ADDENDUM NO. 3

CITY OF SAN ANTONIO
CAPITAL IMPROVEMENTS MANAGEMENT SERVICES

PROJECT NAME: **MISSION MARQUEE PLAZA**

DATE: November 16, 2011

CIMS PROJECT NO. 40-00234

This addendum should be included in and be considered part of the plans and specifications for the name of the project. The contractor shall be required to sign an acknowledgement of the receipt of this addendum and submit with their bid.

GENERAL

ITEM 1: ADDENDUM NO. 3 – ACKNOWLEDGEMENT FORM
Addendum Acknowledgement Form – Submit the form (issued herewith) signed and dated with the bid proposal package indicating receipt of the number of Addendums received.

ITEM 2: GEOTECHNICAL REPORT
Insert Geotechnical Report by Arias & Associates (March 2, 2009) issued herewith.

SPECIFICATIONS

ITEM 3: SECTION 04 43 00 – STONE MASONRY
At page 1, para. 1.2.A, add subparagraph:

> "2. Stone wheel stops formed to shape indicated."

At page 7, line 1, text to read as follows:

> "D. Stone wheel stops: Secure to paving surface with not less than two ¾" diameter galvanized steel dowels embedded with non-shrink grout in full length holes at 1/3 points. Drill placement holes oversize and embed dowels not less than 6" into paving surface. Grout in concrete paving and hot bituminous grout material in asphalt paving."

ITEM 4: SECTION 05 50 00 – METAL FABRICATIONS
At page 1, line 19, add the following:
"Steel Ornamental Gates."

ITEM 5: SECTION 08 80 00 – GLAZING
At page 4, line 13, add the following:

> "Optically Clear Float Glass is the glass product and performance standard to be provided for the project glazing."

ITEM 6: 32 14 01 – STONE PAVERS
Insert Section 32 14 01 Stone Pavers (4 pgs), dated 11-16-11, issued herewith.

ITEM 7: SECTION 10 01 00 – MISCELLANEOUS SPECIALTIES
At page 4, delete text on line 51 in its entirety.

ITEM 8: SECTION 12 93 00 – SITE AMENITIES
At page 3, line 7, add the following:

> "Provide all anchorage for components to secure to posts and mountings with manufacturer's recommended non-removable head anchors."

ITEM 9: SECTION 32 84 01 - IRRIGATION
At page 1, remove reference to water harvesting as this is not a water harvesting system.

ITEM 10: VICKREY & ASSOCIATES (CIVIL) RFI RESPONSES
See Vickrey & Associates RFI responses (2 pgs) dated 11-16-11, issued herewith.

DRAWINGS

ITEM 11: DRAWINGS REVISED 11-16-11 & REISSUED HEREWITH:
The Following Drawings (revised 11-16-11) are issued herewith.
Note: Refer to Narratives on the following pages for further information.

C-102 SITE DIMENSION PLAN
C-104 SITE GRADING & DRAINAGE PLAN
C-105 SITE GRADING PLAN DETAILS "A, B & C"
C-107 SITE DETAILS

IR-101 IRRIGATION PLAN
IR-104 IRRIGATION PLAN
IR-105 IRRIGATION PLAN
IR-106 IRRIGATION PLAN

A-101 OVERALL SITE PLAN
A-104 ENLARGED SITE PLANS
A-401 SUPPORT STRUCTURE SCHEDULES
A-402 SUPPORT STRUCTURE DOOR AND WINDOW DETAILS
A-604 SUPPORT STRUCTURE PLAN DETAILS

S-101 PLAN/DETAIL/GENERAL NOTES
S-202 SUPPORT STRUCTURE FOUNDATION PLAN/DETAILS/SCHEDULE
S-203 SUPPORT STRUCTURE SECTION/DETAILS

M-102 SUPPORT STRUCTURE – MECHANICAL PLANS
E-201 ELECTRICAL ONE-LINE DIAGRAM & SCHEDULES
P-101 MARQUEE PLAZA AND LOOP ROAD PLUMBING PLAN
P-102 SUPPORT STRUCTURE – PLUMBING PLANS
P-201 PLUMBING DETAILS & SCHEDULES
P-202 PLUMBING DETAILS & SCHEDULES

CITY OF SAN ANTONIO
DEPARTMENT OF CAPITAL IMPROVEMENTS MANAGEMENT SERVICES
CONTRACT SERVICES DIVISION

RECEIPT OF ADDENDUM NUMBER (S) ____**3**__ IS HEREBY ACKNOWLEDGED FOR PLANS AND

SPECIFICATIONS FOR CONSTRUCTION OF **MISSION MARQUEE PLAZA – 40-00234**

FOR WHICH BIDS WILL BE OPENED ON **TUESDAY, NOVEMBER 22, 2011 AT 2:00 P.M.**

THIS ACKNOWLEDGEMENT MUST BE SIGNED AND RETURNED WITH THE BID PACKAGE.

Company Name: ____________________________

Address: ____________________________________

City/State/Zip Code: ________________________

Date: ____________

____
Signature

____
Print Name/Title

Geotechnical Engineering Study

Proposed City of San Antonio – District 3 New Branch Library
Roosevelt and VFW Boulevard
San Antonio, Texas

Arias Job No. 08-2298

ARIAS & ASSOCIATES
Geotechnical • Environmental • Testing

Prepared For

Kell Munoz Architects. Inc.
Mr. Ronnie Biediger

March 2, 2009

ARIAS & ASSOCIATES
Geotechnical • Environmental • Testing

March 2, 2009
Arias Job No. 08-2298

Mr. Ronnie Biediger
Kell Munoz Architects, Inc.
1017 North Main, 3rd Floor
San Antonio, Texas 78212

RE: Geotechnical Engineering Study
Proposed City of San Antonio – District 3 New Branch Library
Roosevelt and VFW Boulevard
San Antonio, Texas

Dear Mr. Biediger:

The results of a Geotechnical Engineering Study for the proposed City of San Antonio – District 3 New Branch Library are presented in this report. This project was authorized by Mr. Ronnie Biediger of Kell Munoz Architects, Inc. by Abbreviated Standard Form Agreement Between Architect and Consultant (AIA Document C 142) and contract exhibits which include Arias Proposal No. 08-2298 dated July 28, 2008. The contract was authorized on December 30, 2008.

The purpose of this engineering study was to establish foundation engineering properties of the subsurface soil and groundwater conditions present at the site. The scope of the study is to provide geotechnical engineering criteria for use by design engineers in preparing the foundation and pavement designs. Our findings and recommendations should be incorporated into the design and construction documents for the proposed development.

In order to help contribute to the success of this project, we recommend that the site work and building construction be tested and observed by one of our representatives in accordance with the report recommendations. It is also very important that the geotechnical engineer of record be employed during construction to observe that the site preparation and foundation construction are performed in accordance with the recommendations presented in this report.

Thank you for the opportunity to be of service to you.

Sincerely,
ARIAS & ASSOCIATES INC.

STATE OF TEXAS
MARK J. O'CONNOR
79252
REGISTERED PROFESSIONAL ENGINEER
3/2/09

Ricardo Cruz, E.I.T.
Geotechnical Project Manager

Mark O'Connor, P.E.
Vice President of San Antonio Operations

cc: 3 Above
1 Henry Martinez – AccuTech Consultants, LLC

REPORT FORMAT

To improve clarity in the intent of our geotechnical recommendations for this project, the report is organized into two separate, but equally important sections.

Section I – The *Synopsis* is a summary of our recommendations and geotechnical requirements specific to this project.

Section II - The *Main Report* contains more detailed information including preferable foundation design parameters and site work recommendations.

A study of both of the above referenced sections is recommended for the Project Team Members. Arias & Associates, Inc. cautions that Section I is a consolidated quick reference overview of the more detailed geotechnical recommendations contained in Section II and should not be utilized exclusively from the remainder of the report.

TABLE OF CONTENTS

Page

TABLE OF CONTENTS

Page

TABLE OF CONTENTS

Page

Tables

SECTION I: SYNOPSIS

SYNOPSIS

This synopsis includes a brief description of the project, subsurface findings, recommended foundation types, generalized earthwork requirements for building pad construction, and specific items of concern from a geotechnical standpoint for consideration during the design, construction and maintenance phases of this project.

Table 1: Project Description

Project:	Proposed City of San Antonio – District Three New Branch Library
Project Location:	Roosevelt and VFW Boulevard
Proposed Development:	Single-story building with plan area of 16,000 SF and approximately 100 parking spaces with associated service drives
Construction Type:	Steel-framed structure with a hollow core plank floor
Structural Loads:	Column loads of about 225 kips
Structural Engineer:	Mr. Henry Martinez, P.E. – Accutech Consultants, LLC
Anticipated Foundation Type:	Suspended floor slab supported on drilled pier foundation

Table 2: Existing Conditions at Time of Geotechnical Study

Date of Field Exploration	February 4, 2009
Approximate Elevations Across Development:	566 to 573 feet
Approximate Elevations in Building Footprints:	566 to 570 feet
Proposed Finished Floor Elevation (FFE):	Approximately 5 to 7 feet above the existing drainage channel
Ground Cover:	Trees, grass, and existing asphalt pavement
Geologic Formation:	Alluvial Terrace Deposits (Qt) over weathered and unweathered Shale
Predominant Soil Type:	Highly expansive CLAYS (CH)
(Range)/Average Plasticity Index (PI):	(19-73) / 41
Groundwater Depth Measured:	14 to 18.5 feet
Estimated Potential Vertical Rise (PVR):	3 to 4 inches

1Notes:

1. The approximate elevations presented in Table 2 were estimated from topographic information provided by Kell Munoz Architects.

Table 3: Suspended Floor Slab and Drilled Pier Foundation Recommendations

Recommended Foundation Type:	Drilled pier foundations with suspended floor slab
Minimum Void Space Beneath Floor Slab and Grade Beams:	8 inches
Minimum Pier Depth below Original Grade:	Straight Shaft Piers – at least 25 feet deep

Table 4: Recommended Pavement Sections

Layer	Material (see notes)	Flexible Asphaltic Concrete				Rigid Concrete	
		Parking Area & Light Duty		Truck Lane & Heavy Duty		Parking Area & Light Duty	Truck Lane & Heavy Duty
		Option 1	Option 2	Option 1	Option 2		
Surface	HMAC/PCC	2"	2"	3"	3"	5½"	7"
Base	Flexible Base	8"	10"	12"	15"	--	--
Subgrade Design (see note 1)	Lime Stabilized (see note 2)	6"	--	6"	--	6"	6"
	Moisture Conditioned	--	6"	--	6"	--	--

Notes:

2. Design CBR value of 2.0
3. Tensar geogrid BX-1100 installed on 6-inch thick moisture conditioned compacted subgrade may be substituted in lieu of lime stabilization for asphalt pavement option.
4. Hot-mix asphaltic concrete (HMAC) should be TxDOT Standard Specifications Item 340 Type D
5. Portland cement concrete (PCC) should have a 28-day compressive strength of 3500 psi and should be placed with an approximate 5 inch slump.
6. Flexible base should be TxDOT Standard Specifications Item 247 Type A or B Grade 1 or 2.
7. Stabilization of exposed clays should be performed in accordance with Item 260 of the TxDOT Standard Specifications (2004). The actual quantity of lime required should be determined after the site is stripped of the loose soil and the subgrade soils are exposed. The actual percentage should be determined in laboratory tests on samples of the clayey subgrade prior to construction. The quantity of lime should be sufficient to result in a pH of at least 12.4 when tested in accordance with ASTM C 977, Appendix XI.
8. Garbage dumpster pads should consist of a minimum 8-inch thick rigid concrete pavement.

Table 5: Project Compaction, Moisture and Testing Requirements

Description	Material	Percent Compaction	Optimum Moisture Content	Testing Requirement
		According to Standard Proctor ASTM D 698 except as noted below in parenthesis		
Pavement Areas	Scarified On-site Soil (Subgrade)	≥ 95%	0 to +4%	1 per 5,000 SF
	General Fill or Stabilized Soil (Onsite Material)	≥ 95%	0 to +4%	1 per 5,000 SF; min. 3 per lift
	Base Material	≥ 95% (ASTM D 1557)	±3%	1 per 5,000 SF; min. 3 per lift
	Hot-mix asphaltic concrete	91% to 95% Theoretical Lab Density (TEX 207 F)	Not applicable	1 per 5,000 SF; min. 3 per lift
Non-Structural Areas (Outside Building and Pavement Areas)	General Fill (On-site Material)	≥ 95%	0 to +4%	1 per 5,000 SF; min. 3 per lift

Notes:

1. On-site clay soil used for grade adjustments within the building areas should be relatively free of gravel and organics.

SECTION II: MAIN REPORT

PROJECT AND SITE DESCRIPTION

It is understood that the proposed project is to consist of a New Branch Library for District 3 in San Antonio, Texas. Based on the information received from Mr. Ronnie Biediger with Kell Munoz Architects, Inc. the library will include the construction of a single-story building with plan area of about 16,000 square feet (SF). The new building will consist of a steel-framed structure. The structural floor will be constructed with pre-fabricated hollow planks with a void space beneath. Based on our conversation with Mr. Henry Martinez, P.E., the project structural engineer, the structure will have relatively heavy loading conditions with column loads of about 225 kips. Should design structural loading conditions differ significantly than that noted, we should be contacted to evaluate the recommendations presented in this report.

Based on our conversation with Mr. Henry Martinez, P.E. we understand that a suitable foundation system to support the proposed new district 3 library and the proposed loads is a structural floor slab supported on drilled pier foundations. Onsite parking and access drives are also planned for the project.

The property investigated is located just southeast of the intersection of Roosevelt and VFW Boulevard in San Antonio, Texas. The site terrain generally consists of a lowpoint at about the center of the proposed library at about an Elevation (El.) 566.5 feet. The low point is located within an existing drainage channel. From this lowpoint, the site terrain within the proposed library area is elevated to about El. 570 to 571. Finished Floor Elevations (FFEs) for the proposed buildings were provided as being 5 to 7 feet higher than the existing lowpoint elevation with in the drainage channel.

Existing ground cover generally consists of few trees and grass. The property is currently the mission 4 outdoor theatre with some asphalt parking. A Vicinity Map and Representative Photographs are provided in the Enclosures.

SOIL BORINGS AND LABORATORY TESTS

Eight (8) soil test borings were drilled at the approximate locations shown on the Boring Location Plan provided in Appendix C. The test borings were drilled to depths of approximately 6 to 35 feet below the existing ground surface in accordance with ASTM D1586 and ASTM D1587 procedures for Split Spoon and Shelby Tube sampling techniques as described in Appendix E. A truck-mounted drill rig using continuous flight augers together with the sampling tools noted were used to secure the subsurface soil samples.

Soil classifications and borehole logging were conducted during the exploration by one of our field-logging technicians who are under the supervision of our Geotechnical Geologist. Final soil classifications, as seen on the attached boring logs (Appendix C), were determined in the laboratory based on laboratory and field test results and applicable ASTM procedures.

Pocket Penetrometer values in tons per square foot on clays and standard penetration test (N-values) in blows per foot are also noted on the boring logs. These values provide an indication of the consistency and/or relative density as well as the strength of the subsurface materials.

As a supplement to the field investigation, laboratory testing to determine soil water content, Atterberg Limits, and percent passing the #200 sieve was conducted. The laboratory results are reported in the attached boring logs included in Appendix C. A key to the terms and symbols used on the logs is also included in Appendix E. The soil laboratory testing for this project was done in accordance applicable ASTM procedures with the specifications and definitions for these tests listed in the Appendix.

Remaining soil samples recovered from this exploration will be routinely discarded following submittal of this report.

SUBSURFACE CONDITIONS

Site Stratigraphy and Engineering Properties

The soils at this site generally consist of a stratum I dark gray brown to gray brown, high plasticity Clays (CH) which is underlain by the stratum II tan Clays (CL). The material beneath the Stratum II clays consist of a tan clayey gravel (GC) with sand, tan clayey sand (SC) with gravel and a sandy clay (CL) with gravel. The stratum IV material is composed of a high plasticity tan and gray weathered shale with a formation light bluish gray shale beneath.

Generalized stratigraphy conditions are summarized on the following table:

Table 6: Generalized Soil Conditions

Stratum	Depth (ft)	Material Type	PI range / PI average	No. 200 range / No. 200 average	PP range / PP average	N range / N average
I	(0 – 0.8) to (1 – 10)	Dark gray brown and dark brown Clay (CH) with trace of sand and gravel, stiff to very hard	36-43	84	1.5 – 10.25	--
			40	--	5.3	--
II	(2 – 10) to (6 – 12)	Light brown to tan Clay (CL) some calcareous deposits, very stiff to very hard	19-35	--	3 - 14	23-26
			25	--	7.8	25
III	(8 – 13) to (12.5 – 22.5)	Tan Clayey Gravel (GC) with sand & Clayey Sand (SC) with gravel & tan Sandy Clay (CL), trace gravel, medium dense to very dense	20	11 - 46	1.5 – 4.75	33 – 50/3"
			--	26	2.8	98
IV	(12.5 – 22.5) to 30	Formational weathered Clay (CH), tan and gray, hard	61-73	--	4.5 – 7.0	--
			66	--	5.8	--
V	30 to 35	Formational CLAYSTONE, light bluish gray, hard	--	--	7.0	--
			--	--	--	--

Where:

Depth	-	Depth from existing ground surface at the time of geotechnical study, feet
PI	-	Plasticity Index, %
No. 200	-	Percent passing #200 sieve, %
N	-	Standard Penetration Test (SPT) value, blows per foot
PP	-	Pocket Penetrometer (PP) value, tons per square foot
--	-	No sample selected for testing

Exceptions to the above generalized soil conditions are as follows:

- At the location of Boring B-1, the stratum II tan clays were not encountered.
- At the locations of Boring B-2 and B-4 through B-8, the existing pavement thicknesses were measured between ½ inch to 2 inches and contained approximately 4½ inches to 7 inches of base material beneath the pavement.

It should be noted that these subsurface conditions consider those conditions discovered at the specific boring locations. Significant variations in soil and groundwater conditions between and beyond the borings often exist. Transition boundaries or contacts, noted on the boring logs to separate soil types, are approximate. Actual contacts may be gradual and vary at different locations. If conditions encountered during construction indicate more variation than established as a result of this study, we should be contacted to evaluate the significance of the changed conditions relative to our recommendations.

Groundwater

A dry soil sampling method was used to obtain the soil samples at the project site. Groundwater was observed generally near the 14 to 29 foot depths during or after completion of the soil sampling activities which were performed on February 4, 2009. Groundwater observations made during drilling and at least 24 hours from the time of drilling are noted on the individual boring logs and summarized in the following table. Borings B-6 through B-8 were drilled to the 6 foot depth and no water was encountered at that depth during the drilling activities.

Table 7: Groundwater Conditions

Boring No.	Encountered During Sampling (ft)	Delayed Reading (ft)
B-1	28.4	14.0
B-2	18.0	18.5
B-3	16.8	14.6
B-4	None Observed	29.0
B-5	18.5	17.0

Note: Depth measured from the existing ground surface at the time of geotechnical study.

Based on the groundwater observations made in the field and moisture contents obtained in the laboratory, it appears that the depth to groundwater at this site during our subsurface investigation is currently near the 14 to 18.5 foot depths. Groundwater levels will often change significantly over time and should be verified immediately prior to construction.

After obtaining the delayed groundwater level readings, the drill holes were backfilled with excavated soil, and the site cleaned as required.

See *Subsurface Variations and Groundwater* in SECTION II: ADDITIONAL DESIGN & CONSTRUCTION CONSIDERATIONS for further discussion about variability of subsurface stratigraphy and groundwater.

MOISTURE VARIATIONS AND ESTIMATED SHRINK/SWELL MOVEMENT

Structural damage can be caused by volume changes in clay soils. Clays can shrink when they lose water and swell (grow in volume) when they gain water. The potential of expansive clays to shrink and swell is generally related to the soil's Plasticity Index (PI). Clays with a higher PI typically have a greater potential for soil volume changes due to moisture content variations. The expansive soils found at this site are capable of swelling and shrinking in volume dependent on potentially changing soil water content conditions during or after construction. The term swelling soils implies not only the tendency to increase in volume when water is available, but also to decrease in volume or shrink if water is removed. Shrinkage is merely the reverse process of swelling.

Several methods exist to evaluate swell potential of expansive clay soils. We have estimated potential heave for this site utilizing the TXDOT method (Tex 124-E) and the Suction Method using the "Volflo" computer program. A description of each of these methods is included in *Section II – Additional Design & Construction Considerations* at the end of the report. The following table indicates the magnitude of anticipated potential vertical movement from changes in soil moisture content of the expansive soils due to climate variations. This is a soil heave magnitude considering a change from a dry to wet soil moisture condition within the active zone.

Table 8: Magnitude of Anticipated Movement

Estimation Method	Approximate Heave Magnitude (dry to wet)
Method (Tex 124-E), PVR (in.)	3" to 4"
Suction (Volflo) Method, Ym	3" to 4 "

Note: See Moisture Variations and Estimated Shrink/Swell Movement in SECTION II: DESIGN & CONSTRUCTION CONSIDERATIONS for further discussion.

FOUNDATION RECOMMENDATIONS

The proposed lightly loaded structures can generally be supported on stiffened slab-on-grade foundations constructed on prepared building pads. It is our experience that building pads are typically designed to reduce potential slab-on-grade foundation movements to a PVR magnitude of about one (1) inch or less. A common method for reducing the PVR includes over-excavating a portion of the existing clay soils from the building area and replacing these soils with reconditioned onsite soils and/or imported select fill.

Based on conversations with Mr. Henry Martinez, P.E. with Accutech Consultants, we understand that a stiffened slab-on-grade foundation would not be a feasible foundation option due to the proposed loading condition associated with this project As a result we recommend that the foundation type for the proposed building consist of a structural floor slab supported on drilled pier foundations. Recommendations for this foundation type are included in this report.

The project team may determine that another foundation type is desired for this project during the design phase. Should an alternate foundation type be desired, we should be contacted to provide additional geotechnical design data for the alternate foundation type as a Supplement to this Geotechnical Report.

Drilled Pier Foundation Design Parameters

Straight shaft drilled piers can be considered to support the proposed building structure and suspended floor slabs. Pier capacities provided herein were evaluated based on design methodologies presented by Reese, L.C. and O'Neil, M.W. in their publication entitled Drilled Shafts: Construction Procedures and Design Methods. This publication was prepared for the U.S. Department of Transportation, Federal Highway Administration.

Allowable side friction and end bearing capacity for drilled straight shaft piers are provided in the following Table. Straight shaft piers should be based at least 25 feet below the original grade existing at the time of this study. The recommended pier depths have been provided to bear the piers sufficiently below the zone of anticipated seasonal moisture change. Please note that the minimum depths are required to resist expansive uplift forces. The actual pier depth may need to be deeper to accommodate the compressive load on the pier. Expansive uplift forces are discussed further in the following section of this report.

The following recommended allowable capacities incorporate a minimum factor of safety of 2.0 for friction and 3.0 for end bearing.

Table 9: Recommended Drilled Shaft Axial Design Parameters

Depth, ft	Bearing Material	Allowable Friction & End Bearing		
		Skin Friction, psf	End Bearing, psf	Uplift, kips
0 – 5	Clay (CH-CL)	Neglect Contribution		80*D
5 - 10	CLAY (CH or CL)	800	---	
10 - 15	Clayey Gravel (GC), CLAY (CH-CH), Clayey Sand(SC)	700	--	
15 - 25	CLAY (CH), Clayey Sand (SC), Clayey Gravel(GC)	1,100	12,000	
25-35	Clay (CH) and Claystone	1,500	15,000	

Both end bearing and side friction resistance may be used in evaluating the allowable bearing capacity of the pier shafts. For straight shaft piers, friction capacity for the pier should be neglected for the top 5 feet of soil embedment and for a length equal to at least 1 pier diameter from the bottom of the shaft.

A minimum center-to-center spacing of three shaft diameters for straight shaft piers is recommended. If this spacing cannot be maintained, then we should be consulted to consider the group effect of closely spaced shafts.

Drilled Shafts – Uplift Force and Resistance

Uplift forces are imposed on drilled shafts in the active soil zone as soil moisture changes from a dry to wet condition. As shown in the table above, the potential soil uplift force, in kips, along the shaft of the pier can be estimated for this site as being equal to 60 times the shaft diameter in feet. Accordingly, the resultant design should impose as much dead load on each pier, as possible to resist the uplift force. In consideration of the net uplift force, tensile reinforcement in the pier should be designed in accordance with ACI code requirements.

The uplift resistance of a straight shaft pier is the side friction capacity for that portion of the pier below the estimated active zone depth (15 feet) plus the weight of the pier concrete and the sustained load on the pier.

Suspended Floor Slab

The floor slabs for the proposed buildings can be structurally suspended above grade and supported on drilled pier foundations. Due to the expansive soils encountered at this site, we recommend that a void space of at least 8 inches be constructed to isolate the slab and grade beams from the expansive soil subgrade. The use of a suspended floor slab will significantly reduce the chances for differential vertical foundation movement and distress associated with the expansive soils encountered at this site. However, even with this system some nominal upward movement may occur.

Soil retainers such as precast concrete panels should be placed vertically along the exterior grade beams to: (1) prevent soil from sloughing under the grade beams; and (2) reduce the risk of significant water from migrating into the void space under the floor system. Backfill against the retainers and exterior grade beams should consist of compacted clay soil to aid in preventing the easy movement of outside surface water from infiltrating under the floor system. The backfill clay soil should be compacted to at least 95 percent of the Standard Proctor maximum dry density as evaluated by ASTM D 698 at moisture contents ranging from optimum to plus four (+4) percentage points of optimum moisture content.

Positive drainage should also be provided for the buildings so that surface water does not enter beneath the foundation, or enter into air vents that may be situated in the exterior grade beam. Roof drains should be tied to storm drains or be discharged on top of pavements well outside of the building footprints.

Provision should be made to collect and dispose of any surface and/or subsurface water that may enter in the crawlspace. This can generally be accomplished by constructing a 4" thick unreinforced lean concrete slab or "mudmat" on the surface of the crawlspace beneath the concrete floor. The surface of the "mudmat" should be sloped to drain to a sump where the water can be collected and pumped away from the building. These steps can help reduce the potential for soil moisture fluctuations under the floor which can often lead to pier and floor movement. Proper ventilation should be provided to help limit moisture from collecting in the crawlspace. Mold growth may occur if the crawlspace is not adequately ventilated.

Excavation of trenches for beams may be accomplished with a smooth-mouthed bucket or toothed bucket. Debris in the bottom of the excavation should be removed prior to the placement of void forms, soil retainers, reinforcing steel and concrete. The excavation should be sloped sufficiently to create internal sumps for runoff water collection and removal. Surface water that accumulates in excess of one (1) inch in the bottom of the excavation should be removed.

Flatwork

The flatwork and pavements at this site will be subject to expansive soil-related movement. Differential movement will likely occur between the flatwork and suspended building slabs. It has been our experience that expansive soil shrink/swell cycles can often cause a reversal in drainage patterns over time where surface water eventually drains back towards the suspended building slab. This reversal in drainage can lead to possible foundation movement and distress in the building slabs. To aid in reducing a reversal in drainage patterns, we recommend that the flatwork immediately adjacent to the building foundations be sloped away from the buildings as much as possible to attempt to maintain positive drainage during the life of the buildings.

We do not recommend dowelling the flatwork to the building slabs except at common openings. Structurally tying grade-supported flatwork to a suspended floor slab can cause significant distress to the flatwork and possibly to the building foundation and structure. However, consideration can be given to dowelling the flatwork at common openings to help limit differential movement at these locations that may otherwise result in trip hazards.

Consideration can also be given to suspending movement sensitive flatwork. Suspended flatwork can be designed to bridge from the grade beam of the suspended floor slab to other grade-supported flatwork where differential movements would likely occur at the interface of the suspended/grade-supported flatwork. In this case, the differential movement in the flatwork would likely occur at more desirable locations away from the building. Suspended flatwork should be lightly tied to the foundation grade beam so that the flatwork can move upward and not stress the grade beam. Suspended flatwork should also be sloped away from the buildings as much as possible to attempt to maintain positive drainage during the life of the buildings.

Design Measures to Reduce Changes in Soil Moisture

Although plans are to suspend the building floor slabs above grade to reduce potential shrink/swell related foundation movements, the following elements should also be considered in the design phase:

- Roof drainage should be controlled by gutters and carried well away from the structure. The ground surface adjacent to the building perimeter should be sloped a minimum of 3% grade away from the building for 10 feet to result in positive surface flow or drainage away from the building perimeter.

- Hose bibs, sprinkler heads, and other external water connections should be placed well away from the foundation perimeter such that surface leakage cannot readily infiltrate under the proposed foundations and slabs.

- Utility bedding should not include gravel within 4 feet of the perimeter of the foundation. Compacted clay or flowable fill bedding materials should be used in lieu of permeable bedding materials between 2 feet inside the building to a distance of 4 feet beyond the exterior of the building edge to reduce the potential for water to infiltrate within utility bedding and backfill material.

- Paved areas around the structure are helpful in maintaining equilibrium within the soil water content. If possible, sidewalks should be located immediately adjacent to the building.

- Flower beds and planter boxes should be piped or water tight to prevent water infiltration under the building. Experience indicates that landscape irrigation is a common source of foundation movement problems and pavement distress.

- If perched groundwater conditions are present, French drains or strip drains should be used as a means of cutting off such perched groundwater. However, it is imperative that the French drains be sloped properly and be periodically maintained. Often the French drain is placed adjacent to the building and water collecting within the drain can be drawn into the drier expansive clays under the foundation slab resulting in perimeter floor heave.

- Site work excavations should be protected and backfilled without delay to reduce changes in the natural moisture regime.

See SECTION II: ADDITIONAL DESIGN & CONSTRUCTION CONSIDERATIONS for further discussion of utilities and slab bearing partition walls.

PAVEMENT RECOMMENDATIONS

The pavement recommendations were prepared in accordance with the 1993 AASHTO Guide for the Design of Pavement Structures for asphalt and the ACI Design Guide SCM-28 (95) for concrete. The following design parameters and assumptions were used in our analysis:

Table 10: Pavement Design Assumptions

Traffic Load for Light Duty Pavement	15,000 equivalent single axle loads (ESALs)
Traffic Load for Heavy Duty Pavement	50,000 equivalent single axle loads (ESALs)
Average Daily Truck Traffic vehicle with at least 6 Wheels	One (1)
Concrete Compressive Strength	3,500 psi
Raw Subgrade California Bearing Ratio (CBR)	2.0 for high plasticity clay subgrade
Raw Subgrade Modulus of Subgrade Reaction, k in pci	75 for high plasticity clay subgrade

Options for section thickness for flexible and rigid pavements are provided in SECTION I: SYNOPSIS. Note that the truck lane traffic sections correspond to only one heavy-duty truck per day. If more heavy-duty truck traffic is anticipated, we should be contacted to provide additional recommendations.

A truck traffic section is recommended for use at entrances, driveways and channeled traffic areas. Areas subjected to truck traffic stopping, starting, loading, unloading or turning should not utilize asphalt pavement. For these areas a concrete section is recommended.

Rigid Concrete Pavement Joints

Placement of expansion joints in concrete paving on potentially expansive subgrade or on granular subgrade subject to piping often results in horizontal and vertical movement at the joint. Many times, concrete spalls adjacent to the joint and eventually a failed concrete area results. This problem is primarily related to water infiltration through the joint.

One method to mitigate the problem of water infiltration through the joints is to eliminate all expansion joints that are not absolutely necessary. It is our opinion that expansion or isolation joints are needed only adjacent where the pavement abuts intersecting drive lanes and other structures. Elimination of all expansion joints within the main body of the pavement area would significantly reduce access of moisture into the subgrade. Regardless of the type of expansion joint sealant used, eventually openings in the sealant occur resulting in water infiltration into the subgrade.

The use of sawed and sealed joints should be designed in accordance with current Portland Cement Association (PCA) or American Concrete Institute (ACI) guidelines. Research has proven that joint design and layout can have a significant effect on the overall performance of concrete pavement.

Recommendations presented herein are based on the use of reinforced concrete pavement. Local experience has shown that the use of distributed steel placed at a distance of 1/3 slab thickness from the top is of benefit in crack control for concrete pavements. Improved crack control also reduces the potential for water infiltration.

See *Pavement Design Thickness* and *Pavement Construction Criteria* in SECTION II: ADDITIONAL DESIGN & CONSTRUCTION CONSIDERATIONS for further discussion.

CONSTRUCTION CRITERIA FOR PROPOSED SITE DEVELOPMENT

This section provides Construction Criteria for Building and Pavement Subgrade Preparation and General Sitework Considerations.

Building Subgrade Recommendations

In the building areas, the following subgrade preparation is recommended.

Table 11: Building Pad Subgrade Preparation

Stripping Depth	6 inches or as needed to remove vegetation before undercut excavation
Subgrade Preparation at Base of Excavation	Proofroll with rubber tired vehicle weighting at least 20 tons such as a loaded dump truck with Geotechnical Engineer's representative present during proofrolling. After proofrolling, scarify, moisture condition, and compact soils upper 9" of subgrade.
Pumping/Rutting Areas Discovered During Proofrolling	Remove to firmer materials and replace with compacted general or select fill under direction of geotechnical engineer representative
General Fill	On-site clay soil relatively free of gravel and organics compacted as shown in Table 5.
Maximum Loose Lift Thickness	9" for Select Fill and General Fill

Pavement Subgrade Recommendations

Recommendations for subgrade preparation are as follows.

Table 12: Pavement Subgrade Preparation

Minimum Undercut Depth	6 inches or as needed to remove roots and organics
Reuse Excavated Soils	Provided they are free of roots and debris and meet the general fill material requirements.
Undercut Extent	2 feet beyond the paving limits
Exposed Subgrade Treatment (Moisture Conditioned Option)	Proofroll with rubber tired vehicle weighting at least 20 tons such as a loaded dump truck with Geotechnical Engineer's representative present during proof rolling
Pumping/Rutting Areas Discovered During Proofrolling	Remove to firmer materials and replace with compacted general fill under direction of geotechnical engineer representative
General Fill	On-site material free of roots, debris and other deleterious material with a maximum particle size of 4 inches compacted as shown in Table 5.
Maximum General Fill Loose Lift Thickness	9 inches
Stabilization Option Depth	6 inches
Stabilizer Type	Hydrated lime
Stabilizer Application Rate	7% by dry weight – (see note 1)
Stabilization Procedure	TxDOT Item 260 and 264
Flexible Base Material Type	TxDOT Item 247, Type A or B, Grade 1 or 2
Maximum Flexible Base Loose Lift Thickness	9 inches
Hot Mix Asphaltic Concrete (HMAC) Type	TxDOT Standard Specifications Item 340 Type D

Note:
The actual quantity of lime required should be determined after the site is stripped of the loose soil and the subgrade soils are exposed. The actual percentage should be determined in laboratory tests on samples of the clayey subgrade prior to construction. The quantity of lime should be sufficient to result in a pH of at least 12.4 when tested in accordance with ASTM C 977, Appendix XI.

To prevent degradation of the prepared subgrade, paving preferably should be placed within 14 days. If pavement placement is delayed, protection of the subgrade surface with an emulsion-based sealer should be considered. Alternately, the paving section could be slightly overbuilt so blading performed to remove distressed sections does not reduce the treated subgrade thickness.

General Site Earthwork Recommendations

If fill is needed to raise site grade outside of the building pad area and pavement area, general fill obtained from on-site excavations may be used. Requirements for compacted general fill are outlined in the following table.

Table 13: Site Work (Non Structural) General Fill Requirements

Stripping	6 inch minimum or as needed to remove vegetation
Non Structural Fill Type	On-site material free of roots, debris and other deleterious material with a maximum particle size of 4 inches
Maximum Non Structural Fill Loose Lift Thickness	9 inches

Positive drainage is very important to reducing soil volume changes that can detrimentally affect the performance of the planned development. Proper attention to surface and subsurface drainage details during the design and construction phase of development can prevent many potential soil shrink-swell related problems during and following the completion of the project.

MOISTURE VARIATION PROTECTION MEASURES

It will be very important to consider measures to reduce future moisture fluctuations of the expansive clay under the floor slab. Heave and shrinkage of the clay are best reduced by providing horizontal and/or vertical moisture barriers around the edge of the slab. Typically the horizontal barriers would consist of concrete flatwork or asphalt or concrete pavement placed adjacent to the edge of the building.

If open ground exists next to the building, then shrinkage or heave can occur in the expansive clays located generally within 10 feet of the perimeter of the building. Shrinkage can occur due to hot, dry weather drawing moisture from the soils under the floor slab. Trees and large bushes also draw considerable water from the soils during dry periods increasing the soil shrinkage in the area of the tree. Conversely, periods of high rainfall or irrigated landscape beds can allow water under the edge of the slab creating a heave condition. Providing good surface drainage (min. 5% slope) at least 10 feet away from the building perimeter will be very beneficial. Also, sidewalks and pavements which minimize the infiltration and evaporation of water under the foundation slab will be most beneficial in maintaining long term moisture stability.

Landscape beds can be enclosed and connected to a subsurface drainage system directing water away from underneath the foundation slab. On expansive soil sites, no trees or other vegetation over six (6) feet in height shall be planted within 20 feet of the structure unless specifically accounted for in the foundation design. Roof drainage should be directed into a piping system or dumped at least 3 feet away from the edge of the foundation.

French drains or Strip drains may be used as a means of cutting off a "perched" groundwater condition. However, it is imperative that the French drains are sloped properly and are periodically maintained. Often the French drain is placed adjacent to the building and water collecting within the drain can be drawn into the drier expansive clays under the foundation slab resulting in perimeter floor heave.

Utility entrances into the building should be plugged with compacted clay or flowable fill so that transmission of water through any permeable bedding gravel or backfill material is minimized. The plug should extend at least 2 feet inside the exterior foundation beam to at least 4 feet outside the perimeter of the building.

Other recommendations for reduction in moisture variation under the foundation are shown in the table below.

Table 14: Requirements to Minimize Moisture Fluctuations under Building

Min. Horizontal Barrier Adjacent to Building	8 feet
Horizontal Barrier Type	Concrete or Asphalt Pavement
Roof Drains	Directed at least 5 feet away from Building with splash blocks or connected to storm sewer
Utility Entrance Into Building	No bedding gravel. Use clay bedding or Flowable Fill for outside 4 feet and inside 2 feet from perimeter entrance under floor to minimize water infiltration under foundation

ADDITIONAL DESIGN & CONSTRUCTION CONSIDERATIONS

SUBSURFACE VARIATIONS

Soil conditions may vary between the sample boring locations. Transition boundaries or contacts, noted on the boring logs to separate soil types, are approximate. Actual contacts may be gradual and vary at different locations. If conditions encountered during construction indicate more variation than established as a result of this study, we should be contacted to evaluate the significance of the changed conditions relative to our recommendations.

GEOLOGY

The earth materials underlying the project site have been regionally mapped as part of the Alluvium (Qal) terrace deposits of Quaternary age. No faults are known to cross through the project area and from a geologic point of view future seismic activity should pose minimal seismic risk to the proposed development.

GROUNDWATER

Water levels in open boreholes may require several hours to several days to stabilize depending on the permeability of the soils. Groundwater levels at this site differ during construction because fluctuations in groundwater levels result from seasonal conditions, rainfall, drought, or temperature effects.

Clay soils are generally not conducive to the presence of groundwater; however, pockets or seams of gravels, sands, silts or open fractures and joints can store and transmit "perched" groundwater flow or seepage.

MOISTURE VARIATIONS AND ESTIMATED SHRINK/SWELL MOVEMENT

PVR Method - The Tex 124-E method provides an estimate of potential vertical rise (PVR) using the liquid limits, plasticity indices, and the water contents for soils. The PVR is estimated in the seasonally active zone, which is typically near the 15 foot depth.

Estimated PVRs are based upon assumed typical changes in soil moisture content from a dry to a wet condition; however, soil movements in the field depend on the actual changes in moisture content. Thus, actual soil movements could be less than that calculated if little soil moisture variations occur or the actual movement could exceed the estimated values if actual soil moisture content changes exceed the PVR methods assumed dry and wet limits. This condition is often a result of extended droughts, flooding, "perched" groundwater infiltration, poor surface drainage, and/or leaking irrigation lines or plumbing.

Suction Method - Another method to predict heave of the expansive clay soils is the "Suction Method". Soil suction is the measure of a soil's affinity for water. Moisture migrates from areas of lower total suction to areas of higher total suction. Movements in expansive soils are generated by changes of suction which result from moisture entry or loss into the soil. Soil suction is typically measured using a pF scale. The pF value of a soil is the logarithmic value of a hypothetic column of water in centimeters which the energy state can support. Suction values vary due to climatic cycles from the surface to the depth of constant suction which is typically 5 to 20 feet below the ground surface. Below the constant suction (active) depth, soil suction remains relatively constant and is not affected by seasonal moisture changes.

This method involves taking soil samples at various depths, measuring the water content and the suction of the soil as well as other pertinent soil properties such as Atterberg Limits and complete soil particle size testing. A suction profile for the existing and expected wet to dry and dry to wet soil moisture variations anticipated for this site is estimated. Using the methods outlined in the Post-Tensioning Institute (PTI) 3rd Edition Design manual entitled *Design of Post-Tensioned Slabs-on-Grade*, the computer program "Volflo" was utilized to estimate potential heave values and foundation design parameters considering the soil parameters evaluated for this site.

FOUNDATION SYSTEM OPTIONS

Both shallow and deep foundation types are utilized in this area on expansive soils. Deep drilled piers are suited to buildings with moderate to heavy loading conditions or to support a suspended floor slab. The piers, when properly founded, can minimize foundation movement of the superstructure. Grade beams, isolated from the soil, typically span between the piers and either a structurally suspended slab or soil supported slab-on-grade is used at the ground floor level. The structurally suspended slab option is used when excellent performance is expected from the structure in terms of minimal aesthetic distress, such as floor tile, foundation and wall cracking.

A shallow foundation type consisting of a stiffened beam and slab-on-grade "waffle slab" is a common alternate approach for small to moderate size buildings. This foundation type is commonly used for light to moderate loading conditions and can be more cost-effective than a deep foundation system. When founded within expansive soils, subgrade improvement is recommended in order to reduce potential soil and foundation movement. Some aesthetic distress is normally acceptable to the owner and design team with this foundation alternative.

Each approach has its advantages and disadvantages in terms of cost and overall performance. Positive surface and subsurface drainage away from the foundation can play a key role in reducing the possibility of differential foundation movement and related aesthetic or structural distress. Structures founded on expansive clay soils can be expected to experience some distress.

Expansive clays shrink when they lose water and swell or grow in volume when they gain water content. Change in soil moisture is the single most important factor affecting the shrinking and swelling of clays. Therefore soils having a high Plasticity Index and located in an area that the soil moisture varies considerably from drought to wet seasons will typically experience the highest magnitude of foundation movement. Surface and subsurface drainage and the presence of trees and/or other large vegetation can also affect foundation performance significantly.

Structures constructed during dry periods on expansive soils generally experience the greatest amount of foundation movement as a result of water gaining access under the foundation. Water access under the foundation can occur from various sources including subsurface "perched" groundwater infiltration, poor surface drainage, leaking irrigation or plumbing lines, and/or climate change.

Often movement of a foundation placed on highly expansive clay will be minimal provided the soil moisture content remains stable over time. Although initial construction cost is generally higher, a structurally suspended floor slab system is often used instead of a soil supported floor slab on an improved building pad in order to reduce the risk of excessive foundation movements and floor/wall cracking.

UTILITIES

Utilities which go through the slabs should be designed with some flexibility to allow free movement in the lines as a result of potential soil shrinkage or swelling.

CONTROL AND CONSTRUCTION JOINTS

Concrete, mortar, grout, and concrete or clay masonry units as well as numerous other construction materials shrink and swell upon a loss or gain of moisture in much the same manner as expansive soils. Accordingly, material volume changes or potential foundation movements can cause wall or slab cracking to occur. In general, however, unsightly cracking can normally be eliminated by controlling crack locations and making them inconspicuous so that they do not detract from the appearance of the building. Crack control should typically be implemented in the overall building design by the implementation of control or contraction joints in the structure at proper intervals.

PAVEMENT DESIGN THICKNESS

The design thickness provided in SECTION I, should adequately handle the anticipated traffic loads; however, the recommended pavement thickness design cannot always counter the detrimental shrink-swell behavior of the expansive soils. Successful long-term performance depends in part on the implementation of good drainage, proper subgrade preparation, and good construction practices.

As the subgrade soils are expansive in nature, consideration of an under-drain system should be made to limit potential moisture fluctuations. Minimally, sub drains should be installed within catch basins to provide for some drainage of seepage water within the pavement base course. Accumulation of water beneath the asphaltic surface course or concrete can cause progressive and rapid deterioration of the pavement section. Similarly, pavement surfaces should be well drained to eliminate ponding with a two-percent minimum slope. Curbs should extend through the base materials and penetrate at least 3 inches into clay soils to minimize lateral seepage behind the curbs into the base materials.

Traffic can be allowed on the new concrete once required compressive strength is obtained but not sooner than seven (7) days from the time of placement. Mixture design using high early strength concrete is allowed. In general concrete should be designed and placed in general accordance with ACI 330R. Hot weather concreting should be performed in accordance with ACI 305R and Cold Weather Concreting should be performed in accordance with ACI306R.

Joints are placed in concrete pavements to control transverse and longitudinal cracking due to volume changes in concrete and the combined effects of restrained warping and loads. Joints are also used to divide the pavement into suitable increments for construction purposes.

It is recommended that all joints be sawed. The sawing of transverse contraction and longitudinal joints should be a 2-phase operation. The initial sawing is intended to cause the pavement to crack at the intended joint. It should be made to the required depth with a 1/8 inch blade. The second sawing provides the necessary shape factor for the sealant material. The second sawing can be made any time prior to sealant installation. However, the later the sealant reservoir is made, the better the condition of the joint face.

The time of the initial sawing, both in the transverse and longitudinal directions, is critical in preventing uncontrolled shrinkage cracking. It is very important that sawing begin as soon as the concrete is strong enough to both support the sawing equipment and to prevent raveling during the sawing operation. All joints should be sawed within 12 hours of concrete placement.

Concrete rigid pavement is recommended for use at heavy truck turning, loading, unloading, stopping, and starting areas and in front of and beneath garbage dumpster areas.

PAVEMENT CONSTRUCTION CRITERIA

Lime Stabilized Subgrade

If the decision to use lime is made, the subgrade should be stabilized to the specified thickness in accordance with TxDOT Item 260 of TxDOT Standard Specifications (2004). The quantity of lime required should be determined after the site is stripped of the loose soil and the subgrade soils are exposed. We anticipate that approximately four to seven percent lime will be required depending upon the material encountered; however, the actual percentage should be determined in laboratory tests on samples of the clayey subgrade prior to construction. The quantity of lime should be sufficient to result in a pH of at least 12.4 when tested in accordance with ASTM C 977, Appendix XI. The limed soil should be compacted to at least 95 percent of the standard Proctor maximum dry density as evaluated by ASTM D 698 at moisture contents ranging from optimum to plus four (+4) percentage points of optimum moisture content. A compaction test should be conducted per each 5,000 square feet of subgrade area.

Portland Cement Concrete

Higher concrete compressive strengths may be warranted by project specifications and design criteria. Proper concrete curing practices in accordance with ACI and PCA recommendations should be conducted.

CONSTRUCTION CRITERIA

Site Preparation

Strip away existing asphalt, concrete, utilities, foundations, topsoil, grass, organics, and deleterious debris as needed and dispose outside of the building and pavement areas. Undercut to the required depth and extent as noted in the table shown in the main report. Additional excavation may also be necessary due to encountering deleterious materials such as buried concrete or undesirable soft and wet subgrade conditions. Due to the existing site improvements, it is likely that buried foundations, utilities or other structures will be encountered during construction. The site representative of the geotechnical engineer should observe undercutting operations. Unless passing density reports are provided for a specific area, existing fill soils found during the excavation should be considered as uncertified and removed to suitable natural soils.

After the surface materials are removed, proofrolling of the exposed surface with a heavily loaded dump truck or pneumatic tired roller should be performed. Any areas which excessively yield or pump under the wheel loading should be undercut to the depth specified by the geotechnical engineer's representative and replaced with compacted on-site general fill soils to existing grade as specified. The voids in undercut areas can be backfilled and compacted with on-site general fill materials. The backfill should be placed and compacted in accordance with the General Fill requirements in Section I.

Voids created as a result of demolition and removal of existing structures should be replaced with flowable or where practical with on-site general fill materials placed and compacted as described above.

At least one density test should be conducted per 5,000 square feet of building pad per lift of prepared fill and subgrade or a minimum of three density tests should be taken per lift within the building pad area

Drainage

Good positive drainage during and after construction is very important to minimize expansive soil volume changes that can detrimentally affect the performance of the planned development. Proper attention to surface and subsurface drainage details during the design and construction phase of development can prevent many potential soil shrink-swell related problems during and following the completion of the project.

Earthwork and Foundation Acceptance

Exposure to the environment may weaken the soils at the foundation bearing level if the excavation remains open for long periods of time. Therefore, it is recommended that all foundation excavations be extended to final grade and constructed as soon as possible in order to minimize potential damage to the bearing soils. If bearing soils are exposed to severe drying or wetting, the unsuitable soil must be re-conditioned or removed as appropriate and replaced with compacted fill, prior to concreting. The foundation bearing level should be free of loose soil, ponded water or debris and should be observed prior to concreting by the geotechnical engineer or his representative.

Foundation concrete should not be placed on soils that have been disturbed by rainfall or seepage. If the bearing soils are softened by surface water intrusion during exposure or by desiccation, the unsuitable soils must be removed from the foundation excavation prior to placement of concrete.

Subgrade preparation and fill placement operations should be monitored by the soil engineer or his representative. As a guideline, at least one in-place density test should be performed for each 5,000 sq. ft. of compacted surface per lift or a minimum of three tests per lift. Any areas not meeting the required compaction should be recompacted and retested until compliance is met.

Drilled Piers

The Standard Specification for the Construction of Drilled Piers, ACI 336.1-97 is recommended for use. Acceptable methods of drilled pier installation for this project include a dry method and a temporary casing method. The dry method is generally used if the excavation can be made with little or no caving, sloughing, and with little or no water collecting in the excavation. When excessive sloughing and groundwater is encountered, temporary casing may be required during excavation and concreting. In most all cases, the excavation and concreting operation should be done on the same day without delay.

A major influence on the proper installation and subsequent behavior of drilled pier foundation systems is the existence of water bearing strata within the limits of the excavation. For deep drilled pier construction (below the water table), temporary steel casing will often be necessary to prevent water infiltration and sloughing of the soils into the pier excavation. The temporary casing may be required throughout the complete depth of the piers or through the water bearing granular soil layer and sealing into a lower more impervious clay layer.

Prior to placement of concrete, a Geotechnical Engineer or his representative should observe the drilled pier excavations to verify that piers are placed on bearing material having the qualities assumed in design. This observation should also verify that the excavation is clean, relatively dry and free of all loose material, that the shaft has the specified dimensions, and is plumb. Proper placement of reinforcing steel, and concrete observations and tests should be conducted. Concentric spacing of the rebar cage should be accomplished to establish minimum concrete cover requirements. The geotechnical engineer should be consulted immediately if problems occur with installation of the piers so that any necessary modifications can be made.

Care must be taken during concrete placement and casing removal so that sufficient concrete head is maintained inside the casing to reduce the possibility of soil intrusions in the pier concrete. Concrete should be placed as soon as possible after all loose material has been removed, the pier excavation inspected and reinforcing steel installed. A relatively high slump concrete mix (5 to 7 inches) is suggested to reduce problems related to the concrete adhering to the casing as the casing is removed and to reduce aggregate segregation caused by the reinforcing steel.

The installation techniques should be verified by drilling a test pier prior to actual pier construction. The Geotechnical Engineer or his representative should be present to witness the test pier excavation. No pier excavation should be allowed to stay open overnight.

Due to the presence of gravelly and sandy soils that can transmit perched groundwater and may also be prone to sloughing, the use of temporary casing may be needed for this project to control groundwater influx and/or sloughing soils should they occur. Therefore, a contract pay item for the use of temporary casing should be implemented.

It should be noted that a high torque drilling rig capable of drilling in rock will be necessary for this project due to the very hard clays and dense clayey gravels that were encountered.

A maximum of 6 inches of water seepage is allowed just prior to concreting. If this requirement cannot be met, concrete placement by tremie or temporary casing and pumping out of groundwater from the borehole bottom will be required. Proper tremie or concrete pump requirements are recommended by the Drilled Shaft Inspector's manual prepared by the Joint Liaison Drilled Shaft Committee, 1989. In all cases, the tremie pipe should always be kept well within the rising head of concrete as the pipe is withdrawn.

Add/deduct unit price provisions should also be made in the contract documents for potential field changes to pier design bearing elevation or depths, as needed.

Drilled shaft concrete may be placed by free fall into dry boreholes if it falls to its final position through air without excessively striking the sides of the excavation, the rebar cage or other obstruction. Carefully directing the concrete from the concrete chute down through the center of the shaft is acceptable. Concrete slump should generally fall in the range of five to eight inches.

Trench Excavations

Excavations should comply with OSHA Standard 29CFR, Part 1926, Subpart P and all State of Texas and local requirements. Trenches 20 feet deep or greater require that the protective system be designed by a registered professional engineer. A trench is defined as a narrow excavation in relation to its depth. In general, the depth is greater than the width, but the bottom width of the trench is not greater than 15 feet. Trenches greater than 5 feet in depth require a protective system such as trench shields, trench shoring, or sloping back the excavation side slopes.

The Contractor's "Competent Person" shall perform daily inspections of the trench to verify that the trench is properly constructed and that surcharge and vibratory loads are not excessive, that excavation spoils are sufficiently away from the edge of the trench, proper ingress and egress into the trench is provided and all other items are performed as outlined in these OSHA regulations. It is especially important for the inspector to observe the effects of changed weather conditions, surcharge loadings, and cuts into adjacent backfills of existing utilities. The flow of water into the base and sides of the excavation and the presence of any surface slope cracks should also be carefully monitored.

Although the geotechnical report provides an indication of soil types to be anticipated, actual soil and groundwater conditions will vary along the trench route. The "Competent Person" must evaluate the soils and groundwater in the trench excavation at the time of construction to verify that proper sloping or shoring measures are performed.

Appendix B to the regulations has sloping and benching requirements for short-term trench exposure for various soil types up to the maximum allowable 20-foot depth requirement.

MOISTURE VARIATION PROTECTION MEASURES

In order to reduce the potential for water entering under the floor slab, we recommend that relatively impervious cover (i.e. concrete sidewalks, asphalt pavement) exist around the perimeter of the structure. This will also help reduce soil moisture fluctuations which typically occur near the exterior portion of the foundation due to climate changes and minimize water access into the select fill.

It is very important that all utilities entering under the foundation be sealed with a flowable fill or compacted clay plug so that access for water under the foundation is minimized. The intent of these recommendations is to reduce potential soil movements by reducing the potential for surface water seepage into the foundation soilsl.

QUALITY CONTROL

As Geotechnical Engineer of record, we should be engaged to observe and evaluate the foundation installation and earthwork for site subgrade improvement activities to determine that the actual bearing materials are consistent with those encountered during the field exploration and to monitor and test the subgrade preparation and select fill placement. It is also important that we be given the opportunity to review the design and construction documents. The purpose of this review is to check to see if our recommendations are properly interpreted into the project plans and specifications.

GENERAL COMMENTS

The scope of this study is to provide geotechnical engineering criteria for use by design engineers in preparing the foundation and pavement design. Environmental studies of any kind were not a part of our scope of work or services even though we are capable of providing such services.

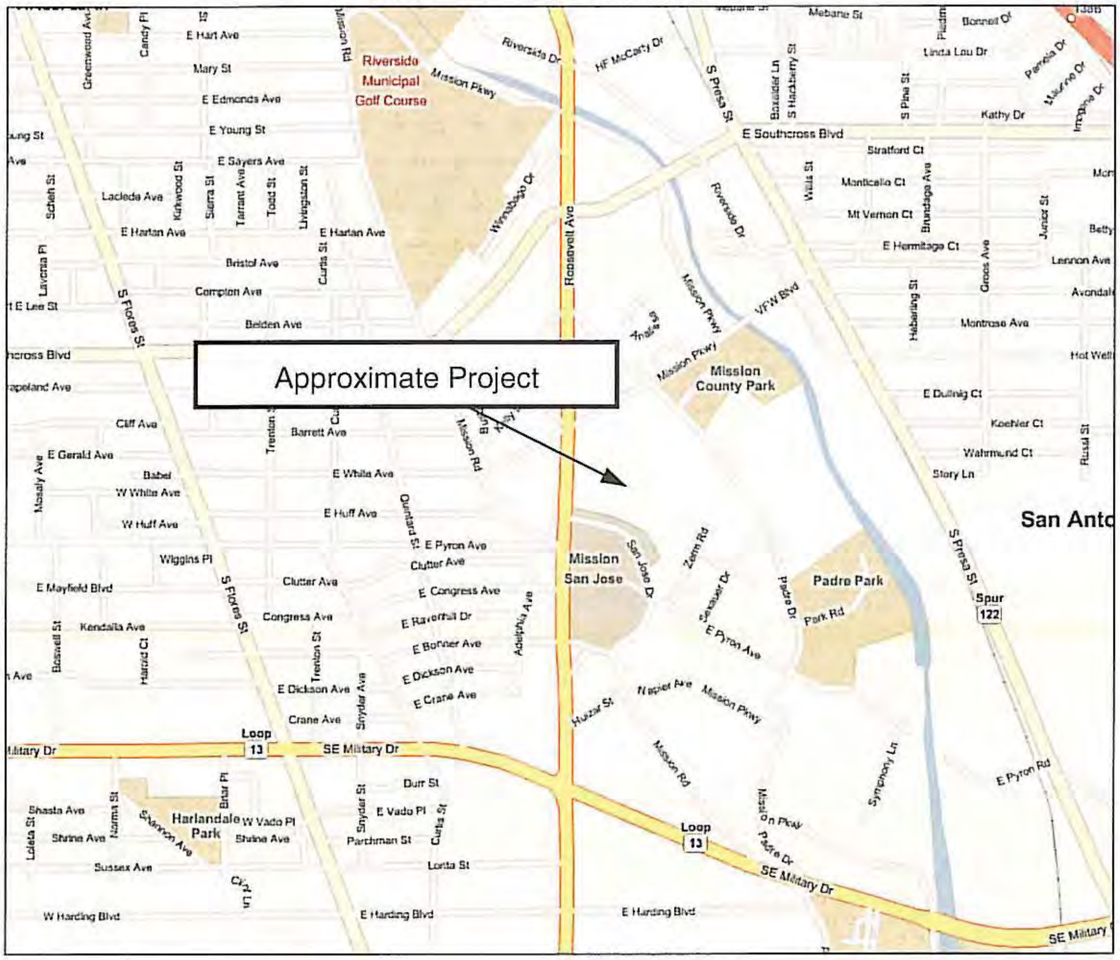
This report was prepared for this project exclusively for the use of Mr. Ronnie Biediger of Kell Munoz Architects, Inc. and his design team. If the development plans change relative to building layout, size or anticipated loads, or if different subsurface conditions are encountered, we should be informed and retained to ascertain the impact of these changes on our recommendations. We cannot be responsible for the potential impact of these changes if we are not informed.

The soils to be penetrated by excavations may vary significantly across the site. Our soil classification is based solely on the materials encountered in widely spaced exploratory test borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, we recommend that Arias be contacted immediately to evaluate the conditions encountered.

This report has been prepared in accordance with ordinary degree of skill and care that would be used by other reasonably competent geotechnical engineers under similar circumstances, taking into consideration the contemporary state of the art and geographic idiosyncrasies.

APPENDIX A: SITE VICINITY MAP

SITE VICINITY MAP



Proposed New District 3 Branch Library
Roosevelt and VFW Boulevard
San Antonio, Texas

APPENDIX B: REPRESENTATIVE SITE PHOTOS

Representative Site Photos

Photo No. 1

Photo No. 2

Representative Site Photos

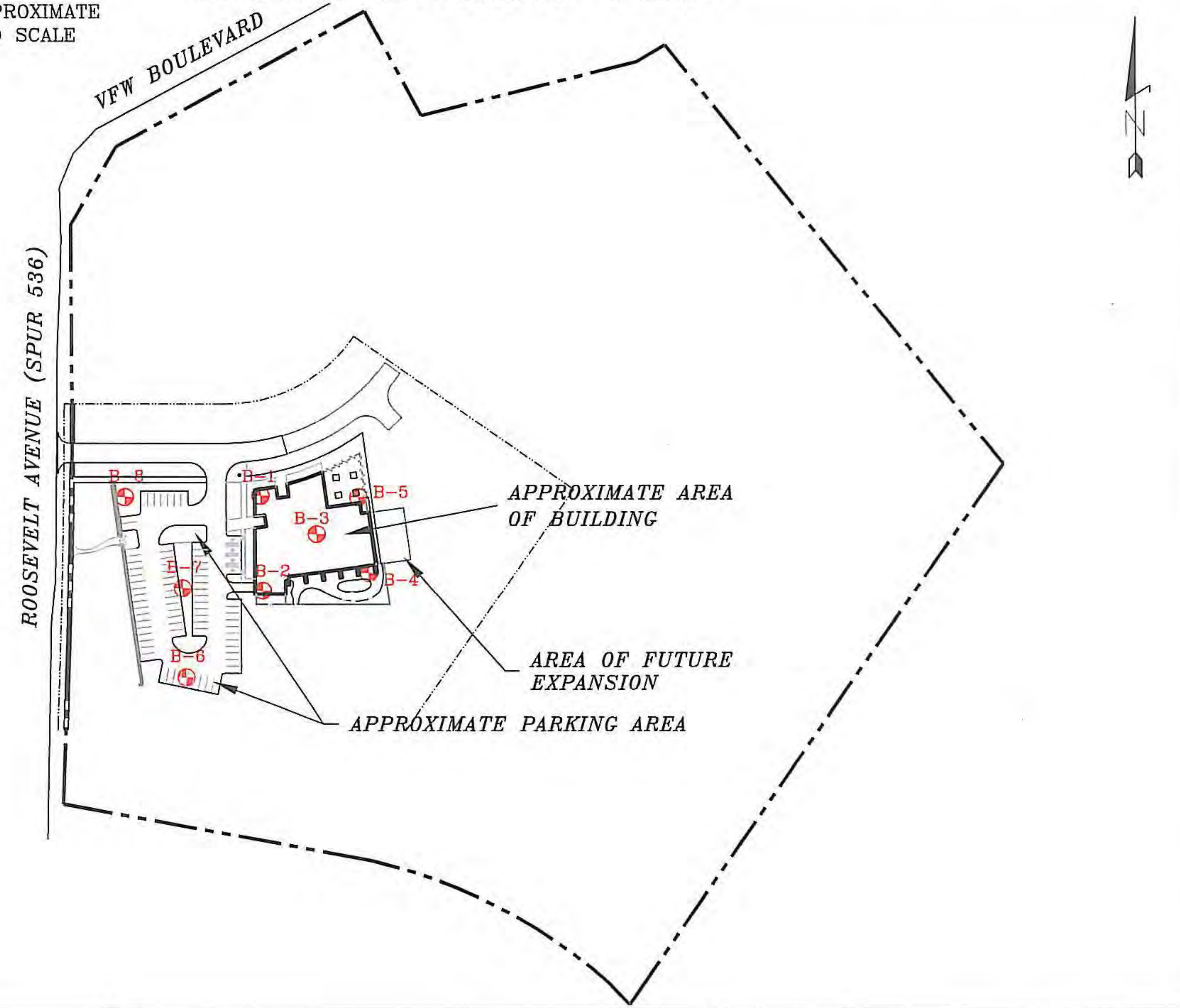
Photo No. 3

Photo No. 4

APPENDIX C: BORING LOCATION PLAN AND SOIL BORING LOGS

BORING LOCATION PLAN

NOTE: LOCATIONS ARE APPROXIMATE
DRAWING IS NOT TO SCALE



Arias Job No. 08-2298	City of San Antonio-District 3 New Branch Library Roosevelt Avenue (Spur 536) and VFW Boulevard San Antonio, Texas	ARIAS & ASSOCIATES, INC.

Boring Log No. B-1

Address: **Roosevelt and VFW Boulevard**
San Antonio, Texas
Location:

Project: **District 3 New Branch Library**
Logged By: **RA** Elev.:
Sampling Date: **2/4/09**

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAY (CH), some Sand, trace Gravel, dark gray brown to gray brown, hard to stiff		1: ST	21	21	58	37	5.75		
		2: ST	20				5.0		
	5	3: ST	21				3.50		84
		4: ST	20				2.0		
		5: ST	27				1.50		
	10								
FILL: Clayey GRAVEL (GC), with Sand, tan, dense		6: SS	14					33	14
CLAY (CH), tan and gray, hard									
	15	7: ST	28				4.50		
		8: ST	28	25	89	64	6.25		
	20								
		9: ST	28				5.50		
	25								
		10: ST	28	25	87	62	5.0		
	30								
Completion Depth: 30.0 ft.									

Groundwater During Drilling: Observed at 28.4 ft.
Groundwater 24 hrs After Drilling:Observed at 14.0 ft.
Hole Caved at 18.7 ft.

- ☒ Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- ▽ Water encountered during drilling
- ▼ Delayed water reading

Refer to Appendix for Additional Information

SN = Sample Type and No.
ST = Shelby Tube Sample
SS = Split Spoon Sample
WC = Water Content (%)
N = SPT Blow Counts
PL = Plastic Limit (%)
LL = Liquid Limit (%)
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
-200 = % Passing #200 Sieve

Boring Log No. B-2

Address: **Roosevelt and VFW Boulevard**
San Antonio, Texas
Location:

Project: **District 3 New Branch Library**
Logged By: **RA** Elev.:
Sampling Date: **2/4/09**

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	-200	pF
0.5" ASPHALT FILL: Clayey GRAVEL (GC), with Sand (4.5" Base), tan		1: GB	5 22						3.7
CLAY (CH), dark brown to gray brown, hard		2: ST	22	18	56	38	4.75		3.5
	5	3: ST	18	17	58	41	6.25		4.0
		4: ST	18				4.75		3.7
	10	5: ST	18				5.50		3.5
CLAY (CL), some calcareous deposits, light gray brown to tan, hard to very stiff		6: ST	27	19	38	19	2.0		2.9
Clayey SAND (SC), with Gravel, tan, dense	15	7: ST	21				1.50	33	3.1
Sandy CLAY (CL), trace Gravel, tan, hard	20	8: ST	25				4.75		3.4
CLAY (CH), tan and gray, hard	25	9: ST	29	25	98	73	5.25		3.8
	30	10: ST	29				7.0		3.8
Completion Depth: 30.0 ft.									

Groundwater During Drilling: Observed at 18.0 ft.
Groundwater 24 hrs After Drilling:Observed at 18.5 ft.
Hole Caved at 21.5 ft.

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

Refer to Appendix for Additional Information

SN = Sample Type and No.
ST = Shelby Tube Sample
GB = Grab Bag Sample
WC = Water Content (%)
PL = Plastic Limit (%)
LL = Liquid Limit (%)
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
-200 = % Passing #200 Sieve
pF = Soil Suction

BORING LOG REVISED 08-2298.GPJ ARIAS.GDT 2/26/09

Arias & Associates, Inc.

Job No.: 08-2298

Boring Log No. B-3

Address: **Roosevelt and VFW Boulevard**
San Antonio, Texas
Location:

Project: **District 3 New Branch Library**
Logged By: **RA** Elev.:
Sampling Date: **2/4/09**

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
CLAY (CH), dark gray brown, very hard		1: ST	15				10.25		
CLAY (CL), light brown to tan, very hard to very stiff		2: ST	14	17	48	31	14+		
	5	3: ST	13				14+		
		4: SS	10					26	
	10	5: SS	18	14	36	22		23	
Clayey GRAVEL (GC), with Sand, tan, very dense		6: SS	8					**50/5"	
	15	7: SS	8					**50/6"	27
CLAY (CH), tan and gray, hard	20	8: ST	30	25	94	69	6.75		
	25	9: ST	30				6.0		
	30	10: ST	27				5.75		
CLAYSTONE (Blue Shale), light bluish gray	35	11: ST							
Completion Depth: 35.0 ft.									

Groundwater During Drilling: Observed at 16.8 ft.
Groundwater 24 hrs After Drilling:Observed at 14.6 ft.
Hole Caved at 21.0 ft.

- ☒ Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- ▽ Water encountered during drilling
- ▼ Delayed water reading

Refer to Appendix for Additional Information

SN = Sample Type and No.
ST = Shelby Tube Sample
SS = Split Spoon Sample
WC = Water Content (%)
N = SPT Blow Counts
** = Blow Counts During Seating Penetration
PL = Plastic Limit (%)
LL = Liquid Limit (%)
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
-200 = % Passing #200 Sieve

BORING LOG REVISED 08-2298.GPJ ARIAS.GDT 2/26/09

Boring Log No. B-4

Address: **Roosevelt and VFW Boulevard**
San Antonio, Texas
Location:

Project: **District 3 New Branch Library**
Logged By: **RA** Elev.:
Sampling Date: **2/4/09**

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
2" ASPHALT			5						30
FILL: Clayey GRAVEL (GC), with Sand (7" Base)		1: GB	19						
CLAY (CH), dark brown to brown, hard		2: ST	19	17	53	36	5.0		
	5	3: ST	21				5.0		
CLAY (CL), tan, hard		4: ST	17	14	37	23	5.0		
Clayey GRAVEL (GC), with Sand, tan, very dense		5: SS	8					50/6"	11
	10	6: GB	12						
	15	7: SS	10	17	37	20		50/6"	
CLAY (CH), tan and gray, hard	20	8: ST	29				5.75		
	25	9: ST	27				6.0		
	30	10: ST	27	25	86	61	5.50		
Completion Depth: 30.0 ft.									

Groundwater During Drilling: None Observed
Groundwater 24 hrs After Drilling:Observed at 29.0 ft.
Hole Caved at 29.3 ft.

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

Refer to Appendix for Additional Information

SN = Sample Type and No.
ST = Shelby Tube Sample
SS = Split Spoon Sample
GB = Grab Bag Sample
WC = Water Content (%)
N = SPT Blow Counts
PL = Plastic Limit (%)
LL = Liquid Limit (%)
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
-200 = % Passing #200 Sieve

BORING LOG REVISED 08-2298.GPJ ARIAS.GDT 2/26/09

Boring Log No. B-5

Address: **Roosevelt and VFW Boulevard**
San Antonio, Texas
Location:

Project: **District 3 New Branch Library**
Logged By: **RA** Elev.:
Sampling Date: **2/4/09**

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	N	-200
1.5" ASPHALT			5						
FILL: Clayey GRAVEL (GC), with Sand (6" Base)		1: GB	19	16	59	43			
CLAY (CH), brown, hard		2: ST	19				6.0		
	5	3: ST	19				6.75		
CLAY (CL), tan, hard		4: ST	13				8.75		
	10	5: ST	15	14	39	25	7.0		
Clayey GRAVEL (GC), with Sand, tan, very dense		6: SS	12					**50/6"	24
Clayey SAND (SC), with Gravel, tan, very dense	15	7: SS	13					50/3"	46
Sandy CLAY (CL), with Gravel, tan, hard	20	8: SS	20					33	
CLAY (CH), tan and gray, hard	25	9: ST	29	25	91	66	6.75		
	30	10: ST	28				5.0		
Completion Depth: 30.0 ft.									

Groundwater During Drilling: Observed at 18.5 ft.
Groundwater 24 hrs After Drilling:Observed at 17.0 ft.
Hole Caved at 20.4 ft.

- ☒ Grab Bag Sample (GB)
- ■ Shelby Tube Sample (ST)
- ▯ Split Spoon Sample (SS)
- ▽ Water encountered during drilling
- ▼ Delayed water reading

Refer to Appendix for Additional Information

SN = Sample Type and No.
ST = Shelby Tube Sample
SS = Split Spoon Sample
GB = Grab Bag Sample
WC = Water Content (%)
N = SPT Blow Counts
** = Blow Counts During Seating Penetration

PL = Plastic Limit (%)
LL = Liquid Limit (%)
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
-200 = % Passing #200 Sieve

BORING LOG REVISED 08-2298.GPJ ARIAS.GDT 2/26/09

Boring Log No. B-6

Address: **Roosevelt and VFW Boulevard**
San Antonio, Texas
Location:

Project: **District 3 New Branch Library**
Logged By: **RA** Elev.:
Sampling Date: **2/4/09**

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP
0.5" ASPHALT							
FILL: Clayey GRAVEL (GC), with Sand (6" Base)			4				
FILL: CLAY (CH), brown, hard	1	1: GB	23	17	56	39	
	2						
	3	2: ST	16				7.25
CLAY (CH), dark brown, hard	4						
	5	3: ST	23	18	58	40	5.75
Completion Depth: 6.0 ft.	6						
	7						
	8						

Groundwater During Drilling: None Observed

- Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- Water encountered during drilling
- Delayed water reading

Refer to Appendix for Additional Information

SN = Sample Type and No.
ST = Shelby Tube Sample
GB = Grab Bag Sample
WC = Water Content (%)
PL = Plastic Limit (%)
LL = Liquid Limit (%)
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

BORING LOG REVISED 08-2298.GPJ ARIAS.GDT 2/26/09

Boring Log No. B-7

Address: **Roosevelt and VFW Boulevard**
San Antonio, Texas
Location:

Project: **District 3 New Branch Library**
Logged By: **RA** Elev.:
Sampling Date: **2/4/09**

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP	-200
0.5" ASPHALT								
FILL: Clayey GRAVEL (GC), with Sand (5" Base)			6					18
CLAY (CH), dark brown, hard	1	1: GB	22					
	2							
	3	2: ST	21				6.0	
CLAY (CH), tan, very stiff	4							
	5	3: ST	17	17	52	35	3.0	
Completion Depth: 6.0 ft.	6							
	7							
	8							

Groundwater During Drilling: None Observed

- ☒ Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- ∇ Water encountered during drilling
- ▼ Delayed water reading

Refer to Appendix for Additional Information

SN = Sample Type and No.
ST = Shelby Tube Sample
GB = Grab Bag Sample
WC = Water Content (%)
PL = Plastic Limit (%)
LL = Liquid Limit (%)
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)
-200 = % Passing #200 Sieve

BORING LOG REVISED 08-2298.GPJ ARIAS.GDT 2/26/09

Boring Log No. B-8

Address: **Roosevelt and VFW Boulevard**
San Antonio, Texas
Location:

Project: **District 3 New Branch Library**
Logged By: **RA** Elev.:
Sampling Date: **2/4/09**

Soil Description	Depth (ft)	SN	WC	PL	LL	PI	PP
0.5" ASPHALT							
FILL: Clayey GRAVEL (GC), with Sand (6.5" Base)			6				
CLAY (CH), dark brown, hard	1	1: GB	19	18	60	42	
	2						
	3	2: ST	18				4.75
CLAY (CL), light brown, very stiff	4						
	5	3: ST	18	17	39	22	3.0
Completion Depth: 6.0 ft.	6						
	7						
	8						

Groundwater During Drilling: None Observed

- ☒ Grab Bag Sample (GB)
- Shelby Tube Sample (ST)
- Split Spoon Sample (SS)
- ▽ Water encountered during drilling
- ▼ Delayed water reading

Refer to Appendix for Additional Information

SN = Sample Type and No.
ST = Shelby Tube Sample
GB = Grab Bag Sample
WC = Water Content (%)
PL = Plastic Limit (%)
LL = Liquid Limit (%)
PI = Plasticity Index
PP = Pocket Penetrometer (tsf)

BORING LOG REVISED 08-2298.GPJ ARIAS.GDT 2/26/09

APPENDIX D: KEY TO CLASSIFICATION SYMBOLS

KEY TO CLASSIFICATION SYMBOLS USED ON BORING LOGS

MAJOR DIVISIONS			GROUP SYMBOLS	DESCRIPTIONS
COARSE-GRAINED SOILS (More Than Half of Material LARGER Than No. 200 Sieve size)	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	Silty Gravels, Gravel-Sand-Silt Mixtures
			GC	Clayey Gravels, 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	Silty Sands, Sand-Silt Mixtures
			SC	Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS (More Than Half of Material is SMALLER Than No. 200 Sieve Size)	SILTS & CLAYS	Liquid Limit Less Than 50	ML	Inorganic Silts & 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
	SILTS & CLAYS	Liquid Limit Greater Than 50	MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils, Elastic Silts
			CH	Inorganic Clays of High Plasticity, Fat Clays
FORMATIONAL MATERIALS	SANDSTONE			Massive Sandstones, Sandstones with Gravel Clasts
	MARLSTONE			Indurated Argillaceous Limestones
	LIMESTONE			Massive or Weakly Bedded Limestones
	CLAYSTONE			Mudstone or Massive Claystones
	CHALK			Massive or Poorly Bedded Chalk Deposits
	MARINE CLAYS			Cretaceous Clay Deposits
	GROUNDWATER		▼	Indicates Final Observed Groundwater Level
			▽	Indicates Initial Observed Groundwater Location

Arias & Associates, Inc.

APPENDIX E: LABORATORY AND FIELD TEST PROCEDURES

Laboratory and Field Test Procedures

Soil Classification, ASTM D2487 - Soil testing standard used for classifying soils according to the Unified Soil Classification System. The soil classifications of the earth materials encountered are as noted on the boring logs.

Soil Water Content, ASTM D2216 - Test determines the water content of soil or rock expressed as a percentage of the solid mass of the soil. The test results are listed under MC in the attached boring logs.

Soil Liquid Limit, ASTM D4318 - The soil Liquid Limit identifies the upper limit soil water content at which the soil changes from a moldable (plastic) physical state to a liquid state. The Liquid Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under LL on the boring logs.

Soil Plastic Limit, ASTM D4318 - The soil Plastic Limit identifies a lower limit soil water content at which the soil changes from a moldable (plastic) physical state to a non-moldable (semi-solid) physical state. The Plastic Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under PL on the boring logs.

Plasticity Index, ASTM D4318 - The soil Plasticity Index is the numeric difference between the Liquid Limit and Plastic Limit. This index also defines the range of water content over which the soil-water system acts as a moldable (plastic) material. Higher Plasticity Index (PI) values indicate that the soil has a greater ability to change in soil volume or shrink and swell with lower or higher water contents, respectively. Results are listed under PI on the boring logs.

Standard Penetration Test (SPT) and Split Spoon Sampler (SS), ASTM D 1586 - Standard test method for both the penetration test and split-barrel (spoon) sampling of soils. This sampling method is used for soils or rock too hard for sampling using Shelby Tubes. The method involves penetration of a split spoon sampler into the soil or rock through successive blows of a 140 pound hammer in a prescribed manner.

Blow Counts (N), ASTM D 1586 - The number of blows required to drive a Split Spoon Sampler by means of a 140 pound hammer for a distance of 12 inches in accordance with the variables stated in the test procedures.

Shelby Tube (ST), ASTM D 1587 – Procedure for using a thin-walled metal tube to recover relatively undisturbed soil samples suitable for laboratory tests of physical properties.

Rock Core, ASTM D 2113 – Procedure for using diamond core drilling equipment to obtain core samples of rock and some soils that are too hard to sample by soil-sampling methods.

Dry Density (DD), ASTM D 2937 - Procedure used for the determination of in-place density of soil. The test results are measured in pounds per cubic foot, pcf.

Unconfined Compression Test (UC), ASTM D 2166 - Test method covers the determination of the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition, using strain-controlled application of the axial load.

Minus No. 200 Sieve, ASTM D 1140 - Test method covers determination of the amount of material finer than a Number 200 sieve by washing. The results are stated as a percent of the total dry weight of the sample.

Pocket Penetrometer (PP) - Test method is an accepted modification of ASTM D 1558 test method for establishing the moisture-penetration resistance relationships of fine-grained soils. The test results are measured in tons per square foot, tsf. The strength values provided by this method should be considered qualitatively.

Rock Quality Designation (RQD) - The measure of the quality of a rock mass defined by adding intact rock core pieces greater than four inches in length by the total length of core advance per ASTM 6032.

Recovery Ratio (REC) - The Recovery Ratio is equal to the total length of core recovered divided by the total length of core advance.

Boring Logs - Illustrate a summary of the above described information at each boring location.

SECTION 321401 - STONE PAVERS

PART 1 - GENERAL

RELATED DOCUMENTS

Requirements of Drawings, General and Supplementary Conditions and DIVISION 1 apply to this Section.

SCOPE

Provide all exterior stone paver work including but not necessarily limited to:

Stone pavers, ungrouted mortarless applications

Related work specified elsewhere:

Earthwork	SECTION 312000
Cast-in-place concrete	SECTION 033000
Joint sealants	SECTION 079200
Stone masonry	SECTION 044300

QUALITY ASSURANCE

Prior to installation of stone pavers, fabricate mock-up using materials, pattern and joint treatment indicated for project work, including special features for expansion joints and contiguous work. Build mock-up in form of panel at the site, in location indicated or directed, of full thickness and approximately 12 square feet in area, unless otherwise indicated. Provide range of color, texture and workmanship to be expected in the completed work. Obtain Architect's acceptance of visual qualities of mock-up before start of stone paver work. Retain mock-up during construction as a standard for judging completed unit paver work. Do not move or destroy mock-up until work is completed.

Provide mock-up for each type of stone pavers and application required.

Do not change source of stone for paver units, setting materials, or other during progress of work.

SUBMITTALS

Submit manufacturer's technical data for each manufactured product, including certification that each product complies with specified requirements.

Submit samples made up of actual stone pavers for each type, color and texture required. Include in each set of samples the full range of exposed color and texture to be expected in the completed work. Submit samples of sand materials.

DELIVERY, STORAGE, AND HANDLING

Protect stone pavers and aggregate during storage and construction against wetting by rain, snow or ground water and against soilage or intermixture with earth or other types of materials.

PROJECT CONDITIONS

Do not use frozen materials or materials mixed or coated with ice or frost.

Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

Protect stone paver work against freezing when atmospheric temperature is 40 deg.F (4 deg.C) and falling. Heat materials and provide temporary protection of completed portions of stone paver work. Comply with requirements of International Masonry All-Weather Council's "Guide Specification for Cold-Weather Masonry Construction", Section 04810, Article 3.

PART 2 - PRODUCTS

STONE PAVERS

Stone Pavers Pavers: Solid units matching building stone masonry from same quarry source, dressed exposed side surface, of sizes indicated, complying with the following:

San Saba Sandstone

Color and Texture: Match building stone.

Thickness: 4 inches or as indicated, whichever is greater.

UNGROUTED MORTARLESS SETTING MATERIALS FOR STONE PAVERS

Graded Aggregate for Base: Quality controlled, graded aggregate complying with ASTM D 2940 for base material.

Sand for Leveling Course: Fine aggregate complying with ASTM C 33.

Sand for Joints: ASTM C 144, gradation for unusually thin joints.

Drainage Geotextile Fabric: Nonwoven needle-punched geotextile fabric, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

Survivability: Class 2, AASHTO M 288.
Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.

Permittivity: 0.5 per second, minimum; ASTM D 4491.
UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.

Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

Water: Clean and potable.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Inspect substrate to receive paving. Do not proceed before any unsatisfactory conditions have been corrected.

Do not use pavers with chips, cracks, voids, discolorations or other defects which might be visible or cause staining in finished work.

Mix pavers from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

Cut pavers with motor-driven saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting wherever possible.

Match existing unit paver patterns and jointing as indicated.

Tolerances: Do not exceed 1/16" unit-to-unit offset from flush, and a tolerance of 1/8" in 2'-0" and 1/4" in 10'-0" from level or slope as indicated, for finished surface of paving.

Install joint filler where sealant type joints are shown. For joint filler and sealant materials and for their installation requirements, refer to Section 07920.

Provide edging as indicated, and in compliance with manufacturer’s recommendations. If no edging shown abutting soil conditions, provide 4” metal edging with ground stakes flush to top of pavers. Install edging prior to placing unit pavers.

UNGROUTED MORTARLESS CONCRETE PAVER APPLICATIONS

Place graded aggregate for base over compacted subgrade. Provide compacted thickness of base indicated, but not less than 8 inches. Compact base to at least 100 percent of ASTM D 1557 maximum laboratory density.

Place geotextile fabric over base course, lapping sections not less than 12”.

Place sand for leveling course and screed loose to a thickness of 1” to 1-1/2", taking care to ensure it remains loose until paving units are set and compacted.

Treat leveling base with soil sterilizer to prohibit growth of grass and weeds.

Set stone pavers hand tight, being careful not to disturb leveling base. Ccut edges when full-size units cannot be used. Select pavers from 4 or more pallets to blend color and texture variations.

Vibrate concrete pavers into leveling base with a plate vibrator capable of a 3,500 to 5,000 lb. compaction force, minimum three passes. Protect stone surfaces. Perform this operation on installed areas of paving at end of each day or before any rain. Do not allow traffic on pavers until sand has been vibrated into joints.

Fill joints after vibration with sand for joints. Vibrate and add sand until joints are completely filled, then remove excess sand. Repeat joint-filling process 30 days later.

REPAIR, POINTING, CLEANING & PROTECTION

Remove and replace unit pavers which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit paver work being without damage or deterioration at time of substantial completion.

- Σ -

November 16, 2011

Mr. Victor Carrillo
Kell Munoz
1017 N. Main, suite 300
San Antonio, Texas 78212

Email: victorc@kellmunoz.com

Re: Mission Marquee Plaza
V&A Project No. 2203-003-025

Dear Mr. Carrillo,

This letter is in response to your comment, received by email on November 15, 2011, for the above project. Your comment and our response is as follows:

1. IFB page 1 : bids submit to 114 W. Commerce St. conversely Instructions to bidders page states bids to 100 Military Plaza. PLEASE CLARIFY

   Response: N/A to Civil

2. Instructions to bidders page 5 Item 5(a) 7 "City may reject offer if subcontractor/supplier utilization plan and city of San Antonio subcontractor...utilizing small contract goals is not submitted with bid. No SBEDA information is included in my specification. PLEASE CLARIFY IF SBEDA PLAN IDS REQUIRED AND WHICH OF THE LATEST AND OR GREATEST PLAN APPROACHES WILL BE USED IF ANY.

   Response: N/A to Civil

3. There are two sets of General Conditions included. One for buildings and one for heavy highway. Which dictates? or will there be two contracts issued. I understand the wage breakout between buildings and sitework. PLEASE CLARIFY

   Response: N/A to Civil

4. Civil Sheet 104 section AA has several interesting issues. 1: Is the header curb 2.5" as labeled or 2' 5" or 15" as detailed on C107 detail 4. Same with the 6" stand up curb is it as drawn on AA or 15 1/2" as per C107 detail 12. What is the 1.5" pervious paving that goes over the 1.5" asphalt and over the adjacent sidewalk? This is contrary to the plan sheets.

   Response: The header curb should be 2.5' deep in order to protect the pavement section. The 6" stand up curb is as shown in the details on Sheet C107. An 1.5" thick layer of pervious paving will be added on top of the existing asphalt (see Detail 6 on Sheet C107) as well as over the proposed asphalt (see Detail 13 Sheet C107) and header curb (as shown on Cross Section A-A). The adjacent sidewalk in Cross Section A-A has been removed to match the plan sheet.

5. C100 Note 53 and all civil drawings detail and denote the wheel stops to be concrete. Sheet a106 detail 2 denotes them to be one solid piece of cut SanSaba Stone. Please clarify which and If it is Stone do you have a contact for a supplier. During my site visit I noticed the ones across the street installed by EZ Bel are the standard concrete ones. Will they need to be replaced with stone ones?

   Response: *The wheel stops will be stone. The concrete has been deleted from the civil plans and a note has been added to refer to the architectural drawings for the wheel stop details.*

6. Detail 10 sheet C107: Where are the detectable pavers required. None are located on the plans.

   Response: *A handicapped ramp with detectable pavers has been added where the sidewalk meets the driveway to VFW Blvd.*

7. Where does detail 2 sheet 107 occur, not tagged on the plans.

   Response: *There will be no curb weep holes in this project. Detail 2 has been removed from Sheet C107.*

8. Since the geotechnical report is not part of the documents what is required under the flatwork and front plaza. Detail 11/C107 requires 3" of base under flatwork. The plaza is on the architectural. The PVR for the foundation must be fairly high since piers and carton forms are required. PLEASE CLARIFY

   Response: *The plaza is beyond the scope of the civil plans and should be constructed based on the structural and architectural plans. All interior sidewalks will also now be detailed and constructed based on the architectural plans.*

9. Is the road, once completed by EZ Bel to remain in use during construction and if so what barricading from the general public will be required?

   Response: *The road will only be closed during the installation and subsequent curing of the permeable pavement.*

Please contact us if you have any questions.

Sincerely,

VICKREY & ASSOCIATES, INC.
Texas Board of Professional Engineers Registration #F-159

Allison Guettner

Allison Guettner. E.I.T.
Junior Engineer

Reviewed by:

Brady Baggs

Brady D. Baggs, P.E.
Project Manager

AG/sj:km

DRAWINGS:

ITEM #3 / I-2 SHEET I-101

A. Changed routing of mainline out of bioswale.
B. Adjusted spray heads to accommodate change in landscape.

ITEM #3 / I-3 SHEET I-104

A. Changed routing of mainline out of bioswale.
B. Adjusted spray heads to accommodate change in landscape.

ITEM #3 / I-4 SHEET I-105

A. Changed routing of mainline out of bioswale.
B. Adjusted spray heads to accommodate change in landscape.

ITEM #3 / I-5 SHEET I-106

A. Changed routing of mainline out of bioswale.
B. Adjusted spray heads to accommodate change in landscape.

COSA - MISSION MARQUEE PLAZA
ADDENDUM #3
November 16, 2011

D R A W I N G S -

ITEM # 3/M-1: SHEET M-102

A. Revised keyed note number 4.

B. Revised keyed note number 7.

C. Added keyed note number 8.

D. Removed thermostat wire connection to unit, per the wireless thermostat that is provided by the unit manufacturer for controlling AHU-01.

ITEM # 3/E-1: SHEET E-101, NOT ISSUED

A. At Detail 2, outside the loop road, change keyed note No. 3 to No. 2, and keyed note No. 7 to No. 3.

ITEM # 3/E-2: SHEET E-102, NOT ISSUED

A. At Detail 1, in Corridor 101 change exit lights to ceiling mounted.
B. Modified general note No. 8 from "CORRIDORS, FOYERS, HALLWAYS" to just "CORRIDORS, HALLWAYS."

ITEM # 3/E-3: SHEET E-201

A. Modified panel schedule titles to reflect existing and new panels.
B. Modified division numbers in notes on the equipment connection schedule.
C. Modified NEC code to 2008 in general notes on equipment connection schedule.
D. Added keyed note No. 11 as noted on drawing.

ITEM # 3/P-1: SHEET P-101

A. Added domestic water service to drinking fountains.

B. Added general notes #15 & #16 and keyed notes #5 & #6.

ITEM # 3/P-2: SHEET P-102

A. Revised location of sanitary sewer exit to South East corner of building.
B. Revised location of domestic water service entry to south wall.
C. Added domestic water, valve box and check valve service for drinking fountains.

D. Added general notes #5 & #6 and keyed notes #7, #8 & #9.

ITEM # 3/P-2: SHEET P-201

COSA - MISSION MARQUEE PLAZA
ADDENDUM #3
November 16, 2011

A. Added detail #7 "VALVE IN BOX PIPING DIAGRAM".
B. Added detail #8 "TYPICAL THRUST BLOCK INSTALLATION DETAIL".

<u>ITEM # 3/P-2: SHEET P-202</u>

A. Revised plumbing isometric per relocation of sanitary sewer exit and domestic water service entry.

STATE OF TEXAS
SHARAD V. PARANJAPE
91324
LICENSED
PROFESSIONAL ENGINEER
11-16-2011
CNG ENGINEERING PLLC
REG. NO. F-7964

STATE OF TEXAS
STEVEN LEE GLENN
49153
LICENSED
PROFESSIONAL ENGINEER
11/16/2011
Electrical Only
CNG ENGINEERING, PLLC
REG. NO. F-7964