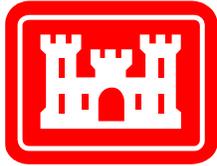


Memphis District

Invitation for Bid No. W912EQ-04-B-0005



**US Army Corps
of Engineers®**

Project Title:

**UPPER CAMP CREEK INTERCEPTOR NORTH
(PROJECT NO. 4-B)**

Location:

DESOTO COUNTY, MISSISSIPPI

Technical Specifications

**THIS IS AN UNRESTRICTED PROCUREMENT. HUBZone Evaluation
Preference Applies.**

DECEMBER 2003

UPPER CAMP CREEK INTERCEPTOR NORTH

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**SECTION 01270
MEASUREMENT AND PAYMENT**

PART I GENERAL

1-01 LUMP SUM ITEMS

1-01.1. General

Payment items for the work of this contract for which contract lump sum payments will be made are listed in the BID FORM and described below. All costs for items of work, which are not specifically mentioned to be included in a particular lump sum or unit price payment item, shall be included in the listed lump sum item most closely associated with the work involved. The lump sum price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided.

1-01.2 Lump Sum Bid Items

A. Mobilization/Demobilization

1. Measurement

Measurement shall be at the percentage determined in accordance with CONTRACT CLAUSE entitled "Mobilization and Demobilization".

2. Payment

Payment shall be at the measured percentage of the lump sum bid price for "Mobilization/Demobilization".

B. Erosion Control

1. Measurement

See Paragraph 4-01 of Section 01356 "Storm Water Pollution Prevention and Erosion Control Measures" for measurement.

2. Payment

See Paragraph 4-02 of Section 01356 "Storm Water Pollution Prevention and Erosion Control Measures" for payment.

C. Seeding, Fertilizing, and Mulching

1. Measurement

See Paragraph 4-01 of Section 02480 “Seeding, Fertilizing, and Mulching” for measurement.

2. Payment

See Paragraph 4-02 of Section 02480 “Seeding, Fertilizing, and Mulching” for payment.

D. Ross Road WWTF Metering Station, Flow Diversion and Accessories

1. Measurement

Measurement for this item shall be per Lump Sum Price “Ross Road WWTF Metering Station, Flow Diversion and Accessories”, as described on the Bid Form and as indicated on the Drawings.

2. Payment

Payment will be made for all costs associated with providing all items installed and in complete working order as shown on or contained within the Drawings and Specifications entitled Upper Camp Creek Interceptor North dated October, 2003, and as indicated on the Bid Form.

1-02 UNIT PRICE BID ITEMS

1-02.1. General

Payment items for the work of this contract on which the contract unit price payments will be made are listed in the BID FORM and described in the applicable section of these Specifications. The unit price and payment made for each item listed shall constitute full compensation for furnishing all labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

1-02.2 Unit Price Items

A. 42” Gravity Sewer Pipe

1. Measurement

See Paragraph 4-02A of Section 02560 “Sanitary Sewage – Gravity Piping” for measurement.

2. Payment

See Paragraph 4-03A of Section 02560 “Sanitary Sewage – Gravity Piping” for payment.

B. 96” Manhole

1. Measurement

See Paragraph 4-02B of Section 02560 “Sanitary Sewage – Gravity Piping” for measurement.

2. Payment

See Paragraph 4-03B of Section 02560 “Sanitary Sewage – Gravity Piping” for payment.

C. 72” Manhole

1. Measurement

See Paragraph 4-02B of Section 02560 “Sanitary Sewage – Gravity Piping” for measurement.

2. Payment

See Paragraph 4-03B of Section 02560 “Sanitary Sewage – Gravity Piping” for payment.

D. Water Tight Manhole Rim and Cover

1. Measurement

See Paragraph 4-02C of Section 02560 “Sanitary Sewage – Gravity Piping” for measurement.

2. Payment

See Paragraph 4-03C of Section 02560 “Sanitary Sewage – Gravity Piping” for payment.

E. Bored Road Crossing, Sta 236+84 to Sta 237+45

1. Measurement

See Paragraph 4-01 of Section 02225 “Roadway Crossings for Utility Lines” for measurement.

2. Payment

See Paragraph 4-02 of Section 02225 “Roadway Crossings for Utility Lines” for payment.

F. Bored Road Crossing, Sta 238+37 to Sta 238+94

1. Measurement

See Paragraph 4-01 of Section 02225 “Roadway Crossings for Utility Lines” for measurement.

2. Payment

See Paragraph 4-02 of Section 02225 “Roadway Crossings for Utility Lines” for payment.

G. Bored Road Crossing, Sta 291+30 to Sta 292+90

1. Measurement

See Paragraph 4-01 of Section 02225 “Roadway Crossings for Utility Lines” for measurement.

2. Payment

See Paragraph 4-02 of Section 02225 “Roadway Crossings for Utility Lines” for payment.

H. 42” Sanitary Sewer Creek Crossing

1. Measurement

Measurement shall be made along the centerline of each installed 54” concrete encased sewer crossing from end to end in linear feet. Measurement shall not be made of incidental work including sheeting, shoring, excavation, backfill, dewatering, or other work related to installation complete and in place.

2. Payment

Payment shall be made at the Contract Unit Price per linear feet for the quantity shown on the Bid Form, complete, in place, and accepted by the Contracting Officer. Such payment shall cover all costs of carrier pipe, concrete encasement, sheeting, shoring, excavation, backfill, dewatering, and installation, labor, materials, equipment, tools and incidentals necessary to complete the work.

I. Grouted Rip Rap

1. Measurement

See Paragraph 4-01 of Section 02272 “Grouted Riprap” for measurement.

2. Payment

See Paragraph 4-02 of Section 02272 "Grouted Riprap" for payment.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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--End of Section--

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**SECTION 01330
SUBMITTAL PROCEDURES**

PART 1 GENERAL

1-01 SUBMITTAL IDENTIFICATION

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1-02 SUBMITTAL CLASSIFICATION

A. Submittals are classified as follows:

1. Government Approved: Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."
2. Information Only: All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1-03 APPROVED SUBMITTALS

- A. The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for an error that may exist, as the Contractor is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, resubmitting for

the purpose of substituting materials or equipment will not be considered unless accompanied by an explanation of why a substitution is necessary.

1-04 DISAPPROVED SUBMITTALS

- A. The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1-05 WITHHOLDING OF PAYMENT

- A. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3-01 GENERAL

- A. The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) representative and each item shall be stamped, signed, and dated by the CQC representative indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3-02 SUBMITTAL REGISTER (ENG FORM 4288R)

- A. At the end of this section is one set of ENG Form 4288R listing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Contracting officer will give the Contractor the submittal register as a diskette containing the computerized ENG Form 4288R and instructions on the use of the diskette. Columns "d" through "q" have been

completed by the Government; the Contractor shall complete columns "a" and "r" through "t" and submit the forms (hard copy plus associated electronic file) to the Contracting Officer for approval within 15 calendar days after Notice to Proceed. The Contractor shall keep this diskette up-to-date and shall submit it to the Government together with the monthly payment request. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated.

3-03 SCHEDULING

- A. Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (15 calendar days for FIO submittals; 30 calendar days for GA submittals and re-submittals; 45 calendar days for submittals requesting variation or deviation from contract requirements) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

3-04 TRANSMITTAL FORM (ENG FORM 4025R)

- A. The sample transmittal form (ENG Form 4025R) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3-05 SUBMITTAL PROCEDURE

- A. Submittals shall be made as follows:
1. Procedures: Submittals shall be prepared as specified with the required number of copies and delivered to:
U.S. Army Corps of Engineers
Wynne Area Office
1932 N. Falls Boulevard
Wynne, Arkansas 72396
 2. Deviations: For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025R shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3-06 CONTROL OF SUBMITTALS

- A. The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3-07 GOVERNMENT APPROVED SUBMITTALS

- A. Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Four copies of the submittal will be retained by the Contracting Officer and two (2) copies of the submittal will be returned to the Contractor.

3-08 INFORMATION ONLY SUBMITTALS

- A. Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3-09 STAMPS

- A. Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to that shown:

CONTRACTOR (Firm Name) _____ Approved _____ Approved with corrections as noted on submittal data and/or attached sheets(s) SIGNATURE: _____ TITLE: _____ DATE: _____

PART 4 COMPENSATION

4-01 GENERAL

- A. No additional compensation will be allowed for requirements described in this section of the Specifications. All requirements described herein will be considered to be “absorbed items”.

1. Section 1 will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals, mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288 for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS
SUBMITTED

- | | | | | | |
|---|----|--|----|----|---|
| A | -- | Approved as submitted. | E | -- | Disapproved (See attached). |
| B | -- | Approved, except as noted on drawings. | F | -- | Receipt acknowledge. |
| C | -- | Approved, except as noted on drawings.
Refer to attached sheet resubmission required. | FX | -- | Receipt acknowledged, does not comply
as noted with contract requirements. |
| D | -- | Will be returned by separate correspondence. | G | -- | Other (<i>Specify</i>) |

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

END OF SECTION
01330-8

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE <i>(Read instructions on the reverse side prior to initiating this form)</i>	DATE	TRANSMITTAL NO.
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SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: <input type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____
SPECIFICATION SEC. NO. <i>(Cover only one section with each transmittal)</i>	PROJECT TITLE AND LOCATION		CHECK ONE: THIS TRANSMITTAL IS FOR <input type="checkbox"/> FIO <input type="checkbox"/> GOV'T. APPROVAL

ITEM NO.	DESCRIPTION OF ITEM SUBMITTED <i>(Type size, model number/etc.)</i>	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. <i>(See instruction no. 8)</i>	NO. OF COPIES	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE	VARIATION <i>(See instruction No. 6)</i>	FOR CE USE CODE
				SPEC. PARA. NO. <i>e.</i>	DRAWING SHEET NO. <i>f.</i>			
<i>a.</i>	<i>b.</i>	<i>c.</i>	<i>d.</i>	<i>e.</i>	<i>f.</i>	<i>g.</i>	<i>h.</i>	<i>i.</i>

REMARKS	I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated. <hr style="width: 80%; margin-left: auto; margin-right: 0;"/> NAME AND SIGNATURE OF CONTRACTOR
---------	--

SECTION II - APPROVAL ACTION		
ENCLOSURES RETURNED <i>(List by Item No.)</i>	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A	--	Approved as submitted.	E	--	Disapproved (See attached).
B	--	Approved, except as noted on drawings.	F	--	Receipt acknowledged.
C	--	Approved, except as noted on drawings. Refer to attached sheet resubmission required.	FX	--	Receipt acknowledged, does not comply as noted with contract requirements.
D	--	Will be returned by separate correspondence.	G	--	Other (<i>Specify</i>)

10. Approval of items does not relieve the contractor from complying with all the requirements of the contact plans and specifications.

(Reverse of ENG Form 4025-R)

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ENVIRONMENTAL PROTECTION
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**SECTION 01355
ENVIRONMENTAL PROTECTION**

PART 1 GENERAL

1-01 REFERENCES

- A. The publications listed below form a part of this specification to the Basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

33 CFR 328	Definitions
40 CFR 68	Chemical Accident Prevention Provisions
40 CFR 152 - 186	Pesticide Programs
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 279	Standards for the Management of Used Oil
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
49 CFR 171 - 178	Hazardous Materials Regulations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(1996) U.S. Army Corps on Engineers Safety and Health Requirements Manual
WETLAND MANUAL	Corps of Engineers Wetlands Delineation Manual Technical Report Y-87-1

1-02 DEFINITIONS

- A. Environmental Pollution and Damage: Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.
- B. Environmental Protection: Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- C. Generated Hazardous Waste: Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples

include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners, excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water.

- D. Land Application for Discharge Water: The term "Land Application" for discharge water implies that the Contractor shall discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" shall occur. Land Application shall be in compliance with all applicable Federal, State, and local laws and regulations.
- E. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "waters of the United States" and would require a permit to discharge water from the governing agency.
- F. Waters of the United States: All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.
- G. Wetlands: Wetlands means those areas that are inundated or saturated by surface or ground-water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLAND MANUAL or as indicated on the plans.

1-03 GENERAL REQUIREMENTS

- A. The Contractor shall minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations.

1-04 SUBCONTRACTORS

- A. The Contractor shall ensure compliance with this section by subcontractors.

1-05 SUBMITTALS

- A. Government approval is required for submittals with a "G" designation. Submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals
Environmental Protection Plan; G, [Construction]
The environmental protection plan

1-06 ENVIRONMENTAL PROTECTION PLAN

- A. Prior to commencing construction activities or delivery of materials to the site, the Contractor shall submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues that the Contractor must address during construction. Issues of concern shall be defined within the Environmental Protection Plan as outlined in this section. The Contractor will address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues that are not identified in this section, but which the Contractor considers necessary, shall be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, the Contractor shall meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan shall be current and maintained onsite by the Contractor.
- B. No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.
- C. The environmental protection plan shall include, but shall not be limited to, the following:
1. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental protection Plan.
 2. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable
 3. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection person
 4. Description of the Contractor's environmental protection personnel training program.
 5. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan shall include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for this plan.

6. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site.
7. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan shall include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.
8. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.
9. Drawing showing the location of borrow areas
10. The Spill Control plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:
 - a. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Contracting Officer and the local Fire Department in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.
 - b. The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.
 - c. Training requirements for Contractor's personnel and methods of accomplishing the training.
 - d. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.
 - e. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.
 - f. The methods and procedures to be used for expeditious contaminant cleanup.
11. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris. The plan shall include schedules

for disposal. The Contractor shall identify any subcontractors responsible for the transportation and disposal of solid waste. Licenses or permits shall be submitted for solid waste disposal sites that are not a commercial operating facility. Evidence of the disposal facility's acceptance of the solid waste shall be attached to this plan during the construction. The Contractor shall attach a copy of each of the Non-hazardous Solid Waste Diversion Reports to the disposal plan. The report shall be submitted on the first working day after the first quarter that non-hazardous solid waste has been disposed and/or diverted and shall be for the previous quarter (e.g. the first working day of January, April, July, and October). The report shall indicate the total amount of waste generated and total amount of waste diverted in cubic meters yards of tons along with the percent that was diverted.

12. A recycling and solid waste minimization plan with a list of measures to reduce consumption of energy and natural resources: The plan shall detail the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source.
13. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.
14. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time shall be included in the contaminant prevention plan. As new hazardous materials are brought on site or removed from the site, the plan shall be updated.
15. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, the plan shall include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the wastewater, the plan shall include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented. If surface discharge will be the method of disposal, a copy of the permit and associated documents shall be included as an attachment prior to discharging the wastewater. If disposal is to a sanitary sewer, the plan shall include documentation that the Waste Water Treatment Plant Operator has approved the flow rate, volume, and type of discharge.
16. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site: and/or identifies procedures to be followed if historical

archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. The plan shall include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Contracting Officer.

- D. Copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents shall be attached, as an appendix, to the Environmental Protection Plan.

1-07 PROTECTION FEATURES

- A. This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. Both the Contractor and the Contracting Officer, upon mutual agreement as to its accuracy and completeness shall sign this survey report. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings regardless of interference that their preservation may cause to the Contractor's work under the contract.

1-08 SPECIAL ENVIRONMENTAL REQUIREMENTS

- A. The Contractor shall comply with all special environmental requirements listed herein.

1-09 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

- A. Any deviations requested by the Contractor from the drawings, plans, and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1-10 NOTIFICATION

- A. The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any

other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTIONS

3-01 ENVIRONMENTAL PERMITS AND COMMITMENTS

- A. The Contractor shall be responsible for obtaining and complying with all environmental permits and commitments required by Federal, State, Regional, and local environmental laws and regulations.

3-02 LAND RESOURCES

- A. The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any the Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. The Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. The Contractor shall remove Stone, soil, or other materials displaced into uncleared areas.
- B. Prior to commencing construction activities, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area that are not to be disturbed shall be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.
- C. Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.
- D. The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor shall construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as indicated on the drawings as specified in Section 01356 STORM WATER POLLUTION PREVENTION

MEASURES. BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation.

- E. The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Erosion and sediment controls shall be provided for on-site borrow and spoil areas to prevent sediment from entering embankments for plant and/or work areas shall be controlled to protect adjacent areas.

3-03 WATER RESOURCES

- A. The Contractor shall monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation unless otherwise affected by construction activities shall be monitored by the Contractor. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.
- B. Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to maintain compliance with existing State water quality standards and designated uses of the surface water body. The Contractor shall comply with the State of Mississippi water quality standards and anti-degradation provisions.
- C. Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State, and local governments.
- D. The Contractor shall not enter, disturb, destroy, or allow discharge of contaminants into any wetlands except as authorized herein. The Contractor shall be responsible for the protection of wetlands shown on the drawings in accordance with paragraph ENVIRONMENTAL PERMITS, REVIEWS, AND APPROVALS. Authorization to enter specific wetlands identified shall not relieve the Contractor from any obligation to protect other wetlands within, adjacent to, or in the vicinity of the construction site and associated boundaries.

3-04 AIR RESOURCES

- A. Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal and State air emission and performance laws and standards.
- B. Dust particles, aerosols and gaseous by-products from construction Activities, and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse,

scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs. The Contractor shall comply with all State and local visibility regulations.

- C. Odors from construction activities shall be controlled at all times. The odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances
- D. The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the State of Mississippi rules.
- E. The Contracting Officer will not allow burning on the project site unless specified in other sections of the specifications or authorized in writing. The specific time, location, and manner of burning shall be subject to approval.

3-05 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

- A. Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.
- B. Solid wastes (excluding clearing debris) shall be placed in containers that are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal option. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. The Contractor shall comply with Federal, State, and local laws and regulations] pertaining to the use of landfill areas.
- C. Chemicals shall be dispensed ensuring no spillage to the ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. The Government will periodically review this documentation. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 150 mm (6 inches) of the top. Wastes shall be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.
- D. Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in

accordance with 40 CFR 279, State, and local laws and regulations. Storage of fuel on the project site shall be accordance with all Federal, State, and local laws and regulations.

E. Disposal of wastewater shall be as specified below:

1. Waste water from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. shall not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. The Contractor shall dispose of the construction related wastewater off-Government property in accordance with all Federal, State, Regional and Local laws and regulations.
2. For discharge of ground water, the Contractor shall obtain a State or Federal permit specific for pumping and discharging ground water prior to surface discharging.
3. Water generated from the flushing of lines after disinfection, or disinfection in conjunction with hydrostatic testing

3-06 RECYCLING AND WASTE MINIMIZATION

A. The Contractor shall participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project.

3-07 NON-HAZARDOUS SOLID WASTE DIVERSION REPORT

A. The Contractor shall maintain an inventory of non-hazardous solid waste diversion and disposal of construction and demolition debris. The Contractor shall submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that non-hazardous solid waste has been generated. The following will be included in the report:

1. Construction and Demolition (C&D) Debris Disposed = [_____] in cubic meters, cubic yards or tons, as appropriate.
2. Construction and Demolition (C&D) Debris Recycled = [_____] in cubic meters, cubic yards or tons, as appropriate.
3. Total C&D Debris Generated = [_____] in cubic meters, cubic yards or tons, as appropriate.
4. Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) = [_____] in cubic meters, cubic yards or tons, as appropriate.

3-08 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

A. If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found,

all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to or the destruction of these resources. The Contractor shall secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3-09 BIOLOGICAL RESOURCES

- A. The Contractor shall minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

3-10 PREVIOUSLY USED EQUIPMENT

- A. The Contractor shall clean all previously used construction equipment prior to bringing it onto the project site. The Contractor shall ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. The Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

3-11 MAINTENANCE OF POLLUTION FACILITIES

- A. The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3-12 TRAINING OF CONTRACTOR PERSONNEL

- A. The Contractor's personnel shall be trained in all phases of environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. Additional meetings shall be conducted for new personnel and when site conditions change. The training and meeting agenda shall include: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

3-13 POST CONSTRUCTION CLEANUP

- A. The Contractor shall clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". The Contractor shall, unless otherwise instructed in writing by

the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area shall be graded, filled and the entire area seeded unless otherwise indicated.

PART 4 COMPENSATION

4-01 GENERAL

- A. No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations.

**SECTION 01356
STORM WATER POLLUTION PREVENTION
AND EROSION CONTROL MEASURES
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**SECTION 01356
STORM WATER POLLUTION PREVENTION
AND EROSION CONTROL MEASURES**

PART 1 GENERAL

1-01 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4439 (1997)	Standard Terminology for Geosynthetics
ASTM D 4491 (1996)	Water Permeability of Geotextiles by Permittivity
ASTM D 4533 (1991; R 1996)	Trapezoid Tearing Strength of Geotextiles
ASTM D 4632 (1991; R 1996)	Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751 (1995)	Determining Apparent Opening Size of a Geotextile
ASTM D 4873 (1995)	Identification, Storage, and Handling of Geosynthetic Rolls

1-02 GENERAL

- A. The Contractor shall implement the storm water pollution prevention measures specified in this section in a manner which will meet the requirements of Section 01355 ENVIRONMENTAL PROTECTION, and the requirements of the National Pollution Discharge Elimination System (NPDES) permit.

1-03 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificate:

Mill Certificate or Affidavit - Certificate attesting that the Contractor has met all specified requirements set forth in the SWPPP for the project and all BMP's as required by MDEQ and as outlined in the plans and other areas in the specifications.

1-04 EROSION AND SEDIMENT CONTROLS

- A. Stabilization Practices: The stabilization practices to be implemented shall include seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, erosion control mats, protection of trees, preservation of mature vegetation, etc. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices

shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1. **Unsuitable Conditions:** Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.
 2. **No Activity for Less Than 21 Days.** Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.
 3. Once all construction activity is ceased in an area permanently, all disturbed areas shall be seeded, mulched and protected from erosion. The contractor shall be responsible for re-seeding and mulching at no additional cost to the Government if seeds are eroded away by rain.
- B. Structural Practices:** Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices. Location and details of installation and construction are shown on the drawings.
1. **Silt Fences:** The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Silt fences shall be installed in the locations indicated on the drawings. Additional silt fences may be required due to construction phasing. Final removal of silt fence barriers shall be upon approval by the Contracting Officer.
 2. **Straw Bales:** The Contractor shall provide bales of straw as a temporary structural practice to minimize erosion and sediment runoff. Bales shall be properly placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in a area between a ridge and drain, bales shall be placed as work progresses, bales shall be removed/replaced/relocated as needed for work to progress in the drainage area). Areas where straw bales are to be used are shown on the drawings. Additional straw bales may be required due to construction phasing. Final removal of straw bale barriers shall be upon approval by the Contracting Officer.
Rows of bales of straw shall be provided as follows:
 - a. At the entrance to culverts that receive runoff from disturbed areas.
 - b. Perpendicular to the flow at the bottom of fill slopes at culvert outlets.

3. **Temporary Berms:** A temporary berm shall be constructed of compacted soil, with a minimum width of 24 inches at the top and a minimum height of 12 inches with or without a shallow ditch, constructed at the top of fill slopes or transverse to centerline on fills. Temporary berms shall be graded so as to drain to a compacted outlet at a slope drain. The area adjacent to the temporary berm in the vicinity of the slope drain must be properly graded to enable this inlet to function efficiently and with only minimum ponding in this area. All transverse berms required on the downstream side of a slope drain shall extend across the grade to the highest point at approximately at 10 degree angle with a perpendicular to centerline. The top width of these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimal disruptions. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to 1 side of the embankment to permit the placement of temporary berms and slope drains on only 1 side of the embankment.

4. **Sediment Structures:** Sediment structures shall be utilized to control sediment at the foot of embankments where slope drains outlet; at the bottom as well as in the ditch lines atop waste sites; in the ditch lines or borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.

When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and property compacted. The existing ground shall be restored to its natural or intended condition.

PART 2 PRODUCTS

2-01 COMPONENTS FOR SILT FENCES

- A. **Filter Fabric** The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments that are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE PHYSICAL PROPERTY TEST PROCEDURE STRENGTH REQUIREMENT (Metric)

Grab Tensile ASTM D 4632	445 N min.
Elongation (%)	30 % max.
Trapezoid Tear ASTM D 4533	245 N min.
Permittivity ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve) ASTM D 4751	20-100

FILTER FABRIC FOR SILT SCREEN FENCE PHYSICAL PROPERTY TEST PROCEDURE
STRENGTH REQUIREMENT (English)

Grab Tensile ASTM D 4632	100 lbs. min.
Elongation (%)	30 % max.
Trapezoid Tear ASTM D 4533	55 lbs. min.
Permittivity ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve) ASTM D 4751	20-100

- B. Silt Fence Stakes and Posts: The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 5 feet.
- C. Mill Certificate or Affidavit: A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.
- D. Identification Storage and Handling: Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

2-02 COMPONENTS FOR STRAW BALES

- A. The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. The bales shall have a standard cross section of 14 inches by 18 inches. All bales shall be either wire-bound or string-tied. The Contractor may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have minimum dimensions of 2 inches x 2 inches in cross section and shall have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 3 feet.

PART 3 EXECUTION

3-01 INSTALLATION OF SILT FENCES

- A. Silt fences shall extend a minimum of 16 inches above the ground surface and shall not exceed 34 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 inch overlap, and securely sealed. A trench shall be excavated approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3-02 INSTALLATION OF STRAW BALES

- A. Straw bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked (gaps filled by wedging with straw), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier. Loose straw shall be scattered over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 18 inches deep into the ground to securely anchor the bales.

3-03 MAINTENANCE

- A. The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.
1. Silt Fence Maintenance: Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 02480.
 2. Straw Bale Maintenance: Straw bale barriers shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales shall be accomplished promptly. Sediment deposits shall be removed when deposits reach one-half of the height of the barrier. Bale rows used to retain sediment shall be turned uphill at each end of each row. When a straw bale barrier is no longer required, it shall be removed. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 02480.

3-04 INSPECTIONS

- A. General: The Contractor shall inspect disturbed areas of the construction site, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.
- B. Inspections Details: Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.
- C. Inspection Reports: For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.
- D. Monthly Inspection Report and Certification Form for Erosion and Sediment Controls

On the first working day of each month the Contractor shall complete, sign, and submit the original form to the State of Mississippi, Office of Pollution Control (OPC) at the following address:

Chief, Environmental Permits Division
Mississippi Department of Environmental Quality, Office of Pollution Control
P.O. Box 10385
Jackson, Mississippi, 39289-0385

A copy of the State of Mississippi's Monthly Inspection Report and Certification Form for Erosion and Sediment Controls is attached to the end of this section. On the first working day of each month the Contractor shall also furnish one copy of the form submitted to the OPC to the Contracting Officer as part of the Contractor's daily CQC Report and attach a copy of the completed form to the Plan. Unless otherwise notified by the OPC, the Contractor shall submit the Monthly Inspection Report and Certification Forms for an additional two months after the final completion of all storm water pollution prevention measures required in this contract have been implemented.

PART 4 COMPENSATION

4-01 MEASUREMENT

- A. The percentage of the lump sum amount for storm water pollution prevention and erosion control will be measured in accordance with the construction schedule submitted by the Contractor and approved by the Contracting Officer within the following limitations:

<u>% of Total Contract Earned*</u>	<u>% of Maximum Lump Sum This Item Allowed</u>
10%	50%
50%	75%
80%	90%

- B. When all work under this Contract is completed by the Contractor and accepted by the Contracting Officer, one hundred percent (100%) of the Lump Sum Amount will be allowed.
1. Total Contract earned will be equal to certified estimates approved by the Contracting Officer exclusive of the Erosion Control Lump Sum and Materials Stored Amounts.

4-02 PAYMENT

- A. Payment for Storm Water Pollution Prevention and Erosion Control shall be made at the contract lump sum price and in accordance with 4-01, MEASUREMENT. This price shall be full compensation for furnishing all materials, labor, supervision, equipment and incidentals necessary to satisfactorily complete the work.
- B. Payment will be made under:
- EROSION CONTROL, Per Lump Sum.

**SECTION 01451
CONTRACTOR QUALITY CONTROL
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SECTION 01451
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1-01 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(1994a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(1993b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1-02 PAYMENT

- A. Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable lump-sum prices contained in the Bidding Schedule.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3-01 GENERAL

- A. The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause entitled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both on-site and off-site, and shall be keyed to the proposed construction sequence.

3-02 QUALITY CONTROL PLAN

- A. General

The Contractor shall furnish for review by the Government, not later than 21 calendar days after receipt of Notice of Award of the contract, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause entitled

"Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 15 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

B. Content of the CQC Plan

The CQC plan shall include, as a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers, and purchasing agents:

1. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC system manager who shall report to the project manager or someone higher in the Contractor's organization. Project manager in this context shall mean the individual with responsibility for the overall management of the project including quality and production.
2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to the Government.
4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with SECTION 01330 – SUBMITTALS.
5. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)
6. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
7. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

8. Reporting procedures, including proposed reporting formats.
9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

C. Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

D. Notification of Changes

After acceptance of the QC plan, the Contractor shall notify the Contracting Officer in writing a minimum of seven calendar days prior to any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3-03 COORDINATION MEETING

- A. After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the Quality Control Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both on-site and off-site work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3-04 QUALITY CONTROL ORGANIZATION

A. CQC System Manager

The Contractor shall identify an individual within his organization at the worksite who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. This CQC System Manager shall be subject to acceptance by the Contracting Officer. The CQC System Manager shall be assigned as System Manager but may have other duties in addition to quality control.

B. CQC Staff

A staff shall be maintained under the direction of the CQC System Manager to perform all CQC activities. An alternate will be identified to serve in the absence of the CQC System Manager. The staff must be of sufficient size to ensure adequate CQC coverage of all work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned CQC responsibilities and must be allowed sufficient time to carry out these responsibilities. The CQC plan will clearly state the duties and responsibilities of each staff member. All CQC Staff members or replacements shall be subject to acceptance by the Contracting Officer.

C. Additional Requirement

In addition to the above requirements, the CQC System Manager, and his alternate, and also includes individuals appointed as alternates, shall complete the course entitled "Construction Quality Management for Contractors" This course is periodically offered by the Memphis District as well as other Corps Districts.

3-05 SUBMITTALS

- A. Submittals shall be in accordance with SECTION 01330 – SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

3-06 CONTROL

- A. The controls shall include at least three phases of control to be conducted by the CQC System Manager for all definable features of work, as follows:

- 1. Preparatory Phase

- This phase shall be performed prior to beginning work on each definable feature of work and shall include:

- a. A review of each paragraph of applicable specifications.
 - b. A review of the contract drawings.

- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. A check to assure that provisions have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for constructing the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that phase of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. The Government shall be notified at least 24 hours in advance of beginning any of the required action of the preparatory phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

2. Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of preliminary work to ensure that it is in compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verification of full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with sample panels is appropriate.

- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work on-site, or any time acceptable specified quality standards are not being met.

3. Follow-Up Phase

Daily checks shall be performed to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

4. Additional Preparatory and Initial Phases

As determined by the Government, additional preparatory and initial phases may be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the applicable CQC staff, on-site production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3-07 TESTS

A. Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product that conforms to contract requirements. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- 1. Verify that testing procedures comply with contract requirements.
- 2. Verify that facilities and testing equipment are available and comply with testing standards.
- 3. Check test instrument calibration data against certified standards.

4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
5. Results of all tests taken, both passing and failing tests, will be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an off-site or commercial test facility will be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

B. Testing Laboratories

All testing of soil, gravel, aggregate, stone, concrete, asphalt and backfill shall be performed by a testing laboratory validated by the Material Testing Center (MTC) of the Corps of Engineers and paid for by the Contractor as an absorbed cost. Refer to the MTC website www.wes.army.mil/SL/MTC/ValStatesTbl.htm for a complete and current list of validated commercial laboratories. If the Contractor proposes to use a commercial laboratory that is not validated or set up an on-site laboratory, he shall make arrangements for validation by contacting the Material Testing Center at Waterways Experiment Station, Vicksburg, Mississippi, telephone number, 601-634-3610 or 601-634-2496, www.wes.army.mil/SL/MTC/inspection.htm. The Government will not be responsible any costs associated with the validation of laboratories that are not currently validated. The validation process could take 60 to 90 days or more. The Contractor shall be responsible for determining the amount of time required for the validation of the proposed laboratory and accounting for this event in his progress schedule. If the Contractor elects to use a non-validated laboratory, work requiring testing shall not commence until the laboratory has been validated by MTC.

1. Capability Check

The Contracting Officer reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

2. Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor. There will be no extension of time allowed due to necessity to perform capability rechecks.

C. On-Site Laboratory

The Contracting Officer reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

D. Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered by the Contractor to a location specified by the Contracting Officer.

3-08 COMPLETION INSPECTION

- A. At the completion of all work or any increment thereof established by a completion time stated in the SPECIAL CONTRACT REQUIREMENTS entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Government. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3-09 DOCUMENTATION

- A. The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:
1. Contractor/subcontractor and their area of responsibility.
 2. Operating plant/equipment with hours worked, idle, or down for repair.

3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
 4. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
 5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
 6. Submittals reviewed, with contract reference, by whom, and actions taken.
 7. Off-site surveillance activities, including actions taken.
 8. Job safety evaluations stating what was checked, results, instructions or corrective actions.
 9. Instructions given/received and conflicts in plans and/or specifications.
 10. Contractor's verification statement.
- B. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3-10 NOTIFICATION OF NONCOMPLIANCE

- A. The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

PART 4 COMPENSATION

4-01 GENERAL

- A. No additional compensation will be allowed for requirements described in this section of the Specifications. All requirements described herein will be considered to be “absorbed items”.

SECTION 01452
PROJECT SIGN, BARRICADES, AND TRAFFIC CONTROL SIGNS
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**SECTION 01452
PROJECT SIGN, BARRICADES, AND TRAFFIC CONTROL SIGNS**

PART 1 GENERAL

1-01 SCOPE

- A. The work covered by this section consists of furnishing, erecting, maintaining, and removing project signs, barricades, and traffic control signs.

1-02 PROJECT SIGN

- A. The Contractor shall furnish, erect, and maintain one double-faced project sign, at the specific location designated by the Contracting Officer. The sign shall be constructed of 3/4-inch A-C exterior plywood or 22 gage metal, mounted on a substantial framework of 2-inch material. Size, lettering, color and paint shall conform to the details shown on the drawing "Temporary Project Sign" included at the end of this section. Upon request, the Government will furnish without cost to the Contractor two decals of the Engineer Castle. The sign shall be erected as soon as practicable, but not later than 15 calendar days after the date established for commencement of work. The sign shall be removed upon completion of all other construction work under the contract and will become the property of the Contractor.

1-03 BARRICADES AND TRAFFIC CONTROL SIGNS

- A. Barricades and traffic control signs shall be those as recommended by the Contracting Officer and conform to the "Manual on Uniform Traffic Control Devices for Streets and Highways," Current Edition.

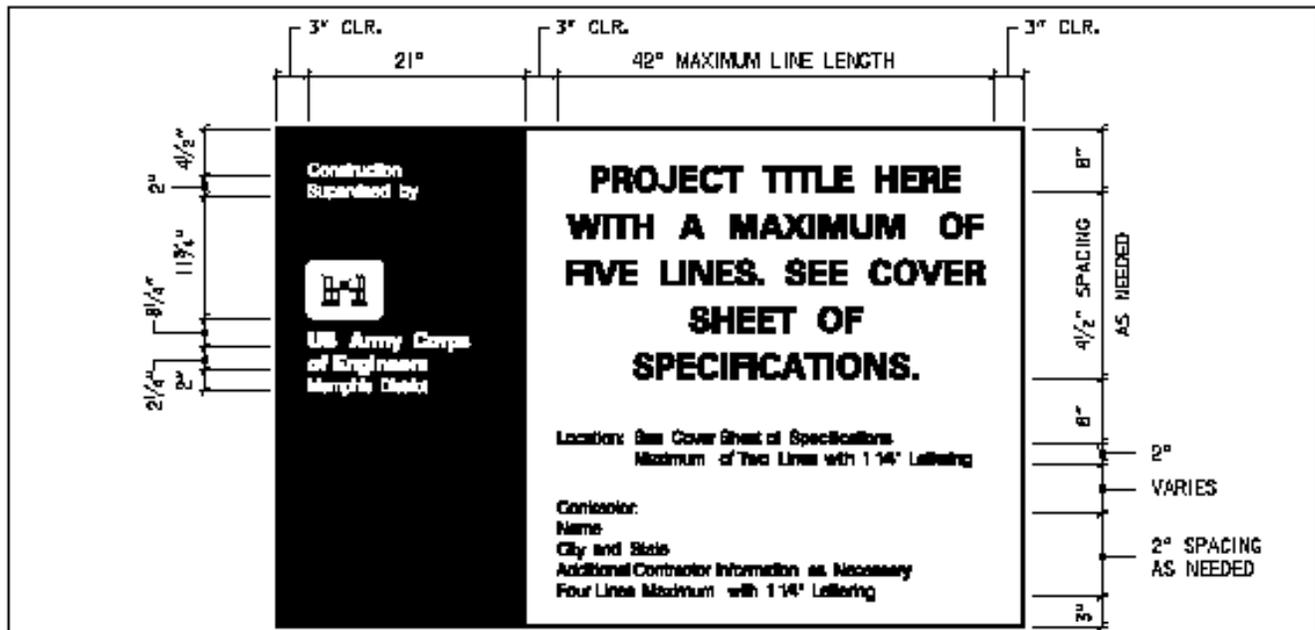
PART - 2 PRODUCTS (Not Applicable)

PART - 3 EXECUTION (Not Applicable)

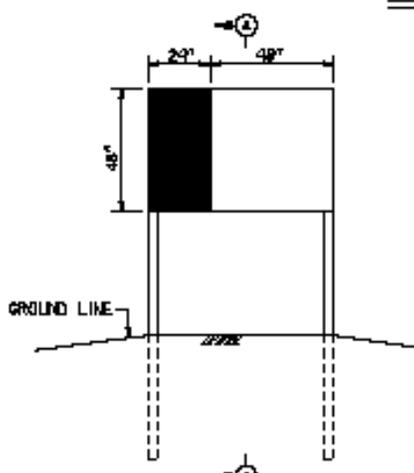
PART 4 COMPENSATION

4-01 GENERAL

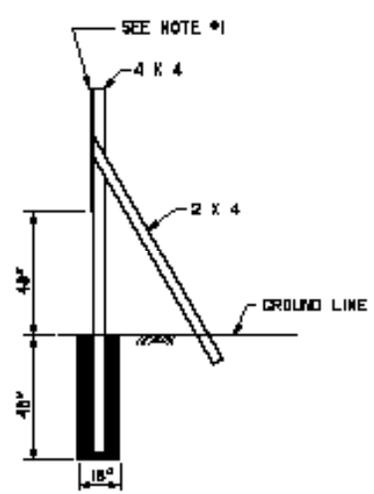
- A. No separate payment will be made for erecting, maintaining and removing project signs, barricades, and traffic control signs and all costs in connection therewith will be considered an incidental obligation of the Contractor.



ELEVATION



ELEVATION



SECTION A-A

SPECIFICATIONS

1. SIGN PANEL SHALL BE 4' x 8' x 3/4" EXTERIOR GRADE PLYWOOD OR BE GAGE SHEET METAL.
2. POSTS AND BRACING SHALL BE TREATED, NO. 1 GRADE YELLOW PINE.
3. ALL EXPOSED SURFACES SHALL BE GIVEN ONE COAT OF LINSEED OIL AND WIPED PRIOR TO PRIMING.
4. ALL EXPOSED SURFACES SHALL BE GIVEN ONE COAT OF WHITE AS PRIMER. SECOND COAT SHALL BE COMMUNICATIONS RED ON LEFT AND WHITE ELSEWHERE.
5. THE LEFT SECTION SHALL BE RED WITH WHITE LEGEND. THE RIGHT SECTION SHALL BE WHITE WITH BLACK LEGEND.
6. PAINT SHALL BE BENJAMIN MOORE NO. 120-60 POLY-SILICONE ENAMEL OR APPROVED EQUAL.
7. ALL LETTERING SHALL BE 1/2" WITH A TWO INCH LETTER SPACING UNLESS NOTED OTHERWISE. THE WORDS "US Army Corps of Engineers" SHALL BE 1 1/2" TALL. THE PROJECT TITLE LETTERING SHALL BE A MINIMUM OF 1 1/2" TALL AND A MAXIMUM OF 3 1/2" TALL. THE LETTERING SIZE SHALL BE CHOSEN SUCH THAT LARGEST POSSIBLE LETTERS ARE USED WITHOUT EXCEEDING A MAXIMUM LINE LENGTH OF 42". THE NUMBER OF LINES IN THE PROJECT TITLE SHALL MATCH THAT SHOWN ON THE COVER SHEET OF THE SPECIFICATIONS.

SCALE: NONE JANUARY 1999

<p>U.S. ARMY ENGINEERING BUREAU CORPS OF ENGINEERS MEMPHIS, TENNESSEE</p>
<p>TEMPORARY PROJECT SIGN</p>

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**SECTION 01781
OPERATION AND MAINTENANCE DATA**

PART 1 GENERAL

1-01 SUBMISSION OF OPERATION AND MAINTENANCE DATA

- A. Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01330, "Submittal Procedures."
- B. Package Quality: Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.
- C. Package Content: Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission.
- D. Changes to Submittals: Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1-02 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

- A. Operating Instructions: Include specific instructions, procedures, and illustrations for the following phases of operation:
 - 1. Safety Precautions: List personnel hazards and equipment or product safety precautions for all operating conditions.
 - 2. Operator Prestart: Include procedures required to set up and prepare each system for use.
 - 3. Startup, Shutdown, and Post-Shutdown Procedures: Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.
 - 4. Normal Operations: Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

5. **Emergency Operations:** Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.
 6. **Operator Service Requirements:** Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.
 7. **Environmental Conditions:** Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.
- B. **Preventive Maintenance:** Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.
1. **Lubrication Data:** Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":
 - a. A table showing recommended lubricants for specific temperature ranges and applications.
 - b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
 - c. A Lubrication Schedule showing service interval frequency.
 2. **Preventive Maintenance Plan and Schedule:** Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.
- C. **Corrective Maintenance (Repair):** Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.
1. **Troubleshooting Guides and Diagnostic Techniques:** Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

2. **Wiring Diagrams and Control Diagrams:** Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.
 3. **Maintenance and Repair Procedures:** Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.
 4. **Removal and Replacement Instructions:** Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.
 5. **Spare Parts and Supply Lists:** Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.
- D. **Corrective Maintenance Work-Hours:** Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.
- E. **Appendices:** Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:
- F. **Parts Identification:** Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.
1. **Warranty Information:** List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

2. Personnel Training Requirements: Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.
3. Testing Equipment and Special Tool Information: Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.
4. Contractor Information: Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1-03 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

A. Furnish the O&M data package specified below for individual technical sections. The required information for each O&M data package is as follows:

1. Data Package
 - a. Safety precautions
 - b. Operator prestart
 - c. Startup, shutdown, and post-shutdown procedures
 - d. Normal operations
 - e. Emergency operations
 - f. Operator service requirements
 - g. Environmental conditions
 - h. Lubrication data
 - i. Preventive maintenance plan and schedule
 - j. Troubleshooting guides and diagnostic techniques
 - k. Wiring diagrams and control diagrams
 - l. Maintenance and repair procedures
 - m. Removal and replacement instructions
 - n. Spare parts and supply list
 - o. Corrective maintenance man-hours
 - p. Parts identification
 - q. Warranty information
 - r. Personnel training requirements
 - s. Testing equipment and special tool information
 - t. Contractor information

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

PART 4 PAYMENT

4-01 GENERAL

- A. No additional compensation will be allowed for requirements described in this section of the Specifications. All requirements described herein will be considered to be “absorbed items”.

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**SECTION 02101
REMOVAL OF STRUCTURES AND OBSTRUCTIONS
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SECTION 02101
REMOVAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 GENERAL

1-01 SCOPE

- A. Removal of Structures and obstructions shall consist of the removal and satisfactory disposal of all buildings, foundations, buried tanks, rubble, debris, fences, structures, old pavements, abandoned pipe lines and other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of under other items in the Contract as directed. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes and pits. When the Proposal does not include Pay Items for removal of Structures and obstructions as set forth in this Section, the cost of such work shall be included in prices bid on other construction items.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3-01 GENERAL

- A. The Contractor shall remove and dispose of all buildings and foundations, structures, fences and other obstructions, any portions of which are in the construction limits, except utilities and those for which other provisions have been made for removal. All designated salvageable material shall remain the property of the Government and shall be removed, without unnecessary damage, in sections or pieces which may be readily transported and shall be stacked at specified storage areas by the Contractor within the project's limits or hauled to a designated maintenance storage yard and stacked. All materials designated not to be salvaged may be destroyed or disposed of off the project outside the limits of view with written permission of the property owner on whose property material is placed. Copies of all agreements with property owners are to be furnished to the Contracting Officer prior to initiating work. Basements or cavities left by structure removal shall be filled to the level of the surrounding ground with select fill and, if within the prism of construction, shall be compacted to the approximate density of the surrounding ground in open areas. Under future roadway, sidewalk and bikepath areas the fill shall be compacted to 95% of standard Proctor density in accordance with ASTM D 698 with stability present.

All materials specified for salvage shall be removed, without unnecessary damage, in sections or pieces which may be readily transported and shall be stacked or stored by the Contractor at such places as may be designated within the project's limits, unless other locations are specified in the Contract.

3-02 REMOVAL OF BRIDGES, CULVERTS AND OTHER DRAINAGE STRUCTURES

- A. Bridges, culverts and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic. Unless otherwise directed, the substructures of existing structures shall be removed to the natural stream bottom and those parts outside of the stream shall be removed one foot (1') below natural ground surface. Where such portions of existing structures lie wholly or in part within the limits for a new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

As specified, steel bridges and wood bridges shall be carefully dismantled without unnecessary damage. The dismantling shall include the stripping of all hardware and the removal of all nails. Steel members shall be match marked before dismantling unless otherwise indicated. All salvaged material shall be stored or removed as specified in Subsection 2-01 and shall remain the property of the Government.

If permitted, blasting or other operations necessary for the removal of an existing structure or obstruction which may damage new construction shall be completed prior to placing the new work.

3-03 MAINTENANCE OF TRAFFIC

- A. The Contractor shall maintain local access to all properties fronting along the project for the duration of the work

PART 4 COMPENSATION

4-01 METHOD OF MEASUREMENT

- A. There will be no separate measurement for removal of structures and obstructions.

4-02 BASIS OF PAYMENT

- A. No separate payment will be made for the removal of structures and obstructions. The cost of this work shall be absorbed in other bid items.

**SECTION 02111
CLEARING AND GRUBBING
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PART 4	COMPENSATION
	4-01 GENERAL

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**SECTION 02111
CLEARING AND GRUBBING**

PART 1 GENERAL

1-01 DESCRIPTION

- A. This item shall consist of the removal and satisfactory disposal of trees, except those that may be designated to remain in place, stumps, logs, snags, brush, weeds and other perishable or objectionable material within the limits of project site or along the length of the project as designated. The Contractor shall only be required to perform clearing and grubbing in those areas within the permanent and temporary easements which are necessary for the operations associated with this project. All areas that are cleared shall also be grubbed.
- B. When specified on the Bid Form as lump sum, this item shall include costs for incidental work required on other non-related items specifically detailed on the Drawings but not listed separately on the Bid Form, which is subsidiary to the completion of that item of work in accordance with the Contract Documents.
- C. This work shall include the stripping and stockpiling of topsoil, stump removal, felling of trees, clearing of brush and other operations as may be detailed herein or indicated on the Drawings.

PART 2 PRODUCTS

2-01 GENERAL

- A. Materials cleared from the site, including merchantable timber, if any, shall become the property of the CONTRACTOR for his disposal unless otherwise noted elsewhere in the Specifications.
- B. The Contractor shall provide equipment of whatever nature is needed to complete the work to the satisfaction of the Contracting Officer. Equipment deemed by the Contracting Officer to be inadequate for the work must be removed from the site.

PART 3 - EXECUTION

3-01 GENERAL

- A. Clearing and grubbing shall be completed a satisfactory distance in advance of earthwork for site preparation, roadways, pipe laying operations etc. and such operations shall not be started until the cleared and grubbed area has been reviewed by the Contracting Officer.
- B. The Contractor shall be responsible for obtaining permits for hauling, dumping, burning, disposal and other operations, as may be required by Local, State and Federal requirements.

3-02 CLEARING AND GRUBBING

- A. The area within the construction limits of the project site shall be cleared of trees, stumps, roots, logs, vegetation and other objectionable matter. Roots over 1-1/2 inches in diameter shall be grubbed out to a minimum depth of 18 inches below original ground or 12 inches below the proposed finished grade in excavated areas. Where indicated on the Drawings or directed by the Contracting Officer, trees that are to remain in place within the project limits, shall be protected from damage by other clearing or construction operations.
- B. Stump holes shall be backfilled and compacted to the density required for subgrades in Section 02200 "Earthwork" where applicable.
- C. When necessary to completely remove grass and small roots from the areas to be covered by earth fill, such as roadways, levees, or other site construction, such areas shall be stripped to sufficient depth to remove same, to the extent directed by the Contracting Officer.
- D. Felling of trees and other clearing operations shall be conducted in a manner that prevents damage to trees that are to remain and to protect existing improvements, structures, utility lines or other items.

3-03 DISPOSAL OF MATERIALS

- A. All merchantable timber shall become the property of the CONTRACTOR for his disposal unless otherwise noted.
- B. Burying of stumps, trees, logs, snags or other vegetative materials will not be permissible within the project site limits unless otherwise provided for in these Specifications.
- C. Contractor has the option of burning all perishable material cleared from the site within cleared areas, as designated by the Contracting Officer. If not burned on site, all cleared materials shall be completely removed from project site to disposal areas approved by the Contracting Officer. Piles for burning shall be placed in the center of cleared areas, and shall be limited in size so that no damage to remaining trees or other vegetation will occur. The Contractor will be responsible for obtaining all permits required and for controlling fires in compliance with all Federal, State and Local laws and regulations for burning. Sufficient watchmen and fire extinguishers shall be provided for constant care of burning material. The Contractor shall submit to the Contracting Officer for review, his proposed method of burning and appropriate precautions for protection of the adjacent areas. The Contractor shall notify the local firefighting unit in advance of burning operations. The Contractor shall furnish and maintain adequate firefighting equipment and personnel at the site during burning operations.
- D. Ashes resulting from burning and incombustible materials such as green roots and debris shall be removed to designated disposal areas provided by the CONTRACTOR and approved by the CONTRACTING OFFICER.

- E. Materials which are stripped from the project site which are not suitable for reuse shall be disposed of by the Contractor at a location provided by him and approved by the Contracting Officer.
- F. The cost of hauling, stockpiling and disposal of material shall be included in the Contract Price bid for Site Work.

PART 4 COMPENSATION

4-01 GENERAL

- A. No additional compensation will be allowed for requirements described in this section of the Specifications. All requirements described herein will be considered to be “absorbed items”.

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**SECTION 02200
EARTHWORK
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**SECTION 02200
EARTHWORK****PART 1 GENERAL**

1-01 DESCRIPTION

- A. This work shall consist of general grading, excavating, site preparation, hauling, placing, processing, filling, spreading, compacting, and protecting areas to be filled in accordance with these Specifications and in conformity with the lines, grades, slopes, and typical cross sections depicted by the CONTRACT DRAWINGS. Additional information is contained within the Geotechnical Investigation – Upper Camp Creek Interceptor prepared by Burns Cooley Dennis, Inc. dated May 19, 2003 for the Contractor's reference in accordance with Section 00800.1.6.d of these Specifications.
- B. This item shall also consist of satisfactorily stockpiling materials or disposing of all unsatisfactory materials encountered within the construction limits of the project site. The work includes grading and subgrade construction on roadways and parking areas, water and sewer main construction and site work for buildings and structures, etc.

1-02 EXAMINATION OF SITE

- A. The Contractor shall visit the site and inform himself fully of the amount of excavation, filling and grading required under the Contract.

The Contractor shall fully familiarize himself with the surrounding area and the conditions of access under which the project is to be completed.

1-03 CLASSIFICATION OF EXCAVATION

- A. All excavation shall be identified as Unclassified Excavation. Additional information concerning site characteristics is contained within the Geotechnical Investigation – Upper Camp Creek Interceptor prepared by Burns Cooley Dennis, Inc. dated May 19, 2003 for the Contractor's reference in accordance with Section 00800.1.6.d of these Specifications.

PART 2 PRODUCTS

2-01 EQUIPMENT

- A. CONTRACTOR may use the type of earth moving, compaction, processing, and watering equipment that he desires or has at his disposal, provided the equipment is in satisfactory condition, of adequate design to perform the work efficiently, and is of such capacity and quantity that the construction schedule can be maintained as planned by the CONTRACTOR and approved by the CONTRACTING OFFICER in accordance with the CONTRACT time contained in the AGREEMENT. The CONTRACTOR shall furnish, operate and maintain such equipment as is necessary to control uniform density, layers of fill and cross sections.

2-02 MATERIALS

- A. Material used for fill shall be free from vegetable matter and other deleterious substances and shall not contain large rocks or lumps. Fill materials shall consist of select, non-organic and debris free silty clays (CL), clayey silt (ML), sandy clays (CL), or clayey sands (SC) having a plasticity index (PI) within the range of 5 to 25 and a liquid limit less than 45.

PART 3 EXECUTION

3-01 GENERAL REQUIREMENTS

- A. Suitable materials excavated in project site construction shall be used insofar as practicable in the formation of fills, subgrades and shoulders as shown on the DRAWINGS.
- B. Sequence of Operations: No site construction shall be started until erosion control measures have been installed and sufficient clearing, grubbing, stripping, and adequate pipe and drainage work to allow proper drainage within construction limits has been satisfactorily completed to allow earthwork to proceed without interruption.
- C. Foundation Preparation:
 - 1. When clearing and grubbing has been completed, stump holes remaining in areas to receive fill shall be filled with suitable material and compacted to the specified density.
 - 2. Prior to placing material on areas to receive fill, the existing ground shall be thoroughly proof-rolled with a roller to prove that the area is of a satisfactory density with stability to begin placement of fill material. Stability shall be determined by proof-rolling with loaded dump trucks or other suitable equipment by the Contractor. At least two (2) full coverage passes over the site should be performed. Any areas that are soft or yielding during proof-rolling should be stabilized as discussed in paragraph 2 above.
- D. All excavations shall be kept in compliance with the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) regulations (29 CFR Part 1926). Shallow excavations (less than 10 ft in depth) shall have temporary slopes no steeper than 1.5 horizontal to 1 vertical where groundwater is not encountered and no steeper than 3 horizontal to 1 vertical where groundwater is present. Deep excavations will require benching, sheeting, or shoring. Sheet pile walls or shoring systems shall be designed by a professional engineer.

Excavation shall be performed at locations indicated on the DRAWINGS, to lines, grades and cross sections shown, and shall be made in such manner that fills can be formed in accordance with the requirements herein. Suitable material encountered within the limits indicated shall be used in the formation of fills. Material not approved for use in fills shall be disposed of in approved Contractor furnished off-site disposal areas or on site if so directed by the Contracting Officer. During the process of excavation, the grade shall be maintained to assure that it will be well drained at all times.

1. The non-organic, non-high plasticity clay debris-free soils removed from the excavated areas should be suitable for use in the embankment. All suitable materials removed from the required excavations shall be utilized in construction of embankments and fills as designated on the Construction Drawings. The Contractor shall organize the excavation and fill such that on-site materials from excavated areas can be used for fill. Excess materials (suitable or unsuitable) shall be wasted or disposed of off-site at a site to be furnished by the Contractor. No separate payment will be considered for the disposal of excess materials (suitable or unsuitable).

The Contractor shall control the excavation work so that the ground surface is properly pitched to prevent water from running into the excavated areas. Water that has accumulated in the excavated areas shall be promptly removed by the Contractor at his expense.

The excavation work may require dewatering. The Contractor shall submit a dewatering plan for approval by the Contracting Officer.

2. Tolerances: Excavation and grading shall be completed to conform to the lines and grades shown on the Drawings. The surface shall conform to the specified grades within 0.5 inches, unless a different tolerance is indicated by the drawings or elsewhere in these Specifications. Deviations shall be corrected by further grading, filling, reshaping and compacting until conformance is obtained.

E. Formation of Fills:

1. Fills for project site shall be constructed to lines, grades, cross sections and dimensions shown on the DRAWINGS.
2. Earth fills shall be formed by distributing the materials in successive uniform horizontal layers not to exceed nine inches (9") in thickness, loose depth, for the full width of the cross sections. Each layer of fill shall be compacted to a density of at least ninety-eight percent (98%) of standard Proctor maximum dry density at moisture contents within four percent (4%) below to three percent (3%) above the optimum water content. The Contractor shall spread, scarify, water, or dry the material to achieve the required moisture content. Stability shall be determined by proof-rolling performed by the Contractor.
3. The upper surface of the fill shall be shaped to provide complete drainage of surface water at all times. The forming of ruts will not be permitted. The Contractor shall protect the work from erosion and adverse weather conditions.

4. Each layer of earth fill shall be compacted as required, with appropriate equipment. Fill material shall be compacted within four percent (4%) below to three percent (3%) above optimum moisture content by processing to dry or watered and properly mixed as needed before being rolled. The furnishing and application of water for construction of fills or processing to dry soils will not be paid for separately; such operations shall be considered as incidental to the formation of fills.
 5. Construction operations shall be performed in such manner that the simultaneous rolling and placing of material in the same lane or section will not occur. To avoid uneven compaction, the hauling equipment shall traverse, as much as possible, the full width of the cross section. Each layer shall be compacted as required before material for the next layer is deposited.
- F. Foundations: Excavation for structural foundations shall be made at slopes that will provide safe working conditions, or adequate sheet piling shall be installed. Additional information concerning existing geotechnical conditions is contained within the Geotechnical Investigation – Upper Camp Creek Interceptor prepared by Burns Cooley Dennis, Inc. dated May 19, 2003 for the Contractor's reference in accordance with Section 00800.1.6.d of these Specifications. Backfill material shall not contain any expansive materials and shall be compacted in lifts to ninety-eight (98%) maximum density with stability present. Where indicated to be required on the Drawings, crushed stone for foundations shall be #57 crushed limestone.
- H. Disposal of Excess Material: All excess material and material unsuitable for use in fills shall be disposed of in approved Contractor furnished off-site disposal areas or as directed by the Contracting Officer, in designated on-site areas. Material disposed of on-site shall be placed and graded to field established contours and elevations. After placement of excess material, such fills shall be consolidated by complete coverage with construction equipment. Fills shall be dressed to present a neat appearance before project acceptance.
- I. Additional information concerning site preparation, dewatering, and existing geotechnical conditions is contained within the Geotechnical Investigation – Upper Camp Creek Interceptor prepared by Burns Cooley Dennis, Inc. dated May 19, 2003 for the Contractor's reference in accordance with Section 00800.1.6.d of these Specifications.

3-02 SEASONAL AND WEATHER LIMITS

- A. No fill material shall be placed, spread or rolled while the ground or fill is frozen or thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

3-03 TESTING

- A. Contractor shall be responsible for determining that material utilized in fills meet project requirements and shall provide Atterburg Units, Gradation, Standard Proctor density tests, field density tests, etc. for all materials utilized in fills, foundations or bases. Proctors shall be run as frequently as necessary to assure consistency of material and wherever changes in material are encountered.
- B. Density tests shall be performed at not less than the following interval:
 - 1. Foundation Backfill - at least in every second lift of vertical fill, or every 100 CY, whichever is more frequent.
 - 2. Subgrade Fills - at least in every second lift of vertical fill in a maximum of 500 linear feet, or every 2000 cubic yards, whichever is more frequent.
 - 3. Road and Street Bases - in every lift of each day's production, with spacing in each lift not to exceed 300 feet, and with total yardage per test not to exceed 2000 cubic yards.

PART 4 - COMPENSATION

4-01 GENERAL

- A. No additional compensation will be allowed for requirements described in this section of the Specifications. All requirements described herein will be considered to be "absorbed items".

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**SECTION 02220
DEWATERING
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**SECTION 02220
DEWATERING****PART 1 GENERAL**

1-01 SCOPE

- A. The work provided for herein consists of furnishing all plant, labor, material and equipment and performing all operations required for designing, furnishing, installing and operating a system or systems to dewater the excavation area; maintaining the area free from water during construction operations; and removing the system.
- B. Additional information is contained within the Geotechnical Investigation – Upper Camp Creek Interceptor prepared by Burns Cooley Dennis, Inc. dated May 19, 2003 for the Contractor's reference in accordance with Section 00800.1.6.d of these Specifications.
- C. The Contractor is solely responsible for the design, operation, function, and all safety associated with any required dewatering system.

1-02 QUALITY CONTROL

- A. The Contractor shall establish and maintain quality control for all dewatering operations to assure compliance with contracting requirements and maintain records of his quality control for all construction operations, including but not limited to the following:
 - 1. Fabrication and workmanship.
 - 2. Installation, operation and removal.
- B. A copy of these records and tests, as well as the corrective action taken, shall be furnished the Government.

1-03 GENERAL

- A. All permanent works under this contract except as otherwise specified shall be carried on in areas free of water. The Contractor shall design, furnish, install, operate and maintain such facilities necessary to accomplish the following:
 - 1. Collect and dispose of all surface water in the protected area regardless of source.
 - 2. Control and dispose of all surface water around the periphery of the excavation areas to prevent such water from entering the excavation.

1-04 DEFINITIONS

- A. Dewatering: Dewatering defines the lowering of the ground water below the slopes and bottom of the excavation to ensure dry, firm working conditions and the reduction to safe

levels of any hydrostatic uplift pressures in any confined foundation strata and/or aquifers which is necessary to ensure the stability and integrity of the foundation.

- B. Dewatering System: Dewatering System defines the machinery, equipment and appurtenances necessary for and related to the accomplishment of dewatering, and the collection and disposal of all surface water within the protected area.
- C. Unwatering: Unwatering is defined as the process of removing all water within an excavation.

1-05 DESIGN

- A. The dewatering system shall be designed using accepted professional methods of engineering design consistent with the best current practice. The Contractor shall perform necessary tests and/or analyses of the water and soil environment at the site to satisfy himself that the materials used in his system will not corrode or otherwise deteriorate to such an extent that the system will not perform satisfactorily during the life of the contract. The dewatering plan shall be submitted to the Contracting Officer for review and approval prior to construction of any facilities for dewatering purposes.

1-06 DEWATERING REQUIREMENTS

- A. The dewatering system for the excavation areas as shown on the plans shall be of a type and capacity to accomplish all requirements specified herein.
 1. The dewatering system shall be designed, installed and operated to dewater the excavation for gravity interceptors, manholes, road bores, metering station and other structures where groundwater is encountered during excavation.
 2. The system shall be of such capacity that it will lower and maintain the free water level at least 18 inches below the bottom of all pipe trenches and at least 5 feet below all earth slopes and excavation surfaces for structures lying within the area, inclusive of the interior slopes of the cofferdam embankments proper, and in accordance with the recommendations contained in the attached Geotechnical Report. The system shall have sufficient capacity to accomplish this desired result allowing for normal variations in soil properties and foundation conditions.
 3. The water level shall be maintained continuously at or below the necessary elevations so that construction operations can be performed without interruption due to wet conditions.
 4. No upward or vertical flow of ground water into the work area will be permitted at any time. The dewatering system shall be designed, constructed and operated at all times so as to prevent movement and/or piping of the foundation, excavation slopes and fill materials. The system shall be operated as necessary during dewatering and unwatering so as to maintain hydrostatic levels, within the dewatered area, at or beneath the elevation of the water level in the excavation.
 5. The system shall consist of wells, pumps, sumps, sump pumps, ditches and necessary appurtenances capable of providing control of surface water. The

required dewatering shall be accomplished by using a system of deep wells to lower the hydrostatic level as required in (3) above to prevent flooding excavated areas and fresh concrete. Protection of all slopes will be required to prevent erosion under normal surface runoff and construction conditions.

6. Initial unwatering of an excavation need not be accomplished by sumping alone, but may utilize sumping in addition to positive dewatering accomplished with a system meeting the requirements of (5) above. Initial unwatering shall at all times fulfill the requirements of (4) above.
7. Burying of headers will be allowed only in areas and to depths absolutely necessary for protection against damage at construction equipment crossing. The effluent from the dewatering system will be required to be discharged into the nearest water body where positive drainage away from the site can be accomplished. The water shall be controlled to prevent erosion or damage to the existing natural ground.
8. The system shall be designed, installed and operated in a manner that will preclude removal of materials from the foundation by the pumping operation (hereafter referred to as "sanding").

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3-01 INITIAL TESTING

- A. Upon installation of the system, the Contractor shall test and evaluate the completed system to demonstrate to the satisfaction of the Contracting Officer that the system is, in fact, capable of performing the intended dewatering operation as outlined herein.

3-02 REVIEW OF SYSTEM DESIGN AND PERFORMANCE

- A. The Contractor shall submit to the Contracting Officer, for review, details of his proposed dewatering facilities, including the type of system, planned layout and sizes of wells, headers, including all lengths requiring burial, collectors, ditches, sumps and pumps; capacities of standby pumping and power supply facilities; number, type, location and proposed method of installation; provisions for disposal of water creekside from the dewatering system; and plan of operation. This submittal shall be submitted no later than 30 days prior to installation of the system. The Contractor's proposed dewatering facilities will be reviewed for general design concept. The Contractor retains full responsibility for design, installation, operation, safety and performance of the system, facilities, and its components. The Contractor shall install sufficient portions of the dewatering system sufficiently ahead of construction excavation to allow satisfactory daily progress and shall not remove portions of the system without the prior written approval of the Contracting Officer. If during the progress of the work, the installed dewatering system proves inadequate to meet the requirements specified, the Contractor shall, at his expense, furnish, install and operate such additional dewatering facilities

and/or make such changes, either in features of the system or the plan of operation, as may be necessary to perform the required dewatering in a satisfactory manner. Such changes and additions shall be approved in writing by the Contracting Officer prior to being made.

3-03 MAINTENANCE AND SERVICING

- A. The Contractor shall be responsible for the maintenance, servicing and repairs of the entire dewatering system and appurtenances during the life of the contract, including replacement of any and all wells and appurtenances found performing unsatisfactorily.

3-04 STANDBY PUMPING EQUIPMENT POWER

- A. The Contractor shall furnish standby pumping equipment power as follows:
1. Diesel or liquid petroleum gas prime movers for pumps shall have 50% standby equipment.
 2. Portable electric generators shall have 100% connected standby equipment.
 3. Commercial electric power, if available, shall have 100% standby electric generating equipment.

3-05 REMOVAL

- A. The dewatering facilities required to maintain a dry condition within the protected area shall be maintained until completion of the work within the protected area, and then shall be completely removed. However, no dewatering facilities of any kind shall be removed without prior approval of the Contracting Officer. All wells, pumps and appurtenances employed in the dewatering system and all materials other than earth shall remain the property of the Contractor, and shall be removed by him from the site of the work. All holes shall be plugged as follows:
1. The riser pipes for all wells and piezometers, of any size, installed at the original ground surface elevation shall be completely removed and filled with bentonite-cement grout. However, the screens of the deep well system may remain upon approval of the Contracting Officer.
 2. The riser pipes for all wells and piezometers, of a diameter of 3 inches or less, installed on a construction bench of five or more feet below the original ground elevation shall be completely removed. However, the screens of the deep well system may remain upon approval of the Contracting Officer. If the area is to be restored to the original ground elevation, these wells and piezometers do not have to be filled with grout.
 3. The riser pipes for all wells and piezometers, of a diameter greater than 3 inches, installed on a construction bench of five or more feet below the original ground elevation shall be completely removed and filled with bentonite-cement grout. However, the screens of the deep well system may remain upon approval of the Contracting Officer.

4. Plugging shall be accomplished by inserting a grout pipe to the full depth of the well or riser pipe and the grout either poured or pumped in as the riser pipe is removed. The grout for plugging the hole shall consist of a mixture of portland cement, bentonite, and water proportioned as directed by the Contracting Officer. The water percentage may be varied for a more effective plugging job. The grouting of abandoned wells and piezometer riser pipes in lieu of removing them will not be permitted unless approved by the Contracting Officer.

PART 4 COMPENSATION

4-01 GENERAL

- A. No additional compensation will be allowed for requirements described in this section of the Specifications. All requirements described herein will be considered to be “absorbed items”.

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SECTION 02225
ROADWAY CROSSINGS FOR UTILITY LINES
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SECTION 02225
ROADWAY CROSSINGS FOR UTILITY LINES

PART 1 GENERAL

1-01 DESCRIPTION

- A. The work includes providing labor, materials, equipment and incidentals to install the pipeline beneath roadway or railroad rights-of-way within steel casing, by boring and jacking as herein specified and shown on Drawings.
- B. Work shall comply with the terms and conditions as set forth by the Government and those having jurisdiction over the affected right-of-way, including approved MDOT and railroad permits.
- C. The work shall include excavation, backfill, construction of cribbing and cofferdams, dewatering, casing material, carrier pipe and all incidental work associated with installation of the crossing.
- D. It must be anticipated that existing piping, cable, telephone lines and utilities shown on Drawings will vary. When encountered during excavation or other work, Contractor shall immediately notify Contracting Officer and applicable utility company. Cost for any required repairs shall be paid by the Contractor.
- E. Installer shall be experienced in this type of work and be approved by the Contracting Officer.
- F. Contractor is solely responsible for contacting the Owners of buried utilities in the vicinity, locating and protecting such utilities.

PART 2 PRODUCTS

2-01 MATERIALS

- A. Casing: Steel casing shall be ASTM A-53, Grade B, plain end steel pipe, butt welded of the size and wall thickness shown in the table below.

OUTSIDE DIAMETER (INCHES)	WALL THICKNESS (INCHES)	
	UNDER HIGHWAY	UNDER RAILROAD
12 AND UNDER	0.188	0.375
16	0.250	0.375
18	0.250	0.375
20	0.250	0.375
24	0.250	0.375
30	0.312	0.469
36	0.375	0.531
48	0.438	0.688
54	0.500	0.781
60	0.562	0.844
72	0.750	1.000

- B. Carrier pipe shall be as specified in Section 02560 of these Specifications and indicated on the Drawings and/or the Bid Form.
- C. Casing end seals shall be 1/8 inch minimum thickness, specially compounded synthetic rubber casing end seals provided by a manufacturer that is regularly engaged in producing casing end seals.
- D. The annular space between the carrier pipe and casing will be filled with cementitious, non-shrink grout. Grout shall not be placed until the carrier pipe has been pressure tested in accordance with Section 02560. Grout shall completely fill the length of the casing pipe. Stainless steel or polyethylene casing spacers shall be utilized to center the carrier pipe within the casing prior to the placement of grout.

PART 3 EXECUTION

3-01 CONSTRUCTION REQUIREMENTS

- A. Restore the work and adjacent areas to original appearance and compaction.
- B. Installation of crossings under highways and railroad rights-of-way shall be performed in accordance with these specifications and requirements of the applicable permit(s) issued for such work.
- C. Contractor shall install the carrier pipe through the casing at no additional charge to the Government.

3-02 BORES

- A. The transmission main shall be installed in steel encasement pipe as shown on the plans and in conformance with profile details. All boring shall be performed in accordance with the approved permits and/or requirements of the Mississippi Department of Transportation, as well as in conformance with all applicable federal, state, city, or other local requirements.
- B. The installation of carrier pipe within encasement pipe shall be carried out in strict

accordance with the pipe manufacturer's recommendations. At no time shall the Contractor be allowed to pull or push the pipe through the encasement pipe without taking proper care and adequate measures to protect the pipe from any structural or coating damage.

C. The carrier pipe shall be installed in the encasement pipe in such a manner so that the pipe shall be electrically isolated from the encasement pipe.

1. Dry Boring

- a. The encasement pipe shall be installed by drilling a hole of a size not larger than 1" greater than the outside radius of the encasement pipe.
- b. Water bearing sands and mucky soils will be well pointed as necessary prior to commencing the bore.
- c. All bores will be accomplished with the auger inside the casing pipe with the cutting edges position just ahead of the pipe.
- d. Care should be exercised at all times to keep the auger properly positioned within the encasement pipe and to maintain sufficient forward pressure upon the encasement pipe to quickly run through any pockets of loose soil.
- e. Borings shall be carefully observed for comparison between the amount of cuttings removed from the hole and the diameter of the bore together with the distance the auger has traveled in the bore. An excessive amount of cuttings removed from the bore indicates caving or spalling of the bore wall and the bore will be stopped until a method for completing the bore has been determined.
- f. An acceptable fluid may be introduced by gravity flow approximately 3 feet back of the forward end of the encasement pipe to lubricate the cuttings in order to facilitate the removal thereof; however, the intemperate use of such fluid causing undue flow back and erosion of the bore shall not be permitted.

2. Wet Boring

- a. The drilling fluid shall be used to lubricate the cutters or reamers, as a binder to bind the cuttings into plugs of appropriate length and to form a filter cake around the circumference of the bore in order to prevent cave-ins or spalling, to maintain the arch and also to lubricate the bore for easy removal of masses or plugs of cuttings from the bore by using compressed air. Liquids other than the drilling fluids described in Alternative 1 and 2 will not be used in the bore. The intemperate use of drilling fluid causing undue flow back and erosion of the bore shall not be permitted.

Alternate 1

The encasement pipe is to be installed by drilling a hole of a size not larger than 1" around the outside circumference of the encasement pipe with an open type bit that leaves the cuttings in place. A gel-forming colloidal drilling fluid consisting of at least 10% by weight of Aqua-gel, or the equivalent of other gel-forming types, when boring in sandy subsoils, fine sands, water bearing sands or any soils

which easily spall or cave and consisting of at least 5% by weight of Aquagel, or the equivalent of other gel-forming types, when boring in dense consolidated soils will be used to consolidate the cuttings and installation of the encasement immediately thereafter. The percentage of gel-forming agent will be increased as required by soil conditions. All information necessary to establish the quality or equivalency of other gel-forming types will be furnished by the Contractor. When boring sandy subsoils, fine sands, water bearing sands or any soil which easily spalls or caves the bore entrance will be plugged or dammed in order to retain the drilling fluid and the cuttings within the bore until immediately before the encasement pipe is installed. Water bearing sands and mucky soils will be well pointed as necessary prior to commencing the bore.

When drilling through dense consolidated soils the cuttings may be partially removed from the hole in approximately three foot plugs by use of compressed air

or by retraction of the cutter or reamer. No cutter or reamer larger than 3" in diameter shall have holes therein larger than 5/16" in diameter through which drilling fluid is forced during boring.

Alternate 2

The encasement pipe is to be installed by drilling a hole of a size not larger than 1" around the outside circumference of the encasement pipe with an open type bit that leaves the cuttings in place. Drilling fluid composed of water and a polymer-surfactant of approximately 61% diesel fuel, 15% sodium carboxyl methyl cellulose of same quality as Drispac, 21.5% water and 2.5% anionic surfactant will be used to consolidate the cuttings and installation of the encasement pipe immediately thereafter.

When boring sandy subsoils, fine sands, water bearing sands or any soil which easily spalls or caves the bore entrance will be plugged or dammed in order to retain the drilling fluid and the cuttings within the bore until immediately before the encasement pipe is installed. Water bearing sands and mucky soils will be well pointed as necessary prior to commencing the bore. When drilling through dense consolidated soils the cuttings may be partially removed from the hole in approximately three foot plugs by use of compressed air.

The polymer-surfactant mixture or drilling fluid when used in dense consolidated soils will consist of not less than 2% of polymer-surfactant by volume and when used in sandy subsoils, fine sands or any soil which easily caves will consist of at least 4% of polymer-surfactant by volume. The percentage of polymer-surfactant will be increased as required by soil conditions. All information necessary to establish the quality or equivalency of any ingredient will be furnished by the Contractor.

PART 4 COMPENSATION

4-01 MEASUREMENT

- A. Measurement shall be along the centerline of the installed casing from end to end in linear feet. Measurement shall not be made of incidental work including sheeting, shoring, excavation, backfill, dewatering, jacking, boring or other work related to installation complete and in place. Measurement shall be made in linear feet for each size specified on the Bid Form.

4-02 PAYMENT

- A. Payment shall be made at the Contract Unit Price per linear foot of the sizes and types specified on the Bid Form, complete, in place and accepted by the Engineer. Such payment shall cover all costs of casing, carrier pipe, spacers, end seals and other items, and installation, labor, materials, equipment, tools and incidentals necessary to complete the work.

**SECTION 02272
GROUTED RIPRAP
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**SECTION 02272
GROUTED RIPRAP**

PART 1 GENERAL

1-01 SCOPE OF WORK

- A. In accordance with the requirements of this Section, the Contractor shall furnish and place stone riprap of the type to the depth designated and in reasonably close conformity with the lines, grades and thicknesses shown on the Drawings.
- B. The work shall include furnishing and placing geotextile fabric under all riprap.

PART 2 PRODUCTS

2-01 STONE AND GROUTED RIPRAP

- A. Aggregate for stone shall be dense, free of clay or shale seams, resistant to the actions of air and water, approximately rectangular in shape, and suitable in all other respects for the purpose intended. Quality requirements for rock to be furnished under these Specifications will be checked or tested by the Contracting Officer prior to use and subsequently if deemed appropriate.
- B. Stone for riprap shall meet the requirements for size by weight of the mass as follows:

Mississippi Department of Transportation Standard Specifications for Road and Bridge Construction, Section 705, 300 Lbs. Rip-Rap.

Weight	Percent (by weight of the mass)
300 lbs to 60 lbs	80%
20 lbs to 59 lbs.	10%
5 lbs to 19 lbs	10%

This gradation sets out minimum requirements for the large stone per size designation. The Contractor shall furnish material well graded with the smaller stones such that a homogeneous blanket of riprap will result with all interstices reasonably well filled with rock.

2-02 GEOTEXTILE FABRIC

- A. The filter cloth material used as a base for rip-rap shall be pervious sheets of strong, rot-proof plastic fabric meeting the following Specifications:

Physical Property	Test Method (latest Revision)	Acceptable Test Results
Tensile Strength, wet, lbs.	ASTM D-1682	200 (min.)
Elongation, wet, %	ASTM D-1682	40 (min.)
Coefficient of Water Permeability, cm/scc	Constant Head	.03 (min.)
Puncture Strength, lbs.	ASTM D-751	100 (min.)
Pore Size - EOS	Corps of Contracting Officers	40 (max.)
U.S. Standard Sieve	CW-02215	

- B. The Contractor shall furnish a certified laboratory test report from an approved testing laboratory with each shipment of materials. Laboratory test reports shall include actual numerical test data obtained on this product.
- C. Pins may be any commercially available pin 6 inches in length capable of retaining a washer.
- D. Washers may be any commercially available washer 2 inches in diameter and compatible with the pin.
- E. The pins and washers shall be manufactured from corrosion resistant metal material.

2-03 GROUT

- A. Grout for riprap shall consist of one part Portland Cement and three (3) parts of sand approved by the Contracting Officer thoroughly mixed with water to product grout having a thick, creamy consistency. Portland Cement shall conform to Section 03300, Paragraph 2.01.1.

2-04 SUBMITTALS

- A. Submit shop drawings and product data, in accordance Section 01330 – Submittal Procedures

PART 3 EXECUTION

3-01 SUBGRADE PREPARATION

- A. Prior to placement of the geotextile fabric or the placement of riprap, the slopes or ground surface shall be shaped to the lines and grades indicated on the Drawings or directed by the

Contracting Officer, and shall be thoroughly compacted by use of mechanical or hand tamps. Unless otherwise stipulated or directed, slopes shall not be steeper than the natural angle of repose of the material upon which riprap is to be placed.

- B. The outer edges and the top of the riprap where the construction terminates shall be formed so that the surface of the riprap will be embedded and even with the surface of the adjacent slope or ground, and the bottom of the riprap shall be placed at least two feet below the natural ground surface unless otherwise directed.

3-02 INSTALLATION OF GEOTEXTILE FABRIC

- A. Filter fabric shall be placed on the prepared and compacted subgrade within the limits shown on the plans for stone rip-rap. The filter fabric shall be laid loosely without wrinkles or creases. When more than one width or length of filter fabric is necessary, the joints shall be overlapped a minimum of 24 inches. Securing pins with washers shall be inserted through both strips of overlapped material and into the materials beneath until the washer bears against the fabric and secures it firmly to the base material. These securing pins shall be inserted through the overlapped fabric at not greater than 2 foot intervals along a line through the midpoint of the overlap. If the fabric is torn or damaged, a patch overlapping the edges of the damaged area by 2 feet shall be sewn securely to the fabric with a continuous, monofilament, rot-proof material.

3-03 PLACING LOOSE RIPRAP

- A. Riprap stone shall be as large as can be conveniently placed in a layer of the required depth. In layers two feet (2') or less in depth. Weight of the stones, with the exception of small stones and spalls used to chink interstices, shall be in accordance with Paragraph 2-01 B. of this Section.
- B. The bed for the riprap shall be shaped and trimmed to provide even surfaces. A footing trench shall be excavated along the toe of the slope.
- C. When the required riprap is less than twenty inches (20") in depth, stone shall be placed by hand. Stone shall be placed to provide a minimum of voids.
- D. The larger stones shall be placed in the toe return, foundation course, and on the outer surface of the riprap.
- E. Stones shall be placed with their longitudinal axis normal to the face of the embankment and so arranged that each rock above the foundation course has at least a three (3) point bearing on the underlying stones. Bearing on smaller stones shall be chinked with small stones and spalls. The finished surface shall be even and tight and shall not vary from the planned surface by more than three inches (3") per foot of depth.
- F. When the required riprap is twenty inches (20") or more in depth, the stones may be placed by dumping and spread in layers by bulldozers or other suitable equipment.
- G. Random riprap shall not be less than eighteen inches (18") in thickness.

3-04 GROUTED RIPRAP

- A. The stones shall be the size as designated in Paragraph 2.01 in this specification and shall be placed in the same manner as specified above for Loose Riprap, care being taken during placing to keep earth or sand from filling the spaces between the stones.
- B. After the stones are in place, the stones shall be thoroughly wet and the spaces between them shall be completely filled with grout from bottom to top. The surface shall be swept with a stiff broom.

3-05 CLEANUP

- A. Upon completion of the Work, the Contractor shall clean the surface of the riprap, remove and dispose of all surplus material and debris, and leave the site in a neat and presentable condition.

PART 4 COMPENSATION**4-01 MEASUREMENT**

- A. Grouted Riprap: Per ton installed to the nearest tenth (1/10).
- B. Grout: Measurement for grout for grouted riprap shall not be made separately but shall be considered an absorbed item for each unit installed of each.
- C. Geotextile: Measurement for Geotextile fabric shall not be made separately, but shall be considered an absorbed item for each unit installed.
- D. Water: Shall not be measured

4-02 PAYMENT

- A. General: Payment for grouted riprap shall be made at the Contract Unit Price per ton complete in place and accepted; which price shall be full compensation for furnishing, hauling and placing all riprap and slope protection materials; for all excavation, subgrade preparation, geotextile fabric in place, and backfilling; for all grouting specified; and for all materials, equipment, tools, labor and incidentals necessary to complete the work in accordance with the Contract Documents.
- B. Grout, water, tamping, and other items incident to completion of the slope protection shall not be measured and no separate payment shall be made for such items.

**SECTION 02480
SEEDING, FERTILIZING, AND MULCHING
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SECTION 02480
SEEDING, FERTILIZING, AND MULCHING

PART 1 GENERAL

1-01 QUALITY ASSURANCES

- A. Conform to the requirements and regulations of the Mississippi Department of Agriculture.

PART 2 PRODUCTS

2-01 MATERIALS

A. Topsoil:

1. Furnish, at expense, sufficient topsoil to properly install all work as specified herein, and as shown on the drawings, if the quantity of stored topsoil is inadequate.
2. Topsoil furnished will be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity, obtained from naturally well-drained areas and not excessively acid or alkaline nor containing toxic substances which may be harmful to plant growth. It will be without admixture of subsoil, cleaned and reasonably free from clay lumps, stones, stumps, roots or similar substances two inches or more in diameter, debris or other objects which might be a hindrance to planting operations.

B. Lime:

1. The Contractor shall determine whether pH adjustment utilizing lime is required to the satisfaction of the Contracting Officer. If required, utilize ground limestone (Dolomite) containing not less than 85 percent of total carbonates and ground to such a fineness that 50 percent will pass through a 100-mesh sieve and 90 percent will pass through a 20-mesh sieve. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve.

C. Commercial Fertilizer:

1. 13-13-13 formula, 13% nitrogen, 13% phosphoric acid, 13% potash, conforming to the applicable state fertilizer laws, uniform in composition, dry and free flowing, and delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

D. Water:

1. Clean, fresh potable water.

E. Grass Seed:

1. The requirements of the Mississippi Department of Agriculture apply. No "below standard" seed will be acceptable.
2. Grass seed furnished under these specifications will be packed in new bags that are sound and not mended.

2-02 SUBMITTALS

- A. Submit shop drawings and product data, in accordance Section 01330 – Submittal Procedures.

PART 3 EXECUTION

3-01 INSTALLATION

- A. Proceed immediately, when other work has progressed sufficiently, to commence work on planting, including placing of topsoil to finished grade. Thereafter, conduct the planting operation under favorable weather conditions during the next season or seasons which are specified herein. Plant only within the period specified herein.

3-02 TIME OF SOWING

- A. The grass seed percentages listed below indicate quantity by weight percent.
 1. Fall:
 - a. Seed mixture for Fall seeding will be 60% Kentucky 31 Fescue, 30% annual rye grass, and 10% white clover, sown during the period of September 15 to December 1 at the rate of 90 pounds per acre.
 2. Spring:
 - a. Seed mixture for Spring seeding will be 70% Kentucky 31 Fescue, 10% annual rye grass, and 20% unhulled Bermuda grass when applied from April 1 to July 1 at a rate of 90 pounds per acre.

3. Summer:
 - a. Seed mixture for summer seeding will be 50% hulled Bermuda and 50% unhulled Bermuda when applied from July 1 to September 15 at a rate of 90 pounds per acre.
4. Do not seed during windy weather, nor when the ground surface is frozen, wet or otherwise non-tillable. No seeding shall occur during December 1 to April 1 without written approval of the Contracting Officer.

3-03 SEEDING

- A. Plant all disturbed areas with little vegetative cover where sodding is not to occur.
- B. Grade and uniformly compact the subsoil so that it will be parallel to the proposed finished grade.
- C. After subgrade soil has been prepared, spread the topsoil evenly thereon and lightly compact. Spread no topsoil in a frozen or muddy condition.
 1. Bring areas to be seeded to finished grade and smooth.
 2. Scarify and smooth areas where the topsoil has not been removed and remove sticks, stones and rubbish.
- D. Soil Improvements:
 1. If required by the Contracting Officer, apply lime at the rate of 2 tons per acre to the areas being prepared for planting.
 2. Apply commercial fertilizer at the rate of 1000 pounds per acre to the areas being prepared for planting.
- E. Planting:
 1. Immediately before any seed is to be sown, scarify the ground as necessary and rake until the surface is smooth, friable and of uniformly fine texture. Seed evenly at the rate designated in Section 3.02, lightly rake, roll with a 200-pound roller, and water with a fine spray. The method of seeding may be varied as required to establish a smooth, uniform turf composed of the grasses specified.
- F. Mulching:
 1. Cover all seeded areas with a 1-inch minimum thickness layer of weed-free straw or other approved mulch, and wet thoroughly.

3-04 MAINTENANCE AND ACCEPTANCE

- A. Maintain the grass seeding, without additional compensation, for not less than 90 days after finishing the sowing, and then until final completion of the Contract. Regrade, reshape, protect, sprinkle, remove obnoxious weeds and perform such other work required to produce a satisfactory condition. Grass coverage will be 90% minimum for acceptance. No eroded areas will be allowed.
- B. Re-seed all grass that does not show satisfactory growth or a uniform stand in accordance with the provisions and requirements set out herein, at no cost to the Government.

PART 4 COMPENSATION

4-01 MEASUREMENT

- A. The percentage of the lump sum amount for this section will be measured in accordance with the quantity submitted for payment by the Contractor and approved by the Contracting Officer. No more than 95% of the total lump sum amount may be requested or paid prior to final acceptance of the project by the Contracting Officer.
- B. When all work under this Contract is completed by the Contractor and accepted by the Contracting Officer, one hundred percent (100%) of the Lump Sum Amount will be allowed.

4-02 PAYMENT

- A. Payment for Seeding, Fertilizing, and Mulching shall be made at the contract lump sum price and in accordance with 4-01, MEASUREMENT. This price shall be full compensation for furnishing all materials, labor, supervision, equipment and incidentals necessary to satisfactorily complete the work.
- B. Payment will be made under:

SEEDING, FERTILIZING, AND MULCHING, Per Lump Sum.

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SANITARY SEWERAGE – GRAVITY PIPING
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SECTION 02560
SANITARY SEWERAGE – GRAVITY PIPING

PART 1 GENERAL

1-01 DESCRIPTION

- A. In accordance with the requirements of these Specifications, the Contractor shall furnish and install materials and perform work necessary for or incidental to constructing sanitary sewer gravity piping complete and ready for use.
- B. The work shall include excavation, trenching and backfilling; furnishing and installing trench sheeting, shoring and bracing; furnishing and installing pipe, specials, services, manholes and related appurtenances; storage and protection of materials; testing, cleanup and other operations necessary to complete the work in accordance with the Specifications and Drawings.
- C. The Contractor shall provide a video inspection of the completed pipeline. The video inspection shall be submitted to the Contracting Officer and approved prior to release of retainage. Inspection, when used in this specification, means visual observation of materials, equipment, or construction work, on an intermittent basis, to determine that the work is in conformance with the contract documents and the design intent. **Such inspection does not constitute acceptance of the work, nor shall it be construed to relieve the Contractor in any way from his responsibility for the means and methods of construction or for SAFETY on the construction site.**

1-02 CONTRACTOR'S EQUIPMENT

- A. The Contractor shall provide and maintain the equipment necessary to prosecute the work in an orderly and safe manner. The equipment shall consist of suitable units designed or selected to perform and expedite the work and incidental items of construction.

1-03 CONFLICTS WITH OTHER UTILITIES

- A. Where the location of the sewer is not clearly defined by dimensions on the Drawings or unless otherwise directed by the Contracting Officer, the sewer shall not be laid closer horizontally than ten feet (10') to a water supply main except that where the bottom of the water pipe will be at least eighteen inches (18") above the top of the sewer pipe, horizontal spacing may be a minimum of six feet (6'). **Water and sewer pipe shall NOT be laid in the same trench.** Where gravity flow sewers cross above water lines, the sewer pipe, for a distance of ten feet (10') each side of the crossing, shall be either ductile iron pressure pipe without any joint closer horizontally than eight feet (8') to the crossing or shall be fully encased in concrete.
- B. Where sewer construction conflicts with underground utilities which are indicated to remain in place, the Contractor shall be fully responsible for protecting these facilities and for restoring the portions of those lines which are damaged or severed as a result of his operations. Where existing lines in conflict are indicated to be removed by others, the

Contractor shall cooperate with the Owner of these utilities to the end that these conflicts may be removed prior to excavation for the sewers.

1-04 APPLICABLE DOCUMENTS

- A. All referenced publications form a part of this Specification and, where referred to by basic designation only, are applicable to the extent indicated. Reference is to the latest edition of each unless specified otherwise.
- B. Local Building Codes: City, County, States or Federal Codes applying to the work.
- C. Miss. Standard Specifications for Road and Bridge Construction, latest edition: Sections as referenced herein.

1-05 SUBMITTALS: The Contractor shall submit testing reports, manufacturer's certifications, shop drawings, manufacturer's catalogs, specification sheets and other incidentals, to the Contracting Officer, prior to ordering material.

PART 2 PRODUCTS

2-01 GENERAL

- A. The Contractor shall furnish materials necessary for or incidental to constructing a gravity sanitary sewer system. Materials shall be new and of first quality with certified tests for pipe and pipe fittings made at the manufacturer's plant to assure conformance with these technical provisions. Three (3) certified copies of each test result shall be furnished to the Contracting Officer prior to installation.
- B. The kinds and classes of materials incorporated into the work shall be designated by the Contracting Officer. The Contractor shall not construe or interpret the several kinds of materials described herein as being equal in their application for the project.

2-02 WATER FOR CONSTRUCTION AND TESTING

- A. The Contractor shall be responsible for water needed in constructing the work, flushing the completed system, testing and other incidental needs. Water used shall be from an approved source relatively free of pollution and shall be of a satisfactory bacteriological quality.
- B. Water used in mixing concrete and mortar shall be fresh, clean and potable, suitable for drinking.

2-03 PIPE AND FITTINGS

A. Acid Resistant Reinforced Concrete Pipe:

1. Pipe: Shall meet the requirements of ASTM C76, Reinforced Concrete Culvert Storm Drain, and Sewer Pipe with wall thickness 'C' and dual o-ring rubber gasket joints. The pipe shall be manufactured in 12 ft. lengths.
2. Design: The design of the pipe shall comply with the requirements of the latest revision of ASTM C76 for non-pressure gravity flow conditions. The pipe shall be designed for the depth of cover as shown on the profile and a live load equal to AASHTO HS20. Minimum wall thickness for all Reinforced Concrete Pipe shall be 7".
3. Materials
 - a. Reinforcement: Shall be in accordance with the requirements of ASTM C76.
 - b. Concrete: Acid Resistant (AR) pipe products meeting the requirements of ASTM C76 for the required pipe strength. The mix design shall be in accordance with the requirements of Dynastone, or equal as approved by the Contracting Officer.
 - c. Cement – Cement shall conform to the requirements of ASTM C 150, Specification for Portland Cement, Type II.
 - d. Admixtures and Blends - Admixtures and blends, other than the activator necessary for the acid resistant concrete pipe products, may be used only with the approval of the Contracting Officer.
 - e. Grouting Material – All material used for grouting and patching shall be Dynastone Patching and Grout Compound or equal as approved by the Contracting Officer
4. Joints: Shall meet the requirements of ASTM C 443 except that dual o-ring grooves shall be cast into the spigot end of each joint and dual o-ring gaskets shall be provided. The joint shall be full R-4 design.
5. Testing: Tests, in-process and final examinations shall be performed by the manufacturer in accordance with the latest revision of ASTM C76. All instruments, gauges and other testing equipment shall be of the proper range, type and accuracy to verify conformance. The Contracting Officer shall have access to all records of tests and inspections related to the manufacture of the pipe.
6. Three Edge Bearing Test: The Three Edge Bearing Test shall be performed in accordance with ASTM C497. Test quantities shall be in accordance with ASTM requirements or as determined by the Contracting Officer. Three-edge-bearing tests shall be observed and verified by an independent testing laboratory. All pipe meeting the three-edge testing requirements shall be stamped with the seal of the verifying lab.
7. Pipe shall be handled, unloaded, and stored in accordance with the recommendations of the pipe manufacturer. All pipe shall be inspected at the time of delivery and damaged pieces rejected and removed from the site of work.

Dropping of pipe from delivery vehicles is not permitted and will cause immediate rejection of the affected materials. Pipe shall be stored to protect the pipe from damage and freezing.

8. Customer Inspection: The Contracting Officer shall be entitled to inspect pipes and witness the manufacturing process.
9. The pipe Manufacturer shall furnish a ten (10) year insurance policy, payable to the DeSoto County Regional Utility Authority (as policyholder), upon completion of the project guaranteeing the material performance of the pipe. The required insurance policy shall have value limits of \$1,000,000 (aggregate). The insurance policy shall provide complete compensation, up to the value limits of the policy, in the event there is a material failure of the pipe during the term of the policy, including, but not limited to, material costs, labor, equipment, and all other costs required to replace the failed pipe(s). The policy shall compensate the policyholder, up to the value limits of the policy, for replacement of the failed section(s) of pipe. Replacement of the failed section(s) of pipe shall be performed by the policyholder utilizing a method or methods of his selection. Material failure of the pipe shall be defined as either the partial or complete collapse of the pipe or loss of up to 1" of wall thickness measured at any point along the pipe.

B. Polymer Concrete Pipe:

1. Materials
 - a. Resin: The manufacturer shall use only polyester or vinyl ester resin systems designed for the service intended. Pipe shall not contain Portland cement or other corrodible elements.
 - b. Filler: All aggregate, sand and quartz powder shall meet the requirements of ASTM C 33, where applicable.
 - c. Additives: Resin additives, such as curing agents, pigments, dyes, fillers and thixotropic agents, when used, shall not be detrimental to the pipe.
 - d. Elastomeric Gaskets: Gaskets shall be EPDM rubber and suitable for the service intended. All gaskets shall meet the requirement of ASTM F 477.
2. Manufacturing and Product Construction
 - a. Pipes: Pipe shall be manufactured by the vibratory vertical casting process resulting in a dense, non-porous, corrosion-resistant, homogeneous, composite structure.
 - b. Joints: Unless otherwise specified, the pipe shall be field connected with glass reinforced plastic sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint water tightness. The joints shall utilize elastomeric sealing gaskets meeting the performance requirements of ASTM 4161.
 - c. Fittings: Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be of the same structural design as adjoining pipe. Fittings shall be manufactured from mitered sections of pipe and joined by epoxy bonding or fiberglass overlay.
 - d. Acceptable manufacturer: Manufacturer of pipe and fittings shall employ manufacturing methods and material formulations used in the manufacture

of polymer concrete direct bury pipe for a minimum of fifteen years. Manufacturer shall be Amitech America, Ltd., Meyer Rohr + Schacht GmbH or equal as approved by the Contracting Officer.

3. Dimensions
 - a. Diameters: The minimum inside diameter of the pipe and joints shall be in accordance with ASTM D 6783. The outside diameter of pipe and joints shall be suitable for use in a gravity sewer application.
 - b. Lengths: Pipe shall be supplied in nominal lengths of 10 feet. Actual lay length shall be nominal ± 1 inch. Special short lengths may be used where surface geography or installation conditions require shorter lengths.
 - c. Wall Thickness: The minimum wall thickness shall be the stated design thickness by the manufacturer for the service indicated and the depths of cut required as indicated on the Drawings. An additional 10% factor of safety (with regard to depth of cut) shall be applied to determine the minimum wall thickness.
 - d. End Squareness: Pipe ends shall be perpendicular to the pipe axis with a tolerance of 0.125 degrees.
4. Testing
 - a. Pipes: Pipe shall be manufactured in accordance with ASTM D 6783.
 - b. Joints: Joints shall meet the requirements of ASTM D 4161.
 - c. Three-edge bearing strength: Pipe shall be designed to meet D-load requirements of external soil and hydrostatic loads. Design strength shall be tested in accordance with the three-edge bearing test method of ASTM D 6783. Test quantities shall be in accordance with ASTM requirements or as determined by the Contracting Officer.
 - d. Compressive strength: Pipe shall have a minimum unconfined compressive strength of 13,000 psi when measured in accordance with ASTM C 579.
5. Customer Inspection: The Contracting Officer shall be entitled to inspect pipes and witness the manufacturing process.
6. Packaging, Handling and Shipping: Packaging, handling and shipping shall be performed in accordance with the Manufacturer's instructions.

C. PVC Large Diameter Heavy Wall Closed Profile Pipe

1. General: The work in this section includes furnishing all labor, equipment, and materials required to supply, install, and test (PVC) closed profile wall pipe, including accessories, as shown on the drawings and/or specified herein. All pipes shall be furnished by a manufacturer with a minimum of five years experience producing closed profile PVC pipe. The pipe manufacturer will also be required to provide a list of not less than 10 successfully completed projects.

2. Quality Assurance:
 - a. The contractor shall submit to the Contracting Officer written evidence that the pipe furnished under this specification is in conformance with the material and mechanical requirements specified herein. All pipes to be installed under this contract shall be inspected at the plant and certified by an independent agency, pre-approved and chosen by the design engineer for compliance with this section. Each PVC closed profile wall pipe length and fitting shall be clearly marked with the following:
 1. Manufacturer's Name
 2. Nominal Pipe Size
 3. Cell Classification
 4. ASTM F 1803 Designation
 5. Uni-Bell Plastic Pipe Association Designation ("UNI-B-9")
 6. Pipe Stiffness - 60 PSI
 - b. All pipe shall be factory air tested with gasket in place and marked accordingly.
3. Handling/Storage
 - a. The pipe shall be handled carefully with nylon slings. The pipe can be unloaded/transported with construction equipment rigged with an "extra long fork" attachment.
 - b. All pipe and accessories shall be stored on flat, level ground with no rocks or other objects under the pipe.
 - c. The maximum stacking height for PVC closed profile wall pipe shall be as directed by the manufacturer.
4. PVC Pipe Materials
 - a. General
 1. Apart from structural voids and hollows associated with profile wall designs, the pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions and other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.
 2. Unless otherwise shown on the drawings or directed by the Engineer or manufacturer, the maximum depth of cover, measured from the pipe crown to the ground surface, permitted for all 21" to 54" sizes will be 30 ft. with standard bedding. The allowable depths are based on the assumption that the ground water level or phreatic surface is at surface grade elevation.
 - b. PVC Large Diameter Heavy Wall Closed Profile Pipe
 1. PVC profile wall pipe and fittings shall be manufactured in accordance with the requirements of ASTM F 1803 latest edition.
 2. PVC profile wall pipe shall be made from a compound meeting the requirements of cell classification 12364A as defined by ASTM D 1784.

c. Joints

1. PVC profile wall pipe joints shall be the bell and spigot type, and shall conform to ASTM D-3212.
 2. Gaskets shall meet the requirements of ASTM F 477 and be molded into a circular form or extruded to the proper section, then spliced into circular form, and shall be made of a properly cured high grade elastomeric compound.
 3. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Field installed gaskets and field cut beveled lengths of pipe shall be done in accordance with the manufacturer's instructions and recommended equipment and materials.
 4. All pipe gaskets and spigots will be thoroughly cleaned and lubricated before assembly.
 5. The use of putty, filler, rubber or plastic inserts to form either the inner or outer wall of the pipe will not be allowed on spigots or bells.
5. Customer Inspection: The Contracting Officer shall be entitled to inspect pipes and witness the manufacturing process.

2-04 MARKING SEWER PIPE

- A. Each pipe or fitting shall have plainly and permanently marked thereon: (1) pipe class; (2) date of manufacture; and (3) manufacturer's name or trademark. Marking shall be neatly stamped in the pipe or painted thereon with waterproof paint.

2-05 CONTRACTOR'S RESPONSIBILITY

- A. The Contractor shall be responsible for the condition of excavations made by him. Slides and cave-ins shall be removed without extra compensation, at whatever time and under whatever circumstances that may occur. **The Contractor is solely responsible for maintaining safe working conditions.**
- B. Installation of sheeting, shoring and bracing shall be the responsibility of the Contractor. Shoring left in place shall not entitle the Contractor to claims for extra compensation unless so indicated on the Bid Form as a separate pay item.

2-06 INCIDENTAL MATERIALS

- A. Gray Iron Castings: Shall conform to the standard specifications for gray iron castings ASTM A-48, Class 25.
- B. Manhole Steps: Steps for manholes shall be cast aluminum alloy meeting (Alloy AA-514) and Federal Specification G4A, or corrosion resistant plastic encased steel.

- C. Foundations: Shall be either precast units or poured in place reinforced concrete as detailed, set on undisturbed earth or select bedding, where required by the Contracting Officer or detailed on the Drawings. Concrete shall be Class "B" 3,000 PSI as specified in Section 03300 "Cast in Place Concrete".
- D. Bituminous Waterproofing: Shall be applied to the exterior of all concrete structures up to the ground line.
- E. Sealed Manhole Lids: Shall be watertight manhole frames with bolted lids, round neoprene gaskets.
- F. Manhole Connections: Manhole connections shall be made using a neoprene boot meeting ASTM Specification C-443. Internal and external band shall be stainless steel meeting ASTM Specification A-167.

2-07 MATERIALS FOR SUPPLEMENTARY WORK

- A. Materials for supplementary work consisting of repairs and replacement of street paving, sidewalks, driveways, parking areas, clay gravel areas, curbs, lawns, grass plots and other related items shall conform to the respective Sections of these Specifications, or as specified on the Drawings.

2-08 BEDDING AND BACKFILL

- A. The pipe shall be installed in accordance with the requirements specified in Part 3, hereafter. Native material excavated from the trench may be used for backfill, where allowed by the Contracting Officer from one foot above the top of pipe to the top of the trench. Such native material shall be non-organic, debris-free soil. Material required for select bedding and backfill is specified in paragraphs B hereafter.
- B. Select Bedding and Backfill: Select bedding and backfill material shall be considered as material hauled in from off site. Material used in meeting this specification shall not be measured or paid for separately but shall be considered an absorbed cost item relative to the cost of pipe installation. Testing costs incurred for tests required to verify that material meets this Specification shall be borne by the Contractor.
 1. Select Bedding: Select granular material for bedding all pipe shall be a mixture of coarse concrete aggregate and coarse river-run sand. The mixture shall consist of two (2) parts coarse concrete aggregate conforming with ASTM Standard Specification C-33 to one (1) part coarse sand. The bedding material shall be thoroughly blended by the Contractor to produce a well-graded uniform mixture prior to placement in the trench. Prior to blending, the coarse concrete aggregate shall conform with the gradation sizing Number 467 specified in Table 2 of ASTM Standard Specification C-33 as follows:

**GRADING REQUIREMENTS FOR COARSE AGGREGATE
(ASTM C-33. TABLE 2, SIZE 467)**

<u>SIEVE SIZE</u>	<u>PERCENT PASSING BY WEIGHT</u>
2 Inch	-- 100
1-1/2 Inch	95/100
3/4 Inch	35/70
3/8 Inch	10/30
Number 4	0/5

The grading limits for fine aggregate shall be as follows:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING BY WEIGHT</u>
3/8 Inch	-- 100
Number 4	95/100
Number 8	80/100
Number 16	50/90
Number 30	30/70
Number 50	3/30
Number 100	0/5

2. Select Backfill: Select material for backfilling pipe trenches shall be select sand-clay material meeting the following gradation limits.

<u>SIEVE SIZE</u>	<u>PERCENTAGE (BY WEIGHT) PASSING SQUARE MESH SIEVES</u>
No. 10	30/100

The material passing the No. 10 sieve shall meet the following:

No. 10	100
No. 40	20/85
No. 60	15/70
No. 200	8/40

The material passing the No. 40 sieve shall meet the following:

Liquid Limit	25 Max.
Plasticity Index (P.I.)	NP to 6 Max.

2-09 DUCTILE IRON FLANGED PIPE AND FITTINGS

- A. Ductile iron pipe shall conform to AWWA C115 and C110 standards. Flanged pipe shall be pressure class 300 as per AWWA C150. All pipe and fittings shall be lined in accordance with Section 02561 contained herein.

- B. Flange joints shall be flat face type meeting ANSI B 16.1 Class 250 requirements. Flange gaskets shall be full face type per AWWA C111 to provide positive sealing for the flange joints. Thickness shall be 1/8 inch unless otherwise indicated. Assembly bolts shall be square headed carbon steel machine bolts with hexagon nuts per ANSI B 18.2. Thread shall conform to ANSI B 1.1. Bolt length shall be such that after joints are assembled, the bolts shall protrude through the nuts, but not more than 1/2 inch.

PART 3 EXECUTION

3-01 SITE PREPARATION

- A. The Contractor shall prepare, on a timely basis, rights-of-way, easements and sites indicated on the Drawings for construction of the wastewater improvements. The work shall include clearing and grubbing, removal of structures and obstructions, and the removal of permanent surfaces and landscaping items designated to be restored upon completion of the installation.
- B. Clearing and grubbing shall conform to the requirements specified elsewhere herein and shall include the removal of trees, roots, vegetation, structures and obstructions unless separate pay items are specifically provided for on the Bid Form. The completion of clearing and grubbing shall leave the site clear and free from undesirable obstructions, ready for trench excavation.

3-02 GENERAL

- A. Install gravity sanitary sewer mains where shown on Drawings, in compliance with manufacturer's instructions.

3-03 COVER

- A. Maintain forty-two inches (42") minimum bury along piping unless otherwise shown on Drawings or directed by the Contracting Officer.

3-04 EXCAVATION AND TRENCHING

- A. Excavation of every description and of whatever substances encountered shall be performed to the depths indicated on the Drawings or as otherwise specified. Excavation shall be done by open cut from the surface except when tunneling or boring is specified or directed in writing by the Contracting Officer. Trench width shall be kept as narrow as practical to provide a safe working area and to minimize excavation, and shall be maintained in strict compliance with OSHA regulations.
- B. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated materials not required or not suitable for backfill shall be removed and wasted as directed by the Contracting Officer. Grading shall be done, as necessary, to prevent surface water from flowing into trenches or other excavations. Water accumulating therein shall be removed by pumping or by other approved methods. Temporary sheeting

and shoring shall be used where necessary for the protection of the work and for the **safety of the personnel.**

- C. During excavation, materials meeting select bedding and/or backfill requirements shall be either separately or selectively stockpiled for use as pipe bedding and pipe backfill material. Sand material shall be handled and stockpiled in such a manner to prevent mixing with clay material when rehandled for backfilling.
- D. Excavation for manholes shall be sufficient to permit the carrying out of the construction as required.
- E. Trenches for process piping and other appurtenances shall be of only such width as necessary for proper laying of the pipe. The net width of the trench at and below the top of the pipe shall be at least the pipe O.D. plus twelve inches but not more than the pipe O.D. plus twenty four inches. The width of the trench above this level may be as wide as necessary for sheeting, bracing, shoring or **for proper safe performance of the work.**
- F. The sides of the trench shall be maintained in strict compliance with OSHA regulations.
- G. The bottom of the trench shall be carefully graded, formed and aligned according to these Specifications and reviewed by the Contracting Officer's observer before piping is laid thereon. The bottom of the trench shall be hollowed under each pipe joint to conform to the shape of the pipe, and holes shall be cut for the bells, allowing the body of the pipe a uniform contact and support throughout its entire length.
- H. The Contractor shall leave a minimum 2 foot berm width on each side of the trench between the trench and the excavated earth, to allow the free passage of workmen, the Contracting Officer's representative, and to permit work in a safe, expeditious and satisfactory manner.
- I. No more than three hundred (300) feet of trench shall be opened in advance of the completed sewer, nor shall more than one hundred (100) feet be left unfilled except by permission from the Contracting Officer. In special cases, the Contracting Officer, when so requested by the Contractor, may waive the distance restriction to which the trench may be opened by notifying the Contractor in writing.

3-05 TUNNELING OR BORING

- A. Tunneling will be permitted only where indicated on the Drawings or by special permission of the Contracting Officer.

3-06 SHEETING, SHORING AND BRACING

- A. Sheeting, shoring, and bracing shall be furnished, placed and maintained by the Contractor as may be required to support the sides of the excavation. The Contractor shall be fully responsible for the sufficiency of such supports to prevent movement which can injure or delay the work or endanger or cause damage to adjacent pavements, buildings or other structures, channels and drainage structures, **or create undue hazards to workmen.** Where in the opinion of the Contracting Officer, damage is likely to result from withdrawing sheeting, the sheeting shall be left in place. **The material and installation requirements**

for sheeting, shoring and bracing shall be in accordance with applicable sections of the Mississippi Standard Specifications for Road and Bridge Construction, latest edition.

- B. Sheeting, shoring and bracing which are not ordered by the Contracting Officer to be left in place shall be removed in such manner as not to endanger the constructed sewer or other structures, utilities or property. Voids left or caused by the withdrawal of sheeting shall be immediately refilled with sand by tamping with tools specifically adapted to the purpose, by watering, or otherwise as may be directed.

3-07 EXCAVATED MATERIAL

- A. Excavated material from trench and structure excavation suitable for backfill shall be placed compactly on the sides of the excavation and kept up so as not to endanger the work and be of as little inconvenience as possible to the public travel and abutting property, and so that free access is maintained to fire hydrants and water valves in the vicinity of the work. Material encountered in the excavation which, in the opinion of the Contracting Officer, is not suitable for use in the work, shall be removed and wasted as directed and shall not be stockpiled along the side of the excavation.
- B. The disposal of surplus and unsuitable excavation shall be the responsibility of the Contractor at his own expense. Surplus and unsuitable material not to be used in the construction of the project shall not be left on the right-of-way or easement of the project, nor adjacent thereto, except by written permission of the affected property owner.

3-08 DEWATERING

- A. The Contractor shall be solely responsible for implementation of adequate dewatering provisions, as described hereafter and in Section 02220 of these Specifications. A copy of the Geotechnical Investigation report associated with this project is included as the last section of these specifications.
- B. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of surface and ground water entering excavations, trenches or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed therein is complete to the extent that no damage from hydrostatic pressure, flotation or other cause will result. The normal water table shall be restored to its natural level in such a manner as not to disturb the pipe and its foundation.
- C. Excavations for trenches which extend down to or below static ground water shall be dewatered by lowering and keeping the ground water level beneath such excavations eighteen inches (18") or more below the bottom of the excavation; except where the pipe is laid in an impervious strata, the lower trench section shall be maintained in a dry condition for bedding. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench.
- D. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

- E. The Contractor will be held responsible for the carrying capacity of pipe or conduit which he may use for drainage purposes. Pipes or conduits shall be kept clean and free of sediment or other restrictions.
- F. **No separate payment will be made for this item.**
- G. Additional information is contained within the Geotechnical Investigation – Upper Camp Creek Interceptor prepared by Burns Cooley Dennis, Inc. dated May 19, 2003 for the Contractor's reference in accordance with Section 00800.1.6.d of these Specifications.

3-09 STEEL SHEET PILING

- A. Unless required by the drawings, steel sheet piling shall be driven at locations to be determined by the Contractor as necessary for protection of buildings, structures, utilities, channels or to prevent hazards to workmen. Piling may be new or used and shall be in such condition that it can be interlocked and driven satisfactorily.
- B. The Contractor shall be responsible for adequately bracing the units against lateral forces. Piling shall be driven before final adjacent excavations are made.
- C. Pile driving equipment used shall be maintained in first class condition and shall operate efficiently in the space provided. Equipment shall be subject to the review of the Contracting Officer.
- D. **The material and installation requirements for sheet piling shall be in accordance with applicable sections of the Mississippi Standard Specifications for Road and Bridge Construction, latest edition.**
- E. **No separate payment will be made for this item unless so indicated on the Bid Form as a separate pay item.**

3-10 PIPE PLACEMENT

- A. General: Unless otherwise noted on the Drawings or directed by the Contracting Officer, the bed for the pipe shall be so shaped that at least the lower quarter of the pipe shall be in continuous contact with the bottom of the trench.
 - 1. When bell and spigot pipes or pipe couplings are used, spaces shall be cut to accommodate the bells or couplings. These spaces shall be deep enough to ensure that the bells or couplings do not bear the load of the pipes. When the pipes are laid, the barrel of each section of pipe shall be in contact with the quadrant shaped bedding throughout its full length, exclusive of the bell or coupling, to support the entire load of the pipe. Adjustments to line and grade shall be made by scraping away or filling in and compacting the earth under the body of the pipe and not by wedging or blocking up the pipe. Pipe shall not be laid on frozen ground.
 - 2. Before pipe is laid in the trench, the section in which pipe is to be placed must be dry and must be kept dry while joints are completed. Pipes, prior to being lowered into the trench, shall be thoroughly inspected by the Contractor's forces so that when

jointed in the trench, there shall not be shoulders or unevenness along the lower half of the pipe. The faces of spigot ends and shoulders in the hubs or sockets shall be true. Abnormal enlargements on these faces shall be cut away before the pipe is lowered into the trench.

3. The pipe shall be laid upstream, without breaks and with the bell end upgrade. Whenever the work ceases for any reason, the unfinished end of the pipe line shall be securely closed with a tight-fitted plug or cover. Pipe shall be so placed and maintained, that at the time of final acceptance of the project, the completed lines will be true to the established alignment and flow line grades.
 4. Construction shall begin at the lowest point, or elevation, and the pipe shall be laid continuously upstream without omitting sections or reaches.
- B. The installation and joining of pipe shall be in strict accordance with the applicable ASTM or AWWA Standards and the pipe manufacturer's recommendations.
- C. The trench subgrade shall consist of firm, stable, non-organic, debris-free soil. In locations where trench excavation exposes unsuitable material, as classified by these specifications, or in the judgement of the Contracting Officer, the subgrade shall be undercut as directed by Contracting Officer for the full design width of the trench and backfilled with select bedding material meeting the requirements of Part 2-08, herein, and installed in accordance with the requirements of Part 3-12 hereafter. Such undercutting and select bedding material will be compensated in accordance with the requirement of Part 4, hereafter. **Select bedding material in the pipe envelope will not be considered for payment.**

3-11 PIPE BEDDING

- A. The pipe shall be placed on compacted select bedding material shaped and placed on the trench bottom. The bedding material shall meet the requirements of Part 2-08 herein and be compacted to at least 90% Standard Proctor.

3-12 ALIGNMENT

- A. The Contractor shall utilize a commercial grade laser beam specifically manufactured to aid in maintaining grade and alignment of pipelines during installation. The primary unit shall be mounted on a heavy duty base and firmly anchored in the downstream manhole of the reach under construction. The maximum distance shall not exceed four hundred feet (400') per set up unless otherwise approved by the Contracting Officer.
- B. Each joint of pipe will be installed using an approved target to align the pipe with the projected laser beam. The methods and procedures shall be in strict accord with the manufacturer's recommendations and instructions. Proper ventilation shall be maintained at all times. Care shall be exercised in order to prevent bumping or misalignment of the projected beam.

3-13 MANHOLE CONSTRUCTION

- A. Polymer Concrete Manholes

1. **Materials**
 - a. **Resin:** The manufacturer shall use only polyester resin systems designed for use with this particular application.
 - b. **Filler:** All aggregate, sand and quartz powder shall meet the requirements of ASTM C 33, where applicable.
 - c. **Additives:** Resin additives, such as curing agents, pigments, dyes, fillers and thixotropic agents, when used, shall not be detrimental to the manhole.
 - d. **Elastomeric Gaskets:** Gaskets shall be suitable for the service intended. All gaskets shall meet the requirement of ASTM F 477.

2. **Manufacturing and Product Construction**
 - a. **Manholes:** Manhole components shall be manufactured by the vibratory vertical casting process resulting in a dense, non-porous, corrosion-resistant, homogeneous, composite structure.
 - b. **Joints:** The manhole components shall be connected with a compatible epoxy bonding agent or an elastomeric sealing gasket as the sole means to maintain joint water-tightness. Joints at pipe tie-ins may use flexible elastomeric couplings, fiberglass overlay or a compatible epoxy material for bonding manhole components directly to the adjoining pipe. Epoxy bonding shall require a flexible pipe joint within one pipe diameter from the manhole's external wall. Epoxy bonding material shall be approved by the manhole manufacturer.
 - c. **Fittings:** Cones, reducer slabs, base slabs and adjusting rings shall be of the same material as adjoining riser sections. Fittings shall be manufactured elastomeric gaskets, epoxy bonding or fiberglass overlay.
 - d. **Acceptable manufacturer:** Manufacturer of pipe and fittings shall employ manufacturing methods and material formulations in use for a minimum of ten years. Manufacturer shall be Amitech America, Ltd., Meyer Rohr + Schacht GmbH or equal as approved by the Contracting Officer.

3. **Design:** Manholes shall be designed to withstand all live loads and dead loads as described in project plans and specifications. Dead loads shall include overburden load, soil side pressure and hydrostatic loading conditions. Manholes shall also be designed to resist buoyancy for the project conditions.

4. **Testing**
 - a. **Joints:** Joints shall meet the requirements of ASTM D 4161
 - b. **Compressive strength:** Pipe shall have a minimum unconfined compressive strength of 13,000 psi when measured in accordance with ASTM C 579
 - c. **Manhole Leakage:** Manhole shall be tested in accordance with ASTM C 1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

5. **Customer Inspection:** The Contracting Officer shall be entitled to inspect manholes and witness the manufacturing process.

6. Packaging, Handling and Shipping: Packaging, handling and shipping shall be performed in accordance with the Manufacturer's instructions.
7. Installation: The installation of manholes shall be in accordance with the project plans and specifications and the manufacturer's recommended practices.
 - a. Handling: All materials shall be handled in accordance with the recommendations of the manufacturer. All materials shall be visually inspected prior to installation to ensure no damage is evident.
 - b. Jointing:
 1. Sealing surfaces and joint components shall be inspected for damage and cleaned of all debris.
 2. Apply joint lubricant to elastomeric seals. Use only lubricants approved by the manufacturer.
 3. Use suitable equipment to handle and set manholes in accordance with the manufacturer's recommendations.
 - c. Placement and compaction of surrounding backfill material shall be applied so as to provide sufficient and equal side pressure on the manhole.

B. Acid Resistant Reinforced Concrete Manholes

1. Manholes: Shall meet the requirements of ASTM C 478, Precast Reinforced Concrete Manhole Sections and joints using preformed flexible joint sealant meeting the requirements of ASTM C 990.
2. Design: The design of the manhole sections shall comply with the requirements of the latest revision of ASTM C478. Where pipe to manhole "Tee" sections are allowed by the project plans, the manufacturer must submit, for the Contracting Officer's approval, a design detail indicating the proposed section dimensions and reinforcing details.
3. Materials
 - a. Reinforcement: Shall be in accordance with the requirements of ASTM C478.
 - b. Concrete: Acid Resistant (AR) Products meeting the requirements of ASTM C478 for the required pipe strength. The mix design shall be in accordance with the requirements of Dynastone, or equal as approved by the Contracting Officer.
 1. Cement – Cement shall conform to the requirements of ASTM C 150, Specification for Portland Cement, Type II.
 2. Admixtures and Blends - Admixtures and blends, other than the activator necessary for the acid resistant concrete pipe products, may be used only with the approval of the Contracting Officer.
 3. Grouting Material – All material used for grouting and patching shall be Dynastone Patching and Grout Compound or equal as approved by the Contracting Officer.
4. Joints: Shall meet the requirements of ASTM C 990 using preformed flexible joint sealants.
5. Jointing:

- a. All joints shall be assembled in accordance with the manufacturer's recommendations and the project plans and specifications. Any conflicts are to be brought to the attention of the Contracting Officer prior to the continuance of work.
 - b. Clean and dry all surfaces of the inside of the bell and outside of the spigot immediately prior to applying the joint sealant.
 - c. Install 2 layers of preformed flexible joint sealant in accordance with the manhole manufacturer's recommendations.
 - d. Center spigot in bell and lower the manhole section into proper final position. Care must be taken to protect the joint ends during the jointing process.
 - e. Testing: Tests, in-process and final examinations shall be performed by the manufacturer in accordance with the latest revision of ASTM C478. All instruments, gauges and other testing equipment shall be of the proper range, type and accuracy to verify conformance. The Contracting Officer shall have access to all records of tests and inspections related to the manufacture of the pipe.
 - f. Prior to backfilling, each manhole shall be tested in accordance with ASTM C1244 – Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
6. Customer Inspection: The Contracting Officer shall be entitled to inspect pipes and witness the manufacturing process.

3-14 PIPE CONNECTIONS TO MANHOLES

- A. General: When the Plans indicate connections to existing manholes, these connections shall be watertight and all work performed in an acceptable manner.
- B. The size of the opening cut in the manhole wall shall be restricted to a nominal diameter sufficient only to insert the sewer pipe. **The pipe shall be inserted into the manhole with a sealed watertight flexible rubber-boot type of connection to prevent water or waste leakage.** Straps and connectors shall be stainless steel.

3-15 BACKFILLING: Backfill shall consist of the material placed as indicated on the detail shown in the construction drawings. As pipe is laid and suitably bedded in accordance with these Specifications, trenches and excavation shall be promptly backfilled to a level 18" above the top of the pipe in relatively thin lifts with select backfill material defined in Part 2-08 and compacted to a minimum 90% standard Proctor maximum dry density (ASTM D 698). Backfill shall be placed and tamped equally and thoroughly along each side of the pipe in a manner to avoid displacement of or damage to the pipe.

- A. Tamping: The backfill shall be placed in equal thickness lifts, each lift being thoroughly compacted to the density specified. Each lift of the backfill material shall have proper moisture content to permit compaction to this density.
 1. In areas where street paving, sidewalks, driveways and other restoration work is required, the backfill above the eighteen inch (18") cover level shall be compacted to the subgrade level or as directed and maintained to eliminate voids and future

settlement. Special compaction procedures involving 95% density on 6" lifts are required at such locations and at other locations shown on the Drawings.

2. In open fields or undeveloped areas, the backfill above the eighteen inch (18") cover level may be placed in twelve inch (12") layers and compacted to a density of not less than that of the surrounding earth. The top of the filled trench shall be mounded slightly above the natural ground to allow for settlement.
3. Landscape and cultivatable areas shall be restored by the replacement of the stockpiled topsoil stripping to a depth of at least twelve inches (12").

B. Jetting: This method of backfill shall not be used.

3-16 MAINTENANCE OF SITE

- A. The Contractor shall prevent, control and correct dust nuisance or muddy conditions developing on roadways as a result of his operation. No payment for maintenance of the site shall be made but shall be considered as a subsidiary obligation of the Contractor.

3-17 PIPELINE TESTING

- A. General: Before any backfill is placed, the piping shall be checked by the Contracting Officer for line, grade and workmanship. Before acceptance, each section of the line between manholes, structures, valves or such other length as determined by the Contracting Officer to be suitable, shall be thoroughly inspected and any defects in workmanship identified shall be immediately corrected.
- B. Location: Each individual joint of the installed sewer line shall be tested. Joint Testing: Prior to backfilling, each joint shall be tested from the inside of the pipe using a Cheme "Air-Loc Joint Tester" or equal. Testing procedures shall be as described in ASTM C 1103, Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
- C. The Contractor shall submit for approval by the Contracting Officer a large diameter pipe "joint tester" mechanism. Such mechanism shall be of standard manufacture and designed specifically to test large diameter pipe in accordance with ASTM C1103, latest revision.
- D. Test procedure and methods shall be in accordance with ASTM C1103, latest revision.
- E. The Contractor shall be responsible for all materials, methods, and safety during all testing.
- F. Test results must be submitted to the Contracting Officer for approval prior to request for payment for the affected length(s) of pipe material. All test results must be submitted to the Contracting Officer for approval prior to a final request for payment.

3-18 FLUSHING

- A. The completed gravity flow system shall be free of mud, siltation and other foreign matter deposited or collected during construction. Flushing shall commence at the upstream end of the completed system and continue downstream manhole to manhole. Only water from an approved source will be permitted.

- B. Water used in flushing will not be permitted to enter into the existing system but shall be disposed of in a manner acceptable to the Contracting Officer.
- C. Individual joints shall be free of any dirt, mud, or debris sufficient in quantity to obstruct or affect the testing.
- D. Flushing will not be required in those sectors of the installed pipes and manholes where the exfiltration test has adequately cleaned the mains.

3-19 CLEAN-UP

- A. After the backfill is completed, the Contractor shall dispose of surplus material, dirt and rubbish from the site. Surplus dirt shall be disposed of in Contractor furnished and approved disposal areas or in on site areas as directed by the Contracting Officer.
- B. After work is completed, the Contractor shall remove tools and other equipment used by him, leaving the entire site free, clear and in clean condition.

PART 4 COMPENSATION

4-01 GENERAL

- A. The compensation as herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, testing, equipment and incidental items of construction furnished by the Contractor.
- B. No measurement will be made of subsidiary items of work and accessories, excavation, trenching, backfill and disposal of surplus excavation and other incidentals included in the related Pay Items or called for in the Contract.

4-02 MEASUREMENT

- A. Sanitary Sewage gravity piping will be measured in linear feet along the centerline of the pipe from center-to-center of manholes and from center of manhole to center of junction with existing main or plugged end. The total length of pipe thus measured will be

separated into the various kinds and sizes to establish the quantities of each Pay Item.

1. No deduction in length of main will be made for diameter of manholes or for space occupied by other specials installed in the interceptor.
 2. Gravity mains installed in cased or tunnelled openings will be compensated for as a part of other section of these Specifications.
- B. Manholes will be measured as the number of completed and accepted units, by diameter, in-place, per vertical linear foot of depth installed and accepted by the Contracting Officer. Depth of installation shall be determined from the finished grade of the top of the completed unit to the invert of the outlet pipe.
1. Should the Contractor construct any manhole with the casting finish grade higher than the indicated finish grade on the Drawings, the Contractor shall not be entitled to additional compensation for change in the increment depth unless the change was previously authorized or directed by the Contracting Officer.
- C. Water tight manhole rims and covers will be measured as the number of units, by type and size indicated on the Bid Form, installed and accepted by the Contracting Officer.

4-03 PAYMENT

- A. Sanitary Sewage Gravity Piping: Payment will be made at the respective Contract Unit Prices bid per linear foot for the various types and sizes of sewer mains, complete in place, and shall include all trench excavation, pipe bedding backfill with select material, backfilling over pipe, for all sheeting, shoring and bracing, for all steel sheet piling, for all dewatering and for testing and flushing the completed system.
- B. Manholes: Manholes will be paid for at the Contract Unit Price per unit per vertical linear foot for the type installed, complete in place and accepted. This price shall include all excavation and backfilling necessary for the satisfactory completion of the work.
- C. Water Tight Manhole Rims and Covers: Manhole castings will be paid for at the Contract Unit Price per unit, per size, per type installed, complete in place, and accepted. This price shall include all appurtenances, grouting, and other materials and work necessary for the satisfactory completion of the work.

**SECTION 02830
CHAIN LINK FENCING AND GATES
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PART 1 GENERAL

1-01 SCOPE OF WORK: The work covered by this Section shall consist of furnishing all plant, labor, equipment, material, and performing all operations in connection with the repair of any fencing, gate assemblies and appurtenances damaged or removed as required to perform this contract. There will be no separate payment for this work. All cost will be included in the Lump Sum Bid Item "Ross Road WWTF Metering Station, Flow Diversion and Accessories".

1-02 DEFINITIONS:

- A. Type I: Type I Fencing is defined as chain link fencing with a barbed wire arm affixed to the top of each post and fitted with three (3) strands of barbed wire.
- B. Fence Height: The height specified on the Drawings or in the Contract Documents shall mean the height of the chain link fabric. If Type I fencing is specified, then the height of the barbed wire supporting arm and strands shall be in addition to the specified height of the fence.

1-03 QUALITY ASSURANCE

- A. Erector Qualifications: Erector must be a firm experienced in the erection of fencing of the type specified and approved by the manufacturer.
- B. Design Criteria: Comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and Federal Specification RR-F-191/1A, unless otherwise shown or specified.
- C. Source Quality Control: Provide each type of fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ASTM A 120, Specification for Blank and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe of Ordinary Uses.
 - 2. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 3. ASTM C 94, Ready-Mixed Concrete.
 - 4. ASTM F 552, Standard Definitions of Terms Relating to Chain Link Fencing.
 - 5. Chain Link Fence Manufacturers Institute, Galvanized Steel Chain-Link Fence Fabric.
 - 6. Chain Link Fence Manufacturers Institute, Standard Guide for Polyvinyl Chloride (PVC)-Coated Steel Chain Link Fence Fabric.
 - 7. Federal Specification, RR-F-191/1A, Fencing, Wire and Post, Metal (Chain-Link Fence Fabric).

1-04 SUBMITTALS

- A. Samples: When requested, submit for approval, samples approximately 6 inches long, or 6 inch square of fabric material, framework members, and typical accessories. CONTRACTING OFFICER'S review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings:
1. Submit for approval Shop Drawings for fences and gates, including plan layout and details illustrating fence height, location and sizes of posts, rails, braces, gates, and footings, hardware list and erection procedures.
 2. Submit for approval copies of manufacturer's technical data test reports on physical properties, and installation instructions for steel fences and gates.

1-05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver material in manufacturer's original packaging with all tags and labels intact and legible.
- B. Handling of Materials: Handle and store material in such manner as to avoid damage.

PART 2 PRODUCTS

2-01 GENERAL

- A. Pipe sizes specified are commercial pipe sizes.
- B. Tube sizes specified are nominal outside dimension.
- C. Roll-formed section sizes are the nominal outside dimensions.
- D. Finish for Framework and Appurtenances: Furnish the following finishes for steel framework and appurtenances:
1. Galvanized finish with minimum weights of zinc as follows:
 - (a) Pipe: ASTM A 120, Schedule 40, 1.8 ounce zinc per square foot.
 - (b) Hardware and Accessories: ASTM A 153 zinc weight per Table I, Federal Specification RR-F-191/1A.

2-02 FABRIC

- A. Furnish chain link fabric as follows:
1. One-piece fabric widths constructed of No. 9 gage wires.
 2. 2-inch mesh.
 3. Top and bottom selvages twisted and barbed.
 4. Galvanized finish with not less than .30 ounces zinc per square foot complying with ASTM A 392.

5. Fabric Height: As shown on Drawings.

2-03 POSTS, RAILS AND BRACES

- A. End, Corner, and Pull Posts: Furnish end, corner, and pull posts of the minimum sizes and weights as follows;
1. 6 feet fabric height: 2.875 inches O.D. pipe weighing 4.64 or greater pounds per linear foot.
- B. Line Posts: Furnish line posts of the minimum sizes and weights as follows: Space posts 10 feet on centers maximum.
1. 6 feet fabric height: 2.375 inches O.D. pipe weighing 3.12 or greater pounds per linear foot.
- C. Gate Posts: Furnish gate posts for supporting each leaf of the double gate installation as follows: for gates twelve (12) to eighteen (18) feet in width, use 6.625 inch O.D. pipe weighing 18.02 or greater pounds per linear foot. For gates six (6) feet in width, use 2.875 inch O.D. pipe weighing 4.64 or greater pounds per linear foot.
- D. Top Rail: Furnish top rails of the following:
1. 1.660 inch O.D. pipe weighing 1.83 pounds per linear foot.
 2. Furnish in manufacturer's longest lengths, but not less than 18 feet, with expansion type couplings, approximately 6 inches long, for each joint. Provide means for attaching the top rail securely to each gate, corner, pull, and end post. Ties or clips shall be provided in sufficient number for attaching the fabric securely to the top rail at intervals not exceeding 24 inches.
- E. Tension Wire: Furnish tension wire consisting of galvanized 7 gage coiled spring wire. Locate at bottom of fabric only.
- F. Barbed Wire Supporting Arms: Furnish pressed steel, wrought iron, or malleable iron barbed wire supporting arms, complete with provisions for anchorage to posts attaching 3 rows of barbed wire to each arm. Supporting arms shall be integral with post top weather cap. Provide single 45 degree arm, one for each post where shown.
- G. Barbed Wire: 3 strand, 11 gage wire with 14 gage, 4-point aluminum alloy barbs spaced 5 inches on center galvanized per manufacturer's standards.
- H. Post Tops: Pressed steel, wrought iron, or malleable iron, designed as a weathertight closure cap, for tubular posts. Furnish one cap for each post unless equal protection is afforded by combination post top cap and barbed wire supporting arm, where barbed wire is required. Furnish caps with openings to permit through passage of the top rail.
- I. Stretcher Bars: One piece lengths equal to full height of fabric, with a minimum cross-section of $\frac{3}{16}$ inch by $\frac{3}{4}$ inch. Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into the post.

- J. Stretcher Bar Bands: Steel, wrought iron or malleable iron, spaced not over 15 inches on center to secure stretcher bars to end, corner, pull, and gate posts. Bands may also be used with special fittings for securing rails to end, corner, pull and gate posts.

2-04 GATES

- A. Fabricate gate perimeter frames of tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Space so that frame members are not more than 8 feet apart. Fabricate as follows:
1. 1.90 inch O.D pipe weighing 2.25 pounds per linear foot.
- B. Assemble gate frames by butt welding for rigid connections. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at not more than 15 inches on center. Attach hardware with rivets or by other means which will provide security against removal or breakage.
- C. Install diagonal cross-bracing consisting of 3/8 inch diameter adjustable length truss rods on gates where necessary to ensure frame rigidity without sag or twist.
1. Where barbed wire is shown above gates, extend the end members of gate frames 1 foot-0 inch above the top member and prepare to receive 3 strands of wire. Provide necessary clips for securing wire to extensions.
- D. Gate Hardware: Furnish the following hardware and accessories for each gate.
1. Hinges: Pressed or forged steel or malleable iron to suit gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1½ pair of hinges of reach leaf over 6 feet nominal height.
 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
 3. Keeper: Provide keeper of all vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
 4. Double Gates: Provide gate stops for double gates, consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Include locking device and padlock eyes as an integral part of the latch, using one padlock for locking both gate leaves.

2-05 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Wire Ties: For tying fabric to line posts, use 9-gage wire ties spaced 12 inches on center. For tying fabric to rails and braces, use 9 gage wire ties spaced 24 inches on center. For tying fabric to tension wire, use 11 gage hog rings spaced 24 inches on center. Finish of ties to match fabric finish.

1. Manufacturer's standard procedure will be accepted if of equal strength and durability.
- B. Concrete: Refer to ASTM C 94, Ready-Mixed Concrete.

PART 3 EXECUTION

3-01 INSPECTION

- A. CONTRACTOR and his installer must examine the conditions under which the fence and gates are to be installed and notify the CONTRACTING OFFICER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the CONTRACTING OFFICER.

3-02 PREPARATION

- A. Do not begin fence installation and erection before the final grading is completed, with finish elevations established.

3-03 INSTALLATION

- A. Excavation: Drill holes of diameters and spacings shown, for post footings in firm, undisturbed or compacted soil.
1. If not shown on the Drawings, excavate holes to the minimum diameters as recommended by fence manufacturer.
 2. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than the post bottom with bottom of posts set not less than 36 inches below the surface when in firm, undisturbed soil.
 - a. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site, as directed.
- B. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
1. Center and align posts in holes 3 inches above bottom of excavation.
 2. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 3. Trowel finish tops of footings, and slope or dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.

- C. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 days after placement, before rails, tension wires, barbed wire, or fabric is installed. Do not stretch and tension fabric and wires, and do not hang gates until the concrete has attained its full design strength.
- D. Top Rails: Run rail continuously through post caps or extension arms. Provide expansion couplings as recommended by fencing manufacturer.
- E. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install tension wires at bottom of fencing by weaving through the fabric and tying each post with not less than 6-gage galvanized wire, or by securing the wire to the fabric.
- G. Fabric: Leave approximately 2 inches between finish grade and bottom selvage, except where bottom of fabric extends into concrete. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
- H. Stretcher Bars: Thread through or clamp to fabric 4 inches on center, and secure to posts with metal bands spaced 15 inches on center.
- I. Barbed Wire: Install 3 parallel wires on each extension arm; on security side of fence, unless otherwise indicated. Pull wire taut and fasten securely to each extension arm.
- J. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.
- K. Tie Wires: Use U-shaped wires conforming to diameter of pipe. Clasp pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
- L. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3-04 ADJUSTMENT AND CLEANING

- A. Adjust all fencing and gates and leave in good working condition.
- B. Repair or replace any broken or bent components as directed by the Contracting Officer.
- C. Protect gates and fencing from construction traffic until acceptance of the Work.
- D. Repair coatings damaged in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's direction.

**SECTION 03100
CONCRETE FORMWORK
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**SECTION 03100
CONCRETE FORMWORK**

PART 1 GENERAL

1-01 DESCRIPTION

- A. Formwork for cast-in-place concrete, complete with shoring, bracing and anchorage.

1-02 SPECIFICATION STANDARDS

- A. Published Specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to work of this section where cited by abbreviations noted below.
1. ACI 347 - "Recommended Practice for Concrete Formwork".
 2. ACI 301 - "Specifications for Structural Concrete".

1-03 SPECIAL REQUIREMENTS

- A. Contractor is cautioned that all exposed concrete work is to be carefully finished and exposed corners or edges must be sharp and clean. Warps and discoloration on surface will not be accepted.

1-04 SUBMITTALS

- A. Manufacturer's literature describing products.
- B. Samples: Only as requested.

PART 2 PRODUCTS

2-01 GENERAL

- A. Form Design and Shoring: The design and engineering of the formwork and shoring, as well as its construction and installation, shall be the responsibility of the Contractor. Formwork shall be designed for loads and lateral pressures outlined in ACI 347 and wind loads as required by the applicable controlling building codes. Design considerations, allowable stresses and other applicable requirements shall conform to ACI 347 and the controlling local building code.
- B. Allowable Tolerances: Formwork shall produce concrete within the following tolerance limits unless otherwise noted.
1. Tolerances for formed surfaces for buildings shall conform to ACI 301.

2. Tolerances for formed surfaces for all other concrete structures shall conform to those outlined in ACI 347, unless otherwise noted.
- C. Cooperation: Fully cooperate with other trades and other sections for the installation of embedded items. Provide suitable templates, inserts, and sleeves for setting items not placed in the forms.

2-02 MATERIALS

- A. Forms shall be plywood, metal, fiberglass, and/or lumber, as specified below. Form materials furnished shall be new, except that metal and fiberglass forms previously used elsewhere will be permitted, provided that they are free of objectionable holes, dents, distortions, and other defects. After initial use on this project, form materials may be reused thereon provided they will produce acceptable concrete surfaces.
1. Framing, backing, bracing, shoring, and other formwork shall be No. 2 Common or better lumber.
 2. Smooth surface forms shall be used for all exterior and interior exposed concrete surfaces and be moisture resistant commercial standard Douglas fir concrete form type plywood, at least five ply, bearing APA grade trade-mark, unless otherwise approved.
 3. Unfinished surface forms may be used for all exterior and interior concealed concrete, except tank and basin interiors, and may be No. 2 Common or better lumber, metal or other type of form material except that wood forms shall be used for all surfaces that are to be plastered.
 4. Earth forms may be used as side forms of footings where soil conditions are suitable and approved by the Contracting Officer.
- B. Form Ties shall be of the snap tie type which can be removed to at least 1-1/2 inches below concrete surfaces leaving an opening no larger than the tie rod diameter, without cones.
1. Provide ties with integral water stops for all structures which are intended to contain water or other liquid and/or to prevent intrusion of ground or other water.
- C. Form sealer shall be non-staining mineral oil or other approved coating.
- D. Form release agent for surfaces intended to receive an applied coating or finish must be compatible with the applied coating or finish.

PART 3 EXECUTION**3-01 CONSTRUCTION**

- A. Construct and erect forms to types, shapes, lines, and grades shown on the drawings with as few joints as practical to insure straight, plumb, level, and smooth concrete surfaces with all angles sharp and true to line and to facilitate safe form removal without damage to concrete. Forms shall have sufficient strength to safely support all construction loads, with no appreciable bulging, sagging, movement, or leakage of mortar, and be clean of all debris at time of concreting.
- B. Provide 3/4 by 3/4 inch chamfer strips, unless noted otherwise, in formwork at exposed external corners.
- C. Bevel, marker and rustication strips shall be applied in straight lines and secured to prevent displacement.
- D. Provide temporary cleanouts and openings in wall and column forms as required for effective removal of loose dirt, debris, and waste material; for inspection of reinforcement; for introduction of vibrators; and where necessary to limit the free fall of the concrete to less than four feet.
- E. Slab Forms:
 - 1. Establish levels and set screeds.
 - 2. Slope to drain where required or shown or noted.
- F. Earth forms for footings shall be cut to sizes and elevations indicated. If dry, all earth or rock surfaces shall be moistened prior to concrete placement.
 - 1. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.
- G. Contact face of forms shall be coated with approved coating; or wood forms may be thoroughly wetted except in freezing weather. Oil coating must be applied and excess wiped off before placing reinforcement.

3-02 OPENINGS IN CONCRETE CONSTRUCTION

- A. Formed Openings: Provide these where required for mechanical, electrical, and other work.
- B. Cutting Openings: Where openings are required in new in-place or existing concrete construction, cut these only at locations approved by the Contracting Officer:
 - 1. Small opening for pipes, conduits, etc.: cut these with suitable rotary core type drills, without spalling the concrete; do not use star drills, chisels, or similar impact type tools, unless otherwise approved.

3-03 REMOVAL OF FORMS

- A. Remove forms only with approval, and in a manner that will insure complete safety of the structures. Where the structure as a whole is supported by shores, the forms for beam and girder sides, columns, and similar vertical surfaces may be removed after 24 hours, provided that the concrete has hardened sufficiently to prevent its injury by form removal. Do not in any case remove supporting forms or shoring until the structural members have acquired sufficient strength to safely support their weight and the load which will be placed thereon. Use every precaution to avoid spalling or otherwise damaging concrete by form removal.

3-04 INSERTS AND FASTENING DEVICES FOR OTHER WORK

- A. Provide for installation of inserts, hangars, metal ties, anchors, bolts, dowels, nailing strips, grounds, and other fastening devices required for attachment of other work.
- B. Other metal items embedded in concrete work are specified under other Divisions of these Specifications. Check Drawings and Specifications carefully for items embedded in concrete work prior to each pour.

PART 4 COMPENSATION

4-01 GENERAL

- A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment and incidental items of construction furnished by the Contractor.
- B. No measurement will be made of subsidiary items of work and accessories, excavation, trenching, backfill and disposal of surplus excavation and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work requiring formwork for conformance with neat lines and grades specified on the Construction Drawings. Measurement of concrete formwork shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement for concrete formwork shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

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SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1-01 DESCRIPTION

- A. The work required under this Section consists of Reinforcing steel bars for cast-in-place concrete, complete with tie wire, bar supports, splices and other reinforcing devices.

1-02 SPECIFICATION STANDARDS

- A. Published Specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to work in this section where cited below:
1. ASTM - American Society for Testing and Materials.
 2. ACI - American Concrete Institute's.
 - a. ACI 315 - "Details and Detailing of Concrete Reinforcement."
 - b. ACI 318 - "Building Code Requirements for Reinforced Concrete."
 3. CRSI - Concrete Reinforcing Steel Institute's.
 - a. CRSI - "Manual of Standard Practice."
 - b. CRSI - "Reinforcing Bar Splices."
 - c. CRSI - "Placing Reinforcing Bars."

1-03 SUBMITTALS

- A. Manufacturer's literature describing products, if requested.
- B. Shop Drawings: Show bending and placing details, size, and location of reinforcing steel. Include diagrammatic wall elevations at scale to show clearly position and erection marks of bars including marginal bars around openings with dowels, splices, etc. in accordance with ACI 315 and CRSI Manual of Standard Practice.
- C. Certified Mill Test Reports.
- D. Samples if required by Contracting Officer.

1-04 STORAGE AND HANDLING

- A. Store reinforcing and accessories in manner to prevent rusting and fouling with grease, dirt, or other bond-weakening coatings.
- B. Take precautions to maintain identification after bundles are broken.

PART 2 PRODUCTS

2-01 REINFORCING STEEL

- A. All reinforcement shall be detailed and fabricated in accordance with ACI 315 and CRSI "Manual of Standard Practice."
- B. Reinforcing bars, except column spirals shall be deformed bars conforming to ASTM A615 "Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement," Grade 60 as indicated on the drawings.

2-02 REINFORCING BAR SUPPORTS

- A. Bar supports shall be provided as recommended in Chapter 3 of CRSI "Manual of Standard Practice."
 - 1. All bar supports in contact with formwork for surfaces which will be exposed to view; be exposed to weather; receive acoustical plaster or paint; and interior surfaces of structures which will normally contain water: CRSI Class 1, plastic-protected, or CRSI Class 2, stainless steel protected, as approved.
 - 2. For other areas, unless otherwise indicated: CRSI Class 3, bright basic.
 - 3. On ground: concrete blocks, or if required, wire bars Class 3 with sand plates.
 - 4. Tie wire shall be black annealed wire, 16-1/2 gauge minimum.

PART 3 EXECUTION

3-01 PLACEMENT

- A. Place reinforcing steel in accordance with the recommended practices in "Placing Reinforcing Bars" by CRSI, as indicated on the drawings and outlined herein
- B. Do not bend or straighten any reinforcing steel in a manner which will weaken or damage the material, nor heat reinforcing steel for bending or straightening.
- C. All splices of reinforcement, minimum concrete cover, placing tolerances and bar spacings shall conform to ACI 318 and to recommended practices in "Reinforcement Anchorages and Splices" by CRSI.

3-02 SUPPORTS

- A. Reinforcing steel shall be accurately placed, in the forms adequately supported and secured against displacement within the tolerances outlined in ACI 318.

- B. Provide spaces, chains, bolsters, and other metal accessories to support all reinforcing steel and secure it in proper position before and during concrete placement.
- C. Splices shall be as indicated on the drawings. Generally splice bottom bars at points of support and top bars at mid-span of slabs, beams, and girders. Avoid splices at points of maximum tensile stress. Stagger horizontal and vertical splices.
- D. Reinforcing steel shall not be welded.

3-03 PROTECTION AGAINST RUST

- A. Where there is danger of rust staining adjacent surfaces, wrap reinforcement with impervious tape or otherwise prevent rust staining.
- B. Remove protective materials and clean reinforcement as required before proceeding with concrete placement.
- C. Prior to concrete placement, verify reinforcement has been properly bent, positioned, and secured in accordance with drawings; and remove ice, oil, grease, dirt, or other bond-weakening coatings.

3-04 INSPECTION

- A. Reinforcing for any pour shall be completely placed and inspected by the Contracting Officer prior to starting the pour.

PART 4 COMPENSATION

4-01 GENERAL

- A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment and incidental items of construction furnished by the Contractor.
- B. No measurement will be made of subsidiary items of work and accessories, excavation, trenching, backfill and disposal of surplus excavation and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work requiring reinforcing steel for conformance with requirements specified on the Construction Drawings. Measurement of reinforcing steel shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement for reinforcing steel shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings

and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

**SECTION 03300
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**SECTION 03300
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1-01 SECTION INCLUDES

- A. Cast-in-place concrete joints, expansion joint fillers, water stops, and anchorage items including slots, inserts, anchors, and bolts etc. for sanitary sewer structures and buildings.

1-02 REFERENCE STANDARDS AND CODES

- A. Published Specifications, standards, tests, or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below:

1. ASTM - American Society for Testing and Materials.
2. ACI - American Concrete Institute's.
3. FS - Federal Specifications.

- B. Materials and work shall conform to the requirements of standards, codes, and recommended practices required in this section. In conflicts between industry standards, required standards and this specification, or this specification and the local building code, the more stringent requirement shall govern.

1. Applicable Standards and Codes:
 - a. ACI 301 - "Specifications for Structural Concrete for Buildings."
 - b. ACI 318 - "Building Code Requirement for Reinforced Concrete."
 - c. ASTM C94 - "Standard Specification for Ready-Mixed Concrete."

1-02 QUALITY ASSURANCE

- A. Concrete work shall conform to all requirements of ACI 301 "Specifications for Structural Concrete for Buildings", except as modified and supplemented herein.

1-03 SUBMITTALS

- A. Manufacturer's literature describing products.
- B. Contractor shall prepare and submit for approval by the Contracting Officer preliminary mix design for each class of concrete specified a minimum of 14 days prior to concrete production.
- C. Contractor shall name his source of supply for concrete materials and submit representative samples of aggregates and cement and reports of quality tests for approval by the Contracting Officer.

D. Other samples only as requested.

1-04 STORAGE OF MATERIALS

A. Store concrete materials in a manner which will effectively segregate each type of material from each other, prevent contamination of materials, and protect the materials from damage by weather and other causes.

1-05 INSPECTION AND TESTING

A. The Contracting Officer and testing laboratory shall have free access to all points where concrete materials are stored, proportioned or mixed, and all materials, equipment and methods used shall be subject to their inspection, tests, and approval.

B. A Corps of Engineer's certified testing laboratory shall perform following services:

1. Test of Portland Cement, one test for each separate carload or certified mill test reports of cement.
2. Test gradation of coarse and fine aggregates.
3. Design and test all mixtures (with admixtures included) to be used on project.
4. If concrete materials are batched away from the project site and mixed on the project or transported to project in mixer or agitator trucks, laboratory inspection shall be provided at job site for checking materials deliveries and concrete consistencies on all pours in excess of 24 cubic yards and on others if required by the Contracting Officer.
5. Cast, cure, and test cylinders of the concrete actually placed on the job, all in accordance with ASTM C31 and ASTM C39, and as follows:
 - a. Quantity of test cylinders required: at least four cylinders of each day's concrete placing, but not less than four cylinders for each 100 cubic yards of concrete placed, and not less than four cylinders for each 5,000 square feet of surface area of concrete placed.
 - b. Testing requirements: test one laboratory and one field cured cylinder at seven days; test one laboratory and one field cured cylinder at 28 days.
6. Slump tests, using ASTM C143, of concrete sample for each strength test and whenever in the Contracting Officer's opinion consistency of concrete appears to vary.
7. Test for air content of normal weight concrete sample for each cylinder in accordance with ASTM C173.
8. Determine temperature of concrete sample for each strength test.

9. Test reports shall be promptly furnished by the laboratory to the Contractor and the Contracting Officer.
10. Daily reports of pouring shall be furnished, giving the date, location, and yardage of pour, specifying materials, proportions, consistencies and class of concrete used, the test cylinder number representing pour, and the weather conditions prevailing.

PART 2 PRODUCTS

2-01 MATERIALS

- A. Cement: ASTM C150, Type II or Type II/V, unless otherwise approved. Use only one brand of cement throughout the project unless otherwise approved by the Contracting Officer. All cement shall have a maximum of 8 percent tre-calcium aluminate.
- B. Aggregates for normal weight concrete shall conform to ASTM C33:
 1. Coarse aggregate: crushed limestone. Maximum size $\frac{3}{4}$ inch.
 2. Fine aggregate: clean, natural sand.
- C. Water: Clean and potable, free from impurities detrimental to concrete.
- D. Admixtures: Use only when conditions of use are approved, or as specified elsewhere in these specifications.
 1. Water reducing admixture: The admixture shall conform to ASTM C494, Type A, and not contain more chloride ions than are present in municipal drinking water.
 2. Water reducing, retarding admixture: The admixture shall conform to ASTM C494, Type D, and not contain more chloride ions than are present in municipal drinking water.
 3. High range water reducing admixture (superplasticizer): The admixture shall conform to ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
 4. Non-Corrosive, Non-Chloride Accelerator: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride irons than are present in municipal drinking water. The admixture manufacturer must have long term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.
 5. Air Entraining Admixture: Conform to ASTM C260.

6. Calcium Chloride: Calcium chloride, thicyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
 7. Certification: Written conformance to above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Contracting Officer.
- E. Bonding Compound: The compound shall be a polyvinyl acetate, rewettable type.
- F. Epoxy Adhesive: The compound shall be a two component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces.
- G. Non-Shrink Non-Metallic Grout: Factory premixed grout containing mineral aggregates and requiring only addition of water at the site. The grout shall conform to CRD-621, "Corps of Engineers Specifications for Non-Shrink Grout".
- H. Curing Materials:
1. Waterproof Paper: ASTM C171, Type 1, regular.
 2. Sheet Plastic: Polyethylene, 4 mils thick, fungus resistant.
- I. Curing and Sealing Compound: The Compound shall conform to Federal Specification TT-C-800A, 30 percent solids content minimum, and have test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per square cm. when applied at a coverage rate of 300 square feet per gallon. Manufacturer's certification required.
- J. Dissipating Resin Curing Compound: The compound shall be a dissipating resin type compound, conforming to ASTM C309, Type I. The film must chemically break down in a two to four week period after application.
1. Curing compounds shall not be used on any surface against which additional concrete or other cementitious materials are to be bonded.
- K. Expansion Joint Fillers:
1. ASTM D1751 - "Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)."
 2. ASTM D1752 - "Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction."
 3. Verify compatibility of joint filler with sealant specified.

- L. Joint Sealant: Joint sealants shall be of high quality material similar to Precora Corporation's Synthacalk→ GC-2+or approved equal. All joint surfaces shall receive a prime coat of Precora Corporation's Synthacalk→ P-53+ or approved equal.
- M. Anchorage Items: Cast-in-place slots, bolts, and inserts for anchoring masonry finish and mechanical items to concrete shall be of the types indicated and/or required to accommodate the subsequently installed fastening devices.
- N. Vapor Barrier: 10 mil (1.0 mm thick) clear polyethylene film, type recommended for below grade application.
- O. Waterproofing. A rubberized asphalt sheet membrane waterproofing shall be applied to all exterior walls of the influent junction box and influent pump station.
- P. Waterstop. Waterstops shall be of the sizes indicated on the plans.
- Q. Non-Slip Aggregate. Aluminum oxide type.

2-02 PROPORTIONING

- A. Proportioning of ingredients for each class of concrete required shall be in accordance with ACI 301 Method 1, laboratory trial batches, or Method 2, past field experience using materials to be employed on the project to produce placeability, durability, specified strengths and properties specified.
 1. This section shall propose mix designs prepared in accordance with Method 1 (trial batches) or Method 2 (field experience) of ACI 301.
 2. If trial batches are used, this section shall instruct Laboratory to base mix designs on use of materials tested and approved by the Testing Agency.

2-03 CONCRETE QUALITIES REQUIRED

- A. Strength: Specified compressive strength at 28 days shall be 4,000 psi.
 1. Average strength shall exceed specified compressive strength as required in accordance with ACI 318.
- B. Water-Cement Ratio: All concrete subjected to freezing and thawing shall have a maximum water-cement ratio of 0.40 by weight. All concrete subjected to deicers and/or required to be watertight shall have a maximum water-cement ratio of 0.45.
- C. Minimum Cement Content:
 1. 5-1/2 sacks per cubic yard for coarse aggregate size No.467 (1-1/2 maximum).
 2. Six sacks per cubic yard for coarse aggregate size No. 57 (one inch maximum) or No. 67 (3/4 inch maximum).

- D. Air Content: All concrete subjected to freezing and thawing after curing and/or required to be watertight shall be air entrained. Total air content as determined in accordance with ASTM C173 shall be:
1. 5 (\pm 1) percent for coarse aggregate size No. 467 (1-1/2 inch maximum).
 2. 6 (\pm 1) percent for coarse aggregate size No. 57 (one inch maximum) or No. 67 (3/4 inch maximum).
 3. All interior slabs to receive a surface hardener or subject to abrasion shall have a maximum total air content of three percent.
- E. Slump: As determined by ASTM C143 for concrete to be vibrated:
1. Slabs and walls: four inches maximum, two inches minimum.

PART 3 EXECUTION

3-01 PRODUCTION OF CONCRETE

- A. Concrete shall be ready-mixed, batched, mixed, and transported in accordance with ASTM C94, "Standard Specification for Ready-Mixed Concrete."
1. Plant equipment and facilities shall conform to "Certification of Ready Mixed Concrete Production Facilities (Checklist with Instructions)" of the National Ready Mixed Concrete Association.

3-02 PREPARATION

- A. Approval: Prior to placing concrete, give the Contracting Officer sufficient advance notice of each proposed placing. Do not place any concrete on any subgrade or in any formwork until the subgrade, formwork, reinforcing steel, anchor bolts, and other embedded items for the placement involved have been inspected and approved by the Contracting Officer.
- B. Bonding and Grouting: Before depositing new concrete on or against concrete which has set, treat existing concrete surfaces which will receive additional concrete, as follows: thoroughly roughen existing concrete surfaces and remove laitance, foreign matter, and loose particles; retighten forms at junction of existing and new concrete; dampen (but do not saturate) existing concrete surfaces; and slush existing concrete surface with cement-sand grout of proportions similar to those of the concrete. Grout coat shall be as thick and practicable on vertical surfaces, and at least 1/2 inch thick on horizontal surfaces. Place new concrete before grout has attained its initial set.
- C. Install construction joints at locations indicated on drawings. Except where indicated, no construction joints will be permitted without prior specific approval. Vertical construction joints in wall footings shall be reduced to a minimum. Construction joints in

slabs and walls, where permitted, shall be located and made so that the strength and usefulness of the structure will not be impaired. Except where shown otherwise, provide keyways at all construction joints as indicated on the plans. Metal keyways are not permissible.

1. Unless otherwise indicated, the spacing of the joints shall not exceed the following in any horizontal direction: suspended slabs, 20 feet; other slabs on grade, 50 feet; walls, 50 feet.
- D. Expansion joints shall be provided at locations indicated on drawings. Joint filler shall be as specified. Do not permit reinforcement or other embedded metal items bonded to concrete (except dowels bonded on only one side of joint) to extend through any expansion joint.
- E. Contraction joints shall be formed in walls with removable strips placed in the forms and in slabs with an early entry dry cut system, both to the depth indicated on the plans.
1. Contraction joints may be formed, tooled or sawed approximately equal to 1/4 the thickness of slab.
 2. The spacing of the joints shall be as shown on the drawings.
 3. All joints shall be sealed with a joint sealant as specified herein.
- F. Placing Embedded Items: Expansion joint material, waterstops and other embedded items shall be positioned accurately and securely against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent entry of concrete into voids.
- G. Anchor bolts shall be set with templates according to approved shop drawings.
- H. Slabs on grade shall be placed on properly leveled and thoroughly compacted sub-grades or granular fill, as indicated. All sub-soils for slabs shall be approved before placing concrete. At locations indicated provide one layer of vapor barrier material, lapped at joints a minimum of 24" inches.
- I. Except where shown otherwise, chamfer all exposed concrete edges $\frac{3}{4}$ ".
- J. Install waterstops in all expansion joints, construction joints and control joints in each structure designed to contain water or other liquid, or designed to prevent intrusion of water or other liquid, as indicated and/or as required to provide watertight structures. Arrange all waterstops to provide continuous seals in all joints between the separate concrete placements in each structure. Carefully fit all waterstops to form turns, tees, crosses, and other arrangements as required to provide a complete, continuous water seal in all joints subject to leakage. Heat weld all joints in waterstops, and install as recommended by the manufacturer.

1. Waterstop shall be securely held in position so that it will not be displaced during concreting. Exercise care to avoid contamination of waterstop surface by form coatings or other substances which would adversely affect bonding.
- K. Concrete Foundations for Mechanical and Electrical Equipment: Provide concrete pads required under all mechanical equipment. Set bolts, anchors, piping, etc., in concrete as required by manufacturer of equipment used. See mechanical and electrical drawings and details for size, design, and location of equipment requiring concrete pads. Pads shall be trowel finished on all top exposed surfaces.

3-03 PLACEMENT

- A. Conveying: Convey concrete from mixer to forms as rapidly as practicable without segregation or loss of ingredients, continuously and at such a rate that no unfinished area will be left exposed or unworked before the concrete takes its initial set. Do not deposit concrete initially set. Cast concrete within one hour after adding water unless otherwise noted. Retempering of concrete which has partially set will not be permitted.
- B. Take precautions to avoid damage to under-slab waterproofing and displacement of reinforcement and formwork.
- C. Chute Placement: When concrete is conveyed by chute, maintain a continuous flow of concrete. Chute shall be of metal or metal-lined wood, with sections set at approximately the same slope, which shall not be less than one vertical to three horizontal, and not more than one vertical to two horizontal. Discharge end of chute shall be provided with a drop chute to prevent segregation. If height of discharge end of chute is more than three times the thickness of the layer being deposited, but not more than four feet above surface of concrete in forms, use a spout with its lower end maintained as near surface of deposit as practicable. When pouring is intermittent, chute shall discharge into a hopper. Clean chutes thoroughly before and after each run. Discharge waste materials and flushing water outside forms. Raised runways for wheeling concrete to place shall be provided when necessary.
- D. Deposit concrete in approximately horizontal layers of 12 to 18 inches as near as possible to its final position. Do not allow concrete to drop vertically more than 3 or 4 feet, nor through a cage of reinforcing steel except when an elephant trunk or tremie is used.
1. Elephant trunks or tremies shall be used in deep walls and columns to prevent free fall of concrete and to allow placement through cage of reinforcement.
- E. Keep forms and reinforcement clean above pour line by removing clinging concrete with wire brush before casting next lift. Also remove leakage or laitance through forms.
- F. Interruption in casting longer than 45 minutes shall be cause for discontinuing casting for remainder of day. In this event, cut back concrete and provide construction joints as the Contracting Officer directs; clean forms and reinforcement as necessary to receive concrete at later time.

- G. Continuously place concrete in units between construction joints so that each unit will be monolithic in construction. Concrete placement rate shall be such that surface of concrete not carried to construction joints will not have attained initial set before additional concrete is placed in the construction unit involved. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at same time as slabs. In walls of structures having door, window, or other openings, lifts of individual pours shall terminate at the tops or bottoms of the openings. Other lifts shall terminate at levels indicated, or to conform to structural requirements or architectural details, or both, as approved. Special provisions shall be made for joining successive pours as detailed or as approved. At least 48 hours shall elapse before placing concrete in the adjoining unit at each construction joint.
- H. Compaction: During and immediately after depositing concrete compact each layer by mechanical internal vibrating equipment supplemented by hand spading, rodding, and tamping, as required. Do not use vibrators to transport concrete inside of forms. Form vibrators shall not be used. Internal vibrators shall maintain not less than 5,000 impulses per minute when submerged in the concrete; maintain at least one vibrator as a stand-by. Limit vibrator duration to the time necessary to produce satisfactory consolidation without causing objectionable segregation. Do not insert vibrator into lower courses which have begun to set. Apply vibrators at uniformly spaced points not farther than the visible effectiveness of the machine. Vibrate thoroughly all concrete at all waterstops to insure their complete embedment in solid concrete.
- I. Hot Weather Concreting: Conform to ACI 305R and following requirements when mean daily temperature rises above 85 degrees Fahrenheit.
1. Temperature of concrete as placed shall be lowest temperature practicable but not higher than 85 degrees Fahrenheit, unless approved otherwise by the Contracting Officer.
 2. Crushed ice in lieu of water will be approved to maintain concrete below maximum temperature.
 3. Addition of water-reducing retarders will be permitted only if the Contracting Officer approves and mix is redesigned.
 4. Concrete shall be discharged within 45 minutes after adding water.
- J. Cold Weather Concreting: Conform to ACI 306R and following requirements when mean daily temperature falls below 40 degrees Fahrenheit.
1. Reinforcement, forms, or ground to receive concrete shall be completely free from frost.
 2. Minimum temperature of concrete as placed shall be 50 degrees Fahrenheit.
 3. Concrete shall be maintained at temperature no lower than 50 degrees Fahrenheit for minimum seven day period after placement.

4. Only the specified non-corrosive, non-chloride accelerator may be used. Calcium chloride, thicyanates, or admixtures containing more than 0.05 percent chloride ions are not permitted.

3-04 REPAIR OF SURFACE DEFECTS

- A. Fin and Protrusion Removal: Immediately after form removal, remove fins and other unnecessary protrusions, flush with concrete surfaces.
- B. Filling and Patching: Surface defects including tie holes, shall be repaired immediately after form removal using one of the following appropriate methods.
 1. For concrete surfaces to receive rubbed finish: as soon as practicable after form removal, fill and patch tie holes, honeycombs, voids, and other unnecessary holes, as follows:
 - a. Remove all loose material.
 - b. Wet concrete for 8 hours before patching.
 - c. Mop surface to receive patch, with slurry of cement and water.
 - d. Fill with "dry" grout of sand and cement in the same proportions as those of the concrete, except with only enough water added to provide a mix that will "ball" in the hand. Force grout into cavities with the greatest practicable pressure.
 - e. Finish surface to match adjacent area.
 - f. Cure fill as specified under curing.
 2. For concrete surfaces to receive waterproof coating and finish: as soon as practicable after form removal, fill and patch tie holes, honeycombs, voids, and other unnecessary holes with commercially prepared patching material. Standard Dry Wall Products "Thorite" or as approved, which has high bonding characteristics; 5,000 psi minimum 28 day strength; recommended by the manufacturer for use in contact with potable water without emitting objectionable tastes or odors to the water; and compatible with the Waterproof Coating and Finish specified above. Apply patching material in strict accordance with the manufacturer's printed instructions. All surfaces shall be approved by the Contracting Officer prior to application of coatings.

3-05 FINISHING OF FORMED SURFACES

- A. Immediately after forms have been removed and concrete surfaces have been repaired as specified under "Repair of Surface Defects" concrete surfaces shall be given one or more of the following finished in locations indicated or specified hereinafter. When completed

the finished exposed concrete surfaces shall be free of defects, with corners, jambs, rises, and angles straight, plumb, true to line, and level, as applicable.

- B. Rubbed Finish: Immediately after form removal, completely rub and finish the concrete surfaces with abrasive stones, as required to obtain uniform and approved surface texture and color.
- C. Related Unformed Surfaces: Tops of walls or buttresses, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and be floated to a texture reasonably consistent with that of the formed surfaces. Continue final finish on formed surfaces uniformly across the unformed surfaces.
- D. Waterproof Coating and Finish: Remove all form release products and membrane curing compounds and apply a waterproof coating. Coating shall be as recommended by the manufacturer for this application and shall bond securely to the concrete surfaces.
 - 1. Waterproof coating shall be Standard Dry Wall Products "Thoroseal" mixed with Acryl 60 bonding agent, or approved equal waterproof coating, applied in two coats in strict accordance with the manufacturer's printed instructions to produce a sand textured finish.

3-06 CONCRETE SLAB FINISHES

- A. General: Finish concrete slabs as specified below. Dusting of wearing surfaces with dry materials will not be permitted. In preparation for finishing, strike slabs off true to the required elevations and grades of the finished slabs. Slabs shall be level, except where drains occur or slopes are indicated, in which case the slabs shall be pitched to the drains or sloped, as applicable. Floors shall be flat and achieve a flatness, F_f of 25 as per ASTM E 1155. Floors shall be level and achieve a levelness, F_l of 15 as per ASTM E 1155.
- B. Wood Float Finish: Finish slabs by screeding and floating with straight edges to bring the surface to the required finished elevation. While the concrete is still green but sufficiently hard to bear a man's weight without deep imprint, wood float the surface to a true even plane with no coarse aggregate visible using sufficient pressure on the wood floats to bring moisture to the surface.
- C. Steel Trowel Finish: First wood float finish the slabs as specified in the paragraph above. Then hand finish the concrete with a steel trowel to produce a smooth impervious surface free from trowel marks.
- D. Machine Finish: Suitable machines may be used to finish the concrete, provided that they produce satisfactory final finishes at least equal to those normally obtained by the hand finishing methods specified above.
- E. Broom Finish. Finish concrete surface with wood float finish as specified above, then broom surface to provide a light grit finish. Broom finish is required on all exterior slabs, pavements and sidewalks.

- F. Roughened Finish: First wood finish the slab as specified above. Rake surface to provide a coarse finish with exposed aggregate of 1/2" maximum amplitude.

3-07 WATERTIGHTNESS OF CONCRETE STRUCTURES

- A. All concrete structures which are intended to contain water or other liquids and/or prevent entry of water into the structure, shall be strictly watertight.
- B. Promptly repair and permanently leakproof all cracks and other defects through which water or other liquids leak before and during the guarantee period, as approved.

3-08 CURING

- A. General: Take curing measures immediately after casting and extend period according to the Contracting Officer's recommendation based upon prevailing temperature, wind, and relative humidity.
 1. Keep concrete continuously moist for minimum 14 days after casting.
 2. Maintain concrete temperature at minimum 50 degrees Fahrenheit for seven days after casting.
 3. Avoid alternate wetting and drying and fluctuations of concrete temperature.
 4. Protect fresh concrete from direct rays of sun, rain, drying winds, soiling, and damage.
 5. Do not permit curing method to affect adversely finishes or treatments applied to finished concrete.
- B. Curing Methods for Slabs: Cure all concrete surfaces with one or a combination of the following methods. Where a specific curing procedure is not specified, at the Contractor's selection, one or more of the following methods shall be used.
 1. Water curing: keep concrete surfaces continuously wet with clean water during the curing period by immersion, maintaining a continuous flow of water over the surface, continuous spraying, continuous sprinkling or a combination of these. For all curing methods, the difference in temperature between the water used for curing and the concrete shall not exceed 20 degrees Fahrenheit.
 2. Wet coverings: cover the concrete surfaces with burlap, cotton mats, sand, earth, or other suitable moisture retaining materials and keep these materials saturated during the curing period. Lap all fabrics at least 8 inches at all joints. On exposed concrete, do not use any type covering which will discolor the concrete surface.
 3. Waterproof coverings: as soon as possible after finishing, thoroughly wet the concrete surfaces and cover the concrete surfaces with waterproof paper or plastic film immediately after wetting. For a period of at least 8 hours after the concrete has taken its initial set, maintain a continuous flow of clean water over the concrete surface under the covering. Lap all joints in the covering at least 8 inches

and provide weights and other means and methods to keep the waterproof covering in direct contact with the concrete during the curing period.

4. Membrane forming curing compounds: an approved liquid membrane forming curing compound may be used after one of the curing methods specified above has been used for at least 24 hours after the concrete has taken its initial set. The membrane forming curing compound shall be applied in strict accordance with the manufacturer's printed instructions. Apply in two coats at right angles to each other at a rate of 200 square feet coverage per gallon per coat unless otherwise recommended by the manufacturer. Apply coats uniformly and free of pinholes, gaps, puddles, and runs.

a. Membrane forming curing compound used on potable water containing structures shall be nontoxic and taste and odor free.

C. Curing Methods for Walls: Cure all concrete walls as follows: Keep forms wet during the period forms are required to remain in place. Immediately after formed concrete has taken its initial set, start a gentle uniform flow of clean water over concrete to thoroughly wet all concrete surfaces and formwork and maintain this flow of water until forms are removed. Immediately after form removal, cure concrete surfaces with one of the curing methods specified.

D. Interior Coating System: All interior concrete surfaces for the influent junction box, influent pump station, influent splitter box and the headworks shall be coated using the following system or an approved equal:

COATING SYSTEM		
		M.D.F.T.
1 ST Coat	Tnemec Series 120-5002 Vinester	15.0-18.0
2 nd Coat	Tnemec Series 120-5003 Vinester F&S	As required to fill voids and bugholes
3 rd Coat	Tnemec Series 120-5001 Vinester	15.0-18.0

E. Surface Preparation: Allow to cure for 28 days. Remove all form oil, dirt, grease, form release agents, curing compounds/membranes, sealers, hardeners and all other contaminants. Application of coatings to be in strict accordance with manufacturer's recommendation. The final system shall be verified void and pinhole free.

PART 4 COMPENSATION

4-01 GENERAL

A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment and incidental items of construction furnished by the Contractor.

- B. No measurement will be made of subsidiary items of work and accessories, excavation, trenching, backfill and disposal of surplus excavation and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work requiring cast in place concrete for conformance with requirements specified on the Construction Drawings. Measurement of cast in place concrete shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement for cast in place concrete shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

- A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

DIVISION 4

THRU

DIVISION 14

(NOT USED)

**SECTION 15121
CAST IRON SLUICE GATE
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**SECTION 15121
CAST IRON SLUICE GATE**

PART 1 GENERAL

1-01 SCOPE

- A. This section covers sluice gates that are required on this project. Each sluice gate will be furnished and installed complete with wall thimble, operating stem, operating floorstand, and other appurtenances or accessories as specified.

1-02 GENERAL

- A. The sluice gates will be in the quantities and sizes indicated on the plans and listed in the Gate schedule elsewhere in the specifications. The sluice gates will be as manufactured by Rodney Hunt Company, or approved equal.

PART 2 PRODUCTS

2-01 DESIGN

- A. Liberal safety factors will be used in the design of all equipment. Working stresses will not exceed the lower value of, one third of the yield strength or one fifth of the ultimate strength of the material. The sluice gates and appurtenances will be designed for installation in the structures shown on the plans.

2-02 MANUFACTURE

- A. All work will be performed in accordance with the best modern practice for the manufacture of high-grade machinery. All parts will have accurately machined mounting and bearing surfaces so that they can be assembled without fitting, chipping, or remachining. All parts will conform accurately to the design dimensions and will be free of all defects in workmanship or material that will impair their service. The sluice gates will be completely shop assembled to insure proper fit and adjustment of all parts.

2-03 MATERIALS

- A. All materials used in construction of the gates and appurtenances will be the best suited for the application and will conform to the following specifications:

<u>Part</u>	<u>ASTM Designation</u>
Iron castings for wall thimbles, frame, disc and guides, stem guides, floorstands, and other items	A-126, Class-B
Bronze castings for wedges, thrust nut, lift nut, and coupling	B-584, C86500
Bronze for seat facings in frame and disc	B-21, C46400
Stainless steel for stems	A-276, Type 304
Stainless steel for fasteners	A-276, Type 304

1. Sluice Gates: The sluice gates will be cast iron; fully bronze mounted, and will have side wedges for seating head conditions. For sluice gates larger than 24” that will be subjected to unseating heads, top and bottom wedges shall be provided. Flush-bottom closure gates, larger than 24” shall be provided with top wedges only.

a. Sluice Gate Schedule

<u>Quantity</u>	<u>Size</u>	<u>Design Seating Head</u>	<u>Design Unseating Head</u>	<u>Operating Head</u>	<u>Type of Operation</u>
1	24” x 24”	10-FT	10-FT	10-FT	OPEN/CLOSE

2. Frame: The frame will be of cast iron, one-piece construction with a mounting flange that has a rectangular or circular opening as indicated on the plans. All contact surfaces of the frame will be machined. The frame will have machined dovetailed grooves on the front face into which bronze seat facings shall be driven and machined to a 63 micro-inch finish. The back of the frame will be machined to bolt directly to the machined face of a wall thimble. For sluice gates greater than 24” wide and subjected to unseating heads, the frame will have integrally cast pads machined with keyways to receive top and bottom wedge seats. Frames for flush-bottom closure gates larger than 24” shall be provided with integrally cast pads with keyways to receive top wedge seats only.
3. Disc or Slide: The disc will be of cast iron, one-piece construction, rectangular with integrally cast vertical and horizontal ribs. A reinforcing rib along each side will be provided to insure rigidity between the side wedges. The disc will have machined dovetailed grooves on the seating face into which bronze seat facings shall be driven and machined to a 63 micro-inch finish. A tongue on each side, extending the full length of the disc, will be machined on all sides with a 1/16” clearance maintained between the disc tongue and gate guide groove. Wedge

pads for side top and bottom wedges when required will be cast integrally on the disc and machined to receive adjustable bronze wedges. A heavily reinforced nut pocket will be cast integrally on the vertical centerline and above the horizontal center, and is of such shape to receive the square-backed traveling thrust nut.

4. Guides: The guides will be cast iron, one-piece, designed to withstand the total thrust due to water pressure and the wedging action. The guides will be machined on all contact surfaces, and a groove will be machined the entire length of the guide to allow 1/16" clearance between the disc tongue and guide groove. The guides will be of such length as to retain and support at least one half the disc in the full open position. The guides will be integrally cast with or attached to the frame with silicon bronze or stainless steel studs and nuts, and will be doweled to prevent any relative motion between the guides and frame. On sluice gates over 48" wide, a reinforcing rib extending from the guide flange over the top of the wedge seat will be provided. Bronze wedge seats will be securely attached to machined pads on the guides.
5. Wedges: The wedges will be solid cast bronze, machined on all contact surfaces. They will be attached to the disc with studs and nuts and will have adjusting screws with lock nuts.
6. Seat Facings: All seat facings will be malleable extruded bronze of a composition, which will increase in wearing ability with cold working. The extruded seat facings will be of special shape to fill and permanently lock in the machined dovetailed grooves when driven into place. Attaching pins and screws will not be allowed. The installed seat facings will be machined to a 63 micro-inch finish or better.
7. Wall Thimbles: Wall thimbles will be furnished for all sluice gates that are not attached to pipe flanges. Wall thimbles will be section "F", section "E", Bell End, or Mechanical Joint. The depth will be as indicated on the plans and listed in the Gate Schedule. They will be cast iron, one-piece construction of adequate section to withstand all operational and reasonable installation stresses. Wall thimbles will be internally braced during concrete placement. A center ring or water stop will be cast around the periphery of the thimble. The front flange will be machined and have tapped holes for the sluice gate attaching studs, and metal stamped vertical centerlines with the word "top" for correct alignment. Large rectangular wall thimbles will be provided with holes in the invert to allow air to escape during concrete placement beneath the thimble. A permanent gasket for uniform thickness or suitable mastic will be provided between the sluice gate and wall thimble.
8. Stems: The operating stem will be of a size to safely withstand, without buckling or permanent distortion, the stresses induced by normal operating forces. In addition, the stem will be designed to transmit in compression at least 2-1/2 times the rated output of the floorstand or benchstand with a 40-pound effort on the crank or handwheel. The threaded portion of the stem will have machine cut threads of the 29° Acme type. Bronze couplings threaded and keyed to the stems

will join stems of more than one section. All threaded and keyed couplings of the same size will be interchangeable. Manually operated, rising stem gates will be provided with an adjustable stop collar on the stem above the floorstand lift nut.

9. Stem Guides: Stem guides will be cast iron, bronze bushed, mounted on cast iron brackets. They will be adjustable in two directions and will be spaced at sufficient intervals to adequately support the stem. Stem guide spacing will not exceed and L/r ratio of 200, and will not be spaced greater than 10 feet except where required by gate travel.

2-04 OPERATOR

- A. Manual operation will be by handwheel, crank operated floorstand, or benchstand as indicated on the plans and specified in the Gate Schedule.
- B. Handwheel operated type will be without gear reduction and crank operated type will have either single or double gear reduction depending upon the lifting capacity required. Each type will be provided with a threaded cast bronze lift nut to engage the operating stem. Roller bearings will be provided above and below a flange on the operating nut to support both opening and closing thrusts.
- C. Floorstands or benchstands will operate the gates under the specified operating head with not greater than a 40 pound pull on the crank or handwheel. Gears, where required, will be steel with machine-cut teeth designed for smooth operation. The stainless steel pinion shafts on crank operated floorstands, whether single or double ratio, shall be supported on tapered roller bearings or needle bearings. All components will be totally enclosed in a cast iron case and cover. Positive mechanical seals will be provided on the operating nut, and the pinion shaft is to exclude moisture and dirt and prevent leakage of lubricant out of the hoist. Lubricating fittings will be provided for the lubrication of all gears and bearings. Removable handwheel or crank will be designed for rough treatment and minimum weight.
- D. Floorstands will include a high strength pedestal designed to position the input, shaft, or handwheel approximately 36" above the operating floor. Benchstands will be provided with a rectangular cast iron base machined and drilled for mounting purposes. An arrow with the word "open" will be permanently attached or cast on the floorstand, benchstand, or handwheel indicating the direction of rotation to open the gate. The operating mechanism will be equal in all respects to the Rodney Hunt Company floorstand or bench-stand shown the plans and listed in the Gate Schedule.

2-05 PAINTING

- A. The gate manufacturer shall be responsible for shop prime and finish painting of all gates and appurtenances supplied under this contract. All coatings shall conform to VOC Emission Regulations in effect at the manufacturing location and at project site to allow touch-up or recoating to be performed with the same products. The type of paint shall be as specified in the following schedule. Where required by application, the coating shall

be approved for contact with drinking water by the NSF, EPA, or other appropriate governing agencies. Number of coats, mil thickness, and surface preparation shall be in accordance with the paint manufacturer's recommendations for that application, but in no case shall be less than the requirements in the following schedule. All coatings shall be free of carcinogens as listed on the IARC monographs.

- B. Colors are to be manufacturer's standards, provided they are selected for ease of field touch-up and color match and are fade resistant. Colors shall be selected to provide contrast between the product and prime coat, and between the prime coat and finish coat, to insure uniform covering and coating thickness. All coatings shall be applied in accordance with the paint manufacturer's recommendations for thinning, technique, and safety precautions. All coatings shall be produced by Ameron Protective Coating Divisions, Brea, CA, or equal as approved by the Contracting Officer.

2-06 LEAKAGE

- A. The sluice gates will be substantially watertight under design head conditions. The leakage will not exceed 0.1 gpm per foot of periphery for seating heads up to 50 feet, and for unseating heads up to 30 feet. For heads greater than 50 feet seating and 30 feet unseating, leakage rates shall not exceed those as specified per AWWA C501-92.

2-07 SHOP TESTING

- A. The completely assembled gate will be shop inspected for proper seating. Seat facings will be machined and wedges adjusted to exclude a 0.004" thickness gauge between the frame and disc seating surfaces. The gate disc will be fully opened and closed in its guide system to insure that it operates freely. Floorstands and benchstands will be shop operated to insure proper assembly and operation.

PART 3 EXECUTION

3-01 INSTALLATION AND STORAGE

- A. The sluice gate equipment and appurtenances will be installed in accordance with the Installation Manual furnished by the gate manufacturer. Extreme care should be used in the handling, storage, and installation of this equipment to prevent damage or distortion of the equipment and to insure proper performance.

3-02 FLUSH BOTTOM CLOSURE

- A. The gate will have a compressible resilient seal attached to the bottom of the disc (sliding member) with a stainless steel bar and fasteners. The seal will be of a specially extruded shape and designed to accurately fit to the bottom rib of the disc. The seal will be shaped to produce a wide sealing area on a machined cast iron stop bar that is bolted to the gate frame to form a flush invert. The differential sealing pressure of the resilient seal on the stop bar will be variable by adjustment of the slide wedges of the gate. The flush bottom

closure gates will be the HY-Q design as manufactured by Rodney Hunt Company, or equal as approved by the Contracting Officer.

PART 4 COMPENSATION

4-01 GENERAL

- A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment, and incidental items of construction furnished by the Contractor.
- B. No measurement will be made of subsidiary items of work and accessories, equipment, grout, and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work required for conformance with requirements specified on the Construction Drawings. Measurement of work required in relation to this section of the Specifications shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

- A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

**SECTION 16010
ELECTRICAL GENERAL REQUIREMENTS
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SECTION 16010
ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1-01 SCOPE

- A. General Provisions for the complete electrical system for lighting, power and other purposes, as herein specified and/or indicated on the drawings, consisting generally of, but not limited to, complete and operable systems and components of the following types:
1. Electrical distribution system including raceways, conductors, connections, circuit breakers and products of the same sort.
 2. Branch circuits and outlets.
 3. Electrical connection of motors and equipment provided by other Sections.
 4. Grounding system including equipment ground.
 5. Wiring devices.
 6. Lighting fixtures, lamps and ballasts.
 7. Concrete pads for ground mounted electrical equipment.
 8. Connection of all equipment furnished under other Divisions and/or by the Owner.
 9. Providing empty raceway systems as shown on the Drawings and/or specified herein.
 10. Testing of all systems furnished, installed, or connected that are provided as a part of the Work of Division 16.
 11. Furnishing of Shop Drawings, Submittals and Brochures.
 12. Operating and maintenance books.
 13. Furnishing of Record Drawings as specified herein.
 14. Miscellaneous items as required for complete and functioning systems as specified herein and indicated on the Drawings.

1-02 QUALITY ASSURANCE

- A. Regulations and Codes: Install this work to the requirements of DeSoto County regulations and to the applicable requirements of the 1999 National Electrical Code. If any work shown on the Drawings, or specified appears to conflict in any way with any regulations and codes, notify the Contracting Officer before performing work.
- B. Permits and Fees: Pay all permits, fees, etc., required for the work in Division 16. Be responsible for all coordination and scheduling with utility companies, if required as a part of the work.
- C. Standards: In addition to applicable codes, the following industry standards, specifications and codes are minimum requirements. Standards are referenced to hereinafter in accordance with the following abbreviations:
 - 1. NEMA - The National Electrical Manufacturer's Association Standards.
 - 2. ICEA - The Insulated Cable Engineers Association Standards.
 - 3. UL - Underwriters' Laboratories, Inc., Standards.
 - 4. ANSI - American National Standards Institute.
 - 5. ETL - Electrical Testing Laboratories, Inc. Standards.
 - 6. CBM - Certified Ballast Manufacturers, Standards.
 - 7. EIA - Electronics Industry Association.
 - 8. NECA – National Electrical Contractors Association
 - 9. NEC - National Fire Protection Association 70, National Electrical Code, 1999.
 - 10. NFPA - National Fire Protection Association.

1-03 SUBMITTALS

- A. Submittal Data Brochures:
 - 1. Submit all equipment, with descriptive data, to the Contracting Officer for approval. Submit all equipment, including items called out on drawings in indexed, three-ring binders (sized appropriately for the mass of contents) for the electrical Sections, with a minimum number of copies as indicated in Section 00800. First submittal should include materials needed first for construction and long lead-time items. Separating submittals allows the Contracting Officer to review and return submittals with less turn-around time. Submit all items in a specification section at one time; partial submittals will not be considered. Do not employ faxed or other unclear copy in brochure preparation. Provide submittals as follows:

Sections 16050, 16155
 - 2. Retain three (3) of the above copies for use in preparing as "Operating and Maintenance" manuals after approval of equipment.
 - 3. Submit brochures describing material and equipment to the Contracting Officer for approval within 60 days of signing of the General Construction contract.

4. Where substitute items are proposed, make submittal as described in Section 00800 section regarding substitutions.
- B. Operating and Maintenance Manuals:
1. Deliver to the Contracting Officer three (3) complete operating and maintenance manuals covering all equipment and systems installed by this Division.
 2. Include parts lists, wiring diagrams, and operating instructions for all operating equipment as well as all contents of the approved submittals and copies of field tests.
 3. Bind manuals in hard back three ring binder and tab indexed to reflect various categories of materials. Label front cover and back spine indicating project name. Include page showing date and local responsible vendors with addresses and telephone numbers for furnishing parts and information on equipment.
- C. Test and Inspection Reports:
1. Provide copies of all test or inspection reports performed by public agencies for electrical system.
- D. Provide the following shop drawings, number of copies as required elsewhere in this specification:
1. As required by Contracting Officer where deviations are to be, or have been made from Contract Documents.

1-04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Make provisions for the delivery and safe storage of all materials. Provide moisture and dirt protection for materials as appropriate.
- B. Arrange to have materials delivered to the job at such stages of the work as will expedite the work as a whole. Mark and store all materials in such a manner as to be easily checked on inspection.
- C. Where materials are indicated to be furnished to this Division for installation and/or connection, make a complete and careful check of all materials thus received and furnish a receipt acknowledging acceptance of the delivery and condition of the materials received. After such acceptance, assume full responsibility for the safe-keeping of same until such time as the completed installation has been approved and accepted.

1-05 JOB CONDITIONS

A. Examination of Site:

1. Bidders must visit the site of the work before submitting bids and satisfy themselves as to the nature and scope of all work to be done, or required by local authorities to be done, to meet with their requirements or codes.
2. The submission of a bid is taken as evidence that such an examination has been made and difficulties, if any, noted and dealt with by inclusion in bid or listed as an exclusion from bid.

B. Coordination:

1. Coordinate all work with that of others on the job, in order to preclude delays in the proper installation and completion of the work. Perform extra work or materials resulting from lack of coordination without additional cost.

C. Openings through walls and slabs:

1. Ascertain that all openings through walls and slabs and through other parts of the structure are sized and located properly. Prepare and furnish to the General Contractor a sleeve plan for all sleeves required in proposed structure. Set all required sleeves in concrete, and/or be responsible for same. Make openings so as to maintain fire rating and water integrity of structure.

D. Protection of Work:

1. Protect installation from damage by freezing, breakage, dirt, foreign materials, damage from the practices of other trades, etc.; replace all work so damaged.
2. Take precautions to protect the work of others, and be responsible for all damage to other work caused by work of or through the neglect of workmen under this Division of the Specifications.
3. Protect raceway openings with temporary plugs or caps. At locations where conduits are turned upward in the field, brace the conduit and flag the location to alert other trades to the presence of the conduits.

1-06 USE OF DOCUMENTS

- A. Drawings and Specifications together describe the project. Provisions occurring in one are considered to occur in both. Where discrepancies occur between Drawings and Specifications, the more stringent requirements prevail.
- B. The Drawings depict loads connected to electrical branch circuits; routing of conduit may be rearranged, where specifically approved by Contracting Officer to best fit conditions.

- C. Refer to the working drawings for other trades in order that work required conforms in detail with the work of others.
- D. No additional compensation is allowed for any labor or material unless Contractor can clearly show same to be in addition to and beyond the requirements of the Drawings and/or Specifications.
- E. The Drawings are diagrammatic; therefore, for all dimensions and exact locations, refer to the drawings of the structure(s) except as specifically noted otherwise.
- F. In preparation of the Drawings it is intended that they be utilized by competent mechanics in completing the system installations.
- G. Install equipment in accordance with manufacturer's recommendations and keep a copy of these recommendations on the job site at all times. Make these installation recommendations available to the Contracting Officer upon a request for same.

1-07 RECORD (AS-BUILT) DRAWINGS

- A. Prepare record drawings of all systems installed herein. Prepare drawings utilizing blue-line or black-line prints of the bidding drawings. Follow standard symbols and drafting techniques. After submitting and obtaining the Contracting Officer's approval of the record drawings, deliver to the Contracting Officer the required copies of the approved drawings.
- B. Each day post neatly to the job site record set of drawings notations to indicate work progress and information for record drawings. Post work performed with colored pencils coded to the various systems. Incorporate all changes and departures from bidding drawings. Show principal dimensions of all concealed work. Show all piping encountered in excavation work.
- C. Contracting Officer makes monthly inspections of job site record set. Approval of monthly payments is dependent on maintain current record set drawings.
- D. The Contractor shall bear all costs for printing, drafting, record keeping, etc., involved in preparation of the above record drawings.
- E. Refer to Section 00800 regarding Record Documents.

1-08 GUARANTEE

- A. Guarantee all work performed to be free from defects in workmanship and materials for the period specified in Section 00800 from date of final acceptance. Lamps are excluded from guarantee; however, one complete and operative set must be in place at time of final acceptance.
- B. Promptly remedy defects arising during this period at no expense to the Government, upon notice by the Contracting Officer.

PART 2 PRODUCTS

2-01 GENERAL

- A. Provide materials and workmanship involved in the specified installation properly applied for the purpose intended and of high quality. Contracting Officer reserves the right to reject any materials and workmanship not in accordance with those specified, either before or after installation. Provide only new materials which be have been inspected and approved by Underwriters Laboratories, Inc., and bear the appropriate U.L. label.
- B. For materials and/or equipment specified herein:
 - 1. Where specifications state “no substitution”, substitutions are not permitted.
 - 2. Where specification states “Manufacturers: Subject to compliance with requirements, provide products by one of the following:” or, if specification does not state “or approved equal”, then substitutions are only considered during the bid period and only if requested in writing and issued as an Addendum.
 - 3. If specification lists manufacturers and states “or approved equal”, then products by an alternate manufacturer may be submitted to the Contracting Officer for approval, provided all space requirements, capacities and features specified are met.

2-02 SAFETY DEVICES

- A. Provide suitable guards to enclose wire connections, electrical contacts, etc. Use sheet metal, wire mesh or insulating material as applicable, rigidly secured so equipment is readily removable.
- B. Provide warning signs to caution personnel of possible dangers.

PART 3 EXECUTION

3-01 GENERAL

- A. Inspect job site thoroughly at commencement of work and plan execution of work around conditions prevailing.
- B. Thoroughly plan execution of the work with respect to all trades. Lay out all openings and systems specifically listed herein and otherwise as required.
- C. Place and arrange equipment so that items requiring periodic service are accessible, including motors, controllers, relays, lamps and such related items.

3-02 WORKMANSHIP

- A. Utilize mechanics competent in their respective fields to install work. At all times the installation is to be under supervision of a supervisor who is thoroughly familiar with the various portions of the installation.
- B. Perform work in a finished and skilled manner in accordance with NECA 1 and best standards of the trade.

3-03 TESTING AND ADJUSTMENTS

- A. Perform tests as specified in the various Sections and/or required by applicable codes.
- B. Test auxiliary systems for proper operation and thoroughly familiarize operating personnel with the proper operating procedure of each system. Provide "along-side" instructions for operating personnel on all systems.
- C. Check and adjust equipment to operate smoothly, quietly and according to manufacturer's recommendations.
- D. Provide all testing equipment including instruments, etc. and prepare required reports.

3-04 SUPPORTS

- A. Provide supports required for electrical installation.

3-05 CLEAN-UP

- A. Maintain premises free from accumulation of waste materials rubbish caused by work herein.
- B. At the completion of the work, remove surplus materials, tools, etc., and leave the premises "broom-clean". Clean fixtures and equipment and remove paste-on tags. Clean items and leave them in a clean condition free of dust, dirt and all foreign materials, including interiors of switch and outlet boxes, panels, etc.

PART 4 COMPENSATION**4-01 GENERAL**

- A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment, and incidental items of construction furnished by the Contractor.
- B. No measurement will be made of subsidiary items of work and accessories, equipment, grout, and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work required for conformance with requirements specified on the Construction Drawings. Measurement of work required in relation to this section of the Specifications shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

- A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

**SECTION 16050
BASIC MATERIALS AND METHODS
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SECTION 16050
BASIC MATERIALS AND METHODS

PART 1 GENERAL

1-01 SUMMARY

- A. This Section includes the following electrical materials and methods to complement other Division 16 Sections:
1. Concrete equipment bases.
 2. Touchup painting.
 3. Installation requirements common to equipment specification sections.
 4. Empty raceway systems.
 5. Excavation and backfill.

1-02 DEFINITIONS

- A. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1-03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

1-04 QUALITY ASSURANCE

- A. Comply with NFPA 70 for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are Underwriters Laboratories listed and labeled, as defined in the National Electrical Code, Article 100.

1-05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site in original factory carton or bundles with labels informing about manufacturer, product name and designation and UL labeling
- B. Protect stored products from moisture and dirt, elevated above grade or floor. Do not exceed the structural capacity of floor, if stored inside.

1-06 SEQUENCING AND SCHEDULING

- A. Coordinate installing required outlet boxes and supporting devices, and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.
- C. Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

PART 2 PRODUCTS

2-01 SLEEVES

- A. The following materials are for walls and slabs above grade:
 - 1. Sleeves for cables: Epoxy fiberglass conduit.
 - 2. Sleeves for conduit: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, galvanized ends.

2-02 CONCRETE EQUIPMENT BASES

- A. Forms and Reinforcing Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- B. Concrete: 4,000 psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2-03 TOUCHUP PAINT

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 EXECUTION

3-01 EQUIPMENT INSTALLATION REQUIREMENTS

- A. Install items level and plumb.

- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- C. Give right of way to piping systems installed at a required slope.

3-02 INSTALLATION

- A. Install devices to securely and permanently fasten and support electrical components.
- B. Raceway Supports: Comply with NFPA 70 and the following requirements:
 - 1. Conform to manufacturer's recommendations for selecting and installing supports.
 - 2. Provide individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments, and other hardware necessary.
 - 3. Support parallel runs of horizontal raceways together.
- C. Miscellaneous Supports: Install PVC coated galvanized steel channel racks for mounting cabinets, panel boards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices except where components are mounted directly to structural features of adequate strength.
- D. Sleeves: Install sleeves for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install sleeves during erection of concrete and masonry walls. Provide mechanical sleeve seals where sleeves penetrate exterior walls above and below grade, and slab on grade. Conduit smaller than 1-1/4" diameter trade size do not require sleeves through an above grade slab if the conduits are installed prior to the structural slab being poured.
- E. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the structure.
 - 1. Drill holes in concrete so holes more than 3/4 inch deep do not cut main reinforcing bars.
 - 2. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.
- F. Provide dimensions for concrete pads and bases according to requirements of Section 03300, "Cast-in-Place Concrete", and provide anchor bolt plans and sizes for precise placement into cast-in-place concrete.

3-03 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill slabs, structure walls, and other surfaces necessary for electrical installations.
- B. Repair disturbed surfaces to match adjacent undisturbed surfaces.

3-04 TOUCHUP PAINTING

- A. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3-05 EMPTY RACEWAY SYSTEMS

- A. Provide empty conduit and box system, as indicated on Drawings.

3-06 MECHANICAL SLEEVE SEALS

- A. Where an underground raceway enters the structure through a membrane-waterproofed wall or floor, an approved malleable-iron, watertight entrance sealing device (such as Link-Seal by Thunderline Corp.) shall be provided. Each end of the device shall have a gland type sealing assembly with pressure bushings, which may be tightened at any time. When there is a concrete envelope specified or shown on the drawings, a sealing gland assembly shall be on the inside. The device shall be securely anchored into the masonry construction with one or more integral flanges. The membrane waterproofing shall be secured to the device in a permanently watertight manner.

3-07 EXCAVATION AND BACKFILL

- A. Excavation and backfill by Division 16 shall be in accordance Division 2.

PART 4 COMPENSATION**4-01 GENERAL**

- A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment, and incidental items of construction furnished by the Contractor.
- B. No measurement will be made of subsidiary items of work and accessories, equipment, grout, and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work required for conformance with requirements specified on the Construction Drawings. Measurement of work required in relation to this section of the Specifications shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

- A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

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**SECTION 16075
ELECTRICAL IDENTIFICATION
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SECTION 16075
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1-01 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.

1-02 REFERENCES

- A. NFPA 70 - National Electrical Code; National Fire Protection Association, 1999.

PART 2 PRODUCTS

2-01 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
 - 2. Communication cabinets.
 - 3. Safety switches.
- C. Letter Size:
 - 1. Use 3/8 inch letters for identifying individual equipment and loads.
 - 2. Use 3/4 inch letters for identifying grouped equipment and loads.
 - 3. Use 1/4 inch letters for identifying safety switches/disconnects.
- D. Labels: Embossed adhesive tape, with 3/16-inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations, and for indoor use only.

2-02 WIRE MARKERS

- A. Description: tape-type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - 2. Control Circuits: Control wire number indicated on shop drawings.

2-03 CONDUIT MARKERS

- A. Description: tape or split sleeve.
- B. Location: Furnish markers for each conduit longer than 6 feet, installed above grade or indoors.
- C. Spacing: 20 feet on center.
- D. Color:
 - 1. 480 Volt System: yellow.
 - 2. 208 Volt System: light blue.
 - 3. Telephone System: black.
 - 4. Controls System: orange.
- E. Legend:
 - 1. 480 Volt System: 480 volts.
 - 2. 208 Volt System: 120/208 volt.
 - 3. Telephone System: Tele/Comm.
 - 4. Controls System: Controls.

2-04 UNDERGROUND WARNING TAPE

- A. Description: 4 inch wide plastic tape, detectable type colored yellow with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3-01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3-02 INSTALLATION

- A. Install nameplates and labels parallel to equipment lines.
- B. Secure nameplates to equipment front using stainless steel screws.
- C. Identify underground conduits using underground warning tape. Install one tape per trench at 12 inches below finished grade.

PART 4 COMPENSATION

4-01 GENERAL

- A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment, and incidental items of construction furnished by the Contractor.

- B. No measurement will be made of subsidiary items of work and accessories, equipment, grout, and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work required for conformance with requirements specified on the Construction Drawings. Measurement of work required in relation to this section of the Specifications shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

- A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

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**SECTION 16155
EQUIPMENT WIRING
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**SECTION 16155
EQUIPMENT WIRING**

PART 1 GENERAL

1-01 SCOPE

- A. System of electrical power wiring for equipment under other Divisions of the Specifications.

PART 2 PRODUCTS

2-01 MATERIALS

- A. Provide materials of the type and quality specified in other Sections of the Specifications.

PART 3 EXECUTION

3-01 WIRING OF OTHER DIVISIONS

- A. Make connections to equipment in accordance with manufacturer's instructions.
- B. Provide power wiring and make final connections including lugs for equipment, unless specifically noted otherwise. Utilize materials and equipment as specified in other Sections of these Specifications.
- C. Providing, connecting, and testing of instrumentation and control wiring is specified as work of Division 17.

3-02 SEPARATELY MOUNTED DEVICES

- A. Mount separately mounted devices, furnished from other Divisions, that require only electrical connections for complete installation. This does not include Division 17 equipment.
- B. Separately mounted devices that form an integral part of or require non-electrical system are mounted by the respective Division prior to power connection by Division 16.
- C. Provide safety switches, manual motor starters, toggle switches, etc., as required or indicated for the proper protection and disconnect means of equipment furnished under other Divisions, where the equipment is not specifically furnished with disconnect means.

3-03 MOTORS

- A. Motor sizes indicated are approximate only and are subject to change to suit standard equipment construction of various manufacturers. Be responsible to check the electrical characteristics of motors specifically approved for installation and provide wiring and devices of proper sizes of these motors. Do not reduce any feeder or branch circuit conductor size or conduit size without prior written consent of the Contracting Officer.
- B. Check motor rotation and connect wiring for proper motor rotation. Make connections as required.
- C. Where fusing is required, provide fusible switch and fusing in accordance with the types, sizes and characteristics of fuses required by the Listing Agency.

- D. Confirm with equipment manufacturers prior to installing safety switches and provide fused protection in safety switches where fuses are required by the UL Listing of the equipment.

PART 4 COMPENSATION

4-01 GENERAL

- A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment, and incidental items of construction furnished by the Contractor.
- B. No measurement will be made of subsidiary items of work and accessories, equipment, grout, and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work required for conformance with requirements specified on the Construction Drawings. Measurement of work required in relation to this section of the Specifications shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

- A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

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**SECTION 17000
TELEMETRY SYSTEM**

PART 1 GENERAL

1-01 DESCRIPTION

- A. Provide a Telemetry System that complies with the requirements of this Section. The Telemetry System contains the control section and metering and monitoring equipment for operation and monitoring of improvements to be constructed at the existing Ross Road Wastewater Treatment Facility. The Telemetry System also includes the Remote Telemetry Unit and radio communication equipment and software necessary for integration of the Upper Camp Creek into the existing SCADA system located at the Short Fork Wastewater Treatment Facility (approximately 10 miles south-southwest of the existing Ross Road Wastewater Treatment Facility). The Telemetry System shall be integrated completely with the electrical system specified in Section 16000 and as indicated on the Drawings. The Contractor shall be completely responsible for furnishing a complete and functional Telemetry System as specified herein and indicated on the Drawings.
- B. The furnished Telemetry System described herein shall be fully integrated with all equipment furnished under Division 16 and the existing equipment to be maintained at the Ross Road Wastewater Treatment Facility.

1-02 SUBMITTALS

- A. See Section 00800 – Administrative Requirements, for submittal procedures.
- B. In the preparation of submittal data for the Telemetry System use submittal data and installation data for the instrumentation and equipment “approved for use” on the project. Obtain data for the instrumentation and equipment from the system supplier and coordinate characteristics of measuring and transmitting devices with the equipment used in the controls section. This coordination must be completed before preparing submittal on the Telemetry System.

1-03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products of the complexity and quality specified in this section with minimum ten years documented experience and with service facilities within 250 miles of the Project. Manufacturer maintains service department and parts department capable of providing service within eight hours of notification, 24 hours a day, 365 days a year. Suppliers employing outside organizations for “ON CALL” service are not acceptable.
- B. Products: Listed and classified by Underwriters Laboratories, Inc., for the completed assembly.

1-04 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

1-05 WARRANTY

- A. Provide warranty for equipment and installation in accordance with the Requirements of Division 1.

PART 2 PRODUCTS**2-01 DESCRIPTION**

- A. Unless indicated otherwise on the Drawings, components of the Telemetry System shall be housed in a NEMA Type 3R, non walk-in enclosure. The enclosure shall be housed adjacent to the enclosure(s) provided under Section 16000.
- B. Finish: Manufacturer's standard gray enamel.
- C. Wiring: Control wiring within the motor control sections uses wiring UL Listed for that purpose. Control wiring in motor controller modules is wired to pull-apart terminal blocks within the modules for easy module removal. Install terminal blocks situated or angled to provide ready access for wiring. Wiring is color coded and marked alpha-numerically at each end using adhesive wire markers. Wires having different functions within the Center have different marks. Submit wiring diagram for each module, identifying the control and power wires and terminals; submit elevation-type drawing of each control module indicating the location and wire identity for each conductor termination.
- D. Combination Motor Controllers: Motor circuit protectors (magnetic only) with motor controller of the type indicated on the Drawings. Each motor controller is provided with thermal compensated thermal overload relay; each controller has three overload elements, sized in accordance with the actual motor nameplate amperes. Overload relay has alarm contact. Each controller has an individual 480:120 volts control power transformer; control power transformer is sized for 25 va plus the va requirement for normal operation. Controller has additional two normally open and two normally closed auxiliary contacts for interlocks. Module housing the combination motor controller is sized sufficiently large to house the motor monitor current transformer.
- E. Variable Frequency Drives: Variable Frequency Drives shall be equal to Yaskawa Model Number GPD506, or equal as approved by the Contracting Officer, and shall come complete with a 5% line reactor to attenuate harmonics and provide protection from transients. Furnish Variable Frequency Drives (VFD's) in the number and voltages shown on the plans and with the current ratings according to application requirements. VFD's shall be UL listed. VFD Systems shall be UL508.

1. The VFD systems shall be compatible with the existing motors to be connected at the Ross Road Wastewater Treatment Facility. Additionally, the VFD systems shall be compatible with any standard NEMA B design 3-phase induction motor and shall be sized to insure the motor full load amps do not exceed the VFD's continuous current rating.
2. To minimize the impact during construction and make optimum use of training and spare parts resources, supply responsibility shall be as follows:
 - a. Specified VFD's shall be supplied by one manufacturer.
 - b. Like components of all VFD Systems, although for different services, shall be interchangeable products of one manufacturer.
 - c. VFD Systems shall be microprocessor based, fully transistorized with a conservatively rated 3 phase, full wave diode bridge input and a PWM sine-coded output waveform. The input diode bridge shall offer complete immunity against voltage dips, line noise and harmonics. The output transistors must be of the IGBT type (Insulated Gate Bipolar Transistor) to facilitate noiseless motor operation. The VFD's shall be tested and rated for a minimum of 20 years Mean Time Between Failure (MTBF). Provide manufacturers typical test results or calculations with submittal to verify MTBF.
 - d. To minimize electrical and acoustical noise, and to eliminate low speed cogging, a minimum switching frequency of 15 kHz shall be used. The VFD shall not "cog" at frequencies above 1.5Hz. There shall be no sudden frequency shifts and associated acoustical noise shifts as the output frequency is varied between 1.5 and 60 hz.
3. The VFD's input displacement power factor shall be 0.98 or better over the entire operating frequency and load range.
4. Efficiency shall be measured at 96% minimum at rated load. Provide manufacturers typical test results or calculations with submittal to verify efficiency and power factor.
5. All VFD's shall have, but not be limited to the following protective features:
 - a. Solid state output ground fault protection shall be provided.
 - b. Adaptive electronic motor overload protection shall be provided which shall protect both the motor and the VFD at all frequencies. Electronic thermal overload circuits which only properly protect the motor at full speed shall not be acceptable. The VFD shall sense the load and speed and shall recalibrate the thermal trip curve to insure low speed motor protection. The initial trip point shall be adjustable from at least 40% of the VFD continuous rating to account for motor magnetizing current.
 - c. Input surge protection shall be performed by MOV's (metal oxide varistors) in accordance with ANSI Specification C62.41-1980.
6. Opto-coupled isolated control inputs shall be provided. The motor speed shall be directly proportional, or inversely proportional to 0-10 VDC, 4-20 mA, and variable resistance signals. In addition, the VFD shall have independent settings

adjustable on the fly for input reference offset (positive and negative) and gain to facilitate signal setting/matching. An optional 3-15 psi input signal capability shall be provided where required for pneumatic speed control.

7. The VFD shall employ modular PC board design for ease of troubleshooting. All connectors must be polarized type and clearly marked on both the connector and PC board to ensure proper connection.
8. VFD operation options shall be programmable, and include at a minimum the following functions:
 - a. Automatic speed holding if speed reference signal is lost.
 - b. DC injection braking at start for anti-windmilling protection with independently adjustable current and time.
 - c. Adjustable hand jog.
 - d. Automatic voltage reduction with load reduction, adjustable on the fly to maximize energy savings, without sacrificing acceleration and deceleration torque.
 - e. 15 preset V/Hz patterns, 4 of which are designed for constant torque loads, 4 of which are designed for variable torque loads, and 2 of which are designed for high speed loads. In addition, user shall have the option of programming a customized pattern simply by entering the desired endpoints. Programming methods requiring separate boost and gain settings are not acceptable due to interactive nature of adjustments.
 - f. Electronic motor reversing.
 - g. Three independently adjustable prohibited frequencies with adjustable bandwidth.
 - h. Independently adjustable levels to engage stall prevention function during acceleration, deceleration, or running.
9. The VFD shall provide the following operational features:
 - a. "Speed search" transfer. The VFD shall have the ability to start from bypass or fault trip into a spinning load without stopping the motor or creating a fault condition. The VFD shall match the motor's speed and then drive the motor to its proper speed reference.
 - b. Programmable current limit.
 - c. Programmable, "intelligent" auto-restart function. Intelligent Auto-restart precludes any attempt at restart in the event of trips typically indicative of component failure.
 - d. Minimum of 40:1 controllable, constant torque speed range.
 - e. Minimum of 2 second power loss ride-through capability, for units 5 HP and larger. In the event of a loss of three-phase power lasting 2 seconds or less, the VFD must maintain operation and prevent nuisance trips upon return of power.
10. The VFD shall be suitable for installation under the conditions of service indicated on the Drawings.

11. The following fault conditions shall cause the VFD to shut off and shall be annunciated via alpha-numeric fault diagnostics (remote annunciation shall be available with a form 'C' fault contact):
 - a. Blown fuse.
 - b. Instantaneous overcurrent trip.
 - c. DC bus overvoltage.
 - d. DC bus undervoltage, phase loss protection.
 - e. Excessive ambient, VFD heatsink overtemperature.
 - f. External fault input.
 - g. Internally diagnosed, control failure.
 - h. Motor thermal overload.
 - i. VFD thermal overload.
 - j. Programmable "Shear pin" current trip.
 12. Programming/Operator Station.
 - a. Include alpha-numeric display of frequency reference, output frequency, output current (accurate +/-3%, regardless of output frequency), output voltage, DC bus voltage, output power (kW), input terminal status, output terminal status, LED lamp check, and EEPROM number.
 - b. Alpha-numeric display of faults. Up to 4 sequential faults shall be retained in non-volatile memory (maintained even after removal of input power).
 13. VFD Systems shall be mounted in a NEMA 1 positive pressure blown & filtered enclosure with the following additional equipment requirements:
 - a. Door mounted digital operator control station.
 - b. Door interlocked input circuit breaker.
 - c. Contactor bypass to isolate the VFD. The VFD must be able to be run for testing purposes while the motor is operating in the bypass mode.
 - d. Output 3-phase current sensing overload relay to provide motor protection in either the VFD or bypass mode.
 14. Testing
 - a. VFD PC Boards shall be cycle tested at 70 degrees C for 96 hours.
 - b. VFD PC Boards shall be spray and brush coated in accordance with MIL-1-46058C.
 - c. VFD Systems shall be full load tested prior to shipment.
- F. Transient Voltage Suppression System (TVSS): The TVSS is mounted as indicated on the Drawings. The TVSS is connected to the main bus with conductors of size and of no greater length than indicated in the TVSS manufacturer's installation instructions.
1. TVSS provides transient voltage surge suppression and electrical high frequency noise filtering, in accordance with. Unit is designed for parallel connection to the switchboard system. TVSS unit uses selenium cells and metal oxide varistors to achieve its performance. Products using gas tubes, spark gaps, silicon avalanche

diodes or other components which under failed conditions would cause system failure.

2. Manufacturer qualifications: The product of a manufacturer engaged in the commercial design and manufacture of the type of product described herein for a minimum five years.
3. Standards: Product complies with the requirements of the following:
 - a. ANSI/IEEE C62.41-1991.
 - b. ANSI/IEEE C62.1 and C62.11.
 - c. UL 489 and UL 198.
 - d. UL 1449 (Listed as a transient voltage surge suppressor).
 - e. UL 1283 (Listed as an electromagnetic interference filter).
 - f. NEMA LS 1-1992 (maximum continuous operating voltage).
4. Operating Voltage: 480 volts, 3 phase, 3 wire + ground.
5. Maximum Continuous Operating Voltage (MCOV): greater than 115 percent of nominal voltage for all products. All suppression filter systems comply with NEMA LS 1-1992.
6. Frequency: Operating frequency range of 47 – 63 Hertz.
7. Protection Modes: all phases – phase to ground; all phases – phase to neutral; all phases – phase to phase; and neutral to ground.
8. Rated Single Pulse Surge Current Capacity: at rated voltage, no less than:

250,000 A	Line to Neutral
225,000 A	Line to Ground
225,000 A	Line to Line
225,000 A	Neutral to Ground
9. Tested Single Pulse Surge Current Capacity: Filter system is designed to withstand a single pulse surge current up to 150 percent of the design rating and tested at an independent test laboratory. In the absence of testing facilities capable of such testing, testing of individual components or sub-assemblies within a mode is accepted by ANSI C62.41-1991; the testing includes a Category C1 surge test followed by a second Category C1 test. The test results demonstrate the unit does not degrade by more than 10 percent from the initial test.
10. Clamping Voltage: Suppression filter system clamping voltages are in compliance NEMA LS 1-1992. Maximum clamping voltages for 480 volts unit with integral fused disconnect are:

Mode		B3/C1 Comb. Wave
L -	L	800
L -	N	780
L -	G	1500

11. High Frequency Filter: EMI-RFI noise rejection or attenuation values comply with test and evaluation procedures of NEMA LS 1-1992.

Attenuation Frequency	100kHz	1MHz	10MHz	100MHz
Insertion loss (ratio)	50:1	350:1	500:1	250:1
Insertion loss (dB)	34	51	54	48

 12. Suppression Filter System: minimum noise attenuation values are:

Attenuation Frequency	100kHz	1MHz	10MHz	100MHz
Insertion loss (ratio)	355:1	50K:1	500K:1	1000K:1
Insertion loss (dB)	51	94	114	120

 13. Overcurrent Protection: Unit includes coordinated UL 489 or UL 198 listed or recognized overcurrent protection devices; if fuses are used unit incorporates non-encapsulated, field replaceable fuses.

 14. Documentation: Provide product data including equipment manual; electrical and mechanical drawings indicated dimensions weights, mounting provisions, connection details and layout diagram; certified tests of UL1449 Listing/Clamp Voltages and NEMA LS 1 compliance; certified single pulse surge current capacity testing; minimum repetitive surge current capacity testing; list of customer-replaceable spare parts; and diagnostic signature card for the unit shipped for installation.

 15. Status Indicators: Unit has long-life, solid state, externally visible status indicators that monitor the on-line status of each phase of the unit.

 16. TVSS system shall be Current Technology Model #SEL150-480-3DG or equal as approved by the Contracting Officer.
- G. Control Sequence: The existing Ross Road pumps no.1 and no.2 shall be the primary pumps controlled by the proposed duplex pump controller (DC1-2) and alternate on each cycle. Existing Ross Road lift pump no.3 shall be utilized as an emergency pump controlled by the proposed simplex pump controller (SC-3) and shall operate only during a high wet well condition when in the automatic mode. The duplex and simplex pump controllers shall receive start/stop commands from the level meter/controller (LMC1-3). The level meter/controller shall receive an analog signal (4-20mA) from the existing Multitrode Level Control Unit. Lift pumps no.1 and no.2 shall be equipped with variable frequency drive starters which will receive speed reference signals from the frequency drive controller (FDC).

2-02 COMPONENTS

- A. PHASE FAILURE PHASE UNBALANCE AND PHASE REVERSAL RELAY - Relay shall be of the negative sequence filter type. The filter shall have a high internal impedance for accurate voltage following. The unit shall be of the voltage comparative type with preset point that will turnoff or de-energize the output relay after 5 seconds.

- B. DUPLEX PUMP CONTROLLER - Duplex Pump Controller shall be equal to CSI Model Number DC101, or equal as approved by the Contracting Officer. Provide a Duplex Controller to control two pumps, that includes the following control functions:

1. OPERATORS AND FRONT PANEL INDICATORS (for each pump)
 - a. Manual-Off-Automatic selector switch
 - b. Green "Pump Running" pilot light
 - c. Red "Pump Failure" pilot light
 - d. Red "Pump Seal Failure" pilot light (if required)
2. A Pump NO. 1 LEAD-ALTERNATE-Pump NO. 2 LEAD sequence selector switch to select either pump as lead pump or to select that the pumps alternate as lead pump on each call for cycle.
3. Signal inputs for: stop, lead pump start, lag pump start and high/low alarm. The sensors shall be optically isolated and operate on 24 Vdc with a maximum current of 16 ma for intrinsic safety.
4. Pilot light indicators for each signal input described above, as well as, pump no.1 and no.2 running inputs.
5. The controller shall operate a pump based upon various combinations of signal inputs. Normal operation shall operate pumps in the following automatic sequence:

With no signal inputs activated and both pumps off, a stop input activation shall not cause a pump to operate. With a stop input activated and a lead start input activated the controller shall start a single pump and the pump shall operate until the lead start and stop inputs are deactivated. With both the stop and lead start inputs activated and one pump operating, a lag start input being activated shall operate the second pump. Both pump shall operate until the lag start, lead start and stop inputs are deactivated.

In the event an input device(s) fails to activate the controller shall operate as follows:

With a stop input device failure, the controller shall operate a single pump based upon the status of the lead start input and a field adjustable short cycle delay. The short cycle delay shall keep the pump operating after the start input deactivates for the delay time setting. If the stop input device fails to activate, the controller shall operate one pump as described above with the lag start input starting the second pump. Both pumps shall operate until both start inputs are deactivated and the individual pump short cycle delays have expired. In the event both the stop and lead start inputs fail to operate the controller shall operate both pumps based upon the status of the lag start input and the individual pump short cycle delay timers. Both pumps shall operate until the lag start input is deactivated and the individual pump short cycle delays have expired. If all input devices fail except the high/low alarm input, the controller shall operate both pumps based upon the status of the high/low alarm input and the individual pump short cycle delay timers. Both pumps shall operate until the high/low alarm input is deactivated and the individual pump short cycle delays have expired.

6. A field adjustable failure time delay for each pump, in the range of 5 seconds to 6½ minutes, to start the lag pump at the lead pump start point if the lead pump fails or if the lead pump selector switch is placed in the off position. If a pump fails, the remaining functional pump shall remain the lead pump on future cycles. The failed pump shall only be called to operate at the lag pump operating point. Normal pump alternation shall resume when the failure condition is corrected and the pump has been reset.
 7. Soft stop feature to require the pumps to stop three (3) seconds apart during the condition that both pumps are running when signaled to stop. Soft start feature to require the pumps to start three (3) seconds apart during conditions that the lead and lag pumps are called for simultaneously.
 8. Individual field adjustable time controls to delay starting each pump in the automatic mode after power failure or during initial startup.
 9. Pump failure, pump seal failure, and high/low alarm red pilot lights shall flash when activated. Provide field selectable controls to allow the seal failure indicator to burn steady when activated.
 10. Manual override inputs for each pump, which can be used to manually override the duplex control's pump outputs when the controls are in the Auto mode. Inputs shall be provided to start or stop each pump from a remote location.
 11. Provide a selectable improper sequence alarm to activate the common alarm in the event the control inputs are activated in the wrong order. The proper order shall be: Stop, Lead Start, Lag Start. The High or Low alarm shall not be included in the improper sequence test. Provide a selectable Lag Stop Level control to allow the lag pump to stop based upon the status of the lead start level input.
 12. Provide automatic pump alternation on pump failure and seal failure when a failure condition is detected and the pumps are in the automatic mode. The failed pump shall be made the lag pump on future cycles until the failure condition is corrected. Pump failure shall require manual reset to clear the failure condition and the seal failure condition shall clear when the failure condition clears. Provide field selectable controls to allow the seal failure condition to not automatically alternate the pumps.
 13. An exterior alarm light output which will flash the light brightly during any common alarm condition which include pump failure, seal failure, improper sequence, and high/low alarm. The output shall allow the light to dim glow under normal conditions to indicate that power is on and the lamp is good. A normally open common alarm output contact shall be energized by these alarm conditions. Provide selectable controls to prevent the seal failure input from activating the common alarm output and alarm light.
 14. A lamp test feature to light all of the front panel pilot lights.
- C. MOTOR MONITOR - Motor Monitors shall be equal to CSI Model Number MM101, or equal as approved by the Contracting Officer. Provide an electronic solid state Motor

Monitor powered by 120VAC, that will accept a zero (0) to five (5) amp input signal, condition the signal to perform ON/OFF or OPEN/CLOSE discrete dry type setpoint contact conditions based on the input signal value. The Motor Monitor shall have the following features.

1. Provide an LCD readout meter providing field adjustable scales of 0-25.0, 0-50.0, 0-100.0, 0-250, 0-500 and 0-1000 to accurately indicate the motor full load current using the 0-5 amp input signal.
2. The Monitor shall be capable of displaying motor total running time up to 99,999.9 hours and be provided with reset capability from the rear of the monitor plus come complete with automatic rechargeable battery backup with 5 year duration.
3. Provide two (2) separate field adjustable setpoints, each with discrete, isolated sealed SPDT relay output contacts. The setting of each setpoint shall be adjustable throughout the complete signal range from the front of the Monitor. Each set point shall be provided with a field adjustable "ON" and "OFF" time delay, adjustable from zero to 15 seconds. The actual setting of each setpoint shall be able to be displayed on the LCD readout at any time. An LED indicator shall be provided for each setpoint and shall operate as follows:

Setpoint No. 1 - When setpoint is timing, the indicator shall burn amber. After timing period and current is at or above setpoint, indicator shall burn green.

Setpoint No. 2 - When set point is timing, the indicator shall burn amber. After set timing period and current is at or above setpoint, indicator shall burn red.

- D. CURRENT TRANSFORMER - Current transformers insulation class shall be 0.6KV BIL 10KV full wave. They shall be manufactured to meet the requirements of UL1244 and have a minimum accuracy of 60Hz of 2%. Current transformers shall be provided with brass stud terminals and mounting bracket.
- E. SIMPLEX CONTROLLER - Simplex Pump Controller shall be equal to CSI Model Number SC101, or equal as approved by the Contracting Officer. Provide a Simplex Pump Controller including the following features:
 1. Manual-Off-Automatic selector switch, green "Pump Running" pilot light, red "Pump Failure" pilot light, and a red "High Level" pilot light.
 2. Pump control inputs shall be optically isolated and their power limited to 24 vdc with a maximum current of 16 mada for intrinsic safety.
 3. Provide a field adjustable time delay to start the pump after pump "Call For" signal is received. This time delay shall be field adjustable to occur each time the pump is called to operate for backspin protection. The timing period shall be adjustable from 13 to 165 seconds.
 4. Provide Common Alarm controls that include a dry-contact output and flashing exterior alarm light output. The controls shall activate the dry-contact output and

flash the alarm light output during pump failure, pump seal failure or high level conditions.

5. Provide a pump failure dry-contact output and flashing alarm indicator. The failure controls shall energize the dry-contact output, flash the pump failure alarm indicator and energize the common alarm circuitry if the pump fails to run when called for while in the Automatic mode of operation.
 6. The Manual-Off-Automatic switch shall bypass all of the controls and energize the pump call-for dry-contact output when placed in the Manual position. In the Manual and Off positions the pump failure alarm shall be disabled.
 7. The Manual-Off-Automatic switch shall be used to reset a pump failure alarm after the failure condition has been cleared, by manually switching the pump to the Off position and back to Automatic.
 8. Provide a pump seal failure alarm and indicator that shall flash the indicator and common alarm light output and close the seal failure dry-contact output and common alarm dry-contact output during a seal failure condition. The seal failure controls shall have a 3 to 9 second field adjustable time delay before activation. The seal failure alarm shall automatically reset when the condition clears.
 9. Provide an input alarm to indicate high level condition. Provide a red panel indicator and dry-contact output for the alarm. On alarm, flash the indicator, close the alarm dry-contact output and energize the Common Alarm circuitry.
 10. Provide a field adjustable time delay to prevent pump failure signal from being activated until the controller has had time to receive a pump "Running" signal. The timing range shall be adjustable from 5 seconds to 5.25 minutes. During pump failure conditions provide the following controls.
 - a. Red "Pump Failure" pilot light on face of controller shall flash when activated.
 - b. Activate the Common Alarm relay and exterior flashing light output.
 - c. Provide a dry type contact closure for remote alarming that will activate during "Pump Failure" condition.
 11. The Simplex Pump Controller shall be solid state and easily replaceable. Conventional relay and/or timer construction is not acceptable.
 12. Provide a lamp test feature to light all front panel pilot lights.
- F. FREQUENCY DRIVE CONTROLLER - Frequency Drive Controller shall be equal to CSI Model Number FDC101, or equal as approved by the Contracting Officer. Provide an electronic solid state controller that can be field configured or programmed to control the speed of up to four Variable Frequency Drives. The controller shall have the following features:
1. Provide four separate isolated output signals, each producing a four (4) to twenty (20) ma output to signal or pace each drive and motor.

2. Provide a 3½ digit LED readout meter on face of controller that can be field calibrated in feet, psi, temperature, etc. This readout shall indicate the value of an input 4-20 mdc signal. The controller shall monitor this input signal and condition the four analog output signals based on this signal and the individual field set Low and High adjustment points.
 3. Provide four input points to receive a dry contact positive running signal from each of four motors.
 4. The operator shall be able to select a signal level at which point the drive will operate at minimum speed and a signal level at which point the drive will operate at maximum speed when the controller is receiving a positive motor running signal for one motor. As the input signal increases from the minimum setting to the maximum setting, the drive shall increase in speed linearly. The operator shall be able to select individual minimum and maximum speed setting with one, two, three and four motors operating.
 5. Provide a 3½ digit LED readout meter on face of controller indicating analog output signals to Variable Frequency Drives. Provide an inconspicuous selector switch to drive the analog output signals to four (4) or twenty (20) ma for testing purposes.
 6. Provide four individual green LED pilot lights to indicate when 1, 2, 3 or 4 motor running input signals are being received.
 7. Provide a Lamp Test feature to illuminate the front panel pilot lights and all digital display segments via a remote pushbutton.
 8. In general, the operator shall be able to select four (4) individual speed ranges over the complete range of the input analog signal being received, selecting a Low and High speed setting for each range depending on whether 1, 2, 3 or 4 motors are operating.
 9. The actual setting of each set point shall be able to be displayed on the digital readout at any time and the setting of each set point shall be adjustable, throughout the complete signal range, from the front of the controller.
- G. FLOW CONTROLLER – Flow Controller shall be equal to CSI Model Number MPCT-6, or equal as approved by the Contracting Officer. Provide an electronic, solid-state, proportional Flow Controller that will accept a four (4) to twenty (20) ma or a one (1) to five (5) VDC signal, condition the signal to provide a valid basis for control and then perform ON/OFF or OPEN/CLOSE discrete dry type set point contact conditions based on the input value of the analog input signal. The Level Meter/Controller shall have the following features,
1. Provided with a 3½ digit LED (or LCD if required) readout meter in gallons per minute. The display shall be capable of being calibrated from the front of the unit and have a maximum display of 10,000, with a decimal point that is user selectable.

2. The display zero indication shall be able to be offset anywhere within the range of the meter, with a minimum range of 60 counts.
 3. Provide 6 or 12 separate setpoints each with discrete, isolated sealed SPDT relay output contacts.
 4. Provide excitation voltage to drive a transducer/transmitter and condition its output signal to provide a continuous display of level.
 5. The setpoints shall be field adjustable to operate on rising above or falling below the setpoint.
 6. An LED indicator shall be provided for each setpoint to indicate when it is activated.
 7. The actual setting of each setpoint shall be able to be displayed on the digital readout at any time.
 8. The setting of each setpoint shall be adjustable throughout the complete signal range from the front of the meter/controller.
 9. Provide a means of manually ramping the meter/controller, up and down, throughout its complete signal range, to test the operation of the setpoints.
 10. The meter/controller shall come complete with a four (4) to twenty (20) ma or a one (1) to five (5) VDC output signal for additional monitoring and control devices.
 11. Provide a Lamp Test feature to test the digital display and individual LED setpoint indicators.
- H. DC POWER SUPPLY _ Power supplies shall be for 120 VAC primary and 13.5 VDC secondary and shall have a frequency range of 47-440 Hz with an inrush current of 35A. Secondary adjustment range shall be $\pm 10\%$ minimum. Line and Load regulation shall be $\pm 0.3\%$. Output ripple shall be no more than 180mV. Voltage Tolerance shall be $\pm 1\%$. Over voltage protection shall clamp at 115-135% and short circuit protection shall be continuous, self-recovering.
- I. UNINTERRUPTIBLE POWER SUPPLY - Uninterruptible Power Supply shall be equal to CSI Model Number UPS101, or equal as approved by the Contracting Officer. Provide a battery charger for 12 VDC Sealed Lead Acid rechargeable batteries with an optional 24 VDC isolated output. The maximum battery current charging current is 2.9 amps for a completely dead battery and typically less than 0.4 amps for battery voltages over 10 VDC. Trickle charging shall stop at a battery voltage of 13.5 VDC. The unit shall operate on 13.8 VDC with a current rating of up to 11 amps. Provide an optional, integral battery backed up 24 VDC option that is capable of being field mounted onto the unit, for powering external 4-20 mA loops or other instrumentation of up to 1 amp maximum load and shall be isolated from the input power supply if necessary. Provide quick-connect terminal blocks for all connectors. Provide optically isolated, solid-state

alarm outputs of the Open Collector, Darlington NPN transistor type for High and Low input power supply voltage.

- J. RADIO MODEM TRANSCEIVERS (RMT) - Provide RMT complete with antenna, coaxial cable, and mast for communication with the Owner's existing SCADA system. A lightning arrester equal to CSI Model Number AP101 shall be provided between the RMT and antenna. The Radio Signal Path Survey described below shall determine the antenna design. After installation, provide written report of all RMT system settings including RMT serial number, frequency Radio Modem Transceiver shall , power setting, radio signal strength to CTU, repeater sites (if required), antenna model, and antenna mounting height above grade. To assure communication with the existing SCADA system, and to assure compliance with FCC regulations, RMT shall be equal to DataRadio Number T-96SR.
- K. Radio Signal Path Survey: Provide a radio signal path survey to measure radio signal strength and to properly design transceivers, antennas, masts, and any other equipment necessary for data radio communication between the CTU and RTU. Contractor shall provide radio repeaters as necessary for this purpose. The existing facilities will be made available for installation of repeater equipment including 120 VAC power if already existing. To assure reliable radio data communication, the minimum acceptable signal strength between RTU sites necessary for communication links shall be -85 dB. Provide a Radio Path Survey Report to the engineer including all measured field data, survey equipment used, site location including latitude and longitude of all sites, and recommended radio equipment and antennas necessary to achieve the required radio signal strength. This report shall be provided to the Contracting Officer for review prior to the installation of any radio equipment. Acceptance of the Radio Path Survey Report shall in no way absolve the system provider from the responsibility for provision of reliable radio communication system required.
- L. Licensing: The provider shall submit an application to the Federal Communications Commission (FCC) in the name of the system owner for a radio frequency license and a license issued for the operation of VHF or UHF narrow band radio data frequencies. All application fees and processing fees for this purpose shall be the responsibility of the system provider.
- M. REMOTE TELEMETRY UNIT (RTU) - RTU shall be equal to CSI Model Number RTU103, or equal as approved by the Contracting Officer. Provide an RTU complete with software and programming for integration into the owner's existing SCADA system. The existing Central Telemetry Unit and Human Machine Interface programming shall be modified to incorporate communications and monitoring of the new Upper Camp Creek RTU described herein. RTU hardware shall be provided for the following inputs and outputs:
- Pump Failures (Quantity of 3)
 - Pump Running (Quantity of 3)
 - Pump Seal Failures (Quantity of 3)
 - High Wet-well Level Alarm
 - Level Transducer Failure
 - Common Alarm
 - Power Failure
 - Low RTU Battery Alarm

Wet-well Level
 Wet-well Effluent Flow Rate
 Metering Station Flow Rate

- N. DC power supplies and UPS with batteries necessary for RTU and radio communications shall be provided of sufficient size to operate the RTU and radio equipment. All components shall be suitable for installation in outdoor environment within NEMA 3R enclosure.
- O. DIGITAL INDICATOR - Flow/Level shall be displayed by a 3 ½ digit LCD indicator powered by a 4-20 maDC loop. The unit shall be scaled to match Flow/Level of the process being measured. The indicator shall be as manufactured by Texmate, Inc., or an approved equal.
- P. UNIVERSAL MODULE - Universal Module shall be equal to CSI Model Number UM101, or equal as approved by the Contracting Officer. Provide a Universal Module(s) including the following features and functions.
1. The Module shall be supplied with any combination of four selector switches, pilot lights or pushbuttons.
 2. Pushbuttons, if used, shall have a rating of 3 amps at 125 volts
 3. Selector Switches, if used, shall have a rating of 3 amps at 125 volts
 4. Pilot Lights, if used, shall be multicolored LED type and have a 24 volt rating
 5. The pilot lights shall be capable of being tested for operation via remote pushbutton.
 6. The Module shall be a flush, front of panel mounted device.
- Q. MAGNETIC FLOW METER - The flow metering equipment shall conform to the following specification:

The Magnetic Flow Meter Sensor shall operate on the principle of Faraday's Law, whereby a conducting media passing through a magnetic field induces a Voltage. This Voltage, which is proportional to the velocity of conducting media, is measured across the Sensor's electrodes and produces a signal proportional to volumetric flow.

The flow tube of the Sensor shall be made of AISI 304 stainless steel with carbon steel flanges. The liner shall be NSF approved fusion-bonded epoxy and the electrodes shall be 316 stainless steel and shall be pointed. The Sensor shall be to NEMA 6. Grounding rings shall be included.

The Signal Converter shall drive the Sensor with a pulsed DC coil excitation and provide automatic zero and span stability. The converter shall be field programmable without the use of external calibrators. Maximum volumetric flow range shall be continuously adjustable, represented by mean velocities from 0-0.2 fps to 0-34 fps. The instantaneous flow rate and the totalized flow shall be displayed on the converter. The converter shall

have zero return when the electrodes are uncovered. The converter shall be mounted either on the flow sensor or wall mounted as shown in the plans.

The amplified output signal shall represent volumetric flow to an accuracy of better than +/- 0.5 of actual flow when installed with straight pipe lengths of 5 pipe diameters upstream and 2 downstream from the Sensor.

The Flow Meter shall be 8 inch size and shall have an output signal of 4-20 mA corresponding to 0-10,000 GPM flow.

The flow Meter shall be Water Specialties UM-06-R-8, or equal as approved by the Contracting Officer.

- R. FLOW METER BURN-OFF UNIT - Flow Meter Burn-Off Unit shall be equal to CSI Model Number FMBO, or equal as approved by the Contracting Officer. Provide an automatic, low voltage, flowtube electrode cleaner (burn-off until) to help maintain proper flow meter operation in conditions where electrode coating is a problem. The unit shall be mounted in a UL listed, NEMA 4X, fiberglass enclosure with corrosion resistant external manual controls. The unit shall operate on 120 VAC and automatically supply a cleaning voltage to the flowtube electrodes at periodic intervals, while protecting the flow transmitter by disconnecting it from the flowtube during the cleaning procedure. The unit shall also have local manual cleaning capability and the provision for an optional remotely mounted manual cleaning pushbutton. The unit shall not require any field calibration or periodic maintenance other than checking to see that conduits are properly sealed to prevent environmental contaminants from entering the enclosure.
- T. ULTRASONIC LEVEL TRANSMITTER - Ultrasonic Level Transmitter shall be a sealed 4-20mA loop powered unit specifically designed for use in waster water and effluent treatment plant applications. The transmitter shall be ATEX certified Intrinsically Safe for use in Zone 0 areas and shall be fitted with up to 50m of two core cable for installation in wet-wells and over open channel flow structures. The transmitter shall be capable of being connected directly to a plant control system used with a transmitter control unit to allow user programmable control functionality. Calibration and programming shall be accomplished through the control unit, or alternatively, if the transmitter is connected directly to the plant control system, using a HART compatible programmer or software tool. The transmitter shall comply with the following:

OPERATING

Range: 0.3 to 12m
 Accuracy: 0.25% of range or +/-3mm, whichever greater
 Resolution: 1mm
 Pressure: 0bar to 3bar
 Temperature: -40°C to +60°C wetside, -40°C to +60°C ambient

ELECTRICAL

Supply voltage: 12V dc to 40V dc (non-hazardous area)
 12V dc to 30V dc (hazardous area)
 Output: 4-20mA

MECHANICAL

Body Material: UPVC (stabilized)
 Cable: PVC two core shielded cable

- U. PARSHALL FLUME - The flume shall be a molded structure of fiberglass reinforced polyester. The interior surface shall have a ten (10) to fifteen (15) mil white ultraviolet-resistant gel-coat backed by a rich layer of resin and chopped glass forming a water and chemical resistant surface. The remainder of the laminate shall be fiberglass reinforced polyester containing not less than thirty percent (30%) glass content by weight. The thickness of the walls and floor of the flume shall not be less than one-fourth (1/4"), and shall be reinforced with stiffeners down the sides and across the bottom on flumes with a throat width of three inches (3") or greater. The stiffeners shall be joined together at the knee to form a rigid dimensionally stable flume.

The flume shall be provided with anchoring clips fastened along the side of the flume to be used for anchorage into the concrete. Stiffeners made of FRP angle/channel shall be provided across the top of the flume to provide structural support during shipping and installation.

Flume dimensions shall be in accordance with the United States Department of Interior, Water Measurement Manual, latest revision. The flume shall be as manufactured by TRACON, Inc. of Roswell, Georgia, or equal as approved by the Contracting Officer.

The flume shall be provided with integral staff gauge.

- V. COMMON ALARM LIGHT - Provide an Alarm Light mounted as indicated on the drawings. The light shall be RAB catalog number VBR100/GL100PGR or equal. The alarm light shall burn dim and steady during normal conditions to indicate electrical power "ON" and lamp good. During any alarm condition the alarm light shall flash brightly.

PART 3 EXECUTION**3-01 INSTALLATION**

- A. Install the Telemetry System housing adjacent to and integral with all component cabinets installed under Section 16000. Install the Telemetry System housing plumb, square and level.
- B. Close all openings in the top or side of sections not required for conduits or manufacturer's ventilation requirements.
- C. Neatly train conductors throughout the control center, supporting and binding the conductors with tie-wraps or similar product.
- D. Set motor circuit protectors to the lowest setting which permits motor starting without nuisance tripping.
- E. Field test all control center components.

- F. Comply with manufacturers' recommendations in the installation and adjustment of instrumentation and control devices.

3-02 ENGINEERING SUPERVISION

- A. Provide the services of a qualified factory representative of the selected single source system supplier to inspect the completed installation, suggest necessary adjustments to place the system in operation, and instruct operating personnel in the care and operation of the equipment furnished. Provide a minimum of two 2-day trips for start-up service and training of operating personnel. Provide these services as a part of the Work.

PART 4 COMPENSATION

4-01 GENERAL

- A. The compensation herein provided shall constitute full payment for performance of the work. The compensation shall further constitute full payment for all materials, labor, equipment, and incidental items of construction furnished by the Contractor.
- B. No measurement will be made of subsidiary items of work and accessories, equipment, grout, and other incidentals included in the related Pay Items or called for in the Contract unless a Pay Item is specifically provided therefore in the Bidder's Proposal.

4-02 MEASUREMENT

- A. Measurement shall include all work required for conformance with requirements specified on the Construction Drawings. Measurement of work required in relation to this section of the Specifications shall be considered as an element of work required for the Lump Sum work to be performed as a part of construction of the modifications at the Ross Road Wastewater Treatment Facility. As such, measurement shall be considered as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment.

4-03 BASIS OF PAYMENT

- A. Payment will be made as a percent complete of the total Lump Sum work required as indicated on the Drawings and listed on the Bid Form. The appropriate Lump Sum Price shall be full compensation for furnishing all materials, formwork, appurtenances, accessories, labor, tools and equipment necessary to complete the work. The estimated percent complete shall be approved by the Contracting Officer prior to request for payment. Payment for all work included in this section will be included in the lump sum bid item for the Ross Road Wastewater Treatment facility Metering Station, Flow Diversion and Accessories.

BURNS COOLEY DENNIS, INC.

GEOTECHNICAL CONSULTANTS

551 SUNNYBROOK ROAD
RIDGELAND, MS 39157

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May 19, 2003

Engineering Associates, Inc.
Post Office Box 22541
Jackson, Mississippi 39225

Report No. 03099

Attention: Mr. Scott Armstrong, P.E., P.L.S.

Geotechnical Investigation Upper Camp Creek Interceptor Desoto County, Mississippi

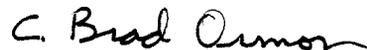
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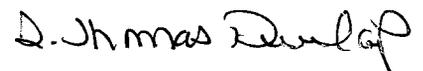
Submitted here is the report of our geotechnical investigation for the above-captioned project. This investigation was performed in general accordance with our proposal No. 03001P-10 dated January 22, 2003. Interim reports of various laboratory and field data have been provided to Mr. Scott Armstrong on March 25, 2003 and April 1, 2003.

We appreciate the opportunity to be of service on this project. If you should have any questions concerning this report, please do not hesitate to call us.

Very truly yours,

BURNS COOLEY DENNIS, INC.


C. Brad Ormon, E.I.


G. Thomas Dunlap, P.E., R.P.G.

GTD/cbo
Copies Submitted: (4)

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INTRODUCTION AND PURPOSE

Plans are being made by Engineering Associates, Inc. to construct the Upper Camp Creek Interceptor in Desoto County, Mississippi. Site plans and profiles illustrating the layout and invert elevations of the proposed interceptor line were provided to Burns Cooley Dennis, Inc. by Mr. Scott Armstrong, a representative of Engineering Associates, Inc. The Upper Camp Creek Interceptor will generally extend from Byhalia Road about 35,000 ft north to the existing Ross Road Sewage Treatment Plant in Desoto County. The interceptor will consist of 48-in. ID concrete or geopolymer pipe, however some ductile iron pipe may be utilized in the vicinity of the treatment plant. A great portion of the pipe alignment will parallel Camp Creek Canal. Based on elevations estimated from the profiles provided, the depth of the canal ranges from about 16 ft to 22 ft. It is our understanding that the top of the pipe must be at least 3 ft below the bottom of the canal. Thus, the bottom of the pipe could be at depths ranging from about 24 ft to 30 ft for the alignment parallel to the canal. Along a northern portion of the alignment, the bottom of the pipe could be at depths on the order of 16 ft to 17 ft. Excavation will be required to install the pipe. Trench boxes may be utilized in the bottom of the excavation. Groundwater control will likely be needed throughout the project alignment. Boring will be required at three locations to install the pipe beneath existing roadways.

The specific purposes of this investigation were:

- 1) to make exploratory soil borings, install temporary piezometers and make field resistivity measurements along the planned alignment for the proposed pipeline;
- 2) to evaluate pertinent physical and chemical properties of the soils encountered in the borings by means of visual examination of the samples and laboratory tests performed on selected representative samples; and
- 3) after analysis of the field and laboratory test data collected by Burns Cooley Dennis, Inc. to provide guideline recommendations for design and construction of the proposed interceptor and pipeline.

FIELD INVESTIGATION

Subsurface conditions along the proposed alignment of the pipeline from Byhalia Road north to the Ross Road Sewage Treatment Plant were explored by means of 22 borings made with a tractor-mounted drill rig. The borings were located in the field by means of hand-held global positioning system (GPS) equipment based on coordinates determined by Burns Cooley Dennis, Inc., based on plans provided by Engineering Associates, Inc. Ground surface elevations at the boring locations were not provided nor determined in the field. Original plans were to make 24 borings at approximate 1,500-ft intervals along the proposed pipeline alignment. However, Borings 3 and 17 originally planned along the proposed alignment for the pipeline could not be drilled due to poor access and site conditions. Other borings had to be relocated from the originally intended location directly along the pipeline centerline due to access restrictions. The actual GPS coordinates for the boring locations are presented on Figure 28 of this report and should be considered approximate. The approximate locations of the borings relative to the proposed centerline of the new pipeline and existing site features are illustrated on Figure 1 of this report.

A synopsis of the Unified Soil Classification System is presented on Figure 2 along with symbols and terminology typically utilized on graphical soil boring logs. Graphical logs of borings illustrating the types of soils and stratification encountered with depth below the ground surface at the individual boring locations are presented on Figures 3 through 24. Graphical profiles of the borings relative to depth below the existing ground surface at each boring at the time of our investigation are presented on Figures 25, 26 and 27 to aid in visualizing subsurface stratification. Tabulated adjacent to the individual profiles for each boring are liquid and plastic limits, water contents, cohesions, dry unit weights, field standard penetration test (SPT) blow counts, and percentages of fines passing the No. 200 sieve.

Borings 5, 7, 11 and 13 were advanced in-the-dry to completion depths of 25 ft and 30 ft using a 4-in. diameter short-flight auger. The remaining borings were initially advanced by dry augering to approximate depths ranging from 6 ft to 25 ft then advanced to the boring completion depth using rotary wash drilling procedures. The borings were drilled to completion depths ranging from approximately 25 ft to 50 ft. Representative samples of the soils encountered during drilling

were obtained from the borings at intervals of depth ranging from 3 ft to 5 ft. Relatively undisturbed samples of some of the fine-grained soils encountered were obtained by pushing a 3-in. OD thin-walled Shelby tube sampler approximately 2 ft into the soil. Representative disturbed samples of the remaining soils encountered were obtained by driving a standard 2-in. OD split-spoon sampler 18 in. into the soil with a 140-lb hammer falling freely a distance of 30 in. Standard penetration test (SPT) blow counts resulting from split-spoon sampling are recorded under the "Blows Per Ft" column of the graphic logs. The blow counts recorded on the logs are for the final 12 in. of split-spoon penetration into the soil. Where the soil was too strong for full sampler penetration, the number of blows for the actual distance driven is recorded. The depths at which the Shelby tube and split-spoon samples were taken are illustrated by the appropriate symbols under the "Samples" column of the graphic boring logs.

All soils encountered during drilling were examined and classified in the field by a geotechnical engineering technician. Each Shelby tube sample was extruded in the field. A representative, approximate 6 in. long portion of each Shelby tube sample was sealed with melted paraffin in a cylindrical cardboard container to prevent moisture loss and structural disturbance. An additional portion of each Shelby tube sample and representative portions of the split-spoon samples were sealed in glass jars to provide material for visual examination and testing in the laboratory.

Observations were made continuously during auger drilling to detect free water entering the open boreholes. After completion of drilling and sampling, each borehole was flushed with water to clear the bentonite mud slurry, and a slotted PVC pipe was placed to the bottom of the borehole to keep the hole open and permit a water level measurement on the following day. Piezometers were installed in the borehole for Boring 2 and in boreholes adjacent to the locations of Borings 11, 16 and 21. Each piezometer basically consists of PVC pipe slotted a few feet above the bottom and set into sandy soils, with the slotted portion surrounded by blasting sand. The borehole annular space above the blasting sand was filled with a few feet of bentonite pellets to create a seal, and the remaining portion of the annular space was filled to the surface with cement-bentonite grout. Water levels were measured in the piezometers during the course of our field investigation. Notes pertaining to groundwater observations are included at the bottom right corner of the graphic boring logs. The water levels measured in the piezometers are tabulated on Figure 29 of this report.

In compliance with Mississippi Department of Environmental Quality regulations, all boreholes not receiving piezometers were filled from bottom-to-top with pumped-in cement-bentonite grout after completion of drilling and sampling.

Field resistivity measurements were made at select locations corresponding to Borings 1, 6, 10, 15, 19 and 24 while making the soil borings. The results of the field resistivity measurements made using the 4-probe Wenner Array are tabulated in Figure 30 of this report.

LABORATORY INVESTIGATION

Laboratory tests were performed on selected, representative samples from the borings to assist in evaluating the strengths, classifications, volume change and chemical properties of the soils encountered. The types of laboratory tests performed are described in the following paragraphs. In addition to the laboratory tests described, all samples were visually examined and classified in the laboratory.

The undrained shear strength characteristics of the fine-grained soils encountered in the borings were investigated by means of field and laboratory estimates of consistency and from the results of 13 unconfined and 15 unconsolidated undrained (UU) triaxial compression tests performed on selected Shelby tube samples. The results of the unconfined and triaxial compression tests in terms of cohesion are plotted as small open circles and triangles, respectively, in the data section of the graphic logs. The water content and dry density were also determined for each unconfined and triaxial compression specimen. The water contents are plotted as small shaded circles in the data section of the logs. The dry densities are tabulated to the nearest lb per cu ft under the "Dry Density" column of the graphic logs. One moisture-density test was performed on an undisturbed sample and reported in the graphic logs as presented in this paragraph.

The classifications and volume change properties of the fine-grained soils encountered in the borings were investigated by means of 17 sets of Atterberg liquid and plastic limit tests. In accordance with the Unified Soil Classification System, fine-grained soils are classified as either clays or silts of low or high plasticity based on the results of liquid and plastic limit tests. The Atterberg limit tests will also define whether a soil is nonplastic. The numerical difference between the liquid limit and plastic limit is defined as the plasticity index (PI). The magnitudes of the liquid

limit and plasticity index and the proximity of the natural water content to the plastic limit are indicators of the potential for a fine-grained soil to shrink or swell upon changes in moisture content or to consolidate under loading. The proximity of the natural water content to the plastic limit is also an indicator of soil strength. The results of the liquid and plastic limit tests are plotted as small crosses interconnected by dashed lines in the data section of the graphic boring logs. The designation “NP” is noted in the data section of the logs where a soil sample is determined to be nonplastic.

To aid in classifying sandy soils and fine-grained soils containing some sand, tests were performed on 12 samples to determine the percent fines passing the No. 200 sieve. The percentages of fines resulting from those tests are tabulated at the appropriate depths under the far right column of the graphic boring logs.

A total of 100 additional water content tests were performed to corroborate field classifications and to extend the usefulness of the plasticity and SPT blow count data. The results of the water content tests are plotted as small shaded circles in the data section of the graphic boring logs. The water content data have been interconnected on the logs to illustrate a continuous profile with depth.

Additionally, select samples were submitted to Southern Technical Services to perform tests to determine pH, soluble sulfates, and chloride ion content. The results of the testing are tabulated on Figures 31 and 32.

GENERAL SOIL CONDITIONS

General

Subsurface soils encountered within the completion depths of the borings made for this investigation include topstratum alluvial deposits consisting of alternating layers of fine-grained soils with minimal sands underlain by substratum alluvial deposits consisting of various coarse-grained sands frequently containing gravel, and by clays of the Tertiary age Kosciusko formation. General descriptions of subsurface soils and groundwater encountered in the borings are provided in the following subsections. The graphical logs presented on Figures 3 through 24 should be referred to for specific soil conditions encountered at each boring location. Stick logs of the borings are shown in profile on Figures 25, 26 and 27 to aid in visualizing subsurface soil conditions. Tabulated

adjacent to the stick logs are liquid and plastic limits, water contents, cohesions, dry densities, field standard penetration test (SPT) blow counts, and percentages of fines passing the No. 200 sieve. As stated previously, ground surface elevations were not determined or provided. The GPS coordinates for each boring presented in Figure 28 can be utilized to approximately determine the boring locations in relation to estimated ground elevations utilizing USGS or other topographic information.

Subsurface Soil Conditions

Topstratum. The ground surface at all the boring locations was found to be underlain by topstratum alluvial deposits consisting primarily of alternating layers of silty clays (CL), silts (ML), clayey silts (ML) and sandy silts (ML) with a significantly lesser quantity of sands (SC, SM). Where encountered, the sand layers are considered to be transitional to the underlying coarse-grained alluvium substratum zone. The topstratum zone extends to the 25-ft completion depths of Borings 5, 6, 7 and 19, to the 30-ft completion depth of Boring 10, and to variable depths ranging from about 17 ft to 31 ft at the remaining boring locations. The silty clays (CL) range in consistency from soft to very stiff. The various silts (ML) range in relative density from very loose to dense. A majority of the topstratum deposits are weak, unstable and compressible with soft to medium stiff consistencies or very loose to loose relative densities. The remaining stiff to very stiff and medium dense to dense deposits are stronger, more stable and less compressible.

Substratum. The topstratum zone described above was found to be underlain by variable substratum deposits of sands (SC, SM, SP-SM) containing gravel and slightly silty sandy gravel (GP-GM) at the locations of Borings 2, 4, 8, 9, 11 through 18 and 20 through 24. The substratum soils extend to depths ranging from about 25 ft to 27 ft at Borings 15, 22, 23 and 24, and to the terminal depths of the remaining borings. The medium dense to very dense sands (SC, SM, SP-SM) and gravels (GP-GM) are strong and stable with very low compressibility.

Kosciusko Formation. The alluvial substratum zone at Borings 15, 22, 23 and 24 is underlain by Tertiary age Kosciusko formation deposits of sandy clays (CL) and clays (CH) to the terminal depths of the borings. The stiff to hard clays are considered to be strong and stable with low compressibility.

Groundwater

Free water was initially encountered at various depths during auger drilling for almost all of the borings. Specific measurements of groundwater levels encountered in the boreholes and four piezometers are documented within the groundwater data section located at the lower right corner of each graphic boring log and in the tabulation shown on Figure 29. We consider groundwater to be present at the site both within the upper topstratum finer-grained, generally lower permeability soils, and within the lower substratum more coarse-grained, higher permeability soils. Perched groundwater is generally present at relatively shallow depths within surficial topstratum soils that are relatively weak and saturated. In our opinion, shallow perched groundwater conditions will be influenced primarily by rainfall and surface drainage. Even where notable free water is not initially observed within shallow excavations made in topstratum fine-grained soils, it could present itself as slow seepage which could accumulate into excavations that are left open for an extended period of time. In our opinion, free water encountered during auger drilling at relatively great depths and the piezometer readings are indicative of deeper groundwater conditions and piezometric heads within the substratum coarse-grained soils. As excavation for the pipeline extends deeper into the topstratum fine-grained soils, at some depth piezometric heads within the underlying coarse-grained substratum soils would cause heaving and blow-out of the excavation bottom. Of course, excavation into the coarse-grained substratum soils would encounter considerable groundwater. Dewatering will be required to lower the groundwater level in the substratum to prevent excavation bottom heave/blow-out and to provide for construction under dry conditions. Groundwater conditions along the alignment of the interceptor pipe will be influenced by nearby bodies of water such as the existing Camp Creek Canal and small creeks and ponds along the alignment.

DISCUSSION AND RECOMMENDATIONS

General

Plans are being made by Engineering Associates, Inc. to design the Upper Camp Creek Interceptor in Desoto County, Mississippi. The proposed 48-in. ID concrete or geopolymer pipe will be approximately 35,000-ft long and generally extends from Byhalia Road north to the existing Ross

Road Sewage Treatment Plant, approximately paralleling the existing Camp Creek Canal along the lower portion of the line.

Borings made by Burns, Cooley, Dennis, Inc. were utilized to evaluate the subsurface conditions along the proposed alignment of the pipeline. Subsurface soils encountered within the maximum completion depth of the borings made along the proposed alignment of the pipeline generally consist of an upper alluvial topstratum of fine-grained soils underlain by coarse-grained alluvial substratum soils and Kosciusko formation clay deposits. A majority of the topstratum soils were found to be weak and unstable at the time of our field investigation. The substratum and Kosciusko deposits are stronger and more stable.

Groundwater was encountered at every boring location as noted at the lower right corner of the graphic boring logs. Groundwater is considered to be located within the upper fine-grained soils in a perched condition with relatively low permeabilities and within the lower substratum soils with much greater permeabilities. The lower Kosciusko clays will exhibit a low permeability. Even where notable free water is not initially encountered during shallow excavation in the fine-grained topstratum, it could present itself as slow seepage with would accumulate into excavations that are left open for an extended period of time.

Based on the pipeline profile provided by Engineering Associates, Inc., the bottom of the pipe could be at depths ranging from about 24 ft to 30 ft for the alignment parallel to the canal, and ranging from depths of about 16 ft to 17 ft along the northern portion of the alignment. The following subsections of this report include guideline recommendations pertaining to the geotechnical-related aspects of design and construction for the proposed pipeline.

Trenching and Excavation

Considering the subsurface soils encountered at the boring locations and the planned invert elevations for the pipeline, the bottom of the excavation for the pipeline will generally be in the bottom portion of the fine-grained topstratum soils or within the highly permeable substratum sands (SC, SM, SP-SM) and gravels (GP-GM). Trench excavations will encounter through relatively weak and unstable topstratum fine-grained silts (ML) and clays (CL) with occasional sand layers and seams. It should be recognized that exceptions to the soil conditions indicated at specific boring

locations will be encountered during construction. In comparison to areas where the soils are generally found to be relatively strong, more trench bracing and/or flatter excavation slopes will be required at locations where weaker soils are encountered.

A detailed analysis of slope stability for trench excavations is beyond the scope of this investigation. Stability of slopes will be dependant upon the type of soil present within the slope and water seepage conditions. Typically, short term construction slopes on the order of 1V:2H are stable for a majority of the natural soil present at the site provided seepage is adequately controlled. Due to the large expanse of the project and limited number of borings, not all possible soil and groundwater conditions could be evaluated. The situation may exist such that excavation slopes become unstable, possibly with only shallow sloughing, which will require occasional slope maintenance, or may require reconfiguration of the slope or different excavation stabilization procedures.

There are many various possible slope configurations and excavation stabilization procedures and combinations of methods contractors may utilize for construction of the pipeline. As an aid in project estimation and planning, we have examined a critical typical excavation slope configuration in the area corresponding to the subsurface conditions of Boring 14. The invert of the pipe in this area is on the order of 30 ft below the ground surface. The lower permeability fine-grained topstratum soils extend to a depth of about 22 ft, underlain by higher permeability sands (SC, SM, SP-SM) and gravels (GP-GM) to the 50-ft completion depth of Boring 14. Water was assumed to be perched, but controlled within the upper topstratum soils, and the excavation was considered to be adequately dewatered within the substratum coarse-grained soils. A minimum factor of safety on the order of 1.3 was achieved for a 1V:2H short term excavation slope assuming these conditions with the critical circular failure surface generally passing through the upper substratum silty sands (SM) of Boring 14 and exiting near the excavation bottom. Also, critical to such excavation operations is placement of spoil adjacent to the slope. In order to maintain an adequate factor of safety, the slope analysis indicates the spoil pile should be no thicker than 10 ft and kept a minimum of 15 ft from the slope edge for a 1V:2H temporary slope. We recommend that the contractor be given complete responsibility for the adequacy and safety of trenching and excavation. Also, the contractor should be required to furnish all sheeting, shoring and bracing necessary to support the sides of trenches and excavations. A suitable sliding trench box or shield could also possibly be utilized. Sheeting and shoring should be removed in a manner that will not cause voids or significant

weakening or loosening of natural or backfill soils. Special care should be taken in trenching and excavation operations to prevent damage to any existing structural features, pavements or facilities located adjacent to the trenches/excavations.

It should be noted that the silts (ML) and silty clays (CL) are highly susceptible to pumping under wet conditions. The construction techniques and types of equipment utilized and site drainage provided during construction will have a great effect on the performance of these soils throughout the project. It should be recognized that soils which are demonstrated to be stable can become unstable if they are disturbed by construction traffic or exposed to rainfall or groundwater.

We recommend that the specifications require the contractor to develop and implement measures to control all groundwater encountered as necessary to achieve a stable excavation and a stable surface for support of the pipe and also to achieve the required compaction of the bedding and backfill soils. More specifics regarding groundwater are presented in the following subsection.

Groundwater Control

As discussed previously, groundwater seepage was encountered within the upper topstratum fine-grained deposits in a generally perched condition while significant groundwater was encountered within the lower substratum sands and gravels. It is likely the presence and quantity of water seepage will be influenced by the season of the year when construction is performed and the water level in the existing Camp Creek Canal and nearby creeks and ponds. As excavation for the pipeline extends deeper into the topstratum fine-grained soils, at some depth piezometric heads within the underlying coarse-grained substratum soils would cause heaving and blow-out of the excavation bottom. Of course, excavation into the coarse-grained substratum soils would encounter considerable groundwater. Dewatering will be required to lower the groundwater level in the substratum to prevent excavation bottom heave/blow-out and to provide for construction under dry conditions. Groundwater control will be the responsibility of the excavating contractor. The silty clays (CL) are considered to exhibit generally low permeability while the clayey silts (ML) and silts (ML) will exhibit permeabilities ranging from low to moderate. The sandy silts (ML) will have greater permeability than the upper silts and the lower sands and gravels will exhibit very high permeabilities. For planning purposes, we expect that the groundwater piezometric level must be lowered several feet below the excavation base by some form of active dewatering. A system of

dewatering wells would likely be needed for deeper sections of the alignment while a series of wellpoints may be adequate for less deep excavations, or may be appropriate for multiple level, benched excavations using a combination of groundwater control methodologies. Removing and/or controlling water retained within the upper topstratum soil zone may require additional effort. The actual extent of needed groundwater seepage control must be evaluated during excavation and should be monitored closely during construction.

Bedding and Backfill

Fairly strong substratum coarse-grained soils were encountered at or near the planned pipe invert at a majority of the boring locations. However, relatively weak unstable fine-grained topstratum soils defined as soft to medium stiff silty clays (CL) or very loose to loose silts (ML) were encountered at or near the planned pipe invert at some of the boring locations. It should be recognized that soils found to be strong at the time of our investigation can become weak while being excavated and/or disturbed in the presence of groundwater. Also, piezometric pressures that cause upward flow into the trench bottom during the excavation process can cause weakening of the soils. Therefore, the exact extent of any weak or unstable soils along the bottom of the trench can only be determined during construction. All weak or unstable soils extending below the trench bottom should be overexcavated for the full design width of the trench to depths determined during construction in the specific reaches where such conditions are encountered. Areas of overexcavation should be backfilled with suitable excavated soils. The classification and compaction of the backfill soils should meet the recommendations provided subsequently for materials placed as bedding around the pipe.

The design width of the pipe trench should be established with consideration given to providing sufficient horizontal space between the pipe and the trench walls to permit proper compaction of bedding soils up to the top of the pipe. As compared to compaction by hand tamping, a greater horizontal space will be required for compaction with hand-held mechanical compactors. A greater horizontal space will also be required for installation with a trench box, shield or sheeting.

In the following discussion the term "bedding" refers to fill soils placed within the vertical zone from the bottom of the trench to a level of 1 ft above the top of the pipe. The term "backfill" refers to fill soils placed between the top of the bedding soils and the ground surface. We

recommend that materials used for bedding consist of nonorganic and debris-free soils that are not too wet or too dry and have a liquid limit not greater than 50. The liquid limit of 50 will exclude the use of the clays (CH). Any imported materials used for bedding should consist of either silty clays (CL), sandy clays (CL) or sands (SM, SC, SP-SM and SP). Additionally, silts (ML), clayey silts (ML) and sandy silts (ML) can be utilized as backfill since they represent a significant amount of natural soils available locally to the area, however the silts (ML) may require stricter monitoring during compaction due to their sensitivity to moisture. The contractor should be allowed to select whichever of these material types best suits the subsurface soil and groundwater conditions and the required groundwater control as necessary to perform the work. The existing site soils removed during construction can be used as backfill provided they are not too wet or too dry prior to placement as fill.

The pipe should initially be bedded in 4 in. to 6 in. of suitable bedding soils placed over the bottom of the trench. This initial lift and each successive bedding lift up to a level of 1 ft above the top of the pipe should have a minimum loose thickness of 6 in. or less and should be compacted to not less than 92 percent of standard Proctor maximum dry density (ASTM D 698) by hand tamping or by utilizing a hand-held mechanical compactor. The moisture content within the bedding soils should be as required to provide a firm and stable condition for compaction. The bedding soils should be brought up simultaneously at the same level on both sides of the pipe.

The proposed pipeline will primarily cross areas that are undeveloped, but some portions of the line may extend into developed areas. A variation in compaction requirements is considered to be appropriate for these two general conditions. Backfill placed above the level of the bedding materials should consist of the same types of soil utilized for bedding. In undeveloped areas, the backfill should be compacted in relatively thin lifts to not less than 85 percent of standard Proctor maximum dry density. In developed areas where existing or future construction is planned, the backfill soils should be compacted in relatively thin lifts to not less than 95 percent of standard Proctor maximum dry density. Excavations should be backfilled as soon as practicable. Special care and planning will be required in the areas of the existing Camp Creek Canal and any other lakes or ponds while excavating along the embankments to prevent instability of the embankments.

The final surface at the top of the backfill over the pipeline should be sloped to provide effective and rapid drainage of rainfall and surface water away from the pipe alignment. Assuming future settlement will occur within the backfill, we recommend that the backfill materials generally be crowned or mounded along the length of the pipeline in undeveloped areas at least 12 in. higher at the centerline and sloped downward to natural ground levels. The surface at the top of the backfill in developed areas should be monitored for settlement and maintained to provide drainage away from the alignment.

Soil Parameters

Pipeline strength design considers stresses produced by a combination of internal pressure and external loads. The external loads include dead or earth loads due to the weight of backfill soils over the pipe and live loads imposed by highway trucks, trains, construction traffic and other structures. Dead or earth loads are normally calculated by the Marston equations for specific section dimensions of the pipe, trench and embankment and for specific or estimated backfill parameters. Recommended soil parameters for evaluation of earth or dead loads on the pipe are as follows:

Soil Description	Unit Weight (pcf)
Backfill soils compacted to 85 percent of standard Proctor density	115
Backfill soils compacted to 90 percent of standard Proctor density	120
Backfill soils compacted to 95 percent of standard Proctor density	125

Ratio of lateral to vertical earth pressure, $K = 0.4$

Coefficient of sliding friction between fill materials and trench walls, $\mu = 0.33$

Settlement ratio, $R_{sd} = 0.8$

In calculation of earth loads, additional earth loads may result from future construction over the pipeline, such as widening of roadways and railroad embankments.

Live loads imposed on pipes by highway trucks, construction equipment and buildings or other structures over or adjacent to the pipeline can be calculated using Boussinesq equations (with

appropriate impact factors for dynamic loading) or they can be obtained from published tables in design manuals of the AWWA and others. Live loads which may be imposed by heavy construction equipment should be given special consideration, and certain limitations should be set forth in the project specifications. These limitations should establish a minimum depth (or depths) of earth cover over the top of the pipe before construction equipment is permitted to cross the pipe, in conjunction with the maximum wheel load allowed for the minimum or greater depths of earth cover.

For calculations predicting the deflection of buried flexible pipe, the modulus of soil reaction, E' , can be approximated by a value of about 400 lbs per sq in. for the previously recommended bedding condition.

RESISTIVITY, pH, CHLORIDES AND SULFATES TESTING

As described previously, field resistivity surveys were performed using a 4-probe Wenner Array at six boring locations spaced along the project alignment. Results of the resistivity study are presented in tabular form in Figure 30.

Selected soil samples were submitted to Southern Technical Services to perform tests to determine pH, soluble sulfates, and chloride ion content. The results of the testing are tabulated on Figures 31 and 32. The pH's of the samples were found to range between 3.5 and 5.6. The results of the tests for chlorides indicated that the chlorides range from 10.9 to 36.9 parts per million. The results of the tests for sulfates range from less than 20 to 135 parts per million.

REPORT LIMITATIONS

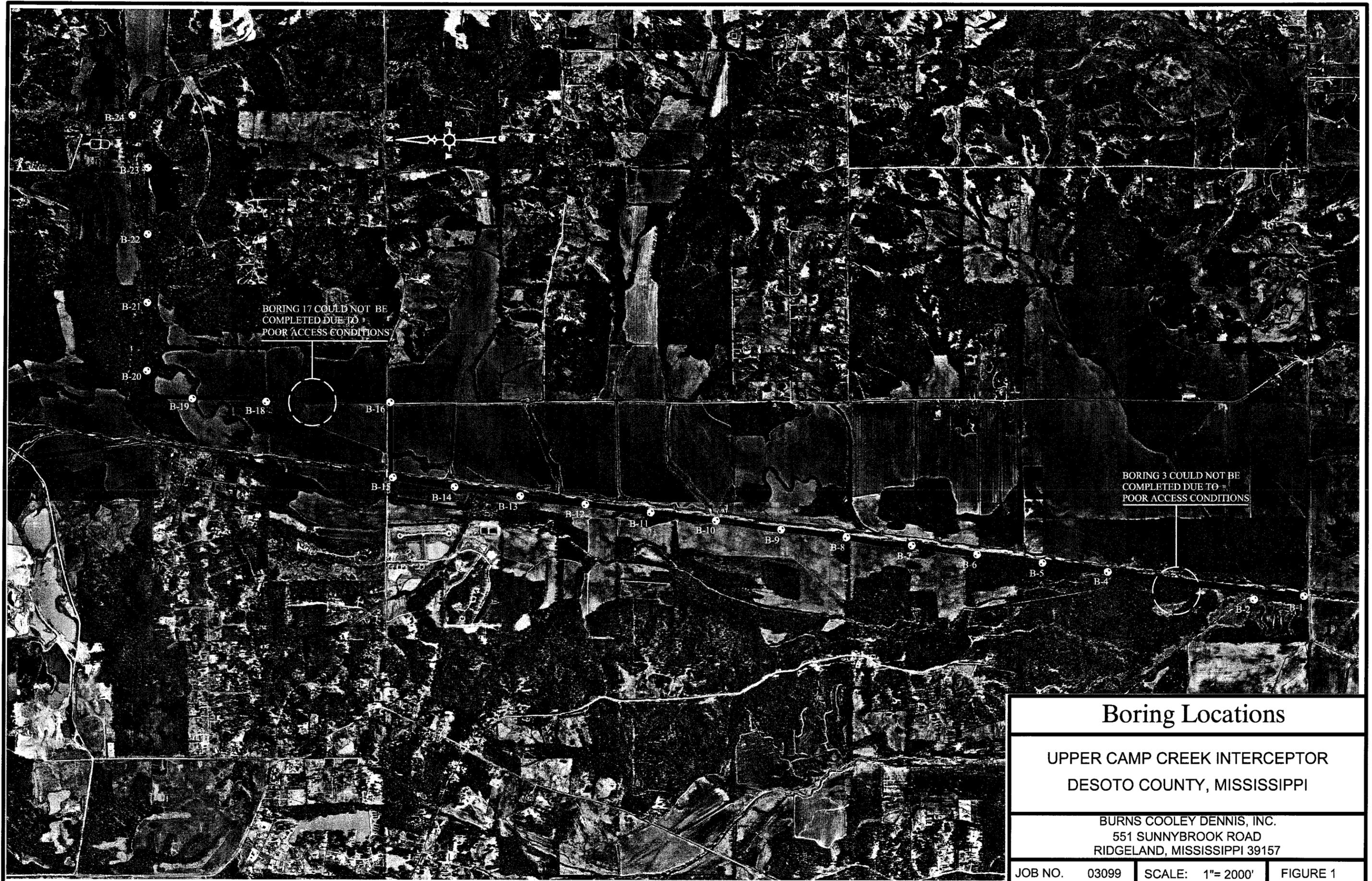
The analyses, conclusions and recommendations discussed in this report are based on conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of subsurface conditions throughout the areas investigated. It should be noted that actual subsurface conditions between and beyond the borings might differ from those encountered at the boring locations. If subsurface conditions are encountered during construction that vary from those discussed in this report, Burns Cooley Dennis, Inc., should be

notified immediately in order that we may evaluate the effects, if any, on the recommendations provided

Burns Cooley Dennis, Inc., should be retained for a general review of project plans and specifications. It is advised that we be retained to observe earthwork construction for the project in order to help confirm that our recommendations are valid or to modify them accordingly. Burns Cooley Dennis, Inc., cannot assume responsibility or liability for the adequacy of recommendations if we do not observe construction.

This report has been prepared for the exclusive use of Engineering Associates, Inc., for specific application to the geotechnical aspects of design and construction for the Upper Camp Creek Interceptor to be constructed in Desoto County, Mississippi. The only warranty made by us in connection with the services provided is we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, express or implied, is made or intended.

FIGURES



Boring Locations

UPPER CAMP CREEK INTERCEPTOR
DESOTO COUNTY, MISSISSIPPI

BURNS COOLEY DENNIS, INC.
551 SUNNYBROOK ROAD
RIDGELAND, MISSISSIPPI 39157

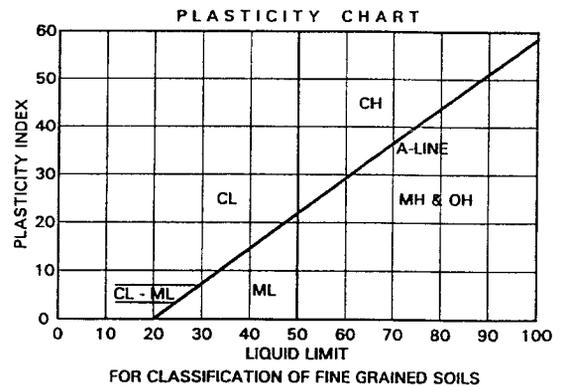
JOB NO. 03099 SCALE: 1"= 2000' FIGURE 1

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL & LETTER	DESCRIPTION		
COARSE-GRAINED SOILS More than half of material larger than No. 200 sieve size	GRAVELS More than half of coarse fraction larger than No. 4 sieve size	Clean Gravels (Little or no fines)	GW WELL GRADED GRAVEL, GRAVEL-SAND MIXTURE		
			GP POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURE		
		Gravels with fines (Appreciable amount of fines)	GM SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURE		
			GC CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURE		
	SANDS More than half of coarse fraction smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW WELL GRADED SAND, GRAVELLY SAND		
			SP POORLY GRADED SAND, GRAVELLY SAND		
		Sands with fines (Appreciable amount of fines)	SM SILTY SAND, SAND-SILT MIXTURE		
			SC CLAYEY SAND, SAND-CLAY MIXTURE		
			FINE-GRAINED SOILS More than half of material smaller than No. 200 sieve	SILTS AND CLAYS Liquid limit less than 50	ML SILT WITH LITTLE OR NO PLASTICITY
					ML CLAYEY SILT, SILT WITH SLIGHT TO MEDIUM PLASTICITY
CL SILTY CLAY, LOW TO MEDIUM PLASTICITY					
CL SANDY CLAY, LOW TO MEDIUM PLASTICITY (30% TO 50% SAND)					
SILTS AND CLAYS Liquid limit greater than 50	MH SILT, FINE SANDY OR SILTY SOIL WITH HIGH PLASTICITY				
	CH CLAY, HIGH PLASTICITY				
	OH ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY				
HIGHLY ORGANIC SOILS		PT PEAT, HUMUS, SWAMP SOIL			

TERMS CHARACTERIZING SOIL STRUCTURE

- Slickensided - Clays with polished and striated planes created as a result of volume changes related to shrinking, swelling and/or changes in overburden pressure.
- Fissured - Clays with a blocky or jointed structure generally created by seasonal shrinking and swelling.
- Laminated - Composed of thin alternating layers of varying color and texture.
- Calcareous - Containing appreciable quantities of calcium carbonate.
- Parting - Paper thin (less than 1/8 inch).
- Seam - 1/8 inch to 3 inch thickness.
- Layer - Greater than 3 inches in thickness.



DENSITY AND CONSISTENCY

COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
PENETRATION RESISTANCE, N	PENETRATION RESISTANCE, N	COHESION Kips/Sq.Ft	PENETRATION RESISTANCE, N
DENSITY	Blows per Foot	CONSISTENCY	Blows per Foot
Very loose	0 - 4	Very Soft	<0.25
Loose	5 - 10	Soft	0.25 - 0.50
Medium Dense	11 - 30	Medium Stiff	0.50 - 1.00
Dense	31 - 50	Stiff	1.00 - 2.00
Very Dense	>50	Very Stiff	2.00 - 4.00
		Hard	>4.00

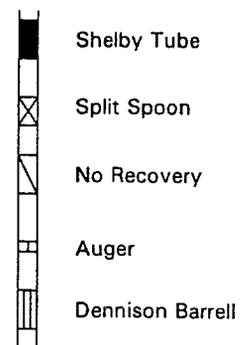
PARTICLE SIZE IDENTIFICATION

- Cobbles - Greater than 3 inches
- Gravel - Coarse - 3/4 inch to 3 inches
Fine - 4.76 mm to 3/4 inch
- Sand - Coarse - 2 mm to 4.76mm
Medium - 0.42 mm to 2 mm
Fine - 0.074 mm to 0.42 mm
- Silt & Clay - Less than 0.074 mm

RELATIVE COMPOSITION

- Slightly - 5 - 15%
- With - 16 - 29%
- Sandy (or gravelly) - 30 - 50%

SAMPLE TYPES (Shown in Sample Column)



CLASSIFICATION, SYMBOLS AND TERMS USED ON GRAPHICAL BORING LOGS

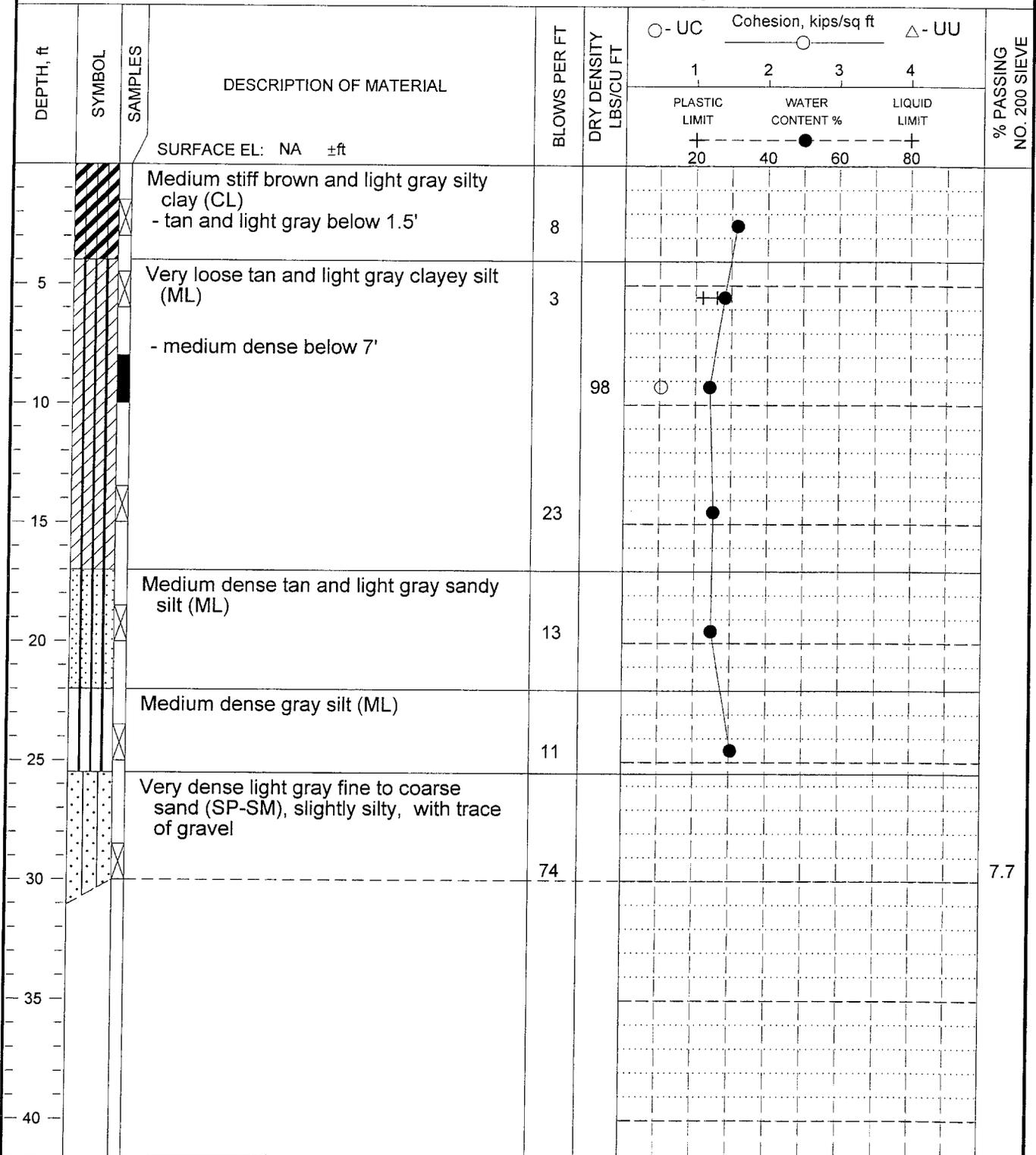
LOG OF BORING NO. 1

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 10',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 30 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 7' during auger drilling. Water level at 6' after 15 minutes and at 6' on following day.

DATE: 03/11/03

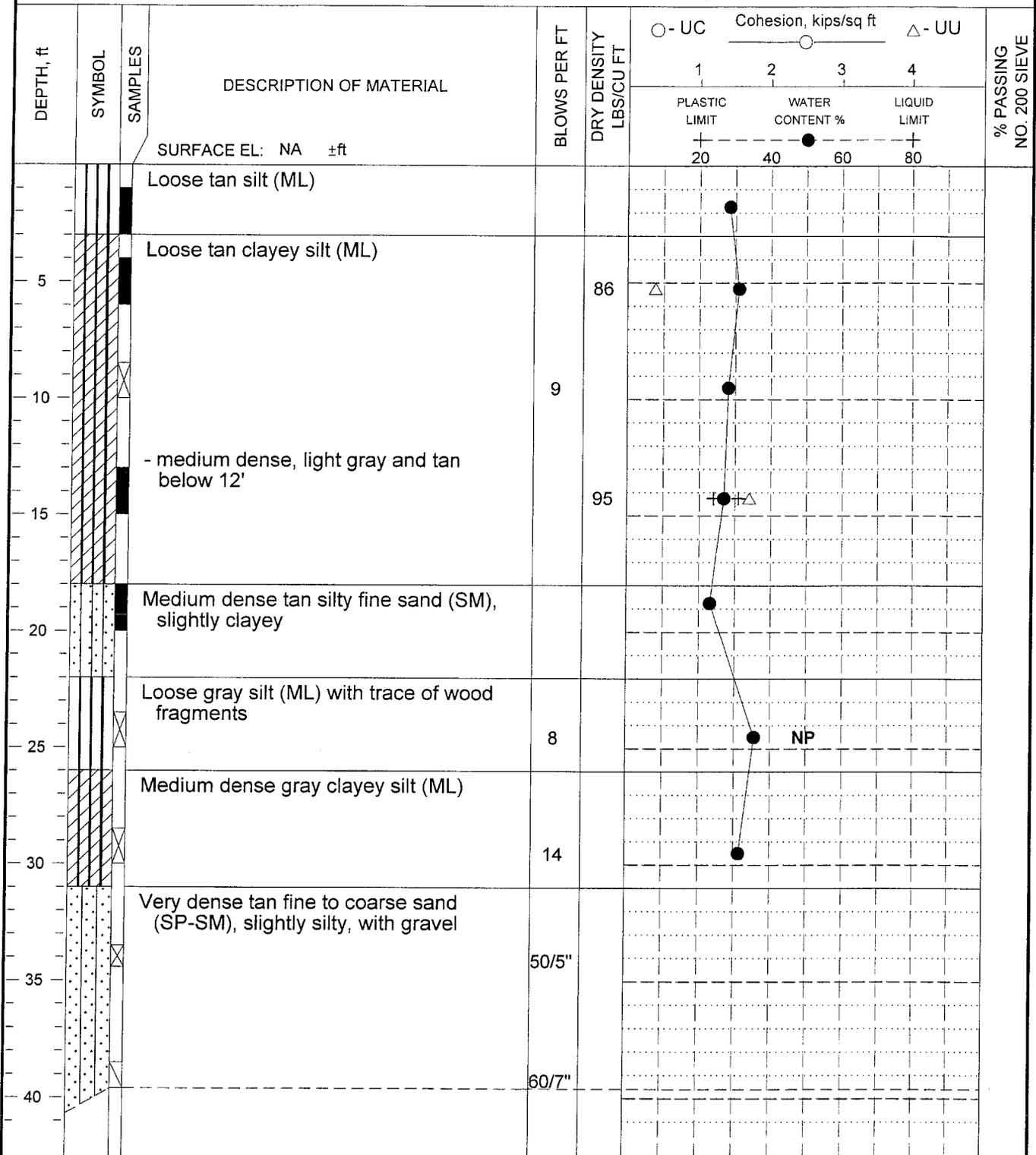
03099 DD ar

LOG OF BORING NO. 2

UPPER CAMP CREEK INTERCEPTOR
DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 10',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 39.6 ft

DATE: 03/11/03

COMMENTS: Piezometer set in boehole
after completion of drilling and sampling.

GROUNDWATER DATA: Free water encountered at 7'
during auger drilling. Water level at 5.5' after 15
minutes. Piezometer P-2 set in borehole with water
level at 12.5' on 3/12/03 and 3/14/03.

03089 DD ar

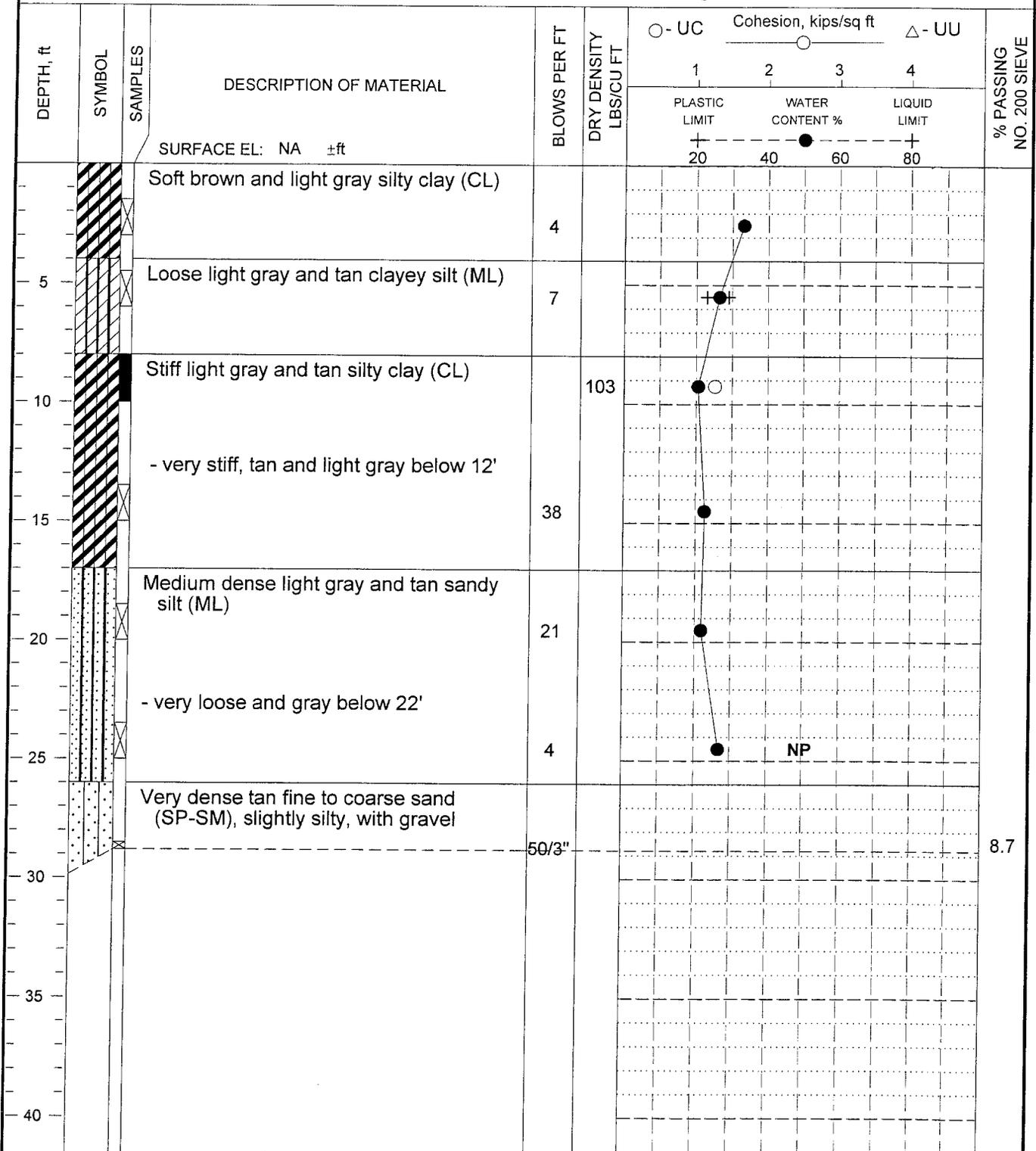
LOG OF BORING NO. 4

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 6',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 28.8 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 4' during auger drilling. Water level at 2' after 15 minutes and 3' on following day.

DATE: 03/04/03

03099 DD ar

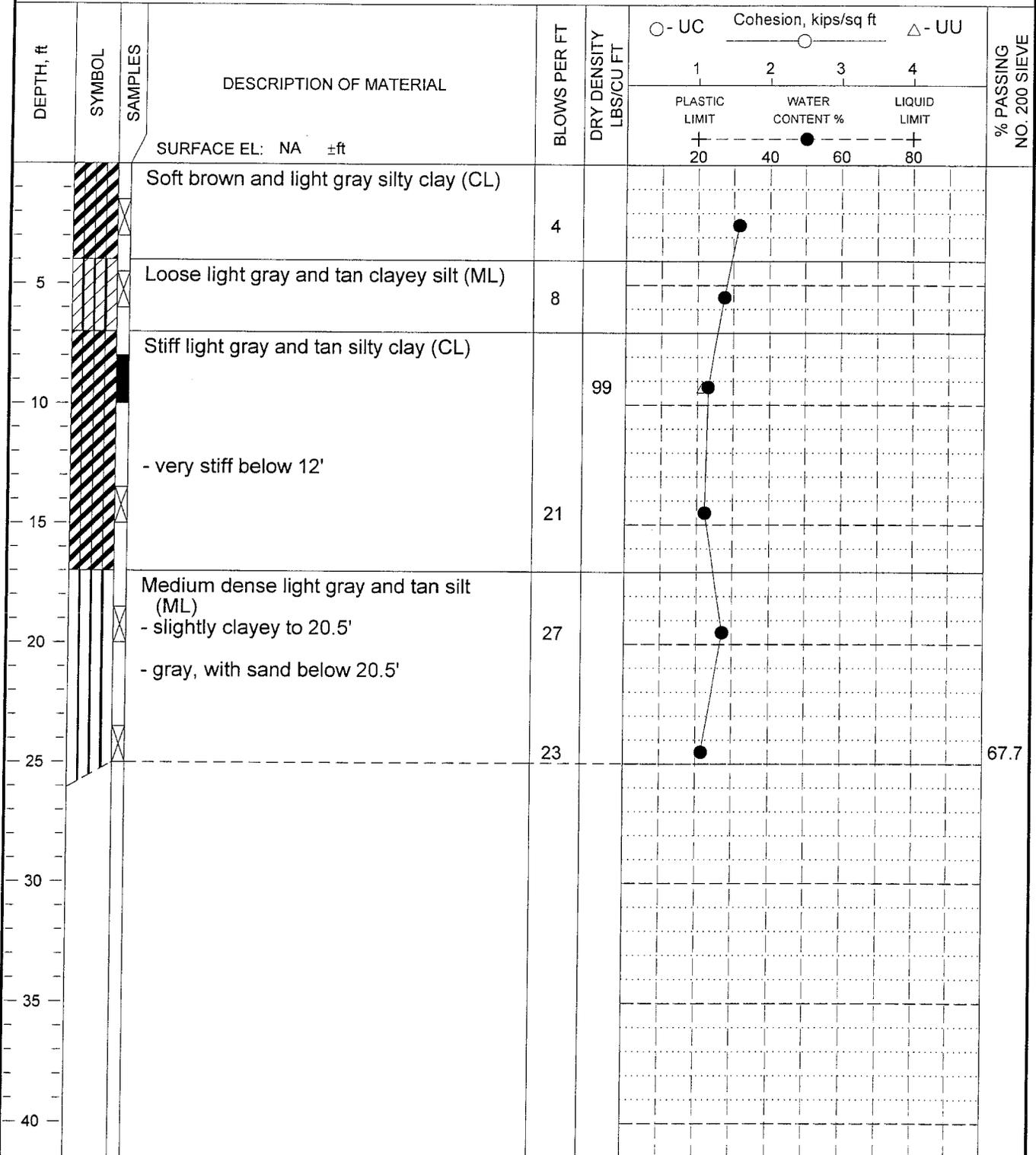
LOG OF BORING NO. 5

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger

LOCATION: See Figure 1



BORING DEPTH: 25 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 20' during auger drilling. Water level at 16' after 15 minutes and 3.3' on following day.

DATE: 03/04/03

03089 DD ar

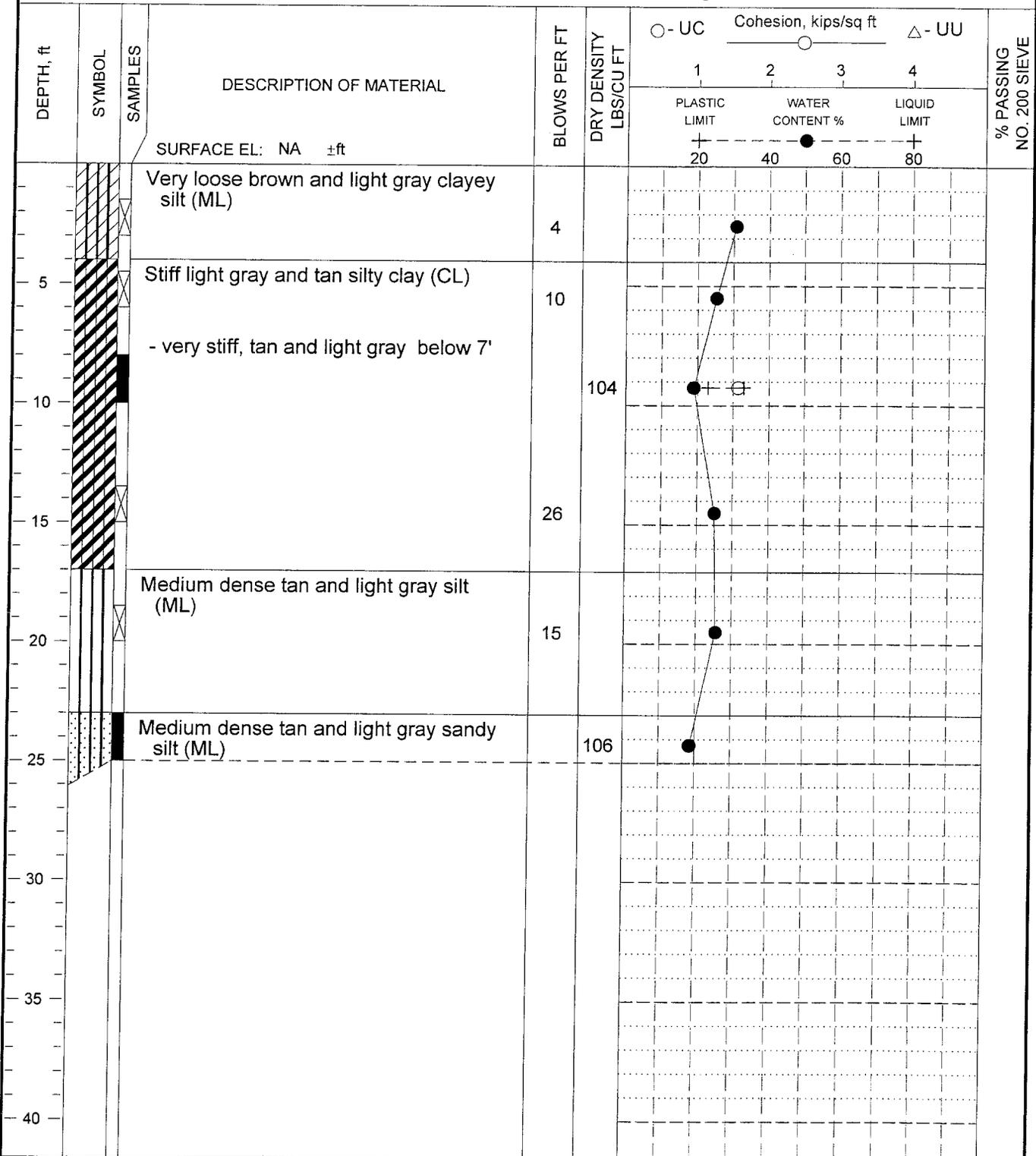
LOG OF BORING NO. 6

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 6',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 25 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: No free water encountered during auger drilling. Water level at 4.5' on following day.

DATE: 03/04/03

03099 DD ar

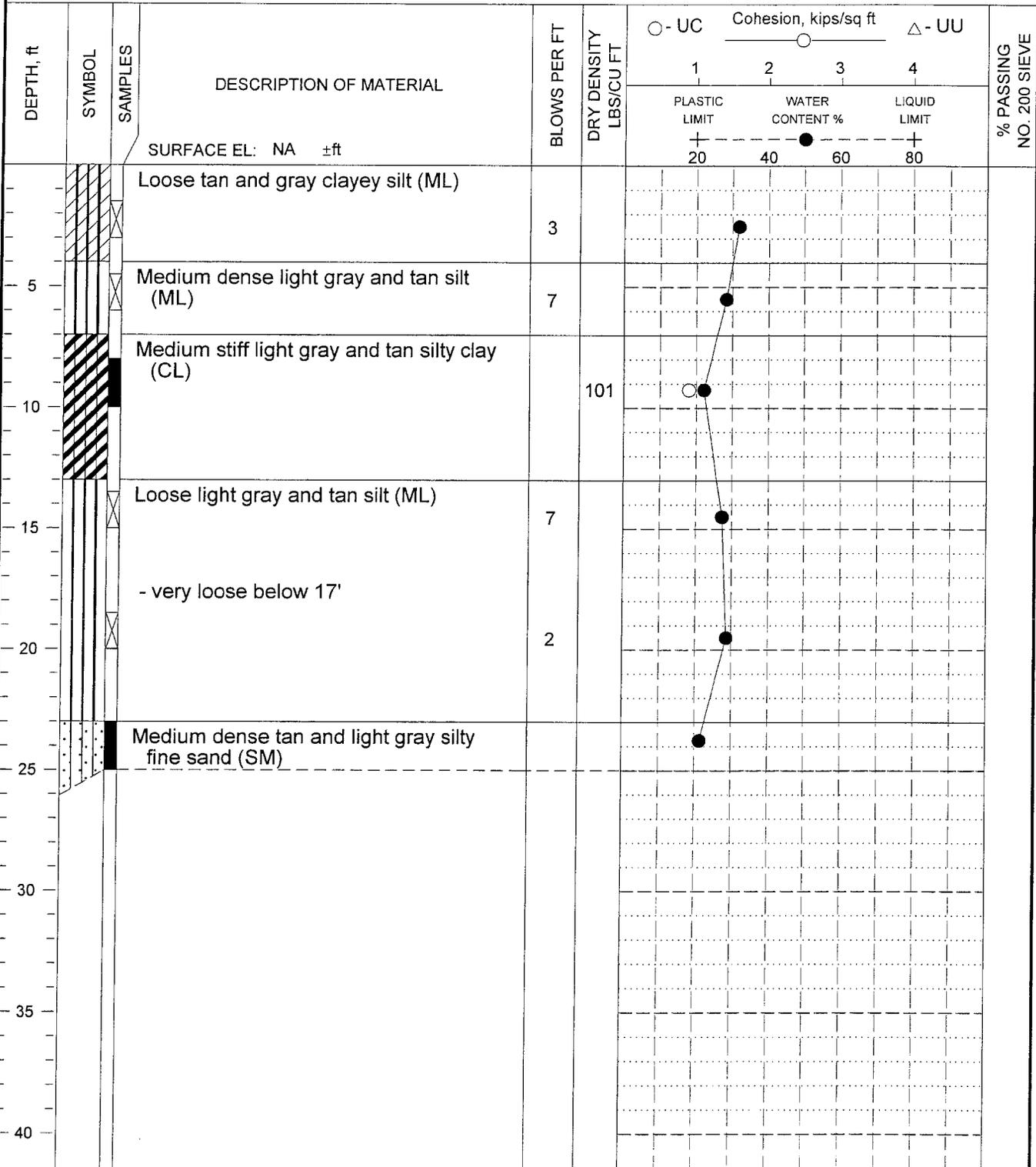
LOG OF BORING NO. 7

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger

LOCATION: See Figure 1



BORING DEPTH: 25 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 4' during auger drilling. Water level at 2.5' after 15 minutes and 4' on following day.

DATE: 03/04/03

03089 DD ar

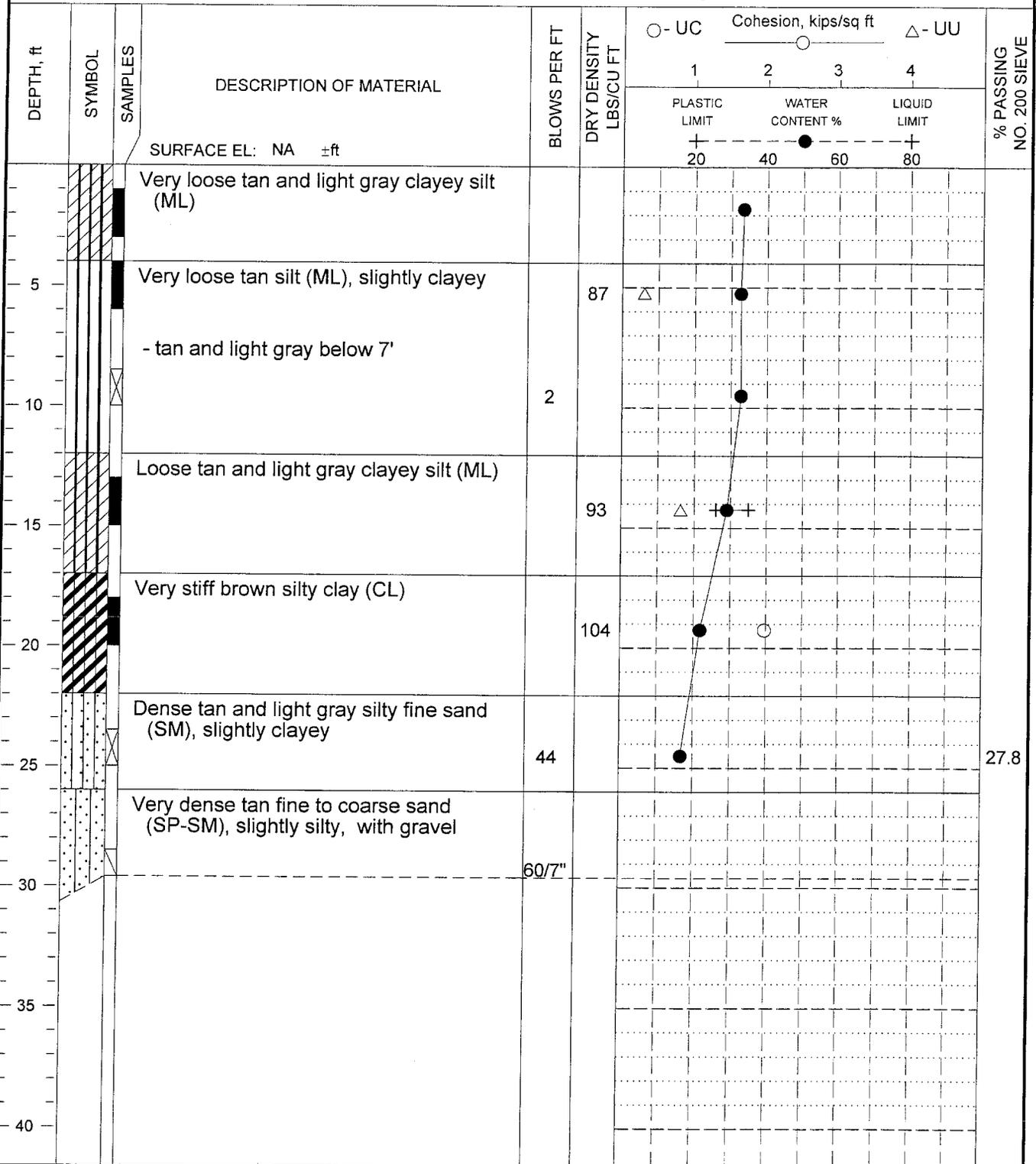
LOG OF BORING NO. 8

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 10',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 29.6 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 8' during auger drilling. Water level at 6' after 15 minutes and 7' on following day.

DATE: 03/03/03

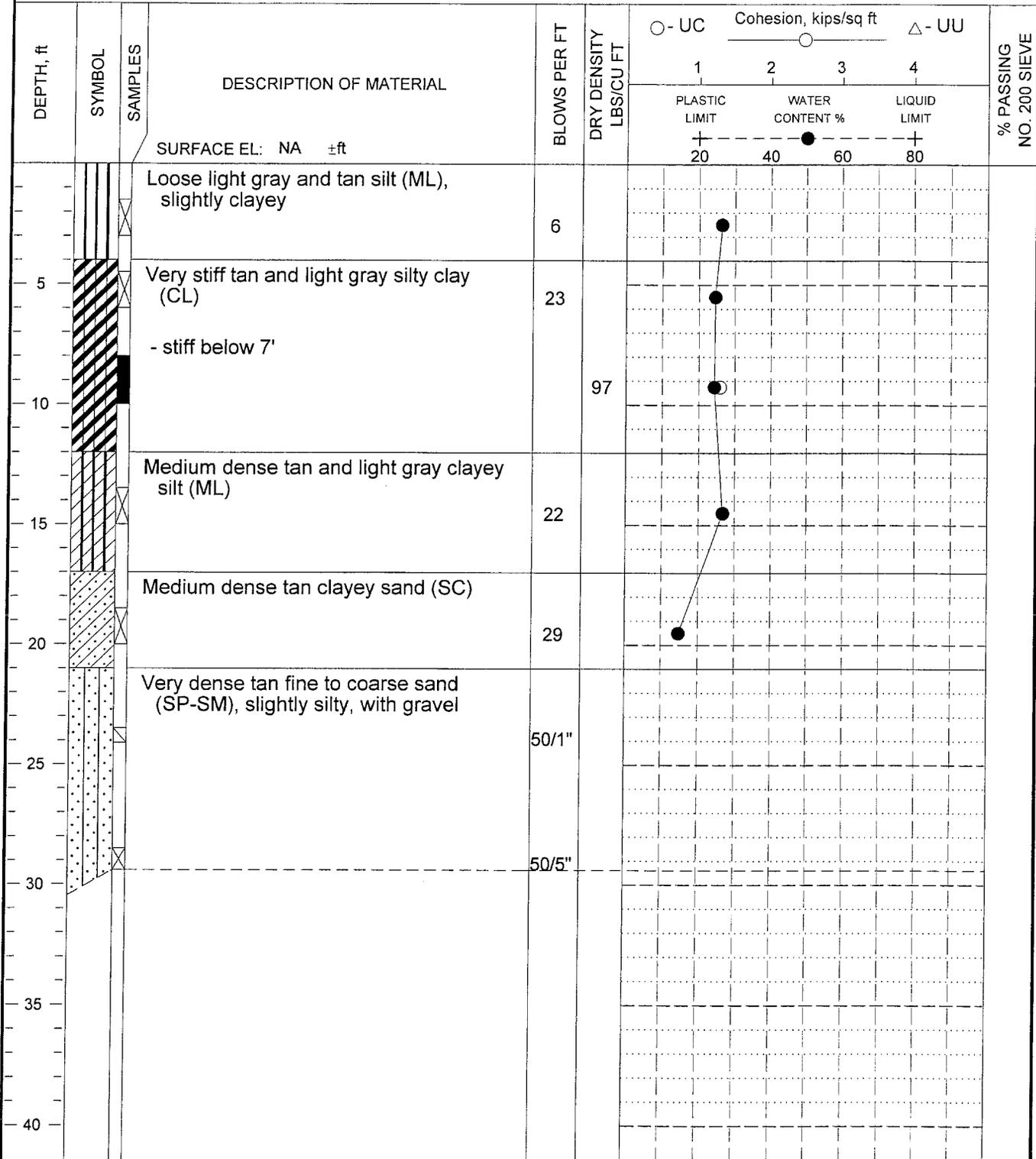
03099 DD ar

LOG OF BORING NO. 9

UPPER CAMP CREEK INTERCEPTOR DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 15',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 29.4 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 13' during auger drilling. Water level at 12.5' after 15 minutes and 12.5' on following day.

DATE: 03/03/03

03099 DD ar

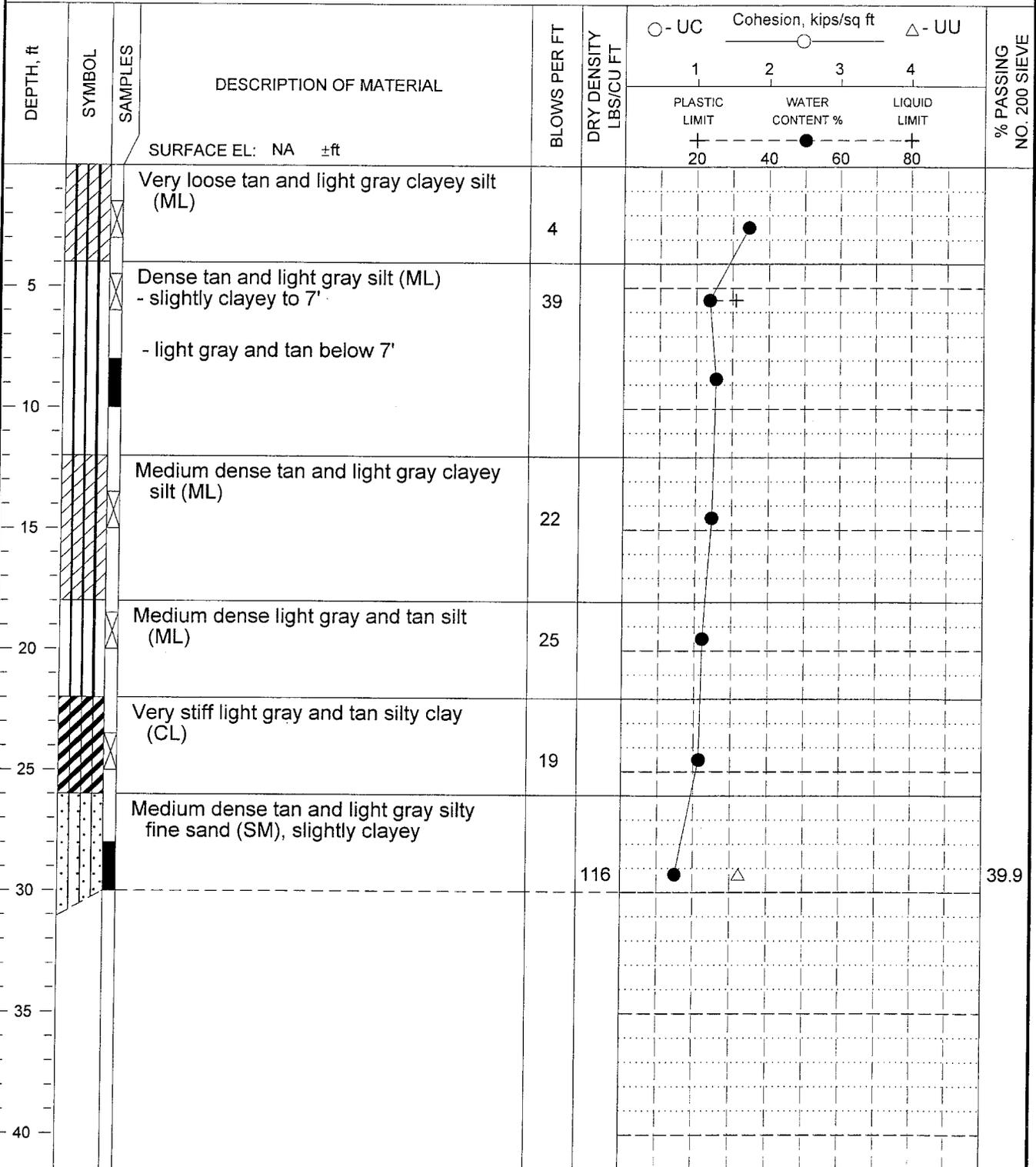
LOG OF BORING NO. 10

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 13',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 30 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 13' during auger drilling. Water level at 12.5' after 15 minutes and 12.5' on following day.

DATE: 03/03/03

03099 DD ar

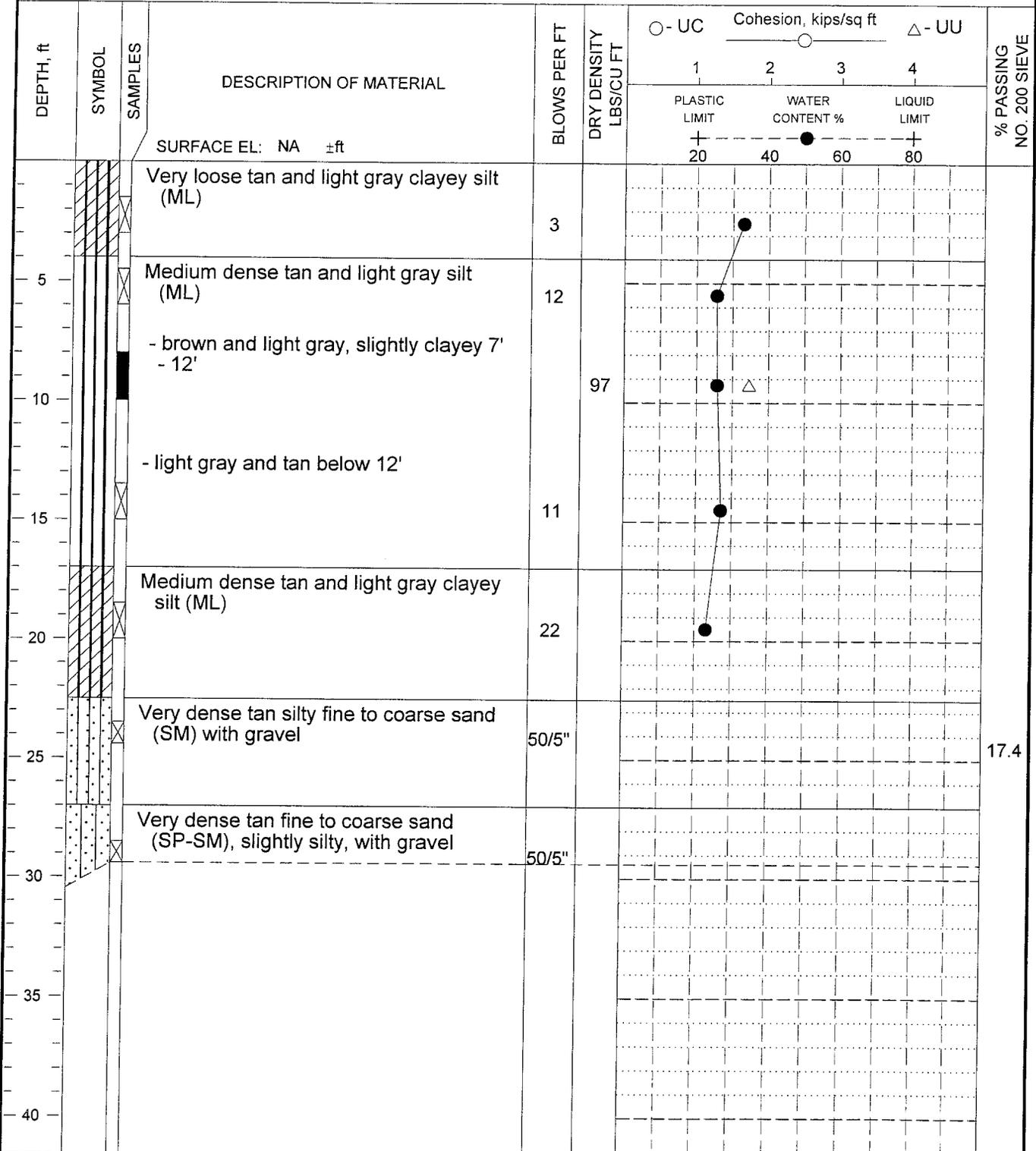
LOG OF BORING NO. 11

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger

LOCATION: See Figure 1



BORING DEPTH: 29.4 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 23' during auger drilling. Water level at 4' on following day. Piezometer P-1 set in adjacent hole, and water level at 14' on 3/14/03.

DATE: 03/03/03

03099 DD ar

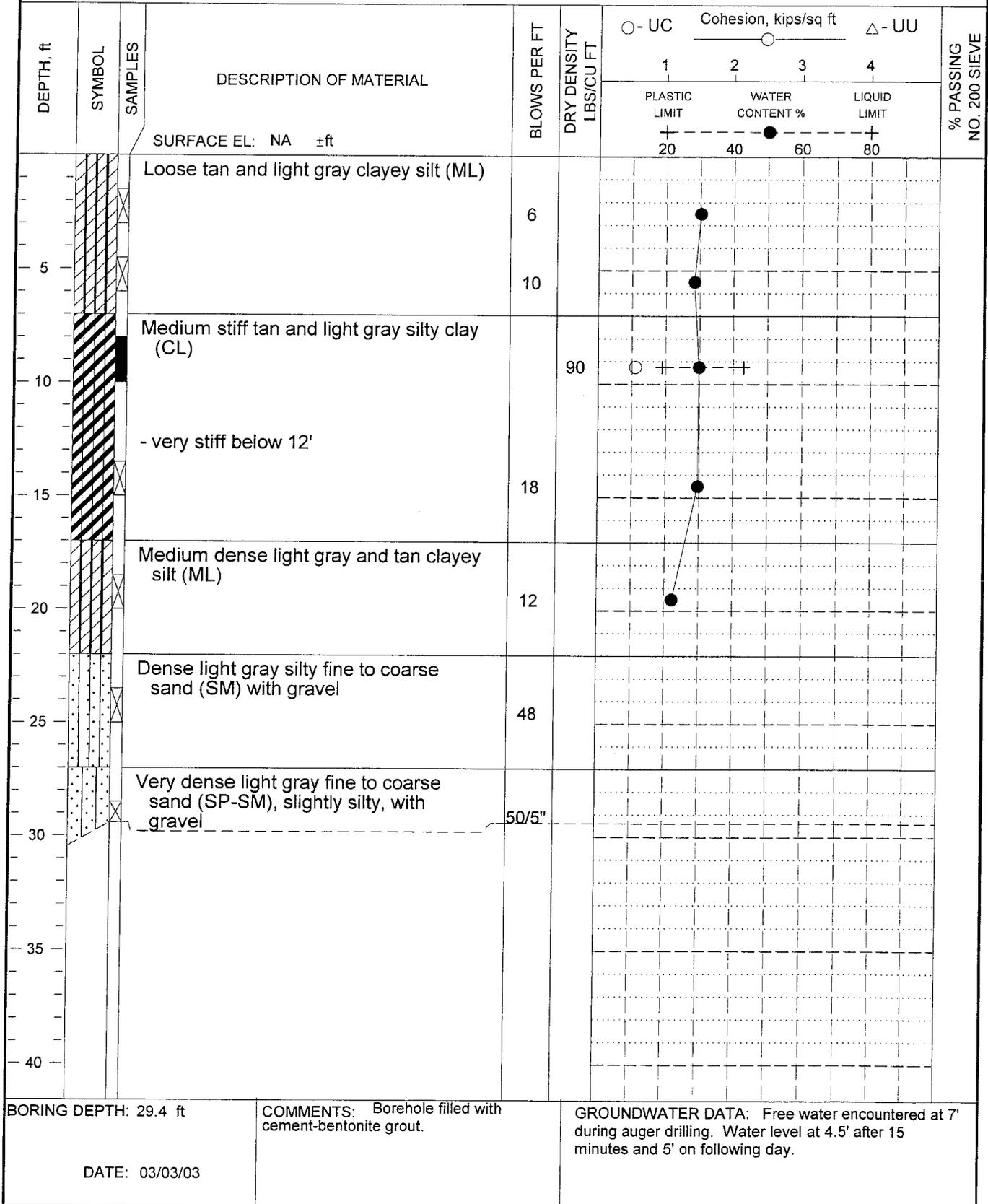
LOG OF BORING NO. 12

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 10',
then rotary wash to completion

LOCATION: See Figure 1



03089 DD ar

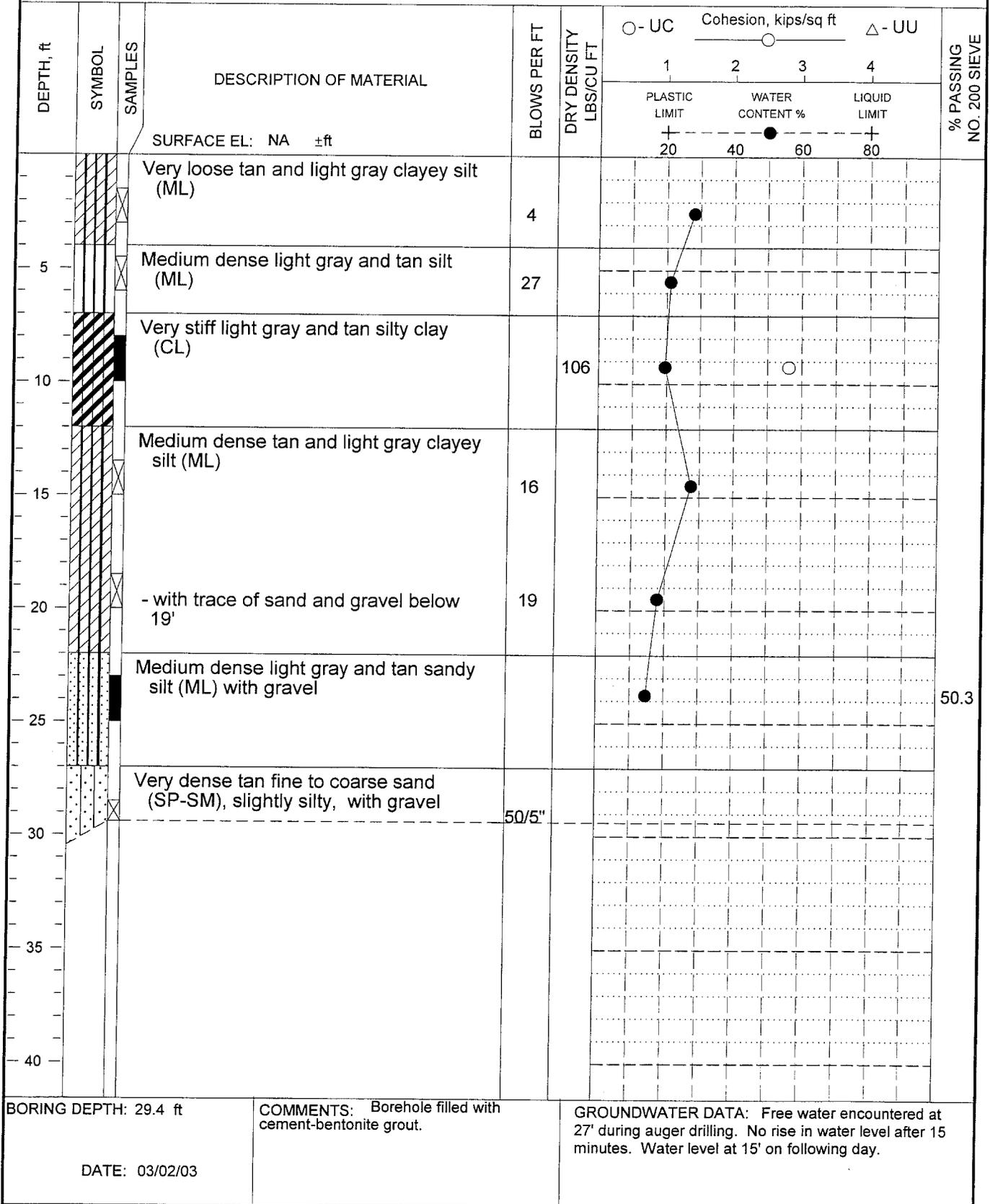
LOG OF BORING NO. 13

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger

LOCATION: See Figure 1



03099 DD ar

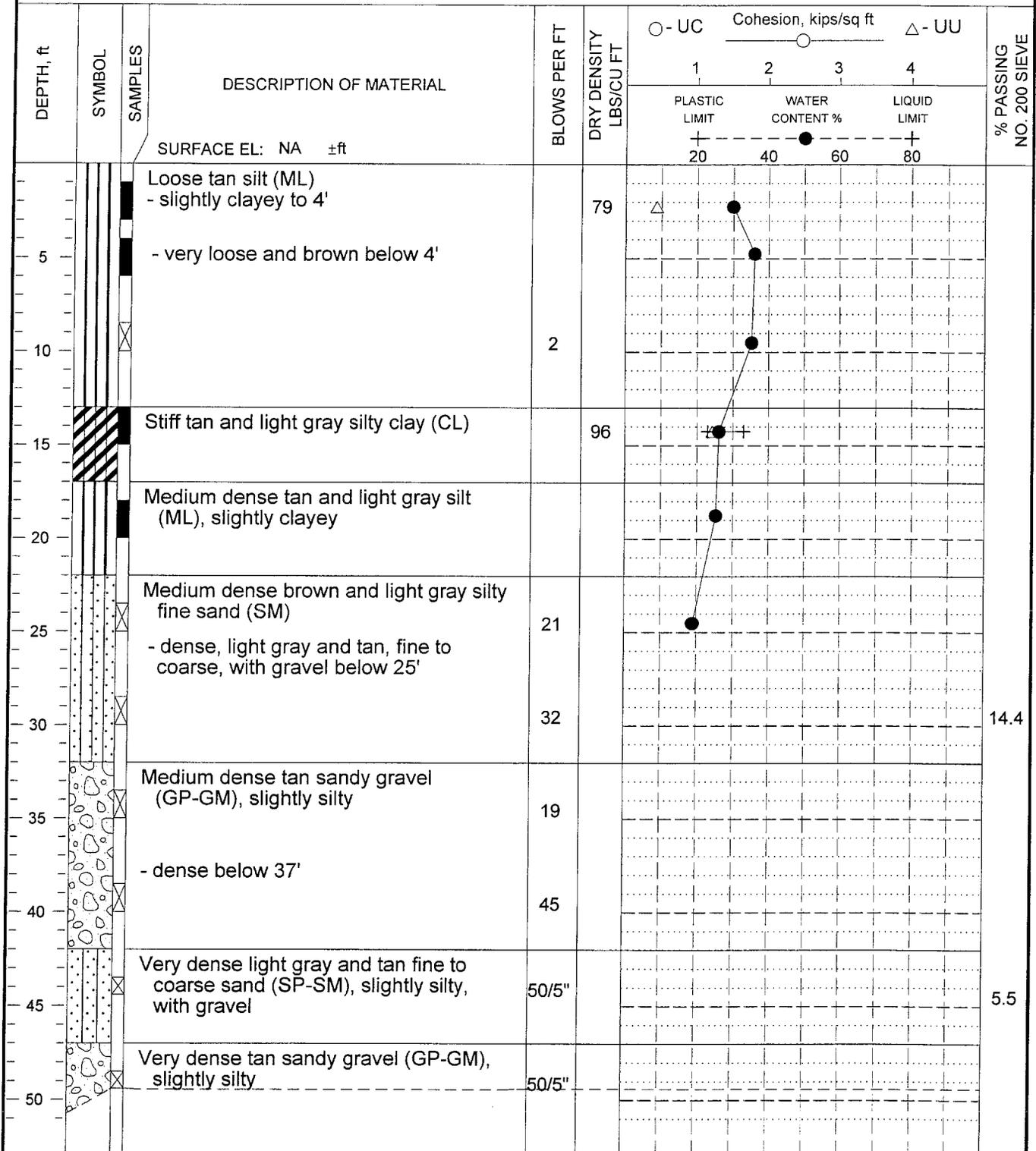
LOG OF BORING NO. 14

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 10',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 49.4 ft

DATE: 02/28/03

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 8' during auger drilling. Water level at 7' after 15 minutes and 6' on following day.

03099 DD ar

LOG OF BORING NO. 15

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 25',
then rotary wash to completion

LOCATION: See Figure 1

DEPTH, ft	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	DRY DENSITY LBS/CU FT	Cohesion, kips/sq ft				% PASSING NO. 200 SIEVE	
						○ - UC	Cohesion, kips/sq ft		△ - UU		
						1	2	3	4		
						PLASTIC LIMIT	WATER CONTENT %	LIQUID LIMIT			
						+	●	+			
						20	40	60	80		
			SURFACE EL: NA ±ft								
7			Loose tan and light gray clayey silt (ML)	7							
14			- medium dense, light gray and tan below 4'	14							
93			Medium stiff light gray and tan silty clay (CL)	93							
14			Medium dense brown silt (ML), slightly sandy	14							
13			Medium dense brown and light gray silty fine sand (SM)	13							
37			- with trace of gravel 21' - 25' - dense, red and brown, fine to coarse below 24'	37							
41			Very stiff tan and light gray clay (CH) with sand seams	41							

BORING DEPTH: 35 ft

DATE: 02/28/03

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 21' during auger drilling. No rise in water level after 15 minutes. Water level at 17' on following day.

03089 DD ar

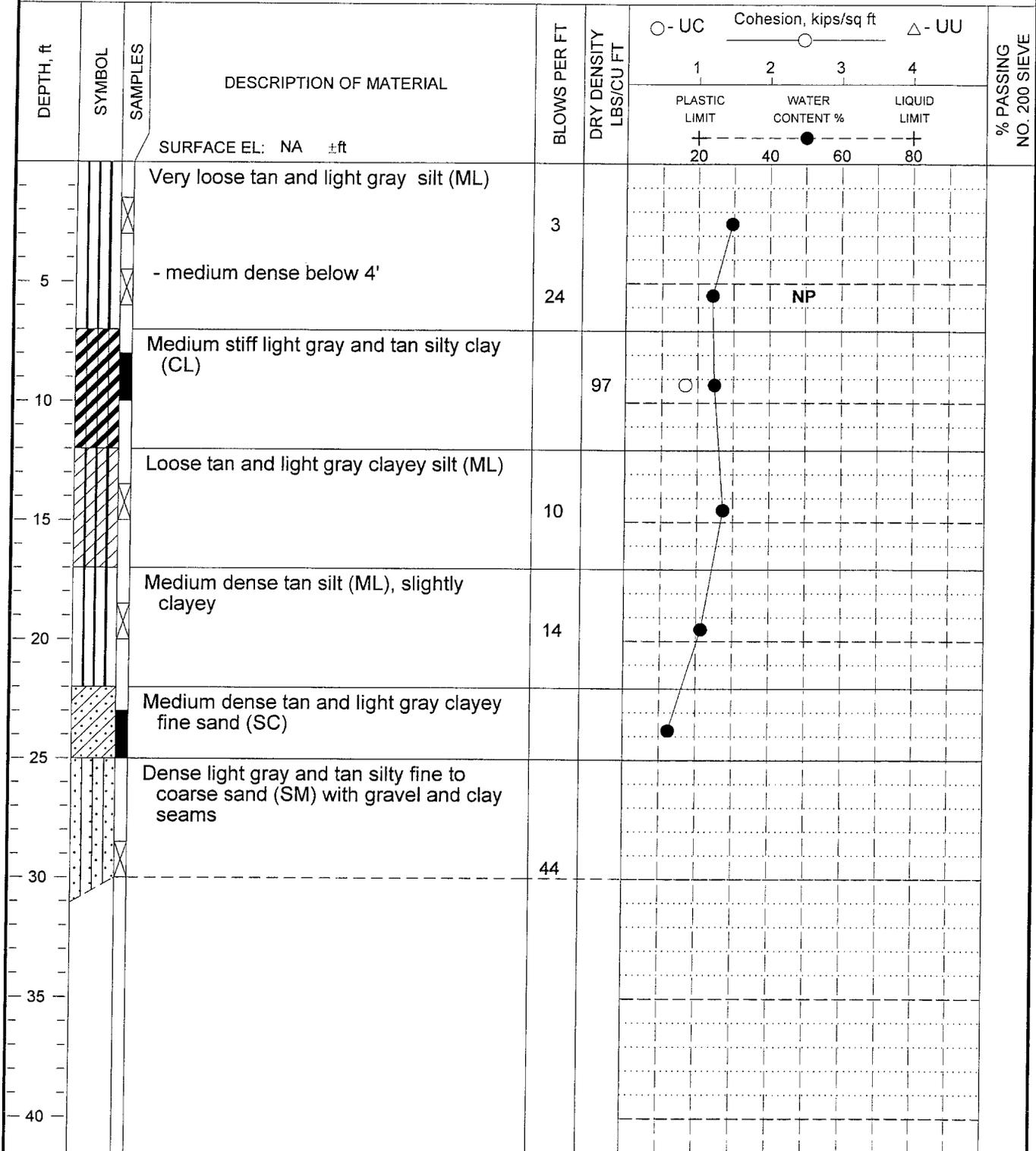
LOG OF BORING NO. 16

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 6',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 30 ft

DATE: 02/28/03

COMMENTS: Borehole filled with cement-bentonite grout.

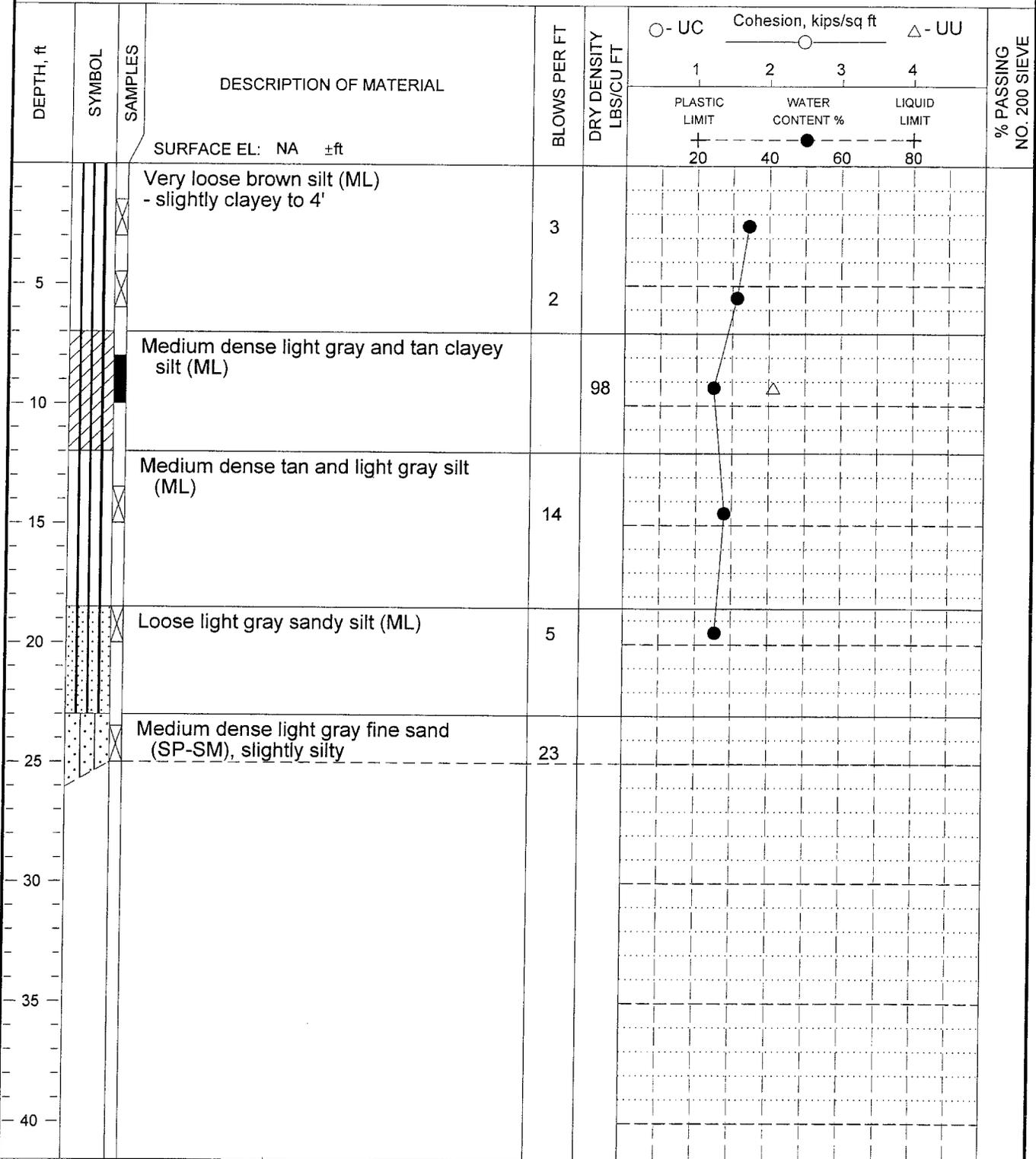
GROUNDWATER DATA: Free water encountered at 6' during auger drilling. Water level at 4' after 15 minutes and 1.5' on following day. Piezometer P-3 set in adjacent hole and water level at 15.5' on 3/14/03.

03099 DD ar

LOG OF BORING NO. 19
 UPPER CAMP CREEK INTERCEPTOR
 DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 6',
 then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 25 ft
 DATE: 03/01/03

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 2' during auger drilling. No rise in water level after 15 minutes. Water level at 1' on following day.

03099 DD ar

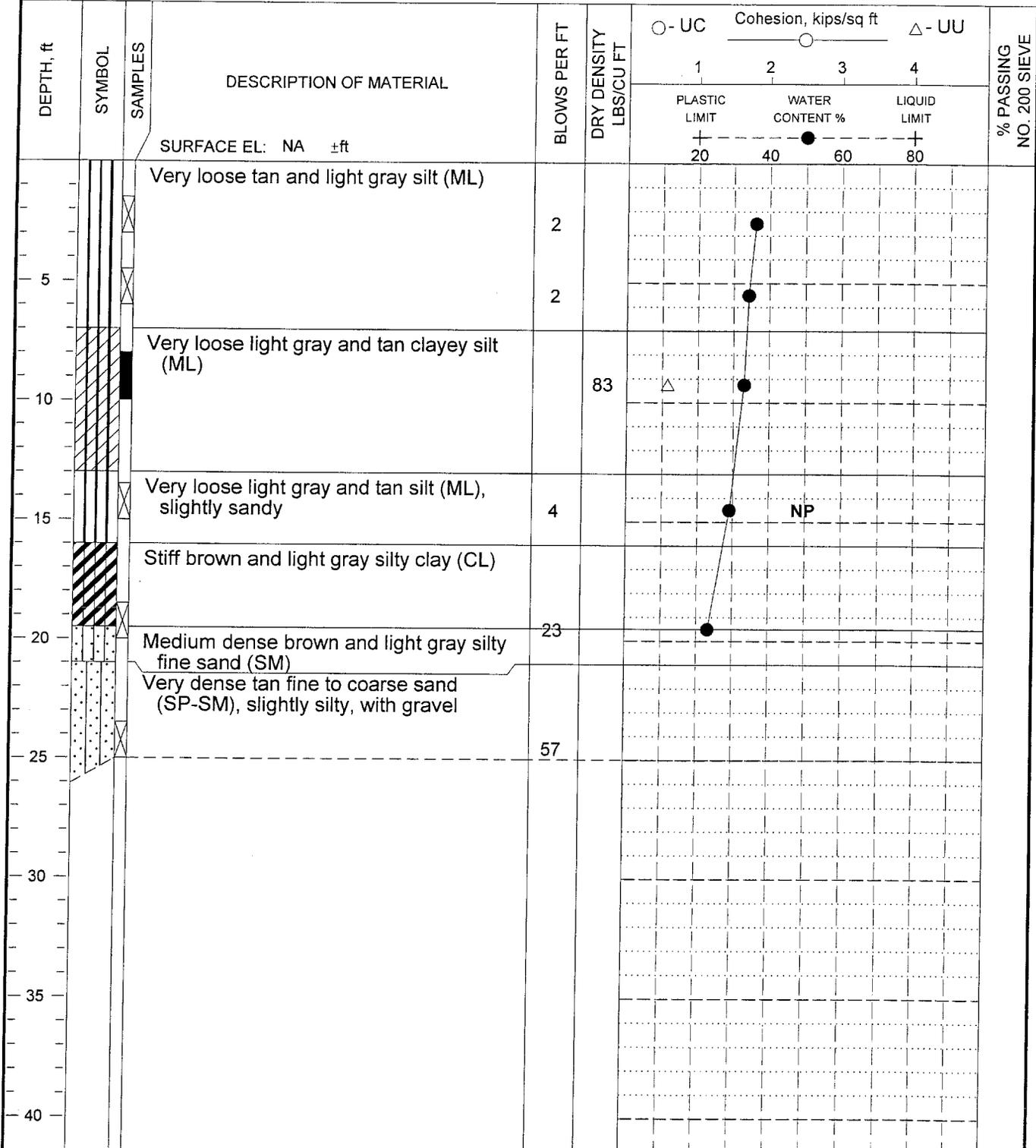
LOG OF BORING NO. 20

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 6',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 25 ft

DATE: 03/01/03

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 3' during auger drilling. No rise in water level after 15 minutes. Water level at 0.5' on following day.

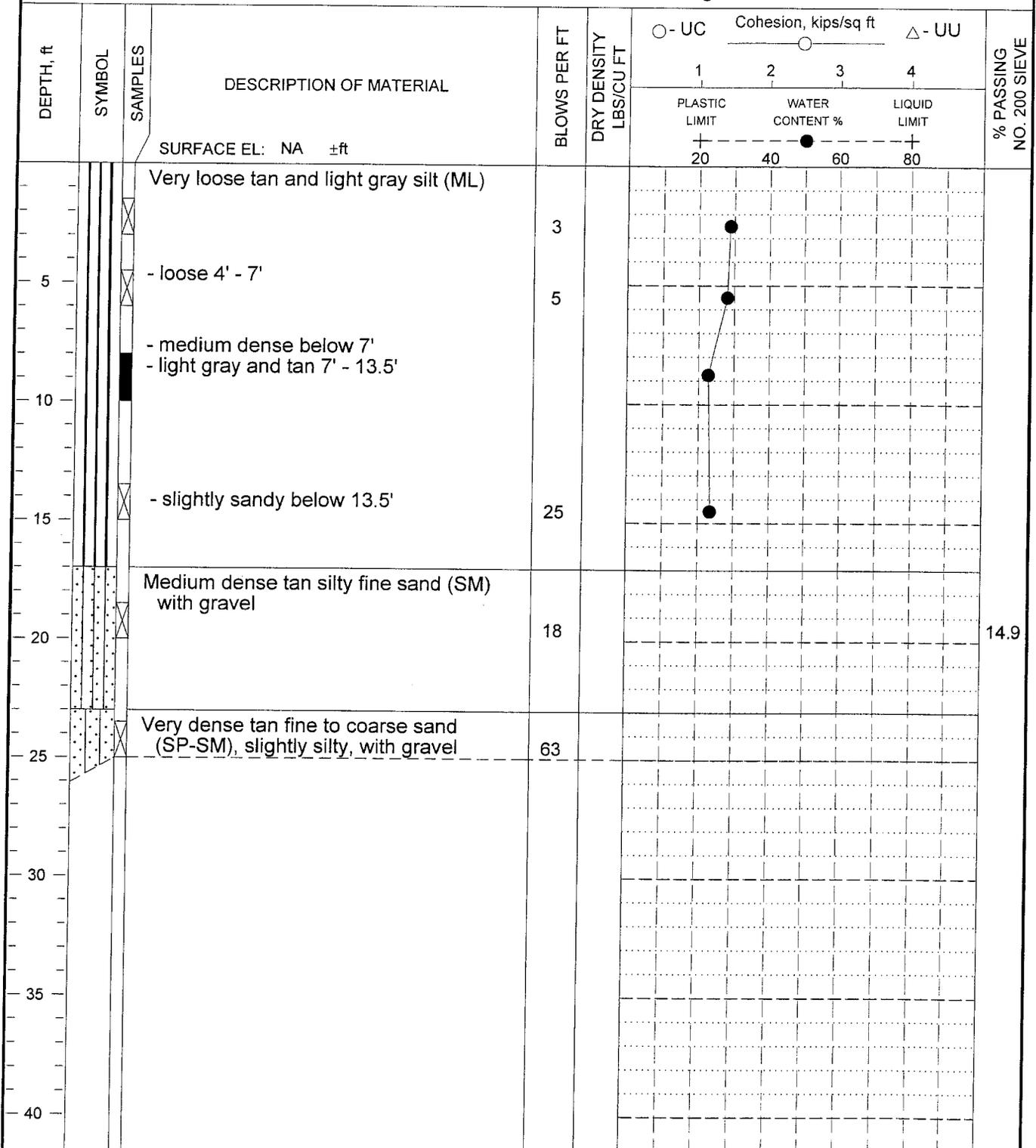
03099 DD ar

LOG OF BORING NO. 21

UPPER CAMP CREEK INTERCEPTOR
DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 10',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 25 ft

DATE: 03/01/03

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: No free water encountered during auger drilling. Water level at 5' on following day. Piezometer P-4 set in adjacent hole, and water level at 10' on 3/14/03.

03099 DD, ar

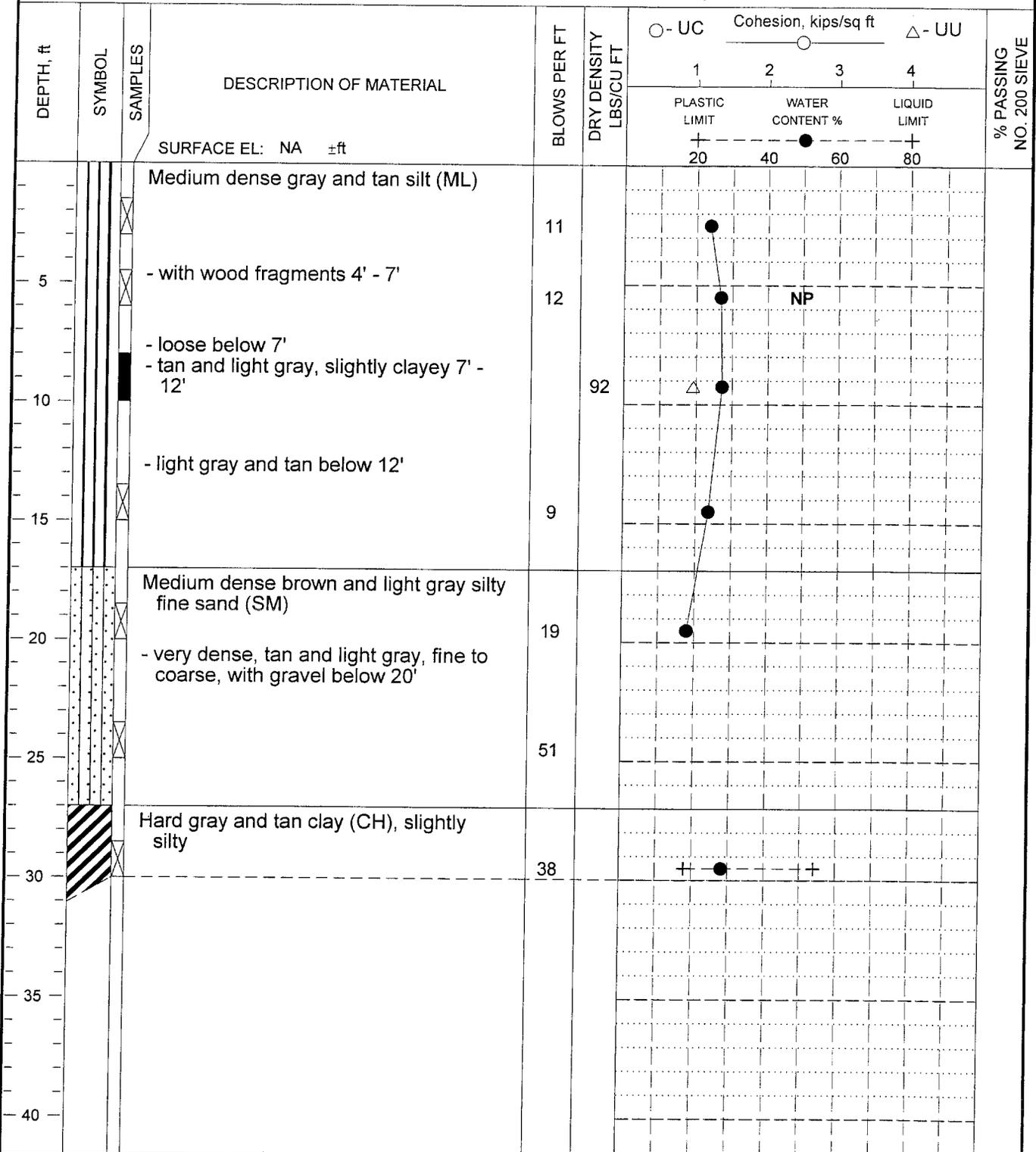
LOG OF BORING NO. 22

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 10',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 30 ft

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 8' during auger drilling. Water level at 6.5' after 15 minutes and 5' on following day.

DATE: 03/01/03

03099 DD ar

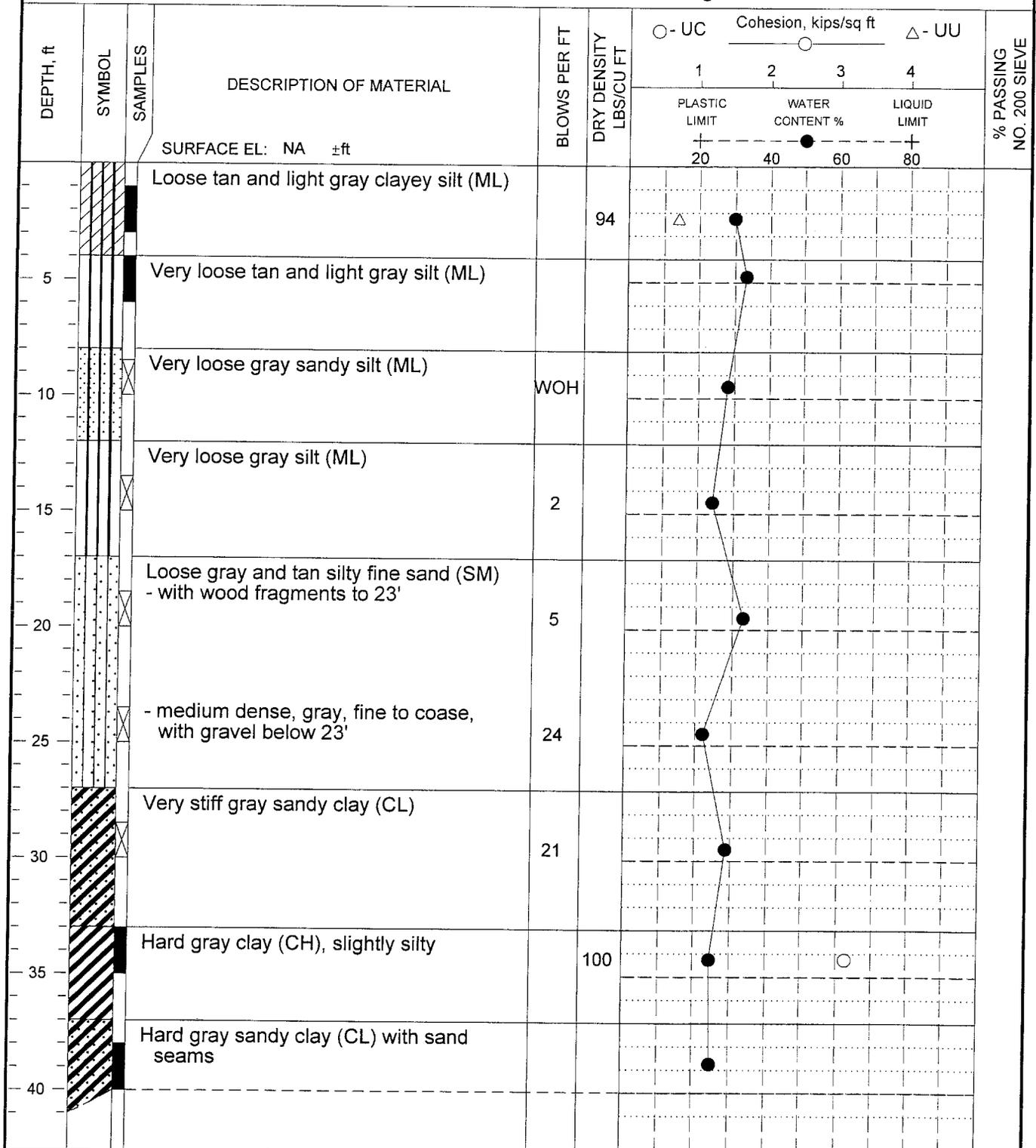
LOG OF BORING NO. 23

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 6',
then rotary wash to completion

LOCATION: See Figure 1



BORING DEPTH: 40 ft
DATE: 03/02/00

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 4' during auger drilling. Water level at 2' after 15 minutes and 0.5' on following day.

03099 DD ar

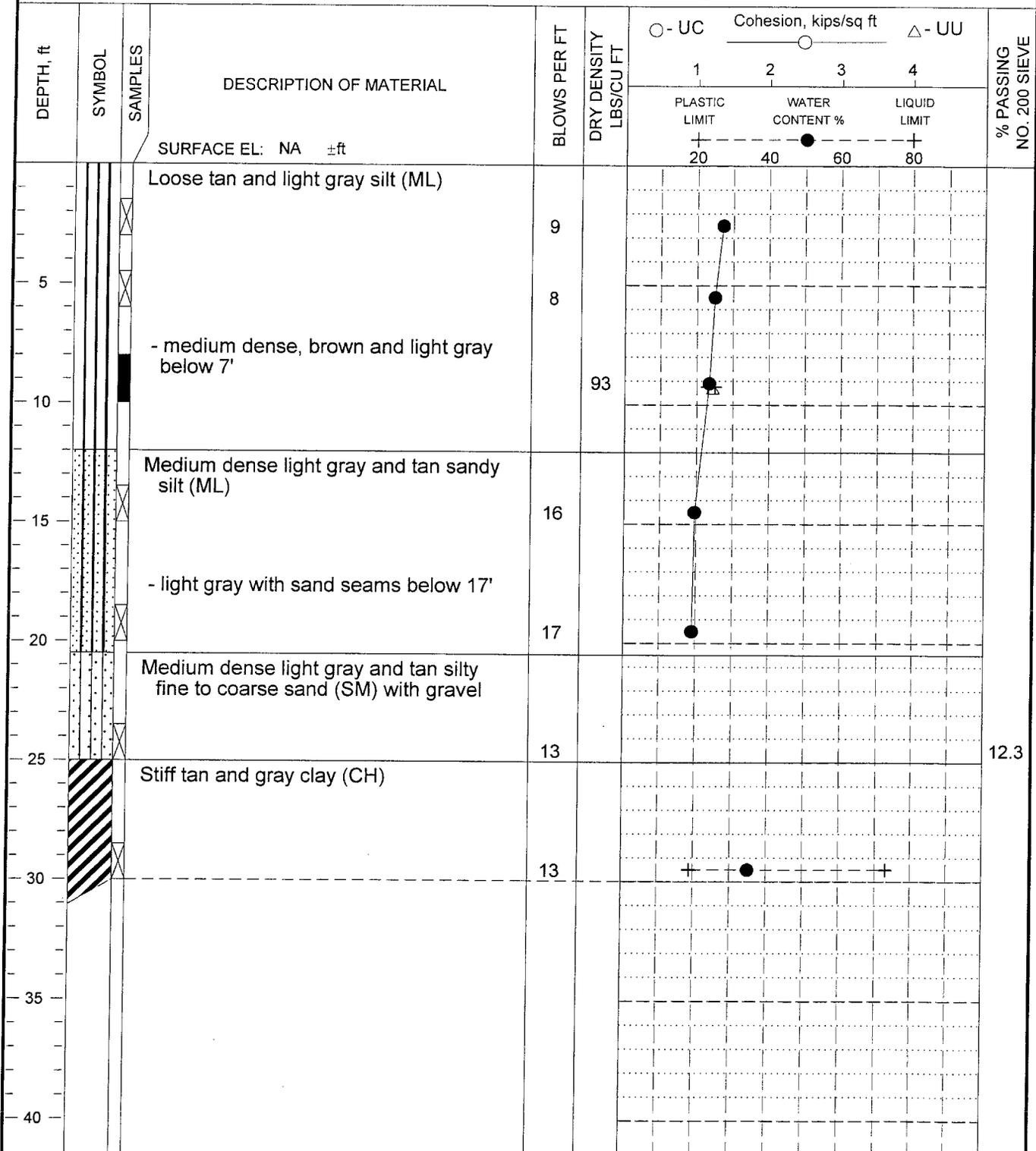
LOG OF BORING NO. 24

UPPER CAMP CREEK INTERCEPTOR

DESOTO COUNTY, MISSISSIPPI

TYPE: 4" Short-flight auger to 20',
then rotary wash to completion

LOCATION: See Figure 1

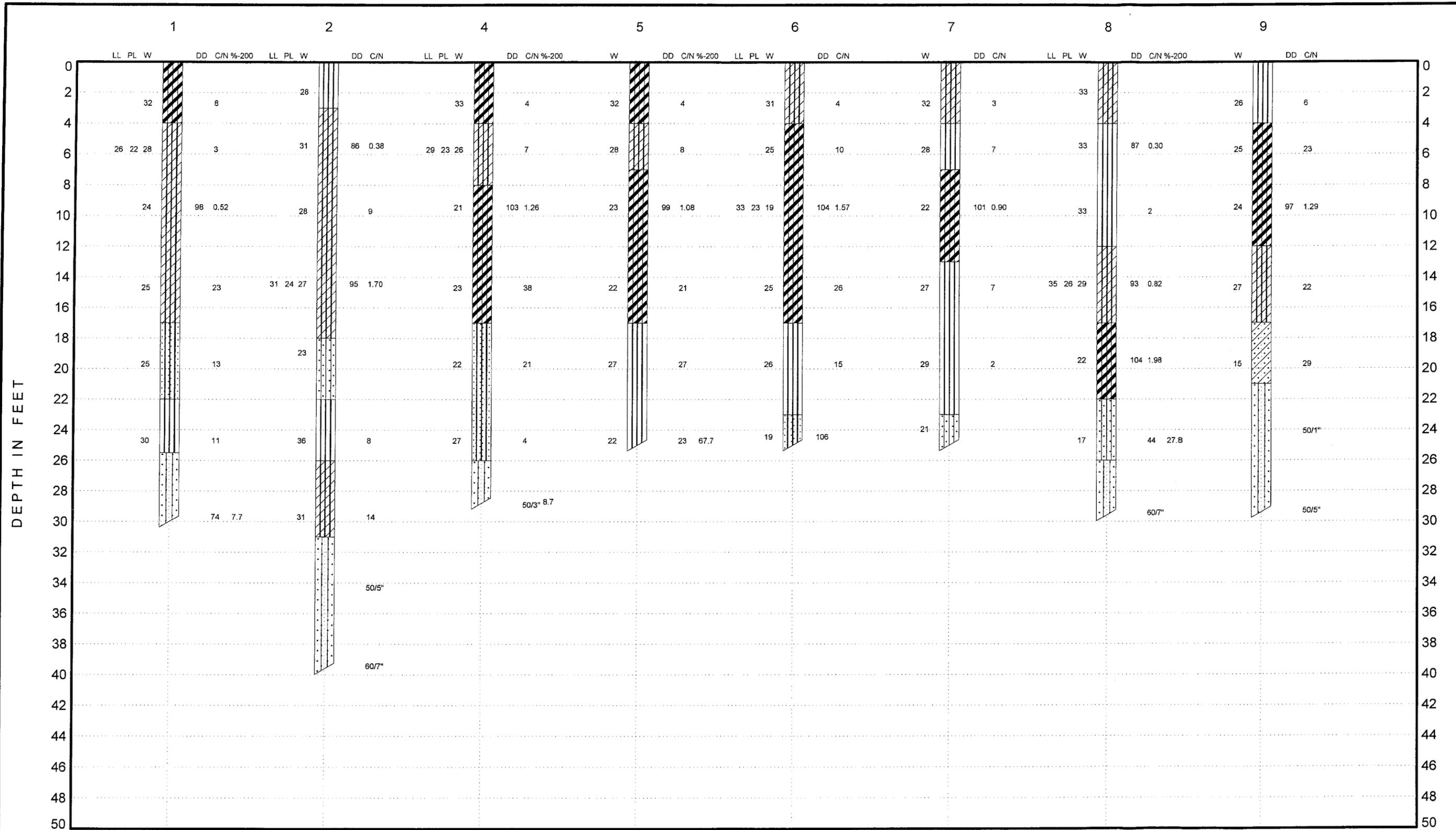


BORING DEPTH: 30 ft
DATE: 03/02/03

COMMENTS: Borehole filled with cement-bentonite grout.

GROUNDWATER DATA: Free water encountered at 20' during auger drilling. No rise in water level after 15 minutes. Water level at 14' on following day.

03099 DD ar



LEGEND:
 LL = Liquid Limit
 PL = Plastic Limit
 W = Water Content
 DD = Dry Density (pcf)
 C/N = Cohesion (ksf)/Penetration Resistance, N (blows per ft) in the same column
 % -200 = % Passing No. 200 Sieve

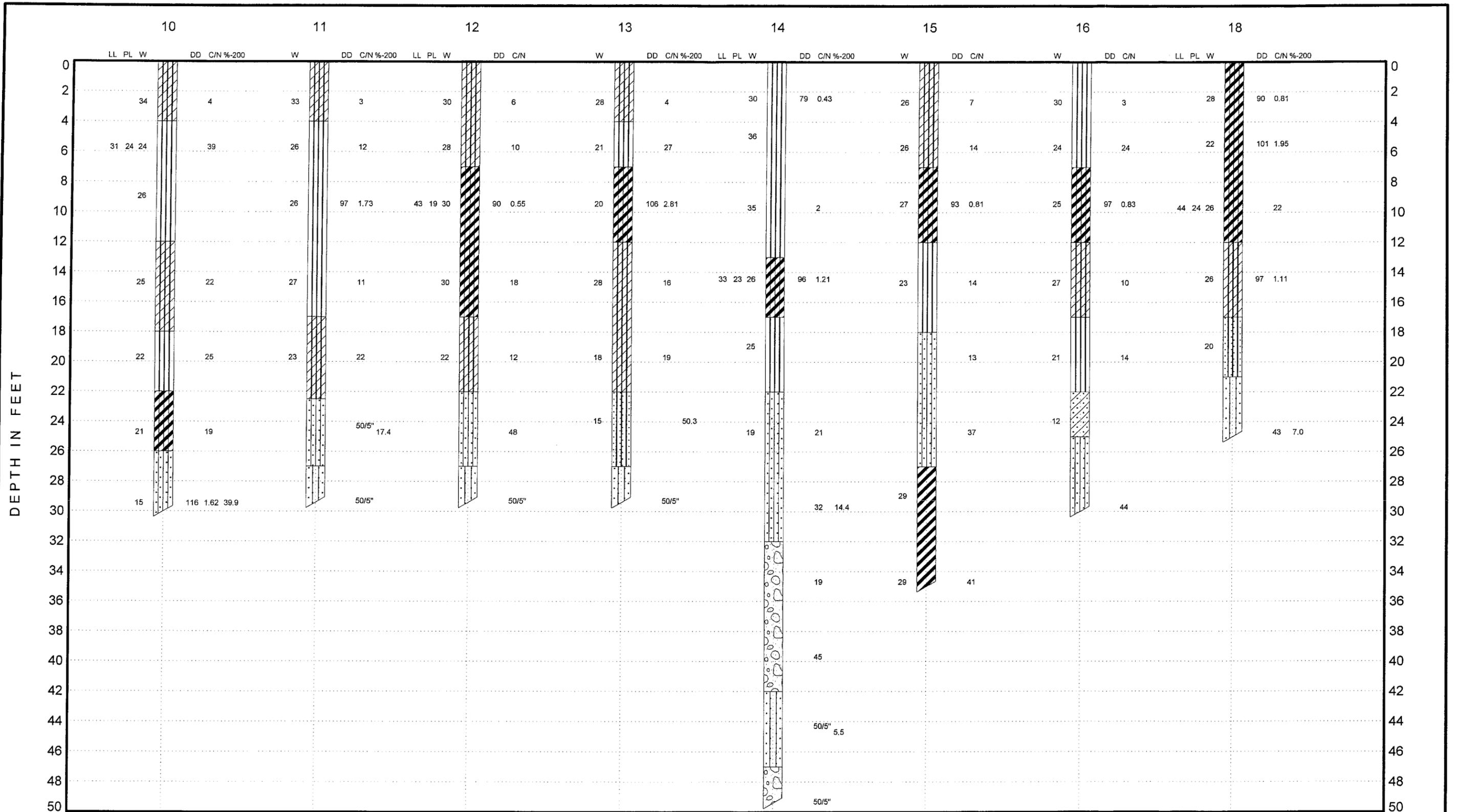
NOTE: See Figure 2 for boring log legend.

SUBSURFACE PROFILE

UPPER CAMP CREEK INTERCEPTOR
 DESOTO COUNTY, MISSISSIPPI

Job No.	03099	Date	3/28/03	Figure	25
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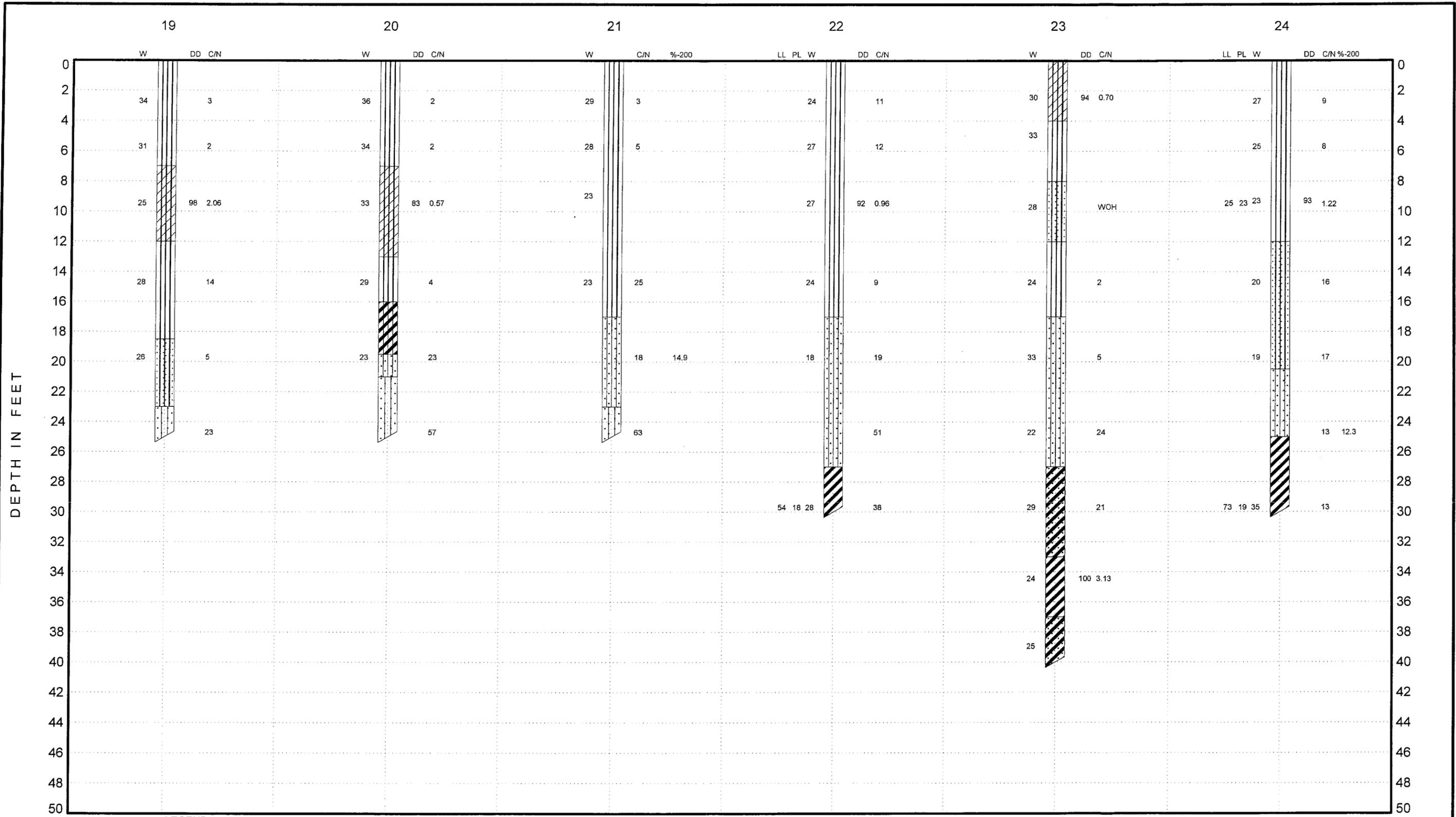
GENERAL ENGINEERING, INC.



LEGEND:
 LL = Liquid Limit
 PL = Plastic Limit
 W = Water Content
 DD = Dry Density (pcf)
 C/N = Cohesion (ksf)/Penetration Resistance, N (blows per ft) in the same column
 %-200 = % Passing No. 200 Sieve

NOTE: See Figure 2 for boring log legend.

SUBSURFACE PROFILE				
UPPER CAMP CREEK INTERCEPTOR DESOTO COUNTY, MISSISSIPPI				
Job No.	03099	Date	3/28/03	Figure 26



LEGEND:
 LL = Liquid Limit
 PL = Plastic Limit
 W = Water Content
 DD = Dry Density (pcf)
 C/N = Cohesion (ksf)/Penetration Resistance, N (blows per ft) in the same column
 %-200 = % Passing No. 200 Sieve

NOTE: See Figure 2 for boring log legend.

SUBSURFACE PROFILE			
UPPER CAMP CREEK INTERCEPTOR DESOTO COUNTY, MISSISSIPPI			
Job No.	03099	Date	3/28/03
Figure	27		

GENERIC.FENCE.BIG

BORING LOCATIONS
Upper Camp Creek Interceptor
DeSoto County, Mississippi

Boring No.	Northing	Easting	Latitude	Longitude
1	1950632.4	2432400.9	34 51 39.8	89 52 50.1
2	1951771.4	2432324.9	34 51 51.1	89 52 51.0
4	1955098.1	2432950.8	34 52 24.0	89 52 43.3
5	1956584.4	2433153.3	34 52 38.7	89 52 40.8
6	1958072.5	2433341.2	34 52 53.4	89 52 38.5
7	1959558.0	2433547.5	34 53 08.1	89 52 35.9
8	1961042.3	2433735.1	34 53 22.7	89 52 33.6
9	1962532.3	2433906.0	34 53 37.5	89 52 31.4
10	1964018.0	2434107.5	34 53 52.2	89 52 28.9
11	1965506.6	2434292.1	34 54 06.9	89 52 26.6
12	1966995.2	2434476.7	34 54 21.6	89 52 24.3
13	1968481.9	2434664.3	34 54 36.3	89 52 22.0
14	1969977.3	2434869.9	34 54 51.1	89 52 19.5
15	1971381.0	2435083.6	34 55 04.9	89 52 16.8
16	1971446.3	2436795.9	34 55 05.5	89 51 56.2
18	1974266.8	2436803.0	34 55 33.4	89 51 56.0
19	1975945.4	2436870.1	34 55 50.0	89 51 55.1
20	1976981.2	2437499.9	34 56 00.2	89 51 47.5
21	1976981.5	2439050.0	34 56 00.1	89 51 28.9
22	1976981.8	2440599.9	34 56 00.1	89 51 10.2
23	1976982.0	2442099.9	34 56 00.0	89 50 52.2
24	1977448.7	2443142.0	34 56 04.6	89 50 39.7

Notes:

- 1) Boring 3 not made because its location was not accessible to drilling equipment.
- 2) Boring 17 not made because permission not given by landowner to drill at its location.

**Piezometer Readings
Upper Camp Creek Interceptor
DeSoto County, Mississippi**

Boring No.	Piezometer No.	Date	Depth to Water Level Below Ground Surface (ft)
11	P-1	3/14/03	14.0
2	P-2	3/14/03	12.5
16	P-3	3/14/03	15.5
21	P-4	3/14/03	10.0

FIELD RESISTIVITY SURVEY RESULTS

Upper Camp Creek Interceptor
DeSoto County, Mississippi

Location	Probe Spacing (ft)	Meter Reading (ohms)	Resistivity (ohm-m)
B-1	5	24.8	237.47
B-1	10	42.4	812.01
B-1	20	5.68	217.56
B-1	30	7.37	423.43
B-1	40	5.44	416.73
B-15	5	17.04	163.17
B-15	10	6.56	125.63
B-15	20	3.24	124.10
B-15	30	2.04	117.21
B-15	40	1.61	123.33
B-10	5	31.90	305.46
B-10	10	18.30	350.47
B-10	20	5.68	217.56
B-10	30	2.93	168.34
B-10	40	1.94	148.61
B-6	5	35.10	336.10
B-6	10	8.96	171.59
B-6	20	2.63	100.74
B-6	30	1.59	91.35
B-6	40	1.00	76.60
B-19	5	20.80	199.17
B-19	10	6.60	126.40
B-19	20	1.95	74.69
B-19	30	0.87	49.98
B-19	40	0.44	33.71
B-24	5	17.28	165.47
B-24	10	10.67	204.34
B-24	20	5.22	199.94
B-24	30	3.06	175.81
B-24	40	1.78	136.36

FIGURE 30



SOUTHERN TECHNICAL SERVICES INC.

CHEMISTS – BACTERIOLOGISTS
BIOLOGISTS – ENVIRONMENTAL SCIENTISTS
1627 WESTHAVEN BLVD.
JACKSON, MS 39209
(601) 922-8652

BURNS, COOLEY, DENNIS ENGINEERING, INC.
P.O. BOX 12828
JACKSON, MS 39236
ATTN: MR. DAVID DENNIS

REPORT OF TESTS ON SOIL SAMPLE(S) RECEIVED FROM YOU 03-18-03.

SAMPLE ID: PRJ 03099

STS LOG NO(S): 0303020-30

SAMPLE ID	pH,SU	SULFATES, SO ₄ PPM	CHLORIDES Cl, PPM	
B-4 S-7 25'	4.6	<20.0	36.9	
B-5 S-6 20'	5.1	52.0	32.6	
B-6 S-8 24.5'	4.9	<20.0	23.9	
B-7 S-7 254'	3.9	135	30.4	
B-8 S-10 25'	4.0	<20.0	26.1	
B-9 S-7 30'	4.1	50.0	23.9	
B-10 S-9 29.5'	5.6	50.0	19.6	
B-11 S-7 25'	3.5	<20.0	23.9	
B-12 S-7 25'	4.2	<20.0	20.6	
B-13 S-9 30'	4.3	<20.0	26.1	
B-14 S-11 30'	4.6	<20.0	21.7	

TEST PROCEDURES: *Methods for Soil Analysis, ASTM D-2974.*

DATE ANALYZED: 03/19-21/03 by GMC/JKB.

Gene M. Coxwell

National Registry of Environmental Professionals
Registration # 840

SOUTHERN TECHNICAL SERVICES INC.
 CHEMISTS – BACTERIOLOGISTS
 BIOLOGISTS – ENVIRONMENTAL SCIENTISTS
 1627 WESTHAVEN BLVD.
 JACKSON, MS 39209
 (601) 922-8652



BURNS, COOLEY, DENNIS ENGINEERING, INC.
 P.O. BOX 12828
 JACKSON, MS 39236
 ATTN: MR. DAVID DENNIS

REPORT OF TESTS ON SOIL SAMPLE(S) RECEIVED FROM YOU 03-18-03.

SAMPLE ID: PRJ 03099

STS LOG NO(S): 0303031-42

SAMPLE ID	pH,SU	SULFATES, SO ₄ PPM	CHLORIDES Cl, PPM	
B-15 S-8 29'	4.3	<20.0	20.6	
B-16 S-7 24'	4.2	<20.0	21.7	
B-18 S-8 19'	4.7	<20.0	18.5	
B-19 S-6 20'	4.4	<20.0	17.4	
B-20 S-6 20'	3.5	<20.0	17.4	
B-21 S-5 20'	4.0	<20.0	17.4	
B-22 S-7 25'	4.5	<20.0	13.0	
B-23 S-8 25'	3.7	51.0	10.9	
B-23 S-9 30'	NO	SAMPLE		
B-24 S-7 25'	3.5	50.0	13.0	
B-1 S-7 25'	3.6	<20.0	19.6	
B-2 S-10 25'	3.1	65.0	23.9	

TEST PROCEDURES: *Methods for Soil Analysis, ASTM D-2974.*

DATE ANALYZED: 03/19-21/03 by GMC/JKB.

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