, slightly indurated, w/clay pockets (SC)						
25			Hard tan silty clay, w/silty fine sand and iron stained laminations (CL)						
30			Hard grayish-green silty clay, w/fine sand seams and tan clay laminations (CL)						
35			Very stiff gray clay, bentonitic, w/sand seams (CH)						
40			Hard gray clay, w/silt laminations -w/fine sand laminations and seams -w/lignitic clay laminations below 45.0'						
45									
50									

(Continued)

LOG OF BORING NO. B-87 (Cont'd.)
FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			(CH)						0+	
60			Hard gray silty clay, w/silt laminations (CL)						0+	
65			Very dense grayish-brown clayey fine sand, w/gray clay laminations (SC)							
70			Very dense gray silty fine sand							
75			(SM)	50/3" seat						
80			Hard grayish-green clay, w/silty fine sand laminations and seams						0+	
85									0+	
90									0+	
95			(CL-CH)							
100			Hard greenish-gray clay, w/occasional silt laminations (CH)						0+	

COMPLETION DEPTH: 100.0'
DATE: 4/13/77

DEPTH TO WATER: Surface - Caved at 5.0'
DATE: 4/14/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-88

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

TYPE BORING: Undisturbed Sample LOCATION: N371673; E3336422

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
			ELEVATION: 282.5						
			Loose light brown silty fine sand (SM)						
5			Firm tan clay, w/fine sand laminations (CH)						
10			Very stiff light tan sandy clay (CL)						
			Moderately hard gray and tan silty sandstone, w/iron stained fractures						
15			Hard tan clay, slightly indurated, w/iron laminations						
20			-w/light tan silty clay seam						
			-w/silt laminations						
25			-dark tan (CL)						
30			Hard tan clay, w/silty clay and iron stained laminations (CH)						
35			Hard grayish-green and dark gray clay, w/silt laminations						
40			-dark brown, w/silty clay pockets (CL)						
45			Very dense gray clayey fine sand, w/silty clay laminations (SC)						
50			Very dense gray silty fine sand						

(Continued)

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

LOG OF BORING NO. B-88 (Cont'd.)

FINAL PLANT SITE INVESTIGATION
GIBBONS CREEK STEAM ELECTRIC STATION
GRIMES COUNTY, TEXAS

DEPTH, FT.	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS PER FT.	% PASSING NO. 200 SIEVE	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT, %	SHEAR STRENGTH IN TONS/SQ FT. (0.5 1.0 1.5)	UNIT DRY WT. LBS./CU. FT.
55			-w/greenish-gray clay laminations	50/5"						
60			(SM)							
65										
70										
75										
80										
85										
90										
95										
100										

COMPLETION DEPTH: 60.0'
DATE: 4/13/77

DEPTH TO WATER: 23.0' - Caved at 24.0'
DATE: 4/14/77

NATIONAL SOIL SERVICES, INC.
CONSULTING ENGINEERS.

PLATE

A. PLANT ROADS

1. Plant Access Road:

** As indicated on Drawing C-230-006, the plant access road shall consist of a 9 inch lime stabilized subgrade, a 9 inch flexible base and a 2 inch H.M.A.C. pavement. Drawing C-230-006 shows this profile to STA. 15 + 50; however, for the site preparation contract this profile shall stop at STA. 11 + 00. From STA. 11 + 00 to STA. 15 + 50 the plant access road shall be constructed in accordance with Section 17, Drawing C-230-004.

2. Plant Roads:

Plant roads will not be constructed in final form as indicated by drawing C-230-006. All plant roads shown on drawing C-230-001 will be constructed in accordance with section 17, drawing C-230-004. For this site preparation contract, the plant roads will be temporary roads for use during construction and will be built in final form at a later date by a later contract.

* The location of the centerlines of the plant roads are as indicated on Drawing C-230-001. The approximate starting and stopping points are as indicated below:

Plant Road	START	STOP
a. From plant access road to C. W. Discharge Seal Well	STA. 5 + 50 on Plant Access Road	N374 110, E3 337 605
b. From plant access road to Switchyard	STA. 6 + 00 on Plant Access Road	N372 910, E3 336 755
c. Turnout from plant access road to Switchyard road	STA. 7 + 40 on Plant Access Road	N372 825, E3 336 120
d. From plant access road by office, warehouse and F.O. Facility to Pump at Plant Collection Pond	STA. 10 + 60 on Plant Access Road	N370 580, E3 335 460
e. From the end of the plant access road to the stop of the Plant Haul Road	STA. 15 + 50 on Plant Access Road	N371 735, E3 338 235
f. From curve west of Culvert No. 11 to join road north of Culvert 15	N371 825, E3 336 535	N372 700, E3 337 580
g. From curve near Culvert No. 19 to C. W. Intake Structure	N372 300, E3 338 140	N371 925, E3 338 640
h. Connecting road between two curves in Haul Road	N369 870, E3 337 260	N369 870, E3 337 470
i. From curve in Haul Road to Storage Silos	N369 855, E3 337 115	N370 740, E336 985"

*(REVISED BY ADDENDUM NO. 2)

**(REVISED BY ADDENDUM NO. 3)

3. Plant Railroads:

Railroads 1, 2 and 3 shall be built to profile grade only. For Railroads 1 and 2, this will include the 12 in. of lime stabilization above the subgrade. However, the 12 in. of lime stabilization for Railroad No. 3 shall be omitted.

Since Railroad No. 3 will be constructed at a much later date, it shall be sprigged with Coastal Bermudagrass under this site preparation contract. The 12 inches of topsoil specified for sprigging shall be substituted for the 12 inches of lime stabilization. The extent of sprigging shall consist of sprigging the railroad bed (30 feet in width) and 15 feet (measured horizontally) on each side. The sprigging shall commence at STA. 60 + 00 on Railroad No. 3 (limits of sprigging on the yard collection pond dam) and shall be discontinued at approximately STA. 94 + 60 where riprap has been specified. The sprigging between STA. 60 + 00 and STA. 94 + 60 shall be continuous, except where the Plant Access Road is crossed. At this crossing, Drawing C-230-006 (typical road section) shall be adhered to. Also, Railroad No. 3 shall be sprigged in a similar manner from STA. 6 + 50 to STA. 19 + 75."

4. Plant Access Haul Road:

The plant access haul road will not be constructed in final form under this site preparation contract. The typical access haul road section on Drawing C-230-009 indicates 18 in. of flexible base and 30 in. of lime stabilization. This flexible base and lime stabilization shall be omitted for the site preparation contract. The top of the road profile established by Drawings C-230-001 and C-230-009 remains unchanged as the 18 in. of flexible base and 30 in. of lime stabilization shall be replaced with 4 feet of controlled compacted fill (CCF).

5. Haul Roads:

Haul roads in the plant area shall be constructed in accordance with section 16, Drawing C-230-004. For this site preparation contract, the haul roads shall be temporary roads for use during construction and will be built in final form at a later date by a later contract.

The location of the centerline of the haul roads are as indicated on Drawing C-230-001. The approximate starting and stopping points are as indicated below:

	Haul Road	START	STOP
a.	From Lignite Receiving Hopper loop to Fly Ash Dispensing Facility	N369 735, E3 337 350	N371 735 E3 338 235
b.	From Lignite Receiving Hopper, across Culvert No. 22, to join Access Haul Road	N369 510, E3 337 265	N369 210 E3 337 110

Jack Barkley to review this!

*(REVISED BY ADDENDUM NO. 2)

A. SUBBASE

Subbase work shall consist of treating the road subgrade by the addition of lime, mixing and compacting the mixed materials to the required density. The work shall be constructed as specified herein and in conformity with the typical sections, lines and grades as shown on the plans.

1. Lime Treatment:

   a. Lime treatment for roadway and railroad subgrade soils shall be in accordance with Texas Highway Department "1972 Standard Specifications for Construction of Highways, Streets and Bridges" Item 260.

   b. Subgrade shall be lime stabilized to a depth of nine inches (9") using a maximum of six inch (6") compacted layers.

   c. Lime slurry shall be a thirty percent (30%) solution and shall be applied to obtain a seven percent (7%) lime application (approximately 6.5 pounds per cubic foot of soil).

   d. Lime treated soils shall be compacted to a minimum dry density of 95% of maximum dry unit weight as defined by Texas Highway Department Procedure Tex 113-E, using 13.26 foot-pounds per cubic inch of compactive effort. The moisture content of the lime treated soils shall be approximately four percent (4%) above optimum at the time of mixing and two percent (2%) at the time of compaction. Insufficient moisture content at the time of mixing and compaction would result in subsequent loss of strength when additional moisture is absorbed. Therefore, failure to have adequate moisture content will be sufficient cause for rejection of the work.

B. BASE COURSE

Base course work shall consist of a foundation course and shall be composed of crushed or broken aggregate. The work shall be constructed as specified herein and in conformity with the typical sections, lines and grades as shown on the plans.

1. Flexible Base:

   a. Flexible base for roadway shall be in accordance with Texas Highway Department "1972 Standard Specifications for Construction of Highways, Streets and Bridges" Item 248.

   b. Material shall be Type A, Grade 2.

   c. The flexible base course shall be nine inches (9") thick and shall be compacted in loose lifts not exceeding nine inches (9") in thickness. The moisture content in the base shall be less than one percent (1%) below the optimum value and it shall not exceed three (3%) above the optimum value when compaction is completed. The compactive effort shall be great enough to provide a density that is at least 98 percent of the maximum dry unit weight determined using the Texas Highway Department Specification, Tex 113-E.

C. SEAL COAT

*This item shall consist of a surface treatment composed of a single application of asphalt covered with aggregate for the sealing of future building foundations in accordance with these specifications.

1. The office (80' x 140'), north warehouse (80' x 150'), south warehouse (80' x 150'), and the maintenance building (300' x 150') areas shall be seal-coated under this site preparation contract.

*(REVISED BY ADDENDUM NO. 3)

* 2. After final grade has been achieved at the location of the office, warehouses and maintenance buildings, the soils encountered at grade shall be scarified to a depth of six inches, recompacted and immediately protected by an asphalt seal coat.

3. The seal coat shall be in accordance with Texas Highway Department '1972 Standard Specifications for Construction of Highways, Streets and Bridges', Item 316.

4. The aggregate shall be Type A, Grade 4.

5. Good drainage shall be provided around these seal-coated areas so that water will not pond in the low spots.

D. H.M.A.C. PAVEMENT

This item shall consist of a base course, a leveling-up course, a surface course or any combination of these courses as shown on the plans, each to be composed of a compacted mixture of mineral aggregate and asphaltic material.

1. The 2" of H.M.A.C. pavement shall be in accordance with Texas Highway Department '1972 Standard Specifications for Construction of Highways, Streets and Bridges', Item 340.

2. The paving mixture shall be Type D (Fine Graded Surface Course).

3. The lab density shall be not less than 95% nor greater than 99% of theoretical density with HVEEM stability greater than 30%.

E. ONE COURSE SURFACE TREATMENT

This item shall consist of a wearing surface composed of a single application of asphaltic material covered with aggregate, constructed on the prepared base course or surface in accordance with these specifications.

1. The one course surface treatment shall be in accordance with Texas Highway Department '1972 Standard Specifications for Construction of Highways, Streets and Bridges', Item 320.

2. The aggregate shall be Type A, Grade 4."

*(REVISED BY ADDENDUM NO. 3)

V. MISCELLANEOUS ITEMS

A. CONCRETE

All concrete shall have a minimum compressive strength of 3,000 psi. All exposed concrete on the culvert headwalls shall be hand rubbed to a smooth finish. Owner shall prepare concrete cylinders for testing.

B. REINFORCING STEEL

Reinforcing steel shall be of the sizes as shown on the drawings and shall have a 60,000 psi minimum yield point.

C. CONCRETE PIPE

Concrete pipe shall be reinforced concrete sewer pipe and shall conform to ASTM C76 specifications, Class as noted on drawings. All other items, including jointing, shall conform to THD 1972 Standard Specifications for Construction of Highways, Streets and Bridges, Item 464.

Concrete pipe shall receive a Class "B" bedding.

D. REINFORCED PLASTIC PIPE

Reinforced plastic pipe at the ash disposal ponds shall be a A. O. Smith-Inland epoxy resin "VU" or Engineer approved equal. Joints shall be butted and wrapped as per manufacturer's recommendation.

After installation of the pipe, the ends shall be plugged and the pipe tested to withstand a 20 foot hydrostatic head for 24 hours. After testing and berm construction are completed, the location of the ends of the pipe shall be marked by a steel rod protruding above the ground surface.

* The plastic pipe shall be installed in the following manner:

a. Excavate a trench 43 inches wide in the compacted embankment with the bottom of the trench being 6 inches below the specified grade for the plastic pipe.

b. Place 6 inches of bedding material in the bottom of the trench, consisting of pea gravel (rounded stones ranging in size from 3/16 in. to 3/4 in.) compacted to a minimum of 85% maximum density by the THD Test Method (TEX-113E).

c. Use a rake to loosen a 2 inch deep by 12 inch wide area to form a trough in the center of the ditch to serve as a pipe cradle.

d. Install the plastic pipe and then place 21 inches of pea gravel around the sides and under the pipe haunches. The pea gravel shall be compacted to 85% to 95% of the maximum density obtained by TEX-113E Method.

e. Add 37 inches of additional pea gravel compacted to 85% to 95% of the maximum density obtained by TEX-113E Method.

f. At no time shall rolling equipment or heavy compactors be used over the plastic pipe until the pea gravel in Step e. has been added and compacted.

g. Use fill as specified in drawings and specifications for the remainder of fill above the pipe.

h. Care shall be taken to limit the pea gravel to only the trench areas specified above to prevent fluid flow through the dikes."

*(REVISED BY ADDENDUM NO. 2)

E. SIGN

The project sign as detailed on drawing C-230-008 and located on drawing C-230-001 shall be constructed and erected as soon as possible after construction commences.

Supports for sign shall be creosote treated poles. Face of sign shall be 14 gauge sheet metal secured to medium density overlay plywood. Paints used shall be exterior grade enamels.

F. CAST IRON PIPE

Where shown on drawings cast iron pipe shall be extra heavy cast iron soil pipe. Pipe and fittings shall be as per ASTM-A74 specifications and of even thickness of wall, free from defects and of uniform texture.

G. SALVAGABLE MATERIALS

Any salvagable structural materials existing on site shall become the property of the Owner. These materials shall be as determined by the Engineer."

TIPPETT & GEE, INC.

CONSULTING ENGINEERS

ABILENE, TEXAS

ADDENDUM NO. 1

TO

SPECIFICATIONS AND CONTRACT DOCUMENTS

SITE PREPARATION

GIBBONS CREEK STEAM ELECTRIC STATION

UNIT NO. 1

TEXAS MUNICIPAL POWER AGENCY

Re: Specification No. GC-1022

May 4, 1977

The following changes and additions have been made to the specifications and contract documents. Incorporate these changes and additions in your bid, sign the acknowledgment, and attach a signed copy of the Addendum to each copy of your proposal when submitted.

A. SUMMARY OF PROPOSAL

1. Page SP-2, Item D.1 shall read:
"1. Price per cubic yard for general earth excavation (machine)."

2. Page SP-2, Add Item D.9:
"9. Price per cubic yard for restricted excavation, such as over-excavation in the inspection trenches (machine)."

3. Page SP-2, Add Item D.10:
"10. Price per cubic yard for backfill compacted to 90% maximum density."

B. TECHNICAL SPECIFICATIONS

On Page 11-7, section J. Broadcast Sprigging, introductory paragraphs shall read:

"Broadcast sprigging of Coastal Bermudagrass shall consist of placing 12 inches of top soil (free from noxious weeds or other matter deleterious to the growth of Coastal Bermudagrass), preparing the soil, placing of Coastal Bermudagrass sod, fertilizing the sod, and watering as directed by the Engineer.

"Areas to be sprigged are the top and outside faces of the outer ash disposal dikes, top and outside face of the sludge disposal dike, top and on the slopes of the yard collection pond dam, south slope of the switchyard area, and on the north, east and west slopes of the lignite storage area. Sprigging on the yard collection pond dam shall be discontinued at STA. 60 + 00 on R.R. NO. 3."

C. GENERAL CONDITIONS

On Page 6, section 19. Safety and Protection; Emergencies:, add Paragraph D., as follows:

"D. All work will be performed in accordance with the latest edition of Occupational Safety and Health General Industry Standards and Interpretations, published by the U. S. Department of Labor."

ACKNOWLEDGMENT

The undersigned bidder hereby certifies that the revisions herein set forth have been incorporated in his bid and form a part of the contract documents.

R. N. ADAMS CONSTRUCTION COMPANY Bidder	P.O. BOX 340 Address
Carlatt	KAUFMAN, TEXAS 75142
Vice-President Title	June 28 1977 Date

TIPPETT & GEE, INC.

CONSULTING ENGINEERS

ABILENE, TEXAS

ADDENDUM NO. 2

TO

SPECIFICATIONS AND CONTRACT DOCUMENTS

SITE PREPARATION

GIBBONS CREEK STEAM ELECTRIC STATION

UNIT NO. 1

TEXAS MUNICIPAL POWER AGENCY

Re: Specification No. GC-1022

May 13, 1977

The following changes and additions have been made to the specifications and contract documents. Incorporate these changes and additions in your bid, sign the acknowledgment, and attach a signed copy of the Addendum to each copy of your proposal when submitted.

A. TECHNICAL SPECIFICATIONS

1. On Page V-1, section D, Reinforced Plastic Pipe, add the following paragraph:

"The plastic pipe shall be installed in the following manner:

a. Excavate a trench 43 inches wide in the compacted embankment with the bottom of the trench being 6 inches below the specified grade for the plastic pipe.

b. Place 6 inches of bedding material in the bottom of the trench, consisting of pea gravel (rounded stones ranging in size from 3/16 in. to 3/4 in.) compacted to a minimum of 85% maximum density by the THD Test Method (TEX-113E).

c. Use a rake to loosen a 2 inch deep by 12 inch wide area to form a trough in the center of the ditch to serve as a pipe cradle.

d. Install the plastic pipe and then place 21 inches of pea gravel around the sides and under the pipe haunches. The pea gravel shall be compacted to 85% to 95% of the maximum density obtained by TEX-113E Method.

e. Add 37 inches of additional pea gravel compacted to 85% to 95% of the maximum density obtained by TEX-113E Method.

f. At no time shall rolling equipment or heavy compactors be used over the plastic pipe until the pea gravel in Step e. has been added and compacted.

g. Use fill as specified in drawings and specifications for the remainder of fill above the pipe.

h. Care shall be taken to limit the pea gravel to only the trench areas specified above to prevent fluid flow through the dikes."

2. On Page II-9, section L. Riprap, add the following introductory paragraph:

"Riprap shall be placed as indicated on the drawings and as specified below. The riprap indicated for the outfall pipe of culvert No. 20 shall be placed in a strip 10 feet wide

with the outfall pipe being in the center of the strip. The strip shall start at the end of the outfall pipe and shall extend across the adjacent ditch and two feet up the dike (measured vertically) at the pump complex."

3. On Page I-4, section P. Clarification, add the following paragraph:

"The only pipes to be installed under this contract are the two reinforced plastic pipes in the ash ponds, all concrete pipes in culverts, the C.I. drain pipe in the F.O. Facility dike and the C.I. drain pipe in the Pump Complex dike. The water lines from the Turbine Room to the C. W. Intake Structure and the C. W. Discharge Seal Well and the sewer lines are shown for information purposes only and are not a part of this contract."

4. On Page III-1, section A. 2. Plant Roads, add the following paragraph:

"The location of the centerlines of the plant roads are as indicated on Drawing C-230-001. The approximate starting and stopping points are as indicated below:

Plant Road	START	STOP
a. From plant access road to C. W. Discharge Seal Well	STA. 5 + 50 on Plant Access Road	N374 110, E3 337 605
b. From plant access road to Switchyard	STA. 6 + 00 on Plant Access Road	N372 910, E3 336 755
c. Turnout from plant access road to Switchyard road	STA. 7 + 40 on Plant Access Road	N372 825, E3 336 120
d. From plant access road by office, warehouse and F.O. Facility to Pump at Plant Collection Pond	STA. 10 + 60 on Plant Access Road	N370 580, E3 335 460
e. From the end of the plant access road to the stop of the Plant Haul Road	STA. 15 + 50 on Plant Access Road	N371 735, E3 338 235
f. From curve west of Culvert No. 11 to join road north of Culvert 15	N371 825, E3 336 535	N372 700, E3 337 580
g. From curve near Culvert No. 19 to C. W. Intake Structure	N372 300, E3 338 140	N371 925, E3 338 640
h. Connecting road between two curves in Haul Road	N369 870, E3 337 260	N369 870, E3 337 470
i. From curve in Haul Road to Storage Silos	N369 855, E3 337 115	N370 740, E336 985"

5. On Page III-1, section A. 4. Plant Access Haul Road, the paragraph shall be changed to read as follows:

"The plant access haul road will not be constructed in final form under this site preparation contract. The typical access haul road section on Drawing C-230-009 indicates 18 in.

of flexible base and 30 in. of lime stabilization. This flexible base and lime stabilization shall be omitted for the site preparation contract. The top of the road profile established by Drawings C-230-001 and C-230-009 remains unchanged as the 18 in. of flexible base and 30 in. of lime stabilization shall be replaced with 4 feet of controlled compacted fill (CCF)."

6. On Page III-1, section A. Plant Roads, add the following section:

"5. Haul Roads:

Haul roads in the plant area shall be constructed in accordance with section 16, Drawing C-230-004. For this site preparation contract, the haul roads shall be temporary roads for use during construction and will be built in final form at a later date by a later contract.

The location of the centerline of the haul roads are as indicated on Drawing C-230-001. The approximate starting and stopping points are as indicated below:

Haul Road	START	STOP
a. From Lignite Receiving Hopper loop to Fly Ash Dispensing Facility	N369 735, E3 337 350	N371 735 E3 338 235
b. From Lignite Receiving Hopper, across Culvert No. 22, to join Access Haul Road	N369 510, E3 337 265	N369 210 E3 337 110"

7. On Page III-1, section A. 3. Plant Railroads, the paragraph shall be changed to read as follows:

"3. Plant Railroads:

Railroads 1, 2 and 3 shall be built to profile grade only. For Railroads 1 and 2, this will include the 12 in. of lime stabilization above the subgrade. However, the 12 in. of lime stabilization for Railroad No. 3 shall be omitted.

Since Railroad No. 3 will be constructed at a much later date, it shall be sprigged with Coastal Bermudagrass under this site preparation contract. The 12 inches of topsoil specified for sprigging shall be substituted for the 12 inches of lime stabilization. The extent of sprigging shall consist of sprigging the railroad bed (30 feet in width) and 15 feet (measured horizontally) on each side. The sprigging shall commence at STA. 60 + 00 on Railroad No. 3 (limits of sprigging on the yard collection pond dam) and shall be discontinued at approximately STA. 94 + 60 where riprap has been specified. The sprigging between STA. 60 + 00 and STA. 94 + 60 shall be continuous, except where the Plant Access Road is crossed. At this crossing, Drawing C-230-006 (typical road section) shall be adhered to. Also, Railroad No. 3 shall be sprigged in a similar manner from STA. 6 + 50 to STA. 19 + 75."

B. DRAWINGS:

C-230-001	Revised per Addendum No. 2 - Revised orientation of section markers 3, 4, 5 and 6.
C-230-002	Revised per Addendum No. 2 - Added Borings B-77 through B-88.

C-230-004	Revised per Addendum No. 2 - Changed 6 in. crushed limestone to read 6 in. flexible base.
C-230-007	Revised per Addendum No. 2 - Revised letters M, N, O, P and Q in Section - Culvert #20 to show actual bar sizes and added Note 1.

ACKNOWLEDGMENT

The undersigned bidder hereby certifies that the revisions herein set forth have been incorporated in his bid and form a part of the contract documents.

R. N. ADAMS CONSTRUCTION COMPANY
Bidder

P.O. BOX 340
Address

Arbatt

KAUFMAN, TEXAS 75142

Vice-President
Title

JUNE 28, 1977
Date

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE, TEXAS

ADDENDUM NO. 3

TO

SPECIFICATIONS AND CONTRACT DOCUMENTS

SITE PREPARATION

GIBBONS CREEK STEAM ELECTRIC STATION

UNIT NO. 1

TEXAS MUNICIPAL POWER AGENCY

Re: Specification No. GC-1022 May 18, 1977

The following changes and additions have been made to the specifications and contract documents. Incorporate these changes and additions in your bid, sign the acknowledgment, and attach a signed copy of the Addendum to each copy of your proposal when submitted.

A. TECHNICAL SPECIFICATIONS

1. On Page III-1, Section A.1. Plant Access Road, the paragraph shall be changed to read as follows:

"As indicated on Drawing C-230-006, the plant access road shall consist of a 9" lime stabilized subgrade, a 9" flexible base and a 2" H.M.A.C. pavement. Drawing C-230-006 shows this profile to STA. 15 + 50; however, for the site preparation contract this profile shall stop at STA. 11 + 00. From STA. 11 + 00 to STA. 15 + 50 the plant access road shall be constructed in accordance with Section 17, Drawing C-230-004."

2. On Page IV-1, Section C. SEAL COAT, the paragraph shall be changed to read as follows:

"C. SEAL COAT

This item shall consist of a surface treatment composed of a single application of asphalt covered with aggregate for the sealing of future building foundations in accordance with these specifications.

1. The office (80' x 140'), north warehouse (80' x 150'), south warehouse (80' x 150'), and the maintenance building (300' x 150') areas shall be seal-coated under this site preparation contract.

2. After final grade has been achieved at the location of the office, warehouses and maintenance buildings, the soils encountered at grade shall be scarified to a depth of six inches, recompacted and immediately protected by an asphalt seal coat.

3. The seal coat shall be in accordance with Texas Highway Department '1972 Standard Specifications for Construction of Highways, Streets and Bridges', Item 316.

4. The aggregate shall be Type A, Grade 4.

5. Good drainage shall be provided around these seal-coated areas so that water will not pond in the low spots."

3. On Page IV-1, Section IV. SUBBASE AND BASE COURSES, add the following sections:

"D. H.M.A.C. PAVEMENT

This item shall consist of a base course, a leveling-up course, a surface course or any combination of these courses as shown on the plans, each to be composed of a compacted mixture of mineral aggregate and asphaltic material.

1. The 2" of H.M.A.C. pavement shall be in accordance with Texas Highway Department '1972 Standard Specifications for Construction of Highways, Streets and Bridges', Item 340.

2. The paving mixture shall be Type D (Fine Graded Surface Course).

3. The lab density shall be not less than 95% nor greater than 99% of theoretical density with HVEEM stability greater than 30%.

E. ONE COURSE SURFACE TREATMENT

This item shall consist of a wearing surface composed of a single application of asphaltic material covered with aggregate, constructed on the prepared base course or surface in accordance with these specifications.

1. The one course surface treatment shall be in accordance with Texas Highway Department '1972 Standard Specifications for Construction of Highways, Streets and Bridges', Item 320.

2. The aggregate shall be Type A, Grade 4."

4. On Page II-7, Section J. BROADCAST SPRIGGING, it shall be changed to read as follows:

"J. BROADCAST SPRIGGING

Broadcast sprigging of Coastal Bermudagrass shall consist of placing 12 inches of top soil (free from noxious weeds or other matter deleterious to the growth of Coastal Bermudagrass), preparing the top soil, fertilizing the area, placing of Coastal Bermudagrass sprigs, disking, rolling and watering as directed by the Engineer.

Areas to be sprigged are listed as follows:

a. Top and outside slopes of the outer ash disposal dikes.

b. Top and outside slopes of the sludge disposal dike.

c. Top and slopes (outside and inside) of the yard collection pond dam.

d. South slope of switchyard area.

e. North, east and west slopes of the lignite storage area.

f. Railroad No. 3

1. Planting Season:

All sprigging shall be done between the average date of the last freeze in the Spring (March 1) and six weeks prior to the average date for the first freeze in the Fall (December 4).

2. Materials:

Coastal Bermudagrass sprigs shall be obtained from a live growing source having a healthy virile root system of dense, thickly matted roots throughout the soil. Sprigs which have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted shall be rejected.

The sprigs shall be free from noxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. The sprigs shall come from a source that has been closely pastured, burned, or closely mowed and raked to remove all weeds and long standing stems. Sources from which sprigs are taken shall be approved by the Engineer.

Care shall be taken at all times to keep the sprigs moist and protected from the sun and wind from the time they are dug until planted. When so directed by the Engineer, the sprig source shall be watered to the extent required prior to digging. The time between digging and planting shall not exceed 24 hours.

Sprigs shall be delivered to the planting site in a loose condition, or may be baled if desired by the contractor. Sprigs shall be free of native soil.

3. Soil Preparation:

The top soil on which sprigging is to be placed shall be loosened by disking or other approved method to a depth of not less than 4 inches. All large clods shall be pulverized and boulders, rocks or other debris shall be removed until in the opinion of the Engineer, a friable, firm seedbed is prepared. The contractor shall take full advantage of weather conditions, but the work may be suspended when in the judgment of the Engineer, the continuation of the same may result in unfavorable planting conditions. When so directed by the Engineer, the planting site shall be watered to the extent required prior to planting. After the planting site has been prepared for sprigging, fertilization shall be uniformly distributed over the area in accordance with the provisions of Item 5., Fertilizer.

4. Sprigging:

The sprigs shall be broadcast by hand or mechanically spread over the prepared area at a minimum rate of 75 cubic feet of baled, live springs per acre.

The sprigs shall be immediately disked under to a depth of 2 to 3 inches.

The sprigged area shall then be rolled with a corrugated roller of the 'cultipacker' type. All rolling of slope areas shall be on the contour.

The area shall then be thoroughly watered and kept in a moist condition as directed by the Engineer.

5. Fertilizer:

Fertilizer shall be applied at planting time and after growth is established to insure a satisfactory cover. Fertilizer types and rates of application are as follows:

a. Planting time

Rates of Application (lbs/acre)		
$\frac{N}{40}$	$\frac{P_2O_5}{40}$	$\frac{K_2O}{0}$

Mixture of: Ammonium Nitrate (33.5-0-0) 120 lbs per acre
Superphosphate, triple (0-46-0) 87 lbs. per acre

b. Growth Established

Rates of Application (lbs/acre)		
$\frac{N}{40}$	$\frac{P_2O_5}{0}$	$\frac{K_2O}{0}$

6. Watering:

The sprigged area shall be watered at such times and in the manner and quantity as directed by the Engineer."

5. On Page II-9, Section L, RIPRAP, the Section shall be changed to read as follows:

"L. RIPRAP

18 inches of riprap shall be placed in the following areas:

1. Plant Collection Pond.
2. C. W. Intake Canal
3. In areas specified for riprap that join the lake.

12 Inches of riprap shall be placed in the following areas:

1. At the discharge of Culvert No. 20.
2. Southwest of the sludge disposal pond (Drwg.C-230-001)
3. In the future coal receiving area (Drwg.C-230-001)

1. Material:

a. Stone for riprap shall be durable and of a suitable quality to insure permanence in the structure and in the climate in which it is to be used. It shall be free from cracks, seams and other defects which would tend to unduly increase its deterioration from natural causes and it shall be reasonably well graded between the prescribed limits as specified. Material will be rejected when failing to meet the following specification requirements:

b. The riprap shall meet the following tests:

1. Soundness in magnesium sulfate

The riprap stone shall have a maximum loss of 20% on a weighted average at 5 cycles when tested for soundness in magnesium sulfate in accordance with ASTM Standard C-88. The test for soundness of aggregate by use of sodium sulfate shall be run using particles passing a 2-1/2 inch sieve and retained on a 1-1/2 inch sieve. After final drying the material will be screened over the 1-1/4 inch sieve.

2. Resistance to Abrasion

The riprap shall have maximum percent of wear of 35% after 1,000 rev. as determined by ASTM designation C-535, Grading 1.

c. The riprap shall meet the following gradation requirements:

18 inch Riprap		12 inch Riprap	
U.S. Stand. Sieve Size	Specification Limits % Passing	U.S Stand. Sieve Size	Specification Limits % Passing
18 in.	100	12 in.	90-100
12 in.	30-50	8 in.	40-60
8 in.	0-15	6 in.	10-30
6 in.	0-5	3 in.	0-20

d. Place in manner to insure that largest rock fragments are uniformly distributed and that smaller rock fragments serve to fill spaces between larger rock fragments in such manner as will result in dense uniform course of riprap.

e. Riprap may be placed by dumping and shall be placed to its full course thickness in one operation. Hand placing to limited extent may be used only to extent necessary to secure specified results.

f. Average Thickness Riprap Courses:

Not less than full thickness indicated, except tolerances of 4 in. from slope lines and grades will be allowed to finish surfaces, provided extremes of such tolerance shall not occur within areas less than 10 feet square.

2. Placing:

The riprap shall be placed on a 6 inch layer of blanket material which shall meet the following gradation requirements:

6 Inch Blanket Material	
U.S. Standard Sieve Size	Specification Limits % Passing
3 in.	95-100
1-1/2 in.	80-100
3/4 in.	65-84
3/8 in.	54-68
#4	43-58
#40	5-24
#100	0-10

a. The blanket material shall meet the following tests:

1. Soundness in magnesium sulfate

The blanket material shall have a maximum loss of 25% on a weighted average at 5 cycles when tested for soundness in magnesium sulfate in accordance with ASTM Standard C-88. The 'Test for Soundness of Aggregate by use of Sodium Sulfate' shall be run using particles passing a 2-1/2 inch sieve and retained

on a 1-1/2 inch sieve. After final drying, the material shall be screened over the 1-1/4 inch sieve.

2. Resistance to Abrasion

The blanket material shall have a maximum percentage of wear of 35% after 1,000 rev. as determined by ASTM designation C-535, 'Method of Test for Resistance to Abrasion of Large Size Coarse Aggregate by Use of the Los Angeles Abrasion Machine,' Grading 1.

b. The blanket material shall be durable and of a suitable quallty to insure permanence in the structure. It shall contain no organic matter and meet the above gradation requirements."

6. On Page II-3, Section F. FILL, add the following paragraph:

"The following Sections, Class 1, Regular Compacted Fill and Class 2, Controlled Compacted Fill specify 90% and 95%, respectively, of the maximum density obtained by the Texas Highway Department Method (TEX-113 E). However, when highly plastic clays are encountered, the Standard Compaction Test (ASTM D-698) shall be used. For highly plastic clays, Class 1 and Class 2 fill shall be compacted to 90% and 95% respectively, of the maximum density obtained by the Standard Compaction Test (ASTM D-698)."

7. On Page V-1, Section V. MISCELLANEOUS ITEMS, add the following section:

"G. SALVAGABLE MATERIALS

Any salvagable structural materials existing on site shall become the property of the Owner. These materials shall be as determined by the Engineer."

8. On Page II-5, Section 3, Surplus Fill Material, the paragraph shall be changed to read as follows:

"The dirt balance will result in a considerable surplus of fill material. This material shall be stockpiled west of the plant (bounded by Highway 244, Plant Access Road, Railroad No. 3 and the Plant Access Haul Road) and in other areas as approved by the Engineer. The stockpiled material shall be placed in a manner that would not obstruct existing drainage flows nor be placed in a manner that could be easily washed down stream.

B. SUMMARY OF PROPOSAL

On Page SP-2, Add Item D.11:

"11. Price per cubic yard, per mile transported for transporting surplus fill material for stockpiling to areas not yet designated."

ACKNOWLEDGMENT

The undersigned bidder hereby certifies that the revisions herein set forth have been incorporated in his bid and form a part of the contract documents.

R. N. ADAMS CONSTRUCTION COMPANY Bidder	P.O. BOX 340 Address
Garlett	KAUFMAN, TEXAS 75142
Vice - President Title	JUNE 28 1977 Date

TEXAS MUNICIPAL POWER AGENCY

CONSTRUCTION CONTRACT

LETTER OF INTENT

The Texas Municipal Power Agency ("TMPA") hereby awards to R.N. Adams Construction Company ("Contractor") a contract for the construction of Site Preparation (GC-1022) for Gibbons Creek Steam Electric Station ("Contract").

Further terms and conditions of the Contract shall be defined in a written agreement to be executed by TMPA and Contractor, at which time, such terms and conditions shall relate back to the date of this Letter of Intent, and govern all of Contractor's activities under the Contract.

Pending execution of the written agreement, or in the event a written agreement is not executed, Contractor and TMPA will remain legally obligated to each other under this Letter of Intent according to the following conditions.

1. The total price for the Contract shall be $5,869,991.54.

2. Contractor will use Contractor's best professional efforts in performing the Contract under this Letter of Intent.

3. The item or items purchased by TMPA will be as described in the attached Work Order Attachment.

4. The date for completion of the Contract shall be March 1, 1978.

5. Contractor shall be an independent contractor, but TMPA shall exercise and have the right to exercise control over the day to day activities of Contractor.

6. This Letter of Intent, and Contractor and TMPA's performance of the Contract shall be governed by the laws of the State of Texas.

DATED this 21st day of June, 1977.

TMPA

BY: Paul R. C

ACCEPTED BY CONTRACTOR

R. N. ADAMS CONSTRUCTION COMPANY

BY: Gilbert Vice Pres.

June 27, 1977

(DATE)

WORK ORDER ATTACHMENT
GIBBONS CREEK STEAM ELECTRIC STATION
UNIT #1
SITE PREPARATION
CONTRACT GC-1022

Item A.1	Material and Equipment	$3,006,929.71
Item A.2	Labor	2,863,061.83
	TOTAL WORK ORDER	$5,869,991.54

All of the above in accordance with Contract Specification GC-1022, R. N. Adams Construction proposal dated May 24, 1977 and subsequent letter dated May 25, 1977.

TEXAS MUNICIPAL POWER AGENCY

600 ARLINGTON DOWNS TOWER

2225 E. RANDOL MILL ROAD

ARLINGTON, TEXAS 76011

(817) 461-4400

July 6, 1977

LETTER OF CONTRACT AGREEMENT

BETWEEN: R.N. Adams Construction Co.
P.O. Box 340
Kaufman, Texas 75142

AND: Texas Municipal Power Agency
Suite 600, Arlington Downs Tower
2225 E. Randol Mill Road
Arlington, Texas 76011

FOR: Site preparation construction.

This letter of contract agreement shall be in effect for the period July 1, 1977 to March, 1978 authorizing R.N. Adams Construction Co. to perform the above indicated work for the Texas Municipal Power Agency. Attached is Work Order No. 136; this work order number should be referenced in all pertinent correspondence and billings. Work shall be directed by instructions from Mr. F. K. Smith. All billing shall be monthly and directed to Texas Municipal Power Agency, Suite 600, 2225 E. Randol Mill Road, Arlington, Texas. Attention: Accounting.

Progress reports shall be directed to Mr. F.K. Smith.

Please note that the amount of this work order cannot be exceeded without prior written authorization from the appropriate officials of the Agency. Amounts billed in excess of written authorization will not be paid by the Agency.

Please note that no work is to commence until you have been issued the "Notice to Proceed" from T.M.P.A.
APPROVED:

_____ Date: July 14, 1977
R.N. Adams Construction Co.
Title: Vice President

_____ Date: _____
Paul R. Cunningham
General Manager
TEXAS MUNICIPAL POWER AGENCY.

cc: L.S. Gee
Sam Skinner
F.K. Smith
John Turlak
Mary Smith.

TEXAS MUNICIPAL POWER AGENCY
600 ARLINGTON DOWNS TOWER
2225 E. RANDOL MILL ROAD
ARLINGTON, TEXAS 76011
(817) 461-4400

July 7, 1977

R. N. Adams Construction Company
P.O. Box 340
Kaufman, Texas 75142

Attn: Mr. R. N. Adams

SUBJECT: GC-1, G-1022
Site Preparation
Notice To Proceed

Dear Mr. Adams:

Your attention is called to Item L., Priorities and Completion Dates on Page 1-3 of Specifications and Contract Documents For Site Preparation, GC-1022, for Gibbons Creek Steam Electric Station. Reference is made to completion items after Notice To Proceed.

This letter is your official Notice To Proceed. Work should begin on July 11, 1977.

Please sign in the appropriate place and return this letter to the TMPA.

Very truly yours,

F. K. Smith, P.E.
Project Manager

FKS/JGT/js

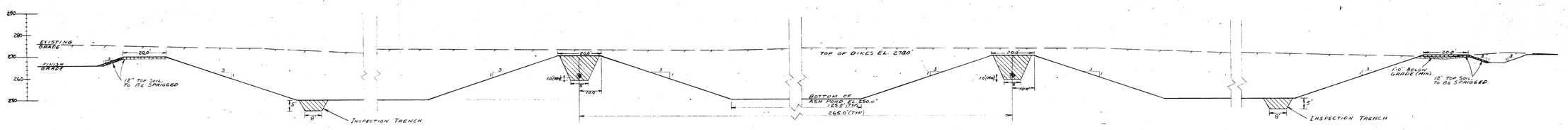
ACKNOWLEDGED:

R. N. Adams
R. N. Adams Construction Company

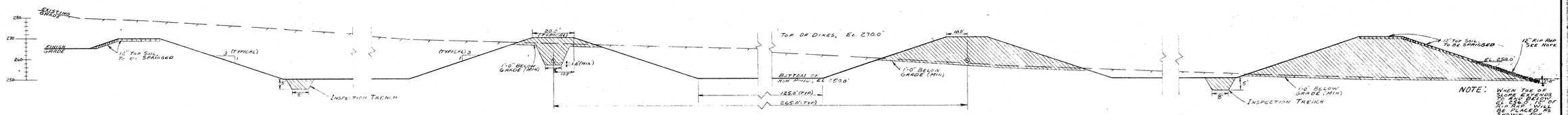
President
Title

cc: Paul R. Cunningham, TMPA
A. H. Eubanks III, TMPA
Sam Skinner, TMPA
L. S. Gee, Tippett & Gee

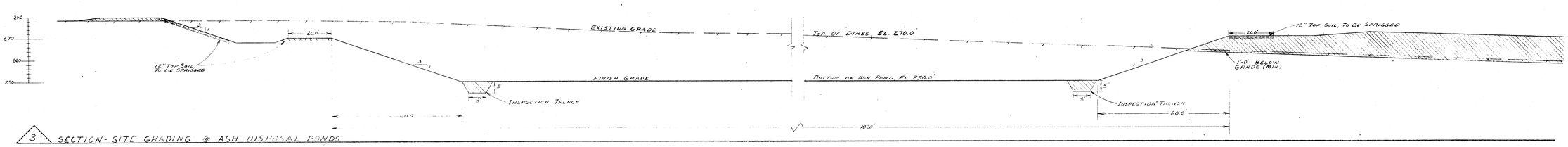
T&G 1977b *Sections, Site-Grading, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Drawing No. C-230-003*, Tippet & Gee, Inc. April 21, 1977, revised October 28, 1977.



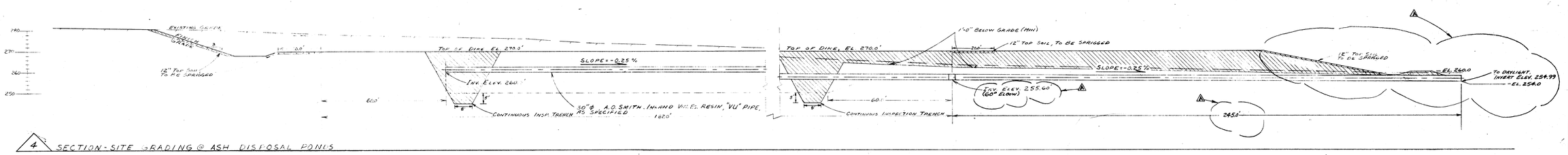
1 SECTION - SITE GRADING @ ASH DISPOSAL PONDS



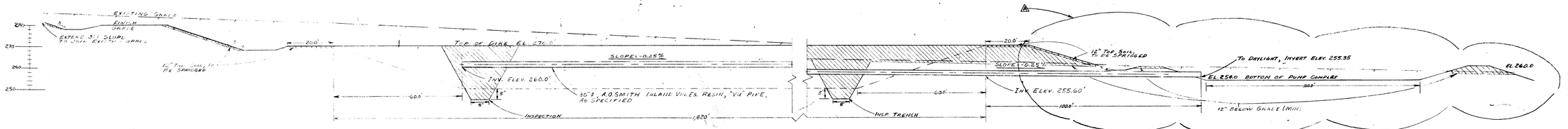
2 SECTION - SITE GRADING @ ASH DISPOSAL PONDS



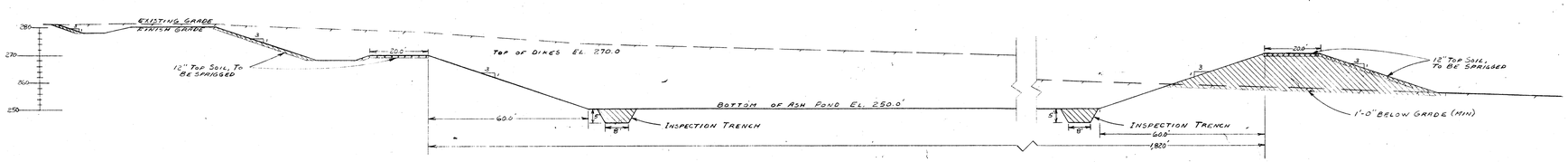
3 SECTION - SITE GRADING @ ASH DISPOSAL PONDS



4 SECTION - SITE GRADING @ ASH DISPOSAL PONDS



5 SECTION - SITE GRADING @ ASH DISPOSAL PONDS



6 SECTION - SITE GRADING @ ASH DISPOSAL PONDS

NOTES

REV	DATE	BY	DESCRIPTION
A	10-28-77	JLW	ADDED 30' OF PIPE TO SEC. 4 & 11' OF PIPE TO SEC. 5

SCALE 1"=20'
DRAWN JLW
DATE 4-21-77
CHECKED WGH
APPROVED WGH, JLW

LOUIS A. SCOTT 1935 · W. G. HUNT 13137 · JAMES W. GEE 3081

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

GIBBONS CREEK S.E.S.
UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

SECTIONS
SITE-GRADING

JOB NO. GC-1022 REV. A
DRAWING NO. C-2[illegible]

T&G 1978 *Plant Site Layout, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Drawing No. C-230-001*, Tippet & Gee, Inc. April 21, 1977, revised August 28, 1978.

NOTE:

MAXIMUM PROBABLE FLOOD STAGE - 254.5'
TOP OF CONSERVATION STORAGE - 245.0'
AVERAGE OPERATING LEVEL - 243.5'
NORMAL LOW OPERATING LEVEL - 240.0'
MINIMUM OPERATING LEVEL - 234.3'

℄ TOP OF DIKE IS PARALLEL TO R.R. NO. 2 S 2°-1'-53" W

℄ OF NORTHWEST WALL OF C.W. INTAKE STRUCTURE N 371 875 E 3 338 750

NOTE: FINISH CONTOURS OF INT. [illegible] PLANT PARKING AREA ARE [illegible] REVISED

MAIN-LK. SEC. FENCE

ASH DISPOSAL PONDS (3)

ASH HANDLING AREA

INTERFACE WITH FGD PLANT HAUL ROAD

FGD PLANT ROAD

PLANT R.R. #1

PLANT R.R. #2

CONTOURS IN THIS AREA TO BE FURNISHED UNDER A SEPARATE CONTRACT

RIP RAP AS INDICATED STA 4+40 TO FGD PLANT ROAD FROM EL 250 TO EL 258 AS INDICATED

C.W. DISCHARGE SEAL WELL

DELETE CULVERTS C-14 & C-15

C.W. LINES

UNIT NO. 2 AREA - (FUTURE)

FUTURE SLUDGE DISPOSAL AREA

LIMESTONE FACILITY

LIGNITE DEAD STORAGE

SLUDGE DISPOSAL POND 3:1 SIDE SLOPES

CONVEYORS

STORAGE SILOS

TRANSFER HOUSE

RAILROAD TRESTLE

PRECIPITATOR

SCRUBBERS

BOILER

SEWAGE PUMP STATION

MAINTENANCE

RELOCATE C.W. LINE TO HERE

STOP CONSTRUCTION ROAD

FUTURE COAL REC.

PLACE 6" NAVASOTA BASE & CONSTRUCT 20' x 110' TEMPORARY SHED

RIPRAP AS INDICATED

GUARD HOUSE

OPEN STORAGE

FUEL OIL FACILITY

FUTURE FENCE BY OTHERS

℄ NORTH HEADWALL OF CUL. C-25A LOCATED 1'-0" OUTSIDE FUTURE FENCE OR N 371,870.5

PLANT COLLECTION POND. LIMITS OF RIP RAP ON POND SLOPES 12% BETWEEN EL 244.0' & EL 254.0'

CONSTRUCTION PARKING

SIDE SLIDE ELEC. GATE LATER CONTRACT

℄ SOUTH HEADWALL OF CULVERT C-25B IS LOCATED 1'-0" OUTSIDE FUTURE FENCE OR N 371,679.5

N 373,140.00 E 3,335,500.00 INTERFACE WITH FGD PLANT ACCESS ROAD

PROJ. SIGN TO BE INSTALLED NEAR INTERSECTION OF FM 288 & PLANT ACCESS ROAD

PLANT R.R. #3 (FOR UNIT #2 IN FUTURE)

CHAIN-LK. SEC. FENCE

RIP RAP AS INDICATED

SLOPES ARE 6:1 AS PER CHG. ORDER NO. 3

MATCH LINE A-A

MATCH LINE B-B

NOTES
1. PLANT ACCESS ROAD ——— (P.A.R.)
2. PLANT ROAD ——— (P.R.)
3. HAUL ROAD ——— (H.R.)
4. MINIMUM RADIUS OF CURVATURE FOR HAUL ROADS IS 100'
5. EXISTING CONTOURS ——— 250 ———
6. FINISH CONTOURS ——— 250 ———
7. AREAS UNDER SEPARATE CONTRACT
8. RAILROAD ——— ——— ———
9. SEWER LINES ——— ——— ———

REV	DATE	BY	DESCRIPTION
E	8-28-78	KZL	ADDED CULVERTS C-25A & C-25B, RELOCATED WAREHOUSE & FENCE.

REV	DATE	BY	DESCRIPTION
	5-18-77	JLW	REVISED ORIENTATION OF SEC. MARKERS, S.A.S.E.
A	8-3-77	JLW	ADDED TRACKYARD, CHANGED COORDINATES OF C.W. INTAKE STRUCTURE, ETC. FOR FGD SYSTEM
B	8-29-77	JLW	REVISED STRUCTURE ENC. (SEE) AND CONTOURS, RELOCATED CONVEYORS, C-13, C-14 & ASSOCIATED ROADS, REMOVED TRANSFORMER, CULVERTS, VALLEY TO ASH DISP. POND, ENLARGED TURBINE ROOM, ETC.
A	10-4-77	JLW	RELOCATE CULVERT C-22, ADDED P.R. #3, STACK & MODIFIED LIGNITE ROAD
C	4-14-78	LTE	ADDED PARKING AREA, ROAD TO C.W. INTAKE STRUCTURE & MISC. CHANGES
D	6-14-78	LTE	ADDED CULVERTS C-25A & C-25B, RELOCATED WAREHOUSE & FENCE.

SCALE 1"=200'
DRAWN R.A.B. / J.K.W.
DATE 8-21-77
CHECKED WSH
APPROVED JGH, JLW

LOUIS S. GEE 9930 — WILLIAM C. HOLLOWAY 15137 — JAMES L. WEBB 36691 — REGISTERED PROFESSIONAL ENGINEER — STATE OF TEXAS

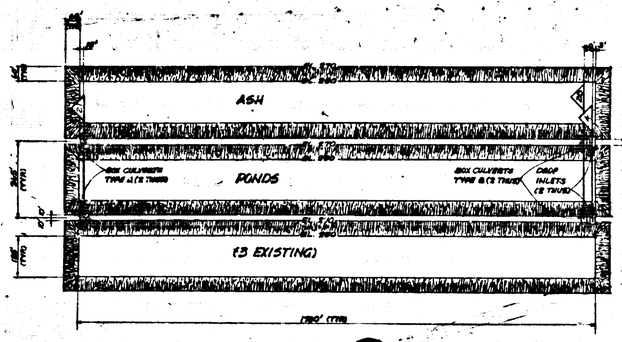
TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

GIBBONS CREEK S.E.S.
UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

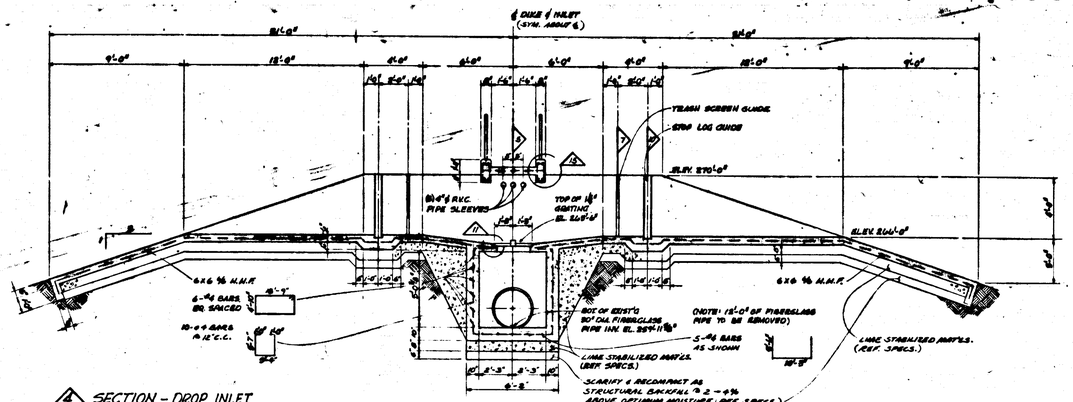
PLANT SITE LAYOUT

JOB NO.	REV.
GC-1022	E
DRAWING NUMBER	
C-230-00	

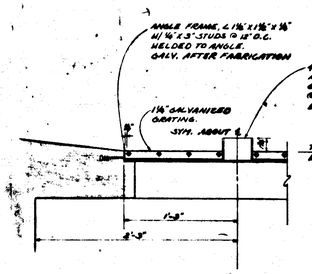
T&G 1979a *Ash Ponds – Drop Inlets & Culvert Plans & Sections, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Drawing No. 15-C-235*, Tippet & Gee, Inc. January 16, 1979, revised August 16, 1979.



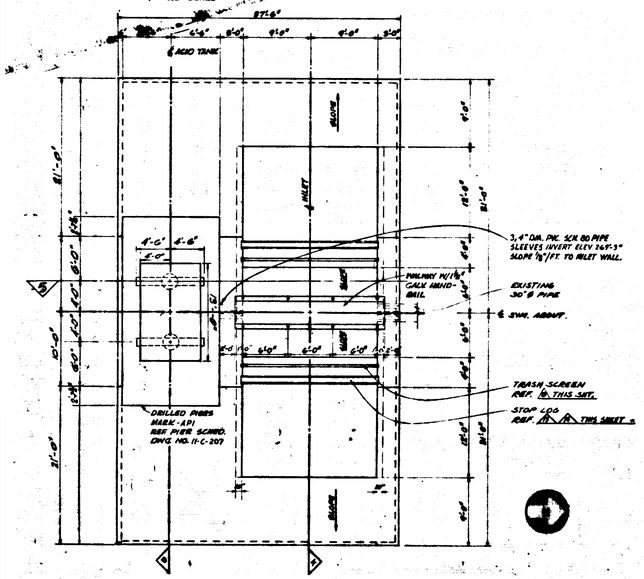
1 KEY PLAN - ASH PONDS
NO SCALE



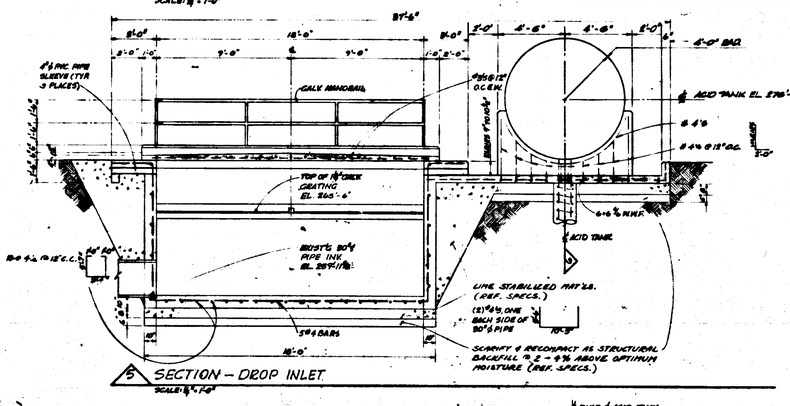
4 SECTION - DROP INLET
SCALE: ½" = 1'-0"



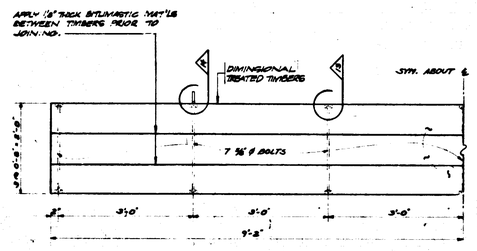
11 SECTION
SCALE: 1½" = 1'-0"



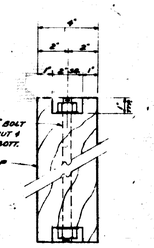
2 PLAN - DROP INLET @ ASH DISPOSAL POND (2 THUS)
SCALE: ⅜" = 1'-0"



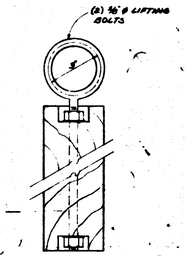
5 SECTION - DROP INLET
SCALE: ½" = 1'-0"



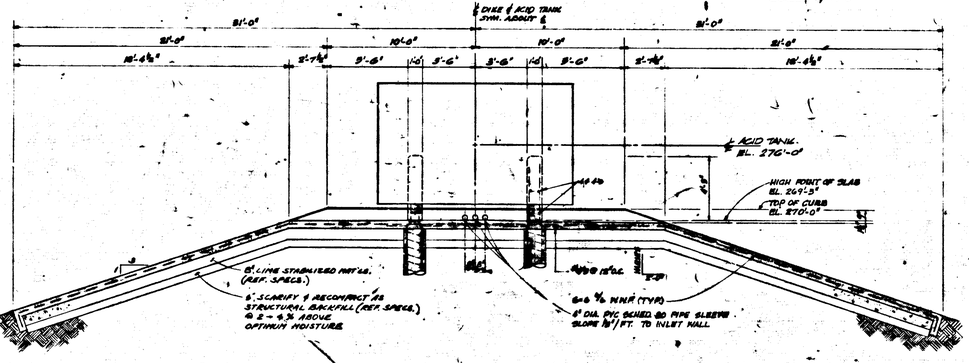
12 STOP LOG DETAILS (4 THUS, AS SHOWN, FOR DROP INLETS)
SCALE: ¾" = 1'-0"



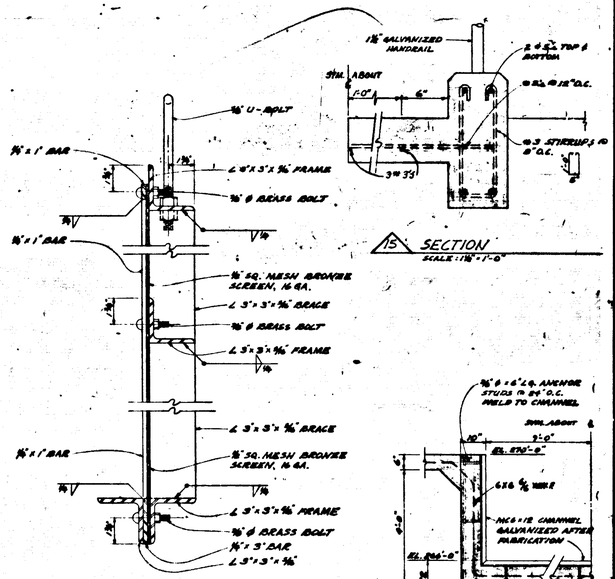
13 SECTION
SCALE: 3" = 1'-0"



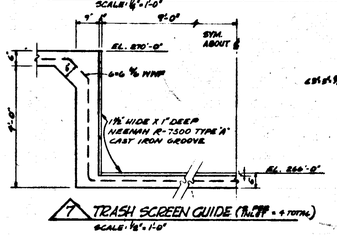
14 SECTION
SCALE: 3" = 1'-0"



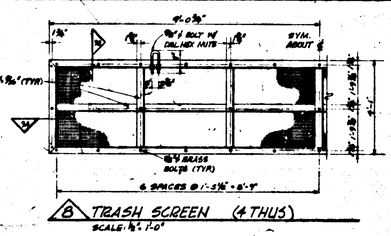
6 SECTION - ACID TANK @ DROP INLET
SCALE: ½" = 1'-0"



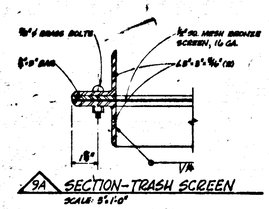
15 SECTION
SCALE: 1½" = 1'-0"



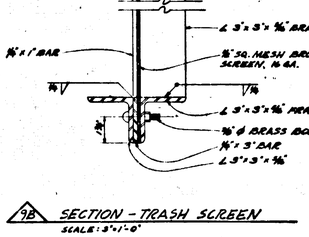
7 TRASH SCREEN GUIDE (2 THUS = 4 TOTAL)
SCALE: 1½" = 1'-0"



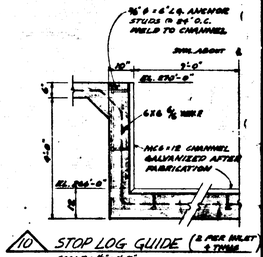
8 TRASH SCREEN (4 THUS)
SCALE: ½" = 1'-0"



9A SECTION - TRASH SCREEN
SCALE: 3" = 1'-0"



9B SECTION - TRASH SCREEN
SCALE: 3" = 1'-0"



10 STOP LOG GUIDE (2 PER INLET & TYING)
SCALE: ½" = 1'-0"

246

NOTES:

NO.	DATE	BY	DESCRIPTION
1	1/16/79	WF	RELEASED FOR CONST. NO CHANGES FROM ORIGINAL

SCALE	AS SHOWN
DRAWN	DJT
DATE	1-16-79
CHECKED	L.W.
APPROVED	C.A.O.

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

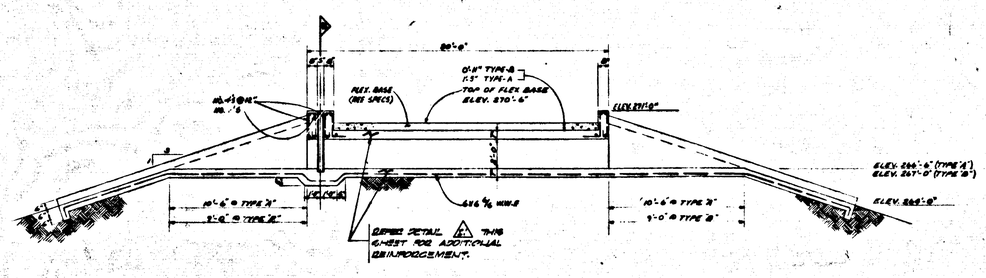
GIBBONS CREEK S.E.S.
UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

ASH PONDS - DROP INLETS & CULVERT PLANS & SECTIONS

JOB NO.	REV.
80-1200	1
DRAWING NUMBER	
15-C-235	

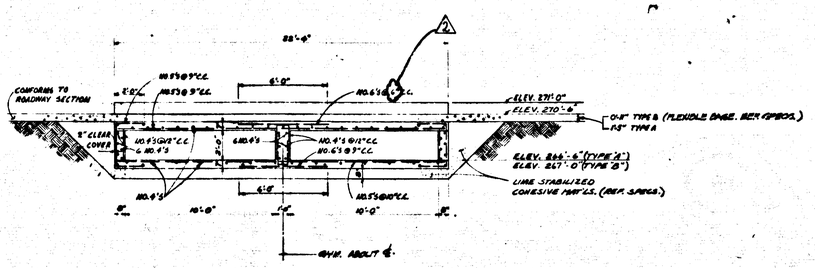
DRAWING NUMBER
15-C-235 R1
DRAWING NUMBER

T&G 1979b *Ash Ponds – Drop Inlets & Culvert Sections & Details, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Drawing No. 15-C-236*, Tippet & Gee, Inc. June 1, 1979, revised June 25, 1981.



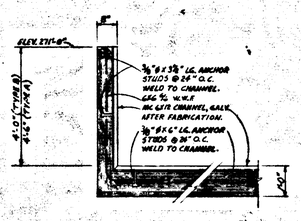
20 SECTION - BOX CULVERTS

15-C-235 SCALE: 3/8"=1'-0"



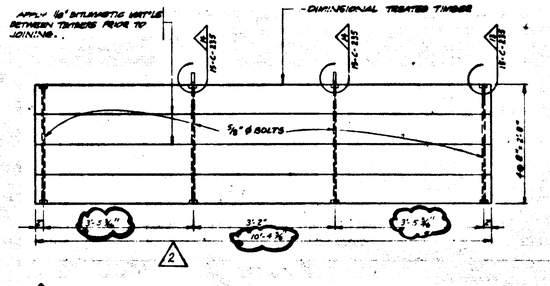
21 SECTION BOX - CULVERTS

15-C-235 SCALE: 3/8"=1'-0"



22 STOP LOG GUIDE

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



23 STOP LOG DETAILS (6 THUS, AS SHOWN, FOR BOX CULVERTS)

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

NOTES:

NO.	BY	DATE	DESCRIPTION
1	WRIGHT	12/27/78	WIZZARD RE-COPY FOR CHANGES FROM ORIGINAL
2	L.W.	4/25/81	REV. DIMENSION AT DETAILS 2 & 3

SCALE	AS NOTED
DRAWN	DT/LB
DATE	6-1-79
CHECKED	L.W.
APPROVED	G.A.D.

TIPPETT & GEE, INC.
CONSULTING ENGINEERS
ABILENE TEXAS

GIBBONS CREEK S.E.S.
UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

ASH PONDS - DROP INLETS & CULVERT SECTIONS & DETAILS

JOB NO.	REV.
80-1200	2
DRAWING NUMBER	
15-C-236	

RELEASE FOR CONSTRUCTION

247

DRAWING NUMBER
15-C-236 A-2

T&G 1981 *Ash Pond Lining Certification, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency,* Tippet & Gee, Inc., March 13, 1981.

1. P S 1106 ENTERED TO RMS
2. File FILE COPY

Tippett & Gee
Consulting Engineers
502 NORTH WILLIS STREET ABILENE, TEXAS 79603 PHONE 673-8291 AREA CODE 915
TELEX: 739457 TIP&GEE ABI

March 13, 1981

FILE COPY

RECEIVED TMPA
MAR 17 1981

Mr. John Turlak, P. E.
Project Engineer
Texas Municipal Power Agency
600 Arlington Downs Tower
Arlington, TX 76011

Re: GLT-2920
GC-1100
General Construction
ASH Pond Lining Certification
Gibbons Creek S.E.S.
Unit No. 1
TMPA

Dear Mr. Turlak:

Attached are four bound reports from National Soils Services (NSS). These reports essentially certify that the Ash Ponds now meet the requirements outlined by the Texas Department of Water Resources.

We have previously forwarded to TMPA similar certifications by NSS for the Sludge Pond and the Plant Collection Pond. Accordingly, all ponds requiring special linings at the plant site proper are now certified by NSS.

Please give these reports to Mr. Dean Mathews for his use. These four reports consist of both Tippett & Gee copies and two copies received from Construction Management. We have retained a xerox copy and it is my understanding that TMPA, CM-Document Control has retained one bound set.

Yours truly,

TIPPETT & GEE, INC.

Larry Webb

Larry Webb, P. E.

JLW/bch
Encl.
cc: Mr. Edwin Broesche, T&G, INC.
Mr. Sam Skinner, TMPA, CM

original Reports:
1 - GC-1100
1 - John Moffat
1 - TxDWR
1 - B-3319 Application Permit File

TMPA 1983a *GCSES, C-5610 Seepage from GCSES Sludge Pond,* Ed Wagoner, TMPA, May 20, 1983.

TMPA

ving e cities of Bryan, Denton, Garland & Greenville.

ATTACHMENT 1

May 20, 1983

Subject: GCSES, C-5610
Seepage From GCSES Sludge
Pond

Mr. Dick Whittington
Regional Administrator
USEPA, Region VI
1201 Elm Street
Dallas, Texas 75270

Dear Mr. Whittington:

The Sludge Pond at our Gibbons Creek Steam Electric Station has recently developed a low flow seepage problem in the southern and western embankments. The seepage is intermittently draining into a minor drainageway flowing into Big Branch Creek, which flows into Lake Carlos. The material placed in the pond originally contained approximately 5% scrubber sludge in process water.

TMPA is investigating solutions to the structural problems in the embankments and is monitoring both sediments and water in the pond to insure that the present drainage does not pose either an environmental or public health hazard.

We will continue to keep you informed on this issue. If you have any questions please feel free to contact me at the address below or at 409/873-2013.

Sincerely,

Texas Municipal Power Agency

Ed Wagoner

Ed Wagoner
General Manager

EW/RB

cc: Executive Director, TDWR

TMPA 1983b *Specifications For Material and Installation of a Flexible Membrane Liner for a Sludge Disposal Pond, Gibbons Creek Steam Electric Station, Unit No. 1, Texas Municipal Power Agency, Specification No. SPPE-84001*, J. Shoults, TMPA, December, 1983.

SPECIFICATIONS

FOR

MATERIAL AND INSTALLATION

OF A

FLEXIBLE MEMBRANE LINER

FOR A

SLUDGE DISPOSAL POND

GIBBONS CREEK STEAM ELECTRIC STATION

UNIT NO. 1

TEXAS MUNICIPAL POWER AGENCY

SPECIFICATION NO. SPPE-84001 DECEMBER, 1983

TABLE OF CONTENTS

SPECIFICATION FOR MATERIAL AND INSTALLATION OF A FLEXIBLE MEMBRANE LINER FOR A SLUDGE DISPOSAL POND AT GIBBONS CREEK S.E.S., CARLOS, GRIMES COUNTY, TEXAS

1.0 SCOPE

The work covered by these specifications comprise the furnishing and installation of a flexible membrane liner to an existing sludge disposal pond.

1.1 LOCATION OF WORK

The work is located at the TMPA's Gibbons Creek S.E.S. in Grimes County, Texas, approximately 3 miles north of Carlos, Texas.

1.2 OUTLINE OF WORK

A list of the work as hereinafter specified and/or shown on the drawings, included in general but is not limited to the following:

A. Liner fabrication

B. Liner installation

C. Quality Control - Quality assurance

D. Drainage and gas venting

E. Appurtenances and penetrations

1.3 Materials and Services Furnished by Contractor

A. All material, fabrication and delivery of a reinforced Hypalon flexible membrane liner.

B. All materials, fabrication and delivery of liner vents, test strips, adhesives and battens.

C. All labor, supervision, material, tools and equipment necessary for

complete installation of the flexible membrane liner. Installation to include but not limited to the following:

a. Unrolling, spreading and anchoring the fabricated panels.

b. Anchor trench digging and backfill.

c. Field seaming of fabricated panels.

d. Liner vents and test strips.

e. Adhesives and battens to fasten fabricated panels to concrete structures.

D. All equipment for quality control.

E. Warranties on flexible membrane liner and installation.

1.4 Materials and Services Furnished by Owner

A. Facility design drawings.

B. Site preparation, embankment and other earthwork, except anchor trench.

C. Subgrade preparation.

D. Soil Sterilization.

E. Installation of concrete structures.

F. Installation of 18 inch soil cover.

G. Testing of liner samples and testing and evaluation program.

2.0 Design Criteria

2.1 Minimum service life of flexible membrane liner life shall be 20 years.

2.2 The fluid to be pumped into the facility will have the following estimated chemical analysis.

Constituent	Concentration
Solids %	0 - 25

$CaSO_4$	10% of above
$CaSO_3$	90% of above
$CaCO_3$	10% (max.)
pH	4.0 - 7.0
Specific Gravity @ 60/60 F°	1.0 - 1.17
Temperature Range (max.)	158°F

2.3 Ambient Air Conditions

Temperature Range	5° - 100°F
Wind	Tropical hurricanes moving inland from the Gulf Coast may result in the area.

2.4 Physical Characteristics of the Pond

Maximum embankment slope	3H:1V
Average depth	20 feet (17' Water Depth)
Subgrade	Compacted clays, silty clays, and sandy clays to a density of at least 95 percent of the maximum dry weight.

3.0 Material

3.1 General

The material supplied under these specifications shall be new, first quality products designed and manufactured specifically for the purpose of installation as flexible membrane liner at the facility covered by this specification and which has been satisfactorily demonstrated by prior use to be suitable and durable for such purposes. The contractor shall at the time of bidding, supply the

Engineer with the name of the lining fabricator and later, a certified test report from the sheeting producer that the sheeting meets these specificiations. The Owner reserves the right to visit and inspect the Manufaturer's and Fabricator's plants prior and during manufacturing and fabrication of the flexible liner.

3.2 Description of Reinforced Hypalon Material

The membrane lining material shall be fabric-reinforced Hypalon, consisting of two plies of Hypalon and one ply of scrim. The finished membrane liner shall be manufactured by the calendering process and shall be uniform in the color, thickness, size and surface texture. The finished lining shall be a sunlight and weather resistant membrane that is flexible, durable, watertight product free from pinholes, blisters, blemishes, creases, blocking, hardened nodules, delaminations, wrinkled edges, seams, contaminations, or other defects.

a. Hypalon utilized for incapsulation of the scrim shall be manufactured from a composition of high quality ingredients, suitably compounded, of which Industrial Grade Hypalon, 45% by volume synthetic rubber resin is the sole elastomer. Zinc compounds of any kind, including zinc oxide, zinc stearate and zinc dusting agents are prohibited. Dusting agents of any kind are prohibited on the finished product. The uncured sheets shall be a uniform 15 mil (0.015") thickness and provide a uniform 36 mil (0.036") thickness after laminating, when measured per ASTM D-412.

b. Scrim utilized within the membrane shall be 10 X 10 - 1000d (maximum), 6 X 6 - 1000d (minimum) polyester of an open type

weave that permits strike through of the Hypalon through the fabric to facilitate adhesion between the plies of Hypalon. All trim salvage edges must be trimed prior to applying the hypalon coating. Reinforcing fabric shall extend to between 1/8" and 1/2" from the sheet edge. Exposed fabric or indications of delamination will not be permitted.

c. The Fabricator shall be an experienced firm customarily engaged in factory - fabricating individual widths of fabric - reinforced Hypalon roll stock into large sheets. Factory seams shall have a minimum of 1-1/2" scrim to scrim overlay when made by the solvent seaming method, and 5/8" scrim to scrim overlap when made by the heat welded method.

Each factory - fabricated sheet shall be given prominent, unique indelible identifying markings indicating proper direction of unrolling and/or unfolding to facilitate layout and postioning in the field. Each factory - fabricated sheet shall be individually packaged in a heavy cardboard or wooden crate fully enclosed and protected to prevent damage to it during shipment, prominently identified in the same fashion as the sheet within and showing the date of shipments. Until installed, factory - fabricated sheets shall be stored in their original unopened crates; if outdoors, they shall be stored on pallet and shall be protected from the direct rays of the sun under a light-colored heat-reflective opaque cover in a manner that provides a free-flowing air space between the crate and cover.

d. The Hypalon flexible membrane shall have the following minimum manufactured properties:

Hypalon, Unsupported

Property	Test Method	Manufacturing Specifications
Tensile Strength	ASTM D-412	1500 psi (min)
Elongation @ Break(%)	ASTM D-412	300 (min)
Water Absorption (%) (14 days @ 50°C)	ASTM D-471	2.0 (max)
Cold Bend (1/8" mandrel for 4 hours)	ASTM D-2136	- 45°F
Ozone Resistance (3 ppm @ 30% Strain @ 104°F, 72 hours)	ASTM D-1149	No effect

Hypalon, Reinforced

Property	Test Method	Manufacturing Specifications
Tensile Strength	ASTM D-751	200 lbs. (min)
Tear Strength	ASTM D-751	
Initial		80 lbs. (min)
After Heat Aging (30 days @ 212°F)		25 lbs. (min)
Puncture Resistance	FTMS 101B 2031	180 lbs. (min)
Ozone Resistance (3 ppm @ 30% Strain @ 104°F, 72 hours)	ASTM D-1149	No effect
Water Absorption (14 days @ 50°C)	ASTM D-471	2% (max)
Seam Strength	ASTM D-751	200 lbs. (min)

4.0 Installation of Lining

4.1 General

The contractor shall follow the Manufacturer's/or Fabricator's complete written instructions for the storage, handling, installation, seaming and repairs of the liner for the conditions of their warranties and in compliance with these specifications herein.

Prior to ordering fabric-reinforced Hypalon material, the Contractor shall submit, for the Engineer's approval, shop drawings showing lining sheet layout with proposed size, number, position, of all factory-fabricated sheets an indicating the location of all field joints, shop drawings shall also show complete details for the Engineer's approval, any and/or methods for anchoring the lining at the top of slope, making of filed joints, seals at structures, appurtenances, penetrations and etc.

The lining shall be placed over the prepared surfaces to be lined in such a manner as to assure minimum handling.

Any portion of the lining damaged during construction by any cause shall be removed or repaired with a piece of the membrane material itself according to the manufacturer's recommendations.

The Contractor shall provide full time supervision at the job site during all times work is being performed. Supervision shall be fully trained in the proper field placement and seaming techniques which have been acquired through installation experience and according to Manufacturer's and/or Fabricator's recommendation and requirements.

The Contractor shall provide a technical representative of the lining Manufacturer and/or Fabricator during the entire installation and who shall provide technical assistance during the installation.

An authorized representative of the Contractor shall certify in writing that the surface on which the lining is to be placed is acceptable. No installation of lining shall commence until this certification is furnished to the Owner. It shall be the responsibility of the Contractor installing the flexible membrane lining to keep the receiving surface in the accepted condition until complete installation of the lining is accomplished.

The liner shall not be placed during rain, sleet, or snow; or placed on frozen subgrade or subgrade that is excessively wet.

4.2 Field Joints

The Contractor shall follow the Manufacturer's/Fabricator's written instructions for field seaming for the conditions of their warranties and in compliance with these specifications herein.

Field seams will not be permitted to be made when ambient air temperature is between 35 and 50°F, unless the panels are heated according to Manufacturer's/Fabricator's recommendations.

All field joints shall provide a "Film Tearing Bond" (Defined as a bond sufficiently strong so that failure of the seam will not occur at the bonded surfaces).

Lap joints, where permitted, shall provide a minimum bonded overlap of the reinforcing fabric of 4 inches and shall extend to the edge

of the sheet so that no loose edge is present on the top side of the sheet.

The contact surface of the bonding area shall be wiped clean to remove all dirt, dust, moisture or other foreign material. Sufficient Hypalon-to-Hypalon bonding solution shall be applied to both contact surfaces of the joint area and the two surfaces pressed together and rolled, any wrinkles shall be smoothed out and any cut edges of the reinforced Hypalon shall be sealed with a flood coat of Hypalon solution to prevent wicking are field joints between sections of linings shall be made on a supporting smooth surface.

All field seams shall be 100% visually inspected during seaming for compliance with Manufacture's/Fabricator's instructions and as specified herein. All field seams shall be checked using a 3/16" air nozzle using a minimum 50 psi directed at the seams leading edge and interfaced to detect loose edges. The nozzle shall be held no more than 6" from the seam edge. Any imperfection shall be repaired as soon as practicable. All patches shall have rounded corners with the scrim properly flood coated to insure incapsulation.

4.3 Anchor Trench

Dirt from the trench shall be piled behind the trench, away from the facility, and used to backfill after the liner has been tucked into the trench.

4.4 Wind and Gas Vents

Gas vents shall be installed adequate to vent any/all gas which may accummulate beneath the liner. Maximum distance allowable between vents not to exceed 25' center to center.

5.0 Completion

The installation will not be considered complete until all fabricated and field seams have been 100% inspected and accepted by the Owner.

On completion of the installation, the contractor shall dispose of all trash, waste, material and equipment used in connection with the work herein, and shall leave the premises in a neat and acceptable condition as approved by the Engineer.

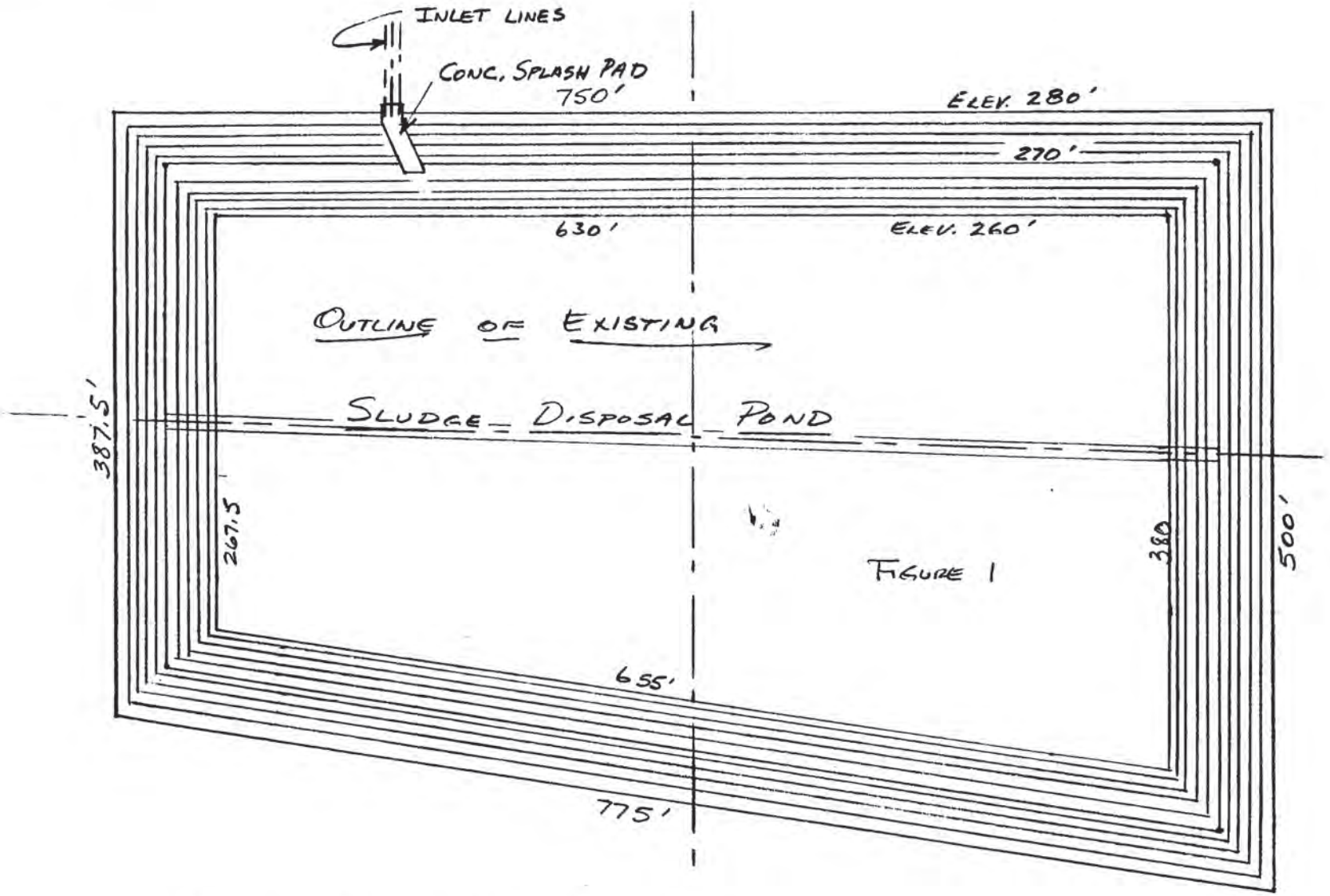


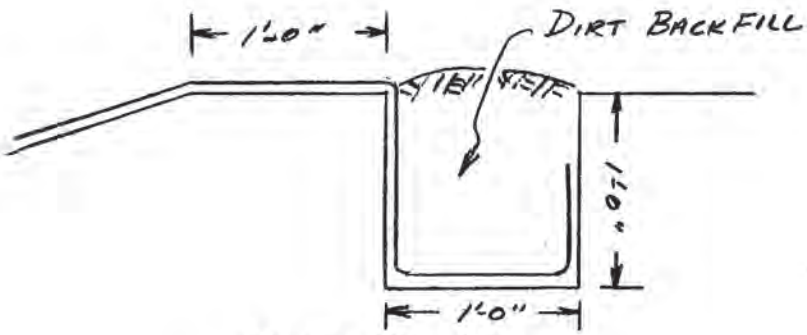
FIGURE 1

SKETCH NO. SKPE-84001A

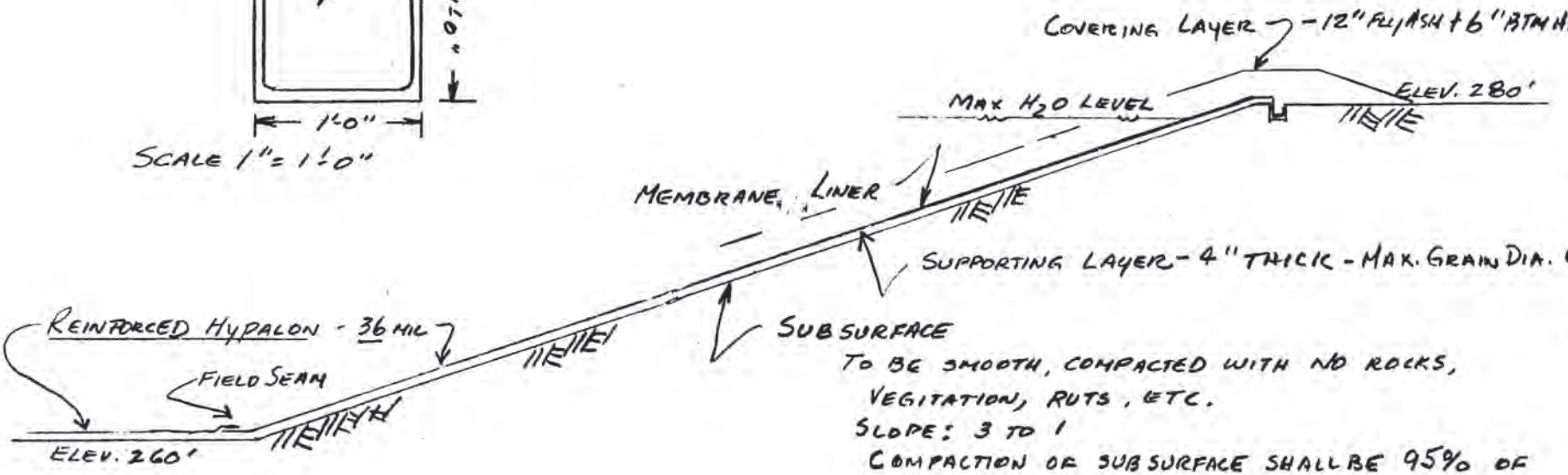
11/1/83 J.M.S.

SCALE: 1" = 100'

ANCHOR TRENCH



SCALE 1" = 1'-0"



TO BE SMOOTH, COMPACTED WITH NO ROCKS, VEGITATION, RUTS, ETC.
SLOPE: 3 TO 1
COMPACTION OF SUBSURFACE SHALL BE 95% OF STANDARD PROCTOR DENSITY

TYPICAL SLOPE DETAIL W/ MEMBRANE LINER

FIGURE 2

SKETCH NO. SKPE-84001B

11/1/83 J.M.S.

SCALE: 1" = 10'

SUMMARY OF PROPOSAL FOR
MATERIAL AND INSTALLATION OF A FLEXIBLE
MEMBRANE LINER FOR A SLUDGE DISPOSAL POND
GIBBONS CREEK STEAM ELECTRIC STATION UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

CONTRACTOR _____

A. PRICE

1. Furnish and deliver f.o.b. plant site (not f.o.b. factory, freight allowed) Material and Installation of a Flexible Membrane Liner for a Sludge Disposal Pond..... _____
   Owner reserves the right to accept or reject any or all bids.

B. CONTRACTOR REPRESENTATIVE OPTION

1. Cost per day for adjusting the above prices
   A.1. for service time..... _____

C. Are above prices firm? ..... _____

D. ESCALATION

1. Portion of price subject to escalation. _____

2. Does bidder agree that portion of price subject to escalation will be adjusted in accordance with published price indices such as those complied by the U. S. Dept. of Labor "Iron Age", etc... _____

3. List price indices to be used ..... _____
   _____
   _____

4. Bidder shall give here the limit beyond which the contract price will not be adjusted. Limit expressed as a percentage of the adjustable portion of the price is ..... _____

E. DRAWINGS

Time required after contract is awarded before drawings required for ordering flexible membrane liner will be submitted for approval ..... _____

F. MILESTONE DATES

1. Date bidder can complete delivery of the liner material ..... _____

2. Date bidder can complete project following delivery of the liner material ..... _____

G. POINT OF SHIPMENT

H. INSTALLATIONS BY CONTRACTOR

1. Submit list of installations for utilities under identical or similiar service as outlined in Section 2.0 - 2.2 of the SPECIFICATIONS including the following:
   a. Customer's name, address and telephone.
   b. Customer's contact.
   c. Material installed, size and date of installation.

I. EXCEPTIONS AND BIDDER'S ALTERNATIVES

Exceptions to the Specifications shall be kept to a minimum; however if exceptions are taken by the Bidders to the Specification, they shall be duly and completely noted below.

If any conflict arises between the Specifications and the Contractor's proposal (other than exceptions noted below), the Specifications shall govern.

These instructions do not constitute an agreement on the part of the Owner that exceptions to the specifications will be allowed.

Dated at _____ this _____ day of _____, 1984.

_____
Contractor

_____
Signature of Contractor

_____
Title

Business Address of Contractor:

_____

_____

_____

Attn: _____

Phone: _____

Texas Municipal Power Agency (TMPA)
STANDARD INSURANCE AND INDEMNITY PROVISIONS

1. Contractor shall procure and maintain, at Contractor's expense, and shall require all of its Subcontractors to procure and maintain in full force during the term of this contract, insurance policies from an insurer or insurers satisfactory to OWNER (TMPA) of the nature and in the amounts indicated below:

Comprehensive General Liability, or other acceptable policy form, including Contractual Liability covering the indemnity provisions of Part 2 below with limits of liability not less than:

Bodily Injury Liability	Property Damage Liability
Each Occurrence $500,000	Each Occurrence $500,000
Aggregate, if any $500,000	Aggregate, if any $500,000

Automobile Public Liability insurance upon each motor vehicle used in connection with the work, providing coverage of not less than:

Bodily Injury Liability	Property Damage Liability
Each Person $500,000	Each Occurrence $100,000
Each Occurrence $500,000	

Workers' Compensation and Employers' Liability with limit not less than $100,000 providing coverage for any state in which operations are to be performed.

Contractor shall furnish to the Agency certificate, or certificates, signed by a duly authorized agent of the insurance company issuing policies providing the above coverage. Each such certificate shall be approved by the Agency before any work is begun hereunder.

All policies provided by the Contractor or Subcontractors shall contain waivers of the right of subrogation in favor of the OWNER.

2. INDEMNITY

Contractor shall indemnify and hold harmless OWNER, and OWNER's employees, agents and representatives from and against all claims, damages, losses, and expenses including attorneys fees:

(1) In the event of personal injury to or death of an employee, agent, representative, licensee, or invitee of Contractor, or any Subcontractor, when such personal injury or death occurs at any place which is on or in the vicinity of the work.

(2) In the event of personal injury to or death of any person (including employees, agents, representatives, licensees or invitees of Contractor or any Subcontractor) or damage to property (including damage to the work itself) when such personal injury, death, or damage arises out of, is attributable to, or results directly or indirectly from the performance of Contractor's or any Subcontractor's obligations under the Contract Documents.

Contractor shall require all Subcontractors to indemnify OWNER, and OWNER's employees, agents, representatives, and shall require the indemnity provisions of this contract to be incorporated in all subcontracts, to make such provisions applicable to the respective Subcontractors.

CONTINUED ON REVERSE

The indemnity provisions of this contract shall apply regardless of whether or not any claim, damage, loss or expense is caused or contributed to by the concurrent negligence of OWNER, or OWNER's employees, agents and representatives.

The OWNER shall not be responsible or held liable for any damage or injury to persons or property or for any loss or damages of any kind resulting from use, misuse, failure, or defect of any machinery, equipment, construction equipment, tools, facilities, processes or other items employed in the work, including damage to, theft of, or loss of such items, regardless of whether such items are provided by or leased by the OWNER.

It is understood that damage to the work itself is not a part of Contractor's indemnity obligation to OWNER. The purpose of this exclusion is to direct the parties of this contract to Builder's Risk Insurance for damage to the work. Should the Project be damaged and the damage not be covered by the applicable Builder's Risk Insurance policy, Contractor shall be responsible for such damage, to the extent such damage is caused by Contractor's negligence or Contractor's willful act.

The provisions of indemnity contained in this Section are severable, and the invalidity or ineffectiveness, if such, of any word, phrase or sentence shall not impair the validity or effectiveness of all remaining words, phrases, and sentences in this Section.

Cost of providing such indemnification shall be included in Contractor's fee(s).

The OWNER shall provide Builders Risk insurance for the job and the contractor shall not include any Builders Risk premiums in the contract cost.

CONTRACT NO. _____

DESCRIPTION _____

_____

TEXAS MUNICIPAL POWER AGENCY

THE STATE OF TEXAS

COUNTY OF TARRANT

THIS AGREEMENT made this _____ day of _____, 19_____,

between TEXAS MUNICIPAL POWER AGENCY, a Governmental Agency (hereinafter called "Agency"), and _____

_____

_____ (hereinafter called "Contractor"):

W I T N E S S E T H:

SECTION 1. Contractor agrees to do and perform for Agency that work provided in a purchase order issued to Contractor in connection herewith, said work to be done on the terms and conditions expressed in such purchase order and in this agreement, and for the consideration stated in such purchase order. Such purchase order, and any drawings and specifications pertaining to the work, shall constitute a part of this contract.

SECTION 2. Each purchase order, when issued, will establish when work under this contract shall commence and the number of calendar days to complete. Each purchase order, when issued, will stipulate liquidated damages, if any, for each and every day beyond the specified completion date required to complete the work.

SECTION 3. Unless otherwise provided in the purchase order, all materials to be furnished by Contractor shall be of the finest quality available for the use intended. All work to be done hereunder is to be performed and completed in accordance with Agency standards, specifications and the industry practices pertaining to similar work, and any specific provisions in said purchase order, or in this agreement, and shall be subject to inspection from time to time by Agency's representatives. Upon completion, said work shall be subject to approval and acceptance by such Agency's representatives. However, all such inspection and approval shall be concerned as to results only and not as to the method or manner of performing said work.

SECTION 4. Contractor shall employ and direct all persons performing any work hereunder, and such persons shall be and remain the sole employees of, and subject to the control and direction of, Contractor, and shall not be the employees of, or subject to, the direction and control of Agency, it being the intention of the parties hereto that Contractor shall be and remain an independent contractor, and nothing herein contained shall be construed as inconsistent with that status. Contractor is to determine the manner and method in which the work shall be performed, to conduct the work in the name of the Contractor, and agrees to inform all persons employed by him/it and working upon said undertaking that they are employed by and work for said Contractor and that they are not employed by Agency.

SECTION 5. Contractor shall comply with all applicable State and/or Federal enactments and regulations with reference to workmen's compensation and hours; payments to State and Federal authorities covering social security and unemployment benefits, and income tax withholdings and deductions pertaining to Contractor's employees.

SECTION 6. Where (a) personal injury, or death, of any person, including, but not limited to, any employee, invitee or licensee of Agency occurs, or damage to property, which arises out of, is attributable to, or results directly or indirectly from, the performance of this contract, or is in any manner related thereto, including, but not limited to, any work performed by subcontractors; or (b) personal injury or death of Contractor, or of any subcontractor, or of any employee, invitee, or licensee of either, occurs during the term of this contract, from any cause, at any place; then Contractor shall, as to each and all of such, at all times protect, indemnify, defend and hold harmless the Agency, its officers, directors, employees, agents and representatives, from all losses, damages, including exemplary and punitive damages, liability, claims, causes of action, suits, judgments, costs, or expenses, (including attorneys' fees) arising out of or related to such. Contractor shall, in addition to the foregoing, promptly pay to Agency upon demand, any sums paid under or in accordance with the Workmen's Compensation Law, Longshoremen's and Harbor Workers' Act, or Employers' Liability Act, by or on behalf of Agency, or by Agency's workmen's compensation insurance carrier, to, or for the account of, an employee, or his beneficiaries, because of any injuries to or death of an employee of Agency.

The indemnity provisions of this Section 6 shall apply regardless of whether or not any such loss, damage, exemplary or punitive damages, liability, claim, cause of action, suit, judgment, cost, or expense (including attorney's fee) and/or payment is caused, or contributed to, by negligence or other wrongful act of Agency, or its employees, agents, directors, or representatives, notwithstanding the degree of negligence of Agency, or its employees, agents, directors, or representatives and regardless of whether any of the foregoing shall be based in whole or part, on a theory of strict liability. The provisions of this Section 6 are severable, and the invalidity or ineffectiveness, if such, of any word, phrase or sentence shall not impair the validity and effectiveness of all remaining words, phrases and sentences in this section. The insurance required by Section 9 of this agreement shall be in addition to and supplementary of the foregoing provisions, and not in lieu of such.

SECTION 7. Contractor shall be responsible for, and shall pay to Agency upon demand, any loss, expense or damage suffered or incurred by Agency, because of any loss or damage to any of the Agency's property, real or personal (including, but not limited to, any of Agency's property used in the performance of the contract), which loss or damage arises out of or is in any manner, directly or indirectly, connected with Contractor's or his/its subcontractors' performance of this contract, regardless of whether or not any such loss or damage is caused, or contributed to, by Contractor's or his/its subcontractors' negligence, or by the negligence of the employees of either of them, and regardless of whether or not any such property has any relation to the performance of this contract.

SECTION 8. Contractor also agrees to pay direct to the owners of lands and crops, any and all damages resulting to their property from Contractor's and his subcontractors' work, including damages to the right of way, crops, buildings and other structures, roads, bridges and fences, irrespective of whether or not caused, or contributed to, by the negligence of Contractor or subcontractors, or by the negligence of the employees of either; and Contractor agrees to indemnify and protect Agency from any such claims or liability.

SECTION 9. Prior to commencing work hereunder, Contractor, at his/its expense, will procure insurance, and furnish to Agency, certificate as to such on Agency standard certificate form, certifying coverage as follows:

(a) Workmen's Compensation and Employers' Liability with statutory limits.

(b) Comprehensive General Public Liability, including broad form Contractual Liability specifically covering the indemnities herein provided in Sections 6, 7 and 8, with limits not less than _____ per occurrence for bodily injury, and _____ per occurrence for property damage.

(c) Automobile Public Liability, _____/_____ for bodily injury, and _____/_____ for property damage.

(d) Contractor shall waive any rights of subrogation against Agency, its agents and employees.

SECTION 10. The materials to be furnished by Agency shall be available to Contractor at Agency's storerooms, unless otherwise specified in the purchase order. Contractor shall return to Agency's storeroom from which material is received, any material not used on a job or removed from a job.

SECTION 11. All of Agency's circuits and equipment are to continue in normal operation during the performance of any work carried out under this agreement except in instances where arrangements are made by Contractor with Agency, prior to commencing the work, for operation of the equipment and circuits other than normal. Contractor shall provide and use all protective equipment necessary to guard against interfering with the normal operation of Agency's circuits and equipment, as well as the possibility of accidents to all persons, including Contractor's employees.

SECTION 12. Irrespective of the way and manner provided for payment in such purchase order, Agency reserves the right to pay, from time to time during the progress of the work, progress payments. Agency may withhold from any payment due under this contract such sum as may be necessary in Agency's judgment to protect it from loss from default of Contractor under the contract provisions and from any loss or claim which may arise or be filed as a result of this work. Agency shall have the right to require from Contractor, before making any payment due hereunder, proof satisfactory to it that all claims for labor and material theretofore incurred, and any amount due subcontractors employed by the Contractor in doing the work herein described, have been paid in full.

SECTION 13. Should there be any conflict between the provisions of this agreement and the terms and provisions of the purchase order to form a part hereof, then, as to such conflict, the provisions of such purchase order will control.

SECTION 14. Contractor shall not, without prior written approval of Agency, assign this contract, or any portion of same, nor shall he/it, without such prior written approval, subcontract any of the work provided herein.

SECTION 15. If, in the opinion of Agency, the Contractor neglects to prosecute the work properly, or fails to perform any provision of the contract, Agency may immediately terminate the contract in whole or in part, by giving written notice to Contractor without prejudice to any other remedy Agency may have, make good the deficiencies and deduct the cost thereof from the payment then or thereafter due to Contractor, or, at its option, Agency may terminate the contract and take possession of all materials and finish the work by such method as it sees fit.

SECTION 16. The terms of this agreement shall be for a period of one year and the terms thereafter shall be extended and continued after said one year until such time as either the Agency or Contractor shall give the other thirty days' written notice of cancellation.

IN WITNESS WHEREOF, the parties have caused this agreement to be duly executed, in multiple originals, the day, month and year first above written.

WITNESSES:

TEXAS MUNICIPAL POWER AGENCY

_____ By _____

_____ Title _____

_____
(Contractor)

_____ By _____

_____ Title _____

Texas Municipal Power Agency (TMPA)

PURCHASE ORDER TERMS

1. **Contract Document**
This is a legal contract between the Texas Municipal Power Agency (TMPA) and vendor named on the other side. It includes the data contained on the front side of this page.

Any changes or additions to this contract must be agreed to in writing by TMPA. If another set of contract documents for this order is subsequently executed by TMPA and the vendor, that other set of documents will take priority over this Purchase Order, but the legal effect of this document does not depend on any other documents being executed.

2. **Description**
The items or services purchased are those described on the other side of this document. In the event vendor submitted a written bid which was accepted by TMPA, the description in the bid shall be used to describe the goods or services being purchased. The description may be modified by written statement of TMPA, or orally provided TMPA confirms in writing.

3. **Shipment Date**
Time is of the essence of this contract.

4. **Vendor's Acceptance**
Vendor's acceptance of this contract is limited to the terms proposed by TMPA, or agreed to in writing executed by TMPA.

5. **Indemnity**
Vendor indemnifies TMPA from any loss caused solely by a defect in the material or workmanship of the goods or services purchased, including any loss caused to persons or property by such defect, for one (1) year after the contract is completed. This indemnity is an addition to any other common law, statutory of contractual rights.

Should vendor and TMPA have agreed in writing to exceptions that differ from this section 5, the provisions of such exceptions and not this section shall govern.

6. **Independent Contractor**
Vendor shall be an independent contractor, not the employee or agent of TMPA. TMPA shall not have the right to control the day-to-day activities of vendor.

7. **Governing Law**
This agreement is governed by the laws of the State of Texas.

8. **Consent of Vendor**
Vendor's performance of this contract either (1) by shipping or delivering the item(s) purchased to TMPA or (2) by signing an acknowledgement copy of this document shall constitute vendor's acceptance of these terms.

9. **Performance and Payment Bonds**
Vendor shall furnish TMPA with Performance and Payment Bonds if required by Texas law. (Such bonds apply if the contract is more than $25,000 and if the contract is for the furnishing of labor, or is for the furnishing of materials which are specially fabricated for use in a TMPA job, or are consumed as part of a TMPA job, or are to be incorporated in a TMPA job.)

10. **Liens**
Vendor shall retain no lien against the work or against any TMPA property.

11. **Engineering Practice Act**
Engineering Services, if any, provided hereby are to be governed by the practices approved by the State Board of Registration for Professional Engineers, P.O. Box 18329, Austin, Texas 78760, (512) 475-4131.

12. **Insurance and Indemnity Provisions**
See attachment.

TEXAS MUNICIPAL POWER AGENCY

SAFETY WORK RULES FOR CONTRACTORS

Personal Protective Equipment

Hard hats and safety glasses will be required throughout the plant site except in the following areas:

1. Administration Building, Grounds and Parking Lot
2. Warehouse Office
3. Maintenance Building Offices
4. Foot traffic between the Administration Building, Warehouse Office and Maintenance Building Offices
5. When riding in a vehicle with a roof and windshield
6. Main Control Room
7. Auxiliary Control Room Building except the Lab where safety glasses will be required
8. FGD Building Control Room

The performance of certain tasks will require additional personal protective equipment such as welding hoods, dust masks, gloves or protective clothing. It is the responsibility of both the employee and the supervisor to insure that all necessary protective equipment is available and used.

Certain areas on the plant site have a high noise level that could contribute to hearing loss. These areas will be designated and shall require hearing protection. Employees entering these areas must use ear plugs or other appropriate protection.

Housekeeping

All employees and their supervisors will be responsible for keeping their respective work areas in a clean and safe condition. Particular attention should be paid to the storage and handling of combustible or flammable material. No job will be considered completed until the necessary clean up action has been taken.

Horseplay

Horseplay (running, scuffling, misuse of equipment, etc.) will not be tolerated. Employees participating in horseplay will be subject to disciplinary action.

Alcohol and Drugs

The use of intoxicating liquor or drugs by an employee on TMPA property or during working hours is forbidden and any violations will be sufficient cause for dismissal. Any employee reporting for duty while under the influence of intoxicating liquor or drugs shall be detained or immediately escorted outside the security fence pending further action.

Restricted Areas

Certain areas on the plant site will have restrictions placed on them of a permanent or temporary nature. These restrictions will be denoted by warning signs, barrier tape, etc. All employees are to comply with these restrictions when entering such areas.

CONTRACTOR'S STATEMENT

I have read, understand and will comply with the TMPA Safety Work Rules.

_____
Name

_____
Title

_____
Company

_____
Date

ADDENDUM NO. 1
TO
SPECIFICATIONS
FOR
MATERIAL AND INSTALLATION
OF A
FLEXIBLE MEMBRANE LINER
FOR A
SLUDGE DISPOSAL POND
GIBBONS CREEK STEAM ELECTRIC STATION
UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

SPECIFICATION NO. SPPE-84001 JANUARY 17, 1984

The following changes, additions, corrections or clarifications have been made to the specifications. Incorporate these changes or additions to your bid, sign the acknowledgment, and attach a signed copy of the Addendum to each copy of your bid when submitted.

SPECIFICATIONS

On Page 4, Sec. 3.2(a), lines 3 & 4, change to:

"suitably compounded, of which Industrial Grade Hypalon, 45% by weight synthetic rubber resin is the sole elastomer."

SKETCH NO. SKPE-84001A

Sketch No. SKPE-84001A, dated 11/01/83 replace with Revision dated 01/17/84, attached.

ACKNOWLEDGMENT

The undersigned bidder hereby certifies that the revisions herein set forth have been incorporated in his bid and form a part of the specification.

Bidder	Address
Title	Date

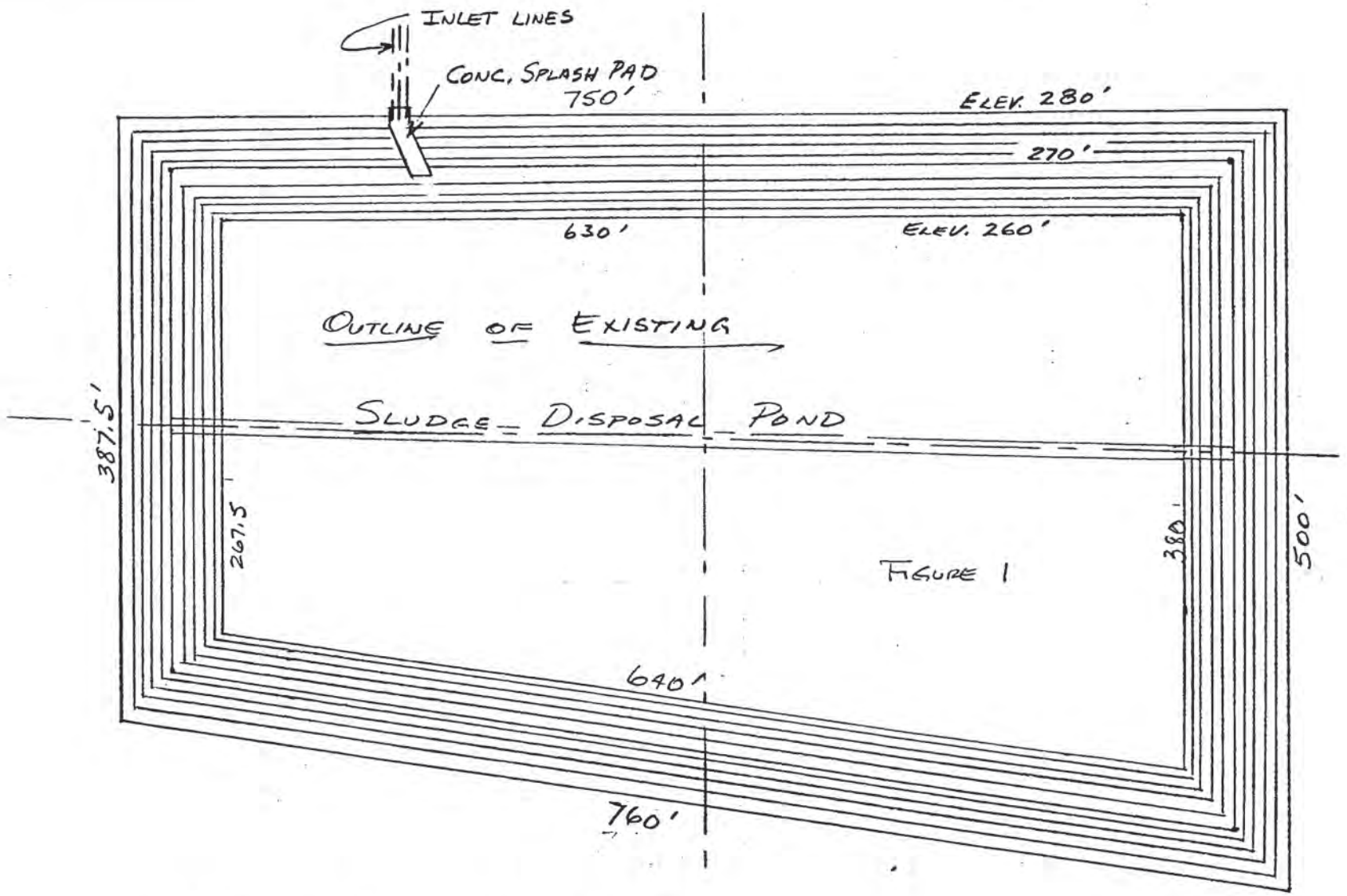


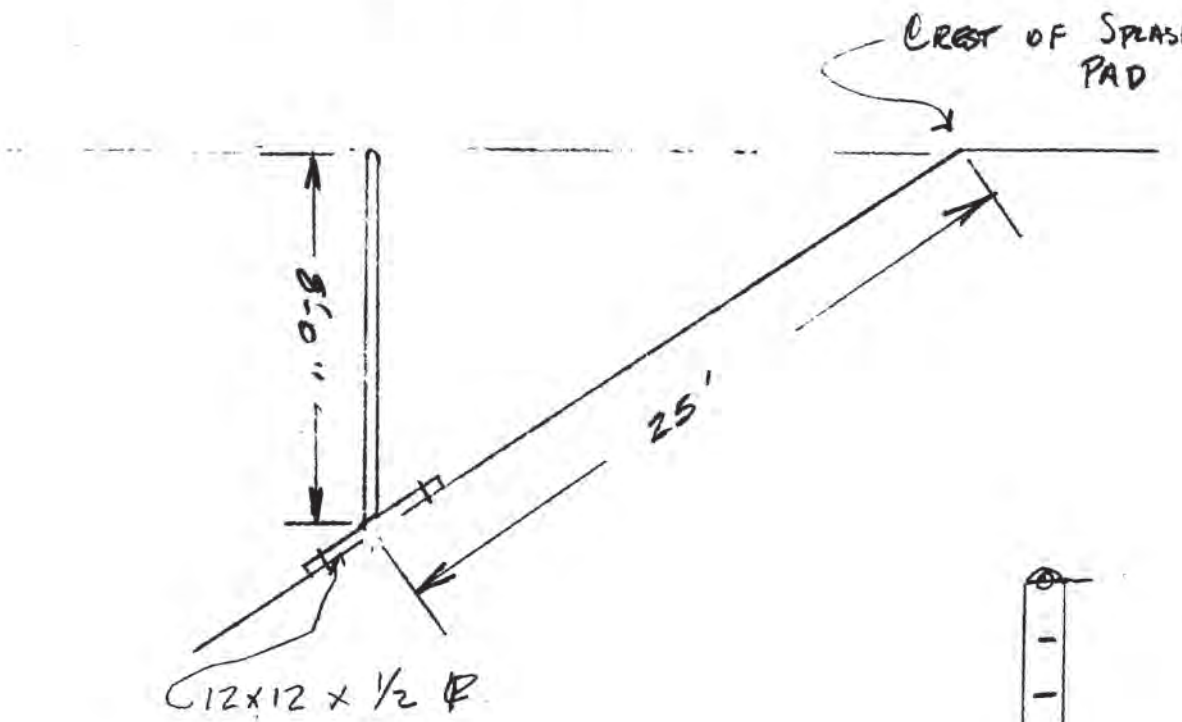
FIGURE 1

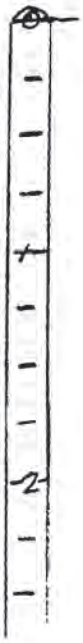
SKETCH NO. SKPE-84001A

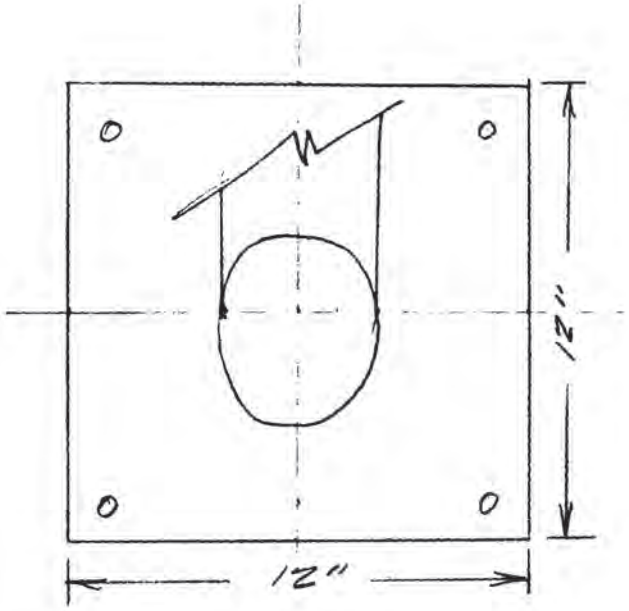
11/1/83 J.M.S.
REV. 1/17/84
SCALE: 1" = 100'

TMPA 1985 *Sludge Pond Gauge*, JMS, TMPA, Sketch, February 20, 1985.

Sludge Pond Gauge

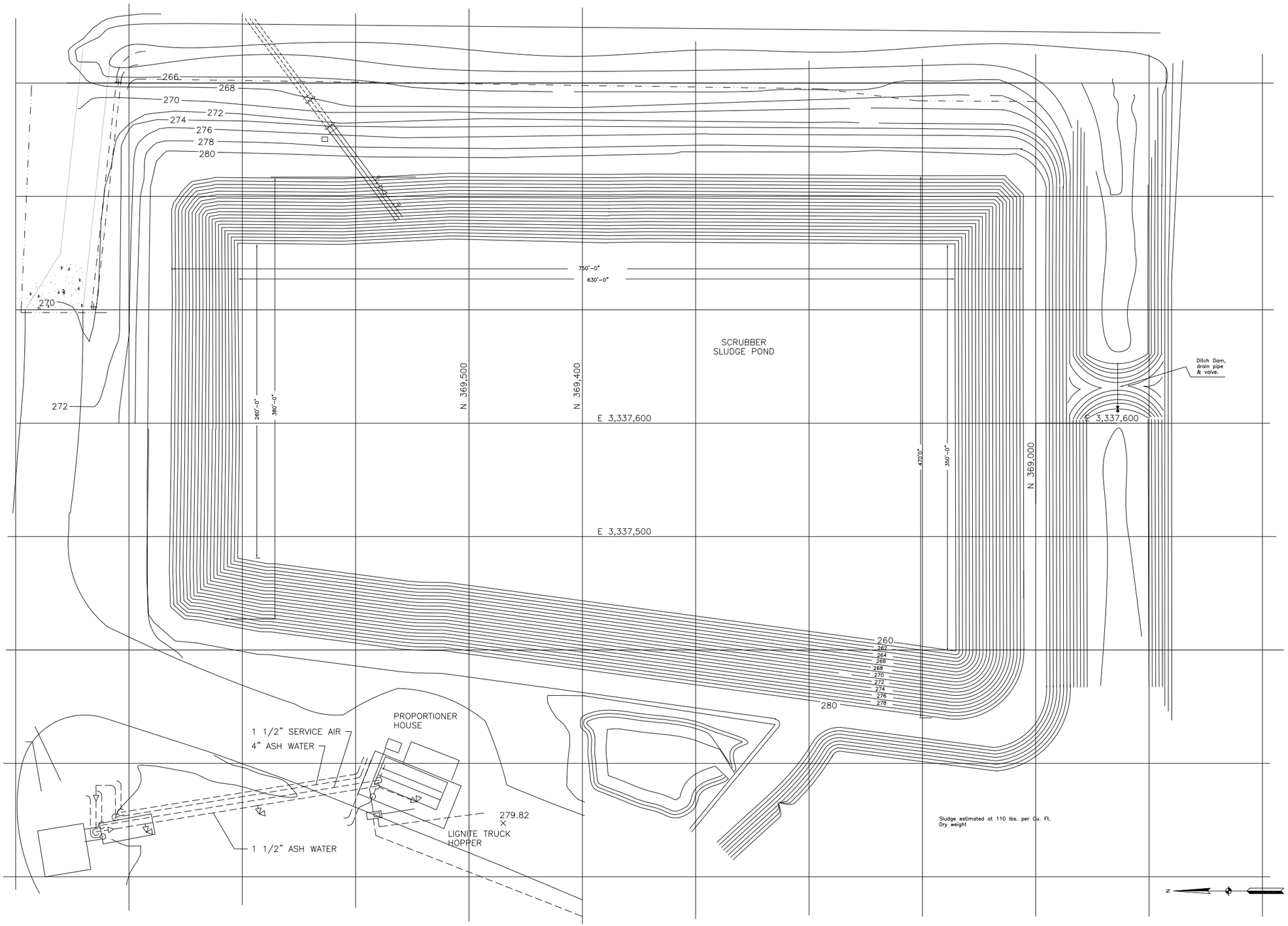






2/20/85
JMS

TMPA 2000 *Sludge Pond for Survey Information, Gibbons Creek S.E.S. Unit No. 1, Texas Municipal Power Agency, Dwg. No. 11-C-19.1,* TMPA, February 15, 2000.



NOTES

North / south dimensions scaled from drawing
East to west dimensions, at approximately elevation 280'-0", measured on 2/15/00

REV	DATE	BY	DESCRIPTION

SCALE N/A
REVISED BY Homer R.
DATE 2/15/00
CHECKED hdr
APPROVED B. Lane

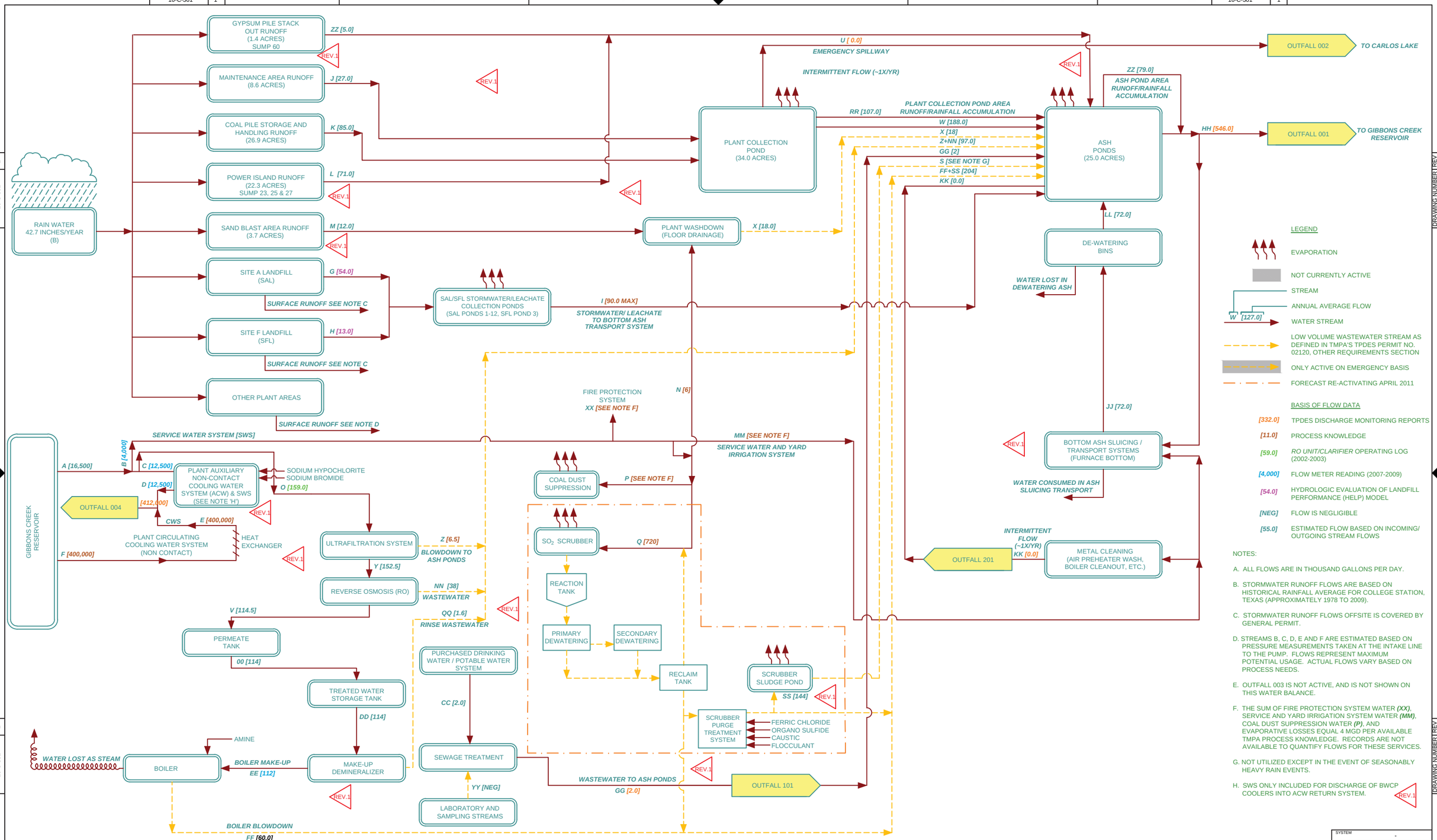
SLUDGE POND

GIBBONS CREEK S.E.S.
UNIT NO. 1
TEXAS MUNICIPAL POWER AGENCY

FOR SURVEY INFORMATION.

JOB NO.	REV.
ABN 809	0
DRAWING NUMBER	
11-C-19.1	

TMPA 2013 *TMPA Water Balance Diagram*, ERM Drawing No 10-C-301, September 24, 2010, Revised by Texas Municipal Power Agency, August 15, 2013.



NOTES:

A. ALL FLOWS ARE IN THOUSAND GALLONS PER DAY.

B. STORMWATER RUNOFF FLOWS ARE BASED ON HISTORICAL RAINFALL AVERAGE FOR COLLEGE STATION, TEXAS (APPROXIMATELY 1978 TO 2009).

C. STORMWATER RUNOFF FLOWS OFFSITE IS COVERED BY GENERAL PERMIT.

D. STREAMS B, C, D, E AND F ARE ESTIMATED BASED ON PRESSURE MEASUREMENTS TAKEN AT THE INTAKE LINE TO THE PUMP. FLOWS REPRESENT MAXIMUM POTENTIAL USAGE. ACTUAL FLOWS VARY BASED ON PROCESS NEEDS.

E. OUTFALL 003 IS NOT ACTIVE, AND IS NOT SHOWN ON THIS WATER BALANCE.

F. THE SUM OF FIRE PROTECTION SYSTEM WATER ***(XX)***, SERVICE AND YARD IRRIGATION SYSTEM WATER ***(MM)***, COAL DUST SUPPRESSION WATER ***(P)***, AND EVAPORATIVE LOSSES EQUAL 4 MGD PER AVAILABLE TMPA PROCESS KNOWLEDGE. RECORDS ARE NOT AVAILABLE TO QUANTIFY FLOWS FOR THESE SERVICES.

G. NOT UTILIZED EXCEPT IN THE EVENT OF SEASONABLY HEAVY RAIN EVENTS.

H. SWS ONLY INCLUDED FOR DISCHARGE OF BWCP COOLERS INTO ACW RETURN SYSTEM. REV.1

REV	DATE	BY	APP	DESCRIPTION
1	02/17/2016	PR	KW	REVISED PER RED LINE, ABN 1626

NOTE:

1. This drawing was provided by ERM (Environmental Resource Management), September 24, 2010

TEXAS MUNICIPAL POWER AGENCY
PROUDLY SERVING THE TEXAS CITIES OF BRYAN• DENTON• GARLAND• GREENVILLE

TMPA
WATER BALANCE
DIAGRAM

SYSTEM	-		
LOCATION	-		
SCALE: N.T.S.	SIZE D	DATE	
DRAWN	PAR	08-15-13	
DEPT.	PWRPR	08-15-13	
CHECKED	JF	08-15-13	
APPROVED	JF	08-15-13	

PROPERTY OF TMPA

ABN NO.	REV
13443	1

DRAWING NO. 10-C-301

DRAWING NUMBER 10-C-301 REV 1

--- (unknown) *Specifications, Site Preparation of Sludge Pond Prior to Installation of Liner*, unknown author, unknown date.

SPECIFICATIONS

SITE PREPARATION OF SLUDGE POND PRIOR TO INSTALLATION OF LINER

1. Water in the pond will be pumped out, prior to site preparation, by the owner.

2. Contractor shall remove all the wet material including sludge to a depth directed by TMPA. Care shall be taken not to over-excavate the slopes or the bottom of the pond. All material removed shall be deposited in the plant waste disposal area.

3. TMPA, at their option, may direct the contractor to bring in dry dirt or fly ash available on site and spread it on the slopes and/or the bottom of the pond. This material shall be mixed in with in situ dirt using a disc or a plow.

4. After all the surfaces of the pond have dried out, contractor shall regrade them to an even surface. The reworked material shall then be compacted using a smooth vibratory roller to 95% of the maximum dry unit weight as determined by the standard Proctor method. Final surfaces shall be smooth and even, free of rocks, vegetation, ruts, etc.

5. Over this surface a 4" layer of uncompacted sand (max. grain dia. 0.12") shall be put on throughout the pond. This sand shall be obtained from borrow areas on the site or from off site sources. Additional compensation will be provided for transporting sand from offsite sources. Sand shall be spread out evenly in 4" layers using light weight equipment.

6. Pond liners will be installed by others.

7. After the liners have been installed and accepted by TMPA, Contractor shall bring in sandy material from on site borrow areas as shown on attached map. No mechanical equipment shall be driven directly on the liner. Loads of dirt shall be deposited on the liner from top of slope and pushed down with a grader. A path wide enough to drive a dump truck shall be made with a minimum of 18" of covering on the liner. Bottom of the pond shall be first covered with 18" thick sandy material. Earth covering of the side slopes shall be placed at the bottom and pushed up on the slope. Again a minimum of 18" cover shall be achieved on the side slopes.

PUBLIC SOURCE DOCUMENTS

Environmental Resources Management
206 East 9th Street, Suite 1700
Austin, Texas 78701
(512) 459-4700

TCEQ 2015 *Texas Pollutant Discharge Elimination System Permit No. WQ0002120000,* Texas Commission on Environmental Quality, issued April 29, 2009, renewal issued December 15, 2015.

TPDES PERMIT NO. WQ0002120000
[For TCEQ office use only -
EPA I.D. No. TX0074438]

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
P. O. Box 13087
Austin, Texas 78711-3087

This is a renewal of TPDES Permit No. WQ0002120000, issued on April 29, 2009.

PERMIT TO DISCHARGE WASTES
under provisions of
Section 402 of the Clean Water Act
and Chapter 26 of the Texas Water Code

Texas Municipal Power Agency

whose mailing address is

P. O. Box 7000
Bryan, Texas 77805-7000

is authorized to treat and discharge wastes from Gibbons Creek Steam Electric Station, a coal-powered, steam electric power generating facility (SIC 4911)

located adjacent to Gibbons Creek Reservoir, approximately 2.5 miles north (via Farm-to-Market Road 244) of the intersection of State Highway 30 and Farm-to-Market Road 244, at 12824 Farm-to-Market Road 244, Anderson, Grimes County, Texas 77830

via Outfall 001 to an unnamed ditch; thence to Gibbons Creek Reservoir; thence to Gibbons Creek; thence to the Navasota River Below Lake Limestone; via Outfall 002 to Big Branch Creek; thence to Carlos Lake; thence to Big Branch Creek; thence to Gibbons Creek; thence to the Navasota River Below Lake Limestone; via Outfalls 003 and 004 to Gibbons Creek Reservoir; thence to Gibbons Creek; thence to the Navasota River Below Lake Limestone in Segment No. 1209 of the Brazos River Basin

only according to effluent limitations, monitoring requirements and other conditions set forth in this permit, as well as the rules of the Texas Commission on Environmental Quality (TCEQ), the laws of the State of Texas, and other orders of the TCEQ. The issuance of this permit does not grant to the permittee the right to use private or public property for conveyance of wastewater along the discharge route described in this permit. This includes, but is not limited to, property belonging to any individual, partnership, corporation or other entity. Neither does this permit authorize any invasion of personal rights nor any violation of federal, state, or local laws or regulations. It is the responsibility of the permittee to acquire property rights as may be necessary to use the discharge route.

This permit shall expire at midnight on May 1, 2020.

ISSUED DATE: December 15, 2015

For the Commission

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS — Outfall Number 001

1. During the period beginning upon date of issuance and lasting through date of expiration, the permittee is authorized to discharge low volume wastewater (*1), ash transport water (*2), coal pile runoff (*3), previously monitored effluents, and storm water subject to the following effluent limitations:

   Volume: Intermittent and flow variable.

Effluent Characteristics	Discharge Limitations			Minimum Self-Monitoring Requirements	
	Daily Average	Daily Maximum	Single Grab	Report Daily Average and Daily Maximum	
	mg/L	mg/L	mg/L	Measurement Frequency	Sample Type
Flow (MGD)	(Report)	(Report)	N/A	1/day (*5)	Estimate
Total Suspended Solids	30	50	50	1/week (*5)	Grab
Biochemical Oxygen Demand, 5-day (BOD_5)	N/A	30	30	1/week (*5)	Grab
Chemical Oxygen Demand	N/A	300	300	1/week (*5)	Grab
Oil and Grease	15	20	20	1/week (*5)	Grab
Selenium, Total (*4)	0.016	0.033	0.033	1/week (*5)	Grab
Total Dissolved Solids	Report	Report	N/A	1/week (*5)	Grab
Sulfate	947	2,004	2,004	1/week (*5)	Grab

(*1) See definitions located in the Other Requirements, Item No. 1.E.
(*2) See definitions located in the Other Requirements, Item No. 1.H.
(*3) See definitions located in the Other Requirements, Item No. 1.I.
(*4) See Other Requirements, Item No. 3.
(*5) When discharge occurs.

2. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per week (*5), by grab sample.

3. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.

4. Effluent monitoring samples shall be taken at the following location: At Outfall 001 where the ash ponds and wastewater ponds discharge to the unnamed drainage ditch.

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS — Outfall Number 101

1. During the period beginning upon date of issuance and lasting through date of expiration, the permittee is authorized to discharge treated domestic wastewater subject to the following effluent limitations:

   Volume: Intermittent and flow variable.

Effluent Characteristics	Discharge Limitations			Minimum Self-Monitoring Requirements	
	Daily Average	Daily Maximum	Single Grab	Report Daily Average and Daily Maximum	
	mg/L	mg/L	mg/L	Measurement Frequency	Sample Type
Flow (MGD)	(Report MGD)	(Report MGD)	N/A	1/day (*1)	Estimate
Total Suspended Solids	20	45	45	1/week (*1)	Grab
Biochemical Oxygen Demand (5-day)	20	45	45	1/week (*1)	Grab
E. Coli (cfu or MPN/100 ml) (*2)	(Report) (*3)	(Report) (*3)	N/A	2/month (*1)	Grab
E. Coli (cfu or MPN/100 ml) (*2)	126 (*4)	394 (*4)	N/A	2/month (*1)	Grab

(*1) When discharge occurs.
(*2) *E. coli* bacteria measured as colony forming units (cfu) or most probable number (MPN) per 100 ml.
(*3) Beginning upon the permit issuance date and lasting one year from the permit issuance date.
(*4) Beginning one year from the permit issuance date and lasting through the date of permit expiration.

2. The effluent shall contain a chlorine residual of at least 1.0 mg/L and shall not exceed a chlorine residual of 4.0 mg/L after a detention time of at least 20 minutes (based on peak flow), and shall be monitored daily, when discharging domestic wastewater, by grab sample. An equivalent method of disinfection may be substituted only with prior approval of the Executive Director.

3. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per week (*1), by grab sample.

4. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.

5. Effluent monitoring samples shall be taken at the following location: At Outfall 101 after the final domestic wastewater treatment unit and prior to mixing with any other water.

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS — Outfall Number 201

1. During the period beginning upon date of issuance and lasting through date of expiration, the permittee is authorized to discharge metal cleaning wastewater (*1) subject to the following effluent limitations:

   Volume: Intermittent and flow variable.

Effluent Characteristics	Discharge Limitations			Minimum Self-Monitoring Requirements	
	Daily Average	Daily Maximum	Single Grab	Report Daily Average and Daily Maximum	
	mg/L	mg/L	mg/L	Measurement Frequency	Sample Type
Flow (MGD)	(Report)	(Report)	N/A	1/day (*3)	Estimate
Total Suspended Solids	30	100	100	1/week (*3)	Grab
Oil and Grease	15	20	20	1/week (*3)	Grab
Iron, Total (*2)	1.0	1.0	1.0	1/week (*3)	Grab
Copper, Total (*2)	1.0	1.0	1.0	1/week (*3)	Grab

(*1) See definitions located in the Other Requirements, Item No. 1.D.
(*2) See Other Requirements, Item No. 3.
(*3) When discharge occurs.

2. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per week (*3), by grab sample.

3. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.

4. Effluent monitoring samples shall be taken at the following location: At Outfall 201 where metal cleaning wastewaters are released prior to mixing with any other waters.

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS — Outfall Number 002

1. During the period beginning upon date of issuance and lasting through date of expiration, the permittee is authorized to discharge low volume wastewater (*1), coal pile runoff (*2), and storm water subject to the following effluent limitations:

   Volume: Intermittent and flow variable.

Effluent Characteristics	Discharge Limitations			Minimum Self-Monitoring Requirements	
	Daily Average	Daily Maximum	Single Grab	Report Daily Average and Daily Maximum	
	mg/L	mg/L	mg/L	Measurement Frequency	Sample Type
Flow (MGD)	(Report)	(Report)	N/A	1/day (*3)	Estimate
Total Suspended Solids	30	100	100	1/week (*3)	Grab
Biochemical Oxygen Demand, 5-day (BOD_5)	N/A	30	30	1/week (*3)	Grab
Chemical Oxygen Demand	N/A	300	300	1/week (*3)	Grab
Oil and Grease	15	20	20	1/week (*3)	Grab
Selenium, Total (*4)	0.05 (*5)	0.1 (*5)	0.1 (*5)	1/week (*3)	Grab
Selenium, Total (*4)	0.0074 (*6)	0.0158 (*6)	0.0158 (*6)	1/week (*3)	Grab
Total Dissolved Solids	Report (*5)	Report (*5)	N/A (*5)	1/week (*3)	Grab
Total Dissolved Solids	1694 (*6)	3584 (*6)	3584 (*6)	1/week (*3)	Grab
Chloride, Total	Report (*5)	Report (*5)	N/A (*5)	1/week (*3)	Grab
Chloride, Total	462 (*6)	978 (*6)	978 (*6)	1/week (*3)	Grab
Sulfate, Total	Report (*5)	Report (*5)	N/A (*5)	1/week (*3)	Grab
Sulfate, Total	299 (*6)	633 (*6)	633 (*6)	1/week (*3)	Grab

(*1) See definitions located in the Other Requirements No. 1E.
(*2) See definitions located in the Other Requirements, Item No. 1.I.
(*3) When discharge occurs.
(*4) See Other Requirements, Item No. 3.
(*5) Beginning upon the permit issuance date and lasting three years from the permit issuance date.
(*6) Beginning three years from the permit issuance date and lasting through the date of permit expiration.
(*7) See Other Requirements, Item No. 7.

2. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per week (*3), by grab sample.
3. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.
4. The plant collection pond level in feet and the total rain gauge level in inches of the storm event which precipitated discharge shall be reported once per day while discharge occurs (*7).
5. Effluent monitoring samples shall be taken at the following location: At Outfall 002, the emergency spillway from the plant collection pond to Big Branch Creek.

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS — Outfall Number 003

1. During the period beginning upon date of issuance and lasting through date of expiration, the permittee is authorized to discharge ash landfill leachate subject to the following effluent limitations:

   The daily maximum flow of effluent shall not exceed 0.032 million gallons per day (MGD).

Effluent Characteristics	Discharge Limitations			Minimum Self-Monitoring Requirements	
	Daily Average	Daily Maximum	Single Grab	Report Daily Average and Daily Maximum	
	mg/L	mg/L	mg/L	Measurement Frequency	Sample Type
Flow (MGD)	(Report)	(Report)	N/A	1/day (*2)	Record
Selenium, Total (*1)	0.016	0.033	0.033	1/week (*2)	Grab
Arsenic, Total (*1)	0.577	1.220	1.220	1/week (*2)	Grab
Total Dissolved Solids (TDS)	820	1735	N/A	1/week (*2)	Grab

(*1) See Other Requirements, Item No. 3.
(*2) When discharge occurs.

2. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per day (*2), by grab sample.

3. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.

4. Effluent monitoring samples shall be taken at the following location: At Outfall 003, at the French Drain at the downstream limit of the constructed Overland Flow Treatment area. The ash landfill leachate is referred to as low volume waste in databases such as PARIS (Permitting and Registration Information System) and ICIS (Integrated Compliance Information System).

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS — Outfall Number 004

1. During the period beginning upon date of issuance and lasting through date of expiration, the permittee is authorized to discharge once through cooling water (*1) and auxiliary non-contact cooling water subject to the following effluent limitations:

   The daily average flow of effluent shall not exceed 511 million gallons per day (MGD).

Effluent Characteristics	Discharge Limitations			Minimum Self-Monitoring Requirements	
	Daily Average	Daily Maximum	Single Grab	Report Daily Average and Daily Maximum	
	mg/L	mg/L	mg/L	Measurement Frequency	Sample Type
Flow (MGD)	(Report)	(Report)	N/A	Continuous (*2)	Record
Total Residual Chlorine	N/A	0.2 (67 lb/day)	N/A	1/week (*3)	Grab
Temperature (°F) (*6)	(106)	(112)	N/A	Continuous (*4)	Record
Selenium, Total (*5)	Report	Report	N/A	2/week	Grab

(*1) See definition located in Other Requirements, Item No. 1. F.
(*2) Pumping records may be used if adequately calibrated and recorded.
(*3) Sample shall be representative of periods of chlorination. Also see definition in Other Requirements, Item No. 1.B.
(*4) See definition located in the Other Requirements, Item No. 1. A.
(*5) Selenium monitoring is applicable only during the reuse of Plant Collection Pond Effluent. Please see Other Requirements, Item No. 18.
(*6) See Other Requirements, Item No. 23.

2. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per week, by grab sample.

3. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.

4. Effluent monitoring samples shall be taken at the following location: At Outfall 004, at the seal well outlet where the cooling water discharges into the cooling canal.

DEFINITIONS AND STANDARD PERMIT CONDITIONS

As required by Title 30 Texas Administrative Code (TAC) Chapter 305, certain regulations appear as standard conditions in waste discharge permits. 30 TAC §§305.121 - 305.129 (relating to Permit Characteristics and Conditions) as promulgated under the Texas Water Code (TWC) §§5.103 and 5.105, and the Texas Health and Safety Code (THSC) §§361.017 and 361.024(a), establish the characteristics and standards for waste discharge permits, including sewage sludge, and those sections of 40 Code of Federal Regulations (CFR) Part 122 adopted by reference by the Commission. The following text includes these conditions and incorporates them into this permit. All definitions in Texas Water Code §26.001 and 30 TAC Chapter 305 shall apply to this permit and are incorporated by reference. Some specific definitions of words or phrases used in this permit are as follows:

1. Flow Measurements

   a. Annual average flow - the arithmetic average of all daily flow determinations taken within the preceding 12 consecutive calendar months. The annual average flow determination shall consist of daily flow volume determinations made by a totalizing meter, charted on a chart recorder, and limited to major domestic wastewater discharge facilities with a one million gallons per day or greater permitted flow.

   b. Daily average flow - the arithmetic average of all determinations of the daily flow within a period of one calendar month. The daily average flow determination shall consist of determinations made on at least four separate days. If instantaneous measurements are used to determine the daily flow, the determination shall be the arithmetic average of all instantaneous measurements taken during that month. Daily average flow determination for intermittent discharges shall consist of a minimum of three flow determinations on days of discharge.

   c. Daily maximum flow - the highest total flow for any 24-hour period in a calendar month.

   d. Instantaneous flow - the measured flow during the minimum time required to interpret the flow measuring device.

   e. 2-hour peak flow (domestic wastewater treatment plants) - the maximum flow sustained for a two-hour period during the period of daily discharge. The average of multiple measurements of instantaneous maximum flow within a two-hour period may be used to calculate the 2-hour peak flow.

   f. Maximum 2-hour peak flow (domestic wastewater treatment plants) - the highest 2-hour peak flow for any 24-hour period in a calendar month.

2. Concentration Measurements

   a. Daily average concentration - the arithmetic average of all effluent samples, composite or grab as required by this permit, within a period of one calendar month, consisting of at least four separate representative measurements.

      i. For domestic wastewater treatment plants - When four samples are not available in a calendar month, the arithmetic average (weighted by flow) of all values in the previous four consecutive month period consisting of at least four measurements shall be utilized as the daily average concentration.

      ii. For all other wastewater treatment plants - When four samples are not available in a calendar month, the arithmetic average (weighted by flow) of all values taken during the month shall be utilized as the daily average concentration.

   b. 7-day average concentration - the arithmetic average of all effluent samples, composite or grab as required by this permit, within a period of one calendar week, Sunday through Saturday.

   c. Daily maximum concentration - the maximum concentration measured on a single day, by the sample type specified in the permit, within a period of one calendar month.

   d. Daily discharge - the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in terms of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the sampling day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the sampling day. The "daily discharge" determination of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the "daily discharge" determination of concentration shall be the arithmetic average (weighted by flow value) of all samples collected during that day.

e. Bacteria concentration (Fecal coliform, E. coli, or Enterococci)-the number of colonies of bacteria per 100 milliliters effluent. The daily average bacteria concentration is a geometric mean of the values for the effluent samples collected in a calendar month. The geometric mean shall be determined by calculating the nth root of the product of all measurements made in a calendar month, where n equals the number of measurements made; or computed as the antilogarithm of the arithmetic mean of the logarithms of all measurements of made in a calendar month. For any measurement of bacteria equaling zero, a value of one shall made for input into either computation method. If specified, the 7-day average for bacteria is the geometric mean of the values for all effluent samples collected during a calendar week.

f. Daily average loading (lbs/day) - the arithmetic average of all daily discharge loading calculations during a period of one calendar month. These calculations must be made for each day of the month that a parameter is analyzed. The daily discharge, in terms of mass (lbs/day), is calculated as (Flow, MGD x Concentration, mg/l x 8.34).

g. Daily maximum loading (lbs/day) - the highest daily discharge, in terms of mass (lbs/day), within a period of one calendar month.

3. Sample Type

a. Composite sample - For domestic wastewater, a composite sample is a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow, and collected at the intervals required by 30 TAC §319.9 (a). For industrial wastewater, a composite sample is a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow, and collected at the intervals required by 30 TAC §319.9 (b).

b. Grab sample - an individual sample collected in less than 15 minutes.

4. Treatment Facility (facility) - wastewater facilities used in the conveyance, storage, treatment, recycling, reclamation and/or disposal of domestic sewage, industrial wastes, agricultural wastes, recreational wastes, or other wastes including sludge handling or disposal facilities under the jurisdiction of the Commission.

5. The term "sewage sludge" is defined as solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in 30 TAC Chapter 312. This includes the solids that have not been classified as hazardous waste separated from wastewater by unit processes.

6. Bypass - the intentional diversion of a waste stream from any portion of a treatment facility.

MONITORING AND REPORTING REQUIREMENTS

1. Self-Reporting

Monitoring results shall be provided at the intervals specified in the permit. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall conduct effluent sampling and reporting in accordance with 30 TAC §§319.4 - 319.12. Unless otherwise specified, a monthly effluent report shall be submitted each month, to the Enforcement Division (MC 224), by the 20th day of the following month for each discharge that is described by this permit whether or not a discharge is made for that month. Monitoring results must be reported on an approved self-report form that is signed and certified as required by Monitoring and Reporting Requirements No. 10.

As provided by state law, the permittee is subject to administrative, civil and criminal penalties, as applicable, for negligently or knowingly violating the Clean Water Act; TCW Chapters 26, 27, and 28; and THSC Chapter 361, including but not limited to knowingly making any false statement, representation, or certification on any report, record, or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, or falsifying, tampering with or knowingly rendering inaccurate any monitoring device or method required by this permit or violating any other requirement imposed by state or federal regulations.

2. Test Procedures

a. Unless otherwise specified in this permit, test procedures for the analysis of pollutants shall comply with procedures specified in 30 TAC §§319.11 - 319.12. Measurements, tests, and calculations shall be accurately accomplished in a representative manner.

b. All laboratory tests submitted to demonstrate compliance with this permit must meet the requirements of 30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.

3. Records of Results

   a. Monitoring samples and measurements shall be taken at times and in a manner so as to be representative of the monitored activity.

   b. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503), monitoring and reporting records, including strip charts and records of calibration and maintenance, copies of all records required by this permit, records of all data used to complete the application for this permit, and the certification required by 40 CFR §264.73(b)(9) shall be retained at the facility site, or shall be readily available for review by a TCEQ representative for a period of three years from the date of the record or sample, measurement, report, application or certification. This period shall be extended at the request of the Executive Director.

   c. Records of monitoring activities shall include the following:

      i. date, time, and place of sample or measurement;
      ii. identity of individual who collected the sample or made the measurement;
      iii. date and time of analysis;
      iv. identity of the individual and laboratory who performed the analysis;
      v. the technique or method of analysis; and
      vi. the results of the analysis or measurement and quality assurance/quality control records.

      The period during which records are required to be kept shall be automatically extended to the date of the final disposition of any administrative or judicial enforcement action that may be instituted against the permittee.

4. Additional Monitoring by Permittee

   If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit using approved analytical methods as specified above, all results of such monitoring shall be included in the calculation and reporting of the values submitted on the approved self-report form. Increased frequency of sampling shall be indicated on the self-report form.

5. Calibration of Instruments

   All automatic flow measuring or recording devices and all totalizing meters for measuring flows shall be accurately calibrated by a trained person at plant start-up and as often thereafter as necessary to ensure accuracy, but not less often than annually unless authorized by the Executive Director for a longer period. Such person shall verify in writing that the device is operating properly and giving accurate results. Copies of the verification shall be retained at the facility site and/or shall be readily available for review by a TCEQ representative for a period of three years.

6. Compliance Schedule Reports

   Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of the permit shall be submitted no later than 14 days following each schedule date to the Regional Office and the Enforcement Division (MC 224).

7. Noncompliance Notification

   a. In accordance with 30 TAC §305.125(9) any noncompliance that may endanger human health or safety, or the environment shall be reported by the permittee to the TCEQ. Report of such information shall be provided orally or by facsimile transmission (FAX) to the Regional Office within 24 hours of becoming aware of the noncompliance. A written submission of such information shall also be provided by the permittee to the Regional Office and the Enforcement Division (MC 224) within five working days of becoming aware of the noncompliance. The written submission shall contain a description of the noncompliance and its cause; the potential danger to human health or safety, or the environment; the period of noncompliance, including exact dates and times; if the noncompliance has not been corrected, the time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance, and to mitigate its adverse effects.

   b. The following violations shall be reported under Monitoring and Reporting Requirement 7.a.:

      i. unauthorized discharges as defined in Permit Condition 2(g);
      ii. any unanticipated bypass that exceeds any effluent limitation in the permit; and

iii. violation of a permitted maximum daily discharge limitation for pollutants listed specifically in the Other Requirements section of an Industrial TPDES permit.

c. In addition to the above, any effluent violation that deviates from the permitted effluent limitation by more than 40% shall be reported by the permittee in writing to the Regional Office and the Enforcement Division (MC 224) within 5 working days of becoming aware of the noncompliance.

d. Any noncompliance other than that specified in this section, or any required information not submitted or submitted incorrectly, shall be reported to the Enforcement Division (MC 224) as promptly as possible. For effluent limitation violations, noncompliances shall be reported on the approved self-report form.

8. In accordance with the procedures described in 30 TAC §§35.301 - 35.303 (relating to Water Quality Emergency and Temporary Orders) if the permittee knows in advance of the need for a bypass, it shall submit prior notice by applying for such authorization.

9. Changes in Discharges of Toxic Substances - All existing manufacturing, commercial, mining, and silvicultural permittees shall notify the Regional Office, orally or by facsimile transmission within 24 hours, and both the Regional Office and the Enforcement Division (MC 224) in writing within five (5) working days, after becoming aware of or having reason to believe:

a. That any activity has occurred or will occur that would result in the discharge, on a routine or frequent basis, of any toxic pollutant listed at 40 CFR Part 122, Appendix D, Tables II and III (excluding Total Phenols) that is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

i. one hundred micrograms per liter (100 µg/L);
ii. two hundred micrograms per liter (200 µg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/L) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
iii. five (5) times the maximum concentration value reported for that pollutant in the permit application; or
iv. the level established by the TCEQ.

b. That any activity has occurred or will occur that would result in any discharge, on a nonroutine or infrequent basis, of a toxic pollutant that is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

i. five hundred micrograms per liter (500 µg/L);
ii. one milligram per liter (1 mg/L) for antimony;
iii. ten (10) times the maximum concentration value reported for that pollutant in the permit application; or
iv. the level established by the TCEQ.

10. Signatories to Reports - All reports and other information requested by the ED shall be signed by the person and in the manner required by 30 TAC §305.128 (relating to Signatories to Reports).

11. All Publicly Owned Treatment Works (POTWs) must provide adequate notice to the Executive Director of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger that would be subject to CWA §301 or §306 if it were directly discharging those pollutants;

b. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit; and

c. For the purpose of this paragraph, adequate notice shall include information on:

i. the quality and quantity of effluent introduced into the POTW; and
ii. any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

PERMIT CONDITIONS

1. General

a. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in an application or in any report to the Executive Director, it shall promptly submit such facts or information.

b. This permit is granted on the basis of the information supplied and representations made by the permittee during action on an application, and relying upon the accuracy and completeness of that information and those representations. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked, in whole or in part, in accordance with 30 TAC Chapter 305, Subchapter D, during its term for good cause including, but not limited to, the following:

i. violation of any terms or conditions of this permit;
ii. obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or
iii. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

c. The permittee shall furnish to the Executive Director, upon request and within a reasonable time, any information to determine whether cause exists for amending, revoking, suspending, or terminating the permit. The permittee shall also furnish to the Executive Director, upon request, copies of records required to be kept by the permit.

2. Compliance

a. Acceptance of the permit by the person to whom it is issued constitutes acknowledgment and agreement that such person will comply with all the terms and conditions embodied in the permit, and the rules and other orders of the Commission.

b. The permittee has a duty to comply with all conditions of the permit. Failure to comply with any permit condition constitutes a violation of the permit and the Texas Water Code or the Texas Health and Safety Code, and is grounds for enforcement action, for permit amendment, revocation, or suspension, or for denial of a permit renewal application or an application for a permit for another facility.

c. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit.

d. The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal or other permit violation that has a reasonable likelihood of adversely affecting human health or the environment.

e. Authorization from the Commission is required before beginning any change in the permitted facility or activity that may result in noncompliance with any permit requirements.

f. A permit may be amended, suspended and reissued, or revoked for cause in accordance with 30 TAC §§305.62 and 305.66 and TWC §7.302. The filing of a request by the permittee for a permit amendment, suspension and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

g. There shall be no unauthorized discharge of wastewater or any other waste. For the purpose of this permit, an unauthorized discharge is considered to be any discharge of wastewater into or adjacent to water in the state at any location not permitted as an outfall or otherwise defined in the Other Requirements section of this permit.

h. In accordance with 30 TAC §305.535(a), the permittee may allow any bypass to occur from a TPDES permitted facility that does not cause permitted effluent limitations to be exceeded or an unauthorized discharge to occur, but only if the bypass is also for essential maintenance to assure efficient operation.

i. The permittee is subject to administrative, civil, and criminal penalties, as applicable, under Texas Water Code §§7.051 - 7.075 (relating to Administrative Penalties), 7.101 - 7.111 (relating to Civil Penalties), and 7.141 - 7.202 (relating to Criminal Offenses and Penalties) for violations including, but not limited to, negligently or knowingly violating the federal CWA §§301, 302, 306, 307, 308, 318, or 405, or any condition or limitation implementing any sections in a permit issued under the CWA § 402, or any requirement imposed in a pretreatment program approved under the CWA §§402 (a)(3) or 402 (b)(8).

3. Inspections and Entry

a. Inspection and entry shall be allowed as prescribed in the TWC Chapters 26, 27, and 28, and THSC Chapter 361.

b. The members of the Commission and employees and agents of the Commission are entitled to enter any public or private property at any reasonable time for the purpose of inspecting and investigating conditions relating to the quality of water in the state or the compliance with any rule, regulation, permit, or other order of the Commission.

Members, employees, or agents of the Commission and Commission contractors are entitled to enter public or private property at any reasonable time to investigate or monitor or, if the responsible party is not responsive or there is an immediate danger to public health or the environment, to remove or remediate a condition related to the quality of water in the state. Members, employees, Commission contractors, or agents acting under this authority who enter private property shall observe the establishment=s rules and regulations concerning safety, internal security, and fire protection, and if the property has management in residence, shall notify management or the person then in charge of his presence and shall exhibit proper credentials. If any member, employee, Commission contractor, or agent is refused the right to enter in or on public or private property under this authority, the Executive Director may invoke the remedies authorized in TWC §7.002. The statement above, that Commission entry shall occur in accordance with an establishment=s rules and regulations concerning safety, internal security, and fire protection, is not grounds for denial or restriction of entry to any part of the facility, but merely describes the Commission=s duty to observe appropriate rules and regulations during an inspection.

4. Permit Amendment or Renewal

   a. The permittee shall give notice to the Executive Director as soon as possible of any planned physical alterations or additions to the permitted facility if such alterations or additions would require a permit amendment or result in a violation of permit requirements. Notice shall also be required under this paragraph when:

      i. the alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in accordance with 30 TAC §305.534 (relating to New Sources and New Dischargers); or

      ii. the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are subject neither to effluent limitations in the permit, nor to notification requirements in Monitoring and Reporting Requirements No. 9; or

      iii. the alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

   b. Prior to any facility modifications, additions, or expansions that will increase the plant capacity beyond the permitted flow, the permittee must apply for and obtain proper authorization from the Commission before commencing construction.

   c. The permittee must apply for an amendment or renewal at least 180 days prior to expiration of the existing permit in order to continue a permitted activity after the expiration date of the permit. If an application is submitted prior to the expiration date of the permit, the existing permit shall remain in effect until the application is approved, denied, or returned. If the application is returned or denied, authorization to continue such activity shall terminate upon the effective date of the action. If an application is not submitted prior to the expiration date of the permit, the permit shall expire and authorization to continue such activity shall terminate.

   d. Prior to accepting or generating wastes that are not described in the permit application or that would result in a significant change in the quantity or quality of the existing discharge, the permittee must report the proposed changes to the Commission. The permittee must apply for a permit amendment reflecting any necessary changes in permit conditions, including effluent limitations for pollutants not identified and limited by this permit.

   e. In accordance with the TWC §26.029(b), after a public hearing, notice of which shall be given to the permittee, the Commission may require the permittee, from time to time, for good cause, in accordance with applicable laws, to conform to new or additional conditions.

   f. If any toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is promulgated under CWA §307(a) for a toxic pollutant that is present in the discharge and that standard or prohibition is more stringent than any limitation on the pollutant in this permit, this permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition. The permittee shall comply with effluent standards or prohibitions established under CWA §307(a)for toxic pollutants within the time provided in the regulations that established those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

5. Permit Transfer

   a. Prior to any transfer of this permit, Commission approval must be obtained. The Commission shall be notified in writing of any change in control or ownership of facilities authorized by this permit. Such notification should be sent to the Applications Review and Processing Team (MC 148) of the Water Quality Division.

b. A permit may be transferred only according to the provisions of 30 TAC §305.64 (relating to Transfer of Permits) and 30 TAC §50.133 (relating to Executive Director Action on Application or WQMP update).

6. Relationship to Hazardous Waste Activities

This permit does not authorize any activity of hazardous waste storage, processing, or disposal that requires a permit or other authorization pursuant to the Texas Health and Safety Code.

7. Relationship to Water Rights

Disposal of treated effluent by any means other than discharge directly to water in the state must be specifically authorized in this permit and may require a permit pursuant to TWC Chapter 11.

8. Property Rights - A permit does not convey any property rights of any sort, or any exclusive privilege.

9. Permit Enforceability - The conditions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

10. Relationship to Permit Application

The application pursuant to which the permit has been issued is incorporated herein; provided, however, that in the event of a conflict between the provisions of this permit and the application, the provisions of the permit shall control.

11. Notice of Bankruptcy.

a. Each permittee shall notify the executive director, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any chapter of Title 11 (Bankruptcy) of the United States Code (11 USC) by or against:

i. the permittee;
ii. an entity (as that term is defined in 11 USC, §101(15)) controlling the permittee or listing the permit or permittee as property of the estate; or
iii. an affiliate (as that term is defined in 11 USC, §101(2)) of the permittee.

b. This notification must indicate:

i. the name of the permittee;
ii. the permit number(s);
iii. the bankruptcy court in which the petition for bankruptcy was filed; and
iv. the date of filing of the petition.

OPERATIONAL REQUIREMENTS

1. The permittee shall at all times ensure that the facility and all of its systems of collection, treatment, and disposal are properly operated and maintained. This includes, but is not limited to, the regular, periodic examination of wastewater solids within the treatment plant by the operator in order to maintain an appropriate quantity and quality of solids inventory as described in the various operator training manuals and according to accepted industry standards for process control. Process control, maintenance, and operations records shall be retained at the facility site, or shall be readily available for review by a TCEQ representative, for a period of three years.

2. Upon request by the Executive Director, the permittee shall take appropriate samples and provide proper analysis in order to demonstrate compliance with Commission rules. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall comply with all applicable provisions of 30 TAC Chapter 312 concerning sewage sludge use and disposal and 30 TAC §§319.21 - 319.29 concerning the discharge of certain hazardous metals.

3. Domestic wastewater treatment facilities shall comply with the following provisions:

a. The permittee shall notify the Municipal Permits Team, Wastewater Permitting Section (MC 148) of the Water Quality Division, in writing, of any facility expansion at least 90 days prior to conducting such activity.

b. The permittee shall submit a closure plan for review and approval to the Land Application Team, Wastewater Permitting Section (MC 148) of the Water Quality Division, for any closure activity at least 90 days prior to conducting such activity. Closure is the act of permanently taking a waste management unit or treatment facility out of service and includes the permanent removal from service of any pit, tank, pond, lagoon, surface impoundment and/or other treatment unit regulated by this permit.

4. The permittee is responsible for installing prior to plant start-up, and subsequently maintaining, adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during electrical power failures by means of alternate power sources, standby generators, and/or retention of inadequately treated wastewater.

5. Unless otherwise specified, the permittee shall provide a readily accessible sampling point and, where applicable, an effluent flow measuring device or other acceptable means by which effluent flow may be determined.

6. The permittee shall remit an annual water quality fee to the Commission as required by 30 TAC Chapter 21. Failure to pay the fee may result in revocation of this permit under TWC §7.302(b)(6).

7. Documentation

For all written notifications to the Commission required of the permittee by this permit, the permittee shall keep and make available a copy of each such notification under the same conditions as self-monitoring data are required to be kept and made available. Except for information required for TPDES permit applications, effluent data, including effluent data in permits, draft permits and permit applications, and other information specified as not confidential in 30 TAC §1.5(d), any information submitted pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted in the manner prescribed in the application form or by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, information may be made available to the public without further notice. If the Commission or Executive Director agrees with the designation of confidentiality, the TCEQ will not provide the information for public inspection unless required by the Texas Attorney General or a court pursuant to an open records request. If the Executive Director does not agree with the designation of confidentiality, the person submitting the information will be notified.

8. Facilities that generate domestic wastewater shall comply with the following provisions; domestic wastewater treatment facilities at permitted industrial sites are excluded.

a. Whenever flow measurements for any domestic sewage treatment facility reach 75% of the permitted daily average or annual average flow for three consecutive months, the permittee must initiate engineering and financial planning for expansion and/or upgrading of the domestic wastewater treatment and/or collection facilities. Whenever the flow reaches 90% of the permitted daily average or annual average flow for three consecutive months, the permittee shall obtain necessary authorization from the Commission to commence construction of the necessary additional treatment and/or collection facilities. In the case of a domestic wastewater treatment facility that reaches 75% of the permitted daily average or annual average flow for three consecutive months, and the planned population to be served or the quantity of waste produced is not expected to exceed the design limitations of the treatment facility, the permittee shall submit an engineering report supporting this claim to the Executive Director of the Commission.

If in the judgment of the Executive Director the population to be served will not cause permit noncompliance, then the requirement of this section may be waived. To be effective, any waiver must be in writing and signed by the Director of the Enforcement Division (MC 149) of the Commission, and such waiver of these requirements will be reviewed upon expiration of the existing permit; however, any such waiver shall not be interpreted as condoning or excusing any violation of any permit parameter.

b. The plans and specifications for domestic sewage collection and treatment works associated with any domestic permit must be approved by the Commission, and failure to secure approval before commencing construction of such works or making a discharge is a violation of this permit and each day is an additional violation until approval has been secured.

c. Permits for domestic wastewater treatment plants are granted subject to the policy of the Commission to encourage the development of area-wide waste collection, treatment, and disposal systems. The Commission reserves the right to amend any domestic wastewater permit in accordance with applicable procedural requirements to require the system covered by this permit to be integrated into an area-wide system, should such be developed; to require the delivery of the wastes authorized to be collected in, treated by or discharged from said system, to such area-wide system; or to amend this permit in any other particular to effectuate the Commission's policy. Such amendments may be made when the changes required are advisable for water quality control purposes and are feasible on the basis of waste treatment technology, engineering, financial, and related considerations existing at the time the changes are required, exclusive of the loss of investment in or revenues from any than existing or proposed waste collection, treatment or disposal system.

9. Domestic wastewater treatment plants shall be operated and maintained by sewage plant operators holding a valid certificate of competency at the required level as defined in 30 TAC Chapter 30.

10. For Publicly Owned Treatment Works (POTWs), the 30-day average (or monthly average) percent removal for BOD and TSS shall not be less than 85%, unless otherwise authorized by this permit.

11. Facilities that generate industrial solid waste as defined in 30 TAC §335.1 shall comply with these provisions:

    a. Any solid waste, as defined in 30 TAC §335.1 (including but not limited to such wastes as garbage, refuse, sludge from a waste treatment, water supply treatment plant or air pollution control facility, discarded materials, discarded materials to be recycled, whether the waste is solid, liquid, or semisolid), generated by the permittee during the management and treatment of wastewater, must be managed in accordance with all applicable provisions of 30 TAC Chapter 335, relating to Industrial Solid Waste Management.

    b. Industrial wastewater that is being collected, accumulated, stored, or processed before discharge through any final discharge outfall, specified by this permit, is considered to be industrial solid waste until the wastewater passes through the actual point source discharge and must be managed in accordance with all applicable provisions of 30 TAC Chapter 335.

    c. The permittee shall provide written notification, pursuant to the requirements of 30 TAC §335.8(b)(1), to the Corrective Action Section (MC 127) of the Remediation Division informing the Commission of any closure activity involving an Industrial Solid Waste Management Unit, at least 90 days prior to conducting such an activity.

    d. Construction of any industrial solid waste management unit requires the prior written notification of the proposed activity to the Registration and Reporting Section (MC 129) of the Permitting and Remediation Support Division. No person shall dispose of industrial solid waste, including sludge or other solids from wastewater treatment processes, prior to fulfilling the deed recordation requirements of 30 TAC §335.5.

    e. The term "industrial solid waste management unit" means a landfill, surface impoundment, waste-pile, industrial furnace, incinerator, cement kiln, injection well, container, drum, salt dome waste containment cavern, or any other structure vessel, appurtenance, or other improvement on land used to manage industrial solid waste.

    f. The permittee shall keep management records for all sludge (or other waste) removed from any wastewater treatment process. These records shall fulfill all applicable requirements of 30 TAC Chapter 335 and must include the following, as it pertains to wastewater treatment and discharge:

        i. Volume of waste and date(s) generated from treatment process;
        ii. Volume of waste disposed of on-site or shipped off-site;
        iii. Date(s) of disposal;
        iv. Identity of hauler or transporter;
        v. Location of disposal site; and
        vi. Method of final disposal.

        The above records shall be maintained on a monthly basis. The records shall be retained at the facility site, or shall be readily available for review by authorized representatives of the TCEQ for at least five years.

12. For industrial facilities to which the requirements of 30 TAC Chapter 335 do not apply, sludge and solid wastes, including tank cleaning and contaminated solids for disposal, shall be disposed of in accordance with THSC Code Chapter 361.

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OTHER REQUIREMENTS

1. DEFINITIONS

A. The flow weighted average temperature (FWAT) shall be computed and recorded on a daily basis. FWAT shall be computed at equal time intervals not greater than two hours. The method of calculating FWAT is as follows:

$$\text{FWAT} = \frac{\text{SUMMATION (INSTANTANEOUS FLOW X INSTANTANEOUS TEMPERATURE)}}{\text{SUMMATION (INSTANTANEOUS FLOW)}}$$

The "daily average temperature" shall be the arithmetic average of all FWATs calculated during the calendar month.

The "daily maximum temperature" shall be the highest FWAT calculated during the calendar month.

B. The term "total residual chlorine" (or total residual oxidants for intake water with bromides) means the value obtained using any of the "chlorine—total residual" methods in Table IB in 40 CFR Part 136.3(a), or other methods approved by the permitting authority.

Total residual chlorine may not be discharged from any single generating unit for more than two hours per day unless the discharger demonstrates to the permitting authority that discharge for more than two hours is required for macroinvertebrate control.

Simultaneous multi-unit chlorination is permitted.

C. The term "free available chlorine" means the value obtained using any of the "chlorine—free available" methods in Table 1B in 40 CFR Part 136.3(a) where the method has the capability of measuring free available chlorine, or other methods approved by the permitting authority.

D. The term "metal cleaning waste" means any wastewater resulting from cleaning (with or without chemical compounds) any metal process equipment including, but not limited to, boiler tube cleaning, boiler fireside cleaning, and air preheater cleaning.

The term "chemical metal cleaning waste" means any wastewater resulting from the cleaning of any metal process equipment with chemical compounds, including, but not limited to, boiler tube cleaning.

E. The term "low-volume waste sources" means, taken collectively as if from one source, wastewater from all sources except those for which specific limitation are otherwise established in 40 CFR Part 423. Low volume waste sources include, but are not limited to, wastewaters from: wet scrubber air pollution control systems, ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, boiler blowdown, floor drains, cooling tower basin cleaning wastes, and recirculating house service water systems. Sanitary and air conditioning wastes are not included.

F. The term "once through cooling water" means water passed through the main cooling condensers in one or two passes for the purpose of removing waste heat.

G. The term "average concentration" as it relates to chlorine discharge means the average of analyses made over a single period of chlorine release which does not exceed two hours.

H. The term "ash transport water" shall mean water used in the transport of either fly ash or bottom ash.

I. The term "coal pile runoff" means the rainfall runoff from or through any coal, ash, or other material storage pile.

J. The term "blowdown" means the minimum discharge of recirculating water for the purpose of discharging materials contained in the water, the further buildup of which would cause concentration in amounts exceeding limits established by best engineering practices.

K. The term "10-year, 24-hour rainfall event" shall mean a rainfall event with the probable recurrence interval of once in ten years as defined by the National Weather Service, or by equivalent regional or state rainfall probability information.

2. The permittee is hereby placed on notice that this permit may be reviewed by the Texas Commission on Environmental Quality (TCEQ) after the completion of any new intensive water quality survey on Segment No. 1209 of the Brazos River Basin and any subsequent updating of the water quality model for Segment No. 1209, in order to determine if the limitations and conditions contained herein are consistent with any such revised model. The permit may be amended, pursuant to 30 TAC Sections 305.62, as a result of such review.

3. Violations of daily maximum limitations for the following pollutants shall be reported orally to TCEQ Region 9, within 24 hours from the time the permittee becomes aware of the violation followed by a written report within five days:

POLLUTANT	MAL (mg/L)
Arsenic, Total	0.010
Copper, Total	0.010
Iron, Total	1.000
Selenium, Total	0.010

Test methods utilized shall be sensitive enough to demonstrate compliance with the permit effluent limitations. Permit compliance/noncompliance determinations will be based on the effluent limitations contained in this permit with consideration given to the minimum analytical level (MAL) for the parameters specified above.

When an analysis of an effluent sample for any of the parameters listed above indicates no detectable levels above the MAL and the test method detection level is as sensitive as the specified MAL, a value of zero (0) shall be used for that measurement when determining calculations and reporting requirements for the self-reporting form. This applies to determinations of daily maximum concentration, calculations of loading and daily averages, and other reportable results.

When a reported value is zero (0) based on this MAL provision, the permittee shall submit the following statement with the self-reporting form either as a separate attachment to the form or as a statement in the comments section of the form.

> "The reported value(s) of zero (0) for ____[list parameter(s)]____ on the self-reporting form for [monitoring period date range]___ is based on the following conditions: 1) the analytical method used had a method detection level as sensitive as the MAL specified in the permit, and 2) the analytical results contained no detectable levels above the specified MAL."

When an analysis of an effluent sample for a parameter indicates no detectable levels and the test method detection level is not as sensitive as the MAL specified in the permit, or an MAL is not specified in the permit for that parameter, the level of detection achieved shall be used for that measurement when determining calculations and reporting requirements for the self-reporting form. A zero (0) may not be used.

4. There shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid.

5. There shall be no discharge of cooling tower blowdown.

6. Chronic toxic criteria apply at the edge of the mixing zone. The mixing zones (MZ) for Outfalls 003 and 004 are defined as a volume of water within a radius of 100 feet extending over the receiving water from the point where the discharges reach Gibbons Creek Reservoir.

Acute toxic criteria apply at the point of discharge. There is no mixing zone for Outfall 001, established for this discharge to an unnamed ditch which is determined to be an intermittent stream. There is also no mixing zone for Outfall 002, established for this discharge to Big Branch Creek, an intermittent stream.

7. There shall be no discharge via Outfall 002 except as a result of rainfall from a 10-year, 24-hour storm event (8.5 inches), or a series of rainfall events within a continuous 72-hour period that either equal or exceed that event (8.5 inches). A rain gauge shall be maintained on-site. Continuous rainfall records are not required, but it is the burden of the permittee to demonstrate that discharges via Outfall 002 are in compliance with this provision of the permit.

   Storm water runoff caused by rainfall events less than a 10-year, 24-hour rainfall event shall be routed into the plant collection pond prior to discharge via Outfall 002 and the ash ponds prior to discharge via Outfall 001.

8. This provision supersedes and replaces Provision 1, Paragraph 1 of Monitoring and Reporting Requirements found on Page 4 of this permit.

   Monitoring results shall be provided at the intervals specified in the permit. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall conduct effluent sampling and reporting in accordance with 30 TAC §§ 319.4 - 319.12. Unless otherwise specified, a monthly effluent report shall be submitted each month, to the location(s) specified on the reporting form or the instruction sheet, by the 25th day of the following month for each discharge which is described by this permit whether or not a discharge is made for that month. Monitoring results must be reported on the approved TPDES self-report form, Discharge Monitoring Report (DMR) Form EPA No. 3320-1, signed and certified as required by Monitoring and Reporting Requirements No. 10.

9. This requirement is applicable to the treatment and disposal of domestic wastewater (sewage) at Outfall 101 only.

   On-site disposal of sewage sludge is not authorized. The permittee shall ensure that all sewage sludge which is not a hazardous waste (as defined in 30 TAC Chapter 335) is handled, transported, and disposed of in compliance with the applicable provisions of 30 TAC Chapter 312. The permittee shall ensure that all sewage sludge which is a hazardous waste (as defined in 30 TAC Chapter 335) is handled, transported, and disposed of in compliance with the applicable provisions of 30 TAC Chapter 335.

   The sludge from the treatment process shall be digested, dewatered and disposed of in accordance with all the applicable rules of the TCEQ. The permittee shall ensure that the disposal of sludge does not cause any contamination of the ground or surface waters in the state. The permittee shall keep records of all sludges removed from the wastewater treatment plant site. Such records will include the following information:

   a. volume (dry weight basis) of sludge disposed;
   b. date of disposal;
   c. identity and registration number of hauler;
   d. location and registration or permit number of disposal site; and,
   e. method of final disposal.

   The above records shall be maintained on a monthly basis and be available at the plant site for inspection by authorized representatives of the TCEQ for at least five years.

10. This permit authorizes the use of wastewater from the ash ponds (3 in series) for dust suppression on mine roads adjacent to the facility. Records of the volume and quality of effluent used for dust suppression shall be kept on-site for a period of five years. The reclaimed water shall be analyzed once per quarter during use for dust suppression by grab sample for the following constituents and shall meet the following quality:

    a. Chemical Oxygen Demand (COD) not to exceed 150 mg/L;
    b. Nitrate Nitrogen not to exceed 10 mg/L;
    c. Oil and Grease not to exceed 10 mg/L;

d. pH not less than 6.0 nor greater than 9.0 standard units; and,
e. Fecal Coliform not to exceed 75 per 100 mL.

11. All wastewater retention ponds shall be operated in such a manner as to maintain a minimum freeboard of two feet.

12. The permittee shall notify the Executive Director in writing, at least 90 days prior to discontinuing use of any surface impoundment, pit, or basin authorized by this permit. The permittee shall, at the request of the Executive Director, submit such information as is necessary to evaluate closure of the waste management unit(s) including, but not limited to, chemical analyses of bottom sediments, soils, and groundwater samples.

13. Subsequent to this permit issuance date, all new process wastewater ponds shall be lined in compliance with one of the following requirements:

    a. Soil Liner: The soil liner shall contain at least 3 feet of clay-rich (liquid limit greater than or equal to 30 and plasticity index greater than or equal to 15) soil material along the sides and bottom of the pond compacted in lifts of no more than 9 inches, to 95% standard proctor density at the optimum moisture content to achieve a permeability equal to or less than 1×10^{-7} cm/sec.

    b. Plastic/Rubber Liner: The liner shall be either a plastic or rubber membrane liner at least 40 mils (i.e.,40 mils = 0.04 inch) in thickness which completely covers the sides and the bottom of the pond and which is not subject to degradation due to reaction with wastewater with which it will come into contact. If this lining material is vulnerable to ozone or ultraviolet deterioration it should be covered with a protective layer of soil of at least 6 inches. A leak detection system is also required.

    c. Alternate Liner: The permittee shall submit plans for any other pond lining method. Pond liner plans must be approved in writing by the Executive Director of the TCEQ prior to pond construction.

    The permittee shall notify the TCEQ Regional Office upon completion of construction of the pond and at least a week prior to its use. Certification of the lining specifications shall be provided by a Texas licensed professional engineer and shall be available for inspection by TCEQ personnel upon request. For new construction, the certification and the test results of soils forming the bottom and sides of the pond shall be submitted to the TCEQ, Wastewater Permitting Section (MC-148) and Regional Office for review prior to discharging any wastewaters into the ponds. Permeability tests shall be made with material typical of the expected use.

14. For Outfall 003, reporting requirements pursuant to 30 TAC Sections 319.1 -319.12 and any additional effluent reporting requirements contained in the permit are suspended from the effective date of the permit until construction or discharge, whichever comes first, from the wetlands treatment unit described by this permit. A mature, properly functioning constructed wetlands must be developed before wastewater is processed through the system. The permittee shall provide written notice to the TCEQ, Applications Review and Processing Team (MC-148) of the Water Quality Division, and Regional Office, 45 days prior to plant start-up or anticipated discharge.

15. Flow measuring devices and readily accessible sampling points shall be provided by the permittee for Outfall 003.

16. The following requirements apply to the constructed wetlands prior to Outfall 003.

    A. This permit does not authorize the use of any land defined as a natural wetland for wastewater treatment.

    B. The use of non-native, harmful or potentially harmful wetland plants and organisms must first be approved by the Texas Parks and Wildlife Department.

    C. Methods of constructed wetlands maintenance shall not result in a deterioration of water quality.

D. Design: Constructed wetlands facilities for the retention of treated or untreated wastewater shall be designed in accordance with 30 TAC §§217.

E. Constructed wetlands facilities for the retention of treated or untreated wastewater shall be adequately lined to control seepage. The following methods of lining are acceptable.

1. Soil liner requirements:

(a). All placed clay or in-situ soils used for basin liners shall be certified by adequate geotechnical test results. For all in-situ soils, the design engineer shall present adequate soil borings information which ensures the homogeneousness of the selected soil. Placed clay or in-situ soils shall have a measured permeability of less than 10^{-7} cm/sec and/or the following characteristics:

(1). More than 30% passing a #200 mesh sieve.
(2). Liquid limit greater than 30%.
(3). Plasticity index greater than 15.
(4). No clods larger than two (2) inches.
(5). Minimum compacted thickness of two feet for placed clay liners and four feet for in-situ soils.

(b). All placed clay liners shall be installed according to the following criteria. However, when using in-situ soils for the required liner, only the upper six inches should be reworked as follows:

(1). Maximum loose lift of eight inches, six inches compacted.
(2). Minimum compaction effort of 95 percent Standard Proctor (ASTM D-698).
(3). Liners shall be keyed into the existing in-situ soils.

2. Synthetic liner requirements:

All synthetic liners shall have a minimum thickness of 30 mils and contain underdrain leak detection which shall consist of leachate collection and detection systems. Proper installation of the materials mentioned in subparagraph (a) of this requirement shall be described in the project's specifications. The liner material shall be resistant to or protected from ultra-violet (UV) light degradation.

3. An alternate method of pond lining may be utilized with prior approval from the Executive Director.

The permittee shall furnish certification by a Texas Licensed Professional Engineer that the completed lining meets the appropriate criteria above prior to utilization of the facilities. The certification shall be sent to the TCEQ Regional Office (MC Region 9) and the Enforcement Division (MC 224).

F. Operation: Constructed wetlands facilities for the retention of treated or untreated wastewater shall be operated in accordance with 30 TAC §§217.

G. Herbicides, insecticides, and fertilizers shall not be used in constructed wetlands.

17. The following requirements apply to the overland flow system prior to Outfall 003: The permittee is authorized to use overland flow following the constructed wetland as an essential treatment element for the effluent discharged via Outfall 003. The use of the overland flow system is subject to the following conditions and limitations:

A. The maximum overland flow shall not exceed a volume of 31,680 gallons. Flow will be measured immediately prior to wastewater application to the land. The permittee shall keep daily records specifying the amount of effluent applied and location of acreage receiving the effluent and the amount of effluent applied. The records shall be retained for at least five years and be made available to representatives of the Commission upon request.

B. An effluent sampling station shall be provided as a part of the discharge outfall.

C. A vegetative cover shall be maintained on the overland flow site. The plant types selected shall provide uniform coverage of soil to prevent short circuiting and channelization of the area.

D. Wastewater application areas shall not receive effluent for the purpose of treatment and discharge until cover crops have provided adequate coverage to prevent erosion and support the treatment process.

E. Wastewater shall not be applied during rainfall events nor during frozen conditions.

F. Wastewater shall be applied in cycles with alternating periods for resting. The cycle shall provide a maximum of ten hours of application followed by a minimum of fourteen hours of resting.

G. The method of application shall provide a uniform flow onto and across the overland flow site.

H. The permittee shall maintain at least four days of storage for operational flexibility and convenience.

I. Holding ponds shall conform to 30 TAC §§217 requirements for stabilization ponds with regard to construction, levee design and a minimum of two (2) feet of freeboard shall be maintained.

J. The application area shall be protected from flooding.

K. The boundary of the overland flow site shall be bermed to insure that off-site storm water runoff does not enter the overland flow site.

L. Adequate screening shall be provided to prevent solids from clogging the flow distribution system.

18. On an emergency basis, the pemittee may route wastewater from the Plant Collection Pond for reuse in the auxiliary cooling system prior to discharge via Outfall 004. The permittee shall submit written notification to the Wastewater Permitting Section, Industrial Permits Team (MC-148) within seven (7) days of the incident and oral notification within 24 hours to the TCEQ Region 9 Office.

19. COOLING WATER INTAKE STRUCTURE REQUIREMENTS: 316(b) of the Clean Water Act

The permittee shall continue to operate and maintain the cooling water intake structure (CWIS) configuration consistent with the documents titled Texas Municipal Power Agency's Gibbons Creek Steam Electric Station Supplemental Information for 316(b) Determination of Best Technology Available (BTA) submitted as part of the permit application received November 16, 2007 in which is included a description of how the facility meets BTA for minimizing Adverse Environmental Impact (AEI).

Specifically, the permittee shall adhere to the following conditions related to the operation, maintenance, and monitoring of the CWIS:

a. bar grates shall be cleaned as needed but not less frequently than every three years;

b. screens conditions shall be visually checked daily, when operating;

c. the screens must initiate a cleaning cycle whenever the water level differential (before and after the screens) exceeds eight inches, when operating;

d. screens shall be in proper operating conditions whenever the circulating water pumps are withdrawing water. If a screen must be taken out of service for maintenance the differential across the screens must maintain compliance with item "c" above;

e. screens shall be rotated through a cleaning cycle a minimum of once per week;

f. Water and impinged material resulting from the cleaning process shall enter a concrete trench from which water and material returns to the reservoir. If any material is removed it shall be properly disposed in accordance with applicable TCEQ regulations;

g. routine preventive maintenance shall be conducted to ensure proper operating conditions of the screens on an as needed basis, but at a minimum of once each three months;

h. sediment shall be cleaned from the bottom of the intake structure periodically, but not less frequently than every five years. Periodic inspections of the bottom of the intake structure, occurring at a frequency of no less than every five years, may satisfy this requirement if it is documented that sediment has not accumulated and cleaning is not needed; and,

i. records documenting the operation and maintenance described above shall be kept on site for a minimum of three years, and made available to TCEQ personnel upon request.

If it later determined that the current CWIS configuration is not representative of BTA for minimizing AEI, the permit may be reopened to incorporate additional requirements.

20. SCHEDULE OF COMPLIANCE FOR WATER QUALITY BASED EFFLUENT LIMITS

The permittee shall comply with the following schedule of activities for the attainment of water quality-based final effluent limitations for total selenium, total dissolved solids, total chloride and total sulfate at Outfall 002:

A. determine exceedance cause(s);
B. develop control options;
C. evaluate and select control mechanisms;
D. implement corrective action; and
E. attain final effluent limitations no later than three years from the date of permit issuance.

The permittee shall submit quarterly progress reports in accordance with the following schedule. The requirement to submit quarterly progress reports shall expire three years from the date of permit issuance.

PROGRESS REPORT DATE

January 1
April 1
July 1
October 1

The quarterly progress reports shall include a discussion of the interim requirements that have been completed at the time of the report and shall address the progress towards attaining the water quality-based final effluent limitations for total selenium, total dissolved solids, total chloride and total sulfate at Outfall 002 no later than three years from the date of permit issuance.

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

All reports shall be submitted to the Region 9 Office and to the Enforcement Division (MC 224) of the TCEQ.

21. Tables 1, 2 and 3 shall be completed with the analytical results for the applicable outfalls and sent to the TCEQ, Wastewater Permitting Section (MC 148), within 90 days following commencement of discharge. Based on a technical review of the submitted analytical results, an amendment may be initiated by TCEQ staff to include additional effluent limitations or monitoring requirements.

Test methods utilized to determine compliance with the permit monitoring and reporting requirements or limitations shall be according to EPA methodology and sensitive enough to detect the parameters listed below at the minimum analytical level (MAL).

Table 1: For Outfall 001 (upon permit issuance), analysis is required for all pollutants. Wastewater shall be sampled and analyzed for those parameters listed in Table 1 for a minimum of four (4) separate sampling events which are a minimum of one (1) week apart.

Table 2: For Outfall 002 (upon permit issuance when discharge commences). Wastewater shall be sampled and analyzed for those parameters listed in Table 2 for a minimum of four (4) separate sampling events which are a minimum of one (1) week apart. Sample analysis submitted with the application can be used as part of the four required sampling events if tested to the appropriate MAL.

Table 3: For Outfall 004 (upon permit issuance), analysis is required for all pollutants. Wastewater shall be sampled and analyzed for those parameters listed in Table 3 for a minimum of four (4) separate sampling events which are a minimum of one (1) week apart. Sample analysis submitted with the application can be used as part of the four required sampling events if tested to the appropriate MAL.

TABLE 1

Outfall No.: 001 ☐C ☐G	**Effluent Concentration (mg/l)**					**MAL (mg/L)**
Pentachlorophenol						50

TABLE 2

Outfall No.: 002 ☐C ☐G	**Effluent Concentration (mg/l)**					**MAL (mg/L)**
Benzo(a)anthracene						10
Benzo(a)pyrene						10
Chrysene						10
Hexachlorobenzene						10
Pentachlorophenol						50
1,2,4,5-Trichlorobnezene						20

TABLE 3

Outfall No.: 004 ☐C ☐G	**Effluent Concentration (mg/l)**					**MAL (mg/L)**
Benzo(a)anthracene						10
Benzo(a)pyrene						10
Chrysene						10
Hexachlorobenzene						10
Hexachlorobutadiene						10
Pentachlorophenol						50
1,2,4,5-Trichlorobnezene						20

22. Wastewater shall be tested for all pollutants on Attachment A upon initiation of discharge via Outfall 003. Wastewater shall be sampled and analyzed for those parameters listed for a minimum of four (4) separate sampling events (any sample which was tested to the appropriate MAL and submitted with the application may be used for the applicable outfall) which are a minimum of one (1) week apart. The completed table with the results of these analyses shall be submitted to the Industrial Permits Team, Wastewater Permitting Section MC 148, Water Quality Division, TCEQ, within 90 days following permit issuance or final applicable discharge event. Based on a technical review of the submitted analytical results, an amendment may be initiated by TCEQ staff to include additional effluent limitations and/or monitoring requirements. Test methods utilized to determine compliance with the permit monitoring and reporting requirements and/or limitations shall be according to EPA methodology and sensitive enough to detect the parameters listed below at the minimum analytical level (MAL). When an analysis of an effluent sample for these parameters results in a measurement of less than the MAL, that parameter shall be reported as "< (MAL value)" and this shall be interpreted as a value of zero (0) for compliance purposes.

23. The permittee shall develop and submit to the TCEQ, within one year of the permit effective date, a plan to characterize the thermal plume in the receiving water through either the use of a model, mass balance, or via collected or existing in-stream temperature data. The permittee would then be required to implement the plan following its approval by the TCEQ.

    The permittee is hereby placed on notice that the Executive Director of the TCEQ will be initiating changes to evaluation procedures and/or rulemaking that may affect thermal requirements for this facility.

ATTACHMENT A

Outfall No.: ☐C ☐G	Effluent Concentration (mg/L)					
Pollutants	**Samp. 1**	**Samp. 2**	**Samp. 3**	**Samp. 4**	**Average**	
BOD (5-day)						
CBOD (5-day)						
Chemical Oxygen Demand						
Total Organic Carbon						
Dissolved Oxygen						
Ammonia Nitrogen						
Total Suspended Solids						
Nitrate Nitrogen						
Total Organic Nitrogen						
Total Phosphorus						
Oil and Grease						
Total Residual Chlorine						
Total Dissolved Solids						
Sulfate						
Chloride						
Fluoride						
E.Coli bacteria						
Temperature(°F)						
pH (Standard Units; min/max)						
	Effluent Concentration (mg/L)					**MAL (mg/L)**
Total Aluminum						30
Total Antimony						30
Total Arsenic						10
Total Barium						10
Total Beryllium						5
Total Cadmium						1
Total Chromium						10
Trivalent Chromium						N/A
Hexavalent Chromium						10
Total Copper						10
Cyanide						20
Total Lead						5
Total Mercury						0.2
Total Nickel						10
Total Selenium						10
Total Silver						2.0
Total Thallium						10
Total Zinc						5

(*1) Indicate units if different from mg/L.

CHRONIC BIOMONITORING REQUIREMENTS: FRESHWATER

The provisions of this Section apply to Outfalls 001, 003, and 004 for whole effluent toxicity (WET) testing.

1. Scope, Frequency and Methodology

a. The permittee shall test the effluent for toxicity in accordance with the provisions below. Such testing will determine if an appropriately dilute effluent sample adversely affects the survival, reproduction, or growth of the test organisms.

b. The permittee shall conduct the following toxicity tests utilizing the test organisms, procedures and quality assurance requirements specified in this Part of the permit and in accordance with AShort-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition (EPA-821-R-02-013), or its most recent update:

1) Chronic static renewal survival and reproduction test using the water flea (*Ceriodaphnia dubia*) (Method 1002.0). This test should be terminated when 60% of the surviving adults in the control produce three broods or at the end of eight days, whichever comes first. This test shall be conducted once per quarter.

2) Chronic static renewal 7-day larval survival and growth test using the fathead minnow (*Pimephales promelas*) (Method 1000.0). A minimum of five replicates with eight organisms per replicate shall be used in the control and in each dilution. This test shall be conducted once per quarter.

The permittee must perform and report a valid test for each test species during the prescribed reporting period. An invalid test must be repeated during the same reporting period. An invalid test is herein defined as any test failing to satisfy the test acceptability criteria, procedures, and quality assurance requirements specified in the test methods and permit. All test results, valid or invalid, must be submitted as described below.

c. For Outfalls 001 and 003, the permittee shall use five effluent dilution concentrations and a control in each toxicity test. These additional effluent concentrations are 6%, 8%, 11%, 15%, and 20% effluent. The critical dilution, defined as 15% effluent, is the effluent concentration representative of the proportion of effluent in the receiving water during critical low flow or critical mixing conditions.

For Outfall 004, the permittee shall use five effluent dilution concentrations and a control in each toxicity test. These additional effluent concentrations are 32%, 42%, 56%, 75%, and 100% effluent, with a critical dilution of 100% effluent.

d. This permit may be amended to require a WET limit, Chemical-Specific (CS) effluent limits, a Best Management Practice (BMP), or other appropriate actions to address toxicity. The permittee may be required to conduct a Toxicity Reduction Evaluation after multiple toxic events.

e. Testing Frequency Reduction

1) If none of the first four consecutive quarterly tests demonstrates significant toxicity, the permittee may submit this information in writing and, upon approval, reduce the testing frequency to once per six months for the invertebrate test species and once per year for the vertebrate test species.

2) If one or more of the first four consecutive quarterly tests demonstrates significant toxicity, the permittee shall continue quarterly testing for that species until the permit is reissued. If a testing frequency reduction had been previously granted and a subsequent test demonstrates significant toxicity, the permittee will resume a quarterly testing frequency for that species until the permit is reissued.

2. Required Toxicity Testing Conditions

a. Test Acceptance - The permittee shall repeat any toxicity test, including the control and all effluent dilutions, which fail to meet the following criteria:

1) a control mean survival of 80% or greater;

2) a control mean number of water flea neonates per surviving adult of 15 or greater;

3) a control mean dry weight of surviving fathead minnow larvae of 0.25 mg or greater;

4) a control Coefficient of Variation percent (CV%) of 40 or less in between replicates for the young of surviving females in the water flea reproduction and survival test; and the growth and survival endpoints in the fathead minnow growth and survival test.

5) a critical dilution CV% of 40 or less for young of surviving females in the water flea reproduction and survival test; and the growth and survival endpoints for the fathead minnow growth and survival test. However, if statistically significant lethal or nonlethal effects are exhibited at the critical dilution, a CV% greater than 40 shall not invalidate the test.

6) a Percent Minimum Significant Difference of 47 or less for water flea reproduction;

7) a Percent Minimum Significant Difference of 30 or less for fathead minnow growth.

b. Statistical Interpretation

1) For the water flea survival test, the statistical analyses used to determine if there is a significant difference between the control and an effluent dilution shall be Fisher's Exact Test as described in the manual referenced above, or its most recent update.

2) For the water flea reproduction test and the fathead minnow larval survival and growth tests, the statistical analyses used to determine if there is a significant difference between the control and an effluent dilution shall be in accordance with the manual referenced above, or its most recent update.

3) The permittee is responsible for reviewing test concentration-response relationships to ensure that calculated test-results are interpreted and reported correctly. The EPA manual, "Method Guidance and Recommendation for Whole Effluent Toxicity (WET) Testing (40 CFR Part 136)" (EPA 821-B-00-004), provides guidance on determining the validity of test results.

4) If significant lethality is demonstrated (that is, there is a statistically significant difference in survival at the critical dilution when compared to the control), the conditions of test acceptability are met, and the survival of the test organisms are equal to or greater than 80% in the critical dilution and all dilutions below that, then the permittee shall report a survival No Observed Effect Concentration (NOEC) of not less than the critical dilution for the reporting requirements.

5) The NOEC is defined as the greatest effluent dilution at which no significant effect is demonstrated. The Lowest Observed Effect Concentration (LOEC) is defined as the lowest effluent dilution at which a significant effect is demonstrated. A significant effect is herein defined as a statistically significant difference at the 95% confidence level between the survival, reproduction, or growth of the test organism(s) in a specified effluent dilution compared to the survival, reproduction, or growth of the test organism(s) in the control (0% effluent).

6) The use of NOECs and LOECs assumes either a monotonic (continuous) concentration-response relationship or a threshold model of the concentration-response relationship. For any test result that demonstrates a non-monotonic (non-continuous) response, the NOEC should be determined based on the guidance manual referenced in Item 3 above.

7) Pursuant to the responsibility assigned to the permittee in Part 2.b.3), test results that demonstrate a non-monotonic (non-continuous) concentration-response relationship may be submitted, prior to the due date, for technical review. The above-referenced guidance manual will be used when making a determination of test acceptability.

8) Staff will review test results for consistency with rules, procedures, and permit requirements.

c. Dilution Water

1) Dilution water used in the toxicity tests shall be the receiving water collected as close as possible to the point of discharge into the lake but unaffected by the discharge.

2) Where the receiving water proves unsatisfactory as a result of pre-existing instream toxicity (i.e. fails to fulfill the test acceptance criteria of item 2.a.), the permittee may substitute synthetic dilution water for the receiving water in all subsequent tests provided the unacceptable receiving water test met the following stipulations:

a) a synthetic lab water control was performed (in addition to the receiving water control) which fulfilled the test acceptance requirements of item 2.a;

b) the test indicating receiving water toxicity was carried out to completion (i.e., 7 days);

c) the permittee submitted all test results indicating receiving water toxicity with the reports and information required in Part 3 of this Section.

3) The synthetic dilution water shall consist of standard, moderately hard, reconstituted water. Upon approval, the permittee may substitute other appropriate dilution water with chemical and physical characteristics similar to that of the receiving water.

d. Samples and Composites

1) The permittee shall collect a minimum of three composite samples from the outfall being sampled. The second and third composite samples will be used for the renewal of the dilution concentrations for each toxicity test.

2) The permittee shall collect the composite samples such that the samples are representative of any periodic episode of chlorination, biocide usage, or other potentially toxic substance discharged on an intermittent basis.

3) The permittee shall initiate the toxicity tests within 36 hours after collection of the last portion of the first composite sample. The holding time for any subsequent composite sample shall not exceed 72 hours. Samples shall be maintained at a temperature of 0-6 degrees Centigrade during collection, shipping, and storage.

4) If the outfall being sampled ceases discharging during the collection of effluent samples, the requirements for the minimum number of effluent samples, the minimum numbers of effluent portions, and the sample holding time, are waived. However, the permittee must have collected an effluent composite sample volume sufficient to complete the required toxicity tests with renewal of the effluent. When possible, the effluent samples used for the toxicity tests shall be collected on separate days if the discharge occurs over multiple days. The sample collection duration and the static renewal protocol associated with the abbreviated sample collection must be documented in the full report.

3. Reporting

All reports, tables, plans, summaries, and related correspondence required in any Part of this Section shall be submitted to the attention of the Standards Implementation Team (MC 150) of the Water Quality Division.

a. The permittee shall prepare a full report of the results of all tests conducted in accordance with the manual referenced above, or its most recent update, for every valid and invalid toxicity test initiated whether carried to completion or not.

b. The permittee shall routinely report the results of each biomonitoring test on the Table 1 forms provided with this permit.

1) Annual biomonitoring test results are due on or before January 20th for biomonitoring conducted during the previous 12 month period.

2) Semiannual biomonitoring test results are due on or before July 20th and January 20th for biomonitoring conducted during the previous 6 month period.

3) Quarterly biomonitoring test results are due on or before April 20th, July 20th, October 20th, and January 20th, for biomonitoring conducted during the previous calendar quarter.

4) Monthly biomonitoring test results are due on or before the 20th day of the month following sampling.

c. Enter the following codes for the appropriate parameters for valid tests only:

1) For the water flea, Parameter TLP3B, enter a "1" if the NOEC for survival is less than the critical dilution; otherwise, enter a "0."

2) For the water flea, Parameter TOP3B, report the NOEC for survival.

3) For the water flea, Parameter TXP3B, report the LOEC for survival.

4) For the water flea, Parameter TWP3B, enter a "1" if the NOEC for reproduction is less than the critical dilution; otherwise, enter a "0."

5) For the water flea, Parameter TPP3B, report the NOEC for reproduction.

6) For the water flea, Parameter TYP3B, report the LOEC for reproduction.

7) For the fathead minnow, Parameter TLP6C, enter a "1" if the NOEC for survival is less than the critical dilution; otherwise, enter a "0."

8) For the fathead minnow, Parameter TOP6C, report the NOEC for survival.

9) For the fathead minnow, Parameter TXP6C, report the LOEC for survival.

10) For the fathead minnow, Parameter TWP6C, enter a "1" if the NOEC for growth is less than the critical dilution; otherwise, enter a "0."

11) For the fathead minnow, Parameter TPP6C, report the NOEC for growth.

12) For the fathead minnow, Parameter TYP6C, report the LOEC for growth

d. Enter the following codes for retests only:

1) For retest number 1, Parameter 22415, enter a "1" if the NOEC for survival is less than the critical dilution; otherwise, enter a "0."

2) For retest number 2, Parameter 22416, enter a "1" if the NOEC for survival is less than the critical dilution; otherwise, enter a "0."

4. Persistent Toxicity

The requirements of this Part apply only when a test demonstrates a significant effect at the critical dilution. A significant effect is defined as a statistically significant difference, at the 95% confidence level, between a specified endpoint (survival, growth, or reproduction) of the test organism in a specified effluent dilution when compared to the specified endpoint of the test organism in the control. Significant lethality is defined as a statistically significant difference in survival at the critical dilution when compared to the survival of the test organism in the control. Significant sublethality is defined as a statistically significant difference in growth/reproduction at the critical dilution when compared to the growth/reproduction of the test organism in the control.

a. The permittee shall conduct a total of 2 additional tests (retests) for any species that demonstrates a significant effect (lethal or sublethal) at the critical dilution. The two retests shall be conducted monthly during the next two consecutive months.

b. The permittee shall not substitute either of the two retests in lieu of routine toxicity testing. All reports shall be submitted within 20 days of test completion. Test completion is defined as the last day of the test.

c. If the retests are performed due to a demonstration of significant lethality, and one or both of the two retests specified in item 4.a. demonstrates significant lethality, the permittee shall initiate the TRE requirements as specified in Part 5. The provisions of item 4.a. are suspended upon completion of the two retests and submittal of the TRE Action Plan and Schedule defined in Part 5.

If neither test demonstrates significant lethality and the permittee is testing under the reduced testing frequency provision of Part 1.e., the permittee shall return to a quarterly testing frequency for that species.

d. If the two retests are performed due to a demonstration of significant sublethality, and one or both of the two retests specified in item 4.a. demonstrates significant lethality, the permittee shall again perform two retests as stipulated in item 4.a.

e. If the two retests are performed due to a demonstration of significant sublethality, and neither test demonstrates significant lethality, the permittee shall continue testing at the quarterly frequency.

f. Regardless of whether retesting for lethal or sublethal effects, or a combination of the two, no more than one retest per month is required for a species.

5. Toxicity Reduction Evaluation

a. Within 45 days of the retest that demonstrates significant lethality, or within 45 days of being so instructed due to multiple toxic events, the permittee shall submit a General Outline for initiating a Toxicity Reduction Evaluation (TRE). The outline shall include, but not be limited to, a description of project personnel, a schedule for obtaining consultants (if needed), a discussion of influent and effluent data available for review, a sampling and analytical schedule, and a proposed TRE initiation date.

b. Within 90 days of the retest that demonstrates significant lethality, or within 90 days of being so instructed due to multiple toxic events, the permittee shall submit a TRE Action Plan and Schedule for conducting a TRE. The plan shall specify the approach and methodology to be used in performing the TRE. A TRE is a step-wise investigation combining toxicity testing with physical and chemical analysis to determine actions necessary to eliminate or reduce effluent toxicity to a level not effecting significant lethality at the critical dilution. The TRE Action Plan shall lead to the successful elimination of significant lethality for both test species defined in item 1.b. As a minimum, the TRE Action Plan shall include the following:

1) Specific Activities - The TRE Action Plan shall specify the approach the permittee intends to utilize in conducting the TRE, including toxicity characterizations, identifications, confirmations, source evaluations, treatability studies, and alternative approaches. When conducting characterization analyses, the permittee shall perform multiple characterizations and follow the procedures specified in the document entitled, "Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I" (EPA/600/6-91/005F), or alternate procedures.

The permittee shall perform multiple identifications and follow the methods specified in the documents entitled, "Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/080) and "Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/081). All characterization, identification, and confirmation tests shall be conducted in an orderly and logical progression;

2) Sampling Plan - The TRE Action Plan should describe sampling locations, methods, holding times, chain of custody, and preservation techniques. The effluent sample volume collected for all tests shall be adequate to perform the toxicity characterization/ identification/ confirmation procedures, and chemical-specific analyses when the toxicity tests show significant lethality. Where the permittee has identified or suspects specific pollutant(s) and source(s) of effluent toxicity, the permittee shall conduct, concurrent with toxicity testing, chemical-specific analyses for the identified and suspected pollutant(s) and source(s) of effluent toxicity;

3) Quality Assurance Plan - The TRE Action Plan should address record keeping and data evaluation, calibration and standardization, baseline tests, system blanks, controls, duplicates, spikes, toxicity persistence in the samples, randomization, reference toxicant control charts, as well as mechanisms to detect artifactual toxicity; and

4) Project Organization - The TRE Action Plan should describe the project staff, project manager, consulting engineering services (where applicable), consulting analytical and toxicological services, etc.

c. Within 30 days of submittal of the TRE Action Plan and Schedule, the permittee shall implement the TRE with due diligence.

d. The permittee shall submit quarterly TRE Activities Reports concerning the progress of the TRE. The quarterly reports are due on or before April 20th, July 20th, October 20th, and January 20th. The report shall detail information regarding the TRE activities including:

1) results and interpretation of any chemical-specific analyses for the identified and suspected pollutant(s) performed during the quarter;

2) results and interpretation of any characterization, identification, and confirmation tests performed during the quarter;

3) any data and substantiating documentation which identifies the pollutant(s) and source(s) of effluent toxicity;

4) results of any studies/evaluations concerning the treatability of the facility's effluent toxicity;

5) any data which identifies effluent toxicity control mechanisms that will reduce effluent toxicity to the level necessary to meet no significant lethality at the critical dilution; and

6) any changes to the initial TRE Plan and Schedule that are believed necessary as a result of the TRE findings.

Copies of the TRE Activities Report shall also be submitted to the U.S. EPA Region 6 office.

e. During the TRE, the permittee shall perform, at a minimum, quarterly testing using the more sensitive species; testing for the less sensitive species shall continue at the frequency specified in Part 1.b.

f. If the effluent ceases to effect significant lethality (herein as defined below) the permittee may end the TRE. A "cessation of lethality" is defined as no significant lethality for a period of 12 consecutive months with at least monthly testing. At the end of the 12 months, the permittee shall submit a statement of intent to cease the TRE and may then resume the testing frequency specified in Part 1.b. The permittee may only apply the "cessation of lethality" provision once.

This provision accommodates situations where operational errors and upsets, spills, or sampling errors triggered the TRE, in contrast to a situation where a single toxicant or group of toxicants cause lethality. This provision does not apply as a result of corrective actions taken by the permittee. "Corrective actions" are herein defined as proactive efforts which eliminate or reduce effluent toxicity. These include, but are not limited to, source reduction or elimination, improved housekeeping, changes in chemical usage, and modifications of influent streams and effluent treatment.

The permittee may only apply this cessation of lethality provision once. If the effluent again demonstrates significant lethality to the same species, the permit will be amended to add a WET limit with a compliance period, if appropriate. However, prior to the effective date of the WET limit, the permittee may apply for a permit amendment removing and replacing the WET limit with an alternate toxicity control measure by identifying and confirming the toxicant and an appropriate control measure.

g. The permittee shall complete the TRE and submit a Final Report on the TRE Activities no later than 28 months from the last test day of the retest that confirmed significant lethal effects at the critical dilution. The permittee may petition the Executive Director (in writing) for an extension of the 28-month limit. However, to warrant an extension the permittee must have demonstrated due diligence in their pursuit of the TIE/TRE and must prove that circumstances beyond their control stalled the TIE/TRE. The report shall provide information pertaining to the specific control mechanism(s) selected that will, when implemented, result in reduction of effluent toxicity to no significant lethality at the critical dilution. The report will also provide a specific corrective action schedule for implementing the selected control mechanism(s). A copy of the TRE Final Report shall also be submitted to the U.S. EPA Region 6 office.

h. Based upon the results of the TRE and proposed corrective actions, this permit may be amended to modify the biomonitoring requirements, where necessary, to require a compliance schedule for implementation of corrective actions, to specify a WET limit, to specify a BMP, and to specify CS limits.

OUTFALL 001

TABLE 1 (SHEET 1 OF 4)

BIOMONITORING REPORTING

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION

Dates and Times Composites Collected — Date Time / Date Time

No. 1 FROM: _____ TO: _____

No. 2 FROM: _____ TO: _____

No. 3 FROM: _____ TO: _____

Test initiated: _____am/pm _____date

Dilution water used: _____ Receiving water _____ Synthetic Dilution water

NUMBER OF YOUNG PRODUCED PER ADULT AT END OF TEST

REP	Percent effluent					
	0%	6%	8%	11%	15%	20%
A						
B						
C						
D						
E						
F						
G						
H						
I						
J						
Survival Mean						
Total Mean						
CV%*						
PMSD						

*Coefficient of Variation = standard deviation x 100/mean (calculation based on young of the surviving adults)
Designate males (M), and dead females (D), along with number of neonates (x) released prior to death.

OUTFALL 001

TABLE 1 (SHEET 2 OF 4)

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION TEST

1. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

Is the mean number of young produced per adult significantly less than the number of young per adult in the control for the % effluent corresponding to significant nonlethal effects?

CRITICAL DILUTION (15%): _____ YES _____ NO

PERCENT SURVIVAL

	Percent effluent					
Time of Reading	0%	6%	8%	11%	15%	20%
24h						
48h						
End of Test						

2. Fisher's Exact Test:

Is the mean survival at test end significantly less than the control survival for the % effluent corresponding to lethality?

CRITICAL DILUTION (15%): _____ YES _____ NO

3. Enter percent effluent corresponding to each NOEC\LOEC below:

a.) NOEC survival = _____% effluent

b.) LOEC survival = _____% effluent

c.) NOEC reproduction = _____% effluent

d.) LOEC reproduction = _____% effluent

OUTFALL 001

TABLE 1 (SHEET 3 OF 4)

BIOMONITORING REPORTING

FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL

		Date Time		Date Time
Dates and Times Composites Collected	No. 1 FROM:	_____	TO:	_____
	No. 2 FROM:	_____	TO:	_____
	No. 3 FROM:	_____	TO:	_____

Test initiated: _____ am/pm _____ date

Dilution water used: _____ Receiving water _____ Synthetic dilution water

FATHEAD MINNOW GROWTH DATA

Effluent Concentration	Average Dry Weight in replicate chambers					Mean Dry Weight	CV%*
	A	B	C	D	E		
0%							
6%							
8%							
11%							
15%							
20%							
PMSD							

* Coefficient of Variation = standard deviation x 100/mean

1. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean dry weight (growth) at 7 days significantly less than the control's dry weight (growth) for the % effluent corresponding to significant nonlethal effects?

   CRITICAL DILUTION (15%): _____ YES _____ NO

OUTFALL 001

TABLE 1 (SHEET 4 OF 4)

BIOMONITORING REPORTING

FATHEAD MINNOW GROWTH AND SURVIVAL TEST

FATHEAD MINNOW SURVIVAL DATA

Effluent Concentration	Percent Survival in replicate chambers					Mean percent survival			CV%*
	A	B	C	D	E	24h	48h	7 day	
0%									
6%									
8%									
11%									
15%									
20%									

* Coefficient of Variation = standard deviation x 100/mean

2. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean survival at 7 days significantly less than the control survival for the % effluent corresponding to lethality?

   CRITICAL DILUTION (15%): _____ YES _____ NO

3. Enter percent effluent corresponding to each NOEC\LOEC below:

   a.) NOEC survival = _____% effluent

   b.) LOEC survival = _____% effluent

   c.) NOEC growth = _____% effluent

   d.) LOEC growth = _____% effluent

OUTFALL 003

TABLE 1 (SHEET 1 OF 4)

BIOMONITORING REPORTING

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION

		Date Time		Date Time
Dates and Times Composites Collected	No. 1	FROM: _____	TO:	_____
	No. 2	FROM: _____	TO:	_____
	No. 3	FROM: _____	TO:	_____

Test initiated: _____am/pm _____date

Dilution water used: _____ Receiving water _____ Synthetic Dilution water

NUMBER OF YOUNG PRODUCED PER ADULT AT END OF TEST

REP	Percent effluent					
	0%	6%	8%	11%	15%	20%
A						
B						
C						
D						
E						
F						
G						
H						
I						
J						
Survival Mean						
Total Mean						
CV%*						
PMSD						

*Coefficient of Variation = standard deviation x 100/mean (calculation based on young of the surviving adults)
Designate males (M), and dead females (D), along with number of neonates (x) released prior to death.

OUTFALL 003

TABLE 1 (SHEET 2 OF 4)

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION TEST

1. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean number of young produced per adult significantly less than the number of young per adult in the control for the % effluent corresponding to significant nonlethal effects?

   CRITICAL DILUTION (15%): _____ YES _____ NO

PERCENT SURVIVAL

	Percent effluent					
Time of Reading	0%	6%	8%	11%	15%	20%
24h						
48h						
End of Test						

2. Fisher's Exact Test:

   Is the mean survival at test end significantly less than the control survival for the % effluent corresponding to lethality?

   CRITICAL DILUTION (15%): _____ YES _____ NO

3. Enter percent effluent corresponding to each NOEC\LOEC below:

   a.) NOEC survival = _____% effluent

   b.) LOEC survival = _____% effluent

   c.) NOEC reproduction = _____% effluent

   d.) LOEC reproduction = _____% effluent

OUTFALL 003

TABLE 1 (SHEET 3 OF 4)

BIOMONITORING REPORTING

FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL

Dates and Times Composites Collected

Date Time Date Time

No. 1 FROM: _____ TO: _____

No. 2 FROM: _____ TO: _____

No. 3 FROM: _____ TO: _____

Test initiated: _____ am/pm _____ date

Dilution water used: _____ Receiving water _____ Synthetic dilution water

FATHEAD MINNOW GROWTH DATA

Effluent Concentration	Average Dry Weight in replicate chambers					Mean Dry Weight	CV%*
	A	B	C	D	E		
0%							
6%							
8%							
11%							
15%							
20%							
PMSD							

* Coefficient of Variation = standard deviation x 100/mean

1. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean dry weight (growth) at 7 days significantly less than the control's dry weight (growth) for the % effluent corresponding to significant nonlethal effects?

   CRITICAL DILUTION (15%): _____ YES _____ NO

OUTFALL 003

TABLE 1 (SHEET 4 OF 4)

BIOMONITORING REPORTING

FATHEAD MINNOW GROWTH AND SURVIVAL TEST

FATHEAD MINNOW SURVIVAL DATA

Effluent Concentration	Percent Survival in replicate chambers					Mean percent survival			CV%*
	A	B	C	D	E	24h	48h	7 day	
0%									
6%									
8%									
11%									
15%									
20%									

* Coefficient of Variation = standard deviation x 100/mean

2. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean survival at 7 days significantly less than the control survival for the % effluent corresponding to lethality?

   CRITICAL DILUTION (15%): _____ YES _____ NO

3. Enter percent effluent corresponding to each NOEC\LOEC below:

   a.) NOEC survival = _____% effluent

   b.) LOEC survival = _____% effluent

   c.) NOEC growth = _____% effluent

   d.) LOEC growth = _____% effluent

OUTFALL 004

TABLE 1 (SHEET 1 OF 4)

BIOMONITORING REPORTING

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION

Dates and Times Composites Collected

Date Time Date Time

No. 1 FROM: _____ TO: _____

No. 2 FROM: _____ TO: _____

No. 3 FROM: _____ TO: _____

Test initiated: _____am/pm _____date

Dilution water used: _____ Receiving water _____ Synthetic Dilution water

NUMBER OF YOUNG PRODUCED PER ADULT AT END OF TEST

REP	Percent effluent					
	0%	32%	42%	56%	75%	100%
A						
B						
C						
D						
E						
F						
G						
H						
I						
J						
Survival Mean						
Total Mean						
CV%*						
PMSD						

*Coefficient of Variation = standard deviation x 100/mean (calculation based on young of the surviving adults)
Designate males (M), and dead females (D), along with number of neonates (x) released prior to death.

OUTFALL 004

TABLE 1 (SHEET 2 OF 4)

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION TEST

1. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean number of young produced per adult significantly less than the number of young per adult in the control for the % effluent corresponding to significant nonlethal effects?

   CRITICAL DILUTION (100%): _____ YES _____ NO

PERCENT SURVIVAL

	Percent effluent					
Time of Reading	0%	32%	42%	56%	75%	100%
24h						
48h						
End of Test						

2. Fisher's Exact Test:

   Is the mean survival at test end significantly less than the control survival for the % effluent corresponding to lethality?

   CRITICAL DILUTION (100%): _____ YES _____ NO

3. Enter percent effluent corresponding to each NOEC\LOEC below:

   a.) NOEC survival = _____% effluent

   b.) LOEC survival = _____% effluent

   c.) NOEC reproduction = _____% effluent

   d.) LOEC reproduction = _____% effluent

OUTFALL 004

TABLE 1 (SHEET 3 OF 4)

BIOMONITORING REPORTING

FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL

Dates and Times Composites Collected — Date Time

No. 1 FROM: _____ TO: _____

No. 2 FROM: _____ TO: _____

No. 3 FROM: _____ TO: _____

Test initiated: _____ am/pm _____ date

Dilution water used: _____ Receiving water _____ Synthetic dilution water

FATHEAD MINNOW GROWTH DATA

Effluent Concentration	Average Dry Weight in replicate chambers					Mean Dry Weight	CV%*
	A	B	C	D	E		
0%							
32%							
42%							
56%							
75%							
100%							
PMSD							

* Coefficient of Variation = standard deviation x 100/mean

1. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean dry weight (growth) at 7 days significantly less than the control's dry weight (growth) for the % effluent corresponding to significant nonlethal effects?

   CRITICAL DILUTION (100%): _____ YES _____ NO

OUTFALL 004

TABLE 1 (SHEET 4 OF 4)

BIOMONITORING REPORTING

FATHEAD MINNOW GROWTH AND SURVIVAL TEST

FATHEAD MINNOW SURVIVAL DATA

Effluent Concentration	Percent Survival in replicate chambers					Mean percent survival			CV%*
	A	B	C	D	E	24h	48h	7 day	
0%									
32%									
42%									
56%									
75%									
100%									

* Coefficient of Variation = standard deviation x 100/mean

2. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean survival at 7 days significantly less than the control survival for the % effluent corresponding to lethality?

   CRITICAL DILUTION (100%): _____ YES _____ NO

3. Enter percent effluent corresponding to each NOEC\LOEC below:

   a.) NOEC survival = _____% effluent

   b.) LOEC survival = _____% effluent

   c.) NOEC growth = _____% effluent

   d.) LOEC growth = _____% effluent

24-HOUR ACUTE BIOMONITORING REQUIREMENTS: FRESHWATER

The provisions of this section apply to Outfalls 001, 003, and 004 for whole effluent toxicity (WET) testing.

1. Scope, Frequency and Methodology

a. The permittee shall test the effluent for lethality in accordance with the provisions in this Section. Such testing will determine compliance with the Surface Water Quality Standard, 307.6(e)(2)(B), of greater than 50% survival of the appropriate test organisms in 100% effluent for a 24-hour period.

b. The toxicity tests specified shall be conducted once per six months. The permittee shall conduct the following toxicity tests utilizing the test organisms, procedures, and quality assurance requirements specified in this section of the permit and in accordance with "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition" (EPA-821-R-02-012), or its most recent update:

1) Acute 24-hour static toxicity test using the water flea (*Daphnia pulex* or *Ceriodaphnia dubia*). A minimum of five replicates with eight organisms per replicate shall be used in the control and in each dilution.

2) Acute 24-hour static toxicity test using the fathead minnow (*Pimephales promelas*). A minimum of five replicates with eight organisms per replicate shall be used in the control and in each dilution.

A valid test result must be submitted for each reporting period. The permittee must report, and then repeat, an invalid test during the same reporting period. The repeat test shall include the control and the 100% effluent dilution and use the appropriate number of organisms and replicates, as specified above. An invalid test is herein defined as any test failing to satisfy the test acceptability criteria, procedures, and quality assurance requirements specified in the test methods and permit.

c. In addition to an appropriate control, a 100% effluent concentration shall be used in the toxicity tests. Except as discussed in item 2.b., the control and dilution water shall consist of standard, synthetic, moderately hard, reconstituted water.

d. This permit may be amended to require a WET limit, a Best Management Practice (BMP), Chemical-Specific (CS) limits, or other appropriate actions to address toxicity. The permittee may be required to conduct a Toxicity Reduction Evaluation (TRE) if WET data indicate multiple toxic events.

e. As the dilution series specified in the Outfall 004 Chronic Biomonitoring Requirements includes a 100% effluent concentration, the results from those tests may fulfill the requirements of this Section; any tests performed in the proper time interval may be substituted. Compliance will be evaluated as specified in item a. The 50% survival in 100% effluent for a 24-hour period standard applies to all tests utilizing a 100% effluent dilution, regardless of whether the results are submitted to comply with the minimum testing frequency defined in item b.

2. Required Toxicity Testing Conditions

a. Test Acceptance - The permittee shall repeat any toxicity test, including the control, if the control fails to meet a mean survival equal to or greater than 90%.

b. Dilution Water - In accordance with item 1.c., the control and dilution water shall normally consist of standard, synthetic, moderately hard, reconstituted water. If the permittee utilizes the results of a chronic test to satisfy the requirements in item 1.e., the permittee may use the receiving water or dilution water that meets the requirements of item 2.a as the control and dilution water.

c. Samples and Composites

1) The permittee shall collect one composite sample from Outfalls 001, 003, and 004.

2) The permittee shall collect the composite samples such that the samples are representative of any periodic episode of chlorination, biocide usage, or other potentially toxic substance discharged on an intermittent basis.

3) The permittee shall initiate the toxicity tests within 36 hours after collection of the last portion of the composite sample. Samples shall be maintained at a temperature of 0-6 degrees Centigrade during collection, shipping, and storage.

4) If Outfalls 001, 003, and 004 ceases discharging during the collection of the effluent composite sample, the requirements for the minimum number of effluent portions are waived. However, the permittee must have collected a composite sample volume sufficient for completion of the required test. The abbreviated sample collection, duration, and methodology must be documented in the full report.

3. Reporting

All reports, tables, plans, summaries, and related correspondence required in any Part of this Section shall be submitted to the attention of the Standards Implementation Team (MC 150) of the Water Quality Division.

a. The permittee shall prepare a full report of the results of all tests conducted in accordance with the manual referenced above, or its most recent update, for every valid and invalid toxicity test initiated.

b. The permittee shall routinely report the results of each biomonitoring test on the Table 2 forms provided with this permit.

1) Semiannual biomonitoring test results are due on or before January 20th and July 20th for biomonitoring conducted during the previous 6 month period.

2) Quarterly biomonitoring test results are due on or before January 20th, April 20th, July 20th, and October 20th, for biomonitoring conducted during the previous calendar quarter.

c. Enter the following codes on for the appropriate parameters for valid tests only:

1) For the water flea, Parameter TIE3D, enter a "0" if the mean survival at 24-hours is greater than 50% in the 100% effluent dilution; if the mean survival is less than or equal to 50%, enter a "1."

2) For the fathead minnow, Parameter TIE6C, enter a "0" if the mean survival at 24-hours is greater than 50% in the 100% effluent dilution; if the mean survival is less than or equal to 50%, enter a "1."

d. Enter the following codes for retests only:

1) For retest number 1, Parameter 22415, enter a "0" if the mean survival at 24-hours is greater than 50% in the 100% effluent dilution; if the mean survival is less than or equal to 50%, enter a "1."

2) For retest number 2, Parameter 22416, enter a "0" if the mean survival at 24-hours is greater than 50% in the 100% effluent dilution; if the mean survival is less than or equal to 50%, enter a "1."

4. Persistent Mortality

The requirements of this Part apply when a toxicity test demonstrates significant lethality, here defined as a mean mortality of 50% or greater to organisms exposed to the 100% effluent concentration after 24-hours.

a. The permittee shall conduct 2 additional tests (retests) for each species that demonstrates significant lethality. The two retests shall be conducted once per week for 2 weeks. Five effluent dilution concentrations in addition to an appropriate control shall be used in the retests. These additional effluent concentrations are 6%, 13%, 25%, 50% and 100% effluent. The first retest shall be conducted within 15 days of the laboratory determination of significant lethality. All test results shall be submitted within 20 days of test completion of the second retest. Test completion is defined as the 24th hour.

b. If one or both of the two retests specified in item 4.a. demonstrates significant lethality, the permittee shall initiate the TRE requirements as specified in Part 5 of this Section.

5. Toxicity Reduction Evaluation

a. Within 45 days of the retest that demonstrates significant lethality, the permittee shall submit a General Outline for initiating a Toxicity Reduction Evaluation (TRE). The outline shall include, but not be limited to, a description of project personnel, a schedule for obtaining consultants (if needed), a discussion of influent and effluent data available for review, a sampling and analytical schedule, and a proposed TRE initiation date.

b. Within 90 days of the retest that demonstrates significant lethality, the permittee shall submit a TRE Action Plan and Schedule for conducting a TRE. The plan shall specify the approach and methodology to be used in performing the TRE. A TRE is a step-wise investigation combining toxicity testing with physical and chemical analysis to determine actions necessary to eliminate or reduce effluent toxicity to a level not effecting significant lethality at the critical dilution. The TRE Action Plan shall lead to the successful elimination of significant lethality for both test species defined in item 1.b. As a minimum, the TRE Action Plan shall include the following:

1) Specific Activities - The TRE Action Plan shall specify the approach the permittee intends to utilize in conducting the TRE, including toxicity characterizations, identifications, confirmations, source evaluations, treatability studies, and alternative approaches. When conducting characterization analyses, the permittee shall perform multiple characterizations and follow the procedures specified in the document entitled, "Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures" (EPA/600/6-91/003), or alternate procedures.

The permittee shall perform multiple identifications and follow the methods specified in the documents entitled, "Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/080) and "Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/081). All characterization, identification, and confirmation tests shall be conducted in an orderly and logical progression;

2) Sampling Plan - The TRE Action Plan should describe sampling locations, methods, holding times, chain of custody, and preservation techniques. The effluent sample volume collected for all tests shall be adequate to perform the toxicity characterization/ identification/ confirmation procedures, and chemical-specific analyses when the toxicity tests show significant lethality. Where the permittee has identified or suspects specific pollutant(s) and source(s) of effluent toxicity, the permittee shall conduct, concurrent with toxicity testing, chemical-specific analyses for the identified and suspected pollutant(s) and source(s) of effluent toxicity;

3) Quality Assurance Plan - The TRE Action Plan should address record keeping and data evaluation, calibration and standardization, baseline tests, system blanks, controls, duplicates, spikes, toxicity persistence in the samples, randomization, reference toxicant control charts, as well as mechanisms to detect artifactual toxicity; and

4) Project Organization - The TRE Action Plan should describe the project staff, project manager, consulting engineering services (where applicable), consulting analytical and toxicological services, etc.

c. Within 30 days of submittal of the TRE Action Plan and Schedule, the permittee shall implement the TRE with due diligence.

d. The permittee shall submit quarterly TRE Activities Reports concerning the progress of the TRE. The quarterly TRE Activities Reports are due on or before April 20th, July 20th, October 20th, and January 20th. The report shall detail information regarding the TRE activities including:

1) results and interpretation of any chemical-specific analyses for the identified and suspected pollutant(s) performed during the quarter;

2) results and interpretation of any characterization, identification, and confirmation tests performed during the quarter;

3) any data and substantiating documentation which identifies the pollutant(s) and source(s) of effluent toxicity;

4) results of any studies/evaluations concerning the treatability of the facility's effluent toxicity;

5) any data which identifies effluent toxicity control mechanisms that will reduce effluent toxicity to the level necessary to eliminate significant lethality; and

6) any changes to the initial TRE Plan and Schedule that are believed necessary as a result of the TRE findings.

Copies of the TRE Activities Report shall also be submitted to the U.S. EPA Region 6 office.

e. During the TRE, the permittee shall perform, at a minimum, quarterly testing using the more sensitive species; testing for the less sensitive species shall continue at the frequency specified in Part 1.b.

f. If the effluent ceases to effect significant lethality (herein as defined below) the permittee may end the TRE. A "cessation of lethality" is defined as no significant lethality for a period of 12 consecutive weeks with at least weekly testing. At the end of the 12 weeks, the permittee shall submit a statement of intent to cease the TRE and may then resume the testing frequency specified in Part 1.b. The permittee may only apply the "cessation of lethality" provision once.

This provision accommodates situations where operational errors and upsets, spills, or sampling errors triggered the TRE, in contrast to a situation where a single toxicant or group of toxicants cause lethality. This provision does not apply as a result of corrective actions taken by the permittee. "Corrective actions" are herein defined as proactive efforts which eliminate or reduce effluent toxicity. These include, but are not limited to, source reduction or elimination, improved housekeeping, changes in chemical usage, and modifications of influent streams and effluent treatment.

The permittee may only apply this cessation of lethality provision once. If the effluent again demonstrates significant lethality to the same species, the permit will be amended to add a WET limit with a compliance period, if appropriate. However, prior to the effective date of the WET limit, the permittee may apply for a permit amendment removing and replacing the WET limit with an alternate toxicity control measure by identifying and confirming the toxicant and an appropriate control measure.

g. The permittee shall complete the TRE and submit a Final Report on the TRE Activities no later than 18 months from the last test day of the retest that demonstrates significant lethality. The permittee may petition the Executive Director (in writing) for an extension of the 18-month limit. However, to warrant an extension the permittee must have demonstrated due diligence in their pursuit of the TIE/TRE and must prove that circumstances beyond their control stalled the TIE/TRE. The report shall specify the control mechanism(s) that will, when implemented, reduce effluent toxicity as specified in item 5.g. The report will also specify a corrective action schedule for implementing the selected control mechanism(s). A copy of the TRE Final Report shall also be submitted to the U.S. EPA Region 6 office.

h. Within 3 years of the last day of the test confirming toxicity, the permittee shall comply with 307.6.(e)(2)(B), which requires greater than 50% survival of the test organism in 100% effluent at the end of 24-hours. The permittee may petition the Executive Director (in writing) for an extension of the 3-year limit. However, to warrant an extension the permittee must have demonstrated due diligence in their pursuit of the TIE/TRE and must prove that circumstances beyond their control stalled the TIE/TRE. The requirement to comply with 307.6.(e)(2)(B) may be exempted upon proof that toxicity is caused by an excess, imbalance, or deficiency of dissolved salts. This exemption excludes instances where individually toxic components (e.g. metals) form a salt compound. Following the exemption, the permit may be amended to include an ion-adjustment protocol, alternate species testing, or single species testing.

i. Based upon the results of the TRE and proposed corrective actions, this permit may be amended to modify the biomonitoring requirements where necessary, to require a compliance schedule for implementation of corrective actions, to specify a WET limit, to specify a BMP, and to specify a CS limit.

OUTFALL _____

TABLE 2 (SHEET 1 OF 2)

WATER FLEA SURVIVAL

GENERAL INFORMATION

	Time	Date
Composite Sample Collected		
Test Initiated		

PERCENT SURVIVAL

Time	Rep	Percent effluent					
		0%	6%	13%	25%	50%	100%
24h	A						
	B						
	C						
	D						
	E						
	MEAN						

Enter percent effluent corresponding to the LC50 below:

24 hour LC50 = _____% effluent

OUTFALL _____

TABLE 2 (SHEET 2 OF 2)

FATHEAD MINNOW SURVIVAL

GENERAL INFORMATION

	Time	Date
Composite Sample Collected		
Test Initiated		

PERCENT SURVIVAL

Time	Rep	Percent effluent					
		0%	6%	13%	25%	50%	100%
24h	A						
	B						
	C						
	D						
	E						
	MEAN						

Enter percent effluent corresponding to the LC50 below:

24 hour LC50 = _____% effluent

TCEQ 2016 *Notice of Registration, Industrial and Hazardous Waste*, Texas Municipal Power Agency, Solid Waste Registration No. 32271, EPA Id. TXD000751073, Texas Commission on Environmental Quality, August 8, 2016.

*** TEXAS COMMISSION ON ENVIRONMENTAL QUALITY ***
Notice of Registration
Industrial and Hazardous Waste

32271 TEXAS MUNICIPAL POWER AGENCY

Solid Waste Registration Number: 32271 **EPA Id:** TXD000751073

Company Name: Texas Municipal Power Agency
Site Name: TEXAS MUNICIPAL POWER AGENCY
Site Location: FM 244 2.5 MI N OF HWY 30 CARLOS TX
Primary Contact: BARNEY, HERBERT
Mailing Address: PO BOX 7000
BRYAN, TX 77805-7000

Region: 9
County: 093 GRIMES
Land Type: Private
Title: ENVIRONMENTAL SPECIALIST
Site Street Address:
,

Initial Registration Date: 02/05/1982
Last Amendment Date: 08/05/2016
Last Date NOR Computer update: 08/05/2016
Phone: 936-873-1145

Registration Status: Active
Registration Type: Generator
Generator Type:
Receiver Type:
Transporter Type:
Transport Wst Class:

Reporting Method: STEERS
Hazardous Waste Generation Status: Conditionally Exempt Small Quantity Generator

Universal Waste Activity:
Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more):
Type(s) Managed:
Destination Facility for Universal Waste:

NAICS Code: 221122 Electric Power Distribution
Tax Identification #: 17418818161
Handler Status:

Operator Information

Name: Texas Municipal Power Agency
Phone: 936-873-1145
Address: PO BOX 7000
BRYAN, TX 77805-7000

Owner Information:

Name: Texas Municipal Power Agency
Phone: 936-873-1145
Address: PO BOX 7000
BRYAN, TX 77805-7000

Billing Contact:
Billing Address:
PO BOX 7000
BRYAN, TX 77805-7000

Title:
Phone:

Other Contact: BARNEY, HERBERT
Mailing Address: PO BOX 7000
BRYAN, TX 77805-7000
Role: IHW: Steers Contact
Phone: 936-873-1145

Other Contact: Manager, Environmental
Mailing Address: PO BOX 7000
BRYAN, TX 77805-7000
Role: IHW: Owner Contact
Phone: 936-873-1145

***** TEXAS COMMISSION ON ENVIRONMENTAL QUALITY *****
Notice of Registration
Industrial and Hazardous Waste

32271 TEXAS MUNICIPAL POWER AGENCY

Solid Waste Registration Number: 32271 **EPA Id:** TXD000751073

Company Name: Texas Municipal Power Agency
Site Name: TEXAS MUNICIPAL POWER AGENCY
Site Location: FM 244 2.5 MI N OF HWY 30 CARLOS TX
Primary Contact: BARNEY, HERBERT
Mailing Address: PO BOX 7000
BRYAN, TX 77805-7000

Region: 9
County: 093 GRIMES
Land Type: Private
Title: ENVIRONMENTAL SPECIALIST
Site Street Address:
,

Initial Registration Date: 02/05/1982
Last Amendment Date: 08/05/2016
Last Date NOR Computer update: 08/05/2016
Phone: 936-873-1145

Registration Status: Active
Registration Type: Generator
Generator Type:
Receiver Type:
Transporter Type:
Transport Wst Class:

Reporting Method: STEERS
Hazardous Waste Generation Status: Conditionally Exempt Small Quantity Generator

Universal Waste Activity:
Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more):
Type(s) Managed:
Destination Facility for Universal Waste:

NAICS Code: 221122 Electric Power Distribution
Tax Identification #: 17418818161
Handler Status:

Operator Information

Name: Texas Municipal Power Agency
Phone: 936-873-1145
Address: PO BOX 7000
BRYAN, TX 77805-7000

Owner Information:

Name: Texas Municipal Power Agency
Phone: 936-873-1145
Address: PO BOX 7000
BRYAN, TX 77805-7000

Billing Contact: **Title:** **Phone:**
Billing Address:
PO BOX 7000
BRYAN, TX 77805-7000

Other Contact: BARNEY, HERBERT **Role:** IHW: Steers Contact **Phone:** 936-873-1145
Mailing Address: PO BOX 7000
BRYAN, TX 77805-7000

Other Contact: Manager, Environmental **Role:** IHW: Owner Contact **Phone:** 936-873-1145
Mailing Address: PO BOX 7000
BRYAN, TX 77805-7000

As of 08/05/2016 - The next unassigned sequence number for WASTES is 0037 and
The next unassigned sequence number for UNITS is 011

32271 TEXAS MUNICIPAL POWER AGENCY

**** WASTE INFORMATION ****

Texas Waste Code	Waste Class	Status	Date of Status	Managed Onsite/ Offsite	Radio-active	TCEQ Audit Complete
****** Active Wastes ******						
00011142	2	Active	08/05/2016	On & Off	No	No

Description from Generator: Deionized ultra pure water is fed into a steam boiler to generate steam to turnthe turbine & generator to produce electricity.
Texas Form Code: 114 Other aqueous waste with low dissolved solids
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Surface impoundment 006

00021132	2	Active	08/05/2016	On & Off	No	No

Description from Generator: Water demineralizers are regenerated with 5% sulfuric acid (H2SO4) and 4 % sodium hydroside (NaOH).
Texas Form Code: 113 Other aqueous waste with high dissolved solids
Origin Code: 5 Residual from on-site treatment, disposal or recycling of hazardous waste
Current Management Units: Surface impoundment 006

00081132	2	Active	08/05/2016	On & Off	No	No

Description from Generator: Boiler ash water/water used to hydraulically transport class 3 bottom ash from the boiler to FGD facility
Texas Form Code: 113 Other aqueous waste with high dissolved solids
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Surface impoundment 006 005

00093922	2	Active	08/05/2016	On & Off	No	No

Description from Generator: Dewatered scrubber sludge from a wet scrubber. This waste has not been generated since 1996, but is still managed on site.
Texas Form Code: 392 Nonhazardous dewatered air pollution control device sludge
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Landfill 001
Surface impoundment 004

00106082	2	Active	08/05/2016	Off-site	No	No

Description from Generator: Actrivated sewage sludge/domestic sewage system
Texas Form Code: 608 Sewage or other untreated biological sludge
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

32271 TEXAS MUNICIPAL POWER AGENCY

Texas Waste Code	Waste Class	Status	Date of Status	Managed Onsite/ Offsite	Radio-active	TCEQ Audit Complete

******** Active Wastes ********

00113042 2 Active 08/05/2016 On & Off No No

Description from Generator: Fly ash from a coal fired boiler captured by an air pollution control device (electro static precipitator). Fly ash from lignite has not been generated since 1996; however, it is managed on site. The generator of this wastehas notified the TCEQ that it is being recycled.
Texas Form Code: 304 Other "dry" ash, slag or thermal residue
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Landfill 001
Surface impoundment 008

00133922 2 Active 08/05/2016 On & Off No No

Description from Generator: Fly ash mix with dewatered scrubber sludge from air pollution control devices /1983.
Texas Form Code: 392 Nonhazardous dewatered air pollution control device sludge
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Landfill 001
Surface impoundment 008

00143082 2 Active 08/05/2016 On & Off No No

Description from Generator: Empty containers / contents completely used / 1983.
Texas Form Code: 308 Empty or crushed metal drums or conainers
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Container storage area 003

00159012 2 Active 08/05/2016 On & Off No No

Description from Generator: Plant Production Refuse / Clean-up & Plant Maintenance / 1983.
Texas Form Code: 901
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

00169022 2 Active 08/05/2016 Off-site No No

Description from Generator: Metal parts, floor sweeping, scrap material, Class 2 rags. miscellaneous insulation (non-asbestos)/plant cleanup and maintenance. 1983.
Texas Form Code: 902 Class 2 supplemental plant production refuse
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

00173043 3 Active 08/05/2016 On & Off No No

Description from Generator: Ash residue from the burning of coal in a boiler which settles in the bottom of the boiler. Bottom ash from lignite has not been generated since 1996;however, it is managed on site. Generated since 1983.
Texas Form Code: 304 Other "dry" ash, slag or thermal residue
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Landfill 001
Surface impoundment 008 006 005

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Texas Waste Code	Waste Class	Status	Date of Status	Managed Onsite/ Offsite	Radio-active	TCEQ Audit Complete

******** Active Wastes ********

00189032 2 Active 08/05/2016 Off-site No No

Description from Generator: Plant Office Refuse. 1983
Texas Form Code: 903
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

00213101 1 Active 08/05/2016 Off-site No No

Description from Generator: Vehicle maintenance used lubricating oil filters shipped off site for recycling. Generated since 1982.
Texas Form Code: 310 Spent solid filters or adsorbents
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

00221162 2 Active 08/05/2016 On-site No No

Description from Generator: Class 2 and Class 3 combustion waste products from burning coal in a boilerto generate electricity, fly ash, bottom ash and FGD scrubber sludge are landfilled on-site in Management Unit Number 001.
Texas Form Code: 116 Leachate
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Surface impoundment 007 004 008
Tank 010

00234891 1 Active 08/05/2016 On & Off No No

Description from Generator: Petroleum contaminated solids. Generated since 1982
Texas Form Code: 489 Petroleum contaminated solids
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Boiler 009
Container storage area 003

00254902 2 Active 08/05/2016 On & Off No No

Description from Generator: Waste Generated from removing paint or rust from metal surfaces using a Non-Hazardous sand blasting material. 1983.
Texas Form Code: 490 Sand blasting waste
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Landfill 001
Surface impoundment 008

00272961 1 Active 08/05/2016 Off-site No No

Description from Generator: Antifreeze generated from cleaning or repair/maintenance vehicle & equipment radiators. Reclassification of 00262962.
Texas Form Code: 296 Ethylene glycol based antifreeze
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

32271 TEXAS MUNICIPAL POWER AGENCY

Texas Waste Code	Waste Class	Status	Date of Status	Managed Onsite/ Offsite	Radio-active	TCEQ Audit Complete
****** Active Wastes ******						
00281132	2	Active	08/05/2016	On-site	No	No

Description from Generator: Air Perheater Wash Water, Filtered (Metal Cleaning Waste) /1998
Texas Form Code: 113 Other aqueous waste with high dissolved solids
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

00291132	2	Active	08/05/2016	On-site	No	No

Description from Generator: Boiler Chemical Wash Waste (Metal Cleaning Waste) / 1998
Texas Form Code: 113 Other aqueous waste with high dissolved solids
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

00301192	2	Active	08/05/2016	Off-site	No	No

Description from Generator: Filterate removed in processing scubber sludge being removed from waste managment unit 004
Texas Form Code: 119 Other inorganic liquids
Origin Code: 3 Derived from on-site management of a nonhazardous waste
Company's Internal Code(s): FGD process water
Current Management Units: Landfill 001
Surface impoundment 008
Tank 010

00312031	1	Active	08/05/2016	On & Off	No	No

Description from Generator: Non-Hazardous spent solvent from parts washers
Texas Form Code: 203 Non-halogenated solvent
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Container storage area 003

00340011	1	Active	08/05/2016	Off-site	No	No

Description from Generator: Lab packs of old chemicals, Non-Hazardous, One time shipping
Texas Form Code: 001 Lab packs of old chemicals only
Origin Code: 2 Result of spill clean-up, equipment decommissioning or emergency removal
Company's Internal Code(s): NON- HAZARDOUS LAB P
Current Management Units: None

32271 TEXAS MUNICIPAL POWER AGENCY

Texas Waste Code	Waste Class	Status	Date of Status	Managed Onsite/ Offsite	Radio-active	TCEQ Audit Complete
****** Active Wastes ******						
0036310H	H	Active	08/05/2016	On & Off	No	No

Description from Generator: Waste materials resulting from the clean-up of a NaHS spill. To include but not limited to absorbents, PPE, rags, etc.
Texas Form Code: 310 Spent solid filters or adsorbents
EPA Form Code: W319 Other inorganic solids
Origin Code: 2 Result of spill clean-up, equipment decommissioning or emergency removal
Source Code: G32 Cleanup of spill residues
NAICS Code: 221112 Fossil Fuel Electric Power Generation
Company's Internal Code(s): NASH SPILL CLEANUP R
EPA Hazardous Waste Numbers: D002 D003
Current Management Units: Container storage area 003

As of 08/05/2016, The next unassigned sequence number for WASTES is 0037

32271 TEXAS MUNICIPAL POWER AGENCY

Texas Waste Code	Waste Class	Status	Date of Status	Managed Onsite/ Offsite	Radio-active	TCEQ Audit Complete

**** No Longer Generated Wastes ****

00052062 2 Inactive 08/05/2016 On & Off No No

Description from Generator: Waste oil/equipment maintenance
Texas Form Code: 206 Waste oil
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Tank 002

00071131 1 Inactive 08/05/2016 On & Off No No

Description from Generator: Neutralized solution of ethylenediaminetetraacetic acid, diammonium salt.Used Waste inactivated due to error in submission.
Texas Form Code: 113 Other aqueous waste with high dissolved solids
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

0019604H H Inactive 08/05/2016 On & Off No No

Description from Generator: Waste is generated from cleaning oil based paint residues from spray painting equipment, paint brushes, etc. using methyl ethyl ketone, acetone and toluene. As of 2009: Hazardous waste currently being managed under UniversalWaste rules. Generated since 1982
Texas Form Code: 604 Organic paint or ink sludge
EPA Form Code: W604 Paint or ink sludges, still bottoms in sludge form
Origin Code: 1 Generated on-site from a product process or service activity
Source Code: G06 Painting and coating
NAICS Code: 221112 Fossil Fuel Electric Power Generation
EPA Hazardous Waste Numbers: D001 F003 F005
Current Management Units: None

0020203H H Inactive 08/05/2016 Off-site No No

Description from Generator: Parts cleaning with naptha in the machine shop and automotive maintenance shop to remove oil and grease residues. As of 2009:Due to change in the product produced, this waste is no longer generated.
Texas Form Code: 203 Non-halogenated solvent
EPA Form Code: W203 Concentrated non-halogenated (e.g., non-chlorinated) solvent
Origin Code: 1 Generated on-site from a product process or service activity
Source Code: G01 Dip, flush or spray rinsing
NAICS Code: 221112 Fossil Fuel Electric Power Generation
EPA Hazardous Waste Numbers: D001
Current Management Units: None

00245042 2 Inactive 08/05/2016 On & Off No No

Description from Generator: Sludge from Alum coagulation of surface water to remove suspended solids. Predominantly aluminum and clay. Due to change(s) in the product produced, this waste is no longer generated.
Texas Form Code: 504 Other wastewater treatment sludge
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: None

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Texas Waste Code	Waste Class	Status	Date of Status	Managed Onsite/ Offsite	Radio-active	TCEQ Audit Complete

**** No Longer Generated Wastes ****

00262962 2 Inactive 08/05/2016 On & Off No No

Description from Generator: Waste Generated from the cleaning or repair of vehicle and equipment radiators
Texas Form Code: 296 Ethylene glycol based antifreeze
Origin Code: 1 Generated on-site from a product process or service activity
Current Management Units: Boiler 009

0032701H H Inactive 08/05/2016 Off-site No No

Description from Generator: Chlorine;gas over liquid, 150pound cylinder, leaking. One time shipping number. Waste inactivated due to error in submission.
Texas Form Code: 701 Inorganic gases
EPA Form Code: W801 Compressed gases
Origin Code: 2 Result of spill clean-up, equipment decommissioning or emergency removal
Source Code: G33 Leak collection and floor sweeping
NAICS Code: 221122 Electric Power Distribution
EPA Hazardous Waste Numbers: D002
Current Management Units: None

00337011 1 Inactive 08/05/2016 Off-site No No

Description from Generator: Chlorine;gas over liquid, 150pound cylinder, leaking. One time shipping number. Waste inactivated due to one-time shipment.
Texas Form Code: 701 Inorganic gases
Origin Code: 2 Result of spill clean-up, equipment decommissioning or emergency removal
Current Management Units: None

0035001H H Inactive 08/05/2016 No No

Description from Generator: Lab packs of old chemicals, Hazardous, One time shipping, Generated in July, 2016 only; One time shipment.
Texas Form Code: 001 Lab packs of old chemicals only
EPA Form Code: W004 Lab packs containing acute hazardous waste
Origin Code: 2 Result of spill clean-up, equipment decommissioning or emergency removal
Source Code: G19 Other one-time or intermittent processes
NAICS Code: 221112 Fossil Fuel Electric Power Generation
Company's Internal Code(s): LAB PACKS-HAZARDOU
EPA Hazardous Waste Numbers:

D001	D002	D003	D004	D005	D007	D008	D009	D011	D018	P105
P106	U003	U031	U070	U108	U112	U122	U154	U161	U188	U196
U220	U239									

Current Management Units: None

As of 08/05/2016, The next unassigned sequence number for WASTES is 0037

32271 TEXAS MUNICIPAL POWER AGENCY

**** UNITS AT THIS SITE MANAGING WASTE ****

Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
007	Surface impoundment	ACTIVE	03/03/1994	2 / NA	NA	NA	05 Non-Hazardous Regulated	YES /

Description from Company: 12 Sedimentation Ponds @ Ash Landfill cell "A". These ponds are clay lined earthen ponds
System Types: 141 Storage, bulking, and/or transfer off site - no treatment/recovery, fuel blending or disposal at this site. 122 Evaporation
Wastes Currently Managed at Unit: 00221162 Class 2 and Class 3

Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
008	Surface impoundment	ACTIVE	01/31/2003	2 / NA	NA	NA	05 Non-Hazardous Regulated	YES /

Description from Company: Retention pond within Ash Landfill cell"F"(SWM 001). This is an existing pond that is a low-lying portion of SWM 001 and is clay lined.
System Types: 132 Landfill or surface impoundment that will be closed as landfill (to include on-site treatment and/or stabilization) 141 Storage, bulking, and/or transfer off site - no treatment/recovery, fuel blendir or disposal at this site.
Wastes Currently Managed at Unit: 00113042 Fly ash from a coal fired 00133922 Fly ash mix with dewatered 00221162 Class 2 and Class 3 00173043 Ash residue from the 00254902 Waste Generated from 00301192 Filterate removed in

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Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
009	Boiler	ACTIVE	05/13/1994	12 / NA	NA	NA	05 Non-Hazardous Regulated	YES /

Description from Company: Reserve Lignite Storage used for fuel in the boiler to produce steam and ge nerate electricity. Reserve area is South of plant island.
System Types: 040 Incineration - thermal destruction other than use as a fuel 050 Energy recovery at this site - use as fuel (includes on-site fuel blending)
Wastes Currently Managed at Unit: 00234891 Petroleum contaminated

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Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
010	Tank	ACTIVE	01/31/2003	2 / NA	NA	NA	05 Non-Hazardous Regulated	YES /

Description from Company: Water storage and sedimentation tank
System Types: 141 Storage, bulking, and/or transfer off site - no treatment/recovery, fuel blending or disposal at this site.
Wastes Currently Managed at Unit: 00221162 Class 2 and Class 3 00301192 Filterate removed in

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Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
001	Landfill	ACTIVE	10/01/1982	2 / NA	NA	NA	06	YES / 04/01/1990

Description from Company: Ash landfill- Cells "A" and "F"
System Types: 132 Landfill or surface impoundment that will be closed as landfill (to include on-site treatment and/or stabilization)
Wastes Currently Managed at Unit: 00113042 Fly ash from a coal fired 00133922 Fly ash mix with dewatered 00173043 Ash residue from the 00254902 Waste Generated from 00301192 Filterate removed in 00093922 Dewatered scrubber sludge

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Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
002	Tank	ACTIVE	10/01/1982	2 / NA	NA	NA	06	YES /

Description from Company: Used Oil Storage Tanks (2 - 1000 gl. tanks)
System Types: 141 Storage, bulking, and/or transfer off site - no treatment/recovery, fuel blending or disposal at this site.

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Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
003	Container storage area	ACTIVE	10/01/1982	1 / NA	NA	NA	06	YES /

Description from Company: DOT certified containers drum storage area
System Types: 141 Storage, bulking, and/or transfer off site - no treatment/recovery, fuel blending or disposal at this site.
Wastes Currently Managed at Unit: 00234891 Petroleum contaminated; 00312031 Non-Hazardous spent; 00143082 Empty containers / contents; 0036310H Waste materials resulting
Wastes Previously Managed at Unit: 0019604H Waste is generated from

Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
004	Surface impoundment	ACTIVE	04/01/1982	12 / NA	NA	NA	06	YES /

Description from Company: 115 acft sludge pond
System Types: 141 Storage, bulking, and/or transfer off site - no treatment/recovery, fuel blending or disposal at this site.
Wastes Currently Managed at Unit: 00221162 Class 2 and Class 3; 00093922 Dewatered scrubber sludge
Wastes Previously Managed at Unit: 00071131 Neutralized solution of

Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
005	Surface impoundment	ACTIVE	03/01/1982	23 / NA	NA	NA	06	YES /

Description from Company: 275 acft plant collection pond. Discharged regulated under TNRCC wastewate r permit # 02120 and NPDES permit # TX0074438
System Types: 141 Storage, bulking, and/or transfer off site - no treatment/recovery, fuel blending or disposal at this site.
Wastes Currently Managed at Unit: 00081132 Boiler ash water/water used; 00173043 Ash residue from the

Unit Number	Unit Type	Unit Status	Date of Status	Classes of Waste Managed in Unit Onsite / Offsite	Unit Permit Number	Unit # on Permit	Regulatory Status	Deed Recording Needed/Date
006	Surface impoundment	ACTIVE	10/01/1982	2 / NA	NA	NA	06	YES /

Description from Company: 456 acft ash ponds (3 - ponds). Discharged regulated under TNRCC wastewa ter permit # 02120 and NPDES permit # TX0074438
System Types: 141 Storage, bulking, and/or transfer off site - no treatment/recovery, fuel blending or disposal at this site.
Wastes Currently Managed at Unit: 00081132 Boiler ash water/water used; 00011142 Deionized ultra pure water; 00021132 Water demineralizers are; 00173043 Ash residue from the
Wastes Previously Managed at Unit: 00245042 Sludge from Alum

As of 08/05/2016, The next unassigned sequence number for UNITS is 011