THE COUNTY OF GALVESTON

RUFUS G. CROWDER, CPPO, CPPB
PURCHASING AGENT

COUNTY COURTHOUSE
722 Moody (21st Street)
Fifth (5th) Floor
GALVESTON, TEXAS 77550

October 23, 2023

PROJECT NAME: **California Avenue Improvement Project (FM 517 to 20th St)**

SOLICITATION NO: **ITB #B231032**

RE: **ADDENDUM #1**

To All Prospective Bidders:

The following information is being provided to aid in preparation of your proposal submittal(s):

Revised Bid Opening:
The original Submission Deadline/Bid Opening date for ITB #B231032, California Avenue Improvements Project (FM 517 to 20th St.) has been revised: The revised date is listed below:

Date: **Thursday, November 2, 2023**

Time: **2:00 P.M.**

Questions:

Question #1: ***Is there a Geotech avaible?***

Response: Yes, the Geotech report will be provided. See attached.

Question #2: ***What is the projected start date?***

Response: Estimated construction start in January 2024.

Question #3: ***Please reconsider contract time for this project. After review of our preliminary cost estimate and phasing- 8 months is not enough time to build on this project. Our estimate is about 12 months.***

Response: A 12 month duration will be utilized.

Question #4: ***Please confirm requirement for pipeline crossing on sheet 60 with proposed 8x3 box. Is there requirement to tunnel this section? Please clarify.***

Response: Magellan has not stipulated specific installation method as long as Magellan encroachment requirements provided are fulfilled. See attached general encroachment requirements.

Question #5: ***Plan notes call for crushed limestone temporary driveways to maintain resident access. Can the pay item be added per each?***

Response: Temporary driveway maintenance is incidental to the driveway installation item, and residents will need access through the duration of construction.

Question # 6: ***Pay item for LPCB # 79 only includes 1000 LF to furnish and install. According to TCP, Phase 2 step 1 and Phase 3 step 1, we will need much more than 1000 LF. Please review quantities in bid.***

Response: Low Profile Barrier quantities have been slightly revised. See revised bid proposal.

Question #7: ***Detail on sheet 135 shows 6'csand and overtop of boxes and 1' over pipe for standard bedding and backfill, but note on the sheet also says csand backfill will extend to the bottom of subgrade. Since nearly all pipe is under paving, please clarify if csand is to extend to the bottom of subgrade for all storm sewer. Or to be installed per detail drawing on this sheet.***

Response: Please reference sheet 135A which is an updated detail that resolves this issue. See attached.

Question #8: ***Please provide Geotechnical report so soil conditions and groundwater levels can be evaluated. If a well point is anticipated, there needs to be a pay item added by LF.***

Response: Geotech report will be provided and an optional additional well pointing line item will be added. See attached.

Question #9: ***Plans call to regrade ditches down both sides of the road for the entire length of the job. Is this work included in the excavation and fill items by the CY or can a pay item be added by LF to regrade the ditches?***

Response: Added a pay item to regrade ditches. See attached revised bid proposal.

Question #10: ***Are there any requirements for Buy America domestic materials on this project?***

Response: No requirement.

Question #11: ***Can you provide the details of item #27 Asphalt DW's? What thickness of base or Type B Asphalt under the 2' Asphalt Type D?***

Response: The asphalt driveway detail is located on the driveway table or page 49 of the plans. It details 2" H.M.A.C., 5" Black Base, and 8" Lime Stabilized Subgrade.

Question #12: ***Do you [the city] have a testing lab contracted for this project yet or can we create a proposal for you to consider?***

Response: The County has a testing lab contracted for the construction phase.

Question #13: ***Can you confirm the amount of retainage?***

Response: There is a 5% construction retainage held on each pay estimate.

If you have any further questions regarding this bid, please address them to Rufus Crowder, CPPO CPPB, Purchasing Agent, via e-mail at rufus.crowder@co.galveston.tx.us, or contact the Purchasing Department at (409) 770-5371.

Rufus G. Crowder, CPPO CPPB
Galveston County Purchasing Agent
722 Moody, Fifth (5th) Floor
Galveston, Texas 77550
E-mail: purchasing.bids@co.galveston.tx.us

Please excuse us for any inconvenience that this may have caused.

Sincerely,

Rufus G. Crowder, CPPO CPPB
Purchasing Agent
Galveston County

BID PROPOSAL

CALIFORNIA AVENUE IMPROVEMENT PROJECT (FM 517 TO 20TH STREET)

ITEM NO.	SPEC. NO.	DESCRIPTION[1]	UNIT	QUAN.	UNIT PRICE[2]	TOTAL PRICE
A	**SITE PREPARATION AND EARTHWORK**					
1	DWG	PROJECT SIGN	EA	2.00		
2	102	CLEARING AND GRUBBING	LS	1.00		
3	104	REMOVING OLD CONCRTETE (PAVEMENT)	SY	2,232.30		
4	104	REMOVING OLD CONCRTETE (SIDEWALK)	SY	30.60		
5	104	REMOVING OLD CONCRTETE (CURB)	LF	69.00		
6	110	ROADWAY EXCAVATION INCLUDING 3" TOPSOIL	CY	6,772.00		
7	110	REGRADE ROADSIDE DITCHES	LF	9,238.00		
8	132	EMBANKMENT	CY	1,836.00		
9	465	REMOVE AND DISPOSE OF EXISTING CONCRETE OR METAL PIPE (ALL SIZES)	LF	3,600.00		
10	495	REMOVING OLD STRUCTURES (INLETS - ALL DEPTHS)	EA	11.00		
11	495	REMOVING OLD STRUCTURES (SAFETY END TREATMENTS)	EA	1.00		
12	495	REMOVING OLD STRUCTURES (HEADWALLS 0-5FT)	EA	6.00		
13	500	REMOVE AND RELOCATE TRAFFIC SIGNS, MAIL BOXES AND ROADWAY SIGNS	EA	1.00		
14	540	REMOVE AND DISPOSE EXISTING ASPHALTIC SURFACE AND BASE MATERIAL (ALL DEPTHS)	SY	18,452.50		
15	550	REMOVE AND REINSTALL WOOD FENCE	LF	482.00		
16	550	REMOVE AND REINSTALL CHAINLINK FENCE	LF	263.00		
SUBTOTAL FOR ITEM A						
B	**PAVING**					
17	220	LIME STABILIZED SUBGRADE (8" DEPTH)	SY	22285.50		
18	220	LIME STABILIZED SUBGRADE (6" DEPTH)	SY	2,768.73		
19	221	HYDRATED LIME (SLURRY) OR COMMERCIAL LIME SLURRY	TON	1,052.28		

ITEM NO.	SPEC. NO.	DESCRIPTION[1]	UNIT	QUAN.	UNIT PRICE[2]	TOTAL PRICE
20	TXDOT 292	HOT MIX ASPHALTIC CONCRETE BASE COURSE (BLACK BASE) 5" DEPTH	TON	374.60		
21	360	CONCRETE PAVEMENT (7")	SY	18,946.98		
22	433	CEMENT STABILIZED SAND (3")	SY	2,768.73		
23	530	5' REINFORCED CONCRETE SIDEWALKS (4")	SY	2,500.14		
24	530	3' REINFORCED CONCRETE SIDEWALKS (5")	SY	24.90		
25	530	REINFORCED CONCRETE CURB (6")	LF	121.00		
26	530	COMMERCIAL CONCRETE DRIVEWAY (7")	SY	225.20		
27	530	RESIDENTIAL CONCRETE DRIVEWAY (6"), REPLACE IN KIND	SY	627.80		
28	TXDOT 340	RESIDENTIAL ASPHALT DRIVEWAY (2") TYPE D REPLACE IN KIND	TON	106.78		
29	530	ADA RAMP - TYPE 7	EA	34.00		
SUBTOTAL FOR ITEM B						
C	**STORM SEWER**					
30	421	STRUCTURAL CONCRETE (HEADWALL WITH FLARED WINGS FOR 45° SKEW PIPE CULVERTS)	CY	10.10		
31	429	TRENCH SAFETY SYSTEM (5' TO 10')	LF	6,310.00		
32	429	TRENCH SAFETY SYSTEM (10' TO 15')	LF	722.00		
33	429	TRENCH SAFETY SYSTEM (15' TO 20')	LF	100.00		
34	460	REINFORCED CONCRETE PIPE, C76, CLASS III, RUBBER GASKET (24")	LF	3,275.00		
35	460	REINFORCED CONCRETE PIPE, C76, CLASS III, RUBBER GASKET (30")	LF	829.00		
36	460	REINFORCED CONCRETE PIPE, C76, CLASS III, RUBBER GASKET (36")	LF	1,081.00		
37	460	REINFORCED CONCRETE PIPE, C76, CLASS III, RUBBER GASKET (42")	LF	1,313.00		
38	460	REINFORCED CONCRETE PIPE, C76, CLASS III, RUBBER GASKET (48")	LF	490.00		
39	460	REINFORCED CONCRETE PIPE, C76, CLASS III, RUBBER GASKET (54")	LF	860.00		
40	460	REINFORCED CONCRETE PIPE, C76, CLASS III, RUBBER GASKET (66")	LF	742.00		
41	460	REINFORCED CONCRETE PIPE, C76, CLASS III, RUBBER GASKET (72")	LF	888.00		
42	460	REINFORCED CONCRETE ARCH PIPE, C76, CLASS III, RUBBER GASKET (18" X 28.5")	LF	438.00		
43	460	REINFORCED CONCRETE ARCH PIPE, C76, CLASS III, RUBBER GASKET (22.5" X 36.25")	LF	392.00		

ITEM NO.	SPEC. NO.	DESCRIPTION[1]	UNIT	QUAN.	UNIT PRICE[2]	TOTAL PRICE
44	460	REINFORCED CONCRETE ARCH PIPE, C76, CLASS III, RUBBER GASKET (26.625" X 43.75")	LF	86.00		
45	464	6" PVC PIPE	LF	10.00		
46	471	PRECAST CONCRETE STANDARD MANHOLE (5' TO 10')	EA	10.00		
47	471	PRECAST CONCRETE EXTRA DEEP MANHOLE (10' TO 15')	EA	5.00		
48	471	PRECAST JUNCTION BOX (6' X 6')	EA	1.00		
49	471	PRECAST JUNCTION BOX (7' X 7')	EA	1.00		
50	471	PRECAST JUNCTION BOX (8' X 8')	EA	5.00		
51	471	PRECAST JUNCTION BOX (10' X 10')	EA	2.00		
52	472	TYPE E INLET	EA	30.00		
53	472	TYPE A INLET	EA	1.00		
54	473	ADJUST EXISTING STORM SEWER MANHOLE	EA	1.00		
55	480	REINFORCED CONCRETE BOX CULVERT (8' X 3')	LF	38.00		
56	COH 2632	CONCRETE COLLAR	EA	2.00		
57	COH 2632	CONFLICT JUNCTION BOX (4' X 4')	EA	2.00		
58	COH 2632	CONFLICT JUNCTION BOX (4' X 8')	EA	1.00		
59	COH 2632	CONFLICT JUNCTION BOX (5' X 5')	EA	1.00		
60	COH 2632	CONFLICT JUNCTION BOX (6' X 6')	EA	3.00		
61	COH 2632	CONFLICT JUNCTION BOX (7' X 7')	EA	3.00		
62	COH 2632	CONFLICT JUNCTION BOX (7' X 11')	EA	1.00		
63	COH 2632	CONFLICT JUNCTION BOX (8' X 8')	EA	3.00		
64	COH 2632	CONFLICT JUNCTION BOX (8' X 15' W/ 30° SKEW	EA	1.00		
SUBTOTAL FOR ITEM C						
D	**WATER DISTRIBUTION**					
65	WCID DWG	6-INCH WATER LINE, COMPLETE IN PLACE	LF	553.00		
66	WCID DWG	8-INCH WATER LINE, COMPLETE IN PLACE	LF	196.00		
67	WCID DWG	12-INCH WATER LINE, COMPLETE IN PLACE	LF	419.00		
68	WCID DWG	2-INCH WET CONNECTION	EA	5.00		
69	WCID DWG	6-INCH WET CONNECTION	EA	7.00		
70	WCID DWG	8-INCH WET CONNECTION	EA	14.00		
71	WCID DWG	12-INCH WET CONNECTION	EA	18.00		
72	WCID DWG	6-INCH GATE VALVE	EA	12.00		
73	WCID DWG	8-INCH GATE VALVE	EA	3.00		

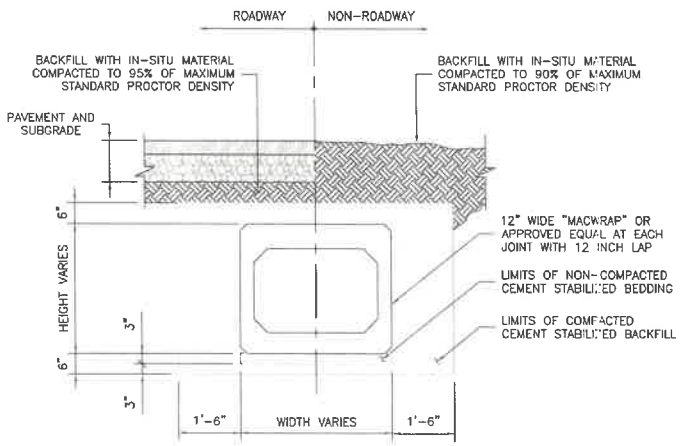
ITEM NO.	SPEC. NO.	DESCRIPTION[1]	UNIT	QUAN.	UNIT PRICE[2]	TOTAL PRICE
74	WCID DWG	ADJUST EXISTING GATE VALVE, STACK, AND LID	EA	35.00		
75	WCID DWG	NEW SERVICE LINE, LONG SIDE	EA	7.00		
SUBTOTAL FOR ITEM D						
E	**SANITARY SEWER**					
76	WCID DWG	SANITARY SEWER SERVICE LEAD, LONG SIDE	EA	12.00		
77	473	ADJUST EXISTING SANITARY SEWER MANHOLE	EA	28.00		
SUBTOTAL FOR ITEM E						
F	**TRAFFIC CONTROL PLAN**					
78	671	TRAFFIC CONTROL - BARRICADES, BARRIERS, BARRELS, CONES, AND SIGNING	MO	7.00		
79	673	CONSTRUCTING DETOURS - 8" BLACK BASE	SY	2,163.00		
80	696	LOW PROFILE CONCRETE BARRIER (FURNISH AND INSTALL)	LF	2,000.00		
81	696	LOW PROFILE CONCRETE BARRIER (RELOCATE)	LF	4,885.00		
82	696	LOW PROFILE CONCRETE BARRIER (REMOVE)	LF	2,000.00		
SUBTOTAL FOR ITEM F						
G	**SIGNING AND PAVEMENT MARKINGS**					
83	624	ALUMINUM SIGNS (GROUND MOUNTED) - FURNISH & INSTALL	EA	32.00		
84	660	REFLECTORIZED PAVEMENT MARKINGS TYPE I (THERMOPLASTIC) 4" YELLOW/SOLID - FURNISH AND INSTALL	LF	9,909.00		
85	660	REFLECTORIZED PAVEMENT MARKINGS TYPE I (THERMOPLASTIC) 4" WHITE/SOLID - FURNISH AND INSTALL	LF	13,546.00		
86	660	REFLECTORIZED PAVEMENT MARKINGS TYPE I (THERMOPLASTIC) 12" WHITE/SOLID - FURNISH AND INSTALL	LF	761.00		
87	660	REFLECTORIZED PAVEMENT MARKINGS TYPE I (THERMOPLASTIC) 24" WHITE/SOLID - FURNISH AND INSTALL	LF	328.00		
88	663	REFLECTORIZED PAVEMENT MARKERS TYPE II-A-A YELLOW - FURNISH AND INSTALL	EA	324.00		
89	663	REFLECTORIZED PAVEMENT MARKERS TYPE II BLUE - FURNISH AND INSTALL	EA	11.00		
90	665	WORK ZONE PAVEMENT MARKINGS (NON-REMOVEABLE) 4" YELLOW/SOLID	LF	4,310.00		
91	665	WORK ZONE PAVEMENT MARKINGS (NON-REMOVEABLE) 4" WHITE/SOLID	LF	4,310.00		

ITEM NO.	SPEC. NO.	DESCRIPTION[1]	UNIT	QUAN.	UNIT PRICE[2]	TOTAL PRICE
92	665	WORK ZONE PAVEMENT MARKINGS (NON-REMOVEABLE) 24" WHITE/SOLID	LF	165.00		
93	665	WORK ZONE PAVEMENT MARKINGS (REMOVEABLE) 4" YELLOW SOLID	LF	4,500.00		
94	665	WORK ZONE PAVEMENT MARKINGS (REMOVEABLE) 4" WHITE SOLID	LF	4,500.00		
95	670	TYPE III BARRICADE	EA	1.00		
SUBTOTAL FOR ITEM G						
H	**STORM WATER POLLUTION PREVENTION PLAN**					
96	162	SODDING FOR EROSION CONTROL (VARIOUS WIDTH)	SY	2170.40		
97	165	HYDRO-MULCH SEEDING	AC	3.90		
98	713	REINFORCED FILTER FABRIC BARRIER (60% OF UNIT COST FOR FURNISH & INSTALLITION AND 40% OF UNIT COST FOR REMOVAL	LF	1,634.00		
99	730	CONCRETE TRUCK WASHOUT STRUCTURES (60% OF UNIT COST FOR FURNISH & INSTALLITION AND 40% OF UNIT COST FOR REMOVAL	LS	1.00		
100	741	INLET PROTECTION BARRIER (FOR STAGE II INLETS, GRAVEL BAGS; 60% OF UNIT COST FOR FURNISH & INSTALLATION AND 40% OF UNIT COST FOR REMOVAL	LF	820.00		
100	751	SWPPP INSPECTION AND MAINTENANCE (MIN. BID. - $6,000.00)	LS	1.00		
SUBTOTAL FOR ITEM H						
I	****EXTRA WORK ITEMS**					
101	TXDOT 247	FLEXIBLE BASE TY A, GR II (8") - COMPLETE IN PLACE	SY	568.90		
102	436	WELL POINTING	LS	1.00		
103	559	CONSTRUCTION SAFETY FENCE	LF	365.00		
104	672	OFF-DUTY PEACE OFFICER - AS DIRECTED BY ENGINEER (MIN. BID. - $50/HR)	HR	1.00		
105	WCID DWG	12" GATE VALVE	EA	1.00		
106	WCID DWG	12" X 6" TS&V	EA	1.00		
107	WCID DWG	12" X 8" TS&V	EA	1.00		
SUBTOTAL FOR ITEM I						
TOTAL BASE BID						

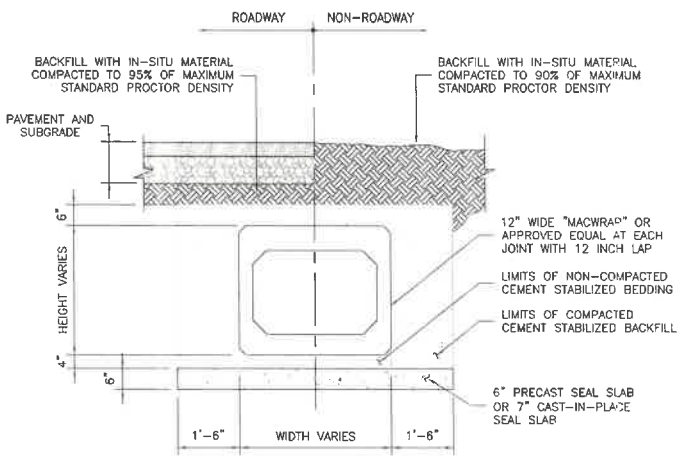
Notes:

1. The intent of the Contract Documents is for the Contractor to include all items necessary for the proper execution and completion of the Work described in the Contract Documents. No separate measurement and payment shall be made for any work unless identified as a pay item in the BID. Include the cost of work not identified as a separate pay item in Contract price bid for items of which this work is a component. In case of discrepancy between measurement and payment within the BID and Technical Specification Section, the BID shall govern.

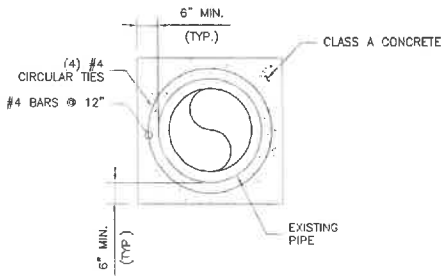
2. In the event of a discrepancy, this column shall govern.



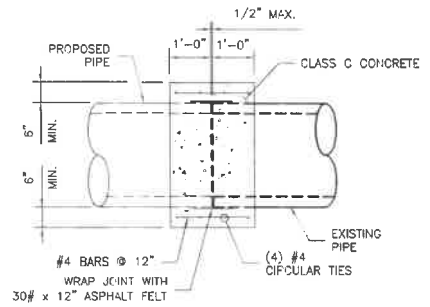
REINFORCED CONCRETE BOX CULVERT



REINFORCED CONCRETE BOX CULVERT WITH SEAL SLAB



SECTION VIEW

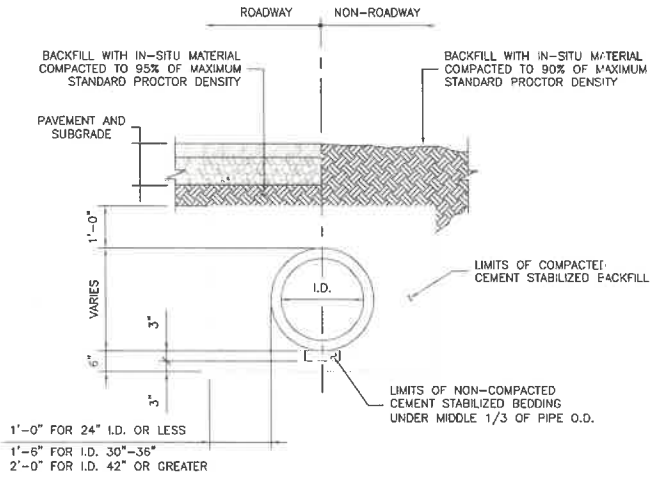


ELEVATION VIEW

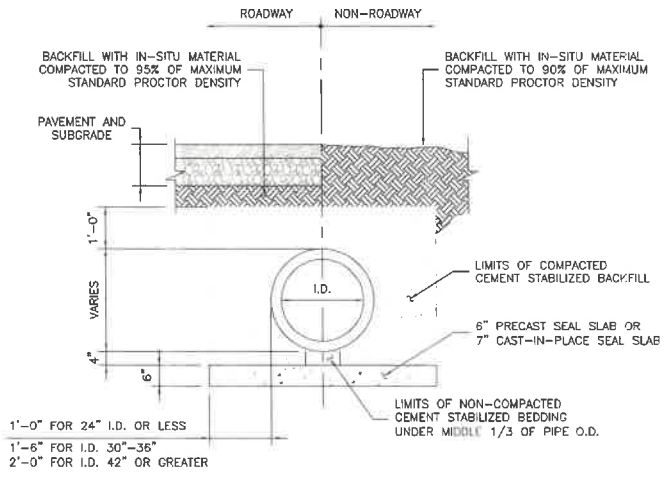
TYPICAL CONCRETE COLLAR FOR 36" & SMALLER RCP

GENERAL NOTES:

1. FOR RCP LARGER THAN 36" DIAMETER, CONCRETE COLLARS MUST BE DESIGNED BY THE ENGINEER OF RECORD.



PIPE



PIPE WITH SEAL SLAB

NO.	REVISIONS	DATE	NAME

GALVESTON COUNTY ENGINEERING DEPARTMENT

McDONOUGH
Civil Engineers ▼ Project Managers
TBPLS Firm Registration No. 10101900
TBPE Registration No. F-000340
3525 Schumacher Lane
Houston, Texas 77057
(713) 975-9900
www.mecltx.com

STATE OF TEXAS AUSTIN P. MCLEAN 132535 LICENSED PROFESSIONAL ENGINEER
10/19/2023

PROJECT TITLE

STORM SEWER CONSTRUCTION DETAILS

CIVIL STANDARD: SSC

DRAWN BY: JDZ
CHK'D BY: PDG
SCALE: 1" = 1'-6"
DATE: 10/10/23
SHEET NO: 135A / 163

J:\Engineering Specs\HC Standard Civil Drawings- Master File\2023 Standard Civil Drawings\3-Storm Sewer\SSC_23.10.10.dwg

Addendum #1

MAGELLAN PIPELINE COMPANY, L.P.

General Encroachment Requirements

A. GENERAL - These requirements define the minimum standards governing permitted encroachments by a landowner (including any developer, business entity, utility company or individual working for, or on behalf of, or with permission of landowner), its and their heirs, successors, and assigns (herein referred to collectively as "**Owner**") to pipeline corridors and rights of way ("**Magellan's Easement Tract**") owned or operated by Magellan Pipeline Company, L.P. ("**Magellan**"). Upon written request by Owner to Magellan, a copy of these minimum requirements shall be provided to any developer, business entity, utility company or individual working on behalf of Owner or with the permission of Owner within Magellan's Easement Tract. Specific circumstances may require additional precautions or more stringent methods in order to protect the integrity of Magellan's pipelines and facilities. Magellan's Easement Tract, for purposes of these General Encroachment Requirements, shall be considered to be any area within fifty (50) feet of any Magellan pipeline or other Magellan-owned or operated facility unless a different right of way width is specified by one or more recorded right of way or easement documents (herein collectively called "**Easement**", whether one or more), in which case such specified width shall define Magellan's Easement Tract.

1. **Encroachment Definition.** An "encroachment" is any use of the land within Magellan's Easement Tract which is not permitted by the express provisions of the Easement or which could interfere with Magellan's Easement rights or which Magellan determines could create safety concerns for pipelines and/or facilities located on Magellan's Easement Tract. Encroachments include, but are not limited to: structures, fixtures, personal property, landscaping, foreign utilities, foreign pipelines, roadways, railroads, waterway crossings, water impoundments, walls, heavy equipment and heavy loads on Magellan's Easement Tract, and also any excavation, digging, drilling, tunneling and addition, removal or disturbance of soil or subsoil within Magellan's Easement Tract. All encroachments as described in this section 1 are hereinafter referred to as "**Encroachments**", whether one or more.

2. **Magellan Representative Required On-Site.** Magellan pipeline systems operate at high pressures, and for safety reasons, Magellan requires its company representatives to be on-site while Owner is excavating or performing other activities which could endanger the pipelines or other facilities on Magellan's Easement Tract. For other activities of the Owner on the Magellan Easement

Tract, the Magellan field representative shall determine whether Magellan's continuous presence or periodic monitoring of encroachment activities will be required and shall inform the Owner. A Magellan representative will be made available upon 48 hours notice (exclusive of weekends and holidays) to determine the location and approximate depth of any Magellan pipelines. No excavation shall be commenced without prior written approval from Magellan and verification by Magellan of the location and approximate depth of its pipelines.

3. **Magellan's Facilities.** The facilities include, but are not limited to, the Easement, rights of way, pipelines, meter and valve sites, aboveground piping manifolds, and cathodic protection systems.

4. **Land Use Change - Notification.** The Owner and tenant, if any, must notify Magellan at any and every time when the land use will be changed for land on or adjacent to Magellan's Easement Tract. Examples of such land use changes are, without limitation:
   - Change from pasture to cultivation
   - Change in depth of tilling (e.g. plowing deeper or deep-breaking the land)
   - Change in that terraces will be cut or re-cut
   - Change from agricultural use to residential, commercial or industrial use.
   - Change from residential to commercial or from commercial to industrial.

5. **Governmental Regulations and Industry Guidelines.** Owner must comply with all applicable laws and regulations, as well as Magellan's policies as expressed herein. Owner is also hereby referred to the Common Ground Alliance Best Practices which can be found on the web site: www.commongroundalliance.com (See "Program Information" / "Best Practices") and which is available from Common Ground Alliance in booklet form for easy reference. Best Practices addresses the most common issues for damage prevention for an encroaching party, including, among others: Planning and Design; One-Call Center; Locating and Marking; Excavation; and Mapping.

   In the even of a conflict between laws and regulations, Magellan's policies and the Common Ground Alliance Best Practices, the following priority shall govern all encroachments on Magellan's Easement Tract: 1st -- laws and regulations; 2nd -- Magellan policies; and 3rd -- Common Ground Alliance Best Practices.

B. MAGELLAN RIGHT OF WAY PRACTICES

1. **Personal Property and Fixtures To Be Kept Off of Magellan's Easement Tract.** In order to keep Magellan rights of way clear for operations, maintenance,

inspection, repair, replacement, and emergency access, personal property and fixtures shall not be placed, stored, or maintained on Magellan's Easement Tract. Personal property and fixtures include, but are not limited to, storage sheds, automobiles, trailers, mobile homes, above-ground swimming pools, business equipment, product inventory, scrap metal, boulders, large rocks, debris, junk, and piles of materials.

2. **Encroachments Subject to Being Cleared from Magellan's Easement Tract.** Subject to the terms of its Easement (including right of way agreement[s] and other written agreements), Magellan shall have the right, but not the obligation, to keep Magellan's Easement Tract clear of items that Magellan determines may hinder the exercise of Magellan's rights to construct, operate, inspect, maintain, repair, replace, and access its pipelines and other facilities. Clearing of the Magellan Easement Tract shall include, but not be limited to, the following: removal of trees, brush, crops, other vegetation and non-permitted encroachments located on or overhanging all or part of any Magellan's Easement Tract. Trees or other vegetation overhanging Magellan's Easement Tract may be side-trimmed.

C. ENCROACHMENT PLANNING

1. **Plan Review Required by Magellan.** For any Encroachment, Magellan must be provided project plans to review and approve, *prior to such encroachment occurring*, for purposes of damage prevention.
2. **Submission of Complete Plans.** Owner must submit complete plans to Magellan for review. Incomplete plans could delay Magellan's engineering impact study and insufficient information could result in increased costs. Plans must include:
    - A plan view of the project with the *pipeline(s) location included.*
    - An illustration in *profile* of the existing surface elevations, the proposed surface elevations and the elevation of the pipeline(s).
    - A comprehensive utility/structure/grading plan depicting the relationship to the pipeline(s).
    - A proper legal description of the project location.
    - Complete landscaping plans.
    - Complete plans for backfilling and compaction of backfill material.

3. **Plans Must Show Magellan's Easement Tract, Pipelines and Facilities.** **All** construction plans (prints) showing lands where all or any part of Magellan's Easement Tract, and where any pipeline or facility is located thereon must contain the following:
    - Location and depth of all pipelines and facilities
    - The width of Magellan's Easement Tract

- A standard warning statement *conspicuously displayed* containing the following language:

WARNING
HIGH-PRESSURE PIPELINE(S)

Excavation and/or Construction Prohibited

Without compliance with **State One-Call**, AND

Without Written Permission From

MAGELLAN PIPELINE COMPANY, L.P.

4. **Written Encroachment Agreement Required.** A written, fully executed Encroachment Agreement must be in place between Magellan and Owner before Owner commences work on any encroachment.

5. **Costs.** Unless otherwise agreed in writing, all costs and expenses sustained or incurred by Magellan that result from any encroachment shall be the obligation of Owner and shall be paid in full to Magellan pursuant to Magellan invoice. Such costs and expenses may include, but shall not be limited to: Modification, replacement, lowering, and protection of pipelines, including engineering evaluation and design, field labor and real estate research and document preparation and handling,

6. **Pipeline Integrity Inspection.** Prior to the installation of any structure, parking lot, roadway or other facility which might interfere with or hinder Magellan's inspection of any pipeline or facility, Magellan will perform an integrity review of its pipeline and any other assets which may be affected by the proposed structure, parking lot, roadway or other encroaching facility in order to determine that Magellan's assets comply with integrity requirements and to allow Magellan to make any needed changes prior to construction of any approved encroachments.

7. **Soil On Magellan's Easement Tract -- Removing and Adding.** No soil shall be removed from or added to Magellan's Easement Tract without prior written authorization from Magellan. Any soil added must be clean fill dirt (without contaminants, trash or debris) and must be *limited in amount* so that the resulting cover (vertical distance from the surface of the land to the top of Magellan's

pipeline) is not greater than eight feet (8').

8. **Erosion Control Materials.** Erosion-control materials may be allowed on Magellan's Easement Tract for temporary periods of construction and restoration.

9. **Proof of Title to Property.** Magellan may require Owner to provide proof of current ownership of the land and all interests in the land where the proposed encroachment is to be located. Such proof shall be such proof as is satisfactory to Magellan and, without limitation of the foregoing, may be in the form of a title commitment or title policy.

10. **Subdivision Plat.** Magellan requires a copy of the Subdivision Plat, if applicable. If the plat has been recorded, Magellan requires a copy of the recorded plat which reflects the book and the page of the recording.

11. **Location and Approximate Depth of Pipelines.** A Magellan representative is normally available with 48 hours notice (exclusive of weekends and holidays) to determine the location and approximate depth of the pipeline(s). Determining actual depths of pipelines may require pot-holing or hand-digging by, and at the expense of Owner in the presence of an authorized Magellan representative. No excavation on Magellan's Easement Tract shall take place without prior approval by Magellan.

12. **Vertical Separation Between Magellan Pipeline or Facility and an Encroaching Object or Structure.** Vertical separation is defined in this document as the vertical distance between the outermost part of a pipeline, facility or appurtenance (for example, the outside of the pipe [for uncased pipe] or the outside of the pipe casing [for cased pipe]) and the outermost part of the encroaching object (for example, the outside of the encroaching pipeline or the outside of its conduit).

13. **Construction Equipment Information.** Owner shall provide to Magellan information as to the type, size, and weight of construction equipment that Owner proposes to use over or in the vicinity of the pipeline(s).

D. ENCROACHMENT DESIGN REQUIREMENTS & STANDARDS

1. **Risk of Loss and Damage.** Owner shall bear the risk of loss for all damage and/or destruction to any structure, fence, landscaping or improvement placed within the boundaries of Magellan's Easement Tract (whether approved by

Magellan or not), and shall indemnify and hold Magellan harmless from and against any such damages or destruction of structures (including, without limitation, any consequential damages) which may arise out of Magellan or its designees exercising Magellan's Easement rights or which may arise out of accessing Magellan's Easement Tract, pipelines or facilities.

2. **Buildings, Structures and Fences.**

   a. **Buildings and Structures.** No buildings, houses, barns, garages, patios, playhouses, sheds, septic systems or drain fields, swimming pools (above-ground or below-ground), reinforced concrete slabs or other similar structures will be permitted on the Magellan's Easement Tract.
   b. **Septic System not permitted.** No septic-system, including any lateral lines will be permitted on Magellan's Easement Tract.
   c. **Retaining Walls.** Retaining walls are not permitted on Magellan's Easement Tract.
   d. **Fences.** No fence shall be constructed or maintained on Magellan's Easement Tract without a written agreement.
   e. **Requirements for Fences.** If fencing on Magellan's Easement Tract is authorized by a written agreement with Magellan, the fencing must comply with the following:
      1) **Not Parallel to Pipeline.** No fence shall be allowed to be constructed parallel to, and closer than 10 feet to, any pipeline within the boundaries of Magellan's Easement Tract.
      2) **Fence Posts Location.** No fence posts will be allowed to be within five (5) feet of any pipeline or facility.
      3) **Gates Required.** Magellan may require any fence constructed within the boundaries of Magellan's Easement Tract to have gates of such size and suitability as is necessary or convenient for Magellan to access its pipelines and/or facilities for its operations, including inspections, at each point where the fence crosses a Magellan pipeline or facility boundary. Magellan shall be allowed to put a Magellan lock on such gates, which will allow access to Magellan's Easement Tract and/or facilities through such gates.
      4) **Angle of Fence Crossing.** Fence crossings across Magellan's Easement Tract must be as close to 90 degrees as possible.

3. **Landscaping, Elevation Changes and Water.**

   a. **Landscaping Definition.** Landscaping shall include, but not be limited to, trees, shrubs, underground irrigation or sprinkler systems, sidewalks or

other paths, retaining walls, terraces or other land grade changes, within Magellan's Easement Tract.

b. **General Landscaping Requirements.** The following are the general rules for landscaping on Magellan's Easement Tract:
   1) **Written Approval.** Landscaping proposed to be done on Magellan's Easement Tract must be approved by Magellan in a **written *encroachment agreement***. Among other terms, the encroachment agreement will release Magellan from any liability for damages to the landscaping from the exercise of Magellan's Easement rights.
   2) **Trees Not Permitted.** Trees are not permitted on Magellan's Easement Tract.
   3) **Shrubs.** Shrubs exceeding 3 feet in height and/or obstructing the view of any Magellan pipeline marker posts are not permitted on Magellan's Easement Tract.
   4) **Irrigation Systems, Field Drain Lines, and Sidewalks.** Irrigation systems, field drain lines and sidewalks that are to cross a pipeline must cross such pipeline at an angle as close to 90 degrees as possible, but in no event at an angle less than 45 degrees and must comply with other applicable provisions of this document.

c. **No Water Bodies on Magellan's Easement Tract.** Retention of water, including but not limited to, livestock ponds, lakes, retention ponds, or wetlands, may not be constructed or formed on Magellan's Easement Tract.

d. **Surface Grade and Elevation Changes.** Surface grade or elevation changes must be reviewed and approved in writing by Magellan.

4. **Foreign Pipeline & Utility Crossings.** No foreign pipelines or utility lines of any type shall be allowed to be constructed parallel to any pipeline within the boundaries of Magellan's Easement Tract.

   a. **Minimum Angle for Pipeline/Utility Crossing.** Any foreign pipeline or utility that is proposed to cross a pipeline on Magellan's Easement Tract must cross such pipeline at an angle as close to 90 degrees as possible, but in no event at an angle less than 45 degrees.

   b. **Vertical Separation Requirements for Crossing.** Foreign pipeline(s), utilities (except high-voltage lines – see below) or flow lines should cross pipeline(s) on Magellan's Easement Tract with at least 24 inches of vertical separation. Special written authorization must be given in the event vertical separation is less than that specified in these General Encroachment Requirements. The preferred method for a foreign pipeline

or utility to cross a pipeline is to cross ***below*** the Magellan pipeline.

c. **Warning Tape Required.** When any foreign pipeline or utility line is proposed to cross a pipeline on Magellan's Easement Tract, Owner must place 6" wide McMaster-Carr No. 8288T12 or equal within Magellan's Easement Tract in the following manner:
   1) The tape must be placed directly over (parallel to) and at least 15 inches above the foreign line for the entire distance that it occupies Magellan's Easement Tract. Additionally, the tape must be placed directly over (parallel to) and at least 15 inches above each pipeline that is crossed for a minimum distance which is the greater of:
      (a) a minimum distance of 20 feet on each side of the pipeline, or
      (b) across the entire width of Magellan's Easement Tract
   2) The placement of warning tape on each side of pipeline(s) on Magellan's Easement Tract will not be required for utility cables that are installed using the directional drill or jacking method.

d. **Crossings by Metal Pipelines or Conduits.** Metallic pipe crossing pipeline(s) on Magellan's Easement Tract may require Magellan to perform a cathodic protection interference survey. If interference with Magellan's cathodic protection system is detected and remediation is necessary, Owner agrees to cooperate with Magellan and to make necessary adjustments in Owner's interfering metallic pipe or other remediation to correct such interference problem insure that the Magellan cathodic protection system is operating properly.

e. **Crossing Requirements.** Electrical, fiber optic, local service communication, long distance carrier telephone, and utility cables should cross Magellan pipeline(s) with a ***minimum of 24-inches of vertical separation***. All such lines must be covered with a *Concrete Slab* for the full width of the **Easement Tract**, if requested by Magellan. If such lines have an exposed concentric neutral, a test point from the ground wire shall be installed by the power company.

f. **Crossing Requirements for Lines Going Over a Magellan Pipeline.** In the event the electrical, fiber optic, local service communication, long distance carrier telephone, and utility cable crosses ***over*** a pipeline on Magellan's Easement Tract, such line shall be ***encased in red concrete across the full width of Magellan's Easement Tract***, unless a variance is granted by Magellan, as set forth below.

g. **Written Authorization for Variance.** Owner must have written authorization from Magellan for any variance from the vertical separation requirements listed above and/or for any variance from the requirement for encasement of high-voltage electrical lines in red concrete.

h. **Utility Poles and Guy Anchors.** Utility poles and guy anchors shall not

be placed on Magellan's Easement Tract without a written agreement. With a written agreement, poles and anchors may be placed no closer than 20 feet to any pipeline on Magellan's Easement Tract. Poles shall not be allowed to run parallel to a pipeline within the Magellan Easement Tract.

i. **Directional Drilling / Boring.**

1) Prior to commencing any horizontal directional drilling, Owner shall submit plans showing procedure and material descriptions for Magellan's approval. The plans and description shall include, but not be limited to the following:
   - Profile and plan showing location of entry and exit points
   - Work space required to perform the work
   - Mud containment and disposal sites
2) Owner shall positively locate and stake the location of existing pipelines and other underground facilities on Magellan's Easement Tract, including exposing any facilities located within 10 feet of the designed drilled path. Prior to commencing drilling operations, Owner shall modify drilling practices and down-hole assemblies to prevent damage to existing pipelines and other facilities. Owner shall be responsible for losses and repairs occasioned by damage all pipelines and other facilities resulting from drilling or boring operations.
3) At all times, Owner shall provide and maintain instrumentation to document and accurately locate the pilot hole and the drill bit, to measure drill-string axial and torsional loads, and to measure drilling fluid discharge rate and pressure. At Magellan's request, Owner shall promptly provide Magellan with reasonable access to information and readings provided by these instruments, including copies of any written documentation.
4) Pilot Hole.
   - The pilot hole shall be drilled along the path shown in the plan and profile drawings. No pilot hole shall be made that will result in any of the encroaching utility being installed in violation of laws and regulations or of Magellan's requirements described herein. However, safety for any adjacent utilities and/or structures is of utmost importance. Therefore, the listing of separation distances or tolerances herein does not relieve Owner from responsibility for safe operations or for damage to adjacent utilities and structures.
   - If tolerances are not specified in the plan and profile drawings, the pilot hole shall have the following tolerances:
     - Elevation of +0 feet and -15 feet
     - Alignment of +/-20 feet as long as it does not come to

within 10 feet of a pipeline on Magellan's Easement Tract

- Initial penetration of ground surface at exact location shown in the plan and profile drawings
- Final penetration of the ground surface within +/-10 feet of the alignment and within +30 feet and -0 feet of the length shown in the plan and profile drawings
- Curves shall be drilled at a radius equal to or greater than that specified in the plan and profile drawings. The drilled radius will be calculated over any 3 joints (range 2 type drill pipe) segment using the following formula:

Rdrilled = (Ldrilled/Aavg) x 180/π

Where: Rdrilled =drilled radius over Ldrilled

Ldrilled = length drilled; no less than 75 feet and no greater than 100 feet

Aavg = total change in angle over Ldrilled

- At the completion of the pilot-hole drilling, Owner shall provide to Magellan a tabulation of horizontal and vertical coordinates, referenced to the drilled entry point, which accurately describe the location of the pilot hole.

5) **Drilling Fluids.**

- The composition of drilling fluids proposed for use shall comply with all applicable laws and regulations.
- Owner is responsible for obtaining, transporting and storing any water required for drilling fluids.
- Disposal of drilling fluids and drill cuttings shall be Owner's responsibility and shall be conducted in compliance with applicable laws and regulations. Drilling fluid shall *not* be disposed of by placing fluids on or under the surface of Magellan's Easement Tract.
- Owner shall employ best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than entry and exit points shall be minimized. If annular circulation is lost, Owner shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand-placed barriers (e.g., hay bales, sand bags, silt fences, etc.) and collected using pumps as practical. If the amount of surface return is not great enough to allow practical collection, the affected area will be diluted with fresh water and the fluid will be allowed to dry and dissipate naturally. If the amount of surface return exceeds that which can be contained

with hand-placed barriers, small collection sumps (less than 5 cubic yards) may be used unless permits or other regulations prohibit the use of collection sumps. If the amount of surface return exceeds that which can be contained and collected using barriers or small sumps, or if the return of drilling fluids occurs in the body of water proper, drilling operations will be suspended until surface return volumes can be controlled.

6) **As-Built Drawing.** Owner shall promptly provide to Magellan an as-built plan and profile drawing of the drilled crossing showing the location of the new crossing as well as the location of pipelines on Magellan's Easement Tract.

5. **Roadway, Driveway, Railroad and Equipment Crossings.** No roadway, driveway, railroad or equipment crossings of any type shall be allowed to be constructed parallel to any pipeline within the boundaries of Magellan's Easement Tract.

   a. **Pipeline Integrity Inspection.** A pipeline integrity review shall be performed by Magellan as described in provision "*6*" under "*C. ENCROACHMENT PLANNING*" (above).
   b. **Load Bearing and Stress Limit Requirements.** Prior to any road, driveway, rail bed or equipment crossing construction, Magellan's engineer must determine whether the proposed compacted cover meets load-bearing requirements and provides adequate protection to limit stress on pipelines or other facilities, and must advise Owner of any additional requirements necessary to provide adequate protection.
   c. **No Crossing over Pipeline Bend.** Paved surfaces or rail beds shall not be allowed to cross a pipeline bend (point of inflection).
   d. **Minimum Angle of Crossing.** Crossings should be as close as possible to 90 degrees to pipeline(s) on Magellan's Easement Tract, but not less than 30 degrees.
   e. **Pipeline Casing Issues.** Magellan prefers that cased roadway and railroad crossings no longer be installed. If the carrier pipe under roadways and railroads requires adjustment or relocation, then instead of using casing, the carrier pipe will consist of extra strength material or heavier wall thickness to accommodate the additional longitudinal stress due to external loads. If a road or railroad crossing currently uses casing and the road or railroad is being widened and no other adjustment or relocation of the carrier pipe is required, then Magellan may elect to extend the casing pipe on the existing crossing(s) to accommodate additional road surface. If casing is used, it must not end under the roadway surface or track

structure, but must extend across the entire length of the roadway or railroad right of way.

f. **Railroad Crossing Requirements.** Railroads shall be installed with a minimum compacted cover over the carrier pipe, as measured from the base of the rail to the top of the pipe, as follows (*see Figures 1 and 3*):

Location of Pipeline	**Minimum Compacted Cover Over Top of Pipeline**
Under track structure proper (Below bottom of rail)	6.0 feet
Under all other surfaces within the right of way or from the bottom of ditches	3.0 feet

g. **Roadway and Driveway Crossings.** Roadways and driveways, shall be installed with a minimum compacted cover over the carrier pipe, as measured from the top of the roadway surface to the top of the pipe, as follows (*see Figures 2 and 4*):

Location of Pipeline	**Minimum Compacted Cover Over Top of Pipeline**
Under roadway surface proper (Below surface of pavement)	4.0 feet
Under all other surfaces within the right of way or from the bottom of ditches	3.0 feet

h. **Crossing Pipelines Transporting Highly Volatile Liquids.** For pipelines transporting highly volatile liquids, minimum cover for a crossing at a drainage ditch must be 4.0 feet.

i. **When Additional Depth Required.** Depth greater than the minimum depths stated above may be required for a pipeline due to the combined stress of internal pipeline pressure and external loading pressure. Magellan will analyze each proposed crossing based on information provided by Owner to determine any additional depth that may be required for the pipeline for safe operation.

j. **Temporary Roads and Equipment Crossings.** Any such road or crossing must meet the following requirements:

- Must be located at a site approved by a Magellan field representative.
- Must provide adequate protection for pipelines and other facilities, as determined by the appropriate Magellan engineer, so that the compacted cover meets load-bearing requirements and provides adequate protection to limit stress on the pipeline or other facilities.
- Owner shall place Six-inch wide plastic warning tape, McMaster-Carr No. 8288T12 or equal, over each pipeline for the width of the temporary road or equipment crossing, plus an additional 20 feet past each outside edge of such temporary road or equipment crossing

k. **Owner Required to Protect Magellan Pipelines.** Magellan may require Owner to put in place additional cover and/or stabilization (timbers, steel plate, crushed rock, concrete slab, etc.) at any approved equipment crossing in order to protect pipelines on Magellan's Easement Tract, taking into account possible effects of weather, pipeline depth, and type of vehicles proposed to cross the pipelines. Magellan will analyze each proposed crossing based on information provided by Owner to determine any additional depth or protection that may be required for safe pipeline operation.

l. **Heavy Equipment - Definition and Requirements.** Heavy equipment shall be defined as any vehicle having a *gross weight* in excess of 80,000 pounds. Heavy equipment shall be prohibited from working directly on top of the active pipeline. For vehicles having a *gross weight* of 80,000 pounds or less, the pipeline must have a minimum of 4 feet of cover. Magellan must analyze the additional longitudinal stress due to external loads if the vehicles have a *gross weight* in excess of 80,000 pounds in order to determine required pipeline depth for safe operation.

6. **Parking Lots and Other Pavement.**

a. **Parking Lot and Pavement Requirements.** All parking lots and other pavement installed on Magellan's Easement Tract shall consist of a flexible surface such as asphalt. No reinforced concrete will be allowed.

b. **Pipeline Depth Under Parking Lot.** The depth of pipelines under a parking lot must meet or exceed compacted cover requirements listed in the previous "Roadway, Driveway, Railroad, and Equipment Crossings" section above

7. **Waterway Crossings.**

a. **Pipeline Depth Requirements.** If Owner proposes to cross a pipeline with a waterway (river, stream, creek, irrigation canal, or drainage ditch),

such crossing must result in the pipelines meeting or exceeding the minimum depth below the bottom of the waterway for compliance with then current pipeline construction standards and federal, state, and local regulations.

b. Requirements for Waterway Crossings:

1) **Minimum Angle or Crossing.** Crossings should be as close as possible to 90 degrees to pipeline(s) on Magellan's Easement Tract, but not less than 45 degrees.

2) **Vertical Separation Requirements for Waterway Crossing.** Pipelines to be crossed must have a minimum vertical separation of five (5) feet, as measured from the bottom of the waterway to the outermost part of such pipelines, facility or appurtenance

3) **Adding Weight to Pipeline for Negative Buoyancy.** Owner shall bear all liability and obligation for the cost of Magellan adding sufficient weight or mechanical devices to any pipeline on Magellan's Easement Tract crossed by a waterway in order to create negative buoyancy for such pipeline.

8. **Blasting.**

a. **Magellan Written Approval Required – Plan To Be Submitted.** Magellan must approve any proposed blasting operations that could affect pipelines or facilities on Magellan's Easement Tract. Should blasting be necessary, a comprehensive plan must be submitted to Magellan for review and written approval.

b. **Safety Considerations – Damage Prevention Plan.** For safety and preservation of Magellan assets, all blasting shall be in accordance with federal, state, and local governing agencies and the Magellan's "Damage Prevention Plan for Blasting Near Company Facilities". A copy of said plan will be made available upon request.

E. EXCAVATION NEAR MAGELLAN PIPELINES.

1. **STATE "ONE-CALL" REQUIRED.** No excavation or activity listed in "*A. GENERAL - 1. Encroachment Definition*" above shall be performed by Owner in the vicinity of Magellan's facilities or within Magellan's Easement Tract until proper telephone notification has been made to the appropriate "One Call" system and a Magellan representative is on-site to monitor excavation activities. All of the states in which Magellan conducts pipeline operations have "One Call" laws, which require 48-72-hours notification prior to any excavation related activities. After making a One-Call, the state One-Call agency will notify Magellan to mark

accurately, in a reasonable and timely manner, the location of Magellan's pipeline facilities in the vicinity of the proposed encroachment.

2. **ONE-CALL NOTIFICATION.** *The following list is provided for convenience, but is not warranted by Magellan to be complete or accurate (telephone numbers were copied from each state's web site on 1/5/2004).* **Owner is required to acquire and call the appropriate One-Call number(s) for its location of activity.**

Current "ONE-CALL" numbers and information can be found on each state's "ONE-CALL" website:

Arkansas - http://www.arkonecall.com/	- 800 482-8998
Colorado - www.uncc2.org/	- 800 922-1987
Connecticut - www.cbyd.com/	- 800 922-4455
Delaware - www.missutility.net/delaware/	- 800 257-7777
Illinois - www.illinois1call.com/	- 800 892-0123
Iowa - www.iowaonecall.com/	- 800 292-8989
Kansas - www.kansasonecall.com/	- 800 344-7233
Louisiana - www.laonecall.com/	- 800 272-3020
Minnesota - www.gopherstateonecall.org/	- 800 252-1166
Missouri - www.mo1call.com/	- 800 344-7483
Nebraska - www.ne-diggers.com/	- 800 331-5666
New Mexico - www.nmonecall.org/	- 800 321-2537
North Dakota - www.ndonecall.com/	- 800 795-0555
Oklahoma - www.callokie.com/	- 800 522-6543
South Dakota -www.sdonecall.com/index.asp	- 800 781-7474
Texas - www.texasonecall.com/	- 800 245-4545
Wisconsin - www.diggershotline.com/	- 800 242-8511
Wyoming - www.onecallofwyoming.com/	- 800 849-2476

Alternatively, the National One-Call number – (888) 258-0808 - may be used to register a proposed excavation and to subsequently notify underground utility operators with assets in the vicinity.

3. **Excavation Plan Approval.** Owner shall submit to Magellan for its approval plans for any proposed excavation on Magellan's Easement Tract. No excavation on Magellan's Easement Tract shall be commenced until Owner has secured Magellan's written approval of the plans. The excavation work shall be in compliance with all applicable laws and regulations. Owner is also referred to the

Common Ground Alliance Best Practices (referenced in this document).

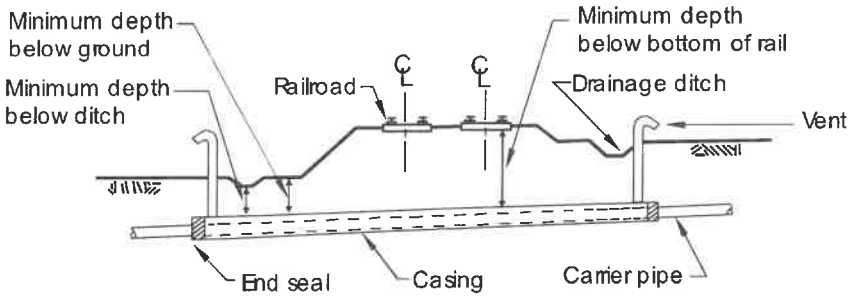
4. **Magellan Representative On-Site for Excavation.** A Magellan representative must be on-site when an excavation is occurring on Magellan's Easement Tract (*see provision "2" under "A. General" beginning on page 1*).

5. **Removal of Side-Cutting Teeth from Equipment.** Side-cutting teeth shall be removed from buckets of excavating equipment.

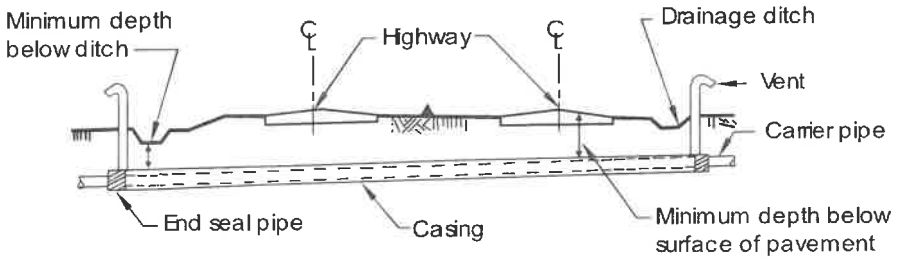
6. **Parallel Excavating Required.** When, in preparation for crossing any pipeline on Magellan's Easement Tract with any other pipeline or with electric line, communication line, roadway or any other structure or facility, Owner needs to locate the pipelines by use of mechanical means. Owner must perform such locating activity by excavating parallel to each of the pipelines with such mechanical means, but shall cease using the mechanical means when it reaches a point within two feet of the Magellan pipeline (*see next provision*).

7. **Exposing Pipeline by Hand.** Excavating within 2 feet of any pipeline on Magellan's Easement Tract shall be done by *hand-digging* until the pipeline is exposed and its location is accurately known. Then, Owner must position the excavation equipment so that from the point of operations the equipment will not reach within 2 feet of any pipeline.

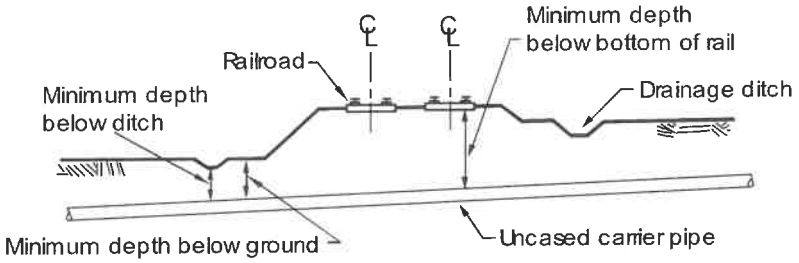
RAILROAD AND HIGHWAY CROSSINGS



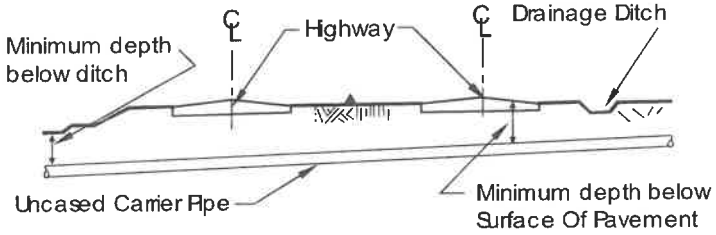
CASED RAILROAD CROSSING
FIGURE 1



CASED HIGHWAY CROSSING
FIGURE 2



UNCASED RAILROAD CROSSING
FIGURE 3



UNCASED HIGHWAY CROSSING
FIGURE 4

ASSOCIATED TESTING LABORATORIES
77054

3143 Yellow Stone Blvd., Houston, TX

COVER SHEET

Memo

To: Mr. Austin McLean, PE
Design Engineer
(austinm@mectx.com)

Cc: Mr. David Evans
(davide@mectx.com)

Ref: Driveways Recommendation
California Avenue
City of Dickenson, Texas

From: Nutan Palla, Ph.D., P.E.
Phone: 713-748-3717
Cell: 409-673-1032
Fax: 713-748-3748
Email: nutan@associatedtesting.com

Date: June 6, 2022

ATL #: G2021-131

Subgrade Stabilization

The surficial soils encountered in the project borings consist of high plasticity cohesive fat clays. We recommend the top 8-in. depth of the final grade be stabilized because stabilization will help prevent construction delays due to inclement weather and increase the modulus of subgrade reaction and thus, the pavement life.

For planning purposes, a lime 8% lime, by dry weight, may be considered. We recommend establishing a separate line item for stabilizer since the actual stabilization requirements should be verified in the field by trial. Verification is typically done by performing unconfined compressive tests on stabilized and remolded samples containing various lime contents. The specifications require that stabilized subgrade should cure at least seven days before placing pavement.

Actual stabilization requirements should be determined in the field by trial. Lime stabilization may be performed in accordance with TxDOT Standard Specification Item 260, Lime Stabilized Subgrade, or equivalent. Stabilized soils should have a minimum thickness of 6-in. and compacted to at least 95% of the standard Proctor maximum dry density (ASTM D 698). The compacted moisture content should be within two percentage points of the optimum moisture content.

Pavement Thickness Recommendations

The usage classifications presented in below Table may be considered for a pavement section supported on properly compacted and prepared subgrade soils.

Vehicle Classification and Traffic Loading

Classification	Gross Vehicle Load (lb)	Description of Typical Pavement Application
Medium	10,000	Driveways

Flexible pavement alternatives for the various usage classifications are presented in the table below.

ASSOCIATED TESTING LABORATORIES

3143 Yellow Stone Blvd., Houston, TX 77054

Recommended Pavement Thickness

Flexible Pavement Thickness (in.)	
Usage Classification	**Driveways**
Base Course Alternatives:	
Cement-stabilized Crushed Limestone	8
Black Base	5
Surface Course:	
H.M.A.C. (for either of above base courses)	2

The cement-stabilized crushed limestone base should conform to TxDOT Specifications, Item 247, Type A or D, Grade 2 with 5.5% cement. Black base and the surface course should conform to TxDOT Specifications, Items 292 and 340, respectively.

Cement-stabilized crushed limestone should be compacted to 95% of the maximum dry density determined by ASTM D 1557. Black base should have an asphalt content of between 3% and 9% and produce a mixture meeting the requirements in Table 2 (TxDOT Specification Item 292) for the grade shown on the plans, as determined by Test Method Tex-126-E. Dense graded hot-mix asphalt surface course should be designed using the weight design example given in Tex –204-F, Part I, to design a mixture meeting the requirements listed in Tables 1 through 6 (TxDOT Specification Item 340). H.M.A.C. surface course should be compacted to 96% of the theoretical density (Gt) as determined by Test Method Tex-207-F. The surface course should provide a minimum Hveem stability of 30.

If you have any questions, please contact us. Please contact us if you have any questions.

Thank you,

Associated Testing Laboratories, Inc.
TBPE Firm Registration No.: F-4560

Nutan Palla, Ph.D., P.E.
Director, Geotechnical Services

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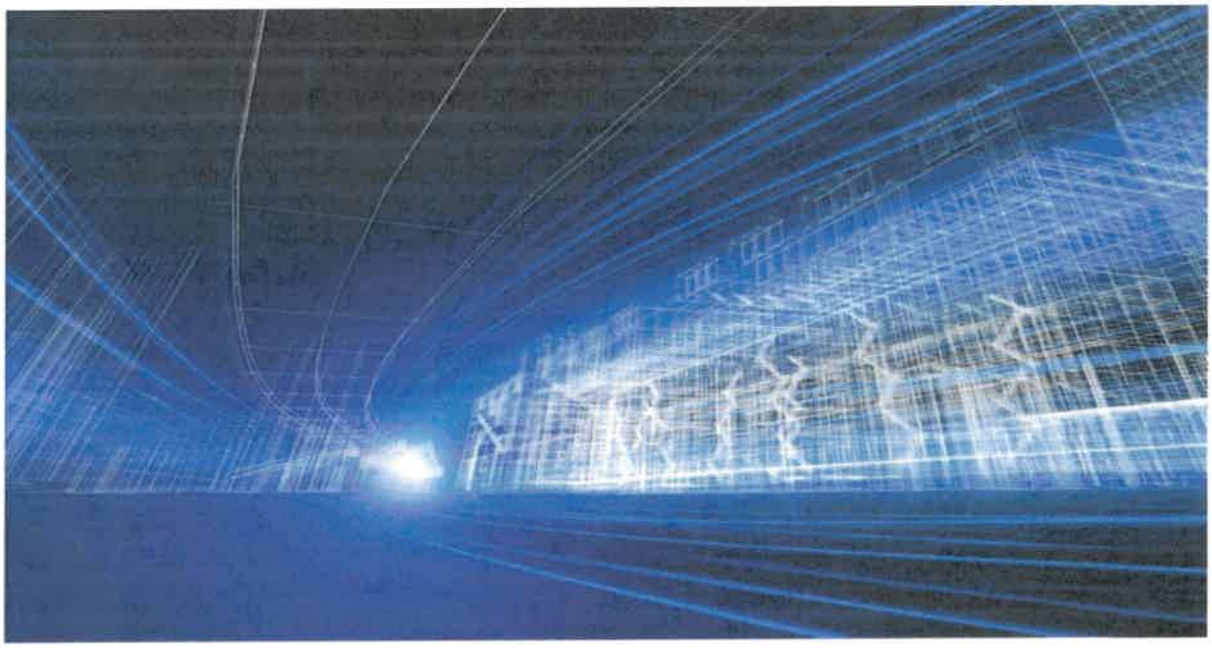

ATL Project # G2021-131

Report
Geotechnical Investigation
Road Reconstruction and Drainage Improvements of California Ave.
City of Dickinson, Texas

Prepared For

McDonough Engineering Corporation
5625 Schumacher Lane
Houston, Texas 77057

May 4, 2021

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May 4, 2021
Project No: G2021-131

Mr. Austin McLean, P. E.
Design Engineer
McDonough Engineering Corporation
5625 Schumacher Lane
Houston, Texas 77057

Reference: Geotechnical Investigation
Road Reconstruction and Drainage Improvements of California Ave.
City of Dickinson, Texas

Dear Mr. McLean

Associated Testing Laboratories, Inc. is pleased to present our report for the above referenced project. This report summarizes our investigations, analyses and recommendations for design and construction of the project.

Once you are ready for construction, we will be pleased to assist you in field / laboratory testing of materials and construction inspection.

It has been a pleasure working with you on this project. If you have any question regarding this report, please contact us. We look forward to be of further assistance as construction begins.

Very truly yours,

ASSOCIATED TESTING LABORATORIES, INC.
(TBPE Firm Registration No. F-4560)

Nutan V Palla, Ph.D., P.E.
Director of Geotechnical Services

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Executive Summary

Based on our investigations, recommendations and conclusions of the geotechnical engineering study for the subject project Road Reconstruction and Drainage Improvements of California Ave. in Galveston County, Texas are summarized as follows:

The generalized subsurface stratigraphy, interpreted from borings B-1 through B-14, consists of soft to very stiff, high plasticity cohesive fat clay with sand (CH), sandy lean clay with sand (CL), and lean clay (CL) layers soils to the explored depths of 15 feet. The clays contain ferrous and large calcareous nodules. No groundwater was encountered during drilling.

Rigid pavement thickness recommendations are based on the "AASHTO Guide for Design of Pavement Structures–1993" prepared by the American Association of State Highway and Transportation Officials. The recommend pavement thickness for California Avenue is about 7-inches for 20 years design period.

Existing reinforced concrete pipes (RCP) removed and replaced with new RCP. Removal of old structures including culverts and pipes shall meet the criteria of the latest edition of the HCED Standards, Item 495. New reinforced concrete pipes shall meet the criteria of HCED Standards, Item 460. Based on Borings B-1 through B-14 information and the estimated foundation depth of about 5 to 6 feet below existing grade, a net allowable soil bearing capacity of 2,000 psf (dead and sustained live load only; FS=3.0) and 3,000 psf (total load, FS=2.0) may be used to proportion the foundation of the proposed culvert.

Cement stabilized soil material used for the new RCP bedding and backfill shall meet the criteria of HCED Standard Specification Item 433. Soils around cross pipes or culvert will be protected by the head walls and wing walls structures.

Based on the soil and groundwater conditions revealed by the borings, ATL recommends that the top 5 feet of the onsite clay soils be classified as OSHA Soil Type "C", and all clay soils below a depth of 5 feet and all sands (SP/SM/SC) and silts (ML) be classified as OSHA Soil Type "D".

Based on the subsurface soils found in project Borings, and the anticipated ditch depth of about 5 feet below existing grade, the proposed roadside ditches will be excavated in firm to very stiff Lean Clays (CL) and Fat Clays (CH). Based on the proposed ditch depth and the subsurface soil conditions, and past engineering experience, ATL recommends a side slope of 3H:1V.

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Introduction

General

Associated Testing Laboratories, Inc. (ATL) is pleased to submit this report presenting the results of the geotechnical investigation performed for the Road Reconstruction and Drainage Improvements of California Ave. in Galveston County, Texas. This investigation was authorized by Mr. Austin McLean of McDonough Engineering Corporation, and by acceptance of ATL Proposal No. GP2020-1005- Rev 2 dated November 23, 2020. The project layout is presented on **Figure 1a: Site Vicinity Map**.

Project Description

Based on the information provided by Mr. Austin McLean, PE., McDonough Engineering Corporation, ATL understands that the project consists of reconstruction of California Avenue from East FM 517 to East 20th Street from a existing two-lane asphalt roadway into two-lane concrete paved roadway with roadside ditches and storm sewer on one side and improvements does not include Gum Bayou. Project alignment begins at FM 517 intersection to 20th St. (i.e. about 7.000 linear feet) and is presented below Figure (shaded in "**Red**").

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Scope of Work

A geotechnical investigation was conducted to determine subsurface soil conditions along the proposed project alignments and to develop geotechnical engineering recommendations for the construction of pavement reconstruction and storm sewer line. **Associated Testing Laboratories, Inc. (ATL)** has completed a subsurface exploration program for this project consisting of the following scope:

- Review available geologic and geotechnical data pertinent to the project site
- Investigate the subsurface conditions by drilling and sampling fourteen (14) geotechnical borings to depths of approximately 15-ft below the ground surface with a truck-mounted rig, in accordance with ASTM Standards
- Perform geotechnical laboratory tests on selected soil samples obtained from the borings in accordance with ASTM Standards
- Develop boring logs (in gINT format) and boring log profiles to present the general subsurface soil and groundwater conditions
- Provide subsurface properties and groundwater information
- Evaluate side slopes for the roadside ditches
- Recommend erosion protection
- Subgrade preparation and compaction requirements.
- Discuss open cut/trench excavation safety and OSHA safety requirements.
- Recommend trench bedding and backfill.
- Recommend loads on buried pipes including dead and live loads (vehicle loads).
- Recommend thrust restrain
- Dewatering considerations
- Provide geotechnical recommendations for the following:
    - Subsurface conditions
    - Site preparation and select fill requirements
    - Rigid pavement recommendations
    - Construction monitoring recommendations

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Field Exploration

General

The field exploration consisted of drilling and sampling of a fourteen (14) at 15-ft deep soil borings and groundwater level information.

Based on the available project information, the following borings are explored to investigate the subsurface soils and groundwater conditions along the project alignments and site boring location plans are presented in **Figures 1b: Boring Location Plan**.

Exploration Location No.	Date Completed	Coordinates		*Point Elevation (ft)	Total Depth (ft)
		Latitude	Longitude		
B-1	April 6, 2021	29.463969°	-95.037309°		15
B-2	April 6, 2021	29.465312°	-95.037342°		15
B-3	April 6, 2021	29.466695°	-95.037354°		15
B-4	April 6, 2021	29.468056°	-95.037378°		15
B-5	April 6, 2021	29.469423°	-95.037390°		15
B-6	April 6, 2021	29.470790°	-95.037443°		15
B-7	April 7, 2021	29.472193°	-95.037461°		15
B-8	April 7, 2021	29.473694°	-95.037497°		15
B-9	April 7, 2021	29.474970°	-95.037514°		15
B-10	April 7, 2021	29.476394°	-95.037561°		15
B-11	April 6, 2021	29.477733°	-95.037597°		15
B-12	April 6, 2021	29.479110°	-95.037619°		15
B-13	April 2, 2021	29.480512°	-95.037660°		15
B-14	April 2, 2021	29.481904°	-95.037686°		15

* *Waiting for Survey Information*

Premobilization

We marked the test boring locations and conducted Texas 811 Utility calls. All the boring locations required coring of asphalt pavement.

Test Borings

The boreholes were drilled and sampled under the observations of our experienced geotechnical engineering technician and performed in accordance with ASTM Standards. The field drilling was performed with a truck-mounted drilling rig and was advanced using dry auger method until

groundwater was encountered. Groundwater levels were observed for about 15-minutes before completing the borings.

Soil samples were obtained continuously to a depth of 15-ft. Undisturbed samples of cohesive soils were obtained from the borings by pushing 3.0-inch diameter thin-wall, seamless steel Shelby tube samplers.

The undisturbed samples of cohesive soils were extruded mechanically from the Shelby tubes in the field and wrapped in aluminum foil. All soil samples were inspected and classified and sealed in plastic bags to reduce moisture loss and disturbance. The samples were placed in core boxes and transported to the laboratory for further testing. Strength of the cohesive soils are estimated in the field using a hand penetrometer.

The boreholes were backfilled with grout upon completion of drilling. All cored pavements were patched using cold patch asphalt.

Boring Logs

Boring logs are presented in **Appendix A** and include our interpretations of the general subsurface conditions at the boring locations. Soil classifications are based on the Unified Soil Classification System (ASTM D2487).

The boring logs present results from the field tests, including hand penetrometer measurements and SPT blow-counts. The hand penetrometer measurements presented on the boring logs are uncorrected. SPT N-values are also presented on the boring logs.

(In our analysis, we implemented the correction factor 0.67 was applied to the hand penetrometer measurements and for SPT N-values, based on a standard energy ratio of 60 percent (Skempton, 1986) was included).

The boring logs also include geographic location coordinates (decimal degrees) and ground surface elevations. It should be noted the stratigraphic lines that delineate strata boundaries depicted on the boring logs are approximate. In addition, strata boundaries could be transitional. Therefore, the actual strata boundaries might differ from those shown on the boring logs.

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Laboratory Analytical Program

Laboratory testing are being performed on selected representative soil samples collected during the field investigation to measure physical and engineering properties. The types of laboratory tests are shown in the following table.

Type of Test	Testing Method
Natural Water Content	ASTM D 2216
Atterberg Limits	ASTM D 4318
Sieve Analysis No. 200	ASTM D 1140
Unconfined Compression	ASTM D 2166
Unconsolidated-Undrained Triaxial Compression	ASTM D 2850
Soil Classification	ASTM D2487

Description of the laboratory tests:

- ***Moisture Content of Soil*** –. The moisture content of the soil (in percentage) is defined as the ratio of the mass of fluid to the mass of soil solid. The moisture content can provide an indication of cohesive soil plastic state of cohesive soils.

- ***Atterberg Limits (Liquid Limit, Plastic Limit and Plasticity Index).*** These tests are used for soil plasticity (high, low or non) and provide an indication of volume change potential when considered in conjunction with the natural moisture content. The liquid limit and plastic limit establish the boundaries of the consistency states of plastic soils. The difference between the liquid limit and the plastic limit is defined as plastic index.

- ***Sieve Analysis No. 200 (75-μm) Sieve*** –. This test measures the total amount of material (in percentage) in soils finer than the No. 200 sieve.

- ***Unconfined Compressive Strength of Cohesive Soil*** –. This test measures the unconfined compressive strength of cohesive soils in undisturbed or remolded condition, using strain-controlled deformation under load application. The undrained shear strength of a cohesive soil sample is one-half of the unconfined compressive strength.

- ***Unconsolidated-Undrained Triaxial Compression.*** This compression test consists of placing a relatively undisturbed cylindrical specimen in a pressurized triaxial chamber and then loading it to failure, without allowing drainage, using strain-controlled application of the axial load. The compressive strength of a cohesive soil sample is twice its undrained shear strength.

The results of the laboratory tests are presented on the test boring logs and the test summary sheets and test reports in **Appendix A**.

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General Subsurface Conditions

Geology of the Coastal Plain

The proposed project area is located within the Gulf Coast Structural Province, a huge sedimentary basin containing several thousand feet of sediments. In general, these sediments consist of loose sands, silts and clays, which slope gently toward the Gulf of Mexico.

The site is underlain by the Beaumont Formation of Pleistocene age. This formation consists of over consolidated clays, silts and sands with some shell calcium carbonate and iron oxides. This formation can extend to more than 100 feet. The near surface materials are often weakened by the weathering process.

Natural Hazards

Among the geologic and geomorphological features in this region are sedimentary deposits broken by structure such as normal faults, salt domes, etc. The sedimentary deposits slope gently toward the Gulf of Mexico. They are broken by normal faults, most of which dip toward the Gulf and extend downward many thousands of feet. The earth movements that caused these faults took place within the last 50,000 years. In general, the regional faults in the Houston-Gulf Coast area trend parallel to the Gulf Coast. Only the local faults over the salt domes show a radial pattern associated with the up thrust of the salt mass.

There are numerous faults and fault systems in the Houston-Gulf Coast area. The movement of many of these faults has been affected in recent history by area subsidence. The subsidence is exacerbated by removal of oil and groundwater.

Based on our preliminary fault evaluation involving review of the published geologic fault maps of Houston and surrounding area. Based on the available information, ATL does not recommend a Phase I fault investigation.

Pavement Coring

Existing pavement conditions found at the boring locations are presented in the boring logs. Pavement core photographs are presented in **Appendix C - Pavement Coring Photos.**

Borings	Thickness (in.)	
	Existing Pavement	Base Material,
B-1	13.75" thick asphalt	
B-2	2" thick asphalt	6" Cement Treated Base & 8 " Cement Stabilized Base
B-3	1½" thick asphalt	8.5" Cement Treated Base & 10" Cement Stabilized Sand Base
B-4	2" thick asphalt	10" thick Cement Treated Base
B-5	2.5" thick asphalt	10.5" Cement Treated Base & 12" Cement Stabilized sand Base
B-6	2.5" thick asphalt	8" Cement Treated Base & 8" Cement Stabilized sand Base
B-7	2" thick asphalt	11.5" Cement Treated Base
B-8	2.5" thick asphalt	10" Cement Treated Base
B-9	2" thick asphalt	8" Crushed Gravel
B-10	3" thick asphalt	8" Crushed Gravel
B-11	2" thick asphalt	6" Cement Treated Base
B-12	6" thick asphalt	8" Cement Stabilized sand Base
B-13	8" thick asphalt	3" Cement Stabilized sand Base
B-14	7.5" thick asphalt	2" Cement Stabilized sand Base

Subsurface Conditions

The subsurface soils as found in project Borings B-1 through B-14, drilled in this study are presented in **Appendix D: Soil Profile Drawings**. Based on information from project Borings, the subsurface soils along the project alignments consist of the following:

The generalized subsurface stratigraphy, interpreted from project borings (B-1 through B-14) consists of predominantly medium to high plasticity cohesive [fat clay (CH), lean clay (CL) and lean clays] soils below pavement to about 5-ft depth.

Our assessment of the subsurface conditions is based on the results of the test borings. Borings B-1 through B-14 generally encountered by firm to stiff consistency cohesive soils (fat clays or lean clays) to the explored depth. The clays contain calcareous and ferrous nodules.

Groundwater Information

No groundwater was encountered during drilling and sampling. The groundwater levels observed in the test borings might not be typical of longer term monitoring data from piezometers. In addition, the groundwater levels can vary seasonally and over longer term wet and dry cycles. The groundwater levels should be checked prior to excavations for underground lines, or sumps.

Boring No	Boring Depth	Dry Augering Depth	Ground water Depth		
			While Augering	After 15 min	24 Hr Readings
B-1	15	Dry	Dry	Dry	Dry
B-2	15	Dry	Dry	Dry	Dry
B-3	15	Dry	Dry	Dry	Dry
B-4	15	Dry	Dry	Dry	Dry
B-5	15	Dry	Dry	Dry	Dry
B-6	15	Dry	Dry	Dry	Dry
B-7	15	Dry	Dry	Dry	Dry
B-8	15	Dry	Dry	Dry	Dry
B-9	15	Dry	Dry	Dry	Dry
B-10	15	Dry	Dry	Dry	Dry
B-11	15	Dry	Dry	Dry	Dry
B-12	15	Dry	Dry	Dry	Dry
B-13	15	Dry	Dry	Dry	Dry
B-14	15	Dry	Dry	Dry	Dry

Sands and silts, and clay stratum containing considerable lenses/seams/layers of more permeable soils such as silty/clayey sand or sandy silt, can become pathways for water infiltration during rain events and form perched water. The rate of flow of groundwater produced by these layers will depend upon the weather conditions such as amount of precipitation and ambient temperature etc., at the time of construction. It should also be noted that the groundwater level is generally influenced by such factors as topography and surface drainage features.

It should be noted that a detailed hydro-geological investigation of the proposed project area is beyond the scope of this investigation. Groundwater depths measured during and at completion of drilling are shown on the respective boring logs.

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Subgrade Preparation Recommendations

Site Preparation

Areas to be cut or filled should be stripped to remove the organic materials, and other deleterious materials to expose competent soils. Generally, the depth of stripping should be on the order of 1-in to 2-in. The stripped materials should not be used as compacted fill. If encountered, loose or wet soils should be undercut and replaced with compacted backfill.

The ground surface should be appropriately graded throughout construction to prevent ponding of rainfall runoff and provide positive drainage.

Proof Rolling

The effective depth of proof rolling will depend on the vehicle weight and tire pressures. We recommend that proof rolling be performed using earthmoving equipment such as loaders and scrapers, compactors, or tracked vehicles.

Proof rolling should extend beyond the construction limits and should include overlapping perpendicular passes in two directions.

The proof rolling specifications should provide for the following acceptance criteria:

- Rut depths less than 2 inches
- No visual evidence of pumping

A geotechnical representative should be present to observe and document each proof rolling and to delineate areas of weak or compressible soils. Areas that are not in compliance with the proof rolling specifications could require remediation. Remedial options include disking and air drying, application of geogrid reinforcement, and chemical treatment.

Conditioning Prior to Fill Placement

Based on the depths of the existing pavement section that will be removed, it requires imported select fill to be used under the proposed pavements. New pavement areas to receive fill should be scarified to a depth of approximately 6 inches., moisture conditioned to near optimum moisture content, and recompacted using sheepsfoot rollers or other suitable equipment. The moisture content should be maintained at or near optimum moisture content and the area should be compacted to at least 95%. Optimum moisture content and maximum dry density should be determined per ASTM D-698 test procedures.

During the scarification, moisture conditioning, and compaction, the areas should be observed by an experienced geotechnical engineer. Areas which do not support the compaction operation should be excavated and replaced with compacted fill. The excavated soils should then be moisture conditioned and reused as compacted fill, unless the soils have significant organic content.

Fill Placement and Compaction

The fill materials should be placed in layers, typically on the order of nine (9) inches in thickness according to TXDOT Specifications Item 210. The actual layer thickness will be dependent on the compaction equipment. Each layer should be moisture conditioned to near optimum moisture content and compacted to the full depth to achieve 95%. The lifts should not be allowed to dry or become saturated prior to placing the next lift. The fill area should be sealed at the end of each day with a smooth roller and graded to drain.

The fill compaction should proceed to the specified final elevation prior to placing pavements, or other final improvements. Depending on the construction schedule, the final fill surface should be protected by grading to drain and sealing the surface with a smooth roller. A minimum 1% slope should be used for drainage. For exposure periods of more than about 1 month, protection could include utilizing a layer of crushed recycled concrete base aggregate or recycled asphaltic concrete base.

Select Fill

For areas such as below pavements, sidewalks and below soil supported foundations such as spread footings, the select fill should meet the following specifications.

Item	Specification	Test Reference
soil fines	More than 60% and less than 85% passing No. 200 sieve	ASTM D 1140
plasticity index (PI)	10 to 20	ASTM D 4318
liquid limit	less than 40	ASTM D 4318
classification	CL	ASTM D 2487 & 2488
organic content	less than 4 percent	ASTM D 2974
Compaction	95% of max. Standard Proctor	ASTM D 698
Moisture Content	±3	ASTM D 2216

The fill should be placed in uniform layers or lifts. Typically, a maximum 8 in. lift thickness (loose measure) is appropriate for most conventional compactors. The fill should be compacted to at least 95 percent of the maximum dry density determined by the Standard Proctor test (ASTM D 698). The water content should be at or above the optimum water content.

Lime stabilized on-site soils and flowable fill are a suitable option for select fill. There could be other materials that will be fit for purpose as select fill. These should be evaluated on a case by case basis based on laboratory tests on remolded compacted specimens.

Lime Stabilization

Subgrade soils for pavements should be lime stabilized to a depth of at least 8 inches to reduce the tendency for shrinking and swelling and to improve all-weather access. The following outlines the

suggested procedures for lime stabilization.

The lime or lime slurry used should meet the TXDOT Specifications for Type A or Type B hydrated lime or lime slurry using Tex 121-E test procedure. The supplier should provide certificates that the lime meets these specifications. The volume of soil to be stabilized should be verified each day by measurement of length, width, and thickness. The geotechnical engineer should perform in-place field density tests to calculate the soil dry weight. The contractor should survey and stake the limits of the area to be lime treated and provide weight tickets to confirm that the required weight of lime was added.

The lime stabilizer should be added and blended into the soil with a pulvimixer capable of mixing the entire layer thickness. During the mixing process, water should be added as needed to maintain the soil lime mixture at a minimum of 2% above the optimum moisture content, based on ASTM D 698 test procedures. The layer surface should then be sealed with a rubber-tired roller and left to mellow for about 48 hours or as evaluated during mixing. The surface should be kept moist with a water truck.

During the above mixing and prior to sealing, the soil and lime should be well blended and the maximum particle size of the blend should not exceed one (1) inch. Prior to sealing, the pH of the mixture should be checked to confirm that the pH is at least 12.4

After the mellowing period, the stabilized soil should be remixed, conditioned to at least 2% above the optimum moisture content and compacted to a minimum dry density of 95% per ASTM D-698. The surface of the compacted subgrade should be sealed each day and maintained in a moist condition until pavement components are placed.

The optimum lime content should be determined by testing during construction. For budgeting purposes, we estimate the optimum lime content to be on the order of 8% lime by dry weight of soil.

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Pavement Recommendations

The pavement subgrade preparation including stripping, proof-rolling, subgrade stabilization, and fill placement may be required prior to the construction of rigid pavement. The pavement design analysis and improvements that includes selection of design parameters, in accordance with the 1993 AASHTO Design Guide.

We performed rigid pavement design analysis that included selection of design parameters, in accordance with the 1993 AASHTO Design Guide. The AASHTO pavement prediction method requires the traffic, performance criteria, material properties for structural design, and structural characteristics. The design procedure is based on cumulative expected 18-kip Equivalent Single Axle Load (ESAL) applications during the analysis period.

In the absence of recent traffic study, and judging from the performance of the existing pavements, we understand the proposed lanes widening roadway will consist of the following continuously reinforced Portland cement concrete pavement sections. We recommend the proposed typical cross-section and presented on **Figure 1C** and also shown below:

7" Jointed Reinforced Concrete Pavement
8" Lime Stabilized Subgrade

The top 8-inches under the Pavement should be stabilized and compacted, as discussed in "*Lime Stabilization*". Construction of the PCC pavements should meet the TXDOT Standard Specifications, Item 360 "Concrete Pavement".

Construction of Portland Cement Concrete (PCC) Pavement:

- Remove the existing asphalt (AC) pavements with new PCC applicable sections of TXDOT Standard Specifications Item 360 "*Concrete Pavement*".
- Remove existing base material, soft/wet soils or other deleterious materials, if any. Excavate to an elevation at least 2 inches below the base of the replacement pavement. Compact the excavated subgrade soils at a moisture content between -3 and +3 percent of optimum, to at least 95 percent of the maximum dry density at as determined by the Standard Proctor Compaction Test (Tex 114-E).
- Select fill should be placed to the desired elevation. The borrowed soils should be meet the specification as described in "*Select Fill*".
- If no select fill is required, then the top 8-inches of subgrade should be lime stabilized. Lime stabilization should be performed accordingly as presented in the report "Lime Stabilization".
- Good surface drainage should be provided away from the edges of paved areas to minimize lateral moisture transmission into the subgrade.

Reinforcement Design

Reinforcing steel (rebar) is required to control pavement cracks, deflections across pavement joints and resist warping stresses. The cross-sectional area of steel (As) required per foot of slab width can be calculated as follows:

$$A_s = W*T*L*F/(2f_s)$$
$$S = 12*A/A_s$$

Where:
- A_s = Required cross-sectional area of reinforcing steel per foot of width, in^2
- F = Coefficient of friction between slab and subgrade
- W = Weight of pavement slab, (150 pcf)
- L = Distance between free transverse joints or between free longitudinal edges, feet
- T = Thickness of pavement slab, feet
- f_s = Allowable working stress of steel rebar (75% of steel yield strength), psi
  Note: HCPID Construction Specifications Item 360 and 440 specifies Grade 60 steel.
- S = Maximum spacing between reinforcing steel, inches
- A = Area of a single reinforcing steel, in^2

Based on AASHTO, a coefficient of resistance, F = 1.8 may be used in the above equation. The above equation is for both longitudinal and transverse steel. ATL understands that an expansion joint spacing of 80 and 160 feet will be used for this project. Based on the recommended 7-inch thick PCC pavement, and with a longitudinal expansion joint spacing of 80 and 160 feet, the maximum allowable longitudinal and transverse reinforcing steel spacing, considering various rebar sizes and a rebar yield strength of 60,000 psi, are provided in the table below.

Pavement Thickness	Joint Spacing	Rebar Size	Rebar Area (in^2)	Maximum Rebar Spacing
7"	80' (Longitudinal)	#4	0.20	17
		#5	0.31	26
		#6	0.44	36
		#7	0.6	36
	160' (Longitudinal)	#4	0.20	8
		#5	0.31	13
		#6	0.44	18
		#7	0.6	25
	25' (transverse)	#4	0.20	36

Notes:

1. ***Rebar size** and **spacing** shall be selected considering the material availability, cost, contractor's ability to work with various rebar size, and other factors.*
2. ***Reinforcing bars** should be placed on maximum 36 inches center each way (Item 360 page 9)*

Typical end spacing is 3 or 4 inches from the edge of pavement. The interior rebars shall be distributed at equal center-to-center spacing not exceeding the maximum allowable rebar spacing requirements. Design of the PCC pavements, including reinforcement and jointing details, should meet the TXDOT Standard Specifications, Item 360 "Concrete Pavement".

Design Example

Assuming that expansion joints are spaced 80-feet longitudinally and transversally, allowable tensile stress in the steel f_s = 0.75 x 60,000 psi (*Ref. AASHTO Design Guide 1993, Page II-28)* = 45,000 psi, and concrete pavement thickness of 10-in., steel reinforcement is calculated as follows:

$$A_s = \frac{(9\text{-in}/12\text{-in}) \times 150 \text{ pcf} \times 1.8 \times 80\text{-feet}}{2 \times 45{,}000 \text{ psi}} = 0.180 \text{ in}^2/\text{ft}$$

Using # 5 deformed steel reinforcing bars (cross-sectional area $=\pi * (5/8/2)^2 = 0.31$ in^2)

$$S = 12 \times 0.31/0.18$$

Steel spacing is equal to [12 in/ft x (0.31 in^2/0.20 in^2/ft) x] = 21 in.

Pavement Maintenance

It is essential to maintain the pavement to prevent infiltration of water into the subgrade soils. Allowing water into the subgrade will accelerate pavement failure and maintenance requirements. Periodic maintenance must be performed on the pavement sections to seal any surface cracks and prevent infiltration of water.

Utility Recommendations

We assumed that the proposed RCP lines will be installed within the upper 10-ft depth. The recommendations presented in this report are based on an assessment of the observed subsurface conditions at widely spaced project borings. Excavation retention and construction dewatering are the responsibility of the contractor. The contractor should collect additional subsurface information as necessary to determine if the conditions reported herein are representative.

Open Cut/Trench Excavation

The proposed construction of any utility relocations will be handled by City of Dickinson and storm sewers will involve open cut and/or trenching. The estimated excavation depths and the subsurface conditions found in the soil borings are shown in the Boring Logs. Accordingly, the construction excavations will most likely be advanced in firm to very stiff clays (CL/CH), and we did not encounter silty sands.

The trench excavations can be made using cut slopes stepped back to stable slope, vertical cuts supported with sheet piles or other suitably designed retaining system. The excavation should be performed in accordance with the current OSHA 29 CFR Part 1926 of OSHA and Harris County Public Infrastructure Department (HCPID) Standard Specifications, Item 429 – Trench Safety System. Stockpiling of excavated material should not be allowed near the excavation. Generally, a distance of at least one-half the excavation depth on both sides of the trench should be kept clear of any excavated material and height of stockpile should be limited to no more than 3 feet. If this is not possible due to space limitations, then the retaining system design should be designed to take into account the surcharge loads.

OSHA Soil Types: The onsite soils within the excavation depth may be classified as OSHA Soil Type B for the determination of allowable maximum excavation side slope or selection and design of the protective system. All sands and silts and other soils with limited cohesion, and all soils subjected to groundwater seepage pressures or vibrations shall be classified as OSHA Soil Type "C".

Excavation/Trenching: Trenches should be provided with a proper trench support system. For the trench supporting system, the lateral pressures exerted on trench walls by stiff clays and cohesionless soils are presented in **Figure 3**. Where soft to firm cohesive soils are encountered, the lateral pressure may be computed as given in **Figure 4**. Where cohesive soils are underlain by sandy soils, the lateral pressure may be computed as given in **Figure 5**. Temporary earth retaining walls are sometimes designed assuming an equivalent fluid pressure, in such cases, a lateral earth pressure equivalent imposed by a 84 PCF and 102 PCF fluid is recommended for clay soils above and below the water table, respectively; in sandy soils, a lateral earth pressure equivalent imposed by a 48 PCF and 85 PCF fluid is recommended for soils above and below the water table, respectively. Timber shoring as outlined in 29 CFR Part 1926 of OSHA recommendation may be used in the construction of trench supporting system. Trench boxes are commonly used for trench safety without shoring or bracing in

open-cut excavations with vertical walls. In all cases, excavations should conform to OSHA guidelines.

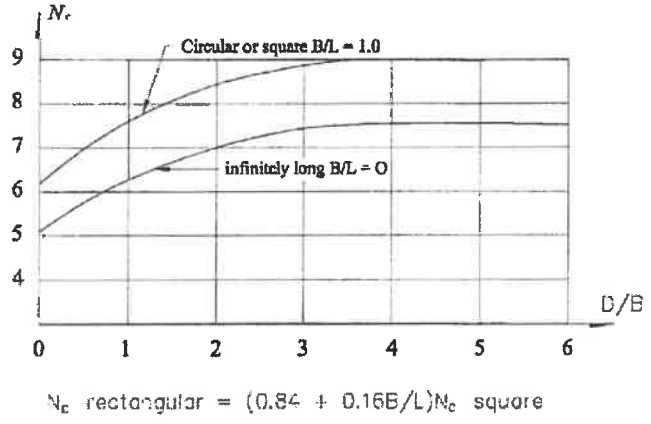
Vehicular and Other Surcharge Loadings: Under normal loading conditions, a surcharge magnitude of q psf can result in lateral earth pressure of about 0.5q in cohesive soils and about 0.4q in sandy soils. All surcharge loads to a distance of 0.5 times the wall height should be considered. Due to the likely presence of buried pipelines along the road improvement, the effects of vehicular traffic should be considered while designing the lateral supporting systems. The highway loading imposed by a H20 truck on a pipe under various depths of soil cover is presented in **Figure 6**. **Figure 7** presents Boussinesq's equation for computing both horizontal and vertical stresses imposed by a surface surcharge load.

Trench Bottom Stability: In stable cohesive soils and where groundwater is lowered at least 3 feet below the excavation bottom, and if the sheeting terminates at the base of cut, the trench bottom stability can be evaluated in the following manner:

$$\text{Factor of safety } (F_s) = \frac{(N_c)\,C}{(\Upsilon)\,D + q}$$

Where,

N_c = Bearing capacity factor that depends on dimensions of the excavation:



C = Average undrained shear strength of clay in failure zone beneath and surrounding base of cut, psf.
Υ' = Average effective unit weight of soils above trench bottom, pcf.
q = Surface surcharge, psf.
D = Depth of trench, ft.
L = Length of trench, ft.
B = Width of trench, ft.

If the factor of safety is less than 1.5, sheeting should be extended below the base of the cut to insure stability. The extended sheeting depth should be at least 1.5 times the trench width.

Buoyant Uplift of Buried Structures

Portion of a buried structure located below the water table is subject to an upward hydrostatic pressure, called the *buoyant uplift pressure*. Resistance to buoyant uplift pressure is provided by the following components:

- *Weight of the structure (W)*
- *Weight of the soil above the base extension beyond the wall(Ws)*
- *Frictional force between the soil and foundation (Fs).*

Buoyant Uplift Resistance = W + Ws + Fs

W and Ws can be readily computed. The computation of the buoyant uplift, and the skin friction resistance are recommended in **Figure 2**. If base extension option is used, we recommend using a buoyant unit weight of backfill soil above the base extension of 65 pcf when computing Ws.

Utility Bedding and Backfill Criteria

Bedding and backfill for any utility relocations will be handled by City of Dickinson, and storm sewers should be constructed using City of Houston Department of Public Works and Engineering *Standard Construction Specifications for Wastewater Collection Systems, Water Lines, Storm Drainage, and Street Paving*, or an equivalent standard. In accordance with these specifications, the backfill requirements should conform to Section 02317 – "Excavation and Backfill for Utilities," and Section 02320 – "Utility Backfill Material."

Storm Sewers. Bedding recommendations outlined on Drawing No. 02317-03, are expected to be applicable for storm and sanitary sewer lines bedded within stable soils. Drawing No. 02317-2 may be required for wet bedding conditions provided the trench bottom is pressure-relieved through dewatering.

Backfill Placement. Backfill placement should be in accordance with the City of Houston Standard Construction Specifications. Trench zone backfill placement and compaction requirements are provided in Section 02317, *Excavation and Backfill for Utilities*, and are summarized in the following table:

Trench Zone Backfill Placement and Compaction

Soil Type	Maximum Lift Thickness (Compacted)	Minimum Compacted Density (ASTM D 698)	Compacted Moisture Content (ASTM D 698)
Bank Run Sand	9 inches	95%	±3 points
Cement-Stabilized Sand	12 inches	95% [1]	Less than optimum [1]
Select Fill	6 inches	95%	± 2 points
Random Fill [2]	9 inches (clay) 12 inches (sand)	90%	None

[1] As determined by ASTM D 558
[2] Random fill is to be used outside pavement areas.

We recommend a minimum 95% relative compaction for random fill. Backfill material specifications for bank run sand, select backfill, and random backfill are provided in the Specification Section 02320, Utility Backfill Materials. The City of Houston Standard Construction Specifications preclude the use of silt, organic clay, and peat as utility backfill materials. Cement-stabilized sand material specifications are provided in Section 02321, Cement Stabilized Sand.

The City of Houston Standard Construction Specifications require in-place density testing of pipe embedment and trench zone backfill at a minimum frequency of one test per 40 linear feet (embedment) and two tests per 40 linear feet (backfill), with a minimum of three density tests for each shift of work (Section 02317).

Groundwater Control

No free water was encountered in the borings at a depth of about 15 feet during drilling. However, it should also be noted that groundwater level may cause fluctuations corresponding to rain events. The groundwater levels should be checked prior to excavations for underground lines, or sumps.

Groundwater, if present, may cause instability of the soils by saturation and seepage pressures. Dewatering in cohesive and semi cohesive soils can usually be accomplished by sump and pump arrangements because the seepage is relatively slow. For shallow dewatering to a depth of about fifteen (15) feet, wellpointing may be adapted. For dewatering below this depth and in granular soils, deep wells with submersible pumps or educators would be preferable. HCPID Standard Construction Specifications Item 436 "Well Pointing" outlined the requirements for temporary dewatering of trenches for installation of utilities.

Seams and pockets of sands, silt, ferrous nodules, and calcareous nodules that exist in the cohesive soil layers may pose a threat if they form a drainage path for the groundwater and as a result, accelerate the rate of seepage. If such unexpected phenomenon is observed during the trench excavation and construction, appropriate measures, such as proper dewatering and shoring methods, may have to be implemented.

Roadside Ditches

ATL understands that existing shallow roadside ditches (no more than 5 feet), with side slope of 3H:1V or no steeper slope than 3H:1V, will be reconstructed close to the ROW edges to accommodate the construction. If slope is steeper than 3H:1V, then it shall be protected with liner (concrete, clay or riprap liner). If the exposed surface soils of the excavated roadside ditches consist of sands/silts/clay soils with PI of less than 12, ATL recommends that placing a minimum 4 inches of compacted clay soils with a PI of 15 or above to mitigate the potential erosion. All exposed surface soils should be protected by immediate establishment of vegetation cover by sodding or seeding, or a combination of both.

Roadside Ditch Construction: The site preparation and site completion for the proposed ditches should be conducted in according to requirements as outlined in HCPID Standard Specifications Item 120. ATL recommends the following measures to improve slope stability and erosion protection of the slope soils of the roadside ditches:

1) Trim earth slopes to no steeper than 3H:1V (preferably flatter where feasible). Cutting or filling or a combination of both may be carried out in the trimming of the earth slopes to the designed inclination. If filling is carried out, clean onsite lean clays with PI between 15 and 35 (containing no more than 40 percent sand-sized particles, and no sand pockets and seams) may be used and compacted to at least 95 percent of the Standard Proctor (ASTM D 698) maximum dry density.
2) CL-ML/ML/SM/SC/SP type soils exposed during ditch slope excavation, as well near the toe or bank of the slopes (if encountered) should be replaced with a minimum 2-foot thick of clean onsite lean clays with PI between 15 and 35 (containing no more than 40 percent sand-sized particles, and no sand pockets and seams) may be used and compacted to at least 95 percent of the Standard Proctor (ASTM D 698) maximum dry density.
3) Exposed soil surface as a result of the roadside ditch construction shall be protected by immediate vegetation cover by sodding, seeding and erosion control blanket or hydro-mulching, or a combination of these measures, per requirements of HCPID Standard Specifications Item 162, 164 and 165, respectively.

Groundwater Control During Construction

Based on groundwater information from our borings, and considering the estimated excavation depths, groundwater will not likely be encountered during excavations. Perched water may be encountered at shallower depths at location located near ditches or other water sources. It should also be noted that groundwater level may fluctuations corresponding to rain events.

Groundwater, if present, may cause instability of the soils by saturation and seepage pressures. Dewatering in cohesive and semi cohesive soils can usually be accomplished by sump and pump arrangements because the seepage is relatively slow. For shallow dewatering to a depth of about fifteen

(15) feet, wellpointing may be adapted. For dewatering below this depth and in granular soils, deep wells with submersible pumps or educators would be preferable.

Seams and pockets of sands, silt, ferrous nodules, and calcareous nodules that exist in the cohesive soil layers may pose a problem if they form a drainage path for perched or ground water and as a result, accelerate the rate of seepage. If such a phenomenon is observed during the construction excavation, appropriate measures, such as proper dewatering and shoring methods, shall be implemented as necessary.

HCFCD Standard Specifications Section 02241 "Care and Control of Water" outlines the requirements for the care and control of surface and ground water in open excavations and trenches for installation of utilities. Equivalent HCTRA and TXDOT Standards may also be used.

ASSOCIATED TESTING LABORATORIES

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Tel: (713) 748-3717 Fax: (713) 748-3748

Construction Review

Quality Control

Associated Testing Laboratories, Inc. (ATL) recommends implementation of a quality control program under the supervision of a Professional Engineer considering there will be excavation and backfilling will be required for this project. Structural integrity and stability is particularly dependent on quality foundation installation, subgrade preparation, fill placement and compaction. An independent testing laboratory should be assigned to test and inspect construction materials during the construction phase.

To ensure that excavation will remain stable, to provide sufficient headroom for working, to provide worker's safety and to protect adjacent structures, the excavations will have to be provided with sufficient side slopes or shored in accordance with OSHA "Trench Safety Systems" (29 CFR Part 1926), as published in the Federal Register, Vol. 52, No.72, Section 1926-650 through 1926-653. Excavation of the trenches and access pits should be carried out under the supervision of an experienced construction supervisor and necessary shoring and/or bracing of the trenches should be properly installed.

In temporary braced or shored excavations and in access pits where the sheeting terminates at the base of the trench, lateral earth pressure, surcharge, and seepage pressure caused by a differential hydrostatic head moving upward to the bottom of the trench can cause trench bottom instability. Therefore, it is recommended that, if the bottom stability evaluation yields a factor of safety less than 1.5, the sheeting should be extended below the base of cut. Before filling operations take place, representative samples of the proposed fill material should be tested by an independent laboratory to determine the compaction and classification characteristics.

Monitoring

Due to the scope of this geotechnical exploration, there is always the possibility that actual subsurface conditions may differ from the predicted conditions because conditions between soil borings can be different from those at specific boring locations.

Any excessive ground movements like settlement and lateral movement should be monitored and controlled. This can be done by performing a preconstruction survey including photography and documentation of existing conditions like elevations, cracks, etc., and by installing ground movement monitoring devices such as inclinometers, crack monitors, and establishing elevation monitor stations along the project alignment to monitor the ground movement after commencement of the excavation.

ATL recommends a regular inspection and overall project monitoring by a geotechnical engineer during the construction phase. The purpose of inspection is to provide sound engineering and judgment alternatives during construction, if unanticipated conditions occur.

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Limitations

The recommendations contained in this report are based on data derived from test borings at the location, a reasonable volume of laboratory tests, and professional interpretation and evaluation of such data, from the project information furnished. Should it become apparent during construction that soil conditions differ significantly from those discussed in this report, this office should be notified immediately so that an evaluation, and any necessary adjustments can be made.

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1. Joseph E. Bowles (1982), "Foundation Analysis and Design," 3rd ed., McGraw-Hill Book Company.
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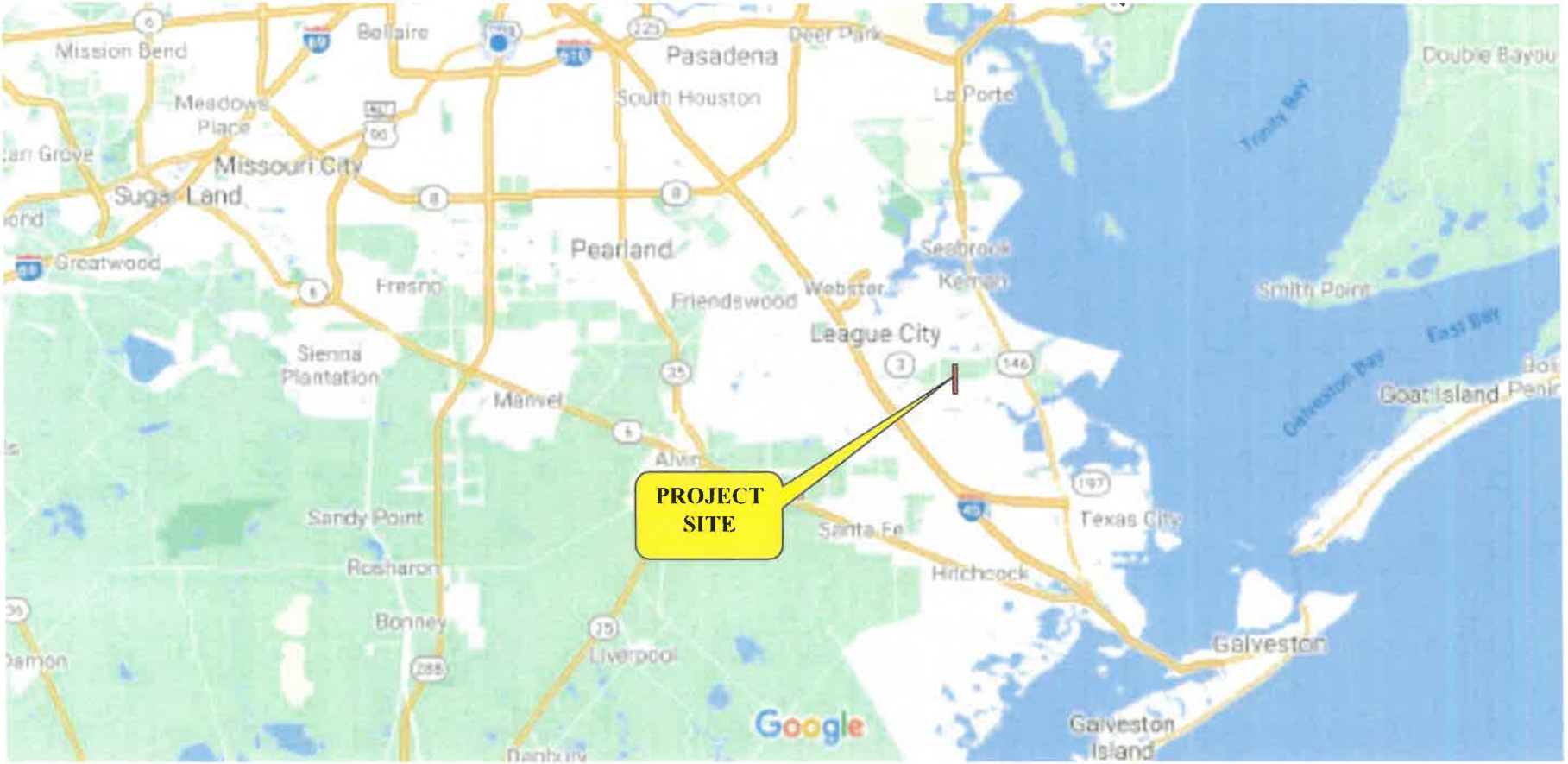
Figures

NORTH



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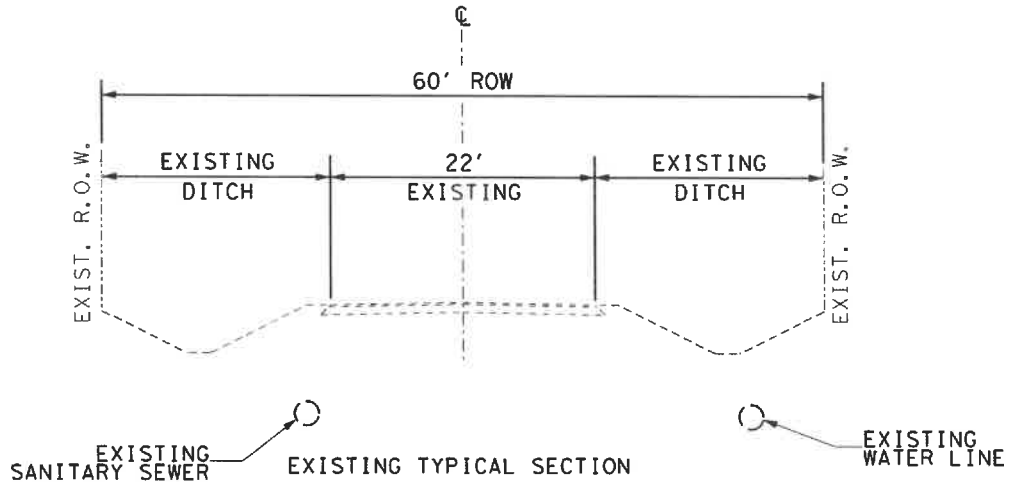
Project : Road Reconstruction & Drainage Improvements Of California Ave. City of Dickinson, Texas	ASSOCIATED TESTING LABORATORIES	Project No.: G2021-131
		Not to Scale
Client: McDonough Engineering Corporation Houston, Texas	Site Vicinity Map	FIGURE 1a

Notes:
⊕ Soil Borings B-1 thru B-14 at 15-ft. deep (Total = 210 LF)

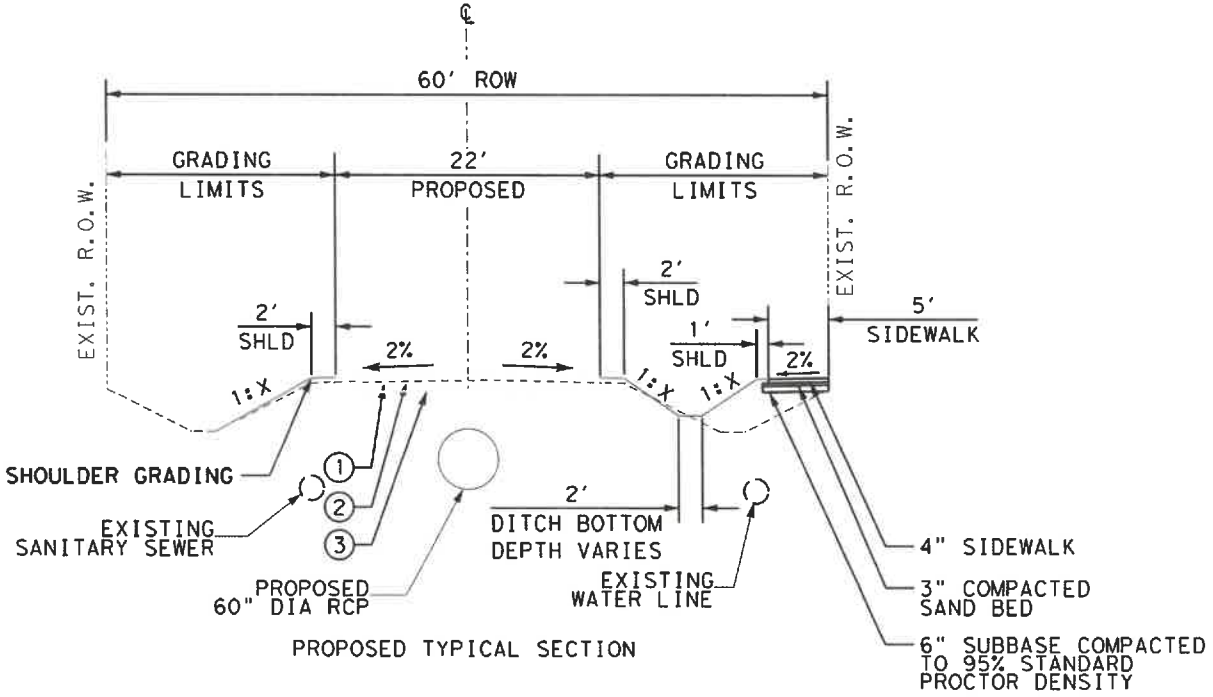
Project: Road Reconstruction & Drainage Improvements Of California Ave. City of Dickinson, Texas	ASSOCIATED TESTING LABORATORIES	Project No.: G2021-131 Not to Scale
Client: McDonough Engineering Corporation Houston, Texas	Boring Location Plan	FIGURE 1b



LEGEND

1. 7" JOINTED REINFORCED CONCRETE PAVEMENT
2. REMOVE EXISTING ASPHALT PAVEMENT AND BASE
3. STABILIZED SUBGRADE

NOTE:
1. MANHOLES & VALVES TO BE ADJUSTED TO FINISH GRADE



0 2.5 5 10 20
SCALE: 1" = 10' - 0"

THESE DOCUMENTS ARE FOR INTERIM REVIEW AND NOT FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

RESPONSIBLE ENGINEER:
R.G. MILLER ENGINEERS, INC.
TBPE FIRM REGISTRATION NO. F-487
AMBER J. FORREST, P.E.
TEXAS LICENSE NO. 98423

DATE	BY	REV	REVISION

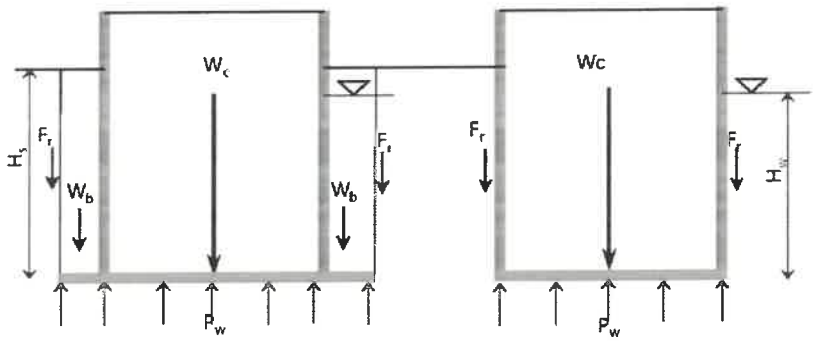
r.g.miller engineers

CALIFORNIA AVENUE

FED. RD. DIST. NO.	PROJECT NO.		SHEET NO.
XX			
DES.: XX	STATE	DIST.	COUNTY
CHK.: XX	TEXAS		GALVESTON
DRN.: XX			
CHK.: XX			

DATE: $DATE$ $TIME$
FILE: $FILE$

Figure 1C



Dead Weight of Structure + Dead Weight of Backfill Above Base Extension + Frictional Resistance

$P_w = H_w\gamma_w$
$F_u = A_bP_w$
$W_c/S_{fa}+W_b/S_{fb}+F_r/S_{fc} \geq F_u$
(S_{fa} = 1.1; S_{fb} = 1.5; S_{fc} = 3.0)

Dead Weight of Structure + Frictional Resistance

$P_w = H_w\gamma_w$
$F_u = A_bP_w$
$W_c/S_{fa}+F_r/S_{fc} \geq F_u$
(S_{fa} = 1.1; S_{fc} = 3.0)

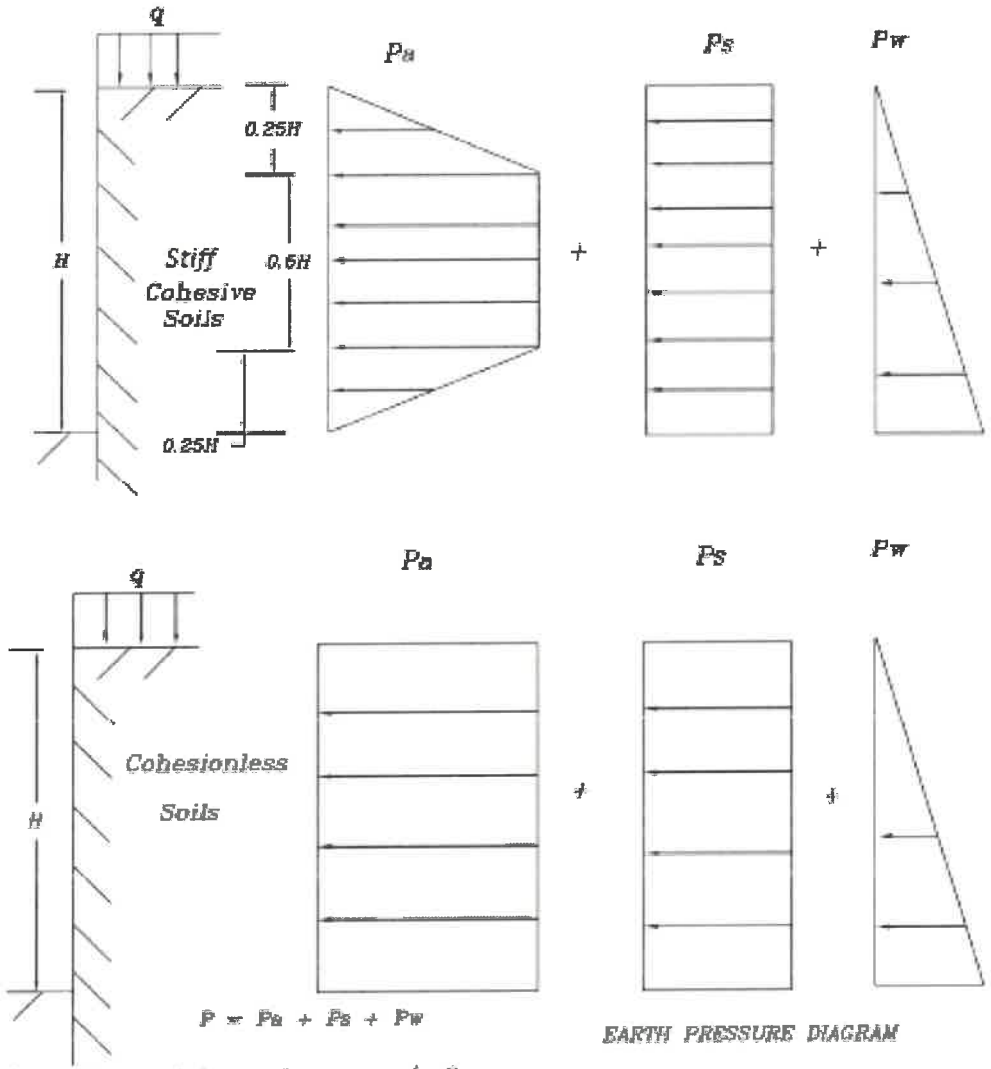
For cohesive soils:
$F_r = \alpha c_n A_n$

For cohesionless soils,
$Fr = p_n K \tan\delta_n A_n$

Where,

H_s	=	Buried depth of wall, ft
H_w	=	Height of water table above base of structure, ft
P_w	=	Total uplift pressure = 62.4 x Hw, psf
F_u	=	Total uplift force exerted on base of structure = Pw x A_b
W_c	=	Dead weight of structure, lbs
W_b	=	Weight of backfill above base of structure, lbs (use a soil unit weight of 120 lbs)
A_b	=	Area of base, ft^2
F_r	=	Friction resistance developed at the soil/wall interface, lbs
A_n	=	Contact area between the soil/wall interface in layer"n"
c_n	=	Undrained shear strength of cohesive soils at layer "n" at soil/wall interface. See individual boring logs. c_n for the top 8 ft of clays with PI higher than 20 percent should be discounted because of the shrink-swell characteristics of high plasticity clays.
α	=	Adhesion factor, to be multiplied with c_n to obtain the adhesion between the soil/wall interface. Use 0.75 if c_n is less than 0.25 tsf, use 0.67 if c_n is between 0.25 and 0.5 tsf, use 0.5 if c_n is greater than 0.5 tsf but limit the adhesion to 1.5 ksf.
K	=	Coefficient of lateral earth pressure of cohesionless soils. Use 0.4.
p_n	=	Average overburden stress at the mid-depth of cohesionless soil layer "n", psf
δ_n	=	Average frictional angle between cohesionless soil layer "n" and the walls of the structure, use 0.75 of the angle of internal friction (ϕ) of the cohesionless soil. A ϕ of 28 degrees may be used if no specific value is given.
$S_{fa,b,c}$	=	Factors of safety against buoyant uplift force.

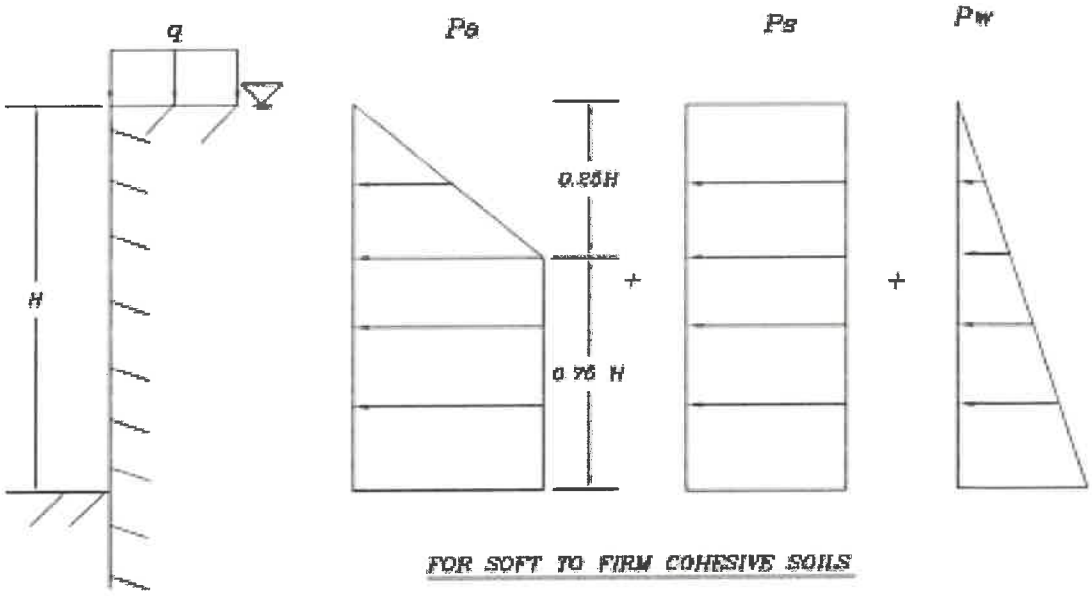
PROJECT: Road Reconstruction & Drainage Improvements Of California Ave. City of Dickinson, Texas	ASSOCIATED TESTING LABORATORIES	**Project No:** G2021-131
CLIENT: McDonough Engineering Corporation Houston, Texas	**Bouyant Uplift Resistance Of A Buried Structure**	**FIGURE 2**



Where P = Total lateral pressure (psf)
Pa = Active earth pressure(psf) = $K_A \gamma H = 0.4 \gamma H$ for Stiff Clays
= $0.65\ K_A \gamma H = 0.25 \gamma H$ for cohesionless Sands ($0.33 \gamma H$–for loose sand)
Ps = Lateral pressure due to surcharge load (psf) = 0.5q for Clays
= 0.4q for Sands
(0.5q for loose Sands)
Pw = Hydrostatic pressure (psf) = 62.4* water depth
H = Depth of braced excavation (ft)
q = Surcharge load (psf) usually taken as 500 psf
γ = Submerged density of soils (pcf) = use 60 pcf (use 50 pcf for loose Sands)

Source: Peck, R.B. 1969. "Deep Excavations and Tunneling in Soft Ground".

PROJECT: Road Reconstruction & Drainage Improvements of California Ave. City of Dickinson, Texas	ASSOCIATED TESTING LABORATORIES	**Project No:** G202-131
CLIENT: McDonough Engineering Corporation Houston, Texas	**Lateral Earth Pressure**	**FIGURE 3**



FOR SOFT TO FIRM COHESIVE SOILS

Where P = Total lateral pressure (psf)

Pa = Active earth pressure(psf) = $1.0K_a\gamma H$ for soft clays

K_a = Active Earth pressure coefficient

$= 1-m\frac{2q_u}{\gamma H} = 1-m\frac{4C}{\gamma H}$ (taking $C=\frac{q_u}{2}$)

Here m=1 for N<4 and m=0.4 for N>5

N= Stability number $=\gamma H/C$

Ps = Lateral pressure due to surcharge load (psf) = K_a for clays

Pw = Hydrostatic pressure (psf) = 62.4* water depth

H = Depth of braced excavation (ft)

q = Surcharge load (psf) usually taken as 500 psf

γ = density of soils (pcf) = use 60 pcf below groundwater and 110 pcf above groundwater

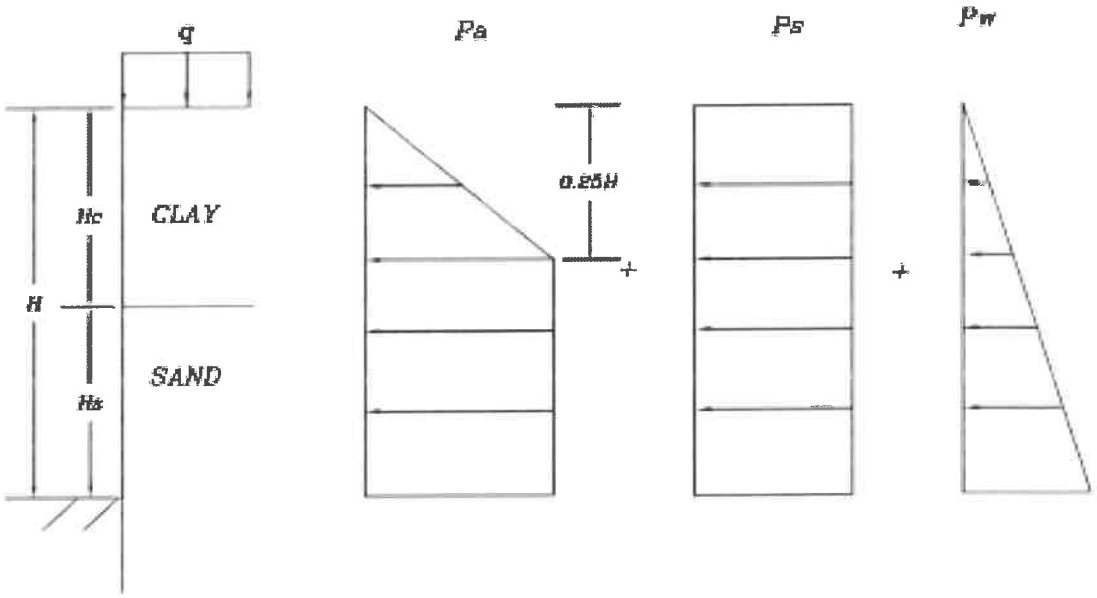
q_u = Unconfined compressive strength, psf

C = Undrained shear strength, psf

Note: Neglect hydrostatic pressure above groundwater level

Source: Peck, R.B. 1969. "Deep Excavations and Tunneling in Soft Ground".

PROJECT: Road Reconstruction & Drainage Improvements of California Ave. City of Dickinson, Texas	ASSOCIATED TESTING LABORATORIES	Project No: G2021-131
CLIENT: McDonough Engineering Corporation Houston, Texas	Lateral Earth Pressure	FIGURE 4



$$P = Pa + Ps + Pw$$

Where P = Total lateral pressure (psf)

Pa = Active earth pressure(psf) = $K_A \cdot \gamma \cdot H = 0.4 \cdot \gamma \cdot H$

Ps = Lateral pressure due to surcharge load (psf) = 0.5q

Pw = Hydrostatic pressure (psf) = 62.4* water depth

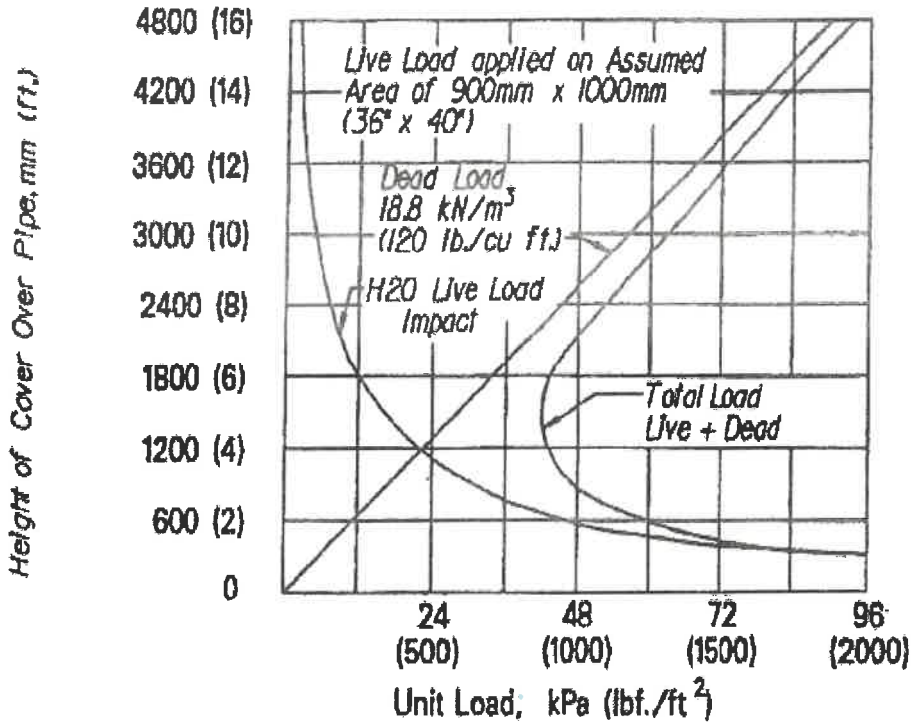
H = Depth of braced excavation (ft)

q = Surcharge load (psf) usually taken as 500 psf

γ = Submerged density of soils (pcf) = use 60 pcf

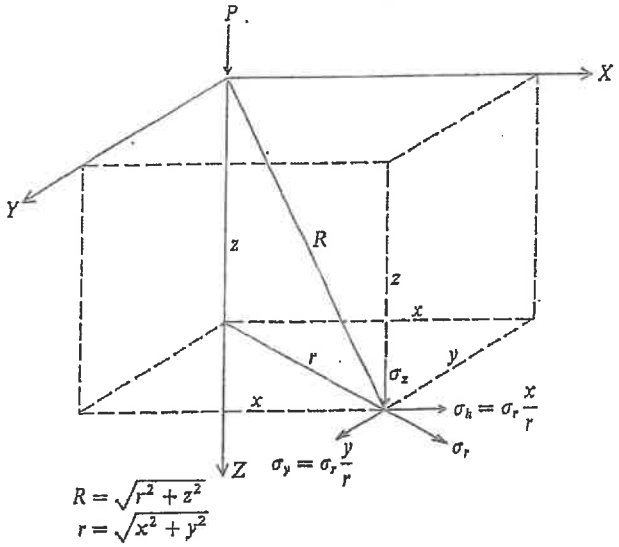
Source: Peck, R.B. 1969. ["Deep Excavations and Tunneling in Soft Ground"

PROJECT: Road Reconstruction & Drainage Improvements of California Ave. City of Dickinson, Texas	ASSOCIATED TESTING LABORATORIES	**Project No:** G2021-131
CLIENT: McDonough Engineering Corporation Houston, Texas	**Lateral Earth Pressure**	**FIGURE 5**



Combined H20 highway live load and dead load is a minimum at about 1500mm (5 ft.) of cover, applied through a pavement 300mm (1 ft.) thick.

Project: Road Reconstruction & Drainage Improvements of California Ave. City of Dickinson, Texas	ASSOCIATED TESTING LABORATORIES	**Project No:** G2021-131
Client: McDonough Engineering Corporation Houston, Texas	**Highway Loading on a Pipe Under Various Soil Cover**	**FIGURE 6**



Lateral Pressure, $\sigma_r = (P/2\pi)\ \{3r^2z/R^5)-([1-2\mu]/R[R+z])\}$
For $\mu = 0.5$
$\sigma_r = P/2\pi\ (3r^2z/R^5)$

Vertical Pressure, σ_z :
$\sigma_z = 3\ Pz^3 / 2\pi R^5$

P= Point load surcharge
μ = Poisson's ratio if soils, use 0.5
X,y,z = respective distance in x, y and z direction,

Project: Road Reconstruction & Drainage Improvements of California Ave. City of Dickinson, Texas	ASSOCIATED TESTING LABORATORIES	**Project No:** G2021-131
Client: McDonough Engineering Corporation Houston, Texas	**Boussinesq's Equation for Point Load Surcharge**	**FIGURE 7**

Appendix A

LOG OF BORING B-1

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 16 FT
DATE: 4-6-21

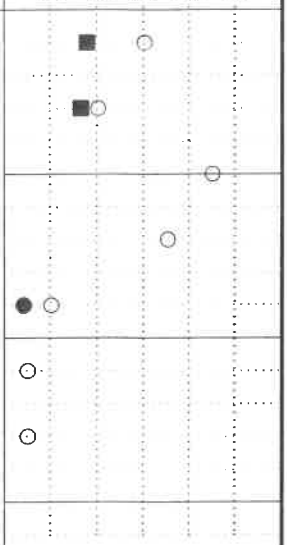
LOCATION: Dickinson, Texas

Northing: 29.46397
Easting: -95.03731

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 16 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 13.75" thick Asphalt			107	20	54	15	39
				FAT CLAY (CH), very stiff, dark gray - stiff below 2'		85.2	112	21	53	16	37
	5			**FAT CLAY WITH SAND (CH)**, hard, dark gray				20			
						82.9		19			
				LEAN CLAY (CL), firm, light gray & tan			109	21			
	10			- soft below 10'				25	29	20	9
								23			
	15			- very stiff to hard below 14.5'	28			24			
				Boring terminated at 16 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5



WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 16.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-2

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-6-21

LOCATION: Dickinson, Texas

Northing: 29.46531
Easting: -95.03734

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 2" thick Asphalt							
				6" Cement Treated Base & 8" Cement Stabilized Sand Base		94.1		30			
				FAT CLAY (CH), stiff, dark gray			94	29	73	24	49
	5					92.9		29			
							101	26	66	22	44
				- hard below 8'				23			
	10			- very stiff below 10'			100	26			
								25	62	21	41
	15							23			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-3

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-6-21

LOCATION: Dickinson, Texas

Northing: 29.46670
Easting: -95.03735

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 1.5" thick Asphalt							
				8.5" Cement Treated Base & 10" Cement Stabilized Sand Base							
				FAT CLAY (CH), stiff, dark gray		94.1	88	33	76	23	53
								33			
	5					94.1	88	34			
								36	79	24	55
				- very stiff below 8'				31			
	10			- stiff below 10'			92	32			
				- very stiff below 12'				21	51	16	35
	15							20			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-4

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-6-21

LOCATION: Dickinson, Texas

Northing: 29.46806
Easting: -95.03738

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 2" thick Asphalt							
				10" Cement Treated Base							
				FAT CLAY (CH), stiff, dark gray				30	66	22	44
						98.5	87	29			
	5							31	73	22	51
						94.2	92	30			
				- very stiff below 8'				26			
	10							21	57	16	41
							95	29			
	15							20			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-5

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-6-21

LOCATION: Dickinson, Texas

Northing: 29.46942
Easting: -95.03739

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 2.5" thick Asphalt				36			
				10.5" Cement Treated Base & 12" Cement Stabilized Sand Base							
				FAT CLAY (CH), firm, dark gray		87.7	76	33	82	33	49
	5			- stiff below 4'		96.2	85	34			
								32	80	26	54
				- very stiff below 8'				34			
	10							32			
							93	28	71	24	47
	15							20			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-6

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

LOCATION: Dickinson, Texas

Northing: 29.47079
Easting: -95.03744

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-6-21

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 2.5" thick Asphalt							
				8" Cement Treated Base & 8" Cement Stabilized Sand Base			84	35	77	26	51
				FAT CLAY (CH), stiff, dark gray		96.4	89	36			
				- stiff below 2'							
	5							32	82	24	58
						97.7		32	80	26	54
				- very stiff below 8'							
								27			
	10										
							97	25	74	24	50
								25	71	24	47
	15							19			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-7

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

LOCATION: Dickinson, Texas

Northing: 29.47219
Easting: -95.03746

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-7-21

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 2" thick Asphalt							
				11.5" Cement Treated Base		94.5		33			
				FAT CLAY (CH), stiff, dark gray			89	32	73	26	47
	5			- very stiff below 4'		94.5	93	30			
								33	81	25	56
				- stiff below 8'			92	30			
	10			- very stiff below 10'				29			
								29	65	23	42
	15							28			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-8

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-7-21

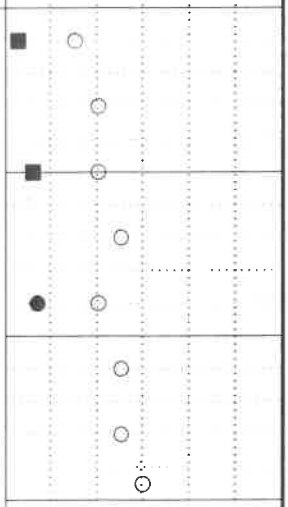
LOCATION: Dickinson, Texas

Northing: 29.47369
Easting: -95.03750

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 2.5" thick Asphalt							
				10" Cement Treated Base		93.1	83	37	72	26	46
				FAT CLAY (CH), stiff, dark gray							
				- tan & gray below 2'				28			
	5						94	29	73	22	51
				- very stiff below 6'		95.6		28			
				- stiff below 8'			92	30			
	10							25	65	19	46
								27			
	15							25			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5



WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-9

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

LOCATION: Dickinson, Texas

Northing: 29.47497
Easting: -95.03751

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-7-21

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 2" thick Asphalt							
				8" Crushed Gravel Base		94.1	101	22			
				FAT CLAY (CH), very stiff, dark gray				25	64	21	43
	5					93.7		22			
				- firm below 6'			94	24	66	19	47
								23			
	10			- very stiff below 10'			109	20			
				LEAN CLAY (CL), hard, tan & reddish brown				23	45	16	29
	15							24			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-10

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-7-21

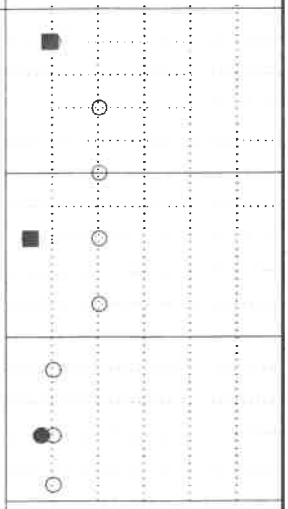
LOCATION: Dickinson, Texas

Northing: 29.47639
Easting: -95.03756

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 3" thick Asphalt							
				8" Crushed Gravel Base			97	26	55	22	33
				SANDY FAT CLAY (CH), stiff, dark gray		56.1		15			
				- stiff below 2'							
	5			**FAT CLAY (CH)**, stiff, light gray				26	67	19	48
						91.8	91	27			
				- stiff below 8'				25			
	10			- very stiff below 10'				22	60	20	40
							100	22			
	15							19			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5



WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-11

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-6-21

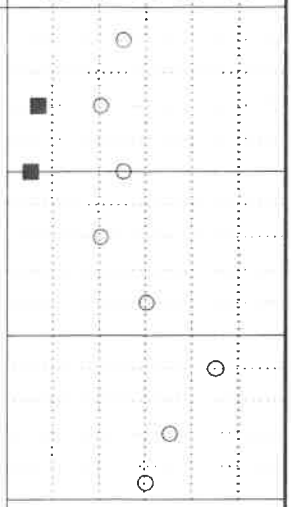
LOCATION: Dickinson, Texas

Northing: 29.47773
Easting: -95.03760

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 2" thick Asphalt							
				6" Cement Treated Base		91.2		26			
				FAT CLAY (CH), very stiff, dark gray							
				- stiff below 2'			89	31	72	23	49
	5			- very stiff below 4'		90.1	95	29			
				LEAN CLAY (CL), stiff, dark gray & tan				20	46	16	30
				- very stiff below 8'				20			
	10			- hard below 10'				19			
				FAT CLAY (CH), very stiff, dark gray				23	60	19	41
	15							23			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5



WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-12

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-6-21

LOCATION: Dickinson, Texas

Northing: 29.47911
Easting: -95.03762

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 6" thick Asphalt							
				8" Cement Stabilized Base							
				FAT CLAY (CH), stiff, dark gray			88	32			
						96		33			
	5			- very stiff below 4'			102	23	62	19	43
						86		21			
				- firm below 8'				29			
	10			- stiff below 10'			99	26	54	19	35
				- very stiff below 12'				28			
	15							26			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-13

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-2-21

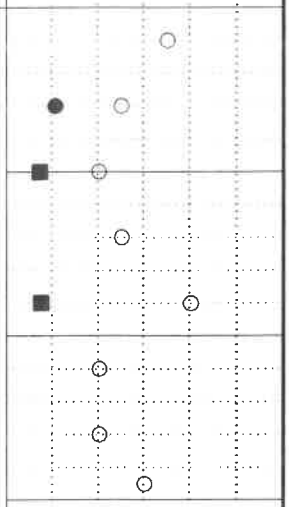
LOCATION: Dickinson, Texas

Northing: 29.48051
Easting: -95.03766

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 8" thick Asphalt							
				3" Cement Stabilized Sand Base		94.3		23			
				FAT CLAY (CH), stiff, dark gray			98	26	55	18	37
	5					94.4	101	25			
								27	51	20	31
				LEAN CLAY (CL), stiff, light gray			101	24			
	10							23	39	18	21
								23			
	15			**FAT CLAY (CH)**, very stiff, reddish brown & light gray				24			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5



WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

LOG OF BORING B-14

PROJECT:
Road Reconstruction & Drainage Improvements of California Ave.

LOCATION: Dickinson, Texas

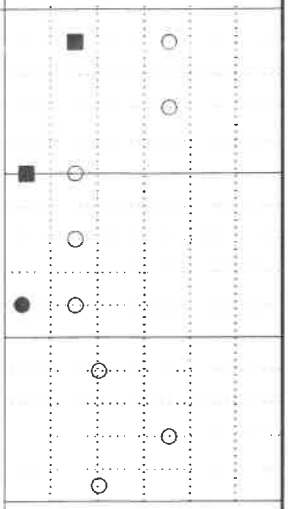
Northing: 29.48190
Easting: -95.03769

PROJECT NO.: G21-131
SURFACE ELEVATION: FT
COMPLETION DEPTH: 15 FT
DATE: 4-2-21

SAMPLER: Shelby Tube/Split Spoon
DRY AUGER: 0 TO 15 FT
WET ROTARY: TO FT

ELEVATION, FT	DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
	0			Pavement : 7.5" thick Asphalt							
				2" Cement Stabilized Sand Base			105	20	39	17	22
				LEAN CLAY (CL), very stiff, dark gray		88.6		21			
	5			- firm below 4'			99	22	48	17	31
				FAT CLAY (CH), stiff, dark gray		92.8		28			
							97	27			
	10							19	52	17	35
				- very stiff below 12'				29			
	15							22			
				Boring terminated at 15 feet							

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5



WATER LEVEL OBSERVATIONS:
▽ FREE WATER 1ST ENCOUNTERED Dry FT. DURING DRILLING; AFTER 15.0 MIN. Dry FT.
▼ WATER DEPTH END OF DRILLING Dry FT., HOLE OPEN TO 15.0FT.

NOTES:
Borehole was backfilled with cement-bentonite slurry.
After 24 hr. Borehole was dry.

Drilled By: DM Logged By: KR

ASSOCIATED TESTING LABORATORIES, INC.

KEY TO LOG TERMS AND SYMBOLS

SOIL TYPE


CONCRETE


ASPHALT


FILL


FAT CLAY (CH)


LEAN CLAY (CL)


Poorly Graded Sand (SP)


Silty Clayey Sand (SC-SM)

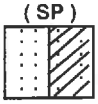

SILT (ML)


SILTY SAND (SM)


CLAYEY SAND (SC)


SILTY CLAY (CL-ML)


GRAVEL


Poorly Graded Sand with Clay (SP-SC)


Poorly Graded Sand with Silt (SP-SM)

SAMPLER TYPE


AUGER SAMPLE


SHELBY TUBE


SPLIT SPOON


NO RECOVERY


ROCK CORE


TCP / THD Value

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS LESS THAN 50% PASSING No. 200 SIEVE	GRAVEL & GRAVELY SOILS LESS THAN 50% PASSING No.4 SIEVE	CLEAN GRAVELS LITTLE OR NO FINES	GW	WELL GRADEED GRAVELS,GRAVELSAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS,GRAVEL SAND MIXTURES WITH LITTLE OR NO FINES
		W/ APPRECIATEBLE FINES	GM	SILTY GRAVELS,GRAVEL SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS,GRAVEL SAND-CLAY MIXTURES
	SANDS MORE THAN 50% PASSING No.4 SIEVE	CLEAN SANDS LITTLE FINES	SW	WELL GRADED SAND,GRAVELY SAND (LITTLE FINES)
			SP	POORLY GRADED SANDS,GRAVELY SAND(L. FINES)
		SANDS WITH APPREA. FINES	SM	SILTY SANDS,SAND-SILT MIXTURES
			SC	CLAYEY SANDS,SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS & VERY FINE SANDS,ROCK FLOUR SILTY OR CLAYEY FINE SANDS OR CLAYEY SILT W/PI
			CL	INORGANIC CLAY OF LOW TO MEDIUM PI LEAN CLAY, GRAVELY LEAN CLAYS,SANDY LEAN CLAYS,LEAN CLAYS WITH SAND
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PI
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS,MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS, FAT CLAYS WITH SAND, SANDY FAT CLAYS, FAT CLAYS WITH GRAVEL
			OH	ORGANIC CLAYS OF MED TO HIGH PI, ORGANIC SILT
HIGHLY ORGANIC SOIL			FT	PEAT AND OTHER HIGHLY ORGANIC SOILS
UNCLASSIFIED FILL MATERIALS				ARTIFICIALLY DEPOSITED AND OTHER UNCLASSIFIED SOILS FILL MATERIALS

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNDRAINED SHEAR STRENGTH IN TSF	SPT N-VALUE
VERY SOFT	< 0.125	< 2
SOFT	0.125 TO 0.25	2 TO 4
FIRM	0.25 TO 0.5	4 TO 8
STIFF	0.5 TO 1.0	8 TO 16
VERY STIFF	1.0 TO 2.0	16 TO 32
HARD	> 2.0	> 32

RELATIVE DENSITY - GRANULAR SOILS

CONSISTENCY	SPT N-VALUE (BLOWS PER FT)
VERY LOOSE	< 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	> 50

Density (Cohesionless)	Consistency (Cohesive)	TCP-VALUES (BLOWS PER FT)
VERY LOOSE	VERY SOFT	0-8
LOOSE	SOFT	8-20
SLIGHTLY COMPACT	STIFF	20-40
COMPACT	VERY STIFF	40-80
DENSE	HARD	80-5"/100
VERY DENSE	VERY HARD	5"/100 - 0"/100

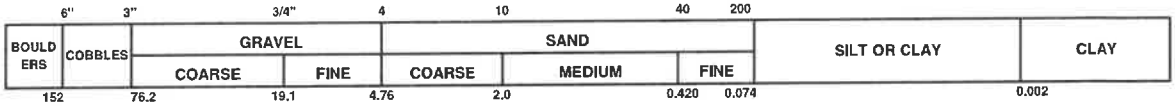
Note. U.S.S denotes undrained shear strength

DEGREE OF PLASTICITY OF COHESIVE SOILS

PLASTICITY INDEX	0-4	5 - 10	11 - 20	21 - 40	> 40
PLASTICITY CLASSIFICATION	NONE	SLIGHT	MEDIUM	HIGH	VERY HIGH

CLASSIFICATION OF GRANULAR SOILS

U.S.STANDARD SIEVE SIZE(S)



GRAIN SIZE IN MM

ASSOCIATED TESTING LABORATORIES

3143 Yellowstone Blvd., Houston, Texas 77054
Tel: (713) 748-3717 Fax: (713) 748-3748

Appendix B

SUMMARY OF SAMPLING DATA

Project: Road Reconstruction & Drainage Improvements of California Ave, Dickinson , Texas
Client: McDonough Engg Corp Project No.:

Boring	Interval	Description	Sample Type	N-Value	NM (%)	LL	PL	PI	% -200	Dry Density (pcf)	Pocket Pen (tsf)	UC/UU Compression (tsf)	Strain %
B-1													
	0	13.75" Asphalt											
	1.14	FAT CLAY (CH), very stiff, dark gray			20.0	54	15	39		107	3.0	2.951	15.0
	2-4	- stiff below 2'			21.0				85.2		2.0		
	4-6	FAT CLAY WITH SAND (CH), hard, dark gray			19.6	53	16	37		112	4.5	2.727	8.9
	6-8				18.7				82.9		3.5		
	8-10	LEAN CLAY (CL), firm, light gray & tan			20.9					109	1.0	0.635	9.2
	10-12	- soft below 10'			24.8	29	20	9			0.5		
	12-14				23.1						0.5		
	14.5	- very stiff to hard below 14. 5'		28	23.9								
	16												
B-2													
	0	2" Asphalt, 6"Cement Treated Base & 8" Cement Stabilized Sand Base											
	1.33	FAT CLAY (CH), stiff, dark gray			30.1				94.1		2.0		
	2-4				29.2	73	24	49		94	2.0	0.894	5.2
	4-6				28.9				92.9		2.0		
	6-8				25.6	66	22	44		101	2.0	0.970	15.0
	8-10	- hard below 8'			23.0						4.5		
	10-12	- very stiff below 10'			26.0					100	3.0	1.326	4.0
	12-14				25.4	62	21	41			3.0		
	14-15				23.3						3.0		
	15												
B-3													
	0	1.5" Asphalt, 8.5" Cement Treated Base & 10" Cement Stabilized Sand Base											
	1.67	FAT CLAY (CH), stiff, dark gray			33.1	76	23	53	94.1	88	2.0	0.857	7.3
	2-4				32.8						1.5		
	4-6				34.3				94.1	88	2.0	0.711	6.3
	6-8				36.2	79	24	55			1.5		
	8-10	- very stiff below 8'			30.8						3.0		
	10-12	- stiff below 10'			32.1					92	1.5	0.638	14.2
	12-14	- very stiff below 12'			20.6	51	16	35			3.5		
	14-15				19.6						3.5		
	15												
B-4													
	0	2" Asphalt, 10" Cement Treated Base	SW										
	1	FAT CLAY (CH), stiff, dark gray			30.4	66	22	44			1.5		
	2-4				28.8				98.5	87	2.0	0.862	6.1
	4-6				31.4	73	22	51			2.0		
	6-8				29.9				94.2	92	2.0	0.767	6.3
	8-10	- very stiff below 8'			26.0						3.0		
	10-12				21.0	57	16	41			3.0		
	12-14				28.9					95	3.0	0.668	1.2
	14-15				20.3						3.5		
	15												
B-5													
	0	2.5" Asphalt, 10.5" Cement Treated Base & 12" Cement Stabilized Sand Base											
	2-4				36.3	82	33	49		76	1.0	0.427	4.7
	2.08	FAT CLAY (CH), firm, dark gray			33.3				87.7				
	4-6	- stiff below 4'			33.7				96.2	85	2.0	0.696	9.2

SUMMARY OF SAMPLING DATA

Project: Road Reconstruction & Drainage Improvements of California Ave, Dickinson , Texas
Client: McDonough Engg Corp
Project No.:

Boring	Interval	Description	Sample Type	N-Value	NM (%)	LL	PL	PI	% -200	Dry Density (pcf)	Pocket Pen (tsf)	UC/UU Compression (tsf)	Strain %
	6-8				32.4	80	26	54			2.0		
	8-10	- very stiff below 8'			34.0						3.0		
	10-12				31.6						3.0		
	12-14				28.0	71	24	47		93	3.5	1.455	4.1
	14-15				20.4						4.0		
	15												
B-6													
	0	2.5" Asphalt, 8" Cement Treated Base & 8" Cement Stabilized Sand Base											
	1.54	FAT CLAY (CH), stiff, dark gray			34.8	77	26	51		84	2.0	0.822	8.7
	2-4	- stiff below 2'			35.7				96.4		1.5		
	4-6				31.9	82	24	58		89	1.5	0.735	4.3
	6-8				32.2	80	26	54	97.7		2.0		
	8-10	- very stiff below 8'			26.9						2.5		
	10-12				24.8	74	24	50		97	2.5	0.644	1.3
	12-14				25.4	71	24	47			4.0		
	14-15				18.7						2.5		
	15												
B-7													
	0	2" Asphalt, 11.5" Cement Treated Base											
	1.12	FAT CLAY (CH), very stiff, dark gray			32.8				94.5		4.0		
	2-4	- stiff below 2'			32.1	73	26	47		89	2.0	1.194	12.2
	4-6	- very stiff below 4'			30.4				94.5	93	2.5	1.156	12.9
	6-8				32.8	81	25	56			2.5		
	8-10	- stiff below 8'			30.1					92	2.0	0.688	4.6
	10-12	- very stiff below 10'			29.1						3.5		
	12-14				29.0	65	23	42			2.5		
	14-15				27.9						2.5		
	15												
B-8													
	0	2.5" Asphalt, 10.5" Cement Treated Base											
	1.08	FAT CLAY (CH), stiff, dark gray			36.7	72	26	46	93.1	83	1.5	0.467	4.4
	2-4	- tan & gray below 2'			28.3						2.0		
	4-6				28.7	73	22	51		94	2.0	1.001	4.8
	6-8	- very stiff below 6'			28.5				95.6		2.5		
	8-10	- stiff below 8'			29.7					92	2.0	1.112	9.1
	10-12				25.4	65	19	46			2.5		
	12-14				26.9						2.5		
	14-15				24.8						3.0		
	15												
B-9													
	0	2" Asphalt, 8" Crushed Gravel Base											
	0.83	FAT CLAY (CH), very stiff, dark gray			21.9				94.1	101	1.0	2.538	7.3
	2-4				24.8	64	21	43			1.0		
	4-6				22.1				93.7		1.0		
	6-8	- firm below 6'			24.3	66	19	47		94	1.0	0.698	5.6
	8-10				22.7						1.0		
	10-12	- very stiff below 10'			20.0					109	4.0	1.505	15.0
	12-14	LEAN CLAY (CL), hard, tan & reddish brown			22.7	45	16	29			4.5		
	14-15				23.8						4.5		
	15												
B-10													

SUMMARY OF SAMPLING DATA

Project: Road Reconstruction & Drainage Improvements of California Ave, Dickinson , Texas
Client: McDonough Engg Corp Project No.:

Boring	Interval	Description	Sample Type	N-Value	NM (%)	LL	PL	PI	% -200	Dry Density (pcf)	Pocket Pen (tsf)	UC/UU Compression (tsf)	Strain %
	0	3" Asphalt, 8" Crushed Gravel Base											
	0.92	SANDY FAT CLAY (CH), stiff, dark gray			26.4	55	22	33		97	1.5	1.564	7.9
	2-4				15.4				56.1		2.0		
	4-6	FAT CLAY (CH), stiff, light gray			25.6	67	19	48			2.0		
	6-8				27.0				91.8	91	2.0	0.891	8.3
	8-10				24.7						2.0		
	10-12	- firm below 10'			21.6	60	20	40			1.0		
	12-14				22.5					100	1.0	1.212	12.6
	14-15				19.4						1.0		
	15												
B-11													
	0	2" Asphalt, 6"Cement Treated Base											
	0.67	FAT CLAY (CH), very stiff, dark gray			26.2				91.2		2.5		
	2-4	- stiff below 2'			31.1	72	23	49		89	2.0	1.095	7.1
	4-6	- very stiff below 4'			29.4				90.1	95	2.5	0.850	3.0
	6-8	LEAN CLAY (CL), stiff, dark gray & tan			19.7	46	16	30			2.0		
	8-10	- very stiff below 8'			20.3						3.0		
	10-12	- hard below 10'			18.8						4.5		
	12-14	FAT CLAY (CH), very stiff, dark gray			23.3	60	19	41			3.5	1.697	9.3
	14-15				23.4						3.0		
	15												
B-12													
	0	6" Asphalt & 8" Cement Stabilized Base											
	1.17	FAT CLAY (CH), stiff, dark gray			31.8					88	2.0	1.199	4.8
	2-4				32.6				96.0		1.25		
	4-6	- very stiff below 4'			23.4	62	19	43		102	2.25	1.648	15.0
	6-8				20.6				86.0		2.25		
	8-10	- firm below 8'			28.7						1.0		
	10-12	- stiff below 10'			26.0	54	19	35		99	1.5	1.024	15.0
	12-14	- very stiff below 12'			27.9						2.5		
	14-15				25.6						2.25		
	15												
B-13													
	0	8" Asphalt & 3" Cement Stabilized Sand Base											
	0.92	FAT CLAY (CH), stiff, dark gray			23.3				94.3		3.5		
	2-4				26.4	55	18	37		98	2.5	1.706	15.0
	4-6				25.3				94.4	101	2.0	1.204	10.1
	6-8				27.4	51	20	31			2.5		
	8-10	LEAN CLAY (CL), stiff, light gray			24.4					101	4.0	1.247	12.6
	10-12				23.1	39	18	21			2.0		
	12-14				23.4						2.0		
	14-15	FAT CLAY (CH), very stiff, reddish brown & light gray			23.9						3.0		
	15												
B-14													
	0	7.5" Asphalt & 2" Cement Stabilized Sand Base											
	0.79	LEAN CLAY (CL), very stiff, dark gray			20.3	39	17	22		105	3.5	2.495	15.0
	2-4				20.6				88.6		3.5		
	4-6	- firm below 4'			22.1	48	17	31		99	1.5	0.778	10.9
	6-8	FAT CLAY (CH), stiff, dark gray			27.9				92.8		1.5		
	8-10				27.2					97	1.5	0.557	6.3
	10-12				18.9	52	17	35			2.0		
	12-14	- very stiff below 12'			28.8						3.5		

SUMMARY OF SAMPLING DATA

Project: Road Reconstruction & Drainage Improvements of California Ave, Dickinson , Texas
Client: McDonough Engg Corp Project No.:

Boring	Interval	Description	Sample Type	N-Value	NM (%)	LL	PL	PI	% -200	Dry Density (pcf)	Pocket Pen (tsf)	UC/UU Compression (tsf)	Strain %
	14-15	- stiff below 14'			22.3						2.0		
	15												

ASSOCIATED TESTING LABORATORIES

3143 Yellowstone Blvd., Houston, Texas 77054
Tel: (713) 748-3717 Fax: (713) 748-3748

Appendix C

G2021-131 - Pavement Core Summary Report - California Ave.			
Boring No:	**Layer Composition**	**Thickness (in)**	**Photo**
B-1	**Aspahlt**	**13.75"**	
B-2	**Asphalt**	**2"**	
	Cement Treated Base	**6"**	
	Cement Stab. Sand Base	**8"**	
B-3	**Aspahlt**	**1.5"**	
	Cement Treated Base	**8.5'**	
	Cement Stab. Sand Base	**10"**	
B-4	**Asphalt**	**2"**	
	Cement Treated Base	**10"**	
B-5	**Asphalt**	**2.5"**	
	Cement Treated Base	**10.5"**	
	Cement Stab. Sand Base	**12"**	

G2021-131 - Pavement Core Summary Report - California Ave.			
Boring No:	**Layer Composition**	**Thickness (in)**	**Photo**
B-6	**Asphalt**	**2.5"**	
	Cement Treated Base	**8"**	
	Cement Stab. Sand Base	**8"**	
B-7	**Asphalt**	**2"**	
	Cement Treated Base	**11.5"**	
B-8	**Aspahlt**	**2.5"**	
	Cement Treated Base	**10"**	
B-9	**Asphalt**	**2"**	
	Crushed Gravel Base	**8"**	
B-10	**Aspahlt**	**3"**	
	Crushed Gavel Base	**8"**	

G2021-131 - Pavement Core Summary Report - California Ave.			
Boring No:	**Layer Composition**	**Thickness (in)**	**Photo**
B-11	**Asphalt**	**2"**	
	Cement Treated Base	**6"**	
B-12	**Aspahlt**	**6"**	
	Cement Treated Base	**8"**	
B-13	**Asphalt**	**8"**	
	Cement Treated Base	**3"**	
B-14	**Asphalt**	**7.5"**	
	Cement Stab. Sand Base	**2"**	

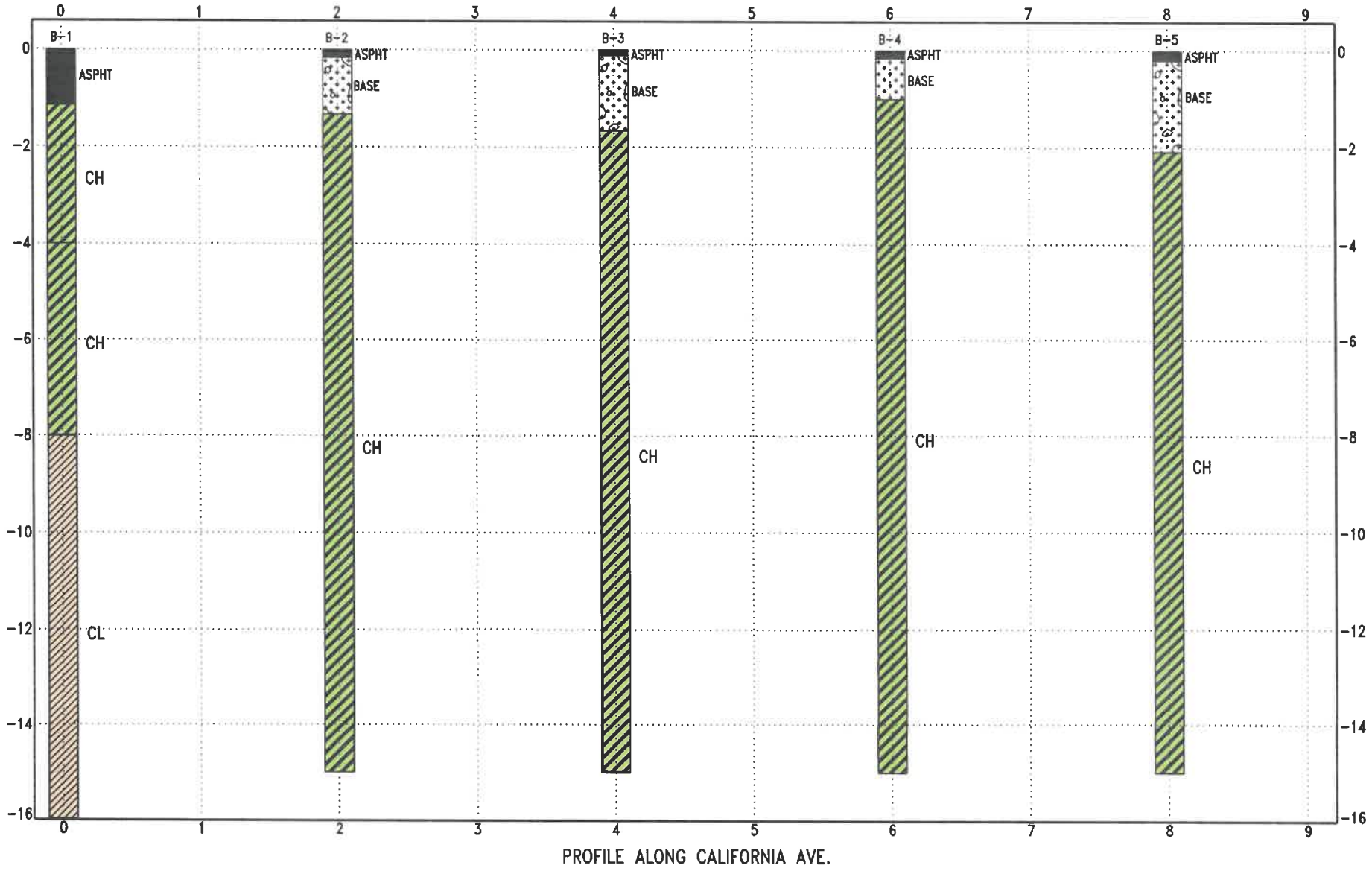
Appendix D

LEGEND:

- Silt, ML
- Poorly Graded Soil with Silt, SP-SM
- Poorly Graded Sand,SP
- Concrete
- Silty Sand,SM
- Silty Clayey Sand, SC-SM
- Asphalt
- Low Plasticity Sandy Lean Clay, CL
- Low Plasticity Lean Clay,CL
- Fat Clay,CH
- Clayey Silty Sand CL-ML
- Clayey Sand,SC
- FILL CL/CH
- BASE

PROJECT Road Reconstruction & Drainage

PROJECT LOCATION Dickinson, Texas PROJECT NUMBER: G21-131



PROFILE ALONG CALIFORNIA AVE.

STRATIGRAPHY & GW - A SIZE - GINT STD US LAB.GDT - 4/19/21 09:29 - T:\GEO GINT LOGS\G21-131.GPJ

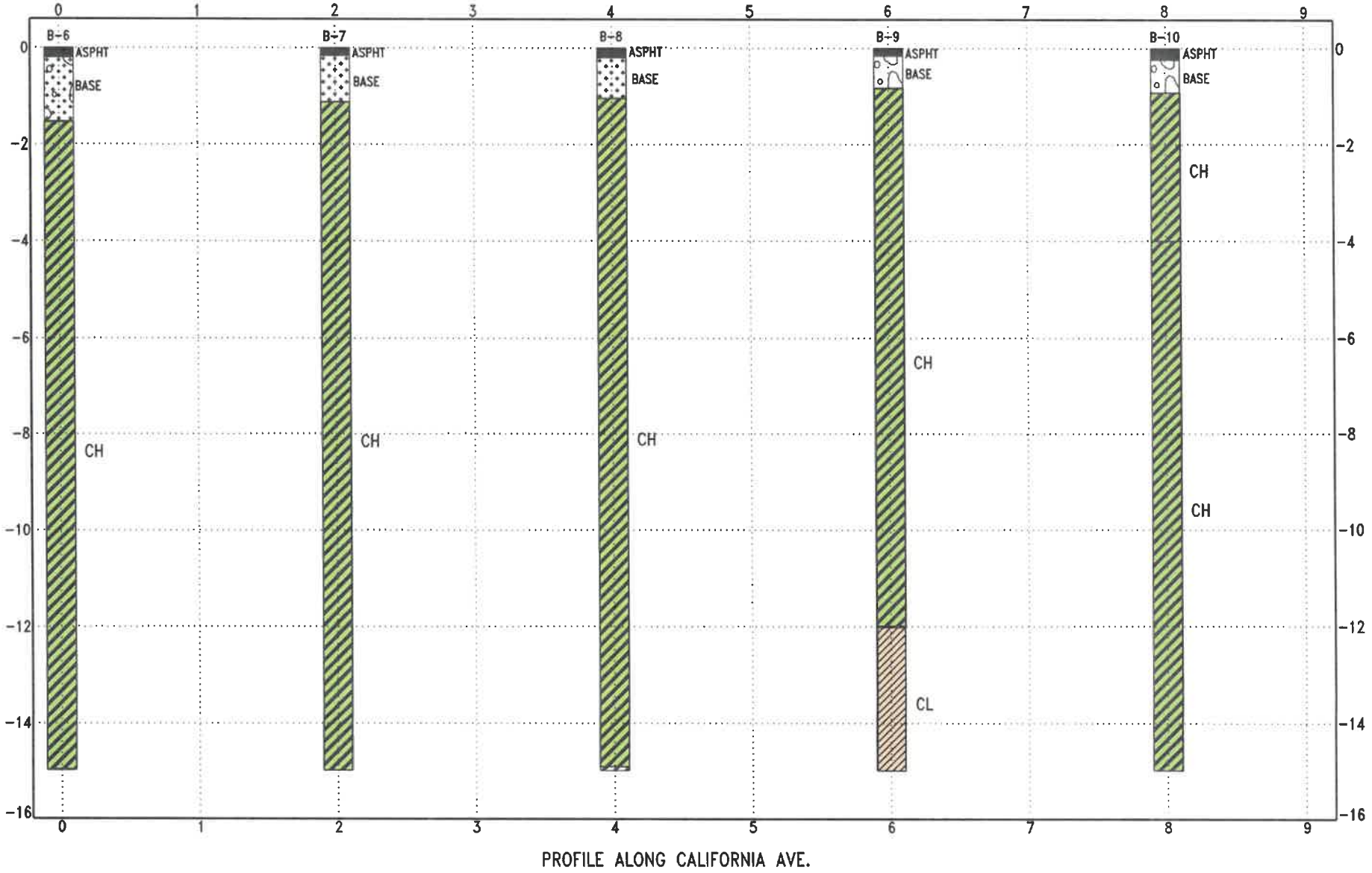
APPENDIX D - SUBSURFACE PROFILE

LEGEND:

- Silt, ML
- Concrete
- Asphalt
- Fat Clay,CH
- FILL CL/CH
- Poorly Graded Soil with Silt, SP-SM
- Silty Sand,SM
- Low Plasticity Sandy Lean Clay, CL
- Clayey Silty Sand CL-ML
- BASE
- Poorly Graded Sand,SP
- Silty Clayey Sand, SC-SM
- Low Plasticity Lean Clay,CL
- Clayey Sand,SC

PROJECT Road Reconstruction & Drainage

PROJECT LOCATION Dickinson, Texas PROJECT NUMBER: G21-131



PROFILE ALONG CALIFORNIA AVE.

STRATIGRAPHY & GW - A SIZE - GINT STD US LAB.GDT - 4/19/21 09:43 - T:\GEO GINT LOGS\G21-131.GPJ

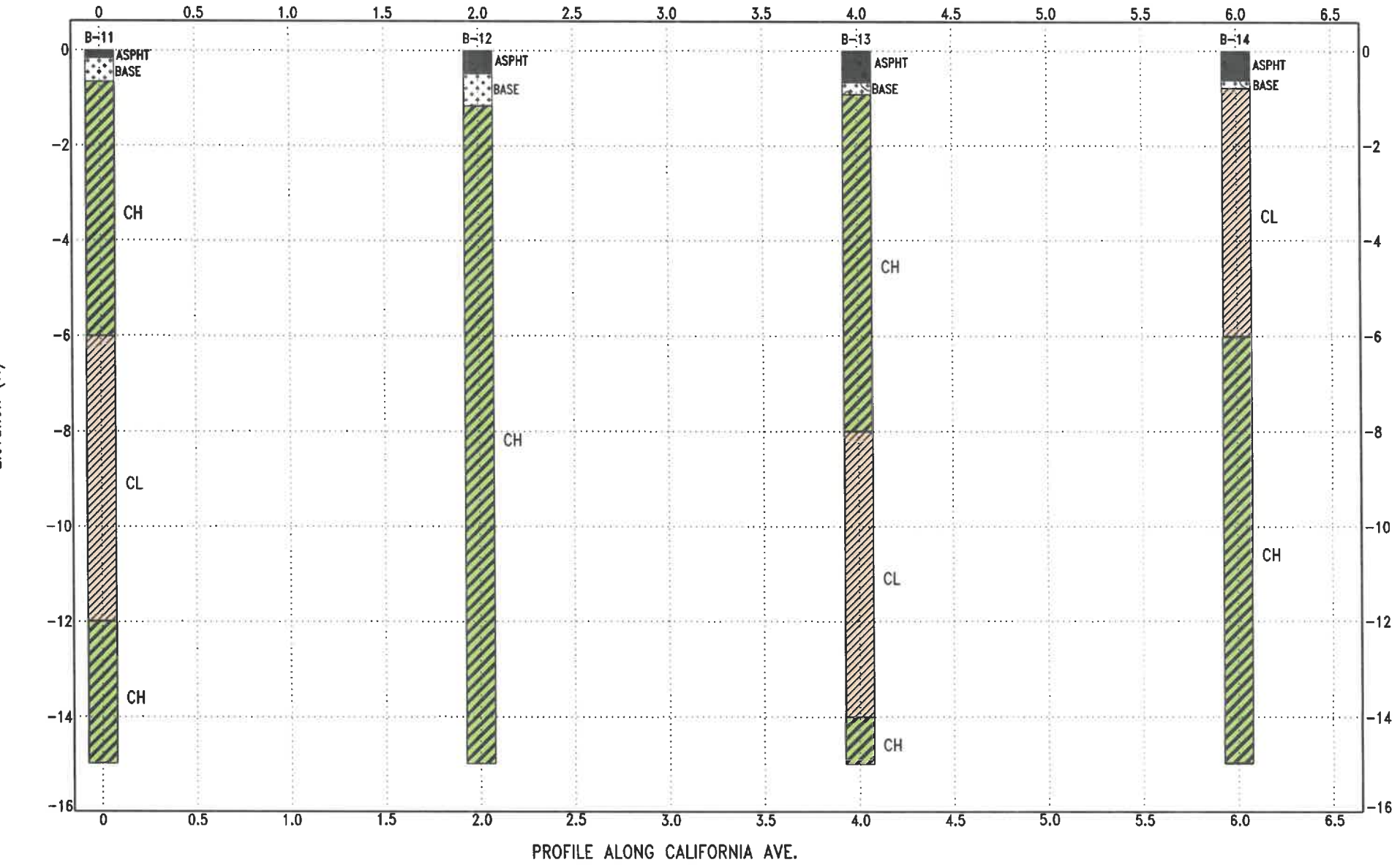
APPENDIX D - SUBSURFACE PROFILE

LEGEND:

Silt, ML
Poorly Graded Soil with Silt, SP-SM
Poorly Graded Sand,SP
Concrete
Silty Sand,SM
Silty Clayey Sand, SC-SM
Asphalt
Low Plasticity Sandy Lean Clay, CL
Low Plasticity Lean Clay,CL
Fat Clay,CH
Clayey Silty Sand CL-ML
Clayey Sand,SC
FILL CL/CH
BASE

PROJECT Road Reconstruction & Drainage

PROJECT LOCATION Dickinson, Texas PROJECT NUMBER: G21-131



PROFILE ALONG CALIFORNIA AVE.

STRATIGRAPHY & GW - A SIZE - GINT STD US LAB.GDT - 4/19/21 09:45 - T:\GEO GINT LOGS\G21-131.GPJ

APPENDIX D - SUBSURFACE PROFILE