

**TEO-TEST**

**GEOTECHNICAL  
ENGINEERING SERVICES  
JOB NO. 1-70510  
LA PUEBLA FIRE STATION ADDITION  
SANTA FE COUNTY, NEW MEXICO**

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**PREPARED FOR  
SANTA FE COUNTY**

June 19, 2007  
Job No. 1-70510

**Santa Fe County  
PFMD Project Development Division  
PO Box 276  
Santa Fe, New Mexico 87504-0276**

**ATTN: Ron Sandoval  
Project Manager**

**RE: Geotechnical Engineering Services Report  
La Puebla Fire Station  
Santa Fe County, New Mexico**

Dear Mr. Sandoval:

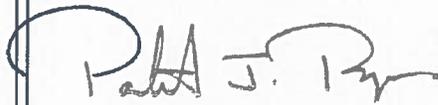
Submitted herein is the Geotechnical Engineering Services Report for the above referenced project. The report contains the results of our field investigation and laboratory testing, and recommendations for foundation design, slab support, as well as criteria for site grading.

It has been a pleasure to serve you on this project. If you should have any questions, please contact this office.

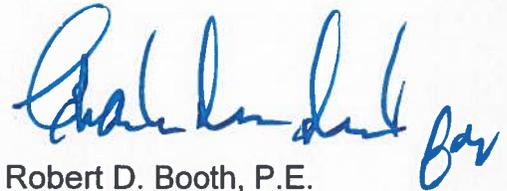
Respectfully submitted:

Reviewed by:

**GEO-TEST, INC.**



Patrick J. Byres, P.E.



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## **INTRODUCTION**

This report presents results of the geotechnical engineering services investigation performed by this firm for the proposed addition to La Puebla Fire Station in Santa Fe County, New Mexico.

The objectives of this investigation were to:

- 1) Evaluate the nature and engineering properties of the subsurface soils underlying the site.
- 2) Provide recommendations for foundation design, slab support, and site grading.

The investigation includes subsurface exploration, selected soil sampling, laboratory testing of the samples, performing an engineering analysis and preparation of this report.

## **PROPOSED CONSTRUCTION**

It is our understanding that the proposed addition to the fire station will consist of a single story office/living quarters structure. No basements are planned and concrete floor slabs will be cast on-grade. Foundation loads are expected to be relatively light to moderate with wall and column loads ranging to approximately 3 kips per lineal foot and 40 kips, respectively.

Should structural loads or other project details vary significantly from those outlined above, this firm should be notified for review and possible revision of recommendations contained herein.

## **FIELD EXPLORATION**

Two exploratory borings were drilled to depths of approximately 21 feet below existing grade. The locations of the borings are shown on the attached Boring Location Map, Figure 1. The soils encountered in the borings were continuously examined, visually classified and logged during the drilling operation. The boring logs are presented in a following section of this report. Drilling was accomplished using a truck mounted drill rig equipped with 5-inch diameter continuous flight hollow stem auger. Subsurface materials were sampled at five-foot intervals or less utilizing an open tube split barrel sampler driven by a standard penetration test hammer.

### **LABORATORY TESTING**

Selected soil samples were tested in the laboratory to determine certain engineering properties of the soils. Moisture content determinations were made on all open-end drive samples recovered. The results of these tests are shown on the boring logs.

Sieve analysis and Atterberg limits tests were performed on selected samples to aid in soil classification. Results of these tests are shown in the Summary of Laboratory Results presented in a following section of this report.

### **SURFACE CONDITIONS**

The site is located on Firehouse Road, off La Puebla Road (NM 88) which is off US 285 north of Santa Fe. The site has previously been developed as a fire station. This project consists of an addition to the existing fire station. The original construction included fill placement on the east side of the structure, which is the area of the proposed addition.

### **SUBSURFACE SOIL CONDITIONS**

As indicated by the exploratory borings, the near surface soils consist of man-made fill comprised of non-plastic silty sand. The man-made fill ranges from medium dense to very loose and extends to approximately 13 feet below surface grade at the boring locations. Native soils underlying the man-made fill consist of medium dense to dense, non-plastic silty sands.

No free groundwater was encountered and soil moisture contents were low to moderate throughout the extent of the borings.

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **Analysis Of Results**

The man-made fills soils underlying the site of the proposed addition are not considered suitable to provide reliable of the structure. Footings and floor slabs supported on this fill would be susceptible to excessive settlements, particularly upon significant soils moisture increases. Accordingly, it is recommended that all existing man-made fills soils be removed from throughout the proposed building area and replaced as necessary as structural fill. With these provisions, the proposed addition can then be supported on shallow spread-type footings and slabs on-grade bearing directly on the native soils, or on structural fill brought up from the native

soils. Where footings are to bear on structural fill, the structural fill should also extend laterally from the footing perimeters equal to the depth of fill beneath their bases. Detailed recommendations concerning site preparation and foundation design are presented in the following sections of this report.

Post-construction moisture increases in the supporting soils could cause some differential foundation movements. Therefore, moisture protection is an important design consideration and should be reflected in overall site grading and drainage details as recommended in the Moisture Protection section of this report.

### **FOUNDATIONS**

Shallow spread-type footings, bearing directly on the native soils, or on structural fill, are recommended for the support of the proposed addition. An allowable soil bearing pressure of 2,000 pounds per square foot is recommended for the design of shallow spread-type footings. This bearing value applies to full dead load plus realistic live loads, and can be safely increased by one-third for total loads including wind or seismic forces.

Exterior footings should be established a minimum of 2.0 feet below the lowest adjacent finished grade, while interior footings should be at least 12 inches below finished floor grade. Two feet and 1.33 feet are the minimum recommended width of isolated and continuous footings, respectively.

Maximum settlements of foundations designed and constructed as recommended herein are estimated not to exceed  $\frac{3}{4}$  inch for the soil moisture contents encountered during this investigation or moisture contents introduced during construction. Differential movements should be less than 75 percent of total movements. Significant post-construction moisture increases of the supporting soils would create additional movements and, thus, the moisture protection procedures recommended in a following section of this report are considered important for the satisfactory performance of the structures.

### **SITE SEISMICITY**

In accordance with IBC 2003, Site Class D should be used for structural design.

### **LATERAL LOADS**

Resistance to lateral forces will be provided by soil friction between the base of the floor slabs and footings and by passive earth resistance against the

edges of footings and stem walls. A coefficient of friction of 0.40 should be used for computing the lateral resistance between bases of footings and slabs and the soil. With backfill placed as recommended in the site grading section of this report, a passive soil resistance equivalent to a fluid weighing about 325 pounds per cubic foot can be used for analysis.

### **SLABS ON GRADE**

Adequate support for lightly loaded slab-on-grade floors will be provided by the subgrade when prepared as recommended in a following section of this report. Thus, the use of granular base for structural support of lightly loaded slabs is not considered necessary. However, should it be desired as a working surface, a course of granular base can be placed beneath concrete floor slabs.

Where granular base is used beneath the slabs, it should have a plasticity index of no greater than 3 and meet the following grading requirements:

<b>Sieve Size (Square Openings)</b>	<b>Percent Passing by Dry Weight</b>
1 Inch	100
¾ Inch	85-100
No. 4	45-95
No. 200	0-8

The granular base should be compacted to at least 70 percent of relative density as determined in accordance with ASTM D4253 and D4254, or 95 percent of maximum dry density as determined in accordance with ASTM D1557.

The granular base will act as a capillary barrier, but will not totally eliminate the rise of moisture to the slabs. If floor coverings are proposed which are highly sensitive to moisture, it is recommended the slab be placed in accordance with the procedures recommended by the American Concrete Institute.

### **SITE-GRADING**

The following general guidelines should be included in the project construction specifications to provide a basis for quality control during site grading. It is recommended that all structural fill and backfill be placed and compacted under engineering observation and in accordance with the following:

- 1) After site clearing and grubbing, the existing man-made fill soils throughout the area of the proposed addition should be removed in their entirety. The area of fill removal should also extend beyond perimeters of the footings equal to the depth of fill below their bases. The exposed native soils should then be densified prior placement of structural fill.
- 2) Densification of the soils should consist of scarifying, moisture conditioning to the optimum moisture content or above, and compacting the area to a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D-1557.
- 3) Most of the over-excavated soils may be used as structural fill, however, some blending may be required. All structural fill or backfill material should be free of vegetation, debris, and contain no rocks larger than 3 inches. The gradation of the structural fill, as determined in accordance with ASTM D-422, should be as follows:

Size	Percent Passing
3 inch	90 - 100
No. 4	60 - 100
No. 200	15 - 45

- 4) The plasticity index of the structural fill, when tested in accordance with ASTM D-4318, should not exceed 15.
- 5) Fill or backfill, consisting of soil approved by the geotechnical engineer, should be placed in 8-inch un-compacted lifts and compacted with approved compaction equipment.
- 6) All compaction of structural fill or backfill should be accomplished to a minimum of 95 percent of the maximum dry density determined in accordance with ASTM D-1557. The moisture content of the structural fill should be within 2 percent of the optimum moisture content.
- 7) Tests for degree of compaction should be determined by the ASTM D-1556. Observation and field tests should be carried on during fill and backfill placement by the geotechnical engineer to assist the contractor in obtaining the required degree of compaction. If less than

95 percent is indicated, additional compaction effort should be made with adjustment of the moisture content as necessary until 95 percent compaction is obtained.

### **MOISTURE PROTECTION**

Precautions should be taken during and after construction to minimize moisture increases of foundation soils. Positive drainage should be established away from the exterior walls of the structures. A typical adequate slope is 6 inches in the first 5 feet with positive drainage being provided from those points to streets or natural water courses. Backfill should be well compacted and should meet the specifications outlined in the site grading section of this report. Irrigation within 10 feet of foundations should be carefully controlled. All utility trenches leading into the structures should be backfilled with compacted fill. Special care should be taken during installation of the subfloor sewers and water lines to reduce the possibility of post-construction soil moisture increases beneath the structures.

Proper landscaping and drainage maintenance is required to preclude accumulation of excessive moisture in the soils below the structures. Accumulations of excessive moisture could be harmful to some types of interior flooring and can weaken or cause other changes in the soils supporting the slabs and foundations. This can cause additional differential movement of foundations and can result in cosmetic or structural damage to the structures.

If any water line leaks or if irrigation system leaks are detected, they should be promptly repaired. In addition, if any depressions develop from settlement of soils in utility trenches or other areas, they should be backfilled to maintain the grade so that surface water drains rapidly away from the structure.

### **FOUNDATION REVIEW AND INSPECTION**

This report has been prepared to aid in the evaluation of this site and to assist in the design of this project. It is recommended that the geotechnical engineer be provided the opportunity to review the final design drawings and specifications in order to determine whether the recommendations in this report are applicable to the final design. Review of the final design drawings and specifications should be noted in writing by the geotechnical engineer.

Variations from soil conditions presented herein may be encountered during construction of this project. In order to permit correlation between the

conditions encountered during construction and to confirm recommendations presented herein, it is recommended that the geotechnical engineer be retained to perform sufficient review during construction of this project. Observation and testing should be performed during construction to confirm that suitable fill soils are placed upon competent materials and properly compacted and foundation elements penetrate the recommended soils.

### **CLOSURE**

Our conclusions, recommendations and opinions presented herein are:

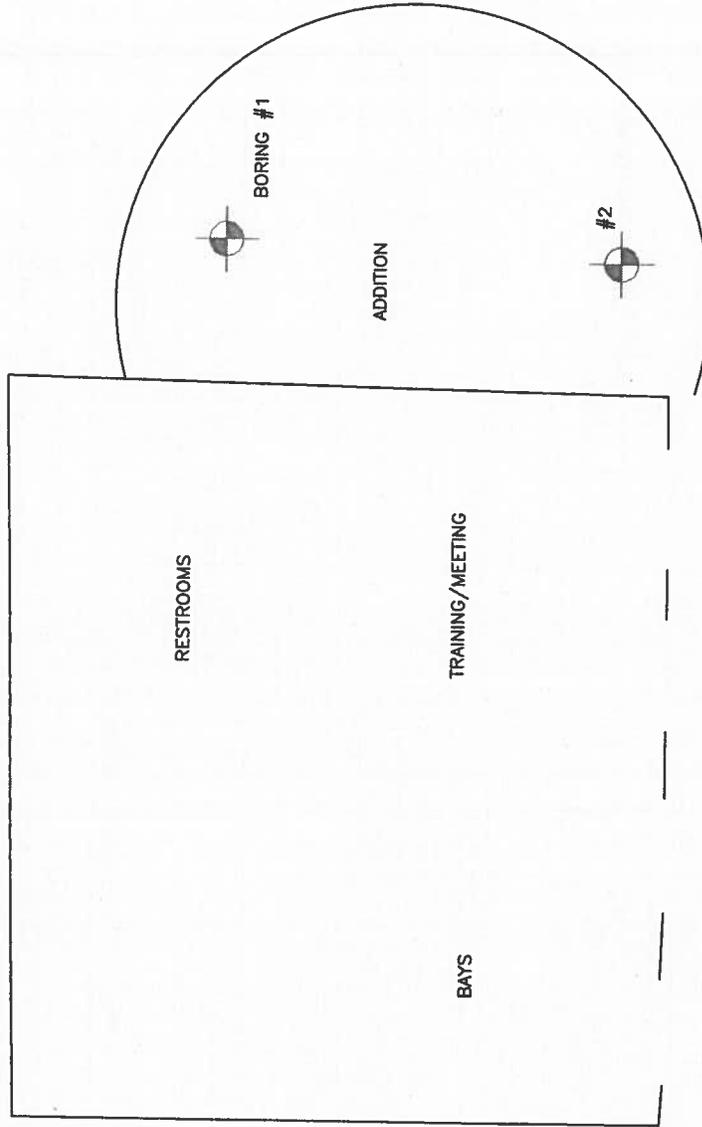
- 1) Based upon our evaluation and interpretation of the findings of the field and laboratory program.
- 2) Based upon an interpolation of soil conditions between and beyond the explorations.
- 3) Subject to confirmation of the conditions encountered during construction.
- 4) Based upon the assumption that sufficient observation will be provided during construction.
- 5) Prepared in accordance with generally accepted professional geotechnical engineering principles and practice.

We make no other warranty, either express or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as he deems necessary to satisfy himself as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project. If conditions encountered during construction appear to be different than indicated by this report, this office should be notified.

This report has been prepared for the sole use of Santa Fe County PFMD Project Development Division, specifically for the design of the proposed addition to be constructed at the existing La Puebla Fire Station, located in Santa Fe County, New Mexico, and not for the use or benefit of any third parties.

All soil samples will be discarded 60 days after the date of this report unless we receive a specific request to retain the samples for a longer period of time.

BORING LOCATION MAP



ADDITION TO LA PUEBLA FIRE STATION  
SANTA FE COUNTY, NEW MEXICO  
JOB NO. 1-70510

**DEO-TEST**  
GEOTECHNICAL ENGINEERING, ENVIRONMENTAL  
MATERIAL TESTING  
SANTA FE - ALBUQUERQUE - LAS CRUCES

Figure 1



Project: La Puebla Fire Station

Date: 05/22/2007

Project No: 1-70510

Elevation:

Type: 5" OD HSA

# LOG OF TEST BORINGS

# GROUNDWATER DEPTH

NO: 1

During Drilling: None

After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE						SUBSURFACE PROFILE	
		SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION	N blows/ft 20 40 60 80
0 - 5	[Cross-hatched pattern]	5-7-8 15	SS	3			FILL	MANMADE FILL: SILTY SAND, fine grained, non-plastic, loose to medium dense, slightly moist, brown	15
5 - 10	[Cross-hatched pattern]	4-4-5 9	SS	4		9			
10 - 15	[Cross-hatched pattern]	1-1-1 2	SS	3		2			
15 - 20	[Dotted pattern]	5-6-8 14	SS	4		14			
20 - 21	[Dotted pattern]	7-9-12 21	SS	2		21		STOPPED AUGER AT 19' 6" STOPPED SAMPLER AT 21'	
25									

LOG OF TEST BORING 1-70510 LA PUEBLA FIRE STATION.GPJ GEO TEST GDT 6/1/07

### LEGEND

SS - Split Spoon  
 AC - Auger Cuttings  
 CAL - Modified California Sampler

AMSL - Above Mean Sea Level  
 CS - Continuous Sampler  
 UD - Undisturbed

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.



Project: La Puebla Fire Station

Date: 05/22/2007

Project No: 1-70510

Elevation:

Type: 5" OD HSA

LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 2

During Drilling: None

After 24 Hours:

LOG OF TEST BORING 1-70510 LA PUEBLA FIRE STATION GPJ GEO TEST GDT 6/1/07

DEPTH (Ft)	LOG	SAMPLE						SUBSURFACE PROFILE				
		SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION	N blows/ft 20 40 60 80			
5	[Cross-hatched pattern]	5-6-8	SS	14	4		FILL	MANMADE FILL: SILTY SAND, fine grained, non-plastic, loose to medium dense, slightly moist, brown	14			
		4-5-6	SS	11	4				11			
10		2-3-3	SS	6	4				6			
15		3-7-10	SS	17	4				17			
20	[Dotted pattern]	9-11-13	SS	24	4		SM	SILTY SAND, fine grained, non-plastic, medium dense, slightly moist, brown	24			
25									STOPPED AUGER AT 19' 6" STOPPED SAMPLER AT 21'			

LEGEND

SS - Split Spoon

AC - Auger Cuttings

CAL - Modified California Sampler

AMSL - Above Mean Sea Level

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UD - Undisturbed

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Classification	Water Content (%)	Dry Density (pcf)	Falling Perm (cm/sec)	Specific Gravity
1	2.5	NP	NP	NP	19	23	SM	3.2			
1	5.0							3.9			
1	10.0							3.2			
1	15.0							3.7			
1	20.0							1.6			
2	2.5							3.7			
2	5.0	NP	NP	NP	4.75	27	SM	4.3			
2	10.0							3.9			
2	15.0							3.9			
2	20.0							3.8			

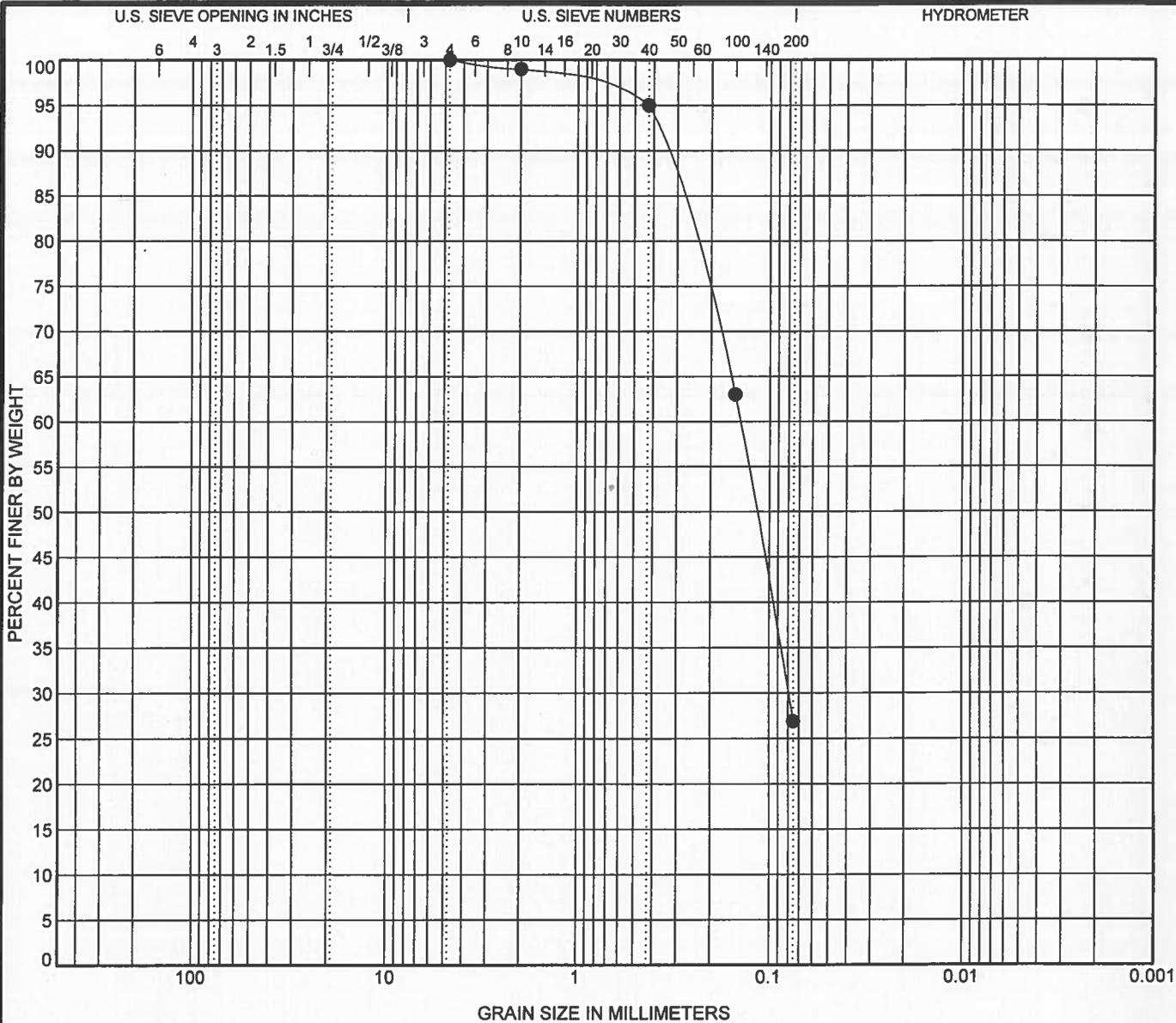
US LAB SUMMARY 1-70510 LA PUEBLA FIRE STATION GPJ GEO TEST GDT 6/19/07

**Summary of Laboratory Results**



Project: La Puebla Fire Station  
 Location: Santa Fe County, New Mexico  
 Number: 1-70510





COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● 2      5.0	<b>SILTY SAND(SM)</b>	<b>NP</b>	<b>NP</b>	<b>NP</b>		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2      5.0	<b>4.75</b>	<b>0.142</b>	<b>0.08</b>		<b>0.0</b>	<b>73.1</b>	<b>26.9</b>	

**GRAIN SIZE DISTRIBUTION**

Project: La Puebla Fire Station  
 Location: Santa Fe County, New Mexico  
 Number: 1-70510



US GRAIN SIZE 1-70510 LA PUEBLA FIRE STATION.GPJ GEO TEST.GDT 6/19/07