

Tab # 4

Geotechnical Report

Geotechnical Engineering Report

Building 10 Addition – VA Medical Center

1501 San Pedro Drive SE

Albuquerque, New Mexico

July 21, 2010

Terracon Project No. 66105035

Prepared for:

K.F. Davis Engineering, Inc.

Danville, California

Prepared by:

Terracon Consultants, Inc.

Albuquerque, New Mexico

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**GEOTECHNICAL ENGINEERING REPORT
BUILDING 10 ADDITION – VA MEDICAL CENTER
1501 SAN PEDRO DRIVE SE
ALBUQUERQUE, NEW MEXICO**

**Terracon Project No. 66105035
July 21, 2010**

EXECUTIVE SUMMARY

This geotechnical executive summary should be used in conjunction with the entire report for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled General Comments should be read for an understanding of the report limitations.

A geotechnical exploration has been performed for the addition to Building 10 at the VA Medical Center located at 1501 San Pedro Drive SE in Albuquerque, New Mexico. Terracon's geotechnical scope of work included the advancement of two (2) test borings to approximate depths of 21-½ to 26-½ feet below existing site grades.

Based on the information obtained from our subsurface exploration, the site is suitable for development of the proposed project. The following geotechnical considerations were identified:

Site Development: Existing structures and pavements currently occupy the site. These features will need to be razed prior to new construction.

Site Soils: The site surface soils generally consisted of silty to clayey sand with varying amounts of gravel. The underlying near surface and subsurface soils generally consisted of sandy lean clay. Groundwater was not encountered in any test boring at the time of drilling. On-site soils are suitable for use as engineered fill beneath foundations and floor slabs.

Foundations: The building addition at the site may be supported by shallow spread footings bearing on a zone engineered fill. The masonry screen wall can be supported on shallow spread footings bearing on undisturbed soils, provided that some movement can be tolerated.

Floor Slabs: The on-site surface and near surface soils are expected to exhibit non- to low expansive potentials when compacted and subjected to light loading conditions such as those imposed by floor slabs. Construction of floor slabs (if used) bearing on engineered fill is considered acceptable for the project, provided that some movement can be tolerated.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during construction

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July 21, 2010



K.F. Davis Engineering, Inc.
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Danville, California 94526

Attn: Ms. Lesa Durham
P: [925] 743-8884
E: lesa.durham@kfde.com

Re: Geotechnical Engineering Report
Building 10 Addition – VA Medical Center
1501 San Pedro Drive SE
Albuquerque, New Mexico
Terracon Project No. 66105035

Dear Ms. Durham:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. These services were performed in general accordance with our proposal number P6610-0127 dated June 16, 2010. This geotechnical engineering report presents the results of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

A blue ink signature of Meagan J. Duneman.

Meagan J. Duneman, E.I.
Staff Engineer

Document1



Michael E. Anderson, P.E.
Office Manager/Principal

Copies to: Addressee (1 via email, 3 via mail)

**GEOTECHNICAL ENGINEERING REPORT
BUILDING 10 ADDITION – VA MEDICAL CENTER
1501 SAN PEDRO DRIVE SE
ALBUQUERQUE, NEW MEXICO**

**Terracon Project No. 66105035
July 21, 2010**

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services performed for the proposed addition to Building 10 at the VA Medical Center located at 1501 San Pedro Drive SE in Albuquerque, New Mexico. The report addresses the following:

- subsurface soil conditions
- earthwork
- seismic considerations
- lateral earth pressure
- groundwater conditions
- foundation design and construction
- floor slab design and construction

Our geotechnical engineering scope of work for this project included the advancement of two (2) test borings to depths ranging from approximately 21-½ to 26-½ feet below existing site grades.

Logs of the borings along with an Area Map and Boring Location Diagram are included in Appendix A of this report. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included in Appendix B of this report. Descriptions of the field exploration and laboratory testing are included in their respective appendices.

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Structure	Proposed two-story addition to the existing building. The size of the addition will be on the order of about 10,000 square feet (5,000 square feet per floor). Elevator and possible exterior mechanical room with masonry screen walls. Planned crawl space construction. However, a slab-on-grade may be considered. Seismic separation will be provided between existing building and addition.

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Building 10 Addition – VA Medical Center ■ Albuquerque, New Mexico

July 21, 2010 ■ Terracon Project No. 66105035



ITEM	DESCRIPTION
Building construction	Anticipate masonry load bearing walls (1 st floor) with masonry load bearing walls or steel frame (2 nd floor).
Finished floor elevation	Within 2 to 3 feet of existing site grade (assumed)
Maximum loads	Columns: 60 to 80 kips (assumed) Walls: 3 to 4 klf (assumed) Slabs: 150 psf max (assumed)
Maximum allowable settlement	Columns: 1-inch Walls: ½ inch over 40 feet
Existing construction and foundation	CMU and steel frame with stucco finish. Foundation is spread footings. Partial basement and crawl space areas.
Grading	Maximum cut and fills on the order of about 2 to 3 feet (assumed)
Cut and fill slopes	Not applicable
Free-standing retaining walls	Not applicable
Below Grade Areas	Not applicable

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	Building No. 10, 1501 San Pedro Drive SE, VA Medical Center, Albuquerque, New Mexico.
Existing improvements	Existing building, detached garages, and pet storage areas (in operation), asphalt and/or Portland cement concrete paved parking areas, drives, landscaping, and utilities.
Current ground cover	Asphalt and Portland cement concrete pavements, existing building, and landscaping.
Existing topography	Relatively level project site bordered to north, south, and west by existing buildings and parking lots, and to the east by an asphalt concrete street/drive.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Subsurface Profile

Specific conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in Appendix A of this report. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/Density
Stratum 1	0.3 to 0.8	Asphalt concrete Aggregate base course	N/A
Stratum 2	6-½ to 8-½	Clayey sand. Gravel content varies	Loose to Medium Dense
Stratum 3	17-½ to 21-½	Silty sand. Gravel and clay content varies	Loose to Medium Dense
Stratum 4	26-½	Sandy lean clay. Gravel content varied	Stiff

The surface and subsurface soils were non-plastic to medium in plasticity.

Laboratory tests were conducted on selected soil samples and the test results are presented in Appendix B. Laboratory test results indicate that the surface and near surface soils exhibit low compressibility potential at in-situ moisture contents. The near surface soils typically exhibit a low to high tendency for hydro-compaction (collapse) when wetted under foundation loads. When water is added to samples of laboratory compacted near-surface soils, we anticipate that the compacted soils will exhibit non- to low expansive potential when subjected to light loading conditions such as those imposed by floor slabs. Due to the low moisture content and granular nature of the subsurface soils, the results of the testing may reflect some sample disturbance. It is our opinion that the surface and subsurface soils typically exhibit a low to moderate tendency for hydro-compaction.

Laboratory test results indicate that on-site soils exhibit a soluble sulfate concentration of 29 mg/kg, a pH value of 8.4, and a minimum resistivity of 5,020 ohm-cms.

3.2 Groundwater

Groundwater was not observed in the test borings at the time of field exploration, nor when checked upon completion of drilling. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

Fluctuations in groundwater levels can best be determined by implementation of a groundwater monitoring plan. Such a plan would include installation of groundwater monitoring wells, and periodic measurement of groundwater levels over a sufficient period of time.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings. Potentially compressible soils which show a tendency for hydro-compaction when elevated in moisture content will require particular attention in the design and construction. Hydro-compactive soils, sometimes referred to as "collapsible" soils, are materials which undergo volume decrease (settlement/consolidation) when subjected to increases in moisture content under constant load.

Existing structures and pavements currently occupy the site. These features will need to be razed prior to new construction.

Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, we recommend that the proposed building addition be supported on a spread footing foundation system. Due to the potential for hydro-compaction and variability in the near surface soils, spread footings bearing on engineered fill are recommended for support of the proposed foundations. The masonry screen wall can be supported on shallow spread footings bearing on undisturbed soils, provided that some movement can be tolerated. Slab-on-grade (if used) may be utilized for the interior floor system provided that this element is supported on a zone of engineered fill and some movement can be tolerated.

On-site soils should be suitable for use as engineered fill beneath the foundation systems and floor slabs.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing (which are presented in Appendices A and B), engineering analyses, and our current understanding of the proposed project.

4.2 Earthwork

The following presents recommendations for site preparation, excavation, subgrade preparation and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations, slabs and pavements are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

4.2.1 Site Preparation

Strip and remove vegetation, debris, pavements and other deleterious materials from proposed building and pavement areas. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

Demolition of the existing detached garages and pet storage area should include complete removal of all foundation systems within the proposed construction area. This should include removal of any loose backfill found adjacent to existing foundations. All materials derived from the demolition of existing structures and pavements should be removed from the site, and not be allowed for use in any on-site fills.

Stripped materials consisting of vegetation and organic materials (if applicable) should be wasted from the site, or used to revegetate landscaped areas or exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas, and in fill sections not exceeding 5 feet in height.

The site should be initially graded to create a relatively level surface to receive fill, and to provide for a relatively uniform thickness of fill beneath proposed building addition structure.

Evidence of underground facilities and utilities were observed during the site reconnaissance. Therefore, such features will likely be encountered during construction. If unexpected fills or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

4.2.2 Excavation

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

4.2.3 Subgrade Preparation

Engineered fill should extend below proposed footings a depth equal to the width of wall footings, and a depth equal to one-half the width of column footings; however, a minimum of three (3) feet of engineered fill is recommended below all footings. The engineered fill should extend laterally an additional distance of 8 inches for each additional foot of excavation beyond the 3-foot minimum depth. In addition, a minimum of two (2) feet of engineered fill is recommended below the slab-on-grade floor system (if used). If engineered fill is placed beneath the entire building, it should extend horizontally a minimum distance of 5 feet beyond the outside edge of perimeter footings.

Exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of 10 inches, conditioned to near optimum moisture content, and compacted.

Areas of loose soils may be encountered at foundation bearing depth after excavation is completed for footings. When such conditions exist beneath planned footing areas, the subgrade soils should be surficially compacted prior to placement of the foundation system. If sufficient compaction can not be achieved in-place, the loose soils should be removed and replaced as engineered fill. For placement of engineered fill below footings, the excavation should be widened laterally, at least eight inches for each foot of fill placed below footing base elevations.

Subgrade soils beneath the masonry screen wall and exterior slabs should be scarified, moisture conditioned and compacted to a minimum depth of 10 inches. The moisture content and compaction of subgrade soils should be maintained until slab or pavement construction.

4.2.4 Fill Materials and Placement

All fill materials should be inorganic soils free of vegetation, debris, and fragments larger than six inches in size. Pea gravel or other similar non-cementitious, poorly-graded materials should not be used as fill or backfill without the prior approval of the geotechnical engineer.

Clean on-site soils or approved imported materials may be used as fill material for the following:

- general site grading
- foundation areas
- interior floor slab areas
- exterior slab areas
- foundation backfill

Imported soils for use as fill material within proposed building and structure areas should conform to low volume change materials as indicated in the following specifications:

<u>Gradation</u>	<u>Percent Finer by Weight (ASTM C 136)</u>
6"	100
3"	70-100
No. 4 Sieve	50-100
No. 200 Sieve	45 (max)
■ Liquid Limit	30 (max)
■ Plasticity Index	15 (max)
■ Maximum expansive potential (%)*	1.0

*Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged/inundated.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed ten inches loose thickness.

4.2.5 Compaction Requirements

Recommended compaction and moisture content criteria for engineered fill materials are as follows:

Material Type and Location	Per the Modified Proctor Test (ASTM D 1557)		
	Minimum Compaction Requirement (%)	Range of Moisture Contents for Compaction	
		Minimum	Maximum
On-site granular or approved imported fill soils:			
Beneath foundations:	95	-3%	+3%
Beneath slabs:	95	-3%	+3%
Aggregate base	95	-3%	+3%
Miscellaneous backfill	90	-3%	+3%

4.2.6 Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Infiltration of water into utility trenches or foundation excavations should be prevented during construction. Planters and other surface features which could retain water in areas adjacent to the building or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 5 percent for at least 5 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Downspouts, roof drains or scuppers should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems should not be installed within five feet of foundation walls. Landscaped irrigation adjacent to the foundation systems should be minimized or eliminated.

4.2.7 Corrosion Potential

Laboratory test results indicate that on-site soils have a soluble sulfate concentration of 29 mg/kg. Results of soluble sulfate testing indicate that ASTM Type I Portland cement is suitable for all concrete on and below grade. Foundation concrete should be designed for low sulfate exposure in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

Laboratory test results indicate that on-site soils exhibit a pH value of 8.4, and a minimum resistivity of 5,020 ohm-cms.

Refer to Summary of Laboratory Results contained in Appendix B for the complete results of the corrosivity testing conducted on the site soils in conjunction with this geotechnical exploration.

4.3 Foundation Recommendations

The building addition and masonry screen wall can be supported by a shallow footing foundation system. Design recommendations for foundations for the proposed addition and related structural elements are presented in the following paragraphs.

4.3.1 Design Recommendations

DESCRIPTION	VALUE
Foundation Type	Spread/continuous footings
Structure	Two (2) story, at-grade building addition Masonry screen wall
Bearing Material	Building Addition: Minimum three (3) feet of engineered fill Screen Wall: Compacted subgrade
Allowable Bearing Pressure	Addition: 2,000 psf Screen Wall: 1,000 psf
Minimum Dimensions	Columns: 24 inches Walls: 16 inches
Minimum Embedment Depth Below Finished Grade	Exterior: 18 inches Interior: 12 inches
Total Estimated Settlement	1 inch
Estimated Differential Settlement	$\frac{3}{4}$ inch in 40 feet under walls $\frac{3}{4}$ inch between columns

Finished grade is defined as the lowest adjacent grade within five feet of the foundation for perimeter (or exterior) footings and finished floor level for interior footings. The allowable foundation bearing pressures apply to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

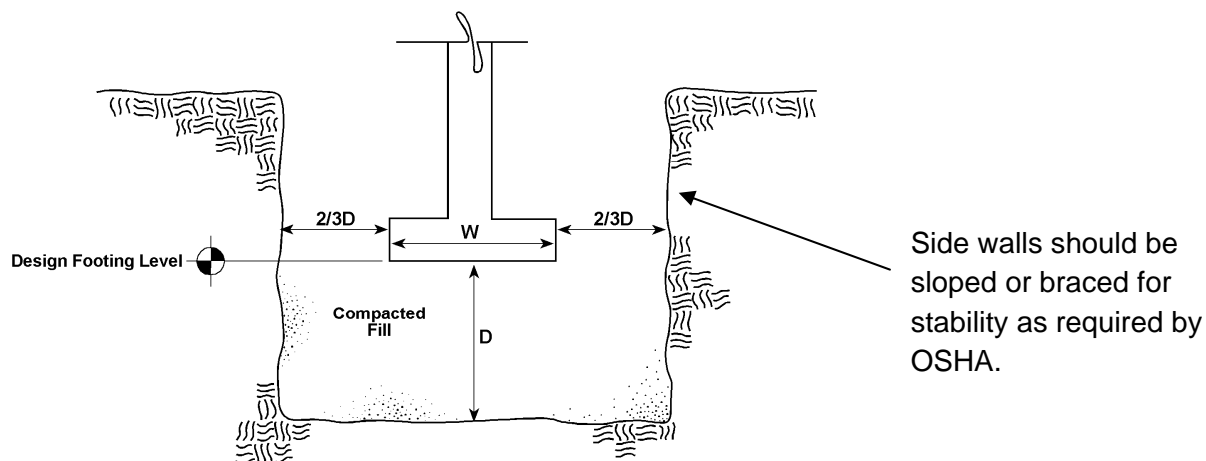
Footings should be proportioned to reduce differential foundation movement. Proportioning on the basis of equal total settlement is recommended; however, proportioning to relative constant dead-load pressure will also reduce differential settlement between adjacent footings.

Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage should be provided in the final design and during construction. Footings, foundations, and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations and engineered fill placement operations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

4.3.2 Construction Considerations

Engineered fill should extend below proposed footings a depth equal to the width of individual wall footings, and a depth equal to half the width of column footings; however, a minimum of three (3) feet of engineered fill is recommended below all footings. The subgrade soils should be removed to a minimum depth of three (3) feet and a minimum of two (2) feet horizontally beyond the edge of footings. The engineered fill should extend laterally an additional distance of 8 inches for each additional foot of excavation beyond the three (3)-foot minimum depth. The soils should be replaced as engineered fill, conditioned to near optimum moisture content and compacted. If engineered fill is placed beneath the entire building, it should extend horizontally a minimum distance of 5 feet beyond the outside edge of perimeter footings. The overexcavation and backfill procedure is described in the adjacent figure.



The type of foundation system supporting the existing building consists of spread footings. Provisions should be made during construction to prevent undermining or disturbing the soils supporting the existing building foundation. If new foundations are constructed adjacent to the existing foundations, there is a risk that the bearing material could become undermined and/or overstressed due to overlapping stresses. Maintaining a sufficient clear distance between new and existing foundations will reduce the potential for increased bearing stresses and additional foundation settlement. The new footings should be constructed at the same elevation of the

existing footings. Connections between the existing building and the new addition should allow for some differential movement.

4.4 Seismic Considerations

DESCRIPTION	VALUE
2006 International Building Code Site Classification (IBC) ¹	D ²
Site Latitude	N 35.0536°
Site Longitude	W 106.5850°
S _{Ms} Spectral Acceleration for a Short Period	0.764g
S _{M1} Spectral Acceleration for a 1-Second Period	0.362g
S _{Ds} Spectral Acceleration for a Short Period	0.510g
S _{D1} Spectral Acceleration for a 1-Second Period	0.241g
F _a Site Coefficient for a Short Period	1.346
F _v Site Coefficient for a 1-Second Period	2.115

¹ Note: In general accordance with the 2006 International Building Code, Table 1613.5.2. IBC Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile.

² Note: The 2006 International Building Code (IBC) requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the required 100 foot soil profile determination. Borings extended to a maximum depth of 26-½ feet, and this seismic site class definition considers that very dense soil continues below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.

4.5 Floor Slab

If a concrete slab-on-grade floor system is used for the project, the following recommendations should be followed.

4.5.1 Design Recommendations

DESCRIPTION	VALUE
Interior floor system	Slab-on-grade concrete.
Floor slab support	Minimum two (2)-foot thickness of engineered fill
Subbase	Compacted subgrade
Modulus of subgrade reaction	150 pounds per square inch per inch (psi/in) (The modulus was obtained based on our experience with similar subgrade conditions, and estimates obtained from ACI design charts.)

Construction of floor slabs directly on compacted fills composed of on-site soils are considered acceptable for the project. The on-site soils generally exhibit non- to low expansive potential.

In areas of exposed concrete, control joints should be saw cut into the slab after concrete placement in accordance with ACI Design Manual, Section 302.1R-37 8.3.12 (tooled control joints are not recommended). Additionally, dowels should be placed at the location of proposed construction joints. To control the width of cracking (should it occur) continuous slab reinforcement should be considered in exposed concrete slabs.

Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement. Interior trench backfill placed beneath slabs should be compacted in accordance with recommendations outlined in the Earthwork section of this report. Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

The use of a vapor retarder or barrier should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

4.5.2 Construction Considerations

Some differential movement of a slab-on-grade floor system is possible should the subgrade soils become elevated in moisture content. Such movements are anticipated to be within general tolerance for normal slab-on-grade construction. To reduce potential slab movements, the subgrade soils should be prepared as outlined in the Earthwork section of this report.

4.6 Lateral Earth Pressures

4.6.1 Design Recommendations

For soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements when using on-site soils as backfill are:

ITEM	SOIL TYPE	VALUE
Active Case	On-site soils	40 psf/ft
Passive Case	On-site soils	375 psf/ft
At-Rest Case	On-site soils	60 psf/ft
Coefficient of Base Friction	On-site soils	0.35 ¹

¹Note: The coefficient of base friction should be reduced to 0.30 when used in conjunction with passive pressure.

The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if such conditions are to be included in the design.

Fill against foundations (if applicable) should be compacted to densities specified in the Earthwork section of this report. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors.

5.0 GENERAL COMMENTS

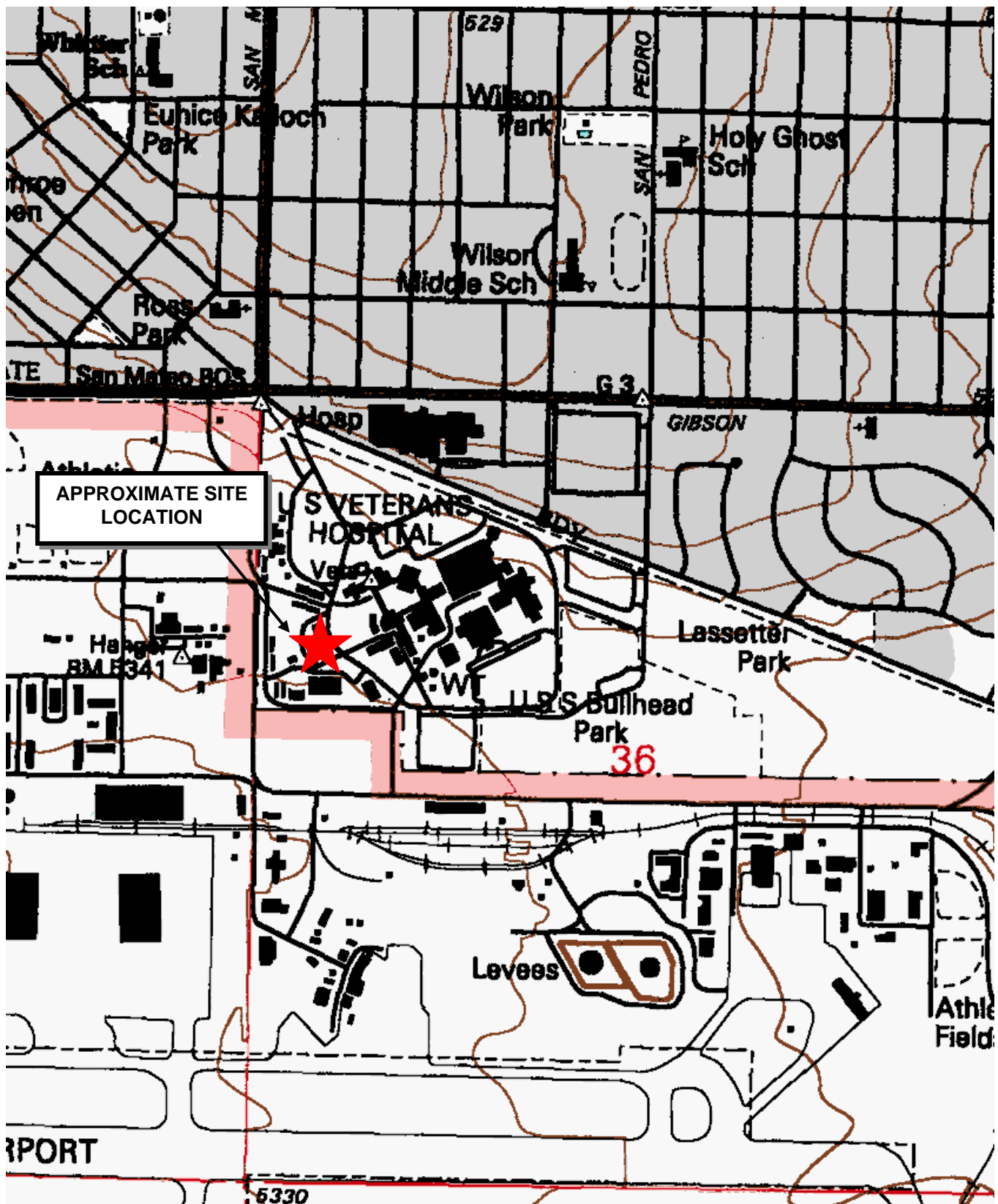
Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION



Source: USGS 7.5-Minute Topographic Map "Albuquerque East", New Mexico, United States, dated 1990.

Project Mngr:	MJD
Drawn By:	N/A
Checked By:	MEA
Approved By:	MEA

Project No.	66105035
Scale	1" ≈ 1000'
File No.	
Date:	07/2010

Terracon
Consulting Engineers & Scientists
4905 Hawkins, NE
Albuquerque, New Mexico 87109
505.797.4287 Fax: 505.797.4288

AREA MAP

Building No. 10 Addition
VA Hospital
Albuquerque, New Mexico

FIG No.

A1

Geotechnical Engineering Report

Building 10 Addition – VA Medical Center ■ Albuquerque, New Mexico

July 21, 2010 ■ Terracon Project No. 66105035



Field Exploration Description

A total of two (2) test borings were drilled at the site on July 2, 2010. The borings were drilled to depths ranging from approximately 21-½ to 26-½ feet below the ground surface at the approximate locations shown on the attached Area Map and Boring Locations Diagram. The test borings were located as follows:

Borings	Location	Depths (feet)
B-01 and B-02	Building Addition	21-½ to 26-½

The test borings were advanced with a truck-mounted CME-75 drill rig utilizing 8-inch diameter hollow-stem augers.

The borings were located in the field by using the proposed site plan of the site and measuring from existing property lines. The accuracy of boring locations should only be assumed to the level implied by the method used.

Lithologic logs of each boring were recorded by the field engineer during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon or ring-barrel samplers.

Penetration resistance measurements were obtained by driving the split-spoon and ring-barrel samplers into the subsurface materials with a 140-pound automatic hammer falling 30 inches. The penetration resistance value is a useful index in estimating the consistency or relative density of materials encountered.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Groundwater conditions were evaluated in each boring at the time of site exploration. Due to safety considerations, the borings were backfilled and patched upon the completion of drilling.

LOG OF BORING NO. B-01

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CLIENT

K.F. Davis Engineering, Inc.

SITE

1501 San Pedro Drive SE
Albuquerque, NM

PROJECT

Building 10 Addition - VA Medical Center

GRAPHIC LOG

DESCRIPTION

DEPTH, ft.

USCS SYMBOL

NUMBER

TYPE

RECOVERY, in.

SPT - N
BLOWS / ft.

WATER
CONTENT, %

DRY UNIT WT
pcf

UNCONFINED
STRENGTH, psf

0.3 Approximately 3 inches Asphalt Concrete
CLAYEY SAND; trace gravel, brown, loose

SC

1

SS

18

9

8

5

SC

2

SS

18

9

13

SC

3

RS

6

9

6

113

8.5 **SILTY SAND**; trace gravel, brown, loose

10

SM

4

SS

18

7

11

15

SM

5

SS

18

7

11

17.5 **SANDY LEAN CLAY**; trace gravel, brown, stiff to very stiff

20

CL

6

SS

18

13

16

25

CL

7

SS

18

21

15

26.5 Boring Terminated at 26.5 Feet.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft

WL NE WD

WL WD

WL

Terracon

BORING STARTED 7-2-10

BORING COMPLETED 7-2-10

RIG CME-75 FOREMAN MJD

APPROVED MEA JOB # 66105035

BOREHOLE 99 66105035.GPJ TERRACON.GDT 7/21/10

LOG OF BORING NO. B-02

Page 1 of 1

CLIENT K.F. Davis Engineering, Inc.									
SITE 1501 San Pedro Drive SE Albuquerque, NM		PROJECT Building 10 Addition - VA Medical Center							
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	0.3 Approximately 3 inches Asphalt Concrete								
	0.8 Approximately 6 inches Aggregate Base Course								
	CLAYEY SAND ; trace gravel, brown, loose to medium dense		SC	1	SS	18	29	10	
		5	SC	2	RS	6	13	3	106
	6.5 SILTY, CLAYEY SAND ; trace gravel, brown, medium dense		SC SM	3	SS	18	13	7	
		10	SM	4	SS	18	11	9	
	9 SILTY SAND ; trace gravel, brown, medium dense to dense								
		15	SM	5	SS	18	13	6	
		20	SM	6	SS	18	42	7	
	21.5 Boring Terminated at 21.5 Feet.								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft

WL	NE	WD
WL		
WL		

Terracon

BORING STARTED		7-2-10	
BORING COMPLETED		7-2-10	
RIG	CME-75	FOREMAN	MJD
APPROVED	MEA	JOB #	66105035

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1- ³ / ₈ " I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value". For 3" O.D. ring samplers (RS) the penetration value is reported as the number of blows required to advance the sampler 12 inches using a 140-pound hammer falling 30 inches, reported as "blows per foot," and is not considered equivalent to the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

<u>Unconfined Compressive Strength, Qu, psf</u>	<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Consistency</u>
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Relative Density</u>
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

<u>Major Component of Sample</u>	<u>Particle Size</u>
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^A

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification		
					Group Symbol	Group Name ^B	
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	Cu ≥ 4 and 1 ≤ Cc ≤ 3 ^E		GW	Well-graded gravel ^F	
			Cu < 4 and/or 1 > Cc > 3 ^E		GP	Poorly graded gravel ^F	
		Gravels with Fines More than 12% fines ^C	More	Fines classify as ML or MH		GM	Silty gravel ^{F,G,H}
				Fines classify as CL or CH		GC	Clayey gravel ^{F,G,H}
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^D	Cu ≥ 6 and 1 ≤ Cc ≤ 3 ^E		SW	Well-graded sand ^I	
			Cu < 6 and/or 1 > Cc > 3 ^E		SP	Poorly graded sand ^I	
		Sands with Fines More than 12% fines ^D		Fines classify as ML or MH		SM	Silty sand ^{G,H,I}
				Fines Classify as CL or CH		SC	Clayey sand ^{G,H,I}
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line ^J		CL	Lean clay ^{K,L,M}	
			PI < 4 or plots below "A" line ^J		ML	Silt ^{K,L,M}	
		organic	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}	
			Liquid limit - not dried			Organic silt ^{K,L,M,O}	
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay ^{K,L,M}	
			PI plots below "A" line		MH	Elastic Silt ^{K,L,M}	
		organic	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K,L,M,P}	
			Liquid limit - not dried			Organic silt ^{K,L,M,Q}	
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat	

^ABased on the material passing the 3-in. (75-mm) sieve

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^DSands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.

^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name.

^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^JIf Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^KIf soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^LIf soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

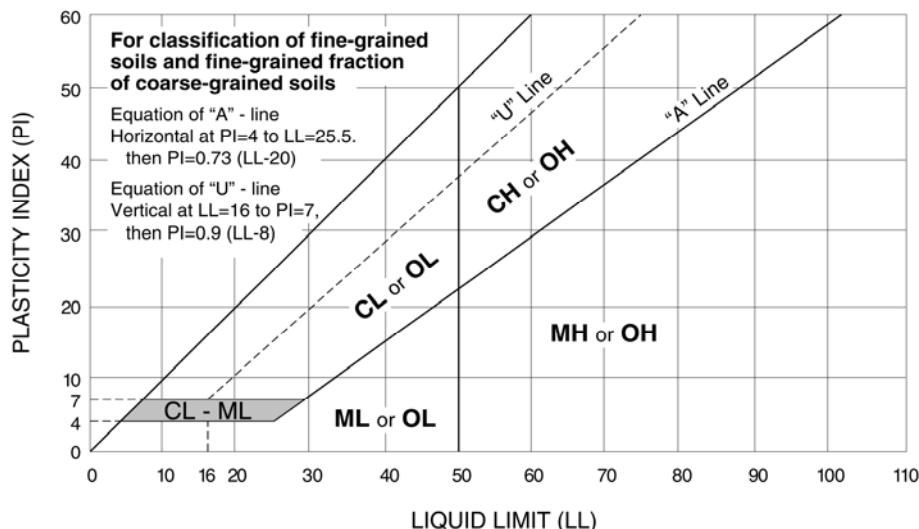
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



Terracon

APPENDIX B
LABORATORY TESTING

Geotechnical Engineering Report

Building 10 Addition – VA Medical Center ■ Albuquerque, New Mexico

July 21, 2010 ■ Terracon Project No. 66105035



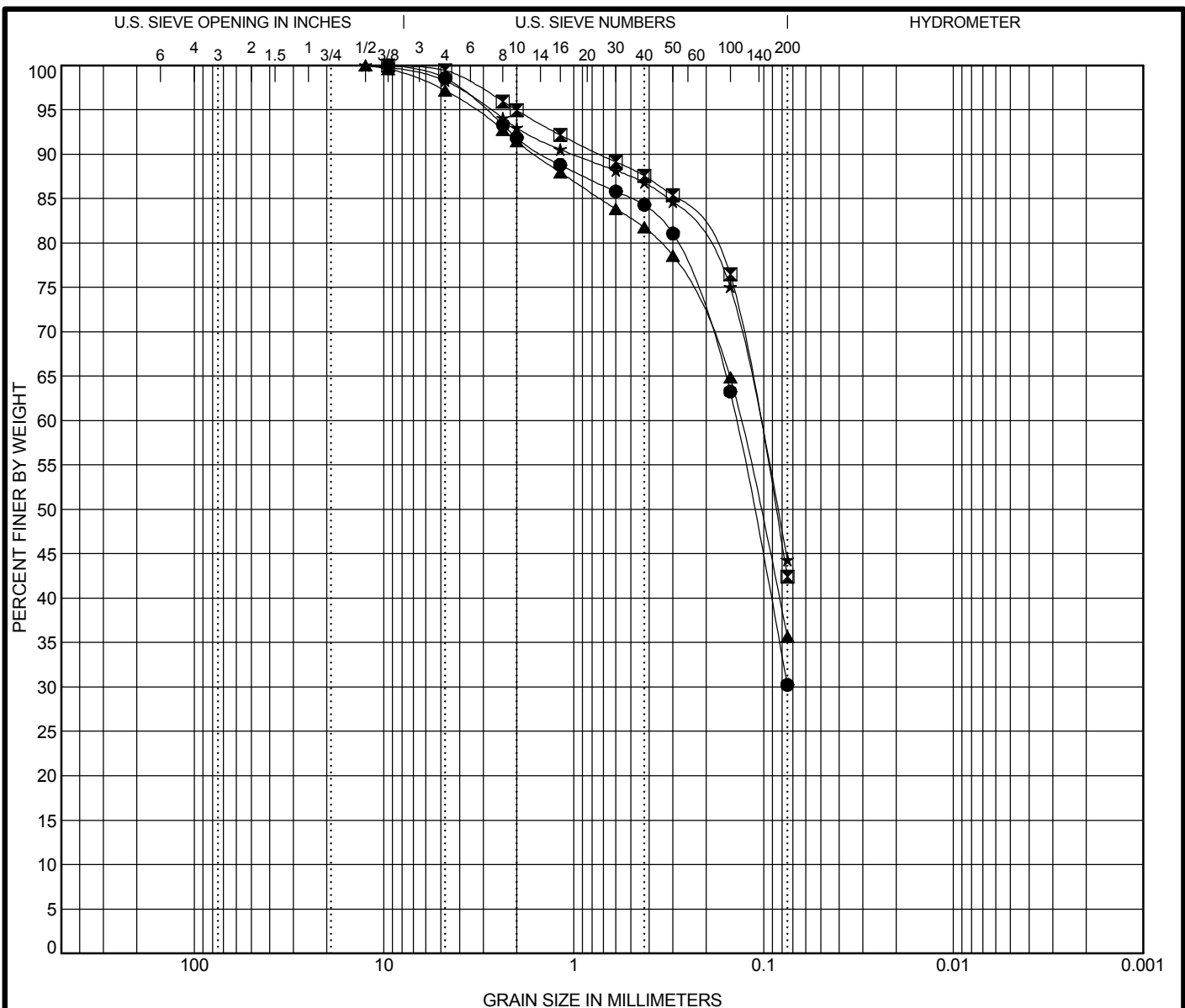
Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix A. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- | | |
|-----------------------------|-------------------------|
| ■ Consolidation/Compression | ■ In-situ Water Content |
| ■ Sieve Analysis | ■ In-situ Dry Density |
| ■ Atterberg Limits | ■ Soluble Sulfates |
| ■ pH | ■ Resistivity |



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

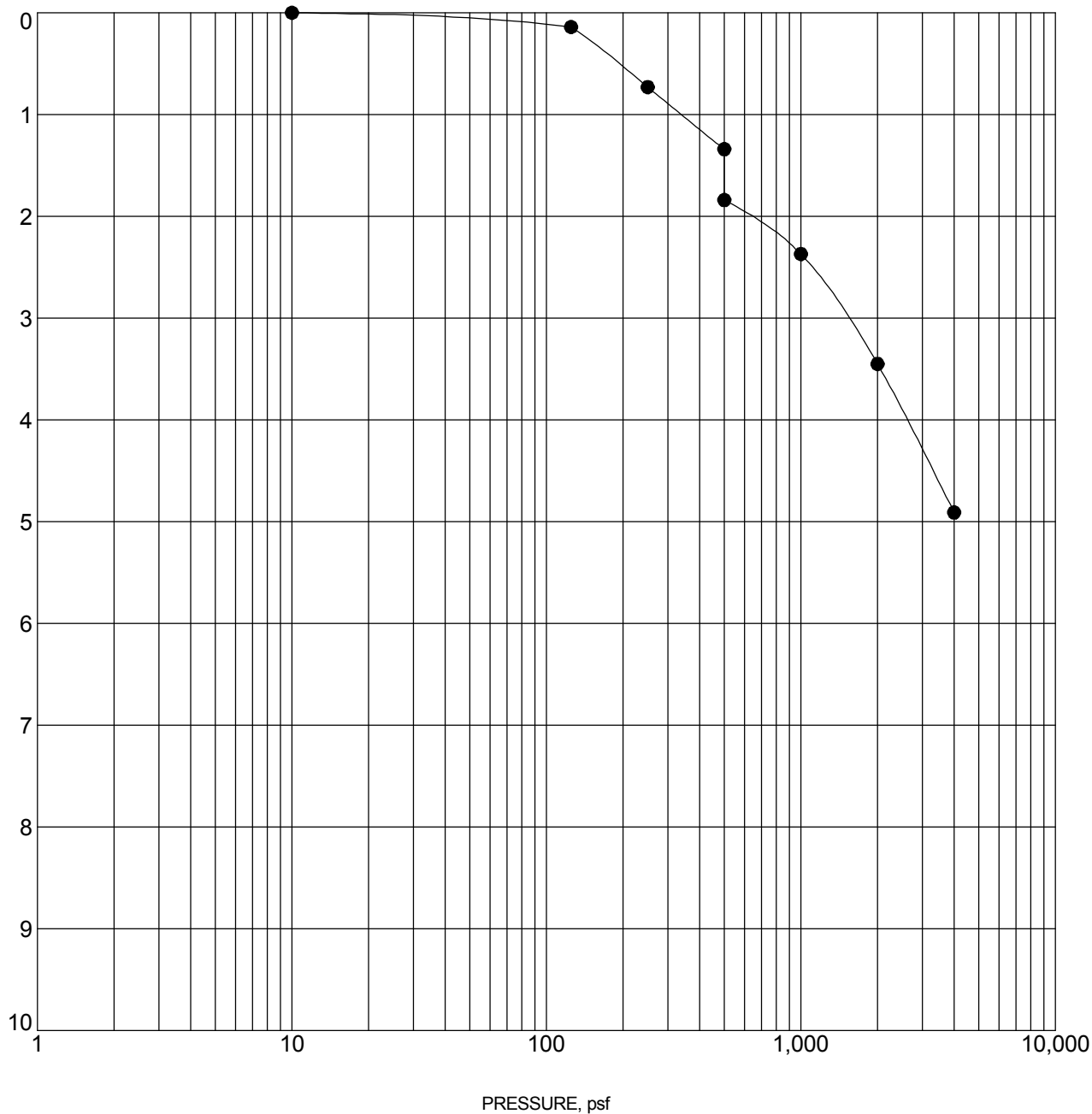
Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	B-01	5.0ft	CLAYEY SAND(SC)			32	21	11		
☒	B-01	10.0ft	SILTY SAND(SM)			NP	NP	NP		
▲	B-02	2.0ft	CLAYEY SAND(SC)			39	24	15		
★	B-02	7.0ft	SILTY, CLAYEY SAND(SC-SM)			22	17	5		
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-01	5.0ft	9.5	0.14			1.4	68.3	30.2	
☒	B-01	10.0ft	9.5	0.107			0.5	57.1	42.4	
▲	B-02	2.0ft	12.5	0.134			2.8	61.5	35.7	
★	B-02	7.0ft	12.5	0.107			1.7	54.0	44.3	

GRAIN SIZE DISTRIBUTION

Terracon

Project: Building 10 Addition - VA Medical Center
 Site: 1501 San Pedro Drive SE Albuquerque, NM
 Job #: 66105035
 Date: 7-21-10

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
● B-01	7.0ft	CLAYEY SAND (SC)	113	6

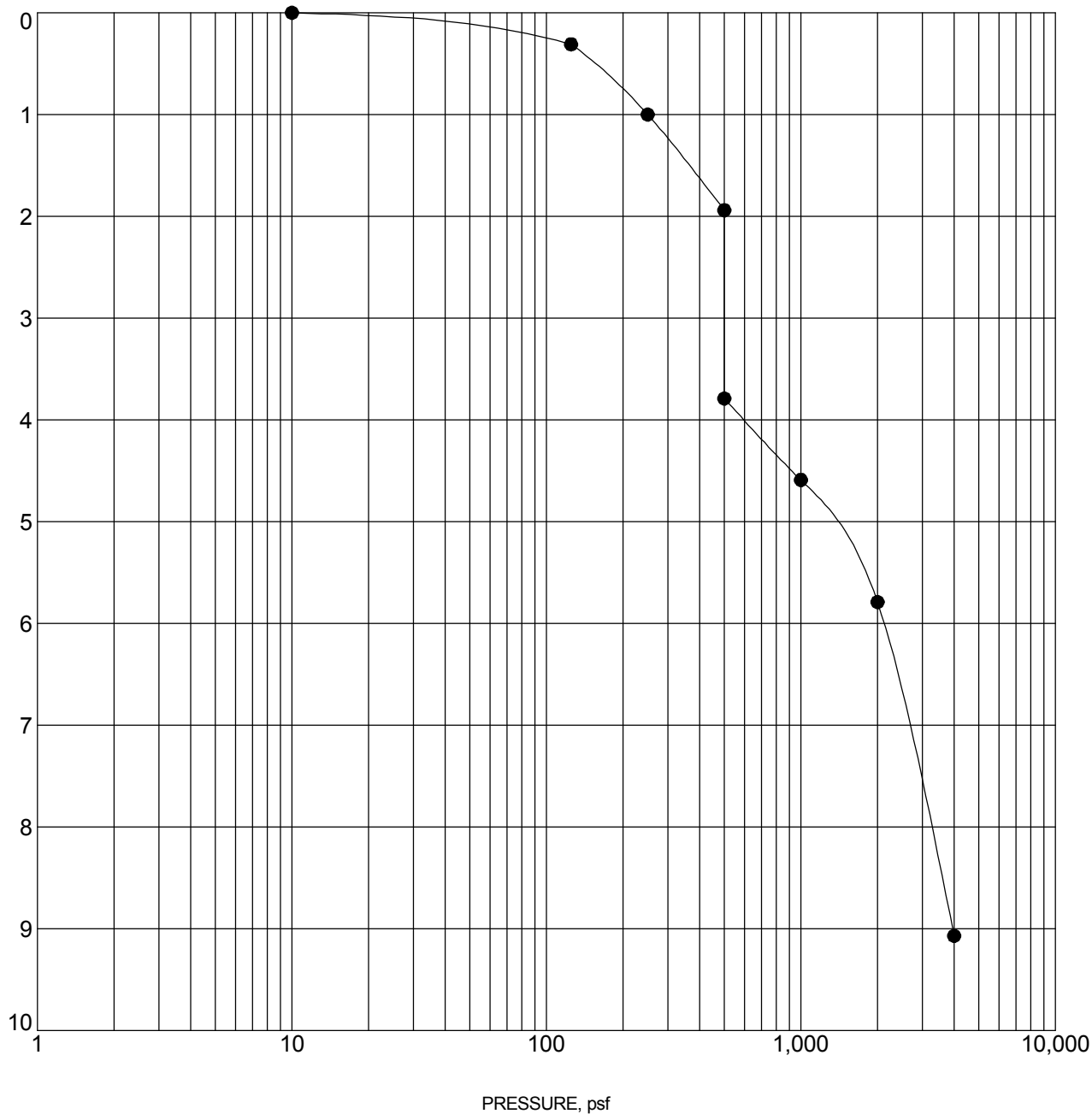
Notes: Results may reflect some sample disturbance

Terracon

CONSOLIDATION TEST

Project: Building 10 Addition - VA Medical Center
 Site: 1501 San Pedro Drive SE Albuquerque, NM
 Job #: 66105035
 Date: 7-21-10

AXIAL STRAIN, %



Specimen Identification		Classification	γ_d , pcf	WC, %
● B-02	5.0ft	CLAYEY SAND (SC)	106	3

Notes: Results may reflect some sample disturbance

Terracon

CONSOLIDATION TEST

Project: Building 10 Addition - VA Medical Center
 Site: 1501 San Pedro Drive SE Albuquerque, NM
 Job #: 66105035
 Date: 7-21-10

Borehole	Depth ft	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	USCS Class- ification	Water Content (%)	Dry Unit Weight (pcf)	Satur- ation (%)	Void Ratio
B-01	2.0							8			
B-01	5.0	32	21	11	9.5	30	SC	13			
B-01	7.0							6	112.7		
B-01	10.0	NP	NP	NP	9.5	42	SM	11			
B-01	15.0							11			
B-01	20.0							16			
B-01	25.0							15			
B-02	2.0	39	24	15	12.5	36	SC	10			
B-02	5.0							3	105.9		
B-02	7.0	22	17	5	12.5	44	SC-SM	7			
B-02	10.0							9			
B-02	15.0							6			
B-02	20.0							7			

SUMMARY OF LABORATORY RESULTS



Project: Building 10 Addition - VA Medical Center
 Site: 1501 San Pedro Drive SE Albuquerque, NM
 Job #: 66105035
 Date: 7-21-10

COVER LETTER

Monday, July 19, 2010

Mark Hillier
Terracon
4905 Hawkins, NE
Albuquerque, NM 87109

TEL: (505) 715-0375

FAX (505) 797-4288

RE: Building 10 Addition

Order No.: 1007232

Dear Mark Hillier:


Hall Environmental Analysis Laboratory, Inc. received 1 sample(s) on 7/8/2010 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. Below is a list of our accreditations. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites.

Reporting limits are determined by EPA methodology.

Please do not hesitate to contact HEAL for any additional information or clarifications.

Sincerely,


For Andy Freeman, Laboratory Manager

NM Lab # NM9425 NM0901

AZ license # AZ0682

ORELAP Lab # NM100001

Texas Lab# T104704424-08-TX



Hall Environmental Analysis Laboratory, Inc.

Date: 19-Jul-10

CLIENT: Terracon
Lab Order: 1007232
Project: Building 10 Addition
Lab ID: 1007232-01

Client Sample ID: B-1 @ 2'
Collection Date: 7/1/2010 8:00:00 AM
Date Received: 7/8/2010
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 300.0: ANIONS						Analyst: LJB
Sulfate	29	1.5		mg/Kg	1	7/17/2010 10:23:50 PM
SM4500-H+B: PH						Analyst: KS
pH	8.36	0.1		pH Units	1	7/9/2010 1:19:00 PM
RESISTIVITY						Analyst: TAF
Resistivity	5020	1.00		Ohms * cm	1	7/19/2010 3:06:00 PM

Qualifiers:

* Value exceeds Maximum Contaminant Level
E Estimated value
J Analyte detected below quantitation limits
NC Non-Chlorinated
PQL Practical Quantitation Limit

B Analyte detected in the associated Method Blank
H Holding times for preparation or analysis exceeded
MCL Maximum Contaminant Level
ND Not Detected at the Reporting Limit
S Spike recovery outside accepted recovery limits

QA/QC SUMMARY REPORT

Client: Terracon
Project: Building 10 Addition

Work Order: 1007232

Analyte	Result	Units	PQL	SPK Va	SPK ref	%Rec	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Method: EPA Method 300.0: Anions											
Sample ID: MB-23012		MBLK									
Sulfate	ND	mg/Kg	1.5								
Sample ID: LCS-23012		LCS									
Sulfate	28.29	mg/Kg	1.5	30	0	94.3	90	110			

Batch ID: 23012 Analysis Date: 7/14/2010 4:24:41 PM

Batch ID: 23012 Analysis Date: 7/14/2010 4:42:06 PM

Qualifiers:

E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	NC	Non-Chlorinated
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits

Hall Environmental Analysis Laboratory, Inc.

Sample Receipt Checklist

Client Name **TER-ALB**

Date Received:

7/8/2010

Work Order Number **1007232**

Received by: **AMF**

Checklist completed by:

Signature

Date

Sample ID labels checked by:

Initials

Matrix:

Carrier name: Client drop-off

Shipping container/cooler in good condition?

Yes ☐

No ☐

Not Present ☒

Custody seals intact on shipping container/cooler?

Yes ☐

No ☐

Not Present ☐

Not Shipped ☒

Custody seals intact on sample bottles?

Yes ☐

No ☐

N/A ☒

Chain of custody present?

Yes ☒

No ☐

Chain of custody signed when relinquished and received?

Yes ☒

No ☐

Chain of custody agrees with sample labels?

Yes ☒

No ☐

Samples in proper container/bottle?

Yes ☒

No ☐

Sample containers intact?

Yes ☒

No ☐

Sufficient sample volume for indicated test?

Yes ☒

No ☐

All samples received within holding time?

Yes ☒

No ☐

Water - VOA vials have zero headspace?

No VOA vials submitted ☒

Yes ☐

No ☐

Water - Preservation labels on bottle and cap match?

Yes ☐

No ☐

N/A ☒

Water - pH acceptable upon receipt?

Yes ☐

No ☐

N/A ☒

Number of preserved
bottles checked for
pH:

<2 >12 unless noted
below.

Container/Temp Blank temperature?

28.0°

<6° C Acceptable

If given sufficient time to cool.

COMMENTS:

Client contacted _____ Date contacted: _____ Person contacted _____

Contacted by: _____ Regarding: _____

Comments: _____

Corrective Action _____

Turn-Around Time:

☒ Standard ☐ Rush

email or Fax#:

☐ Standard ☐ Level 4 (Full Validation)

☐ NELAP ☐ Other

☐ EDD (Type)

Container Type and #	Preservative Type
-------------------------	----------------------

1

Date _____ Time _____

Relinquished by:

Date _____ Time _____

Tel. 505-345-3975 Fax 505-345-4107

Project Manager:	
------------------	--

☐ Standard ☐ Level 4 (Full Validation)

Accreditation

☐ NELAP ☐ Other

☐ EDD (Type)

Container

دعا

Container Type and #	Preservative Type
-------------------------	----------------------

1

Remarks:

Date	Time
------	------

Date _____ Time _____

if necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.