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April 17, 2007

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Subject: **Report of Geotechnical Exploration/Evaluation**
Little Hurst Canal Culvert at CSX Railroad
Near Georgia Highway 21
Port Wentworth, Chatham County, Georgia
MACTEC Project No. 6139-06-0171

Dear Mr. Greuel:

MACTEC Engineering and Consulting, Inc. (MACTEC) has completed the geotechnical subsurface investigation for the proposed culvert at the CSX Railroad Crossing of the Little Hurst Canal in Port Wentworth, Georgia. This work was conducted in general accordance with our proposal number PROP06ATLN.0048 dated February 7, 2006. This report outlines our investigative procedures and results and presents our conclusions and recommendations.

We appreciate the opportunity of serving you on this project and look forward to our continued association. Please contact us if you have any questions about this report, or if we may be of further service.

Very Truly Yours,

MACTEC Engineering and Consulting of Georgia, Inc.

Vaughn Godet, E.I.T.
Project Engineer

Pieter J. DePree, P.E.
Principal Engineer

Copies submitted: Addressee (3)

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APPENDIX

1 INTRODUCTION

We understand the following based on review of topographic drawings and published maps and aerial photographs as well as our site visit and conversations with INTSE personnel. Elevations are estimated based on the topographic plan provided and our site visit and should be considered approximate.

1.1 Site Description

The project site includes the CSX railroad crossing of the Little Hurst (aka Hearst) Canal or Branch as well as access roads to either side of the railroad crossing. The CSX crossing occurs about 750 feet east of the crossing of Georgia Highway 21 over the Little Hurst Canal and about 2 miles west of the Savannah River. The Little Hurst Canal is a tributary of Black Creek and flows generally from west to east, entering Black Creek which flows into the Savannah River. The Little Hurst Canal has evidently been channelized in the area, as evidenced by the well defined channel and spoil piles along the sides. Flow is expected to be generally from west to east, although given the proximity of the tidal estuary of the Savannah River, it is likely that flow reverses under some conditions.

The canal surface is at about elevation 2 to 4 feet and the top of the railroad embankment at the crossing is about elevation 14 feet. The natural grades in the immediate vicinity of the canal are about 5 to 7 feet. Two approximately 36 inch diameter reinforced concrete pipes (RCP) with an invert elevation of about 3 feet, pass beneath the railroad embankment at the canal. Another, approximately 48 inch diameter RCP with a higher invert elevation (perhaps 6 feet) passes beneath the embankment approximately 25 feet north of the Little Hurst Canal. No headwalls were present on the pipes, but some rip rap was observed around both ends of all the pipes.

The area appears to be poorly drained and is vegetated with mature secondary growth of soft and hardwood with undergrowth. At the time of our site visits in June, 2006 and March, 2007, the surface away from the canal and defined drainages was generally trafficable with light construction equipment including a small bulldozer, the drilling rig, and the drill support truck (a 4WD Pickup).

The CSX Railroad includes two tracks on a well defined embankment. The topographic plan provided shows the railroad embankment ending at the south bank of the Little Hurst Canal and then resuming approximately 200 feet north. We presume that this is an older topographic plan and that the track or tracks formerly were supported on a trestle through this area. The topographic plan does not show the defined drainage channel. We conjecture that the trestle may have crossed a poorly defined drainage and that the current embankment construction and the channelization of the Little Hurst occurred in the same period of time. An unimproved grass access road parallels the north side of the Little Hurst on the west side of the railroad. A power line easement crosses the Little Hurst and parallels the tracks about midway between Highway 21 and the CSX Railroad.

1.2 Project Description

We understand that additional culvert capacity is required under the railroad embankment to prevent flooding of Highway 21 and areas to the west of the railroad. The capacity may be achieved by one or more culverts in addition to or in place of one or more of the existing culverts. The new culverts are expected to be installed using jack and bore or other horizontal boring methods to avoid disruption of the railroad traffic. Jack and bore operations will require a jacking pit on at least one side of the embankment. Heavy equipment access will need to be along the existing access road or a new access road to the east side of the embankment.

2 EXPLORATION AND RESULTS

2.1 Field Exploration

Four borings, designated B-7 through B-10, were conducted in the two likely jacking pit locations on either side of the railroad embankment. These borings were extended to a depth of 50 feet to assess conditions for the pit shoring and potential reaction piles for the jacking equipment. The remaining 9 borings (B-1 through B-6 and B-11, 12, and 13 were conducted to a depth of 15 feet along potential access roads to assess the support conditions for the anticipated heavy equipment traffic.

Borings included Standard Penetration Test (SPT) samples at 2.5 foot intervals in the upper 10 feet and 5 foot intervals thereafter to assess the composition and consistency of the soils. Several relatively undisturbed samples were collected for laboratory testing.

Boring locations are shown on the attached boring location plan. Elevations were interpolated from the topographic plan provided. Locations were determined in the field using hand-held GPS, which has an accuracy of about 15 to 20 feet. Locations and elevations should, therefore, be considered approximate.

A reconnaissance of the railroad embankment, including several shallow (approximately 4 feet) hand auger borings drilled vertically or horizontally into the embankment, was conducted. Hand auger borings were generally able to penetrate the embankment at elevations below the railroad ballast and away from the rip-rap armor around the pipes. Some ties were observed on the embankment.

2.2 Laboratory Testing

Our laboratory testing program included classification and in-situ density tests on a relatively undisturbed samples.

2.3 Stratigraphic Interpretation

Our stratigraphic interpretation is based on our field and laboratory data. The surficial soils to a depth of about 3 to 7 feet indicated a large degree of disturbance, possibly from past agricultural activities including tilling and old drainage canals and/or the more recent canal construction. These soils typically contained significant organic matter in a matrix of clayey sand or sandy clay and had moderate consistencies with SPT N-values of 5 to 10 blows per foot.

Beneath these disturbed soils, borings encountered alluvial soils consisting of interbedded sandy silty clays, clayey sands, and relatively clean sands. The stratigraphy was non-uniform with variable thicknesses of clay and sand in adjacent borings. Clays were generally of high plasticity and clay-sand mixtures with only 15 percent fines still exhibited considerable plasticity. SPT N-values ranged between 0 (weight of hammer) and 23 blows per foot down to about elevation -30 feet. Below this, N-values increased significantly in dense sands and hard silts and clays which we interpret as marl. Zones of very soft clay were encountered in borings B-1, 2, 3, 4, 7, 8, 9, and 13 in the upper 20 feet.

The alluvial stratigraphy is consistent with deposition in swamp or tidal marsh where clays accumulate in quiescent water and sands in channels with slightly higher velocities. Over time and with varying sea levels, the channels clog and new channels are formed creating the interbedded conditions. Agriculture, especially for rice, would have involved excavation of new channels to control flooding of the swamp with variable depths of disturbance.

Groundwater was fairly consistent at depths of about 4 feet, which is roughly consistent with the water level in the canal as would be expected in the generally sandy soils.

2.4 Site and Area Geology

The site lies in the lower Coastal Plain Physiographic Province. Published mapping indicates that the site is underlain by young (Pleistocene) deposits described as the "Pamlico Shoreline Complex, Marsh and Lagoonal Facies". This deposit would have included accumulated marine and fresh water sediments deposited in bays or lagoons behind a line of sandy barrier islands in relatively quiescent conditions, allowing for interbedding of the finer (silt and clay) with coarser (sand) deposits as well as accumulations of organic peat from marsh or other vegetative growth.

3 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on the project description and information presented in this report, our observations at the site, our interpretation of the field and laboratory data obtained during the exploration, and our experience with similar subsurface conditions. If this descriptive information is incorrect, or if additional information is available, please contact us so that our conclusions and recommendations can be revised. Borings are widely spaced, so these conclusions and recommendations should be considered general in nature.

3.1 General

A number of discrete steps will be required to allow the jack and bore operations to proceed efficiently. These include:

1) Access road construction.
2) Surface water management and diversion.
3) Subsurface water management.
4) Excavation insertion and reception pits.
5) Pipe installation.
6) Grouting.
7) Grading.
8) Pit closure.
9) Site restoration.

The difficulty with each of these steps will depend on the planned jacking elevation as well as surface water conditions at the time of jacking. In general, jacking a new pipe with a higher invert elevation and out of the existing canal flow line will encounter fewer challenges with water control, dewatering, and diversion than would jacking a pipe at a lower invert and/or directly in the canal flow line. However, jacking a pipe with a top elevation closer to the railroad subgrade and ballast will increase the risk of loss of ground or subsidence under the tracks.

We recommend that the required hydraulic capacity be achieved by use of multiple, relatively small diameter (30 to 48 inch) pipes driven at relatively high invert elevations (3 to 4 feet) away from the existing main canal. Pipes should be installed serially, so that multiple adjacent pits are not open simultaneously and so that experience from each pipe installation can be employed to enhance installation of the next pipe. Subsequent grading, such as widening the canal or installing berms, could be used to enhance flow to the additional pipes. If possible, pipes should be spaced at least 3 diameters, center to center, to reduce risks of interaction with each operation.

3.2 Access Road Construction

The planned access roads will need to accommodate heavy equipment, potentially including excavators, cranes, and various trucks to bring materials and remove spoils. A concern with the access road either from Highway 21 or to the east along the canal will be side slope stability of the canal. The canal bottom, assumed to be at about elevation 2, but possibly deeper, is approximately consistent with a zone of very soft clay in borings B-1, 2, 3, and 4. This clay will be of low strength and may allow sliding of a block of soil into the canal that could include part of the roadbed. To reduce the risk of such failure, we recommend that the outside edge of the access road be below a line extending from the low point of the canal bank or bottom upward at a 3 horizontal to 1 vertical angle. Assuming the canal bottom is at about 2 feet and the road is at 7 feet elevation, this would be a minimum of about 15 feet from the bank which will likely require additional clearing. During operations, an OSHA competent person should observe the roadway and bank daily for signs of incipient movement, including bulging, cracking, or subsidence. Unstable areas that develop may require shoring of the bank or shifting of the access road further from the bank.

Subgrade along the access road consists of the disturbed soils and ranges from clay to clayey sand. SPT N-values suggest moderate consistency (5 to 11 bpf with an automatic hammer) near the surface. Based on experience with similar soils, we anticipate a CBR of 3 should be generally available. The paving should be designed based on the anticipated traffic and season of work. For temporary paving to support a limited number of passes of heavy, over the road trucks such as dump trucks or concrete trucks, we recommend stabilizing the roadway with 8 to 12 inches of angular ASTM #34 stone. The stone should be placed in a single lift and rolled into the subgrade with a tracked vehicle. Generally, greater thickness will be needed in wet conditions and for more traffic and less for dry conditions and limited traffic. If all heavy traffic is low-pressure vehicles, such as off-road trucks or tracked vehicles, it may be possible to dispense with stone over much of the route. As evidenced by our exploration, light vehicles such as pick-up trucks can likely operate in the area in dry conditions if the surface is not degraded by heavier traffic.

We recommend that a stockpile of stone be maintained on site to enhance or repair areas that degrade under bad weather or traffic. Larger stone, such as angular Georgia DOT Type 3 rip-rap, may be required to stabilize areas that degrade significantly.

An alternative to stone would be to use clean sand with a geotextile. A medium-weight separation/stabilization geotextile with 24 inches of sand placed over it should provide similar stabilization to the 12 inches of stone. A drawback to use of geotextile is that if areas degrade under traffic or weather conditions, the sand and geotextile must be removed, usually involving waste of the geotextile, and replaced with a thicker or multiple layers of sand and geotextile whereas additional stone can be placed and rolled into the weak areas to create interlock.

3.3 Water Management

Given the sandy nature of at least some soils, the distinction between surface and groundwater may be somewhat academic as water will move rapidly between the surface and subsurface. Water management will require control of routine surface flows through the canal, control of storm flows that may occur during the construction period, and control of groundwater seepage into any excavations.

If the additional culvert capacity is installed out of the main canal flow line, the existing canal and culverts could serve to handle normal flows. For storm flows, we recommend moving critical equipment, vehicles, etc. out of the pits. Should a storm occur when a pipe is jacked partway under the tracks, there is a risk that stormwater could create loss of ground into the pipe. The risk of this could be reduced by grouting at the end of the pipe at the end of each shift.

If the additional culvert capacity is to be installed in place of the existing 36-inch culverts in the flow-line of the canal, it will be necessary to create cofferdams above and below the work area and pump water around the work area using large agricultural pumps with hose or piping passing through the 48-inch culvert. Cofferdams can be constructed using clayey soils in the canal, although seepage under or around the soil cofferdams may be significant. Cofferdams could also be constructed using sheeting penetrating into clayey zones at depth to reduce seepage. The sheeting could also serve to define the jacking and receiver pits.

If additional culverts have invert elevations above the normal water level, pits may extend to or only slightly below the groundwater. In such case, a limited dewatering program of sump pits may be workable. If jacking and receiver pits extend more deeply below the groundwater, more aggressive measures such as sealing the pit with sheeting and/or a system of well points may be required. In either case, dewatering should maintain groundwater levels at least 3 feet below the bottom of the excavation to avoid softening of the excavation bottom. Dewatering will need to be continuous to avoid softening of the excavation bottom and flooding of any equipment, so back-up systems or 24-hour monitoring may be necessary. The dewatering program will need to be adjusted to meet the subsurface soil and groundwater conditions encountered and will depend on the size and depth of the pits. Sumps or wells may need to intercept various seams of sand that may carry relatively unrelated water tables. Sumps or wells in clay will produce little recovery, but sumps or wells in relatively clean sand may produce recoveries in the order of 10's of gallons per minute.

3.4 Excavation of Insertion and Reception Pits

Pit excavation difficulties will increase significantly with increasing depth below the normal groundwater elevation, about 3 feet at the time of our investigation. Pits extending to elevation 2 or 3 feet can likely be excavated without shoring, with side slopes of 2 horizontal to 1 vertical or flatter. Some stabilization of the pit bottom with ASTM #3 Stone to type 3 Rip-rap should be anticipated to provide a working surface.

Pits extending deeper than about elevation 2 feet, including excavation in the existing channel, will likely require sheeting to shore the excavation sides and limit water infiltration. Given the interbedded conditions, seepage limitation may require sheeting to extend deeper than would be necessary for toe in alone. If sheeting does not terminate in a uniform clay layer, which may be at elevation -20 feet, seepage through sand seams may cause portions of the excavation bottom to soften quickly due to excess pore pressures.

Shoring should be designed for an equivalent fluid unit weight of 70 pcf above the groundwater level and 100 pcf below. Surcharge loading due to equipment or stockpiles around the pit and especially the railroad embankment, should be added to this. Shoring can be internally braced or use tie-back anchors. Tie-back anchors extending into the marl and double grouted may be designed using a bond strength of 25 psi (allowable) on the bond area in the marl.

3.5 Pipe Jacking or Ramming

Two common methods of trenchless installation are pipe jacking and pipe ramming. Pipe jacking uses hydraulic jacks to slowly push the pipe through the subsurface while the material at the face of the pipe is excavated. Pipe ramming uses dynamic force, typically from a pneumatic ram, to drive the pipe horizontally through the subsurface, often without excavation of the material in front of or in the pipe.

Other trenchless technologies, including tunneling with tunnel liner, horizontal boring, and micro-tunneling could be considered, but are unlikely to be cost competitive with jacking or ramming.

3.5.1 Equipment Foundation

Jacking or ramming equipment is large and requires some degree of alignment and reaction. Small equipment in shallow pits may tolerate support on subgrade soils stabilized with compacted stone. Larger equipment may require a mat slab and/or pile support. Vertical piles, such as driven timber piles, extending to the marl can provide capacities of up to 30 tons for an 8 inch tip diameter pile. Equipment on-site to drive sheeting may also be used for driving piles. Steel H-section or pipe piles may be considered if higher capacities are required. Auger cast piles may be considered, but would require alternate equipment.

3.5.2 Pipe Jacking

Pipe jacking typically requires a large reaction to advance the pipe. This reaction can be derived from shoring at the back of the pit or vertical or battered piles.

Pipe jacking involves excavation at the end of the pipe. Limited exploration of the railroad embankment suggests that it consists of relatively clean sands, with railroad ballast in the upper portion. Pipe jacking will entail a risk that sands or ballast could ravel rapidly into the pipe. Groundwater is generally near or below the bottom of the embankment, but the risk of raveling will be increased below the groundwater or during periods of heavy rainfall when water infiltrating through the ballast may enter the advancing pipe and carry sandy fill.

We recommend that jacking not be performed within 2 feet below the ballast, as stabilizing ballast and preventing rapid raveling will be difficult or impossible. The sand embankment should be stabilized by permeation grouting using a chemical grout such as polyurethane foam to produce a cohesive mass that can be penetrated by the jacking operation with reduced potential for raveling. We recommend grouting extend at least 1 pipe diameter outside each jacked pipe.

In a pipe jacking operation, soils can be removed from the pipe using various methods depending on the size of the pipe and the type of soils. Hand excavation can be used and may be required to penetrate obstructions such as timbers or pieces of rip-rap in any case. Horizontal augers may also be used. Washing methods are not recommended due to the risk of loss of ground above or around the pipe.

3.5.3 Pipe Ramming

Pipe ramming is a dynamic process and uses the mass of the ram to provide much of the reaction, so required reactions may be less than for jacking. Soils are generally not excavated from the pipe or at least from the near the advancing end of the pipe, so raveling concerns are reduced. The dynamic ramming may create vibrations that will affect side stability of the embankment, canal, or pits and that may cause the water table to rise. If ramming encounters obstructions, such as timbers, it may be necessary to stabilize the zone with permeation grouting, excavate the pipe, and enter the pipe to remove the obstruction, which would entail significant delays.

3.6 Monitoring

The tracks and embankment should be continuously observed and monitored for deformations in the tracks (settlement, heave, or lateral displacement), cracking or bulging of the embankment sides, or other indications of movement within 100 feet of the jacking or ramming operation. Should movement be detected, train traffic can be slowed or stopped while remedial measures, such as additional grouting or re-ballasting are undertaken.

3.7 Final Stabilization

In spite of precautions such as permeation grouting, it is possible that pipe jacking or ramming will create voids in the embankment around the outside of the pipe. Such voids may not be apparent at the time of construction, but could eventually migrate upward and cause track subsidence. Therefore, we recommend post grouting around the outside of the pipes. Post grouting should consider chemical (foam) grouts as cement grouts under pressure may rapidly break out to the surface or into the ballast due to the relatively shallow pipe depths. Injection may be through ports inserted through the sides of the pipe or through one or more pipes attached to the outside of the culvert pipe and driven along with it.

3.8 Design Review and Construction Observations

Given the preliminary stage of planning, our recommendations have been necessarily general. As the design process advances, we recommend that the geotechnical engineer be provided an opportunity to review plans and provide more focused recommendations. During construction, the geotechnical engineer or his representative on-site should observe grading of the access roads, excavation of the pits, dewatering measures, installation of shoring and deep foundations, and pipe jacking/ramming operations to confirm that subsurface conditions are as expected and that the recommendations are appropriate.

4 QUALIFICATIONS OF CONCLUSIONS AND RECOMMENDATIONS

Our evaluation of the project has been based on our understanding of the furnished site and project information and the data obtained during the exploration. If the site and project information described in the Introduction section of this report is incorrect, or if additional relevant information is available, please contact us so that our conclusions and recommendations can be reviewed.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers from MACTEC should monitor and provide oversight to earthwork operations to verify that the conditions actually encountered are as anticipated.

Our professional services have been performed, our findings derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. This company is not responsible for the conclusions, opinions or recommendations of others based on these data.

This geotechnical investigation did not include any assessment or evaluation of environmental conditions or contamination in the soil, groundwater, or surface water.

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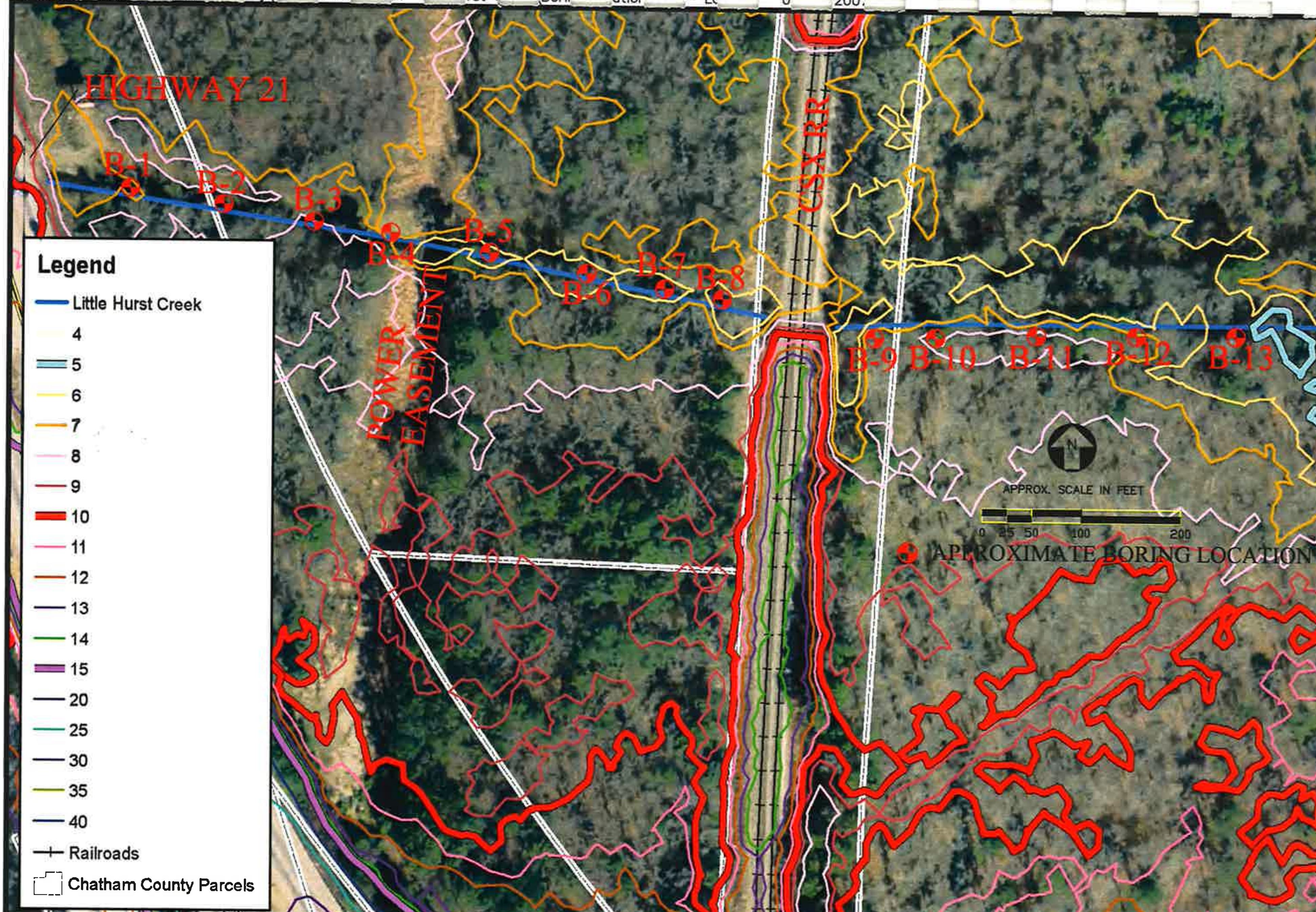
APPENDIX

Boring Location Plan
Subsurface Profile
Field and Laboratory Procedures
Key to Symbols and Descriptions
Soil Test Boring Records (13)
Laboratory Results
ASFE Information about Geotechnical Reports



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LITTLE HURST CANAL CULVERTS
PORT WENTWORTH, GEORGIA

BORING LOCATION PLAN

Job Number	Task	Date	Scale	Drawn By	Reviewed By	Figure
6139-06-0171	01	March, 2007	Not to scale	MLH	PDP	1

FIELD EXPLORATORY PROCEDURES

SOIL TEST BORING

All boring and sampling operations are conducted in general accordance with ASTM designation D 1586-67. Initially, borings are advanced by mechanically augering through the soils. Below the water table, a heavy drilling fluid is used to stabilize the sides and bottom of the drill hole. At regular intervals, the drilling tools are removed and soil samples obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler is first seated six inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is recorded and is designated the "standard penetration resistance". The penetration resistance, when properly evaluated, is an index to the soil strength, consistency and ability to support foundations.

Representative portions of the soil samples are placed in glass jars and transported to the laboratory where they are examined to verify the driller's field classifications. Soil descriptions and penetration resistances are graphically presented on boring records.

UNDISTURBED SAMPLING

The split tube samples obtained during penetration testing are suitable for visual examination and classification tests, but are not sufficiently intact for quantitative laboratory testing. Consequently, relatively undisturbed samples are obtained by forcing sections of 3-inch I.D., thin-wall steel tubing into the soil at the desired sampling level. This sampling procedure is essentially described by ASTM D 1587.

LABORATORY TESTING PROCEDURES

MOISTURE CONTENT

The moisture content of soil is defined as the weight of water in a given soil mass divided by the weight of dry soil solids in the same mass. Natural moisture contents are determined in accordance with ASTM designation D 2216.

GRAIN SIZE DISTRIBUTION TEST

Grain size tests are performed to determine the particle size and distribution of soil samples. The grain size distribution of soils coarser than 0.75 mm in diameter is determined by passing the sample through a set of nested sieves. Material less than 0.075 mm in diameter is suspended in water and the grain size distribution measured by the rate of settlement. These tests are similar to those described by ASTM D 1140 and D 422. The results are presented in the form of a curve showing the distribution of particle diameters.

IN-PLACE SOIL DENSITY

A relatively undisturbed soil sample was used to determine the in-place soil density. The volume of the sample is obtained by direct measurement. The in-place dry unit weight of the soil is expressed as the dry weight of the soil divided by the volume of soil and is usually reported in pounds per cubic foot (pcf). The test procedure is described in ASTM Standard D 2937.

The natural moisture content, in-place density and specific gravity are used to calculate the soil's void ratio. The void ratio, which is defined as the volume of voids divided by the volume of solids, is an important soil index property related to compressibility.

STANDARD COMPACTION TEST

Compaction tests are run on representative soil samples to determine the dry density obtained by a uniform compactive effort at varying moisture contents. The results of the test are used to determine the moisture content and unit weight desired in the field for similar soils. Proper field compaction is necessary to improve the engineering characteristics of the fill relative to settlement, strength and permeability.

A representative sample of the proposed fill material is obtained in the field. A standard Proctor compaction test (ASTM D 698) is performed on the soils to determine their compaction characteristics, including their maximum dry density and optimum moisture content. Loose soils are placed in a metal mold and compacted in three layers with 25 blows of a 5.5-pound hammer falling 12 inches. The moisture content and unit weight of each compacted sample is determined. Usually four to five such tests are run at different moisture contents. Test results are presented in the form of a dry unit weight-versus-moisture content curve.

GRAIN SIZE DISTRIBUTION TEST

Grain size tests are performed to determine the particle size and distribution of soil samples. The grain size distribution of soils coarser than 0.75 mm in diameter is determined by passing the sample through a set of nested sieves. Material less than 0.075 mm in diameter is suspended in water and the grain size distribution measured by the rate of settlement. These tests are similar to those described by ASTM D-1140 and D-422. The results are presented in the form of a curve showing the distribution of particle diameters.

SOIL PLASTICITY TEST

A representative sample of soil is tested to determine its plasticity characteristics as an indication of the shrink-swell potential. The soil's plastic index (PI) is representative of this characteristic and is bracketed by the liquid limit (LL) and the plastic limit (PL). The LL is the moisture content at which the soil will flow as a heavy viscous fluid. The PL is the moisture content at which the soil begins to lose its plasticity. These determinations are in general accordance with ASTM D-4318.

KEY TO SYMBOLS AND DESCRIPTIONS

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			GP	Poorly graded gravels or grave - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel - sand - silt mixtures.
			GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand - silt mixtures
			SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
			CL	Inorganic lays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

Undisturbed Sample	Auger Cuttings
Standard Penetration Test or Dynamic Cone Penetration Test	Bulk Sample
Rock Core	Crandall Sampler
Dilatometer	Pressure Meter
Packer	No Recovery
Water Table at time of boring	Stabilized Water Level

Correlation of Standard Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
Over 50	Very Dense	16 - 30	Very Stiff
		31 - 50	Hard
		Over 50	Very Hard

Correlation of Dynamic Cone Penetration Resistance with Relative Density and Consistency (Piedmont Residual Soils)

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 15	Loose	3 - 4	Soft
16 - 30	Medium Dense	5 - 10	Firm
		11 - 30	Stiff

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DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" - 2nd 6" - 3rd 6")
0	**FILL** - Stiff, dark brown, clayey SILT with organics	7	SPT-1	X	2-4-6 (N = 10)
	FILL - Stiff, dark gray, silty CLAY with sand		SPT-2	X	0-5-6 (N = 11)
5	**ALLUVIUM** - Soft, gray, sandy silty CLAY	2	SPT-3	X	1-2-1 (N = 3)
			SPT-4	X	0-1-0 (N = 1)
10		-3			
	Loose, light brown, fine to medium, silty clayey SAND		SPT-5	X	5-4-4 (N = 8)
15	Boring terminated at 15 ft	-8			
20		-13			
25		-18			
30		-23			
35		-28			
40		-33			
45		-38			
50		-43			
55		-48			

PL (%) NM (%) LL (%)
▲ FINES (%)
● SPT (bpf)
0 10 20 30 40 50 60 70 80 90 100

SOIL TEST BORING BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Hollow Stem Auger
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 4 feet at time of drilling.
BY: AAT	
CHECKED:	

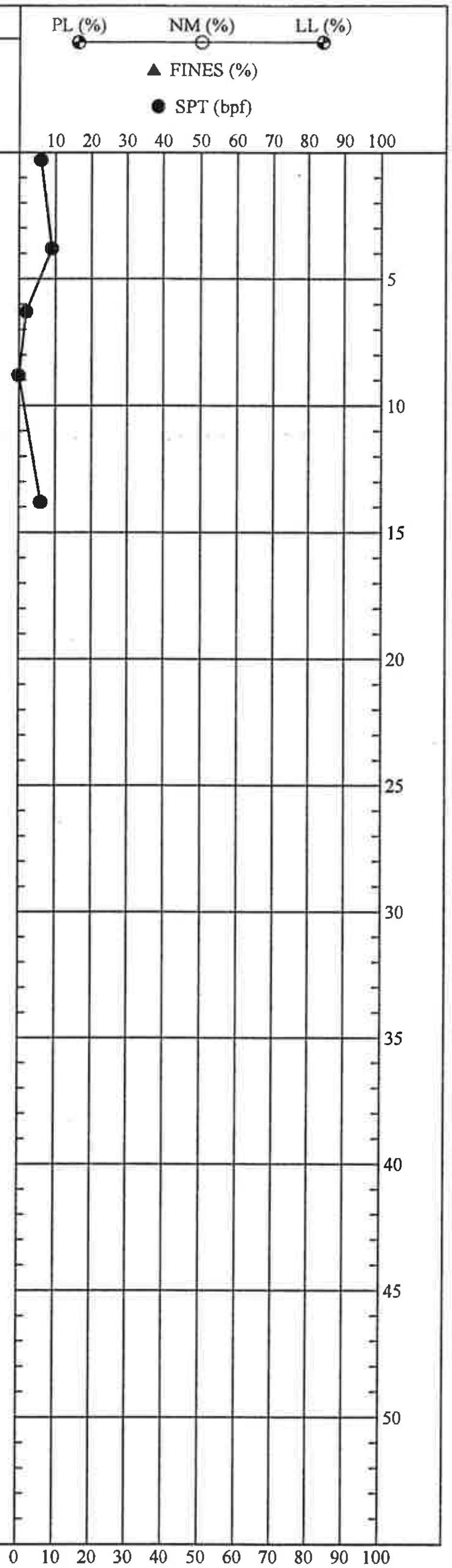
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-01
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 21, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.)	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	**FILL** - Loose, light brown, fine, silty clayey SAND with organics and seams of CLAY	7	SPT-1		2-3-3 (N = 6)
			SPT-2		3-4-5 (N = 9)
5	No recovery	2	SPT-3		1-1-1 (N = 2)
	ALLUVIUM - Very soft, gray, sandy silty CLAY		SPT-4		0-0-0 (N = 0)
10		-3			
	Loose, dark gray, fine to medium, SAND with silty clay layers		SPT-5		2-2-4 (N = 6)
15	Boring terminated at 15 ft	-8			
20		-13			
25		-18			
30		-23			
35		-28			
40		-33			
45		-38			
50		-43			
55		-48			



SOIL TEST BORING BORING LOGS.GPJ LAW_GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Hollow Stem Auger
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 4 feet at time of drilling.
BY: AAT	
CHECKED:	

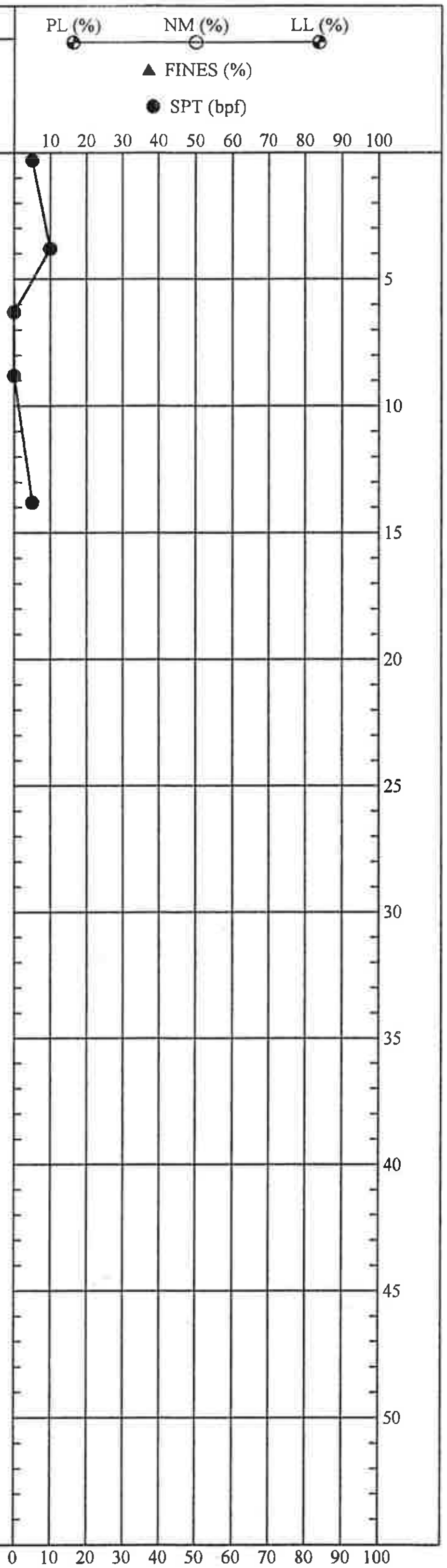
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-02
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 21, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.)	ELEV (ft)	IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	**FILL** - Loose, light brown, fine, silty SAND	7	SPT-1	X	3-3-2 (N = 5)
			SPT-2	X	2-4-6 (N = 10)
5	**ALLUVIUM** - Very soft, dark gray, sandy silty CLAY	2	SPT-3	X	0-0-0 (N = 0)
	gray		SPT-4	X	0-0-0 (N = 0)
10		-3			
	Loose, gray, fine to medium, slightly silty clayey SAND		SPT-5	X	0-0-5 (N = 5)
15	Boring terminated at 15 ft	-8			
20		-13			
25		-18			
30		-23			
35		-28			
40		-33			
45		-38			
50		-43			
55		-48			



SOIL TEST BORING BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Hollow Stem Auger
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 4 feet at time of drilling.
BY: AAT	
CHECKED:	

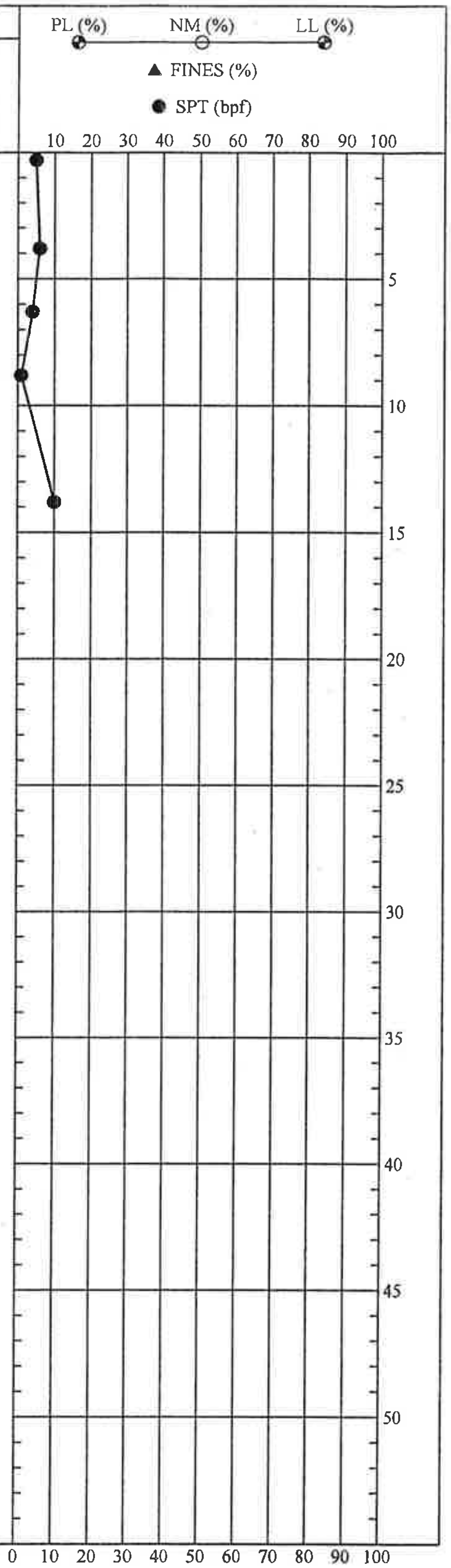
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-03
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 21, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.)	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" / 2nd 6" / 3rd 6")
0	**FILL** - Loose, light brown, fine, silty SAND	7	SPT-1		2-3-2 (N = 5)
	ALLUVIUM - Loose, brown, fine to medium, silty clayey SAND		SPT-2		2-4-2 (N = 6)
5	Very soft to soft, gray, sandy silty CLAY	2	SPT-3		2-2-2 (N = 4)
			SPT-4		0-0-1 (N = 1)
10		-3			
	Stiff		SPT-5		0-3-7 (N = 10)
15	Boring terminated at 15 ft	-8			
20		-13			
25		-18			
30		-23			
35		-28			
40		-33			
45		-38			
50		-43			
55		-48			



SOIL TEST BORING LOGS BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER: MACTEC-L. Carter
EQUIPMENT: CME-550 ATV (Auto-Hammer)
METHOD: Hollow Stem Auger
HOLE DIA.: 3.25 inches
REMARKS: Groundwater encountered at 4 feet at time of drilling.

BY: AAT
CHECKED:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

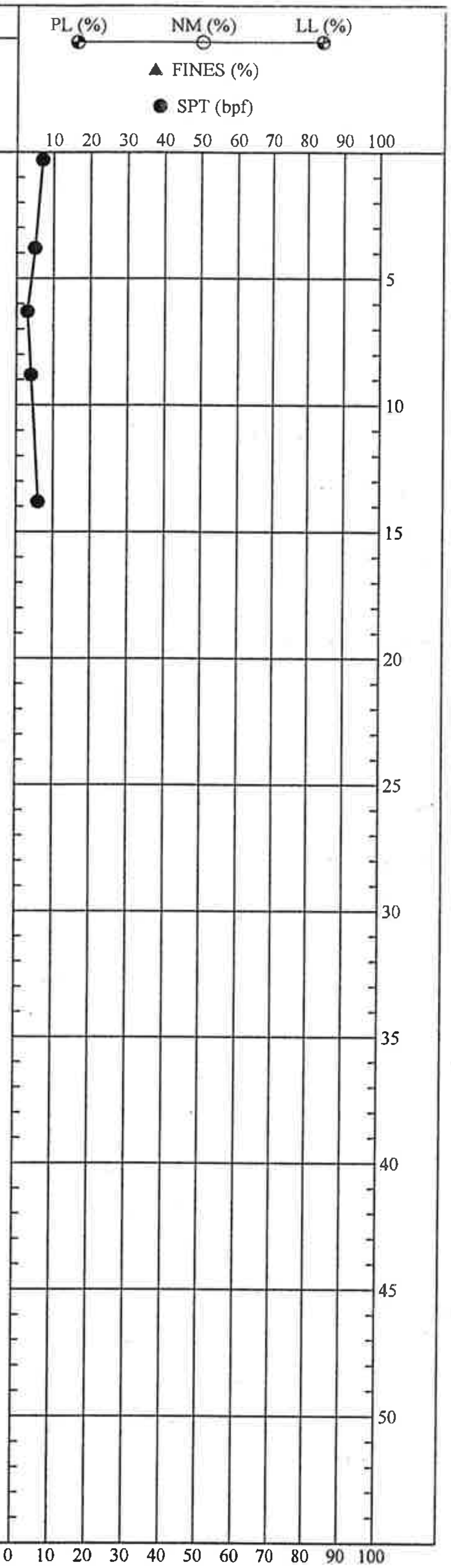
SOIL TEST BORING RECORD

BORING NO.: B-04
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 22, 2007
PROJECT NO.: 6139-06-0171

MACTEC

SOIL TEST BORING RECORD

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.)	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	**FILL** - Firm, brown, sandy silty CLAY with organic matter	7	SPT-1	☒	2-3-4 (N = 7)
	ALLUVIUM - Soft to firm, gray sandy silty CLAY				
5		2	SPT-2	☒	2-2-3 (N = 5)
			SPT-3	☒	1-1-2 (N = 3)
			SPT-4	☒	0-2-2 (N = 4)
10		-3			
15		-8	SPT-5	☒	2-2-4 (N = 6)
15	Boring terminated at 15 ft				
20		-13			
25		-18			
30		-23			
35		-28			
40		-33			
45		-38			
50		-43			
55		-48			



SOIL TEST BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Hollow Stem Auger
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 4 feet at time of drilling.

BY: AAT
CHECKED:

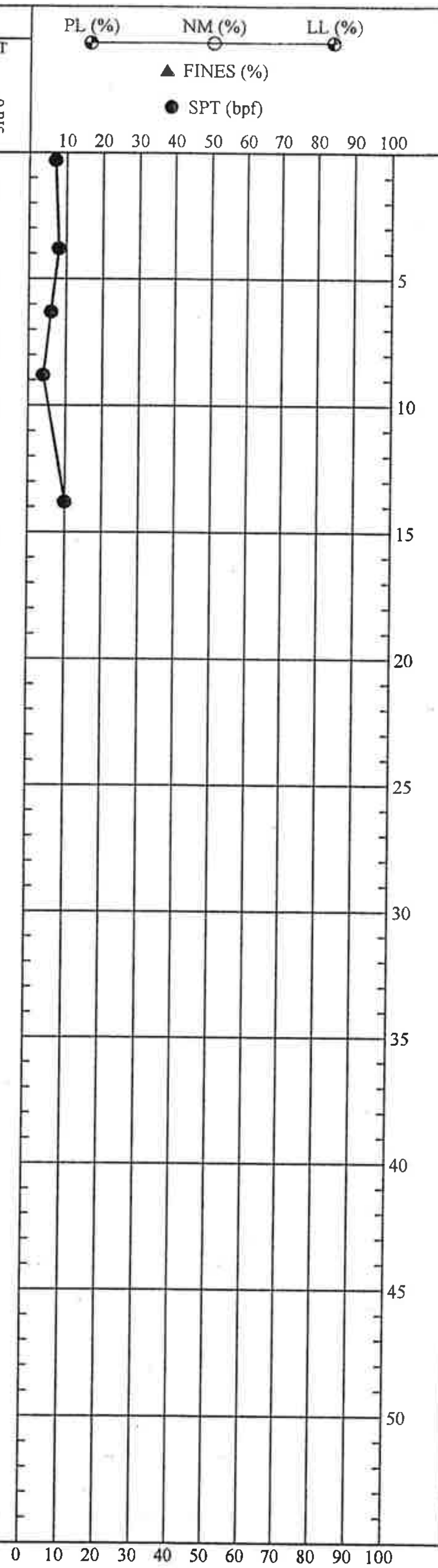
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-05
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 22, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	**FILL** - Firm, dark brown, silty CLAY		7	SPT-1		3-3-4 (N = 7)
	ALLUVIUM - Firm, dark brown, sandy silty CLAY					
	Very soft			SPT-2		3-3-5 (N = 8)
5			2	SPT-3		2-2-4 (N = 6)
				SPT-4		0-2-2 (N = 4)
10			-3			
	Medium dense, gray, fine, silty SAND			SPT-5		3-3-7 (N = 10)
15	Boring terminated at 15 ft		-8			
20			-13			
25			-18			
30			-23			
35			-28			
40			-33			
45			-38			
50			-43			
55			-48			



SOIL TEST BORING BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Hollow Stem Auger
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 4 feet at time of drilling.
BY: AAT	
CHECKED:	

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-06
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 22, 2007
PROJECT NO.: 6139-06-0171

MACTEC

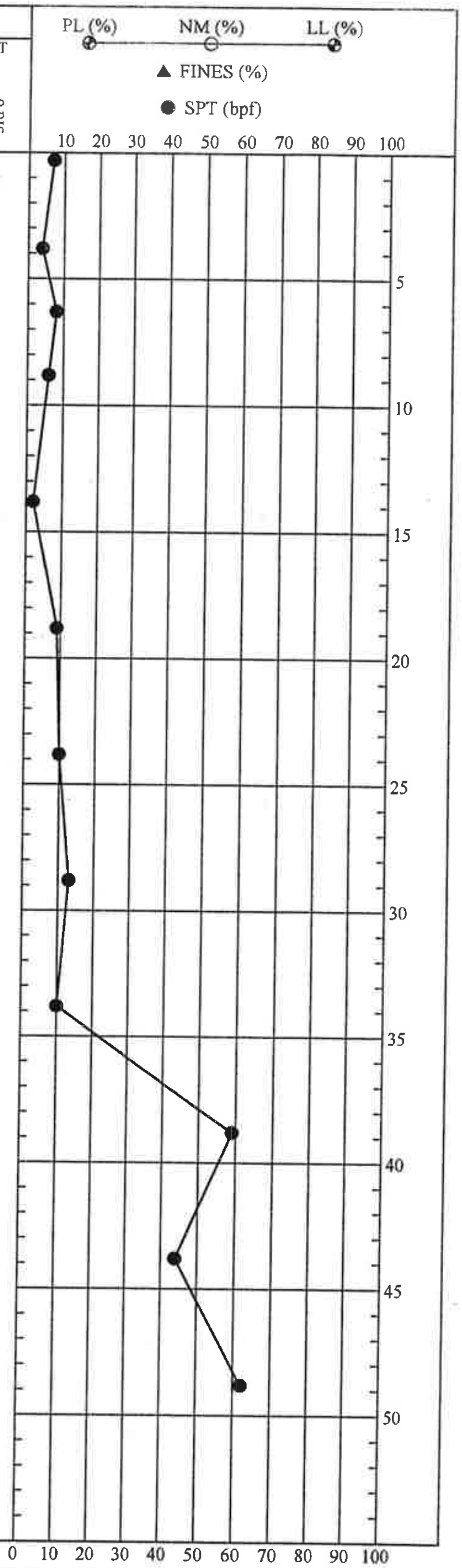
SOIL CLASSIFICATION AND REMARKS

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	**FILL** - Firm, dark brown, sandy SILT with organics	7
2.5	**ALLUVIUM** - Soft, light brown, sandy silty CLAY	
5	Firm, grayish green	2
12	Very soft, dark gray	
17	Loose, gray, fine, silty clayey SAND	
22	Stiff, gray, sandy silty CLAY	
37	Very dense, gray, medium to coarse, SAND with silt	
47	Very hard, dark gray, sandy SILT	
50	Boring terminated at 50 ft	-43

SAMPLES

IDENT	N-COUNT (1st 6" - 2nd 6" - 3rd 6")
SPT-1	4-3-4 (N = 7)
SPT-2	2-2-2 (N = 4)
SPT-3	2-4-4 (N = 8)
SPT-4	2-2-4 (N = 6)
SPT-5	0-0-2 (N = 2)
SPT-6	2-3-6 (N = 9)
SPT-7	4-4-6 (N = 10)
SPT-8	5-7-6 (N = 13)
SPT-9	3-5-5 (N = 10)
SPT-10	18-29-30 (N = 59)
SPT-11	10-17-27 (N = 44)
SPT-12	10-23-39 (N = 62)



DRILLER: MACTEC-L. Carter
EQUIPMENT: CME-550 ATV (Auto-Hammer)
METHOD: Mud Rotary
HOLE DIA.: 3.25 inches
REMARKS: Groundwater encountered at 4 feet at time of drilling.

BY: AAT
CHECKED:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-07
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 28, 2007
PROJECT NO.: 6139-06-0171

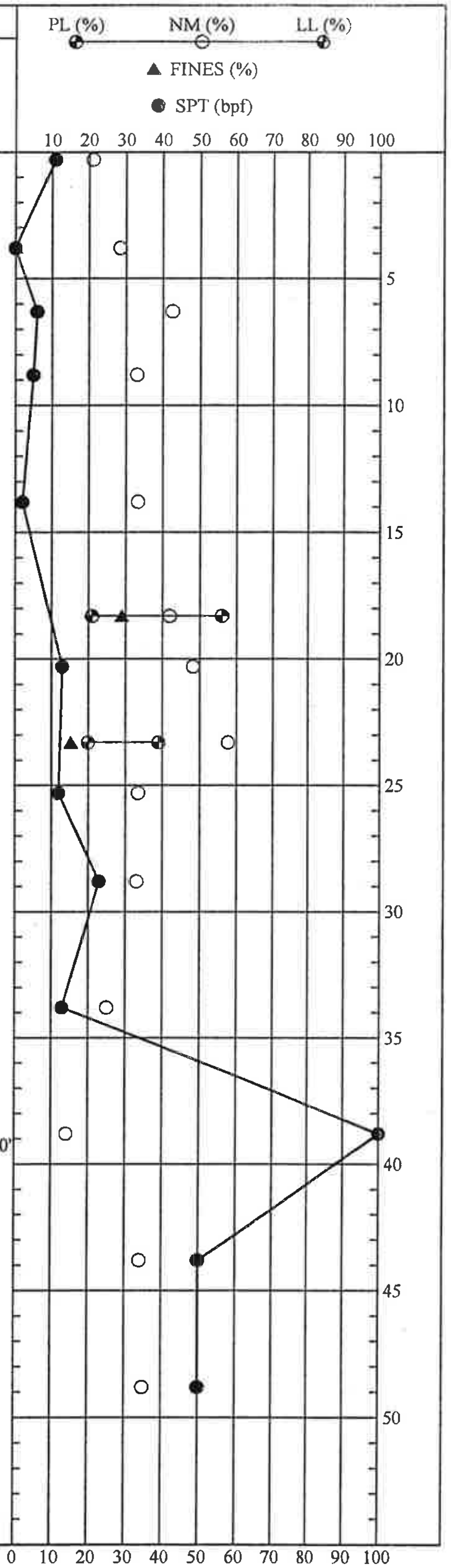
PAGE 1 **OF** 1

MACTEC

SOIL TEST BORING BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	ELEV (ft)
0	**FILL** -Stiff, dark gray, SILT with organics	7
	ALLUVIUM - Very soft, grayish brown, sandy CLAY	
5	Firm, greenish gray	2
	Loose, greenish gray, fine, silty clayey SAND	
10		-3
	Very soft, gray, sandy silty CLAY	
15		-8
	Stiff, dark gray Shelby Tube davanced from 18 to 20 ft; 24 inches recovered Dry Density - 78.3 pcf	
20		-13
	Medium dense, dark gray, fine, slightly clayey SAND Dry Density - 72.9 pcf Dry Density - 64.7 pcf	
25		-18
30		-23
	Medium dense, dark gray, fine to coarse, silty clayey SAND	
35		-28
	Very dense, gray, medium to coarse, SAND	
40		-33
	Very hard, dark gray, sandy SILT	
45		-38
50	Boring terminated at 50 ft	-43
55		-48

SAMPLES IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
SPT-1	X	3-5-6 (N = 11)
SPT-2	X	0-0-0 (N = 0)
SPT-3	X	2-3-3 (N = 6)
SPT-4	X	2-2-3 (N = 5)
SPT-5	X	0-0-2 (N = 2)
UD-1		
SPT-6	X	3-5-8 (N = 13)
UD-2		
SPT-7	X	3-4-8 (N = 12)
SPT-8	X	10-9-14 (N = 23)
SPT-9	X	5-5-8 (N = 13)
SPT-10	X	27-50/3"-50/10"
SPT-11	X	11-20-30 (N = 50)
SPT-12	X	13-21-29 (N = 50)



SOIL TEST BORING BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Mud Rotary
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 4 feet at time of drilling.
BY: AAT	
CHECKED:	

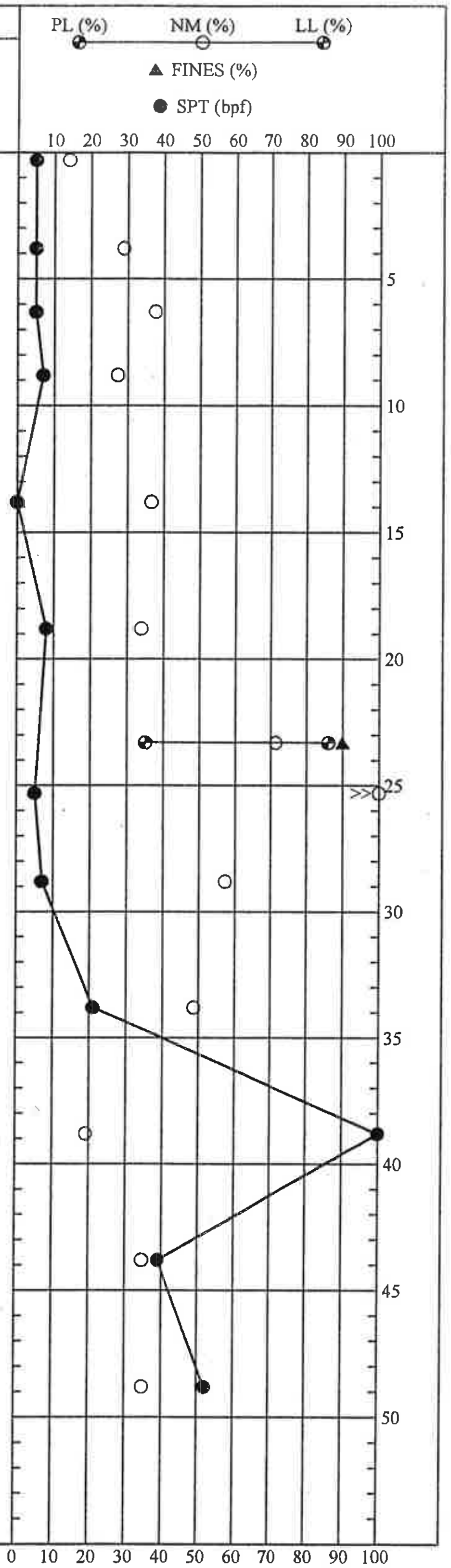
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-08
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 28, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.)	ELEV (ft)	SAMPLES IDENT	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	FILL -Firm, brownish gray, sandy SILT	7	SPT-1	2-3-2 (N = 5)
	ALLUVIUM - Firm, light gray, gray and light brown, silty CLAY with sand			
5		2	SPT-2	3-2-3 (N = 5)
			SPT-3	0-2-3 (N = 5)
	Loose, greenish gray, fine to medium, silty clayey SAND		SPT-4	2-4-3 (N = 7)
10		-3		
	Very soft, gray, sandy silty CLAY			
15		-8	SPT-5	0-0-0 (N = 0)
	Firm, dark gray, very sandy			
20		-13	SPT-6	3-4-4 (N = 8)
	Shelby Tube advanced from 23 to 25 ft; 24 inches recovered Dry Density - 64.7 pcf		UD-1	
25	Firm, dark gray, silty CLAY	-18	SPT-7	0-2-3 (N = 5)
			SPT-8	0-3-4 (N = 7)
30		-23		
	Very stiff, gray, very sandy			
35		-28	SPT-9	7-10-11 (N = 21)
	Very dense, gray, fine to medium, SAND			
40		-33	SPT-10	11-27-50/2"
	Hard to very hard, dark gray, sandy SILT			
45		-38	SPT-11	12-18-21 (N = 39)
			SPT-12	11-22-30 (N = 52)
50	Boring terminated at 50 ft	-43		
55		-48		



SOIL TEST BORING BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER: MACTEC-L. Carter
EQUIPMENT: CME-550 ATV (Auto-Hammer)
METHOD: Mud Rotary
HOLE DIA.: 3.25 inches
REMARKS: Groundwater encountered at 4 feet at time of drilling.

BY: AAT
CHECKED:

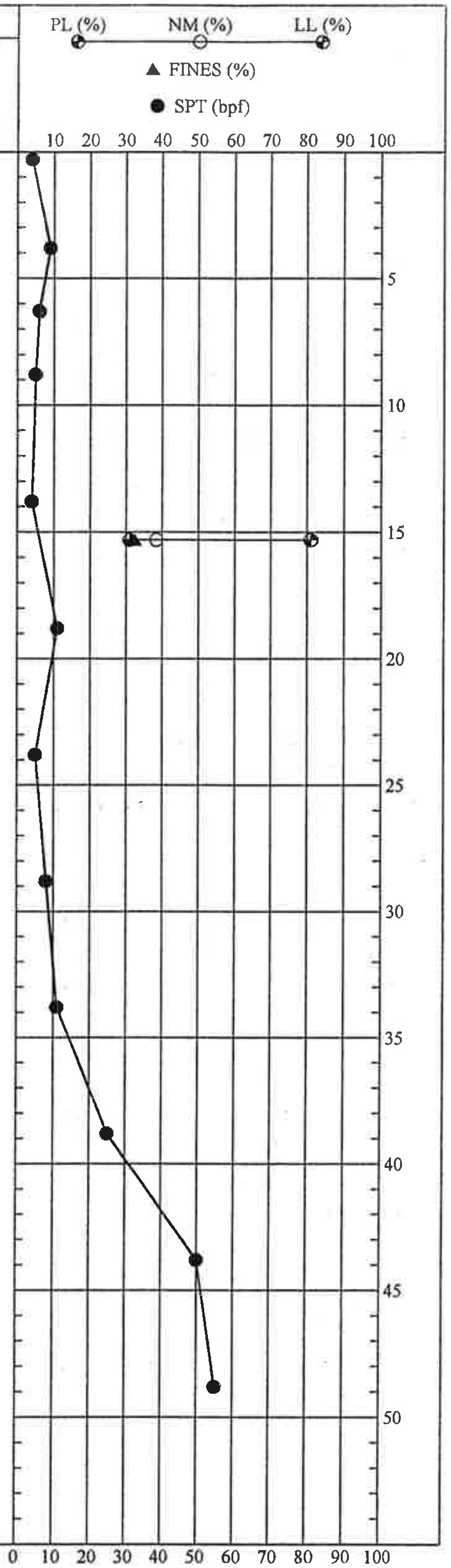
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-09
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 27, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	**FILL** -Firm, brown, sandy SILT		7	SPT-1		3-2-2 (N = 4)
	▼			SPT-2		3-4-5 (N = 9)
5	**ALLUVIUM** - Loose gray clayey SAND		2	SPT-3		3-3-3 (N = 6)
				SPT-4		2-2-3 (N = 5)
10			-3			
				SPT-5		2-2-2 (N = 4)
15	Shelby Tube advanced from 15 to 17 ft; 24 inches recovered Dry Density - 80.2 pcf		-8	UD-1		
	Medium dense, gray, fine to medium, SAND with clay			SPT-6		6-6-5 (N = 11)
20			-13			
	Firm to stiff, gray, silty CLAY			SPT-7		3-3-2 (N = 5)
25			-18			
				SPT-8		3-4-4 (N = 8)
30			-23			
				SPT-9		2-5-6 (N = 11)
35			-28			
	Medium dense, gray, fine to coarse, gravelly SAND with silt			SPT-10		4-14-11 (N = 25)
40			-33			
	Very hard, grayish brown, sandy CLAY			SPT-11		12-24-26 (N = 50)
45			-38			
				SPT-12		20-25-30 (N = 55)
50	Boring terminated at 50 ft		-43			
55			-48			



SOIL TEST BORING BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Mud Rotary
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 4 feet at time of drilling.

BY: AAT
CHECKED:

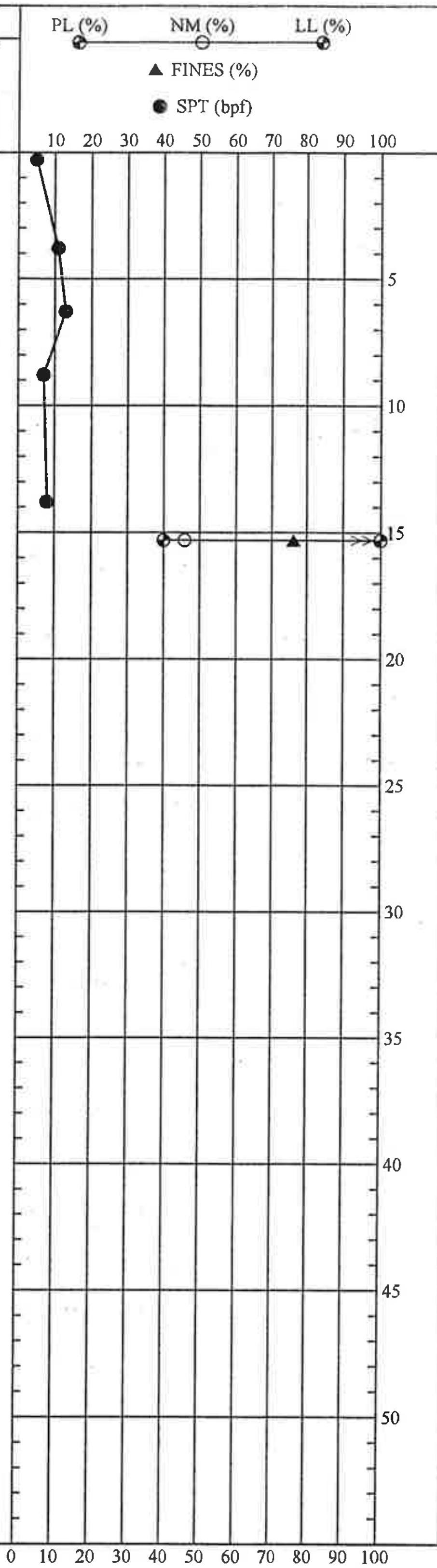
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-10
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 27, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	**FILL** - Firm, brown, sandy silty CLAY with organic matter		7	SPT-1		2-2-3 (N = 5)
				SPT-2		4-4-7 (N = 11)
5	**ALLUVIUM** - Stiff, gray, sandy silty CLAY with root fragments ▽		2	SPT-3		3-4-9 (N = 13)
	Firm, gray, sandy CLAY			SPT-4		3-4-3 (N = 7)
10			-3			
				SPT-5		2-3-5 (N = 8)
15	Shelby tube advanced 15 to 17 feet; 24 inches recovered Dry Density - 69.6 pcf		-8	UD-1		
	Boring terminated at 17 ft					
20			-13			
25			-18			
30			-23			
35			-28			
40			-33			
45			-38			
50			-43			
55			-48			



SOIL TEST BORING BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Hollow Stem Auger
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 7 feet at time of drilling.
BY: AAT	
CHECKED:	

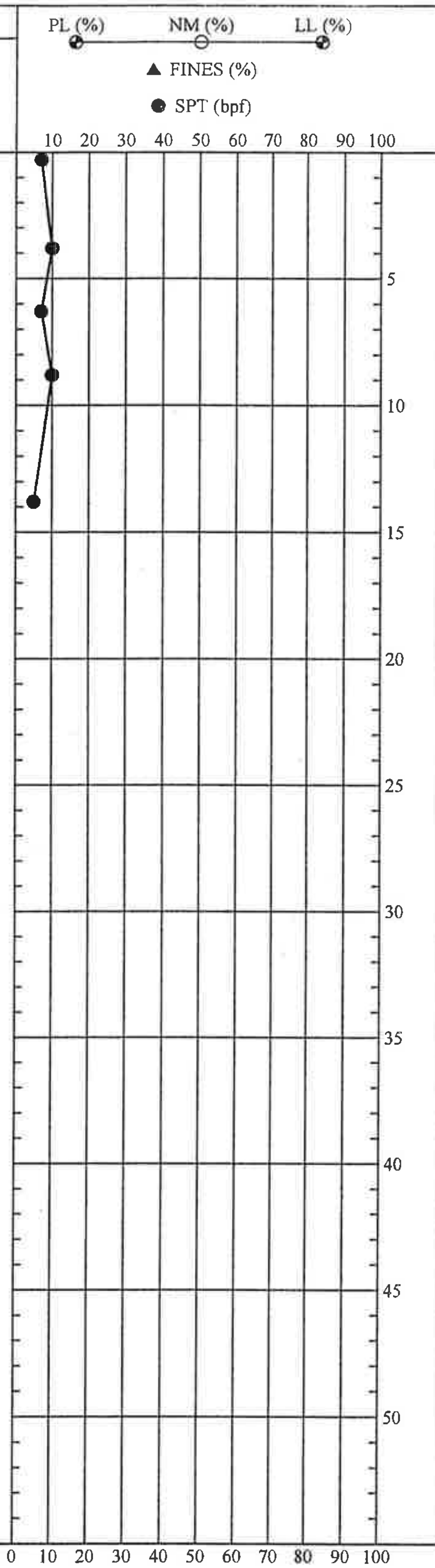
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-11
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 26, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	**FILL** - Firm, brown, sandy SILT		7	SPT-1		4-4-3 (N = 7)
5	**ALLUVIUM** - Firm to stiff, light brown and gray, sandy silty CLAY		2	SPT-2		4-5-5 (N = 10)
				SPT-3		3-3-4 (N = 7)
10	∇		-3	SPT-4		4-5-5 (N = 10)
15	Boring terminated at 15 ft		-8	SPT-5		2-3-2 (N = 5)
20			-13			
25			-18			
30			-23			
35			-28			
40			-33			
45			-38			
50			-43			
55			-48			



SOIL TEST BORING LOGS.GPJ LAW GIBB.GDT 4/18/07

DRILLER:	MACTEC-L. Carter
EQUIPMENT:	CME-550 ATV (Auto-Hammer)
METHOD:	Hollow Stem Auger
HOLE DIA.:	3.25 inches
REMARKS:	Groundwater encountered at 10 feet at time of drilling.

BY: AAT
CHECKED:

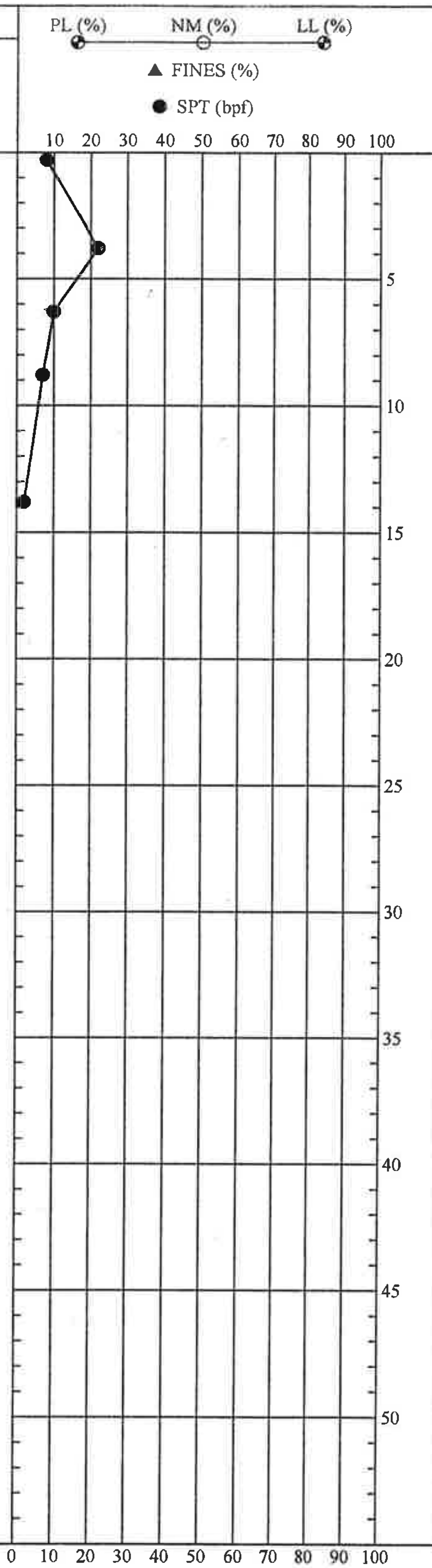
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-12
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 26, 2007
PROJECT NO.: 6139-06-0171

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" 2nd 6" 3rd 6")
0	**FILL** - Firm, dark brown, clayey SILT	7	SPT-1		2-3-5 (N = 8)
	ALLUVIUM - Very stiff, dark brown, sandy silty CLAY		SPT-2		3-7-15 (N = 22)
5	Medium dense, light gray silty clayey SAND	2	SPT-3		3-5-5 (N = 10)
	Firm, grayish green, sandy silty CLAY		SPT-4		2-3-4 (N = 7)
10		-3			
	Very soft, gray,		SPT-5		2-1-1 (N = 2)
15	Boring terminated at 15 ft	-8			
20		-13			
25		-18			
30		-23			
35		-28			
40		-33			
45		-38			
50		-43			
55		-48			



SOIL TEST BORING LOGS.GPJ LAW_GIBB.GDT 4/18/07

DRILLER: MACTEC-L. Carter
EQUIPMENT: CME-550 ATV (Auto-Hammer)
METHOD: Hollow Stem Auger
HOLE DIA.: 3.25 inches
REMARKS: Groundwater encountered at 4 feet at time of drilling.

BY: AAT
CHECKED:

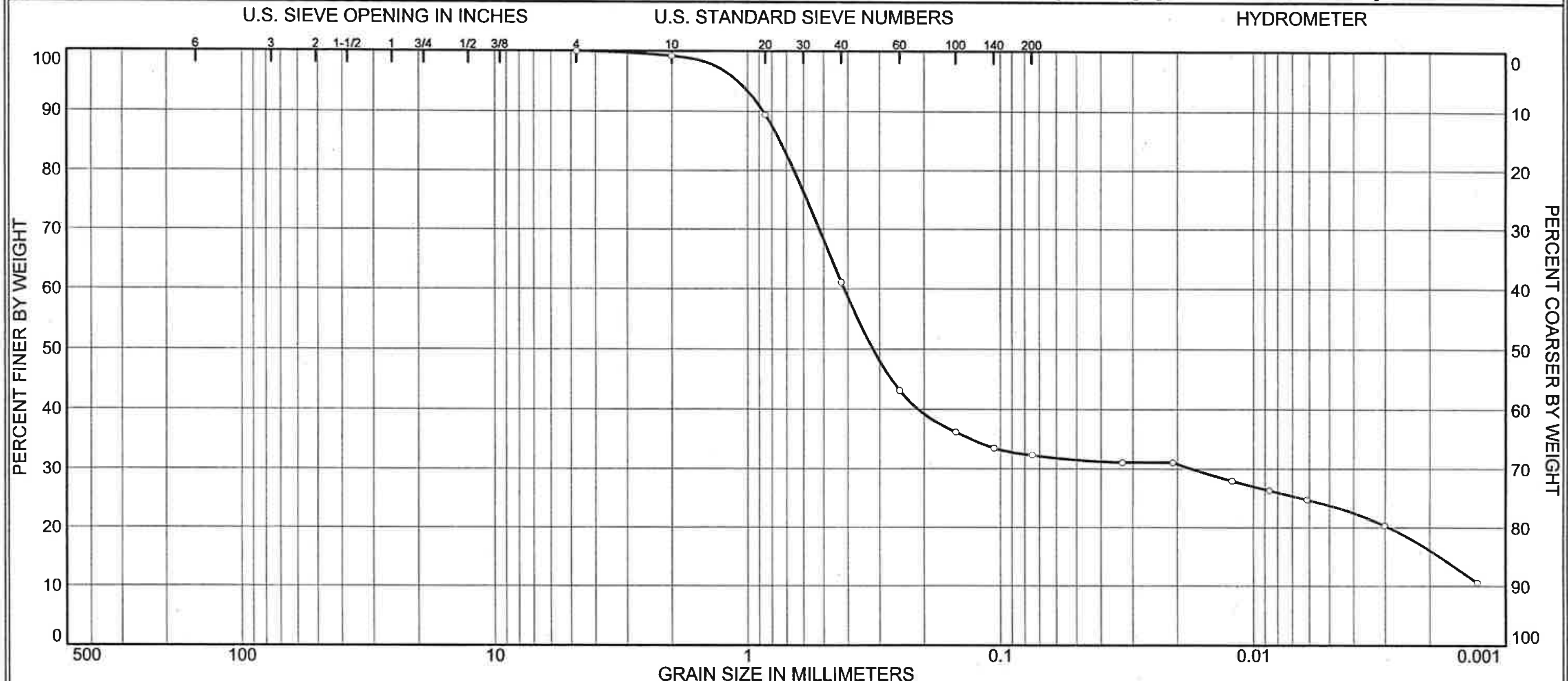
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: B-13
PROJECT: Little Hurst Canal Culverts
LOCATION: Port Wentworth, Georgia
DRILLED: March 26, 2007
PROJECT NO.: 6139-06-0171

MACTEC

Particle Size Distribution Report ASTM D422-63 (Reapproved 2002)



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.8	38.1	28.8	8.6	23.7

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	B-10	UD	15-17 Ft.	4/11/07	SC	Dark Gray Clayey sand		81	31

Client INTSE

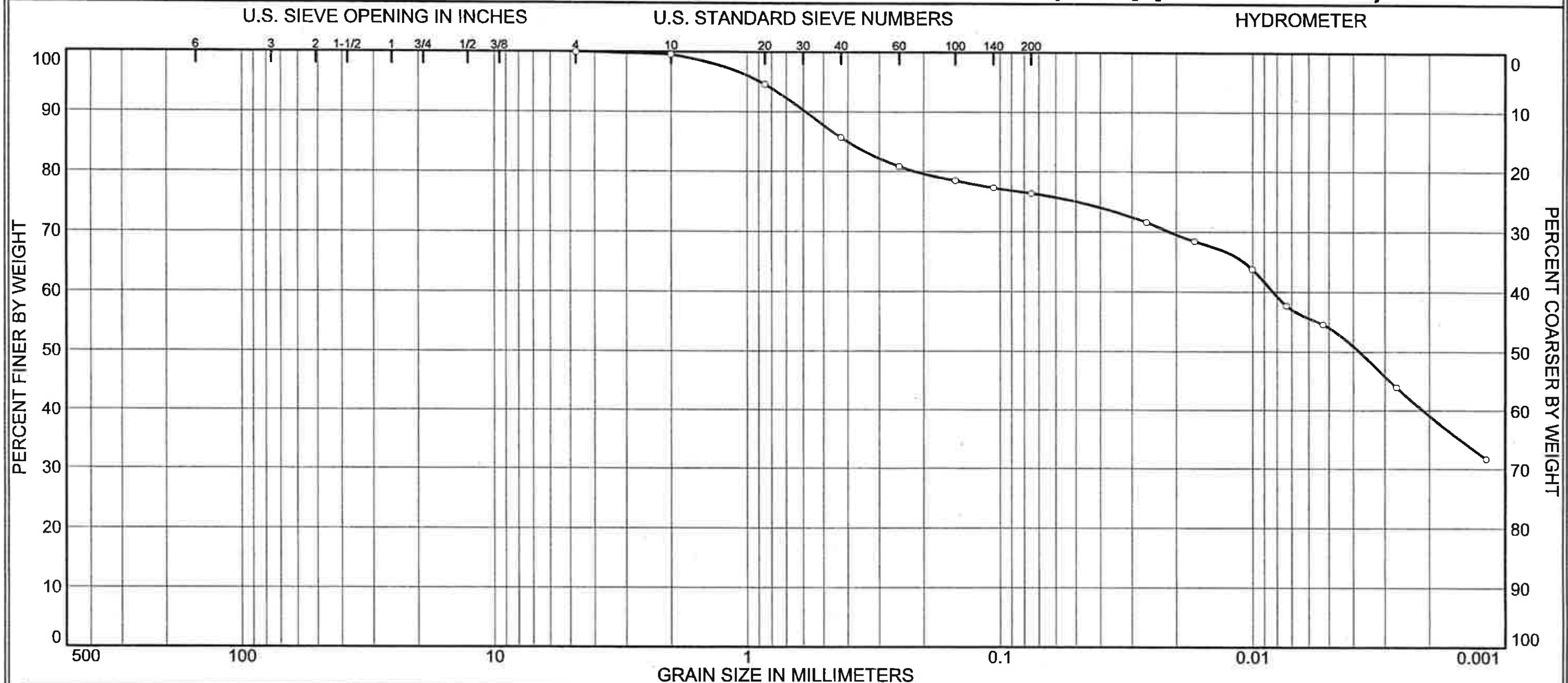
Project Little Hurst Canal SVH

Project No. 6139-06-0171.01 Lab no.

MACTEC ENGINEERING AND CONSULTING, INC.

○ Tested by: BM Reviewed by: HJ

Particle Size Distribution Report ASTM D422-63 (Reapproved 2002)



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.4	13.9	9.4	22.3	54.0

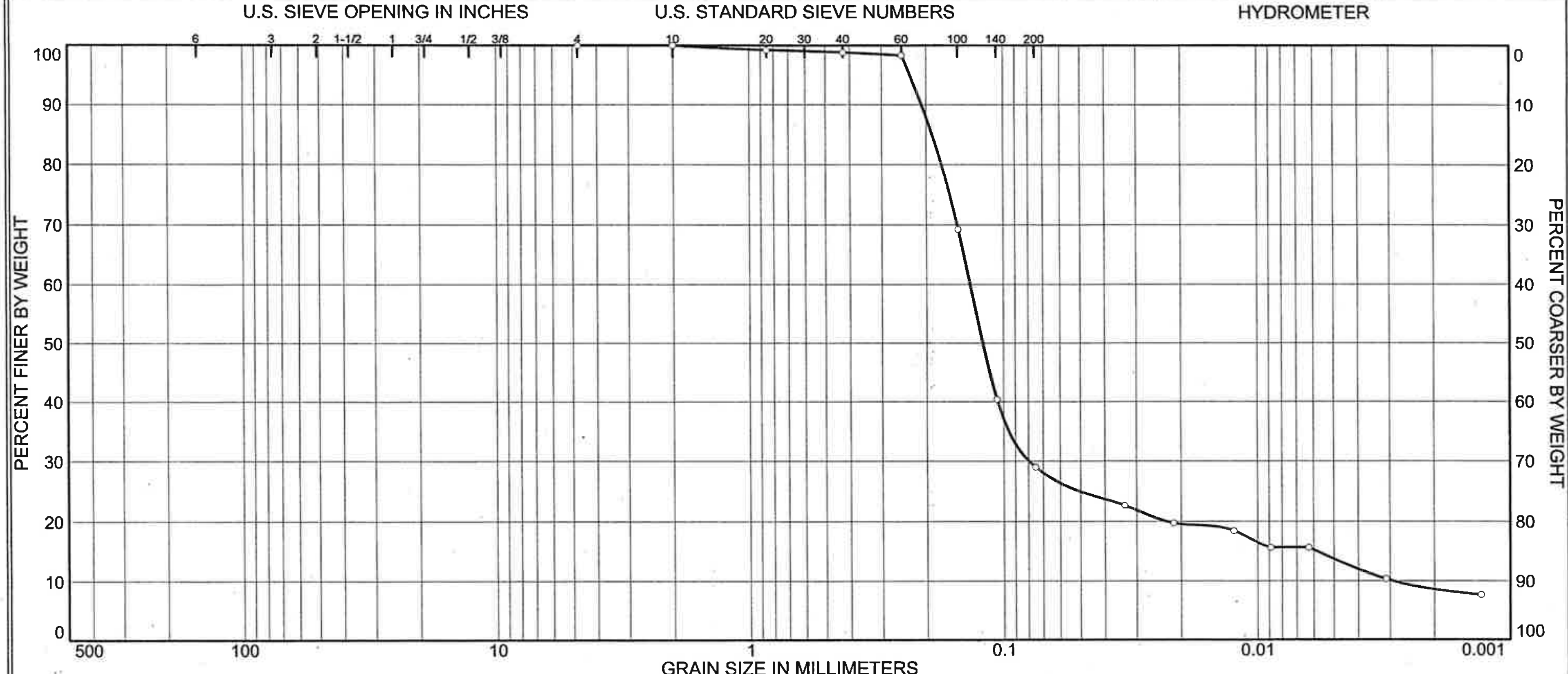
	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	B-11	UD	15-17 Ft.	4/9/07	CH	Gray Fat clay with sand		109	40

Client INTSE
Project Little Hurst Canal SVH
Project No. 6139-06-0171.01 Lab no.

MACTEC ENGINEERING AND CONSULTING, INC.

○ Tested by: BM Reviewed by: HJ

Particle Size Distribution Report ASTM D422-63 (Reapproved 2002)



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.0	0.0	1.2	69.8	15.3	13.7

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	B-8	UD	18-20 Ft.	4/9/07	SC	Gray Clayey sand		56	21

Client INTSE

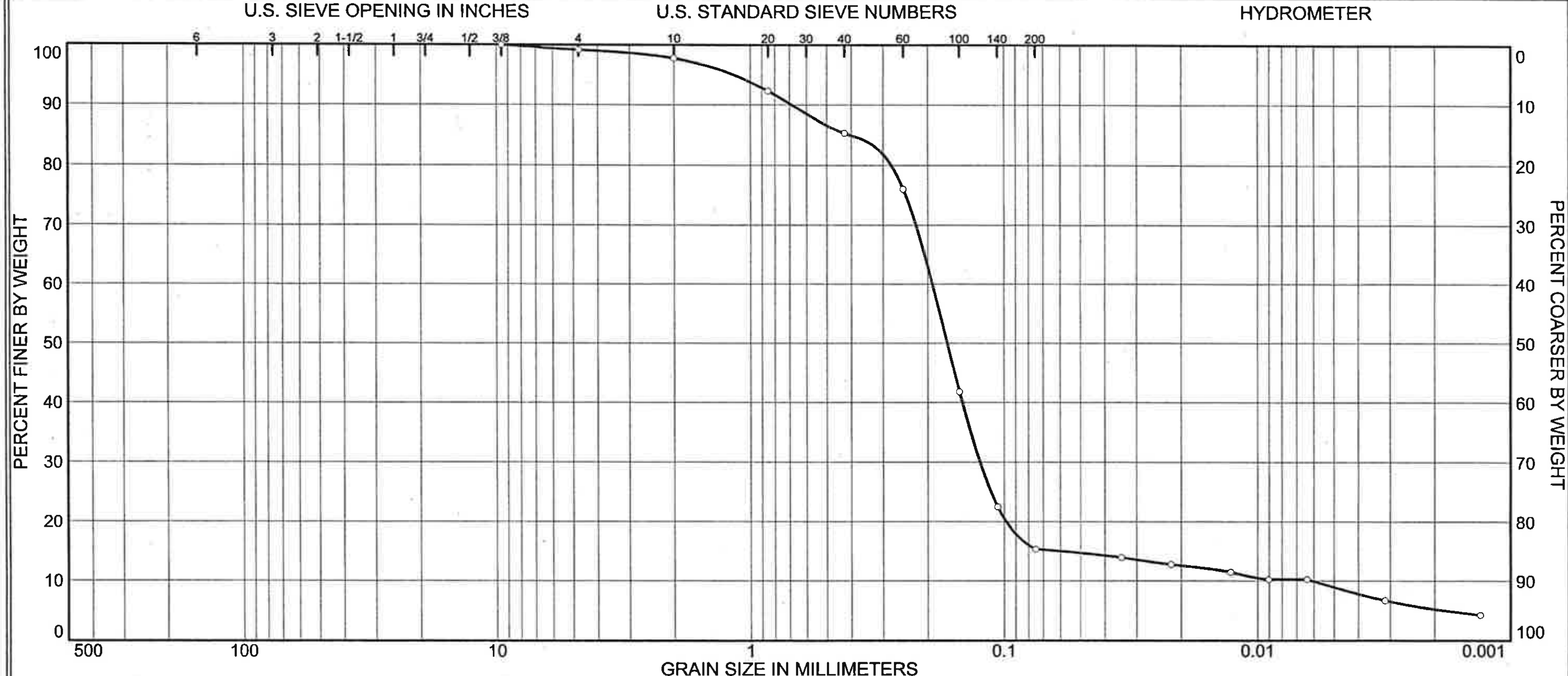
Project Little Hurst Canal SVH

Project No. 6139-06-0171.01 Lab no.

MACTEC ENGINEERING AND CONSULTING, INC.

○ Tested by: BM Reviewed by: HJ

Particle Size Distribution Report ASTM D422-63 (Reapproved 2002)



	% COBBLES	% GRAVEL		% SAND			% FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.9	1.4	12.4	70.0	6.4	8.9

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○	B-8	UD	23-25 Ft.	4/9/07	SC	Gray Clayey sand		39	20

Client INTSE

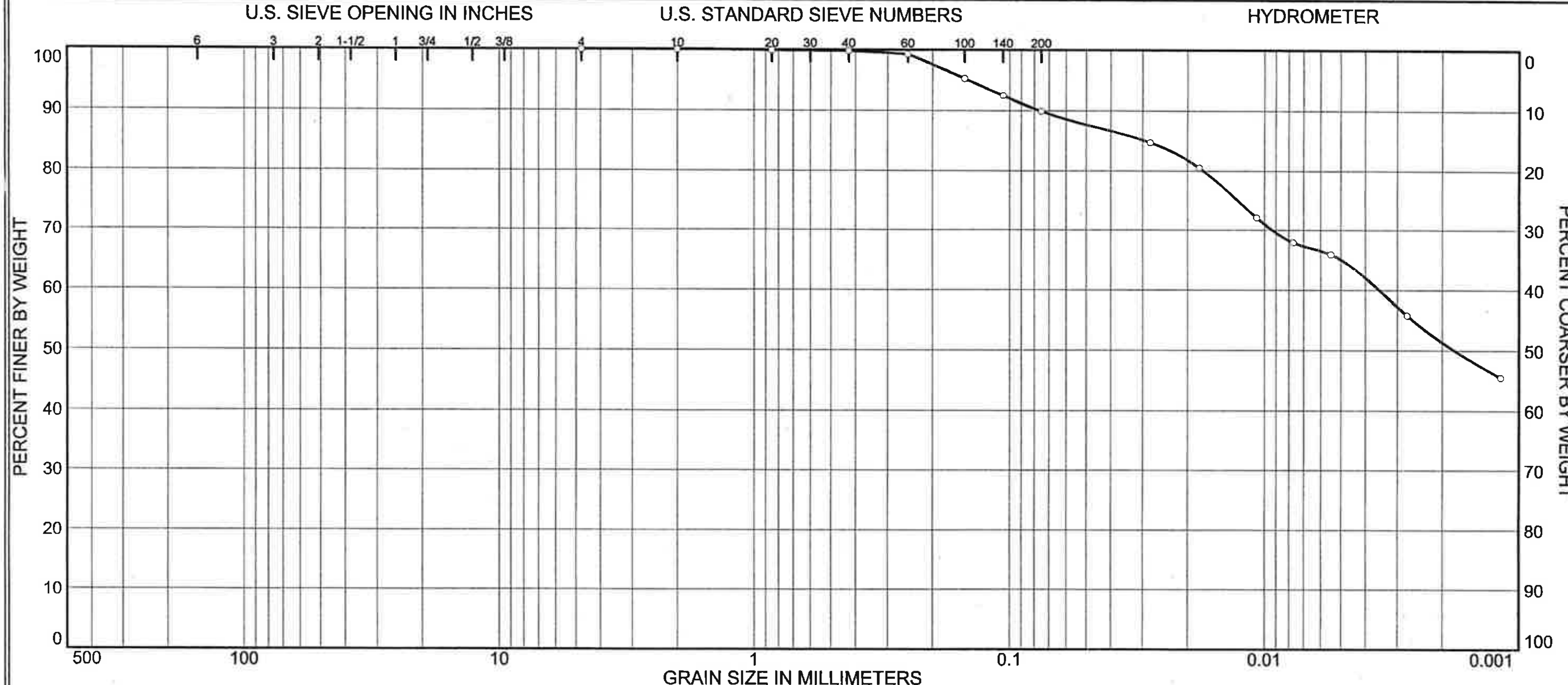
Project Little Hurst Canal SVH

Project No. 6139-06-0171.01 Lab no.

MACTEC ENGINEERING AND CONSULTING, INC.

○ Tested by: BM Reviewed by: HJ

Particle Size Distribution Report ASTM D422-63 (Reapproved 2002)



% COBBLES	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.2	9.9	24.8	65.1

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
B-9	UD	23-25 Ft.	4/9/07	CH	Dark Gray Fat clay		86	35

Client INTSE

Project Little Hurst Canal SVH

Project No. 6139-06-0171.01 Lab no.

MACTEC ENGINEERING AND CONSULTING, INC.

Tested by: BM Reviewed by: HJ

COMPACTION TEST REPORT

Project No.: 6139-06-0171.01 **Date:**
Project: Little Hurst Canal SVH

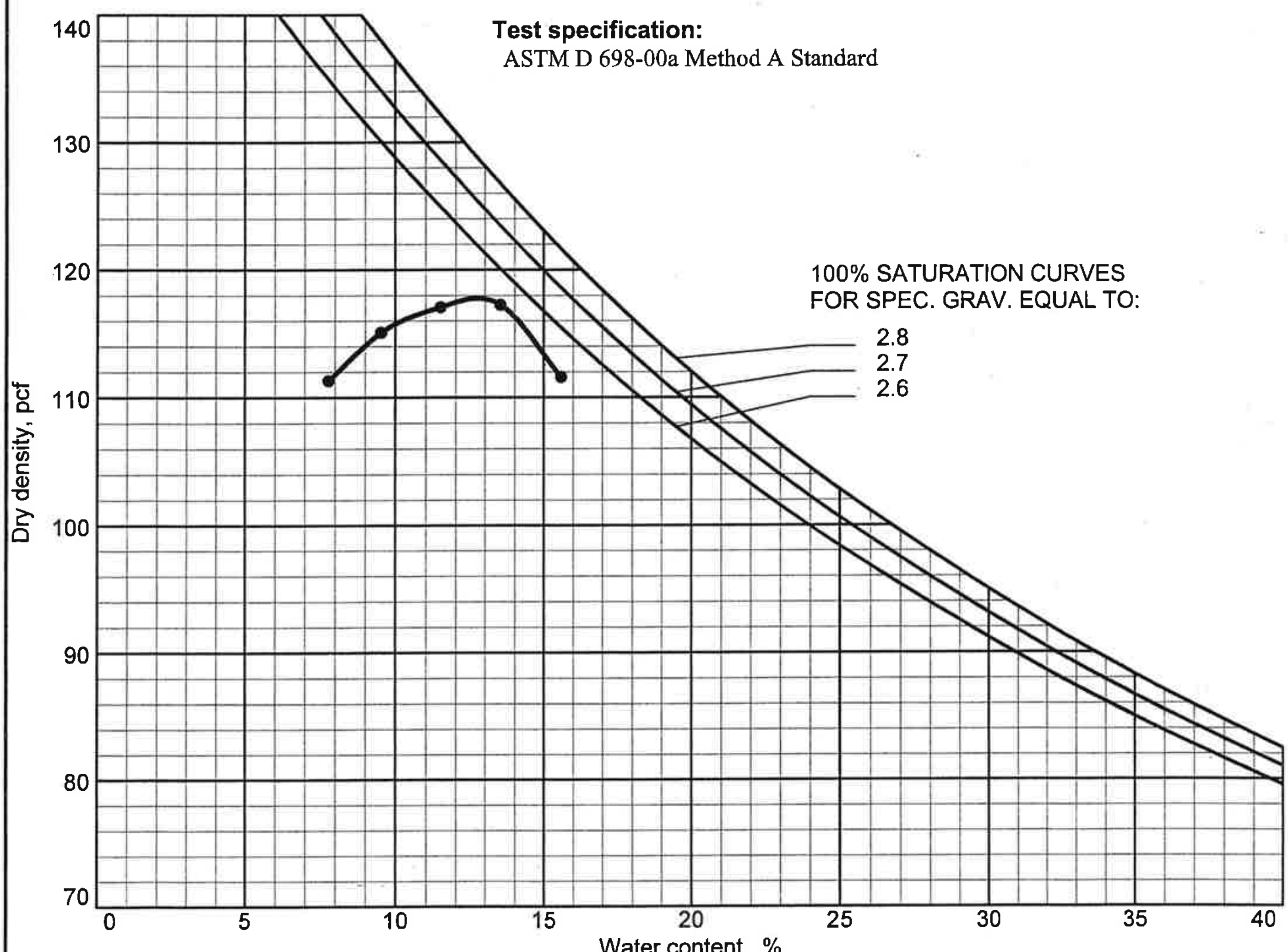
Location: B-10
Elev./Depth: 0-5 ft **Sample No.** Bag
Remarks:

MATERIAL DESCRIPTION

Description: Gray Clayey Silty Sand

Classifications - **USCS:** **AASHTO:**
Nat. Moist. = **Sp.G. =** 2.7
Liquid Limit = **Plasticity Index =**
% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 117.8 pcf
Optimum moisture = 12.8 %



Lab

MACTEC Engineering and Consulting, Inc.

COMPACTION TEST REPORT

Project No.: 6139-06-0171.01 **Date:** 4/12/07
Project: Little Hurst Canal SVH

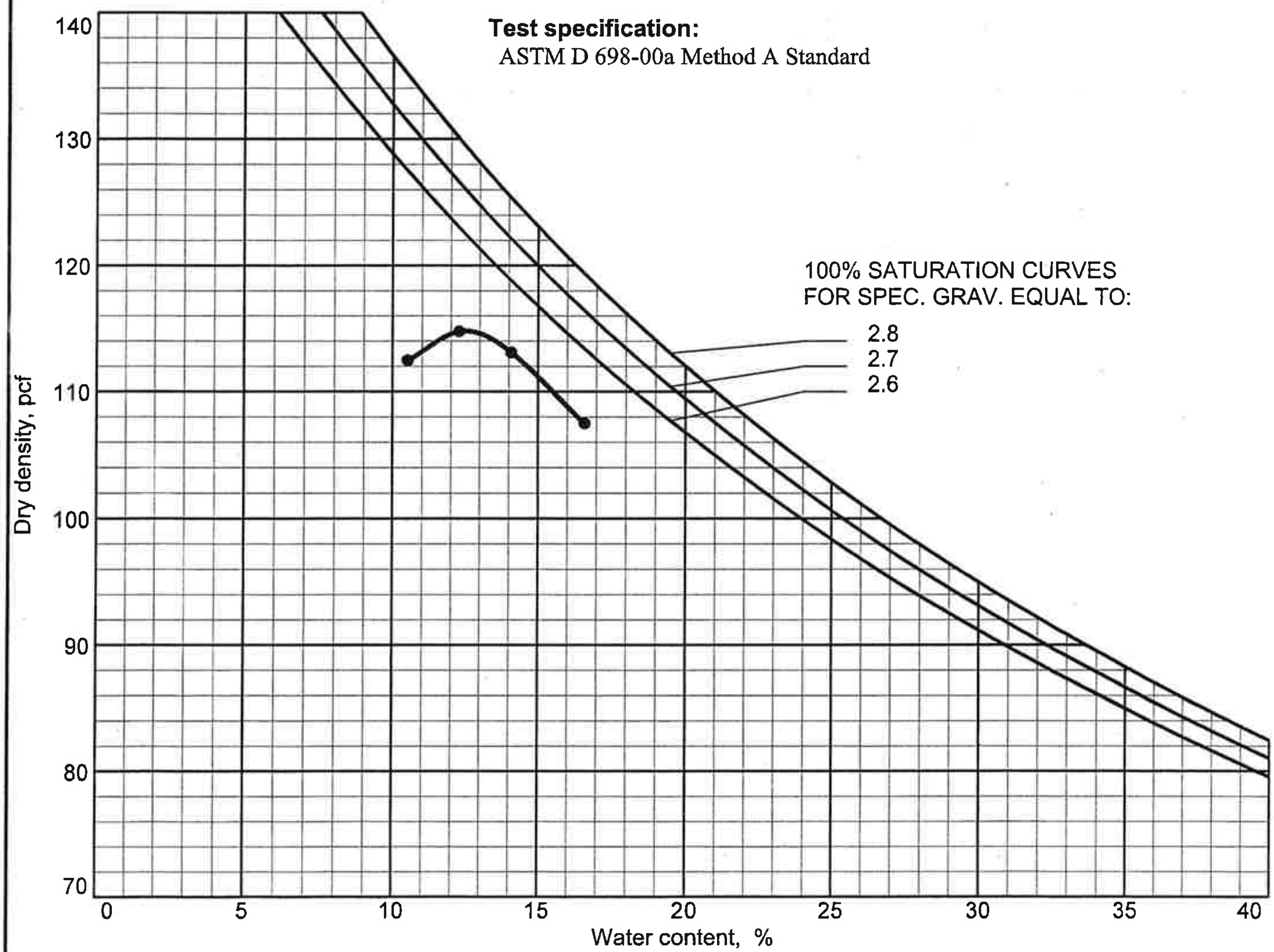
Location: B-9
Elev./Depth: 0-5 ft. **Sample No.** Bag
Remarks: Tested by: EH Reviewed by: HJ

MATERIAL DESCRIPTION

Description: Gray Clayey Sand

Classifications - **USCS:** **AASHTO:**
Nat. Moist. = **Sp.G. =** 2.7
Liquid Limit = **Plasticity Index =**
% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 114.8 pcf
Optimum moisture = 12.5 %



Test specification:
ASTM D 698-00a Method A Standard

Lab

MACTEC Engineering and Consulting, Inc.

MACTEC

UNIT WEIGHT OF SAMPLE

Project No.:	6139-06-0171.01	Boring No.:	B-8
Lab No:	7340	Depth:	18-20 Ft.
Project Name:	Little Hurst Canal	Sample ID:	Ud
Tested By:	BM	Reviewed By:	HJ
Date:	04/04/07	Date:	04/07/07

Total Sample Height, *inches*		**Inside Diameter of Cut Tube, *inches***		**Moisture Content**		
1	6.16			Tare No.	Z-24	
2	6.16	Top	2.846	Tare Weight	83.95	*grams*
3	6.14	Bottom	2.849	Wet Weight + Tare	1216.19	*grams*
Average	6.08	Average	2.856	Dry Weight + Tare	881.17	*grams*
				Moisture Content	42.0	%

Total Weight of Soil + Tube Section	1581.17	*grams*
Weight of Clean, Dry Tube Section	445.10	*grams*
Wet Weight of Soil	2.50	*lbs*
Volume of Sample	0.023	ft^3

RESULT SUMMARY

Moisture Content	**42.0**	**%**
Wet Density	**111.2**	***pcf***
Dry Density	**78.3**	***pcf***

Remarks:

MACTEC

UNIT WEIGHT OF SAMPLE

Project No.:	6139-06-0171.01	Boring No.:	B-8
Lab No:	7341	Depth:	23-25 Ft.
Project Name:	Little Hurst Canal	Sample ID:	Ud
Tested By:	BM	Reviewed By:	HJ
Date:	04/04/07	Date:	04/07/07

Total Sample Height, *inches*		**Inside Diameter of Cut Tube, *inches***		**Moisture Content**		
1	6.12			Tare No.	L-20	
2	6.1	Top	2.865	Tare Weight	90.99	*grams*
3	6.1	Bottom	2.865	Wet Weight + Tare	1193.27	*grams*
Average	6.08	Average	2.865	Dry Weight + Tare	836.71	*grams*
				Moisture Content	47.8	%

Total Weight of Soil + Tube Section	1555.86	*grams*
Weight of Clean, Dry Tube Section	447.28	*grams*
Wet Weight of Soil	2.44	*lbs*
Volume of Sample	0.023	ft^3

RESULT SUMMARY

Moisture Content	**47.8**	*%*
Wet Density	**107.8**	***pcf***
Dry Density	**72.9**	***pcf***

Remarks:

MACTEC

UNIT WEIGHT OF SAMPLE

Project No.:	6139-06-0171.01	Boring No.:	B-9
Lab No:	7343	Depth:	23-25 Ft.
Project Name:	Little Hurst Canal	Sample ID:	Ud
Tested By:	BM	Reviewed By:	HJ
Date:	04/04/07	Date:	04/07/07

Total Sample Height, *inches*		**Inside Diameter of Cut Tube, *inches***		**Moisture Content**		
1	6.07			Tare No.	LS-49	
2	6.08	Top	2.853	Tare Weight	87.89	*grams*
3	6.08	Bottom	2.859	Wet Weight + Tare	1124.18	*grams*
Average	6.08	Average	2.856	Dry Weight + Tare	745.08	*grams*
				Moisture Content	57.7	%

Total Weight of Soil + Tube Section	1481.29	*grams*
Weight of Clean, Dry Tube Section	438.55	*grams*
Wet Weight of Soil	2.30	*lbs*
Volume of Sample	0.023	ft^3

RESULT SUMMARY

Moisture Content	**57.7**	**%**
Wet Density	**102.0**	***pcf***
Dry Density	**64.7**	***pcf***

Remarks:

MACTEC

UNIT WEIGHT OF SAMPLE

Project No.:	6139-06-0171.01	Boring No.:	B-9
Lab No:	7343 (2)	Depth:	23-25 Ft.
Project Name:	Little Hurst Canal	Sample ID:	Ud
Tested By:	BM	Reviewed By:	HJ
Date:	04/04/07	Date:	04/07/07

Total Sample Height, *inches*		Inside Diameter of Cut Tube, *inches*		Moisture Content		
1	6.00			Tare No.	LS-46	
2	6	Top	2.854	Tare Weight	93.23	*grams*
3	6	Bottom	2.857	Wet Weight + Tare	1062.91	*grams*
Average	6.08	Average	2.865	Dry Weight + Tare	658.78	*grams*
				Moisture Content	71.5	%

Total Weight of Soil + Tube Section	1406.82	*grams*
Weight of Clean, Dry Tube Section	428.79	*grams*
Wet Weight of Soil	2.16	*lbs*
Volume of Sample	0.023	ft^3

RESULT SUMMARY

Moisture Content	**71.5**	**%**
Wet Density	**95.1**	***pcf***
Dry Density	**55.5**	***pcf***

Remarks:

MACTEC

UNIT WEIGHT OF SAMPLE

Project No.:	6139-06-0171.01	Boring No.:	B-10
Lab No:	7345	Depth:	15-17 Ft.
Project Name:	Little Hurst Canal	Sample ID:	Ud
Tested By:	BM	Reviewed By:	HJ
Date:	04/04/07	Date:	04/07/07

Total Sample Height, *inches*		**Inside Diameter of Cut Tube, *inches***		**Moisture Content**		
1	6.12			Tare No.	N-22	
2	6.12	Top	2.820	Tare Weight	48.21	*grams*
3	6.14	Bottom	2.807	Wet Weight + Tare	1175.87	*grams*
Average	6.08	Average	2.856	Dry Weight + Tare	862.99	*grams*
				Moisture Content	38.4	%

Total Weight of Soil + Tube Section	1578.29	*grams*
Weight of Clean, Dry Tube Section	444.13	*grams*
Wet Weight of Soil	2.50	*lbs*
Volume of Sample	0.023	ft^3

RESULT SUMMARY

Moisture Content	**38.4**	*%*
Wet Density	**111.0**	*pcf*
Dry Density	**80.2**	*pcf*

Remarks:

MACTEC

UNIT WEIGHT OF SAMPLE

Project No.: 6139-06-0171.01
Lab No: 7346
Project Name: Little Hurst Canal
Tested By: BM
Date: 04/04/07

Boring No.: B-11
Depth: 15-17 Ft.
Sample ID: Ud
Reviewed By: HJ
Date: 04/07/07

Total Sample Height, *inches*		**Inside Diameter of Cut Tube, *inches***		**Moisture Content**		
1	6.14			Tare No.	LS-61	
2	6.12	Top	2.885	Tare Weight	88.91	*grams*
3	6.14	Bottom	2.858	Wet Weight + Tare	1144.30	*grams*
Average	6.13	Average	2.872	Dry Weight + Tare	812.95	*grams*
				Moisture Content	45.8	*%*

Total Weight of Soil + Tube Section	1492.62	*grams*
Weight of Clean, Dry Tube Section	434.21	*grams*
Wet Weight of Soil	2.33	*lbs*
Volume of Sample	0.023	ft^3

RESULT SUMMARY

Moisture Content	**45.8**	***%***
Wet Density	**101.5**	***pcf***
Dry Density	**69.6**	***pcf***

Remarks: