State of Utah

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

Department of Administrative Services
KIMBERLY K. HOOD
Executive Director

Division of Facilities Construction and Management
DAVID G. BUXTON
Director

ADDENDUM NO. 1

Date: July 16, 2009

To: Contractors

From: Craig Wessman – Project Manager

Reference: Boiler Replacement and Building Repairs
Utah State Developmental Center – American Fork, Utah
DFCM Project No. 08194410

Subject: **Addendum No. 1**

Pages			
	Addendum Cover Sheet	1	page
	Revised Project Schedule	1	page
	Revised Bid Form	2	pages
	Geotechnical Investigation – RB&G Engineering	24	pages
	Total	28	pages

Note: This Addendum shall be included as part of the Contract Documents. Items in this Addendum apply to all drawings and specification sections whether referenced or not involving the portion of the work added, deleted, modified, or otherwise addressed in the Addendum. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to Disqualification.

While we contend that SB220 should only be potentially applicable to a contract issued after the effective date of said bill, this is to clarify that for purposes of this contract, regardless of the execution or effective dates of this contract, the status of Utah Law and remedies available to the State of Utah and DFCM, as it relates to any matter referred to or affected by said SB220, shall be the Utah law in effect at the time of the issuance of this Addendum.

1.1 SCHEDULE CHANGES: See attached revised Project Schedule

1.1.1 Final addendum deadline changed to Monday, July 20, 2009 at 3:00 PM
1.1.2 Bid/Bid Bond submittal date and time changed to Wednesday, July 22, 2009 at 3:30 PM.
1.1.3 Subcontractors List submittal date and time changed to Thursday, July 23, 2009 at 3:30 PM.

1.2 GENERAL ITEMS:

1.2.1 See attached Revised Bid Form – Additive Alternate No. 1 added.
1.2.2 See attached Geotechnical Investigation
1.2.3 The new DFCM Supplemental General Conditions effective July 1, 2009 dealing with health insurance and immigration are available at http://dfcm.utah.gov/StdDocs/index.html

4110 State Office Building, Salt Lake City, Utah 84114 · telephone 801-538-3018 · facsimile 801-538-3267 · www.dfcm.utah.gov

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

Stage II – REVISED
PER ADDENDUM NO. 1 DATED JULY 16, 2009
PROJECT SCHEDULE

PROJECT NAME: **BOILER REPLACEMENT AND BUILDING REPAIRS**
UTAH STATE DEVELOPMENTAL CENTER - AMERICAN FORK, UTAH
DFCM PROJECT #: **08194410**

Event	Day	Date	Time	Place
Stage II Bidding Documents Available	Wednesday	June 24, 2009	4:00 PM	DFCM 4110 State Office Building SLC, UT and the DFCM web site*
Mandatory Pre-bid Site Meeting	Wednesday	July 1, 2009	9:00 AM	Human Resources Conference Rm Heather Building Utah State Developmental Center 863 East 1000 North American Fork, UT
Deadline for Submitting Questions	Monday	July 13, 2009	4:00 PM	Craig Wessman, PE – DFCM E-mail cwessman@utah.gov Fax (801) 538-3267
Addendum Deadline (exception for bid delays)	**Monday**	**July 20, 2009**	**3:00 PM**	**DFCM web site***
Prime Contractors Turn in Bid and Bid Bond	**Wednesday**	**July 22, 2009**	**3:30 PM**	**DFCM** **4110 State Office Building** **SLC, UT**
Subcontractors List Due	**Thursday**	**July 23, 2009**	**3:30 PM**	**DFCM** **4110 State Office Building** **SLC, UT** **Fax (801) 538-3677**
Substantial Completion Date	Friday	January 15, 2010		

* NOTE: DFCM's web site address is **http://dfcm.utah.gov**

BID FORM – REVISED
PER ADDENDUM NO. 1 DATED JULY 16, 2009

NAME OF BIDDER ____ DATE __________________

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Invitation to Bid" and in accordance with the Request for Bids for the **BOILER REPLACEMENT AND BUILDING REPAIRS - UTAH STATE DEVELOPMENTAL CENTER AMERICAN FORK, UTAH - DFCM PROJECT NO. 08194410** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _______________________________________

BASE BID: For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

____ DOLLARS ($____________)
(In case of discrepancy, written amount shall govern)

ADDITIVE ALTERNATE NO. 1: For all work shown on the Drawings and described in the Specifications and Contract Documents to provide a third boiler identified as B-3 complete with installation and start-up, I/we agree to perform for the sum of:

____ DOLLARS ($____________)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **January 15, 2010,** should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$210.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of ___________________________________

The undersigned Contractor's License Number for Utah is _______________________.________

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within time set forth.

Type of Organization: ____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

____

Respectfully submitted,

____
Name of Bidder

ADDRESS:

____

____

____
Authorized Signature

GEOTECHNICAL INVESTIGATION

AMERICAN FORK DEVELOPMENTAL CENTER

NEW BOILER PLANT STRUCTURE & SEWER LINE

American Fork, Utah

Prepared for:
Utah State DFCM

March 2009

RB&G
ENGINEERING, INC.

200901-006

RB&G
ENGINEERING, INC.

March 17, 2009

Craig Wessman
DFCM
4110 State Office Building
Salt Lake City, Utah 84114

Subject: American Fork Developmental Center
New Boiler Plant Structure & Sewer Line
Geotechnical Investigation

Gentlemen:

A Geotechnical Investigation has been completed for the proposed new boiler plant structure and sewer line to be located at the American Fork Developmental Center in American Fork, Utah. The results of the study are summarized in the report transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER
NO. 162291
BRADFORD E.
PRICE
3/17/09
STATE OF UTAH

Bradford E. Price, P.E.

bep/jal

1435 WEST 820 NORTH, PROVO, UTAH 84601-1343
PROVO 801-374-5771 SALT LAKE CITY 801-521-5771 FAX 801-374-5773

Geotechnical Investigation

American Fork Developmental Center
New Boiler Plant Structure & Sewer Line

American Fork, Utah

Prepared for:
Utah State DFCM

March 2009

RB&G ENGINEERING, INC.

AMERICAN FORK DEVELOPMENTAL CENTER NEW BOILER PLANT STRUCTURE & SEWER LINE American Fork, Utah

RB&G ENGINEERING, INC.

Geotechnical Investigation

INTRODUCTION

This report outlines the results of a geotechnical investigation performed for the proposed new boiler plant structure and sewer line to be located at the American Fork Developmental Center in American Fork, Utah, at the location shown on Figures 1 and 2. The purpose of this investigation was to determine the characteristics of the subsurface material throughout the site so that satisfactory substructures can be designed to support the proposed facilities.

The information contained in the report is discussed under the following headings: (1) Geological and Existing Site Conditions, (2) Field and Laboratory Testing Procedures, (3) Subsurface Soil and Water Conditions, (4) Site Preparation and Compacted Fill Requirements, and (5) Foundation Considerations and Recommendations.

I. GEOLOGICAL AND EXISTING SITE CONDITIONS

The natural surface materials in this general area have been mapped as stream alluvium related to the Bonneville phase of the Bonneville lake cycle (upper Pleistocene) and deltaic deposits relating to the Provo regressive phase of the Bonneville lake cycle (upper Pleistocene).

The Wasatch Fault Zone is located approximately 2.5 miles east of the site. Utah County Natural hazards maps identify this area as having low liquefaction potential.

The native ground in the vicinity of the new boiler site slopes down from northeast to southwest at ~5 to 7% grade and forms a deltaic hillside to the southwest. Within the excavated area, the slope is ~2% north to south with a 1:1 side slope on the north, east and west. Asphalt parking area exists to the south and east. The vegetative cover adjacent to the north, east and west includes grasses and sparse native brush. Trees surround the parking area. One tree is located between the proposed and existing buildings. The existing building is located east and south of the proposed structure as shown on Figure 2.

The existing boiler plant building is a masonry two story structure which appears to be supported using spread footings. Some cracking of foundation and brick walls was observed, indicative of differential settlement.

No major water conveyance facilities or other water bodies exist in the immediate vicinity, which would influence the groundwater level at this site. There is historical record of perched water moving along less permeable layers and exiting the deltaic hillside slope west of the site. It is our understanding that these flows increase during spring and summer months due to runoff and irrigation. No impermeable layers were encountered within the depth investigated at the building site that would restrict groundwater flow. Other than the information provided above, no conditions appear to exist at this site which would adversely affect foundation performance.

II. FIELD AND LABORATORY TESTING PROCEDURES

The subsurface investigation was performed using a CME 55 rotary drill rig with a tri-cone rock bit and NW casing to advance the boring and water as the drilling fluid. During the subsurface investigation, sampling was performed at three-foot intervals throughout the depth investigated. Both disturbed and undisturbed samples were obtained during the field investigations. Disturbed samples were obtained by driving a 2-inch split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. The standard penetration value, corrected for overburden and hammer energy, provides a good indication of the in-place density of sandy material; however, it only provides an indication of the relative stiffness of the cohesive material, since the penetration resistance of materials of this type is a function of the moisture content. Considerable care must be exercised in interpreting the standard penetration value in gravelly-type soils, particularly where the size of the granular particle exceeds the inside diameter of the sampling spoon. If the spoon can be driven through the full 18 inches with a reasonable core recovery, the standard penetration value provides a good indication of the in-place density of gravelly-type material.

Undisturbed samples were obtained at select locations by pushing a thin-walled sampling tube into the subsurface material using the hydraulic pressure on the drill rig. The location at which the undisturbed samples were obtained is shown on the boring logs.

Miniature vane shear tests, which provide an indication of the undrained shearing strength of cohesive materials, were performed on samples of the clay soil during the field investigations. The results of these tests are shown on the boring logs as the torvane value in tsf.

Each sample obtained in the field was classified in the laboratory according to the Unified Soil Classification System. The symbol designating the soil type according to this system, is presented on the boring logs. A description of the Unified Soil Classification System is presented in the appendix, and the meaning of the various symbols, shown on the logs, can be obtained from this figure.

Laboratory tests performed during this investigation to define the characteristics of the subsurface material throughout the proposed site included in-place dry unit weight, natural moisture content, Atterberg Limits, mechanical analyses, and consolidation tests. Testing was performed following procedures outlined in the American Society for Testing and Materials (ASTM) standards.

III. SUBSURFACE SOIL AND WATER CONDITIONS

The characteristics of the subsurface material were evaluated by drilling two borings in the proposed building area to a depth of 21.5 feet and two borings along the proposed sewer alignment to a depth of 16.5 feet at the approximate locations shown in Figure 2. The logs for the borings are presented in the appendix.

Building Area

It will be observed that the subsurface profile in the area of the proposed building consists predominately of dense to very dense granular soils. Boring 09-B2, located on the south side of the existing excavation encountered about 4 feet of cohesive sandy silt at the surface. Groundwater was not encountered within the 21 foot depth investigated.

Sewer Line Alignment

Boring 09-B3 was located in a filled parking area on the westerly side of 860 East Street, as shown in Figure 2. The soil profile to a depth of about 10 feet is fill consisting predominantly of loose clayey gravel and sand with some cobbles. Below a depth of 10 feet, the soil profile consisted of loose to dense silty sand with gravel. No groundwater was encountered within the 16.5 foot depth investigated.

Boring 09-B4 was located on the south side of 700 North Street, as shown in Figure 2. It will be observed from the boring log that 6 inches of asphalt pavement exists at the surface, underlain predominantly by medium dense silty sand. Lean clay layers were encountered at a depth of between 7 and 8 feet and between 12.5 and 14.5 feet. Groundwater was encountered at a depth of 4.4 feet at the time the field investigation was performed (February 2009).

The results of classification, density and moisture tests are presented on the boring logs, and the results of all laboratory tests, with exception of the consolidation test, are summarized in Table 1, Summary of Test Data in the appendix. It will be noted from Table 1 that the in-place dry unit weight of the silt obtained at 2.5 to 4 feet in Boring 09-B2 was 92.1 pcf. The natural moisture content of the cohesive soil ranges from 12.1 to 25.9%. The cohesive soil has a liquid limit varying from 23 to 28 and a plasticity index ranging from 6 to 7. The gravelly material has 36 to 57% gravel size particles, 32 to 42% sand and 8 to 32% silt. The sandy soil has 0 to 45% gravel, 46 to 75% sand, and 9 to 27% silt size material.

The compressibility characteristics of the cohesive material were evaluated by performing one consolidation test on a sample obtained at a depth of 2.5 to 4 feet in Boring 09-B2, and the results of this test are also presented in the appendix. During performance of the consolidation test, the sample was permitted to absorb water at the beginning of the test to determine the effect of moisture on the compressibility characteristics of this material. Expansive soils always experience an increase in void ratio on absorbing water. It will be observed from this test that no increase in the void ratio occurred as the sample absorbed moisture. It is concluded from the consolidation and classification tests that the subsurface materials at this site do not have expansive characteristics. Furthermore, there is no indication that any of the samples tested have collapsible characteristics.

IV. SITE PREPARATION AND COMPACTED FILL REQUIREMENTS

As indicated above, the vegetative cover throughout the building site consists of grasses, sparse native brush and trees. We recommend that the upper 4 to 6 inches be stripped from the area and that tree roots be grubbed to remove the excess organic matter in the upper portion of the soil profile.

The final grading plan was not known as of the preparation of this report, however, it is our understanding that the floor level will be near the existing elevation of the excavated area. Boring 09-B1 was at this level, while Boring 09-B2 was several feet higher, south of the excavation.

We recommend that the on-site cohesive silt, encountered in the upper 4 feet of Boring 09-B2, not be used as fill beneath the building area. This material can be used to establish final grade outside of the building area. The on-site granular soils (silty sand and gravel) can be used, if needed, to establish final grade beneath the building footprint. If imported fill is needed to establish final grade throughout the site, it is recommended that the fill consist of granular soil having a maximum size of 6 inches with less than 30% passing a No. 200 sieve. We recommend that the material passing a No. 200 sieve have a plasticity index less than 6. The fill should be compacted to an in-place density equal to at least 95% of the maximum density as determined by ASTM D 1557.

If the floor level is as assumed, the subgrade soils beneath the floor will consist of granular soils, which will serve adequately as the subbase and no free-draining layer is required. If final grading results in a portion of the floor being located on the cohesive silt subgrade, a free-draining granular layer should be placed as subbase. The free-draining layer should be at least 6 inches thick and should have a maximum size less than 1 inch and not more than 5% passing a 200 sieve. The free-draining material should be densified using at least 4 passes of a smooth drum 5-ton vibratory roller or equivalent. The granular material will prevent the accumulation of moisture beneath the floor slab and will also serve adequately as a base beneath the floor slabs. A subgrade modulus of 150 pci can be used for design.

Grading around the structure should be performed in such a manner that all surface water will flow freely from the area and that no ponding will occur adjacent to the structure which will permit deep percolation into the foundation area. Roof drains should extend well beyond the building lines to prevent seepage into the foundation soils. Sprinkler heads located adjacent to the building should be directed away from the structure to prevent the percolation of water into the foundation zone.

Backfilling around foundation walls should be performed using granular material densified to an in-place unit weight equal to at least 90% of the maximum laboratory density indicated above.

V. FOUNDATION CONSIDERATIONS AND RECOMMENDATIONS

A. FOUNDATION TYPES AND BEARING CAPACITIES

We understand that the proposed boiler plant structure will be a two-story masonry building covering a footprint of less than 10,000 sq ft. It is anticipated that the facility will be supported using continuous and spot footings. The magnitude of the structural loads are not known as of the preparation of this report; however, it has been assumed that the wall loads will not likely exceed 5 klf and that column loads, if any, will not likely exceed 100 kips.

As discussed in Section IV, we understand that the lower floor level will be below the 4 foot layer of plastic silt encountered in Boring 09-B2. We recommend that all exterior foundations be located at a depth below finished grade sufficient to provide frost protection, which is about 2.5 feet in this area, and that interior footings be located at least 1 foot below floor level. If this action is taken, it is apparent from the boring logs that zone of significant stress for foundations will be located within the dense granular soils.

It is recommended that the upper 8 inches of the soils (silty sand or gravel) beneath structural foundations be densified to an in-place unit weight equal to at least 92% of the maximum laboratory density as determined by ASTM D 1557.

To ensure that compaction requirements are met, each lift should be tested, with testing performed at 50 foot intervals along continuous footing lines and at each spot footing. Testing should be performed in accordance with ASTM D 6938 (nuclear method), or ASTM D 1556 (sand cone method).

It should be recognized that the allowable soil bearing pressure for granular material is a function of the width of the footing and the depth of the footing below finished grade. We recommend that the foundations be sized using the bearing capacity chart presented in Figure 3, except that in no case should the width of any footing be less than 24 inches. In preparing Figure 3, consideration has been given to both shear failure and differential settlement. The lines sloping upward to the right define the allowable soil bearing pressure with respect to shear failure using a factor of safety of 2.5. The line sloping downward to the right defines the allowable soil bearing pressure such that the maximum settlement of any footing will not exceed 1 inch. If the foundations for the proposed facility are sized in accordance with Figure 3, differential settlement throughout the structure should not exceed 0.5 inch.

If the foundations for the proposed facility are designed in accordance with the recommendations outlined above, the maximum settlement of any footing should not exceed one inch and differential settlement throughout the structure should not exceed 0.5 inch. It is generally recognized that the tolerable differential settlement for steel and concrete structures is about 0.002 times the column spacing. This criterion is tantamount to a differential settlement of about 0.5 inch for column spacings of 20 feet and 0.7 inch for column spacings of 30 feet. Since it is not anticipated that the column spacing for this structure will be less than 20 feet, a differential settlement of 0.5 inch should be satisfactory for the proposed facility.

B. SEISMIC CONSIDERATIONS

The site is classified as Site Class D, as per Section 1613 of the 2006 International Building Code. The site is located at latitude 40.3941° North and longitude 111.7779° West. Probabilistic peak ground acceleration (PGA) values are tabulated below:

Probabilistic ground motion values in %g.

	10%PE in 50 yr	2%PE in 50 yr
PGA	19.74	54.74
0.2 sec SA	46.95	125.26
1.0 sec SA	15.81	52.58

The allowable soil bearing pressure indicated above may be increased by one-third where seismic forces are involved in the structural loads. If the frictional resistance of the footings and floor slabs are used to resist seismic forces, we recommend a coefficient of friction of 0.40 be used to calculate these forces. See Section C below for recommendations related to resistance provided by passive earth pressures.

Since the granular soils are in a dense state and no groundwater was encountered within the upper 20 feet of the soil profile, problems associated with liquefaction during a seismic event are unlikely at this site, and no special mitigation of the foundation soils is required.

C. LATERAL EARTH PRESSURES

It is anticipated that earth-retaining structures may be required for the proposed facility. If backfilling is performed using granular material, and if the backfill behind the wall is horizontal, we recommend that the earth pressures be calculated using the following equation, along with the earth pressure coefficient outlined below:

$$P = \tfrac{1}{2}\,\gamma\,K\,H^2$$

Where P = total lateral force on wall, plf
K = earth pressure coefficient
γ = unit weight of soil (130 pcf)
H = height of retained soil against wall

The earth pressure coefficient used in designing the walls will depend upon whether the wall is free to move during backfilling operations, or whether the wall is restrained during backfilling. If the wall is free to move during backfilling operations and the backfill material is granular soil, we recommend an active earth pressure coefficient of 0.30 be used in the above equation to calculate the lateral earth pressures. If the walls are restrained from any movement during backfilling and the backfill material is granular soil, we recommend an at-rest earth pressure coefficient of 0.47 be used to calculate the lateral earth pressure. A passive earth pressure coefficient of 3.25 may be used to estimate the lateral resistance of the soil in cases where the wall tends to move toward the backfill. In each of these cases, the earth pressure diagram may be approximated as a triangle, such that the resultant earth pressure force P acts at a height of approximately H/3 above the base of the wall.

For the seismic event having a 2-percent probability of exceedance in 50 years, the additional active earth pressure due to ground acceleration may be estimated using a coefficient of 0.19. The seismic ground motion will reduce the available passive resistance. This reduction may be accounted for as an earth pressure acting in the direction opposite the passive resistance, and computed using a coefficient of 0.53. The pressure diagrams for these forces may be roughly approximated as inverted triangles, such that the resultant forces of the seismic components act at heights of approximately 2H/3 above the base of the wall.

For non-yielding walls, the increase in earth pressure corresponding to the seismic event may be estimated using the equation $P_{EQ} = a_h \gamma H^2$, where a_h is a seismic coefficient of 0.33. This force is in addition to the at-rest pressure, and acts at a height of about 0.53H above the base of the wall.

It should be recognized that the pressures calculated by the above equation are earth pressures only and do not include hydrostatic pressures. Where hydrostatic pressures may exist behind a retaining structure, we recommend either the wall be designed to resist hydrostatic pressure, or that a drainage system be placed behind the wall to prevent the development of hydrostatic pressures.

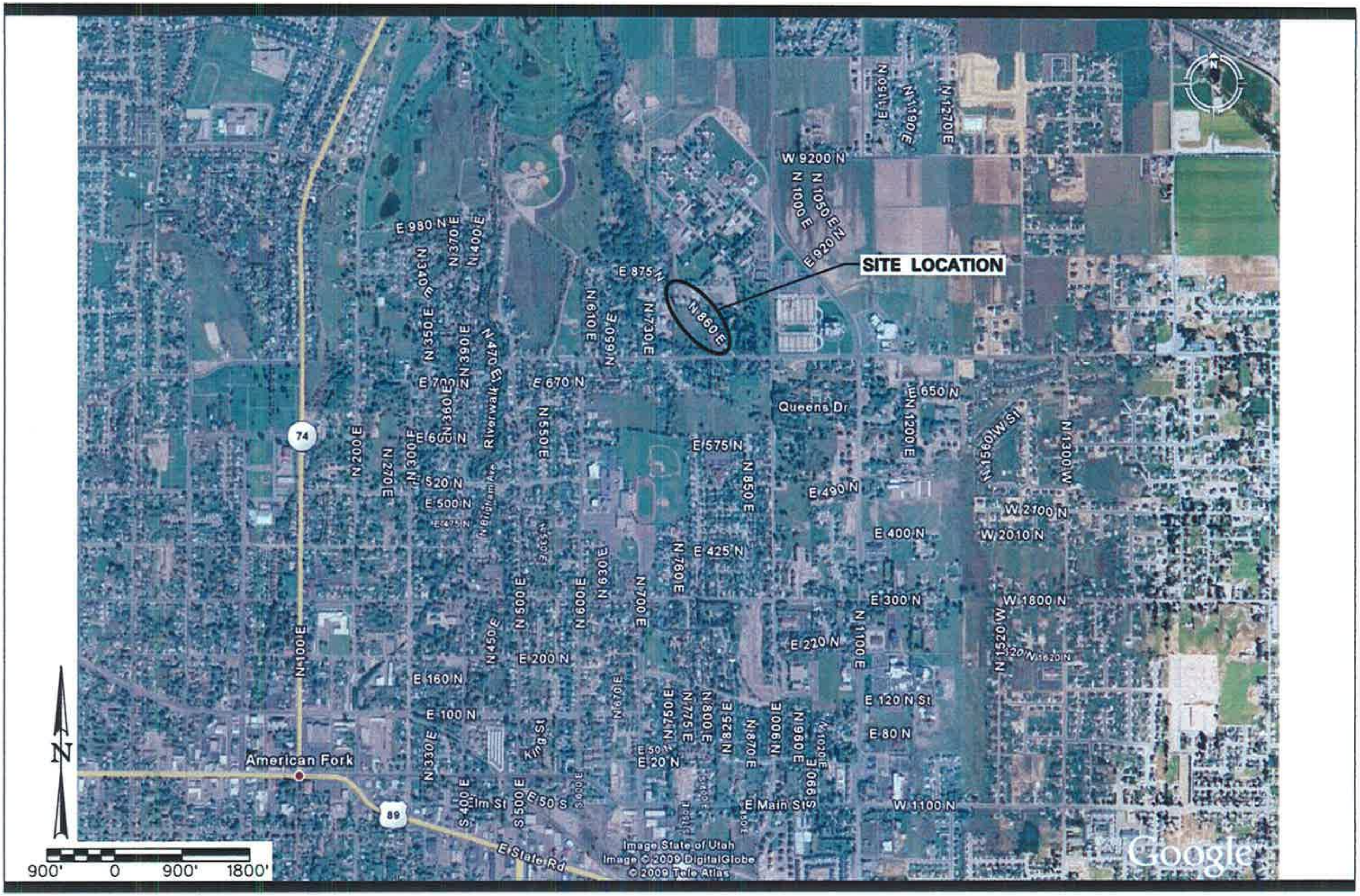
VII. LIMITATIONS

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests which, in our opinion, define the characteristics of the subsurface material throughout the site in a satisfactory manner. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist throughout this site which could not be defined during this investigation.

If during construction, conditions are encountered which appear to be different than those presented in this report, it is requested that we be advised in order that appropriate action may be taken.

The information contained in this report is provided for the specific location and purpose of the client named herein and is not intended or suitable for reuse by any other person or entity whether for the specified use, or for any other use. Any such unauthorized reuse, by any other party is at that party's sole risk and RB&G Engineering, Inc. does not accept any liability or responsibility for its use.

Figures



RB&G ENGINEERING, INC.

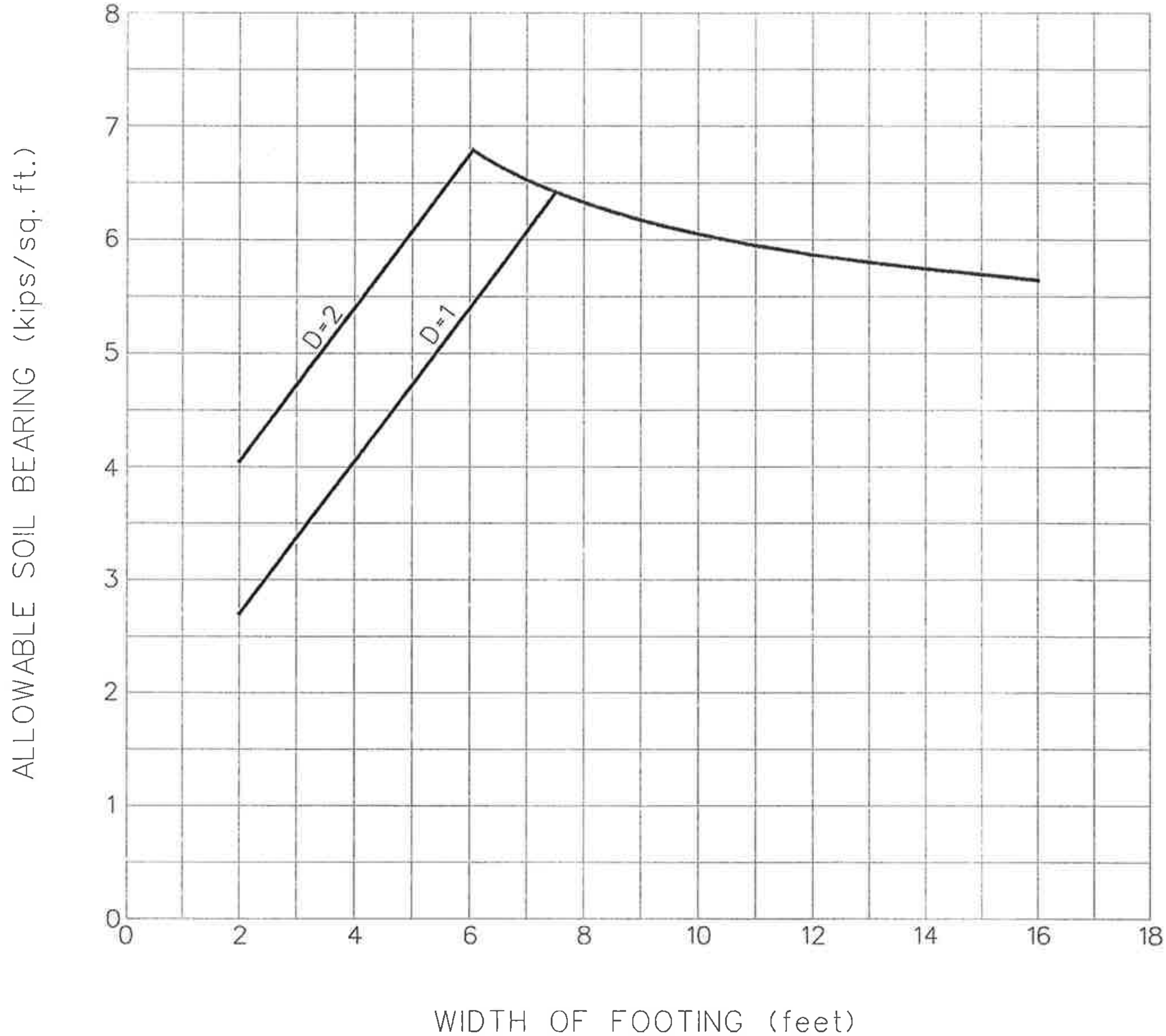
Figure 1 **VICINITY MAP**

American Fork Developmental Center New Boiler & Sewer Line
American Fork, Utah

RB&G ENGINEERING, INC.

Figure 2 **SITE PLAN & TEST HOLE LOCATIONS**

American Fork Developmental Center
New Boiler & Sewer Line
American Fork, Utah



Recommended allowable soil bearing pressures on:

- ☒ natural material
- ☒ compacted fill

Type of footings:

- ☒ spread (where D=Depth of surcharge adjacent to bottom of footing)
- ☒ spot
- ☒ continuous

RB&G ENGINEERING, INC.

Figure 3 BEARING CAPACITY CHART

American Fork Developmental Center
New Boiler & Sewer Line
American Fork, Utah

Appendix

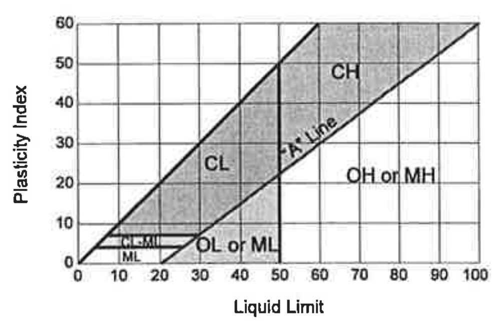
Unified Soil Classification System

Major Divisions			Group Symbols	Typical Names
COARSE-GRAINED SOILS *more than half of material is larger than No. 200 sieve*	**Gravels** *more than half of coarse fraction is larger than 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, gravel-sand mixtures, little or no fines
		Gravels With Fines *appreciable amount of fines*	GM* d / u	Silty gravels, poorly graded gravel-sand-silt mixtures
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
	Sands *more than half of coarse fraction is smaller than No. 4 sieve size*	**Clean Sands** *little or no fines*	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands, gravelly sands, little or no fines
		Sands with Fines *appreciable amount of fines*	SM* d / u	Silty sands, poorly graded sand-silt mixtures
			SC	Clayey sands, poorly graded sand-clay mixtures
FINE-GRAINED SOILS *more than half of material is smaller than No. 200 sieve*	**Silts and Clays** *liquid limit is less than 50*		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays *liquid limit is 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

Laboratory Classification Criteria

For laboratory classification of coarse-grained soils Determine percentage of gravel and sand from grain-size curve. Depending on percentage of fines (*fraction smaller than No. 200 sieve size*), coarse-grained soils are classified as follows: **Less than 5%** GW, GP, SW, SP **More than 12%** GM, GC, SM, SC **5% to 12%** Borderline cases requiring use of dual symbols**	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3		GW
	Not meeting all gradation requirements for GW		GP
	Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols	GM
	Atterberg limits above "A" line, or PI greater		GC
	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3		SW
	Not meeting all gradation requirements for SW		SP
	Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols	SM
	Atterberg limits above "A" line, or PI greater		SC

For laboratory classification of fine-grained soils



Plasticity Chart

*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

***Borderline classification*: Soils possessing characteristics of two groups are designated by combinations of group symbols. (For example GW-GC, well graded gravel-sand mixture with clay biner.)

DRILL HOLE LOG

BORING NO. 09-B1

SHEET 1 OF 1

PROJECT: AM. FORK DEVELOPMENTAL CENTER NEW BOILER & SEWER LINE
CLIENT: UTAH DIVISION OF FACILITIES & CONSTRUCTION MANAGEMENT
LOCATION: SEE SITE PLAN
DRILLING METHOD: 96-CME-55 / N.W. CASING TO 20'
DRILLER: E. RICHARDSON
DEPTH TO WATER - INITIAL: ▽ >20.0'   **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200901.006
DATE STARTED: 1/30/09
DATE COMPLETED: 1/30/09
GROUND ELEVATION: NOT MEASURED
LOGGED BY: C. SANBORN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample: Type	Sample: Rec. (in)	Sample: See Legend	Sample: USCS (AASHTO)	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter.: Liquid Limit	Atter.: Plast. Index	Gradation: Gravel (%)	Gradation: Sand (%)	Gradation: Silt/Clay (%)	Other Tests
						SC	dk. brown, wet	CLAYEY SAND W/GRAVEL								
				11	1,7,13,(42)	GM	dk. brown, moist, med. dense	SILTY GRAVEL W/SAND cobbles								
				12	9,13,12,(52)	SP-SM	dk. brown, moist, very dense	SAND W/SILT & GRAVEL cobbles		9.1		NP	45	46	9	
	5															
				10	11,16,16,(64)	GP-GM	dk. brown, moist, dense	GRAVEL W/SILT & SAND cobbles		6.1		NP	56	36	8	
	10			8	12,16,14,(50)	GP-GM	brown, moist, med. dense									
				12	8,15,16,(45)	SM	brown, moist, dense	SILTY SAND								
	15			9	10,16,18,(45)	SM	brown, moist, dense									
	20			10	9,11,19,(34)	SM	brown, moist, dense	SILTY SAND silt layers								

DH_LOGV1 AFDEVCENTER.GPJ US EVAL.GDT 3/18/09

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6"; ← $(N_1)_{60}$ Value; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 09-B2

SHEET 1 OF 1

PROJECT: AM. FORK DEVELOPMENTAL CENTER NEW BOILER & SEWER LINE

CLIENT: UTAH DIVISION OF FACILITIES & CONSTRUCTION MANAGEMENT

PROJECT NUMBER: 200901.006

LOCATION: SEE SITE PLAN

DATE STARTED: 1/30/09

DRILLING METHOD: 96-CME-55 / N.W. CASING TO 20'

DATE COMPLETED: 1/30/09

DRILLER: E. RICHARDSON

GROUND ELEVATION: NOT MEASURED

DEPTH TO WATER - INITIAL: ▽ N.M. **AFTER 24 HOURS:** ▼ N.M.

LOGGED BY: C. SANBORN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample: Type	Sample: Rec. (in)	Sample: See Legend	Sample: USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.: Liquid Limit	Atter.: Plast. Index	Gradation: Gravel (%)	Gradation: Sand (%)	Gradation: Silt/Clay (%)	Other Tests
			Disturbed	12	2,3,4,(15)	ML	brown, very moist, firm								
							SANDY SILT plastic								
			Undisturbed	10	Pushed 0.42	ML	brown, moist, firm	92.2	25.9	28	6				CT
	5														
			Disturbed	9	12,17,17,(68)	GP-GM	brown, moist, dense		8.0		NP	49	42	9	
							GRAVEL W/SILT & SAND cobbles								
	10		Disturbed	9	15,19,19,(63)	GP-GM	brown, moist, dense		6.5		NP	57	35	8	
			Disturbed	11	15,19,19,(55)	GM	brown, moist, dense								
							SILTY GRAVEL W/SAND cobbles, silty sand layers								
	15		Disturbed	13	17,14,21,(46)	GM	brown, moist, med. dense								
						SM	brown, moist, dense								
							SILTY SAND								
							SAND W/SILT								
	20		Disturbed	13	15,18,16,(39)	SP-SM	brown, moist, dense								

DH_LOGV1 AFDEVCENTER.GPJ US EVAL.GDT 2/20/09

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) 0.45 — Blow Count per 6"; $(N_1)_{60}$ Value; Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED 0.45 — Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer

DRILL HOLE LOG

BORING NO. 09-B3

SHEET 1 OF 1

PROJECT: AM. FORK DEVELOPMENTAL CENTER NEW BOILER & SEWER LINE

CLIENT: UTAH DIVISION OF FACILITIES & CONSTRUCTION MANAGEMENT

PROJECT NUMBER: 200901.006

LOCATION: SEE SITE PLAN

DATE STARTED: 2/6/09

DRILLING METHOD: 96-CME-55 / N.W. CASING TO 10.7'

DATE COMPLETED: 2/6/09

DRILLER: E. RICHARDSON

GROUND ELEVATION: NOT MEASURED

DEPTH TO WATER - INITIAL: ∇ N.M. **AFTER 24 HOURS:** ▼ N.M.

LOGGED BY: C. SANBORN, J. BOONE

Elev. (ft)	Depth (ft)	Sample: Type	Sample: Rec. (in)	Sample: See Legend	Sample: USCS (AASHTO)	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter.: Liquid Limit	Atter.: Plast. Index	Gradation: Gravel (%)	Gradation: Sand (%)	Gradation: Silt/Clay (%)	Other Tests
					-	black, moist	MILLED ASPHALT								
			15	3,7,8,(31) *0.50*	CL	dk. brown, moist, stiff	GRAVELLY LEAN CLAY W/SAND (fill)								
			9	5,2,4,(13)	GC-GM	brown, moist, very loose	SILTY CLAYEY GRAVEL W/SAND cobbles, organics (fill)		15.8	26	7	36	32	32	
	5														
			9	7,5,4,(18)	GC-GM	brown, very moist, loose			12.1	23	6	46	33	21	
			13	8,5,3,(13)	SC-SM	brown, moist	SILTY CLAYEY SAND W/GRAVEL								
	10				SM	brown, moist, med. dense	SILTY SAND W/GRAVEL								
			12	3,1,2,(4)	SM	brown, very moist, very loose			14.9		NP	24	55	21	
	15														
			11	6,4,5,(12)	SM	brown, wet, med. dense									

DH_LOGV1 AFDEVCENTER.GPJ US EVAL.GDT 3/23/09

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6"; ← $(N_1)_{60}$ Value; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED; 0.45 ← Torvane (tsf)

OTHER TESTS
- UC = Unconfined Compression
- CT = Consolidation
- DS = Direct Shear
- UU = Unconsolidated, Undrained
- CU = Consolidated, Undrained
- HYD = Hydrometer
- SS = Soluble Salt
- DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 09-B4

SHEET 1 OF 1

PROJECT: AM. FORK DEVELOPMENTAL CENTER NEW BOILER & SEWER LINE
CLIENT: UTAH DIVISION OF FACILITIES & CONSTRUCTION MANAGEMENT
LOCATION: SEE SITE PLAN
DRILLING METHOD: 96-CME-55 / N.W. CASING TO 15'
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ∇ 4.4' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200901.006
DATE STARTED: 2/24/09
DATE COMPLETED: 2/24/09
GROUND ELEVATION: NOT MEASURED
LOGGED BY: C. SANBORN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample: Type	Sample: Rec. (in)	Sample: See Legend	Sample: USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.: Liquid Limit	Atter.: Plast. Index	Gradation: Gravel (%)	Gradation: Sand (%)	Gradation: Silt/Clay (%)	Other Tests
							6" ASPHALT								
						GM	gray, moist — SILTY GRAVEL W/SAND (SLAG)								
						SM	brown, moist — SILTY SAND W/GRAVEL								
				13	11,15,15,(63)	SM	brown, moist, very dense								
				13	2,3,4,(16)	SM	brown, wet, med. dense — SILTY SAND, silt lenses		22.7		NP	0	73	27	
∇	5														
				15	3,4,5,(20)	SM	brown, wet, med. dense		25.8		NP	0	75	25	
					0.57	CL	brown, moist, stiff — LEAN CLAY								
	10			7	4,6,6,(25)	SM	dk. brown, wet, med. dense — SILTY SAND, occasional clay layers to 1/4" thick, occasional gravels								
				14	3,4,4,(15)	SM	dk. brown, wet, med. dense								
					0.75	CL	brown, moist, stiff — LEAN CLAY, many silt lenses & layers								
	15			17	4,5,6,(20)	SM	dk. brown, wet, med. dense — SILTY SAND W/GRAVEL, clay lenses & layers								

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE: 2,3,2,(6) — Blow Count per 6"; (6) — $(N_1)_{60}$ Value; *0.45* — Torvane (tsf)

UNDISTURBED SAMPLE: PUSHED; *0.45* — Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay

Table 1

SUMMARY OF TEST DATA

PROJECT American Fork Developmental Center
New Boiler & Sewer Line

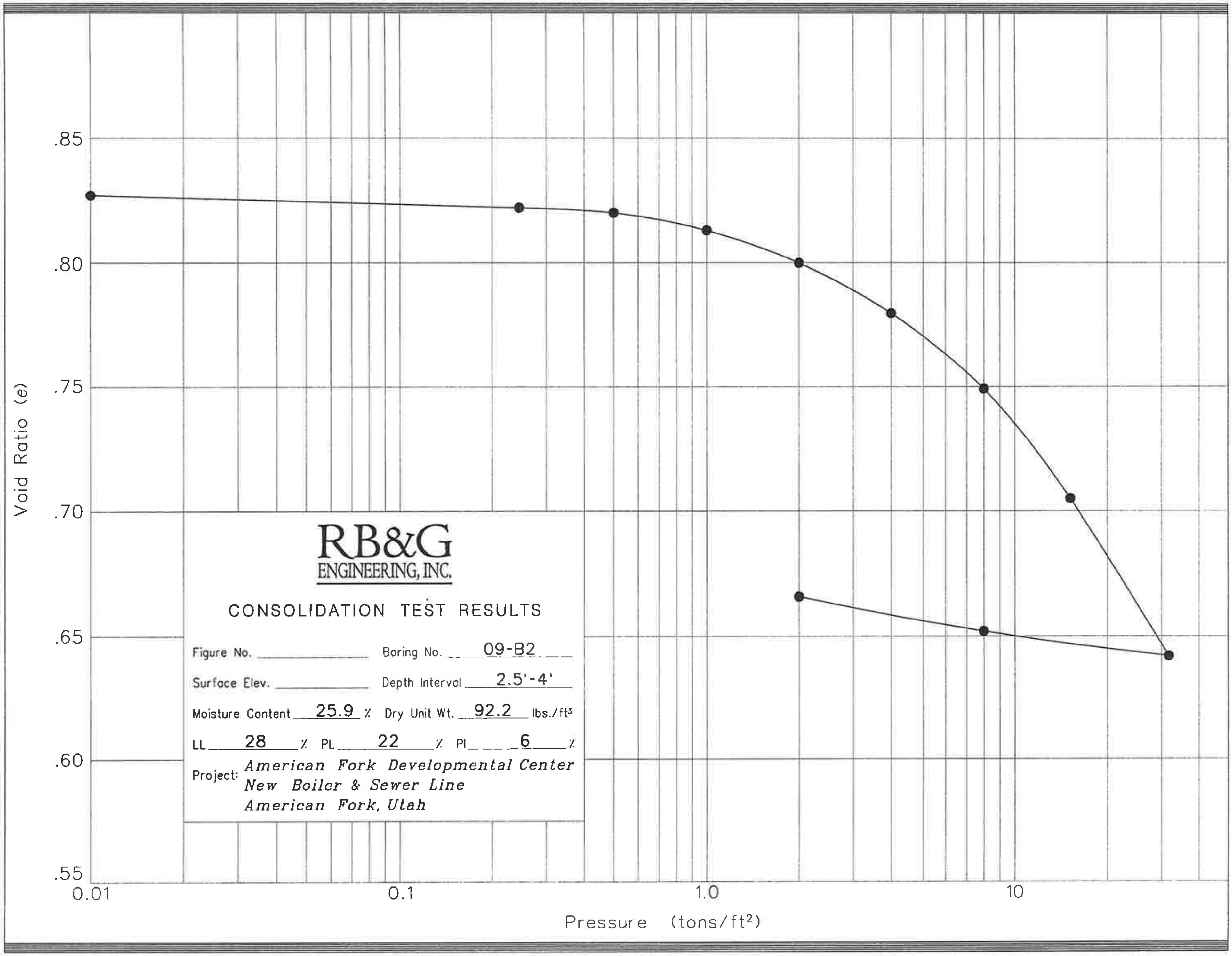
PROJECT NO. 200901-006

LOCATION American Fork, Utah

FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT Corrected (N_1)60	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
09-B1	3-4.5	52		9.1				NP	45	46	9	SP-SM
	6-7.5	64		6.1				NP	56	36	8	GP-GM
09-B2	2.5-4	Shelby	92.1	25.9		28	22	6				ML
	6-7.5	68		8.0				NP	49	42	9	GP-GM
	9-10.5	63		6.5				NP	57	35	8	GP-GM
09-B3	3-4.5	13		15.8		26	19	7	36	32	32	GC-GM
	6-7.5	18		12.1		23	17	6	46	33	21	GC-GM
	12-13.5	4		14.9				NP	24	55	21	SM
09-B4	3-4.5	16		22.7				NP	0	73	27	SM
	6-7.5	20		25.8				NP	0	75	25	SM

NP=Nonplastic



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CONSOLIDATION TEST RESULTS

Figure No. ______ Boring No. 09-B2

Surface Elev. ______ Depth Interval 2.5'-4'

Moisture Content 25.9 % Dry Unit Wt. 92.2 lbs./ft³

LL 28 % PL 22 % PI 6 %

Project: *American Fork Developmental Center*
New Boiler & Sewer Line
American Fork, Utah