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USACE / NAVFAC / AFCEC / NASA **UFGS-02 32 13 (February 2021)**

Preparing Activity: USACE **Superseding without Revision UFGS-02 32 00 (May 2010)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION TABLE OF CONTENTS

DIVISION 02 - EXISTING CONDITIONS

SECTION 02 32 13

SUBSURFACE DRILLING AND SAMPLING

02/21

-- End of Section Table of Contents --

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SECTION 02 32 13

SUBSURFACE DRILLING AND SAMPLING
02/21

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NOTE: This guide specification covers the requirements for determining the type, nature, and characteristics of subsurface materials as they exist to the depths and at the locations specified. This section was originally developed for USACE Civil Works projects.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

NOTE: TO DOWNLOAD UFGS GRAPHICS
Go to
http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/for
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PART 1 GENERAL

1.1 UNIT PRICES

****
NOTE: If Section 01 20 00 PRICE AND PAYMENT PROCEDURES is included in the project specifications, this paragraph title (UNIT PRICES) should be deleted from this section and the remaining appropriately edited subparagraphs below should be inserted into Section 01 20 00.

****

Make all measurements for payment by or in the presence of the Contracting Officer. Preserve all holes in good condition until final measurement and until the records and samples have been examined and accepted. Payment will be made only for drilling and pressure testing those holes or for excavating those test pits that are included in the SCHEDULE OF DRILLING, SAMPLING, AND TESTING, or are directed by the Contracting Officer to be so drilled or excavated. Payment will not be made for any hole or testing for which satisfactory records (and samples), as determined by the Contracting Officer, are not furnished.

1.1.1 Mobilization and Demobilization

1.1.1.1 Payment

Payment will be made for costs associated with mobilization and demobilization. Sixty percent of the Mobilization and Demobilization lump sum price will be paid following completion of moving onto the site, including complete assembly in working order, of all equipment necessary to perform the required drilling, sampling, pressure-testing and test pit excavation operations. The remaining 40 percent of the contract lump sum price will be paid after all site restoration is completed and all equipment has been removed from the site. No separate payment will be made for moves between holes or test pits.

1.1.1.2 Unit of Measure

Unit of measure: lump sum.

1.1.2 Auger Boring and Sampling of Drill Holes

1.1.2.1 Payment

Payment will be made for costs associated with Auger Boring and Sampling, [_____] mm inch Diameter Drill Holes.

1.1.2.2 Measurement

Auger Boring and Sampling, [_____] mm inch Diameter Drill Holes will be measured for payment to the nearest 300 mm linear foot, based upon the linear meters feet of holes that were actually drilled through overburden with augers in accordance with the specifications. Measurements will be made from the original ground surface.

1.1.2.3 Unit of Measure

Unit of measure: linear meter foot.

1.1.3 Drive Sample Boring and Sampling

1.1.3.1 Payment

Payment will be made for costs associated with Drive Sample Boring and Sampling, - [_____] mm inch Diameter Samples.

1.1.3.2 Measurement

Drilling for drive sample boring and sampling will be measured for payment

to the nearest 300 mm linear foot, based upon the linear meters feet of holes that were actually drilled by drive-sample-boring methods in accordance with the specifications. Measurements will be made from the original ground surface.

1.1.3.3 Unit of Measure

Unit of measure: linear m foot.

1.1.4 Undisturbed Sample Boring and Sampling

1.1.4.1 Payment

Payment will be made for costs associated with Undisturbed Sample Boring and Sampling, [_____] mm inch Diameter Samples.

1.1.4.2 Measurement

Drilling for undisturbed sample boring and sampling will be measured for payment to the nearest 300 mm foot, based upon the linear meters feet of holes that were actually drilled by undisturbed sampling methods in accordance with the specifications. Measurements will be made from the original ground surface.

1.1.4.3 Unit of Measurement

Unit of measure: linear m foot.

1.1.5 Core Hole Overburden Drilling, Without Sampling

1.1.5.1 Payment

Payment will be made for costs associated with Core Hole Overburden Drilling, Without Sampling, [_____] mm inch Diameter Drill Holes, [Vertical] [Inclined].

1.1.5.2 Measurement

Core hole drilling through overburden in order to permit core drilling of rock for [vertical] [inclined] holes where sampling of overburden is not required will be measured for payment to the nearest 300 mm foot, based upon the linear meters feet of hole actually drilled and cased in accordance with these specifications.

1.1.5.3 Unit of Measure

Unit of measure: linear m foot.

1.1.6 Core Drilling, [Vertical] [Inclined] Holes

1.1.6.1 Payment

Payment will be made for costs associated with Core Drilling [Vertical] [Inclined] Holes for [_____] mm inch Diameter Cores.

1.1.6.2 Measurement

Core Drilling [Vertical] [Inclined] Holes for [_____] mm inch Diameter Cores will be measured for payment to the nearest 300 mm foot, based upon

the linear meters feet of hole actually drilled in rock in accordance with the specifications.

1.1.6.3 Unit of Measure

Unit of measure: linear m foot.

1.1.7 Pressure Testing (Hydraulic)

1.1.7.1 Payment

Payment will be made for costs associated with Pressure Testing (Hydraulic).

1.1.7.2 Measurement

Pressure Testing (Hydraulic) will be measured for payment based upon the number of hours that pressure testing (hydraulic) was actually performed at the direction of the Contracting Officer and in accordance with the specifications or as otherwise required. Pressure testing (hydraulic) will be measured from the time the pressure testing is begun at the direction of the Contracting Officer to the time of completion of the test as determined by the Contracting Officer. Time spent in placing packer elements in the holes, raising or lowering the packer elements from one lift to another, or removing the packer elements from the holes and time spent in preparation for testing will not be included.

1.1.7.3 Unit of Measure

Unit of measure: hour.

1.1.8 Test Pit Excavation

1.1.8.1 Payment

****

NOTE: Delete the first bracketed option below if the payment paragraphs are inserted in Section 01 20 00 PRICE AND PAYMENT PROCEDURES; otherwise delete the second bracketed option.

****

Payment will be made for costs associated with excavating test pits in accordance with [this section] [Section 01 20 00 PRICE AND PAYMENT PROCEDURES].

1.1.8.2 Measurement

Test Pit Excavation will be measured for payment based upon the contract unit price for each test pit excavated[, which includes the cost of all shoring materials].

1.1.8.3 Unit of Measure

Unit of measure: each.

1.1.9 Test Pit Undisturbed Sample

1.1.9.1 Payment

****

NOTE: Delete the first bracketed option below if the payment paragraphs are inserted in Section 01 20 00 PRICE AND PAYMENT PROCEDURES; otherwise delete the second bracketed option.

****

Payment will be made for costs associated with undisturbed sampling in a test pit in accordance with [this section] [Section 01 20 00 PRICE AND PAYMENT PROCEDURES].

1.1.9.2 Measurement

Test Pit Undisturbed Sample will be measured for payment based upon the contract unit price for each sample obtained.

1.1.9.3 Unit of Measure

Unit of measure: each.

1.1.10 Material for Shoring/Lining Pit Excavation

1.1.10.1 Payment

Payments will be made for costs associated with Shoring/Lining Test Pit Excavations at the contract unit price for each test pit excavation.

1.1.10.2 Measurement

Material used for shoring/lining test pit excavations will be measured for payment based upon the amount of material actually used as directed by the Contracting Officer for shoring/lining the excavations. Material salvaged and re-used at the direction of the Contracting Officer will be paid for at the rate of 30 percent of the contract unit price.

1.1.10.3 Unit of Measure

Unit of measure: each.

1.1.11 Casing Left in Drill Holes

1.1.11.1 Payment

Payment will be made for costs associated with Casing Left in Drill Holes, [_____] mm inch Diameter.

1.1.11.2 Measurement

Casing Left in Drill Holes will be measured for payment to the nearest 300 mm foot, based upon the linear meters feet of casing actually left in the drill holes at the direction of the Contracting Officer.

1.1.11.3 Unit of Measure

Unit of measure: linear m foot.

1.2 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

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

ASTM INTERNATIONAL (ASTM)

ASTM D1452/D1452M	(2016) Standard Practice for Soil Exploration and Sampling by Auger Borings
ASTM D1586/D1586M	(2018) Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils
ASTM D1587/D1587M	(2015) Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
ASTM D2113	(2014) Rock Core Drilling and Sampling of Rock for Site Investigation
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2488	(2017; E 2018) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-1-1906	(1996) Engineering and Design -- Soil Sampling

1.3 SYSTEM DESCRIPTION

Provide the data to determine the type, nature, and characteristics of subsurface materials and the extent and conditions of the various materials as they exist to the depths and at the locations specified. This is to be accomplished by means of [auger borings], [drive sample borings] [undisturbed sample borings] [core drilling] [pressure testing] [test pits] [_____].

1.3.1 Auger Borings and Sampling

An auger boring is any boring made in unconsolidated soils with a conventional manually or power-driven earth auger for the purpose of obtaining samples of subsurface materials. Auger boring and sampling shall be performed in accordance with [Chapter [_____], EM 1110-1-1906] [ASTM D1452/D1452M], [as directed by the Contracting Officer].

1.3.2 Drive Sample Borings and Sampling

A drive sample boring is a boring made through unconsolidated or partly consolidated sediments or decomposed rock by means of a mechanically driven sampler. The purpose of these borings is to obtain knowledge of the composition, the thickness, the depth, the sequence, the structure, and the pertinent physical properties of foundation or borrow materials. Drive sample boring and sampling shall be performed in accordance with [Chapter [_____] of EM 1110-1-1906] [ASTM D1587/D1587M] [as directed by the Contracting Officer]. Standard Penetration Tests (SPT) shall be performed in accordance with [Appendix [_____] of EM 1110-1-1906] [ASTM D1586/D1586M].

1.3.3 Undisturbed Sample Borings and Sampling

An undisturbed sample boring is a boring made to obtain soil samples which, when tested, will show properties as close to the in situ (in place) properties as any sample which can be obtained. All undisturbed sampling shall be accomplished in accordance with [Chapter [_____] of EM 1110-1-1906] [ASTM D1587/D1587M] [as directed by the Contracting Officer].

1.3.4 Core Drilling

****
NOTE: See TABLE 1 COMMON CORE DIAMETERS.
****

Core drilling shall be [_____] mm inch Diameter. Core Drilling of cores shall be [by any approved standard and accepted method of rotary rock core drilling that will provide continuous and complete rock cores of the required diameter from any subsurface interval of bedrock specified for investigation] [performed in accordance with ASTM D2113]. The method used shall provide equally good recovery of cores from both hard and soft rocks.

1.3.5 Pressure Testing (Hydraulic)

Hydraulic pressure testing is the process of forcing water under pressure into subsurface rock formations through pre-drilled holes for the purpose of determining the subsurface leakage conditions and possible grouting requirements.

1.3.6 Test Pit Excavation and Sampling

A test pit is any excavation in soil, hardpan, decomposed rock, or other unconsolidated or partially consolidated overburden materials which has an open cross-sectional area large enough to permit efficient excavation and shoring/lining, engineering and geological inspection and photographing of the subsurface soils and manual undisturbed sampling from within the test pit. All test pits shall be excavated, dewatered (if necessary), shored/lined and protected from surface water drainage in accordance with all applicable Federal, State, local, Corps of Engineers, and OSHA safety regulations.

1.3.7 Sequencing and Scheduling

1.3.7.1 Schedule of Drilling, Sampling, and Testing

Prior to starting work, submit a plan for drilling, sampling, testing, and safety. The plan shall include, but shall not be limited to, the proposed method of drilling and sampling including a description of the equipment and sampling tools that will be used, a listing of any subContractors to include a description of how the subContractors will be used and a description of all methods and procedures that will be utilized to insure a safe operation and to protect the environment. No work shall be performed until this plan has been approved and no deviation from the approved plan will be permitted without prior approval by the Contracting Officer. The schedule of Drilling, Sampling, and Testing is [indicated.] [listed in the following schedule:]

SCHEDULE OF DRILLING, SAMPLING AND TESTING				
[HOLE NO.][PIT NO.]	METHOD	DEPTH (METERS) (FEET)	VERTICAL OR INCLINED	SPECIAL INSTRUCTIONS

1.3.7.2 Order of Work

****
NOTE: Select appropriate alternative.
****

[The order in which the work is to be accomplished will be determined in the field by the Contracting Officer.] [Commence operations on [Hole No. [_____]] [Test Pit No. [_____]] [_____] and proceed so as to complete [Holes] [Test Pit] [Nos. [_____], [_____], and [_____]] before starting [Hole] [Test Pit] Nos. [_____] and [_____].]

[1.3.7.2.1 Numerical Sequence

It is intended that the [drilling] [test pit excavating] [_____] be accomplished in the numerical sequence indicated in the [SCHEDULE OF DRILLING, SAMPLING, AND TESTING shown on the drawings] [listed in

paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING]; however, the Contracting Officer may vary the order whenever and in whatever manner is deemed best for accomplishing the work.

1.3.7.2.2 Reporter

Provide a qualified, licensed Geologist experienced in subsurface exploration for each drill unit to oversee all drilling, sampling, and field testing operations. This individual shall be responsible for the preparation of a separate log and/or report for each boring, pressure test, or test pit. This individual shall also be responsible for the preparation of all soil and rock samples for delivery to the designated point.

1.3.7.2.3 Government Oversight

The presence of a Government representative or the keeping of separate drilling records by the Contracting Officer shall not relieve the Contractor of the responsibility for the work specified in this specification.

]1.4 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drilling Log; G[, [_____]]

SD-03 Product Data

Permits, Certifications, and Licenses
Schedule of Drilling, Sampling, and Testing; G[, [_____]]

1.5 QUALITY ASSURANCE

Comply with all Federal, State and local laws, regulations and ordinances relating to the performance of this work. Procure all required permits, certifications and licenses required by Federal, State, and local law for the execution of this work. Submit copies of all permits, certifications, and licenses prior to starting work. This submittal shall also include a statement of the prior experience, in the type of work described in these specifications, of the person or persons designated to perform the work specified herein.

1.6 DELIVERY, STORAGE, AND HANDLING

****
NOTE: Insert delivery address for samples.
****

1.6.1 General

The Contractor is solely responsible for preserving all samples in good condition. Samples shall be kept from freezing and from undue exposure to the weather, and shall keep all descriptive labels and designations on sample jars, tubes, and boxes clean and legible until final delivery of samples to, and acceptance by, the Contracting Officer. Except as otherwise specified, deliver samples to [_____]. Samples shall be delivered within the time limits specified for each type of investigation or in accordance with schedules prepared by the Contracting Officer.

1.6.2 Undisturbed Samples

Take every precaution to avoid damage to samples as a result of careless handling and undue delay in shipping. Samples shall be shipped in containers approved by the Contracting Officer and shall be of sufficient durability to protect the samples from any damage during shipment. The sample tubes shall be well packed in vermiculite or other equal material approved by the Contracting Officer to protect the samples against vibration. Avoid exposing sealed and crated samples to precipitation, direct sunlight, freezing and temperatures in excess of 38 degrees C 100 degrees F. Samples permitted to freeze, even partially, shall be replaced by the Contractor. In general, no undisturbed samples shall remain on the site of sampling for more than one week before shipment. Samples shall be stored and shipped with the tube in a [horizontal] [vertical] position in

order to prevent consolidation and segregation or change of water content.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Environmental Requirements

****
NOTE: Select appropriate alternative.
****

[Comply with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.] [In order to prevent and to provide for abatement and control of any environmental pollution arising from Contractor activities in the performance of this contract, the Contractor and its subContractors shall comply with all applicable Federal, State, and local laws, regulations, and ordinances concerning environmental pollution control and abatement.

a. The Contractor is responsible for keeping informed of all updates and changes in all applicable laws, regulations, and ordinances.

b. Do not pollute lakes, ditches, rivers, springs, canals, waterways, groundwaters, or reservoirs with drill fluids, fuels, oils, bitumens, calcium chloride, insecticides, herbicides, or other materials that may be harmful to the environment or a detriment to outdoor recreation.]

1.7.2 Field Measurements

The approximate locations of [drill holes] [test pits] [_____] are shown on the attached drawings. The actual locations will be established in the field by the Contracting Officer prior to the start of work. The elevations of the established locations will also be provided by the Contracting Officer prior to the start of work. Provide access to the locations as necessary for the prosecution of the work. Since no separate payment will be made for access construction, include all costs associated with this in the cost of [drilling] [excavating].

PART 2 PRODUCTS

2.1 CONTAINERS

Furnish jars, tubes, and boxes that meet the following requirements. All such containers will become the property of the Government and the cost thereof will be included in the contract price for the applicable item for which payment is provided.

2.1.1 Sample Jars

Sample jars shall be [0.5 L 1 pint] [1.0 L 1 quart] capacity, wide-mouth [over 57 mm 2-1/4 inches in diameter] [glass] [plastic] jars with moisture-tight screw tops.

2.1.2 Shipping Boxes

Boxes for shipping sample jars shall be [corrugated cardboard] [wooden] boxes that have the capacity to hold no more than 12 sample jars and the strength to contain and protect the jars and their contents under ordinary handling and environmental conditions.

2.1.3 Tubes and Crates

Undisturbed samples shall be shipped in thin walled Shelby tubes packed in crates.

2.1.4 Core Boxes

Use longitudinally partitioned, hinged top, wooden core boxes constructed of plywood and dressed lumber or other approved materials in general accordance with the arrangement and dimensions shown in FIGURE 1 for all rock cores. As many core boxes as may be required shall be used to box all core. Furnish core boxes completely equipped with all necessary partitions, hinges, and a hasp for holding down the cover. Also provide wood spacers made of surfaced lumber (not plywood) and having dimensions that are 3 mm 1/8 inch less than the inside dimensions of the individual core box troughs and no less than 19 mm 3/4 inch thick for blocking the core in the boxes and for providing a marking space to identify core runs and pull depths/elevations. The quantities of these blocks that are required are: ten blocks per core box for 75 mm 3 inch or smaller core, five blocks per core box for 100 mm 4 inch and PQ core, and three blocks per core box for 150 mm 6 inch core. The box should have the following capacities:

Box Capacities	
150-mm6-inch core	single row of core
100-mm4-inch or PQ core	2 rows of core
75-mm3-inch or smaller core	3 or 4 rows of core

The maximum length of a core box shall be 1.2 m 4 feet for 75 mm 3 inch or smaller core and shall be dimensioned so that a box will hold 3.6 to 4.9 m 12 to 16 feet of core. The maximum length of a core box for core that is larger than 75 mm 3 inches shall be 1.5 m 5 feet.

2.2 LABELS

2.2.1 Sample Jar Labels

A printed or type-written, fade resistant and waterproof label shall be affixed to the outside of each jar and shall contain the following information:

PROJECT	(such as Table Rock Dam)	LOCATION	(such as Borrow Area B)
HOLE NO.		STATION	
JAR NO.		of	_____ JARS

TOP ELEVATION OF HOLE		DEPTH OF SAMPLE	
DESCRIPTION OF MATERIAL	(such as moist, silty, medium sand)		

2.2.2 Shipping Box Labels

Each box of jar samples shall be identified with weatherproof and wear-proof labels indicating the following:

PROJECT	[_____]
LOCATION	
JAR SAMPLES FROM HOLE OR HOLES	

2.2.3 Core Box Labels

Core boxes shall be identified with stenciled labels. The information on this label shall contain the following:

PROJECT	[_____]
HOLE NO.	
BOX NO.	
TOTAL NUMBER OF BOXES FOR THE HOLE	

2.3 EQUIPMENT AND SUPPLIES

2.3.1 Auger Boring and Sampling

Furnish the equipment for making auger borings including, but not limited to, standard continuous flight augers and/or standard cup-type earth augers, similar or equal to the Iwan Auger and not less than 100 mm 4 inches in diameter unless otherwise approved. The augers shall be completely equipped with all the accessories necessary for boring and sampling of overburden materials to the depths and diameters specified or shown on the drawings.

2.3.2 Drive Sample Boring and Sampling

Furnish equipment for making drive sample borings including, but not limited to, standard [50 mm 2-inch OD] [[_____] mm inch OD] [split barrel] [solid barrel] drive samplers and power-driven drilling machinery of a type or types approved by the Contracting Officer, complete with a [_____] kN drive-hammer drive-hammer of [_____]-pound weight and all other accessories for taking samples of all types of soils or decomposed rock at the locations and to the depths indicated [in the SCHEDULE OF DRILLING, SAMPLING, AND TESTING shown on the drawings] [in the schedule in paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING]. The drive shoe for the split barrel samplers shall be of hardened steel and shall be replaced or repaired when it becomes dented or distorted. Supplies shall include, but not be limited to, all casing, drill stem, drill bits, drill fluid and

additives, pumps, and power necessary to accomplish the required boring and sampling.

2.3.3 Undisturbed Sample Boring and Sampling

Furnish equipment for making undisturbed sample borings including, but not limited to, power-driven drilling machinery of an approved type or types complete with the special devices and accessories enumerated and described hereinafter. Drilling machinery shall be of the hydraulic feed type. Supplies shall include, but not be limited to, all samplers, casing, drill stem, drill bits, drill fluid and additives, pumps, and power necessary to accomplish the required boring and sampling. Drill casing, if used, shall be of such minimum inside diameter as to allow use of the selected sampler.

2.3.3.1 Sands and Cohesive Soils

The sampling device used to sample fine to medium grain sands and cohesive soils shall be a fixed or stationary piston type that uses a [75-mm 3-inch] [125-mm 5-inch] diameter thin wall Shelby tube. [Subject to the approval of the Contracting Officer, floating or free piston and non-piston type samplers may be used provided adequate means, such as check valve or vacuum system, are provided to prevent loss of samples.]

2.3.3.2 Stiff and Dense Soils

The sampling device for obtaining samples of stiff and dense soils shall be similar or equal to a Denison double tube, swivel head core barrel, or a Pitcher sampler and must be approved by the Contracting Officer prior to use.

2.3.4 Core Drilling

****
NOTE: See TABLE 1 COMMON CORE DIAMETERS.
****

Core drilling shall be [_____] mm inch Diameter Core. Furnish equipment for core drilling including core-drilling machinery of a type or types approved by the Contracting Officer, complete with all the accessories needed to take continuous rock cores of a diameter consistent with bit size to the depths specified. Use, as a minimum, a standard ball-bearing, swivel-head, double-tube core barrel, or equivalent. The capacity of the core barrel shall not exceed 3.2 m 10.5 feet of core. Supplies for core drilling shall include, but not be limited to, all casing, drill rods, core barrels, coring bits, piping, pumps, water, tools, and power required for drilling and all boxes and containers required for core samples. Selection of the type of bit shall be at the Contractor's discretion provided that the selected bit produces high quality rock core (see paragraph SUPPLEMENTAL [BORINGS] [PITS]).[Drilling equipment shall be capable of drilling inclined as well as vertical core holes as specified.]

2.3.5 Pressure Testing (Hydraulic)

Furnish pressure testing equipment including, but not limited to, the following: water pump with a minimum capacity of 3.15 L/second 50 gpm that is capable of delivering a constant discharge pressure of [_____] kPa psi, double expander packers with rubber expansion elements set [1.5] [3] [_____] m [5] [10] [_____] feet apart with piping so arranged that water may be admitted either below the bottom packer element or between the two

packer elements, a pressure relief valve, a pressure gage capable of measuring water pressures to the nearest [_____] kPa psi and water meter capable of measuring flows to the nearest [_____] 0.1 L/second gpm. Supplies shall include, but not be limited to, all accessory valves, gages, surge tanks, stopcocks, plugs, expanders, potable water for testing, standby pumps, fuels, pipes, pressure hose, and tools necessary for maintaining uninterrupted tests for each boring to be tested. The pressure test equipment shall be configured so that the pressure gage is located at the top of the hole, a by-pass water line and valve are located between the pump and the gage, a flow meter is located between the by-pass and the pressure gage, and a valve is located in the line between the flow meter and the pressure gage. All equipment and supplies used for pressure testing shall be approved by the Contracting Officer prior to use.

2.3.6 Test Pit Excavation and Sampling

Selection of the test pit excavation, shoring/lining and dewatering (if necessary) methods and equipment shall be at the Contractor's discretion but must be approved by the Contracting Officer. When the number of test pits to be excavated is large, and when adaptable mechanical trenching equipment is available, the Contracting Officer may require that such mechanical excavating equipment be used to expedite completion of the pits. Supplies for obtaining undisturbed samples shall include, but not be limited to, split metal cylinders and/or metal or wooden boxes of acceptable sizes and types. The minimum inside dimensions of the cylinders shall be [_____] mm inches in diameter by [_____] mm inches in length. The wooden boxes shall be cubic in shape with a minimum inside dimension of [_____] mm inches. Accessories shall include, but not be limited to, a small sample trimming shovel or spade, hatchet, trimming knife, [_____] wax and facilities for melting and brushing same, trowels, labels, and boxes for shipping samples. Also furnish all materials required for shoring/lining to comply with all applicable safety regulations. The Contracting Officer may require the Contractor to salvage and re-use this shoring/lining material in successive test pits.

PART 3 EXECUTION

3.1 MOBILIZATION AND DEMOBILIZATION

****
NOTE: Delete this paragraph if Mobilization and Demobilization is not a separate payment item.
****

3.1.1 Mobilization

Mobilization consists of the delivery to the site of all plant, equipment, materials and supplies to be furnished by the Contractor, the complete assembly in satisfactory working order of all such plant and equipment at the jobsite and the satisfactory storage at the site of all such materials and supplies.

3.1.2 Demobilization

Demobilization consists of the removal from the site of all plant, equipment, materials and supplies after completion of the work and also includes, at the direction of the Contracting Officer, the cleanup and removal of all scrap, waste backfill material, waste drilling fluid, soil contaminated with engine/hydraulic oil, backfilling all sumps or

excavations resulting from the operations and, in general, returning the site as close to its original condition as possible.

3.2 IDENTIFYING SAMPLES

Sample jars, shipping boxes, and labels shall comply with PART 2, paragraphs SAMPLE JARS, SHIPPING BOXES, and LABELS, respectively. [In addition, a moisture proof label containing the project name, hole number and sample number shall be placed inside the jar or this information can be written using a waterproof pen or scribed on the jar lid.] Take all precautions required to insure that the shipping boxes are not subjected to rough handling or damaging environmental conditions [, and complies with paragraph CARE AND DELIVERY OF SAMPLES]. [A copy of the boring log for the portion of the boring that the samples came from shall be enclosed in the shipping box.]

3.3 AUGER BORING AND SAMPLING

Samples shall be labeled in accordance with paragraph IDENTIFYING SAMPLES. Samples shall be obtained for each change of overburden material and at maximum vertical intervals of [0.3] [1] [1.5] [_____] m [1] [3] [5] [_____] feet [as directed by the Contracting Officer]. In order to retain the natural moisture content of the material to the fullest extent possible, all samples shall be of sufficient volume to completely fill the sample jars and the samples shall be placed in the sample jars as soon as possible after they are taken from the hole. All sample jars shall be labeled. In general, no sample shall remain on the site of boring for more than 1 week after being taken from the boring and placed in a jar.

3.4 DRIVE SAMPLE BORING AND SAMPLING

Samples shall be labeled in accordance with paragraph IDENTIFYING SAMPLES. Drive sample borings drilled through overburden materials shall be suitably cased to permit obtaining drive samples of the size or sizes specified or as directed. Samples shall be taken either continuously or at maximum vertical intervals of [1] [1.5] [_____] m [3] [5] [_____] feet or at a change in materials [in accordance with instructions contained in the SCHEDULE OF DRILLING, SAMPLING, AND TESTING] [as shown on the drawings] or as otherwise directed by the Contracting Officer. The sampler shall be driven with the force of the [620 140] [_____] N pound drive hammer under a free fall of [_____] mm inches. To minimize the compacting effect of casing driving when casing is used to stabilize a boring, the bottom of the casing shall be kept as high above the soil sampling zone as conditions permit. If hollow stem auger is used as a casing and/or to advance the boring, a plug assembly must be used to keep soil from entering the inside of the auger. Above the water table, samples shall be obtained from a dry hole. Below the water table, water shall be maintained within the hole at or above the groundwater level. Where information on the natural water content of soils above the water table is not needed and when approved by the Contacting Officer, boreholes may be drilled without casing by using a suitable drilling fluid to prevent collapse of sidewalls. When a drilling fluid is used, soil sampling shall be done by such means that will prevent inclusion of drilling fluid in the samples. The samples shall be placed in sample jars as soon as possible after they are taken from the hole and, when possible, the volume of the sample shall be large enough to completely fill the sample jar in order that the natural moisture content of the material may be retained to the fullest extent possible. All samples shall be labeled. No sample shall remain at the site of boring for more than one

week after being taken from the hole.

3.5 UNDISTURBED SAMPLE BORING AND SAMPLING

In general, labeling of undisturbed samples shall conform to paragraph IDENTIFYING SAMPLES. Particular care shall be taken to indicate the top and bottom of each sample tube. Tubes and crates for undisturbed samples shall be labeled "DO NOT JAR OR VIBRATE" and "HANDLE, HAUL, AND SHIP IN A [HORIZONTAL] [VERTICAL] POSITION".

3.5.1 Procedure

The procedure for Undisturbed Sample Boring and Sampling shall be the same as outlined in paragraph DRIVE SAMPLE BORING AND SAMPLING, except that the sampling device shall be advanced downward by one continuous, smooth drive using the drill rig's hydraulic feed system. The hydraulic down pressure shall be read and recorded at 150 mm 6 inch intervals during each sample drive. The sampling device for stiff and dense soils shall be advanced by continuous rotation of the outer cutting barrel in conjunction with use of drill fluid circulation. Driving of any undisturbed sampling device by means such as a drop hammer will not be permitted.

3.5.2 Sealing

3.5.2.1 Alternate 1

The soil sample obtained in a thin wall Shelby tube shall be retained in the tube and sealed on both ends with a mechanically expandable O-ring sealing disk of the appropriate size.

3.5.2.2 Alternate 2

The soil sample obtained in a thin wall Shelby tube shall be extruded from the tube in the field as soon as the tube is removed from the boring by a method approved by the Contracting Officer. The extruded soil sample shall immediately be wrapped in [aluminum foil] [thin plastic wrap] and placed in the center of a [metal bottomed, waxed cardboard] [plastic] tube that has a diameter of at least 25 mm 1 inch larger than the diameter of the soil sample, is at least 25 mm 1-inch longer than the length of the soil sample, and has at least 13 mm 1/2-inch of congealed [50/50 mixture of paraffin and microcrystalline wax] [microcrystalline wax] in the bottom. The annular space between the soil sample and the tube shall be filled with [a 50/50 mixture of paraffin and microcrystalline wax] [microcrystalline wax] to a distance of at least 13 mm 1/2-inch above the top of the soil sample.

3.5.2.3 Alternate 3

Both ends of the soil sample tube/liner obtained with a Denison barrel, or its equivalent, shall be cleaned out to remove all drill fluid contaminated and/or disturbed soil or to a minimum distance of 50 mm 2 inches from the ends of the tube/liner. Any material removed that is not contaminated with drill fluid shall be placed in a sample jar and labeled in accordance with paragraph IDENTIFYING SAMPLES. The cleaned out ends of the sample liner tube shall then be sealed with [a 50/50 mixture of paraffin and microcrystalline wax] [microcrystalline wax]. A metal or wooden disk, having a diameter just slightly smaller than the inside diameter of the liner tube shall be inserted into the wax to a distance of 6 mm 1/4-inch from the end of the soil sample. The wax plugs shall be

flush with the ends of the tube and a final seal consisting of a metal cap or tape shall be placed over the ends of the tube.

3.6 CORE HOLE OVERBURDEN DRILLING

[Where samples of overburden materials are required in connection with core drilling, the soil overburden shall be drilled and sampled in accordance with the applicable provisions for the type of samples required.] [Where sampling of the overburden materials is not required, the Contractor may utilize any method and equipment for drilling and, if required, casing through the overburden that will not affect the quality of the core drilling from the rock surface downward in accordance with these specifications. The method chosen must be approved by the Contracting Officer prior to starting any overburden drilling.]

3.7 CORE DRILLING

****
NOTE: See TABLE 1 COMMON CORE DIAMETERS.
****

Core drilling shall be [_____] mm inch Diameter Core

3.7.1 Procedure

All holes shall be drilled [vertically] [at the inclined angles [indicated in the SCHEDULE OF DRILLING, SAMPLING, AND TESTING shown on the drawings] [listed in paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING]] to the bottom elevations or depths specified unless indicated in the schedule of borings or directed to be drilled otherwise. Off-setting of borings from the locations specified in the Plan of Borings or as shown on the drawings, will not be permitted without prior approval. Casing through the overburden may be required. This casing shall be sealed in the rock at the elevation where rock is encountered prior to commencement of rock coring. Operate the drills at required speeds and down pressures to control drill fluid pressures and quantities to insure maximum core quality and recovery in whatever kind of rock is encountered. Where soft or broken rock is encountered, reduce the length of runs to 1.5 m 5 feet or less in order to reduce and/or keep core loss and core disturbance to the minimum. Failure to comply with the foregoing procedures will constitute justification for the Contracting Officer to require redrilling, at the Contractor's expense, of any boring from which the core recovery is unsatisfactory. Exercise particular care in recording zones of water loss, cavities, rod jerks, rough drilling and other unusual and non-ordinary coring experiences that, supplementing the core record, will throw light on the nature and the extent of any fracturing or abnormalities.

3.7.2 Arrangement of Core

Core boxes shall comply with PART 2, paragraph CORE BOXES. All cores shall be arranged neatly in the partitioned boxes in the same sequence in which they occurred before removal from the hole. Facing the open box with the hinged cover above and the open box below, cores shall be arranged in descending sequence beginning at the left end of the trough nearest the hinges and continuing in the other troughs from left to right. The highest part of the core shall be placed in box 1, and the lower portions of the core shall be placed in the other boxes in consecutive order.

3.7.3 Preservation of Core

Representative samples of core (not less than [_____] percent of the total core drilled) shall be wrapped in [aluminum foil] [thin plastic wrap] [cheese cloth] and then sealed by applying [paraffin wax] [microcrystalline wax] [50/50 mixture of paraffin and microcrystalline wax] to the outside of the wrapping material prior to placing the core in the core box. This sealing process shall be accomplished as soon as possible after the core is removed from the core barrel. The minimum length of core that is preserved from each boring shall be no less than 2.5 times the core diameter. Spacer blocks shall be marked and placed in the core box to show where samples have been removed.

3.7.4 Labeling, Marking and Packing Core

Stenciled labels for core boxes complying with paragraph CORE BOX LABELS shall be placed on the inside and outside of the top cover in addition to each end. In addition, the depths (or elevations) of each core run/pull shall be marked with a black waterproof pen on the spacer blocks that are placed between core pulls. When a box is full, the space between the core and the trough sides shall be filled with finely ground vermiculite or other packing material approved by the Contracting Officer.

3.7.5 Disposition of Core

While onsite, protect the filled core boxes from direct sunlight, precipitation, and freezing by some form of Contracting Officer approved shelter that allows ventilation to the boxes. Upon completion of core drilling and sampling operations, core boxes containing cores shall be [stored in an area provided by the Contracting Officer near the site of drilling] [shipped or delivered to [provide address]].

3.8 PRESSURE TESTING (HYDRAULIC)

[Pressure-test each hole in [1.5] [3] [_____] m [5] [10] [_____] foot sections commencing at the top of bedrock and progressing downward to the bottom of the hole or to such depths as determined by the Contracting Officer below which testing of the hole is not necessary.] [Pressure test the bottom [1.5] [3] [_____] m [5] [10] [_____] foot section of hole immediately after it is cored. After a [_____] m foot section is cored, the coring equipment will be removed from the section and a single rubber expansion packer placed at the top of the section (bottom of the previously tested section) and the section pressure tested. After the pressure test is completed, the packer assembly shall be removed and the next [_____] m foot section cored and then pressure tested. This procedure shall be continued to the bottom of the hole or to depths determined by the Contracting Officer.] Where core data from the test holes indicate only isolated zones that are open or fractured, pressure testing may be limited by the Contracting Officer to these zones only. Water pressure employed for each lift shall be determined in the field by the Contracting Officer and shall not exceed 22.6 kPa per meter of depth one pound per square inch per foot of depth to the upper expander and, in no case, shall the pressure be greater than [_____] kPa psi. The pressure test will be divided into two phases; the first phase will be a flow test which shall then be followed by the second phase which is a duration test. In performing the first phase, water is pumped slowly at first, and the flow then gradually increased to the point where the predetermined maximum pressure is maintained, by adjusting the valve on the by-pass

line. The allowable pressure shall be held for 1 minute before any readings are taken. The volume of flow into the test section shall be measured for a period of 5 minutes during which time the pressure shall not vary by more than 34.5 kPa 5 psi. After this 5-minute test, the second phase shall be started by closing the valve located between the flow meter and the pressure gage. The drop in pressure is then read for a period of 5 minutes at [15] [30] [_____]-second intervals. In some situations, such as in a very tight formation, the Contracting Officer may eliminate phase one of the test. The Contractor may be required to make check tests at its own expense if the testing equipment or its assembly and arrangement are found to be faulty during or after the testing of any holes. Record all gage and meter readings made during a pressure test on a suitable form approved by the Contracting Officer. A sample form is shown in FIGURE 2 - PRESSURE TEST DATA FORM.

3.9 TEST PIT EXCAVATION AND SAMPLING

3.9.1 Excavation

The test pits shall be excavated in the order scheduled in [the SCHEDULE OF DRILLING, SAMPLING, AND TESTING shown on the drawings] [paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING], and shall be excavated to depths and dimensions indicated [in paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING] [on the drawings]. Become thoroughly familiar with work site and with all available subsurface data, particularly groundwater conditions, before excavating pits. Regardless of the method of excavation employed, the pits shall be excavated [, dewatered] and shored/lined in conformance with all applicable safety regulations.

3.9.2 Sampling

Obtain soil samples from each pit [at the depths/elevations indicated in paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING] [at depths of [_____] m feet, [_____] m feet, and [_____] m feet,] [at depths determined by the Contracting Officer]. A total of [_____] samples shall be obtained from each test pit. In obtaining samples from test pits, the undisturbed in situ (in place) natural physical and structural characteristics of the sampled materials shall be preserved insofar as possible both while samples are being taken and during shipment to the point of testing. In cohesive and partially cohesive soils this may be accomplished by isolating the soil column or cube to be sampled by gently trenching around it and knife-trimming it to the required dimensions of the split cylinder or box. A thin coating of melted [50/50 mixture of paraffin and microcrystalline][microcrystalline] wax shall then be applied quickly but gently to the sample with a paint brush to seal it against loss of moisture. The metal or wooden sample container, with the top and bottom removed shall then be placed over the wax coated sample such that the sample is centered within the container and the top of the container sides are at least 25 mm 1 inch above the top of the sample. The spaces between the sample and the side walls of the container shall then be filled with melted [_____] wax. After this wax has congealed, the space between the top of the sample container sides and the top of the sample shall be filled with [_____] wax. After this wax has congealed, it shall be trimmed so that when the top of the sample container is installed there is no void between the container top and the wax. After the container top is installed, the soil column or cube shall then be cut off a few hundred mm inches below the container, the sample and container inverted and removed from the pit and the sample trimmed at the base so that the bottom of the sample is at least 25 mm 1 inch below the bottom of the container. This

space shall be filled with [_____] wax and, after the wax has congealed, it shall be trimmed so that when the bottom of the container is installed, there shall be no void between the wax and the bottom of the container. Where overburden materials to be sampled are only partially cohesive, it is best not to expose the entire soil column before waxing. By exposing and waxing small sections at a time, the sample will be subjected to less disturbance. Where natural moisture content is an important factor, delay shall be avoided in taking the sample in order that the natural moisture content of the material may be retained to the fullest extent.

3.9.3 Disposition of Samples

Samples shall be packed in vermiculite or a packing material approved by the Contracting Officer and shipped in sturdy wooden boxes of strength and construction sufficient to guarantee against damage during shipment. Boxes should be no larger than is required for shipping two such samples. All sample boxes shall be marked FRAGILE-HANDLE WITH CARE and shall be identified by labels, similar to those as specified in paragraph IDENTIFYING SAMPLES, attached to the outside of each box. Extreme care shall be taken to indicate the top and bottom of each sample. Avoid exposing sealed and crated samples to precipitation and extremes of temperature. Undisturbed samples permitted to freeze, even partially, shall be replaced by the Contractor at its expense. Do not hold these samples at the site for a period in excess of one week. Prior to shipment, each sealed and boxed sample shall be checked for correct labeling.

3.10 SUPPLEMENTAL [BORINGS] [PITS]

[Borings] [Pits] that are abandoned or from which [unsatisfactory samples or cores are obtained] [less than [_____] percent total core recovery has been obtained, exclusive of open or filled cavities] will be supplemented by other [borings] [pits] adjacent to the original in order that satisfactory samples or the required information will be obtained. Actual locations of any supplemental [borings] [pits] will be established by the Contracting Officer. Penetration to the depth where the original was abandoned or to the depths where unsatisfactory samples were obtained may be made by any method selected by the Contractor that in the opinion of the Contracting Officer will permit satisfactory completion and sampling below the elevation where the last satisfactory sample was obtained in the abandoned or satisfactory sampling in the reaches where satisfactory samples were not obtained in the original [borings] [pits]. No payment will be made for supplemental [borings] [pits] that are required to be [drilled] [excavated] to replace [borings] [pits] that were abandoned or from which satisfactory samples were not obtained because of mechanical failure of drilling and sampling equipment, negligence on the part of the Contractor, or other preventable cause for which the Contractor is responsible except that payment will be made for acceptable portions of these supplementary [borings] [pits] below the depths or outside the reaches for which payment was made for the original [borings] [pits].

3.11 BACKFILLING

3.11.1 Drill Holes

Unless otherwise noted in these specifications or directed by the Contracting Officer, all drill holes shall be backfilled and abandoned in accordance with all Federal, State, and local laws, regulations and ordinances. Preserve all holes in good condition until final measurement

and until the records and samples have been accepted. As a minimum, all holes shall be grouted from the bottom of the hole to within 600 mm 2 feet of the ground surface using a grout mixture of 23 to 30 liters six to eight gallons of water per sack (42.6 kg) (94 pounds) of portland cement. All grout shall be pumped through a [tremie] [_____] pipe that is inserted to the bottom of the boring to insure that the grout fills the full extent of the hole. The remaining ungrouted top 600 mm 2 feet of the hole shall be backfilled with local soil and tamped. All backfilling operations shall be performed in the presence of the Contracting Officer and, if required by regulation, Federal, State, and local officials. No separate payment will be made for backfilling drill holes. The cost of this work shall be included in the drilling costs.

3.11.2 Test Pits

Backfill all test pits with local soil compacted to original densities as directed by the Contracting Officer. No separate payment will be made for backfilling test pits. The cost of this work shall be included in the test pit excavation costs.

3.12 RECORDS

Submit complete, legible copies of DRILLING LOG, ENG FORM 1836 and 1836A, and records to the Contracting Officer [upon completion of the work or at such other time or times as directed] [within [_____] days after a [hole] [test pit] is completed]. Keep accurate driller's logs (DRILLING LOG, ENG FORM 1836, and 1836-A will be provided by the Contacting Officer) and records of all work accomplished under this contract and deliver complete, legible copies of these logs and records to the Contracting Officer [upon completion of the work or at such other time or times as directed] [within [_____] days after a [hole] [test pit] is completed]. All such records shall be recorded during the actual performance of the work and shall be preserved in good condition and order until they are delivered and accepted. The Contracting Officer has the right to examine and review all such records at any time prior to their delivery and has the right to request changes to the record keeping procedure. The following information shall be included on the logs or in the records for each [hole] [test pit]:

a. [Hole] [Test Pit] number or designation and elevation of top of [hole] [test pit].

b. Driller's name and Geologist's name.

c. Make, size, and manufacturer's model designation of [drilling,] [sampling,] [pressure testing,] [and] [test-pit excavating] equipment.

d. Type of [drilling,] [sampling,] [and] [pressure testing] operation by depth.

e. Hole diameter.

f. Dates and time by depths when [test-pit excavation,] [drilling,] [sampling,] [and] [pressure testing] operations were performed.

g. Time required for [drilling each run] [and] [pressure testing each interval tested].

h. Drill action, rotation speed, hydraulic pressure, water pressure, tool

drops, and any other unusual and non-ordinary experience which could indicate the subsurface conditions encountered.

i. Depths [at which samples or cores were recovered or attempts made to sample or core including top and bottom depth of each run] [and] [of each interval pressure tested].

j. Classification or description by depths of the materials [sampled,] [cored,] [or] [penetrated] using the Unified Soil Classification System (ASTM D2487) and including a description of moisture conditions, consistency and other appropriate descriptive information described in paragraph SUPPLEMENTAL [BORINGS] [PITS] of ASTM D2488. This classification or description shall be made immediately after the samples or cores are retrieved.

k. Classification and description by depths of rock materials [sampled] [or] [cored] including rock type, composition, texture, presence and orientation of bedding, floiation, or fractures, presence of vugs or other interstices, and the RQD for each cored interval.

l. Indication of penetration resistance such as [drive-hammer blows given in blows per foot for driving sample spoons and casing] [and] [the pressure in kPa psi applied to push thin-wall or piston-type samplers].

m. Force Weight of drive hammer.

n. Percentage of sample or core recovered per run.

o. Depth at which groundwater is encountered initially and when stabilized.

p. Depths at which drill water is lost and regained and amounts.

q. Depths at which the color of the drill water return changes.

r. Type and weight of drill fluid.

s. Depth of bottom of hole.

t. Pressures employed in pressure testing.

TABLE 1 - COMMON CORE DIAMETERS

	CORE DIAMETER MMINCHES	HOLE DIAMETER MMINCHES
Conventional Core Barrels		
AWG	301.185	481.890
BWG	421.655	602.360
NWG	552.155	762.980
HWG	763.000	993.907

TABLE 1 - COMMON CORE DIAMETERS		
Wireline Core Barrels*		
A	271.064	481.890
B	36.51.432	602.360
N	47.61.875	762.980
H	622.450	943.716
	853.345	1234.827
Large Diameter Series		
2-3/4" X 3-7/8"	682.690	983.875
4" X 5-1/2"	1003.970	1405.495
6" X 7-3/4"	151.65.970	1977.750
* No Industry Standard for Wireline Sizes. Diameters shown for wireline core barrels are nominal and vary between manufacturers.		

FIGURE 2 - PRESSURE TEST DATA FORM

SHEET ____ 0F ____
DATE _____

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE _____ RIVER _____ HOLE NO. ____ RIG NO. ____
LOCATION OF HOLE _____
CONTRACTOR _____ DRILLER _____ ELEV. TOP OF HOLE ____

DATA ON FLOW TEST											
SECTION OF HOLE TESTED						WATER METER READINGS					
TOP		BOTTOM		PRESSURE DURING TEST	START TIME	STOP TIME	TIME MINUTES	AT START OF	AT END OF	TOTAL WATER USED (L) (GAL)	(L)(GAL) PER SEC
DEPTH	ELEV	DEPTH	ELEV								

DATA ON PRESSURE DURATION TEST									
SECTION OF HOLE TESTED									
TOP		BOTTOM		GAGE PRESSURE AT TEST INTERVAL					REMARKS
DEPTH	ELEV	DEPTH	ELEV						
OBSERVED BY _____									

****

NOTES: Insert TYPICAL CORE BOX, FIGURE 1, after the previous table. FIGURE 1 - TYPICAL CORE BOX, exist as CADD files stored on
http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/for

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-- End of Section --