



SKA Project No. 6022-0001
Via Federal Express

September 22, 2023

Mr. Robert Pedersen, P.E.
Municipal Solid Waste Permits Section
Texas Commission on Environmental Quality
12100 Park 35 Circle, MC 124, Bldg. F
Austin, Texas 78753

**RE: *Application for Development Permit for Proposed Enclosed Structure Over Closed Municipal Solid Waste Landfill
Permit Modification for Doty Sand Pit Venture Landfill (MSW Permit No. 1247)
12000 Bissonnet Street, Houston, Harris County, Texas***

Dear Mr. Pedersen:

SKA Consulting, L.P. (SKA), on behalf of Impact Residential Development, LLC, (Impact and Applicant) has prepared the enclosed Texas Commission on Environmental Quality (TCEQ) Application for Development Permit for Proposed Enclosed Structure Over Closed Municipal Solid Waste Landfill and Permit Modification for Doty Sand Pit Venture Landfill (MSW Permit No. 1247). The DSPV Landfill is a Type IV landfill which closed in 2000 and is currently within the post-closure care period.

This Application for Development Permit for Proposed Enclosed Structures Over Closed Municipal Solid Waste Landfill for the proposed Kirkwood Crossing Apartments and pertains to the development of four multi-family, apartment buildings and a clubhouse on the Subject Property. The proposed apartment buildings will be three-stories, wood framed, on concrete, slab-on-grade foundations. The clubhouse will be a single-story, wood-framed, structure on a concrete, slab-on-grade foundation.

SKA appreciates the opportunity to submit this permit modification. Please do not hesitate to contact us at (713) 266-6056, or at mike.schultz@skaconsulting.com if you have any questions.

Sincerely,

SKA CONSULTING, L.P.

A handwritten signature in blue ink that reads "Mandi Hawkins".

Mandi Hawkins
Project Environmental Engineer

A handwritten signature in blue ink that reads "Mike Schultz".

Mike Schultz, P.E.
Executive Vice President, Partner

Enclosures

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SKA Consulting, L.P. • 1888 Stebbins Drive, Suite 100 • Houston, Texas 77043 • 713.266.6056 phone • 713.266.0996 fax
Texas Registered Engineering Firm F-005009 • Texas Registered Geoscience Firm 50011
Texas Department of State Health Services Asbestos Consultant Agency 10052

Mr. Robert Pederson, P.E.
September 22, 2023
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Application for Development Permit for Proposed Enclosed Structures Over Closed Municipal Solid Waste Landfill (TCEQ Form 20785 and Attachments)

Permit Modification (TCEQ Form 20650 and Attachments)

cc: Ms. Jessica Mullins, Impact Residential Development, LLC, w/ electronic enclosure
Mr. Mark Lester, Northwest Metro Holdings, CS 34, LLC (w/ electronic enclosure)
Ms. Karina Rocha, Waste Program Manager, TCEQ Region 12 Office (w/o enclosures)
Ms. Elita Castleberry, Harris County Pollution Control Services Department (w/ electronic enclosures)



September 22, 2023

SKA Project No. 6022-0001
(Via Federal Express)

Financial Administration Unit, MC-181
Texas Commission on Environmental Quality (TCEQ)
12100 Park 35 Circle
Austin, Texas 78753

**RE: *Application for Development Permit for Enclosed Structure
Kirkwood Crossing Apartments
Impact Residential Development, LLC
12000 Bissonnet Street, Houston, Harris County, Texas
TCEQ MSW Permit No. 1247***

To Whom It May Concern:

SKA Consulting, L.P. (SKA), on behalf of Impact Residential Development, LLC, (Impact and Applicant) submits the enclosed checks for the Application for Development Permit for Proposed Enclosed Structures Over Closed Municipal Solid Waste Landfill (\$2,500) and the Permit Modification Application (\$150) to the Texas Commission on Environmental Quality (TCEQ) pursuant to the above referenced applications to the TCEQ Municipal Solid Waste Permit Section.

Please do not hesitate to contact us at (713) 266-6056, or at mike.schultz@skaconsulting.com if you have any questions.

Sincerely,

SKA CONSULTING, L.P.

Handwritten signature of Mandi Hawkins in blue ink.

Mandi Hawkins
Project Environmental Engineer

Handwritten signature of Mike Schultz in blue ink.

Mike Schultz, P.E.
Executive Vice President, Partner

Enclosures

Application for Development Permit for Enclosed Structure Check
Permit Modification Check

cc: Ms. Jessica Mullins, Impact Residential Development, LLC (w/o enclosures)
Mr. Mark Lester, Northwest Metro Holdings, CS 34, LLC (w/o enclosures)
Ms. Karina Rocha, Waste Program Manager, TCEQ Region 12 Office (w/o enclosures)

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Texas Commission on Environmental Quality
Application for Development Permit for Proposed Enclosed Structure Over Closed Municipal Solid Waste Landfill

Application Tracking Information

Applicant Name: _____

Facility Name: _____

Development Permit Number: _____

Initial Submission Date: _____

Revision Date: _____

Use this form to apply for a development permit for proposed enclosed structure over a closed municipal solid waste (MSW) landfill. Rules about use of land over a closed MSW landfill are in [Title 30, Texas Administrative Code](#)¹, Chapter 330, Subchapter T. Instructions for completing this form are provided in form [TCEQ 20785-instr](#)². Include a Core Data Form, available at www.tceq.texas.gov/goto/coredata with the application. If you have questions, contact the Municipal Solid Waste Permits Section by email to mswper@tceq.texas.gov, or by phone at 512-239-2335.

If you have an existing enclosed structure, use form [TCEQ-20786](#)³, Registration for Existing Enclosed Structure Over Closed Municipal Solid Waste Landfill. If you are proposing a non-enclosed structure, use form [TCEQ-20787](#)⁴, Authorization to Disturb Final Cover Over Closed Municipal Solid Waste Landfill for Non-Enclosed Structure.

Application Data

1. Application Type
<input type="checkbox"/> New Development Permit <input type="checkbox"/> Revisions of Existing Permit <input type="checkbox"/> Transfer of an Existing Permit If existing Permit, indicate the Permit Number: _____
2. Submission Type
<input type="checkbox"/> Initial Submission <input type="checkbox"/> Notice of Deficiency (NOD) Response

¹ www.tceq.texas.gov/goto/view-30tac
² www.tceq.texas.gov/downloads/permitting/waste-permits/msw/forms/20785-instr.pdf
³ www.tceq.texas.gov/downloads/permitting/waste-permits/msw/forms/20786.pdf
⁴ www.tceq.texas.gov/downloads/permitting/waste-permits/msw/forms/20787.pdf

3. Application Fee

The application fee for a development permit is \$2,500.

Paid by Check

Paid Online

If paid online, ePay Confirmation Number: _____

4. Enrollment in Other TCEQ Programs

Indicate if the site is enrolled in the Voluntary Cleanup Program or other Remediation Program.

Yes No

If Yes, indicate the program: _____

5. Development Type

Is the development a single-family or double-family home that is not part of a housing subdivision?

Yes No

If "Yes", the construction is exempt from the development permit requirement.

6. Enclosed Structure Description

Provide a brief description of the proposed enclosed structure for which the development permit is requested.

7. Soil Tests

Size of the property (acres): _____

Was the existence of the landfill determined through:

Test I

Test II

Test III

Other. Please describe: _____

If soil tests were performed prior to development in accordance with 30 TAC §330.953, the test results shall be included in this application.

8. Notification of MSW Landfill Determination

If soil tests were used to determine the presence of a closed MSW landfill, provide evidence that the engineer who performed the soil tests has notified the following persons of that determination in accordance with 30 TAC §330.953(d).

- Each owner and lessee
- Executive Director
- Local Government Officials
- Regional Council of Governments

9. Landfill Permit Status

What is the permit status of the landfill?

- Active MSW Permit Landfill in Post-Closure Care
- Revoked MSW Permit Non-Permitted Landfill

If the landfill is still in the post-closure care period subject to an active MSW Permit, this development permit application for proposed enclosed structures shall be accompanied by a Permit Modification application prepared in accordance with 30 TAC §305.70, and by a certification signed by an independent engineer in accordance with 30 TAC §330.957(b)(2).

If the landfill has completed the post-closure care period, but the MSW permit has not been revoked (site affected by an active MSW Permit), a Voluntary Revocation request of the MSW Permit shall be submitted in accordance with 30 TAC §330.465 prior to the submittal of this development permit application for proposed enclosed structures over a closed MSW landfill.

10. Application URL

Enter the URL address of a publicly accessible internet web site where the application and all revisions to that application will be posted in the box below:

11. Public Place for Copy of Application

Name of the Public Place: _____

Physical Address: _____

City: _____ County: _____ State: TX Zip Code: _____

Phone Number: _____

Normal Operating Hours: _____

12. Party Responsible for Publishing Notice

Indicate who will be responsible for publishing notice:

Applicant Consultant

Contact Name: _____

Title: _____

Email Address: _____

13. Alternative Language Notice

Use the Alternative Language Checklist on Public Notice Verification Form TCEQ-20244-Waste-NAORPM available at www.tceq.texas.gov/permitting/waste_permits/msw_permits/msw_notice.html to determine if an alternative language notice is required.

Is an alternative language notice required for this application?

Yes No

Indicate the alternative language: _____

14. Confidential Documents

Does the application contain confidential documents?

Yes No

If "Yes", cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked "CONFIDENTIAL."

15. Permits and Construction Approvals

Mark the following tables to indicate status of other permits or approvals.

Permits and Construction Approvals

Permit or Approval	Received	Pending	Not Applicable
Zoning Approval			
Preliminary Subdivision Plan			
Final Plat			
Fire Inspector's Approval			
Building Inspector's Approval on Plans			
Water Service Tap			
Wastewater Service Tap			
On-site Wastewater Disposal System Approval			

Other Environmental Permits

Other Environmental Permits (list)	Received	Pending

16. General Project Information

Facility Name: _____

SubT Development Permit Number (if available): _____

Regulated Entity Reference Number (if issued): **RN** _____

Street or Physical Address: _____

City: _____ County: _____ State: TX Zip Code: _____

Phone Number: _____

If Regulated Entity Reference Number has not been issued for the facility, complete a Core Data Form (TCEQ-10400) and submit it with this application.

17. Contact Information

Applicant (Lessee/Project Owner)

Name: _____

Customer Reference Number (if issued): **CN** _____

Mailing Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

If Customer Reference Number has not been issued, complete a Core Data Form (TCEQ-10400) and submit it with this application. List the Applicant as the Customer.

Property Owner

Name: _____

Mailing Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

If the Property Owner is the same as Applicant, indicate "Same as "Applicant".

Consultant (if applicable)

Firm Name: _____

Texas Board of Professional Engineers and Land Surveyors Firm Number: _____

Mailing Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Consultant Name: _____

Phone Number: _____

Email Address: _____

Engineer Who Performed Soil Tests

Firm Name: _____

Texas Board of Professional Engineers and Land Surveyors Firm Number: _____

Mailing Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Engineer Name: _____

Phone Number: _____

Email Address: _____

18. Other Governmental Entities Information:

Fire Chief, Fire Marshal or Fire Inspector Information

Fire Department Name: _____

Person's Name: _____

Mailing Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

Local Floodplain Authority (if applicable)

Authority Name: _____

Contact Person's Name: _____

Street or P.O. Box: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

City Mayor Information

City Mayor's Name: _____

Office Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

City Health Authority Information

Contact Person's Name: _____

Office Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

Director of Public Works

Department Name: _____
Contact Person's Name: _____
Office Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____
Email Address: _____

Director of Utilities

Utility Name: _____
Contact Person's Name: _____
Office Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____
Email Address: _____

Director of Planning

Agency Name: _____
Contact Person's Name: _____
Office Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____
Email Address: _____

Building Inspector

Agency Name: _____
Contact Person's Name: _____
Office Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____
Email Address: _____

County Judge Information

County Judge's Name: _____
Office Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____
Email Address: _____

County Engineer Information

County Engineer's Name: _____

County Engineer's P.E. Registration No.: _____

Office Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

County Health Authority

Agency Name: _____

Contact Person's Name: _____

Office Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

State Representative Information

District Number: _____

State Representative's Name: _____

District Office Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

State Senator Information

District Number: _____

State Senator's Name: _____

District Office Address: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

Council of Government (COG)

COG Name: _____

COG Representative's Name: _____

COG Representative's Title: _____

Street Address or P.O. Box: _____

City: _____ County: _____ State: _____ Zip Code: _____

Phone Number: _____

Email Address: _____

Local Government Jurisdiction

Is the property located within the limits or in the ETJ of any City?

Yes No

If "Yes" city regulations may apply. Issuance of Development Permit for an Enclosed Structure does not exempt the applicant from complying with city codes and zoning.

Within City Limits of: _____

Within Extraterritorial Jurisdiction of City of: _____

19. Deed Recordation

Verify that the property owner filed a written notice for record in the real property records in the county where the land is located in accordance with 30 TAC §330.962 stating: (a) the former use of the land; (b) the legal description of the tract of land that contains the closed MSW landfill; (c) notice that restrictions on the development or lease of the land exist in the Texas Health and Safety Code and in MSW rules; and (d) the name of the owner.

A certified copy of the Notice to Real Property Records is included in this application in accordance with 30 TAC §330.957(p).

20. Notice to Buyers, Lessees, and Occupants of the Structure

Did the property owner give written notice to all prospective buyers, lessees and/or occupants of the structure in accordance with 30 TAC §330.963 stating the land's former use as a landfill, and the structural controls in place to minimize potential future danger posed by the closed MSW landfill?

Yes New Structure Not Yet Constructed

If "Yes" certified copies of the notices shall be submitted to TCEQ in accordance with 30 TAC §330.957(p).

If "New Structure Not Yet Constructed" a draft notice to all prospective buyers, lessees and/or occupants of the proposed structure, and procedures for its implementation upon structure's construction shall be included in this application.

21. Notice of Lease Restrictions on the Property

Is the property leased?

Yes No

If "Yes", verify that the property owner provided written notice to all prospective lessees of the property in accordance with 30 TAC §330.964 concerning:

(a) what is required to bring the property into compliance with 30 TAC Chapter 330, Subchapter T?

(b) the prohibitions or requirements for future disturbance of the final cover?

A certified copy of the notice is included in the application in accordance with 30 TAC §330.957(p).

Professional Engineer's Certification of No Potential Threat to Public Health or the Environment

The applicant's engineer for this project shall complete one of the following certifications:

"I, _____, Texas PE Number _____, certify that the proposed development is necessary to reduce a potential threat to public health or the environment. Further, I certify that the proposed development will not damage the integrity or function of any component of the Closed Municipal Solid Waste Landfill Unit, including, but not limited to, the final cover, containment systems, monitoring system, or liners. This certification includes all documentation of all studies and data on which I relied in making these determinations."

Engineer's seal, with signature and date:

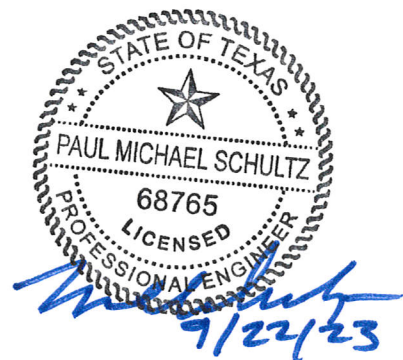
Engineering Firm Name: _____

Texas Board of Professional Engineers and Land Surveyors Firm Number: _____

Or:

" I, **Mike Schultz, P.E.**, Texas PE Number **68765**, certify that the proposed development will not increase or create a potential threat to public health or the environment. Further, I certify that the proposed development will not damage the integrity or function of any component of the Closed Municipal Solid Waste Landfill Unit, including, but not limited to, the final cover, containment systems, monitoring system, or liners. This certification includes all documentation of all studies and data on which I relied in making these determinations."

Engineer's seal, with signature and date:



Engineering Firm Name: SKA Consulting, L.P.

Texas Board of Professional Engineers and Land Surveyors Firm Number: 5009

Signature Page

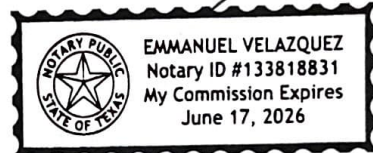
Applicant Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: Jessica Mullins Title: Vice President
Signature: [Signature] Date: 9/11/2023
Email Address: jmullins@impactresidential.com

SUBSCRIBED AND SWORN to before me by the said Jessica Mullins
On this 11th day of September, 2023
My commission expires on the 17th day of June, 2026
Notary's Name: Emmanuel Velazquez [Signature]

Notary Public in and for
Montgomery County, Texas



Property Owner Authorization

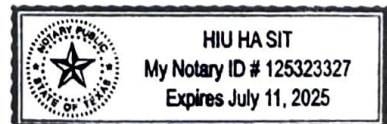
To be completed by the property owner if the property owner is not the applicant.

I John Quinlan, President of Bissonnet 136, LLC, the owner of the property identified by the address 12000 Bissonnet St, Houston, TX 77099, hereby authorize the applicant to proceed with the project described in this application, and to apply for any necessary authorizations in order to conduct this project. I understand that, as property owner, I am responsible for maintaining the integrity of the final cover over the closed MSW landfill.

Property Owner Name: Bissonnet 136, LLC
Signature: [Signature] President of Bissonnet 136, LLC Date: 9/6/2023
Email Address: john.quinlan@gmail.com

SUBSCRIBED AND SWORN to before me by the said John Quinlan
On this 6 day of September 2023
My commission expires on the ___ day of _____, ____
Notary's Name: Huifa SA

Notary Public in and for
[Signature] County, Texas



Attachments for New Development Permit

Required Attachments

A. Narrative

Attachment	Attachment Number
Proposed Project Description	Narrative-Section 1.1
Existing Conditions Summary	Narrative-Section 1.2
Legal Authority	Narrative-Section 2.1
Evidence of Competency	Narrative-Section 2.2
Notice of Engineer Appointment	Narrative-Section 2.3
Notices of Coordination with Governmental Agencies and Officials	Narrative-Section 2.4
Geology and Soil Statement	Narrative-Section 3.2
Groundwater and Surface Water Statement	Narrative-Section 3.3
Foundation Plans	Narrative-Section 4.3
Soil Tests	Narrative-Section 3.1
Closure Plan	Narrative-Section 4.5
Structures Gas Monitoring Plan	Narrative-Section 5.1
Site Operating Plan	Narrative-Section 5.2
Safety and Evacuation Plan	Narrative-Section 5.3

B. Maps and Plans

Attachment	Attachment Number
Adjacent Landowners Map	Narrative-Figure 3
Adjacent Landowners List	Narrative-Section 2.7
Electronic List or Mailing Labels	
General Location Map	Narrative-Figure 1
General Topographic Map	Narrative-Figure 2
Site Layout Plan with Limits of Waste Disposal Area	Narrative-Figure 3
Foundation Plans	Narrative-Appendix 6
Structure Layout Plan	Narrative-Appendix 6
Methane Monitoring Equipment Location Plans	Narrative-Appendix 6
Construction Details and Engineering Drawings	Narrative-Appendix 6

C. Copies of Legal Documents

Attachment	Attachment Number
Property Legal Description	Narrative-Section 2.5
Notice of Landfill Determination	
Notice to Real Property Records	Narrative-Appendix 1
Notices to Buyers, Lessees, and Occupants	Narrative-Appendix 1
Notices of Lease Restrictions (if applies)	

Additional Attachments as Applicable

Attachment	Attachment Number
<input checked="" type="checkbox"/> TCEQ Core Data Form(s)	Narrative-Appendix 1
<input type="checkbox"/> Confidential Documents	
<input checked="" type="checkbox"/> Soil Tests Boring Logs	Narrative-Appendix 2
<input type="checkbox"/> Other maps, plans and engineering drawings	
<input checked="" type="checkbox"/> Methane Monitoring Equipment Specifications	Narrative-Appendix 9
<input type="checkbox"/> Methane Monitoring Report	
<input type="checkbox"/> Waste Disposal Manifests	
<input checked="" type="checkbox"/> Fee Payment Receipt	Narrative-Appendix 1
<input type="checkbox"/> Final Plat Record of Property	

Attachments for Revisions to Existing Development Permit

Required Attachments

A. Revised Pages

Attachment	Attachment Number
Marked (Redline/Strikeout) Pages	
Unmarked Revised Pages	

B. Narrative

Attachment	Attachment Number
Description of Proposed Revisions	
Foundation Plans (if revised)	
Closure Plan (if revised)	
Site Operating Plan (if revised)	
Structures Gas Monitoring Plan (if revised)	
Safety and Evacuation Plan (if revised)	

C. Maps and Plans

Attachment	Attachment Number
General Location Map	
Site Layout Plan	
Structure Layout Plan	
Methane Monitoring Equipment Location Plans	

Additional Attachments as Applicable

Attachment	Attachment Number

Facility Name: Doty Sand Pit Venture Landfill
Permittee/Registrant Name: Northwest Metro Holdings, CS 34, LLC
MSW Authorization #: 1247
Initial Submittal Date: 9/22/2023
Revision Date:



Texas Commission on Environmental Quality

Permit/Registration Modification and Temporary Authorization Application Form for an MSW Facility

1. Reason for Submittal

- Initial Submittal Notice of Deficiency (NOD) Response

2. Authorization Type

- Permit Registration

3. Application Type

- Modification with Public Notice Modification without Public Notice
 Temporary Authorization (TA) Modification for Name Change/Transfer

4. Application Fees

- Pay by Check Online Payment

If paid online, enter ePay Trace Number:

5. Application URL

Is the application submitted for a permit/registration modification with public notice?

- Yes No

If the answer is "Yes", enter the URL address of a publicly accessible internet web site where the application and all revisions to that application will be posted in the space provided: <http://>

6. Confidential Documents

Does the application contain confidential documents?

- Yes No

If "Yes", cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked "CONFIDENTIAL."

7. General Facility Information

Facility Name: **Doty Sand Pit Venture Landfill**
MSW Authorization No.: **1247**
Regulated Entity Reference No.: **RN101288322**
Physical or Street Address (if available): **12000 Bissonnet Street**
City: **Houston** County: **Harris** State: **Texas** Zip Code: **77099**
(Area code) Telephone Number: **Not Applicable**
Latitude: **29.680378** Longitude: **-95.591888**

8. Facility Type(s)

- | | | |
|------------------------------------|---|----------------------------------|
| <input type="checkbox"/> Type I | <input checked="" type="checkbox"/> Type IV | <input type="checkbox"/> Type V |
| <input type="checkbox"/> Type I AE | <input type="checkbox"/> Type IV AE | <input type="checkbox"/> Type VI |

9. Description of the Revisions to the Facility

Provide a brief description of all revisions to the permit/registration conditions and supporting documents referred by the permit/registration, and a reference to the specific provisions under which the modification/temporary authorization application is being made. Also, provide an explanation of why the modification/temporary authorization is requested:

This authorization pertains to a related Application for Development Permit for Proposed Enclosed Structure Over Closed Municipal Solid Waste Landfill for the proposed Kirkwood Crossing Apartments. The Kirkwood Crossing Apartments are proposed to be developed within the boundary of MSW Permit No. 1247. The Kirkwood Crossing Apartment development is 12.05 acres in the south-central portion of the Doty Sand Pit Venture Landfill. The Kirkwood Crossing Apartments will consist of 4 three-story, concrete, slab-on-grade apartment buildings and a single-story clubhouse. Please see the Application for Development Permit for more details on the Kirkwood Crossing Apartment development.

This section is intentionally left blank; please continue to the next page.

10. Facility Contact Information

Site Operator (Permittee/Registrant) Name: Northwest Metro Holdings, CS 34, LLC

Customer Reference No. (if issued)*: **CN605724707**

Mailing Address: **P.O. Box 2058 1141 Capuchino Avenue**

City: **Burlingame** County: **San Mateo** State: **CA** Zip Code: **94011**

(Area Code) Telephone Number: **(650) 638-0900**

Email Address: **mlester@landcorealestate.com**

TX Secretary of State (SOS) Filing Number: **0803343508**

*If the Site Operator (Permittee/Registrant) does not have this number, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Site Operator (Permittee/Registrant) as the Customer.

Operator Name¹: Northwest Metro Holdings, CS 34, LLC

Customer Reference No. (if issued)*: **CN605724707**

Mailing Address: **P.O. Box 2058 1141 Capuchino Avenue**

City: **Burlingame** County: **San Mateo** State: **CA** Zip Code: **94011**

(Area Code) Telephone Number: **(650) 638-0900**

Email Address: **mlester@landcorealestate.com**

Charter Number:

¹If the Operator is the same as Site Operator/Permittee type "Same as "Site Operator (Permittee/Registrant)".

*If the Operator does not have this number, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Operator as the customer.

Consultant Name (if applicable): Mike Schultz, P.E. (SKA Consulting, L.P.)

Texas Board of Professional Engineers Firm Registration Number: **68765**

Mailing Address: **1888 Stebbins Drive, Suite 100**

City: **Houston** County: **Harris** State: **Texas** Zip Code: **77043**

(Area Code) Telephone Number: **(713) 266-6056**

Email Address: **mike.schultz@skaconsulting.com**

Agent in Service Name (required only for out-of-state): Jeff Carruth

Mailing Address: **11 East Greenway Plaza, Suite 1400**

City: **Houston** County: **Harris** State: **Texas** Zip Code: **77046**

(Area Code) Telephone Number:

Email Address: **jcarruth@wkpz.com**

11. Ownership Status of the Facility

Is this a modification that changes the legal description, the property owner, or the Site Operator (Permittee/Registrant)?

Yes No

If the answer is "No", skip this section.

Does the Site Operator (Permittee/Registrant) own all the facility units and all the facility property?

Yes No

If "No", provide the information requested below for any additional ownership.

Owner Name: Bissonnet 136, LLC

Street or P.O. Box: **P.O. Box 2058 1141 Capuchino Avenue**

City: **Burlingame** County: **San Mateo** State: **TX** Zip Code: **94011**

(Area Code) Telephone Number: **(650) 638-0900**

Email Address: **mlester@landcorealestate.com**

Charter Number:

Signature Page

Site Operator or Authorized Signatory

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: Mark Lester Title: Applicant

Email Address: mlester@landcorealestate.com

Signature: [Handwritten Signature] Date: 8-31-2023

Operator or Principal Executive Officer Designation of Authorized Signatory

To be completed by the operator if the application is signed by an authorized representative for the operator.

I hereby designate Mike Schultz as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a Texas Water Code or Texas Solid Waste Disposal Act permit. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any permit which might be issued based upon this application.

Operator or Principal Executive Officer Name: Mark Lester

Email Address: mlester@landcorealestate.com

Signature: [Handwritten Signature] Date: 8-31-2023

Notary

SUBSCRIBED AND SWORN to before me by the said MARK D. LESTER

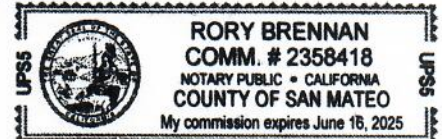
On this 31ST day of AUGUST, 2023

My commission expires on the 16TH day of JUNE, 2025

[Handwritten Signature: Rory Brennan]

Notary Public in and for

SAN MATEO County, Texas CALIFORNIA RB



Note: Application Must Bear Signature and Seal of Notary Public

Permit/Registration Modification without Public Notice or TA

(See Instructions for P.E. seal requirements.)

Required Attachments (for Modifications only)

Attachment No.

Marked (Redline/Strikeout) Pages

Unmarked Revised Pages

Additional Attachments as Applicable- Select all those apply and add as necessary

- Signatory Authority
- Fee Payment Receipt
- Confidential Documents

1

ATTACHMENT 1
NARRATIVE



Environmental Engineering and Consulting Excellence Since 2001

**Application for Development Permit for
Proposed Enclosed Structures
Over a Closed Municipal Solid Waste Landfill**

**Kirkwood Crossing Apartments
12000 Bissonnet Street
Houston, Harris County, Texas 77099
TCEQ MSW Permit No. 1247**

Prepared for:

**Impact Residential Development, LLC
400 Galleria Parkway, Suite 1450
Atlanta, Georgia 30339**

September 22, 2023

SKA Project No. 6022-0001

**SKA Consulting, L.P.
1888 Stebbins Drive, Suite 100
Houston, Texas 77043**

P: 713.266.6056 | F: 713.266.0996

www.skaconsulting.com



**APPLICATION FOR DEVELOPMENT PERMIT FOR PROPOSED ENCLOSED
STRUCTURES OVER CLOSED MUNICIPAL SOLID WASTE LANDFILL**

**KIRKWOOD CROSSING APARTMENTS
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099
TCEQ MSW PERMIT NO. 1247**

SKA PROJECT NO. 6022-0001

Prepared for:

**IMPACT RESIDENTIAL DEVELOPMENT, LLC
400 GALLERIA PARKWAY, SUITE 1450
ATLANTA, GEORGIA 30339**

Submitted by:

**SKA CONSULTING, L.P.
1888 STEBBINS DRIVE, SUITE 100
HOUSTON, TEXAS 77043**

Prepared by:

**MANDI HAWKINS
PROJECT ENVIRONMENTAL ENGINEER**

Signature

Reviewed by:

**MIKE SCHULTZ, P.E.
EXECUTIVE VICE PRESIDENT AND PARTNER**

Signature

SEPTEMBER 22, 2023

**TEXAS REGISTERED ENGINEERING FIRM NO. F-005009
TEXAS REGISTERED GEOSCIENCE FIRM NO. 50011
TEXAS ASBESTOS CONSULTANCY 100525**

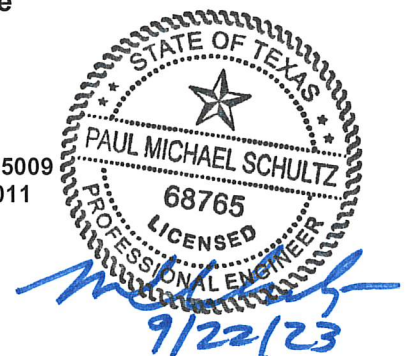


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1.0 Introduction

This Application for Development Permit for Proposed Enclosed Structures Over Closed Municipal Solid Waste Landfill has been prepared by SKA Consulting, L.P. (SKA) on behalf of Impact Residential Development, LLC (Impact and Applicant). Impact is a Delaware corporation registered to do business in Texas. The Texas Secretary of State registration is provided in **Appendix 1**. A Core Data form for Impact is provided in **Appendix 1**.

1.1 Project Description

The Subject Property is approximately 12.085 acres located at 12000 Bissonnet Street in Houston, Harris County, Texas (*Figure 1*). The Subject Property is part of the closed 118.778-acre Doty Sand Pit Venture (DSPV) Landfill [Municipal Solid Waste (MSW) Permit No. 1247]. The DSPV Landfill is currently in post-closure care. See **Figure 1** for Subject Property location.

This Application for Development Permit for Proposed Enclosed Structures Over Closed Municipal Solid Waste Landfill pertains to the development of four multi-family, apartment buildings and a clubhouse on the Subject Property. The proposed apartment buildings will be three-stories, and constructed of wood framing on concrete, slab-on-grade foundations. The clubhouse will be a single-story structure, wood-framed, and constructed on a concrete, slab-on-grade foundation. The building size information is provided in the table below.

Structure	Foundation Area (Sq. Ft.)	Total Area (Sq. Ft.)	Occupancy
Apartment Building 1	9,000	26,940	133
Apartment Building 2	11,850	34,690	176
Apartment Building 3	12,955	38,355	193
Apartment Building 4	16,920	50,250	253
Clubhouse	3,440	3,440	230

No portions of the proposed structures to be occupied by people are below the existing or final grade of the land. Associated civil site improvements such as grading, utilities, parking, drainage landscaping, and irrigation are included in this Application. Stormwater detention is located off the Subject Property and will be addressed under a separate Application for Development Permit for Non-Enclosed Structure.

1.2 Existing Site Conditions and History

The DSPV Landfill was vacant land since at least 1939 until development of the property began in the 1960's as a sand mining operation. As the sand was mined out, the property was converted to a Type IV construction and demolition debris landfill in the 1970's. The DSPV Landfill operated from the 1970s to 1999 and has been in post closure care since closed. The landfill is currently capped with an original compacted clay layer to isolate the waste and prevent infiltration of precipitation. The Sugar Hills Golf Course operated on the DSPV Landfill from 2000 to 2005. Over a million cubic yards of fill soil was brought on site to shape the golf course. The clay cap is covered by up to 15 feet of soil (golf course soil) that was placed to shape the golf course in 2000. The DSPV Landfill property has been vacant land since the closing of the Sugar Hills Golf Course in 2005. The DSPV Landfill property still exhibits evidence of being developed as a golf course. The existing surface cover is fully vegetated and semi-annually maintained. A general topographic map of the Subject Property is provided as **Figure 2**. The

surrounding land use is shown on **Figure 3**. The prevailing wind direction is shown on **Figure 4**.

On July 17, 1977, the Harris County Health Department issued a license to Doty Sand Pit, Inc. to operate a sanitary landfill. On May 11, 1981, the Texas Department of Health (TDH) issued a Type IV MSW Landfill permit to Doty Sand Pit, Inc. On March 13, 1985, the Texas Health Department transferred the Type IV MSW Landfill permit to Doty Sand Pit Venture. Based on the April 28, 1999, letter from ENSR to the Texas Natural Resource Conservation Commission (TNRCC, currently named the TCEQ), final cover was documented as being in place and the landfill was closed. The extent of waste disposal as documented by ENSR is provided on the site plan in **Figure 5**.

On June 26, 2019, Bissonnet 136, LLC acquired the DSPV Landfill property and adjacent Olshan Demolishing Landfill property. In June 2020, MSW Permit No. 1247 was transferred to Northwest Metro Holding CS 34, Ltd (Northwest Metro), a related entity to Bissonnet 136, LLC. Northwest Metro has installed additional gas vents, repaired the gas monitoring probe network, and removed ponded surface water. As property owner, Bissonnet 126, LLC has obtained a Municipal Setting Designation (MSD) for the DSPV Landfill property, the Olshan Demolishing Landfill property, and adjacent City of Houston rights-of-way. Northwest Metro has an MSW permit revocation request for MSW Permit No. 1247 pending before the TCEQ.

2.0 Authority and Coordination

This Application for Development Permit for Proposed Enclosed Structure Over a Closed Municipal Solid Waste Landfill is submitted for the proposed development of four residential apartment buildings and a clubhouse and associated civil site improvements such as grading, utilities, parking, and drainage.

2.1 Legal Authority

Impact was originally incorporated in the State of Delaware as Impact Development Partners, LLC on October 13, 2021. On April 2022, the name of Impact Development Partners, LLC was changed to Impact Residential Development, LLC. Impact Residential Development, LLC is in good standing with the State of Delaware. Please see **Appendix 1** for the certificate of incorporation, name change, and certificate of good standing.

2.2 Evidence of Competency

Jessica Mullins as Vice President of Impact Residential Development, LLC has the legal authority to submit this Application for Development Permit.

2.3 Notice of Engineer Appointment

The Applicant has appointed Mike Schultz, P.E. (TX PE 68765) of SKA Consulting, L.P. as the Applicant's Environmental Engineer for this Application for Development Permit. SKA Consulting, L.P. is licensed Texas engineering firm F-5009.

The Applicant's Geotechnical Engineer for the Application for Development Permit is Gary Goodheart, P.E. (TX PE 141883) of Goodheart & Associates, LLC. Goodheart & Associates, LLC is licensed Texas engineering firm F-21548.

The Applicant's Civil Engineer for the Application for Development Permit is Rosie Kaetzer, P.E. (TX PE 110833) of Kimley-Horn and Associates, Inc. Kimley-Horn and Associates, Inc. is licensed Texas engineering firm F-928.

2.4 Notice of Coordination with Governmental Agencies and Officials

The Applicant has provided notification to the following government agencies and officials of the intent to submit this Development Permit Application. The sample notification letter is provided in **Appendix 1**.

Ms. Elita Castleberry, Harris County Pollution Control Services Department
Mr. Samuel Pena, Houston Fire Department
Ms. Tina Petersen, Harris County Flood Control District
The Honorable Sylvester Turner, Mayor of Houston
Mr. Stephen L. Williams, City of Houston Health Department
Ms. Carol Haddock, P.E., City of Houston Public Works Department
Ms. Yvonne W. Forrest, City of Houston Public Works Department – Water Utilities
Ms. Margaret Brown Wallace, City of Houston Planning and Development Department
Mr. Byron King, City of Houston Public Works Department – Building Code Enforcement
The Honorable Lina Hidalgo, Harris County Judge

Mr. Milton Rahman, P.E., Harris County Engineer
Ms. Barbie Robinson, Harris County Public Health Department
The Honorable Alma A. Allen, State Representative, District 131
The Honorable Borris L. Miles, State Senator, District 13
Mr. Rick Guerrero, Houston-Galveston Area Council

2.5 Subject Property Legal Description

The Subject Property legal description is:

A TRACT OR PARCEL CONTAINING 12.085 ACRES OR 526,429 SQUARE FEET OF LAND BEING OUT OF AND PART OF A CALLED 136.888 ACRE TRACT OF LAND CONVEYED TO BISSONNET 136, LLC, AS RECORDED UNDER HARRIS COUNTY CLERK'S FILE (H.C.C.F.) NO. RP-2019-275311 SITUATED IN THE HT&B RR CO SURVEY, SECTION 11, ABSTRACT NO. 406 AND HT&B RR CO SURVEY, SECTION 9, ABSTRACT NO. 407, WITH SAID 12.085 ACRE TRACT BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS, WITH ALL BEARINGS BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE (NAD 83):

COMMENCING AT A 3/4 INCH IRON ROD FOUND ON THE NORTH RIGHT-OF-WAY (R.O.W.) LINE OF BISSONNET STREET, FOR THE SOUTHWEST CORNER OF UNRESTRICTED RESERVE A BLOCK 1, GOLF PLAZA, MAP OR PLAT THEREOF RECORDED UNDER FILM CODE (F.C.) NO. 580258, OF THE HARRIS COUNTY MAP RECORDS (H.C.M.R.), AND THE SOUTHEAST CORNER OF UNRESTRICTED RESERVE A BLOCK 1, SUGARHILL ADDITION, RECORDED UNDER F.C. NO. 450135 H.C.M.R.

THENCE, NORTH 02 DEG. 34 MIN. 28 SEC. WEST, ALONG THE COMMON LINE OF SAID GOLF PLAZA, MAP OR PLAT THEREOF AND SAID SUGARHILL ADDITION, A DISTANCE OF 400.90 FEET TO THE MOST SOUTHERLY POINT OF SAID CALLED 136.888 ACRE TRACT, THE NORTHWEST CORNER OF SAID GOLF PLAZA, AND THE NORTHEAST CORNER OF SAID UNRESTRICTED RESERVE A SUGARHILL ADDITION TO A 5/8 INCH IRON ROD FOUND BEARS N 15 DEG. 19 MIN. EAST-1.04 FEET;

THENCE, NORTH 72 DEG. 56 MIN. 44 SEC. WEST, ALONG THE SOUTH LINE OF SAID CALLED 136.888 ACRE TRACT, A DISTANCE OF 90.24 FEET TO A POINT;

THENCE, OVER AND ACROSS SAID CALLED 136.888 ACRE TRACT, (9) COURSES AND DISTANCES:

1. NORTH 02 DEG. 34 MIN. 26 SEC. WEST, A DISTANCE OF 784.41 FEET TO A CAPPED 5/8 INCH IRON ROD STAMPED WINDROSE SET FOR THE SOUTHEAST CORNER AND POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT;
2. SOUTH 87 DEG. 20 MIN. 44 SEC. WEST, A DISTANCE OF 609.88 FEET TO A CUT X SET FOR THE MOST SOUTHERLY SOUTHWEST CORNER OF THE HEREIN DESCRIBED TRACT;
3. NORTH 53 DEG. 56 MIN. 45 SEC. WEST, A DISTANCE OF 574.83 FEET TO A CAPPED 5/8 INCH IRON ROD STAMPED WINDROSE SET FOR THE BEGINNING OF A

NON-TANGENT CURVE TO THE LEFT AND THE MOST WESTERLY CORNER OF THE HEREIN DESCRIBED TRACT;

4. WITH SAID CURVE TO THE LEFT, HAVING A RADIUS OF 1,285.00 FEET, A CENTRAL ANGLE OF 26 DEG. 43 MIN. 50 SEC., AN ARC LENGTH OF 599.50 FEET, AND A CHORD BEARING AND DISTANCE OF NORTH 52 DEG. 49 MIN. 14 SEC. EAST - 594.07 FEET TO A CUT X SET FOR A POINT OF TANGENCY OF THE HEREIN DESCRIBED TRACT;

5. NORTH 39 DEG. 27 MIN. 19 SEC. EAST, A DISTANCE OF 172.79 FEET TO A CAPPED 5/8 INCH IRON ROD STAMPED WINDROSE SET A NORTHWESTERLY CORNER OF THE HEREIN DESCRIBED TRACT;

6. NORTH 84 DEG. 27 MIN. 19 SEC. EAST, A DISTANCE OF 21.21 FEET TO A CAPPED 5/8 INCH IRON ROD STAMPED WINDROSE SET FOR THE MOST NORTHERLY CORNER OF THE HEREIN DESCRIBED TRACT;

7. SOUTH 50 DEG. 32 MIN. 41 SEC. EAST, A DISTANCE OF 242.71 FEET TO A CAPPED 5/8 INCH IRON ROD STAMPED WINDROSE SET FOR THE BEGINNING OF A CURVE TO THE RIGHT;

8. WITH SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 765.00 FEET, A CENTRAL ANGLE OF 47 DEG. 58 MIN. 15 SEC., AN ARC LENGTH OF 640.50 FEET, AND A CHORD BEARING AND DISTANCE OF SOUTH 26 DEG. 33 MIN. 34 SEC. EAST - 621.95 FEET TO A CAPPED 5/8 INCH IRON ROD STAMPED WINDROSE SET MARKING POINT OF TANGENCY;

9. SOUTH 02 DEG. 34 MIN. 26 SEC. EAST, A DISTANCE OF 94.09 FEET TO THE PLACE OF BEGINNING AND CONTAINING 12.085 ACRES OR 526,429 SQUARE FEET OF LAND.

A site survey is included in **Appendix 1**.

2.6 Notice to Real Property Records

A Notice to Real Property Records, Buyers, Lessees and Occupants Regarding Land Which Overlies a Closed Municipal Solid Waste Landfill was filed in the real property records of Harris County, Texas by Bissonnet 136, LLC on May 20, 2022. A copy of the Notice is provided in **Appendix 1**.

A notice to future buyers, lessees, and occupants is also provided in **Appendix 1**.

2.7 Adjacent Landowners

The Subject Property is completely surrounded by the DSPV Landfill; therefore, the only adjacent landowner is the owner of the DSPV property:

Bissonnet 136, LLC
Attn: Mark Lester
20 Park Road, Suite G
Burlingame, CA 94010

The adjacent landowner is shown on **Figure 3**.

2.8 Permit Fees

The development permit fee is \$2,500. A copy of the fee payment is provided in **Appendix 1**.

A permit modification to MSW No. 1247 will also be required. The permit modification fee is \$150. A copy of the fee payment for the permit modification is also provided in **Appendix 1**.

2.9 Public Participation Plan

A public participation plan (TCEQ Form 20960) has been completed and is included in **Appendix 1**.

3.0 Subsurface Description

This Application for Development Permit for Proposed Enclosed Structure Over a Closed Municipal Solid Waste Landfill is submitted for the proposed development of four residential apartment buildings and a clubhouse and associated civil site improvements such as grading, utilities, parking, and drainage.

3.1 Soil Tests

A geotechnical investigation was performed on the Subject Property by Goodheart & Associates, LLC in September 2022 in which 12 soil borings were installed. The depth of the soil borings ranged from 10 feet to 75 feet. Five soil borings fully penetrated the waste. The thickness of the cap and golf course fill soil over the landfill waste ranged from 2.5 to 13.5 feet. Of the soil borings that full penetrated the landfill waste, the waste thickness ranged from 45 to 68.5 feet. The full geotechnical report including boring logs is provided in **Appendix 2**.

3.2 Geology and Soil Statements

Sampling of surface soil [0 to 15 feet below ground surface(ft-bgs)] was performed across the DSPV Landfill and the results were provided to the TCEQ MSW Permits Section in an Affected Property Assessment Report (APAR) dated October 3, 2022. The affected property in the APAR fully encompassed the Subject Property. A Municipal Setting Designation (MSD) for the DSPV Landfill, the Olshan Demolishing Landfill, and associated City of Houston rights-of-way was certified by the TCEQ on October 12, 2022. The MSD restricts the groundwater from potable use and closes the groundwater-protective soil pathway and the groundwater ingestion pathway. The MSD fully encompasses the Subject Property. The APAR was reviewed and acknowledged by the TCEQ MSW Permits Section by letter dated December 16, 2022.

The Subject Property contains a permitted waste control unit (the DSPV Landfill); therefore, no subsurface soil samples (greater than 15 ft-bgs) were collected for analytical testing.

Chemicals of concern (COCs) detected in surface soil (0 to 15 ft-bgs) include the following:

- Metals – arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc,
- VOCs – methylene chloride and total xylenes.

Only arsenic and methylene chloride were identified in surface soil at concentrations exceeding their residential assessment levels (RALs) without an MSD in place, as discussed below. The remaining COCs detected in surface soils are below their RALs without an MSD in place.

- Arsenic was detected in two surface soil samples collected from soil borings SB-14 and SB-18 at concentrations exceeding its RAL of 5.9 mg/kg without an MSD in place. However, the detected arsenic concentrations do not exceed the RAL of 24 mg/kg with an MSD in place.
- Methylene chloride was detected in four surface soil samples collected from soil borings SB-20, SB-23A, SB-24A and SB-29 at concentrations exceeding its RAL of 0.0065 mg/kg without an MSD in place. Groundwater was not affected by methylene chloride;

as such, the slightly elevated methylene chloride concentrations identified in surface soils appear to be protective of groundwater and methylene chloride may potentially be a laboratory contaminant. The detected methylene chloride concentrations do not exceed the RAL of 1,500 mg/kg with an MSD in place.

In addition, no evidence of NAPL was identified in surface soils and no potential ecological receptors were not identified on or within ¼ mile of the DSPV Landfill property.

A surface soil concentration map is included as **Figure 6**. A summary of laboratory soil sample analytical results for the DSPV Landfill are included in **Table 1**.

In summary, the Subject Property has an MSD certificate from TCEQ that prevents exposure to the designated groundwater for potable purposes (i.e., groundwater ingestion). With the MSD, the ^{GW}Soil_{Ing} exposure pathway is no longer considered complete, and the RALs are based on the ^{Tot}Soil_{Comb} exposure pathway for surface soils (0-15 ft-bgs). Based on the results of the affected property assessment, concentrations detected in surface soils are below their RALs with an MSD in place. Subsurface soils were not analyzed as part of the affected property assessment due to the presence of the landfill.

3.3 Groundwater and Surface Water Statements

The Subject Property has an MSD certificate from TCEQ to prevent exposure to, through use of, designated groundwater for potable purposes (i.e., groundwater ingestion). Therefore, the ^{GW}GW_{Ing} exposure pathway will no longer be considered complete, and the RALs for groundwater will only be based on the ^{Air}GW_{Inh-v} exposure pathway. Based on the groundwater analytical data and with the approval of an MSD, the COCs in groundwater at the Subject Property do not exceed their respective RALs with an MSD in place.

The compiled results from the groundwater assessment and a discussion of the nature and extent of COCs in groundwater are provided for the first and second groundwater-bearing units (GWBUs). No direct or indirect evidence of NAPL was encountered in groundwater during this affected property assessment.

According to groundwater level measurements collected by SKA in January 2020 through October 2020, the groundwater flow direction at the Subject Property is generally to the north or northeast with an average hydraulic gradient of approximately 0.0015 feet per foot (ft/ft). The October 2020 groundwater gradient map is provided as **Figure 7**.

A water well search was performed for the Subject Property and the mapped water wells are shown on **Figure 8**. The water well search results are provided in **Appendix 3**.

3.3.1 First Groundwater-Bearing Unit

COCs detected in the first GWBU include the following:

- Metals –arsenic, barium, chromium, iron, lead, manganese, selenium, and zinc;
- VOCs – acetone, benzene, chlorobenzene, chloroform, chloromethane, 1,2-dichlorobenzene, 1,4-dichlorobenzene, ethylbenzene, p-isopropyltoluene, MEK, MTBE, toluene, and total xylenes;
- SVOCs – benzoic acid; and

- TPH – the C₆ to C₁₂ carbon range.

COC concentrations detected in the first GWBU exceeding their respective RALs without an MSD are arsenic, chromium, manganese, and TPH, as described in detail below.

- Arsenic was detected in the first GWBU groundwater samples at concentrations exceeding its RAL of 0.010 mg/L in on-site monitoring wells MW-9 and MW-10 and in off-site monitoring wells MW-1, MW-2, MW-5, MW-7, and MW-15. However, the most recent groundwater sample collected from monitoring well MW-9 did not exhibit arsenic concentrations exceeding its RAL. The arsenic groundwater contaminant plume is delineated in the hydrogeologically downgradient direction by monitoring wells MW-6, MW-8, MW-9, MW-11, MW-12, MW-16, and MW-18. The arsenic groundwater contaminant plume is also vertically delineated by monitoring wells MW-1D, MW-2D, and MW-3D installed in the second GWBU.
- Chromium was detected in the first GWBU in March 2019 at a concentration exceeding its RAL of 0.10 mg/L in off-site monitoring well MW-1. Subsequent groundwater samples collected from monitoring wells MW-1 through MW-18 between September 2019 and October 2020, however, did not contain concentrations of chromium exceeding its RAL. Based on the extensive groundwater sampling, chromium is not considered a COC in groundwater.
- Manganese was detected in the first GWBU at concentrations exceeding its RAL of 1.1 mg/L in on-site monitoring well MW-10 and off-site monitoring wells MW-1, MW-2, MW-5, and MW-7. However, groundwater samples collected from monitoring well MW-10 between January and July 2020 did not exhibit concentrations of manganese exceeding its RAL. The manganese groundwater contaminant plume is delineated in the hydrogeologically downgradient direction by monitoring wells MW-9, MW-11, MW-12, MW-16, and MW-18. The manganese groundwater contaminant plume is also vertically delineated by monitoring wells MW-1D, MW-2D, and MW-3D installed in the second GWBU.
- TPH (C₆ to C₁₂) was detected in the uppermost GWBU in July 2019 at a concentration exceeding its RAL of 0.98 mg/L in off-site monitoring well MW-8. However, groundwater samples collected from this monitoring well between September 2019 and July 2020 reported no concentrations of TPH (C₆ to C₁₂) exceeding its RAL. Further, no other on-site or off-site monitoring wells have exhibited detectable concentration of TPH. Based on this extensive groundwater sampling, TPH is not considered a COC in groundwater.

In summary, only arsenic and manganese consistently exceeded their RALs in the groundwater sampled from the first GWBU. There are no known anthropogenic sources of arsenic or manganese in site soils or groundwater. Concentrations of arsenic and manganese in soil minerals tend to mobilize due to the reducing geochemical conditions in the landfill leachate and surrounding groundwater caused by decomposition of organic waste in the landfill. The reducing conditions have caused naturally-occurring arsenic and manganese in the soil minerals to become more soluble in groundwater.

A first GWBU COC concentration map is provided as **Figure 9**. A summary of laboratory first GWBU sample analytical results for the DSPV Landfill are included in **Table 2**.

3.3.2 Second Groundwater-Bearing Unit

COCs detected in the second GWBU near the Subject Property include the following:

- Metals – arsenic, barium, chromium, iron, lead, manganese, selenium, and zinc;
- VOCs – chlorobenzene, chloroform, 1,2-dichlorobenzene, MTBE, and toluene; and
- SVOCs – bis(2-ethylhexyl)phthalate and 1,2-dichlorobenzene.

A second GWBU COC concentration map is provided as **Figure 10**. A summary of laboratory second GWBU sample analytical results for the DSPV Landfill are included in **Table 2**.

COC concentrations were not detected in the second GWBU exceeding their respective RALs with or without an MSD. In summary, COC concentrations in the first and second GWBU do not exceed RALs with an MSD in place.

3.3.3 Surface Water

There is no surface water on the Subject Property. The nearest surface water body is Harris County Flood Control District (HCFCD) Drainage Ditch D120-00-00 which is located about 1,200 feet north of the Subject Property. See **Figure 2**. This HCFCD ditch flows into Brays Bayou, a tidal stream located approximately 1.8 miles northeast of the Subject Property. Brays Bayou is TCEQ classified stream Segment 1007B with a use classification as navigation and industrial water supply.

4.0 Construction Plans

A complete copy of the as-built construction plans for the proposed development will be maintained at the property manager's office at the Subject Property. The dimensional control plan for the proposed development is provided in **Sheet C4.0 Dimension Control and Paving Plan** in the civil drawing set in **Appendix 5**. Code Analysis sheets are provided as **Sheets G100A** and **G100B** in **Appendix 5**.

4.1 Ground Improvement

The Applicant has investigated various ground improvement options and plans to implement a deep dynamic compaction (DDC) program proposed by Densification, Inc. to densify the site soils and improve the soil bearing capacity. DDC involves using a typical 6 to 20 ton steel weight dropped from 40 to 70 feet by a crane onto the foundation footprint of each proposed building. The compaction effect is predicted to extend to a depth of 20 feet below grade. As the footprint of each building is compacted, the footprint will be re-graded to be level and fill added as needed. There are two passes planned for each building footprint. The DDC process does not involve any pilings or piers through the landfill cap. The DDC work plan by Densification, Inc. is provided in **Appendix 4**.

4.2 Grading and Drainage Plan

The grading plan is provided on **Sheet C5.0 Grading Plan** of the civil drawing set in **Appendix 5**. Side slopes on the northeast, south and southwest sides of the proposed development are shown to be a maximum of 4h:1v (25%) and comply with 30 TAC 330.453(c). The property area where the apartment buildings and clubhouse will be developed has an overall slope of less than 6% as required in 30 TAC 330.453(c) and generally drains to the south. The cut-and-fill balance for the Subject Property indicates a cut of 12,343 cubic yards (cy) and fill of 83,180 cy. The cut-and-fill balance is shown graphically on **Figure 11**. With a fill volume of over 6 times the cut volume, there is reduced likelihood of excavating into waste during site grading, and the overall cover thickness will increase.

The Subject Property is bounded on the east and northwest sides by roadways which will contain and divert the Subject Property drainage to the south. The southwest property boundary will have a swale which will also divert drainage to the south. Along the southern Subject Property boundary is a drainage ditch which will capture runoff from the Subject Property and route the drainage to an off-site detention pond. **Sheet C6.0 Proposed Drainage Area Map** in the civil drawing set in **Appendix 5** shows the proposed Subject Property drainage patterns.

The finished floor elevations (FFE) of the proposed structures are described below and shown on **Sheet C5.0 Grading Plan** in the civil drawing set in **Appendix 5**:

Structure	FFE (ft MSL)
Clubhouse	113.0
Building 1	113.5
Building 2	113.5
Building 3	107.5
Building 4	107.5

The FFEs for each building are above the existing ground surface at their respective building locations, and as described above, the building footprints will be compacted using DDC as described above. Therefore, fill will be needed to prepare the subgrade. Development of the detention ponds (described in a future Application for Development Permit for Non-Enclosed Structure) will result in a surplus of fill soil that can be used as foundation fill. As described in the boring logs in the geotechnical report (**Appendix 2**), the surficial fill soil on the DSPV Landfill is predominantly a low plasticity clay (CL) with lesser areas of high plasticity clay. This surficial fill soil is expected to be suitable for building subgrade material.

4.3 Foundation Plans

The proposed foundation plans for all of the buildings on the Subject Property along with the respective gas collection system in each building are provided in **Appendix 6**. As shown on the drawings in **Appendix 6**, the foundation is described as: (1) compacted subgrade by DDC, (2) a geotextile fabric, (3) 12-inch thick permeable gravel bed of graded No. 57 stone, (4) a geotextile fabric, (5) a chemical vapor barrier of Land Science TerraShield, or equivalent, (6) an 8-inch-thick, reinforced and post-tensioned concrete, slab-on-grade foundation with perimeter grade beams, but no interior grade beams.

Within the permeable gravel layer, a landfill gas collection system will be installed consisting of:

- Inlet air intakes composed of 4-inch, Schedule 40, PVC pipe along the long exterior wall of each building. Intakes will have insect screens.
- 4-inch, Schedule 40, perforated PVC pipes for distribution of the inlet air. The inlet air distribution piping runs parallel to the long exterior walls.
- A perforated 4-inch, Schedule 40, PVC pipe for landfill gas collection running along the long axis of the building. Each perforated collector pipe serves two zones of the building as shown and is connected to 4-inch, solid, PVC pipe for the run to a storage closet on the end of the building where the control and monitoring equipment will be located.
- Connected to the perforated 4-inch collector pipe will be collection laterals consisting of Land Science TerraVent, or equivalent. Terravent is a 1-inch thick by 12-inch wide low head loss collection piping.

As described above, the foundation system will include inlet air piping to provide dilution air to the permeable gravel bed. Air intakes will be mounted to the sides of the building above grade. Within the concrete foundation will be vacuum pressure test points where sub slab negative pressures can be monitored to ensure an adequate pressure field is created.

The Land Science TerraShield vapor barrier is a three-part composite consisting of a TerraBase fabric, a Nitra-Core nitrile asphaltic core, and a protection fabric. TerraBase is a 25-mil thick composite membrane comprised of flexible, chemically resistant polyethylene and metalized films laminated to a tear resistant woven polyethylene and a high puncture reinforcement geotextile. Nitra-Core is a nitrile-modified asphaltic latex spray applied to 40 mils thick. The protection fabric is a 50-mil thick geotextile bonded to the Nitra-Core. The composite TerraShield vapor barrier has a total thickness of 115 mils. The three-part composite TerraShield vapor barrier system is field-assembled with penetrations and overlaps field-sealed with spray-applied Nitra-Core at a minimum thickness of 60 mils. Land Science TerraVent is a low-profile soil vapor venting conduit with low entry friction loss. Specifications and detail sheets for the Land Science TerraShield and TerraVent are provided in **Appendix 7**.

Quality control of the TerraShield installation will be maintained through coupon testing and smoke testing. Coupons will be cut from the installed TerraShield vapor barrier before the protection fabric is attached on the basis of one coupon per 1,000 square feet of foundation area and the thickness of the coupon will be measured with a caliper. The combined TerraBase and NitraCore should measure a minimum of 65 mils thick. The coupon location will be repaired per the TerraShield installation instructions. Once coupon testing has verified that the TerraShield vapor barrier meets the required thickness, smoke testing will be performed to identify any leaks. Leaks will be repaired, as needed, with Nitra-Core and additional TerraBase, if needed. After quality control testing is completed, the protection fabric will be added. Various overlap, repair, and termination sequence drawings are provided in **Appendix 7**.

Below the permeable gravel layer will be a Mirafi 140N Geotextile fabric, or equivalent to ensure separation between the subgrade and the gravel. The Mirafi 140N geotextile is composed of polyethylene fibers and is resistant to chemical and biological degradation. The Mirafi 140 N geotextile has a minimum apparent opening size of 0.212 mm. Additional details on the Mirafi 140N geotextile are provided in **Appendix 7**.

The landfill gas collector piping will be connected to a 6-inch vertical PVC riser installed within a utility closet on the end of each building and vented to the roof. In the clubhouse, the vertical riser will be located in an interior closet. This portion of the gas collection system is more fully described in the Structures Gas Monitoring Plan.

All potable water plumbing on the Subject Property will be in secondary containment using lined utility trenches as shown in **Detail B6** of **Sheet C9.4 Construction Details (5 of 6)** in the civil drawing set in **Appendix 5**.

4.4 Landscape and Irrigation Plans

The unimproved areas of the Subject Property will be landscaped with a mixture of shrubs, small shallow-rooted trees, and grasses as shown on **Sheet L5.01** in the landscape and irrigation plan set in **Appendix 8**.

Landscaped and grassy areas of the developed Subject Property will be irrigated from the municipal water supply. All subsurface piping in the irrigation system that is continuously pressurized will be installed in lined trenches as shown in **Detail B6** of **Sheet C9.4 Construction Details (5 of 6)** in the civil drawing set in **Appendix 5**. Any leaks in the irrigation system piping or broken irrigation fixtures will be repaired promptly.

4.5 Closure Plan

The entire DSPV Landfill site has been closed and capped for more than 20 years. In addition, more than a million cubic yards of soil was imported to the site and deposited over the compacted clay cap to shape the Sugar Hills Golf Course which operated from 2000 to 2005. There are no areas of waste deposition that require closure. Any areas where waste is exposed during the proposed construction will be backfilled with 2 feet of compacted clay consistent with the original landfill cap. Any waste that must be excavated during the proposed construction will be stockpiled and protected as described in **Section 4.8** until the waste can be removed for off-site disposal at an approved facility. A typical utility installation is shown on **Detail B6** of **Sheet C9.4 Construction Details (5 of 6)** of the civil drawing set in **Appendix 5**.

4.6 Landfill Gas Management During Construction

A site-specific health and safety plan shall be prepared and implemented prior to any work activities at the site. A Landtec GEM 5000 Landfill Gas Monitor (GEM 5000) will be used to monitor the methane concentrations in the ambient air of the project site during any subsurface work or grading activities where waste may be exposed. If ambient methane concentrations exceed 1% [20% of the lower explosive limit (LEL)], the work area will be evacuated until methane concentrations dissipate to below 20% of the LEL. Similarly, the GEM 5000 will be used to monitor for hydrogen sulfide in the ambient air during subsurface work or grading activities where waste may be exposed. If ambient hydrogen sulfide concentrations exceed 10 ppm [OSHA time-weighted average (TWA) concentration], the work area will be evacuated until hydrogen sulfide concentrations dissipate to below the TWA.

4.7 Water Management During Construction

The depth to leachate/groundwater will be assessed during any excavation activity or the installation of utilities. If leachate/groundwater is encountered, the planned activity will be evaluated to determine if the activity can be performed without removing the leachate/groundwater. Leachate/groundwater that requires removal shall be containerized in drums, totes, or tanks. Containerized leachate/groundwater will be sampled and tested. Depending on sample results, containerized leachate/groundwater may be disposed to the City of Houston sanitary sewer system through a one-time discharge authorization. If sanitary sewer disposal is not an option, leachate/groundwater will be disposed at the appropriate off-site facility.

4.8 Waste Management During Construction

If waste must be excavated during construction, the waste shall be stored on plastic sheeting and covered by plastic sheeting. Waste that is exposed but not excavated shall be covered with plastic during construction activities. No waste will be left exposed overnight. Exposed waste will be backfilled with a minimum of 2 feet of compacted clay after completion of construction activities. No waste that is removed from an excavation is proposed to be redeposited at the site. The excavated and stockpiled waste will be sampled, profiled, and disposed at an approved off-site landfill facility. Previous waste materials excavated during site investigative activities was profiled as a Class 2 industrial waste and disposed at the WCA's Fort Bend Regional Landfill in Needville, TX.

5.0 Operating Plans

The DSPV Landfill is no longer operating though at the time of this submittal, MSW Permit No. 1247 for the DSPV Landfill is still active. The MSW permittee has engaged SKA Consulting, L.P. to continue the post-closure care activities required under MSW Permit No. 1247. The Applicant for this development permit will engage the services of an environmental professional to monitor and maintain the landfill gas collection and monitoring systems for the enclosed structures as required under 30 TAC 330 Subchapter T. The approved permit, operating plans, and monitoring results will be maintained at the property manager's office on the Subject Property.

5.1 Structures Gas Monitoring Plans

The structures gas monitoring plan discusses the location and design of the proposed structures, age of the landfill, historical landfill gas monitoring results, and the landfill gas collection system.

5.1.1 Proposed Enclosed Structures

The proposed enclosed structures under this Application include four, three-story, multi-family apartment buildings and a single-story clubhouse constructed with concrete, slab-on-grade foundations. The proposed structures are intended for full-time occupancy by family units. These structures will all be constructed on waste deposition areas within the former DSPV Landfill. The DSPV Landfill stopped receiving waste in 1999 and was closed and capped in 2000 with a minimum of 2 feet of compacted clay. In 2000, the Sugar Hills Golf Course was developed over the DSPV Landfill and over a million cubic yards of fill soil was brought onto the DSPV Landfill to shape the golf course resulting in 4 to 15 feet of additional soil over the cap. A landfill gas venting and perimeter monitoring network was installed around the DSPV Landfill during this period. The perimeter monitoring system is sampled quarterly. Though the landfill waste is about 25 to 50 years old, the waste still generates landfill gas as documented in the perimeter monitoring network.

Potential routes of landfill gas entry into the proposed structures include plumbing penetrations and cracks in the concrete foundation. Preferential flow pathways could also include subgrade utility trenches. The proposed structures will not have natural gas service or fireplaces which eliminates potential sources of ignition from open flames and pilot lights. Other potential sources of ignition could include electrical sparks and smoking.

The depth of cover over the waste will vary but will be a minimum of 2 feet of compacted clay cap plus four feet of compacted subgrade soil (mostly clay) beneath the foundations for subgrade utilities. In addition, beneath each building foundation will be a permeable gravel layer, landfill gas collection system, and a very low permeability vapor barrier as described in **Section 4.3** of this Application narrative.

5.1.2 Landfill Gas Accumulation Prevention, Detection, and Elimination

The permeable gravel layer, landfill gas collection system, and a very low permeability vapor barrier installed below each proposed structures will serve to prevent the accumulation of landfill gas in the proposed structures and also as the means of eliminating any landfill gas that might enter the permeable gravel layer from the subgrade soil. The sub slab gas collection system

pipng will be connected to vertical risers which transfer landfill gas through a vent on the roof of each building. The sub slab gas collection system will be under negative pressure from an explosion-proof, electric exhaust fan. Methane is lighter than air and will dissipate upward and away from vents on each building.

Subgrade water and electrical utilities will enter the proposed buildings through the building frame to reduce the number of slab penetrations. Wastewater drainage penetrations through the slab will be caulked to prevent any landfill gas migration. Subgrade utility trenches outside the footprint of the building will also be dammed with cement-stabilized sand to prevent migration of landfill gas from outside of the building footprint. After slab installation, any cracks, contraction joints, or other openings will be caulked to prevent landfill gas migration.

Closed subgrade utility vaults and other subgrade non-enclosed structures will have vent holes in the lids to prevent the accumulation of landfill gases. Utility vaults and other subgrade non-enclosed spaces will be inspected and monitored for landfill gas on a quarterly basis.

The landfill gas collection system will have ports for sampling the air stream collected from beneath the slab. In addition, sub slab vacuum pressure monitoring points will be installed in the building slab to allow for monitoring of the negative pressure field created by the gas collection system. These monitoring points will be installed in breezeways outside of the occupied spaces.

Each apartment unit on all floors will be equipped with a methane detector mounted at the ceiling of the unit. The methane detector will include an audible alarm. The proposed methane detector is a Safety Siren Carbon Monoxide, Propane, and Methane Detector manufactured by Family Safety Products. Additional descriptive information and owner's manual for the Safety Siren is provided in **Appendix 9**.

In addition, the DSPV Landfill and the adjacent Olshan Demolishing Landfill have a perimeter gas collection and control system (GCCS) consisting of more than 120 gas vents and more than 50 gas monitoring probes. This GCCS was installed in approximately 2005 and is currently monitored quarterly in accordance with MSW Permit No. 1247. No portion of the GCCS is located on the Subject Property, however, the presence and operation of the GCCS reduces the potential for landfill gas accumulation on the Subject Property.

5.1.3 Landfill Gas Ventilation System

Within the permeable gravel layer under each building foundation will be a landfill gas collection system consisting of 4-inch, Schedule 40, perforated PVC pipes for inlet air and a perforated 4-inch PVC pipe for landfill gas collection. Connected to the perforated 4-inch collector pipe will be collection laterals consisting of Land Science TerraVent, or equivalent. As described above, the foundation system will include inlet air piping to provide dilution air to the permeable gravel bed. Inlet air intakes will be mounted to the sides of the building above grade. The landfill gas collector piping will be connected to a vertical 6-inch, Schedule 40 PVC riser installed within a utility closet on the end of each building and vented to the roof. Each 4-inch collector line will have a gate valve (**Appendix 10**) to regulate flow. The 6-inch vertical riser will have an explosion-proof, in-line, electric fan to induce negative pressure in the permeable gravel layer. The proposed fan is an Air Systems International Model SVF-10EXP. Specification sheets on the proposed fan are provided in **Appendix 10**. Landfill gas collected will be vented to the atmosphere above the roof line of the proposed buildings. The vent will protrude at least 3 feet

above the highest point of the roof and will be capped with a stainless-steel chimney cap (**Appendix 10**).

As required by 30 TAC 330.957(t)(2)(C), the non-methane organic compounds (NMOC) emission rate for the Subject Property is estimated at 46 megatons per year using the formulas and assumptions contained in 30 TAC 115.152 and 40 CFR 60.754. At this NMOC emission rate, the Subject Property is exempt from the requirements in 30 TAC 115.152(a). Because the DSPV Landfill is permanently closed and no longer receiving waste, the estimated NMOC emissions rate will continue to decline year over year.

5.1.4 Landfill Gas Monitoring Equipment

Landfill gas will be monitored by three different sensors. Within the occupied spaces, a permanently mounted Family Safety Products, Inc. Safety Siren Pro Series carbon monoxide, propane, and methane detector (Model No. HS80504) will be used. On the sub slab landfill gas collection system, a permanently mounted RKI Instruments M2A gas sensor will monitor the exhaust gas stream. For other landfill gas measurements, a Landtec GEM 5000 portable landfill gas detector will be used. Additional information on each of these instruments is provided in **Appendix 9**.

Pressure and air flow readings will be collected using a Dwyer Instruments Series 477AV Handheld Digital Manometer. Additional information on the Dwyer Series 477AV is provided in **Appendix 9**.

5.1.5 Implementation Schedule

The sub slab landfill gas collection system and monitoring sensors and alarms will be in place and operational before any apartment unit is leased.

5.1.6 Sampling Plan and Procedures

Ports on the landfill gas collection system, vacuum test points, and utility vaults and other non-enclosed spaces will be monitored quarterly in accordance with the plans and procedures contained in **Appendix 11**.

5.1.7 Landfill Gas Monitoring Results

A landfill gas sample was collected from gas monitoring probe GMP-9R on January 23, 2023 and analyzed at Enthalpy Analytical, LLC in Deer Park, Texas for methane, hydrogen sulfide, carbon monoxide, mercaptans, and volatile organic compounds (VOCs). Methane, hydrogen sulfide, oxygen, carbon dioxide, and ammonia were measured in the field using a GEM-5000 and an RKI 6000 multi-gas detector. Laboratory results and field notes are provided in **Appendix 12**. The field monitoring results for GMP-9R compared to the laboratory results were:

Parameter	GMP-9R Field Result	GMP-9R Lab Result
Methane (%)	5.1	4.73
Hydrogen Sulfide (ppmv)	0	<0.151 ND
Total Mercaptans (ppmv)	NM	<0.151 ND
Oxygen (%)	0	NM

Carbon Dioxide (%)	19.1	NM
Carbon Monoxide (%)	NM	<0.00655 ND
Ammonia (ppmv)	0	NM
Total VOCs (mg/m ³)	NM	0.49 b

- Notes:
1. "ND" means not detected at the specified sample detection limit.
 2. "NM" means not measured.
 3. "b" means on TO-15 sample results that the cannister used for the sample was certified to contain less than 1 ppmv total VOCs as methane and less 0.5 ppmv total sulfur as hydrogen sulfide prior to sampling. TO-15 sample results below these levels may be due to minor contamination remaining in the cannister after cleaning and certification.

Based on this landfill gas sample from GMP-9R, the landfill gases from the DSPV Landfill do not contain significant concentrations of mercaptans, carbon monoxide, ammonia or VOCs. Methane and elevated carbon dioxide were detected in this landfill gas sample from GMP-9R and hydrogen sulfide has been detected in other gas monitoring probes in the past. These gases are monitored quarterly in the DSPV Landfill GCCS.

The current permittee, Northwest Metro Holding, CS 34, LLC began monitoring the GCCS landfill gas network in 2020. However, the current permittee has historical data on many of the landfill gas monitoring probes going back to 2015. In total the current permittee has over 1,000 landfill gas readings from the GCCS. The data are summarized as follows:

Parameter	No. of Readings	Maximum Conc.	Average Conc.	No. of Non-Zero Readings
Methane (%)	1054	59.2	1.6	210
Hydrogen Sulfide (ppm)	1051	138	1.5	244
Carbon Dioxide (%)	1030	57.6	7.5	998

These data indicate that over 75% of the landfill gas samples contained no detectable methane or hydrogen sulfide. The average methane concentration in the landfill gas is below the LEL and the average hydrogen sulfide concentration in the landfill gas is below the TWA.

5.1.8 Occupied Spaces

Each occupied space in the proposed structures will be equipped with a Family Safety Products, Inc. Safety Siren Pro Series carbon monoxide, propane, and methane detector (Model No. HS80504) equipped with an 85-decibel audible alarm. The methane detector will be mounted 12 inches from the ceiling. The methane detector is set to alarm at 25% of the lower explosive limit (LEL) of methane. For the Safety Siren Pro Series, the methane LEL is 3.8% methane in air (Safety Siren manual, page 14). At 25% of an LEL of 3.8%, the alarm setting is 0.95% methane in air which is less than the 1% methane in air required by 30 TAC 330.957(t)(1)(A)(i). The Safety Siren Pro Series methane detector operates on 110V/60Hz power and is hard-wired and has no batteries to be replaced. Additional specifications on the methane detector are provided in **Appendix 9**.

Each occupied space will be equipped with a graphic evacuation plan map mounted on the entry door of the space. The evacuation plan map will include the floor plan of the building, the evacuation route and a rally point along with the telephone numbers of emergency personnel and the property management.

5.1.9 Landfill Gas Collection System

The sub slab landfill gas collection system in each building will be installed in a storage closet as shown on the drawings in **Appendix 6**. The gas collection system will include a 4-inch, Schedule 40 PVC riser for each building zone and an exhaust fan serving multiple risers through a manifold and a 6-inch, Schedule 40, PVC exhaust riser. Each 4-inch zone riser will have a gate valve to adjust the flow rate. A sample port will be included on each riser to measure the methane concentration in the exhaust sub slab gas. A GEM 5000 will be used to monitor methane levels in each zone stream. RKI Instruments M2A gas sensors will be installed on the exhaust gas stream to monitor methane and hydrogen sulfide. The RKI M2A sensor provides real time gas concentration data. A schematic of the gas collection system controls and instrumentation is provided on **Figure 12**. Additional information on the methane monitoring equipment is included in **Appendix 9**.

An Intek, Inc. rheotherm-type duct mass air flow sensor will be installed in the exhaust riser to measure the exhaust air flow. The mass air flow sensor will be selected with the explosion proof option. More information on the mass air flow sensor is provided in **Appendix 9**.

5.2 Site Operating Plan

The Applicant will engage the services of an environmental professional to monitor and maintain the landfill gas collection and monitoring systems for the enclosed structures. The systems will be inspected monthly at a minimum.

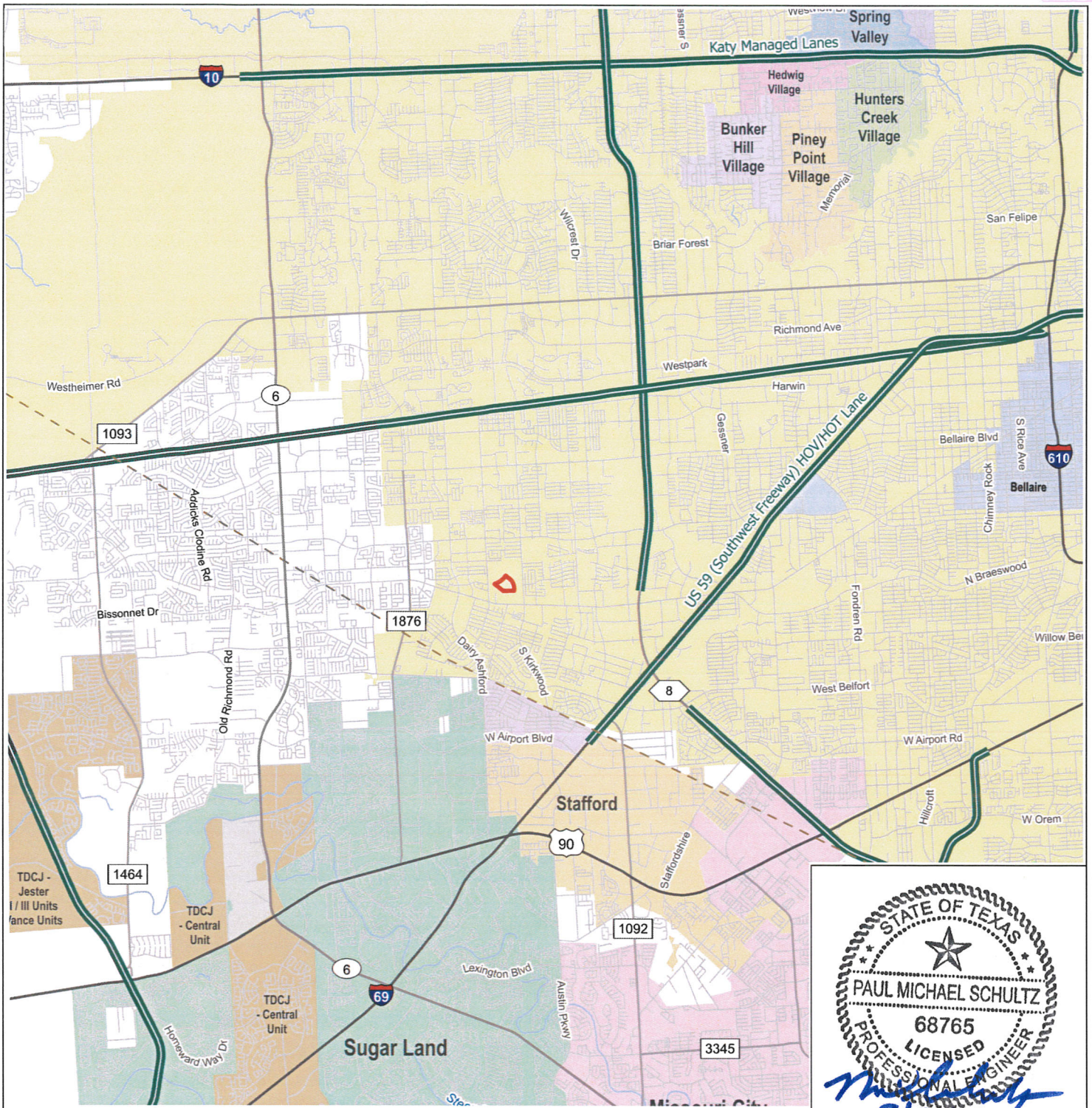
While MSW Permit No. 1247 is active, landfill post-closure activities will continue including quarterly landfill gas monitoring at the DSPV Landfill perimeter landfill gas monitoring network, vegetation maintenance, and removal of any non-permitted ponded water over waste. The active landfilling operations ceased in 1999 and there are no landfilling operations contemplated under this Application.

5.3 Safety and Evacuation Plan

All of the proposed building living spaces will be equipped with methane monitors with audible alarms. The methane monitors will be set to alarm at a reading at or below 1% methane (20% LEL).

Each living space will be equipped with a graphic evacuation plan map directing occupants where to go in the event of an alarm including a rally point and contact phone numbers.

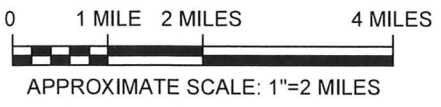
FIGURES



LEGEND

SUBJECT PROPERTY BOUNDARY

REFERENCE: TxDOT GREATER HOUSTON, TEXAS
OCTOBER 2022



SKA CONSULTING, L.P.
1888 STEBBINS DRIVE, SUITE 100
HOUSTON, TX 77043
Texas Registered Engineering Firm F-005009
Texas Registered Geoscience Firm 50011

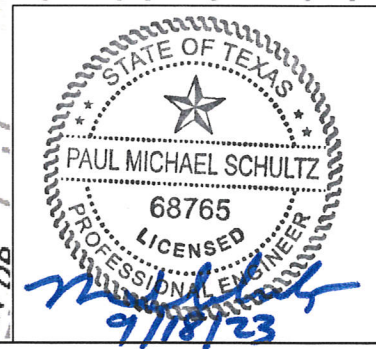
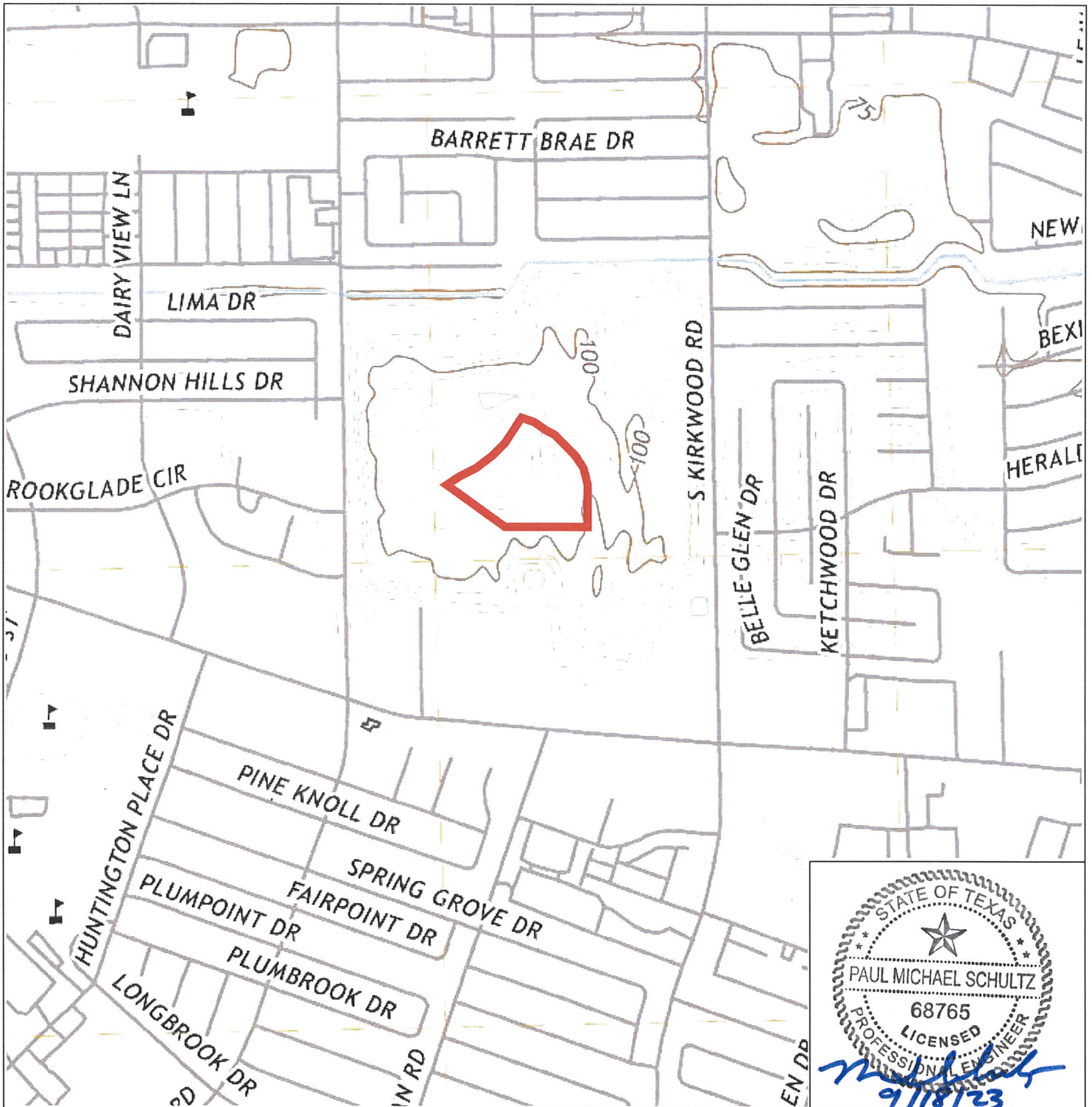
GENERAL LOCATION MAP

DEVELOPMENT PERMIT FOR PROPOSED
ENCLOSED STRUCTURES
KIRKWOOD CROSSING APARTMENTS
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

FIGURE
1



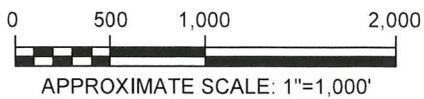
DATE: SEPTEMBER 2023	JOB NO: 6022-0001	SCALE: AS SHOWN
1 FIRST REVISION	DRAWN BY: MLH	
2 SECOND REVISION	CHECKED BY: PMS	
3 THIRD REVISION	APPROVED BY: PMS	



LEGEND

SUBJECT PROPERTY BOUNDARY

REFERENCE: USGS 7.5-MINUTE TOPOGRAPHIC QUADRANGLE
ALIEF, TEXAS 2019



SKA CONSULTING, L.P.
1888 STEBBINS DRIVE, SUITE 100
HOUSTON, TX 77043

Texas Registered Engineering Firm F-005009
Texas Registered Geoscience Firm 50011

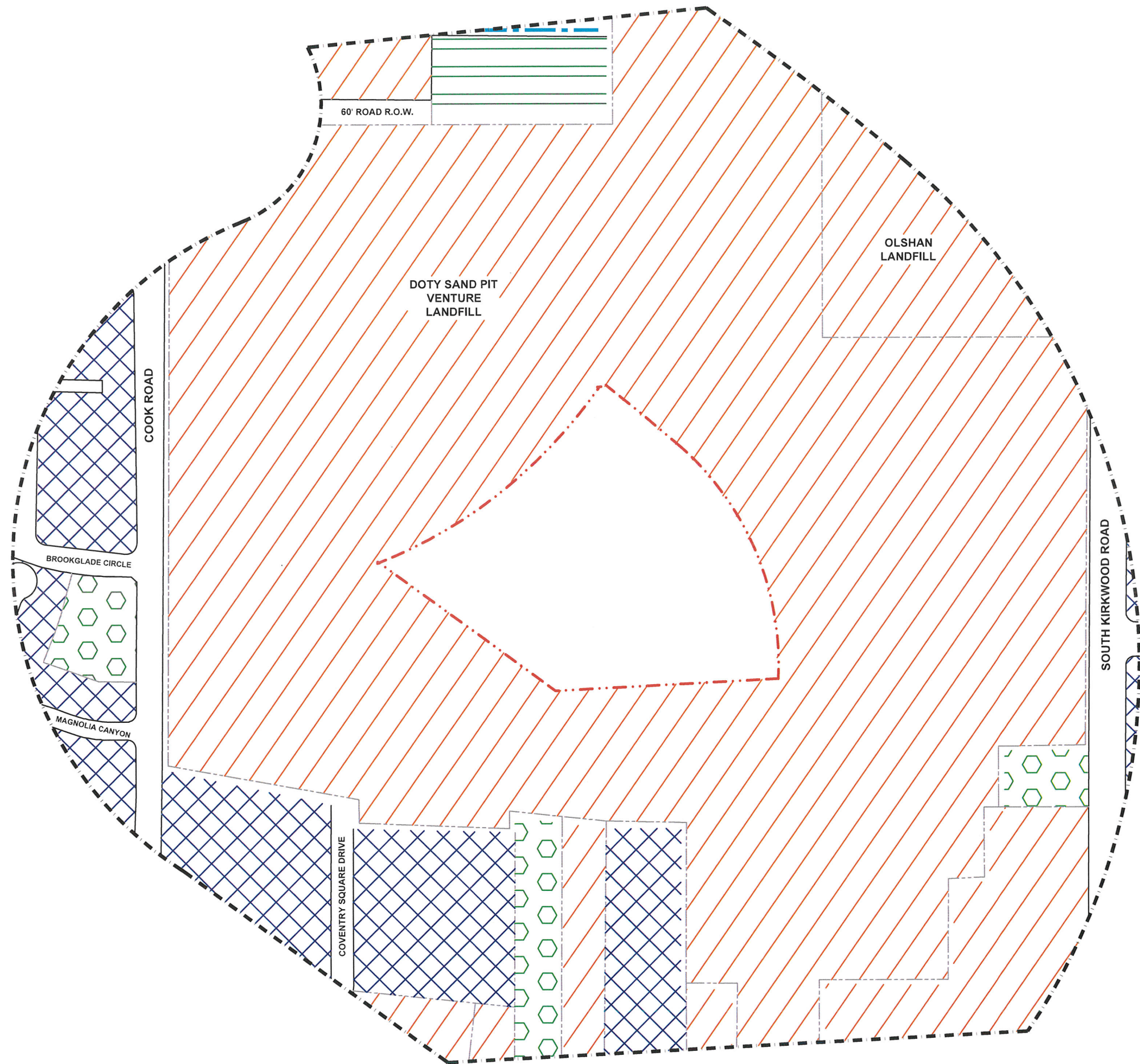
GENERAL TOPOGRAPHY MAP

FIGURE
2

DEVELOPMENT PERMIT FOR PROPOSED
ENCLOSED STRUCTURES
KIRKWOOD CROSSING APARTMENTS
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

DATE: SEPTEMBER 2023	JOB NO: 6022-0001	SCALE: AS SHOWN
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2 SECOND REVISION	CHECKED BY: PMS	
3 THIRD REVISION	APPROVED BY: PMS	



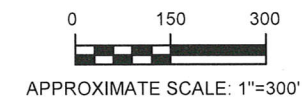


- LEGEND**
- . . . - SUBJECT PROPERTY BOUNDARY
 - LOT BOUNDARY
 - 1,000-FOOT RADIUS
 - HCFCD DRAINAGE DITCH

- PARCEL LAND USE**
- COMMERCIAL/INDUSTRIAL
 - RESIDENTIAL
 - VACANT
 - PUBLIC AND INSTITUTIONAL

NOTES:

- "HCFCD" REPRESENTS HARRIS COUNTY FLOOD CONTROL DISTRICT.
- "R.O.W." REPRESENTS RIGHT OF WAY.
- THE ORIGINAL VERSION OF THIS DRAWING IS IN COLOR. BLACK AND WHITE COPIES MAY NOT ACCURATELY DEPICT CERTAIN INFORMATION.
- THIS DRAWING HAS BEEN PREPARED UNDER THE SUPERVISION OF A PROFESSIONAL ENGINEER OR GEOSCIENTIST. DO NOT ALTER THIS DOCUMENT IN ANY WAY WITHOUT THE WRITTEN CONSENT OF SKA CONSULTING, L.P.



ska SKA CONSULTING, L.P.
 1888 STEBBINS DRIVE, SUITE 100
 HOUSTON, TEXAS 77043
 Texas Registered Engineering Firm F-005009
 Texas Registered Geoscience Firm 50011

SURROUNDING LAND USE

DEVELOPMENT PERMIT FOR PROPOSED
 ENCLOSED STRUCTURES
 KIRKWOOD CROSSING APARTMENTS
 12000 BISSONNET STREET
 HOUSTON, HARRIS COUNTY, TEXAS 77099

FIGURE

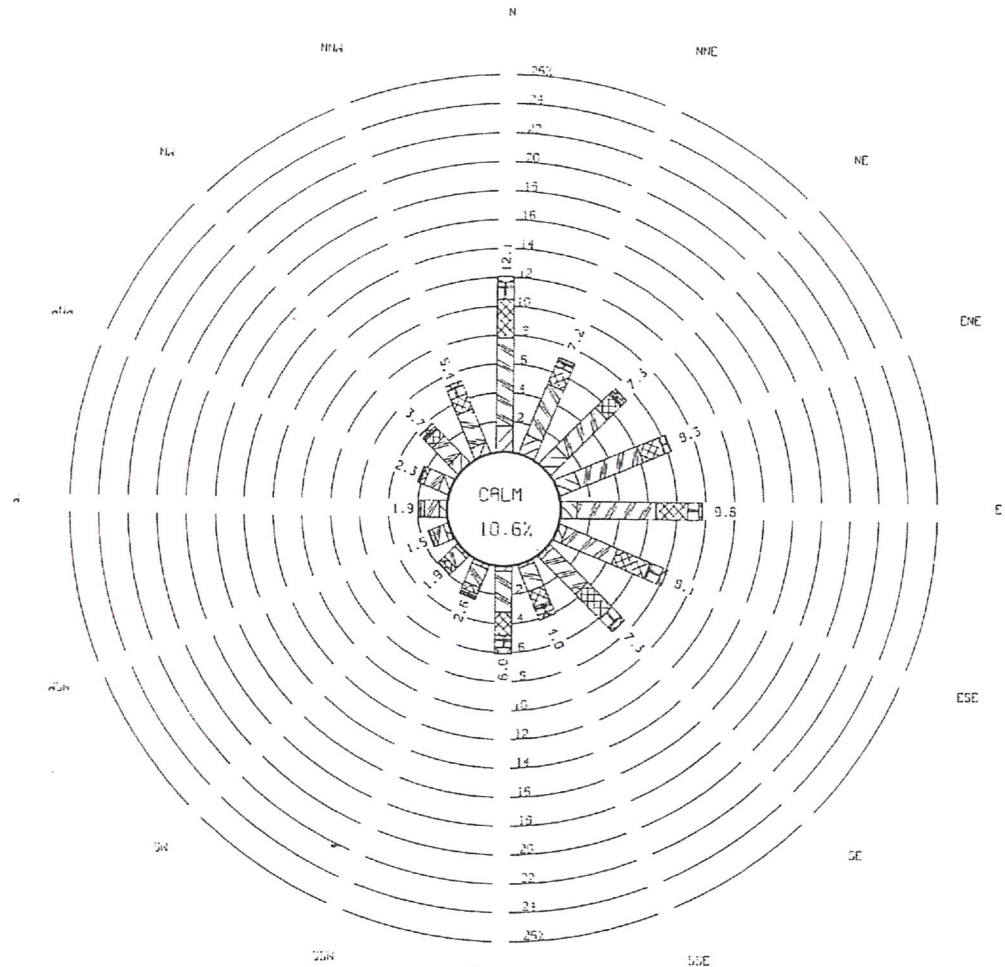
3



DATE: SEPTEMBER 2023 | JOB NO: 6022-0001 | SCALE: AS SHOWN

1	FIRST REVISION	-	DRAWN BY:	MLH
2	SECOND REVISION	-	CHECKED BY:	PMS
3	THIRD REVISION	-	APPROVED BY:	PMS

HOUSTON INTERCONTINENTAL AP
STATION = 12960



- LEGEND
- 1 KT - 3 KTS
 - 4 KTS - 7 KTS
 - 8 KTS - 10 KTS
 - 11 KTS - 13 KTS
 - 14 KTS - 18 KTS
 - ABOVE 18 KTS

PERIOD OF REPORT
YEAR(S) ANALYZED: 1971 -- 1980
MONTHS: SEPT -- NOV
HOURS OF DAY: 0000 -- 2300

REFERENCE: TEXAS DEPARTMENT OF TEXAS,
CLIMATIC ATLAS OF TEXAS, DECEMBER 2019



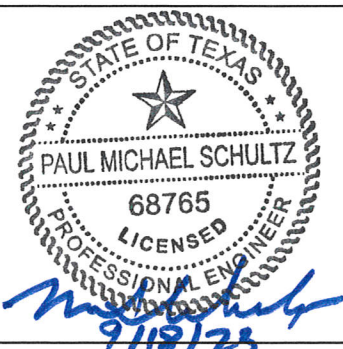
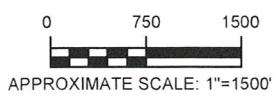
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HOUSTON, TX 77043

Texas Registered Engineering Firm F-005009
Texas Registered Geoscience Firm 50011

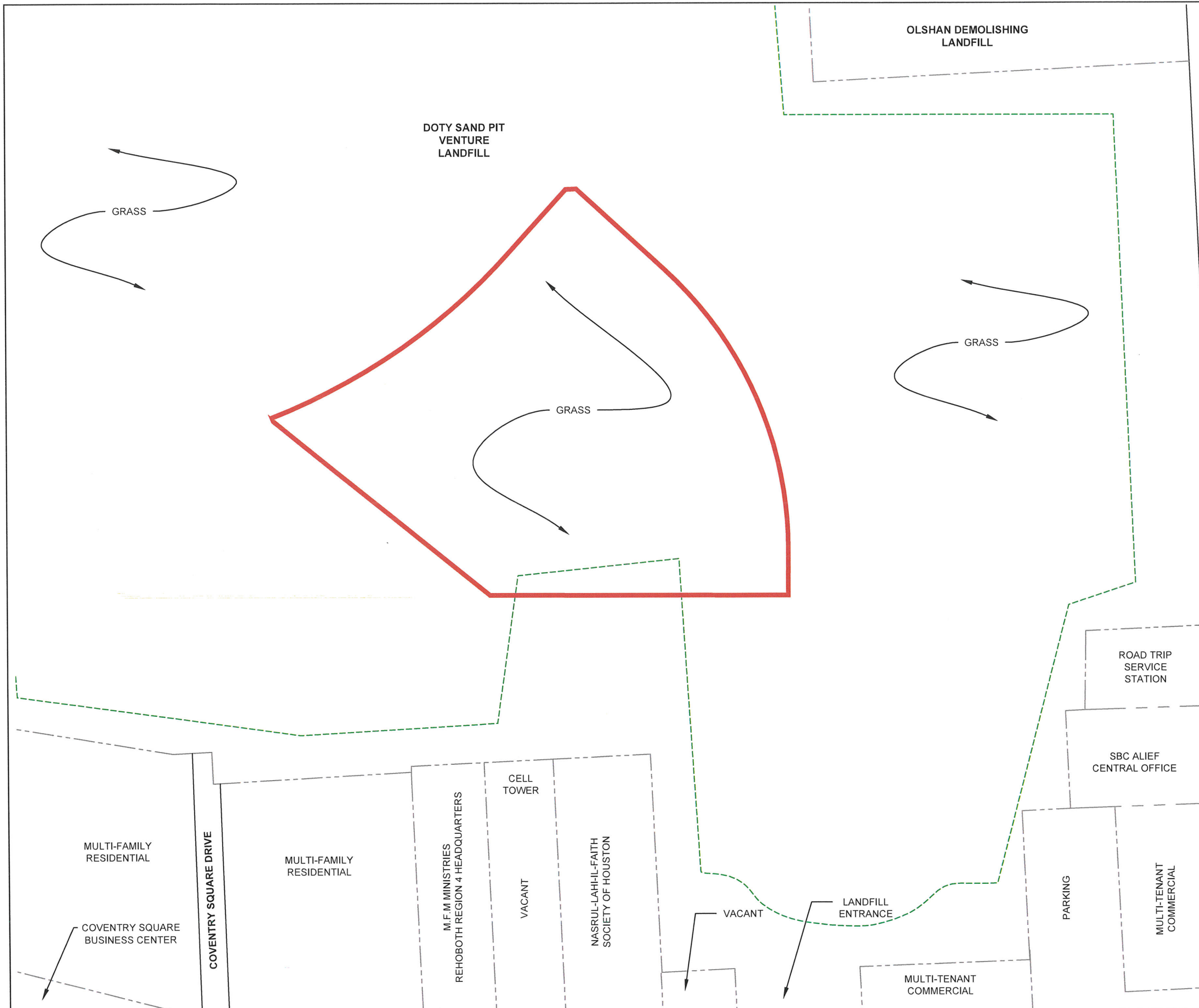
PREVAILING WIND DIRECTION

DEVELOPMENT PERMIT FOR PROPOSED
ENCLOSED STRUCTURES
KIRKWOOD CROSSING APARTMENTS
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

FIGURE
4



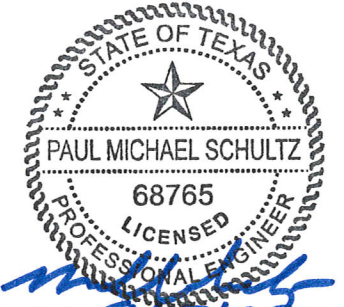
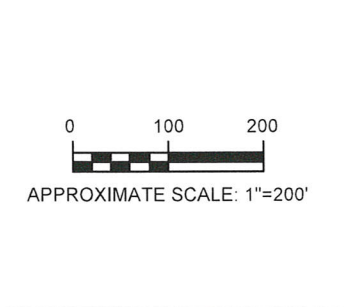
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LEGEND

	SUBJECT PROPERTY BOUNDARY
	LOT BOUNDARY
	APPROXIMATE LANDFILL WASTE BOUNDARY

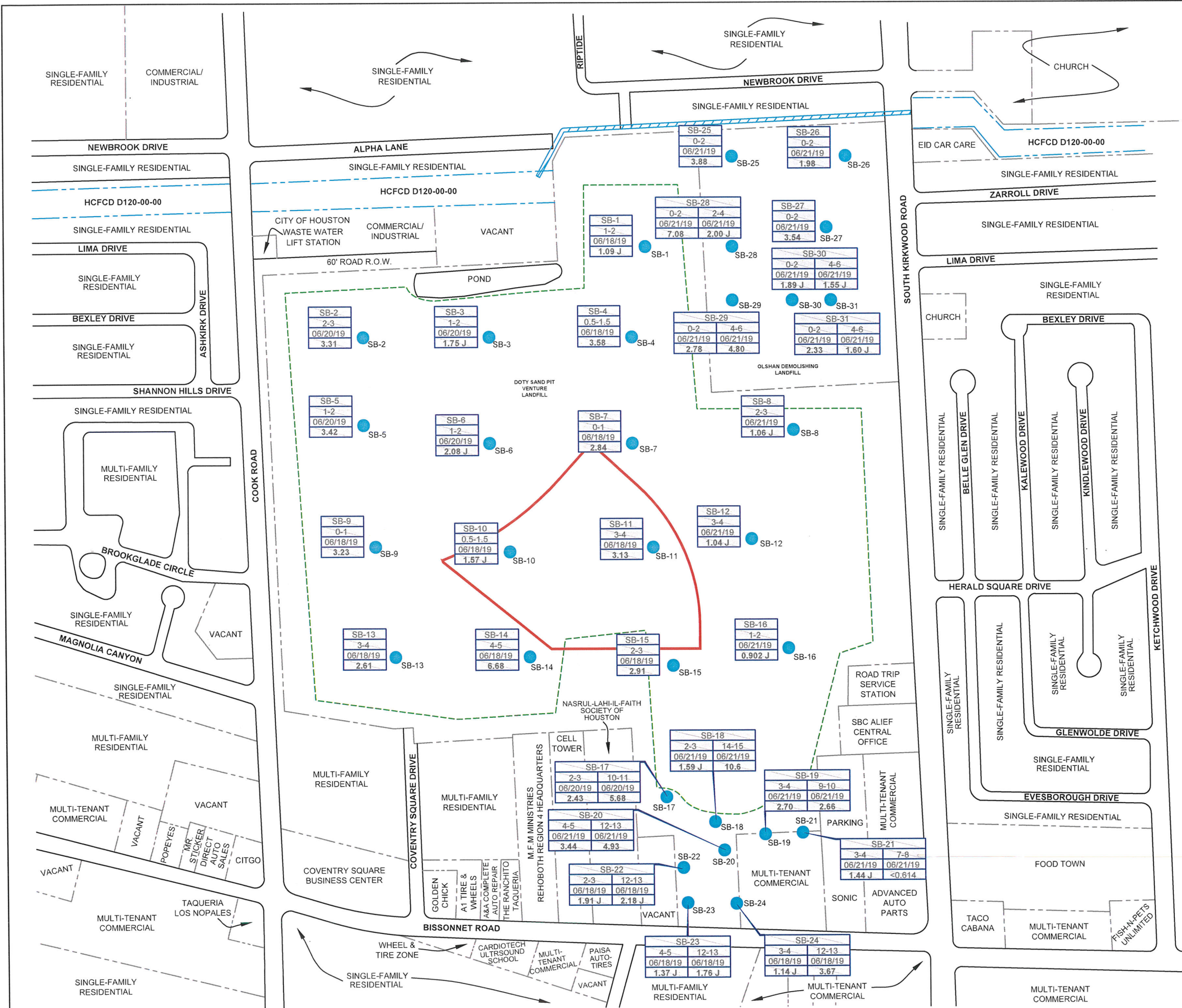
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SITE PLAN		
DEVELOPMENT PERMIT FOR PROPOSED ENCLOSED STRUCTURES KIRKWOOD CROSSING APARTMENTS 12000 BISSONNET STREET HOUSTON, HARRIS COUNTY, TEXAS 77099		
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FIGURE
5



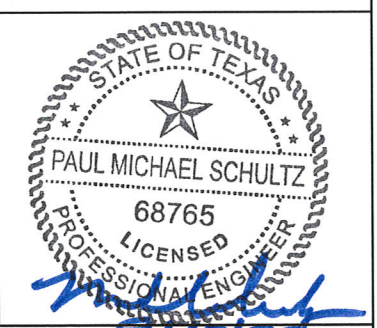
LEGEND

- SUBJECT PROPERTY BOUNDARY
- LOT BOUNDARY
- APPROXIMATE LANDFILL WASTE BOUNDARY
- SOIL BORING LOCATION (SKA, 2019)
- HCFC DRAINAGE DITCH
- HCFC UNDERGROUND BOX CULVERT

SAMPLE NAME	DEPTH	DATE	ARSENIC
SB-1	1-2	06/18/19	1.09 J
SB-2	2-3	06/20/19	3.31
SB-3	1-2	06/20/19	1.75 J
SB-4	0.5-1.5	06/18/19	3.58
SB-5	1-2	06/20/19	3.42
SB-6	1-2	06/20/19	2.08 J
SB-7	0-1	06/18/19	2.84
SB-8	2-3	06/21/19	1.06 J
SB-9	0-1	06/18/19	3.23
SB-10	0.5-1.5	06/18/19	1.57 J
SB-11	3-4	06/18/19	3.13
SB-12	3-4	06/21/19	1.04 J
SB-13	3-4	06/18/19	2.61
SB-14	4-5	06/18/19	6.68
SB-15	2-3	06/18/19	2.91
SB-16	1-2	06/21/19	0.902 J
SB-17	2-3	06/21/19	1.59 J
SB-18	2-3	06/21/19	1.59 J
SB-19	3-4	06/21/19	2.70
SB-20	4-5	06/21/19	3.44
SB-21	3-4	06/21/19	1.44 J
SB-22	2-3	06/18/19	1.91 J
SB-23	4-5	06/18/19	1.37 J
SB-24	3-4	06/18/19	1.14 J
SB-25	0-2	06/21/19	3.88
SB-26	0-2	06/21/19	1.98
SB-27	0-2	06/21/19	3.54
SB-28	0-2	06/21/19	7.08
SB-29	0-2	06/21/19	2.78
SB-30	0-2	06/21/19	1.89 J
SB-31	0-2	06/21/19	1.55 J
SB-31	4-6	06/21/19	1.60 J

NOTES:

- "*" INDICATES NOT ANALYZED.
- "-" REPRESENTS NOT APPLICABLE OR ESTABLISHED.
- "FT-BGS" REPRESENTS FEET BELOW GROUND SURFACE.
- "MG/KG" REPRESENTS MILLIGRAMS PER KILOGRAM.
- "PCL" REPRESENTS PROTECTIVE CONCENTRATION LIMIT.
- "TCEQ" REPRESENTS TEXAS COMMISSION ON ENVIRONMENTAL QUALITY.
- "TRRP" REPRESENTS TEXAS RISK REDUCTION PROGRAM.
- "MSW" REPRESENTS MUNICIPAL SOLID WASTE.
- "<" INDICATES THE ANALYTE WAS NOT IDENTIFIED AT OR ABOVE THE SPECIFIED LABORATORY SAMPLE DETECTION LIMIT (SDL).
- **BOLD** VALUES EXHIBIT A CONCENTRATION AT OR ABOVE THE LABORATORY SDL.
- "J" INDICATES THE TARGET ANALYTE WAS POSITIVELY IDENTIFIED ABOVE THE LABORATORY SDL BUT BELOW THE METHOD QUANTITATION LIMIT (MQL).
- TCEQ TRRP TIER 1 RESIDENTIAL SOIL PCLS (30 TEXAS ADMINISTRATIVE CODE (TAC) 350, TABLE 1: TIER 1 RESIDENTIAL SOIL PCLS, DATED MARCH 1, 2022).
- "SB" REPRESENTS BOREHOLE.
- "HCFC" REPRESENTS HARRIS COUNTY FLOOD CONTROL DISTRICT.
- "MSW" REPRESENTS MUNICIPAL SOLID WASTE.
- "R.O.W." REPRESENTS RIGHT OF WAY.
- "SB" REPRESENTS SOIL BORING.
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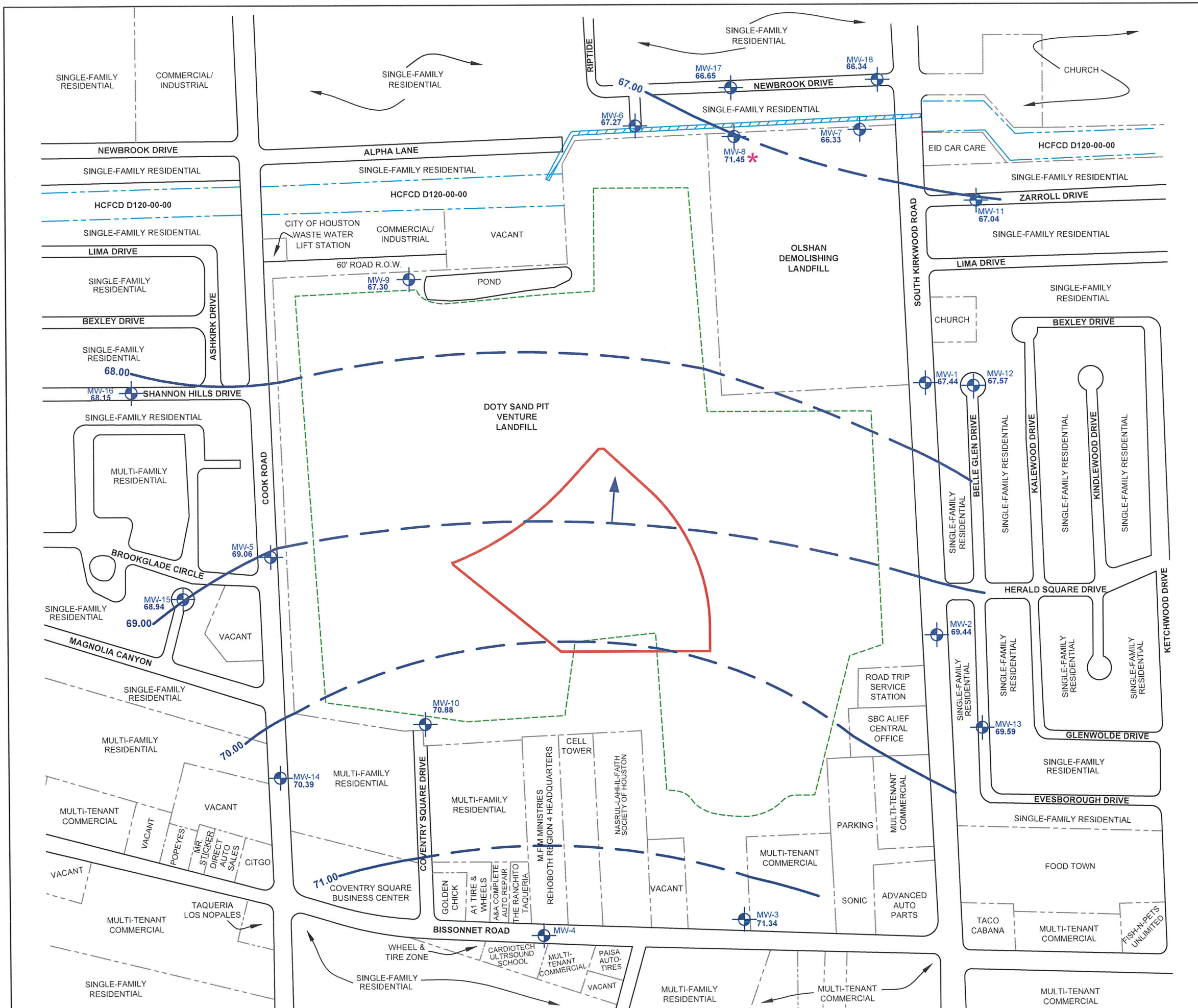
SURFACE SOIL CONCENTRATION MAP

FIGURE 6

DEVELOPMENT PERMIT FOR PROPOSED ENCLOSED STRUCTURES
 KIRKWOOD CROSSING APARTMENTS
 12000 BISSONNET STREET
 HOUSTON, HARRIS COUNTY, TEXAS 77099

DATE: SEPTEMBER 2023 | JOB NO: 6022-0001 | SCALE: AS SHOWN

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3	THIRD REVISION	-	APPROVED BY:	PMS

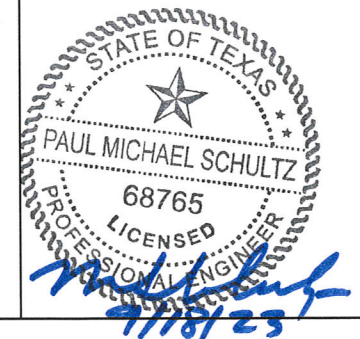
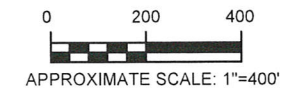


LEGEND

- SUBJECT PROPERTY BOUNDARY
- - - LOT BOUNDARY
- - - APPROXIMATE LANDFILL WASTE BOUNDARY
- ⊕ GROUNDWATER MONITORING WELL
- ~ GROUNDWATER CONTOUR (FEET MSL)
- ← GROUNDWATER FLOW DIRECTION
- 67.67 GROUNDWATER ELEVATION (FEET MSL)
- * ANOMALY
- HCFC D STORMWATER CHANNEL
- ▨ HCFC D BOX CULVER

NOTES:

- "HCFC D" REPRESENTS HARRIS COUNTY FLOOD CONTROL DISTRICT.
- GROUNDWATER ELEVATIONS WITHIN THE LANDFILL ARE INFERRED FROM SURROUNDING WELLS.
- "R.O.W." REPRESENTS RIGHT OF WAY.
- "MSL" REPRESENTS MEAN SEA LEVEL.
- "MSW" REPRESENTS MUNICIPAL SOLID WASTE.
- THE ORIGINAL VERSION OF THIS DRAWING IS IN COLOR. BLACK AND WHITE COPIES MAY NOT ACCURATELY DEPICT CERTAIN INFORMATION.
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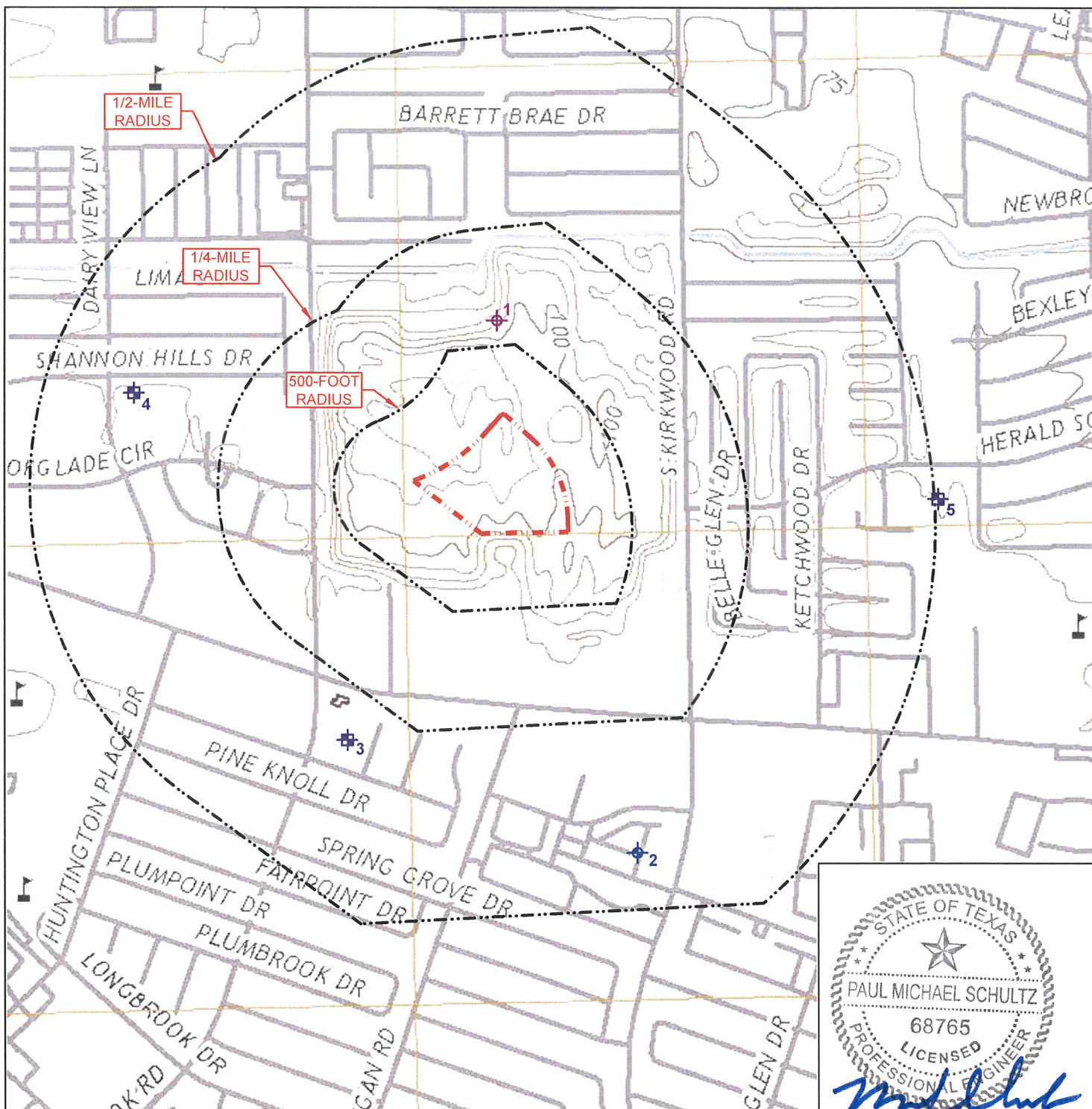
**GROUNDWATER GRADIENT MAP
(OCTOBER 2020)**

DEVELOPMENT PERMIT FOR PROPOSED
 ENCLOSED STRUCTURES
 KIRKWOOD CROSSING APARTMENTS
 12000 BISSONNET STREET
 HOUSTON, HARRIS COUNTY, TEXAS 77099

DATE: SEPTEMBER 2023	JOB NO: 6022-0001	SCALE: AS SHOWN
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FIGURE
7





LEGEND

- - - - - SUBJECT PROPERTY BOUNDARY
- ◆ PRIVATE DRINKING WATER WELL LOCATION
- PUBLIC SUPPLY WATER WELL LOCATION
- ◆ OTHER WATER WELL LOCATION

REFERENCE: USGS 7.5-MINUTE TOPOGRAPHIC QUADRANGLE ALIEF, TEXAS 2019

NOTES

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APPROXIMATE SCALE: 1"=1,000'



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WATER WELL MAP

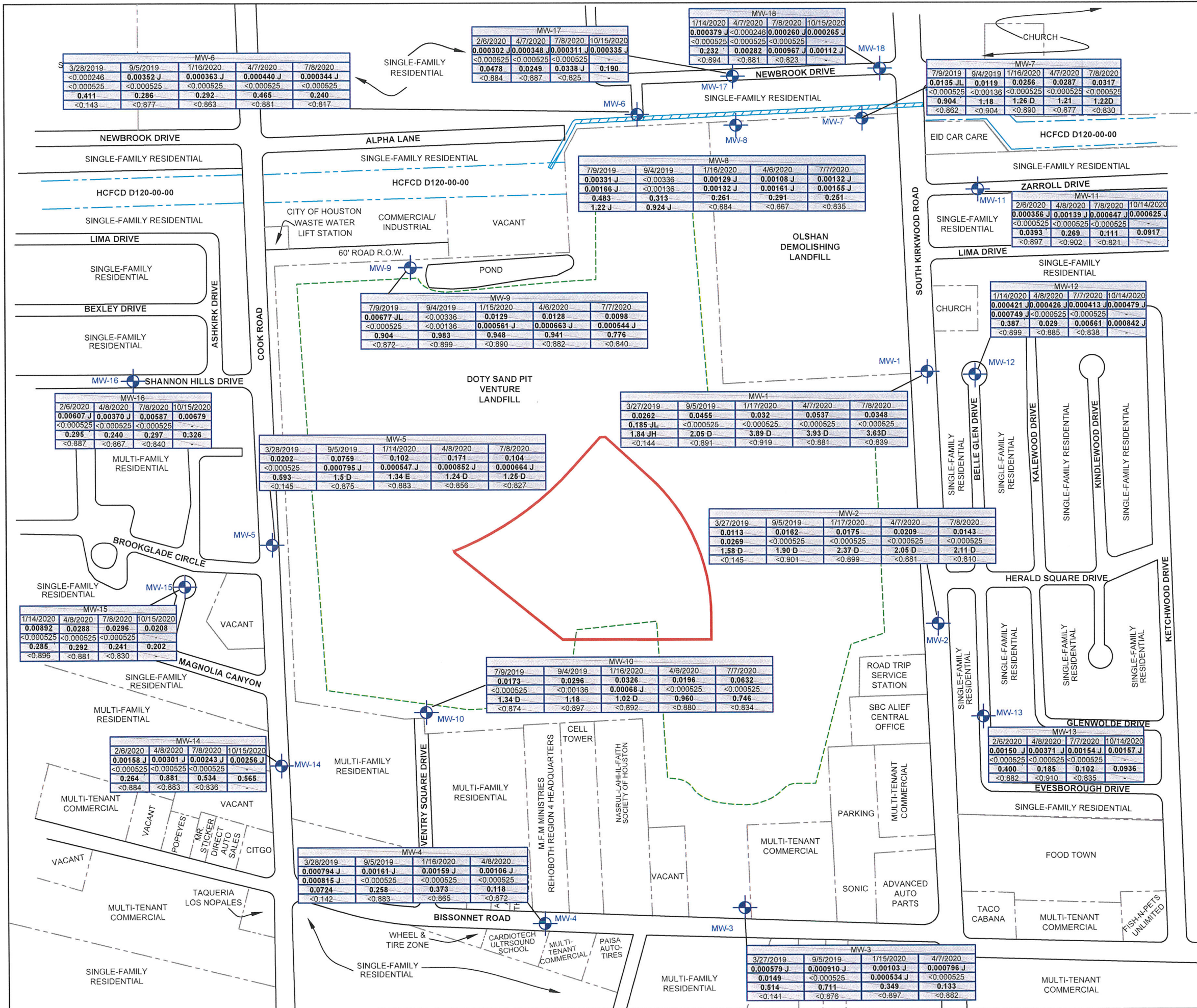
DEVELOPMENT PERMIT FOR PROPOSED
ENCLOSED STRUCTURES
KIRKWOOD CROSSING APARTMENTS
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

FIGURE

8



DATE: SEPTEMBER 2023	JOB NO: 6022-0001	SCALE: AS SHOWN
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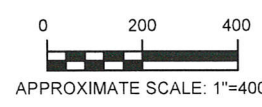
LEGEND

- SUBJECT PROPERTY BOUNDARY
- LOT BOUNDARY
- APPROXIMATE LANDFILL WASTE BOUNDARY
- GROUNDWATER MONITORING WELL
- HCFC DRAINAGE DITCH
- HCFC UNDERGROUND BOX CULVERT
- GROUNDWATER CONCENTRATIONS (mg/L)

SAMPLE NAME	DATE	ARSENIC	CHROMIUM	MANGANESE	TPH (C6-C12)
-------------	------	---------	----------	-----------	--------------

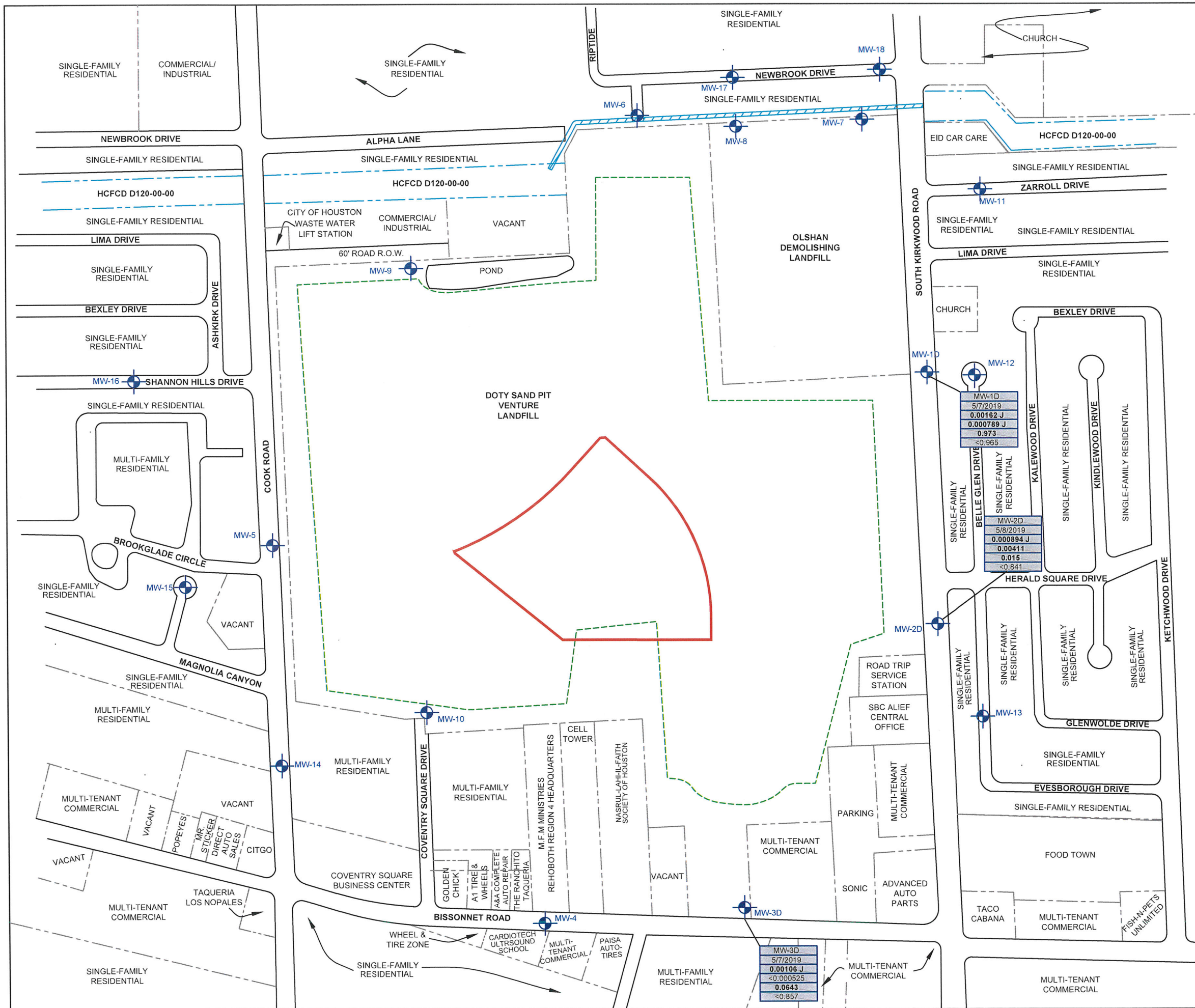
NOTES:

- "HCFC" REPRESENTS HARRIS COUNTY FLOOD CONTROL DISTRICT.
- "mg/L" REPRESENTS MILLIGRAMS PER LITER.
- "<" INDICATES THE ANALYTE WAS NOT IDENTIFIED AT OR ABOVE THE SPECIFIED LABORATORY SAMPLE DETECTION LIMIT (SDL).
- CONCENTRATIONS HIGHLIGHTED YELLOW EXCEED THE APPLICABLE CRITICAL TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) TEXAS RISK REDUCTION PROGRAM (TRRP) TIER 1 RESIDENTIAL GROUNDWATER PROTECTIVE CONCENTRATION LEVELS (PCLS).
- "J" INDICATES AN ESTIMATED CONCENTRATION LESS THAN THE LABORATORY METHOD QUANTIFICATION LIMIT (MQL).
- "H" INDICATES SAMPLE RESULT LIKELY TO BE BIAS HIGH.
- "L" INDICATES SAMPLE RESULT LIKELY TO BE BIAS LOW.
- "D" INDICATES AN ESTIMATED CONCENTRATION BASED ON A DILUTION THAT EXCEEDED THE HIGHEST POINT OF CALIBRATION.
- "E" INDICATES DATA EXCEEDS THE UPPER CALIBRATION LIMITS THEREFORE, THE CONCENTRATION IS REPORTED AS ESTIMATED.
- "R.O.W." REPRESENTS RIGHT OF WAY.
- "MSW" REPRESENTS MUNICIPAL SOLID WASTE.
- "TPH" REPRESENTS TOTAL PETROLEUM HYDROCARBONS.
- TCEQ TRRP TIER 1 RESIDENTIAL SOIL PCLS (30 TEXAS ADMINISTRATIVE CODE (TAC) 350, TABLE 1: TIER 1 RESIDENTIAL SOIL PCLS, DATED MARCH 1, 2022).
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FIRST GROUNDWATER-BEARING UNIT CONCENTRATION MAP		FIGURE 9
DEVELOPMENT PERMIT FOR PROPOSED ENCLOSED STRUCTURES KIRKWOOD CROSSING APARTMENTS 12000 BISSONNET STREET HOUSTON, HARRIS COUNTY, TEXAS 77099		
DATE: SEPTEMBER 2023	JOB NO: 6022-0001	SCALE: AS SHOWN
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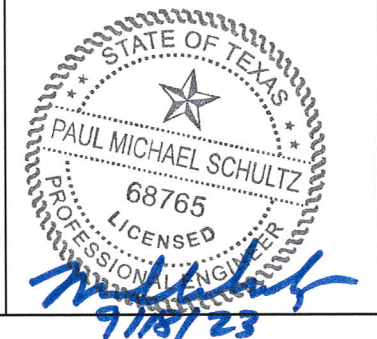
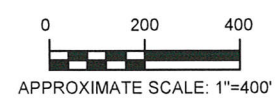
LEGEND

- SUBJECT PROPERTY BOUNDARY
- - - LOT BOUNDARY
- - - - APPROXIMATE LANDFILL WASTE BOUNDARY
- ⊕ GROUNDWATER MONITORING WELL
- HCFC DRAINAGE DITCH
- ▨ HCFC UNDERGROUND BOX CULVERT

SAMPLE NAME	DATE	ARSENIC	CHROMIUM	MANGANESE	TPH (C6-C12)
MW-1D	5/7/2019	0.00162 J	0.000789 J	0.973	<0.965
MW-2D	5/8/2019	0.000894 J	0.00411	0.015	<0.841
MW-3D	5/7/2019	0.00106 J	<0.000525	0.0643	<0.857

NOTES:

- "HCFC D" REPRESENTS HARRIS COUNTY FLOOD CONTROL DISTRICT.
- "mg/L" REPRESENTS MILLIGRAMS PER LITER.
- "<" INDICATES THE ANALYTE WAS NOT IDENTIFIED AT OR ABOVE THE SPECIFIED LABORATORY SAMPLE DETECTION LIMIT (SDL).
- CONCENTRATIONS HIGHLIGHTED YELLOW EXCEED THE APPLICABLE CRITICAL TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) TEXAS RISK REDUCTION PROGRAM (TRRP) TIER 1 RESIDENTIAL GROUNDWATER PROTECTIVE CONCENTRATION LEVELS (PCLS).
- "J" INDICATES AN ESTIMATED CONCENTRATION LESS THAN THE LABORATORY METHOD QUANTIFICATION LIMIT (MQL).
- "H" INDICATES SAMPLE RESULT LIKELY TO BE BIAS HIGH.
- "L" INDICATES SAMPLE RESULT LIKELY TO BE BIAS LOW.
- "D" INDICATES AN ESTIMATED CONCENTRATION BASED ON A DILUTION THAT EXCEEDED THE HIGHEST POINT OF CALIBRATION.
- "E" INDICATES DATA EXCEEDS THE UPPER CALIBRATION LIMITS THEREFORE, THE CONCENTRATION IS REPORTED AS ESTIMATED.
- "R.O.W." REPRESENTS RIGHT OF WAY.
- "MSW" REPRESENTS MUNICIPAL SOLID WASTE.
- "TPH" REPRESENTS TOTAL PETROLEUM HYDROCARBONS.
- TCEQ TRRP TIER 1 RESIDENTIAL SOIL PCLS (30 TEXAS ADMINISTRATIVE CODE (TAC) 350, TABLE 1: TIER 1 RESIDENTIAL SOIL PCLS, DATED MARCH 1, 2022).
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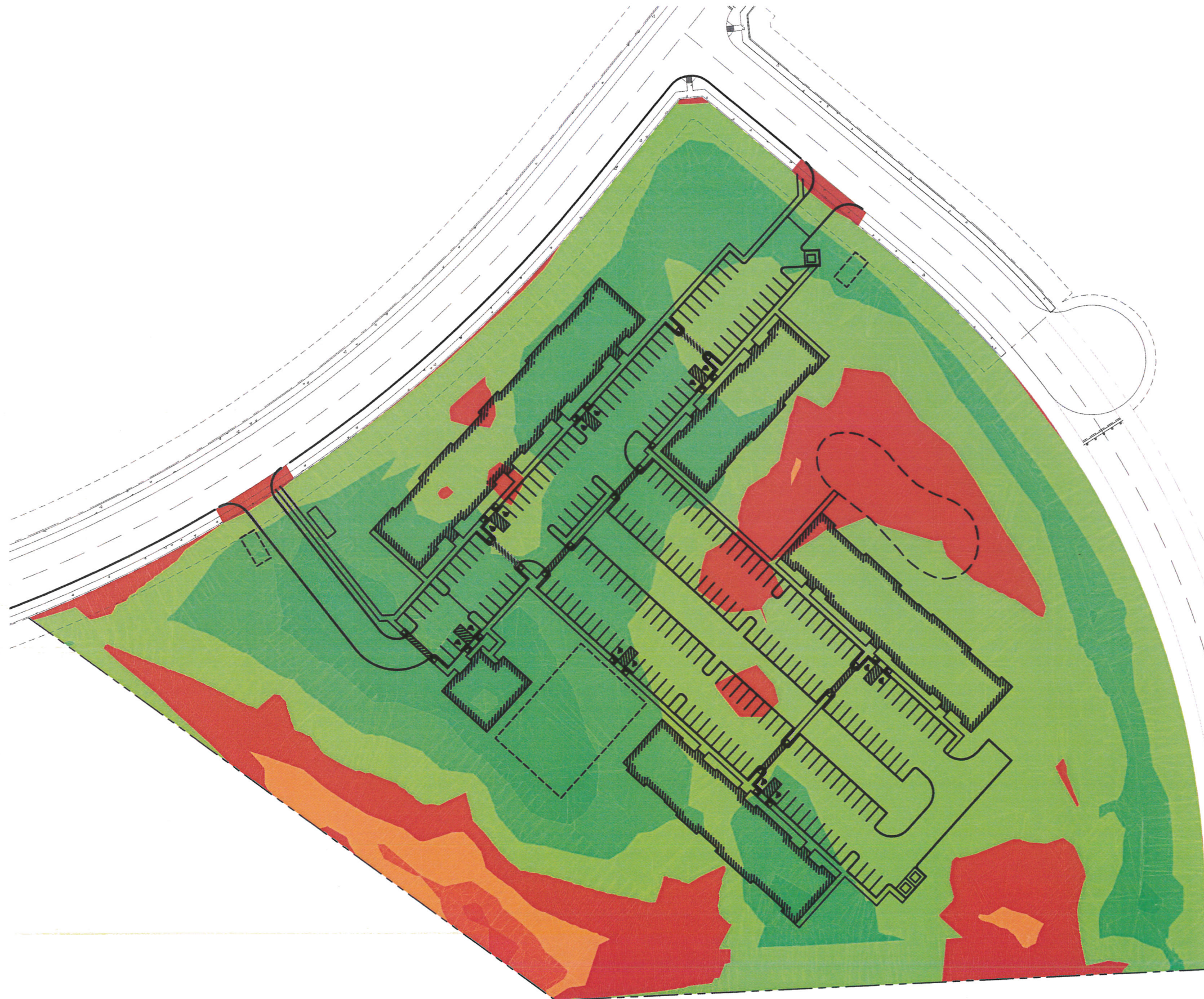


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SECOND GROUNDWATER-BEARING UNIT CONCENTRATION MAP FIGURE 10

DEVELOPMENT PERMIT FOR PROPOSED ENCLOSED STRUCTURES
 KIRKWOOD CROSSING APARTMENTS
 12000 BISSONNET STREET
 HOUSTON, HARRIS COUNTY, TEXAS 77099

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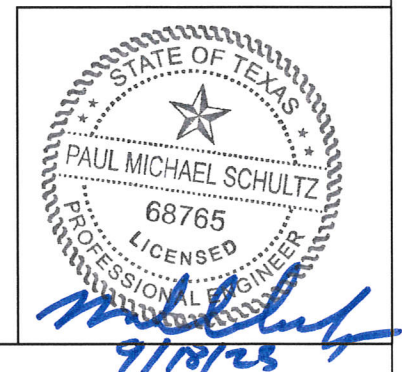
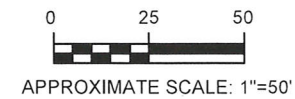


LEGEND	
---	PROPERTY LINE
- - - -	EASEMENT
—+—+—+—	ROAD CENTERLINE

Cut/Fill Values				
Number	Minimum Elevation	Maximum Elevation	Volume (CY)	Color
1	-17.00	-15.00	19.45	Red
2	-15.00	-10.00	532.70	Red
3	-10.00	-5.00	2153.81	Orange
4	-5.00	0.00	8513.62	Red
5	0.00	5.00	55862.44	Light Green
6	5.00	10.00	18223.37	Green
7	10.00	15.00	1522.97	Dark Green

TOTAL	VOLUME (CY)
CUT (RED)	12,343
FILL (GREEN)	83,180

NOTES:
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CUT-AND-FILL BALANCE

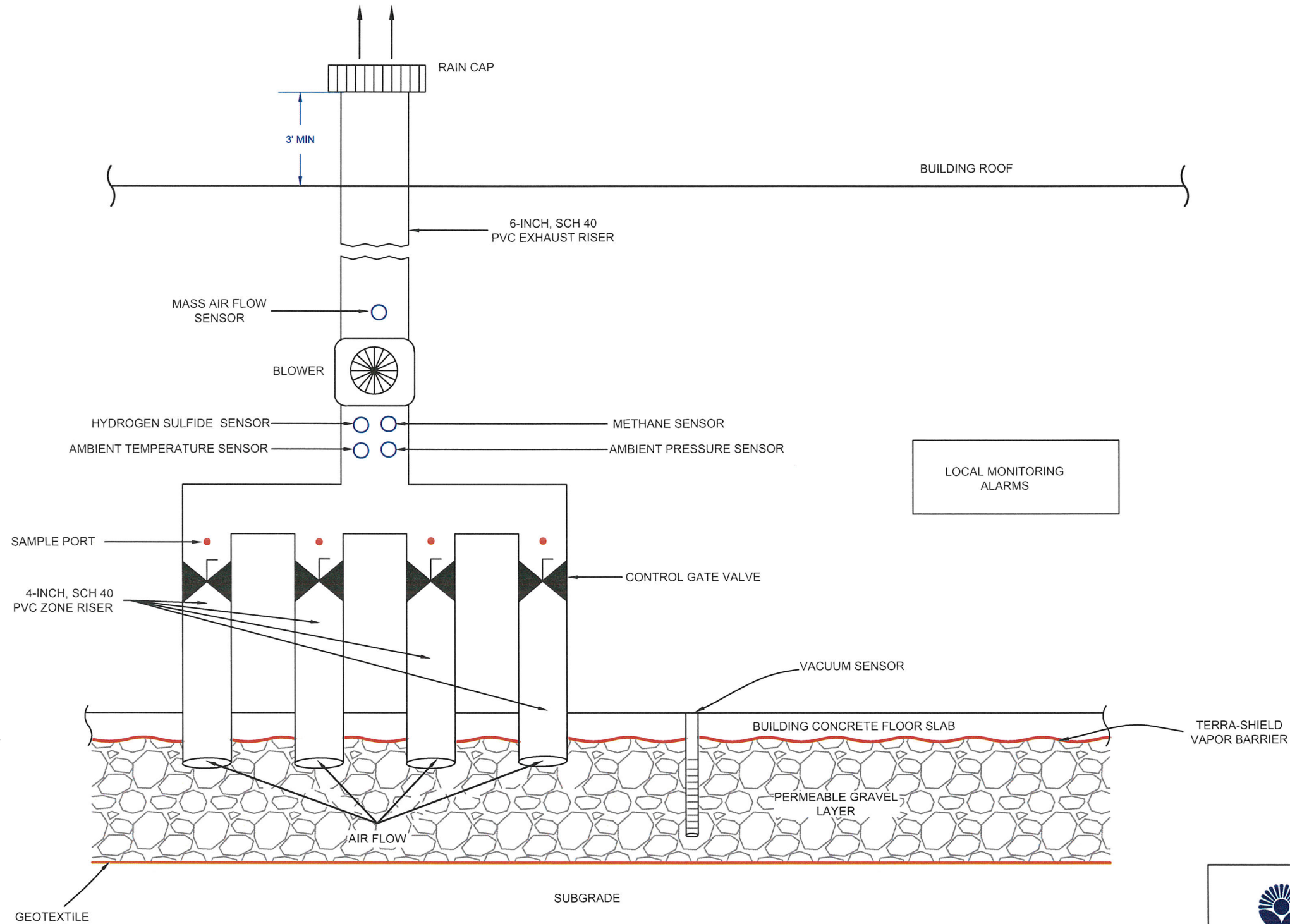
DEVELOPMENT PERMIT FOR PROPOSED
 ENCLOSED STRUCTURES
 KIRKWOOD CROSSING APARTMENTS
 12000 BISSONNET STREET
 HOUSTON, HARRIS COUNTY, TEXAS 77099

DATE: SEPTEMBER 2023 | JOB NO: 6022-0001 | SCALE: AS SHOWN

1	FIRST REVISION	-	DRAWN BY:	MLH
2	SECOND REVISION	-	CHECKED BY:	PMS
3	THIRD REVISION	-	APPROVED BY:	PMS

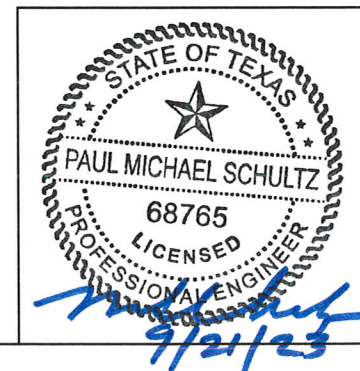
FIGURE
11





NOTES:

1. THE LANDFILL GAS COLLECTION INSTRUMENTATION AND CONTROL SYSTEM WILL BE INSTALLED IN A STORAGE CLOSET IN EACH BUILDING AS SHOWN IN APPENDIX C.
2. A LOCAL MONITORING ALARM SHALL BE IN EACH APARTMENT.



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**SUB SLAB LANDFILL GAS COLLECTION SYSTEM
 INSTRUMENTATION AND CONTROL SCHEMATIC**

FIGURE
12

DEVELOPMENT PERMIT FOR PROPOSED
 ENCLOSED STRUCTURES
 KIRKWOOD CROSSING APARTMENTS
 12000 BISSONNET STREET
 HOUSTON, HARRIS COUNTY, TEXAS 77099

DATE: SEPTEMBER 2023	JOB NO: 6022-0001	SCALE: NTS
1 FIRST REVISION	-	DRAWN BY: MH
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TABLES

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS - METALS & pH
DEVELOPMENT PERMIT
KIRKWOOD CROSSING - SUBSURFACE VENTILATION SYSTEM (SSVS)
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

Sample Name	Sample Depth (ft-bgs)	Sample Date	RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) 8 METALS + COPPER, MOLYBDENUM, NICKEL, & ZINC											pH	
			Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver		Zinc
			Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 7471A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg		Method 6020A mg/kg
ON-SITE SOIL BORINGS															
SB-1	1-2	06/18/19	1.09 J	129	<0.139	13.6	5.71	9.07	0.00748 J	<0.388	8.24	<0.594	<0.190	28.4 J	-
SB-2	2-3	06/20/19	3.31	94.2	<0.135	14.5	4.71	6.30	0.00495 J	0.454 J	10.4	<0.580	<0.186 UJL	37.6	-
SB-3	1-2	06/20/19	1.75 J	130	<0.134	12.0	6.25	8.49	0.00942 J	<0.374	8.77	<0.573	<0.183 UJL	33	-
SB-4	0.5-1.5	06/18/19	3.58	159	<0.132	19.0	6.55	12.2	0.00510 J	<0.368	12.9	<0.563	<0.180	33.5 J	7.45
SB-5	1-2	06/20/19	3.42	135	0.152 J	10.2	4.02 J	9.78	0.00820 J	0.482 J	9.56	0.870 J	<0.178 UJL	27.3 J	-
SB-6	1-2	06/20/19	2.08 J	288	0.133 J	15.5	5.37	11.4	0.00496 J	0.424 J	24.8	<0.515	<0.165 UJL	35.5	-
SB-7	0-1	06/18/19	2.84	112	<0.111	11.2	4.90	17.1	0.00609 J	<0.311	8.31	<0.476	<0.152	20.5 J	-
SB-8	2-3	06/21/19	1.06 J	55.4	<0.138	15.9	6.42	9.45	0.00590 J	<0.384	9.59	0.604 J	<0.189	39.5	-
SB-9	0-1	06/18/19	3.23	328	<0.120	17.9	6.16	7.66	<0.00444	0.949 J	15.7	<0.514	<0.165	41.0	-
SB-10	0.5-1.5	06/18/19	1.57 J	90.2	<0.134	9.38	2.92 J	5.81	<0.00389	<0.373	5.77	<0.572	<0.183	14.7 J	-
SB-11	3-4	06/18/19	3.13	43.5	<0.135	7.59	6.28	21.5	0.00584 J	<0.378	6.71	<0.579	<0.185	19.3 J	-
SB-12	3-4	06/21/19	1.04 J	104	<0.142	11.3	6.04	11.8	0.0132 J	<0.397	8.04	0.708 J	<0.195	58.7	-
SB-13	3-4	06/18/19	2.61	205	<0.128	15.7	6.30	9.56	<0.00463	0.424 J	16.7	<0.545	<0.175	33.7	7.85
SB-14	4-5	06/18/19	6.68	167	<0.144	21.6	8.17	10.0	0.0106 J	0.642 J	17.1	<0.614	<0.197	38.9	-
SB-15	2-3	06/18/19	2.91	163	<0.130	15.6	6.32	12.5	0.00827 J	<0.363	9.57	<0.555	<0.178	28.3 J	-
SB-16	1-2	06/21/19	0.902 J	161	<0.136	13.7	6.32	10.0	0.00619 J	<0.379	8.80	0.588 J	<0.186	44.3	-
SB-17	2-3	06/20/19	2.43	111	<0.112	7.07	6.28	15.9	0.00930 J	0.314 J	7.52	<0.480	<0.154	74.6	-
	10-11	06/20/19	5.68	120	<0.120	13.6	6.06	9.08	0.00719 J	<0.335	13.2	<0.513	<0.164	28.1 J	-
SB-18	2-3	06/21/19	1.59 J	73.6	<0.130	9.39	6.85	6.36	0.00725 J	<0.362	8.53	<0.554	<0.178	26.3 J	-
	14-15	06/21/19	10.6	217	<0.118	11.1	15.9	25.8	<0.00428	0.566 J	28.5	1.36 J	<0.162	23.9 J	-
SB-19	3-4	06/21/19	2.70	73.9	<0.114	11.0	4.24	7.65	0.00716 J	0.870 J	5.45	0.620 J	<0.157	21.0 J	8.97
	9-10	06/21/19	2.66	117	<0.130	11.4	7.15	7.11	<0.00441	<0.364	19.4	<0.558	<0.179	27.8 J	-
SB-20	4-5	06/21/19	3.44	140	<0.112	10.1	4.80	11.5	0.00541 J	<0.313	10.1	0.484 J	<0.154	26.1 J	-
	12-13	06/21/19	4.93	140	<0.136	18.1	8.16	14.0	<0.00396	<0.379	12.9	0.787 J	<0.186	43.3	-
SB-21	3-4	06/21/19	1.44 J	100	<0.125	6.75	5.54	10.0	0.0144 J	<0.349	5.41	<0.534	<0.171	25.4 J	-
	7-8	06/21/19	<0.614	24.0	<0.115	3.66 J	1.54 J	4.13	0.00422 J	<0.322	3.29	<0.493	<0.158	17.5 J	-
SB-22	2-3	06/18/19	1.91 J	105 JL	<0.115	11.4	5.71	7.68	0.0137 J	<0.320	6.67	<0.490	<0.157 UJL	23.8 JH	-
	12-13	06/18/19	2.18 J	140	<0.128	9.01	5.17	4.39	0.00450 J	<0.358	9.83	<0.548	<0.175	19.5 J	-
SB-23	4-5	06/18/19	1.37 J	112	<0.131	9.82	5.17	6.70	0.0166 J	<0.366	10.2	<0.560	<0.179	21.4 J	-
	12-13	06/18/19	1.76 J	71.0	<0.119	9.76	3.21 J	3.08	<0.00448	<0.333	8.26	<0.510	<0.163	21.0 J	8.65
SB-24	3-4	06/18/19	1.14 J	67.6	<0.116	7.22	5.61	8.43	0.0113 J	<0.324	4.76	<0.496	<0.159	14.3 J	-
	10-11	06/18/19	3.67	46.4	<0.128	9.54	5.46	2.99	<0.00449	<0.358	8.49	<0.548	<0.175	20.0 J	-

**TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS - METALS & pH
DEVELOPMENT PERMIT
KIRKWOOD CROSSING - SUBSURFACE VENTILATION SYSTEM (SSVS)
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099**

Sample Name	Sample Depth (ft-bgs)	Sample Date	RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) 8 METALS + COPPER, MOLYBDENUM, NICKEL, & ZINC											pH	
			Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver		Zinc
			Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 7471A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg	Method 6020A mg/kg		Method 6020A mg/kg
ON-SITE SOIL BORINGS															
OFF-SITE SOIL BORINGS															
SB-25	0-2	06/21/19	3.88	105	<0.130	13.6	10.8	23.9	0.151	0.473 J	9.49	<0.557	<0.179	61.2	-
SB-26	0-2	06/21/19	1.98	92.3	0.181 J	10.9	6.71	73.7	0.0237	<0.315	8.12	<0.482	<0.154	148	-
SB-27	0-2	06/21/19	3.54	110	0.275 J	14.4	18.2	28.4	0.0837	0.499 J	8.28	<0.527	<0.169	186	-
SB-28	0-2	06/21/19	7.08	208	<0.138	23.3	9.26	12.8	0.00508 J	0.608 J	15.8	0.884 J	<0.190	57.2	-
	2-4	06/21/19	2.00 J	136	<0.126	7.35	4.79	8.72	0.0114 J	<0.352	5.84	0.586 J	<0.173	23.7 J	-
SB-29	0-2	06/21/19	2.78	133	<0.135	9.55	6.86	9.64	0.00707 J	<0.378	7.60	<0.580	<0.186	24.8 J	-
	4-6	06/21/19	4.80	158	<0.130	11.2	8.09	13.1	0.00876 J	<0.364	11.3	0.776 J	<0.178	34.9	-
SB-30	0-2	06/21/19	1.89 J	150	<0.115	10.6	6.38	15.4	<0.00416	<0.321	9.46	0.525 J	<0.157	26.3 J	-
	4-6	06/21/19	1.55 J	169	<0.136	10.5	6.71	10.8	0.00835 J	<0.381	9.22	0.586 J	<0.187	34.4 J	-
SB-31	0-2	06/21/19	2.33	150	<0.116	14.1	6.51	8.55	0.00683 J	<0.324	10.5	0.512 J	<0.159	38.0	-
	4-6	06/21/19	1.60 J	145	<0.132	8.51	4.54 J	6.58	0.0175 J	<0.368	7.12	0.647 J	<0.180	24.6 J	-
REGULATORY STANDARDS															
TCEQ TRRP Tier 1 Residential ^{GW} Soil _{Ing} PCLs (30-Acre Source Area)			2.5	220	0.75	1,200	520	1.5	1.0	25	79	1.1	0.24	1,200	--
TCEQ TRRP Tier 2 Residential ^{GW} Soil _{Ing} PCLs (30-Acre Source Area)			--	920	--	--	--	270	--	--	--	1.6	--	--	--
TCEQ TRRP Tier 1 with MSD Residential ^{Tot} Soil _{Comb} PCLs (30-Acre Source Area)			24	8,100	51	27,000	1,300	500	5.5	160	840	310	97	9,900	--
Texas-Specific Background Concentrations (30 TAC §350.51(m))			5.9	300	--	30	15	15	0.04	--	10	0.3	--	30	--

Notes:

"-" indicates not analyzed.

"--" represents not applicable or not established.

"ft-bgs" represents feet below ground surface.

"mg/kg" represents milligrams per kilogram.

"TCEQ" represents Texas Commission on Environmental Quality.

"TRRP" represents Texas Risk Reduction Program.

"MSW" represents Municipal Solid Waste.

"MSD" represents Municipal Setting Designation

"<" indicates the analyte was not identified at or above the specified laboratory Sample Detection Limit (SDL).

Bold values exhibit a concentration at or above the laboratory SDL.

"J" indicates the target analyte was positively identified above the laboratory SDL but below the Method Quantitation Limit (MQL).

Concentrations highlighted yellow exceed the applicable Residential Assessment Level (RAL).

TCEQ TRPP Tier 1 Residential Soil Protective Concentration Levels (PCLs) (30 Texas Administrative Code [TAC] 350, Table 1: Tier 1 Residential Soil PCLs, dated January 6, 2021).

TCEQ TRRP Tier 2 Residential Soil PCLs were calculated using site-specific soil data and the equation provided in 30 TAC 350.75(b)(1).

TABLE 1 (CONTINUED)
SUMMARY OF SOIL ANALYTICAL RESULTS - VOCs & TPH
KIRKWOOD CROSSING - SUBSURFACE VENTILATION SYSTEM (SSVS)
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

Sample Name	Sample Depth (ft-bgs)	Sample Date	VOLATILE ORGANIC COMPOUNDS (VOCs)						TOTAL PETROLEUM HYDROCARBONS (TPH)			
			Acetone	Isopropylbenzene (Cumene)	Methylene chloride	Methyl ethyl ketone (2-Butanone)	Naphthalene	Total Xylenes	C6-C12	>C12-C28	>C28-C35	Total TPH (C6-C35)
			Method 8260C mg/kg	Method 8260C mg/kg	Method 8260C mg/kg	Method 8260C mg/kg	Method 8260C mg/kg	Method 8260C mg/kg	TX Method 1005 mg/kg	TX Method 1005 mg/kg	TX Method 1005 mg/kg	TX Method 1005 mg/kg
ON-SITE SOIL BORINGS												
SB-1	1-2	6/18/2019	-	-	-	-	-	-	<22.0	<28.0	<25.9	<22.0
SB-2	2-3	6/20/2019	-	-	-	-	-	-	<20.6	<26.3	<24.3	<20.6
SB-3	1-2	6/20/2019	-	-	-	-	-	-	<21.2	<27.0	<24.9	<21.2
SB-4	0.5-1.5	6/18/2019	-	-	-	-	-	-	<20.2	<25.7	<23.8	<20.2
SB-5	1-2	6/20/2019	-	-	-	-	-	-	<18.0	<22.9	<21.2	<18.0
SB-6	1-2	6/20/2019	-	-	-	-	-	-	<19.0	<24.2	<22.3	<19.0
SB-7	0-1	6/18/2019	-	-	-	-	-	-	<14.9	<18.9	<17.5	<14.9
SB-8	2-3	6/21/2019	-	-	-	-	-	-	<19.9	<25.3	<23.4	<19.9
SB-9	0-1	6/18/2019	-	-	-	-	-	-	<18.1	<23.1	<21.3	<18.1
SB-10	0.5-1.5	6/18/2019	-	-	-	-	-	-	<16.9	<21.6	<19.9	<16.9
SB-11	3-4	6/18/2019	-	-	-	-	-	-	<16.6	<21.2	<19.6	<16.6
SB-12	3-4	6/21/2019	-	-	-	-	-	-	<19.1	<24.3	<22.4	<19.1
SB-13	3-4	6/18/2019	-	-	-	-	-	-	<16.2	<20.7	<19.1	<16.2
SB-14	4-5	6/18/2019	-	-	-	-	-	-	<15.9	<20.3	<18.7	<15.9
SB-15	2-3	6/18/2019	-	-	-	-	-	-	<16.3	<20.8	<19.2	<16.3
SB-16	1-2	6/21/2019	-	-	-	-	-	-	<17.8	<22.7	<22.7	<17.8
SB-17	2-3	6/20/2019	-	-	-	-	-	-	<17.2	<21.9	<20.2	<17.2
	10-11	6/20/2019	-	-	-	-	-	-	<17.5	<22.4	<20.6	<17.5
SB-18	2-3	6/21/2019	-	-	-	-	-	-	<18.8	<24.0	<22.1	<18.8
	14-15	6/21/2019	-	-	-	-	-	-	<17.4	<22.1	<20.4	<17.4
SB-19	3-4	6/21/2019	-	-	-	-	-	-	<15.8	<20.1	<18.6	<15.8
	9-10	6/21/2019	-	-	-	-	-	-	<17.8	<22.6	<20.9	<17.8
SB-20	4-5	6/21/2019	<0.0111	<0.000174	0.0102 J	<0.00365	<0.00200	<0.000437	<18.9	<24.1	<22.2	<18.9
	12-13	6/21/2019	-	-	-	-	-	-	<15.1	<19.2	<17.7	<15.1
SB-21	3-4	6/21/2019	<0.0110	<0.000172	<0.00418	<0.00361	<0.00198	<0.000433	<16.2	<20.6	<19.0	<16.2
	7-8	6/21/2019	-	-	-	-	-	-	<15.8	<20.1	<18.5	<15.8
SB-22	2-3	6/18/2019	<0.0133	<0.000209	<0.00507	<0.00438	<0.00240	0.000541 J	<14.3	<18.2	<16.8	<14.3
	12-13	6/18/2019	-	-	-	-	-	-	<15.6	<19.9	<18.4	<15.6
SB-23	4-5	6/18/2019	-	-	-	-	-	-	<16.2	<20.6	<19.0	<16.2
	12-13	6/18/2019	-	-	-	-	-	-	<16.4	<20.9	<19.3	<16.4
SB-23A	4-5	6/21/2019	<0.0126	<0.000198	0.0135 J	<0.00415	<0.00228	<0.000497	-	-	-	-
SB-24	3-4	6/18/2019	-	-	-	-	-	-	<15.3	<19.4	<17.9	<15.3
	10-11	6/18/2019	-	-	-	-	-	-	<16.0	<20.3	<18.8	<16.0
SB-24A	3-4	6/21/2019	<0.00993	<0.000156	0.00968 J	<0.00327	<0.00179	<0.000391	-	-	-	-
OFF-SITE SOIL BORINGS												
SB-25	0-2	6/21/2019	0.189	0.000213 J	<0.00428	0.00933 J	<0.00203	<0.000443	<17.1	<21.8	<20.1	<17.1
SB-26	0-2	6/21/2019	<0.0107	<0.000167	<0.00405	<0.00350	0.229 J	<0.000420	<16.4	<20.8	<19.2	<16.4
SB-27	0-2	6/21/2019	<0.0134	<0.000210	<0.00509	<0.00440	<0.00241	<0.000527	<19.0	72.5	32.0 J	105
SB-28	0-2	6/21/2019	<0.0113	<0.000178	0.00478 J	<0.00373	<0.00205	<0.000447	<20.6	<26.2	<24.2	<20.6
	2-4	6/21/2019	-	-	-	-	-	-	<19.8	<25.2	<23.3	<19.8
SB-29	0-2	6/21/2019	0.0346 J	<0.000205	0.0120 J	<0.00429	<0.00235	<0.000514	<18.0	<22.9	<21.1	<18.0
	4-6	6/21/2019	-	-	-	-	-	-	<16.7	<21.3	<19.6	<16.7
SB-30	0-2	6/21/2019	0.0187 J	<0.000160	0.00524 J	<0.00335	<0.00184	<0.000401	<14.7	<18.8	<17.3	<14.7
	4-6	6/21/2019	-	-	-	-	-	-	<17.8	<22.7	<21.0	<17.8
SB-31	0-2	6/21/2019	<0.0102	<0.000161	<0.00389	<0.00337	<0.00185	<0.000403	<15.7	<20.0	<18.4	<15.7
	4-6	6/21/2019	-	-	-	-	-	-	<19.9	<25.3	<23.4	<19.9
REGULATORY STANDARDS												
TCEQ TRRP Tier 1 Residential^{GW}Soil_{ing} PCLs (30-Acre Source Area)	21	170	0.0065	15	16	61	33	99	99	--	--	--
TCEQ TRRP Tier 1 with MSD Residential^{Tot}Soil_{Comb} PCLs (30-Acre Source Area)	59,000	3,000	1,500	33,000	120	3,700	1,100	2,000	2,000	2,000	--	--

Notes:
 "-" indicates not analyzed.
 "--" represents not applicable or not established.
 "ft-bgs" represents feet below ground surface.
 "mg/kg" represents milligrams per kilogram.
 "TCEQ" represents Texas Commission on Environmental Quality.
 "TRRP" represents Texas Risk Reduction Program.
 "MSW" represents Municipal Solid Waste.
 "MSD" represents Municipal Setting Designation
 "<" indicates the analyte was not identified at or above the specified laboratory Sample Detection Limit (SDL).
 Bold values exhibit a concentration at or above the laboratory SDL.
 "J" indicates the target analyte was positively identified above the laboratory SDL but below the Method Quantitation Limit (MQL).
 Only VOC analytes detected at or above the laboratory SDL in at least one sample are shown on this table.
 Concentrations highlighted yellow exceed the applicable Residential Assessment Level (RAL).
 TCEQ TRRP Tier 1 Residential Soil Protective Concentration Levels (PCLs) (30 Texas Administrative Code [TAC] 350, Table 1: Tier 1 Residential Soil PCLs, dated January 6, 2021).

TABLE 1 (CONTINUED)
SUMMARY OF SOIL ANALYTICAL RESULTS - PAHs
KIRKWOOD CROSSING - SUBSURFACE VENTILATION SYSTEM (SSVS)
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

Sample Name	Sample Depth (ft-bgs)	Sample Date	POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)															
			Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzofuran	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
			Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg	Method 8270D mg/kg
OFF-SITE SOIL BORING																		
SB-27	0-2	6/21/2019	0.450	0.0438	1.26	5.27 D	3.68	5.46 D	2.68	1.87	4.38 D	0.191	9.64 D	0.472	2.76	0.0801 J	3.96	7.19
REGULATORY STANDARDS																		
TCEQ TRRP Tier 1 Residential ^{GW} Soil _{mg} PCLs (30-Acre Source Area)			120	200	3,400	65	3.8	220	23,000	2,200	5,600	17	960	150	630	16	210	560
TCEQ TRRP Tier 1 with MSD Residential ^{Tot} Soil _{Comb} PCLs (30-Acre Source Area)			3,000	3,800	18,000	41	4.1	41	1,800	420	4,100	270	2,300	2,300	42	120	1,700	1,700

Notes:

"ft-bgs" represents feet below ground surface.
"mg/kg" represents milligrams per kilogram.
"TCEQ" represents Texas Commission on Environmental Quality.
"TRRP" represents Texas Risk Reduction Program.
"MSD" represents Municipal Setting Designation
"MSW" represents Municipal Solid Waste.
Bold values exhibit a concentration at or above the laboratory Sample Detection Limit (SDL).
"J" indicates the target analyte was positively identified above the laboratory SDL but below the Method Quantitation Limit (MQL).
Only PAH analytes detected at or above the laboratory SDL in at least one sample are shown on this table.
Concentrations highlighted yellow exceed the applicable Residential Assessment Level (RAL).
TCEQ TRPP Tier 1 Residential Soil Protective Concentration Levels (PCLs) (30 Texas Administrative Code [TAC] 350, Table 1: Tier 1 Residential Soil PCLs, dated January 6, 2021).

TABLE 1 (CONTINUED)
SUMMARY OF SOIL ANALYTICAL RESULTS - PCBs
KIRKWOOD CROSSING - SUBSURFACE VENTILATION SYSTEM (SSVS)
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

Sample Name	Sample Depth (ft-bgs)	Sample Date	POLYCHLORINATED BIPHENYLS (PCBs)						
			PCB-1016	PCB-1221	PCB-1232	PCB-1242	PCB-1248	PCB-1254	PCB-1260
			Method 8082A mg/kg	Method 8082A mg/kg	Method 8082A mg/kg	Method 8082A mg/kg	Method 8082A mg/kg	Method 8082A mg/kg	Method 8082A mg/kg
ON-SITE SOIL BORINGS									
SB-1	1-2	6/18/2019	<0.00203	<0.00174	<0.00108	<0.00174	<0.00153	<0.00142	<0.000981
SB-2	2-3	6/20/2019	<0.00198	<0.00170	<0.00106	<0.00170	<0.00149	<0.00138	<0.000957
SB-3	1-2	6/20/2019	<0.00196	<0.00168	<0.00105	<0.00168	<0.00147	<0.00137	<0.000947
SB-4	0.5-1.5	6/18/2019	<0.00199	<0.00171	<0.00106	<0.00171	<0.00150	<0.00139	<0.000965
SB-5	1-2	6/20/2019	<0.00197	<0.00169	<0.00105	<0.00169	<0.00148	<0.00137	<0.000952
SB-6	1-2	6/20/2019	<0.00199	<0.00171	<0.00106	<0.00171	<0.00150	<0.00139	<0.000962
SB-7	0-1	6/18/2019	<0.00184	<0.00158	<0.000982	<0.00158	<0.00139	<0.00129	<0.000890
SB-8	2-3	6/21/2019	<0.00205	<0.00176	<0.00109	<0.00176	<0.00154	<0.00143	<0.000992
SB-9	0-1	6/18/2019	<0.00192	<0.00165	<0.00102	<0.00165	<0.00145	<0.00134	<0.000929
SB-10	0.5-1.5	6/18/2019	<0.00184	<0.00158	<0.000983	<0.00158	<0.00139	<0.00129	<0.000891
SB-11	3-4	6/18/2019	<0.00194	<0.00166	<0.00104	<0.00166	<0.00146	<0.00135	<0.000938
SB-12	3-4	6/21/2019	<0.00215	<0.00185	<0.00115	<0.00185	<0.00162	<0.00150	<0.00104
SB-13	3-4	6/18/2019	<0.00200	<0.00172	<0.00107	<0.00172	<0.00151	<0.00140	<0.000969
SB-14	4-5	6/18/2019	<0.00202	<0.00173	<0.00108	<0.00173	<0.00152	<0.00141	<0.000975
SB-15	2-3	6/18/2019	<0.00373	<0.00320	<0.00199	<0.00320	<0.00280	<0.00260	<0.00180
SB-16	1-2	6/21/2019	<0.00205	<0.00176	<0.00110	<0.00176	<0.00155	<0.00144	<0.000994
SB-17	2-3	6/20/2019	<0.00186	<0.00159	<0.000992	<0.00159	<0.00140	<0.00130	<0.000899
	10-11	6/20/2019	<0.00198	<0.00170	<0.00106	<0.00170	<0.00149	<0.00138	<0.000958
SB-18	2-3	6/21/2019	<0.00182	<0.00156	<0.000972	<0.00156	<0.00137	<0.00127	<0.000881
	14-15	6/21/2019	<0.00192	<0.00165	<0.00103	<0.00165	<0.00145	<0.00134	<0.000929
SB-19	3-4	6/21/2019	<0.00183	<0.00157	<0.000977	<0.00157	<0.00138	<0.00128	<0.000886
	9-10	6/21/2019	<0.00191	<0.00164	<0.00102	<0.00164	<0.00143	<0.00133	<0.000922
SB-20	4-5	6/21/2019	<0.00186	<0.00159	<0.000991	<0.00159	<0.00140	<0.00130	<0.000898
	12-13	6/21/2019	<0.00194	<0.00167	<0.00104	<0.00167	<0.00146	<0.00136	<0.000940
SB-21	3-4	6/21/2019	<0.00189	<0.00162	<0.00101	<0.00162	<0.00142	<0.00132	<0.000915
	7-8	6/21/2019	<0.00188	<0.00161	<0.00100	<0.00161	<0.00141	<0.00131	<0.000907
SB-22	2-3	6/18/2019	<0.00186	<0.00160	<0.000995	<0.00160	<0.00140	<0.00130	<0.000902
	12-13	6/18/2019	<0.00190	<0.00163	<0.00102	<0.00163	<0.00143	<0.00133	<0.000921
SB-23	4-5	6/18/2019	<0.00192	<0.00164	<0.00102	<0.00164	<0.00144	<0.00134	<0.000927
	12-13	6/18/2019	<0.00194	<0.00166	<0.00103	<0.00166	<0.00146	<0.00135	<0.000937
SB-24	3-4	6/18/2019	<0.00188	<0.00162	<0.00101	<0.00162	<0.00142	<0.00132	<0.000912
	10-11	6/18/2019	<0.00190	<0.00163	<0.00102	<0.00163	<0.00143	<0.00133	<0.000922
OFF-SITE SOIL BORINGS									
SB-25	0-2	6/21/2019	<0.00183	<0.00157	<0.000977	<0.00157	<0.00138	<0.00128	<0.000886
SB-26	0-2	6/21/2019	<0.00186	<0.00160	<0.000993	<0.00160	<0.00140	<0.00130	<0.000900
SB-27	0-2	6/21/2019	<0.00200	<0.00172	<0.00107	<0.00172	<0.00151	<0.00140	0.0724
SB-28	0-2	6/21/2019	<0.00198	<0.00170	<0.00106	<0.00170	<0.00149	<0.00139	<0.000960
	2-4	6/21/2019	<0.00191	<0.00164	<0.00102	<0.00164	<0.00144	<0.00133	<0.000924
SB-29	0-2	6/21/2019	<0.00202	<0.00173	<0.00108	<0.00173	<0.00152	<0.00141	<0.000975
	4-6	6/21/2019	<0.00197	<0.00169	<0.00105	<0.00169	<0.00149	<0.00138	<0.000955
SB-30	0-2	6/21/2019	<0.00184	<0.00158	<0.000981	<0.00158	<0.00138	<0.00128	<0.000889
	4-6	6/21/2019	<0.00203	<0.00174	<0.00108	<0.00174	<0.00153	<0.00142	<0.000980
SB-31	0-2	6/21/2019	<0.00189	<0.00162	<0.00101	<0.00162	<0.00142	<0.00132	<0.000913
	4-6	6/21/2019	<0.00199	<0.00171	<0.00106	<0.00171	<0.00150	<0.00139	<0.000964
REGULATORY STANDARDS									
TCEQ TRRP Tier 1 Residential^{GW}Soil_{mg} PCLs (30-Acre Source Area)			5.3	5.3	5.3	5.3	5.3	5.3	5.3
TCEQ TRRP Tier 1 with MSD Residential^{Tot}Soil_{comb} PCLs (30-Acre Source Area)			1.1	1.1	1.1	1.1	1.1	1.1	1.1

Notes:

"ft-bgs" represents feet below ground surface.

"mg/kg" represents milligrams per kilogram.

"TCEQ" represents Texas Commission on Environmental Quality.

"TRRP" represents Texas Risk Reduction Program.

"MSW" represents Municipal Solid Waste.

Bold values exhibit a concentration at or above the laboratory Sample Detection Limit (SDL).

"J" indicates the target analyte was positively identified above the laboratory SDL but below the Method Quantitation Limit (MQL).

Concentrations highlighted yellow exceed the applicable Residential Assessment Level (RAL).

TCEQ TRRP Tier 1 Residential Soil Protective Concentration Levels (PCLs) (30 Texas Administrative Code [TAC] 350, Table 1: Tier 1 Residential Soil PCLs, dated January 6, 2021).

**TABLE 2
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - METALS
DEVELOPMENT PERMIT
KIRKWOOD CROSSING - SUBSURFACE VENTILATION SYSTEM (SSVS)
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS**

Sample Name	Sample Date	RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) 8 METALS + IRON, MANGANESE, & ZINC										
		Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Zinc
		Method 6020A mg/L	Method 6020A mg/L	Method 6020A mg/L	Method 6020A mg/L	Method 6020A mg/L	Method 6020A mg/L	Method 6020A mg/L	Method 7470A mg/L	Method 6020A mg/L	Method 6020A mg/L	Method 6020A mg/L
FIRST/UPPERMOST GROUNDWATER-BEARING UNIT (GWBU) MONITORING WELLS												
ON-SITE MONITORING WELLS												
MW-3	03/27/19	0.000579 J	0.230	<0.000147	0.0149	0.179	0.000250 J	0.514	<0.0000263	0.000602 J	<0.000251	0.0125 J
	09/05/19	0.000910 J	-	-	<0.000525	-	-	0.711	-	-	-	-
	01/15/20	0.00103 J	-	-	0.000534 J	-	-	0.349	-	-	-	-
	04/07/20	0.000796 J	-	-	<0.000525	-	-	0.133	-	-	-	-
MW-9	07/09/19	0.00677 JL	0.609	<0.000147	<0.000525	11.1	<0.000152	0.904	<0.0000263	<0.000454	<0.000251	0.00343 J
	09/04/19	<0.00336	-	-	<0.00136	-	-	0.983	-	-	-	-
	01/15/20	0.0129	-	-	0.000561 J	-	-	0.948	-	-	-	-
	04/06/20	0.0128	-	-	0.000663 J	-	-	0.941	-	-	-	-
	07/07/20	0.0098	-	-	0.000544 J	-	-	0.776	-	-	-	-
MW-10	07/09/19	0.0173	1.62	<0.000147	<0.000525	16.0	<0.000152	1.34 D	<0.0000263	<0.000454	<0.000251	0.0190 J
	09/04/19	0.0296	-	-	<0.00136	-	-	1.18	-	-	-	-
	01/16/20	0.0326	-	-	0.00068 J	-	-	1.02 D	-	-	-	-
	04/06/20	0.0196	-	-	<0.000525	-	-	0.960	-	-	-	-
07/07/20	0.0632	-	-	<0.000525	-	-	0.746	-	-	-	-	
OFF-SITE MONITORING WELLS												
MW-1	03/27/19	0.0262	0.472	<0.000147	0.185	5.60	0.00236	1.84 D	<0.0000263	0.000491 J	<0.000251	0.154
	09/05/19	0.0455	-	-	<0.000525	-	-	2.05 D	-	-	-	-
	01/17/20	0.0320	-	-	<0.000525	-	-	3.89 D	-	-	-	-
	04/07/20	0.0537	-	-	<0.000525	-	-	3.93 D	-	-	-	-
	07/08/20	0.0348	-	-	<0.000525	-	-	3.63 D	-	-	-	-
MW-2	03/27/19	0.0113	0.151	<0.000147	0.0269	1.14	0.000454 J	1.58 D	<0.0000263	<0.000454	<0.000251	0.0212 J
	09/05/19	0.0162	-	-	<0.000525	-	-	1.90 D	-	-	-	-
	01/17/20	0.0175	-	-	<0.000525	-	-	2.37 D	-	-	-	-
	04/07/20	0.0209	-	-	<0.000525	-	-	2.05 D	-	-	-	-
	07/08/20	0.0143	-	-	<0.000525	-	-	2.11 D	-	-	-	-
MW-4	03/28/19	0.000794 J	0.168	<0.000147	0.000815 J	0.0671 J	<0.000152	0.0724	<0.0000263 UJL	0.000959 J	<0.000251	0.00188 J
	09/05/19	0.00161 J	-	-	<0.000525	-	-	0.258	-	-	-	-
	01/16/20	0.00159 J	-	-	<0.000525	-	-	0.373	-	-	-	-
	04/08/20	0.00106 J	-	-	<0.000525	-	-	0.118	-	-	-	-
MW-5	03/28/19	0.0202	0.297	<0.000147	<0.000525	5.14	0.000204 J	0.593	<0.0000263 UJL	<0.000454	<0.000251	0.0178 J
	09/05/19	0.0759	-	-	0.000795 J	-	-	1.50 D	-	-	-	-
	01/14/20	0.102	-	-	0.000547 J	-	-	1.34 E	-	-	-	-
	04/08/20	0.171	-	-	0.000852 J	-	-	1.24 D	-	-	-	-
07/08/20	0.104	-	-	0.000664 J	-	-	1.25 D	-	-	-	-	
MW-6	03/28/19	<0.000246	0.142	<0.000147	<0.000525	0.0873 J	<0.000152	0.411	<0.0000263 UJL	0.000931 J	<0.000251	0.00297 J
	09/05/19	0.000352 J	-	-	<0.000525	-	-	0.286	-	-	-	-
	01/16/20	0.000363 J	-	-	<0.000525	-	-	0.292	-	-	-	-
	04/07/20	0.000440 J	-	-	<0.000525	-	-	0.465	-	-	-	-
	07/08/20	0.000344 J	-	-	<0.000525	-	-	0.240	-	-	-	-
MW-7	07/09/19	0.0135 JL	0.411	<0.000147	<0.000525	6.65	0.000173 J	0.904	<0.0000263	<0.000454	<0.000251	0.0351 JH
	09/04/19	0.0119	-	-	<0.00136	-	-	1.18	-	-	-	-
	01/16/20	0.0256	-	-	<0.000525	-	-	1.26 D	-	-	-	-
	04/07/20	0.0287	-	-	<0.000525	-	-	1.21	-	-	-	-
	07/08/20	0.0317	-	-	<0.000525	-	-	1.22 D	-	-	-	-
MW-8	07/09/19	0.00331 J	1.25	<0.000147	0.00166 J	31.0	0.00162 J	0.483	<0.0000263	<0.000454	<0.000251	0.0624
	09/04/19	<0.00336	-	-	<0.00136	-	-	0.313	-	-	-	-
	01/16/20	0.00129 J	-	-	0.00132 J	-	-	0.261	-	-	-	-
	04/06/20	0.00108 J	-	-	0.00161 J	-	-	0.291	-	-	-	-
	07/07/20	0.00132 J	-	-	0.00155 J	-	-	0.251	-	-	-	-
MW-11	02/06/20	0.000356 J	-	-	<0.000525	-	-	0.0393	-	-	-	-
	04/08/20	0.00139 J	-	-	<0.000525	-	-	0.269	-	-	-	-
	07/08/20	0.000647 J	-	-	<0.000525	-	-	0.111	-	-	-	-
	10/14/20	0.000625 J	-	-	-	-	-	0.0917	-	-	-	-
MW-12	01/14/20	0.000421 J	-	-	0.000749 J	-	-	0.387	-	-	-	-
	04/08/20	0.000426 J	-	-	<0.000525	-	-	0.029	-	-	-	-
	07/07/20	0.000413 J	-	-	<0.000525	-	-	0.00561	-	-	-	-
	10/14/20	0.000479 J	-	-	-	-	-	0.000842 J	-	-	-	-
MW-13	02/06/20	0.00150 J	-	-	<0.000525	-	-	0.400	-	-	-	-
	04/08/20	0.00371 J	-	-	<0.000525	-	-	0.185	-	-	-	-
	07/07/20	0.00154 J	-	-	<0.000525	-	-	0.102	-	-	-	-
	10/14/20	0.00157 J	-	-	-	-	-	0.0936	-	-	-	-
MW-14	02/06/20	0.00158 J	-	-	<0.000525	-	-	0.264	-	-	-	-
	04/08/20	0.00301 J	-	-	<0.000525	-	-	0.881	-	-	-	-
	07/08/20	0.00243 J	-	-	<0.000525	-	-	0.534	-	-	-	-
	10/15/20	0.00256 J	-	-	-	-	-	0.565	-	-	-	-
MW-15	01/14/20	0.00892	-	-	<0.000525	-	-	0.285	-	-	-	-
	04/08/20	0.0288	-	-	<0.000525	-	-	0.292	-	-	-	-
	07/08/20	0.0296	-	-	<0.000525	-	-	0.241	-	-	-	-
	10/15/20	0.0208	-	-	-	-	-	0.202	-	-	-	-
MW-16	02/06/20	0.00607 J	-	-	<0.000525	-	-	0.295	-	-	-	-
	04/08/20	0.00370 J	-	-	<0.000525	-	-	0.240	-	-	-	-
	07/08/20	0.00587	-	-	<0.000525	-	-	0.297	-	-	-	-
	10/15/20	0.00679	-	-	-	-	-	0.326	-	-	-	-
MW-17	02/06/20	0.000302 J	-	-	<0.000525	-	-	0.0478	-	-	-	-
	04/07/20	0.000348 J	-	-	<0.000525	-	-	0.0249	-	-	-	-
	07/08/20	0.000311 J	-	-	<0.000525	-	-	0.0338	-	-	-	-
	10/15/20	0.000335 J	-	-	-	-	-	0.0190	-	-	-	-
MW-18	01/14/20	0.000379 J	-	-	<0.000525	-	-	0.232	-	-	-	-
	04/07/20	<0.000246	-	-	<0.000525	-	-	0.00282	-	-	-	-
	07/08/20	0.000260 J	-	-	<0.000525	-	-	0.000967 J	-	-	-	-
	10/15/20	0.000265 J	-	-	-	-	-	0.00112 J	-	-	-	-
SECOND GWBU MONITORING WELLS												
ON-SITE MONITORING WELL												
MW-3D	05/07/19	0.00106 J	0.297	<0.000147	<0.000525	0.0578 J	0.000153 J	0.0643	<0.0000263 UJL	<0.000454	<0.000251	0.00739 J
OFF-SITE MONITORING WELLS												
MW-1D	05/07/19	0.00162 J	0.342	<0.000147	0.000789 J	0.0341 J	0.000182 J	0.973	<0.0000263 UJL	0.000788 J	<0.000251	0.00471 J
MW-2D	05/08/19	0.000894 J	0.0648	<0.000147	0.00411	0.186	0.000449 J	0.015	<0.0000263	<0.000454	<0.000251	0.00328 J
REGULATORY STANDARDS												
TCEQ TRRP Tier 1 Residential ^{GW} G _{ing} PCLs		0.010	2.0	0.005	0.10	--	0.015	1.1	0.002	0.050	0.12	7.3
TCEQ TRRP Tier 1 with MSD Residential ^{Air} G _{inh-v} PCLs (30-Acre Source Area)		--	--	--	--	--	--	--	0.94	--	--	--

Notes:

"-" indicates not analyzed.
 "--" represents not applicable or not established.
 "mg/L" represents milligrams per liter.
 "TCEQ" represents Texas Commission on Environmental Quality.
 "TRRP" represents Texas Risk Reduction Program.
 "MSD" represents Municipal Setting Designation.
 "MSW" represents Municipal Solid Waste.
 "PCL" represents Protective Concentration Limit.
 "<" indicates the analyte was not identified at or above the specified laboratory Sample Detection Limit (SDL).
 Bold values exhibit a concentration at or above the laboratory SDL.
 "J" indicates the target analyte was positively identified above the laboratory SDL but below the Method Quantitation Limit (MQL).
 "UJ" indicates the numerical value of the SDL is estimated and may be inaccurate based on an evaluation of the data in the Data Usability Summary (DUS).
 "L" indicates the analytical result is likely bias low based on an evaluation of the data in the DUS.
 "H" indicates the analytical result is likely bias high based on an evaluation of the data in the DUS.
 "D" indicates that the sample was diluted due to an initial result that exceeded the calibration curve. The reported concentration is from the analysis of an additional dilution.
 "E" indicates the analyte data exceeds the upper calibration limit; therefore, the analyte concentration is reported as estimated.
 Concentrations highlighted yellow exceed the critical TCEQ TRRP Tier 1 Residential groundwater-ingestion (^{GW}G_{ing}) PCL without a Municipal Setting Designation (MSD) in place.
 Concentrations highlighted blue exceed the critical TCEQ TRRP Tier 1 Residential groundwater-to-air inhalation (^{Air}G_{inh-v}) PCL with an MSD in place.
 TCEQ TRRP Tier 1 Residential Groundwater PCLs (30 Texas Administrative Code [TAC] 350, Table 3; Tier 1 Residential Groundwater PCLs, dated January 6, 2021).

**TABLE 2 (CONTINUED)
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - VOCs, SVOCs
KIRKWOOD CROSSING - SUBSURFACE VENTILATION SYSTEM (SSVS)
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS**

Sample Name	Sample Date	VOLATILE ORGANIC COMPOUNDS (VOCs)													SVOCs		
		Acetone	Benzene	Chlorobenzene	Chloroform	Chloromethane	1,2-Dichlorobenzene	1,4-Dichlorobenzene	Ethylbenzene	p-Isopropyltoluene	Methyl ethyl ketone	Methyl tert-butyl ether (MTBE)	Toluene	Total Xylenes	Benzoic acid	Bis(2-ethylhexyl)phthalate	1,2-Dichlorobenzene
		Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8260B mg/L	Method 8270D mg/L	Method 8270D mg/L	Method 8270D mg/L
FIRST/UPPERMOST GROUNDWATER-BEARING UNIT (GWBU) MONITORING WELLS																	
ON-SITE MONITORING WELLS																	
MW-3	03/27/19	<0.0200	<0.00185	<0.000110	0.000110 J	<0.00500	<0.000175	<0.000222	<0.000190	<0.000150	<0.00132	0.000660 J	<0.000500	<0.000500	<0.00129	<0.000441	<0.00100
MW-9	07/09/19	<0.0123 UJ	<0.000214	<0.000159	<0.000259	0.000330 J	<0.000236	<0.000199	<0.000146	<0.000233	0.00633 J	<0.000571	<0.000146	<0.000192	<0.00131 UJ	<0.000450 UJ	<0.00102 UJ
MW-10	07/09/19	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.00130 UJL	<0.000445 UJL	<0.00101 UJL
	07/12/19	0.0171 JL	<0.000214	<0.000159	<0.000259	0.000560 J	<0.000244	<0.000199	<0.000146	0.00033 J	<0.00270	0.000830 J	<0.000146	<0.000192	-	-	-
OFF-SITE MONITORING WELLS																	
MW-1	03/27/19	<0.0200	<0.000185	<0.000110	0.00017 J	<0.00500	<0.000175	<0.000222	0.00024 J	<0.000150	<0.00132	<0.000500	0.0184	0.00116 J	<0.00129	<0.000441	<0.00100
MW-2	03/27/19	<0.0200	<0.000185	<0.000110	<0.000107	<0.00500	<0.000175	<0.000222	<0.000190	<0.000150	<0.00132	0.000890 J	<0.000500	<0.000500	<0.00129	<0.000441	<0.00100
MW-4	03/28/19	<0.0200	<0.000185	<0.000110	0.000490 J	<0.00500	<0.000175	<0.000222	<0.000190	<0.000150	<0.00132	<0.000500	<0.000500	<0.000500	<0.00129 UJL	<0.000441 UJL	<0.00100 UJL
MW-5	03/28/19	<0.0200	<0.000185	0.000670 J	0.000200 J	<0.000190	0.000270 J	0.000560 J	<0.000190	<0.000150	<0.00132	0.000550 J	<0.000500	<0.000500	<0.00130 UJL	<0.000445 UJL	<0.00101 UJL
MW-6	03/28/19	<0.0200	<0.000185	<0.000110	0.000150 J	<0.00500	<0.000175	<0.000222	<0.000190	<0.000150	<0.00132	<0.000500	<0.000500	<0.000500	<0.00131 UJL	<0.000450 UJL	<0.00102 UJL
MW-7	07/09/19	<0.0123 UJ	<0.000214	<0.000159	<0.000259	0.000350 J	<0.000236	<0.000199	<0.000146	<0.000233	0.00808 J	<0.000571	0.000150 J	<0.000192	0.0416	<0.000445	<0.00101
MW-8	07/09/19	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.00130 UJL	<0.000445 UJL	<0.00101 UJL
	07/12/19	<0.0123 UJ	0.000350 J	<0.000159	<0.000259	0.000430 J	<0.000236	<0.000199	0.000210 J	0.0333	<0.00270	<0.000571	0.000230 J	<0.000192	-	-	-
SECOND GWBU MONITORING WELLS																	
ON-SITE MONITORING WELLS																	
MW-3D	05/07/19	<0.0123	<0.000214	<0.000159	<0.000259	<0.00318	0.000250 J	<0.000199	<0.000146	<0.000233	<0.00270	<0.000571	<0.000146	<0.000192	<0.00127	<0.000436	<0.000994
OFF-SITE MONITORING WELLS																	
MW-1D	05/07/19	<0.0123	<0.000214	0.000170 J	0.00151	<0.000318	0.0267	<0.000199	<0.000146	<0.000233	<0.00270	<0.000571	0.000210 J	<0.000192	<0.00127	0.000802 J	0.0162
MW-2D	05/08/19	<0.0123	<0.000214	<0.000159	0.000910 J	<0.00318	0.0213	<0.000199	<0.000146	<0.000233	<0.00270	0.00320 J	0.000340 J	<0.000192	<0.00129	<0.000441	0.0201
REGULATORY STANDARDS																	
TCEQ TRRP Tier 1 Residential ^{GW} GW _{ing} PCLs		22	0.0050	0.10	0.080	0.070	0.60	0.075	0.70	2.4	15	0.24	1.0	10	98	0.006	0.60
TCEQ TRRP Tier 1 with MSD Residential ^{Air} GW _{inh-v} PCLs (30-Acre Source Area)		1,000,000	23	150	2.6	4.7	150	2,200	3,800	--	620,000	520	8,200	1,300	--	--	1,200

Notes:

"-" indicates not analyzed.
 "--" represents not applicable or not established.
 "mg/L" represents milligrams per liter.
 "SVOCs" represents semi-volatile organic compounds.
 "TCEQ" represents Texas Commission on Environmental Quality.
 "TRRP" represents Texas Risk Reduction Program.
 "MSD" represents Municipal Setting Designation
 "MSW" represents Municipal Solid Waste.
 "PCL" represents Protective Concentration Limit.
 "<" indicates the analyte was not identified at or above the specified laboratory Sample Detection Limit (SDL).

Bold values exhibit a concentration at or above the laboratory SDL.
 Only VOC and SVOC analytes detected at or above the laboratory SDL in at least one sample are shown on this table.
 "UJ" indicates the numerical value of the SDL is estimated and may be inaccurate based on an evaluation of the data in the Data Usability Summary (DUS).
 "J" indicates the target analyte was positively identified above the laboratory SDL but below the Method Quantitation Limit (MQL).
 "L" indicates the analytical result is likely bias low based on an evaluation of the data in the DUS.
 Concentrations highlighted yellow exceed the critical TCEQ TRRP Tier 1 Residential groundwater-ingestion (^{GW}GW_{ing}) PCL without a Municipal Setting Designation (MSD) in place.
 Concentrations highlighted blue exceed the critical TCEQ TRRP Tier 1 Residential groundwater-to-air inhalation (^{Air}GW_{inh-v}) PCL with an MSD in place.
 TCEQ TRRP Tier 1 Residential Groundwater PCLs (30 Texas Administrative Code [TAC] 350, Table 3: Tier 1 Residential Groundwater PCLs, dated January 6, 2021).

TABLE 2 (CONTINUED)
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - TPH
KIRKWOOD CROSSING - SUBSURFACE VENTILATION SYSTEM (SSVS)
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS

Sample Name	Sample Date	TOTAL PETROLEUM HYDROCARBONS (TPH)		
		C6-C12	> C12-C28	> C28-C35
		TX Method 1005 mg/L	TX Method 1005 mg/L	TX Method 1005 mg/L
FIRST/UPPERMOST GROUNDWATER-BEARING UNIT (GWBU) MONITORING WELLS				
ON-SITE MONITORING WELLS				
MW-3	03/27/19	<0.141	<0.145	<0.0894
	09/05/19	<0.876	<0.600	<0.600
	01/15/20	<0.897	<0.614	<0.614
	04/07/20	<0.882	<0.604	<0.604
MW-9	07/07/19	<0.872	<0.597	<0.597
	09/04/19	<0.899	<0.615	<0.615
	01/15/20	<0.890	<0.609	<0.609
	04/06/20	<0.882	<0.604	<0.604
	07/07/20	<0.840	<0.819	<0.819
MW-10	07/12/19	<0.874	<0.598	<0.598
	09/04/19	<0.897	<0.614	<0.614
	01/16/20	<0.892	<0.611	<0.611
	04/06/20	<0.880	<0.602	<0.602
	07/07/20	<0.834	<0.813	<0.813
OFF-SITE MONITORING WELLS				
MW-1	03/27/19	<0.144	<0.148	<0.0911
	09/05/19	<0.891	<0.610	<0.610
	01/17/20	<0.919	<0.629	<0.629
	04/07/20	<0.881	<0.603	<0.603
	07/08/20	<0.839	<0.818	<0.818
MW-2	03/27/19	<0.145	<0.149	<0.0916
	09/05/19	<0.901	<0.617	<0.617
	01/17/20	<0.899	<0.615	<0.615
	04/07/20	<0.881	<0.604	<0.604
	07/08/20	<0.810	<0.790	<0.790
MW-4	03/28/19	<0.142	<0.146	<0.0899
	09/05/19	<0.883	<0.604	<0.604
	01/16/20	<0.865	<0.592	<0.592
	04/08/20	<0.872	<0.597	<0.597
MW-5	03/28/19	<0.145	<0.149	<0.0917
	09/05/19	<0.875	<0.599	<0.599
	01/14/20	<0.883	<0.604	<0.604
	04/08/20	<0.856	<0.586	<0.586
	07/08/20	<0.827	<0.806	<0.806
MW-6	03/28/19	<0.143	<0.148	<0.0909
	09/05/19	<0.877	<0.601	<0.601
	01/16/20	<0.863	<0.591	<0.591
	04/07/20	<0.881	<0.604	<0.604
	07/08/20	<0.817	<0.796	<0.796
MW-7	07/07/19	<0.862	<0.590	<0.590
	09/04/19	<0.904	<0.619	<0.619
	01/16/20	<0.890	<0.609	<0.609
	04/07/20	<0.877	<0.600	<0.600
	07/08/20	<0.830	<0.809	<0.809
MW-8	07/12/19	1.22 J	<0.594	<0.594
	09/04/19	0.924 J	<0.632	<0.632
	01/16/20	<0.884	<0.605	<0.605
	04/06/20	<0.867	<0.593	<0.593
	07/07/20	<0.835	<0.814	<0.814
MW-11	02/06/20	<0.897	<0.614	<0.614
	04/08/20	<0.902	<0.618	<0.618
	07/08/20	<0.821	<0.801	<0.801
MW-12	01/14/20	<0.899	<0.616	<0.616
	04/08/20	<0.885	<0.606	<0.606
	07/07/20	<0.838	<0.817	<0.817
MW-13	02/06/20	<0.882	<0.604	<0.604
	04/08/20	<0.910	<0.623	<0.623
	07/07/20	<0.835	<0.814	<0.814
MW-14	02/06/20	<0.884	<0.605	<0.605
	04/08/20	<0.883	<0.605	<0.605
	07/08/20	<0.836	<0.815	<0.815
MW-15	01/14/20	<0.896	<0.614	<0.614
	04/08/20	<0.881	<0.603	<0.603
	07/08/20	<0.830	<0.810	<0.810
MW-16	02/06/20	<0.887	<0.607	<0.607
	04/08/20	<0.867	<0.594	<0.594
	07/08/20	<0.840	<0.819	<0.819
MW-17	02/06/20	<0.884	<0.605	<0.605
	04/07/20	<0.887	<0.607	<0.607
	07/08/20	<0.825	<0.805	<0.805
MW-18	01/14/20	<0.894	<0.612	<0.612
	04/07/20	<0.881	<0.603	<0.603
	07/08/20	<0.823	<0.803	<0.803
SECOND GWBU MONITORING WELLS				
ON-SITE MONITORING WELLS				
MW-3D	05/07/19	<0.857	<0.587	<0.587
OFF-SITE MONITORING WELLS				
MW-1D	05/07/19	<0.965	<0.660	<0.660
MW-2D	05/08/19	<0.841	<0.576	<0.576
REGULATORY STANDARDS				
TCEQ TRRP Tier 1 Residential ^{GW} GW _{ing} PCLs		0.98	0.98	0.98
TCEQ TRRP Tier 1 with MSD Residential ^{Air} GW _{inh-v} PCLs (30-Acre Source Area)		230	970	970

Notes:
"mg/L" represents milligrams per liter.
"TCEQ" represents Texas Commission on Environmental Quality.
"TRRP" represents Texas Risk Reduction Program.
"MSD" represents Municipal Setting Designation
"MSW" represents Municipal Solid Waste.
PCL represents Protective Concentration Limit.
"<" indicates the analyte was not identified at or above the specified laboratory Sample Detection Limit (SDL).
Bold values exhibit a concentration at or above the laboratory SDL.
"J" indicates the target analyte was positively identified above the laboratory SDL but below the Method Quantitation Limit (MQL).
Concentrations highlighted yellow exceed the critical TCEQ TRRP Tier 1 Residential groundwater-ingestion (^{GW}GW_{ing}) PCL without an Municipal Setting Designation (MSD) in place.
Concentrations highlighted blue exceed the critical TCEQ TRRP Tier 1 Residential groundwater-to-air inhalation (^{Air}GW_{inh-v}) PCL with an MSD in place.
TCEQ TRRP Tier 1 Residential Groundwater PCLs (30 Texas Administrative Code [TAC] 350, Table 3: Tier 1 Residential Groundwater PCLs, dated January 6, 2021).

APPENDIX 1

LEGAL AND ADMINISTRATIVE DOCUMENTS



TCEQ Use Only

TCEQ Core Data Form

For detailed instructions regarding completion of this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission (If other is checked please describe in space provided.)		
<input checked="" type="checkbox"/> New Permit, Registration or Authorization (Core Data Form should be submitted with the program application.)		
<input type="checkbox"/> Renewal (Core Data Form should be submitted with the renewal form)	<input type="checkbox"/> Other	
2. Customer Reference Number (if issued)	Follow this link to search for CN or RN numbers in Central Registry**	3. Regulated Entity Reference Number (if issued)
CN		RN

SECTION II: Customer Information

4. General Customer Information		5. Effective Date for Customer Information Updates (mm/dd/yyyy)					
<input checked="" type="checkbox"/> New Customer		<input type="checkbox"/> Update to Customer Information					
<input type="checkbox"/> Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)		<input type="checkbox"/> Change in Regulated Entity Ownership					
The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).							
6. Customer Legal Name (If an individual, print last name first: eg: Doe, John)		If new Customer, enter previous Customer below:					
Impact Residential Development, LLC							
7. TX SOS/CPA Filing Number	8. TX State Tax ID (11 digits)	9. Federal Tax ID (9 digits)	10. DUNS Number (if applicable)				
805208404		87-3261369					
11. Type of Customer:	<input checked="" type="checkbox"/> Corporation	<input type="checkbox"/> Individual	Partnership: <input type="checkbox"/> General <input type="checkbox"/> Limited				
Government: <input type="checkbox"/> City <input type="checkbox"/> County <input type="checkbox"/> Federal <input type="checkbox"/> State <input type="checkbox"/> Other	<input type="checkbox"/> Sole Proprietorship	<input type="checkbox"/> Other:					
12. Number of Employees		13. Independently Owned and Operated?					
<input checked="" type="checkbox"/> 0-20 <input type="checkbox"/> 21-100 <input type="checkbox"/> 101-250 <input type="checkbox"/> 251-500 <input type="checkbox"/> 501 and higher		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					
14. Customer Role (Proposed or Actual) – as it relates to the Regulated Entity listed on this form. Please check one of the following							
<input type="checkbox"/> Owner		<input type="checkbox"/> Operator					
<input type="checkbox"/> Occupational Licensee		<input type="checkbox"/> Responsible Party					
<input checked="" type="checkbox"/> Owner & Operator		<input type="checkbox"/> Voluntary Cleanup Applicant					
		<input checked="" type="checkbox"/> Other: MSW Subchapter T Applicant					
15. Mailing Address:	400 Galleria Parkway, Suite 1450						
	City	Atlanta	State	GA	ZIP	30339	ZIP + 4
16. Country Mailing Information (if outside USA)				17. E-Mail Address (if applicable)			
				jmullins@impactresidential.com			
18. Telephone Number			19. Extension or Code		20. Fax Number (if applicable)		
(713) 344-7055					() -		

SECTION III: Regulated Entity Information

21. General Regulated Entity Information (If 'New Regulated Entity' is selected below this form should be accompanied by a permit application)	
<input checked="" type="checkbox"/> New Regulated Entity <input type="checkbox"/> Update to Regulated Entity Name <input type="checkbox"/> Update to Regulated Entity Information	
The Regulated Entity Name submitted may be updated in order to meet TCEQ Agency Data Standards (removal of organizational endings such as Inc, LP, or LLC).	
22. Regulated Entity Name (Enter name of the site where the regulated action is taking place.)	

23. Street Address of the Regulated Entity: <i>(No PO Boxes)</i>	12000 Bissonnet Street						
	City	Houston	State	TX	ZIP	77099	ZIP + 4
24. County	Harris						

Enter Physical Location Description if no street address is provided.

25. Description to Physical Location:	+/- 12 acres in the central portion of Doty Sand Pit Venture Landfill.							
26. Nearest City	Houston				State	TX	Nearest ZIP Code	77099
27. Latitude (N) In Decimal:	29.6796070			28. Longitude (W) In Decimal:	-95.5915470			
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds			
29	40	46.59	95	35	29.57			
29. Primary SIC Code (4 digits)	30. Secondary SIC Code (4 digits)	31. Primary NAICS Code (5 or 6 digits)		32. Secondary NAICS Code (5 or 6 digits)				
6513	6552	531390		531110				
33. What is the Primary Business of this entity? <i>(Do not repeat the SIC or NAICS description.)</i>								
Closed Type IV Landfill								
34. Mailing Address:	400 Galleria Parkway, Suite 1450							
	City	Atlanta	State	GA	ZIP	30339	ZIP + 4	
35. E-Mail Address:								
36. Telephone Number		37. Extension or Code			38. Fax Number <i>(if applicable)</i>			
(713) 344-7055					() -			

39. TCEQ Programs and ID Numbers Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

<input type="checkbox"/> Dam Safety	<input type="checkbox"/> Districts	<input type="checkbox"/> Edwards Aquifer	<input type="checkbox"/> Emissions Inventory Air	<input type="checkbox"/> Industrial Hazardous Waste
<input checked="" type="checkbox"/> Municipal Solid Waste	<input type="checkbox"/> New Source Review Air	<input type="checkbox"/> OSSF	<input type="checkbox"/> Petroleum Storage Tank	<input type="checkbox"/> PWS
<input type="checkbox"/> Sludge	<input type="checkbox"/> Storm Water	<input type="checkbox"/> Title V Air	<input type="checkbox"/> Tires	<input type="checkbox"/> Used Oil
<input type="checkbox"/> Voluntary Cleanup	<input type="checkbox"/> Waste Water	<input type="checkbox"/> Wastewater Agriculture	<input type="checkbox"/> Water Rights	<input type="checkbox"/> Other:

SECTION IV: Preparer Information

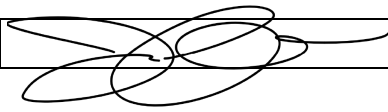
40. Name:	Mike Schultz, P.E.	41. Title:	Principal Engineer
42. Telephone Number	43. Ext./Code	44. Fax Number	45. E-Mail Address
(713) 266-6056		(713) 266-0996	mike.schultz@skaconsulting.com

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

Company:	Impact Residential Development, LLC	Job Title:	Partner
Name <i>(In Print)</i> :	Jessica Mullins	Phone:	(713) 344- 7055

Signature:

A handwritten signature in black ink, consisting of several overlapping loops and a trailing line, is written across the signature field.

Date:

09/18/2023

Delaware

Page 1

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF FORMATION OF "IMPACT DEVELOPMENT PARTNERS, L.L.C.", FILED IN THIS OFFICE ON THE THIRTEENTH DAY OF OCTOBER, A.D. 2021, AT 1:43 O`CLOCK P.M.




Jeffrey W. Bullock, Secretary of State

6305313 8100
SR# 20213501981

Authentication: 204401475
Date: 10-13-21

You may verify this certificate online at corp.delaware.gov/authver.shtml

**CERTIFICATE OF FORMATION
OF
IMPACT DEVELOPMENT PARTNERS, L.L.C.**

1. The name of the limited liability company is Impact Development Partners, L.L.C.

2. The address of its registered office in the State of Delaware is Corporation Trust Center, 1209 Orange Street, in the City of Wilmington, County of New Castle, State of Delaware, 19801. The name of its registered agent at such address is The Corporation Trust Company.

IN WITNESS WHEREOF, the undersigned has executed this Certificate of Formation of Impact Development Partners, L.L.C. on this 13th day of October 2021.

/s/ Nick Antonopoulos
Nick Antonopoulos, as authorized person

Delaware

Page 1

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF AMENDMENT OF "IMPACT DEVELOPMENT PARTNERS, L.L.C.", CHANGING ITS NAME FROM "IMPACT DEVELOPMENT PARTNERS, L.L.C." TO "IMPACT RESIDENTIAL DEVELOPMENT, L.L.C.", FILED IN THIS OFFICE ON THE TWENTY-SECOND DAY OF APRIL, A.D. 2022, AT 12:11 O`CLOCK P.M.




Jeffrey W. Bullock, Secretary of State

6305313 8100
SR# 20221582417

Authentication: 203250773
Date: 04-22-22

You may verify this certificate online at corp.delaware.gov/authver.shtml

**STATE OF DELAWARE
CERTIFICATE OF AMENDMENT**

1. Name of Limited Liability Company: _____
Impact Development Partners, L.L.C.

2. The Certificate of Formation of the limited liability company is hereby amended as follows:

The name of the limited liability company is Impact Residential Development, L.L.C.

IN WITNESS WHEREOF, the undersigned have executed this Certificate on the 22nd day of April, A.D. 2022.

By: /s/ Nick Antonopoulos
Authorized Person(s)

Name: Nick Antonopoulos, as authorized person
Print or Type

State of Delaware
Secretary of State
Division of Corporations
Delivered 12:11 PM 04/22/2022
FILED 12:11 PM 04/22/2022
SR 20221582417 - File Number 6305313

Delaware

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY "IMPACT RESIDENTIAL DEVELOPMENT, L.L.C." IS DULY FORMED UNDER THE LAWS OF THE STATE OF DELAWARE AND IS IN GOOD STANDING AND HAS A LEGAL EXISTENCE SO FAR AS THE RECORDS OF THIS OFFICE SHOW, AS OF THE FIFTH DAY OF JULY, A.D. 2023.

AND I DO HEREBY FURTHER CERTIFY THAT THE ANNUAL TAXES HAVE BEEN PAID TO DATE.




Jeffrey W. Bullock, Secretary of State

6305313 8300

SR# 20232920492

You may verify this certificate online at corp.delaware.gov/authver.shtml

Authentication: 203680075

Date: 07-05-23



SKA Project 6022-0001

Certified Mail with Return Receipt

September 22, 2023

Municipal Solids Waste Permits Section, MC124
Waste Permits Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

**RE: Application for Development Permit for Proposed Enclosed Structure
Over Closed Municipal Solid Waste Landfill and Permit Modification
Doty Sand Pit Venture Landfill
12000 Bissonnet Street, Houston, Harris County, Texas 77099
TCEQ MSW Permit No. 1247**

Dear Sir/Madam:

By this letter Impact Residential Development, LLC (Applicant) transmits an Application for Development Permit for Proposed Enclosed Structure Over Closed Municipal Solid Waste Landfill (Application) and a Permit Modification to Texas Commission on Environmental Quality (TCEQ) Municipal Solid Waste (MSW) Permit No. 1247. This letter also provides notice to governmental agencies and officials per 30 Texas Administrative Code 330.957(g). The proposed Kirkwood Crossing development consists of four apartment buildings and a clubhouse to be constructed on the closed Doty Sand Pit Venture (DSPV) Landfill at 12000 Bissonnet Street, Houston, TX 77099. The DSPV Landfill was formerly a sand mining operation that became a Type IV MSW construction and demolition debris landfill. The DSPV Landfill stopped receiving waste and was closed in 1999. The DSPV Landfill is currently in post-closure care. From 2000 to 2005 the DSPV Landfill was redeveloped as the Sugar Hill Golf Course. Since the Sugar Hill Golf Course closed in 2005, the DSPV Landfill property has been undeveloped.

A physical copy of the Application is available at the Alief-David M. Henington Library, 11903 Bellaire Street, Houston, TX 77702, and at the TCEQ Region 12 office at 5425 Polk Street, Suite H, Houston, TX 77023. An electronic copy of the Application is available at: <https://www.skaconsulting.com/impact-development-permit-documents/>.

On behalf of Impact Residential Development, LLC, please contact me at mike.schultz@skaconsulting.com or (713) 266-6056 if you have any questions.

Sincerely,

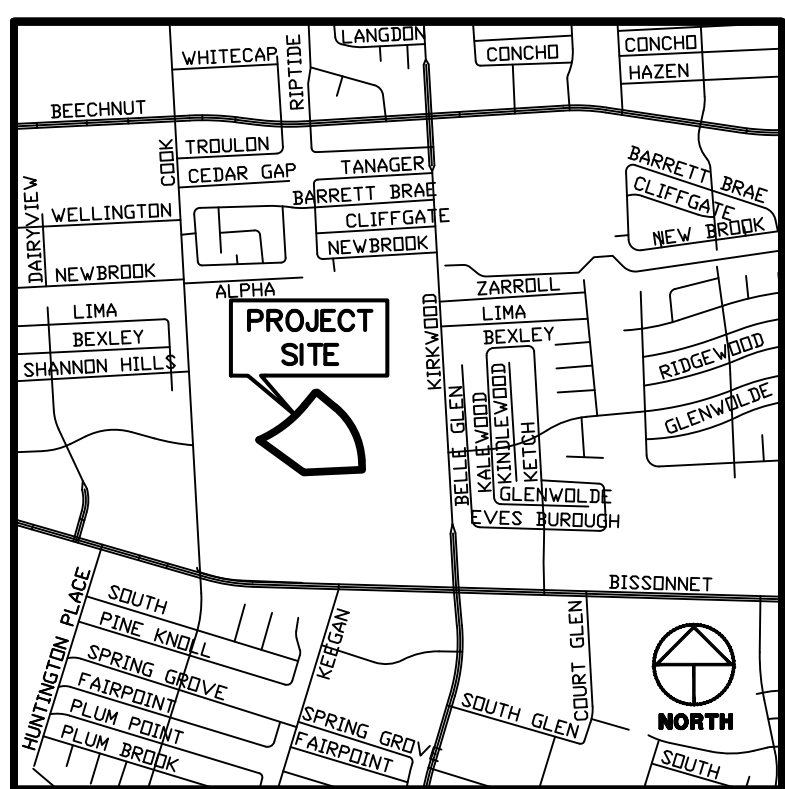
SKA CONSULTING, L.P.

A handwritten signature in blue ink that reads "Mike Schultz".

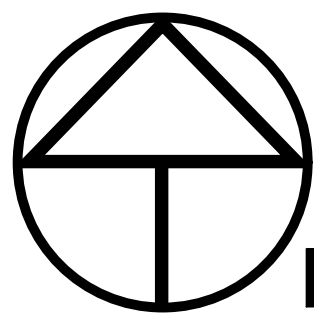
Mike Schultz, P.E.
Executive Vice President, Partner

G:\2022\6022-0001\Letters\6022-0001.L03.docx

cc: Ms. Jessica Mullins, Impact Residential Development, LLC
Mr. Mark Lester, Northwest Metro Holding, CS 34, LLC
Mr. Robert Pedersen, P.E., TCEQ Municipal Solid Waste Permits Section
Ms. Elita Castleberry, Harris County Pollution Control Services Department
Mr. Samuel Pena, Houston Fire Department
Ms. Tina Petersen, Harris County Flood Control District
The Honorable Sylvester Turner, Mayor of Houston
Mr. Stephen L. Williams, City of Houston Health Department
Ms. Carol Haddock, P.E., City of Houston Public Works Department
Ms. Yvonne W. Forrest, City of Houston Public Works Department – Water Utilities
Ms. Margaret Brown Wallace, City of Houston Planning and Development Department
Mr. Byron King, City of Houston Public Works Department – Building Code Enforcement
The Honorable Lina Hidalgo, Harris County Judge
Mr. Milton Rahman, P.E., Harris County Engineer
Ms. Barbie Robinson, Harris County Public Health Department
The Honorable Alma A. Allen, State Representative, District 131
The Honorable Borris L. Miles, State Senator, District 13
Mr. Rick Guerrero, Houston-Galveston Area Council

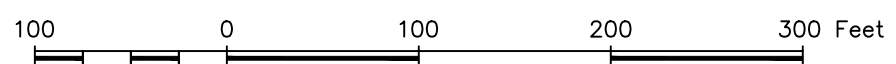


CITY OF HOUSTON, HARRIS COUNTY, TEXAS
VICINITY MAP
SCALE: 1" = 2,000'



NORTH

GRAPHIC SCALE: 1" = 100'



SCHEDULE 'B' NOTES

- 10a. ANY COVENANTS, CONDITIONS OR RESTRICTIONS INDICATING A PREFERENCE, LIMITATION OR DISCRIMINATION BASED ON RACE, COLOR, RELIGION, SEX, HANDICAP, FAMILIAL STATUS, OR NATIONAL ORIGIN ARE HEREBY DELETED TO THE EXTENT SUCH COVENANTS, CONDITIONS OR RESTRICTIONS VIOLATE 42 USC 3604 (C) RESTRICTIVE COVENANTS AS DESCRIBED UNDER FILM CODE NO. 450135 OF THE MAP AND/OR PLAT RECORDS OF HARRIS, TEXAS.
- 10g. A 25 FOOT BUILDING SETBACK LINE ALONG THE SOUTHERLY PROPERTY LINE (BISSONNET STREET) PROPERTY LINE AS SET FORTH ON THE RECORDED PLAT AND DEDICATION. (DOES NOT AFFECT SUBJECT TRACT, SHOWN HEREON)
- 10h. EASEMENT AS SHOWN ON THE RECORDED PLAT AND DEDICATION: PURPOSE: DRAINAGE EASEMENT LOCATION: 15' ON EACH SIDE OF THE CENTER LINE OF ALL GULLIES, RAVINES AND OTHER NATURAL DRAINAGE COURSES ON THE HEREIN DESCRIBED PROPERTY. (AFFECT SUBJECT TRACT, BLANKET IN NATURE)
- 10i. EASEMENT: STORM SEWER EASEMENT RECORDED: OCTOBER 8, 1982 IN COUNTY CLERK'S FILE NO. H651543, OF THE OFFICIAL PUBLIC RECORDS, HARRIS COUNTY, TEXAS. (DOES NOT AFFECT SUBJECT TRACT)
- 10j. EASEMENT: DRAINAGE RECORDED: OCTOBER 8, 1982 IN COUNTY CLERK'S FILE NO. H651544, OF THE OFFICIAL PUBLIC RECORDS, HARRIS COUNTY, TEXAS. (DOES NOT AFFECT SUBJECT TRACT)
- 10k. EASEMENT: PUBLIC STREET EASEMENT RECORDED: SEPTEMBER 15, 2000 IN COUNTY CLERK'S FILE NO. U625060, OF THE OFFICIAL PUBLIC RECORDS, HARRIS COUNTY, TEXAS. (DOES NOT AFFECT SUBJECT TRACT)
- 10l. EASEMENT: PUBLIC STREET EASEMENT RECORDED: MARCH 1, 2001 IN COUNTY CLERK'S FILE NO. U901717, OF THE OFFICIAL PUBLIC RECORDS, HARRIS COUNTY, TEXAS. (DOES NOT AFFECT SUBJECT TRACT)
- 10m. EASEMENT: TEMPORARY CONSTRUCTION EASEMENT RECORDED: NOVEMBER 09, 2001 IN COUNTY CLERK'S FILE NO. V412943, OF THE OFFICIAL PUBLIC RECORDS, HARRIS COUNTY, TEXAS. (DOES NOT AFFECT SUBJECT TRACT)
- 10n. EASEMENT: GRANT OF EASEMENT RECORDED: OCTOBER 21, 2015 IN COUNTY CLERK'S FILE NO. 20150481302, OF THE OFFICIAL PUBLIC RECORDS, HARRIS COUNTY, TEXAS. (NOT A SURVEY RELATED ITEM)

DESCRIPTION

A TRACT OR PARCEL CONTAINING 12,085 ACRES OR 526,429 SQUARE FEET OF LAND BEING OUT OF AND PART OF A CALLED 136.888 ACRE TRACT OF LAND CONVEYED TO BISSONNET 136, LLC, AS RECORDED UNDER HARRIS COUNTY CLERK'S FILE (H.C.C.F.) NO. RP-2019-275311, SITUATED IN THE HT&B RR CO SURVEY, SECTION 11, ABSTRACT NO. 406 AND HT&B RR CO SURVEY, SECTION 9, ABSTRACT NO. 407, WITH SAID 12,085 ACRES TRACT BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS, WITH ALL BEARINGS BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE (NAD 83):

COMMENCING AT A 3/4" INCH IRON ROD FOUND ON THE NORTH RIGHT-OF-WAY (R.O.W.) LINE OF BISSONNET STREET, FOR THE SOUTHWEST CORNER OF UNRESTRICTED RESERVE "A" BLOCK 1, GOLF PLAZA, MAP OR PLAT THEREOF RECORDED UNDER FILM CODE (F.C.) NO. 450135, OF THE HARRIS COUNTY MAP RECORDS (H.C.M.R.), AND THE SOUTHWEST CORNER OF UNRESTRICTED RESERVE "A" BLOCK 1, SUGARHILL ADDITION, RECORDED UNDER F.C. NO. 450135 H.C.M.R.;

THENCE, NORTH 02 DEG. 34 MIN. 26 SEC. WEST, ALONG THE COMMON LINE OF SAID GOLF PLAZA, MAP OR PLAT THEREOF AND SAID SUGARHILL ADDITION, A DISTANCE OF 400.90 FEET TO THE MOST SOUTHERLY POINT OF SAID CALLED 136.888 ACRE TRACT, THE NORTHWEST CORNER OF SAID GOLF PLAZA, AND THE NORTHEAST CORNER OF SAID UNRESTRICTED RESERVE "A" SUGARHILL ADDITION TO A 5/8" INCH IRON ROD FOUND BEARS N 15 DEG. 19 MIN. EAST-1.04 FEET;

THENCE, NORTH 72 DEG. 56 MIN. 44 SEC. WEST, ALONG THE SOUTH LINE OF SAID CALLED 136.888 ACRE TRACT, A DISTANCE OF 90.24 FEET TO A POINT;

THENCE, OVER AND ACROSS SAID CALLED 136.888 ACRE TRACT, THE FOLLOWING NINE (9) COURSES AND DISTANCES:

1. NORTH 02 DEG. 34 MIN. 26 SEC. WEST, A DISTANCE OF 784.41 FEET TO A CAPPED 5/8" INCH IRON ROD STAMPED "WINDROSE" SET FOR THE SOUTHEAST CORNER AND POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT;
2. SOUTH 87 DEG. 20 MIN. 44 SEC. WEST, A DISTANCE OF 609.88 FEET TO A CUT X SET FOR THE MOST SOUTHERLY SOUTHWEST CORNER OF THE HEREIN DESCRIBED TRACT;
3. NORTH 53 DEG. 56 MIN. 45 SEC. WEST, A DISTANCE OF 574.83 FEET TO A CAPPED 5/8" INCH IRON ROD STAMPED "WINDROSE" SET FOR THE BEGINNING OF A NORTH-TANGENT CURVE TO THE LEFT AND THE MOST WESTERLY CORNER OF THE HEREIN DESCRIBED TRACT;
4. WITH SAID CURVE TO THE LEFT, HAVING A RADIUS OF 1,285.00 FEET, A CENTRAL ANGLE OF 26 DEG. 43 MIN. 50 SEC., AN ARC LENGTH OF 599.50 FEET, AND A CHORD BEARING AND DISTANCE OF NORTH 52 DEG. 49 MIN. 14 SEC. EAST - 621.95 FEET TO A CUT X SET FOR A POINT OF TANGENCY OF THE HEREIN DESCRIBED TRACT;
5. NORTH 39 DEG. 27 MIN. 19 SEC. EAST, A DISTANCE OF 172.79 FEET TO A CAPPED 5/8" INCH IRON ROD STAMPED "WINDROSE" SET A NORTHWESTERLY CORNER OF THE HEREIN DESCRIBED TRACT;
6. NORTH 84 DEG. 27 MIN. 19 SEC. EAST, A DISTANCE OF 21.21 FEET TO A CAPPED 5/8" INCH IRON ROD STAMPED "WINDROSE" SET FOR THE MOST NORTHERLY CORNER OF THE HEREIN DESCRIBED TRACT;
7. SOUTH 50 DEG. 32 MIN. 41 SEC. EAST, A DISTANCE OF 242.71 FEET TO A CAPPED 5/8" INCH IRON ROD STAMPED "WINDROSE" SET FOR THE BEGINNING OF A CURVE TO THE RIGHT;
8. WITH SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 765.00 FEET, A CENTRAL ANGLE OF 47 DEG. 58 MIN. 15 SEC., AN ARC LENGTH OF 640.50 FEET, AND A CHORD BEARING AND DISTANCE OF SOUTH 26 DEG. 33 MIN. 34 SEC. EAST - 621.95 FEET TO A CAPPED 5/8" INCH IRON ROD STAMPED "WINDROSE" SET MARKING POINT OF TANGENCY;
9. SOUTH 02 DEG. 34 MIN. 26 SEC. EAST, A DISTANCE OF 94.09 FEET TO THE PLACE OF BEGINNING AND CONTAINING 12,085 ACRES OR 526,429 SQUARE FEET OF LAND.

GENERAL NOTES

1. SURVEYOR DID NOT ABSTRACT SUBJECT PROPERTY. THIS SURVEY WAS PREPARED WITH INFORMATION CONTAINED IN TITLE COMMITMENT OF NO. NCS-1063042-INDY OF FIRST AMERICAN TITLE INSURANCE COMPANY, EFFECTIVE DATE OF APRIL 28, 2021, ISSUED DATE OF MAY 06, 2021, AND IS SUBJECT TO THE LIMITATIONS OF THAT COMMITMENT.
2. BEARINGS WERE BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE (NAD 83). ALL DISTANCES SHOWN HEREON ARE SURFACE DISTANCES AND MAY BE BROUGHT TO GRID BY APPLYING THE FOLLOWING SCALE FACTOR: 0.9999950001.
3. ACCORDING TO THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM) FOR HARRIS COUNTY, TEXAS, MAP NO. 48201C0840L REVISED/DATED JUNE 18, 2007, THE SUBJECT TRACT APPEARS TO LIE WITHIN UNSHADED ZONE "X". THIS DETERMINATION WAS DONE BY GRAPHIC PLOTTING AND IS APPROXIMATE ONLY AND HAS NOT BEEN FIELD VERIFIED. THIS FLOOD STATEMENT DOES NOT IMPLY THAT THE PROPERTY OR STRUCTURES THEREON WILL BE FREE FROM FLOODING OR FLOOD DAMAGE, ON RARE OCCASIONS FLOODS CAN AND WILL OCCUR AND FLOOD HEIGHTS MAY BE INCREASED BY MAN-MADE OR NATURAL CAUSES. THIS FLOOD STATEMENT SHALL NOT CREATE LIABILITY ON THE PART OF WINDROSE LAND SERVICES.
4. DEVELOPMENT OF THIS TRACT IS SUBJECT TO REQUIREMENTS PER CITY OF HOUSTON ORDINANCE NO. 2013-343 WHICH STIPULATES PLATTING AND SETBACK CONSTRAINTS. PROPOSED USAGE OF THIS TRACT WILL DETERMINE ACTUAL BUILDING SETBACK LINE(S) ALONG ANY ADJOINING STREETS. REFER TO CITY OF HOUSTON BUILDING CODES TO ESTABLISH MINIMUM PUBLISHED SETBACK REQUIREMENTS. ULTIMATELY THE CITY OF HOUSTON PLANNING COMMISSION WILL DETERMINE REQUIRED SETBACKS UPON REVIEW OF PLANS OR PLATS SUBMITTED TO SAID COMMISSION. THIS TRACT MAY REQUIRE PLATTING AS A CONDITION FOR RECEIVING BUILDING PERMITS.
5. READILY VISIBLE IMPROVEMENTS AND UTILITIES WERE LOCATED WITH THIS SURVEY. NO SUBSURFACE PROBING, EXCAVATION OR EXPLORATION WAS PERFORMED BY WINDROSE LAND SERVICES.
6. ENVIRONMENTAL AND DRAINAGE ISSUES ARE BEYOND THE SCOPE OF THIS SURVEY.
7. THE SQUARE FOOTAGE TOTALS SHOWN HEREON ARE BASED ON THE MATHEMATICAL CLOSURE OF THE COURSES AND DISTANCES REFLECTED ON THE SURVEY. IT DOES NOT INCLUDE THE TOLERANCES THAT MAY BE PRESENT DUE TO THE POSITIONAL ACCURACY OF THE BOUNDARY MONUMENTATION.
8. THE WORD "CERTIFY" OR "CERTIFICATE" AS SHOWN AND USED HEREON MEANS AN EXPRESSION OF PROFESSIONAL OPINION REGARDING THE FACTS OF THE SURVEY AND DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE EXPRESSED OR IMPLIED.
9. WITH REGARD TO ITEM 2 OF THE ALTA TABLE "A" OPTIONAL SURVEY RESPONSIBILITIES AND SPECIFICATIONS, ACCORDING TO THE HARRIS COUNTY APPRAISAL DISTRICT, THE ADDRESS OF THE SUBJECT TRACT (TAX ID NO. 0430730000076) IS 0 KIRKWOOD DRIVE, HOUSTON, TX 77099.
15. WITH REGARD TO ITEM 6 OF THE ALTA TABLE "A" OPTIONAL SURVEY RESPONSIBILITIES AND SPECIFICATIONS, THE SUBJECT TRACT LIES WITHIN THE CITY OF HOUSTON LIMITS. THERE IS NO ZONING ORDINANCE IN THE CITY OF HOUSTON, AT THIS TIME. NO ZONING REPORT OR LETTER WAS PROVIDED AT THE TIME OF SURVEY.
16. WITH REGARD TO ITEM 9 OF THE ALTA TABLE "A" OPTIONAL SURVEY RESPONSIBILITIES AND SPECIFICATIONS, THERE WERE NO OBSERVED CLEARLY IDENTIFIABLE PARKING SPACES, PARKING LOTS OR STRUCTURES ON THE SUBJECT TRACT AT THE TIME OF SURVEY.
17. WITH REGARD TO ITEM 16 OF THE ALTA TABLE "A" OPTIONAL SURVEY RESPONSIBILITIES AND SPECIFICATIONS, THERE WAS NO OBSERVED EVIDENCE OF EARTH MOVING WORK, BUILDING CONSTRUCTION OR BUILDING ADDITIONS ON THE SUBJECT TRACT AT THE TIME OF SURVEY.
18. WITH REGARD TO ITEM 17 OF THE ALTA TABLE "A" OPTIONAL SURVEY RESPONSIBILITIES AND SPECIFICATIONS, THERE WAS NO OBSERVED EVIDENCE OF RECENT STREET, SIDEWALK CONSTRUCTION OR REPAIRS ON THE SUBJECT TRACT AT THE TIME OF SURVEY.

12.085 ACRES
526,429 SQ.FT.

CALLED 136.888 ACRES
BISSONNET 136, LLC
H.C.C.F. NO. RP-2019-275311

S 87°20'44" W 609.88'

FND 5/8" IRC
"1945 4349"

FND 1/2" IR
7820' E-0.49

FND 5/8" IR
BEARS N 15°19' E-1.04"

P.O.B.
SET 5/8" CAPPED IR
"WINDROSE"

P.O.C.
FND 3/4" IR

LEGEND

- SOME OF THESE ELEMENTS MAY NOT BE USED ON THIS SURVEY**
- BO - BOLLARD
 - - HANDICAP
 - GM - GAS METER
 - GV - GAS VALVE
 - FH - FIRE HYDRANT
 - WM - WATER METER
 - WV - WATER VALVE
 - CV - IRRIGATION CONTROL VALVE
 - - GRATE INLET
 - - GRATE INLET
 - - MANHOLE
 - CO - CLEANOUT
 - TP - TELEPHONE PEDESTAL
 - EB - ELECTRIC BOX
 - TSB - TRAFFIC SIGNAL BOX
 - LP - LIGHT POLE
 - TLP - TRAFFIC LIGHT POLE
 - GL - GROUND/SPOT LIGHT
 - PP - POWER POLE
 - PP/T - POWER POLE W/TRANSFORMER
 - PP/AT - POWER POLE W/LIGHT
 - PP/CT - POWER POLE W/CONDUIT
 - M - METER POLE
 - SP - SERVICE POLE
 - IP - IRON PIPE
 - IR - IRON ROD
 - NO - NUMBER
 - PG - PAGE
 - R.O.W. - RIGHT-OF-WAY
 - SQ. FT. - SQUARE FEET
 - VOL. - VOLUME
 - F.C. - FILM CODE
 - B.L. - BUILDING LINE
 - U.E. - UTILITY EASEMENT
 - - TREE/SHRUB
 - MW - MONITOR WELL
 - TH - THROAT
 - PLM - PIPELINE MARKER
 - UCS - UNDERGROUND CABLE SIGN
 - CTL - CATHODIC TEST LEAD
 - MW - MONITORING WELL
 - P - PIN FLAG/PAINT MARK
 - TC - TOP OF CURB
 - G - GUTTER
 - TG - TOP OF GRATE
 - FL - FLOW LINE
 - HB - HIGHBANK
 - SAN - SANITARY SEWER
 - STM - STORM SEWER
 - CMP - CORRUGATED METAL PIPE
 - CPP - CORRUGATED PLASTIC PIPE
 - RCP - REINFORCED CONCRETE PIPE
 - TEL - TELEPHONE
 - SWBT - SOUTHWESTERN BELL TELEPHONE CO.
 - WTR - WATER
 - UG - UNDERGROUND
 - FND - FOUND
 - H.C.C.F. - HARRIS COUNTY CLERK FILE
 - H.C.D.R. - HARRIS COUNTY DEED RECORDS
 - H.C.M.R. - HARRIS COUNTY MAP RECORDS
 - IR - IRON PIPE
 - IR - IRON ROD
 - NO. - NUMBER
 - PG. - PAGE
 - R.O.W. - RIGHT-OF-WAY
 - SQ. FT. - SQUARE FEET
 - VOL. - VOLUME
 - F.C. - FILM CODE
 - B.L. - BUILDING LINE
 - U.E. - UTILITY EASEMENT
 - - TREE/SHRUB
 - MW - MONITOR WELL
 - TH - THROAT


CURVE CHART				
CURVE	RADIUS	DELTA	LENGTH	BEARING
C1	1,285.00'	26°43'50"	599.50'	N 52°49'14" E
C2	765.00'	47°58'15"	640.50'	S 26°33'34" E


LINE TABLE		
LINE	BEARING	DISTANCE
L1	N 72°56'44" W	90.24'
L2	N 39°27'19" E	172.79'
L3	N 84°27'19" E	21.21'
L4	S 02°34'26" E	94.09'

SURVEYOR'S CERTIFICATION

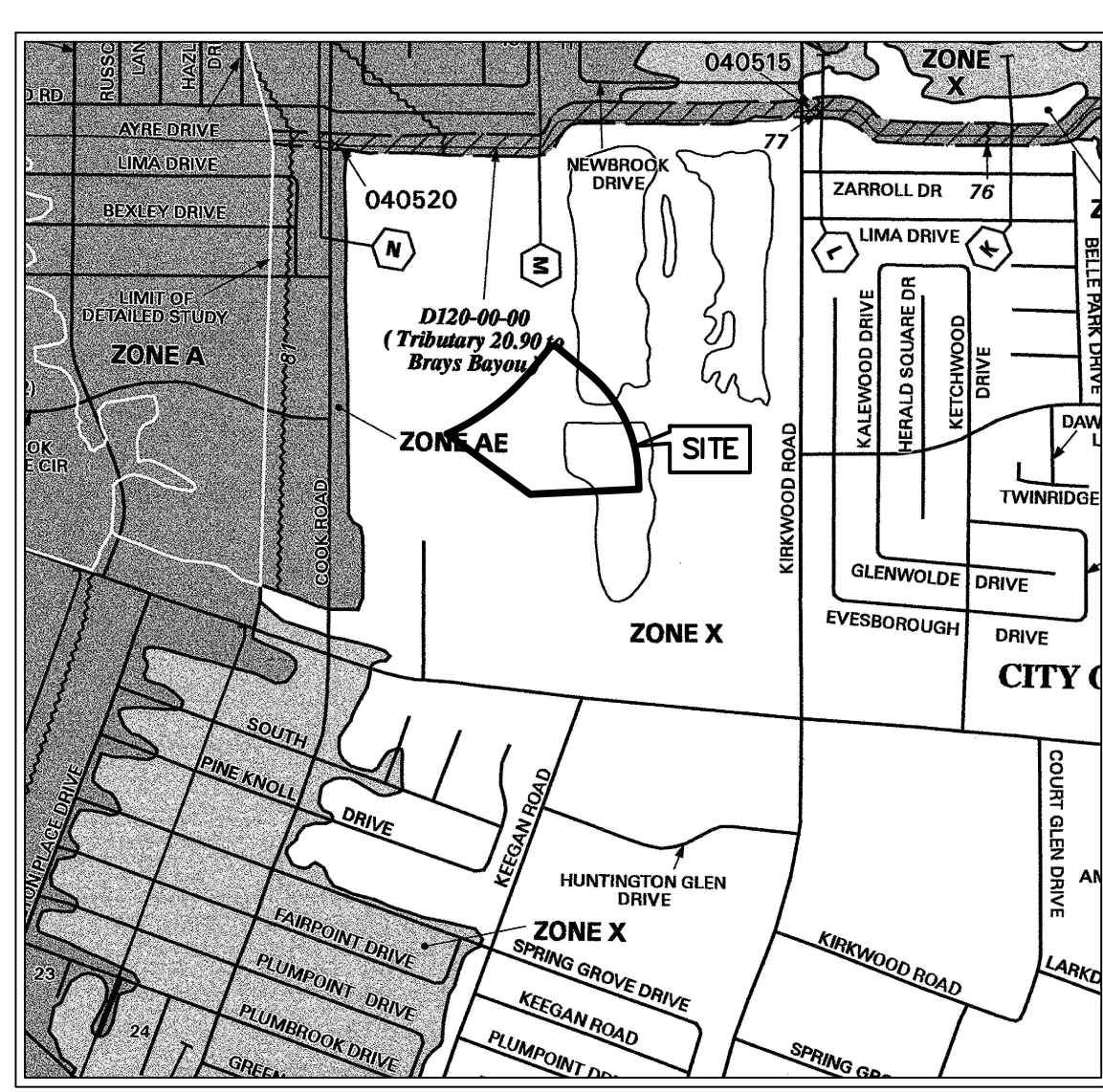
TO: FIRST AMERICAN TITLE INSURANCE COMPANY
KITTLE PROPERTY GROUP, INC.
BISSONNET 136, LLC A TEXAS LIMITED LIABILITY COMPANY

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2021 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1, 2, 3, 4, 6, 7, 8, 9, 13, 14, 16, 17, 18, AND 19 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON NOVEMBER 11, 2021.


ROBERT KNESS
Registered Professional Land Surveyor
Texas Registration No. 6486


ROBERT KNESS
6486
2/14/2022
DATE

FLOOD INFORMATION



FIRM FLOOD INSURANCE RATE MAP
HARRIS COUNTY, TEXAS
AND INCORPORATED AREAS

PANEL 840 OF 1150
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS: NUMBER PANEL SURF.
COMMUNITY: 4006 0840 L
INCORPORATED AREAS: 4007 0840 L

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER 48201C0840L
MAP REVISED: JUNE 18, 2007

Federal Emergency Management Agency

REVISIONS		
DATE	REASON	BY

WINDROSE
LAND SURVEYING & PLATTING

11111 RICHMOND AVE. STE 150 | HOUSTON, TX 77062 | 713.458.2281
FIRM REGISTRATION NO. 10108800 | WINDROSESERVICES.COM

ALTA / NSPS LAND TITLE SURVEY OF
12.085 AC. / 526,429 SQ. FT.
SITUATED IN THE
HT&B RR CO SURVEY, SECTION 11, ABSTRACT NO. 406 &
HT&B RR CO SURVEY, SECTION 9, ABSTRACT NO. 407
CITY OF HOUSTON, HARRIS COUNTY, TEXAS

FIELD BY: JL CHECKED BY: MC JOB NO. 57093-12.09
DRAWN BY: RN DATE: 2/2022 SHEET NO. 1 OF 1

4
Office
cls

**NOTICE TO REAL PROPERTY RECORDS, BUYERS, LEESSES, AND OCCUPANTS
REGARDING LAND WHICH OVERLIES A CLOSED MUNICIPAL SOLID WASTE LANDFILL**

In accordance with the provisions of Chapter 361, Subchapter R, Health and Safety Code (the "Code") and the rules of the Texas Commission on Environmental Quality ("TCEQ") published in Subchapter T, "Use of Land over Closed Municipal Solid Waste Landfills" (30 TAC, Section 330.951-330.964) (the "TCEQ Rules") requiring the preparation and filing of a Notice to Real Property Records of Harris County, Texas, with respect to land overlying a closed municipal solid waste landfill; Bissonnet 136, LLC, the undersigned owner (the "Owner") of the land (the "Land") formerly known as the Doty Sand Pit Venture Landfill described in Exhibit A attached hereto and incorporated herein by reference does hereby state the following:

1. Prior Use of the Land or Tract as a Municipal Solid Waste Landfill

Owner has determined through site investigations that the Land was used for disposal of municipal solid waste by a previous owner and/or operator.

2. Legal Description of the Portion of the Land or Tract that Contains a Closed Municipal Solid Waste Landfill

Exhibit A is a legal description of the portion of the tract of land containing the closed municipal solid waste landfill.

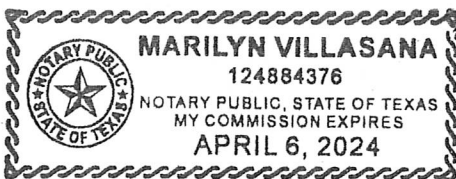
3. Provisions with Respect to Development or Lease of this Property

Provisions with respect to development or lease of this property exist in the Code and the TCEQ Rules (30 TAC, Section 330.951-330.964)

4. Name of Owner

Bissonnet 136, LLC
22310 Grand Corner Drive, Suite 140
Katy, Fort Bend County, TX 77494

This instrument was acknowledged
before me on the 18th day of
May, 2022



By Marilyn Villasana
Date May 18, 2022

Bissonnet 136, LLC

By:

John Quinlan
John Quinlan
President

Attest:

Hiu Ha Sit

Date:

5/18/2022

Ret
Mike Schultz
1888 Stebbins Dr. #100
Houston TX 77043

LEGAL DESCRIPTION

Being 118.778 acres of land being out of a certain called 137.904 acres to Resource Transition Consultants, LLC, a Washington Limited Liability Company as Custodial Receiver with Power of Sale Pursuant to Court Order of the Superior Court of Washington, In and for King County No. 13-2-16960-6SEA and Eduardo S. Espinosa, Receiver as Texas Receiver pursuant to Court Order of District Court of Harris County: 234th Judicial District Cause No. 2014-11141; said 118.78 acres of land being a portion of a call 117.8968 Acre Tract (Harris County Clerk's File (H.C.C.F.) No. U215133), a call 1 8.5993 Acre Tract (H.C.C.F. No. U065389) and a call 1.3688 Acre Tract (H.C.C.F. No. U419454) being out of an original call 74.4127 Acre Tract (H.C.C.F. No. D576145) and an original call 95.87 Acre Tract (H.C.C.F. No. B839886) being in the H.T. & B. Railroad Company Survey, Section No. 11, Abstract No. 406, in the H.T. & B. Railroad Company Survey, Section No. 9, Abstract No. 407, and in the W.E. Sanders Survey, Abstract No. 1138, Harris County, Texas and more particularly described by metes and bounds as follows:

BEGINNING at a set 5/8" iron rod with cap in the Easterly right-of-way line of Cook Road (width varies) for the Northwest corner of Coventry Square Development (Volume 311, Page 55, Map Records of Harris County, Texas); said corner being in the Westerly line of said call 117.8988 Acre Tract, in the Westerly line of said call 74.4127 Acre Tract and being the most Westerly Southwest corner of this 137.904 Acre Tract;

THENCE, N 02°29'49" W (Call N 02°30'00" W), a distance of 1786.87 feet along the Easterly right-of-way of said Cook Road to a set 5/8" iron rod with cap for the most Westerly Northwest corner of this 137.904 Acre Tract; said corner being the Southwest corner of a call 1.011 Acre Tract for public road (H.C.C.F. No. D305424);

THENCE, N 87°42'00" E (Call N 87°42'11" E), a distance of 1219.88 feet along the North line of said call 117.8988 Acre Tract to a found 5/8" iron rod for interior corner;

THENCE, N 02°38'49" W (Call N 02°39'00" W), a distance of 407.10 feet (Call 407.09 feet) to a set 5/8" iron rod with cap for angle corner; from said corner bears a found 5/8" iron rod with cap at N32°53'53"E, 2.98 feet;

THENCE, N 28°36'11" E (Call N 28°36'00" E), a distance of 109.68 feet (Call 109.69 feet) along a Southeasterly line of the Harris County Flood Control District call 43,380 square foot tract (H.C.C.F. No. D353109) to a found 5/8 inch iron rod with cap for the most Northerly Northwest corner of this 137.904 Acre Tract;

THENCE, N 87°21'38" E (Call N 87°21'27" E), a distance of 545.07 feet to a set 5/8" iron rod with cap for the Northwest corner of a call 18.599 Acre Tract to Texas Valla Real Estate I Inc. or Assigns (H.C.C.F. No. U065389);

THENCE, S 02°34'25" E (Call S 02° 34'36" E), a distance of 1064.26 feet along the said West line of the call 18.599 Acre Tract to a set 5/8" iron rod with cap for interior corner;

THENCE, N 87°24'58" E, a distance of 741.00 feet along the South line of the call 18.599 Acre Tract to a set 5/8" iron rod with cap in the Easterly right-of-way line of Kirkwood Drive (Width Varies);

THENCE, S 02°34'25" E (Call S 02°34'36" E) along the present said right-of-way line of Kirkwood Drive, a distance of 1145.95 feet to a set 5/8" iron rod with cap in the North line of a call 1 Acre Tract (H.C.C.F. No. B712666);

THENCE, S 87°23'31" W (Call S 87°23'20" W), a distance of 240.00 feet to a set 5/8" iron rod with cap for interior corner of this tract; said corner being the Northwest corner of said call 1 Acre Tract;

THENCE, S 02°36'29" E (Call S 02°36'40" E), a distance of 167.54 feet to a found 5/8" iron rod for corner; said corner being the Southwest corner of said call 1 Acre Tract;

THENCE, S 87°23'31"W (Call S 87°23'20"W), a distance of 40.00 feet to a set 5/8" iron rod with cap for interior corner of this tract; said corner being the Northwest corner of a call 1.377 Acre Tract (H.C.C.F. No. C287739);

THENCE, S 02°36'29" E (Call S 02°36'40" E), a distance of 200.00 feet to a set 5/8" iron rod with cap for corner of this tract; said corner being the Southwest corner of said call 1.377 Acre Tract;

THENCE, S 87°23'31" W (Call S 87°23'20" W), a distance of 100.00 feet to a set 5/8" iron rod with cap for interior corner of this tract; said corner being the most Northerly Northwest corner of a call 10.082 Acre Tract (H.C.C.F. No. D577580);

THENCE, S 02°33'29" E (Call S 02°36'40" E), a distance of 286.14 feet to a set 5/8" iron rod with cap for corner of this tract; said corner being the Northeast corner of Golf Plaza Reserve "A", Block 1 (Volume 580, Page 258-261, Map Records of Harris County, Texas);

THENCE, S 87°26'31" W (Call S 87°26'20" W), a distance of 350.00 feet to a set 5/8" iron rod with cap for interior corner of this tract; said corner being the Northwest corner of said Golf Plaza Reserve "A" and being the Northeast corner of Sugarhill Addition (Film Code 450135; Map Records of Harris County, Texas); from said corner bears a found 5/8" iron rod at N44°21'17"E, 1.16 feet;

THENCE, S 02°34'26" E (Call S 02°34'37" E), a distance of 400.90 feet to a found 5/8" iron rod with cap for the most Southerly Southeast corner of this 137.904 Acre Tract; said corner being the Southeast corner of said Sugarhill Addition and being in the Northerly right-of-way line of Bissonnet Street (100 feet wide);

THENCE, N 87°39'33" W (Call N 87°39'44" W), a distance of 259.02 feet along the Northerly right-of-way line of said Bissonnet Street to a set 5/8" iron rod with cap for the most Southerly Southwest corner of this 137.904 Acre Tract; said corner being the most Southerly Southwest corner of said Sugarhill Addition; from said corner bears a found 1/2" iron rod at N51°41'37"W, 0.46 feet;

THENCE, N 02°39'16" W (Call N 02°39'27" W), a distance of 370.99 feet to a found 5/8" iron rod with cap set for interior corner of this tract and said Sugarhill Addition;

THENCE, S 87°18'10" W (Call S 87°17'59" W), a distance of 149.40 feet to a set 5/8" iron rod with cap for corner of this tract; said corner being the most Westerly Southwest corner of said Sugarhill Addition;

THENCE, N 02°39'16" W (Call N 02°39'27" W), at 100.00 feet pass a point for the Northwest corner of said Sugarhill Addition, in all 441.31 feet to a found 5/8" iron rod with cap for an interior corner of the herein described tract;

THENCE, S 87°20'44" W (Call S 87°20'33" W), a distance of 200.00 feet to a found 5/8" iron rod with cap for the Northwest corner of a call 4.9320 Acre Tract (H.C.C.F. No. M710134) and the Northeast corner of a call 4.561 Acre Tract (H.C.C.F. No. E751280);

THENCE, N 87°43'49" W (Call N 87°44'00" W), a distance of 255.23 feet to a set 5/8" iron rod with cap for the Northwest corner of a said 4.561 Acre Tract;

THENCE, S 02°38' 49" E (Call S 02°39' 00" E), a distance of 32.14 feet to a set 5/8" iron rod with cap for corner of this tract in an iron fence; said corner being the Northeast corner of Coventry Square Subdivision (Volume 311, Page 55, Map Records of Harris County, Texas);

THENCE, S 87°21'11" W (Call S 87°21'00" W), a distance of 446.00 feet along a Northerly line of said Coventry Square Subdivision to a set 5/8" iron rod with cap for corner;

THENCE, N 02°38'49" W (Call N 02°39'00" W), a distance of 65.00 feet along an Easterly line of said Coventry Square Subdivision to a set 5/8" iron rod with cap for interior corner;

THENCE, S 87°21'11" W (Call S 87°21'00" W), at 60.00 feet pass a point for reentrant corner of said call 2.1261 Acre Tract, in all 80.00 feet along a Northerly line of said Coventry Square Subdivision to a point for corner from which bears a found 5/8" iron rod with cap at N14°38'49"E, 0.26 feet;

THENCE, N 80°35'19" W (Call N 80°35'30" W), a distance of 455.69 feet along a Northerly line of said Coventry Square Subdivision to the **PLACE OF BEGINNING** and containing 118.778 Acres (5,173,987 Square Feet) of land and Reserve "A", in Block One (1), of Sugarhill Addition, a subdivision in Harris County, Texas, according to the map or plat thereof recorded in Film Code No. 450135 of the Map Records of Harris County, Texas.

Mark S. Brown RPLS# 5553
Greenleaf Land Surveys, LLC
10900 Northwest Freeway, Ste 129
Houston, Texas 77092

FILED FOR RECORD

12:23:03 PM

Friday, May 20, 2022



COUNTY CLERK, HARRIS COUNTY, TEXAS

ANY PROVISION HEREIN WHICH RESTRICTS THE SALE RENTAL, OR USE OF THE DESCRIBED REAL PROPERTY BECAUSE OF COLOR OR RACE IS INVALID AND UNENFORCEABLE UNDER FEDERAL LAW.

THE STATE OF TEXAS
COUNTY OF HARRIS

I hereby certify that this instrument was FILED in File Number Sequence on the date and at the time stamped hereon by me; and was duly RECORDED; in the Official Public Records of Real Property of Harris County Texas

Friday, May 20, 2022



COUNTY CLERK
HARRIS COUNTY, TEXAS

Environmental Notice

The Kirkwood Crossing Apartments is a redevelopment on a brownfield, putting land that was formerly a construction and demolition debris landfill back into its highest productive use. The former landfill, known as the Doty Sand Pit Venture Landfill, operated under Texas Commission on Environmental Quality (TCEQ) MSW Permit No. 1247, and closed in 1999.

In order to safely develop the property for residential use, the Kirkwood Crossing Apartments has undergone extensive regulatory review to obtain a development permit from the Texas Commission on Environmental Quality, under the regulations found at 30 Texas Administrative Code (TAC), Chapter 330.

Consistent with the requirements of these regulations and the development permit, the following controls have been implemented:

- Remaining landfill debris is separated from the building by a compacted clay cap cover, with a minimum thickness of 2 feet, with additional soils added up to 15 feet thick over the clay cap.
- The potential for landfill gas is monitored quarterly in gas monitoring probes at the property boundary.
- The building foundation includes a vented, 12-inch-thick permeable gravel layer which contains a gas collection system. Over the gravel layer is a low permeability vapor barrier to prevent gases from penetrating the building.
- Gas sensors are present in the gas collection system installed under the building foundation and within the apartment units. These sensors are connected to an audible alarm. The sensors can detect, and the alarm is set to sound at low concentrations of landfill gas. This means that the alarm will first sound when concentrations are well below levels that would be an actual concern, so that preventative measures can be implemented.

The developer has carefully designed and extensively tested the system such that we anticipate that the audible alarm will rarely, if ever, sound. If it does sound, all occupants should immediately evacuate the building in accordance with the posted evacuation plan, much like a fire alarm evacuation. All occupants and their guests agree to promptly follow the evacuation plan in the event of an audible alarm.

Please sign below to acknowledge receipt of this notice.

Tenant Signature: _____

Date: _____

Tenant Signature: _____

Date: _____

SKA CONSULTING, LP
1888 STEBBINS DRIVE, SUITE 100
HOUSTON, TX 77043

COMERICA BANK
www.comerica.com

32-75/1110
492

020989

DATE

September 21, 2023

PAY

Two Thousand Five Hundred and 00/100 Dollars

AMOUNT

TO THE
ORDER
OF

Texas Commission on Environmental Quality
P.O. Box 13088
MC 214
Austin, TX 78711-3088

\$2,500.00



AUTHORIZED SIGNATURE

⑈020989⑈ ⑆111000753⑆ 1882034497⑈

SKA CONSULTING, LP

020989

Check Date: 9/21/2023

Invoice Number	Date	Voucher	Amount	Discounts	Previous Pay	Net Amount
6022-0001 DevPermit	9/21/2023	0022545	\$2,500.00			\$2,500.00
Texas Commission on Environmental Quality			TOTAL	\$2,500.00		\$2,500.00
Checking	1	TCEQ				

SKA CONSULTING, LP

020989

Check Date: 9/21/2023

Invoice Number	Date	Voucher	Amount	Discounts	Previous Pay	Net Amount
6022-0001 DevPermit	9/21/2023	0022545	\$2,500.00			\$2,500.00
Texas Commission on Environmental Quality			TOTAL	\$2,500.00		\$2,500.00
Checking	1	TCEQ				

SKA CONSULTING, LP
 1888 STEBBINS DRIVE, SUITE 100
 HOUSTON, TX 77043

COMERICA BANK
 www.comerica.com

32-75/1110
 492

020990

DATE

September 21, 2023

PAY

One Hundred Fifty and 00/100 Dollars

AMOUNT

TO THE
 ORDER
 OF

Texas Commission on Environmental Quality
 P.O. Box 13088
 MC 214
 Austin, TX 78711-3088

\$150.00


 AUTHORIZED SIGNATURE

Security features

MP

⑈020990⑈ ⑆111000753⑆ 1882034497⑈

SKA CONSULTING, LP

020990

Check Date: 9/21/2023

Invoice Number	Date	Voucher	Amount	Discounts	Previous Pay	Net Amount
6022-0001 Permi tMod	9/21/2023	0022546	\$150.00			\$150.00
Texas Commission on Environmental Quality			TOTAL			\$150.00
Checking	2	TCEQ				

SKA CONSULTING, LP

020990

Check Date: 9/21/2023

Invoice Number	Date	Voucher	Amount	Discounts	Previous Pay	Net Amount
6022-0001 Permi tMod	9/21/2023	0022546	\$150.00			\$150.00
Texas Commission on Environmental Quality			TOTAL			\$150.00
Checking	2	TCEQ				



Texas Commission on Environmental Quality

Public Involvement Plan Form for Permit and Registration Applications

The Public Involvement Plan is intended to provide applicants and the agency with information about how public outreach will be accomplished for certain types of applications in certain geographical areas of the state. It is intended to apply to new activities; major changes at existing plants, facilities, and processes; and to activities which are likely to have significant interest from the public. This preliminary screening is designed to identify applications that will benefit from an initial assessment of the need for enhanced public outreach.

All applicable sections of this form should be completed and submitted with the permit or registration application. For instructions on how to complete this form, see TCEQ-20960-inst.

Section 1. Preliminary Screening

New Permit or Registration Application

New Activity - modification, registration, amendment, facility, etc. (see instructions)

If neither of the above boxes are checked, completion of the form is not required and does not need to be submitted.

Section 2. Secondary Screening

Requires public notice,

Considered to have significant public interest, **and**

Located within any of the following geographical locations:

- Austin
- Dallas
- Fort Worth
- Houston
- San Antonio
- West Texas
- Texas Panhandle
- Along the Texas/Mexico Border
- Other geographical locations should be decided on a case-by-case basis

**If all the above boxes are not checked, a Public Involvement Plan is not necessary.
Stop after Section 2 and submit the form.**

Public Involvement Plan not applicable to this application. Provide **brief** explanation.

Section 5. Community and Demographic Information

Community information can be found using EPA's EJ Screen, U.S. Census Bureau information, or generally available demographic tools.

Information gathered in this section can assist with the determination of whether alternative language notice is necessary. Please provide the following information.

(City)

(County)

(Census Tract)

Please indicate which of these three is the level used for gathering the following information.

City

County

Census Tract

- (a) Percent of people over 25 years of age who at least graduated from high school

- (b) Per capita income for population near the specified location

- (c) Percent of minority population and percent of population by race within the specified location

- (d) Percent of Linguistically Isolated Households by language within the specified location

- (e) Languages commonly spoken in area by percentage

- (f) Community and/or Stakeholder Groups

- (g) Historic public interest or involvement

Section 6. Planned Public Outreach Activities

(a) Is this application subject to the public participation requirements of Title 30 Texas Administrative Code (30 TAC) Chapter 39?

Yes No

(b) If yes, do you intend at this time to provide public outreach other than what is required by rule?

Yes No

If Yes, please describe.

If you answered “yes” that this application is subject to 30 TAC Chapter 39, answering the remaining questions in Section 6 is not required.

(c) Will you provide notice of this application in alternative languages?

Yes No

Please refer to Section 5. If more than 5% of the population potentially affected by your application is Limited English Proficient, then you are required to provide notice in the alternative language.

If yes, how will you provide notice in alternative languages?

- Publish in alternative language newspaper
- Posted on Commissioner’s Integrated Database Website
- Mailed by TCEQ’s Office of the Chief Clerk
- Other (specify)

(d) Is there an opportunity for some type of public meeting, including after notice?

Yes No

(e) If a public meeting is held, will a translator be provided if requested?

Yes No

(f) Hard copies of the application will be available at the following (check all that apply):

- TCEQ Regional Office TCEQ Central Office
- Public Place (specify)

Section 7. Voluntary Submittal

For applicants voluntarily providing this Public Involvement Plan, who are not subject to formal public participation requirements.

Will you provide notice of this application, including notice in alternative languages?

Yes No

What types of notice will be provided?

- Publish in alternative language newspaper
- Posted on Commissioner’s Integrated Database Website
- Mailed by TCEQ’s Office of the Chief Clerk
- Other (specify)

APPENDIX 2
GEOTECHNICAL REPORT AND SOIL BORING LOGS



GEOTECHNICAL INVESTIGATION REPORT

Project Name:
Kirkwood Crossing
12000 Bissonnet Street
Houston, Texas

Prepared for:
Impact Residential Development, LLC
118 Vintage Park, Suite W406
Houston, TX 77070

Prepared by:
Goodheart & Associates PLLC
2021 Midwest Road, Suite 200
Oak Brook, IL 60523
Project No. 22-009.001

TEXAS REGISTERED ENGINEERING FIRM NO. F-21548

October 21, 2022

Gary F. Goodheart
10/21/2022
Lic Exp 12/31/2022





Geotechnical Investigation Report

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Geotechnical Investigation Report

1. INTRODUCTION

1.1 General

This report presents the results of our geotechnical investigation for the Kirkwood Crossing property located at 12000 Bissonnet Street in Houston, Harris County, Texas (Site). Kirkwood Crossing is a 12.085-acre parcel in southwest Houston currently owned by Bissonnet 136 LLC (Bissonnet 136). Figure 1 presents a Vicinity Map showing the general location of the Site. This report was prepared by Goodheart & Associates PLLC (Goodheart) for Impact Residential Development LLC (IRD) in accordance with our original proposal to IRD, dated April 25, 2022.

A Municipal Solid Waste (MSW) Type IV (construction and demolition debris) landfill occupies the entire Site. IRD is planning to acquire and redevelop the Site with a multi-family housing development project. IRD has retained SKA Consulting, L.P. (SKA) to assist with Texas Commission on Environmental Quality (TCEQ) permitting associated with redevelopment over a landfill. Kimley-Horn and Associates, Inc. (KH) will provide Site civil design services, and Rosemann & Associates, P.C. (Rosemann) will provide architectural and structural engineering services for the project.

Bissonnet 136 will provide roads, utilities, and other infrastructure necessary to access and redevelop the Site. Goodheart is familiar with the overall property and has provided geotechnical consulting services in support of Bissonnet 136 redevelopment efforts. SKA and KH have also supported Bissonnet 136 redevelopment efforts on the overall property, SKA with TCEQ permits and other related environmental matters and KH with master planning and Site civil design services.

1.2 Project Description

Planned Site improvements include five (5) multi-family residential structures, a community building (Clubhouse), surface parking, outdoor lighting, exterior amenities and green space. The multi-family residential structures will be 3-story, walk-up buildings that vary in size and footprint (see Table 1 for basic building information). Building widths will be approximately 100 feet and the length will vary depending on the size of the building and the number of units.



Geotechnical Investigation Report

TABLE 1: BUILDING INFORMATION

Building Number	Gross Size ¹ (SQ FT)	Number of Units ¹	Comments
1	25950	24	3-Story walk-up Residential
2	19560	18	3-Story walk-up Residential
3	25950	24	3-Story walk-up Residential
4	49380	48	3-Story walk-up Residential
5	23070	24	3-Story walk-up Residential
6	3250	--	1-Story Community Building

1 – Information provided by IRD

The residential buildings will be wood-frame construction with variably clad exterior walls (stone 45% and fiber cement 55%) resting on continuous slab-on-grade foundations. Exterior wall loads will range up to 4000 pounds per linear foot, and interior wall loads will range between 2000 and 3700 pounds per linear foot. The Community Building will be supported on a continuous slab-on-grade foundation, with interior wall loads ranging up to 1300 pounds per linear foot and exterior wall loads of approximately 700 pounds per linear foot.

1.3 Purpose and Scope of Services

The purpose of the geotechnical investigation program for this project was to:

- Evaluate the character and nature of the surficial fill, landfill cap, and underlying waste and potential for soft zones or voids beneath the proposed improvements;
- Develop conclusions regarding the need for ground improvement or deep foundations to support the proposed improvements;
- Provide recommended foundation types for support of the proposed structures;
- Develop design criteria for shallow foundations and slabs-on-grade;
- Develop the data necessary to estimate total and differential settlements for the proposed improvements; and
- Provide recommendations for earthwork and shallow foundation construction.

The proposed scope of services for this investigation was outlined in Goodheart’s April 25, 2022, proposal to IRD and included:

1. Developing a field exploration plan based on prior Site knowledge and the Preliminary Site Plan provided by IRD, obtaining a Subchapter T permit as well as a landfill modification permit from



Geotechnical Investigation Report

the Texas Commission on Environmental Quality (TCEQ), staking proposed boring locations in the field, making One Call notifications to clear borings of underground utilities, and selecting subcontractors for the field exploration program.

2. Drilling and sampling twelve (12) soil borings with truck-mounted hollow stem auger (HSA) equipment to depths ranging from 15 to 60 feet below existing surface grade, including three (3) borings to depths of approximately 60 feet below ground surface (bgs), three (3) borings to depths of approximately 55 feet bgs, two (2) borings to depths of approximately 12 feet bgs, and four (4) borings to depths of approximately 10 feet bgs. These borings were expected to encounter overburden soils, landfill waste, and in the six deeper borings, natural soils below the bottom of the landfill. (Note that the field exploration program had to be modified while in progress due to the presence of landfill gases and accessibility issues that were encountered.)
3. Conducting a geotechnical laboratory testing program on the subsurface materials encountered during the field exploration program.
4. Performing geotechnical engineering analyses as required to provide recommendations for design and construction of foundations and earthwork. The anticipated scope of the geotechnical report included:
 - Description of field exploration and laboratory testing methodology
 - Findings of field exploration and laboratory testing programs, including final boring logs and laboratory test data
 - Discussion and conclusions regarding the need for ground improvement or deep foundations to support the proposed improvements (see note below)
 - Shallow foundation design recommendations, including allowable bearing pressures and estimated total and differential settlements
 - Lateral earth pressure design criteria
 - Slab-on-grade design recommendations
 - Utility trench design and construction recommendations
 - Earthwork design and construction recommendations



Geotechnical Investigation Report

2. BACKGROUND INFORMATION

Background information provided in this geotechnical report was summarized using available geotechnical data and Site information developed for the:

- Preliminary Geotechnical Engineering Report, prepared by Civil & Environmental Consultants, Inc., dated August 29, 2006 (CEC report);
- Phase II Environmental Site Assessment Report, Doty Sand Pit Venture Landfill and Olshan Landfill, 12000 Bissonnet, Houston, Harris County, Texas, prepared by SKA Consulting, L.P., dated July 29, 2019 (SKA report); and
- Supplemental Geotechnical Report, prepared by Goodheart & Associates, PLLC, dated February 19, 2020 (Supplemental Report).

The overall Bissonnet 136 property is approximately 136.8 acres in size and is located at 12000 Bissonnet Street on the north side of Bissonnet Street between Kirkwood Road on the east and Cook Road on the west. Two closed Municipal Solid Waste (MSW) Type IV (construction and demolition debris) landfills are located on the Bissonnet 136 property: the Doty Sand Pit Venture (DSPV) Landfill and Olshan Landfill. The DSPV Landfill covers approximately 118.8 acres and includes the IRD Site.

From the 1950's into the 1970's, the DSPV portion of the Site was operated as a sand mine. As sand reserves were depleted, open areas of the DSPV property were landfilled with construction and demolition waste. The DSPV Landfill received waste from about 1960 to 1999 and was permitted to receive construction and demolition waste in May 1970 under Harris County License No. 1. After the Texas Department of Health (TDH) assumed regulatory authority, the DSPV Landfill received an operating permit in May 1981 as a Type IV Landfill (MSW No. 1247). The facility was operational until August 1999. According to TCEQ records, the DSPV Landfill was then closed and capped with a three-foot thick compacted clay layer. The DSPV Landfill was certified closed in January 2001 and has been in post-closure care since that time. MSW Permit No. 1247 is still active with the TCEQ (successor agency to the TDH) pending permit revocation. The MSW 1247 permittee is Northwest Metro Holdings, CS 34, LLC (Northwest Metro), a related entity to Bissonnet 136.



Geotechnical Investigation Report

A landfill gas management and monitoring network (gas vents and gas monitoring probes) was installed around the perimeter of both landfills by others in 2006. This network is currently monitored by SKA for Northwest Metro.

Following DSPV Landfill closure in 2000, some 2 million cubic yards of fill (also referred to in this report as surficial fill) was reportedly brought to the Site to create The Sugar Hills Golf Course on top of both landfills. The depth of surficial fill ranges from 0 to as much as 13.5 feet. The Sugar Hills Golf Course operated on top of the landfills from approximately 2000 to 2005, but was closed and abandoned. This report includes further discussion about the extent and effects of the surficial fill on the Site.



Geotechnical Investigation Report

3. SUBSURFACE EXPLORATION

Field exploration and laboratory testing activities were conducted at the Site to further investigate the surficial fill/landfill cap materials, waste matrix and the depth and character of native soils beneath the Site, and to develop geotechnical data to support recommendations for design and construction of foundations and earthwork.

3.1 Field Exploration Program

Field exploration activities were conducted at the Site during the period July 28 through September 6, 2022. The field exploration program included drilling a total of fifteen (15) soil borings (see Figure 2 - Boring Location Plan, and Table 2 – Summary of Field Exploration Program). Twelve boring locations were pre-determined based on the preliminary layout of the planned improvements developed by Rosemann. Three (3) additional borings were drilled as offsets in relatively close proximity to original boring locations. The pre-determined boring locations were surveyed in the field and ground surface elevations were obtained for those locations prior to the start of drilling. One Call notifications were also made to clear boring locations prior to the start of drilling.

Twelve (12) borings were drilled using a CME 75 truck-mounted drill rig and three (3) borings were drilled using a CME 55 track-mounted drill rig. The borings ranged in depth from 6 feet below ground surface (bgs) to 75 feet bgs. Hollow stem augers (HSAs) were used to advance the borings to their terminal depths using standard methods (ASTM D-6151). Disturbed and undisturbed soil samples were typically obtained at 2½-foot intervals through the surficial fill and landfill cap materials. Sampling was then expanded to 5-foot intervals through the waste and into the underlying native soils (i.e., to the terminal depths of the borings). Twelve (12) soil borings were drilled by Tolunay-Wong Engineers, Inc. (TWE), and three (3) soil borings were drilled by Envirotech Drilling Services (EDS), both under subcontract to Goodheart. Soils encountered in the borings were classified in accordance with the Unified Soil Classification System (USCS) shown on Figure A1 in Appendix A. The Logs of Borings for this investigation are presented in Appendix A.

Disturbed samples were collected in general accordance with ASTM D-1586. A standard split barrel sampler (2.00-inch O.D. by 1.375-inch I.D.) was driven a total of 18 inches with an automatic 140-pound



Geotechnical Investigation Report

hammer falling from a vertical height of 30 inches. The number of blows required to drive the split spoon sampler every 6 inches was recorded, and the number of blows required to drive the sampler the last 12 inches is typically designated as the SPT N-Value. Representative portions of the disturbed samples were placed in plastic bags, labelled and sealed, and transported to the geotechnical testing laboratory for further inspection and possible laboratory testing.

Undisturbed samples were obtained by hydraulically pushing a 3.0-inch diameter by 24-inch long thin-wall Shelby tube in general accordance with ASTM D-1587. Undisturbed samples were obtained in cohesive materials encountered at various locations and depths, as indicated on the boring logs. The thin-wall tubes were field extruded and intact specimens were wrapped in protective foil, placed in rigid plastic tubes and transported to the geotechnical testing laboratory for further inspection and possible laboratory testing. Pocket penetrometer tests were performed on cohesive materials in the field to obtain consistency measurements on the undisturbed samples.

The field exploration program was overseen by an experienced TWE geotechnical technician, who documented the field exploration program, logged the borings, collected representative disturbed and undisturbed samples, maintained communication with the senior project geotechnical engineer, and provided direction to the drillers.

Drill cuttings from the borings were collected and segregated where possible. Soil and waste materials were placed on plastic sheeting so that they could be sampled and analyzed for possible contaminants. Non-impacted soils were spread on the ground surface in the vicinity of the borings, and impacted soils and waste materials were to be managed for off-site disposal.

Groundwater levels were observed as the borings progressed; when groundwater was detected, drilling was halted so that groundwater levels could be observed and measured. Groundwater was encountered in only three borings; the remainder were dry at the time of drilling. Upon completion, the borings were filled with cement-bentonite grout from the bottom to the top.



Geotechnical Investigation Report

Field drilling operations were monitored with a four-gas meter to check for possible explosive or dangerous gases (CH₄, O₂, H₂S and CO). The presence of landfill gases at high concentrations resulted in termination of borings B22-1A, B22-4, B22-5A, B22-6A, and B22-8 before reaching planned depth and modifications to the planned drilling program, including mobilization of a track-mounted HSA drill rig with rotary wash capabilities to complete the field exploration program.

TABLE 2: SUMMARY OF FIELD EXPLORATION PROGRAM

Boring Number	Existing Top Elevation	Thickness of Surficial Fill and Landfill Cap (ft)	Thickness of CCDD Waste Material (ft)	Total Depth of Boring (ft)	Bottom Elevation of Waste	Groundwater Elevation
B22-1A ¹	103.45	2.0	--	3.0	--	Not Encountered
B22-1B	103.45	2.5	68.5	75.0	32.45	Not Encountered
B22-2	104.94	4.0	50.0	55.0	50.94	20.0
B22-3	99.09	8.5	50.0	60.0	40.59	10.5
B22-4 ¹	107.4	6.0	--	10.0	--	Not Encountered
B22-5A ¹	103.37	12.0+	--	12.0	--	Not Encountered
B22-5B	103.4	13.5	45.0	65.0	44.9	Not Encountered
B22-6A ¹	102.08	13.5	--	15.0	--	Not Encountered
B22-6B	102.01	13.0	45.5	60.0	43.21	Not Encountered
B22-7	104.0	4.5	--	10.0	--	Not Encountered
B22-8 ¹	105.46	4.0	--	20.0	--	Not Encountered
B22-9	105.59	10.0+	--	10.0	--	Not Encountered
B22-10	102.82	10.0+	--	10.0	--	Not Encountered
B22-11	98.18	6.5	--	12.0	--	10.0
B22-12	101.09	2.5	--	10.0	--	Not Encountered

1 – Elevated landfill gases encountered in boring during drilling



Geotechnical Investigation Report

3.2 Laboratory Testing

Select samples from the borings were tested to verify field soil classifications and to determine pertinent geotechnical engineering properties of the various materials encountered during the field exploration program. The laboratory testing program included:

- Natural moisture content
- Density and Unit Weight
- Atterberg limits
- Unconfined compression tests on soil
- One-dimensional consolidation tests

Based on geotechnical laboratory testing performed for this investigation, unconfined compressive strength (q_u) of the landfill cap material ranged between 3.0 and about 12+ kips per square foot (ksf), with a weighted average of about 8.0 ksf. Soil density ranged from 103 to 119 pounds per cubic foot (pcf). Soil moisture content for the surficial fill/landfill cap material ranged from 10.3 to 37.8 percent.

Soil classification and strength test results are summarized on Tables 3 and 4 and are presented on the individual boring logs. The results of all tests, including the one-dimensional consolidation tests, are included in Appendix B. Geotechnical laboratory tests were performed in accordance with current test standards as determined by ASTM. Laboratory testing was performed by TWE under subcontract to Goodheart.

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TABLE 3: NATURAL MOISTURE CONTECT AND ATTERBERG LIMITS

Boring No.	Depth (ft)	Natural Moisture Content (%)	Dry Density (pcf)	LL	PL	PI	Comments
B22-2	4.0-6.0	14.8	86.4	NV	NP	NP	Fill/Cap (NP)
B22-2	53.5-55.0	30.3	-	-	-	-	Native (SM)
B22-3	2.0-4.0	13.6	118.9	49	19	30	Fill/Cap (CL-CH)
B22-3	6.0-8.0	22.1	103.2	52	20	32	Fill/Cap (CH)
B22-3	10.5-12.0	37.8	-	48	20	28	Fill/Cap (CL-CH)
B22-3	18.5-20.0	54.5	-	83	30	53	Waste (CH)
B22-4	2.5-4.0	11.1	-	-	-	-	Fill/Cap (SM)
B22-4	4.0-6.0	13.0	117.7	44	17	27	Fill/Cap (CL)
B22-5A	4.0-6.0	18.7	105.2	53	18	35	Fill/Cap (CH)
B22-5A	8.0-10.0	20.8	106.2	53	19	34	Fill/Cap (CH)
B22-6A	2.5-4.0	14.2	-	-	-	-	Fill/Cap (CL)
B22-6A	4.5-6.0	15.7	-	49	19	30	Fill/Cap (CH)
B22-6A	6.5-8.0	27.0	-	65	23	42	Fill/Cap (CH)
B22-6A	8.5-10.0	22.5	-	47	20	27	Fill/Cap (CL)
B22-6B	2.5-4.0	12.7	--	48	18	30	Fill/Cap (CL)
B22-6B	6.5-8.0	17.7	--	51	19	32	Fill/Cap (CH)
B22-6B	58.5-60.0	26.4	--	71	19	52	Native (CH)
B22-7	2.5-4.0	11.8	-	39	18	21	Fill/Cap (CL)
B22-8	2.5-4.0	10.5	-	31	15	16	Fill/Cap (CL)
B22-8	4.0-6.0	-	-	NV	NP	NP	Waste (NP)
B22-9	2.5-4.0	24.6	-	73	27	46	Fill/Cap (CH)
B22-9	8.5-10.0	18.1	-	-	-	-	Fill/Cap (CH)
B22-10	2.0-4.0	10.3	111.9	33	17	16	Fill/Cap (CL)
B22-11	2.5-4.0	13.2	-	38	17	21	Fill/Cap (CL)
B22-11	6.5-8.0	17.4	-	59	21	38	Waste (CH)
B22-11	8.0-10.0	22.8	-	56	22	34	Waste (CH)
B22-11	10.5-12.0	36.6	-	-	-	-	Waste (CH)
B22-12	2.5-4.0	11.6	-	-	-	-	Fill/Cap (CL)
B22-12	4.0-6.0	-	-	NV	NP	NP	Waste (NP)
B22-12	8.5-10.0	29.5	-	-	-	-	Fill/Cap (CH)

Notes: NP – Non plastic
 CL – Low plasticity clay
 CH – High plasticity clay
 SM – Silty Sand



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TABLE 4: U-U TEST RESULTS

Boring No.	Depth (ft)	Soil Description	Test Type	Unconfined- Unconsolidated Compressive Strength (tsf)	Failure Strain (%)	Confining Pressure (psi)
B22-2	4.0-6.0	Dark Gray Tree Bark	U-U	17.1	15.0	4.0
B22-3	2.0-4.0	Gray Lean Clay (CL)	U-U	6.82	5.8	1.9
B22-3	6.0-8.0	Red-Brown Fat Clay (CH)	U-U	1.48	4.4	6.5
B22-4	4.0-6.0	Gray Lean Clay (CL)	U-U	5.87	10.3	4.0
B22-5A	4.0-6.0	Gray Fat Clay (CH)	U-U	2.95	3.24	4.0
B22-5A	8.0-10.0	Gray Fat Clay (CH)	U-U	1.83	14.8	7.5
B22-10	2.0-4.0	Gray Lean Clay (CL)	U-U	6.42	3.1	2.5



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4. SITE CONDITIONS

4.1 Local Geology

The Site is located within the Coastal Plain physiographic province. The surficial native soils in the Site area are Quaternary deposits formed during periods of high standing sea level and are part of the Beaumont Formation of Pleistocene age. In the subsurface, the Beaumont Formation is undifferentiated from the underlying Lissie Formation. Figure 3 provides a Geological Map of the State of Texas and indicates the presence of Beaumont Formation soils at the Site.

Beaumont Formation soils often consist of reddish orange or dark brown to brownish dark gray clays, with very fine to fine quartz sand, silt, and minor fine gravel, intermixed and interbedded. The Beaumont formation includes poorly defined meander-belt ridges and pimple mounds aligned approximately normal to the coast, and marine delta-front sand, lagoonal clay, and near-shore marine sand deposits. Beaumont clays typically exhibit a high Plasticity Index (PI) and are subject to significant shrinking and swelling with changes in moisture content.

The Houston area, and the Gulf Coast in general, is laced by numerous growth faults which are geological hazards that are known to impact and damage house slabs, building-support structures, highways and associated foundations. Figure 4 shows a group of east-northeast-trending geologic features and faults¹, some of which have displaced the land surface in western Houston.

The geologic feature nearest the Site is the Renn Scarp², located approximately 1½ miles northwest of the Site. The Renn Scarp was originally categorized as a fault; however, subsequent drilling has confirmed that the scarp is actually the cutbank of an ancient stream channel. The Renn Scarp has been masked by recent urban development. The closest known growth fault relative to the Site is the Clodine Fault, which is located approximately 3 miles northwest of the Site. Given the location and orientation of the Clodine Fault, it is not a concern, and growth faults will not impact Site development.

1 - *Principal Active Faults in Harris County, Texas*, US Geological Survey and Harris County Coastal Subsidence District (20024)

2 - *Clodine Fault, Southwestern Houston Metropolitan Area, Texas* by E. R. Verbeek, U.S. Geological Survey, and U. S. Clanton, National Aeronautics and Space Administration (1979)



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4.2 Surface Conditions

The Site is located in a mixed commercial and residential area on the west side of Houston and is north of Bissonnet Street between Kirkwood Road on the east and Cook Road on the west. The primary entrance to the Site is currently off Bissonnet Street on the south side, where the former Sugar Hill Golf Course Club House, maintenance facilities and parking areas for the Golf Course were located.

Site surface topography is characterized by undulating terrain which was created when the golf course was graded. Ground surface elevations range between approximately 98 and 106 feet above mean sea level (MSL). The high point is located in the north central portion of the Site, and surface elevations fall off toward the southern portion of the Site. There are no ponds or standing water on the Site.

The Site is heavily overgrown with various grasses, thick brush, and scrub trees up to several inches in diameter. Paved and unpaved golf cart paths traverse the Site, although these are difficult to find and follow in many areas because of the overgrowth. The overgrowth also masks the former fairways, making the fairways difficult to identify in some areas. There is some evidence of minor erosion and raveling across the surface of the landfill, but no major erosional gullies, sinkholes or large depressions have been observed.

4.3 Subsurface Conditions

Soil borings drilled during this investigation were used to characterize subsurface conditions at the Site. Subsurface materials encountered were compared with boring logs from prior investigations to check for consistency and to expand the available geotechnical data base.

4.3.1 Surficial Soils and Landfill Cap

Boring logs from this and prior investigations indicate the landfill cap typically consists of 2½ to 3 feet of medium stiff to hard, lean and fat clays (USCS Classification of CL and CH). The landfill cap is also assumed to extend across the entire Site. Surficial soils on the Site range from 0 to as much as 10½ feet in thickness above the landfill cap. The surficial soils, defined in this report as the material above the 3-foot-thick landfill cap, are mostly medium-stiff lean and fat clays (CL and CH). From a review of prior



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reports, it is unlikely the surficial soils were compacted, so for purposes of this report, the surficial soils are assumed to be an uncontrolled fill.

4.3.2 Landfill Waste Material

Most borings drilled for this investigation and prior investigations extended into the top of the waste. Five borings drilled for this investigation and a prior CEC boring drilled on the Site extended through the waste into the underlying native soils. The thickness of the waste encountered in our borings varied from 45.0 to 68.5 feet across the Site, as indicated in Table 2.

The boring logs suggest that the waste material consists of a matrix of soil and construction debris. Soils in the waste matrix included low and high plasticity clays and non-plastic material (sands, gravel and silty sands). Waste materials encountered in the borings included: paving materials, such as concrete and asphalt fragments; landscape debris; carpeting; wood products, such as construction lumber, particle board, and shredded wood; and plastic bags and miscellaneous construction and demolition debris.

Field observations during drilling indicate the waste material was typically comprised of at least 50% soil, with the majority of the remainder being miscellaneous non-degradable material. From a review of the boring logs in this and prior reports, it is unlikely the waste material was compacted, so for purposes of this report, the waste material are also assumed to be an uncontrolled fill.

4.3.3 Native Soils

The native soils underlying the waste were encountered at depths ranging from 54 to 71 feet bgs (approximately 51 to 32.5 feet MSL). Sand (SM) was encountered in Boring B22-2 at a depth of approximately 54 feet bgs (50 feet MSL). Stiff to very stiff high plasticity clays (CH materials) were encountered in all other borings that extended into the underlying native soils.

4.3.4 Groundwater Levels

Groundwater levels across the Site are variable. Approximate groundwater levels were determined during drilling by noting the depth of free water on the sampling tools and/or by noting the presence of free water in the soil samples. Groundwater levels were noted in Borings B22-2, B22-3 and B22-11 at



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depths ranging from 10 to 20 feet bgs (approximate groundwater elevations from 85 to 90 feet MSL). All other borings were noted as dry to the depths explored. It was noted that moisture content in the surficial fill/landfill cap material tended to increase with depth.

Groundwater level data is also available from the monitoring wells around the perimeter of the larger Bissonnet 136 Site. The upper groundwater-bearing unit is slightly confined with static water levels ranging from 8 to 10 feet below ground surface (approximate groundwater elevations from 67 to 72 feet MSL).



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5. DISCUSSION

The following discussion is based on the overall body of geotechnical information and data developed at the Bissonnet 136 Site, including the findings of this geotechnical investigation, and Goodheart's understanding of the planned Site improvements.

5.1 Interpretation of Field Data

Because it is extremely difficult to obtain and test waste materials, such as those encountered at the Site, we tested the subsurface materials in-place while sampling using the Standard Penetration Test (SPT). The SPT is a simple, cost-effective field-testing procedure widely used in geotechnical engineering to evaluate subsurface materials. Empirical values of the angle of internal friction (Φ), relative density (D_r), and unit weight (γ) of granular soils, and ultimate shear strength (q_u) and consistency of cohesive soils, have been correlated with SPT N-values and published for many years. SPT N-values were compared with shear strength test data from the Site soils (i.e., surficial fill, landfill cap and native soils) to assist in interpretation of subsurface conditions. Due to the relatively small number of undisturbed samples of surficial fill and landfill cap material, and the complete lack of shear strength data from the waste material, much of this investigation depends on interpretation of SPT N-values.

SPT N-values obtained during the field exploration program were plotted versus depth to evaluate the strength of the surficial soils, landfill cap and waste materials (see scatter plot diagram in Figure 5). The data indicates the relative shear strength of the surficial fill and landfill cap material typically ranges from "stiff to very stiff" with an ultimate shear strength ranging between 3.0 and 6.0 ksf. Approximately 15% of the recorded N-values from SPT's taken in the surficial fill and landfill cap material were of medium consistency indicating the presence of some random softer zones of material. SPT N-values in the surficial fill and landfill cap material correlate well with published data and with the limited shear strength data from U-U tests performed for this investigation.

Previous data (CEC report) suggests as much as 80% of the waste material at the Site could be non-degradable, and visual observations of the waste material sampled during this investigation generally seem to bear that out. The waste has been in place for 30 to 40+ years, and for much of that time has been covered with surficial fill and landfill cap material ranging between 2.5 and over 13.5 feet thick.



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Although there is little or no published data to correlate N-values with shear strength of the waste material, the data was qualitatively evaluated to determine whether the waste is suitable as bearing material for the anticipated loads.

Average N-values recorded in the waste material during this investigation ranged from 10 to more than 30 blows per foot. Approximately three-fourths of the recorded N-values from SPT's taken in the waste material were greater than 15 blows per foot while the remaining one-quarter of the recorded N-values ranged between 7 and 15 blows per foot. SPT N-values seem to trend slightly higher with depth, and no apparent voids, extremely soft material, or extensive zones of soft material were encountered in the waste.

From a geotechnical engineering standpoint, and taken as a whole, the data suggests that waste at the Site has substantially settled under its own weight and the surcharge of the surficial fill and landfill cap material. From a bearing standpoint, the waste can support the anticipated foundation loads; however, as much as a quarter of the waste could contain zones of softer material that would be subject to some degree of total and differential settlement, as evidenced by the N-values below 15. This evaluation was performed using the best available information and limited techniques, coupled with geotechnical engineering experience and judgement.

5.2 Foundation Support

5.2.1 Shallow Foundations

Subsurface conditions encountered at the Site vary due to the:

- Character and thickness of the surficial fill and landfill cap material;
- Character and thickness of waste material; and
- Nature and depth of the underlying native soils.

Planned improvements at the Site can be supported on shallow foundations and/or slabs-on-grade provided the recommendations presented herein are followed regarding site preparation, filling and grading, and implementation of ground improvement methods to provide more uniform support and control settlement behavior.



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Significant filling and grading will be required to establish minimum thicknesses of surficial fill and to prevent penetration of the landfill cap. Ground improvement coupled with properly compacted fill will provide good bearing support for conventional foundations. Ground improvement methods considered for the Site are discussed in Section 5.2.3; further design efforts and consultation with specialty contractor(s) are required to develop final recommendations. Recommendations for Site preparation, filling and grading, and foundation design are presented in Section 6.0.

5.2.2 Deep Foundations

The field exploration data, and specifically the SPT data, indicate the likely presence of softer zones of fill and waste material that could result in excessive total and differential settlement; however, there is no evidence to-date that indicates these zones are widespread or excessively thick. Deep foundations will provide excellent bearing and will mitigate the obvious concerns regarding total and differential settlement; however, deep foundations are likely cost-prohibitive for development of the planned improvements, and as noted above, ground improvement coupled with properly compacted fill will provide good bearing support for conventional foundations.

Deep foundations were deemed unnecessary for foundation support of the planned improvements at the Site, and no further evaluation of deep foundations was performed or considered.

5.2.3 Ground Improvement

Geotechnical analysis using the field exploration and laboratory test data indicate lightly loaded shallow foundations and/or slabs-on-grade can be designed for allowable bearing capacities of up to 4.0 ksf. The primary concern, however, is that the Site is essentially a very large uncontrolled fill with combined surficial fill, landfill cap and waste depths of more than 50 feet. It is likely that undetected zones or pockets of soft material exist in the shallow subsurface as well as at depth. Ground improvement is recommended to control settlement and provide a compact, uniform, and consistent subgrade for foundation and slab-on-grade construction.

Ground improvement methods are used at sites with poor or variable subsurface conditions to bridge any soft zones and mitigate the possible damaging effects of total and differential settlements. A



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qualitative evaluation of possible ground improvement methods was performed for the Kirkwood Crossing Site. These ground improvement methods should be further evaluated by the Project Team to determine the optimum method with regard to overall effectiveness, cost and schedule impact:

- Proof-rolling – Proof-rolling with a heavy sheepsfoot roller can be used to compact and tighten the surficial fill and landfill cap materials, thus providing a good working surface for construction of foundations, slabs and pavements. However, proof-rolling will have limited depth of penetration in the mostly clay materials that comprise the surficial fill and landfill cap materials (generally less than 5 feet of total penetration). More importantly, it is very unlikely that heavy proof-rolling would have any effect on the underlying waste, and any soft zones that remain could reflect to the surface and have detrimental effects on foundation performance. Proof-rolling should be performed, but only in conjunction with another ground improvement method that would extend into and compact the waste.
- Pre-Loading or Surcharging – Surcharging can be used to pre-load the surficial fill/landfill cap and waste materials, thus inducing settlement to occur before foundation construction begins. When surcharging is used, the foundation area(s) are typically pre-loaded with excess fill to an amount equal to or greater than the foundation loads. The surcharge is allowed to sit and is monitored until the anticipated settlements have occurred. This method can be cost-effective if: (1) there is readily available fill, and (2) there is sufficient time in the project schedule. However, the overall Bissonnet 136 Site currently has a shortage of fill. To import additional fill would require TCEQ approval, and the time required to implement the process likely precludes surcharging as a viable option for this project.
- Rammed Aggregate Piers – Rammed aggregate piers (RAP™ systems or Geopiers®) create a densified column of aggregate surrounded by a stiffened matrix of soil and waste. Geopiers can be used in many different soil types and applications and would likely be an effective ground improvement solution at Kirkwood Crossing. Goodheart recommends IRD and the Project Team conduct further evaluation of RAP™ to provide settlement control for support of spread footings and slabs-on-grade at the Site, including discussions with specialized subcontractors, and cost and schedule analyses.
- Deep Dynamic Compaction – Dynamic deep compaction (DDC) involves dropping a heavy weight (up to 30 tons falling from as high as 80 to 100 feet) in a grid pattern on the ground surface to compact soils and other soft materials to depths as great as 40 to 50 feet bgs. DDC can be used to reduce foundation settlements and permit construction on soft native soils as well as uncontrolled fills, such as landfills, and would likely be an effective ground improvement solution at Kirkwood Crossing. Goodheart recommends IRD and the Project Team conduct further evaluation of DDC to provide settlement control for support of spread footings and slabs-on-grade at the Site, including discussions with specialized subcontractors, and cost and schedule analyses.



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- Wick Drains – Wick drains are used to remove pore water from soft compressible soil and other subsurface matrices so the soils consolidate faster. Wick drains consist of a flexible core with grooves (that allow water to flow unimpeded) wrapped in geotextile filter fabric. Wick drains are typically installed to design depth in a pattern using a hollow mandrel mounted on an excavator or crane mast, and are usually tied to a sand blanket to capture and remove pore water. While wick drains can be effective in accelerating settlement of saturated subsurface materials, the subsurface materials at the Site are variable and do not appear to contain a lot of water (i.e., their effectiveness would be limited at best). Other considerations regarding the use of wick drains include: (1) the installation process will likely require a special TCEQ permit; (2) the leachate that emanates from the waste will likely have to be captured, treated and properly disposed off-site; and (3) the time required to permit and implement the process likely precludes wick drains as a viable ground improvement option.
- Combination of Methods – Two or more of the foregoing options can also be used together to address potential settlement concerns and accelerate the construction process. For example, heavy proof-rolling can be used in conjunction with either RAP™ or DDC. Also, wick drains are frequently used in conjunction with DDC; however, as noted above, there are several major concerns with the use of wick drains.

5.3 Estimated Settlements

Based on existing conditions at the Site and the planned improvements, total settlements in the surficial fill and landfill cap materials are estimated to be on the order of ½- to 1-inch. Differential settlements in the surficial fill and landfill cap materials are anticipated to be about half the estimated total settlement.

Our qualitative evaluation of total and differential settlements in the waste material indicates shallow foundations and slabs-on-grade should be designed for at least 2- to 4-inches of total and differential settlement, increasing the combined total settlements in the uncontrolled fill at the Site (i.e., surficial fill, landfill cap and waste materials) to as much as 4 to 5 inches. Due to the nature and thickness of the uncontrolled fill, it is likely that differential settlements could also range between 3 and 5 inches.

Ground improvement methods coupled with properly compacted fill will provide good bearing support for slab-on-grade construction and conventional foundations, and should substantially mitigate settlement concerns. In general, implementation of appropriate ground improvement methods should limit total foundation settlements to approximately 1-inch and differential settlements should be on the order of ½-inch.



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5.4 Environmental Considerations

The Site is underlain by 45 to 68+ feet of construction and demolition debris (waste) intermixed with soil. The waste materials include landscape debris, wood products and other degradable materials. Decomposition of the degradable waste generates landfill gases, such as methane and hydrogen sulfide (H₂S), which in elevated concentrations, can be explosive or toxic, respectively. Screening for methane gas and other contaminants while drilling identified the presence of methane gas and other unusual odors emanating from the boreholes.

SKA has been retained by both Bissonnet 136 and IRD to assist with regulatory compliance, landfill post-closure care and permit issues at the Site. SKA is currently maintaining both the groundwater monitoring well network and the landfill gas management and monitoring network (gas vents and gas monitoring probes) around the perimeter of the Bissonnet 136 property. SKA is also working with TCEQ on behalf of Bissonnet 136 to revoke MSW Permit No. 1247 so that the Site can complete the post-closure care process.

Development over closed landfills is regulated by TCEQ under 30 Texas Administrative Code (TAC) Chapter 330, Subchapter T. One purpose of the Subchapter T rules and regulations is to ensure that potentially explosive gases are appropriately monitored and/or abated to protect occupants in these buildings. The Subchapter T rules also regulate practices which could contribute landfill leachate. Subchapter T rules apply to all developments over closed landfills except for single-family or double family homes which are not part of a residential subdivision. A Subchapter T permit from TCEQ will be required for Site development.

Preliminary discussions with TCEQ have determined that ground improvement activities can be performed under the Subchapter T permit provided the landfill cap is maintained and meets the minimum requirements when ground improvement is completed. TCEQ will also require a landfill gas venting system with monitoring beneath all enclosed structures on the Site.



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6. CONCLUSIONS AND RECOMMENDATIONS

This section provides geotechnical conclusions and recommendations for design and construction of the planned Site improvements. The conclusions and recommendations presented herein are based on the geotechnical data developed during this investigation and qualitative analyses and evaluation of the overall geotechnical data base for the Site.

6.1 Earthwork, Mass Grading and General Site Development

General Guidelines. Before construction of the proposed residential development and associated amenities can begin, ground improvement and/or mass grading operations will be necessary to establish roadways, building pads and drainage patterns. Earthwork operations should be designed and conducted so as not to penetrate or disturb any portion of the landfill cap that covers the entire Site footprint. In addition, the total thickness of surficial fill and landfill cap should be at least 8.0 feet thick to allow for foundation and underground utility construction without penetrating or disturbing the landfill cap. This would allow 1 to 2 feet as a buffer zone above the landfill cap in most areas and for elevation variances across the Site.

TCEQ requires that the landfill cap for Type IV (MSW) landfills consist of at least 18 inches of compacted clay (SC or CL) plus 6 inches of topsoil (per 30 TAC 330.453(a)). If the landfill cap is penetrated during mass grading, ground improvement activities, foundation or infrastructure construction, it should be repaired or reconstructed as soon as possible. Landfill cap repairs should be accomplished using clay (SC or CL) compacted in accordance with structural or general fill requirements, depending on where the repairs take place. If waste must be removed to facilitate construction, the waste shall be segregated from the overlying soils, stored on plastic sheeting and covered with plastic sheeting, until disposed off-site. The reburial of waste on Site is not generally permitted by TCEQ once the landfill is in post-closure care.

The surficial soils range from 0 to 10.0+ feet in thickness above the landfill cap. In general, Site elevations are higher across the northern portion of the Site than they are across the southern portion of the Site, whereas the thickness of the surficial fill and landfill cap material is considerably thicker



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across the southern portion of the Site than it is across the northern portion. Therefore, the northern portion of the Site will need to be built up as much as 6 feet above existing grade in order to meet the 8.0-foot thickness requirement. To accommodate the overall Site slope, Goodheart recommends creating a terraced Site with surface grades adjacent to structures in the northern portion of the Site at least 10 to 12 feet higher in elevation than the surface grades adjacent to structures in the southern portion of the Site.

As noted elsewhere in this report, each floor slab should be continuous and maintained on one elevation. Because of the relatively abrupt changes in grade of ground surface elevations to meet the minimum fill requirements over waste, Goodheart anticipates floor slab elevations in adjacent buildings could differ by as much as 10 feet. Grading plans should consider the use of retaining structures to facilitate these abrupt grade changes. Grading plans should also consider switching Building 3 or Building 5 with the Community Building/Club House and adjacent exterior amenities to aid in balancing cut and fill.

Clearing and Grubbing. Due to the extensive amount of dense vegetation at the Site, including high grasses and weeds, thick brush, and widespread scrub trees up to several inches in diameter, clearing and grubbing will be a major consideration for Site development. All brush and trees located above the landfill cap, regardless of size, should be cut and properly disposed in accordance with local regulations. Tree trunks/stumps larger than 4 inches in diameter should be grubbed, and roots larger than 1 inch in diameter should be removed. The ground surface in areas where fill and/or structures will be constructed should be inspected by a qualified geotechnical engineer following initial clearing to check for evidence of sinkholes or erosional features that were not previously evident due to heavy vegetation.

At least the upper 6 inches of surface grass and vegetation should be stripped and properly disposed in accordance with local regulations; additional stripping could be required in some areas, depending on how far the root mass penetrates below the ground surface and as identified by a qualified geotechnical engineer during construction. The upper 6-12 inches of topsoil, immediately underlying surface grass



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and vegetation, should be stripped and stockpiled on Site or properly removed and disposed in accordance with local regulations.

Ground Improvement. Ground improvement activities should be performed in areas where total and differential settlement will have a detrimental effect on the planned improvements. Ground improvement methods should be designed and constructed by specialty contractors, in conjunction with geotechnical and structural design criteria. Ground improvement activities, such as DDC, should generally be performed in areas that contain just the landfill cap (i.e., before significant fill is placed over landfill cap material and after excess surficial fill is removed from the thicker areas) in order to maximize the kinetic energy imparted to the waste and effect pre-construction settlement. Ground improvement activities should be an integral part of the construction sequence.

Proof-compaction and Subgrade Preparation. After stripping, the exposed subgrade material will consist primarily of lean and/or fat clay fill. The exposed subgrade material is generally suitable for structural fill or general fill anywhere on the Site, as determined by a qualified geotechnical engineer. The exposed subgrade materials can also be left in place and used for support of buildings, foundations, roadways, parking lots, or as subgrade for placement of additional fill to bring the area up to finished subgrade elevation. Proof-compaction and subgrade preparation will generally take place after ground improvement activities have been completed.

Exposed subgrade materials that will be left in place should be proof-rolled with at least four passes of a Caterpillar 825K Wedgefoot Soil Compactor (or equivalent) to locate zones of loose and/or unstable soils. Proof-rolling operations should be witnessed by a qualified geotechnical engineer to determine whether soft, loose, or saturated soil and/or detrimental material such as debris and/or degradable materials are present. Zones that exhibit instability during proof-rolling, such as excess rutting or pumping in excess of 1-inch, should be disked, reconditioned, and compacted or removed and replaced with approved fill, as directed by a qualified geotechnical engineer.

If unsuitable soils or other detrimental materials are encountered, the unsuitable material should be removed full depth and replaced with properly compacted fill. Actual depth and volume of undercut



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should be determined at the time of construction based on observations of a qualified geotechnical engineer. Excavated material should be replaced with properly compacted structural fill, as defined in this report.

Structural and General Fill Material. Due to the uneven terrain, construction activities will include a cut and fill grading operation to achieve final grades. Cut areas should not reduce surficial fill and landfill cap thickness to less than 8-feet without the approval of a qualified geotechnical engineer and/or civil design engineer. Compacted structural fill should be used beneath structures and pavements, and either general or structural fill can be used in open areas. Structural fill should generally extend from the bottom of slabs-on-grade (or foundations) down to the top of waste and at least 5 feet outside building footprints. A qualified geotechnical engineer can assist in determining the most efficient means of compaction.

Structural fill used for mass grading and Site earthwork should meet the following minimum requirements:

1. Imported structural fill may consist of locally available lean clay soils (CL) with the following properties:
 - Liquid limit (LL) less than 50 and plasticity index (PI) less than 25,
 - Maximum dry density greater than 100 pounds per cubic foot (pcf), when determined according to the Modified Proctor Method (ASTM D 1557)
2. New structural fill should not contain more than 5% organic material when tested in accordance with ASTM D 2974 test method. The fill shall be free of waste, debris, and frozen or deleterious material.
2. Materials unsatisfactory for use as structural fill include soils classified as silt or organic silt (ML, MH, IL, and OH) in the Unified Soil Classification System (ASTM D 2847).
3. Cohesive materials used as structural fill should be placed in 6- to 9-inch-thick loose lifts, moisture-conditioned to within plus or minus 2% of optimum moisture and compacted to at least 95% modified Proctor density (ASTM D1557 / AASHTO T180).
4. Granular materials used as structural fill should be placed in maximum 10- to 12-inch-thick loose lifts, moisture-conditioned to within plus or minus 3% of optimum moisture and compacted to at least 95% modified Proctor density (ASTM D1557 / AASHTO T180).
5. Fill should be placed where dry and stable conditions exist at design or undercut subgrade.



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General fill should not contain more than 8% organic material when tested in accordance with ASTM D 2974 test method, and should be free of waste, debris, and frozen or deleterious material. Cohesive materials used as general fill should be placed in 6- to 9-inch-thick loose lifts, moisture-conditioned to within plus or minus 3% of optimum moisture and compacted to at least 92% modified Proctor density (ASTM D1557 / AASHTO T180). Granular materials used as general fill should be placed in maximum 10- to 12-inch-thick loose lifts, moisture-conditioned to within plus or minus 3% of optimum moisture and compacted to at least 92% modified Proctor density (ASTM D1557 / AASHTO T180).

In general, the surficial fill materials on the Site meet the requirements outlined herein and can be used as structural or general fill; however, structural fill should be approved by a qualified geotechnical engineer before it is moved on-site or imported to the Site. Silt and other materials designated as ML, MH, PT, OL, and OH can be used for landscaping purposes (i.e., construction of berms).

Goodheart recommends using at least a 6-inch thick layer of well-sorted, compacted granular fill (AASHTO #5 stone or equivalent) beneath building slabs and foundations to allow for landfill gas collection (see Section 6.2). For roadway subbase (i.e., in areas that will be covered by asphalt/concrete pavement), a well-graded, compacted granular fill or crushed aggregate is recommended. Imported granular structural fill can consist of crushed limestone, crushed gravel with sand, or recycled concrete meeting the gradation limits in Table 5. Where wet subgrade conditions are encountered, free-draining crushed limestone similar to the free draining 1.5- or 3-inch gradations in Table 5 should be used.

TABLE 5: COARSE AGGREGATE GRADATIONS

Gradation (% Passing)	Sieve Size	3"	2.5"	2"	1.5"	1"	0.5"	No. 4	No. 16	No. 200
3-inch		100	95±5	60±15	15±15	3±3				
1.5-inch					100	95±5	75±5	43±13	25±15	8±4
1.5-inch FD					40	95±5	45±15	5±5		

FD – Free Draining



Geotechnical Investigation Report

6.2 Foundation Design Criteria

There are a number of considerations associated with design and construction of residential structure foundations at the Site, including:

- The surficial fill material varies in thickness (0 to 13.5 feet), and was apparently placed as an uncontrolled fill;
- The underlying waste material varies in location and thickness (45 to 68+ feet), and was apparently placed as an uncontrolled fill;
- Waste materials over the Site have been allowed to settle under their own weight for a period of at least 20 years and as long as 40+ years for some parts of the landfill;
- The surficial fill has added up to as much as 1500 to 1700 pounds per square foot (psf) of load on the surface of the landfills, causing further consolidation of the waste materials;
- The surficial fill has also settled under its own weight for a period of at least 20 years;
- Although there are no documented voids, sinkholes or depressions on the Site, it is possible that soft zones and/or voids exist which could affect foundation support; and
- The management of landfill gas will require sub-slab venting systems and well-sorted granular backfill along with robust chemical vapor barriers as required by TCEQ.

The planned residential structures can be supported on conventional slab-on-grade foundations provided ground improvement and earthwork operations are conducted as recommended herein. Due to the size and nature of the uncontrolled fill beneath the Site, slab-on-grade foundations should be made sufficiently thick and stiff to spread out the wall loads into the slab to reduce applied foundation loads to allowable limits, to span soft or weak spots and potential small voids in the underlying waste material, to protect against shrinking and/or expansive soils, and to resist potential differential settlements. The slabs should also be designed as continuous structures, without expansion joints, and on one level.

Continuous slab-on-grade foundations should be properly reinforced for shear and load transfer, and stiffened, if necessary, using “waffle slabs” and/or post-tensioning. Slabs-on-grade should incorporate sections at least 30 inches wide and 18 inches thick in areas where interior load-bearing walls of 3 kips per linear foot or more will be constructed and around perimeter walls with loads greater than 3 kips per linear foot. Slab-on-grade foundations can be designed with a maximum allowable soil bearing pressure of 3,000 psf, provided the compacted structural fill and landfill cover material have a minimum



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unconfined compressive strength of 3.0 ksf. Stiffened slabs will spread the applied load and reduce soil bearing pressures and help control total and differential settlement. As an alternative to using a “ribbed slab design, uniformly thick post-tensioned slabs-on-grade should be designed in accordance with PTI design criteria.

Slabs-on-grade should be supported within the upper horizon of a properly constructed building pad, with at least 12 inches of soil embedment around the perimeter of the slab. The ground surface should be graded so that water flows away from the structure. Goodheart recommends the use of at least 6 inches of a well-sorted crushed aggregate base (AASHTO #5 stone or equivalent) beneath building slabs and foundations to provide a capillary break with any underlying groundwater, allow for landfill gas collection, and to provide uniform foundation support. A sub-slab soil vapor venting system should be incorporated into the aggregate base, as required by TCEQ (EPRO e.vent low profile system or equivalent). A chemical vapor barrier (Drago Wrap Vapor Intrusion Barrier, manufactured by Stego Industries, or equivalent) should also be provided above the aggregate base material and beneath the slab. SKA can provide specific details regarding the subsurface vapor collection system.

Foundations for entry steps and porches should be designed and supported integrally to the building foundation. Asphalt, patio blocks or other materials that can withstand minor displacements without causing cracking and/or can be easily replaced should be considered for flatwork, driveways and patios, sidewalks or other approaches to steps and porches.

6.3 Post-Construction Settlement

Most of the Site has settled under the weight of the waste material, landfill cap and surficial fill; however, some additional settlement could occur in areas where significant amounts of new fill (4 plus feet) are placed during mass grading operations. Such consolidation could be detrimental to new structures, roadways and utilities and is very difficult to predict due to the nature and variable thickness of the waste and fill materials at the Site. As noted in Section 5.2.3, ground improvement is recommended to control and/or mitigate settlement, particularly beneath building footprints.



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New fills created during mass grading that are greater than 4 feet thick should be monitored with settlement instrumentation to check for new and on-going movements. Settlement instrumentation should consist of 18-inch x 18-inch x ¼-inch thick steel plates with a ¼-inch solid steel rod welded to the center of the plates. The plates should be installed approximately two feet below existing grade with the ¼-inch steel rod extending vertically in 3-foot-long sections above the ground surface. A 1-inch diameter steel pipe should be placed over the steel rod so that the rod can move freely (without soil friction) within the fill (the pipe should not be connected to the steel plate). The pipe should extend from approximately 2 inches above the steel plate to between 2- and 3-feet above the final grade, leaving 3- to 4-inches of steel rod exposed above the top of the pipe. The steel plate and rod constructed and installed in this manner will allow for periodic measurements of settlement or consolidation in the fill.

Settlement monitoring should be conducted on a weekly basis for the first month and then monthly thereafter until observed movements (i.e., settlements) and “time rate of settlement” analysis indicates future anticipated total settlements will be less than 1 inch. Qualitative analysis suggests this process could take as much as three to six months or more after completion of fill operations, depending on the thickness and nature of the fill and underlying waste materials. A qualified geotechnical engineer should review the settlement data and determine settlement has slowed to a degree that new construction (roadways, parking lots, buildings, etc.) can proceed.

6.4 Lateral Earth Pressures

Lateral resistance to loads can be provided by sliding friction acting on the base of footings and floor slabs (see Section 6.5 for appropriate values). Resistance to lateral loads can also be obtained in part from passive earth pressure against the face of rigid foundation elements.

An equivalent fluid pressure of 250 pcf can be used to resist short-term lateral loads on foundations in compacted structural fill (CL or CH materials). For sustained loading, an equivalent fluid pressure of 150 pcf can be used. The upper 1 foot of soil should be neglected in determining passive resistance when the soil is not confined by paving or floor slabs.



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Retaining structures could be required to transition grades across the Site, particularly between buildings that are relatively close together. Active earth pressures working against retaining structures will vary according to the rigidity of the structure. Walls free to rotate (such as cantilevered retaining walls) should be designed to resist an equivalent fluid pressure of 60 pcf (active condition). Braced walls, which are not free to rotate, should be designed for an equivalent fluid pressure of 75 pcf (at-rest condition). These values assume a hydrostatic level below the base of the structure; design of retaining walls should incorporate drainage behind the walls to eliminate hydrostatic pressures. Also, the influence of surcharge loads should be added to the calculated earth pressures to determine the total lateral stress acting on the walls. A qualified geotechnical engineer should determine appropriate geotechnical design criteria once the type and size of retaining structures have been determined.

6.5 Soil Design Criteria

Soil design criteria have been established by correlation with previous data on similar soils, field testing and laboratory tests. Table 6 summarizes soil design parameters.

TABLE 6: SOIL DESIGN VALUES

Soil Design Parameter	Structural Fill (CL/CH)	Structural Fill (SC, SM, SP)	Waste Material
Angle of Internal Friction (Degrees)	0	34	20 ¹
Cohesion (psf)	3500	0	500 ¹
Saturated Unit Weight (pcf)	125	115	120 ¹
Coefficient of active earth pressure (k_a)	.49	.28	.49
Coefficient of passive earth pressure (k_p)	2.03	3.25	2.03
Coefficient of at-rest earth pressure (k_o)	.60	.45	.50
Coefficient of sliding friction	.35 ¹	.50 ¹	--
Poisson's Ratio	0.25 ¹	0.3 ¹	--
Modulus of vertical subgrade reaction, K_v (K/ft ³)	200 ¹	250 ¹	150 ¹

1 – Estimated value based on published literature and/or engineering judgement

The Site subsurface materials consist of 4 to 8 feet of medium stiff to hard clay fill over 45 to 68+ feet of medium dense waste over stiff to very stiff native clays to the depths explored. The subsurface materials within the top 100 feet have normalized shear strength values of 1.5 tsf or



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greater and average SPT N-values of 15 or greater. In accordance with the 2018 International Building Code (IBC 2018) Section 1613.2.2, the Site has a Seismic Site Classification of D.

6.6 Trench Excavations and Underground Utilities

Stormwater management facilities, including culverts and stormwater structures, water and wastewater (wet) utilities, and gas, electric, and communication (dry) utilities should be designed in accordance with the most recent edition of the City of Houston Infrastructure Design Manual. Stormwater management facilities should also be designed to meet City of Houston code requirements, as complemented by Harris County and the Harris County Flood Control District (HCFCD), and water quality requirements in the Rules and Regulations published by TCEQ. Similarly, wet and dry utilities should also be designed to meet City of Houston and other applicable code requirements. Any stormwater detention facilities must be located off of the waste footprint. Utilities that will be continually wet such as water lines and lift stations, must have secondary containment. Secondary containment may consist of trenches lined with impermeable membranes.

It is anticipated that various drainage enhancements and improvements could be required, including storm sewers, stormwater detention, drainage structures, and overland (sheet) run-off. Stormwater culverts and wet and dry utilities should be constructed in open trenches in the upper 5-foot horizon of surficial fill (i.e., above the landfill cap). The surficial fill should first be constructed to an elevation not less than one (1) foot above the top of the pipe (or utility). Where the surficial fill consists of compact stable clay material, trench excavations can be made using an open cut with vertical sides to a depth of four feet; cuts deeper than 4 feet should be sloped, protected with a trench box or braced, as necessary. Groundwater and unstable or incompressible material in the bottom of the trench excavation should be removed and undercut areas should be backfilled with compacted structural or flowable fill to the design bedding depth.

Class C pipe bedding should be used for stormwater culverts and wet utilities. Goodheart recommends using a minimum of 3 inches of cement stabilized sand for pipe bedding. Trench excavations should be backfilled as soon as practical after installation of the pipe/utility. Trench backfill should meet the



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requirements for structural fill outlined in Section 6.1 and be free from stones large enough to interfere with compaction or other deleterious material.

Trench backfill should be placed at the moisture content needed to obtain the required density, in layers no greater than 6 inches deep (loose measurement) and alternated from side to side to bring up the backfill about equally around the pipe/utility. Trench backfill should be compacted to at least 95% Modified Proctor density using mechanical tamps or rammers. Small rollers may be used to compact backfill if feasible. Stormwater culverts should have at least 12 inches of cover above the pipe, and water and wastewater utilities should be designed to meet the cover requirements in the Infrastructure Design Manual.

If the landfill cap is penetrated by trenches, backfill should include at least 2 feet of compacted clay over the waste material. If waste must be removed to facilitate construction, the waste shall be segregated from overlying soils, stored on plastic sheeting and covered with plastic sheeting, until disposed off-site. The reburial of waste on site is not generally permitted by TCEQ once the landfill is in post closure care.

Depending on Contractor preference and the available fill materials, Goodheart recommends the use of either properly compacted lean clay fill or granular material mixed with bentonite as utility trench backfill. The use of either of these materials as utility trench backfill should be considered “best management practices” that would minimize the potential for migration of methane and/or other soil vapors contained in the underlying landfill materials. If a bentonite/fill mixture is used, mixing can be accomplished on-site either in a pugmill or in thin lifts (preliminary estimate of 2-4% bentonite by dry weight) prior to placing in the trench. Goodheart also recommends all utility penetrations at building foundations be designed using flexible connections that can withstand up to 2 inches of displacement and be sealed to prevent landfill gas intrusion.

6.7 Site Roads and Pavements

Site preparation and mass grading will likely expose a mixture of lean and fat clays (CL and CH materials) at subgrade level. The fat clays will be subject to shrinking and swelling with changes in moisture



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content that cause damage to road and parking lot pavements. Lime stabilization of the exposed subgrade is recommended to reduce soil plasticity and swell potential, reduce the required pavement thickness, aid compaction and create a strong, stable base for construction of road and parking lot pavements.

Grading and alignment of roads and parking lot pavements should establish design subgrade elevations. The upper 9 inches of subgrade materials beneath roads and parking areas should be stabilized with 4% hydrated lime in accordance with the material and installation requirements of the current edition of the Texas Highway Department *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges*.

A small to moderate amount of long-term settlement (up to 1 inch) should be anticipated beneath pavements that receive significant fill (more than 3 feet). Properly designed and constructed flexible pavement sections should be cost-effective and perform adequately at the Site. Flexible pavement that incorporates lime stabilized subgrade as described above can be designed using a CBR of 8 for the subbase layer. A qualified geotechnical engineer should determine appropriate geotechnical design criteria and pavement section(s) once the type of pavement for roads and parking areas has been determined.



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7. CONSTRUCTION CONSIDERATIONS

7.1 Construction Sequencing

Given the timeline to complete construction, and the ground improvement and grading requirements necessary to develop the Site for the proposed improvements, construction sequencing for this project will be important. As a general guideline, each area (building pads and pavements) should be developed in sequence as follows:

- Clear and grub as necessary, then strip topsoil and organic material and stockpile for reuse
- Adjust landfill cap thickness above waste to approximate 3-foot thickness
- Conduct selected ground improvement activities within building footprints and other areas as required
- Level and proof-roll the subgrade within the building footprint, repairing or correcting any deficient areas
- Place compacted fill as necessary to achieve final design grades
- Install gas collection layer and geotextile layers
- Construct underslab utilities (if required) and building slab

It is anticipated that existing surficial fill in the southern portion of the Site will be excavated, moved and reused in the northern portion of the Site. Ground improvement, proof-compaction, and subgrade preparation in the northern portion of the Site should be complete before the surficial fill is moved from the southern portion of the Site.

7.2 Earthwork Construction

All earthwork and mass grading operations at the Site can be conducted with conventional earth-moving equipment (scrapers, bulldozers, backhoes, wedgefoot rollers, etc.). Utility trenches in the surficial fill can be excavated with conventional backhoes. Clay fill materials should be compacted with wedgefoot (Caterpillar 825K Soil Compactor or equivalent) or sheepsfoot rollers that achieve compaction from the bottom up. Smooth drum rollers should be used on the top lifts and road subgrades to seal the surface and limit water infiltration.

Contractors should anticipate some volume change as a result of earthwork cut and fill operations. Although there is limited laboratory data available, Goodheart estimates a 3-5% shrinkage factor should



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be applied to surficial fill materials that are relocated to other areas of the Site and then recompacted to meet project specifications.

7.3 Cut and Fill Slopes

Slopes constructed in the surficial fill materials should not be steeper than 3.0 (horizontal) : 1.0 (vertical). Fill should be placed in horizontal lifts and properly compacted. Surficial fill slopes should be overfilled and then trimmed back to expose a dense, compacted surface. Temporary slopes cut in the surficial fill (e.g., in utility trenches) above the groundwater table will probably be stable at 1.5 (horizontal) : 1.0 (vertical). If temporary slopes are cut through granular materials, they could be subject to drying, wind erosion, and occasional caving or sloughing. Temporary slopes should be monitored for signs of impending failure (surface cracks, continued sloughing and caving, etc.).

Shallow temporary excavations should have a maximum slope of 1.0 horizontal to 1.0 vertical or flatter as required to provide stable side slopes. Excavations should be completed in accordance with OSHA Regulation 1926 Subpart P, Appendix B on "Sloping and Benching". The bottom of excavations should extend a minimum of 1 foot beyond the plan dimensions to allow for adequate working space, and satisfy the over-excavation requirements, as appropriate.

7.4 Groundwater Control

Based on the boring logs, Goodheart does not anticipate cut and fill operations or foundation and trench excavations will extend below the water table. Contractors should establish Site drainage so that surface runoff is directed away from foundation and trench excavations and construct small berms where necessary to prevent surface water from running into excavations. If excavations do extend below the groundwater level, dewatering could be required to enable excavations to be made in the dry. Goodheart anticipates dewatering of shallow excavations can be accomplished with conventional sumps and pumps. Recovered groundwater may require treatment and off-site disposal.



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8. GEOTECHNICAL ENGINEERING SERVICES DURING DESIGN AND CONSTRUCTION

8.1 Review of Plans and Specifications

Prior to construction, Goodheart should review the final plans and specifications for conformance with the intent of our recommendations. In general, we should review plans and specifications related to the following:

1. Site grading and filling
2. Ground improvement plans
3. Earth-retaining structures (if applicable)
4. Slab-on-grade construction
5. Conventional foundations for buildings and Site structures
6. Pavement construction
7. Site detention ponds

Also, we should review Contractor proposed changes in material specifications during bid evaluation.

8.2 Construction Observations

To a degree, the performance of a project is dependent upon the procedures and quality of construction of the Site development work. Site preparation, over-excavation, placement and compaction of fill, roadway construction, and implementation of erosion and sediment control measures should be performed under the inspection of a qualified and experienced geotechnical engineer.

Goodheart or its designated representative should observe site preparation, ground improvement activities, and grading and foundation installation to check that the work is performed in accordance with the plans and specifications. This would allow us to observe field conditions and to provide recommendations and/or solutions regarding any unusual conditions that are noted during site grading. Further, these observations would permit us to determine that soil conditions are as anticipated and to modify our recommendations, if necessary.

We recommend that Goodheart provide a soil engineer at the Site during the initial stages of construction to assist in developing optimum earthwork construction procedures and in overall implementation of the earthwork program.



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Goodheart recommends each building foundation subgrade be inspected and tested by a qualified geotechnical engineer. If subgrade soil fails to meet the minimum unconfined compressive strength, the cover material should be removed full depth and replaced with compacted clay fill. The compacted clay fill should meet the specification provided herein.



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9. LIMITATIONS AND STANDARD OF CARE

The recommendations presented in this report are based on the soils and materials encountered in the boring locations at the time of our borings and on the information and data collected in prior investigations at the Site (CEC, SKA and Goodheart reports). Should conditions encountered during excavation and construction operations differ from those encountered in the borings, Goodheart should be notified so that the recommendations can be reviewed and revised if necessary.

This investigation was performed in accordance with accepted geotechnical engineering practices for determining soil conditions and preparing recommendations for the referenced Site improvements only. The services performed by Goodheart were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical engineering profession practicing contemporaneously under similar conditions in the locality of the project. No other representation is made.

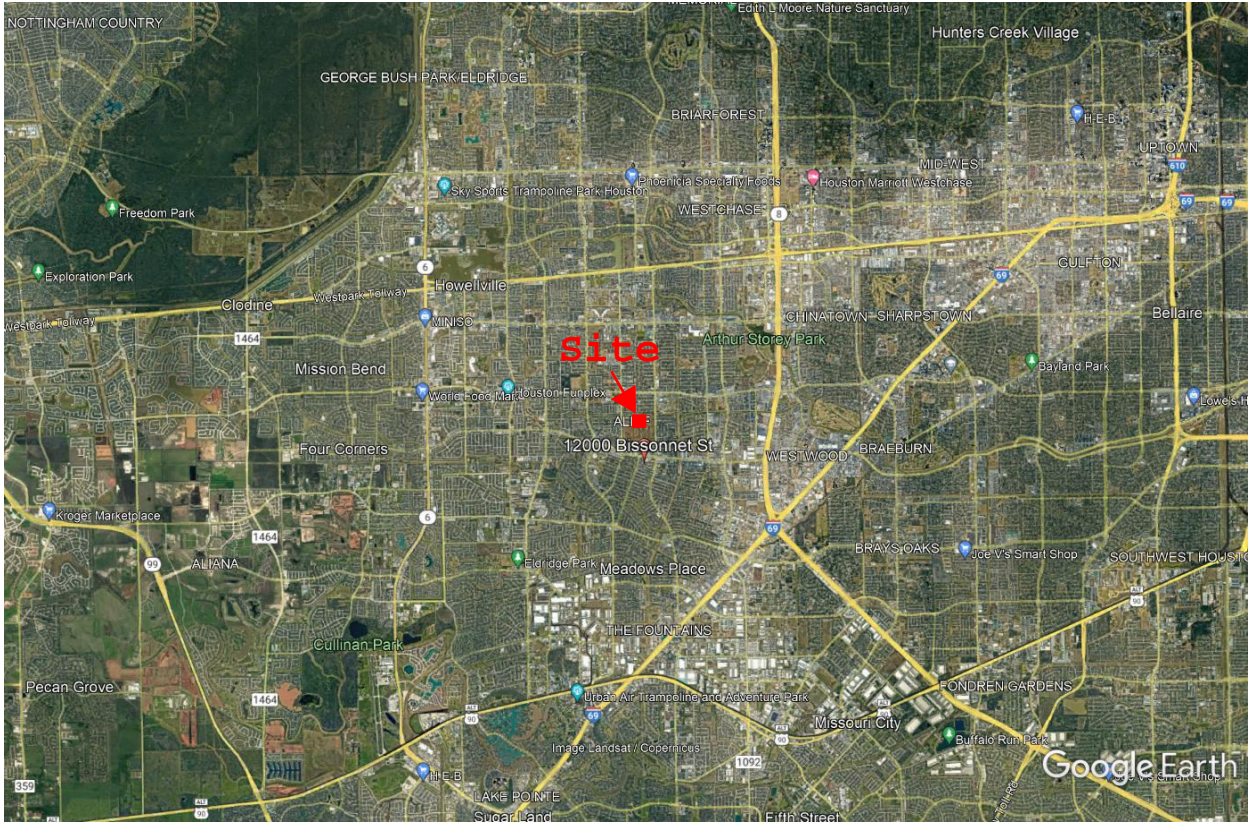
Verification of subsurface conditions for purposes of determining the extent of waste materials, difficulty of excavation and implementation of ground improvements, dewatering, and trafficability is beyond the scope of this investigation. In the event that any changes in the nature, design or location of the proposed construction are made, the conclusions and recommendations contained in this report should not be considered valid until the changes are reviewed and the conclusions and recommendations in this report have been modified or verified in writing.

This report was prepared for the sole use of the Client (Impact Residential Development LLC), the only intended beneficiaries of our work for the specific purposes referenced herein. No other party should rely on the information contained herein without prior written consent of Goodheart.



Geotechnical Investigation Report

FIGURES



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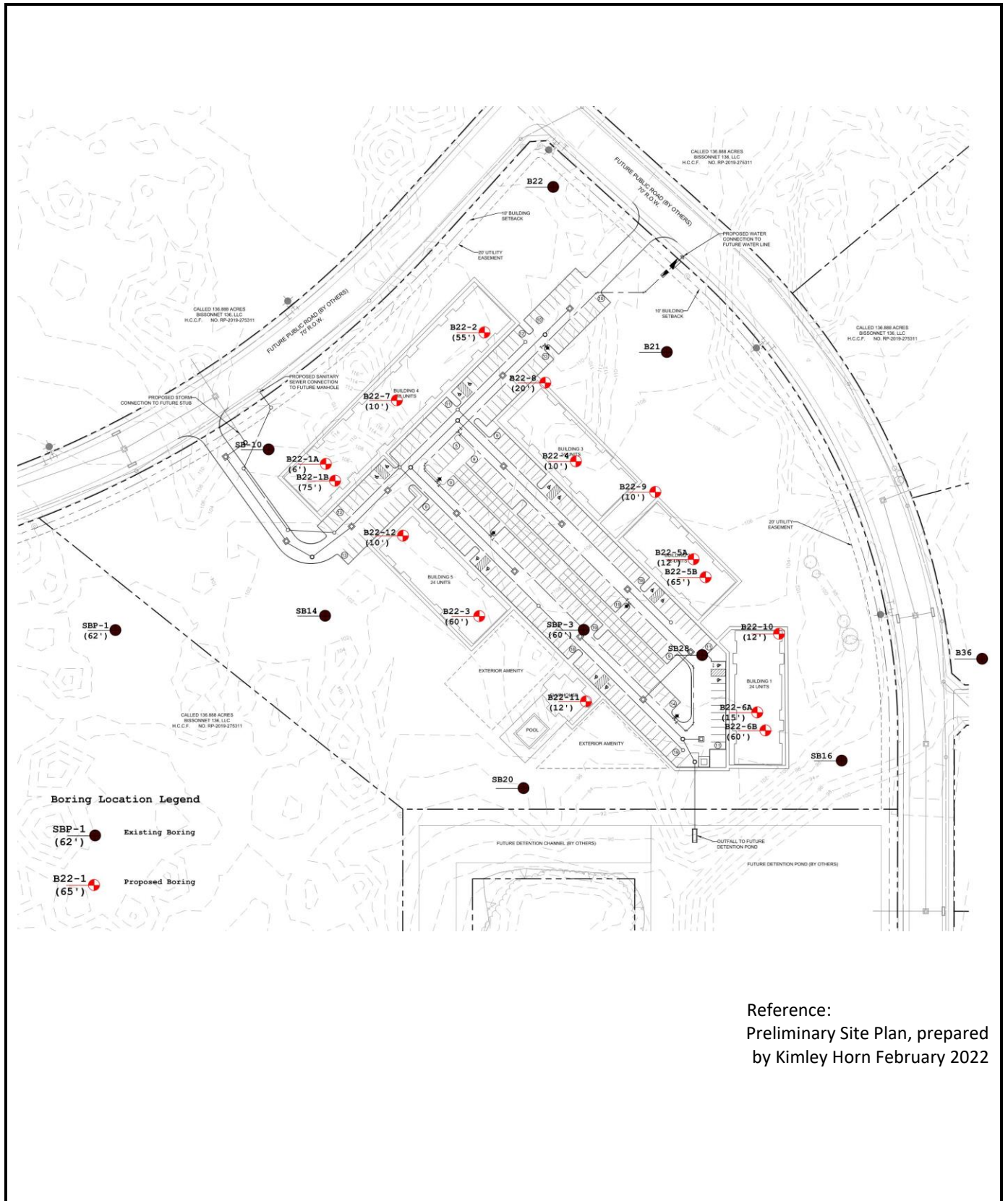
VICINITY MAP
KIRKWOOD CROSSING

FIGURE
1

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JOB NUMBER
22-009.001

DATE
9/16/2022



Reference:
 Preliminary Site Plan, prepared
 by Kimley Horn February 2022



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 Infrastructure Engineering

**BORING LOCATION PLAN
 KIRKWOOD CROSSING**

**FIGURE
 2**

DRAWN
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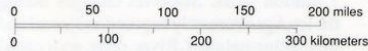
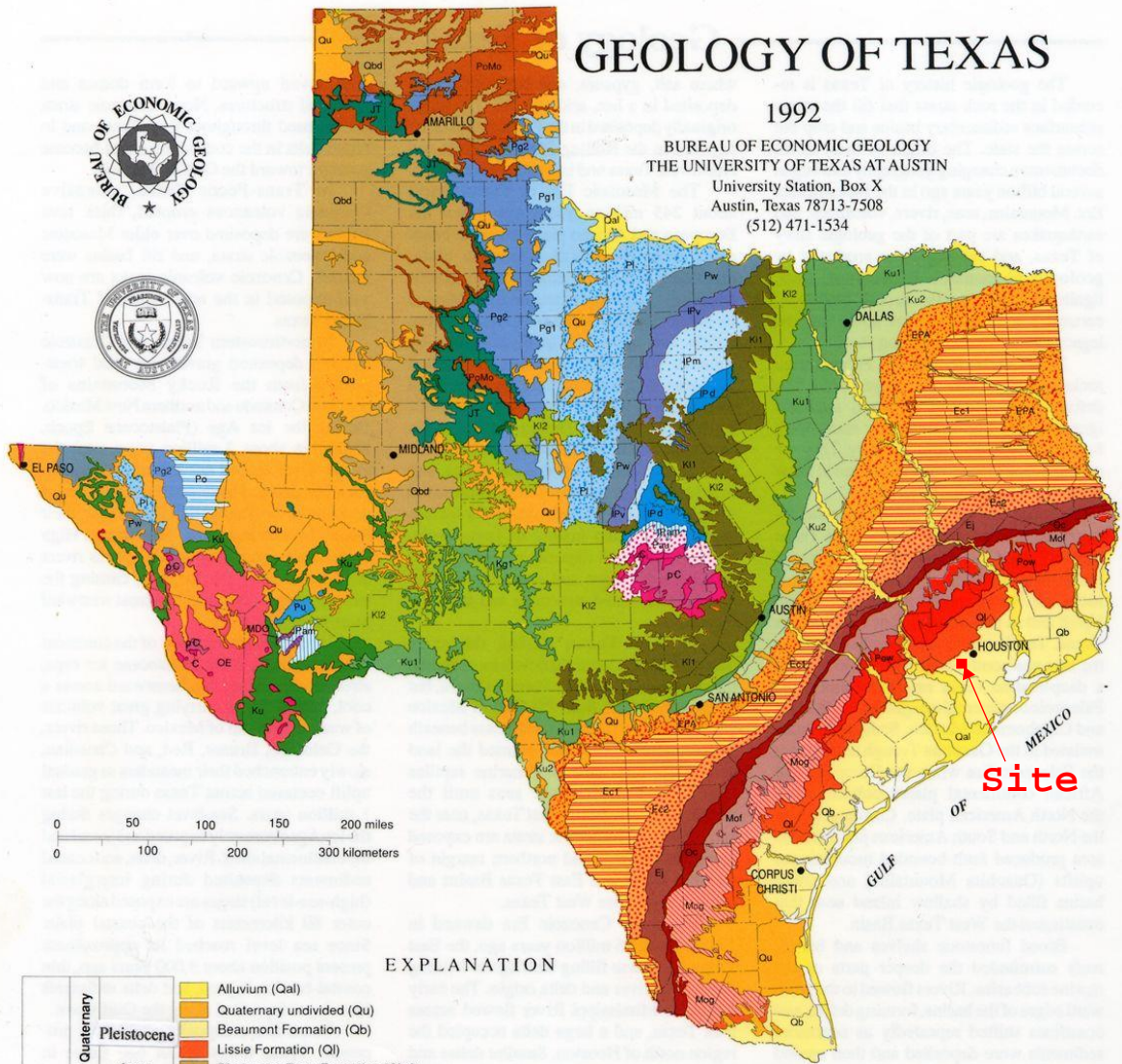
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 22-009.001

DATE
 09/13/2022

GEOLOGY OF TEXAS

1992

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EXPLANATION

CENOZOIC	Tertiary	Time (m.y.)	Formation/Group	Color/Pattern	Time (m.y.)	Series/Group	Color/Pattern		
								Quaternary	Pleistocene
			Alluvium (Qal)	Yellow					
			Quaternary undivided (Qu)	Orange					
			Beaumont Formation (Qb)	Light Orange					
			Lissie Formation (Ql)	Dark Orange					
		2 m.y.	Blackwater Draw Formation (Qbd)	Dark Orange					
		5 m.y.	Willis Formation (Pow)	Red					
			Ogallala Formation (PoMo)	Light Green					
			Goliad Formation (Mog)	Dark Green					
		24 m.y.	Fleming and Oakville Formations (Mof)	Light Green					
			Catahoula Formation (Oc)	Dark Green					
		38 m.y.	Oligocene and Eocene undivided (OE) (volcanic rocks and conglomerates in Trans-Pecos Texas)	Dark Green					
			Jackson Group (Whitsett, Manning, Wellborn, Caddell, Yazoo, and Moodys Branch Fms.) (Ej)	Dark Green					
			Claiborne Group (Yegua Formation) (Ec2)	Dark Green					
		58 m.y.	Claiborne Group (Cook Mountain, Sparta, Weches, Queen City, and Reklaw) (Ec1)	Dark Green					
			Wilcox and Midway Groups (EPA)	Dark Green					
		66 m.y.	Navarro and Taylor Groups (Ku2)	Dark Green					
			Austin, Eagle Ford, Woodbine, and U. Washita Groups (Ku1)	Dark Green					
			Fredericksburg and L. Washita Groups (K12)	Dark Green					
			Trinity Group (K11)	Dark Green					
			Cretaceous undivided (Ku)	Dark Green					
		144 m.y.	Jurassic Triassic undivided (JT)	Dark Green					
		245 m.y.	Ochoan Series (Po)	Light Blue					
			Guadalupian Series (Whitehorse and Quartermaster Formations) (Pg2)	Light Blue					
			Guadalupian Series (Blaine and San Angelo Formations) (Pg1)	Light Blue					
			Leonardian Series (Pl)	Light Blue					
			Wolfcampian Series (Pw)	Light Blue					
			Permian undivided (Pu)	Light Blue					
			Virgilian Series (IPv)	Light Blue					
			Missourian Series (IPm)	Light Blue					
			Desmoinesian Series (IPd)	Light Blue					
			Atokan and Morrowan Series (IPam)	Light Blue					
			Mississippian, Devonian, and Ordovician undivided (MDO)	Light Blue					
			Cambrian (-C)	Light Blue					
			Paleozoic undivided (Pau)	Light Blue					
			Precambrian undivided (p-C)	Light Blue					



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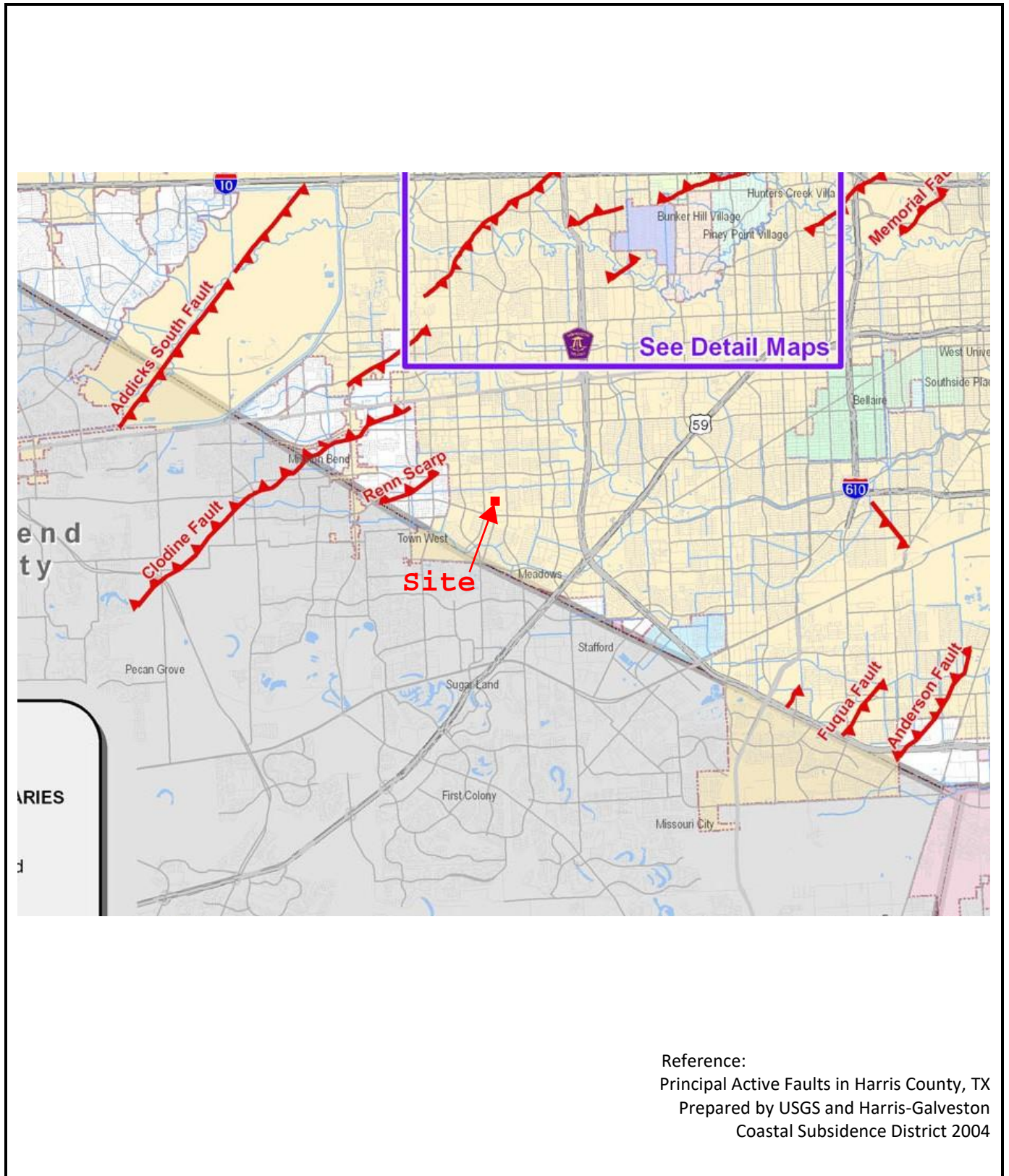
TEXAS GEOLOGICAL MAP KIRKWOOD CROSSING

FIGURE
3

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JOB NUMBER
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DATE
9/26/2022



Reference:
 Principal Active Faults in Harris County, TX
 Prepared by USGS and Harris-Galveston
 Coastal Subsidence District 2004



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 Infrastructure Engineering

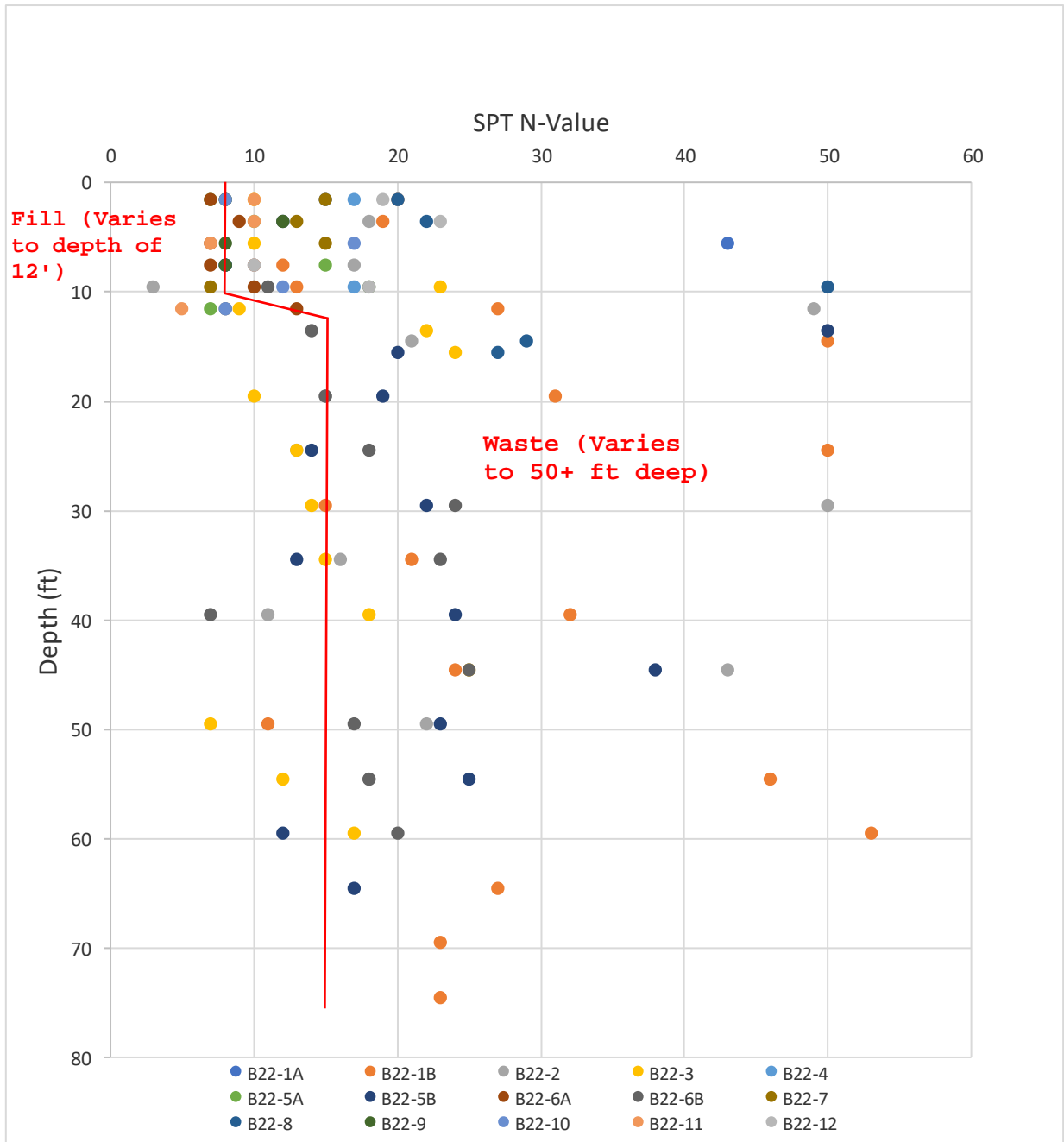
**GEOLOGIC HAZARDS MAP
 KIRKWOOD CROSSING**

**FIGURE
 4**

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DATE
 9/26/2022



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**SPT N-VALUES v. DEPTH
KIRKWOOD CROSSING**

FIGURE
5



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APPENDICES

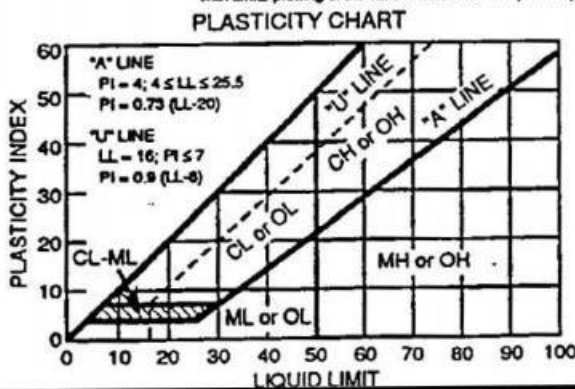


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APPENDIX A BORING LOGS

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)		GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)		GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)		GM	Silty gravels, gravel-sand-silt mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart 	SW	Well graded sands, gravelly sands
			Limits plot above "A" line & hatched zone on plasticity chart 	SP	Poorly graded sands, gravelly sands
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS Limits plot below "A" line & hatched zone on plasticity chart	SILTS OF LOW PLASTICITY (Liquid Limit less than 50)		ML	Inorganic silts, clayey silts of low to medium plasticity
		SILTS OF HIGH PLASTICITY (Liquid Limit 50 or more)		MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
	CLAYS Limits plot above "A" line & hatched zone on plasticity chart	CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)		CL	Inorganic clays of low to medium plasticity, gravelly, sandy, and silty clays
		CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)		CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity
	ORGANIC SILTS AND CLAYS	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)		OL	Organic silts and clays of low to medium plasticity, sandy organic silts and clays
		ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)		OH	Organic silts and clays of high plasticity, sandy organic silts and clays
ORGANIC SOILS	PRIMARILY ORGANIC MATTER (dark in color and organic odor)		PT	Peat	

NOTE: Coarse-grained soils with between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart have dual classifications.



DEFINITION OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200 sieve
Coarse sand	No. 4 to No. 10 sieve
Medium sand	No. 10 to No. 40 sieve
Fine sand	No. 40 to No. 200 sieve
Fines (silt and clay)	Less than No. 200 sieve



Goodheart & Associates, PLLC
Infrastructure Engineering

UNIFIED SOIL CLASSIFICATION SYSTEM
KIRKWOOD CROSSING

FIGURE
A1

DRAWN

JOB NUMBER

DATE

LOG OF BORING B22-1A

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'47.60" W: 85°35'32.42" SURFACE ELEVATION: 103.45 ft	DRILLING METHOD: Dry Augered: 0' to 6' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0	X	[Symbol]	Stiff gray & tan SANDY LEAN CLAY "FILL" w/ sand pockets LANDFILL CAP 0'-2'			8/6" 8/6" 7/6"										
	100	■	[Symbol]	-very stiff to hard & black w/ wood & nails @ 2'-4' "FILL"		(P)4.50+											
	5	X	[Symbol]	Hard black & brown w/ WOOD and plastic			3/6" 6/6" 37/6"										
	95			Terminated @ 6'													
	10																
	90																
	15																
	85																
	20																
	80																
	25																
	75																
	30																
	70																
	35																

COMPLETION DEPTH: 6 ft
 DATE BORING STARTED: 7/29/2022
 DATE BORING COMPLETED: 7/29/2022
 LOGGER: Gayrian Singleton
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water encountered.
 Boring backfilled with cement-bentonite grout upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: TRUCK CME

LOG OF BORING B22-1B

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'47.60" W: 95°35'32.42" SURFACE ELEVATION: 103.45 FT	DRILLING METHOD: Dry Augered: 0' to 75' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED	
				MATERIAL DESCRIPTION														
	0			Very stiff brown & tan SANDY LEAN CLAY "FILL" w/ organic LANDFILL CAP 0'-2'					3/6" 8/6" 12/6"									
	100			-black & gray w/ shingles & wood @ 2.5'-4'					5/6" 7/6" 12/6"									
	5			Hard black & gray LEAN CLAY "FILL" w/ miscellaneous, non degradable material				(P)4.50										
	95			-stiff @ 6.5'-10'					4/6" 5/6" 7/6"									
	10			-brown @ 8.5'-10'					9/6" 7/6" 6/6"									
	10			-very stiff @ 10.5'-12' -w/ wood @ 10.5'-30' -gray @ 10.5'-15'					12/6" 17/6" 10/6"									
	90								50/3"									
	15																	
	85								9/6" 15/6" 16/6"									
	20																	
	80			-gray w/ concrete fragments @ 23.5'-25'					50/3"									
	25																	
	75			-w/ miscellaneous, non-degradable material @ 28.5'-30'					15/6" 7/6" 8/6"									
	30																	
	70			Very stiff gray & reddishbrown FAT CLAY "FILL" w/ trash & sand pockets					7/6" 10/6"									
	35																	

COMPLETION DEPTH: 75 ft
 DATE BORING STARTED: 9/1/2022
 DATE BORING COMPLETED: 9/2/2022
 LOGGER: Omar Rodriguez
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water encountered.
 Boring backfilled with soil cuttings & dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Safety Hammer Drilling Equipment: TRACK EDS

LOG OF BORING B22-1B

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'47.60" W: 95°35'32.42" SURFACE ELEVATION: 103.45 FT	DRILLING METHOD: Dry Augered: 0' to 75' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	35			Very stiff gray & reddishbrown FAT CLAY "FILL"			11/6"										
	65			-hard @ 38.5'-40' -black @ 38.5'-50'			8/6" 13/6" 19/6"										
	40																
	60			-very stiff @ 43.5'-45' -w/ concrete fragments @ 43.5'-50'			9/6" 6/6" 18/6"										
	45																
	55			-stiff w/ sand pockets & wood @ 48.5'-50'			9/6" 5/6" 6/6"										
	50																
	50			Hard black LEAN CLAY "FILL" w/ wood & concrete fragments			11/6" 11/6" 35/6"										
	55																
	45			-w/ trash @ 58.5'-60'			30/6" 30/6" 23/6"										
	60																
	40			Medium dense black SILTY SAND "FILL" w/ wood, concrete & aggregate			24/6" 12/6" 15/6"										
	65																
	35			Very stiff black & gray LEAN CLAY (CL) w/ trash & sand pockets			12/6" 11/6" 12/6"										
	70																

COMPLETION DEPTH: 75 ft
 DATE BORING STARTED: 9/1/2022
 DATE BORING COMPLETED: 9/2/2022
 LOGGER: Omar Rodriguez
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water encountered.
 Boring backfilled with soil cuttings & dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Safety Hammer Drilling Equipment: TRACK EDS

LOG OF BORING B22-1B

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT) DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'47.60" W: 95°35'32.42" SURFACE ELEVATION: 103.45 FT DRILLING METHOD: Dry Augered: 0' to 75' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
			MATERIAL DESCRIPTION												
30		▲	Very stiff black & gray LEAN CLAY (CL) Native material												
75		▲		Terminated @ 75'		9/6" 9/6" 14/6"									
25															
80															
20															
85															
15															
90															
10															
95															
5															
100															
0															
105															

COMPLETION DEPTH: 75 ft
 DATE BORING STARTED: 9/1/2022
 DATE BORING COMPLETED: 9/2/2022
 LOGGER: Omar Rodriguez
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water encountered.
 Boring backfilled with soil cuttings & dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Safety Hammer Drilling Equipment: TRACK EDS

LOG OF BORING B22-2

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'49.33" W: 95°35'30.52" SURFACE ELEVATION: 104.94 ft	DRILLING METHOD: Dry Augered: 0' to 20' Wash Bored: 20' to 55'	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0			Very stiff tan & gray SANDY LEAN CLAY "FILL" SURFICIAL FILL & LAND FILL CAP 0'-4'			7/6" 10/6" 10/6"										
	5			-black w/ wood @ 4'-10' w/ shingles @ 4'-6' -w/ trash @ 4'-8'	(P)4.50		6/6" 9/6" 9/6"		9	86	0	NP	17.06	15	4		
	10			-very stiff @ 6.5'-8'			5/6" 11/6" 6/6"										
	15			-soft & gray @ 8.5'-10'			1/6" 1/6" 2/6"										
	20			Hard black LEAN CLAY "FILL" w/ wood			5/6" 4/6" 45/6"										
	25			Black & brown w/ wood "FILL"			12/6" 10/6" 11/6"										
	30			-w/ tar & gravel @ 23.65'-25'			14/6" 8/6" 7/6"										
	35			-dark gray @ 33.5'-35' -w/ clay pockets @ 33.5'-40'			7/6" 7/6" 6/6"										
	40						50/4"										
	45						7/6" 8/6" 8/6"										

COMPLETION DEPTH: 55 ft
 DATE BORING STARTED: 7/29/2022
 DATE BORING COMPLETED: 7/30/2022
 LOGGER: Gayrian Singleton
 PROJECT NO.: 22.14.222

NOTES: Free Water encountered at 20' during drilling and dry after 10 and 15 minutes.
 Boring backfilled with dry bentonite chips and cement-bentonite grout upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-2

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'49.33" W: 95°35'30.52" SURFACE ELEVATION: 104.94 ft	DRILLING METHOD: Dry Augered: 0' to 20' Wash Bored: 20' to 55'	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED	
				MATERIAL DESCRIPTION														
				Dark gray & black w/ wood "FILL"			11/6" 5/6" 7/6"											
				-miscellaneous non-degradable material @ 43.5'-45'			11/6" 21/6" 22/6"											
				-brown @ 48.5'-50'			11/6" 14/6" 8/6"											
				Medium dense gray SILTY SAND (SM) w/ clay pockets Native material			8/6" 10/6" 8/6"		30									
				Terminated @ 55'														

COMPLETION DEPTH: 55 ft
 DATE BORING STARTED: 7/29/2022
 DATE BORING COMPLETED: 7/30/2022
 LOGGER: Gayrian Singleton
 PROJECT NO.: 22.14.222

NOTES: Free Water encountered at 20' during drilling and dry after 10 and 15 minutes.
 Boring backfilled with dry bentonite chips and cement-bentonite grout upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-3

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'45.80" W: 95°35'30.3"	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				SURFACE ELEVATION: 99.09 ft												
				DRILLING METHOD: Dry Augered: 0' to 14.5' Wash Bored: 14.5' to 60'	MATERIAL DESCRIPTION											
	0			Stiff gray & orange SANDY LEAN CLAY "FILL" w/ ferrous nodules -very stiff to hard w/ calcareous deposits @ 2'-4'	(P)4.50+	4/6" 5/6" 5/6"		14	119	49	30	6.82	6	2		
	5			-stiff & reddishbrown @ 4.5'-6' SURFICIAL FILL & LANDFILL CAP 0'-8.5'		3/6" 4/6" 6/6"										
	95			Stiff reddishbrown & gray FAT CLAY "FILL" w/ ferrous nodules & sand pockets Reddishbrown LEAN CLAY "FILL"	(P)2.00			22	103	52	32	1.48	4 *	7		
	90			Medium dense black w/ wood "FILL"		4/6" 7/6" 16/6"										
	85			Stiff reddishbrown & gray LEAN CLAY "FILL" w/ sand pockets & wood -very stiff & black @ 12.5'-14'		3/6" 3/6" 6/6" 3/6" 8/6" 14/6"		38		48	28					
	80			w/ wood and miscellaneous non-degradable material "FILL"		4/6" 21/6" 3/6"										
	75			Stiff gray & black FAT CLAY "FILL" w/ wood		8/6" 4/6" 6/6"		55		83	53					
	70			Stiff gray & black FAT CLAY "FILL" w/ sand pockets & wood -no recovery @ 28.5'-30'		6/6" 7/6" 6/6" 6/6" 8/6" 7/6"										
	65			FILL w/ TRASH, WOOD, PLASTIC & CONCRETE		14/6" 8/6"										

COMPLETION DEPTH: 60 ft
 DATE BORING STARTED: 7/28/2022
 DATE BORING COMPLETED: 7/29/2022
 LOGGER: Gayrian Singleton
 PROJECT NO.: 22.14.222

NOTES: Free Water encountered at 10' during drilling and dry after 5, 10 and 15 minutes.
 Boring backfilled with dry bentonite chips and cement-bentonite grout upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-3

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'45.80" W: 95°35'30.3" SURFACE ELEVATION: 99.09 ft	DRILLING METHOD: Dry Augered: 0' to 14.5' Wash Bored: 14.5' to 60'	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED	
				MATERIAL DESCRIPTION														
	35			FILL w/ TRASH, WOOD, PLASTIC & CONCRETE			7/6"											
	60			FILL w/ WOOD			8/6" 8/6" 10/6"											
	40																	
	55						8/6" 12/6" 13/6"											
	45																	
	50			Firm reddishbrown FAT CLAY "FILL"			4/6" 3/6" 4/6"											
	50																	
	45			-stiff w/ wood @ 53.5-55'			4/6" 5/6" 7/6"											
	55																	
	40			Very stiff reddishbrown FAT CLAY (CH) slickensided			5/6" 6/6" 11/6"											
	60			Native material														
				Terminated @ 60'														
	35																	
	65																	
	30																	
	70																	

COMPLETION DEPTH: 60 ft
 DATE BORING STARTED: 7/28/2022
 DATE BORING COMPLETED: 7/29/2022
 LOGGER: Gayrian Singleton
 PROJECT NO.: 22.14.222

NOTES: Free Water encountered at 10' during drilling and dry after 5, 10 and 15 minutes.
 Boring backfilled with dry bentonite chips and cement-bentonite grout upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-4

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'47.71" W: 95°35'28.97" SURFACE ELEVATION: 107.4	DRILLING METHOD: Dry Augered: 0' to 10' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0			Loose tan SILTY SAND "FILL" w/ clay pockets SURFICIAL FILL & LANDFILL CAP 0'-6'			1/6" 3/6" 4/6"										
	105			-medium dense brown @ 2.5'-3' Very stiff brown LEAN CLAY "FILL" w/ ferrous nodules			2/6" 6/6" 6/6"		11								
	5			Very stiff to hard dark gray, gray & tan SANDY LEAN CLAY "FILL" w/ ferrous nodules, sand pockets & calcareous deposits	(P)4.50+				13	118	44	27	5.87	10	4		
	100			-dark brown w/ wood & trash @ 6.5'-10'			1/6" 3/6" 5/6"										
	10			Terminated @ 10'			3/6" 8/6" 9/6"										
	95																
	15																
	90																
	20																
	85																
	25																
	80																
	30																
	75																
	35																

COMPLETION DEPTH: 10 ft
 DATE BORING STARTED: 7/30/2022
 DATE BORING COMPLETED: 7/30/2022
 LOGGER: Gayrian Singleton
 PROJECT NO.: 22.14.222

NOTES: Free Water encountered at 10' during drilling and dry after 5, 10 and 15 minutes.
 Boring backfilled with dry bentonite chips and cement-bentonite grout upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-5A

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 40' 46.40" W 95° 35' 27.40" SURFACE ELEVATION: 103.37 ft	DRILLING METHOD: Dry Augered: 0' to Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED	
				MATERIAL DESCRIPTION														
	0			Firm brown & gray FAT CLAY (CH) w/ organic SURFICIAL FILL & LANDFILL CAP 0'-12'			2/6" 3/6" 4/6"											
	100			-stiff @ 2.5'-10' -w/ silt seams @ 2.5'-4'		(P)2.75	2/6" 3/6" 7/6"		19	105	53	35	2.95	13	4			
	5			-w/ ferrous nodules @ 4'-12' -black @ 4'-6'														
	95			-brown @ 6.5'-8'		(P)1.75	5/6" 5/6" 10/6"		21	106	53	34	1.83	15	8			
	10			-w/ calcareous nodules @ 8'-12'														
	10			-firm @ 10.5'-12'			2/6" 2/6" 5/6"											
	90			Terminated @ 12'														
	15																	
	85																	
	20																	
	80																	
	25																	
	75																	
	30																	
	70																	
	35																	

COMPLETION DEPTH: 12 ft
 DATE BORING STARTED: 9/2/2022
 DATE BORING COMPLETED:
 LOGGER: Omar Rodriguez
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-5B

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'46.40" W: 95°36'27.40" SURFACE ELEVATION: 103.4	DRILLING METHOD: Dry Augered: 0' to 65' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0			Very stiff to hard dark gray & brown FAT CLAY "FILL" w/ calcareous deposits SURFICIAL FILL & LANDFILL CAP 0'-13.5'													
	100																
	5			Dark brown w/ miscellaneous non-degradable fill and asphalt "FILL"			50/6"										
	95							40/6" 9/6" 11/6"									
	10			-w/ wood @ 23.5'-55'													
	90							14/6" 9/6" 10/6"									
	15			-w/ brick @ 28.5'-35'													
	85							45/6" 8/6" 6/6"									
	20			-w/ plastic @ 33.5'-35'													
	80							40/6" 8/6" 14/6"									
	25																
	75							11/6" 3/6" 10/6"									
	30																
	70																
	35																

COMPLETION DEPTH: 65 ft
 DATE BORING STARTED: 9/6/2022
 DATE BORING COMPLETED: 9/6/2022
 LOGGER: Joshua Sparks
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Safety Hammer Drilling Equipment: TRACK EDS

LOG OF BORING B22-5B

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'46.40" W: 95°36'27.40"	SURFACE ELEVATION: 103.4	DRILLING METHOD: Dry Augered: 0' to 65' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED	
				MATERIAL DESCRIPTION															
				-w/ miscellaneous non-degradable material "FILL"															
	35																		
	65								15/6"										
	40								10/6"										
	60								12/6"										
	45								18/6"										
	60								20/6"										
	55								16/6"										
	50								9/6"										
	50								14/6"										
	55								20/6"										
	55								11/6"										
	55								14/6"										
	45			Stiff brown FAT CLAY (CH) Native Material					8/6"										
	60								5/6"										
	60								7/6"										
	40			NO RECOVERY					7/6"										
	65								7/6"										
	65			Terminated @ 65'					10/6"										
	35																		
	70																		

COMPLETION DEPTH: 65 ft
 DATE BORING STARTED: 9/6/2022
 DATE BORING COMPLETED: 9/6/2022
 LOGGER: Joshua Sparks
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Safety Hammer Drilling Equipment: TRACK EDS

LOG OF BORING B22-6A

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'44.62" W: 95°35'26.34" SURFACE ELEVATION: 102.08	DRILLING METHOD: Dry Augered: 0' to 15' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0			Firm dark brown FAT CLAY "FILL" w/ sand pockets & calcareous deposits SURFICIAL FILL AND LANDFILL CAP 0'-13.5'			3/6" 3/6" 4/6"										
	100			Stiff dark brown SANDY LEAN CLAY "FILL" w/ calcareous deposits			4/6" 4/6" 5/6"		14								
	5			-firm @ 4.5'-6'			1/6" 2/6" 5/6"		16		49	30					
	95			Firm dark brown FAT CLAY "FILL" w/ sand pockets & calcareous deposits			1/6" 3/6" 4/6"		27		65	42					
				-stiff @ 8.5'-9'			3/6" 4/6" 6/6"		23		47	27					
	10			Stiff dark brown SANDY LEAN CLAY "FILL"			4/6" 6/6"										
	90			Firm dark brown FAT CLAY "FILL" w/ calcareous deposits			2/6" 6/6" 7/6"										
				-stiff brown FAT CLAY "FILL" & trash @ 13.5'-15'													
	15			Terminated @ 15'													
	85																
	20																
	80																
	25																
	75																
	30																
	70																
	35																

COMPLETION DEPTH: 15 ft
 DATE BORING STARTED: 8/3/2022
 DATE BORING COMPLETED: 8/3/2022
 LOGGER: Josh Sparks
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-6B

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'44.62" W: 95°35'26.34"	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				SURFACE ELEVATION: 102.08												
				DRILLING METHOD: Dry Augered: 0' to 15' Wash Bored: 15' to 60'	MATERIAL DESCRIPTION											
	0			Firm dark brown FAT CLAY "FILL" w/ roots SURFICIAL FILL & LANDFILL CAP 0'-13.5'		2/6" 3/6" 5/6"										
	100			Stiff brown SANDY LEAN CLAY "FILL" w/ calcareous deposits -very stiff to hard @ 4'-6'	(P)4.50+	4/6" 5/6" 7/6"		13		48	30				64	
	5			Firm brown FAT CLAY "FILL" w/ ferrous nodules & calcareous deposits -stiff & gray w/ sand pockets @ 8.5'-10'		2/6" 3/6" 5/6" 3/6" 4/6" 7/6"		18		51	32				57	
	95			-firm w/ calcareous deposits @ 10.5'-12' -dark brown @ 10.5'-13'		3/6" 3/6" 5/6"										
	90			Stiff brown w/ wood and miscellaneous non-degradable material "FILL"		3/6" 5/6" 9/6"										
	15															
	85															
	20					11/6" 9/6" 6/6"										
	80															
	25			-w/ carpet @ 23.5'-35'		9/6" 10/6" 8/6"										
	75															
	30					30/6" 15/6" 9/6"										
	70															
	35					14/6" 17/6" 6/6"										

COMPLETION DEPTH: 60 ft
 DATE BORING STARTED: 9/6/2022
 DATE BORING COMPLETED: 9/6/2022
 LOGGER: Josh Sparks
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Safety Hammer Drilling Equipment: TRACK EDS

LOG OF BORING B22-6B

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'44.62" W: 95°35'26.34" SURFACE ELEVATION: 102.08	DRILLING METHOD: Dry Augered: 0' to 15' Wash Bored: 15' to 60'	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	35			Fill w/ miscellaneous non-degradable material													
	65						5/6"										
	40						3/6"										
	60						4/6"										
	45						16/6"										
	60						13/6"										
	45						12/6"										
	55						22/6"										
	50			-w/ carpet @ 48.5'-50'			10/6"										
	50						7/6"										
	55						10/6"										
	55						8/6"										
	45						7/6"		26		71	52					
	60			Very stiff brown FAT CLAY (CH)			9/6"										
	60			Native Material			11/6"										
	40			Terminated @ 60'													
	65																
	35																
	70																

COMPLETION DEPTH: 60 ft
 DATE BORING STARTED: 9/6/2022
 DATE BORING COMPLETED: 9/6/2022
 LOGGER: Josh Sparks
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite upon completion of soil sampling.
 SPT Hammer Type: Safety Hammer Drilling Equipment: TRACK EDS

LOG OF BORING B22-7

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 40' 44.66" W 95° 35' 36.07" SURFACE ELEVATION: 104.0 ft	DRILLING METHOD: Dry Augered: 0' to 10' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0			Stiff dark brown & tan SANDY LEAN CLAY "FILL" w/ calcareous deposits SURFICIAL FILL & LANDFILL CAP 0'-4.5'		4/6" 8/6" 7/6"											
	100			-brown @ 2.5'-6' -orange w/ ferrous nodules @ 2.5'-4'		4/6" 6/6" 7/6"		12		39	21						
	5			-wood and miscellaneous non-degradable material @ 4.5'-6'		4/6" 6/6" 9/6"											
	95			w/ wood "FILL"													
	10			-miscellaneous non-degradable material @ 8.5'-10'		9/6" 4/6" 3/6"											
	10			Terminated @ 10'													
	90																
	15																
	85																
	20																
	80																
	25																
	75																
	30																
	70																
	35																

COMPLETION DEPTH: 10 ft
 DATE BORING STARTED: 8/2/2022
 DATE BORING COMPLETED: 8/2/2022
 LOGGER: Josh Sparks
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite chips upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-8

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N N: 29°40'48.65" WW: 95°35'29.44" SURFACE ELEVATION: 105.46 ft	DRILLING METHOD: Dry Augered: 0' to 20' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
105	0			Very stiff gray SANDY LEAN CLAY "FILL" SURFICIAL FILL & LANDFILL CAP 0'-4'			3/6" 10/6" 10/6"										
				-brown & black @ 2.5'-4'			5/6" 14/6" 8/6"		11		31	16					
	5			Brown, blue & black w/ wood and carpet "FILL"							0	NP					
100				Firm gray & reddishbrown SANDY LEAN CLAY "FILL" Firm gray & reddishbrown FAT CLAY "FILL" w/ carpet			WOH/ 6" 2/6" 6/6"										
				-very stiff to hard @ 8.5'-10' w/ wood			2/6" 5/6" 50/2"										
95	10																
				-very stiff w/ sand pockets & miscellaneous non-degradable material @ 13.5'-15'			3/6" 14/6" 15/6"										
90	15																
				Very stiff brown w/ wood "FILL"			9/6" 13/6" 14/6"										
85	20			Terminated @ 20'													
	25																
	30																
	35																

COMPLETION DEPTH: 20 ft
 DATE BORING STARTED: 8/1/2022
 DATE BORING COMPLETED: 8/1/2022
 LOGGER: Gayrian Singleton
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite chips upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-9

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N: 29°40'47.31" W: 95°25'28.97"	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED	
				SURFACE ELEVATION: 105.59 ft.													
				DRILLING METHOD: Dry Augered: 0' to 10' Wash Bored: to													
				MATERIAL DESCRIPTION													
105	0			Loose dark brown SANDY LEAN CLAY "FILL" w/ calcareous deposits SURFICIAL FILL & LANDFILL CAP 0'-10'		4/6" 4/6" 4/6"											
				Stiff dark brown FAT CLAY "FILL"		2/6" 5/6" 7/6"		25		73	46						
	5			-firm @ 4.5'-7' -gray w/ ferrous nodules @ 4.5'-6'		2/6" 3/6" 5/6"											
100				-brown @ 6.5'-7' Firm tan SILTY SAND "FILL"		2/6" 3/6" 5/6"											
				Very stiff brown & gray FAT CLAY "FILL" w/ ferrous nodules & calcareous deposits		5/6" 8/6" 10/6"		18									
95	10			Terminated @ 10'													
	15																
	20																
	25																
	30																
	35																

COMPLETION DEPTH: 10 ft
 DATE BORING STARTED: 8/2/2022
 DATE BORING COMPLETED: 8/2/2022
 LOGGER: Josh Sparks
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water encountered.
 Boring backfilled with dry bentonite chips upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-10

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 40' 45.62" W 95° 35' 26.08" SURFACE ELEVATION: 102.82	DRILLING METHOD: Dry Augered: 0' to 12' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0			Firm brown SANDY LEAN CLAY (CL) w/ calcareous deposits & roots SURFICIAL FILL & LANDFILL CAP 0'-12' -very stiff to hard & tan @ 2'-4'	(P)4.50+	3/6" 4/6" 4/6"			10	112	33	16	6.42	3 *	3		
	5			Very stiff brown FAT CLAY (CH) w/ calcareous nodules, sand pockets & sand lens		3/6" 8/6" 9/6"											
	5			Stiff tan & brown SANDY LEAN CLAY (CL) w/ roots		2/6" 4/6" 6/6"											
	10			-dark brown w/ clay pockets & calcareous deposits @ 8.5'-10'		3/6" 4/6" 8/6"											
	10			Firm dark brown FAT CLAY (CH) w/ sand pockets, calcareous deposits & roots		2/6" 3/6" 5/6"											
	12			Terminated @ 12'													

COMPLETION DEPTH: 12 ft
 DATE BORING STARTED: 8/2/2022
 DATE BORING COMPLETED: 8/2/2022
 LOGGER: Chuck Doss
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite chips upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-11

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 40' 44.75" W 95° 35' 28.82" SURFACE ELEVATION: 98.18 ft	DRILLING METHOD: Dry Augered: 0' to 12' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0			Stiff dark brown SANDY LEAN CLAY "FILL" w/ calcareous deposits SURFICIAL FILL & LANDFILL CAP 0'-6.5'			5/6" 4/6" 6/6"										
	95			-w/ sand seams @ 2.5'-4'			2/6" 4/6" 6/6"		13		38	21					
	5			-firm & light brown w/ clay pockets @ 4.5'-6'			1/6" 2/6" 5/6"										
	90			Stiff dark brown FAT CLAY "FILL" w/ calcareous deposits & miscellaneous non-degradable material			4/6" 5/6" 5/6"		17		59	38					
	10			Firm dark brown SANDY FAT CLAY "FILL" w/ sand seams & miscellaneous non-degradable material	(P).50				23	97	56	34					
	85			Terminated @ 12'			3/6" 1/6" 4/6"		37								

COMPLETION DEPTH: 12 ft
 DATE BORING STARTED: 8/2/2022
 DATE BORING COMPLETED: 8/2/2022
 LOGGER: Josh Sparks
 PROJECT NO.: 22.14.222

NOTES: Free Water encountered at 10' during drilling and dry from 5 minutes to 15 minutes.
 Boring backfilled with dry bentonite chips upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK

LOG OF BORING B22-12

PROJECT: Bissonnet 136 Site

CLIENT: Goodheart & Associates, LLC

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	COORDINATES: N 29° 40' 46.81" W 95° 35' 31.38" SURFACE ELEVATION: 101.09 ft	DRILLING METHOD: Dry Augered: 0' to 10' Wash Bored: to	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	STD. PENETRATION TEST BLOWCOUNT	N ₆₀	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	PASSING #200 SIEVE (%)	OTHER TESTS PERFORMED
				MATERIAL DESCRIPTION													
	0			Very stiff tan & brown SANDY LEAN CLAY "FILL" w/ calcareous deposits LANDFILL CAP 0'-2.5'			7/6" 9/6" 10/6"										
				-w/ wood & miscellaneous non-degradable material @ 2.5'-4'			7/6" 12/6" 11/6"		12								
	5			-w/ wood and miscellaneous non-degradable material "FILL"							0	NP					
				Stiff dark brown FAT CLAY (CH) w/ wood & miscellaneous non-degradable material			3/6" 4/6" 6/6"										
				-very stiff @ 8.5'-10'			3/6" 10/6" 8/6"		30								
	10			Terminated @ 10'													
	90																
	15																
	85																
	20																
	80																
	25																
	75																
	30																
	70																
	35																

COMPLETION DEPTH: 10 ft
 DATE BORING STARTED: 8/2/2022
 DATE BORING COMPLETED: 8/2/2022
 LOGGER: Josh Sparks
 PROJECT NO.: 22.14.222

NOTES: No Free Water and No Static Water was encountered.
 Boring backfilled with dry bentonite chips upon completion of soil sampling.
 SPT Hammer Type: Automatic Hammer Drilling Equipment: CME TRUCK



Geotechnical Investigation Report

APPENDIX B LABORATORY TEST DATA

SUMMARY OF LABORATORY TESTS

Client: Goodheart & Associates, LLC

Project No. 22.14.222

Project: Bissonnet 136 Site

Boring No.	Sample No.	Depth (ft)	Pocket Pen. (tsf)	Torvane (tsf)	Soil Description	USCS	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plast. Index	Finer than #200 Sieve (%)	pH	Lab Vane Shear (tsf)	Uc/UU. Compr. (tsf)	Failure Strain (%)	Conf. Pres. (psi)	Failure Type
B22-2		0																
		0.5																
		2.5-4																
		4	4.50		Dark gray tree bark	SC	8.9											
		6.5				OH	14.8	86.4	NV	NP	NP				17.06	15.0	4.0	Bulge
		8.5																
		10.5																
		13.5																
		18.5																
		23.5																
		28.5																
		33.5																
		35																
		38.5																
	43.5																	
	48.5																	
	53.5-55				Dark gray tree bark	OH	30.3											
	54																	
	55																	
B22-3		0																
		0.5																
		2-4	4.5+		Gray brown LEAN CLAY; calcareous nodules	CL	13.6	118.9	49	19	30				6.82	5.8	1.9	Multiple shear
		4.5																
		6-8	2.25		Reddish brown gray FAT CLAY; calcareous nodules	CH	22.1	103.2	52	20	32				1.48	4.4	6.6	Slickensid
		7																
		8.5																
		10.5-12																
		12.5								48	20	28						
		14.5																
		18.5-20																
		23.5								83	30	53						
		28.5																
		33.5																

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TOLUNAY-WONG ENGINEERS, INC.

SUMMARY OF LABORATORY TESTS

Project No. 22.14.222

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Boring No.	Sample No.	Depth (ft)	Pocket Pen. (tsf)	Torvane (tsf)	Soil Description	USCS	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plast. Index	Finer than #200 Sieve (%)	pH	Lab Vane Shear (tsf)	Uc/UJ. Compr. (tsf)	Failure Strain (%)	Conf. Pres. (psi)	Failure Type
		35																
		38.5																
		43.5																
		48.5																
		53.5																
		58.5																
		60																
B22-4		0																
		0.5																
		2.5-4				SC	11.1											
		3																
		4-6	4.5+		Gray brown LEAN CLAY; calcareous (Fill)	CL	13.0	117.7	44	17	27			5.87	10.3	4.0	Multiple shear	
		6.5																
		8.5																
		10																
B22-6		0																
		0.5																
		2.5-4				CL	14.2											
		4.5-6				CL	15.7		49	19	30							
		6.5-8				CH	27.0		65	23	42							
		8.5-10				CL	22.5		47	20	27							
		9																
		10.5																
		13.5																
		15																
B22-7		0																
		0.5																
		2.5-4				CL	11.8		39	18	21							
		4.5																
		6																
		8.5																
		10																
B22-8		0																

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SUMMARY OF LABORATORY TESTS

Project No. 22.14.222

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Boring No.	Sample No.	Depth (ft)	Pocket Pen. (tsf)	Tonvane (tsf)	Soil Description	USCS	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plast. Index	Finer than #200 Sieve (%)	pH	Lab Vane Shear (tsf)	Uc/UU Compr. (tsf)	Failure Strain (%)	Conf. Pres. (psi)	Failure Type		
		0.5																		
		2.5-4																		
		4			Tree bark and carpet	CL	10.5		31	15	16									
		6.5				OH			NV	NP	NP									
		7																		
		8.5																		
		13.5																		
		18.5																		
		20																		
B22-9																				
		0																		
		0.5																		
		2.5-4																		
		4.5				CH	24.6		73	27	46									
		6.5																		
		7																		
		8.5-10				CH	18.1													
B22-10		10			No sample															
		0																		
		0.5																		
		2-4	4.5+			CL	10.3	111.9	33	17	16				6.42	3.1	2.5	Slickensided		
		4.5			Gray brown LEAN CLAY with SAND; calcareous (FILL)															
		6.5																		
		8.5																		
		10.5																		
		12																		
B22-11																				
		0																		
		0.5																		
		2.5-4				CL	13.2		38	17	21									
		4.5																		
		6.5-8				CH	17.4		59	21	38									
		8-10	2.75			CH	22.8		56	22	34									
		10.5-12				CH	36.6													
		12																		

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SUMMARY OF LABORATORY TESTS

Project No. 22.14.222

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Boring No.	Sample No.	Depth (ft)	Pocket Pen. (tsf)	Torvane (tsf)	Soil Description	USCS	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plast. Index	Finer than #200 Sieve (%)	pH	Lab Vane Shear (tsf)	Uc/UU. Compr. (tsf)	Failure Strain (%)	Conf. Pres. (psi)	Failure Type
B22-12		0																
		0.5																
		2.5-4				CL	11.6											
		4			Dark gray tree bark	OH			NV	NP	NP							
		6.5																
		8.5-10				CH	29.5											
		10																

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SUMMARY OF LABORATORY TESTS

Client: Goodheart & Associates, LLC

Project No. 22.14.222

Project: Bissonnet 136 Site

Boring No.	Sample No.	Depth (ft)	Pocket Pen. (tsf)	Torvane (tsf)	Soil Description	USCS	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plast. Index	Finer than #200 Sieve (%)	pH	Lab Vane Shear (tsf)	Uc/UU, Compr. (tsf)	Failure Strain (%)	Conf. Pres. (psi)	Failure Type
B22-5A		0																
		0.5																
		2.5																
		4	3.00		Dark gray and gray fat clay w/ CN	CH	18.7	105.3	53	18	35						4.0	Multiple Shear
		6.5																
		8	1.25		Light gray, light brown and dark gray fat clay w/ CN	CH	20.8	106.1	53	19	34							7.5
B22-6B		10.5																
		12																
		0																
		2.5			Brown and dark gray sandy lean clay	CL	12.7		48	18	30	63.7						
		4																
		6.5			Dark gray and light gray fat clay w/ sand and CN	CH	17.7		51	19	32	57.3						
		8.5																
		10.5																
		12.5																
		13																
		18.5																
		23.5																
		28.5																
		33.5																
	35																	
	38.5																	
	43.5																	
	48.5																	
	53.5																	
	58.5				Reddish brown and light gray fat clay	CH	26.4		71	19	52							
	60																	

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Tolunay-Wong Engineers, Inc. in Texas City, TX



Project No. 22.14.222

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Boring	Depth (ft)	Moisture Contents (%)			Dry Density (pcf)			Compressive Strength			Failure Type		
		ww	dw	tw	Moisture	Dia. in.	ht. in.	Wet Wt. gms.	Dry Den. (pcf)	Comp. (tsf)		Strain (%)	Conf. Press. (psi)
B22-5A	4	139.68	122.67	31.94	18.7	2.882	5.765	1233.66	105.3			4.0	Multiple Shear Bulge
	8	145.74	126.09	31.41	20.8	2.864	5.756	1247.92	106.1			7.5	
B22-6B	2.5	154.69	143.69	57.29	12.7								
	6.5	153.54	138.23	51.83	17.7								
	58.5	138.87	116.51	31.72	26.4								

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LIQUID AND PLASTIC LIMIT TEST DATA

9/22/2022

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Project Number: 22.14.222

Location: B22-5A

Depth: 4

Material Description: Dark gray and gray fat clay w/ CN

Sample Date: 09/20/2022

USCS: CH

Atterberg Testing Standard: ASTM D4318 Method B

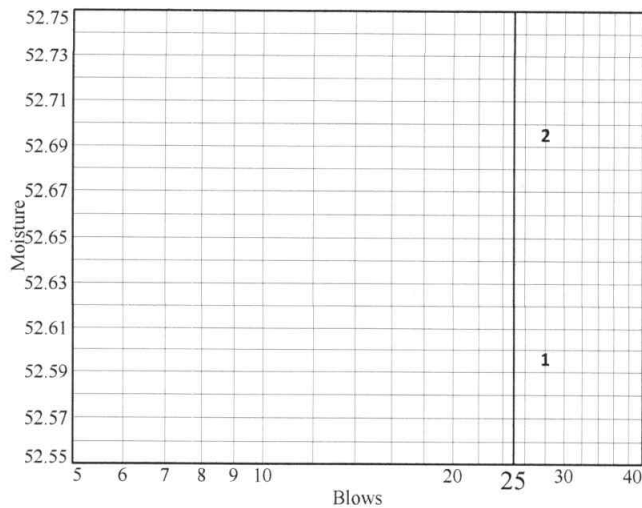
Tested By: K Lopez

Test Date: 09/21/2022

Checked By: R Kowis

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	22.64	22.40				
Dry+Tare	19.50	19.37				
Tare	13.53	13.62				
# Blows	28	28				
Moisture	52.6	52.7				



Liquid Limit= 53
Plastic Limit= 18
Plasticity Index= 35
Natural Moisture= 18.7
Liquidity Index= 0.0

Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare	13.61	13.34		
Dry+Tare	12.65	12.40		
Tare	7.22	7.13		
Moisture	17.7	17.8		

LIQUID AND PLASTIC LIMIT TEST DATA

9/22/2022

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Project Number: 22.14.222

Location: B22-5A

Depth: 8

Material Description: Light gray, light brown and dark gray fat clay w/ CN

Sample Date: 09/20/2022

USCS: CH

Atterberg Testing Standard: ASTM D4318 Method B

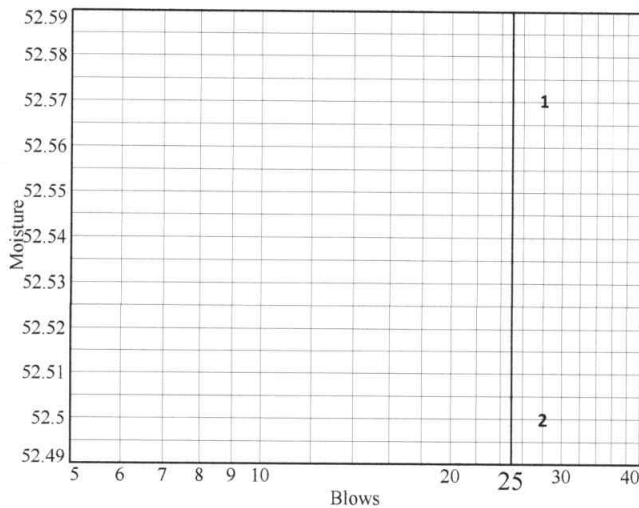
Tested By: K Lopez

Test Date: 09/21/2022

Checked By: R Kowis

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	22.92	22.07				
Dry+Tare	19.75	19.13				
Tare	13.72	13.53				
# Blows	28	28				
Moisture	52.6	52.5				



Liquid Limit= 53
Plastic Limit= 19
Plasticity Index= 34
Natural Moisture= 20.8
Liquidity Index= 0.1

Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare	13.57	13.42		
Dry+Tare	12.53	12.43		
Tare	7.07	7.28		
Moisture	19.0	19.2		

LIQUID AND PLASTIC LIMIT TEST DATA

9/22/2022

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Project Number: 22.14.222

Location: B22-6B

Depth: 2.5

Material Description: Brown and dark gray sandy lean clay

Sample Date: 09/20/2022

USCS: CL

Atterberg Testing Standard: ASTM D4318 Method B

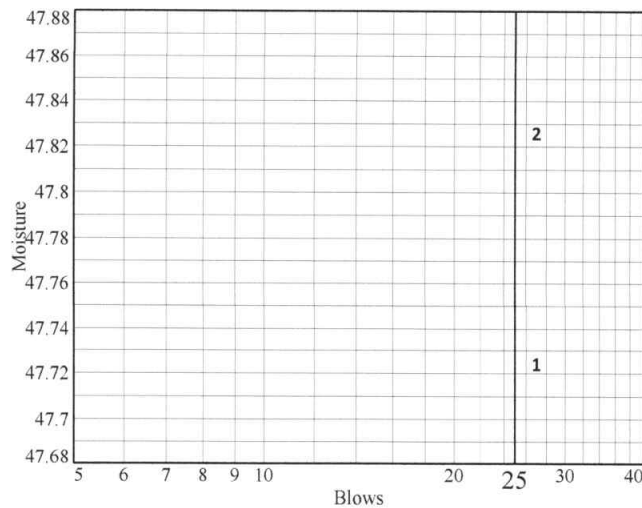
Tested By: K Lopez

Test Date: 09/21/2022

Checked By: R Kowis

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	24.98	27.47				
Dry+Tare	21.31	22.96				
Tare	13.62	13.53				
# Blows	27	27				
Moisture	47.7	47.8				



Liquid Limit= 48
Plastic Limit= 18
Plasticity Index= 30
Natural Moisture= 12.7
Liquidity Index= -0.2

Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare	14.74	14.54		
Dry+Tare	13.60	13.43		
Tare	7.15	7.18		
Moisture	17.7	17.8		

LIQUID AND PLASTIC LIMIT TEST DATA

9/22/2022

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Project Number: 22.14.222

Location: B22-6B

Depth: 6.5

Material Description: Dark gray and light gray fat clay w/ sand and CN

Sample Date: 09/20/2022

USCS: CH

Atterberg Testing Standard: ASTM D4318 Method B

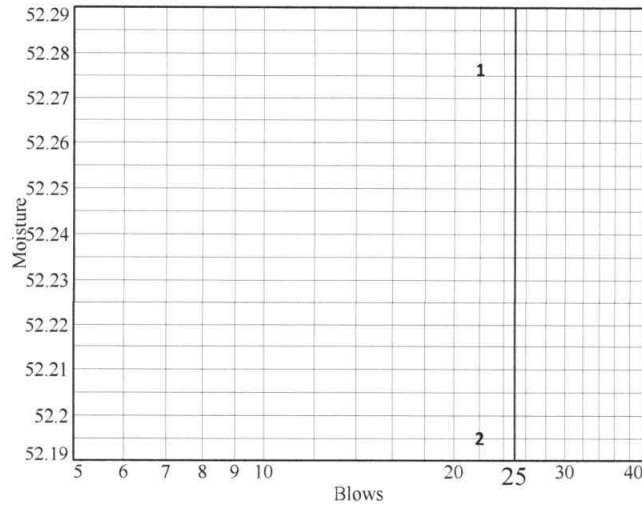
Tested By: K Lopez

Test Date: 09/21/2022

Checked By: R Kowis

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	22.59	22.92				
Dry+Tare	19.49	19.71				
Tare	13.56	13.56				
# Blows	22	22				
Moisture	52.3	52.2				



Liquid Limit= 51
Plastic Limit= 19
Plasticity Index= 32
Natural Moisture= 17.7
Liquidity Index= 0.0

Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare	14.56	14.37		
Dry+Tare	13.41	13.25		
Tare	7.23	7.24		
Moisture	18.6	18.6		

LIQUID AND PLASTIC LIMIT TEST DATA

9/22/2022

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Project Number: 22.14.222

Location: B22-6B

Depth: 58.5

Material Description: Reddish brown and light gray fat clay

Sample Date: 09/20/2022

USCS: CH

Atterberg Testing Standard: ASTM D4318 Method B

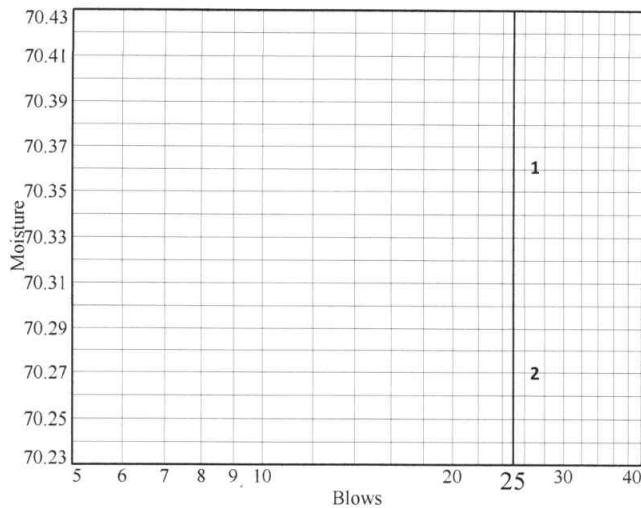
Tested By: K Lopez

Test Date: 09/21/2022

Checked By: R Kowis

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	20.70	19.86				
Dry+Tare	17.78	17.26				
Tare	13.63	13.56				
# Blows	27	27				
Moisture	70.4	70.3				



Liquid Limit= 71
Plastic Limit= 19
Plasticity Index= 52
Natural Moisture= 26.4
Liquidity Index= 0.1

Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare	13.21	13.47		
Dry+Tare	12.23	12.45		
Tare	7.19	7.19		
Moisture	19.4	19.4		

GRAIN SIZE DISTRIBUTION TEST DATA

9/22/2022

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Project Number: 22.14.222

Location: B22-6B

Depth: 2.5

Material Description: Brown and dark gray sandy lean clay

Sample Date: 09/20/2022

PL: 18

LL: 48

PI: 30

USCS Classification: CL

Checked by: R Kowis

Wash Test Data (ASTM D1140)

Test Date: 09/21/2022 **Technician:** K Lopez

Pre #200 Wash Test Weights (grams): Dry Specimen+Tare = 143.69
Tare Wt. = 52.29

Post #200 Wash Test Weights (grams): Dry Specimen+Tare = 243.89
Tare Wt. = 210.68

Minus #200 from wash = 63.7%

GRAIN SIZE DISTRIBUTION TEST DATA

9/22/2022

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Project Number: 22.14.222

Location: B22-6B

Depth: 6.5

Material Description: Dark gray and light gray fat clay w/ sand and CN

Sample Date: 09/20/2022

PL: 19

LL: 51

PI: 32

USCS Classification: CH

Checked by: R Kowis

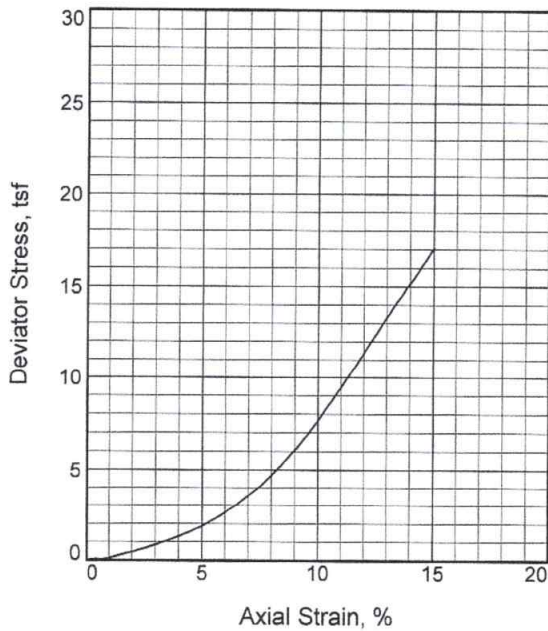
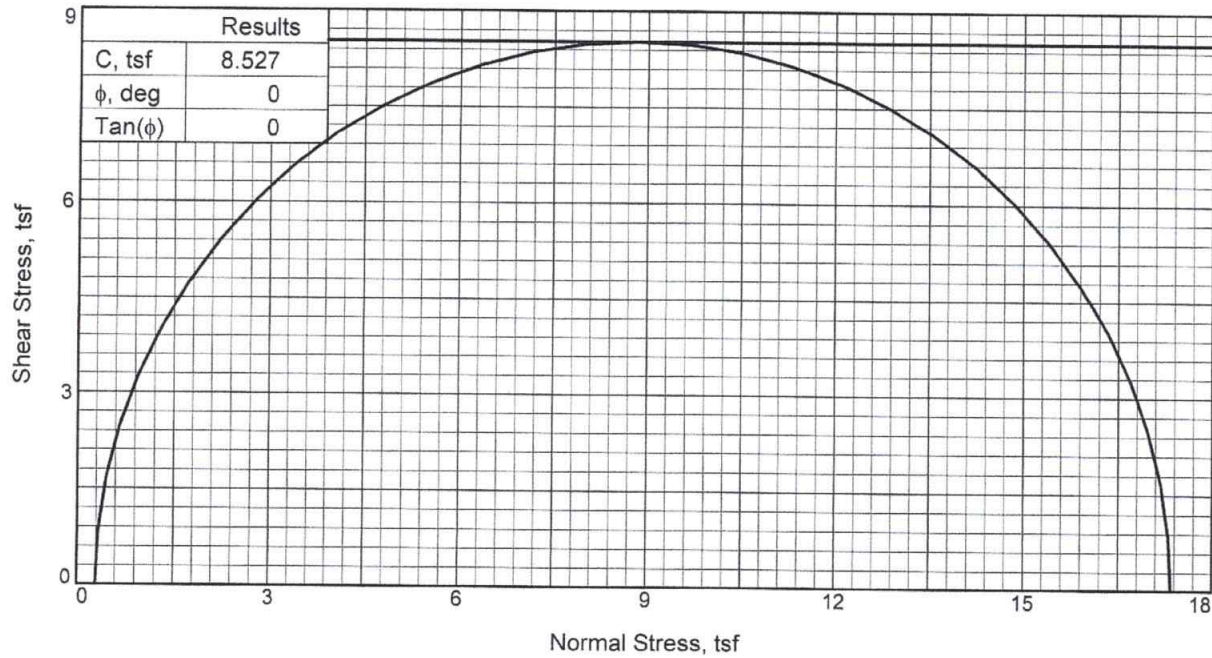
Wash Test Data (ASTM D1140)

Test Date: 09/21/2022 **Technician:** K Lopez

Pre #200 Wash Test Weights (grams): Dry Specimen+Tare = 138.23
Tare Wt. = 51.83

Post #200 Wash Test Weights (grams): Dry Specimen+Tare = 247.48
Tare Wt. = 210.59

Minus #200 from wash = 57.3%



Sample No.		1
Initial	Water Content, %	14.8
	Dry Density, pcf	86.4
	Saturation, %	42.1
	Void Ratio	0.9510
	Diameter, in.	2.87
At Test	Height, in.	5.92
	Water Content, %	5.3
	Dry Density, pcf	86.4
	Saturation, %	15.1
	Void Ratio	0.9510
Diameter, in.		2.87
	Height, in.	5.92
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		4.00
Fail. Stress, tsf		17.1
Strain, %		15.0
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		17.3
σ_3 Failure, tsf		0.3

Type of Test:

Unconsolidated Undrained

Sample Type: Undisturbed

Description: Dark gray tree bark

LL= NV

PI= NP

Assumed Specific Gravity= 2.70

Remarks:

Test method: ASTM D2850

Failure type: Bulge

Figure _____

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

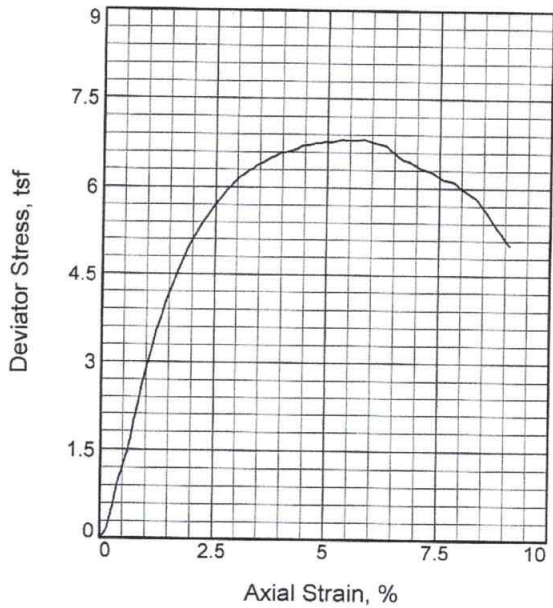
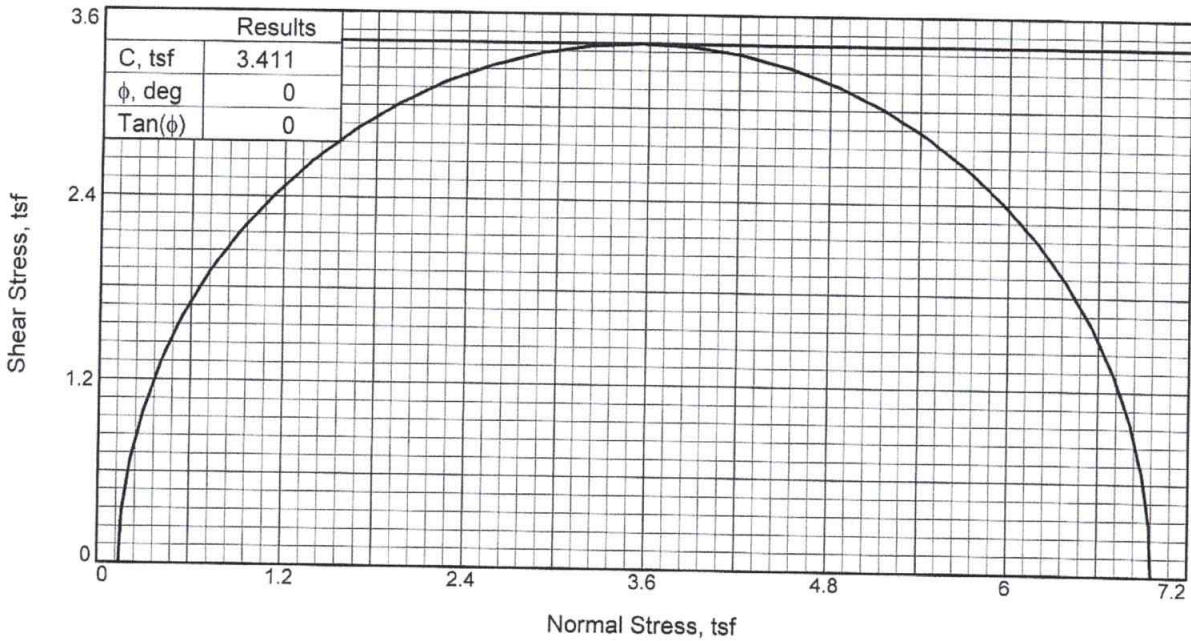
Source of Sample: B22-2

Depth: 4

Proj. No.: 22.14.222

Date Sampled: 8/23/22

TRIAXIAL SHEAR TEST REPORT
 Tolunay-Wong Engineers, Inc.
 Houston, Texas



Sample No.	1	
Initial	Water Content, %	13.6
	Dry Density, pcf	118.9
	Saturation, %	87.7
	Void Ratio	0.4171
	Diameter, in.	2.83
At Test	Height, in.	5.91
	Water Content, %	14.2
	Dry Density, pcf	118.9
	Saturation, %	92.2
	Void Ratio	0.4171
Strain rate, %/min.		1.00
	Back Pressure, psi	0.00
Cell Pressure, psi		1.93
Fail. Stress, tsf		6.82
Strain, %		5.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		6.96
σ_3 Failure, tsf		0.14

Type of Test:

Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray brown LEAN CLAY; calcareous nodules

LL= 49 PL= 19 PI= 30

Assumed Specific Gravity= 2.70

Remarks:

Test method: ASTM D2850

Failure type: Multiple shear

Figure _____

Client: Goodheart & Associates, LLC

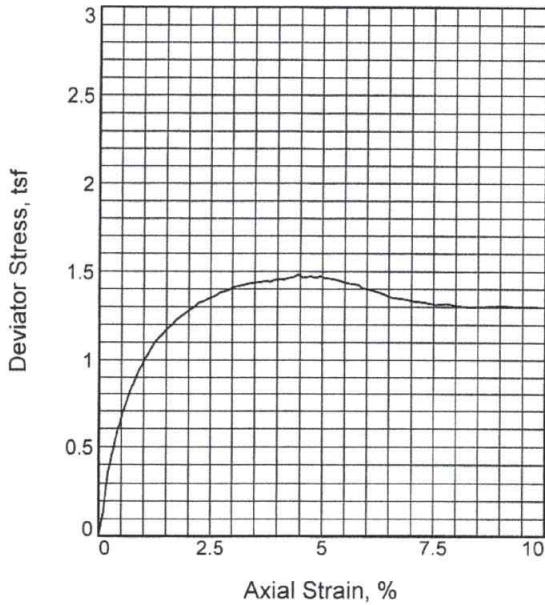
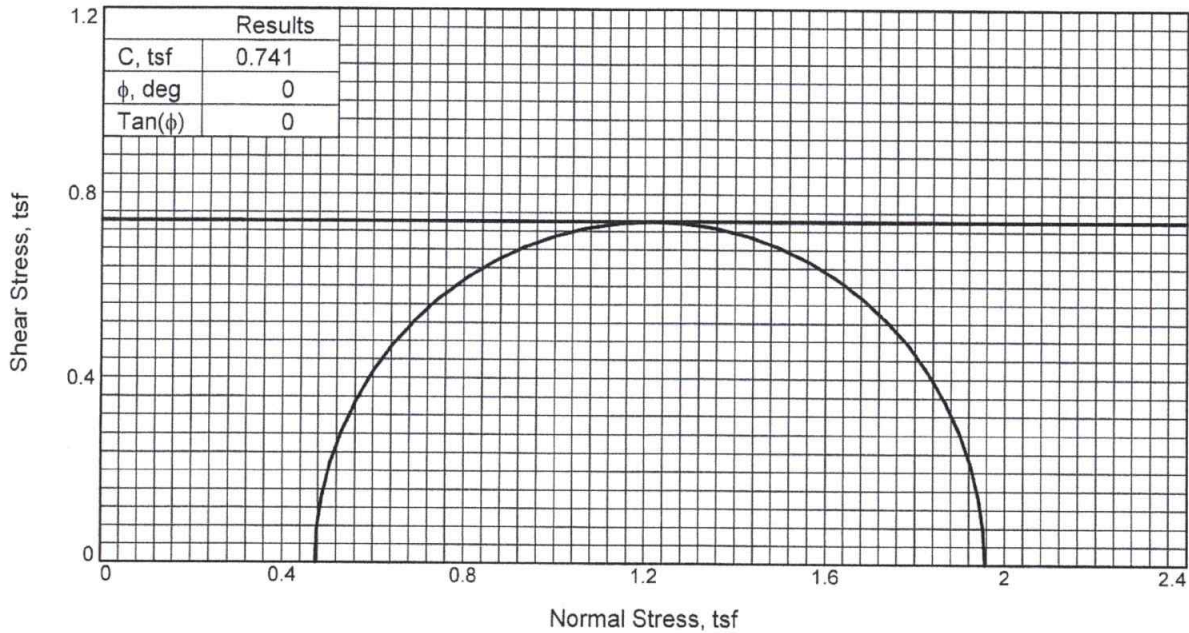
Project: Bissonnet 136 Site

Source of Sample: B22-3 **Depth:** 2-4

Proj. No.: 22.14.222 **Date Sampled:** 08/24/2022

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.
Houston, Texas

Tested By: PK _____



Sample No.	1	
Initial	Water Content, %	22.1
	Dry Density, pcf	103.2
	Saturation, %	91.6
	Void Ratio	0.6628
	Diameter, in.	2.83
	Height, in.	5.86
At Test	Water Content, %	23.9
	Dry Density, pcf	103.2
	Saturation, %	99.1
	Void Ratio	0.6628
	Diameter, in.	2.83
	Height, in.	5.86
Strain rate, %/min.	1.00	
Back Pressure, psi	0.00	
Cell Pressure, psi	6.58	
Fail. Stress, tsf	1.48	
Strain, %	4.4	
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf	1.96	
σ_3 Failure, tsf	0.47	

Type of Test:

Unconsolidated Undrained

Sample Type: Undisturbed

Description: Reddish brown gray FAT CLAY;
calcareous nodules

LL= 52 PL= 20 PI= 32

Assumed Specific Gravity= 2.75

Remarks:

Test method: ASTM D2850

Failure type: Slickensided

Figure _____

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

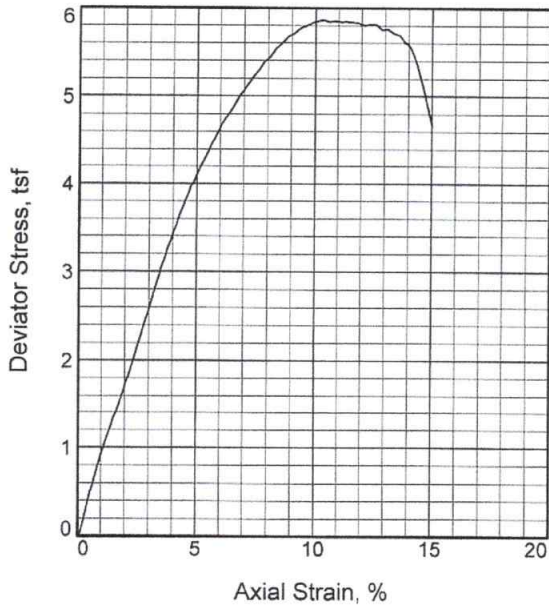
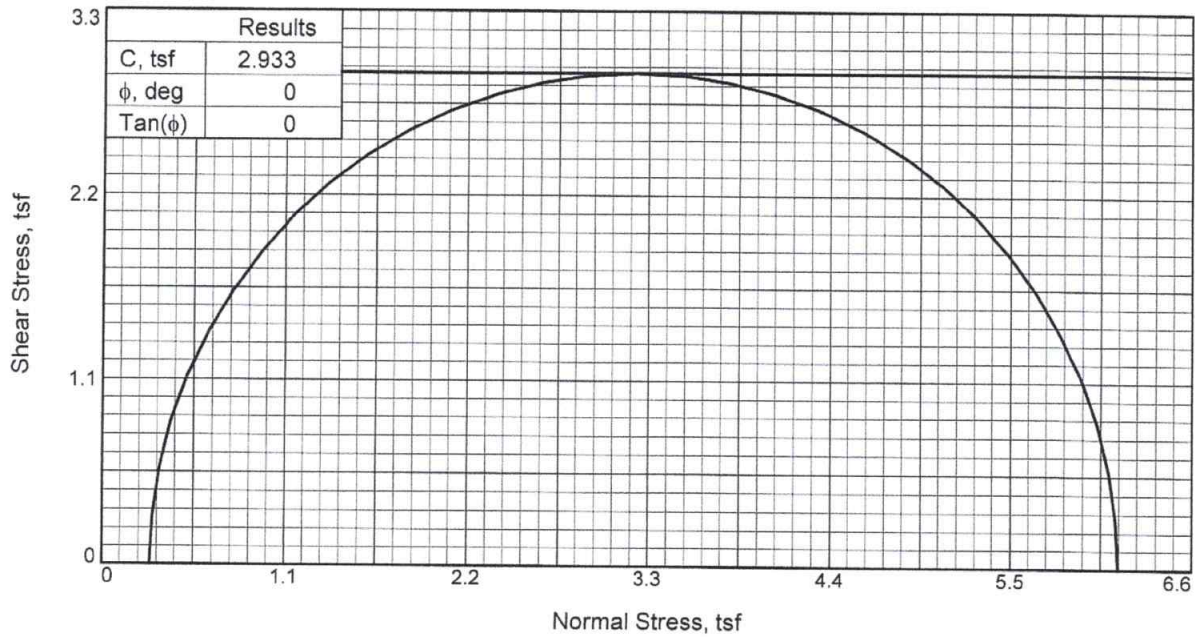
Source of Sample: B22-3 **Depth:** 6-8

Proj. No.: 22.14.222

Date Sampled: 08/24/2022

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.
Houston, Texas

Tested By: PK _____



Sample No.	1	
Initial	Water Content, %	13.0
	Dry Density, pcf	117.7
	Saturation, %	81.5
	Void Ratio	0.4320
	Diameter, in.	2.66
At Test	Height, in.	5.86
	Water Content, %	13.3
	Dry Density, pcf	117.7
	Saturation, %	82.9
	Void Ratio	0.4320
Strain rate, %/min.	Diameter, in.	2.66
	Height, in.	5.86
	Back Pressure, psi	0.00
	Cell Pressure, psi	4.00
	Fail. Stress, tsf	5.87
Strain, %	Strain, %	10.3
	Ult. Stress, tsf	
σ_1 Failure, tsf	Strain, %	
		6.15
σ_3 Failure, tsf		0.29

Type of Test:

Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray brown LEAN CLAY; calcareous (Fill)

LL= 44 PL= 17 PI= 27

Assumed Specific Gravity= 2.70

Remarks:

Test method: ASTM D2850

Failure type: Multiple shear

Figure _____

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

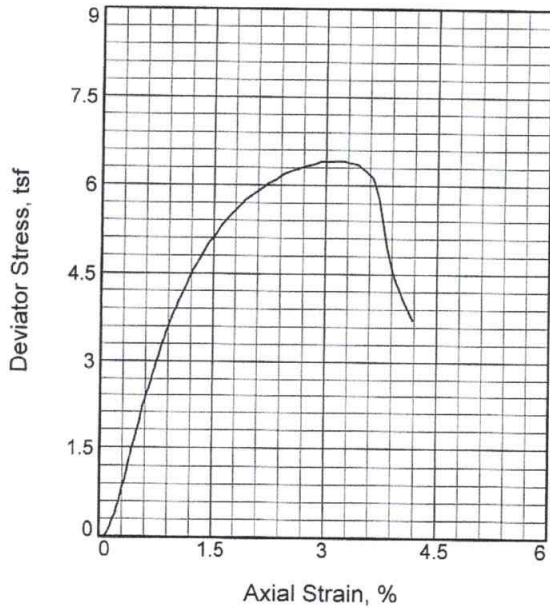
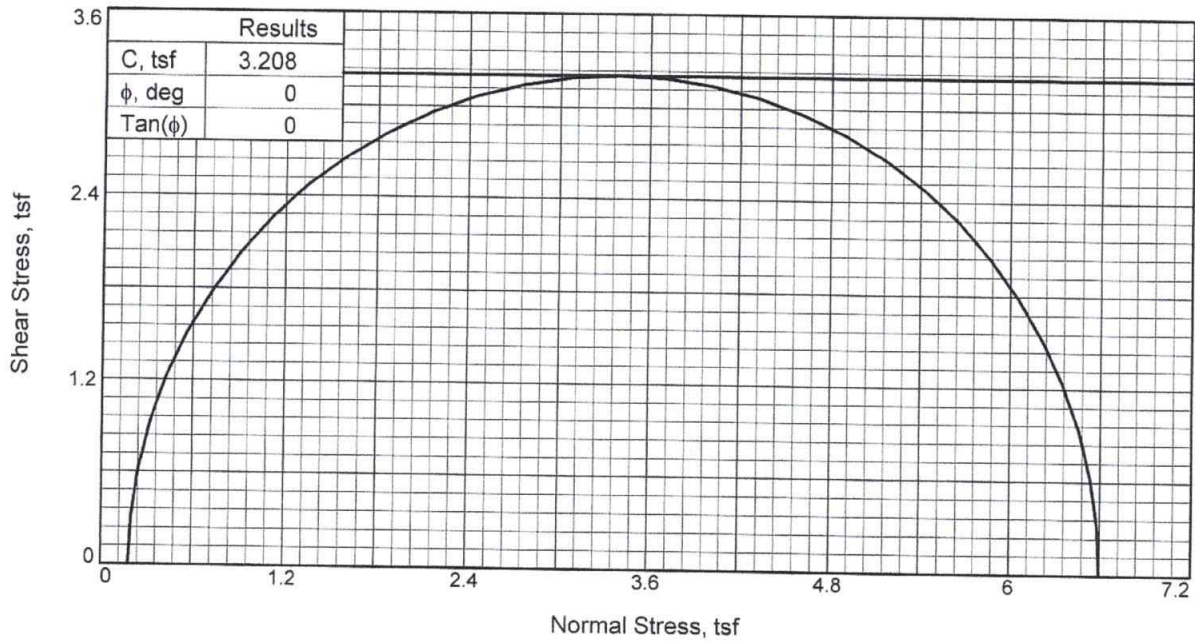
Source of Sample: B22-4 **Depth:** 4-6

Proj. No.: 22.14.222

Date Sampled: 08/24/2022

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.
Houston, Texas

Tested By: PK _____



Sample No.		1
Initial	Water Content, %	10.3
	Dry Density, pcf	111.9
	Saturation, %	55.1
	Void Ratio	0.5064
	Diameter, in.	2.85
At Test	Height, in.	5.89
	Water Content, %	11.2
	Dry Density, pcf	111.9
	Saturation, %	59.7
	Void Ratio	0.5064
Diameter, in.		2.85
Height, in.		5.89
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		2.51
Fail. Stress, tsf		6.42
Strain, %		3.1
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		6.60
σ_3 Failure, tsf		0.18

Type of Test:

Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray brown LEAN CLAY with SAND;
calcareous (FILL)

LL= 33 PL= 17 PI= 16

Assumed Specific Gravity= 2.70

Remarks:

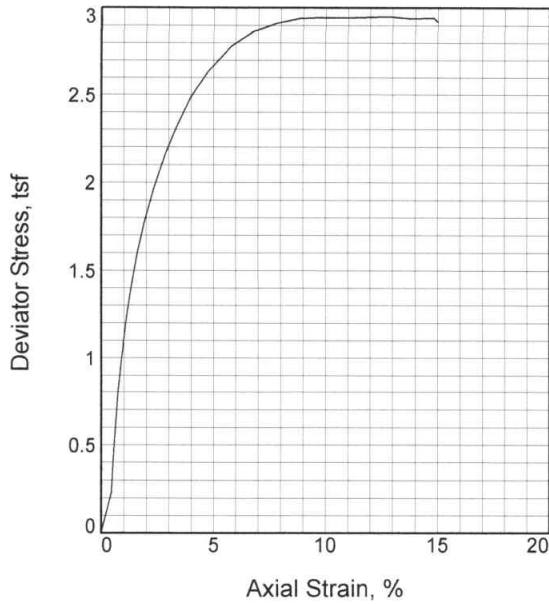
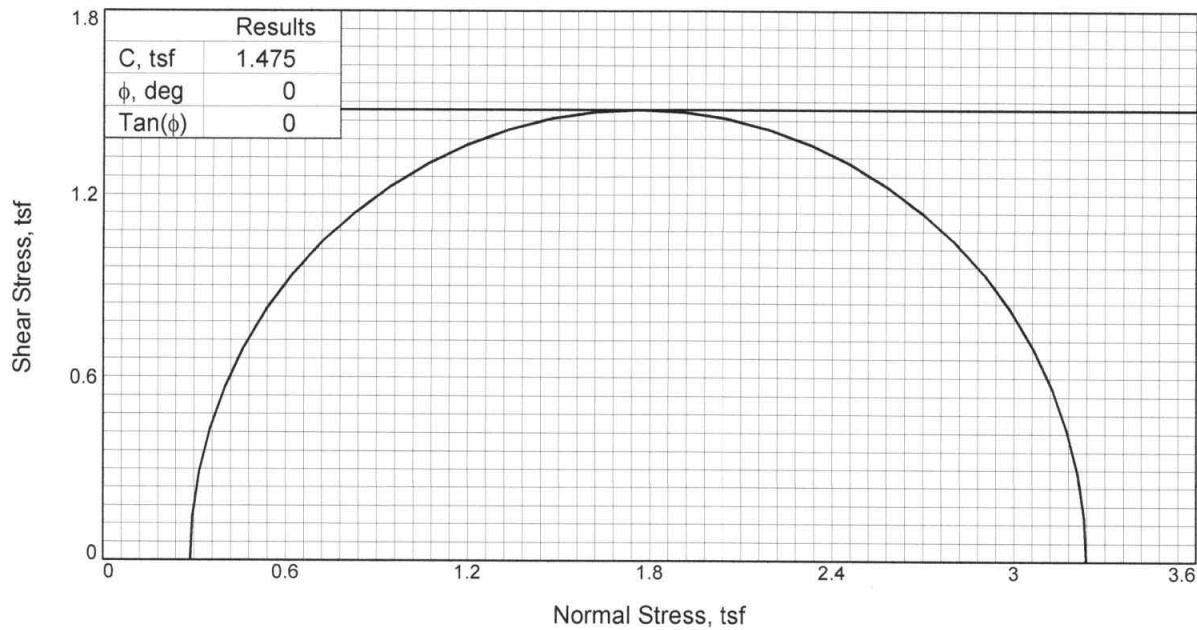
Test method: ASTM D2850

Failure type: Slickensided

Figure _____

Client: Goodheart & Associates, LLC	
Project: Bissonnet 136 Site	
Source of Sample: B22-10	Depth: 2-4
Proj. No.: 22.14.222	Date Sampled: 08/24/2022
TRIAXIAL SHEAR TEST REPORT Tolunay-Wong Engineers, Inc. Houston, Texas	

Tested By: PK



Sample No.	1	
Initial	Water Content, %	18.7
	Dry Density, pcf	105.2
	Saturation, %	84.1
	Void Ratio	0.6017
	Diameter, in.	2.88
At Test	Height, in.	5.76
	Water Content, %	22.3
	Dry Density, pcf	105.2
	Saturation, %	100.0
	Void Ratio	0.6017
Diameter, in.	2.88	
	Height, in.	5.76
Strain rate, %/min.	1.00	
Back Pressure, psi	0.00	
Cell Pressure, psi	4.00	
Fail. Stress, tsf	2.95	
Strain, %	12.8	
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf	3.24	
σ_3 Failure, tsf	0.29	

Type of Test:

Unconsolidated Undrained

Sample Type: Undisturbed

Description: Dark gray and gray fat clay w/ CN

LL= 53

PL= 18

PI= 35

Assumed Specific Gravity= 2.7

Remarks: Test method: ASTM D2850

Failure type: Multiple Shear

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Source of Sample: B22-5A

Depth: 4

Proj. No.: 22.14.222

Date Sampled: 09/20/2022

Figure



Tested By: K Lopez

Checked By: R Kowis

TRIAXIAL COMPRESSION TEST
Unconsolidated Undrained

9/22/2022
10:18 AM

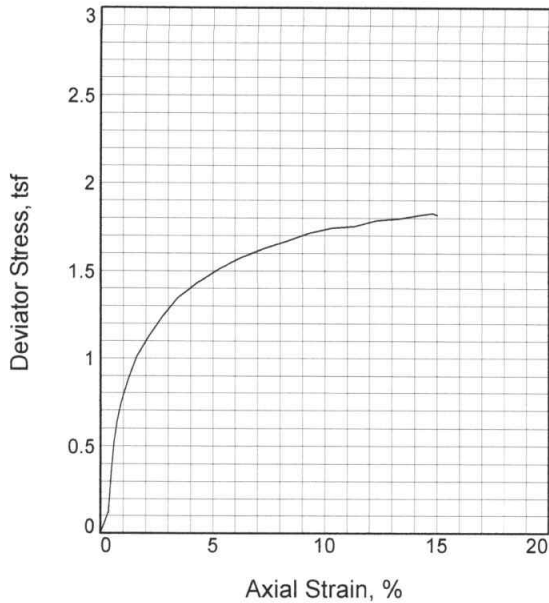
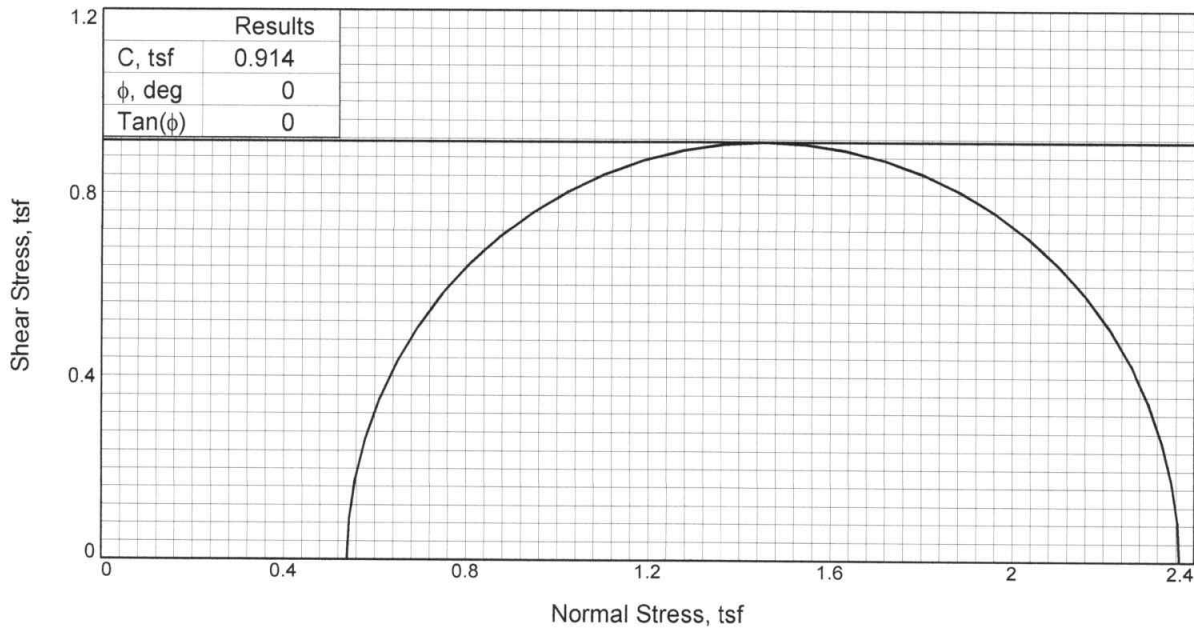
Date: 09/20/2022
Client: Goodheart & Associates, LLC
Project: Bissonnet 136 Site
Project No.: 22.14.222
Location: B22-5A
Depth: 4
Description: Dark gray and gray fat clay w/ CN
Remarks: Test method: ASTM D2850
Failure type: Multiple Shear
Type of Sample: Undisturbed
Assumed Specific Gravity=2.7 **LL**=53 **PL**=18 **PI**=35
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Final
Moisture content: Moist soil+tare, gms.	139.680		161.400
Moisture content: Dry soil+tare, gms.	122.670		140.310
Moisture content: Tare, gms.	31.940		30.950
Moisture, %	18.7	22.3	19.3
Moist specimen weight, gms.	1233.7		
Diameter, in.	2.88	2.88	
Area, in. ²	6.52	6.52	
Height, in.	5.76	5.76	
Net decrease in height, in.		0.00	
Wet density, pcf	125.0	128.7	
Dry density, pcf	105.2	105.2	
Void ratio	0.6017	0.6017	
Saturation, %	84.1	100.0	

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 4.00 psi (0.288 tsf)
Back pressure = 0.00 psi (0.000 tsf)
Strain rate, %/min. = 1.00
Fail. Stress = 2.950 tsf at reading no. 23



Sample No.	1	
Initial	Water Content, %	20.8
	Dry Density, pcf	106.2
	Saturation, %	95.4
	Void Ratio	0.5876
	Diameter, in.	2.86
At Test	Height, in.	5.76
	Water Content, %	21.8
	Dry Density, pcf	106.2
	Saturation, %	100.0
	Void Ratio	0.5876
Strain rate, %/min.	Diameter, in.	2.86
	Height, in.	5.76
	Back Pressure, psi	0.00
	Cell Pressure, psi	7.50
	Fail. Stress, tsf	1.83
Strain, %	Strain, %	14.8
	Ult. Stress, tsf	
Strain, %	Strain, %	
	σ_1 Failure, tsf	2.37
σ_3 Failure, tsf	0.54	

Type of Test:

Unconsolidated Undrained

Sample Type: Undisturbed

Description: Light gray, light brown and dark gray fat clay w/ CN

LL= 53 PL= 19 PI= 34

Assumed Specific Gravity= 2.7

Remarks: Test method: ASTM D2850

Failure type: Bulge

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Source of Sample: B22-5A **Depth:** 8

Proj. No.: 22.14.222

Date Sampled: 09/20/2022

Figure _____



Tested By: K Lopez

Checked By: R Kowis

TRIAXIAL COMPRESSION TEST
Unconsolidated Undrained

9/22/2022
10:21 AM

Date: 09/20/2022
Client: Goodheart & Associates, LLC
Project: Bissonnet 136 Site
Project No.: 22.14.222
Location: B22-5A
Depth: 8
Description: Light gray, light brown and dark gray fat clay w/ CN
Remarks: Test method: ASTM D2850
 Failure type: Bulge
Type of Sample: Undisturbed
Assumed Specific Gravity=2.7 **LL**=53 **PL**=19 **PI**=34
Test Method: COE uniform strain

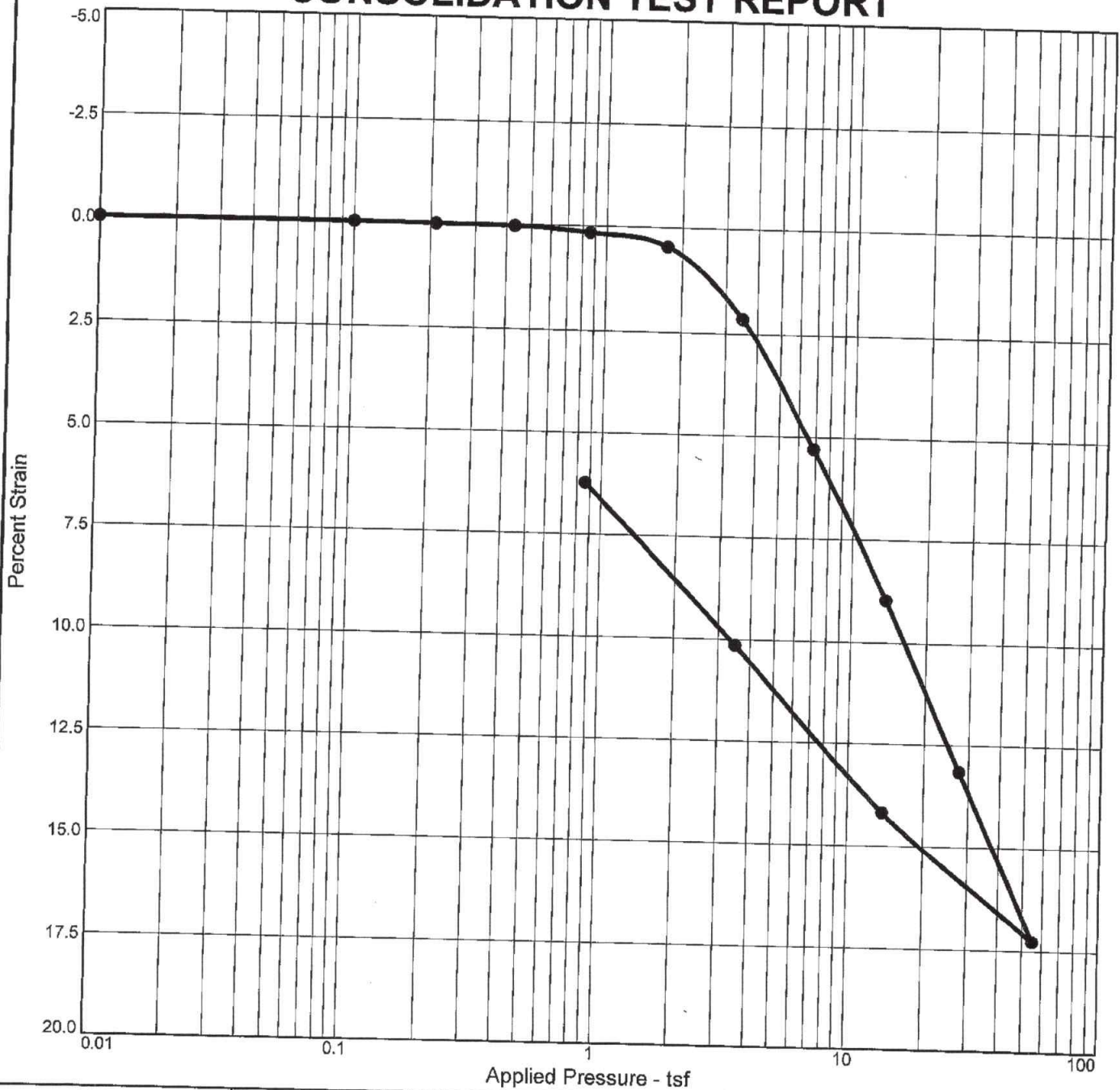
Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Final
Moisture content: Moist soil+tare, gms.	145.740		152.850
Moisture content: Dry soil+tare, gms.	126.090		132.040
Moisture content: Tare, gms.	31.410		30.400
Moisture, %	20.8	21.8	20.5
Moist specimen weight, gms.	1247.9		
Diameter, in.	2.86	2.86	
Area, in. ²	6.44	6.44	
Height, in.	5.76	5.76	
Net decrease in height, in.		0.00	
Wet density, pcf	128.2	129.3	
Dry density, pcf	106.2	106.2	
Void ratio	0.5876	0.5876	
Saturation, %	95.4	100.0	

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 7.50 psi (0.540 tsf)
Back pressure = 0.00 psi (0.000 tsf)
Strain rate, %/min. = 1.00
Fail. Stress = 1.827 tsf at reading no. 24

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
98.3 %	32.8 %	90.4	52	32	2.80	CH		0.933

MATERIAL DESCRIPTION

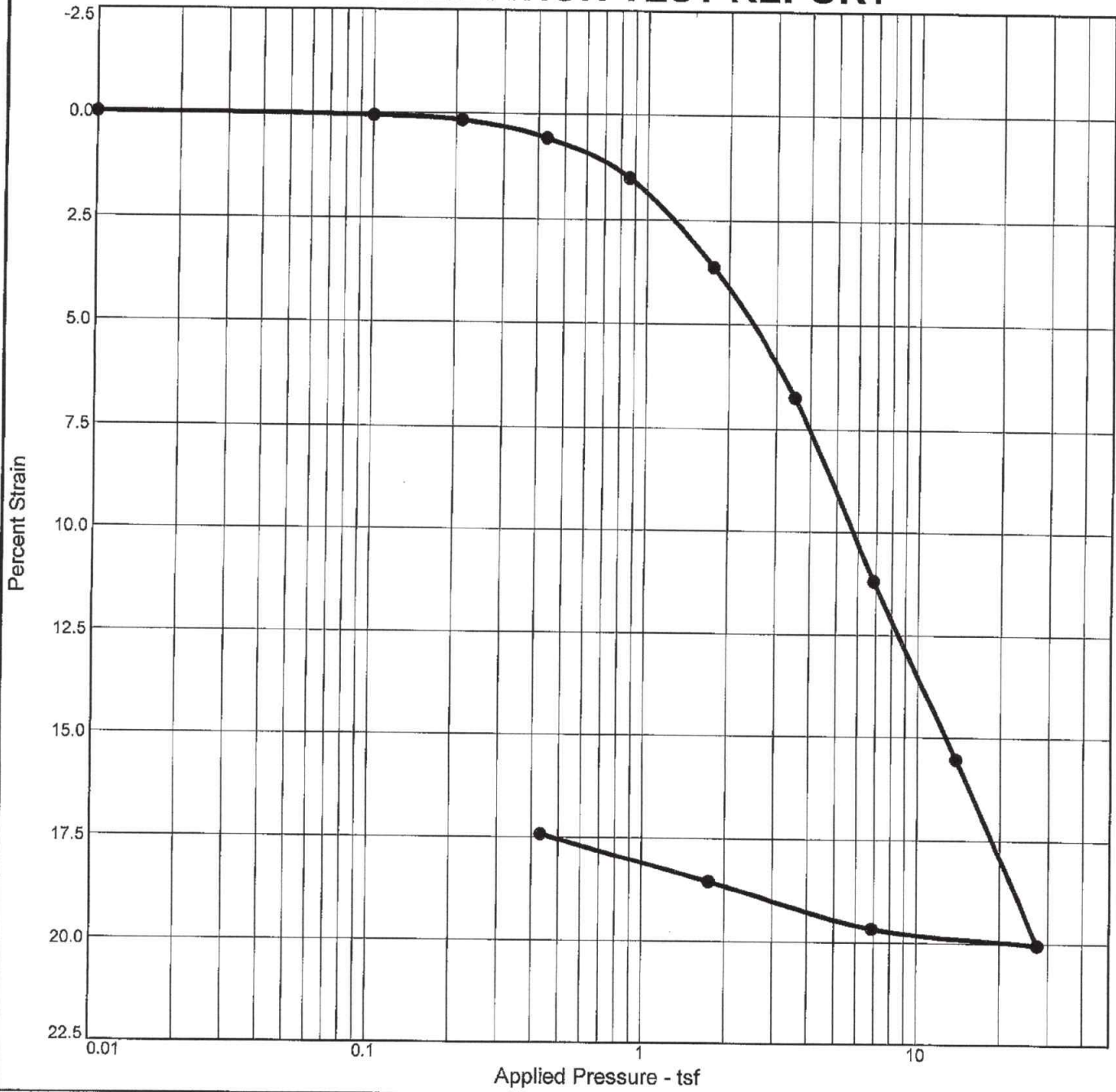
Reddish brown gray FAT CLAY; calcareous nodules

Project No. 22.14.222	Client: Goodheart & Associates, LLC
Project: Bissonnet 136 Site	
Source of Sample: B22-3	Depth: 6-8
Tolunay-Wong Engineers, Inc.	
Houston, Texas	

Remarks:
 Test method: ASTM D2435
 Specific gravity: Assumed

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
91.2 %	27.4 %	93.1	56	34	2.70	CH		0.811

MATERIAL DESCRIPTION

Gray FAT CLAY

Project No. 22.14.222 Client: Goodheart & Associates, LLC Project: Bissonnet 136 Site Source of Sample: B22-11 Depth: 8-10 <p style="text-align: center;">Tolunay-Wong Engineers, Inc.</p> <p style="text-align: center;">Houston, Texas</p>	Remarks: Test method: ASTM D2435 Specific gravity: Assumed
--	---

Figure

CONSOLIDATION TEST DATA

9/6/2022

Client: Goodheart & Associates, LLC

Project: Bissonnet 136 Site

Project Number: 22.14.222

Location: B22-11

Depth: 8-10

Material Description: Gray FAT CLAY

Liquid Limit: 56

Plasticity Index: 34

USCS: CH

Testing Remarks: Test method: ASTM D2435

Specific gravity: Assumed

Test Specimen Data

NATURAL MOISTURE

Wet w+t = 135.86 g.
 Dry w+t = 120.10 g.
 Tare Wt. = 62.52 g.
 Moisture = 27.4 %

VOID RATIO

Spec. Gr. = 2.70
 Est. Ht. Solids = 0.414 in.
 Init. V.R. = 0.811
 Init. Sat. = 91.2 %

AFTER TEST

Wet w+t = 131.38 g.
 Dry w+t = 120.10 g.
 Tare Wt. = 62.52 g.
 Moisture = 19.6 %

UNIT WEIGHT

Height = 0.750 in.
 Diameter = 2.000 in.
 Weight = 73.34 g.
 Dry Dens. = 93.1 pcf

TEST START

Height = 0.750 in.
 Diameter = 2.000 in.

Dry Wt. = 57.58* g.

* Final dry weight used as mineral solids weight

End-Of-Load Summary

Pressure (tsf)	Final Dial (in.)	Machine Defl. (in.)	Deformation (in.)	C _v (ft. ² /yr.)	C _α	Void Ratio	% Strain
start	0.00000		0.00000			0.811	
0.01	0.00000	0.00000	0.00000			0.811	0.0 Compr.
0.10	0.00055	0.00010	0.00045			0.809	0.1 Compr.
0.21	0.00160	0.00040	0.00120			0.808	0.2 Compr.
0.43	0.00510	0.00080	0.00430	27.8	0.000	0.800	0.6 Compr.
0.86	0.01295	0.00160	0.01135	6.8	0.003	0.783	1.5 Compr.
1.75	0.02963	0.00240	0.02723	23.8	0.004	0.745	3.6 Compr.
3.49	0.05380	0.00320	0.05060	27.9	0.000	0.688	6.7 Compr.
6.87	0.08800	0.00410	0.08390	24.4	0.006	0.608	11.2 Compr.
13.75	0.12315	0.00670	0.11645	20.3	0.007	0.529	15.5 Compr.
27.50	0.15855	0.00820	0.15035	11.1	0.004	0.448	20.0 Compr.
6.87	0.15260	0.00510	0.14750	239.6	0.000	0.454	19.7 Compr.
1.75	0.14290	0.00360	0.13930	9.8	0.000	0.474	18.6 Compr.
0.43	0.13325	0.00260	0.13065	1.1	0.000	0.495	17.4 Compr.

Compression index (C_c), tsf = 0.27 Preconsolidation pressure (P_p), tsf = 1.7 Void ratio at P_p (e_m) = 0.747

Overburden (σ_{vo}), tsf = N/A

APPENDIX 3
WATER WELL SEARCH

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
2	5 inches	33 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay Soils.	Max: 0.42 Min: 0.01	Max: 8.4 Min: 6.6
3	33 inches	64 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay Soils.	Max: 0.42 Min: 0.01	Max: 8.4 Min: 6.6

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

<u>DATABASE</u>	<u>SEARCH DISTANCE (miles)</u>
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
I41	USGS40001165953	1/4 - 1/2 Mile West
H47	USGS40001165890	1/4 - 1/2 Mile SSW
M65	USGS40001165944	1/2 - 1 Mile East
P93	USGS40001165993	1/2 - 1 Mile ENE
R100	USGS40001165828	1/2 - 1 Mile SSE
Q102	USGS40001166032	1/2 - 1 Mile WNW
Q103	USGS40001166033	1/2 - 1 Mile WNW
S106	USGS40001165882	1/2 - 1 Mile WSW

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
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GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A1	TXHG60000006995	1/8 - 1/4 Mile North
A2	TXHG60000006996	1/8 - 1/4 Mile North
A3	TXPLU6000001629	1/8 - 1/4 Mile North
B4	TXPLU6000095516	1/4 - 1/2 Mile SW
C5	TXMON6000136088	1/4 - 1/2 Mile SSW
C6	TXMON6000172270	1/4 - 1/2 Mile SSW
C7	TXMON6000136083	1/4 - 1/2 Mile SSW
C8	TXMON6000136084	1/4 - 1/2 Mile SSW
C9	TXPLU6000012868	1/4 - 1/2 Mile SSW
C10	TXPLU6000011115	1/4 - 1/2 Mile SSW
C11	TXPLU6000011109	1/4 - 1/2 Mile SSW
C12	TXPLU6000011112	1/4 - 1/2 Mile SSW
C13	TXPLU6000011110	1/4 - 1/2 Mile SSW
C14	TXPLU6000012869	1/4 - 1/2 Mile SSW
C15	TXMON6000219466	1/4 - 1/2 Mile SW
C16	TXMON6000219465	1/4 - 1/2 Mile SW
D17	TXWDB8000080627	1/4 - 1/2 Mile SE
B18	TXPLU6000007519	1/4 - 1/2 Mile SW
E19	TXPLU6000100541	1/4 - 1/2 Mile NW
E20	TXPLU6000100542	1/4 - 1/2 Mile NW
B21	TXMON6000253931	1/4 - 1/2 Mile SW
B22	TXMON6000253926	1/4 - 1/2 Mile SW
B23	TXMON6000253921	1/4 - 1/2 Mile SW
B24	TXPLU6000129465	1/4 - 1/2 Mile SW
B25	TXPLU6000129464	1/4 - 1/2 Mile SW
B26	TXPLU6000129463	1/4 - 1/2 Mile SW
B27	TXPLU6000007515	1/4 - 1/2 Mile SW
B28	TXPLU6000007514	1/4 - 1/2 Mile SW
B29	TXMON6000054175	1/4 - 1/2 Mile SW
B30	TXMON6000054170	1/4 - 1/2 Mile SW
F31	TXPLU6000007516	1/4 - 1/2 Mile SW
D32	TXWDB8000080626	1/4 - 1/2 Mile SSE
F33	TXPLU6000007520	1/4 - 1/2 Mile SW
G34	TXMON6000079830	1/4 - 1/2 Mile SE
G35	TXPLU6000075584	1/4 - 1/2 Mile SE
G36	TXHG60000001870	1/4 - 1/2 Mile SE
H37	TXBR40000088679	1/4 - 1/2 Mile SSW
H39	TXWDB8000085777	1/4 - 1/2 Mile SSW
H40	TXEQ70000009012	1/4 - 1/2 Mile SSW
J42	TXMON6000414837	1/4 - 1/2 Mile SW
J43	TXMON6000414844	1/4 - 1/2 Mile SW
J44	TXMON6000414853	1/4 - 1/2 Mile SW
J45	TXMON6000414796	1/4 - 1/2 Mile SW

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
H46	TXHG6000000358	1/4 - 1/2 Mile SSW
J48	TXMON6000474777	1/4 - 1/2 Mile SW
J49	TXMON6000489189	1/4 - 1/2 Mile SW
K50	TXMON6000143153	1/4 - 1/2 Mile NNE
K51	TXMON6000143152	1/4 - 1/2 Mile NNE
J52	TXMON6000438743	1/4 - 1/2 Mile SW
J53	TXMON6000438742	1/4 - 1/2 Mile SW
J54	TXMON6000438745	1/4 - 1/2 Mile SW
J55	TXMON6000454274	1/4 - 1/2 Mile SW
J56	TXMON6000454264	1/4 - 1/2 Mile SW
I57	TXWDB8000082417	1/2 - 1 Mile West
I58	TXEQ70000009020	1/2 - 1 Mile West
I59	TXPLU6000007517	1/2 - 1 Mile West
I60	TXHG60000001047	1/2 - 1 Mile West
L61	TXMON6000439298	1/2 - 1 Mile SW
L62	TXMON6000432324	1/2 - 1 Mile SW
L63	TXMON6000489176	1/2 - 1 Mile SW
M64	TXWDB8000081351	1/2 - 1 Mile East
L66	TXMON6000474773	1/2 - 1 Mile SW
L67	TXMON6000438746	1/2 - 1 Mile SW
M68	TXEQ70000009037	1/2 - 1 Mile East
M69	TXHG60000000367	1/2 - 1 Mile East
70	TXHG60000012846	1/2 - 1 Mile NE
N71	TXMON6000364058	1/2 - 1 Mile WSW
N72	TXMON6000364060	1/2 - 1 Mile WSW
N73	TXMON6000364059	1/2 - 1 Mile WSW
N74	TXMON6000364056	1/2 - 1 Mile WSW
75	TXMON6000403268	1/2 - 1 Mile SE
O76	TXMON6000411640	1/2 - 1 Mile WSW
O77	TXMON6000411641	1/2 - 1 Mile WSW
O78	TXMON6000394249	1/2 - 1 Mile WSW
O79	TXMON6000386004	1/2 - 1 Mile WSW
O80	TXMON6000386070	1/2 - 1 Mile WSW
O81	TXMON6000386084	1/2 - 1 Mile WSW
O82	TXMON6000394250	1/2 - 1 Mile WSW
O83	TXMON6000386077	1/2 - 1 Mile WSW
O84	TXMON6000394252	1/2 - 1 Mile WSW
O85	TXMON6000394251	1/2 - 1 Mile WSW
O86	TXMON6000448417	1/2 - 1 Mile WSW
O87	TXMON6000448430	1/2 - 1 Mile WSW
O88	TXMON6000448423	1/2 - 1 Mile WSW
O89	TXMON6000448428	1/2 - 1 Mile WSW
P90	TXHG60000000366	1/2 - 1 Mile ENE
P91	TXWDB8000082419	1/2 - 1 Mile ENE
P92	TXEQ70000009002	1/2 - 1 Mile ENE
94	TXWDB8000076028	1/2 - 1 Mile ESE
95	TXWDB8000092010	1/2 - 1 Mile NNW
96	TXWDB8000082418	1/2 - 1 Mile SSE
Q97	TXWDB8000077124	1/2 - 1 Mile WNW
Q98	TXWDB8000085779	1/2 - 1 Mile WNW
R99	TXEQ70000009039	1/2 - 1 Mile SSE
R101	TXHG60000002247	1/2 - 1 Mile SSE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
104	TXWDB8000077441	1/2 - 1 Mile SSE
S105	TXEQ70000009038	1/2 - 1 Mile WSW
S107	TXHG60000000359	1/2 - 1 Mile WSW
S108	TXWDB8000076448	1/2 - 1 Mile WSW
T109	TXPLU6000174435	1/2 - 1 Mile NE
T110	TXMON6000466844	1/2 - 1 Mile NE
Q111	TXHG60000005042	1/2 - 1 Mile WNW
Q112	TXEQ70000009386	1/2 - 1 Mile WNW
U113	TXPLU6000153535	1/2 - 1 Mile NE
U114	TXMON6000408690	1/2 - 1 Mile NE
Q115	TXEQ70000009385	1/2 - 1 Mile WNW
Q116	TXHG60000005041	1/2 - 1 Mile WNW

OTHER STATE DATABASE INFORMATION

STATE OIL/GAS WELL INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
1	TXOG90001088944	1/2 - 1 Mile NNW

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

A1
North
1/8 - 1/4 Mile
Higher

TX WELLS TXHG6000006995

Database:	Water Well Database	Well #:	8037
Permittee:	Houston, City of	Permit #:	127172
Start Date of Permit:	2/1/2007	Exp Date of Permit:	2/1/2007
Usage:	Other	Active:	Inactive
Year Drilled:	2000	Diameter:	8
Depth (ft):	450	Depth to 1st Screen (ft):	400

A2
North
1/8 - 1/4 Mile
Higher

TX WELLS TXHG6000006996

Database:	Water Well Database	Well #:	8038
Permittee:	Houston, City of	Permit #:	127173
Start Date of Permit:	2/1/2007	Exp Date of Permit:	2/1/2007
Usage:	Other	Active:	Inactive
Year Drilled:	2001	Diameter:	6
Depth (ft):	450	Depth to 1st Screen (ft):	400

A3
North
1/8 - 1/4 Mile
Lower

TX WELLS TXPLU6000001629

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	9568
Well Type:	Monitor	Borehole Depth (ft):	20

B4
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000095516

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	20339
Well Type:	Monitor	Borehole Depth (ft):	20

C5
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000136088

Database:	Submitted Drillers Reports Database		
Well Report #:	138443	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	20
Injurious Water Quality:	Not Reported	Plugging Rpt #:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

C6
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000172270

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	175150	Borehole Depth (ft):	24
Proposed Use:	Monitor	Plugging Rpt #:	73437
Injurious Water Quality:	no		

C7
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000136083

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	138438	Borehole Depth (ft):	19.5
Proposed Use:	Monitor	Plugging Rpt #:	73435
Injurious Water Quality:	Not Reported		

C8
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000136084

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	138439	Borehole Depth (ft):	17
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

C9
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000012868

Database:	Submitted Drillers Reports Database (Plugged)	Well Type:	Monitor
Well Report #:	175150	Plugging Rpt #:	73437
Well Type:	Monitor	Borehole Depth (ft):	24

C10
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000011115

Database:	Submitted Drillers Reports Database (Plugged)	Well Type:	Monitor
Well Report #:	222866	Plugging Rpt #:	73439
Well Type:	Monitor	Borehole Depth (ft):	24

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

C11
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000011109

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	73432
Well Type:	Monitor	Borehole Depth (ft):	0

C12
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000011112

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	73430
Well Type:	Monitor	Borehole Depth (ft):	0

C13
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000011110

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	138438	Plugging Rpt #:	73435
Well Type:	Monitor	Borehole Depth (ft):	20

C14
SSW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000012869

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	22285	Plugging Rpt #:	73438
Well Type:	Monitor	Borehole Depth (ft):	24

C15
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000219466

Database:	Submitted Drillers Reports Database		
Well Report #:	222866	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	24
Injurious Water Quality:	no	Plugging Rpt #:	73439

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

C16
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000219465

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	222865	Borehole Depth (ft):	24
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

D17
SE
1/4 - 1/2 Mile
Higher

TX WELLS TXWDB8000080627

Database:	Groundwater Database	Well #:	6520404
Primary Water Use:	Domestic	Elevation (ft):	86
Well Depth (ft):	331	Observation Type:	Miscellaneous Measurements
Water Quality Review:	No	Aquifer:	112CHCTL - Chicot Aquifer, Lower
Well Type:	Withdrawal of Water		

B18
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000007519

Database:	Submitted Drillers Reports Database (Plugged)	Well #:	
Well Report #:	Not Reported	Plugging Rpt #:	19171
Well Type:	Monitor	Borehole Depth (ft):	20

E19
NW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000100541

Database:	Submitted Drillers Reports Database (Plugged)	Well #:	
Well Report #:	Not Reported	Plugging Rpt #:	3726
Well Type:	Withdrawal of Water	Borehole Depth (ft):	0

E20
NW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000100542

Database:	Submitted Drillers Reports Database (Plugged)	Well #:	
Well Report #:	Not Reported	Plugging Rpt #:	3727
Well Type:	Withdrawal of Water	Borehole Depth (ft):	0

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

B21
SW
 1/4 - 1/2 Mile
 Higher

TX WELLS TXMON6000253931

Database:	Submitted Drillers Reports Database		
Well Report #:	257875	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	12
Injurious Water Quality:	Not Reported	Plugging Rpt #:	131517

B22
SW
 1/4 - 1/2 Mile
 Higher

TX WELLS TXMON6000253926

Database:	Submitted Drillers Reports Database		
Well Report #:	257870	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	12
Injurious Water Quality:	Not Reported	Plugging Rpt #:	131516

B23
SW
 1/4 - 1/2 Mile
 Higher

TX WELLS TXMON6000253921

Database:	Submitted Drillers Reports Database		
Well Report #:	257865	Well Type:	New Well
Proposed Use:	Environmental Soil Boring	Borehole Depth (ft):	12
Injurious Water Quality:	Not Reported	Plugging Rpt #:	131515

B24
SW
 1/4 - 1/2 Mile
 Higher

TX WELLS TXPLU6000129465

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	257875	Plugging Rpt #:	131517
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	12

B25
SW
 1/4 - 1/2 Mile
 Higher

TX WELLS TXPLU6000129464

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	257870	Plugging Rpt #:	131516
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	12

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

B26
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000129463

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	257865	Plugging Rpt #:	131515
Well Type:	Environmental Soil Boring	Borehole Depth (ft):	12

B27
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000007515

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	19167
Well Type:	Monitor	Borehole Depth (ft):	20

B28
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000007514

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	19166
Well Type:	Monitor	Borehole Depth (ft):	20

B29
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000054175

Database:	Submitted Drillers Reports Database		
Well Report #:	55303	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	20
Injurious Water Quality:	Not Reported	Plugging Rpt #:	Not Reported

B30
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000054170

Database:	Submitted Drillers Reports Database		
Well Report #:	55298	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	20
Injurious Water Quality:	Not Reported	Plugging Rpt #:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

F31
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000007516

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	19168
Well Type:	Monitor	Borehole Depth (ft):	20

D32
SSE
1/4 - 1/2 Mile
Higher

TX WELLS TXWDB8000080626

Database:	Groundwater Database	Well #:	6520402
Primary Water Use:	Unused	Elevation (ft):	86
Well Depth (ft):	688	Observation Type:	Miscellaneous Measurements
Water Quality Review:	No	Aquifer:	112CHCTL - Chicot Aquifer, Lower
Well Type:	Withdrawal of Water		

F33
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000007520

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	19172
Well Type:	Monitor	Borehole Depth (ft):	20

G34
SE
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000079830

Database:	Submitted Drillers Reports Database		
Well Report #:	81241	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	20
Injurious Water Quality:	no	Plugging Rpt #:	31162

G35
SE
1/4 - 1/2 Mile
Higher

TX WELLS TXPLU6000075584

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	81241	Plugging Rpt #:	31162
Well Type:	Monitor	Borehole Depth (ft):	20

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

G36
SE
 1/4 - 1/2 Mile
 Higher

TX WELLS TXHG60000001870

Database:	Water Well Database	Well #:	2894
Permittee:	Southwestern Bell Telephone Co.		
Permit #:	16056	Start Date of Permit:	11/1/1982
Exp Date of Permit:	10/31/1983	Usage:	Public Supply
Active:	Inactive	Year Drilled:	1966
Diameter:	4	Depth (ft):	331
Depth to 1st Screen (ft):	306		

H37
SSW
 1/4 - 1/2 Mile
 Higher

TX WELLS TXBR40000088679

Database:	Brackish Resources Aquifer Characterization System Database		
Well ID:	96794	Well Type:	Oil or Gas
Well Use:	Resource production		
Data Source:	RRC GAU Q Paper/Digital Geophysical Logs		
Well Depth (ft):	-99999	Well Bottom Elevation (ft):	-99999
Total Hole Depth (ft):	1410	Bottom Hole Elevation (ft):	-99999
Drill Date:	09/18/1971	Kelly Bushing Height (ft):	0
Remarks:	KB=0		

38
SE
 1/4 - 1/2 Mile
 Higher

AQUIFLOW 58921

Site ID:	108667
Groundwater Flow:	VARIABLE
Shallowest Water Table Depth:	6.8
Deepest Water Table Depth:	9.05
Average Water Table Depth:	Not Reported
Date:	2-28-98

H39
SSW
 1/4 - 1/2 Mile
 Higher

TX WELLS TXWDB8000085777

Database:	Groundwater Database	Well #:	6520410
Primary Water Use:	Public Supply	Elevation (ft):	86
Well Depth (ft):	1180	Observation Type:	USGS Current Observation Well
Water Quality Review:	No	Aquifer:	121EVGL - Evangeline Aquifer
Well Type:	Withdrawal of Water		

H40
SSW
 1/4 - 1/2 Mile
 Higher

TX WELLS TXEQ70000009012

Database:	Public Water Supply Sources Databases		
PWS ID:	1010013	Water Source:	G1010013DI
Locating Agency:	TCEQ	Elevation:	85

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Construction Information:

Record #:	2	Well Interval:	CASING
Top Depth (ft):	0	Bottom Depth (ft):	685
Casing Above Surface:	Not Reported	Diameter (in):	16
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	3	Well Interval:	CASING
Top Depth (ft):	580	Bottom Depth (ft):	696
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	4	Well Interval:	WELL OPENINGS
Top Depth (ft):	696	Bottom Depth (ft):	725
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	29
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	5	Well Interval:	CASING
Top Depth (ft):	725	Bottom Depth (ft):	765
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	6	Well Interval:	WELL OPENINGS
Top Depth (ft):	765	Bottom Depth (ft):	785
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	20
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	7	Well Interval:	CASING
Top Depth (ft):	785	Bottom Depth (ft):	815
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Record #:	8	Well Interval:	WELL OPENINGS
Top Depth (ft):	815	Bottom Depth (ft):	884
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	69
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	9	Well Interval:	CASING
Top Depth (ft):	884	Bottom Depth (ft):	915
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	10	Well Interval:	WELL OPENINGS
Top Depth (ft):	915	Bottom Depth (ft):	944
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	29
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	11	Well Interval:	CASING
Top Depth (ft):	944	Bottom Depth (ft):	980
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	12	Well Interval:	WELL OPENINGS
Top Depth (ft):	980	Bottom Depth (ft):	1005
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	25
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	13	Well Interval:	CASING
Top Depth (ft):	1005	Bottom Depth (ft):	1145
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	14	Well Interval:	WELL OPENINGS
Top Depth (ft):	1145	Bottom Depth (ft):	1175

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	30
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	15	Well Interval:	CASING
Top Depth (ft):	1175	Bottom Depth (ft):	1190
Casing Above Surface:	Not Reported	Diameter (in):	11
Type of Well Opening:	Not Reported	Casing Material:	UNKNOWN
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Water Level Information:

Date Water Level Measure:	19731228	Feet below Ground Surface:	-258
Collecting Agency:	DRILL	Collection Method:	REPORTED - METHOD NOT KNOWN
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19960117	Feet below Ground Surface:	-273.34
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19910114	Feet below Ground Surface:	-328.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19920115	Feet below Ground Surface:	-345.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19930113	Feet below Ground Surface:	-328.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19940105	Feet below Ground Surface:	-310.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19950113	Feet below Ground Surface:	-280.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Remarks: Not Reported

Water Level Information:

Date Water Level Measure:	19960926	Feet below Ground Surface:	-330.0
Collecting Agency:	USGS	Collection Method:	ELECTRIC TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19970123	Feet below Ground Surface:	-279.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	Not Reported		

**I41
West
1/4 - 1/2 Mile
Higher**

FED USGS USGS40001165953

Organization ID:	USGS-TX	Organization Name:	USGS Texas Water Science Center
Monitor Location:	LJ-65-20-416	Type:	Well
Description:	Not Reported	HUC:	12040104
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Coastal lowlands aquifer system		
Formation Type:	Chicot and Evangeline Aquifers	Construction Date:	Not Reported
Aquifer Type:	Confined multiple aquifer	Well Depth Units:	ft
Well Depth:	872	Well Hole Depth Units:	Not Reported
Well Hole Depth:	Not Reported		

Ground water levels,Number of Measurements:	40	Level reading date:	2005-02-04
Feet below surface:	289.11	Feet to sea level:	Not Reported
Note:	Not Reported		

Level reading date:	2004-11-05	Feet below surface:	279
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2004-09-21	Feet below surface:	354
Feet to sea level:	Not Reported	Note:	The site was being pumped.

Level reading date:	2004-04-07	Feet below surface:	339
Feet to sea level:	Not Reported	Note:	The site was being pumped.

Level reading date:	2004-01-21	Feet below surface:	274
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2003-10-31	Feet below surface:	278
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2003-09-12	Feet below surface:	357
Feet to sea level:	Not Reported	Note:	The site was being pumped.

Level reading date:	2003-04-11	Feet below surface:	420
Feet to sea level:	Not Reported	Note:	The site was being pumped.

Level reading date:	2003-01-27	Feet below surface:	262.14
Feet to sea level:	Not Reported	Note:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Level reading date:	2002-11-14	Feet below surface:	274.4
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-09-27	Feet below surface:	352
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2002-06-05	Feet below surface:	290
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-05-13	Feet below surface:	350
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2002-02-28	Feet below surface:	265
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-09-21	Feet below surface:	370
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2001-04-27	Feet below surface:	387
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2001-01-05	Feet below surface:	290
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-12-05	Feet below surface:	292
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-05	Feet below surface:	388
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1998-05-21	Feet below surface:	368
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1998-01-27	Feet below surface:	267.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-01-27	Feet below surface:	269
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-11-05	Feet below surface:	283
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-09-11	Feet below surface:	376
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1997-05-02	Feet below surface:	356
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1997-01-27	Feet below surface:	270.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-09-26	Feet below surface:	378
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1996-01-17	Feet below surface:	267.26
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-01-17	Feet below surface:	272
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-01-13	Feet below surface:	281
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Level reading date:	1995-01-13	Feet below surface:	280.23
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1994-01-04	Feet below surface:	277
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-01-13	Feet below surface:	291
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1992-09-09	Feet below surface:	374
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1992-01-15	Feet below surface:	297
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1991-01-14	Feet below surface:	307
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-01-19	Feet below surface:	296.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-01-17	Feet below surface:	304.21
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-01-06	Feet below surface:	280.31
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1986-01-15	Feet below surface:	285.4
Feet to sea level:	Not Reported	Note:	Not Reported

**J42
SW
1/4 - 1/2 Mile
Higher**

TX WELLS TXMON6000414837

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	422815	Borehole Depth (ft):	20
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

**J43
SW
1/4 - 1/2 Mile
Higher**

TX WELLS TXMON6000414844

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	422812	Borehole Depth (ft):	20
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

**J44
SW
1/4 - 1/2 Mile
Higher**

TX WELLS TXMON6000414853

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	422810		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Proposed Use:	Monitor	Borehole Depth (ft):	12
Injurious Water Quality:	no	Plugging Rpt #:	Not Reported

**J45
SW
1/4 - 1/2 Mile
Higher**

TX WELLS TXMON6000414796

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	422817	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

**H46
SSW
1/4 - 1/2 Mile
Higher**

TX WELLS TXHG60000000358

Database:	Water Well Database	Well #:	1374
Permittee:	Houston, City of	Permit #:	214795
Start Date of Permit:	2/1/2021	Exp Date of Permit:	1/31/2022
Usage:	Public Supply	Active:	Active
Year Drilled:	1972	Diameter:	16
Depth (ft):	1195	Depth to 1st Screen (ft):	700

**H47
SSW
1/4 - 1/2 Mile
Higher**

FED USGS USGS40001165890

Organization ID:	USGS-TX	Organization Name:	USGS Texas Water Science Center
Monitor Location:	LJ-65-20-410	Type:	Well
Description:	Not Reported	HUC:	12040104
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Coastal lowlands aquifer system	Aquifer Type:	Confined multiple aquifer
Formation Type:	Evangeline Aquifer	Well Depth:	1195
Construction Date:	197201	Well Hole Depth:	1195
Well Depth Units:	ft		
Well Hole Depth Units:	ft		

Ground water levels, Number of Measurements:	24	Level reading date:	2005-02-04
Feet below surface:	280.60	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	2004-11-05	Feet below surface:	292.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-01-22	Feet below surface:	271.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-10-31	Feet below surface:	255.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-01-27	Feet below surface:	259.31

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-11-14	Feet below surface:	273.12
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-02-27	Feet below surface:	263.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-01-17	Feet below surface:	298.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-12-05	Feet below surface:	292.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-01-26	Feet below surface:	270
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1997-11-05	Feet below surface:	293
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-09-12	Feet below surface:	334
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1997-05-02	Feet below surface:	310
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1997-01-23	Feet below surface:	279
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-09-26	Feet below surface:	330
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1996-01-17	Feet below surface:	273.34
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-01-17	Feet below surface:	272
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-01-13	Feet below surface:	280
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-01-05	Feet below surface:	310
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-01-13	Feet below surface:	328
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-01-15	Feet below surface:	345
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1991-01-14	Feet below surface:	328
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1990-01-19	Feet below surface:	312
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1972-01	Feet below surface:	225
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

J48
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000474777

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	487476	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

J49
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000489189

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	503830	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

K50
NNE
1/4 - 1/2 Mile
Lower

TX WELLS TXMON6000143153

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	145647	Borehole Depth (ft):	30
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

K51
NNE
1/4 - 1/2 Mile
Lower

TX WELLS TXMON6000143152

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	145646	Borehole Depth (ft):	30
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

J52
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000438743

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	448823	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

J53
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000438742

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	448825	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

J54
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000438745

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	448804	Borehole Depth (ft):	20
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

J55
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000454274

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	465909	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

J56
SW
1/4 - 1/2 Mile
Higher

TX WELLS TXMON6000454264

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	465907	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

I57
West
1/2 - 1 Mile
Higher

TX WELLS TXWDB8000082417

Database:	Groundwater Database	Well #:	6520416
Primary Water Use:	Public Supply	Elevation (ft):	85
Well Depth (ft):	872	Observation Type:	USGS Current Observation Well
Water Quality Review:	Yes	Aquifer:	121EVGL - Evangeline Aquifer
Well Type:	Withdrawal of Water		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

I58
West
1/2 - 1 Mile
Higher

TX WELLS TXEQ70000009020

Database:	Public Water Supply Sources Databases	Water Source:	G1010013DR
PWS ID:	1010013	Elevation:	84
Locating Agency:	TCEQ		

Construction Information:

Record #:	1	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	570
Casing Above Surface:	Not Reported	Diameter (in):	0
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	4	Well Interval:	WELL OPENINGS
Top Depth (ft):	577	Bottom Depth (ft):	866
Casing Above Surface:	Not Reported	Diameter (in):	10
Type of Well Opening:	SCREEN - TYPE NOT KNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	289
Opening Method:	Opening Interval = Top Of Shallowest Screen To Bottom Of Deepest Screen		
Packer Material:	Not Reported		

Water Level Information:

Date Water Level Measure:	19860115	Feet below Ground Surface:	-285.4
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19880106	Feet below Ground Surface:	-280.31
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19890117	Feet below Ground Surface:	-304.21
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19900119	Feet below Ground Surface:	-296.15
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Date Water Level Measure:	19910114	Feet below Ground Surface:	-307.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19920115	Feet below Ground Surface:	-297.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19930113	Feet below Ground Surface:	-291.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19940104	Feet below Ground Surface:	-277.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19950113	Feet below Ground Surface:	-280.23
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19960117	Feet below Ground Surface:	-267.26
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19960926	Feet below Ground Surface:	-378.0
Collecting Agency:	USGS	Collection Method:	ELECTRIC TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19970127	Feet below Ground Surface:	-270.39
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

**I59
West
1/2 - 1 Mile
Higher**

TX WELLS TXPLU6000007517

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	Not Reported	Plugging Rpt #:	19169

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Well Type: Monitor Borehole Depth (ft): 18

I60
West
1/2 - 1 Mile
Higher

TX WELLS TXHG60000001047

Database:	Water Well Database	Well #:	2068
Permittee:	Houston, City of	Permit #:	214827
Start Date of Permit:	2/1/2021	Exp Date of Permit:	1/31/2022
Usage:	Public Supply	Active:	Active
Year Drilled:	1971	Diameter:	10
Depth (ft):	872	Depth to 1st Screen (ft):	606

L61
SW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000439298

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	448799	Borehole Depth (ft):	45
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

L62
SW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000432324

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	442262	Borehole Depth (ft):	20
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

L63
SW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000489176

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	503826	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

M64
East
1/2 - 1 Mile
Lower

TX WELLS TXWDB8000081351

Database:	Groundwater Database	Well #:	6520516
Primary Water Use:	Public Supply	Elevation (ft):	85
Well Depth (ft):	960	Observation Type:	USGS Current Observation Well

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Level reading date:	2001-01-17	Feet below surface:	329.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-12-05	Feet below surface:	330.73
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-05-21	Feet below surface:	355
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1998-01-27	Feet below surface:	276.30
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1997-11-06	Feet below surface:	291.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-01-23	Feet below surface:	280.96
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1996-01-19	Feet below surface:	282.27
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1995-01-19	Feet below surface:	337
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-01-12	Feet below surface:	300.11
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-01-05	Feet below surface:	314
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-01-13	Feet below surface:	314
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1990-01-23	Feet below surface:	305.22
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1975-12	Feet below surface:	246
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.

**L66
SW
1/2 - 1 Mile
Higher**

TX WELLS TXMON6000474773

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	487474	Borehole Depth (ft):	40
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

**L67
SW
1/2 - 1 Mile
Higher**

TX WELLS TXMON6000438746

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	448802	Borehole Depth (ft):	45
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

M68
East
1/2 - 1 Mile
Lower

TX WELLS TXEQ70000009037

Database:	Public Water Supply Sources Databases		
PWS ID:	1010013	Water Source:	G1010013EH
Locating Agency:	TCEQ	Elevation:	83

Construction Information:

Record #:	1	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	690
Casing Above Surface:	Not Reported	Diameter (in):	0
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	2	Well Interval:	OPENING INTERVAL
Top Depth (ft):	700	Bottom Depth (ft):	960
Casing Above Surface:	Not Reported	Diameter (in):	0
Type of Well Opening:	UNKNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	232
Opening Method:	Opening Interval = Top Of Shallowest Screen To Bottom Of Deepest Screen		
Packer Material:	Not Reported		

Geologic Information:

Record #:	1	Top Geo Unit Below Surface (ft):	0
Bottom Geo Unit Below Surface (ft):	3	Geo Unit Thickness (ft):	3
Geo Unit Description:	SURFACE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	2	Top Geo Unit Below Surface (ft):	3
Bottom Geo Unit Below Surface (ft):	15	Geo Unit Thickness (ft):	12
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	3	Top Geo Unit Below Surface (ft):	15
Bottom Geo Unit Below Surface (ft):	39	Geo Unit Thickness (ft):	24
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Record #:	4	Top Geo Unit Below Surface (ft):	39
Bottom Geo Unit Below Surface (ft):	160	Geo Unit Thickness (ft):	121
Geo Unit Description:	CLAY, SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	5	Top Geo Unit Below Surface (ft):	160
Bottom Geo Unit Below Surface (ft):	180	Geo Unit Thickness (ft):	20
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	6	Top Geo Unit Below Surface (ft):	180
Bottom Geo Unit Below Surface (ft):	260	Geo Unit Thickness (ft):	80
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	7	Top Geo Unit Below Surface (ft):	260
Bottom Geo Unit Below Surface (ft):	332	Geo Unit Thickness (ft):	72
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	8	Top Geo Unit Below Surface (ft):	332
Bottom Geo Unit Below Surface (ft):	390	Geo Unit Thickness (ft):	58
Geo Unit Description:	SAND, CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	9	Top Geo Unit Below Surface (ft):	390
Bottom Geo Unit Below Surface (ft):	420	Geo Unit Thickness (ft):	30
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	10	Top Geo Unit Below Surface (ft):	420
Bottom Geo Unit Below Surface (ft):	460	Geo Unit Thickness (ft):	40
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Record #:	11	Top Geo Unit Below Surface (ft):	460
Bottom Geo Unit Below Surface (ft):	590	Geo Unit Thickness (ft):	130
Geo Unit Description:	SAND, ROCK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	12	Top Geo Unit Below Surface (ft):	590
Bottom Geo Unit Below Surface (ft):	603	Geo Unit Thickness (ft):	13
Geo Unit Description:	CLAY ROCK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	13	Top Geo Unit Below Surface (ft):	603
Bottom Geo Unit Below Surface (ft):	670	Geo Unit Thickness (ft):	67
Geo Unit Description:	SAND, ROCK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	14	Top Geo Unit Below Surface (ft):	670
Bottom Geo Unit Below Surface (ft):	700	Geo Unit Thickness (ft):	30
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	15	Top Geo Unit Below Surface (ft):	700
Bottom Geo Unit Below Surface (ft):	710	Geo Unit Thickness (ft):	10
Geo Unit Description:	SAND, ROCK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	16	Top Geo Unit Below Surface (ft):	710
Bottom Geo Unit Below Surface (ft):	749	Geo Unit Thickness (ft):	39
Geo Unit Description:	CLAY ROCK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	17	Top Geo Unit Below Surface (ft):	749
Bottom Geo Unit Below Surface (ft):	959	Geo Unit Thickness (ft):	210
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Record #:	18	Top Geo Unit Below Surface (ft):	959
Bottom Geo Unit Below Surface (ft):	960	Geo Unit Thickness (ft):	1
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19960119	Feet below Ground Surface:	-282.27
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19930113	Feet below Ground Surface:	-314.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19940105	Feet below Ground Surface:	-314.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19940112	Feet below Ground Surface:	-300.11
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19950119	Feet below Ground Surface:	-294.84
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19970123	Feet below Ground Surface:	-280.96
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

**M69
East
1/2 - 1 Mile
Lower**

TX WELLS TXHG6000000367

Database:	Water Well Database	Well #:	1383
Permittee:	Houston, City of	Permit #:	214797
Start Date of Permit:	2/1/2021	Exp Date of Permit:	1/31/2022
Usage:	Public Supply	Active:	Active
Year Drilled:	1975	Diameter:	16
Depth (ft):	950	Depth to 1st Screen (ft):	710

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

70
NE
1/2 - 1 Mile
Lower

TX WELLS TXHG60000012846

Database:	Water Well Database	Well #:	13945
Permittee:	Christ, The Incarnate Word Church		
Permit #:	208998	Start Date of Permit:	5/1/2020
Exp Date of Permit:	4/30/2021	Usage:	Other
Active:	Inactive	Year Drilled:	NULL
Diameter:	4	Depth (ft):	0
Depth to 1st Screen (ft):	0		

N71
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000364058

Database:	Submitted Drillers Reports Database		
Well Report #:	369543	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	25
Injurious Water Quality:	Not Reported	Plugging Rpt #:	Not Reported

N72
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000364060

Database:	Submitted Drillers Reports Database		
Well Report #:	369545	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	20
Injurious Water Quality:	Not Reported	Plugging Rpt #:	Not Reported

N73
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000364059

Database:	Submitted Drillers Reports Database		
Well Report #:	369544	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	20
Injurious Water Quality:	Not Reported	Plugging Rpt #:	Not Reported

N74
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000364056

Database:	Submitted Drillers Reports Database		
Well Report #:	369541	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	25
Injurious Water Quality:	Not Reported	Plugging Rpt #:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

75
SE
1/2 - 1 Mile
Higher

TX WELLS TXMON6000403268

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	409941	Borehole Depth (ft):	15
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	yes		

O76
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000411640

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	419398	Borehole Depth (ft):	35
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

O77
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000411641

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	419397	Borehole Depth (ft):	35
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

O78
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000394249

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	400692	Borehole Depth (ft):	30
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

O79
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000386004

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	392097	Borehole Depth (ft):	30
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

O80
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000386070

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	392166	Borehole Depth (ft):	30
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

O81
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000386084

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	392180	Borehole Depth (ft):	55
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

O82
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000394250

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	400693	Borehole Depth (ft):	25
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

O83
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000386077

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	392173	Borehole Depth (ft):	25
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

O84
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000394252

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	400695	Borehole Depth (ft):	55
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

O85
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000394251

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	400694	Borehole Depth (ft):	25
Proposed Use:	Monitor	Plugging Rpt #:	Not Reported
Injurious Water Quality:	Not Reported		

O86
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000448417

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	460085	Borehole Depth (ft):	25
Proposed Use:	Injection	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

O87
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000448430

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	460090	Borehole Depth (ft):	25
Proposed Use:	Injection	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

O88
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000448423

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	460086	Borehole Depth (ft):	25
Proposed Use:	Injection	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

O89
WSW
1/2 - 1 Mile
Higher

TX WELLS TXMON6000448428

Database:	Submitted Drillers Reports Database	Well Type:	New Well
Well Report #:	460088	Borehole Depth (ft):	25
Proposed Use:	Injection	Plugging Rpt #:	Not Reported
Injurious Water Quality:	no		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

P90
ENE
1/2 - 1 Mile
Lower

TX WELLS TXHG6000000366

Database:	Water Well Database	Well #:	1382
Permittee:	Houston, City of	Permit #:	42079
Start Date of Permit:	2/1/1993	Exp Date of Permit:	1/31/1994
Usage:	Public Supply	Active:	Inactive
Year Drilled:	1967	Diameter:	16
Depth (ft):	945	Depth to 1st Screen (ft):	710

P91
ENE
1/2 - 1 Mile
Lower

TX WELLS TXWDB8000082419

Database:	Groundwater Database	Well #:	6520509
Primary Water Use:	Unused	Elevation (ft):	80
Well Depth (ft):	945	Observation Type:	Historical Observation Well
Water Quality Review:	Yes	Aquifer:	121EVGL - Evangeline Aquifer
Well Type:	Withdrawal of Water		

P92
ENE
1/2 - 1 Mile
Lower

TX WELLS TXEQ70000009002

Database:	Public Water Supply Sources Databases		
PWS ID:	1010013	Water Source:	G1010013CZ
Locating Agency:	TNRCC	Elevation:	0

Construction Information:

Record #:	1	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	695
Casing Above Surface:	Not Reported	Diameter (in):	0
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	2	Well Interval:	OPENING INTERVAL
Top Depth (ft):	714	Bottom Depth (ft):	934
Casing Above Surface:	Not Reported	Diameter (in):	0
Type of Well Opening:	UNKNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	220
Opening Method:	Opening Interval = Top Of Shallowest Screen To Bottom Of Deepest Screen		
Packer Material:	Not Reported		

Water Level Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Date Water Level Measure:	19870107	Feet below Ground Surface:	-426.0
Collecting Agency:	USGS	Collection Method:	REPORTED - METHOD NOT KNOWN
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19900123	Feet below Ground Surface:	-362.93
Collecting Agency:	USGS	Collection Method:	REPORTED - METHOD NOT KNOWN
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19670614	Feet below Ground Surface:	-172.0
Collecting Agency:	TWDB	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19860114	Feet below Ground Surface:	-422.0
Collecting Agency:	USGS	Collection Method:	REPORTED - METHOD NOT KNOWN
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19880106	Feet below Ground Surface:	-423.27
Collecting Agency:	USGS	Collection Method:	REPORTED - METHOD NOT KNOWN
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19890117	Feet below Ground Surface:	-346.0
Collecting Agency:	USGS	Collection Method:	REPORTED - METHOD NOT KNOWN
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19910114	Feet below Ground Surface:	-420.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19920115	Feet below Ground Surface:	-358.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19930111	Feet below Ground Surface:	-350.67
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Date Water Level Measure:	19940113	Feet below Ground Surface:	-346.17
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

**P93
ENE
1/2 - 1 Mile
Lower**

FED USGS USGS40001165993

Organization ID:	USGS-TX	Organization Name:	USGS Texas Water Science Center
Monitor Location:	LJ-65-20-509	Type:	Well
Description:	Not Reported	HUC:	12040104
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Coastal lowlands aquifer system	Aquifer Type:	Not Reported
Formation Type:	Evangeline Aquifer	Well Depth:	945
Construction Date:	19670526	Well Hole Depth:	Not Reported
Well Depth Units:	ft		
Well Hole Depth Units:	Not Reported		

Ground water levels, Number of Measurements:	12	Level reading date:	1994-01-13
Feet below surface:	346.17	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	1993-01-11	Feet below surface:	350.67
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-01-15	Feet below surface:	358
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1992-01-15	Feet below surface:	352.09
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1991-01-14	Feet below surface:	420
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-01-23	Feet below surface:	362.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-01-17	Feet below surface:	346
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1989-01-17	Feet below surface:	351.45
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1988-01-06	Feet below surface:	423.77
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1987-01-07	Feet below surface:	426
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1986-01-14	Feet below surface:	422
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1967-06-14	Feet below surface:	172
Feet to sea level:	Not Reported	Note:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

94
ESE
1/2 - 1 Mile
Higher

TX WELLS TXWDB8000076028

Database:	Groundwater Database	Well #:	6520511
Primary Water Use:	Public Supply	Elevation (ft):	84
Well Depth (ft):	205	Observation Type:	None
Water Quality Review:	No	Aquifer:	112CHCTL - Chicot Aquifer, Lower
Well Type:	Withdrawal of Water		

95
NNW
1/2 - 1 Mile
Lower

TX WELLS TXWDB8000092010

Database:	Groundwater Database	Well #:	6520403
Primary Water Use:	Domestic	Elevation (ft):	81
Well Depth (ft):	65	Observation Type:	Miscellaneous Measurements
Water Quality Review:	Yes	Aquifer:	112CHCTU - Chicot Aquifer, Upper
Well Type:	Withdrawal of Water		

96
SSE
1/2 - 1 Mile
Higher

TX WELLS TXWDB8000082418

Database:	Groundwater Database	Well #:	6520417
Primary Water Use:	Public Supply	Elevation (ft):	86
Well Depth (ft):	1012	Observation Type:	USGS Current Observation Well
Water Quality Review:	No	Aquifer:	121EVGL - Evangeline Aquifer
Well Type:	Withdrawal of Water		

Q97
WNW
1/2 - 1 Mile
Higher

TX WELLS TXWDB8000077124

Database:	Groundwater Database	Well #:	6520421
Primary Water Use:	Public Supply	Elevation (ft):	86
Well Depth (ft):	1684	Observation Type:	USGS Current Observation Well
Water Quality Review:	No	Aquifer:	121EVGL - Evangeline Aquifer
Well Type:	Withdrawal of Water		

Q98
WNW
1/2 - 1 Mile
Higher

TX WELLS TXWDB8000085779

Database:	Groundwater Database	Well #:	6520422
Primary Water Use:	Public Supply	Elevation (ft):	86
Well Depth (ft):	995	Observation Type:	USGS Current Observation Well

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	5	Top Geo Unit Below Surface (ft):	200
Bottom Geo Unit Below Surface (ft):	313	Geo Unit Thickness (ft):	113
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	6	Top Geo Unit Below Surface (ft):	313
Bottom Geo Unit Below Surface (ft):	354	Geo Unit Thickness (ft):	41
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	7	Top Geo Unit Below Surface (ft):	354
Bottom Geo Unit Below Surface (ft):	450	Geo Unit Thickness (ft):	96
Geo Unit Description:	CLAY, SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	8	Top Geo Unit Below Surface (ft):	450
Bottom Geo Unit Below Surface (ft):	463	Geo Unit Thickness (ft):	13
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	9	Top Geo Unit Below Surface (ft):	463
Bottom Geo Unit Below Surface (ft):	480	Geo Unit Thickness (ft):	17
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	10	Top Geo Unit Below Surface (ft):	480
Bottom Geo Unit Below Surface (ft):	520	Geo Unit Thickness (ft):	40
Geo Unit Description:	SAND, ROCK BREAK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	11	Top Geo Unit Below Surface (ft):	520
Bottom Geo Unit Below Surface (ft):	600	Geo Unit Thickness (ft):	80
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	12	Top Geo Unit Below Surface (ft):	600
Bottom Geo Unit Below Surface (ft):	612	Geo Unit Thickness (ft):	12
Geo Unit Description:	SAND, CLAY STRIPS		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	13	Top Geo Unit Below Surface (ft):	612
Bottom Geo Unit Below Surface (ft):	660	Geo Unit Thickness (ft):	48
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	14	Top Geo Unit Below Surface (ft):	660
Bottom Geo Unit Below Surface (ft):	665	Geo Unit Thickness (ft):	5
Geo Unit Description:	SAND, ROCK BREAK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	15	Top Geo Unit Below Surface (ft):	665
Bottom Geo Unit Below Surface (ft):	710	Geo Unit Thickness (ft):	45
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	16	Top Geo Unit Below Surface (ft):	710
Bottom Geo Unit Below Surface (ft):	805	Geo Unit Thickness (ft):	95
Geo Unit Description:	CLAY STRIPS AND SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	17	Top Geo Unit Below Surface (ft):	805
Bottom Geo Unit Below Surface (ft):	823	Geo Unit Thickness (ft):	18
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	18	Top Geo Unit Below Surface (ft):	823
Bottom Geo Unit Below Surface (ft):	1040	Geo Unit Thickness (ft):	217
Geo Unit Description:	SHALE, CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	19	Top Geo Unit Below Surface (ft):	1040
Bottom Geo Unit Below Surface (ft):	1118	Geo Unit Thickness (ft):	78
Geo Unit Description:	SHALE, ROCK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	20	Top Geo Unit Below Surface (ft):	1118
Bottom Geo Unit Below Surface (ft):	1160	Geo Unit Thickness (ft):	42
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19781200	Feet below Ground Surface:	-269.0
Collecting Agency:	USGS		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19880106	Feet below Ground Surface:	-260.8
Collecting Agency:	USGS		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19870127	Feet below Ground Surface:	-262.31
Collecting Agency:	USGS		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19890117	Feet below Ground Surface:	-307.15
Collecting Agency:	USGS		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19900123	Feet below Ground Surface:	-293.76
Collecting Agency:	USGS		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19920114	Feet below Ground Surface:	-294.47
Collecting Agency:	USGS	Collection Method:	STEEL TAPE

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Remarks: Not Reported

Water Level Information:

Date Water Level Measure:	19930113	Feet below Ground Surface:	-291.03
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19940113	Feet below Ground Surface:	-315.34
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	04		

Water Level Information:

Date Water Level Measure:	19950113	Feet below Ground Surface:	-282.85
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19960123	Feet below Ground Surface:	-273.83
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19970123	Feet below Ground Surface:	-278.2
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

**R100
SSE
1/2 - 1 Mile
Lower**

FED USGS USGS40001165828

Organization ID:	USGS-TX	Organization Name:	USGS Texas Water Science Center
Monitor Location:	LJ-65-20-414	Type:	Well
Description:	lat/long updated with Garmin gps on 2/3/2010		
HUC:	12040104	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported	Aquifer:	Coastal lowlands aquifer system
Formation Type:	Chicot and Evangeline Aquifers		
Aquifer Type:	Confined single aquifer	Construction Date:	197812
Well Depth:	1038	Well Depth Units:	ft
Well Hole Depth:	1160	Well Hole Depth Units:	ft

Ground water levels,Number of Measurements:	29	Level reading date:	2005-02-04
Feet below surface:	272.20	Feet to sea level:	Not Reported
Note:	Not Reported		

Level reading date:	2004-11-05	Feet below surface:	303
Feet to sea level:	Not Reported	Note:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Level reading date:	2004-09-21	Feet below surface:	356
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2004-04-02	Feet below surface:	331
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2004-01-21	Feet below surface:	291
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-11-04	Feet below surface:	282
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-09-11	Feet below surface:	356
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2003-05-15	Feet below surface:	353
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2003-01-30	Feet below surface:	274.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-11-14	Feet below surface:	288.01
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-09-27	Feet below surface:	344
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2002-06-05	Feet below surface:	282.79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-02-28	Feet below surface:	267.61
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-11-15	Feet below surface:	291.14
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-01-12	Feet below surface:	299.11
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-12-05	Feet below surface:	299.34
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-01-26	Feet below surface:	274.16
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1997-11-06	Feet below surface:	275.43
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-01-23	Feet below surface:	278.2
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-01-23	Feet below surface:	273.83
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1995-01-13	Feet below surface:	282.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-01-13	Feet below surface:	315.34
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1993-01-13	Feet below surface:	291.03
Feet to sea level:	Not Reported	Note:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Level reading date:	1992-01-14	Feet below surface:	294.47
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1990-01-23	Feet below surface:	293.76
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-01-17	Feet below surface:	307.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-01-06	Feet below surface:	260.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-01-27	Feet below surface:	262.31
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12	Feet below surface:	269
Feet to sea level:	Not Reported	Note:	Not Reported

**R101
SSE
1/2 - 1 Mile
Lower**

TX WELLS TXHG6000002247

Database:	Water Well Database	Well #:	3272
Permittee:	Houston, City of	Permit #:	214880
Start Date of Permit:	2/1/2021	Exp Date of Permit:	1/31/2022
Usage:	Public Supply	Active:	Active
Year Drilled:	1990	Diameter:	16
Depth (ft):	1500	Depth to 1st Screen (ft):	0

**Q102
WNW
1/2 - 1 Mile
Higher**

FED USGS USGS40001166032

Organization ID:	USGS-TX	Organization Name:	USGS Texas Water Science Center
Monitor Location:	LJ-65-20-421	Type:	Well
Description:	Not Reported	HUC:	12040104
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Units:	Not Reported
Aquifer:	Coastal lowlands aquifer system	Aquifer Type:	Confined single aquifer
Formation Type:	Evangeline Aquifer	Well Depth:	1667
Construction Date:	Not Reported	Well Hole Depth:	Not Reported
Well Depth Units:	ft		
Well Hole Depth Units:	Not Reported		

Ground water levels, Number of Measurements:	17	Level reading date:	2004-11-12
Feet below surface:	324.22	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	2004-09-01	Feet below surface:	390
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2004-04-02	Feet below surface:	384
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2004-01-23	Feet below surface:	348
Feet to sea level:	Not Reported	Note:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Level reading date:	2003-10-30	Feet below surface:	364
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-09-11	Feet below surface:	422
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2003-04-09	Feet below surface:	386
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2003-02-02	Feet below surface:	349.68
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-11-12	Feet below surface:	357
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-09-10	Feet below surface:	413
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2002-05-31	Feet below surface:	334.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-02-26	Feet below surface:	331.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-09-19	Feet below surface:	424
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2001-04-25	Feet below surface:	442
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2001-01-04	Feet below surface:	394.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-12-05	Feet below surface:	403
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-06	Feet below surface:	456
Feet to sea level:	Not Reported	Note:	The site was being pumped.

**Q103
WNW
1/2 - 1 Mile
Higher**

FED USGS USGS40001166033

Organization ID:	USGS-TX	Organization Name:	USGS Texas Water Science Center
Monitor Location:	LJ-65-20-422	Type:	Well
Description:	Not Reported	HUC:	12040104
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Coastal lowlands aquifer system		
Formation Type:	Chicot and Evangeline Aquifers		
Aquifer Type:	Confined single aquifer	Construction Date:	19980227
Well Depth:	995	Well Depth Units:	ft
Well Hole Depth:	Not Reported	Well Hole Depth Units:	Not Reported
Ground water levels,Number of Measurements:	18	Level reading date:	2005-01-24
Feet below surface:	330.63	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	2004-09-10	Feet below surface:	347

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2004-04-02	Feet below surface:	336
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2004-01-23	Feet below surface:	286
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-10-30	Feet below surface:	298
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-09-11	Feet below surface:	360
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2003-04-09	Feet below surface:	327
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2003-02-07	Feet below surface:	286.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-11-12	Feet below surface:	285
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-09-26	Feet below surface:	347
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2002-05-31	Feet below surface:	278
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-04-29	Feet below surface:	335
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2002-02-26	Feet below surface:	275.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-09-19	Feet below surface:	368
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2001-04-25	Feet below surface:	392
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2001-01-04	Feet below surface:	334.11
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-12-05	Feet below surface:	342
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-06	Feet below surface:	398
Feet to sea level:	Not Reported	Note:	The site was being pumped.

**104
SSE
1/2 - 1 Mile
Higher**

TX WELLS TXWDB8000077441

Database: Groundwater Database
 Primary Water Use: Public Supply
 Well Depth (ft): 1038
 Water Quality Review: No
 Well Type: Withdrawal of Water

Well #: 6520414
 Elevation (ft): 86
 Observation Type: USGS Current Observation Well
 Aquifer: 121EVGL - Evangeline Aquifer

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

S105
WSW
1/2 - 1 Mile
Higher

TX WELLS TXEQ70000009038

Database:	Public Water Supply Sources Databases	Water Source:	G1010013EI
PWS ID:	1010013	Elevation:	85
Locating Agency:	TCEQ		

Construction Information:

Record #:	1	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	600
Casing Above Surface:	Not Reported	Diameter (in):	0
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	2	Well Interval:	OPENING INTERVAL
Top Depth (ft):	610	Bottom Depth (ft):	985
Casing Above Surface:	Not Reported	Diameter (in):	0
Type of Well Opening:	UNKNOWN	Casing Material:	Not Reported
Opening Material:	UNKNOWN	Opening Length (ft):	375
Opening Method:	Opening Interval = Top Of Shallowest Screen To Bottom Of Deepest Screen		
Packer Material:	Not Reported		

Water Level Information:

Date Water Level Measure:	19940104	Feet below Ground Surface:	-277.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19910114	Feet below Ground Surface:	-295.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19920115	Feet below Ground Surface:	-345.26
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19930113	Feet below Ground Surface:	-283.64
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Date Water Level Measure:	19950113	Feet below Ground Surface:	-277.01
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19960117	Feet below Ground Surface:	-264.74
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19960926	Feet below Ground Surface:	-334.0
Collecting Agency:	USGS	Collection Method:	ELECTRIC TAPE
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19970127	Feet below Ground Surface:	-262.37
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	Not Reported		

**S106
WSW
1/2 - 1 Mile
Higher**

FED USGS USGS40001165882

Organization ID:	USGS-TX	Organization Name:	USGS Texas Water Science Center
Monitor Location:	LJ-65-20-412	Type:	Well
Description:	Not Reported	HUC:	12040104
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Units:	Not Reported
Aquifer:	Coastal lowlands aquifer system		
Formation Type:	Chicot and Evangeline Aquifers	Construction Date:	19731127
Aquifer Type:	Confined multiple aquifer	Well Depth Units:	ft
Well Depth:	1000	Well Hole Depth Units:	ft
Well Hole Depth:	1000		

Ground water levels, Number of Measurements:	38	Level reading date:	2005-02-15
Feet below surface:	278.59	Feet to sea level:	Not Reported
Note:	Not Reported		

Level reading date:	2004-11-05	Feet below surface:	285
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2004-09-21	Feet below surface:	342
Feet to sea level:	Not Reported	Note:	The site was being pumped.

Level reading date:	2004-04-07	Feet below surface:	324
Feet to sea level:	Not Reported	Note:	The site was being pumped.

Level reading date:	2004-01-22	Feet below surface:	278
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2003-10-31	Feet below surface:	288
Feet to sea level:	Not Reported	Note:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Level reading date:	2003-04-11	Feet below surface:	333
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2003-01-31	Feet below surface:	261.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-11-14	Feet below surface:	279
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-09-27	Feet below surface:	333
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2002-06-04	Feet below surface:	268
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-05-13	Feet below surface:	331
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2002-02-27	Feet below surface:	258.74
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-09-21	Feet below surface:	333
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2001-04-27	Feet below surface:	350
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	2001-01-12	Feet below surface:	296.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-12-05	Feet below surface:	299
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-04	Feet below surface:	363
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1998-05-21	Feet below surface:	330
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1998-01-27	Feet below surface:	260.76
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-01-27	Feet below surface:	260
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-11-05	Feet below surface:	277
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-09-11	Feet below surface:	336
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1997-05-02	Feet below surface:	315
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1997-01-27	Feet below surface:	262.37
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-09-26	Feet below surface:	334
Feet to sea level:	Not Reported	Note:	The site was being pumped.
Level reading date:	1996-01-17	Feet below surface:	268
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Level reading date:	1996-01-17	Feet below surface:	264.74
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1995-01-13	Feet below surface:	277
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-01-13	Feet below surface:	277.01
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-01-04	Feet below surface:	277
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-01-13	Feet below surface:	283.64
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1993-01-13	Feet below surface:	281
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1992-01-15	Feet below surface:	345.26
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1991-01-14	Feet below surface:	295
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1990-01-19	Feet below surface:	293
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1990-01-19	Feet below surface:	290.77
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.
Level reading date:	1973-12-28	Feet below surface:	197
Feet to sea level:	Not Reported	Note:	The site had been pumped recently.

S107
WSW
1/2 - 1 Mile
Higher

TX WELLS TXHG6000000359

Database:	Water Well Database	Well #:	1375
Permittee:	Houston, City of	Permit #:	214796
Start Date of Permit:	2/1/2021	Exp Date of Permit:	1/31/2022
Usage:	Public Supply	Active:	Active
Year Drilled:	1990	Diameter:	16
Depth (ft):	1000	Depth to 1st Screen (ft):	610

S108
WSW
1/2 - 1 Mile
Higher

TX WELLS TXWDB8000076448

Database:	Groundwater Database	Well #:	6520412
Primary Water Use:	Public Supply	Elevation (ft):	85
Well Depth (ft):	1000	Observation Type:	USGS Current Observation Well
Water Quality Review:	Yes	Aquifer:	112CEVG - Chicot and Evangeline Aquifers
Well Type:	Withdrawal of Water		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

T109
NE
1/2 - 1 Mile
Lower

TX WELLS TXPLU6000174435

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	479475	Plugging Rpt #:	177632
Well Type:	Monitor	Borehole Depth (ft):	35

T110
NE
1/2 - 1 Mile
Lower

TX WELLS TXMON6000466844

Database:	Submitted Drillers Reports Database		
Well Report #:	479475	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	35
Injurious Water Quality:	no	Plugging Rpt #:	177632

Q111
WNW
1/2 - 1 Mile
Higher

TX WELLS TXHG60000005042

Database:	Water Well Database	Well #:	6076
Permittee:	Houston, City of	Permit #:	215025
Start Date of Permit:	2/1/2021	Exp Date of Permit:	1/31/2022
Usage:	Public Supply	Active:	Active
Year Drilled:	1976	Diameter:	14
Depth (ft):	1020	Depth to 1st Screen (ft):	650

Q112
WNW
1/2 - 1 Mile
Higher

TX WELLS TXEQ70000009386

Database:	Public Water Supply Sources Databases		
PWS ID:	1010013	Water Source:	G1010013RO
Locating Agency:	TCEQ	Elevation:	84

Construction Information:

Record #:	1	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	39
Casing Above Surface:	Not Reported	Diameter (in):	42
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	2	Well Interval:	CASING
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GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Top Depth (ft):	0	Bottom Depth (ft):	50
Casing Above Surface:	Not Reported	Diameter (in):	36
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	3	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	650
Casing Above Surface:	Not Reported	Diameter (in):	30
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	4	Well Interval:	CASING
Top Depth (ft):	3	Bottom Depth (ft):	650
Casing Above Surface:	+	Diameter (in):	24
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	5	Well Interval:	CASING
Top Depth (ft):	590	Bottom Depth (ft):	660
Casing Above Surface:	Not Reported	Diameter (in):	18
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	6	Well Interval:	WELL OPENINGS
Top Depth (ft):	660	Bottom Depth (ft):	691
Casing Above Surface:	Not Reported	Diameter (in):	18
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	31		
Packer Material:	Not Reported		

Construction Information:

Record #:	7	Well Interval:	CASING
Top Depth (ft):	691	Bottom Depth (ft):	718
Casing Above Surface:	Not Reported	Diameter (in):	18
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	8	Well Interval:	WELL OPENINGS
Top Depth (ft):	718	Bottom Depth (ft):	743

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Casing Above Surface:	Not Reported	Diameter (in):	18
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	25		
Packer Material:	Not Reported		

Construction Information:

Record #:	9	Well Interval:	CASING
Top Depth (ft):	743	Bottom Depth (ft):	776
Casing Above Surface:	Not Reported	Diameter (in):	18
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	10	Well Interval:	WELL OPENINGS
Top Depth (ft):	776	Bottom Depth (ft):	846
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	70		
Packer Material:	Not Reported		

Construction Information:

Record #:	11	Well Interval:	CASING
Top Depth (ft):	846	Bottom Depth (ft):	852
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	12	Well Interval:	WELL OPENINGS
Top Depth (ft):	852	Bottom Depth (ft):	906
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	54		
Packer Material:	Not Reported		

Construction Information:

Record #:	13	Well Interval:	CASING
Top Depth (ft):	906	Bottom Depth (ft):	930
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	14	Well Interval:	WELL OPENINGS
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GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Top Depth (ft):	930	Bottom Depth (ft):	940
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN		
Casing Material:	Not Reported	Opening Material:	STAINLESS STEEL
Opening Length (ft):	10	Opening Method:	Not Reported
Packer Material:	Not Reported		

Construction Information:

Record #:	15	Well Interval:	CASING
Top Depth (ft):	940	Bottom Depth (ft):	954
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	16	Well Interval:	WELL OPENINGS
Top Depth (ft):	954	Bottom Depth (ft):	968
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN		
Casing Material:	Not Reported	Opening Material:	STAINLESS STEEL
Opening Length (ft):	14	Opening Method:	Not Reported
Packer Material:	Not Reported		

Construction Information:

Record #:	17	Well Interval:	CASING
Top Depth (ft):	968	Bottom Depth (ft):	995
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	18	Well Interval:	ANNULAR GRAVEL PACK
Top Depth (ft):	600	Bottom Depth (ft):	995
Casing Above Surface:	Not Reported	Diameter (in):	32
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Geologic Information:

Record #:	1	Top Geo Unit Below Surface (ft):	0
Bottom Geo Unit Below Surface (ft):	57	Geo Unit Thickness (ft):	57
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	2	Top Geo Unit Below Surface (ft):	57
Bottom Geo Unit Below Surface (ft):	120	Geo Unit Thickness (ft):	63

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Bottom Geo Unit Below Surface (ft):	400	Geo Unit Thickness (ft):	2
Geo Unit Description:	ROCK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	10	Top Geo Unit Below Surface (ft):	400
Bottom Geo Unit Below Surface (ft):	408	Geo Unit Thickness (ft):	8
Geo Unit Description:	HARD SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	11	Top Geo Unit Below Surface (ft):	408
Bottom Geo Unit Below Surface (ft):	432	Geo Unit Thickness (ft):	24
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	12	Top Geo Unit Below Surface (ft):	432
Bottom Geo Unit Below Surface (ft):	440	Geo Unit Thickness (ft):	8
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	13	Top Geo Unit Below Surface (ft):	440
Bottom Geo Unit Below Surface (ft):	505	Geo Unit Thickness (ft):	65
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	14	Top Geo Unit Below Surface (ft):	505
Bottom Geo Unit Below Surface (ft):	513	Geo Unit Thickness (ft):	8
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	15	Top Geo Unit Below Surface (ft):	513
Bottom Geo Unit Below Surface (ft):	552	Geo Unit Thickness (ft):	39
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Record #:	16	Top Geo Unit Below Surface (ft):	552
Bottom Geo Unit Below Surface (ft):	558	Geo Unit Thickness (ft):	6
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	17	Top Geo Unit Below Surface (ft):	558
Bottom Geo Unit Below Surface (ft):	602	Geo Unit Thickness (ft):	44
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	18	Top Geo Unit Below Surface (ft):	602
Bottom Geo Unit Below Surface (ft):	608	Geo Unit Thickness (ft):	6
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	19	Top Geo Unit Below Surface (ft):	608
Bottom Geo Unit Below Surface (ft):	626	Geo Unit Thickness (ft):	18
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	20	Top Geo Unit Below Surface (ft):	626
Bottom Geo Unit Below Surface (ft):	660	Geo Unit Thickness (ft):	34
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	21	Top Geo Unit Below Surface (ft):	660
Bottom Geo Unit Below Surface (ft):	704	Geo Unit Thickness (ft):	44
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	22	Top Geo Unit Below Surface (ft):	704
Bottom Geo Unit Below Surface (ft):	716	Geo Unit Thickness (ft):	12
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Record #:	23	Top Geo Unit Below Surface (ft):	716
Bottom Geo Unit Below Surface (ft):	742	Geo Unit Thickness (ft):	26
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	24	Top Geo Unit Below Surface (ft):	742
Bottom Geo Unit Below Surface (ft):	768	Geo Unit Thickness (ft):	26
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	25	Top Geo Unit Below Surface (ft):	768
Bottom Geo Unit Below Surface (ft):	940	Geo Unit Thickness (ft):	172
Geo Unit Description:	SAND W/ SMALL HARD		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	26	Top Geo Unit Below Surface (ft):	940
Bottom Geo Unit Below Surface (ft):	950	Geo Unit Thickness (ft):	10
Geo Unit Description:	HARD SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	27	Top Geo Unit Below Surface (ft):	950
Bottom Geo Unit Below Surface (ft):	972	Geo Unit Thickness (ft):	22
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	28	Top Geo Unit Below Surface (ft):	972
Bottom Geo Unit Below Surface (ft):	1056	Geo Unit Thickness (ft):	84
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19980216	Feet below Ground Surface:	-277
Collecting Agency:	DRILL		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

U113
NE
 1/2 - 1 Mile
 Lower

TX WELLS TXPLU6000153535

Database:	Submitted Drillers Reports Database (Plugged)		
Well Report #:	415483	Plugging Rpt #:	155834
Well Type:	Monitor	Borehole Depth (ft):	17

U114
NE
 1/2 - 1 Mile
 Lower

TX WELLS TXMON6000408690

Database:	Submitted Drillers Reports Database		
Well Report #:	415483	Well Type:	New Well
Proposed Use:	Monitor	Borehole Depth (ft):	17
Injurious Water Quality:	no	Plugging Rpt #:	155834

Q115
WNW
 1/2 - 1 Mile
 Higher

TX WELLS TXEQ7000009385

Database:	Public Water Supply Sources Databases		
PWS ID:	1010013	Water Source:	G1010013RN
Locating Agency:	TCEQ	Elevation:	84

Construction Information:

Record #:	1	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	50
Casing Above Surface:	Not Reported	Diameter (in):	36
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	2	Well Interval:	CASING
Top Depth (ft):	0	Bottom Depth (ft):	50
Casing Above Surface:	Not Reported	Diameter (in):	30
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	3	Well Interval:	ANNULAR CEMENT
Top Depth (ft):	0	Bottom Depth (ft):	1070
Casing Above Surface:	Not Reported	Diameter (in):	26
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Opening Method: Not Reported Packer Material: Not Reported

Construction Information:

Record #:	10	Well Interval:	WELL OPENINGS
Top Depth (ft):	1168	Bottom Depth (ft):	1174
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	11	Well Interval:	CASING
Top Depth (ft):	1174	Bottom Depth (ft):	1198
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	12	Well Interval:	WELL OPENINGS
Top Depth (ft):	1198	Bottom Depth (ft):	1204
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	13	Well Interval:	CASING
Top Depth (ft):	1204	Bottom Depth (ft):	1230
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	14	Well Interval:	WELL OPENINGS
Top Depth (ft):	1230	Bottom Depth (ft):	1274
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	15	Well Interval:	CASING
Top Depth (ft):	1274	Bottom Depth (ft):	1296
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	16	Well Interval:	WELL OPENINGS
Top Depth (ft):	1296	Bottom Depth (ft):	1304
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	17	Well Interval:	CASING
Top Depth (ft):	1304	Bottom Depth (ft):	1330
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	18	Well Interval:	WELL OPENINGS
Top Depth (ft):	1330	Bottom Depth (ft):	1342
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	19	Well Interval:	CASING
Top Depth (ft):	1342	Bottom Depth (ft):	1346
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	20	Well Interval:	WELL OPENINGS
Top Depth (ft):	1346	Bottom Depth (ft):	1378
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	21	Well Interval:	CASING
Top Depth (ft):	1378	Bottom Depth (ft):	1402
Casing Above Surface:	Not Reported	Diameter (in):	14

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	22	Well Interval:	WELL OPENINGS
Top Depth (ft):	1402	Bottom Depth (ft):	1408
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	23	Well Interval:	CASING
Top Depth (ft):	1408	Bottom Depth (ft):	1432
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	24	Well Interval:	WELL OPENINGS
Top Depth (ft):	1432	Bottom Depth (ft):	1488
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	25	Well Interval:	CASING
Top Depth (ft):	1488	Bottom Depth (ft):	1516
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	26	Well Interval:	WELL OPENINGS
Top Depth (ft):	1516	Bottom Depth (ft):	1522
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	27	Well Interval:	CASING
Top Depth (ft):	1522	Bottom Depth (ft):	1554

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	28	Well Interval:	WELL OPENINGS
Top Depth (ft):	1554	Bottom Depth (ft):	1560
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	29	Well Interval:	CASING
Top Depth (ft):	1560	Bottom Depth (ft):	1586
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	30	Well Interval:	WELL OPENINGS
Top Depth (ft):	1586	Bottom Depth (ft):	1602
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	31	Well Interval:	CASING
Top Depth (ft):	1602	Bottom Depth (ft):	1618
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	32	Well Interval:	WELL OPENINGS
Top Depth (ft):	1618	Bottom Depth (ft):	1642
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	WIRE-WOUND SCREEN	Opening Material:	STAINLESS STEEL
Casing Material:	Not Reported	Opening Method:	Not Reported
Opening Length (ft):	Not Reported		
Packer Material:	Not Reported		

Construction Information:

Record #:	33	Well Interval:	CASING
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GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Top Depth (ft):	1642	Bottom Depth (ft):	1667
Casing Above Surface:	Not Reported	Diameter (in):	14
Type of Well Opening:	Not Reported	Casing Material:	STEEL
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Construction Information:

Record #:	34	Well Interval:	ANNULAR GRAVEL PACK
Top Depth (ft):	1070	Bottom Depth (ft):	1684
Casing Above Surface:	Not Reported	Diameter (in):	32
Type of Well Opening:	Not Reported	Casing Material:	Not Reported
Opening Material:	Not Reported	Opening Length (ft):	Not Reported
Opening Method:	Not Reported	Packer Material:	Not Reported

Geologic Information:

Record #:	1	Top Geo Unit Below Surface (ft):	0
Bottom Geo Unit Below Surface (ft):	61	Geo Unit Thickness (ft):	61
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	2	Top Geo Unit Below Surface (ft):	61
Bottom Geo Unit Below Surface (ft):	68	Geo Unit Thickness (ft):	7
Geo Unit Description:	SANDY CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	3	Top Geo Unit Below Surface (ft):	68
Bottom Geo Unit Below Surface (ft):	90	Geo Unit Thickness (ft):	22
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	4	Top Geo Unit Below Surface (ft):	90
Bottom Geo Unit Below Surface (ft):	120	Geo Unit Thickness (ft):	30
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	5	Top Geo Unit Below Surface (ft):	120
Bottom Geo Unit Below Surface (ft):	132	Geo Unit Thickness (ft):	12
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	6	Top Geo Unit Below Surface (ft):	132
Bottom Geo Unit Below Surface (ft):	229	Geo Unit Thickness (ft):	97
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	7	Top Geo Unit Below Surface (ft):	229
Bottom Geo Unit Below Surface (ft):	266	Geo Unit Thickness (ft):	37
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	8	Top Geo Unit Below Surface (ft):	266
Bottom Geo Unit Below Surface (ft):	324	Geo Unit Thickness (ft):	58
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	9	Top Geo Unit Below Surface (ft):	324
Bottom Geo Unit Below Surface (ft):	351	Geo Unit Thickness (ft):	27
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	10	Top Geo Unit Below Surface (ft):	351
Bottom Geo Unit Below Surface (ft):	403	Geo Unit Thickness (ft):	52
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	11	Top Geo Unit Below Surface (ft):	403
Bottom Geo Unit Below Surface (ft):	421	Geo Unit Thickness (ft):	18
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	12	Top Geo Unit Below Surface (ft):	421
Bottom Geo Unit Below Surface (ft):	427	Geo Unit Thickness (ft):	6
Geo Unit Description:	SAND, CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	13	Top Geo Unit Below Surface (ft):	427
Bottom Geo Unit Below Surface (ft):	440	Geo Unit Thickness (ft):	13
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	14	Top Geo Unit Below Surface (ft):	440
Bottom Geo Unit Below Surface (ft):	505	Geo Unit Thickness (ft):	65
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	15	Top Geo Unit Below Surface (ft):	505
Bottom Geo Unit Below Surface (ft):	513	Geo Unit Thickness (ft):	8
Geo Unit Description:	SAND, CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	16	Top Geo Unit Below Surface (ft):	513
Bottom Geo Unit Below Surface (ft):	560	Geo Unit Thickness (ft):	47
Geo Unit Description:	HARD SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	17	Top Geo Unit Below Surface (ft):	560
Bottom Geo Unit Below Surface (ft):	609	Geo Unit Thickness (ft):	49
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	18	Top Geo Unit Below Surface (ft):	609
Bottom Geo Unit Below Surface (ft):	627	Geo Unit Thickness (ft):	18
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	19	Top Geo Unit Below Surface (ft):	627
Bottom Geo Unit Below Surface (ft):	666	Geo Unit Thickness (ft):	39
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	20	Top Geo Unit Below Surface (ft):	666
Bottom Geo Unit Below Surface (ft):	695	Geo Unit Thickness (ft):	29
Geo Unit Description:	HARD SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	21	Top Geo Unit Below Surface (ft):	695
Bottom Geo Unit Below Surface (ft):	696	Geo Unit Thickness (ft):	1
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	22	Top Geo Unit Below Surface (ft):	696
Bottom Geo Unit Below Surface (ft):	711	Geo Unit Thickness (ft):	15
Geo Unit Description:	SANDY SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	23	Top Geo Unit Below Surface (ft):	711
Bottom Geo Unit Below Surface (ft):	722	Geo Unit Thickness (ft):	11
Geo Unit Description:	SAND, GRAVEL		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	24	Top Geo Unit Below Surface (ft):	722
Bottom Geo Unit Below Surface (ft):	747	Geo Unit Thickness (ft):	25
Geo Unit Description:	HARD SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	25	Top Geo Unit Below Surface (ft):	747
Bottom Geo Unit Below Surface (ft):	748	Geo Unit Thickness (ft):	1
Geo Unit Description:	SAND W/ SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	26	Top Geo Unit Below Surface (ft):	748
Bottom Geo Unit Below Surface (ft):	763	Geo Unit Thickness (ft):	15
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	27	Top Geo Unit Below Surface (ft):	763
Bottom Geo Unit Below Surface (ft):	768	Geo Unit Thickness (ft):	5
Geo Unit Description:	SANDY CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	28	Top Geo Unit Below Surface (ft):	768
Bottom Geo Unit Below Surface (ft):	784	Geo Unit Thickness (ft):	16
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	29	Top Geo Unit Below Surface (ft):	784
Bottom Geo Unit Below Surface (ft):	786	Geo Unit Thickness (ft):	2
Geo Unit Description:	SAND, GRAVEL		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	30	Top Geo Unit Below Surface (ft):	786
Bottom Geo Unit Below Surface (ft):	913	Geo Unit Thickness (ft):	127
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	31	Top Geo Unit Below Surface (ft):	913
Bottom Geo Unit Below Surface (ft):	925	Geo Unit Thickness (ft):	12
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	32	Top Geo Unit Below Surface (ft):	925
Bottom Geo Unit Below Surface (ft):	955	Geo Unit Thickness (ft):	30
Geo Unit Description:	SANDY SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	33	Top Geo Unit Below Surface (ft):	955
Bottom Geo Unit Below Surface (ft):	961	Geo Unit Thickness (ft):	6
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	34	Top Geo Unit Below Surface (ft):	961
Bottom Geo Unit Below Surface (ft):	974	Geo Unit Thickness (ft):	13
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	35	Top Geo Unit Below Surface (ft):	974
Bottom Geo Unit Below Surface (ft):	1006	Geo Unit Thickness (ft):	32
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	36	Top Geo Unit Below Surface (ft):	1006
Bottom Geo Unit Below Surface (ft):	1012	Geo Unit Thickness (ft):	6
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	37	Top Geo Unit Below Surface (ft):	1012
Bottom Geo Unit Below Surface (ft):	1061	Geo Unit Thickness (ft):	49
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	38	Top Geo Unit Below Surface (ft):	1061
Bottom Geo Unit Below Surface (ft):	1075	Geo Unit Thickness (ft):	14
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	39	Top Geo Unit Below Surface (ft):	1075
Bottom Geo Unit Below Surface (ft):	1082	Geo Unit Thickness (ft):	7
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	40	Top Geo Unit Below Surface (ft):	1082
Bottom Geo Unit Below Surface (ft):	1119	Geo Unit Thickness (ft):	37
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	41	Top Geo Unit Below Surface (ft):	1119
Bottom Geo Unit Below Surface (ft):	1209	Geo Unit Thickness (ft):	90
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	42	Top Geo Unit Below Surface (ft):	1209
Bottom Geo Unit Below Surface (ft):	1219	Geo Unit Thickness (ft):	10
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	43	Top Geo Unit Below Surface (ft):	1219
Bottom Geo Unit Below Surface (ft):	1232	Geo Unit Thickness (ft):	13
Geo Unit Description:	SAND W/ SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	44	Top Geo Unit Below Surface (ft):	1232
Bottom Geo Unit Below Surface (ft):	1284	Geo Unit Thickness (ft):	52
Geo Unit Description:	SANDY SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	45	Top Geo Unit Below Surface (ft):	1284
Bottom Geo Unit Below Surface (ft):	1291	Geo Unit Thickness (ft):	7
Geo Unit Description:	HARD SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	46	Top Geo Unit Below Surface (ft):	1291
Bottom Geo Unit Below Surface (ft):	1299	Geo Unit Thickness (ft):	8
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	47	Top Geo Unit Below Surface (ft):	1299
Bottom Geo Unit Below Surface (ft):	1327	Geo Unit Thickness (ft):	28
Geo Unit Description:	SAND (CUT GOOD)		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	48	Top Geo Unit Below Surface (ft):	1327
Bottom Geo Unit Below Surface (ft):	1399	Geo Unit Thickness (ft):	72
Geo Unit Description:	CLAY		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	49	Top Geo Unit Below Surface (ft):	1399
Bottom Geo Unit Below Surface (ft):	1411	Geo Unit Thickness (ft):	12
Geo Unit Description:	SANDY SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	50	Top Geo Unit Below Surface (ft):	1411
Bottom Geo Unit Below Surface (ft):	1423	Geo Unit Thickness (ft):	12
Geo Unit Description:	HARD SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	51	Top Geo Unit Below Surface (ft):	1423
Bottom Geo Unit Below Surface (ft):	1428	Geo Unit Thickness (ft):	5
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	52	Top Geo Unit Below Surface (ft):	1428
Bottom Geo Unit Below Surface (ft):	1502	Geo Unit Thickness (ft):	74
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	53	Top Geo Unit Below Surface (ft):	1502
Bottom Geo Unit Below Surface (ft):	1528	Geo Unit Thickness (ft):	26
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	54	Top Geo Unit Below Surface (ft):	1528
Bottom Geo Unit Below Surface (ft):	1534	Geo Unit Thickness (ft):	6
Geo Unit Description:	HARD SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	55	Top Geo Unit Below Surface (ft):	1534
Bottom Geo Unit Below Surface (ft):	1535	Geo Unit Thickness (ft):	1
Geo Unit Description:	SANDY SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	56	Top Geo Unit Below Surface (ft):	1535
Bottom Geo Unit Below Surface (ft):	1553	Geo Unit Thickness (ft):	18
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	57	Top Geo Unit Below Surface (ft):	1553
Bottom Geo Unit Below Surface (ft):	1595	Geo Unit Thickness (ft):	42
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	58	Top Geo Unit Below Surface (ft):	1595
Bottom Geo Unit Below Surface (ft):	1612	Geo Unit Thickness (ft):	17
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	59	Top Geo Unit Below Surface (ft):	1612
Bottom Geo Unit Below Surface (ft):	1628	Geo Unit Thickness (ft):	16
Geo Unit Description:	SANDY SHALE, SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	60	Top Geo Unit Below Surface (ft):	1628
Bottom Geo Unit Below Surface (ft):	1723	Geo Unit Thickness (ft):	95
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	61	Top Geo Unit Below Surface (ft):	1723
Bottom Geo Unit Below Surface (ft):	1729	Geo Unit Thickness (ft):	6
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	62	Top Geo Unit Below Surface (ft):	1729
Bottom Geo Unit Below Surface (ft):	1745	Geo Unit Thickness (ft):	16
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	63	Top Geo Unit Below Surface (ft):	1745
Bottom Geo Unit Below Surface (ft):	1754	Geo Unit Thickness (ft):	9
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	64	Top Geo Unit Below Surface (ft):	1754
Bottom Geo Unit Below Surface (ft):	1783	Geo Unit Thickness (ft):	29
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	65	Top Geo Unit Below Surface (ft):	1783
Bottom Geo Unit Below Surface (ft):	1801	Geo Unit Thickness (ft):	18
Geo Unit Description:	HARD SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	66	Top Geo Unit Below Surface (ft):	1801
Bottom Geo Unit Below Surface (ft):	1804	Geo Unit Thickness (ft):	3
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	67	Top Geo Unit Below Surface (ft):	1804
Bottom Geo Unit Below Surface (ft):	1845	Geo Unit Thickness (ft):	41
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	68	Top Geo Unit Below Surface (ft):	1845
Bottom Geo Unit Below Surface (ft):	1860	Geo Unit Thickness (ft):	15
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Geologic Information:

Record #:	69	Top Geo Unit Below Surface (ft):	1860
Bottom Geo Unit Below Surface (ft):	1865	Geo Unit Thickness (ft):	5
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	70	Top Geo Unit Below Surface (ft):	1865
Bottom Geo Unit Below Surface (ft):	1870	Geo Unit Thickness (ft):	5
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	71	Top Geo Unit Below Surface (ft):	1870
Bottom Geo Unit Below Surface (ft):	1888	Geo Unit Thickness (ft):	18
Geo Unit Description:	SHALE		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	72	Top Geo Unit Below Surface (ft):	1888
Bottom Geo Unit Below Surface (ft):	1893	Geo Unit Thickness (ft):	5
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	73	Top Geo Unit Below Surface (ft):	1893
Bottom Geo Unit Below Surface (ft):	1919	Geo Unit Thickness (ft):	26
Geo Unit Description:	ROCK		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Geologic Information:

Record #:	74	Top Geo Unit Below Surface (ft):	1919
Bottom Geo Unit Below Surface (ft):	1927	Geo Unit Thickness (ft):	8
Geo Unit Description:	SAND		
Source of Geo Data:	DRILLERS DESCRIPTION OF FORMATION GEOLOGY		
Remarks:	Not Reported		

Water Level Information:

Date Water Level Measure:	19730425	Feet below Ground Surface:	-287
Collecting Agency:	DRILL		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	FORMERLY G1011591A		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Water Level Information:

Date Water Level Measure:	19940105	Feet below Ground Surface:	-335.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	FORMERLY G1011591A		

Water Level Information:

Date Water Level Measure:	19860116	Feet below Ground Surface:	-336
Collecting Agency:	DRILL		
Collection Method:	REPORTED - METHOD NOT KNOWN		
Remarks:	FORMERLY G1011591A		

Water Level Information:

Date Water Level Measure:	19910126	Feet below Ground Surface:	-354.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	FORMERLY G1011591A		

Water Level Information:

Date Water Level Measure:	19920115	Feet below Ground Surface:	-340.0
Collecting Agency:	USGS	Collection Method:	STEEL TAPE
Remarks:	FORMERLY G1011591A		

Water Level Information:

Date Water Level Measure:	19930106	Feet below Ground Surface:	-367.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	FORMERLY G1011591A		

Water Level Information:

Date Water Level Measure:	19950111	Feet below Ground Surface:	-336.0
Collecting Agency:	USGS	Collection Method:	ANALOG/GRAPHIC RECORDER
Remarks:	FORMERLY G1011591A		

Water Level Information:

Date Water Level Measure:	19960110	Feet below Ground Surface:	-339.0
Collecting Agency:	USGS	Collection Method:	ELECTRIC TAPE
Remarks:	FORMERLY G1011591A		

Water Level Information:

Date Water Level Measure:	19960925	Feet below Ground Surface:	-388.0
Collecting Agency:	USGS	Collection Method:	ELECTRIC TAPE
Remarks:	FORMERLY G1011591A		

Water Level Information:

Date Water Level Measure:	19970107	Feet below Ground Surface:	-342.0
Collecting Agency:	USGS	Collection Method:	AIR LINE
Remarks:	FORMERLY G1011591A		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

Q116
WNW
1/2 - 1 Mile
Higher

TX WELLS TXHG60000005041

Database:	Water Well Database	Well #:	6075
Permittee:	Houston, City of	Permit #:	215024
Start Date of Permit:	2/1/2021	Exp Date of Permit:	1/31/2022
Usage:	Public Supply	Active:	Active
Year Drilled:	1997	Diameter:	14
Depth (ft):	1620	Depth to 1st Screen (ft):	1080

1G
SE
1/4 - 1/2 Mile
Lower

Site ID: 108667
 Groundwater Flow: VARIES
 Shallowest Water Table Depth: 6.8
 Deepest Water Table Depth: 9.05
 Average Water Table Depth: Not Reported
 Date: 2-28-98

AQUIFLOW 58921

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance

Database EDR ID Number

1
NNW
1/2 - 1 Mile

OIL_GAS TXOG90001088944

Surface ID: 176755
Bottom ID: 176755
Current Wells #: 1
Radioactive: Not Reported

Well Number: Not Reported
API #: 42201
Well Type: Dry Hole
Side Track: Not Reported

APPENDIX 4

DEEP DYNAMIC COMPACTION WORK PLAN

DENSIFICATION, INC.

GEOTECHNICAL CONTRACTORS
SPECIALIZING IN DYNAMIC COMPACTION

22 December 2022

Mr. Tyler McIntosh
Starwood Capital Group
2340 Collins Avenue
Miami Beach, Florida 33139
Via Email: tmcintosh@starwood.com

Re: Technical Work Plan & Shop Drawing Submittal
Dynamic Compaction Program
Kirkwood Crossing
Houston, Texas
Densification Job No. 1011

Dear Tyler:

Densification, Inc. is pleased to submit this technical workplan for a dynamic compaction program to improve the uncontrolled landfill materials which exist across the proposed Kirkwood Crossing site in Houston, Texas. Densification, Inc. is uniquely qualified for this work based on our position at the leading dynamic compaction contractor in the United States. We have completed over 1,000 projects nationwide within the last 30 years, including over a dozen jobs in Texas.

The site presently exists as an undeveloped parcel adjacent to Bissonnet Street in Houston, Texas. Prior to its current usage, the site was used as a sand mine and then as municipal solid waste (MSW) landfill until its closure around 2000. Based on available geotechnical information, we understand that the site has up to 10 feet of a clay cap atop the landfill material, which is up to almost 70 feet in thickness. The landfill material generally consists of C&D waste with about 50% of the material comprised of a soil matrix. Groundwater was encountered between depths of 10 to 20 feet below the existing site grades; however, it seems that the encountered water is perched on localized impermeable layers within the MSW material.

The proposed development is to consist of four new residential structures and a community building, along with the associated at-grade drive aisles and parking areas, landscaped areas, and hardscape. Dynamic compaction has been recommended as an alternative to improve the uncontrolled fills to allow for shallow foundation construction. When considering a 10-foot buffer around the building footprints, we anticipate a total improvement area of about 85,000 square feet being required for this project. Upon completion, it is anticipated that the building will be supported by shallow foundations and slab-on-grade construction designed using an allowable bearing pressure of 4,000 pounds per square foot (psf).

DYNAMIC COMPACTION

Technically speaking, dynamic compaction consists of the introduction of multiple passes of high energy impacts at the ground surface by repeatedly dropping steel tampers ranging from 6 to 20 tons from drop heights ranging from 40 to 70 feet. The high energy impact creates a shock wave that densifies the soil at depth and reduces the void ratio; thus improving the consistency and overall engineering properties of the soil mass. In doing so, the need for off-site removal of the existing soils for replacement with compacted granular fill or the installation of deep foundations which bypass the loose soils can be eliminated.

The tamper used in the dynamic compaction process generally results in craters on the order of six feet in diameter and ranging in depth from two to six feet. Following each pass, the craters are backfilled. If suitable, surrounding material can be pushed into the craters, resulting in an overall lowering of the site grade. If not, then imported granular material must be used to backfill the craters in between passes. It should be noted, that should the initial ground response at the site be favorable, that both passes can be conducted simultaneously, which would be the intent of the program, if possible.

In addition to strengthening and compacting the existing fill or natural soils, dynamic compaction is similar to proof-rolling in that it exposes pockets of softer material or materials that are unsuitable to provide foundation support or to construct finished hardscape features upon. These areas, when identified during compaction, can be remediated in one of two ways; either additional pounding can be carried out until the soils are adequately densified, or the soils can be undercut and replaced with compacted fill.

The degree and depth of soil improvement achieved with dynamic compaction depends upon the total amount of energy applied to the soil; i.e., the more energy imparted to the soil, the greater the degree of improvement. Depth of improvement is a function of the amount of weight being dropped and the drop height, with improvement depths of 15 to 25 feet commonly being achieved.

Dynamic compaction is typically performed over a predetermined grid pattern, with multiple passes being implemented on offsetting grids. The grid spacing, number of drops per impact point, drop height, and total number of passes is dependent on the site-specific soil conditions, the observed ground response, and the dissipation of pore water pressure subsequent to pounding.

Comprehensive monitoring of ground response is needed to control the work and allow for modification to the program being implemented. The applied energy, impact grid, and the sequence and timing of the drops can all be adjusted, as needed, to achieve the desired results.

DYNAMIC COMPACTION EXPERIENCE

Densification, Inc. has performed over 1,000 Dynamic Compaction projects throughout the United States, including over a dozen projects in Texas. Since our founding in 1984, we have become the premier geotechnical contractor specializing in dynamic compaction in the country. Our Texas experience is as follows:

2008	Dallas, TX	Senior Housing
2006	Dallas, TX	Railyard Improvements
2006	Dallas, TX	Foundry
2006	Dallas, TX	Martin-Marietta Railyard
2003	Dallas, TX	George Bush Turnpike
2002	Dallas, TX	Rail Offloading Facility
2002	Dallas, TX	Rail Line Expansion
2000	El Paso, TX	375 Loop
2000	Dallas, TX	Ready-Mix Plant
2000	Dallas, TX	DEA Laboratory
1999	El Paso, TX	375 Loop Test Program
1997	Houston, TX	Tanks
1993	Houston, TX	Antifreeze Tanks
1989	Corpus Christi, TX	Homeport Naval Base

TECHNICAL APPROACH

Densification, Inc. will use a company-owned crawler crane equipped with a 16-ton tamper to improve the fill material which exists across the site to the satisfaction of the geotechnical engineer. The exact drop height will be measured at the start of the job and is made visually based how far the rigging is below the boom tip. There is no energy absorbing device on the crane; the weight drops free-fall.

Tamper

The tamper is 16-tons, constructed of steel and concrete and is round with a 7-foot diameter. It has a surface area of 38.5 square feet and produces a static contact pressure of 829 pounds per square foot (psf).

Depth of Influence and Energy Calculations

The conventional depth of influence formula for Dynamic Compaction as reported in the FHWA Manual on Dynamic Compaction¹ is:

$$D = n \sqrt{WH}$$

where: D = depth of influence (m)
n = empirical coefficient (0.40 for fills)
W = weight of tamper (Megagrams)
H = drop height (m)

¹ Lukas, R.G. (1995). *Geotechnical Circular No. 1 – DYNAMIC COMPACTION*, Federal Highway Administration Report FHWA-SA-95-037, March.

Based upon our proposed weight/drop height combination, our depth of influence should be approximately 21 feet.

We will perform two high energy passes on a 15-foot grid, dropping the tamper approximately seven times per point, per pass, depending upon ground. Our proposed drop plan for the site is shown in Figures 1 through 3. A 10-ton roller could then make multiple passes following the crater leveling operation to densify the surficial soils. The craters will need to be leveled on a daily basis, and the site re-graded to provide proper drainage.

Based upon two high energy passes of a 16-ton weight dropped from 60 feet on a 15-foot grid and at least seven drops per point (per pass) within the proposed building footprints, the applied energy will be approximately 268 kilojoules/m³. The calculations² showing this are as follows:

Building Areas

$$\text{Applied Energy} = \frac{(\text{Tamper Weight}) * (\text{Tamper Height}) * (\# \text{ of Drops}) * (\# \text{ of Passes})}{(\text{Grid Spacing}) * (\text{Grid Spacing}) * (\text{Depth})}$$

$$\text{Applied Energy} = \frac{(32,000 \text{ lbs}) * (60 \text{ feet}) * (7 \text{ drops}) * (2 \text{ passes})}{(15 \text{ feet}) * (15 \text{ feet}) * (21 \text{ feet})} * \frac{0.04788 \frac{\text{kJ}}{\text{m}^3}}{\text{ft-lb/ft}^3}$$

$$\text{Applied Unit Energy} = 268 \text{ kJ/m}^3$$

Vibration Monitoring

Vibration levels will need to be monitored during the course of the work at nearby structures and utilities. On-site vibration monitoring will be conducted nearby to existing utilities or the closest structures during our work. At the onset of the work, we will measure vibration levels at various distances to help create a site-specific attenuation curve for use around the site. Based on our review of the site, we note the presence of dozens of single-family residential structures around the site perimeter. We assume that any and all pre-construction surveys of adjacent structures within 500 feet of the site will be conducted by the Owner prior to mobilization, and that should seismic isolation trenches be required, they will be installed as needed, by the earthwork contractor.

Health and Safety

Our scope of work assumes that all work can be completed using Level “D” Personal Protective Equipment, and that air monitoring or other environmental controls are not required. All work will be conducted in accordance with Densification, Inc.’s Corporate Health and Safety Plan.

² Lukas, R.G. (1995). *Geotechnical Circular No. 1 – DYNAMIC COMPACTION*, Federal Highway Administration Report FHWA-SA-95-037, March.

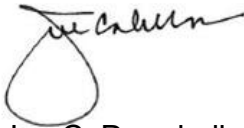
SCHEDULE

Given the required improvement area, we anticipate that our work will take approximately one month to complete the base scope of work. If you have any questions, please do not hesitate to call us at (540) 882-4404.

Very truly yours,
Densification, Inc.



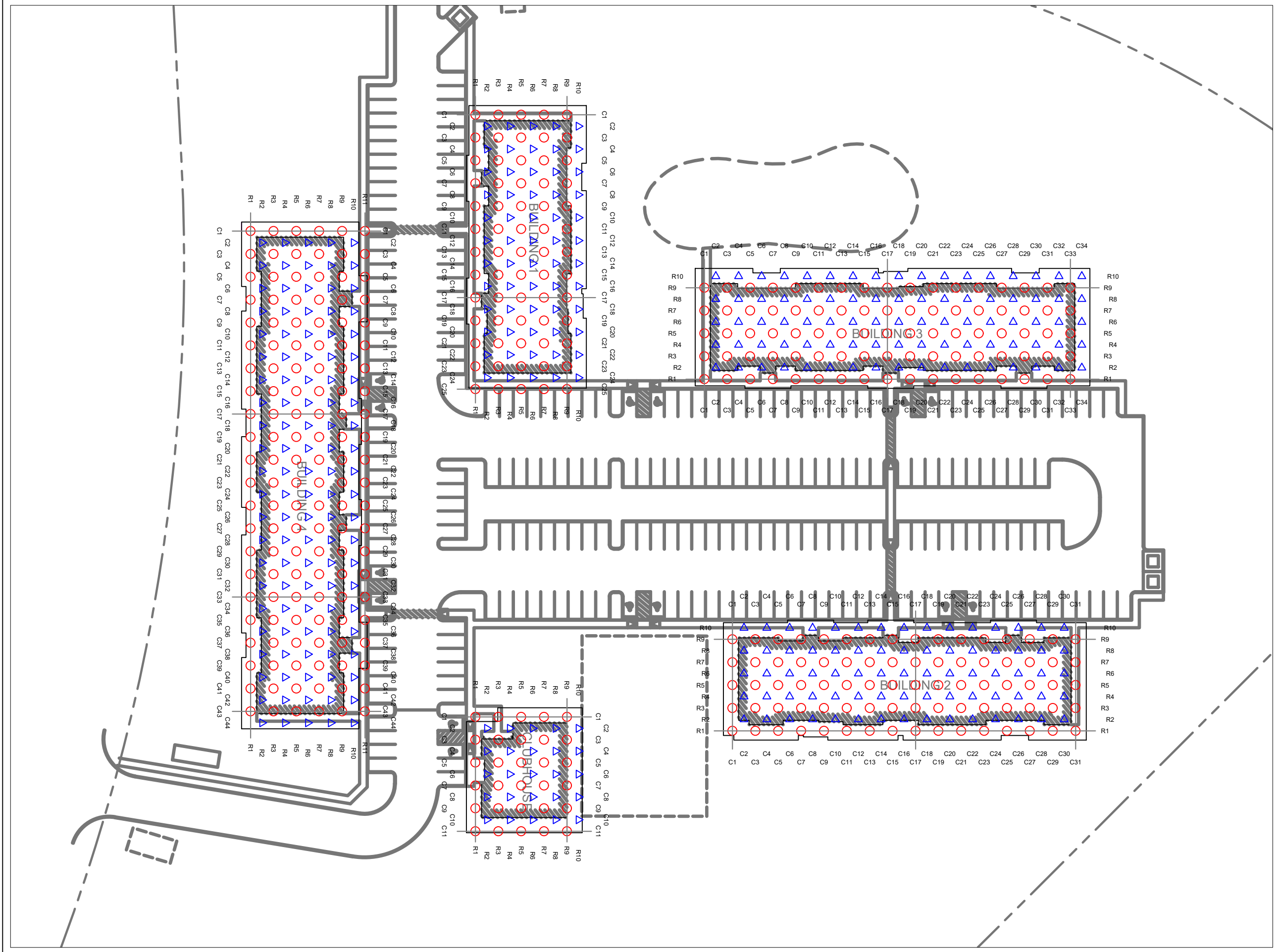
Christian B. Woods, P.E., G.E., D.G.E., LEED^{AP} BD+C
Vice-President
Texas Prof. Eng. Lic. No. 108014



Joe C. Drumheller, P.G.
President and C.E.O.

- Attachments: Figure 1 – Aerial Drop Point Location Plan – w/ Site Plan
Figure 2 – Aerial Drop Point Location Plan – w/o Site Plan
Figure 3 – Aerial Drop Point Location Plan – w/o Site Plan

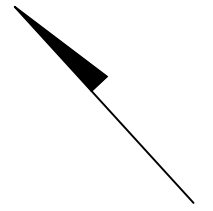




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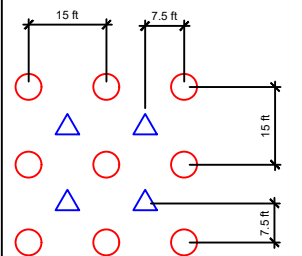
- PRIMARY DROP
- △ SECONDARY DROP

2 PASSES
 15ft GRID
 60ft DROP HEIGHT
 16th DROP WEIGHT
 7-9 DROPS PER POINT



NORTH

TYPICAL LAYOUT PATTERN



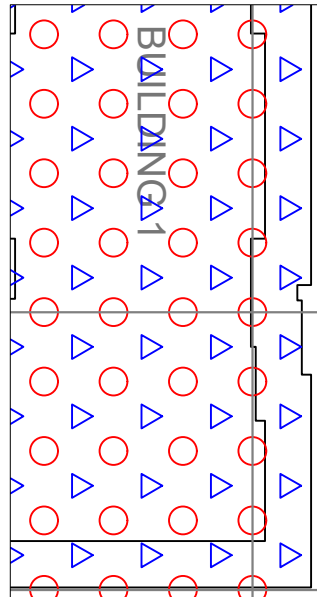
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No.	Revision/Issue	Aprov.

DENSIFICATION, INC.
 40650 HURLEY LANE
 PAEONIAN SPRINGS, VA 20129
 (540) 882-4404 office
 (540) 882-4190 fax

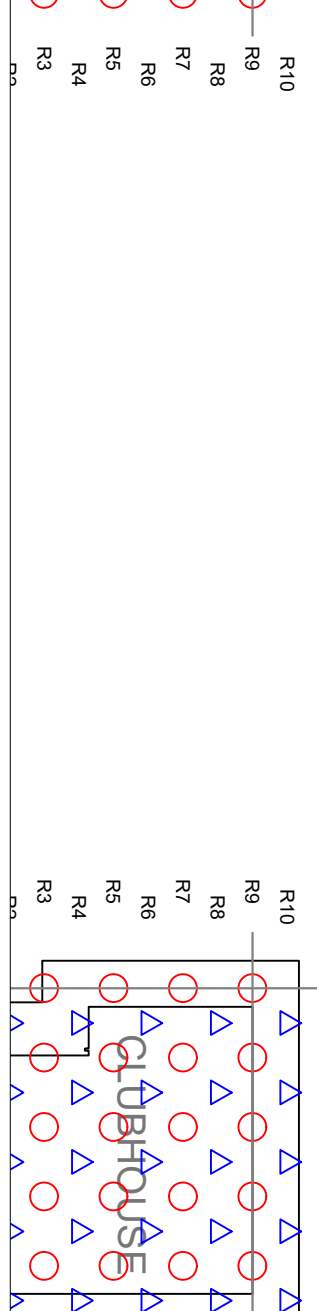
DYNAMIC COMPACTION SPECIALIST

KIRKWOOD CROSSING
 HOUSTON, TX

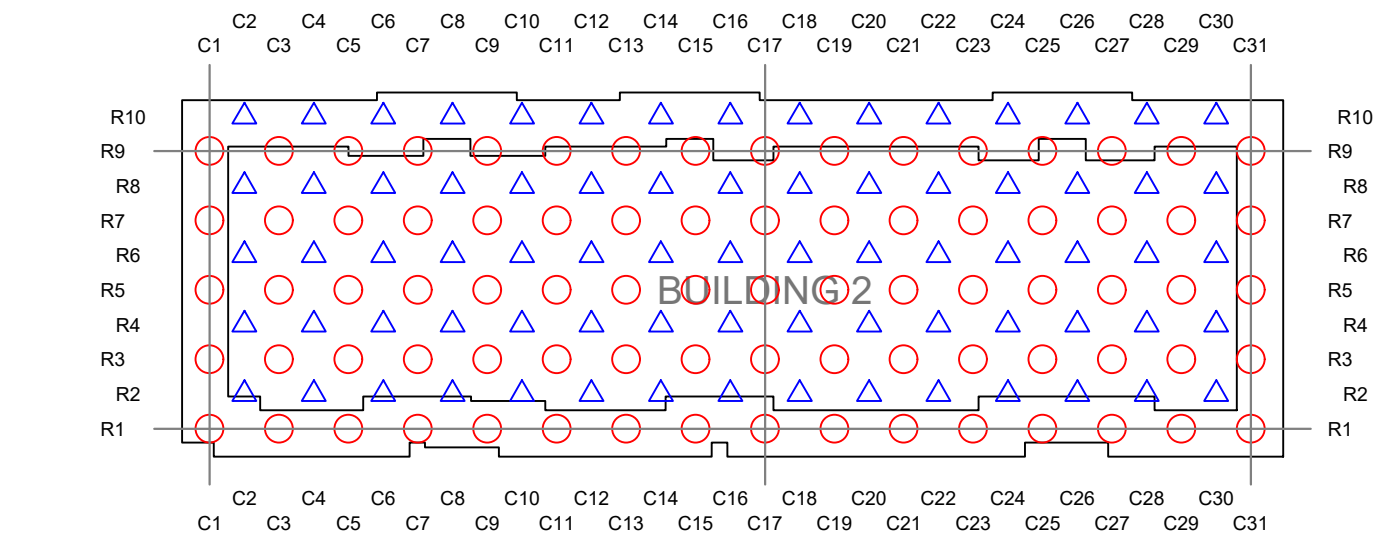
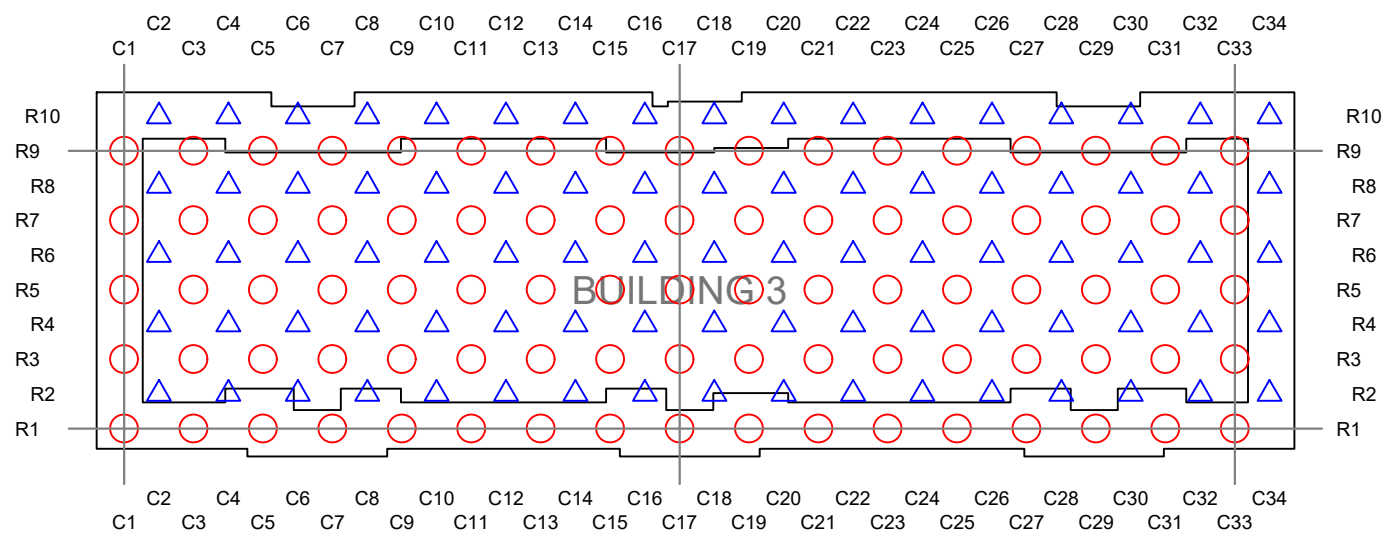
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Date			
Scale	NTS		



C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25



R3 R4 R5 R6 R7 R8 R9 R10
C1 C2 C3 C4 C5 C6 C7 C8 C9 C11



General Notes

○ PRIMARY DROP
△ SECONDARY DROP

2 PASSES
15ft GRID
60ft DROP HEIGHT
16th DROP WEIGHT
7-9 DROPS PER POINT

NORTH

TYPICAL LAYOUT PATTERN

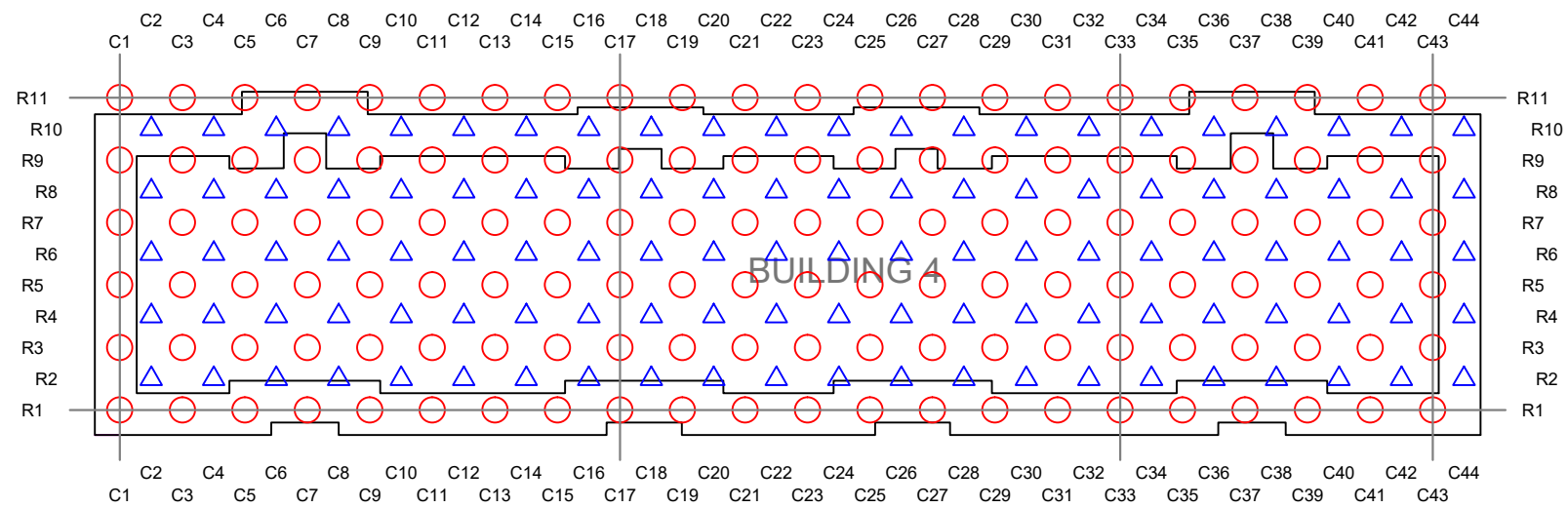
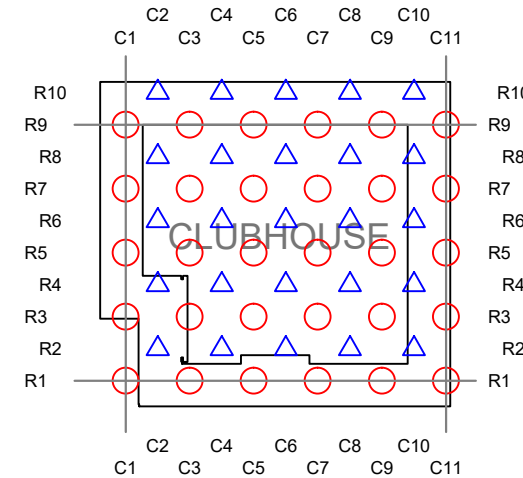
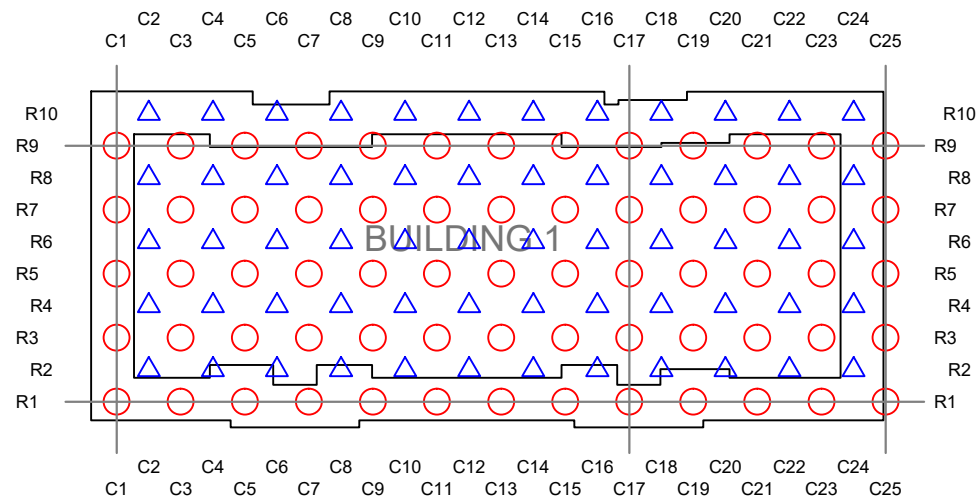
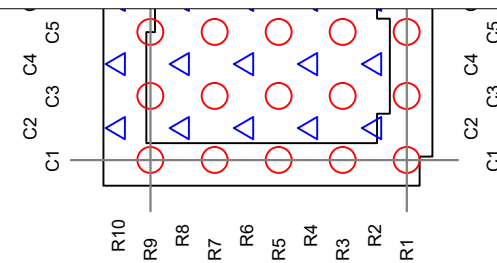
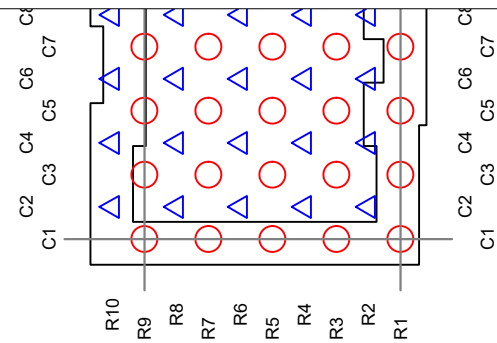
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DYNAMIC COMPACTION SPECIALIST

KIRKWOOD CROSSING
HOUSTON, TX

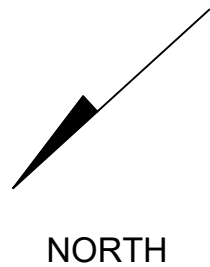
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Date		2 OF 3
Scale	NTS	



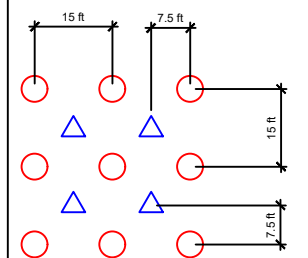
General Notes

○ PRIMARY DROP
 △ SECONDARY DROP

2 PASSES
 15ft GRID
 60ft DROP HEIGHT
 16th DROP WEIGHT
 7-9 DROPS PER POINT



TYPICAL LAYOUT PATTERN



01	SD 13DEC2022	CW
No.	Revision/Issue	Aprov.

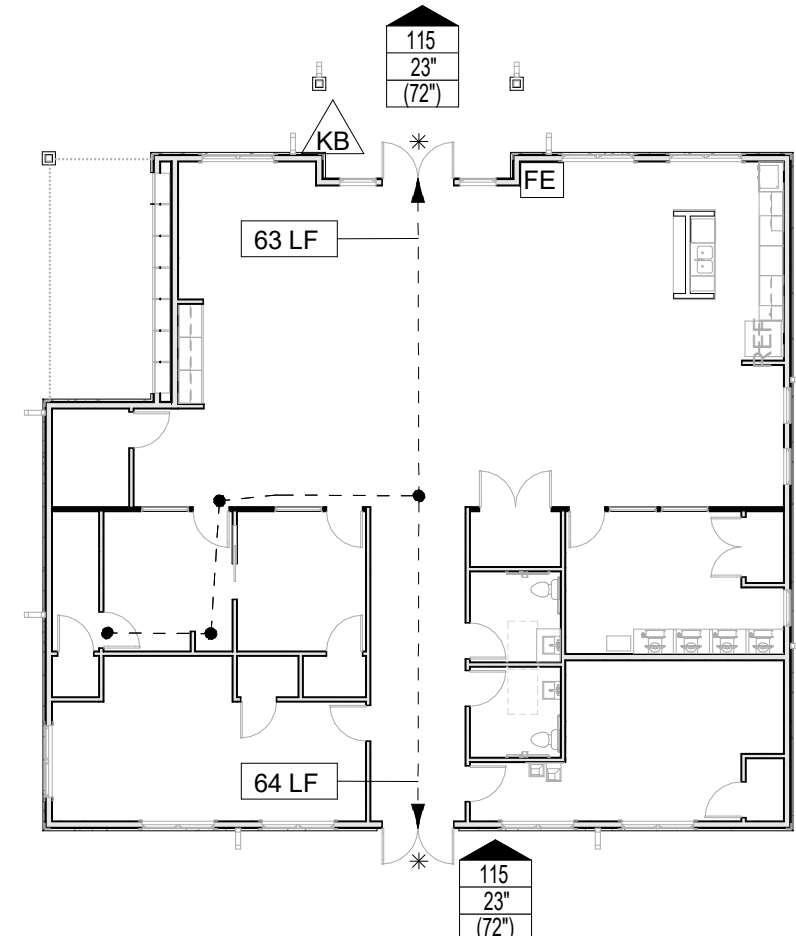
DENSIFICATION, INC.
 40650 HURLEY LANE
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 (540) 882-4190 fax

DYNAMIC COMPACTION SPECIALIST

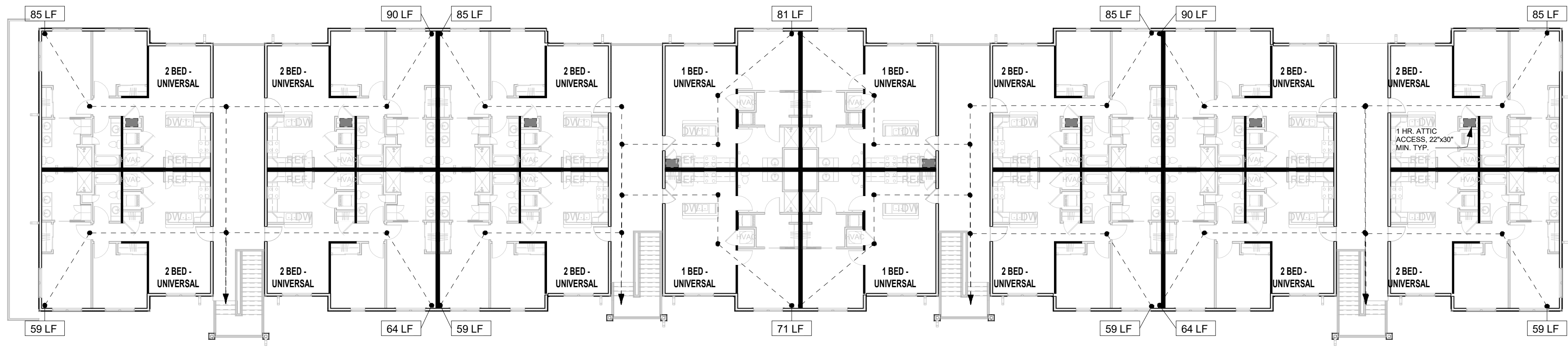
KIRKWOOD CROSSING
 HOUSTON, TX

Project	DI-1011	Sheet
Date		3 OF 3
Scale	NTS	

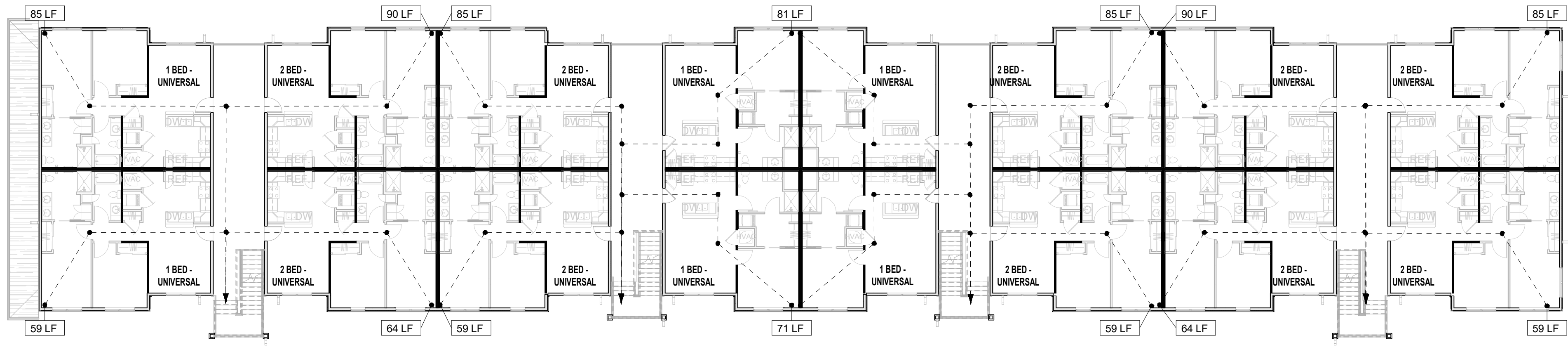
APPENDIX 5
CIVIL DRAWING SET



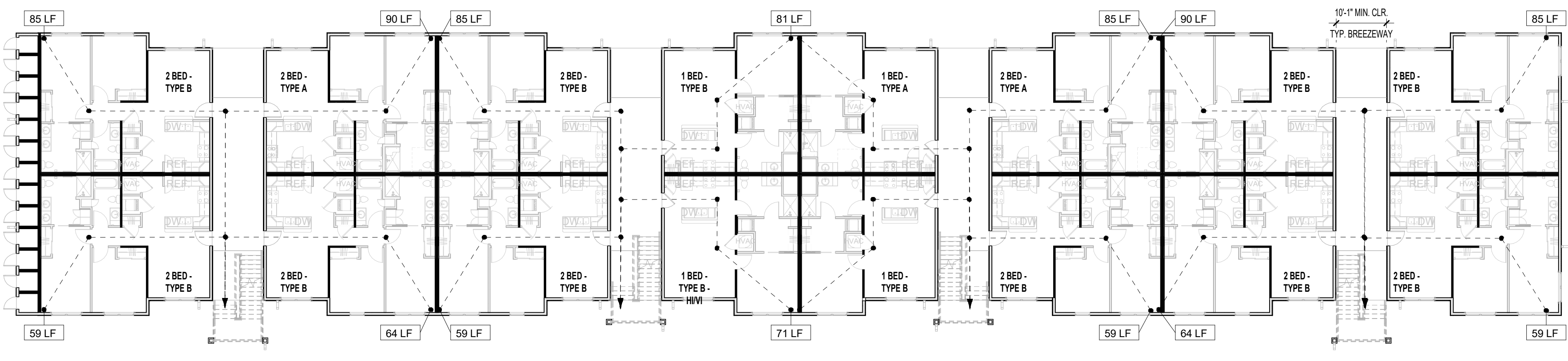
4 CLUBHOUSE - CODE PLAN
1/16" = 1'-0"



3 BLDG 4 - 3RD FLOOR CODE PLAN
1/16" = 1'-0"



2 BLDG 4 - 2ND FLOOR CODE PLAN
1/16" = 1'-0"



1 BLDG 4 - 1ST FLOOR CODE PLAN
1/16" = 1'-0"

CODE PLAN GENERAL NOTES:

- FIRE EXTINGUISHERS SHALL BE LOCATED SO THAT THE MAXIMUM TRAVEL DISTANCE SHALL NOT EXCEED 75 FEET. GENERAL CONTRACTOR TO PROVIDE SEMI-RECESSED FIRE EXTINGUISHER CABINETS WITH FIRE EXTINGUISHERS THROUGHOUT AT ACCESSIBLE HEIGHT.
- SIGNS IDENTIFYING FIRE PROTECTION EQUIPMENT, CONTROLS FOR AIR CONDITIONING SYSTEMS, SPRINKLER RISERS AND VALVES, OR OTHER FIRE DETECTION, SUPPRESSION OR CONTROL ELEMENTS SHALL BE IDENTIFIED FOR THE USE OF THE FIRE DEPARTMENT PER 2015 IBC. SIGNAGE SHALL ALSO MEET 2015 IFC REQUIREMENTS FOR HEIGHT AND LETTERING. GC TO COORDINATE WITH AUTHORITY HAVING JURISDICTION ON ALL SIGNAGE.
- KNOX BOX QUANTITY AND LOCATION TO BE COORDINATED BY THE GENERAL CONTRACTOR WITH AUTHORITY HAVING JURISDICTION.
- ANNUNCIATOR PANEL AND FACP QUANTITY AND LOCATION TO BE COORDINATED BY THE GENERAL CONTRACTOR WITH AUTHORITY HAVING JURISDICTION PRIOR TO INSTALL.
- ALL DIMENSIONS ARE APPROXIMATE ON CODE PLAN. ACTUAL ARCHITECTURAL DIMENSIONS PER ARCHITECTURAL AND STRUCTURAL PLAN.
- PROJECT COMPLIES WITH 2015 INTERNATIONAL ENERGY CONSERVATION CODE (IECC) - COMCHECK REPORT INCLUDED IN THE SPECIFICATIONS.

CODE REVIEW		
PROJECT NAME:	KIRKWOOD CROSSING	
PROJECT LOCATION:	HOUSTON, TX	
CODE:	HOUSTON CONSTRUCTION CODE	
CODE REVIEW COMPLETED BY:	A. J. DOLPH	
CHAPTER THREE		
SECTION 302 CLASSIFICATION:	R-2: APTS, A-3: CLUBHOUSE	
CHAPTER FOUR		
SECTION 420: DWELLING UNIT REQUIREMENTS		
DWELLING UNIT SEPARATION WALLS:	1 HOUR FIRE PARTITIONS	
DWELLING UNIT HORIZONTAL SEPARATION:	1 HOUR FIRE ASSEMBLY	
AUTOMATIC SPRINKLER SYSTEM:	REQUIRED, 13R	
FIRE ALARM SYSTEMS AND SMOKE ALARM SYSTEMS:	REQUIRED	
CHAPTER FIVE		
TABLE 504.3 ALLOWABLE BUILDING HEIGHT IN FEET:		
R-2: 13R, TYPE VA	ALLOWABLE	ACTUAL
BUILDING 1	60'-0"	45'-0"
BUILDING 2		45'-0"
BUILDING 3		45'-0"
BUILDING 4		45'-0"
A-2, B, & S-1: NS, TYPE VB	40'-0"	25'-0"
CLUBHOUSE		
TABLE 504.4 ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE:		
R-2: 13R, TYPE VA	ALLOWABLE	ACTUAL
BUILDING 1	4-STORIES	3-STORIES
BUILDING 2		3-STORIES
BUILDING 3		3-STORIES
BUILDING 4		3-STORIES
A-2, B, & S-1: NS, TYPE VB	1-STORY	1-STORY
CLUBHOUSE		
TABLE 506.2 ALLOWABLE AREA FACTOR IN SQUARE FEET:		
R-2: 13R, TYPE VA	ALLOWABLE	ACTUAL
BUILDING 1	21,000 SQFT	9,000 SQFT
BUILDING 2		11,850 SQFT
BUILDING 3		12,955 SQFT
BUILDING 4		16,920 SQFT
A-2, B, & S-1: NS, TYPE VB	6,000 SQFT	3,440 SQFT
CLUBHOUSE	9,000 SQFT	255 SQFT PER BUILDING
STORAGE		
SECTION 506.2.3 AREA MODIFICATIONS, EQUATION 5-2: $A_a = [A + (NS \times I)] \times S_a$		
R-2: 13R, TYPE VA	$A_a = [12,000 + 12,000 \times 0.75] \times 1$	
	$A_a = 21,000$ ALLOWABLE SQFT	
SECTION 506.3 FRONTAGE INCREASE, EQUATION 5-4: $W = (L1 \times W1 + L2 \times W2) / F$		
R-2: 13R, TYPE VA	$W = 30'$	
SECTION 506.3.3 AMOUNT OF INCREASE, EQUATION 5-5: $I_f = [F/P - 0.25]W/30$		
R-2: 13R, TYPE VA	$I_f = [100/100 - 0.25]30/30$	
	$I_f = 0.75$	
TABLE 508.2 INCIDENTAL USE AREAS:		
LAUNDRY > 100 SF, 1HR		
STORAGE > 100 SF, 1HR		
TABLE 508.4 REQUIRED SEPARATION OF OCCUPANCIES: 1 HOUR BETWEEN R-2 & S-1		
CHAPTER SIX		
TABLE 601 FIRE RESISTANCE REQUIREMENTS FOR BUILDING ELEMENTS (HOURS):		
PRIMARY STRUCTURAL FRAME:	VA - 1 HOUR	VB - 0 HOUR
EXTERIOR BEARING WALL:	VA - 1 HOUR	VB - 0 HOUR
INTERIOR BEARING WALL:	VA - 1 HOUR	VB - 0 HOUR
EXTERIOR NON-BEARING WALLS:	0 HOUR < 30 FEET,	0 > 30 FEET
INTERIOR NON-BEARING WALL:	VA - 1 HOUR	VB - 0 HOUR
FLOOR CONSTRUCTION:	VA - 1 HOUR	VB - 0 HOUR
ROOF CONSTRUCTION:	VA - 1 HOUR	VB - 0 HOUR

2015 IECC	
CLIMATE ZONE:	2A
CONST. TYPE:	V-A
CHAPTER 4-RESIDENTIAL ENERGY EFFICIENCY	
TABLE R402.1.2 - INSULATION & FENESTRATION REQUIREMENTS BY COMPONENT	
FENESTRATION U-FACTOR:	0.40
GLAZED FENESTRATION SHGC:	0.25
CEILING R-VALUE:	38
WOOD FRAME WALL R-VALUE:	20 OR 13+5
FLOOR R-VALUE:	13
SLAB R-VALUE & DEPTH:	0
ALL OF IECC 2015 APPLIES, HOWEVER PARTICULAR NOTE SHALL BE TAKEN OF THE FOLLOWING. ADDITIONALLY, GC TO PROVIDE INSULATION, FENESTRATION, AND OTHER REQUIREMENTS PER BELOW:	
1.	AIR LEAKAGE PER SECTION R402.4
2.	AIR BARRIER PENETRATIONS PER R402.4.1.1
3.	AIR LEAKAGE OF FENESTRATION PER SECTION R402.4.3
4.	HVAC EQUIPMENT PERFORMANCE REQUIREMENTS PER SECTION R403.
5.	DUCTILE INSULATION AND SEALING PER R403.3.5
6.	PIPING INSULATION PER R403.4
7.	LIGHTING/ELECTRICAL SYSTEMS PER SECTION R405

BUILDING OCCUPANCY LOADS			
BUILDING 1	SQ. FT. AREA	LOAD FACTOR	MAX. OCC.
FLOOR 1	9,000	200	45
FLOOR 2	8,745	200	44
FLOOR 3	8,745	200	44
	26,490		133
BUILDING 2			
FLOOR 1	11,850	200	60
FLOOR 2	11,420	200	58
FLOOR 3	11,420	200	58
	34,690		176
BUILDING 3			
FLOOR 1	12,955	200	65
FLOOR 2	12,700	200	64
FLOOR 3	12,700	200	64
	38,355		193
BUILDING 4			
FLOOR 1	16,920	200	85
FLOOR 2	16,665	200	84
FLOOR 3	16,665	200	84
	50,250		253
CLUBHOUSE			
FLOOR 1	3,440	15	230

UNIT OCCUPANCY LOADS			
UNIT TYPE	SQ. FT. AREA	LOAD FACTOR	MAX. OCC.
1 BED UNIT	755	200	4
2 BED UNIT	960	200	5
3 BED UNIT	1,165	200	6

CHAPTER SEVEN		
SECTION 704 FIRE-RESISTANCE RATING OF STRUCTURAL MEMBERS:	SEE TABLE 601	
TABLE 705.8 MAX AREA EXTERIOR WALL OPENINGS:	(UNPROTECTED)	
SECTION 706 FIRE WALLS:	N/A	
SECTION 707 FIRE BARRIERS:	VA - 1 HOUR VB - 0 HOUR	
SECTION 708 FIRE PARTITIONS:	VA - 1 HOUR VB - 0 HOUR	
SECTION 709 SMOKE BARRIERS:	N/A	
SECTION 710 SMOKE PARTITIONS:	N/A	
SECTION 711 HORIZONTAL ASSEMBLIES:	VA - 1 HOUR VB - 0 HOUR	
SECTION 712 VERTICAL OPENINGS:	N/A	
SECTION 713 SHAFT ENCLOSURES:	N/A	
SECTION 714 PENETRATIONS:	VA - 1 HOUR VB - 0 HOUR	
SECTION 715 FIRE-RESISTANT JOINT SYSTEMS:	VA - 1 HOUR VB - 0 HOUR	
SECTION 716 OPENING PROTECTIVES:	CORRIDOR - .33 EXTERIOR - N/A	
SECTION 717 DUCTS AND AIR TRANSFER OPENINGS:	1.5 HOUR DAMPER RATING	
SECTION 718 CONCEALED SPACES:	FIREBLOCK & DRAFTSTOP	
CHAPTER NINE		
SECTION 903 AUTOMATIC SPRINKLER SYSTEM:	R-2: NFPA 13R A-2, B, S-1: NS	
SECTION 905 STANDPIPE SYSTEM:	N/A	
SECTION 907 FIRE ALARM & DETECTION SYSTEM:	R-2: REQUIRED A-3: N/A	
SECTION 909 SMOKE CONTROL SYSTEM:	N/A	
CHAPTER TEN		
TABLE 1004.1.2 MAX FLOOR AREA ALLOW/OCCUP:	R-2: 200 GROSS A-3: 15 NET S-1: 300 GROSS	
SECTION 1005.3 EGRESS WIDTH/OCCUP SERVED:	STAIRS 0.3/OCC. OTHER EGRESS 0.2/OCC.	
TABLE 1006.2.1 SPACES WITH ONE EIT OR EXIT ACCESS DOORWAY:		
R-2:	MAX. OCC. LOAD	MAX. EGRESS TRAVEL DISTANCE
A-3:	10 OCCUPANTS	125'-0"
S-1:	49 OCCUPANTS	75'-0"
	29 OCCUPANTS	75'-0"
TABLE 1006.3.2(1) STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCC.:		
STORY 1, 2, & 3	MAX. DWELLING UNITS	MAX. EGRESS TRAVEL DISTANCE
	4 DWELLING UNITS	125'-0"
SECTION 1011 STAIRWAYS:	44" MINIMUM	
SECTION 1014 HANDRAIL:	34" MIN. - 38" MAX.	
SECTION 1015 GUARDS:	42" MIN.	
TABLE 1017.2 EXIT ACCESS TRAVEL DISTANCE, MAXIMUMS:		
R-2:	NON-SPRINKLED	SPRINKLED
A-2:	200'-0"	250'-0"
S-1:	200'-0"	-
TABLE 1020.1 CORRIDOR FIRE-RESISTANCE RATING:	R-2, 1/2 HOUR RATING (FLOOR)	
1020.4 DEAD ENDS:	20'-0" MAX.	
CHAPTER ELEVEN		
TABLE 1106.1 ACCESSIBLE PARKING SPACES:	AS PER CIVIL	
CHAPTER TWELVE		
1203.4.1 NATURAL VENTILATION:	4% VENTILATION	
1205.2 NATURAL LIGHT:	8% LIGHTING	

LEGEND

- 100 (60") → NUMBER OF OCCUPANTS EXITING REQUIRED EXIT WIDTH
- EXIT WIDTH PROVIDED BY DESIGN
- NON-RATED PARTITION
- 1 HR RATED PARTITION
- 1 HR RATED BARRIER
- ROOM SIGNAGE NUMBER
- 123
- FE → FIRE EXTINGUISHER CABINET
- KB → FIRE DEPARTMENT KNOX BOX
- → FIRE DEPARTMENT CONNECTION
- * → DOOR WITH PANIC HARDWARE
- x → EXIT SIGNAGE, RE: ELECTRICAL

EGRESS PATH OF TRAVEL

- EGRESS STARTING POINT
- EGRESS DISTANCE OF TRAVEL
- EGRESS DIRECTION OF TRAVEL

PRINTS ISSUED
12/20/2022 - CITY SUBMISSION

REVISIONS:

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INTERIOR DESIGN
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REGISTERED ARCHITECT
STATE OF MISSOURI
12/20/2022

KIRKWOOD CROSSING

12000 BISSONNET ST
HOUSTON, TX 77099

SHEET TITLE
CODE ANALYSIS

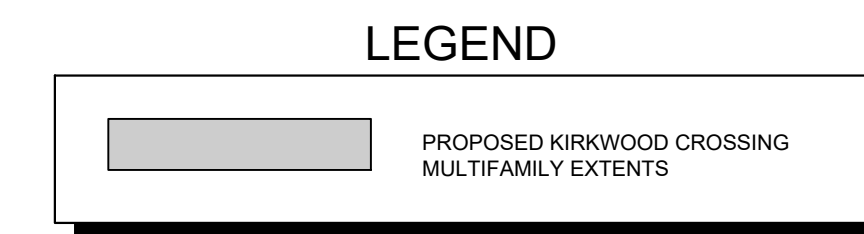
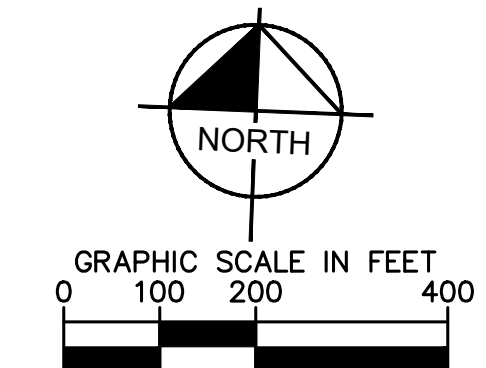
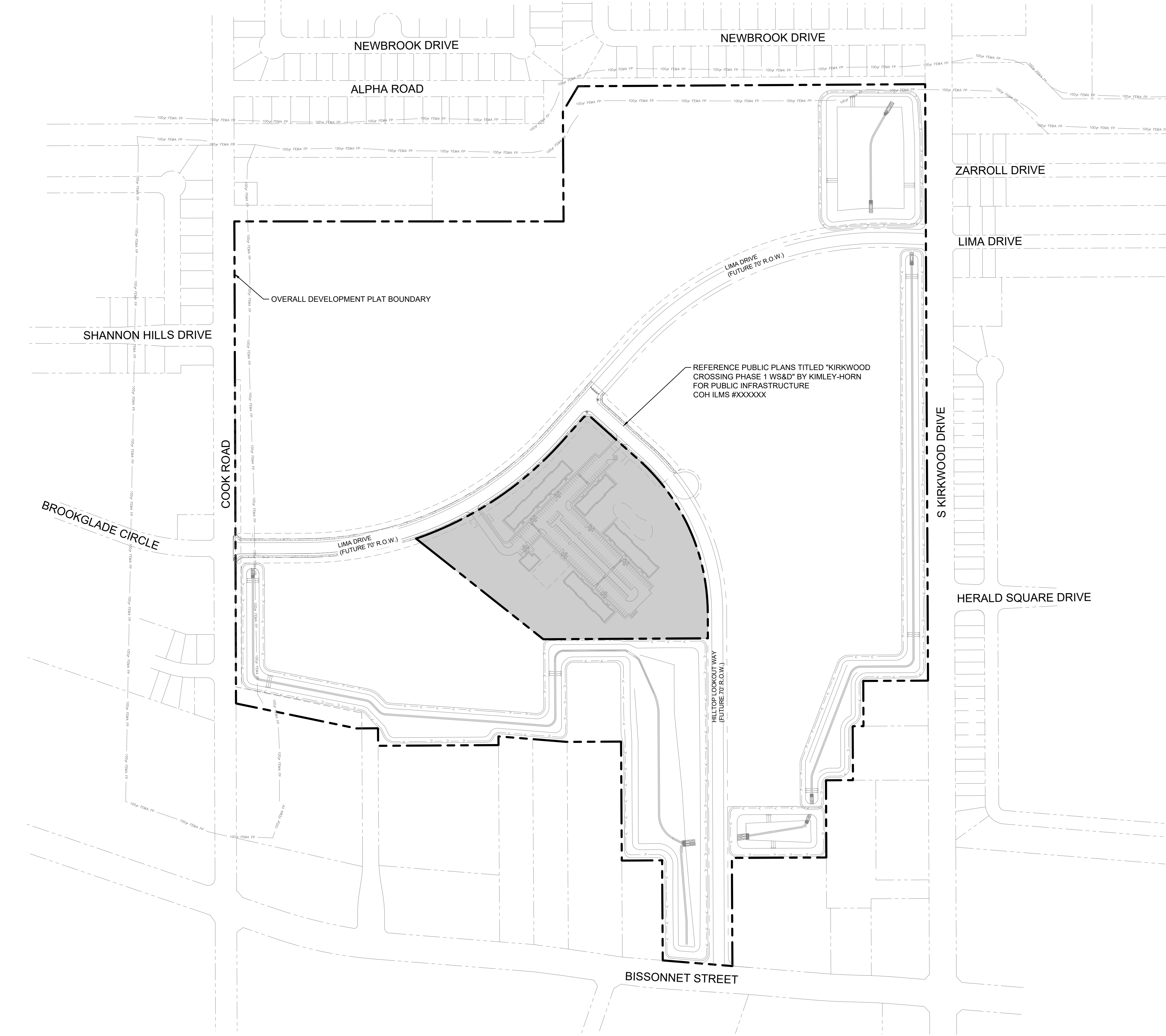
PROJECT NUMBER: 22065

SHEET NUMBER:

G-100A

REFERENCE G-003 FOR GENERAL NOTES

Plotted By: Simmons, Ross Sheet Set: KHA Layout: Overall Development Plan December 16, 2022 10:44:38am K:\HOU_Civil\0645472001\12000 Bissomnet Street\CAD\PlanSheets\C-Overall Development Plan.dwg
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THE SUBJECT PROPERTY IS A +/- 12.085-ACRE TRACT ADDRESSED AT 12000 BISSONNET STREET, HOUSTON, TEXAS 77099. THE SUBJECT PROPERTY IS PART OF AND SURROUNDED BY THE +/-118.778-ACRE DOTY SAND PIT VENTURE (DSPV) LANDFILL. THE DSPV LANDFILL BEGAN AS A SAND MINING OPERATION IN ABOUT 1960 AND TRANSITIONED TO LANDFILL BEFORE 1978 AND CONTINUED TO OPERATE AS A LANDFILL UNTIL ITS CLOSURE IN 1999. IN 1981 THE DSPV LANDFILL RECEIVED A PERMIT FROM THE TEXAS DEPARTMENT OF HEALTH (TDH), (NOW THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ)) TO OPERATE THE SITE AS A TYPE IV LANDFILL FOR CONSTRUCTION AND DEMOLITION DEBRIS DISPOSAL. THE SITE WAS SUBSEQUENTLY ISSUED MUNICIPAL SOLID WASTE (MSW) PERMIT NO. 1247 BY TCEQ IN 1985. MSW PERMIT NO. 1247 IS ACTIVE AND THE SITE HAS BEEN IN POST CLOSURE CARE SINCE 1999. THE CURRENT TCEQ MSW PERMIT NO. 1247 PERMITTEE IS NORTHWEST METRO HOLDINGS, CS 34, LLC OF BURLINGAME, CALIFORNIA.

LOCATED ADJACENTLY NORTH AND EAST OF THE DSPV LANDFILL IS THE +/-18.11-ACRE OLSHAN DEMOLISHING LANDFILL (FORMERLY MSW PERMIT NO. 1259). ALSO A CLOSED TYPE IV LANDFILL THAT REPORTEDLY RECEIVED CONSTRUCTION DEBRIS WASTE FROM SEPTEMBER 1976 UNTIL JULY 1987. IN 2002, THE OLSHAN LANDFILL ENDED POST CLOSURE CARE, AND THE MSW PERMIT WAS REVOKED BY TCEQ.

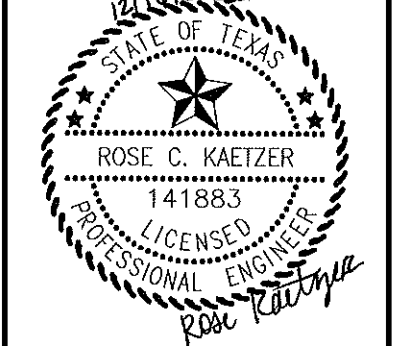
THE SUGAR HILLS GOLF COURSE WAS DEVELOPED ABOVE THE DSPV LANDFILL AND OLSHAN DEMOLISHING LANDFILL AND OPERATED FROM APPROXIMATELY 2000 TO 2005 WITH AN ADDRESS OF 12000 BISSONNET STREET. SINCE THE SUGAR HILLS GOLF COURSE CLOSED, BOTH LANDFILLS HAVE REMAINED DEVELOPED AS A GOLF COURSE, THOUGH ONLY SPARINGLY MAINTAINED.

IN APRIL 2016, ECO 1 DEVELOPMENT, LLC (ECO 1), A PRIOR MSW PERMITTEE, RECEIVED A TYPE IX REGISTRATION NO. 40286 FROM TCEQ FOR MINING OF THE OLSHAN DEMOLISHING LANDFILL UNDER 30 TEXAS ADMINISTRATIVE CODE (TAC) CHAPTER 330, SUBCHAPTER N, ECO 1 REMOVED SOME GOLF COURSE SOIL FROM THE OLSHAN DEMOLISHING LANDFILL, BUT NEVER ACTIVELY MINED WASTE MATERIAL UNDER THE TYPE IX REGISTRATION. TCEQ REVOKED THE TYPE IX REGISTRATION ON AUGUST 1, 2019 FOR LACK OF ACTIVITY. HOWEVER, FOR THE REGISTRATION NO. 40286 APPLICATION, ECO 1 PERFORMED 6 TEST PITS ON THE OLSHAN DEMOLISHING LANDFILL FOR WASTE CHARACTERIZATION, SOIL, AND LEACHATE TESTING AND WASTE DEPTH DETERMINATION. FROM THE 6 TEST PITS, ECO 1 EXCAVATED ABOUT 1,700 CUBIC YARDS OF MATERIAL WHICH SKA CATEGORIZED AS 74% SOIL, 10% WOOD, 10% CONCRETE, 3% METAL, AND 3% OTHER (PLASTIC, RUBBER, TEXTILES, ETC). THE MAXIMUM DEPTH OF THE WASTE MATERIAL WAS REACHED IN TEST PIT 1 AT 26 FEET BELOW GROUND SURFACE (FT-BGS). THE AERIAL EXTENT OF WASTE DEPOSITION WAS NOT EVALUATED BY THE TEST PIT EXCAVATIONS. ALL WASTE OBSERVED WAS CONSISTENT WITH A TYPE IV LANDFILL OPERATION.

THE CURRENT PROPERTY OWNER, BISSONNET 136, LLC, ACQUIRED THE PROPERTY IN JUNE 2019. A RELATED ENTITY, NORTHWEST METRO HOLDINGS, CS 34, LLC BECAME THE MSW NO. 1247 PERMITTEE AFTER A TRANSFER PERMIT MODIFICATION WAS APPROVED BY TCEQ ON JUNE 4 2020.

No.	REVISIONS	DATE	BY

Kimley»Horn
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 TBP# FIRM REGISTRATION F-928

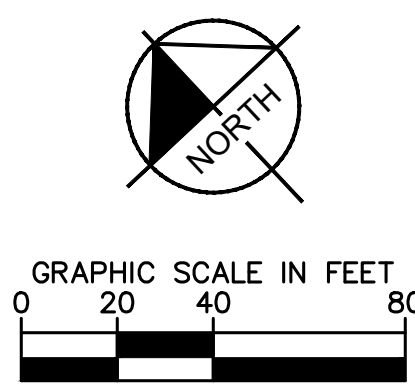
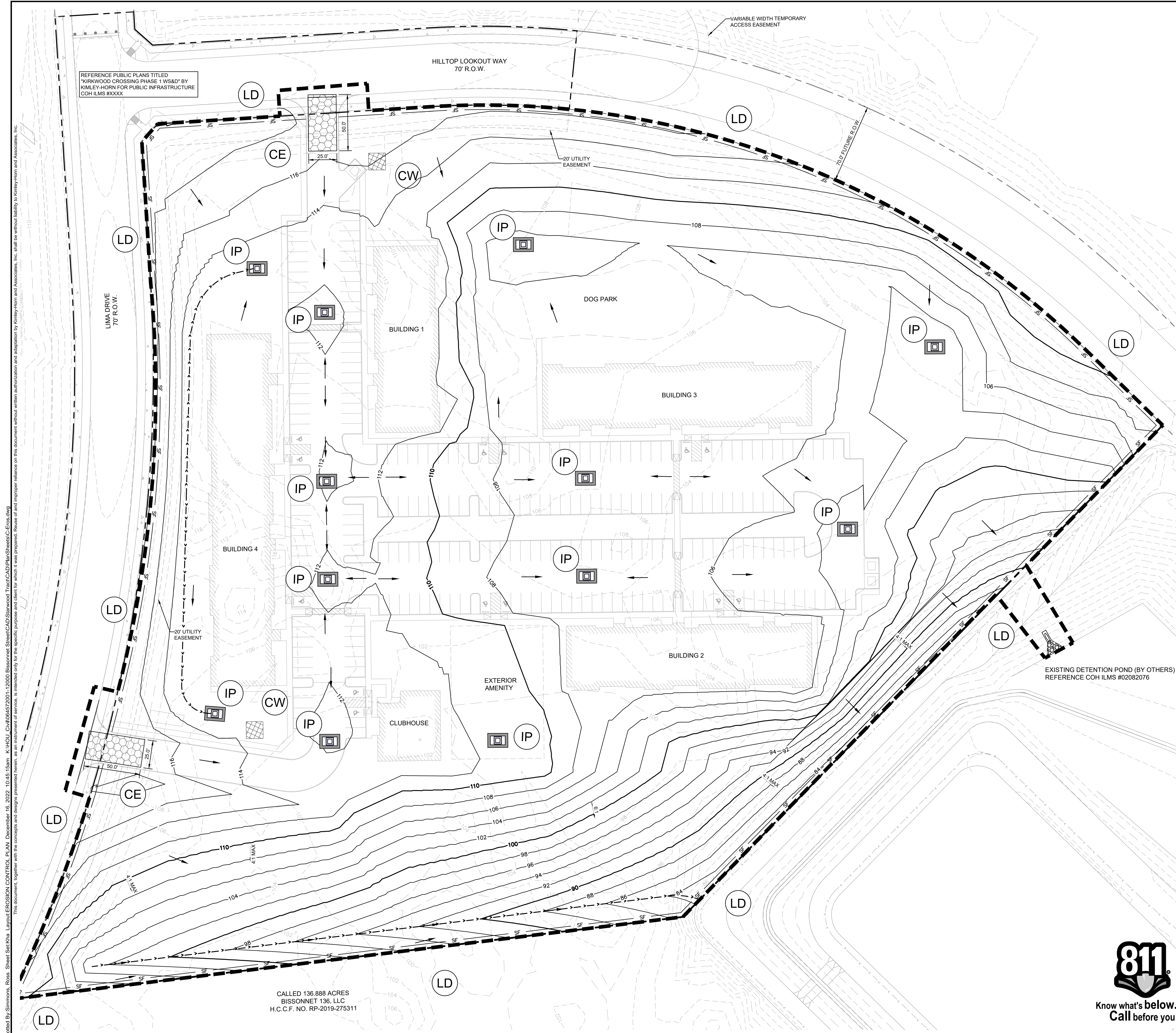


KHA PROJECT	068924000
DATE	DECEMBER 2022
SCALE	AS SHOWN
DESIGNED BY	RHS
DRAWN BY	CAP
CHECKED BY	RCK

OVERALL DEVELOPMENT PLAN

KIRKWOOD CROSSING - MULTIFAMILY
 PREPARED FOR
IMPACT RESIDENTIAL DEVELOPMENT
 HOUSTON TEXAS

SHEET NUMBER
C2.0



REFERENCE PUBLIC PLANS TITLED "KIRKWOOD CROSSING PHASE 1 W&S" BY KIMLEY-HORN FOR PUBLIC INFRASTRUCTURE COH ILM# XXXX

- EROSION CONTROL NOTES**
- CONTRACTOR IS SOLELY RESPONSIBLE FOR SELECTION, IMPLEMENTATION, MAINTENANCE, AND EFFECTIVENESS OF ALL SWPPP CONTROLS - CONTROLS SHOWN ON THIS SITE MAP ARE SUGGESTED CONTROLS ONLY.
 - CONTRACTOR SHALL RECORD INSTALLATION, MAINTENANCE OR MODIFICATION, AND REMOVAL DATES FOR EACH BMP EMPLOYED (WHETHER CALLED OUT ON ORIGINAL SWPPP OR NOT) DIRECTLY ON THIS SITE MAP.
 - DRAINAGE PATTERNS ARE SHOWN ON THIS PLAN BY PROPOSED AND EXISTING CONTOURS.
 - TEMPORARY AND PERMANENT STABILIZATION PRACTICES AND BMP'S SHALL BE INSTALLED AT THE EARLIEST POSSIBLE TIME DURING THE CONSTRUCTION SEQUENCE. AS AN EXAMPLE, PERIMETER SILT FENCE SHALL BE INSTALLED BEFORE COMMENCEMENT OF ANY GRADING ACTIVITIES. OTHER BMP'S SHALL BE INSTALLED AS SOON AS PRACTICABLE AND SHALL BE MAINTAINED UNTIL FINAL SITE STABILIZATION IS ATTAINED. CONTRACTOR SHALL ALSO REFERENCE CIVIL PLANS SINCE PERMANENT STABILIZATION IS PROVIDED BY LANDSCAPING AND SITE PAVING.
 - BMP'S HAVE BEEN LOCATED AS INDICATED ON THIS PLAN IN ACCORDANCE WITH GENERALLY ACCEPTED ENGINEERING PRACTICES IN ORDER TO MINIMIZE SEDIMENT TRANSFER. FOR EXAMPLE, SILT FENCES LOCATED AT TOE OF SLOPE AND INLET PROTECTION FOR INLETS RECEIVING SEDIMENT FROM SITE RUN-OFF.
 - SANITARY SEWER EFFLUENT IS DISPOSED OF VIA AN ONSITE SEWER SYSTEM CONNECTED TO A MUNICIPAL SEWER SYSTEM.
 - CONTRACTOR TO PROVIDE INLET PROTECTION IN PUBLIC ROW ONLY DURING EARTH MOVING ACTIVITIES. CONTRACTOR TO ENSURE PONDING DOES NOT OCCUR IN PUBLIC ROW OR ON ADJACENT PROPERTIES AT ANY TIME DURING CONSTRUCTION.
 - CONSTRUCTION ENTRANCE SHALL BE LOCATED SO AS TO PROVIDE THE LEAST AMOUNT OF DISTURBANCE TO THE FLOW OF TRAFFIC IN AND OUT OF THE SITE. ADDITIONALLY, THE CONSTRUCTION ENTRANCE SHALL BE LOCATED TO COINCIDE WITH THE PHASING OF THE PARKING LOT CONSTRUCTION.
 - CONTRACTOR SHALL PROVIDE INLET PROTECTION FOR ANY AFFECTED INLETS DOWNSTREAM OF THE PROPOSED IMPROVEMENTS, IF NEEDED.
 - THE NATURE OF THIS SITE'S CONSTRUCTION CONSISTS OF CLEARING & SITE PREPARATION, EARTHWORK, PAVING AND LANDSCAPING.
 - SEDIMENTATION BASIN: NEITHER A TEMPORARY NOR PERMANENT SEDIMENTATION BASIN HAS BEEN PROVIDED ON THIS SITE BECAUSE THE SITE IS LESS THAN 10 ACRES IN AREA.
 - POST CONSTRUCTION STORM WATER POLLUTION CONTROL MEASURES INCLUDE STABILIZATION BY PERMANENT PAVING AND LANDSCAPING.
 - DISTURBED PORTIONS OF SITE MUST BE STABILIZED. STABILIZATION PRACTICES MUST BE INITIATED WITHIN 14 DAYS IN PORTIONS OF THE SITE WHERE CONSTRUCTION HAS BEEN EITHER TEMPORARILY OR PERMANENTLY CEASED, UNLESS EXCEPTED WITHIN THE OPDES PERMIT. CONTRACTOR SHALL REMOVE TEMPORARY EROSION CONTROL DEVICES UPON COMPLETION OF STABILIZATION.
 - CONTRACTOR IS RESPONSIBLE FOR MODIFYING THE SWPPPSITE MAP TO INCLUDE BMP'S FOR ANY OFF-SITE MATERIAL WASTE, BORROW OR EQUIPMENT STORAGE AREAS.
 - CONTRACTOR IS RESPONSIBLE FOR SUBMITTAL OF NOI, NOT, POSTING OF SITE NOTICES, AND ANY ADDITIONAL INFORMATION OR SUBMITTALS REQUIRED BY TCEQ, EPA, OR LOCAL JURISDICTION.
 - CONTRACTOR TO MAINTAIN NO MORE THAN 10 ACRES OF DRAINAGE TO ANY SINGLE OUTFALL LOCATION DURING CONSTRUCTION.
 - THE SEQUENCE OF CONSTRUCTION SHOWN ABOVE IS A GENERAL OVERVIEW AND IS INTENDED TO CONVEY THE GENERAL CONCEPTS OF THE EROSION CONTROL DESIGN AND SHOULD NOT BE RELIED UPON FOR CONSTRUCTION PURPOSES. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR DETAILED PHASING AND CONSTRUCTION SEQUENCING NECESSARY TO CONSTRUCT THE PROPOSED IMPROVEMENTS INCLUDED IN THESE PLANS. THE CONTRACTOR SHALL NOTIFY ENGINEER IN WRITING IMMEDIATELY, PRIOR TO AND/OR DURING CONSTRUCTION IF ANY ADDITIONAL INFORMATION ON THE CONSTRUCTION SEQUENCE IS NECESSARY. CONTRACTOR IS SOLELY RESPONSIBLE FOR COMPLYING WITH THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION AND ALL OTHER APPLICABLE LAWS.

LEGEND	
-1.38-	EXISTING CONTOUR ELEVATIONS
-1.38-	PROPOSED CONTOUR ELEVATIONS
EROSION DETAILS	
LD	LIMITS OF DISTURBANCE
IP	GRATE INLET PROTECTION (SEE DETAIL C3.1)
X-SF	SILT FENCE (SEE DETAIL C3.1)
CE	CONSTRUCTION ENTRANCE (SEE DETAIL C3.1)
CW	CONCRETE WASHOUT (SEE DETAIL C3.1)
→	FLOW DIRECTION

SWPPP NOTE

ANY OFF-SITE STAGING AREA UTILIZED BY THE OPERATOR OF THIS SITE MUST BE INCLUDED IN THE SWPPP NARRATIVE PLAN AND TO SWPPP SITE PLAN AS REQUIRED BY THE TPO'S TEXAS GENERAL PERMIT TXR150000 (SECTION F). ANY SUCH AREA INCLUDED IN THE SWPPP WILL BE TREATED BY THE OPERATOR AS ANY OTHER PART OF THE CONSTRUCTION ACTIVITY FOR THE PURPOSES OF STORM WATER POLLUTION PREVENTION.

CAUTION!!

EXISTING UNDERGROUND UTILITIES IN THE AREA. CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE HORIZONTAL AND VERTICAL LOCATION OF ALL UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY REPAIRS TO EXISTING UTILITIES DUE TO DAMAGE INCURRED DURING CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES ON THE PLANS.



Know what's below.
Call before you dig.

CALLED 136.888 ACRES
BISSONNET 136, LLC
H.C.F. NO. RP-2019-275311

Plotted By: Simmons, Ross. Sheet Set: Kira Layout: EROSION CONTROL PLAN. December 16, 2022. 10:45:15am. K:\HOU_Civil\064572001\2000_Bissonnet_StreetCAD\Starwood_Tract\CAD\PlanSheets\C-Eros.dwg. This document, together with the concepts and designs presented herein, is an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.

KIRKWOOD CROSSING - MULTIFAMILY IMPACT RESIDENTIAL DEVELOPMENT

HOUSTON TEXAS

KIMLEY-HORN

EROSION CONTROL PLAN

SHEET NUMBER C3.0

KHA PROJECT 068924000

DATE DECEMBER 2022

SCALE AS SHOWN

DESIGNED BY RHS

DRAWN BY CAP

CHECKED BY RCK

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PHONE: 281-597-9300

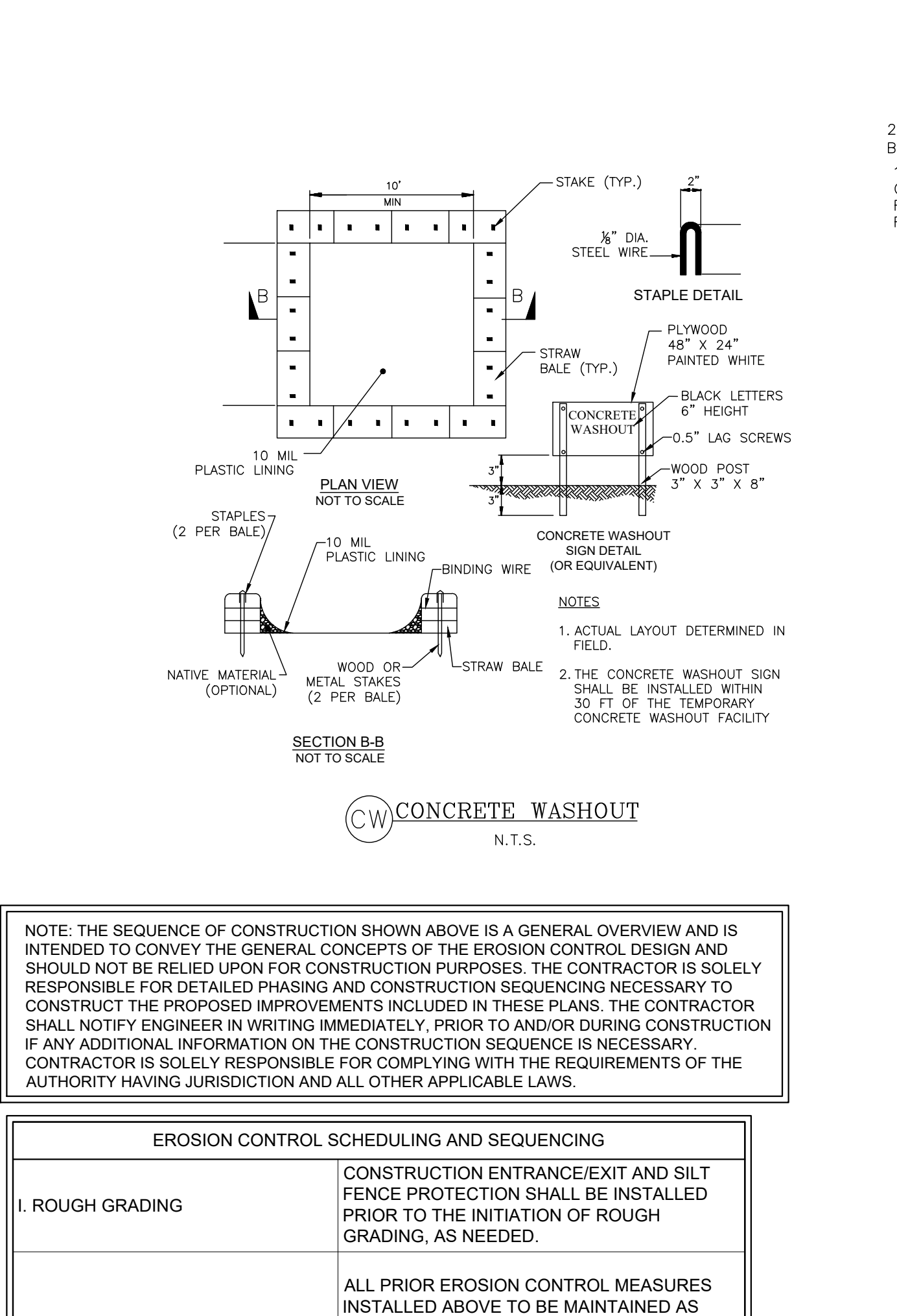
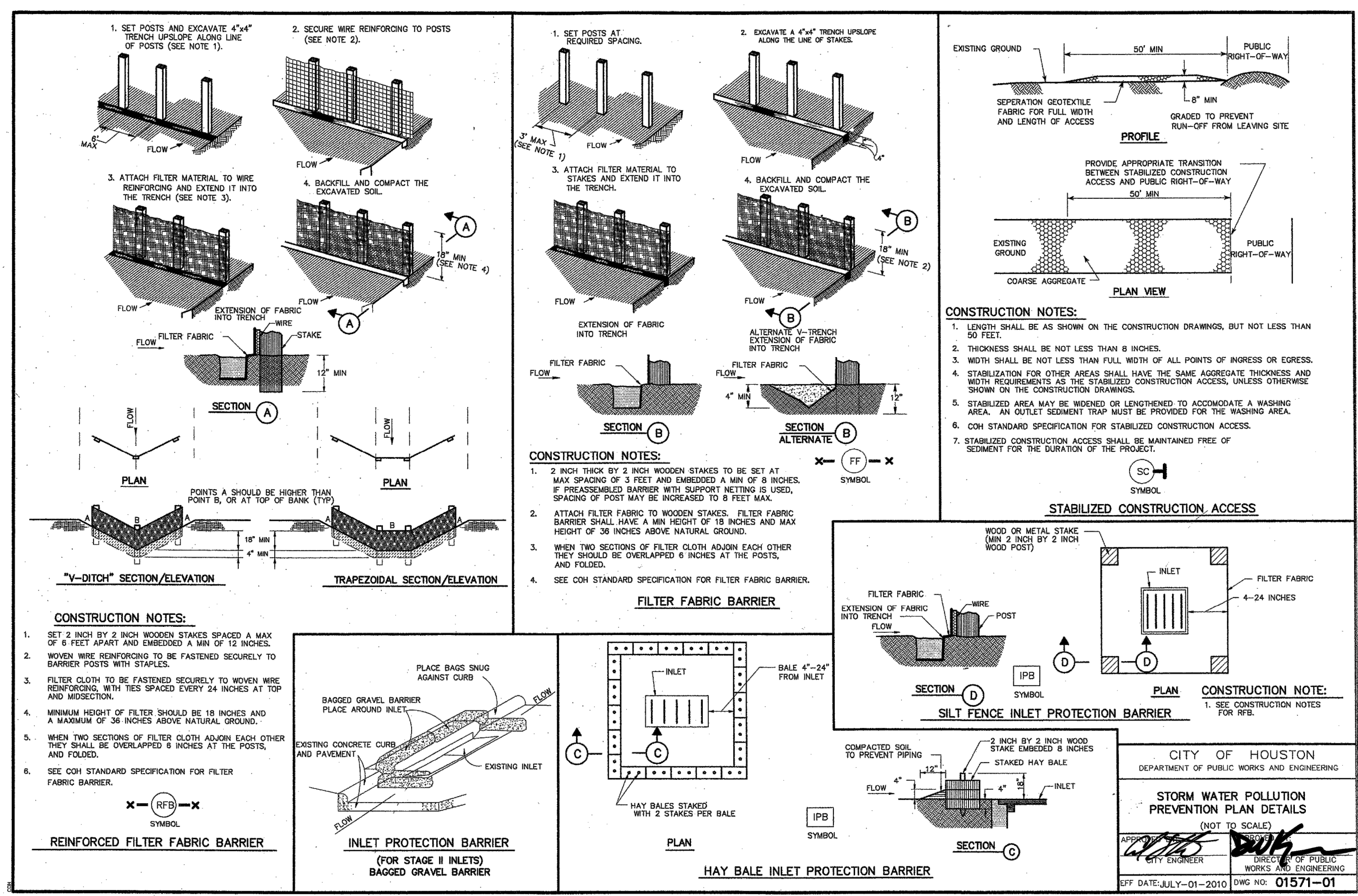
TBE FIRM REGISTRATION F-928

REVISIONS

DATE

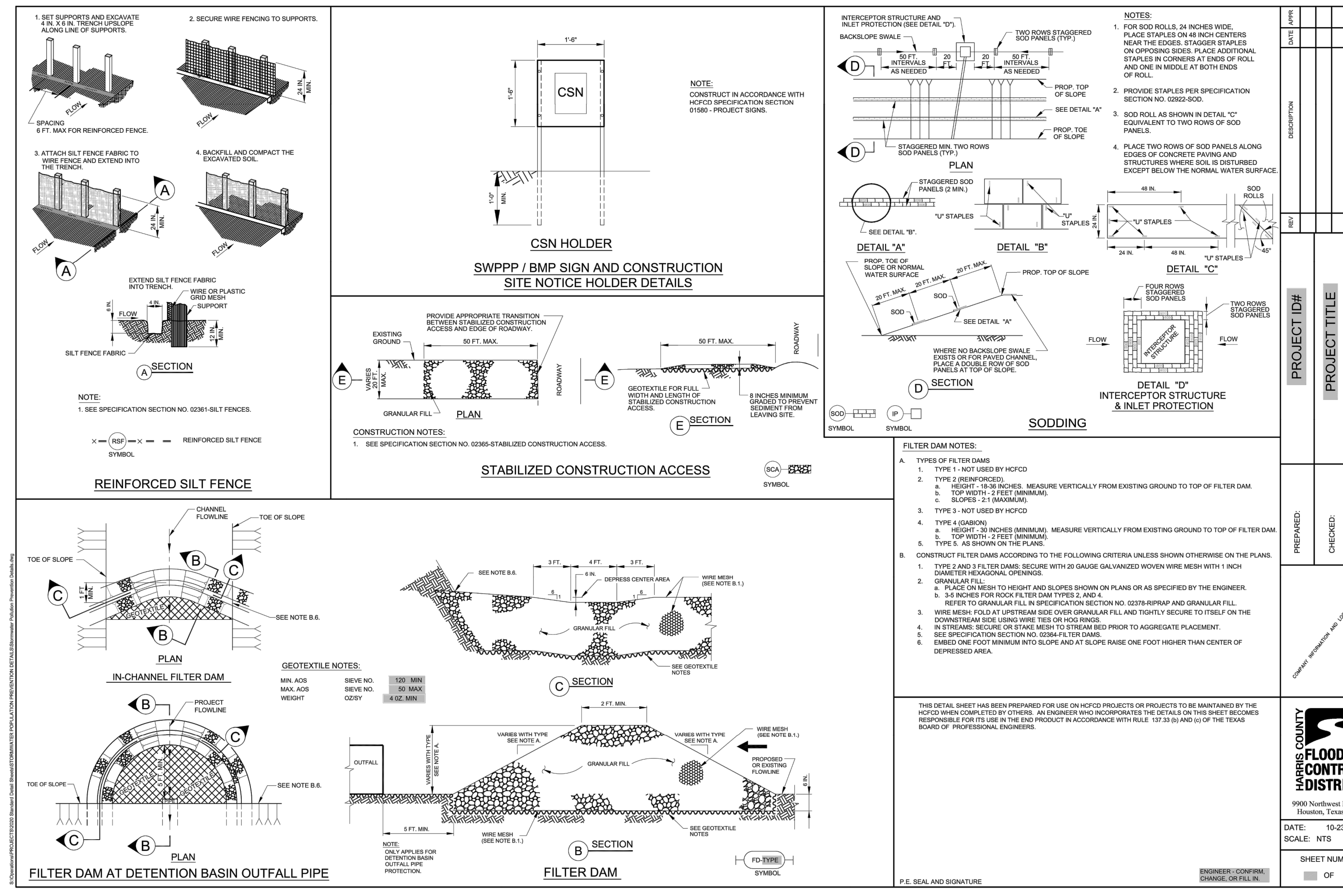
BY

Plotted By: Simmons, Reiss. Sheet Set: KWS Layout: C3.1. December 19, 2022, 10:45:24am. K:\HQ\Civil\064572001-12000 Bissommet Street\CAD\Standard\TrackCAD\Plan\Sheet\C-Eros-Dwg.rvt
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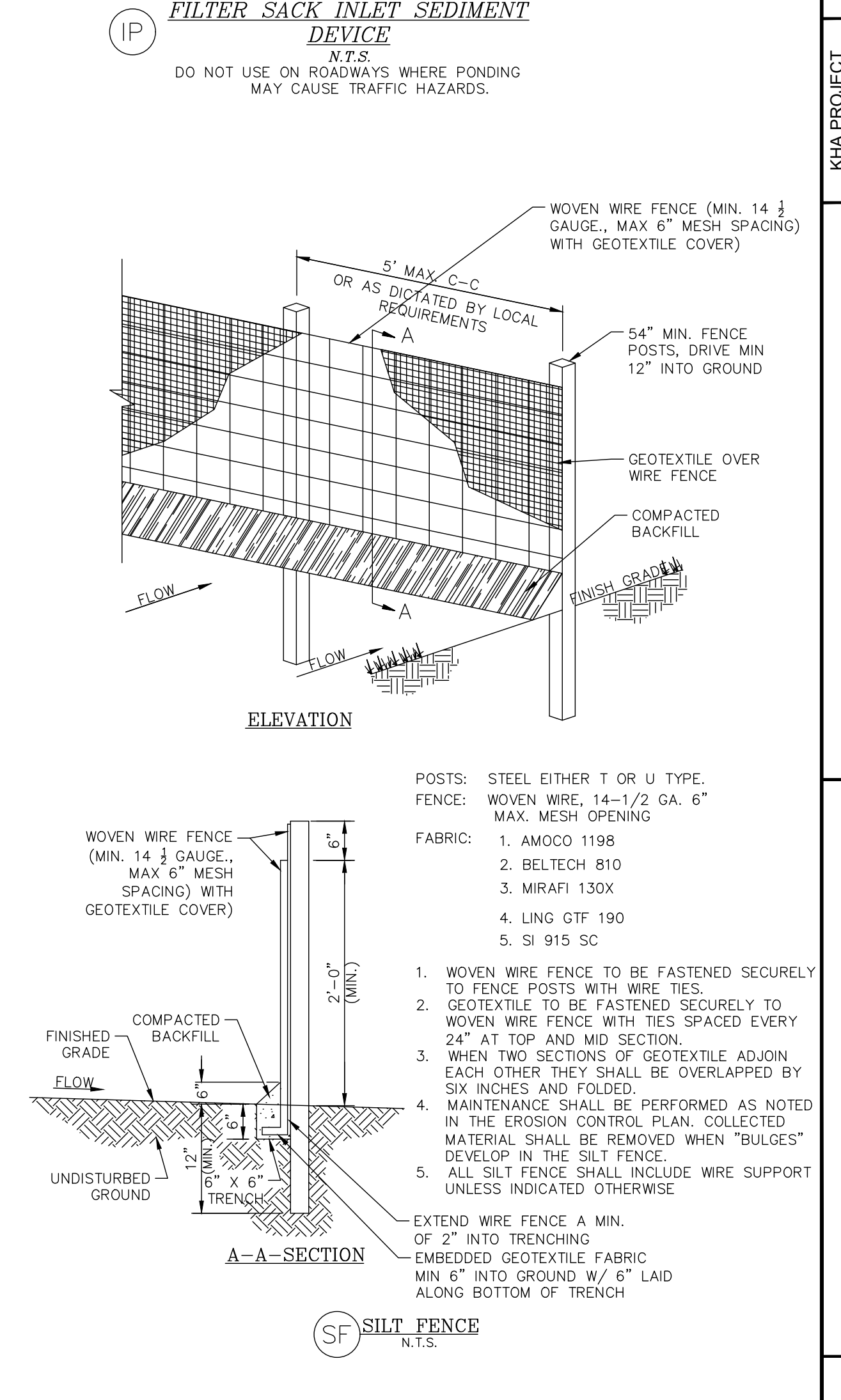
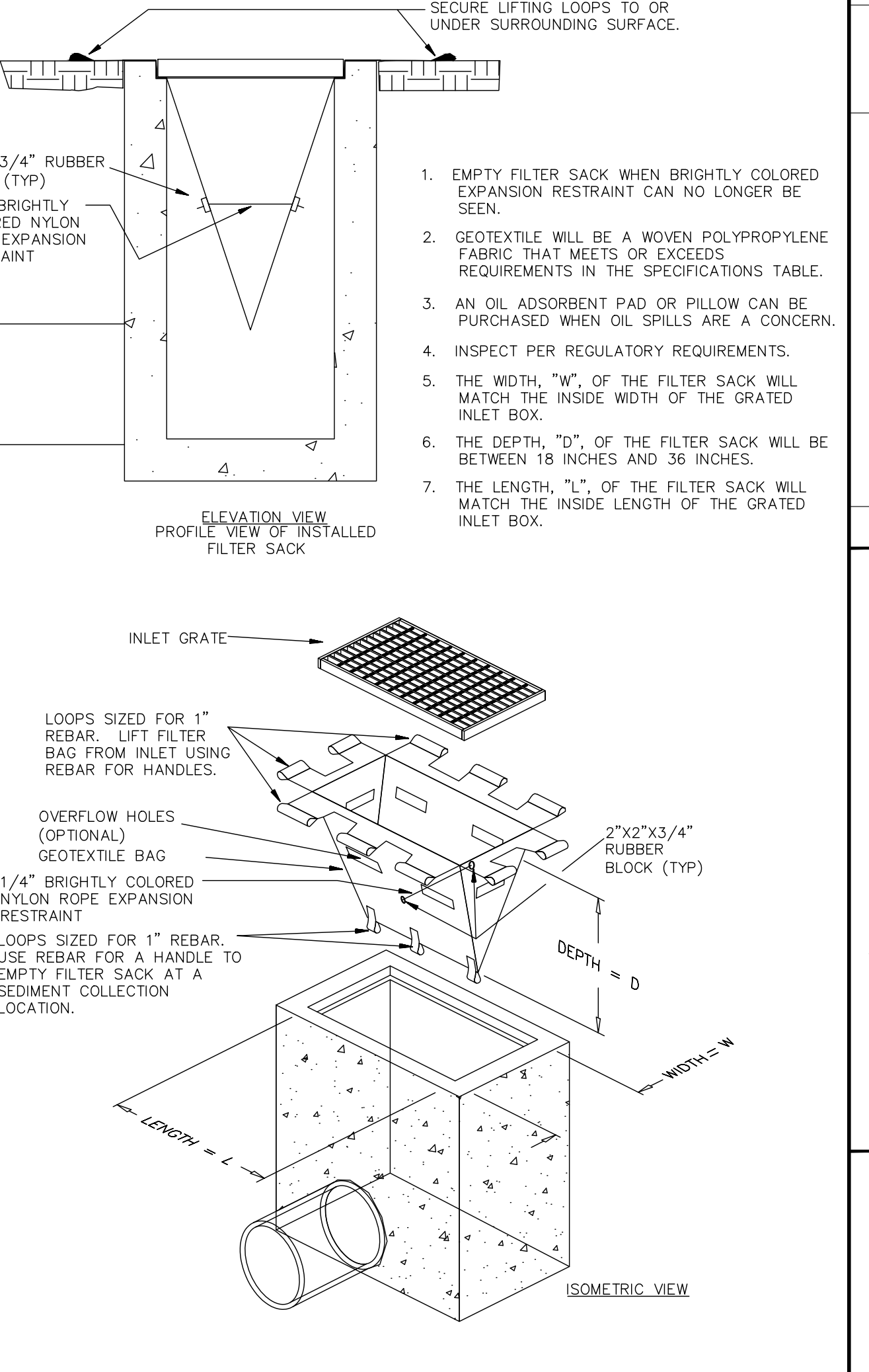
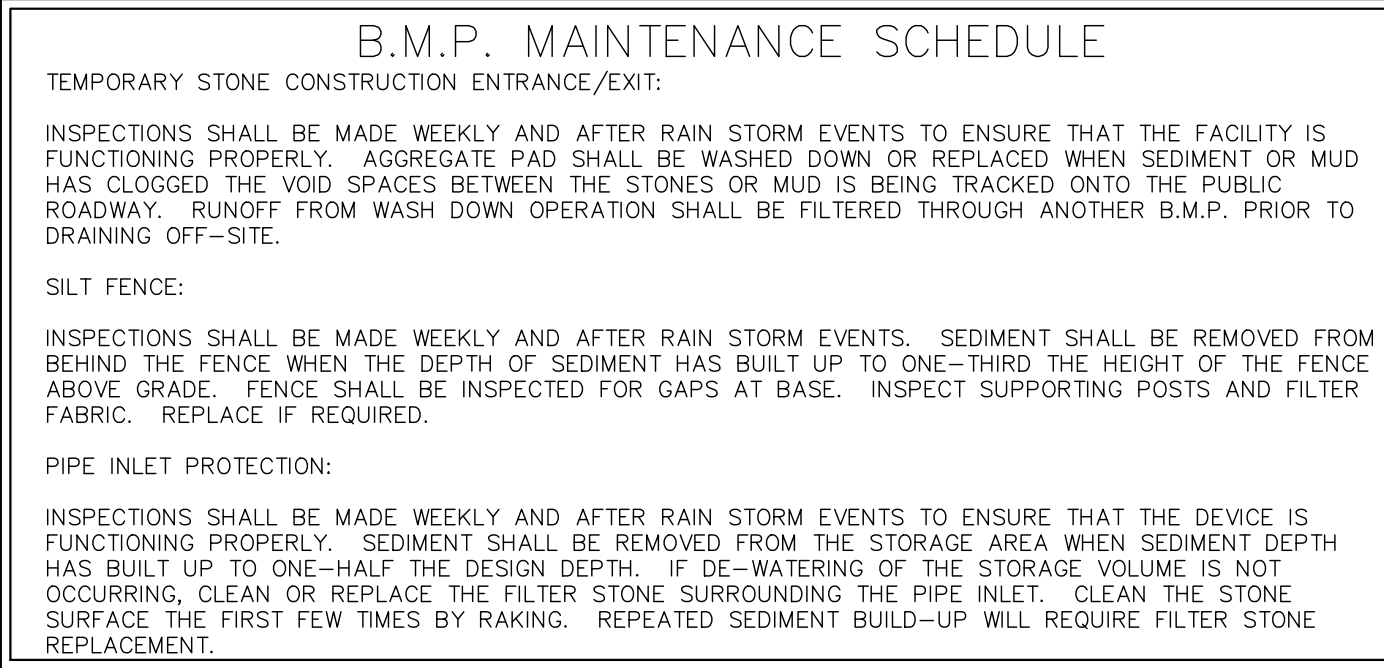


CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
STORM WATER POLLUTION PREVENTION PLAN DETAILS
 (NOT TO SCALE)
 DATE: JULY-01-2010 DWG NO: **01571-01**

EROSION CONTROL SCHEDULING AND SEQUENCING	
I. ROUGH GRADING	CONSTRUCTION ENTRANCE/EXIT AND SILT FENCE PROTECTION SHALL BE INSTALLED PRIOR TO THE INITIATION OF ROUGH GRADING, AS NEEDED.
II. UTILITY INSTALLATION	ALL PRIOR EROSION CONTROL MEASURES INSTALLED ABOVE TO BE MAINTAINED AS NECESSARY DURING UTILITY INSTALLATION. INLET PROTECTION SHALL BE INSTALLED AS STORM DRAINAGE SYSTEM IS CONSTRUCTED.
III. PAVING	ALL PRIOR EROSION CONTROL MEASURES INSTALLED ABOVE TO BE MAINTAINED AS NECESSARY DURING PAVING AND THROUGHOUT THE REMAINDER OF THE PROJECT.
IV. FINAL GRADING/SOIL STABILIZATION/LANDSCAPING	REFERENCE LANDSCAPE PLANS FOR FINAL STABILIZATION OF SITE. ALL TEMPORARY EROSION CONTROL MEASURES TO BE REMOVED AT THE CONCLUSION OF THE PROJECT ONCE FINAL STABILIZATION HAS BEEN ACHIEVED.



- EROSION CONTROL DEVICES AS SHOWN ON THE EROSION CONTROL PLAN FOR THE PROJECT SHALL BE INSTALLED PRIOR TO THE START OF LAND DISTURBING ACTIVITIES ON THE PROJECT.
- ALL EROSION CONTROL DEVICES ARE TO BE INSTALLED IN ACCORDANCE WITH THE APPROVED PLANS AND SPECIFICATIONS FOR THE PROJECT. CHANGES ARE TO BE APPROVED BEFORE CONSTRUCTION BY THE DESIGN ENGINEER AND HARRIS COUNTY ENGINEERING DIVISION.
- IF THE EROSION CONTROL PLAN AS APPROVED CANNOT CONTROL EROSION AND OFF-SITE SEDIMENTATION FROM THE PROJECT THE EROSION CONTROL PLAN WILL BE REQUIRED TO BE REVISED AND/OR ADDITIONAL EROSION CONTROL DEVICES WILL BE REQUIRED ON SITE.
- IF OFF-SITE BORROW OR SPOILS SITES ARE USED IN CONJUNCTION WITH THIS PROJECT, THIS INFORMATION SHALL BE DISCLOSED AND SHOWN ON THE EROSION CONTROL PLAN. OFF-SITE BORROW AND SPOILS AREAS ARE CONSIDERED PART OF EROSION CONTROL REQUIREMENTS. THESE AREAS SHALL BE STABILIZED WITH GROUND COVER PRIOR TO FINAL APPROVAL OF THE PROJECT.
- INSPECTIONS SHALL BE MADE WEEKLY AND AFTER RAIN STORM EVENTS TO INSURE THAT THE DEVICES ARE FUNCTIONING PROPERLY. WHEN SEDIMENT OR MUD HAS CLOGGED THE VOID SPACES BETWEEN STONES OR MUD IS BEING TRACKED ONTO A PUBLIC ROADWAY THE AGGREGATE PAD MUST BE WASHED DOWN OR REPLACED. RUNOFF FROM THE WASH DOWN OPERATION SHALL NOT BE ALLOWED TO DRAIN DIRECTLY OFF SITE WITHOUT FIRST FLOWING THROUGH ANOTHER MBP TO CONTROL OFF-SITE SEDIMENTATION. PERIODIC RE-GRADING OR THE ADDITION OF NEW STONE MAY BE REQUIRED TO MAINTAIN THE EFFICIENCY OF THE INSTALLATION.
- CONTRACTOR SHALL HAVE A COPY OF THE SWPPP ON SITE AT ALL TIMES.
- CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTAL OF N.O.I., N.O.T. AND ANY ADDITIONAL INFORMATION REQUIRED BY THE E.P.A. CONTRACTOR SHALL COMPLY WITH ALL E.P.A. STORM WATER POLLUTION PREVENTION REQUIREMENTS.
- AFTER FINAL STABILIZATION IS ACHIEVED, CONTRACTOR SHALL CLEAN ON-SITE STORM SEWER SYSTEM.
- CONTRACTOR TO INDICATE LOCATIONS OF ALL FUEL DEPOTS, PORT-A-CANS, DUMPSTERS AND DRUMS FILLED WITH ANY CHEMICALS ON THE SWPPP PLAN.



DATE: _____

REVISIONS: _____

NO. _____

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KWA PROJECT	068924000
DATE	DECEMBER 2022
SCALE	AS SHOWN
DESIGNED BY	RHS
DRAWN BY	CAP
CHECKED BY	ROCK

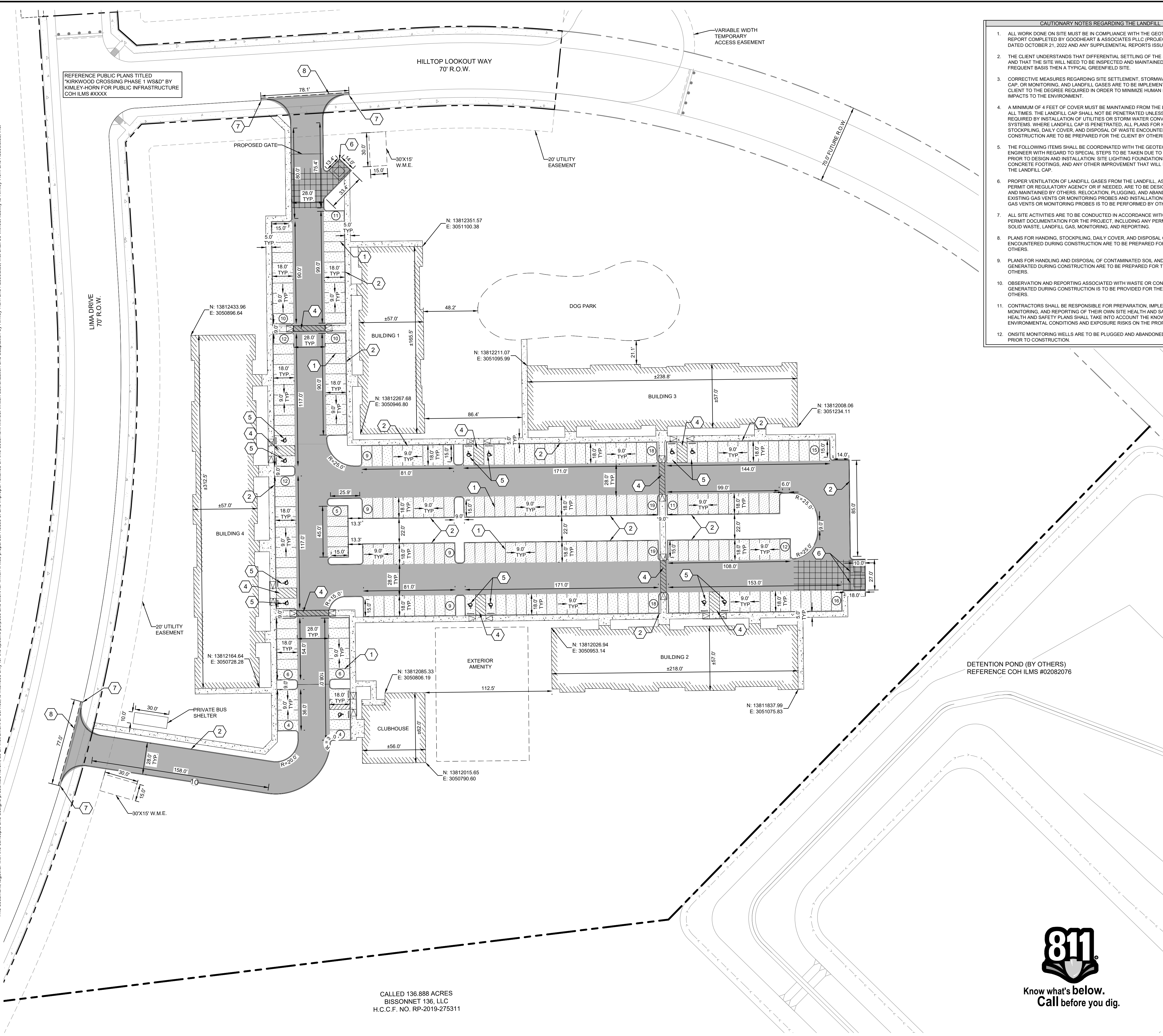
EROSION CONTROL DETAILS

KIRKWOOD CROSSING - MULTIFAMILY PREPARED FOR IMPACT RESIDENTIAL DEVELOPMENT

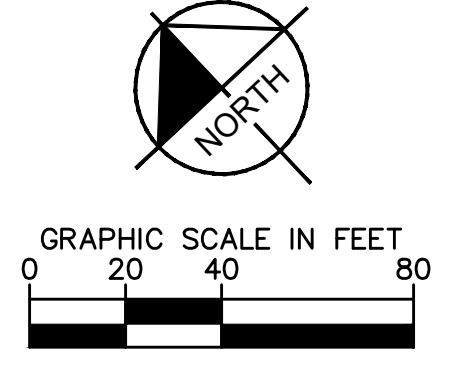
HOUSTON TEXAS

SHEET NUMBER **C3.1**

Plotted By: Menard, Grace Sheet Set: Kha Layout: DIMENSION CONTROL AND PAVING PLAN January 09, 2023 09:21:33am K:\HOU_Civil\064572001-1-2000 Bissonnet Street\CAD\Starwood Tract\CAD\PlanSheets\C-DimC.dwg
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- CAUTIONARY NOTES REGARDING THE LANDFILL**
1. ALL WORK DONE ON SITE MUST BE IN COMPLIANCE WITH THE GEOTECHNICAL REPORT COMPLETED BY GOODHEART & ASSOCIATES PLLC (PROJECT NO. 22-009.001) DATED OCTOBER 21, 2022 AND ANY SUPPLEMENTAL REPORTS ISSUED.
 2. THE CLIENT UNDERSTANDS THAT DIFFERENTIAL SETTLING OF THE SITE WILL OCCUR AND THAT THE SITE WILL NEED TO BE INSPECTED AND MAINTAINED ON A MORE FREQUENT BASIS THEN A TYPICAL GREENFIELD SITE.
 3. CORRECTIVE MEASURES REGARDING SITE SETTLEMENT, STORMWATER, LANDFILL CAP, OR MONITORING, AND LANDFILL GASES ARE TO BE IMPLEMENTED BY THE CLIENT TO THE DEGREE REQUIRED IN ORDER TO MINIMIZE HUMAN HEALTH RISKS OR IMPACTS TO THE ENVIRONMENT.
 4. A MINIMUM OF 4 FEET OF COVER MUST BE MAINTAINED FROM THE LANDFILL CAP AT ALL TIMES. THE LANDFILL CAP SHALL NOT BE PENETRATED UNLESS IN AREAS WHERE REQUIRED BY INSTALLATION OF UTILITIES OR STORM WATER CONVEYANCE SYSTEMS. WHERE LANDFILL CAP IS PENETRATED, ALL PLANS FOR HANDLING, STOCKPILING, DAILY COVER, AND DISPOSAL OF WASTE ENCOUNTERED DURING CONSTRUCTION ARE TO BE PREPARED FOR THE CLIENT BY OTHERS.
 5. THE FOLLOWING ITEMS SHALL BE COORDINATED WITH THE GEOTECHNICAL ENGINEER WITH REGARD TO SPECIAL STEPS TO BE TAKEN DUE TO THE LANDFILL PRIOR TO DESIGN AND INSTALLATION: SITE LIGHTING FOUNDATIONS, FENCE POSTS, CONCRETE FOOTINGS, AND ANY OTHER IMPROVEMENT THAT WILL INTRUDE INTO THE LANDFILL CAP.
 6. PROPER VENTILATION OF LANDFILL GASES FROM THE LANDFILL, AS REQUIRED BY PERMIT OR REGULATORY AGENCY OR IF NEEDED, ARE TO BE DESIGNED, OPERATED, AND MAINTAINED BY OTHERS. RELOCATION, PLUGGING, AND ABANDONMENT OF EXISTING GAS VENTS OR MONITORING PROBES AND INSTALLATION OF ADDITIONAL GAS VENTS OR MONITORING PROBES IS TO BE PERFORMED BY OTHERS.
 7. ALL SITE ACTIVITIES ARE TO BE CONDUCTED IN ACCORDANCE WITH ENVIRONMENTAL PERMIT DOCUMENTATION FOR THE PROJECT, INCLUDING ANY PERMITS REGARDING SOLID WASTE, LANDFILL GAS, MONITORING, AND REPORTING.
 8. PLANS FOR HANDLING, STOCKPILING, DAILY COVER, AND DISPOSAL OF WASTE ENCOUNTERED DURING CONSTRUCTION ARE TO BE PREPARED FOR THE CLIENT BY OTHERS.
 9. PLANS FOR HANDLING AND DISPOSAL OF CONTAMINATED SOIL AND WATER GENERATED DURING CONSTRUCTION ARE TO BE PREPARED FOR THE CLIENT BY OTHERS.
 10. OBSERVATION AND REPORTING ASSOCIATED WITH WASTE OR CONTAMINATED MEDIA GENERATED DURING CONSTRUCTION IS TO BE PROVIDED FOR THE CLIENT BY OTHERS.
 11. CONTRACTORS SHALL BE RESPONSIBLE FOR PREPARATION, IMPLEMENTATION, MONITORING, AND REPORTING OF THEIR OWN SITE HEALTH AND SAFETY PLANS. HEALTH AND SAFETY PLANS SHALL TAKE INTO ACCOUNT THE KNOWN ENVIRONMENTAL CONDITIONS AND EXPOSURE RISKS ON THE PROPERTY.
 12. ONSITE MONITORING WELLS ARE TO BE PLUGGED AND ABANDONED BY OTHERS PRIOR TO CONSTRUCTION.



LEGEND

---	PROPERTY LINE
FL	FIRE LANE STRIPING
④	PARKING COUNT
△	CURB RAMP NOT IN PUBLIC ROW
♿	ACCESSIBILITY SPACE
PAVING MATERIAL LEGEND	
[Pattern]	LIGHT DUTY
[Pattern]	MEDIUM DUTY
[Pattern]	HEAVY DUTY
[Pattern]	SIDEWALK

PAVEMENT IS CURRENTLY REFLECTED AS CONCRETE. ONCE GEOTECHNICAL REPORT IS PROVIDED, ASPHALT PAVEMENT MAY BE USED IN LIEU OF CONCRETE DUE TO FLEXIBLE NATURE OF ASPHALT ON TOP OF LANDFILL.

KEYED NOTES

①	PARKING LOT STRIPING; 4" SOLID WHITE STRIPE
②	PROPOSED 6" CURB.
③	ACCESSIBLE RAMP
④	4" SOLID WHITE STRIPING, 2'-0" O.C. @ 45°
⑤	PROPOSED ACCESSIBLE HC PARKING STALL WITH ACCESSIBLE PARKING SYMBOL AND SIGN
⑥	PROPOSED DUMPSTER LOCATION
⑦	PROPOSED 6" CURB. TIE INTO EXISTING CURB.
⑧	PROPOSED SAWCUTMATCH EXISTING PAVEMENT LINE

- GENERAL NOTES**
1. DIMENSIONS ARE UNLESS TO FACE OF CURB UNLESS OTHERWISE NOTED.
 2. ALL RADII 3' UNLESS OTHERWISE NOTED.
 3. REFER TO ARCHITECTURAL PLANS FOR SITE LIGHTING POLES AND FIXTURES AND ELECTRICAL PLAN PRIOR TO PLACING PAVEMENT.
 4. REFER TO ARCHITECTURAL PLANS FOR EXACT BUILDING DIMENSIONS.
 5. SIDEWALKS TO HAVE A 5% MAXIMUM RUNNING SLOPE AND A 2% MAXIMUM CROSS SLOPE IN ACCORDANCE WITH ADA REQUIREMENTS.
 6. FIELD VERIFY ADA GRADES PRIOR TO PLACING PAVEMENT. CONTRACTOR SHALL CONSTRUCT ALL ACCESSIBLE ROUTES IN ACCORDANCE WITH ADA STANDARDS AND TAS.
 7. REF. IRRIGATION PLANS PRIOR TO PLACING PAVEMENT.
 8. CONTRACTOR SHALL BUDGET FOR ACCESSIBLE STALL STRIPING, FIRE LANE STRIPING, DIRECTIONAL ARROWS, ETC.
 9. SITE LIGHTING IS BY OTHERS. REF. SITE LIGHTING PLANS FOR LOCATIONS AND DETAILS PRIOR TO PLACING PAVEMENT.
 10. REF. BUILDING PLANS FOR ALL EXTERIOR STAIR DETAILS.
 11. CONTRACTOR TO ADJUST EXISTING SANITARY SEWER MANHOLES, STORM SEWER MANHOLES, ELECTRICAL MANHOLES, FIRE HYDRANTS, VALVE BOXES, WATER METERS, ETC. TO MATCH PROPOSED FINISHED GRADES IF NECESSARY.

PARKING SUMMARY

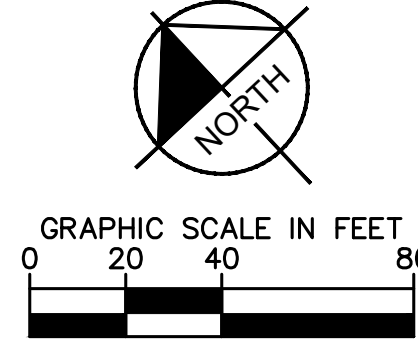
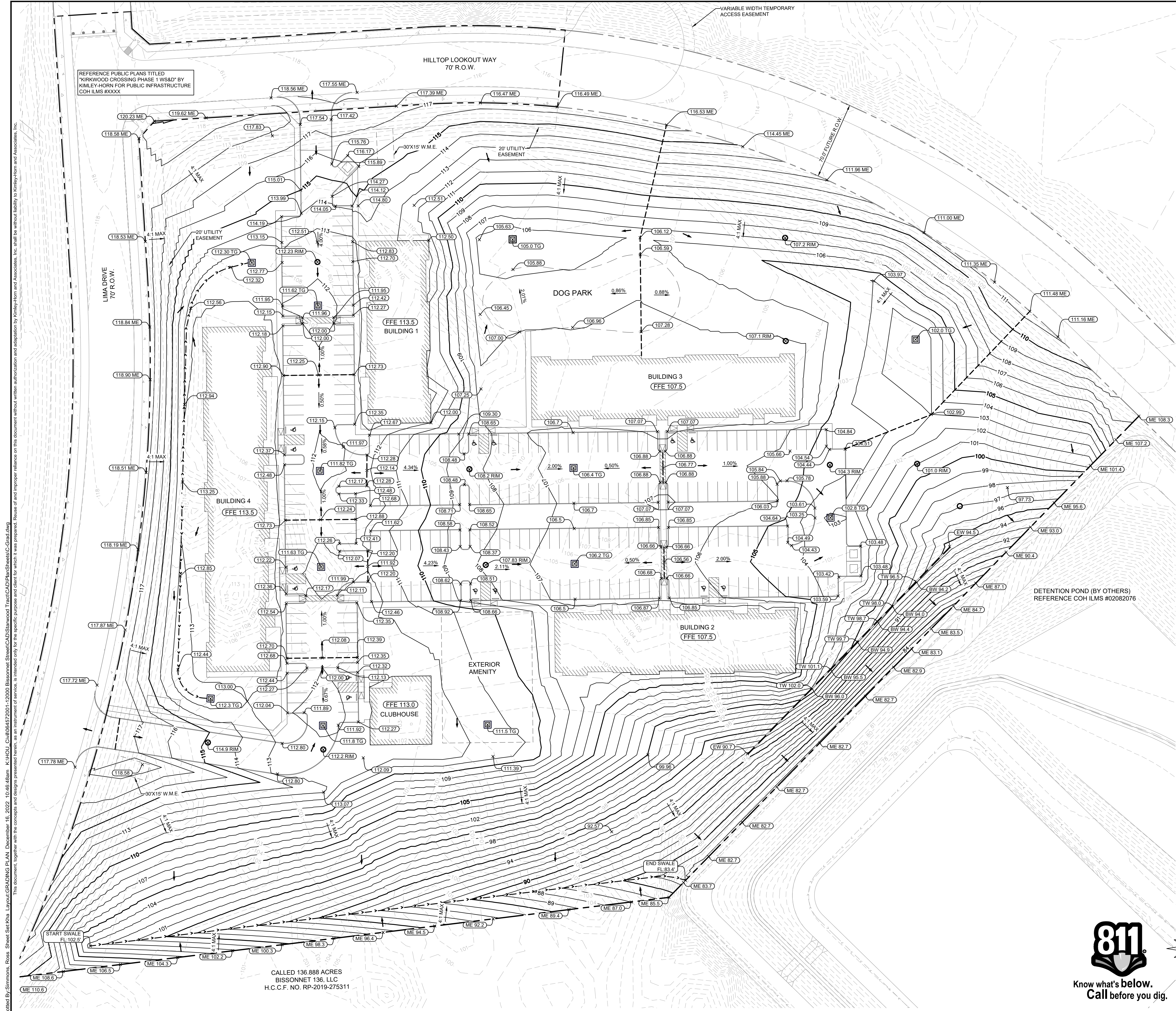
PARKING REQUIRED	USE	UNITS	RATIO REQUIRED	STALLS REQUIRED
1 BEDROOM		36	1.33	48
2 BEDROOM		81	1.66	135
3 BEDROOM		21	2.00	42
TOTAL		138		225
PARKING PROVIDED	ACCESSIBLE	14	STANDARD	230
				244



CAUTION!!

EXISTING UNDERGROUND UTILITIES IN THE AREA CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE HORIZONTAL AND VERTICAL LOCATION OF ALL UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY REPAIRS TO EXISTING UTILITIES DUE TO DAMAGE INCURRED DURING CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES ON THE PLANS.

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	DIMENSION CONTROL AND PAVING PLAN						
KIRKWOOD CROSSING - MULTIFAMILY PREPARED FOR IMPACT RESIDENTIAL DEVELOPMENT	TEXAS						
SHEET NUMBER C4.0							



LEGEND

130	PROPOSED CONTOURS
130	EXISTING CONTOURS
129.75	PROPOSED SPOT ELEVATION
129.33ME	MATCH EXISTING GRADE
129.55TG	TOP OF GRATE INLET
129.55TW	TOP OF WALL
129.55BW	BOTTOM OF WALL
—	HIGH POINT
□	PROPOSED STORM INLET
—	PROPOSED SWALE

- GENERAL NOTES**
1. ALL SPOT ELEVATIONS ARE TO TOP OF PAVEMENT UNLESS OTHERWISE NOTED.
 2. ALL SIDEWALKS AND ACCESSIBLE ROUTES, INCLUDING DRIVEWAY CROSSWALKS, SHALL CONFORM TO ALL APPLICABLE AMERICANS WITH DISABILITIES ACT STANDARDS AND THE TEXAS ACCESSIBILITY STANDARDS. IF ANY DISCREPANCY IS DISCOVERED, THE CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO POURING ANY PAVEMENT.
 3. ALL SIDEWALKS AND ACCESSIBLE ROUTES, INCLUDING DRIVEWAY CROSSWALKS, SHALL NOT EXCEED A RUNNING SLOPE OF 5% (1:20) WITHOUT A RAMP, AND SHALL NOT EXCEED A 2% CROSS SLOPE (1:50).
 4. THE ACCESSIBLE PARKING AND PASSENGER LOADING AREAS SHALL NOT EXCEED A SLOPE OF 2% (1:50) IN ANY DIRECTION.
 5. ALL EXISTING APPURTENANCES ONSITE SHALL BE ADJUSTED TO PROPOSED GRADE AS APPLICABLE.
 6. CONTRACTOR SHALL REFERENCE GEOTECHNICAL REPORT FOR BUILDING PAD LIMITS AND PREPARATION REQUIREMENTS.
 7. CONTRACTOR SHALL ENSURE POSITIVE DRAINAGE AWAY FROM BUILDING IN ALL AREAS. CONTRACTOR SHALL NOTIFY THE ENGINEER IN THE EVENT OF ANY DISCREPANCY PRIOR TO COMMENCEMENT OF CONSTRUCTION.
 8. CONTRACTOR SHALL PROTECT ALL TREES TO REMAIN.

REFER TO BUILDING PLANS FOR DETAILS OF RETAINING WALLS, STAIRS, RAMPS AND EXPOSED FOUNDATIONS INCLUDING VEHICULAR AND PEDESTRIAN BARRIER/RAILINGS.

AS PART OF THE BASE BID FOR THIS PROJECT, CONTRACTOR SHALL ADHERE TO THE PROJECT GEOTECHNICAL REPORT FOR ALL RECOMMENDATIONS FOR BOTH MATERIALS AND PRACTICE OF INSTALLATION GIVEN IN THE PROJECT GEOTECHNICAL REPORT FOR EARTHWORK, SITE SUBGRADE PREPARATION, BUILDING PAD SUBGRADE PREPARATION, PAVING, AND WEIS/OT SOILS CONDITIONS ALONG WITH ANY OTHER SECTIONS PROVIDED IN THE REPORT.

TITLE: GEOTECHNICAL INVESTIGATION REPORT (DRAFT) BY: GOODHEART & ASSOCIATES PLLC DATED: OCTOBER 4, 2022

INCLUDING ALL REVISIONS AND ADDENDA TO THIS REPORT THAT MAY HAVE BEEN RELEASED AFTER THE NOTED DATE.

- LANDFILL NOTES**
1. THE 12000 BISSONNET PROPERTY WAS FORMERLY DEVELOPED AS THE SUGAR HILLS GOLF COURSE. THE GOLF COURSE, WHICH REMAINS LARGELY IN FACT TODAY, WAS DEVELOPED OVER THE DOTY SAND PIT VENTURE (DSPV) LANDFILL. THE DSPV OPERATED AS A TYPE IV LANDFILL FOR CONSTRUCTION AND DEMOLITION DEBRIS DISPOSAL. THE SITE WAS ISSUED A MUNICIPAL SOLID WASTE (MSW) PERMIT NO. 1247 BY TCEQ IN 1985. MSW PERMIT NO. 1247 IS ACTIVE AND THE SITE HAS BEEN IN POST CLOSURE CARE SINCE 1999.
 2. SKA CONSULTING, L.P. IS SUBMITTING THE TCEQ PERMIT REQUIRED UNDER 30 TAC CHAPTER 330 SUBCHAPTER T. THIS PERMIT IS REQUIRED PRIOR TO THE START OF ANY CONSTRUCTION.
 3. ACCORDING TO THE SITE INVESTIGATION REPORT PREPARED BY SKA CONSULTING AND BASED ON 6 TEST PITS IN 2019, THE WASTE BELOW THE CLAY CAP CONSISTS OF 74% SOIL, 10% WOOD, 10% CONCRETE, 3% METAL, AND 3% MISCELLANEOUS MATERIALS SUCH AS RUBBER, PLASTIC, AND TEXTILES. ALL WASTE OBSERVED WAS CONSISTENT WITH A TYPE IV LANDFILL OPERATION. PLEASE REFER TO THE SITE INVESTIGATION REPORT PREPARED BY SKA CONSULTING, L.P. FOR MORE DETAILED INFORMATION ON THE LANDFILL WASTE.
 4. LANDFILL WASTE IS COVERED BY A CLAY CAP APPROXIMATELY 2'-3" DEEP. THE LIMITS OF THE CLAY CAP SURFACE SHOWN ARE APPROXIMATED BASED ON SOIL BORINGS PERFORMED ONSITE AND ARE SHOWN FOR REFERENCE ONLY. ACTUAL LIMITS MAY VARY.
 5. DUE TO THE AGE OF THE LANDFILL ALL WASTE EXCAVATED BELOW THE CLAY CAP MUST BE TRANSPORTED TO CLASS 2 INDUSTRIAL WASTE LANDFILL SITES AND DISPOSED OF IN ACCORDANCE WITH TCEQ REGULATIONS.
 6. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING TEMPORARY SITE DRAINAGE AND CONTROLLING RUNOFF FOR THE DURATION OF THE CONSTRUCTION CONTRACT. THIS SHALL INCLUDE CONSTRUCTION OF TEMPORARY SWALES OR PROVIDING PORTABLE PUMPS, IF REQUIRED, SO THAT CONSTRUCTION PROGRESS MAY CONTINUE.



Know what's below.
Call before you dig.

CAUTION!!

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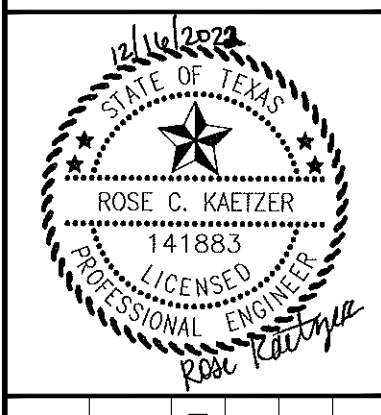
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CALL 136.888 ACRES
BISSONNET 136, LLC
H.O.C.F. NO. RP-2019-275311

NO.	REVISIONS	DATE	BY

Kimley»Horn

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KHA PROJECT	068924000
DATE	DECEMBER 2022
SCALE	AS SHOWN
DESIGNED BY	RHS
DRAWN BY	CAP
CHECKED BY	RCK

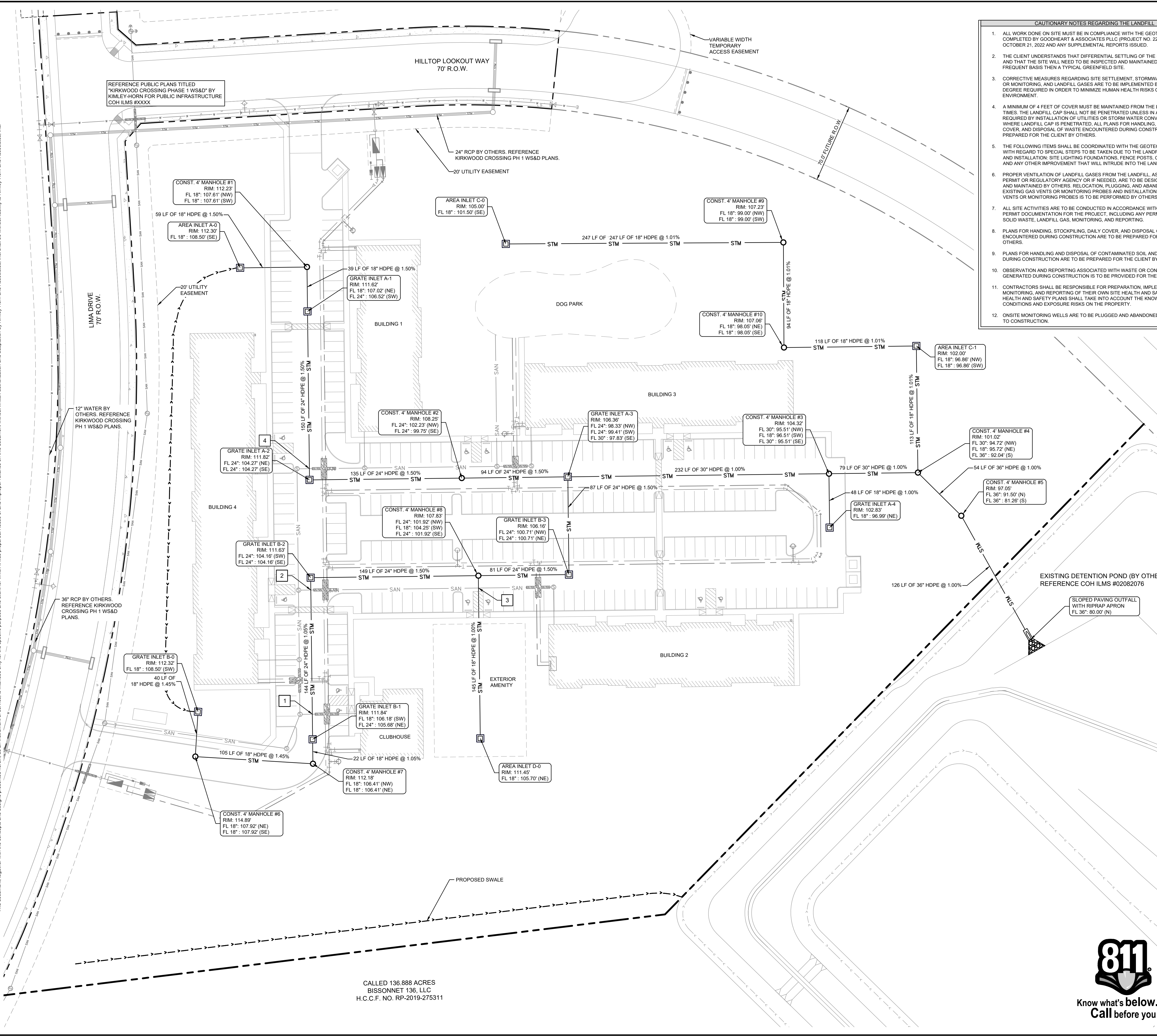
GRADING PLAN

KIRKWOOD CROSSING - MULTIFAMILY
PREPARED FOR
IMPACT RESIDENTIAL DEVELOPMENT

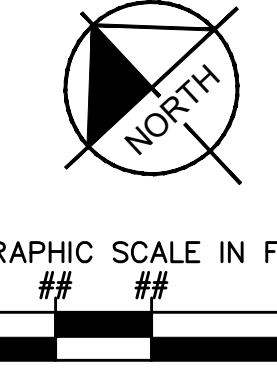
HOUSTON TEXAS

SHEET NUMBER
C5.0

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 2. THE CLIENT UNDERSTANDS THAT DIFFERENTIAL SETTLING OF THE SITE WILL OCCUR AND THAT THE SITE WILL NEED TO BE INSPECTED AND MAINTAINED ON A MORE FREQUENT BASIS THAN A TYPICAL GREENFIELD SITE.
 3. CORRECTIVE MEASURES REGARDING SITE SETTLEMENT, STORMWATER, LANDFILL CAP, OR MONITORING, AND LANDFILL GASES ARE TO BE IMPLEMENTED BY THE CLIENT TO THE DEGREE REQUIRED IN ORDER TO MINIMIZE HUMAN HEALTH RISKS OR IMPACTS TO THE ENVIRONMENT.
 4. A MINIMUM OF 4 FEET OF COVER MUST BE MAINTAINED FROM THE LANDFILL CAP AT ALL TIMES. THE LANDFILL CAP SHALL NOT BE PENETRATED UNLESS IN AREAS WHERE REQUIRED BY INSTALLATION OF UTILITIES OR STORM WATER CONVEYANCE SYSTEMS. WHERE LANDFILL CAP IS PENETRATED, ALL PLANS FOR HANDLING, STOCKPILING, DAILY COVER, AND DISPOSAL OF WASTE ENCOUNTERED DURING CONSTRUCTION ARE TO BE PREPARED FOR THE CLIENT BY OTHERS.
 5. THE FOLLOWING ITEMS SHALL BE COORDINATED WITH THE GEOTECHNICAL ENGINEER WITH REGARD TO SPECIAL STEPS TO BE TAKEN DUE TO THE LANDFILL PRIOR TO DESIGN AND INSTALLATION: SITE LIGHTING FOUNDATIONS, FENCE POSTS, CONCRETE FOOTINGS, AND ANY OTHER IMPROVEMENT THAT WILL INTRUDE INTO THE LANDFILL CAP.
 6. PROPER VENTILATION OF LANDFILL GASES FROM THE LANDFILL, AS REQUIRED BY PERMIT OR REGULATORY AGENCY OR IF NEEDED, ARE TO BE DESIGNED, OPERATED, AND MAINTAINED BY OTHERS. RELOCATION, PLUGGING, AND ABANDONMENT OF EXISTING GAS VENTS OR MONITORING PROBES AND INSTALLATION OF ADDITIONAL GAS VENTS OR MONITORING PROBES IS TO BE PERFORMED BY OTHERS.
 7. ALL SITE ACTIVITIES ARE TO BE CONDUCTED IN ACCORDANCE WITH ENVIRONMENTAL PERMIT DOCUMENTATION FOR THE PROJECT, INCLUDING ANY PERMITS REGARDING SOLID WASTE, LANDFILL GAS, MONITORING, AND REPORTING.
 8. PLANS FOR HANDLING, STOCKPILING, DAILY COVER, AND DISPOSAL OF WASTE ENCOUNTERED DURING CONSTRUCTION ARE TO BE PREPARED FOR THE CLIENT BY OTHERS.
 9. PLANS FOR HANDLING AND DISPOSAL OF CONTAMINATED SOIL AND WATER GENERATED DURING CONSTRUCTION ARE TO BE PREPARED FOR THE CLIENT BY OTHERS.
 10. OBSERVATION AND REPORTING ASSOCIATED WITH WASTE OR CONTAMINATED MEDIA GENERATED DURING CONSTRUCTION IS TO BE PROVIDED FOR THE CLIENT BY OTHERS.
 11. CONTRACTORS SHALL BE RESPONSIBLE FOR PREPARATION, IMPLEMENTATION, MONITORING, AND REPORTING OF THEIR OWN SITE HEALTH AND SAFETY PLANS. HEALTH AND SAFETY PLANS SHALL TAKE INTO ACCOUNT THE KNOWN ENVIRONMENTAL CONDITIONS AND EXPOSURE RISKS ON THE PROPERTY.
 12. ONSITE MONITORING WELLS ARE TO BE PLUGGED AND ABANDONED BY OTHERS PRIOR TO CONSTRUCTION.



LEGEND

---	PROPERTY LINE
- - - -	PROPOSED UTILITY EASEMENT
- · - · -	EXISTING UTILITY EASEMENT
---STM---	PROPOSED STORM LINE
○	PROPOSED STORM MANHOLE
□	PROPOSED GRATE INLET
---	PROPOSED WATER LINE
---	PROPOSED SSWR LINE
⊙	PROPOSED SSWR MANHOLE
⊕	PROPOSED FIRE HYDRANT
---	SSWR LINE BY OTHERS
---	WATERLINE BY OTHERS
---	STORM SEWER LINE BY OTHERS

- STORM SEWER NOTES**
1. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES, AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANIES AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES.
 2. CONTRACTOR SHALL FIELD VERIFY THE EXACT HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING UTILITIES IN FIELD PRIOR TO COMMENCING CONSTRUCTION. NOTIFY ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.
 3. PUBLIC STORM LINES AS WELL AS CONNECTIONS TO EXISTING PUBLIC LINES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LOCAL MUNICIPALITIES STANDARD SPECIFICATIONS AND DETAILS WITH ALL ADDENDA AND AMENDMENTS THERETO.
 4. STORM PIPE SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED:
 A) RCP = ASTM C-76 CLASS III - REQUIRED IN PUBLIC RIGHT OF WAY AND CONNECTION POINTS TO PUBLIC STORM SEWER.
 B) HDPE = N-12 DUAL WALL PIPE WITH BEDDING AND BACKFILL PER MANUFACTURER RECOMMENDATIONS.
 C) PVC = ASTM D 3034 SDR35.
 5. ALL EXISTING AND PROPOSED PIPES AND STRUCTURES ARE TO BE CLEANED OUT AT THE COMPLETION OF CONSTRUCTION TO REMOVE ALL SILT AND DEBRIS.
 6. ALL STORM PIPE ENTERING STRUCTURES SHALL BE GROUTED TO ASSURE CONNECTION AT STRUCTURE IS WATER TIGHT.
 7. ALL STORM SEWER MANHOLES IN PAVED AREAS SHALL BE FLUSH WITH PAVEMENT, AND SHALL HAVE TRAFFIC BEARING RING & COVERS. LIDS SHALL BE LABELED "STORM SEWER".
 8. TOPS OF EXISTING MANHOLES SHALL BE RAISED AS NECESSARY TO BE FLUSH WITH PROPOSED PAVEMENT ELEVATIONS, OR TO BE 2'-4" ABOVE THE PROPOSED GRADE ELEVATIONS IN LANDSCAPE AREAS.
 9. ALL STORM STRUCTURES SHALL HAVE A SMOOTH UNIFORM POURED MORTAR FROM INVERT IN TO INVERT OUT.

PIPE CROSSINGS

CROSSING NUMBER	STORM FLOW LINE ELEVATION	SANITARY FLOW LINE ELEVATION	SPACING BETWEEN PIPES
1	105.52	108.79	1.27'
2	104.20	101.83	1.71'
3	104.30	102.48	1.15'
4	104.34	102.40	1.27'

DETENTION NOTE
 DETENTION FOR THIS MULTIFAMILY DEVELOPMENT IS PROVIDED IN THE OVERALL KIRKWOOD CROSSING DEVELOPMENT PER THE APPROVED DRAINAGE REPORT. REFERENCE APPROVED DRAINAGE REPORT TITLED "12000 BISSONNET (136 ACRES) MASTER DRAINAGE PLAN" DATED JANUARY 2022. COH ILMs #XXXX



**Know what's below.
Call before you dig.**

CAUTION!!
 EXISTING UNDERGROUND UTILITIES IN THE AREA CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE HORIZONTAL AND VERTICAL LOCATION OF ALL UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY REPAIRS TO EXISTING UTILITIES DUE TO DAMAGE INCURRED DURING CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES ON THE PLANS.

CALLED 136.888 ACRES
 BISSONNET 136, LLC
 H.C.C.F. NO. RP-2019-275311

NO.
REVISIONS
DATE
BY

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 11770 KATY FREEWAY, SUITE 800, HOUSTON, TX 77079
 WWW.KIMLEY-HORN.COM
 PHONE 281-597-5930
 TBP# FIRM REGISTRATION F-928

KHA PROJECT 068924000
 DATE DECEMBER 2022
 SCALE AS SHOWN
 DESIGNED BY RWS
 DRAWN BY CAP
 CHECKED BY RCK

STORM SEWER PLAN

KIRKWOOD CROSSING - MULTIFAMILY PREPARED FOR IMPACT RESIDENTIAL DEVELOPMENT

HOUSTON TEXAS

SHEET NUMBER
C7.0

Plotted By: Simmons, Ross. Sheet Set: Kira Layout: STORM CALCULATIONS December 15, 2022 11:43:35am K:\HOU_Civil\06457200-1\2000 Blommed Street\CAD\Storm\Drawings\StormCalc\StormCalc.dwg
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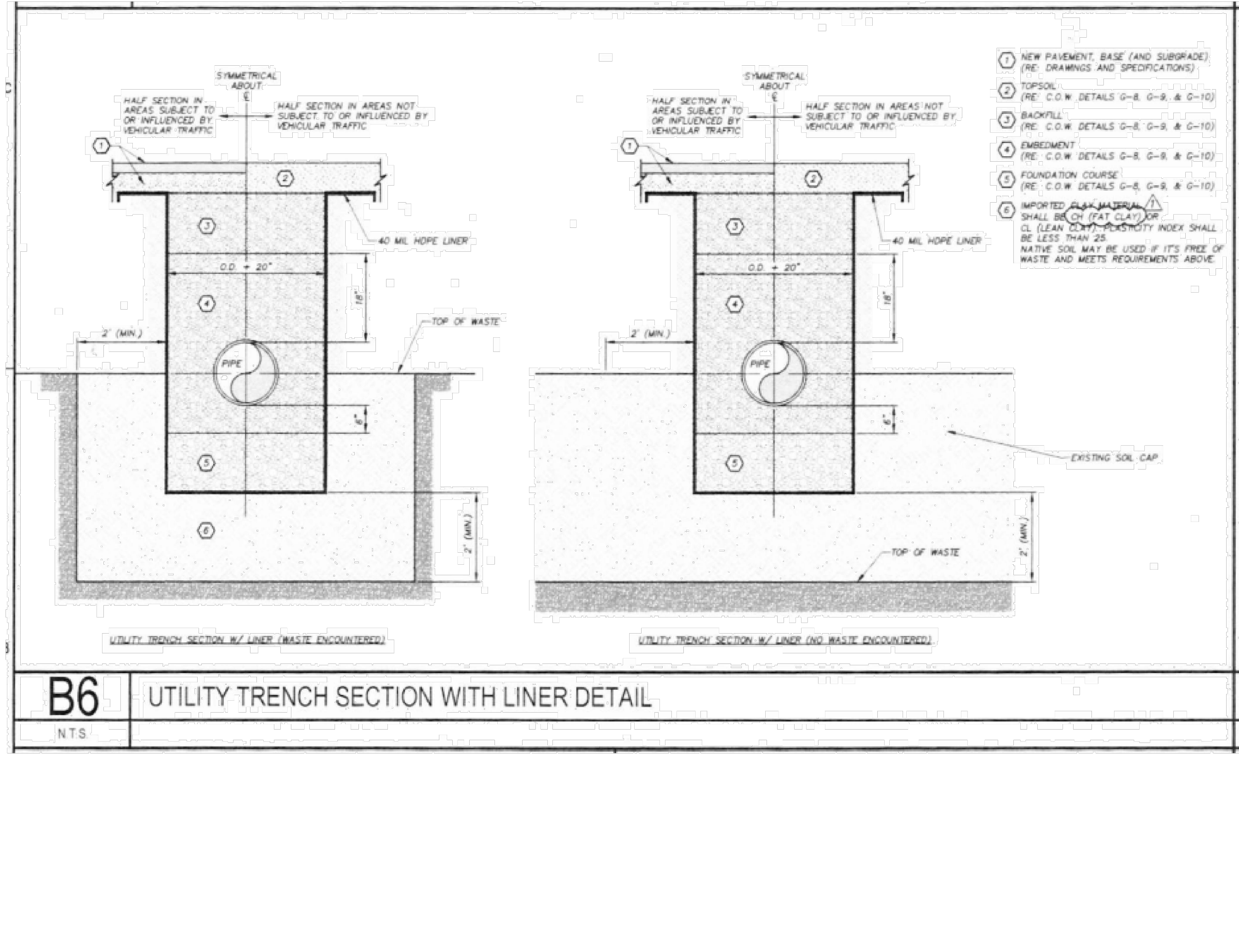
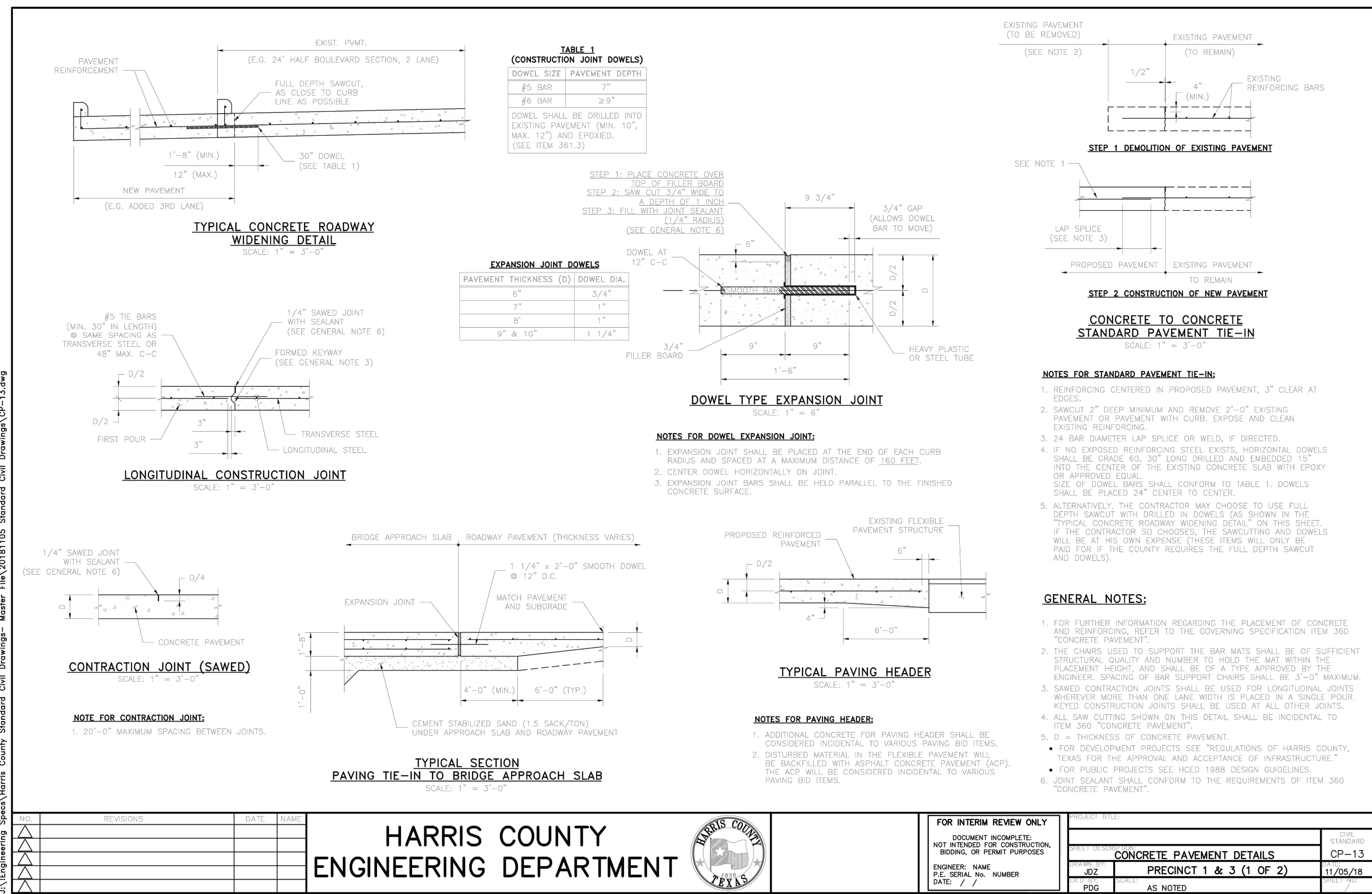
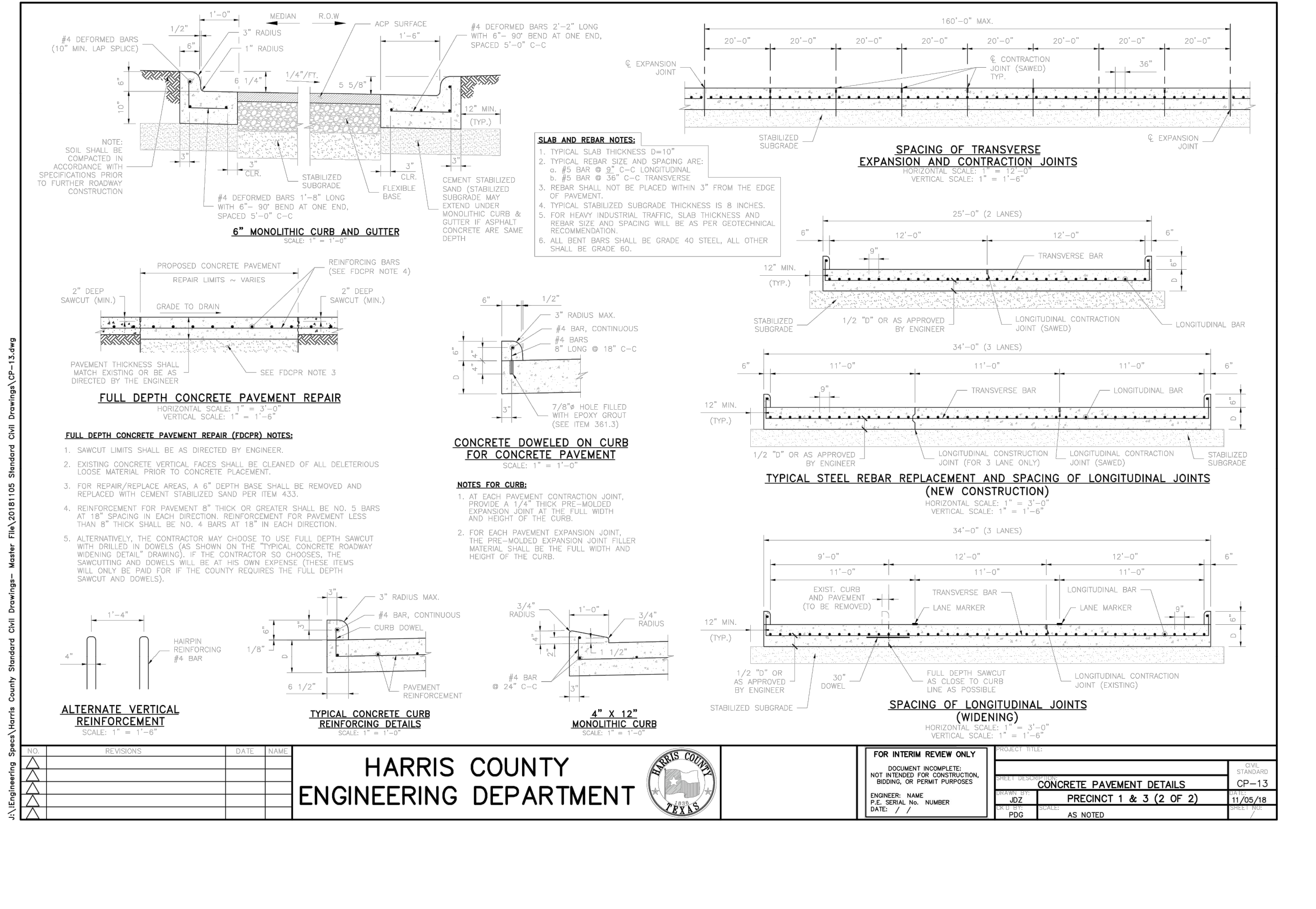
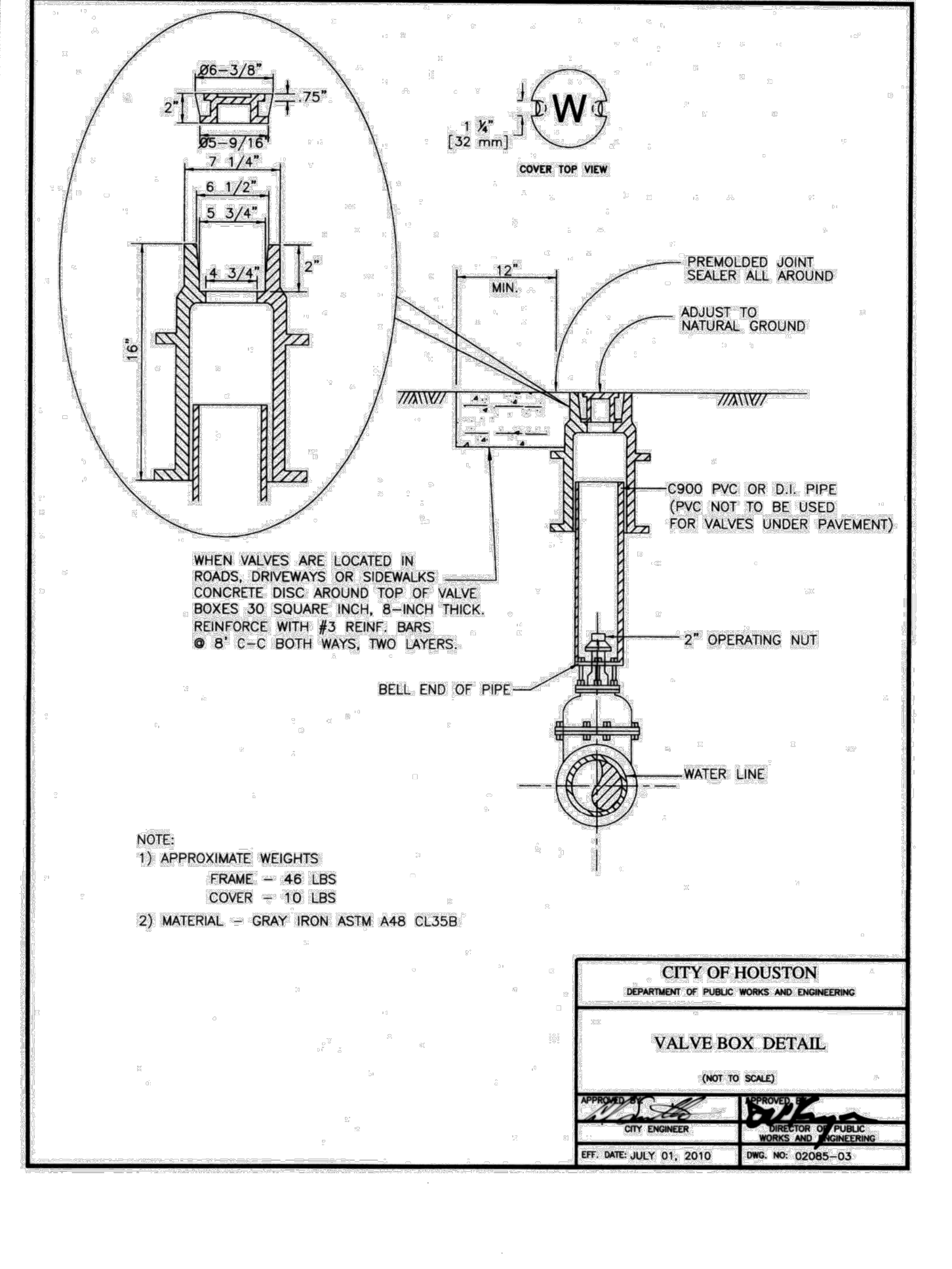
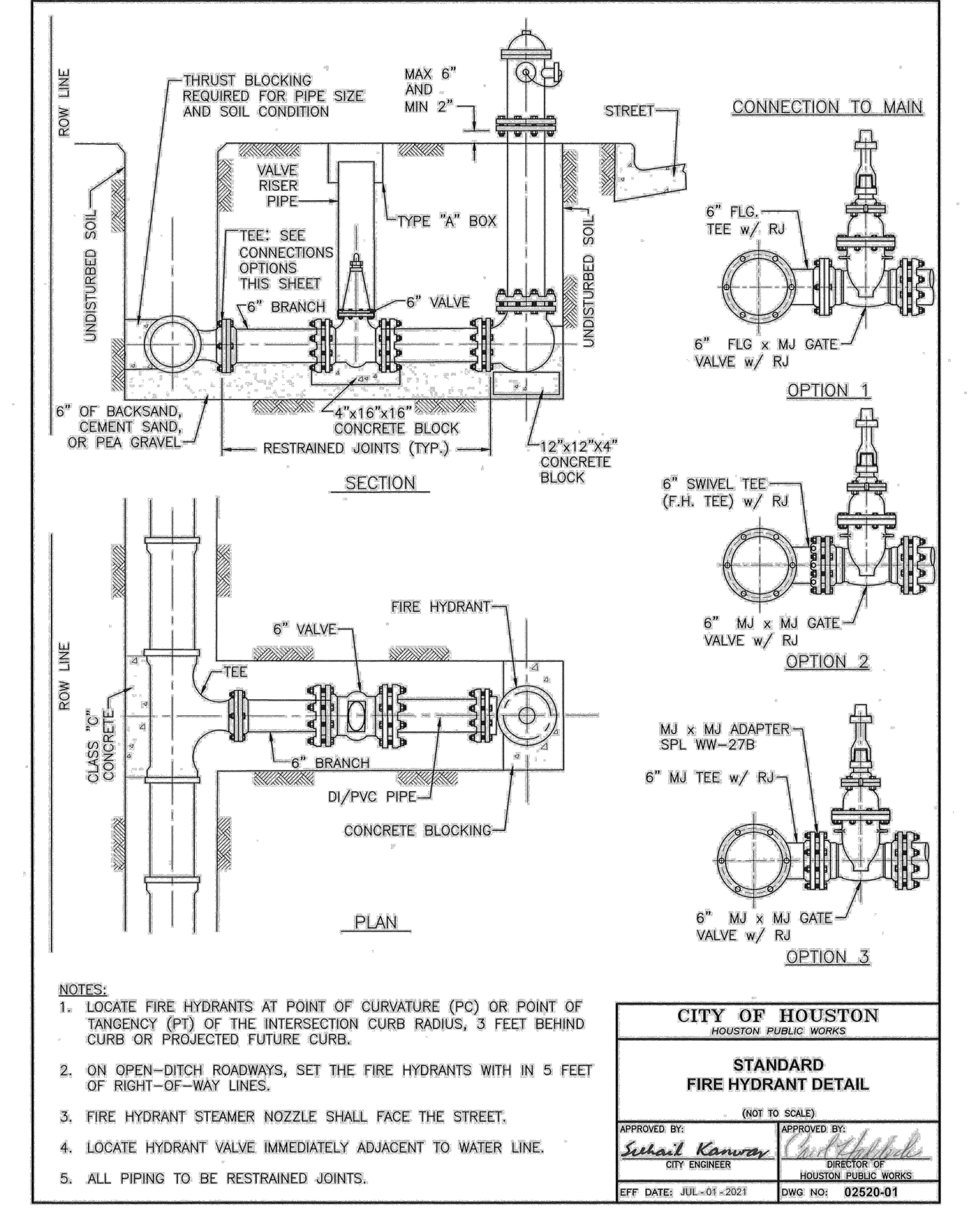
2 YEAR CALCULATIONS

STRUCTURE		DRAINAGE AREA (ACRES)	TOTAL AREA (ACRES)	RUNOFF C	TOTAL C*A	TC (MIN)	1-2-YR (IN/HR)	DRAINAGE AREA FLOW 2-YR (CFS)	TOTAL FLOW 2-YR (CFS)	REACH LENGTH (FT)	DIAMETER (IN)	DESIGN SLOPE (%)	MANNING'S ROUGHNESS COEFFICIENT "n"	PIPE DESIGN CAPACITY (CFS)	DESIGN VELOCITY (FT/SEC)	AREA (SQ FT)	WETTED PERIMETER (FT)	FALL (FT)	FLOWLINE ELEVATION UPSTREAM (FT)	FLOWLINE ELEVATION DOWNSTREAM (FT)	2-YR ACTUAL VELOCITY (FT/SEC)	ACTUAL HYDRAULIC GRADIENT (%)	CHANGE IN HEAD (FT)	ELEVATION OF 2-YR HYD. GRADE LINE UPSTREAM (FT)	ELEVATION OF 2-YR HYD. GRADE LINE DOWNSTREAM (FT)	FINISHED GRADE UPSTREAM (FT)	FINISHED GRADE DOWNSTREAM (FT)	COVER (FT)
FROM	TO																											
A0	MH1	0.77	0.77	0.8	0.62	24.55	3.79	2.33	5.31	59	18	1.50	0.012	13.94	7.9	1.8	4.7	0.89	108.50	107.61	1.32	0.22%	0.13	109.24	109.11	112.31	112.23	2.31
MH1	A1	0.00	0.77	0.8	0.62	24.88	3.76	0.00	2.32	40	18	1.50	0.012	13.94	7.9	1.8	4.7	0.59	107.61	107.02	1.31	0.21%	0.09	108.60	108.52	112.23	111.63	3.12
A1	A2	0.64	1.41	0.8	1.13	25.10	3.74	1.92	4.22	150	24	1.50	0.012	30.02	9.6	3.1	6.3	2.25	106.52	104.27	1.34	0.15%	0.23	106.50	106.27	111.63	111.82	3.11
A2	MH2	0.38	1.79	0.8	1.43	25.92	3.68	1.12	5.27	135	24	1.50	0.012	30.02	9.6	3.1	6.3	2.03	104.27	102.23	1.68	0.24%	0.32	104.56	104.23	111.82	108.25	5.55
MH2	A3	0.00	3.13	0.8	2.50	26.51	3.64	0.00	9.11	94	24	1.50	0.012	30.02	9.6	3.1	6.3	1.42	99.75	98.33	2.90	0.72%	0.68	101.01	100.33	108.25	106.36	6.50
A3	MH3	0.68	6.12	0.8	4.90	27.85	3.54	1.93	17.34	232	30	1.00	0.012	44.44	9.1	4.9	7.9	2.32	97.83	95.51	3.53	0.80%	1.84	100.06	98.21	106.36	104.32	6.03
MH3	MH4	0.00	7.10	0.8	5.68	28.33	3.51	0.00	19.92	79	30	1.00	0.012	44.44	9.1	4.9	7.9	0.79	95.51	94.72	4.06	1.05%	0.83	98.05	97.22	104.32	101.02	6.31
MH4	MH5	0.00	8.83	0.8	7.06	28.47	3.50	0.00	24.71	54	36	1.00	0.012	72.26	10.2	7.1	9.4	0.55	92.05	91.50	3.50	0.61%	0.33	94.83	94.50	101.02	97.05	5.97
MH5	OUT	0.00	8.83	0.8	7.06	28.58	3.49	0.00	24.66	126	36	1.00	0.012	72.26	10.2	7.1	9.4	1.26	81.26	80.00	3.49	0.61%	0.77	83.77	83.00	97.05	76.50	12.79
A4	MH3	0.98	0.98	0.8	0.78	24.96	3.76	2.94	2.94	48	18	1.00	0.012	11.38	6.4	1.8	4.7	0.48	96.99	96.51	1.67	0.35%	0.17	98.38	98.21	102.83	104.32	4.34
B0	MH6	0.49	0.49	0.8	0.39	23.82	3.85	1.51	1.51	40	18	1.45	0.012	13.70	7.8	1.8	4.7	0.58	108.50	107.92	0.85	0.09%	0.04	109.46	109.42	112.32	114.89	2.32
MH6	MH7	0.00	0.49	0.8	0.39	24.16	3.82	0.00	1.50	105	18	1.45	0.012	13.70	7.8	1.8	4.7	1.52	107.92	106.41	0.85	0.09%	0.09	108.00	107.91	114.89	112.18	5.47
MH7	B1	0.00	0.49	0.8	0.39	25.07	3.75	0.00	1.47	22	18	1.05	0.012	11.66	6.6	1.8	4.7	0.23	106.41	106.18	0.83	0.09%	0.02	107.70	107.68	112.18	111.84	4.27
B1	B2	0.57	1.06	0.8	0.85	25.27	3.73	1.70	3.16	144	24	1.05	0.012	25.11	8.0	3.1	6.3	1.52	105.68	104.16	1.01	0.09%	0.12	106.28	106.16	111.84	111.63	4.16
B2	MH8	0.33	1.39	0.8	1.11	26.31	3.65	0.96	4.06	149	24	1.50	0.012	30.02	9.6	3.1	6.3	2.24	104.16	101.92	1.29	0.14%	0.21	104.13	103.92	111.63	107.83	5.47
MH8	B3	0.00	1.66	0.8	1.33	27.16	3.59	0.00	4.77	81	24	1.50	0.012	30.02	9.6	3.1	6.3	1.21	101.92	100.71	1.52	0.20%	0.16	102.87	102.71	107.83	106.16	3.91
B3	A3	0.65	2.31	0.8	1.85	27.55	3.56	1.85	6.58	87	24	1.50	0.012	30.02	9.6	3.1	6.3	1.31	100.71	99.41	2.10	0.38%	0.33	101.73	101.41	106.16	106.36	3.45
C0	MH9	1.34	1.34	0.8	1.07	25.53	3.71	3.98	3.98	247	18	1.01	0.012	11.44	6.5	1.8	4.7	2.50	101.50	99.00	2.251	0.63%	1.57	104.28	102.71	105.00	107.23	2.00
MH9	MH10	0.00	1.34	0.8	1.07	15.00	4.83	0.00	5.17	94	18	1.01	0.012	11.44	6.5	1.8	4.7	0.95	99.00	98.05	2.928	1.05%	0.98	102.65	101.66	107.23	107.06	6.73
MH10	C1	0.00	1.34	0.8	1.07	15.00	4.83	0.00	5.17	117	18	1.01	0.012	11.44	6.5	1.8	4.7	1.19	98.05	96.86	2.928	1.05%	1.22	101.66	100.44	107.06	102.00	7.51
C1	MH4	1.37	2.71	0.8	2.17	25.57	3.71	4.06	8.04	112	18	1.01	0.012	11.44	6.5	1.8	4.7	1.14	96.86	95.72	4.549	2.59%	2.90	100.12	97.22	102.00	101.02	3.64
D0	MH7	0.27	0.27	0.8	0.22	22.94	3.93	0.85	0.85	145	18	1.00	0.012	11.38	6.4	1.8	4.7	1.45	105.70	104.25	0.480	0.03%	0.04	105.79	105.75	111.45	107.83	4.25

100 YEAR CALCULATIONS

STRUCTURE		DRAINAGE AREA (ACRES)	TOTAL AREA (ACRES)	RUNOFF C	TOTAL C*A	TC (MIN)	1-100-YR (IN/HR)	DRAINAGE AREA FLOW 2-YR (CFS)	DRAINAGE AREA FLOW 100-YR (CFS)	TOTAL FLOW 100-YR (CFS)	REACH LENGTH (FT)	DIAMETER (IN)	DESIGN SLOPE (%)	MANNING'S ROUGHNESS COEFFICIENT "n"	PIPE DESIGN CAPACITY (CFS)	DESIGN VELOCITY (FT/SEC)	AREA (SQ FT)	WETTED PERIMETER (FT)	FALL (FT)	FLOWLINE ELEVATION UPSTREAM (FT)	FLOWLINE ELEVATION DOWNSTREAM (FT)	100-YR ACTUAL VELOCITY (FT/SEC)	ACTUAL HYDRAULIC GRADIENT (%)	CHANGE IN HEAD (FT)	ELEVATION OF 100-YR HYD. GRADE LINE UPSTREAM (FT)	ELEVATION OF 100-YR HYD. GRADE LINE DOWNSTREAM (FT)	FINISHED GRADE UPSTREAM (FT)	FINISHED GRADE DOWNSTREAM (FT)	COVER (FT)
FROM	TO																												
A0	MH1	0.77	0.77	0.8	0.62	24.55	8.61	2.33	5.31	5.31	59	18	1.50	0.012	13.94	7.9	1.8	4.7	0.89	108.50	107.61	3.00	0.22%	0.13	109.24	109.11	112.31	112.23	2.31
MH1	A1	0.00	0.77	0.8	0.62	24.88	8.56	0.00	0.00	5.27	40	18	1.50	0.012	13.94	7.9	1.8	4.7	0.59	107.61	107.02	2.98	0.21%	0.09	108.60	108.52	112.23	111.63	3.12
A1	A2	0.64	1.41	0.8	1.13	25.10	8.52	1.92	4.36	9.61	150	24	1.50	0.012	30.02	9.6	3.1	6.3	2.25	106.52	104.27	3.06	0.15%	0.23	106.50	106.27	111.63	111.82	3.11
A2	MH2	0.38	1.79	0.8	1.43	25.92	8.39	1.12	2.55	12.01	135	24	1.50	0.012	30.02	9.6	3.1	6.3	2.03	104.27	102.23	3.82	0.24%	0.32	104.56	104.23	111.82	108.25	5.55
MH2	A3	0.00	3.13	0.8	2.50	26.51	8.29	0.00	0.00	20.77	94	24	1.50	0.012	30.02	9.6	3.1	6.3	1.42	99.75	98.33	6.61	0.72%	0.68	101.01	101.08	108.25	106.36	6.50
A3	MH3	0.68	6.12	0.8	4.90	27.85	8.09	1.93	4.40	39.62	232	30	1.00	0.012	44.44	9.1	4.9	7.9	2.32	97.83	95.51	8.07	0.80%	1.84	100.06	98.89	106.36	104.32	6.03
MH3	MH4	0.00	7.10	0.8	5.68	28.33	8.02	0.00	0.00	45.58	79	30	1.00	0.012	44.44	9.1	4.9	7.9	0.79	95.51	94.72	9.29	1.05%	0.83	98.05	97.22	104.32	101.02	6.31
MH4	MH5	0.00	8.83	0.8	7.06	28.47	8.00	0.00	0.00	56.54	54	36	1.00	0.012	72.26	10.2	7.1	9.4	0.55	92.05	91.50	8.00	0.61%	0.33	94.83	94.50	101.02	97.05	5.97
MH5	OUT	0.00	8.83	0.8	7.06	28.58	7.99	0.00	0.00	56.43	126	36	1.00	0.012	72.26	10.2	7.1	9.4	1.26	81.26	80.00	7.98	0.61%	0.77	83.77	83.00	97.05	76.50	12.79
A4	MH3	0.98	0.98	0.8	0.78	24.96	8.54	2.94	6.70	6.70	48	18	1.00	0.012	11.38	6.4	1.8	4.7	0.48	96.99	96.51	3.79	0.35%	0.17	98.38	98.21	102.83	104.32	4.34
B0	MH6	0.49	0.49	0.8	0.39	23.82	8.74	1.51	3.43	3.43	40	18	1.45	0.012	13.70	7.8	1.8	4.7	0.58	108.50	107.92	1.94	0.09%	0.04	109.46	109.42	112.32	114.89	2.32
MH6	MH7	0.00	0.49	0.8	0.39	24.16	8.68	0.00	0.00	3.40	105	18	1.45	0.012	13.70	7.8	1.8	4.7	1.52	107.92	106.41	1.93	0.09%	0.09	108.00	107.91	114.89	112.18	5.47
MH7	B1	0.00	0.49	0.8	0.39	25.07	8.53	0.00	0.00	3.34	22	18	1.05	0.012	11.66	6.6	1.8	4.7	0.23	106.41	106.18	1.89	0.09%	0.02	107.70	107.68	112.18	111.84	4.27
B1	B2	0.57	1.06	0.8	0.85	25.27	8.49	1.70	3.87	7.20	144	24	1.05	0.012	25.11	8.0	3.1	6.3	1.52	105.68	104.16	2.29	0.09%	0.12	106.28	106.16	111.84	111.63	4.16
B2	MH8	0.33	1.39	0.8	1.11	26.31	8.32	0.96	2.20	9.26	149	24	1.50	0.012	30.02	9.6	3.1	6.3	2.24	104.16	101.92	2.95	0.14%	0.21	104.13	103.92	111.63	107.83	5.47
MH8	B3	0.00	1.66	0.8	1.33	27.16	8.20	0.00	0.00	10.88	81	24	1.50	0.012	30.02	9.6	3.1	6.3	1.21	101.92	100.71	3.46	0.20%	0.16	102.87	102.71	107.83	106.16	3.91
B3	A3	0.65	2.31	0.8	1.85	27.55	8.14	1.85	4.23	15.04	87	24	1.50	0.012	30.02	9.6	3.1	6.3	1.31	100.71	99.41	4.79	0.38%	0.33	101.73	101.41	106.16	106.36	3.45
C0	MH9	1.34	1.34	0.8	1.07	25.53	8.45	3.98	9.06	9.06	247	18	1.01	0.012	11.44	6.5	1.8	4.7	2.50	101.50	99.00	5.13	0.63%	1.57	104.28	104.33	105.00	107.23	2.00
MH9	MH10	0.00	1.34	0.8	1.07	15.00	10.86																						

Plotted By: Simmons, Ross. Sheet Set: Rhs Layout: CONSTRUCTION DETAILS (5 OF 6). December 16, 2022. 10:50:28am. K:\HOU_Civil\045472001-12000 BlossomStreet\CAD\PlanSheets\C-Detail.dwg
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NO.	REVISIONS	DATE	NAME

HARRIS COUNTY
ENGINEERING DEPARTMENT

FOR INTERIM REVIEW ONLY

DOCUMENT INCOMPLETE. NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.

ENGINEER: NAME: / / P.E. SERIAL NO. NUMBER: / / DATE: / /

CONCRETE PAVEMENT DETAILS CP-13

PRECINCT 1 & 3 (1 OF 2) 11/05/18

AS NOTED

NO.	REVISIONS	DATE	NAME

Kimley»Horn

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 WWW.KIMLEY-HORN.COM
 PHONE: 281-597-9300
 TUBE FIRM REGISTRATION F-928

KIRKWOOD CROSSING - MULTIFAMILY PREPARED FOR IMPACT RESIDENTIAL DEVELOPMENT

CONSTRUCTION DETAILS (5 OF 6)

TEXAS

HOUSTON

SHEET NUMBER **C9.4**

RHS PROJECT 068924000
 DATE DECEMBER 2022
 SCALE AS SHOWN
 DESIGNED BY RHS
 DRAWN BY CAP
 CHECKED BY RCK

REVISIONS

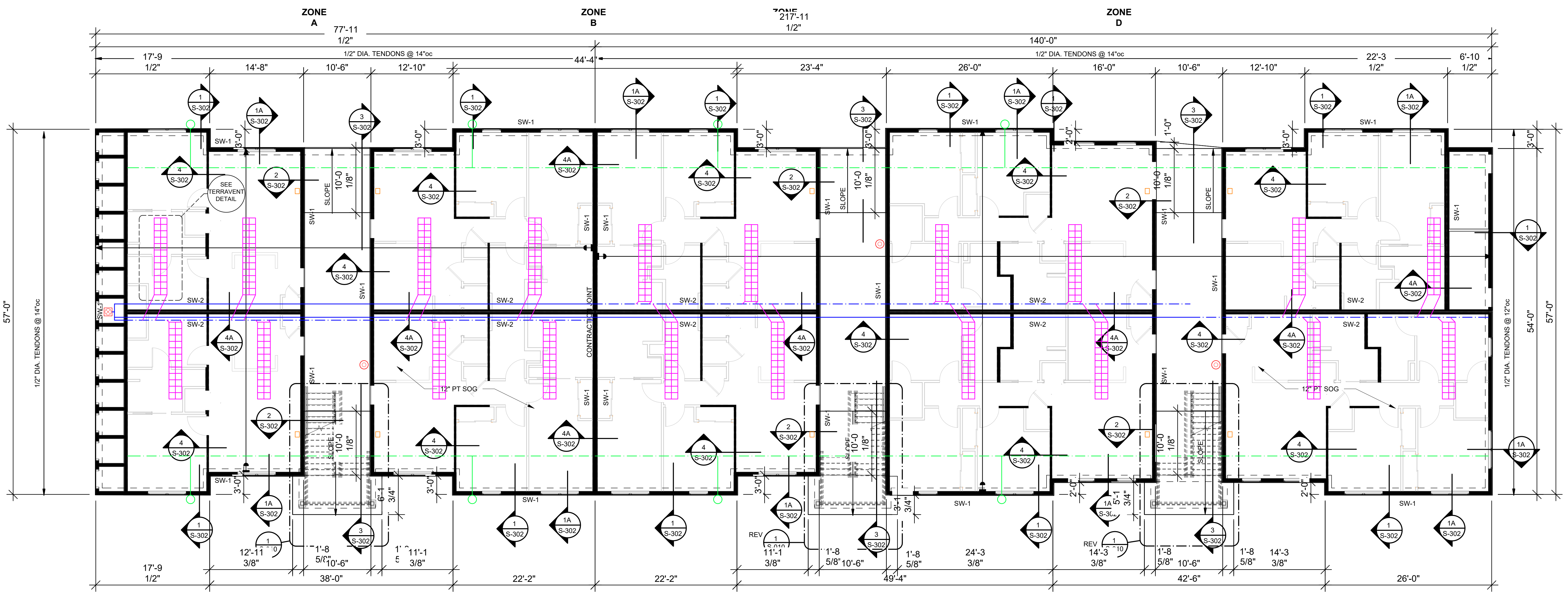
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DATE

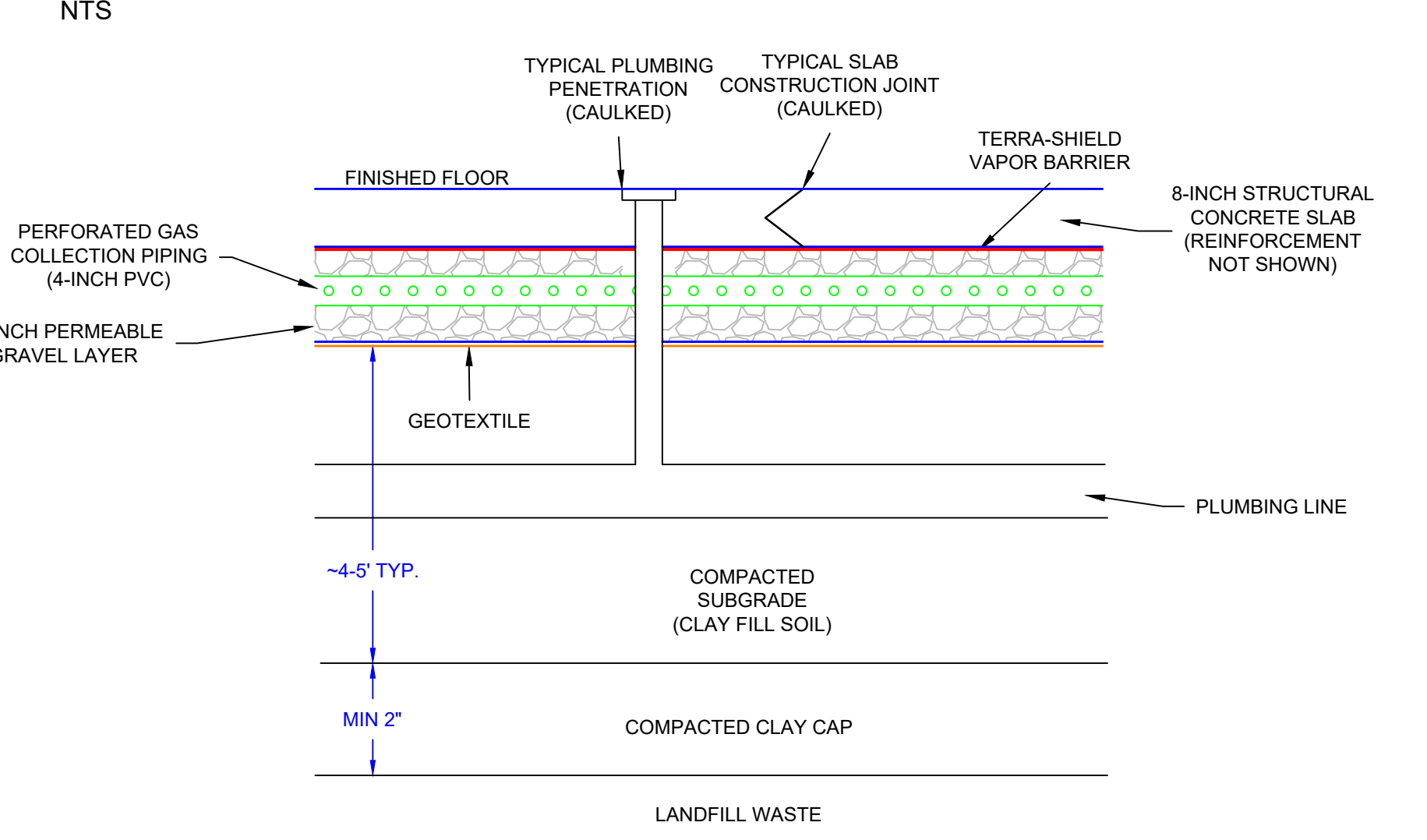
APPENDIX 6

FOUNDATION PLANS WITH

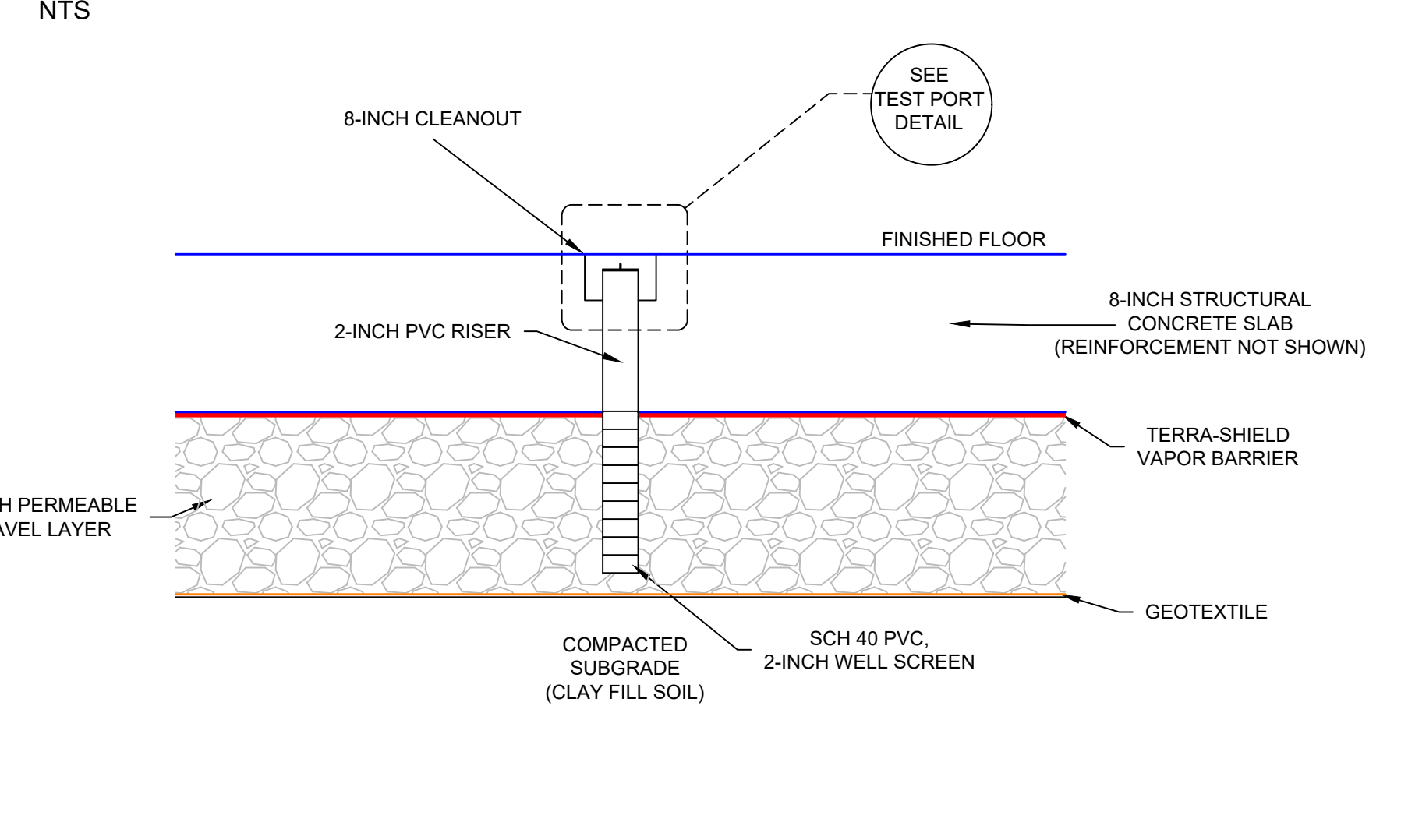
LANDFILL GAS COLLECTION SYSTEM



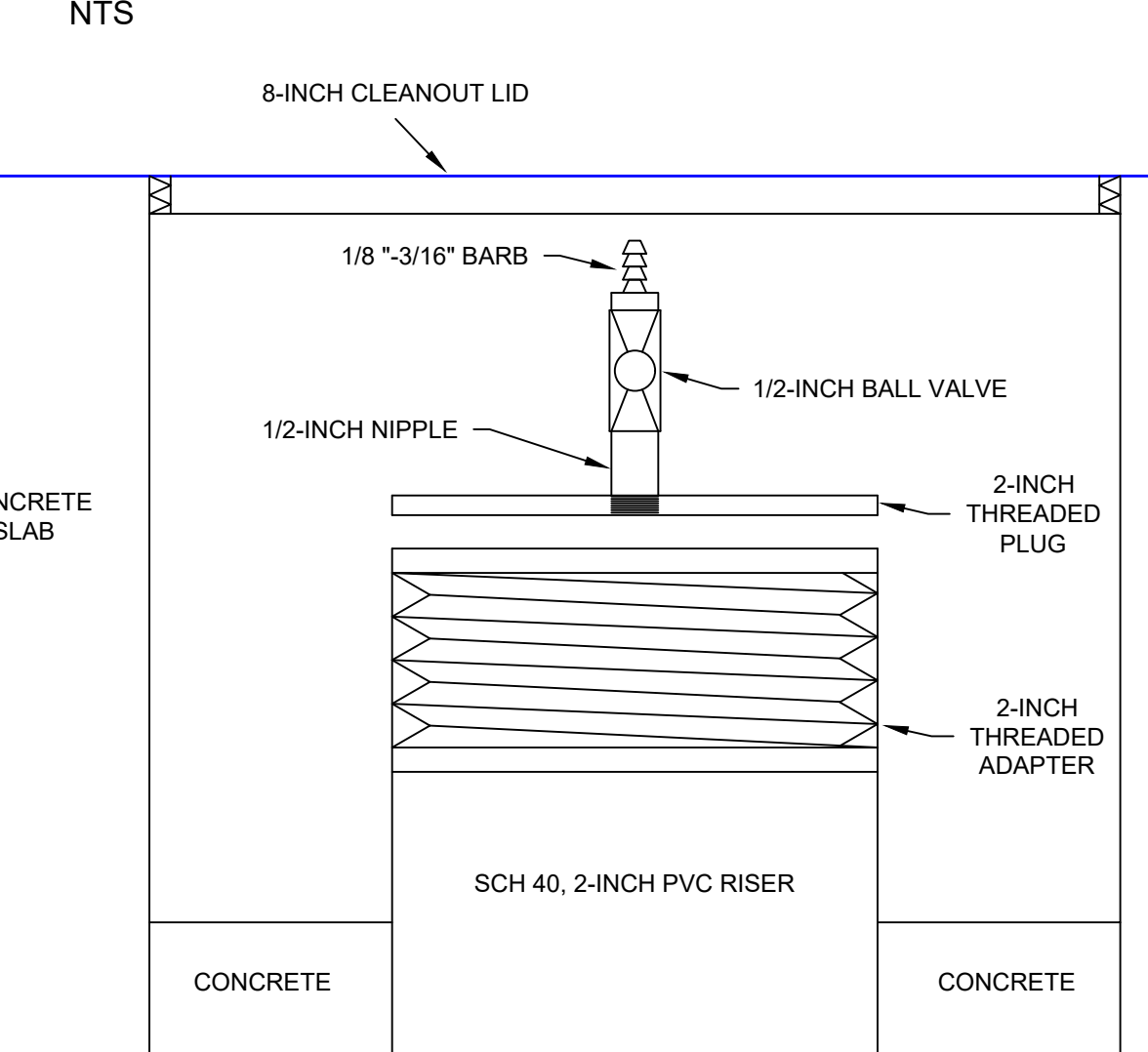
SLAB PROFILE DETAIL (TERRAVENT NOT SHOWN)
NTS



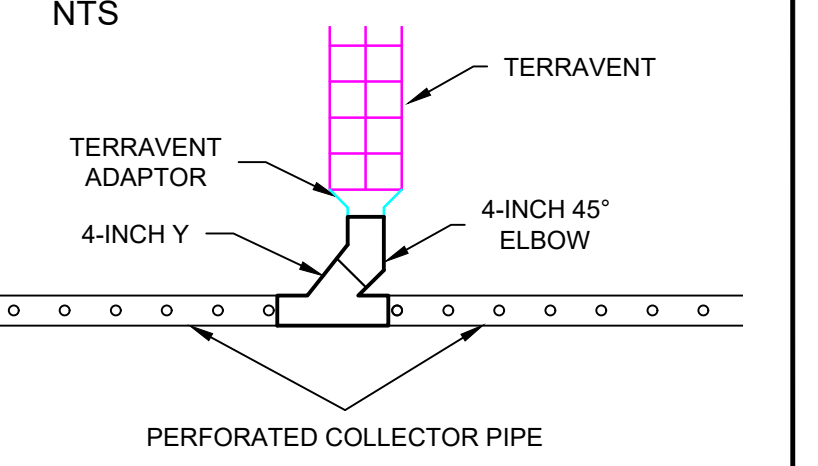
VACUUM TEST POINT DETAIL
NTS



TEST PORT DETAIL
NTS



TERRAVENT DETAIL
NTS

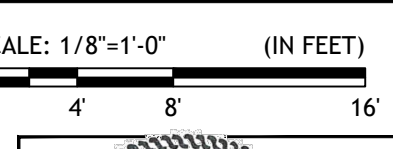


LEGEND

- INLET AIR PIPE (SOLID, 4-INCH PIPE)
- - - INLET AIR PIPE (PERFORATED, 4-INCH PIPE)
- COLLECTOR PIPE (SOLID, 4-INCH PIPE)
- - - COLLECTOR PIPE (PERFORATED, 4-INCH PIPE)
- ▤ TERRAVENT
- ⊙ EXHAUST FAN
- ⊙ VACUUM TEST POINT
- ⊙ AIR INLET
- ⊙ METHANE MONITOR

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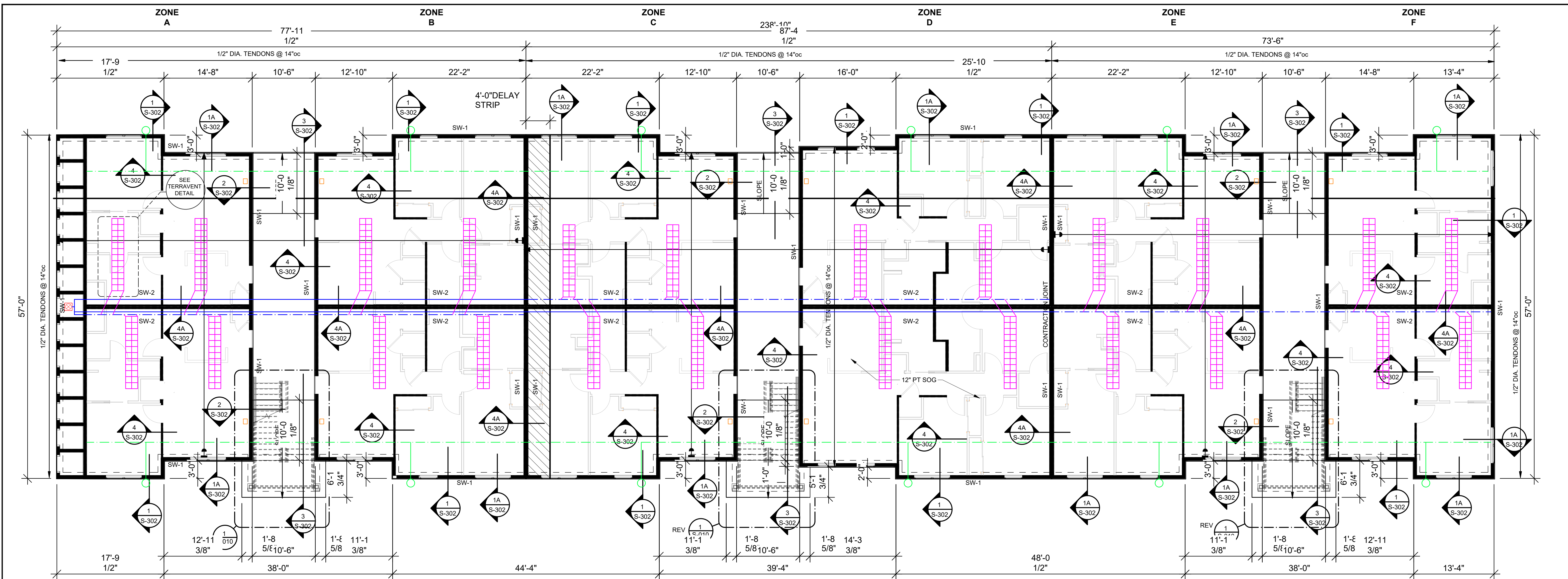
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DEVELOPMENT PERMIT FOR PROPOSED ENCLOSED STRUCTURES
KIRKWOOD CROSSING APARTMENTS
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

DATE: SEPTEMBER 2023 JOB NO: 6022-0001 SCALE: AS SHOWN

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3. THIRD REVISION	APPROVED BY: PMS

ATTACH 6.2

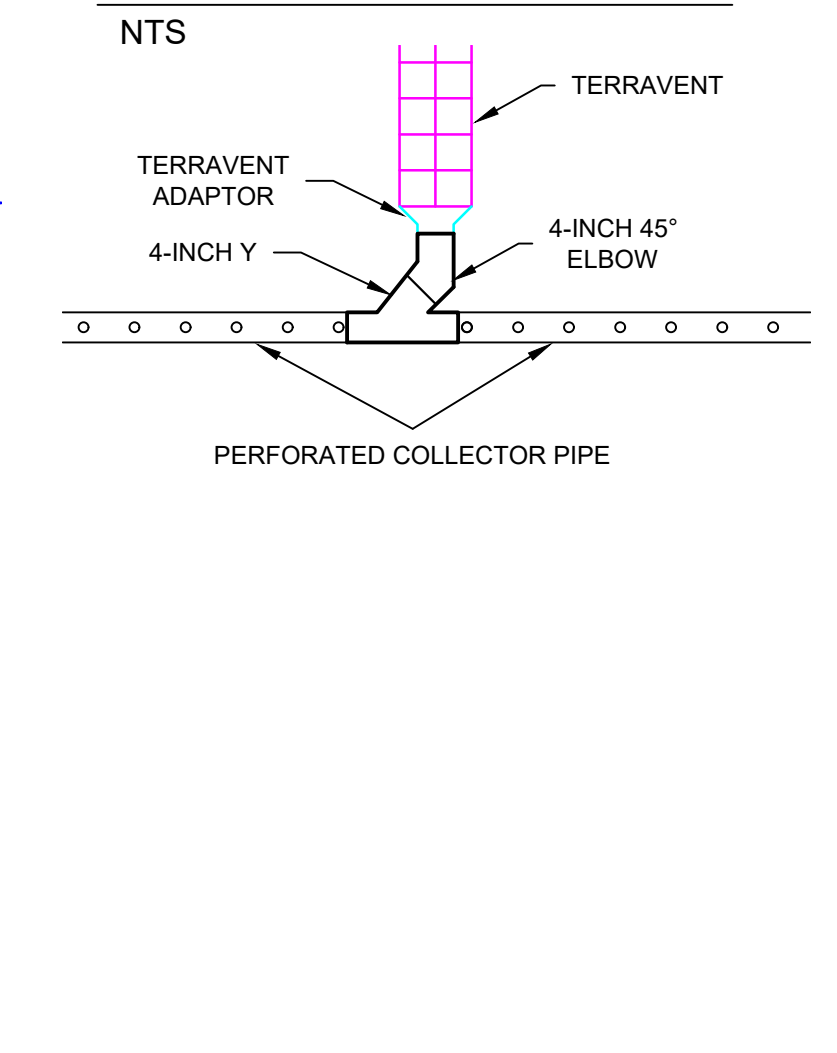
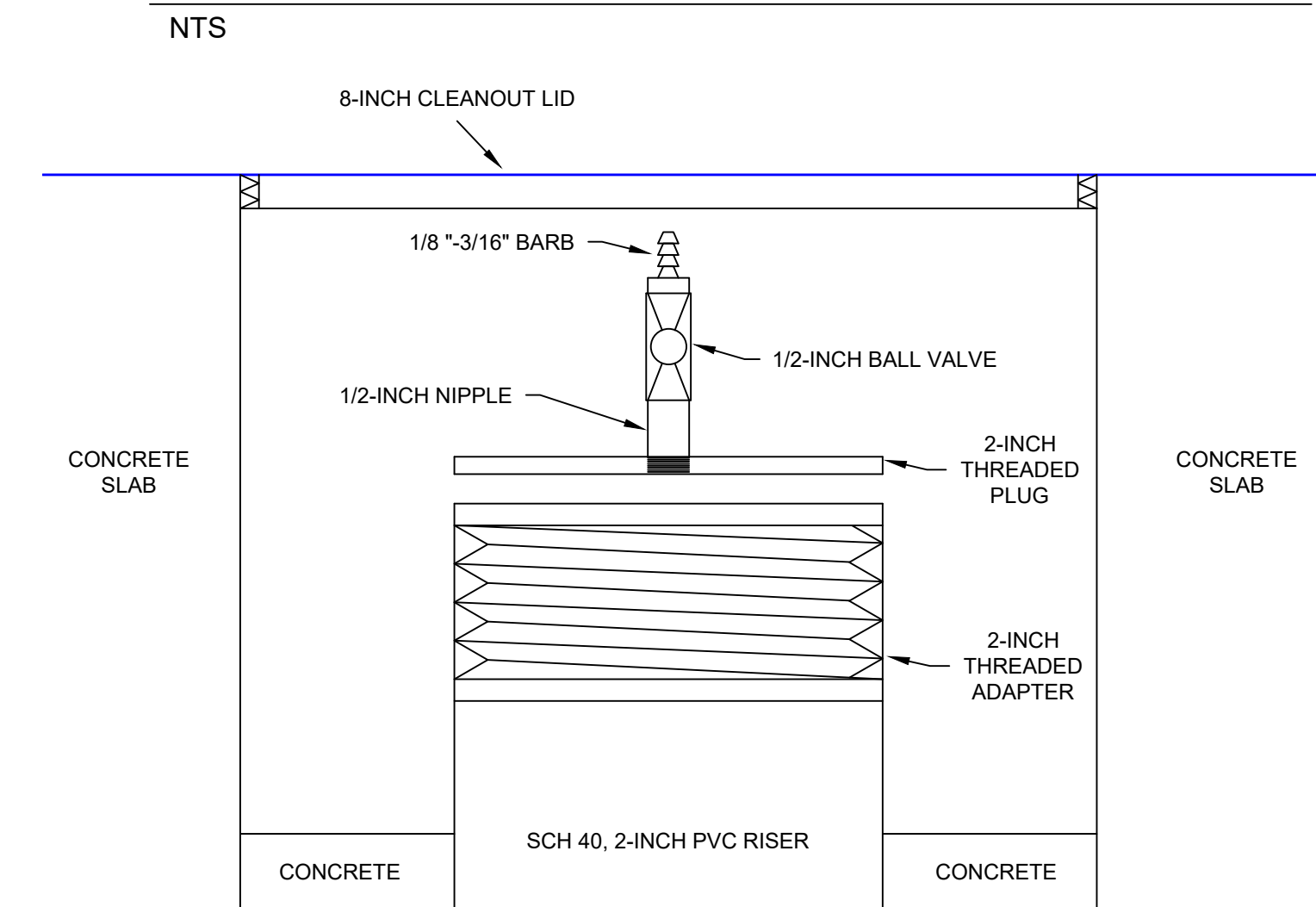
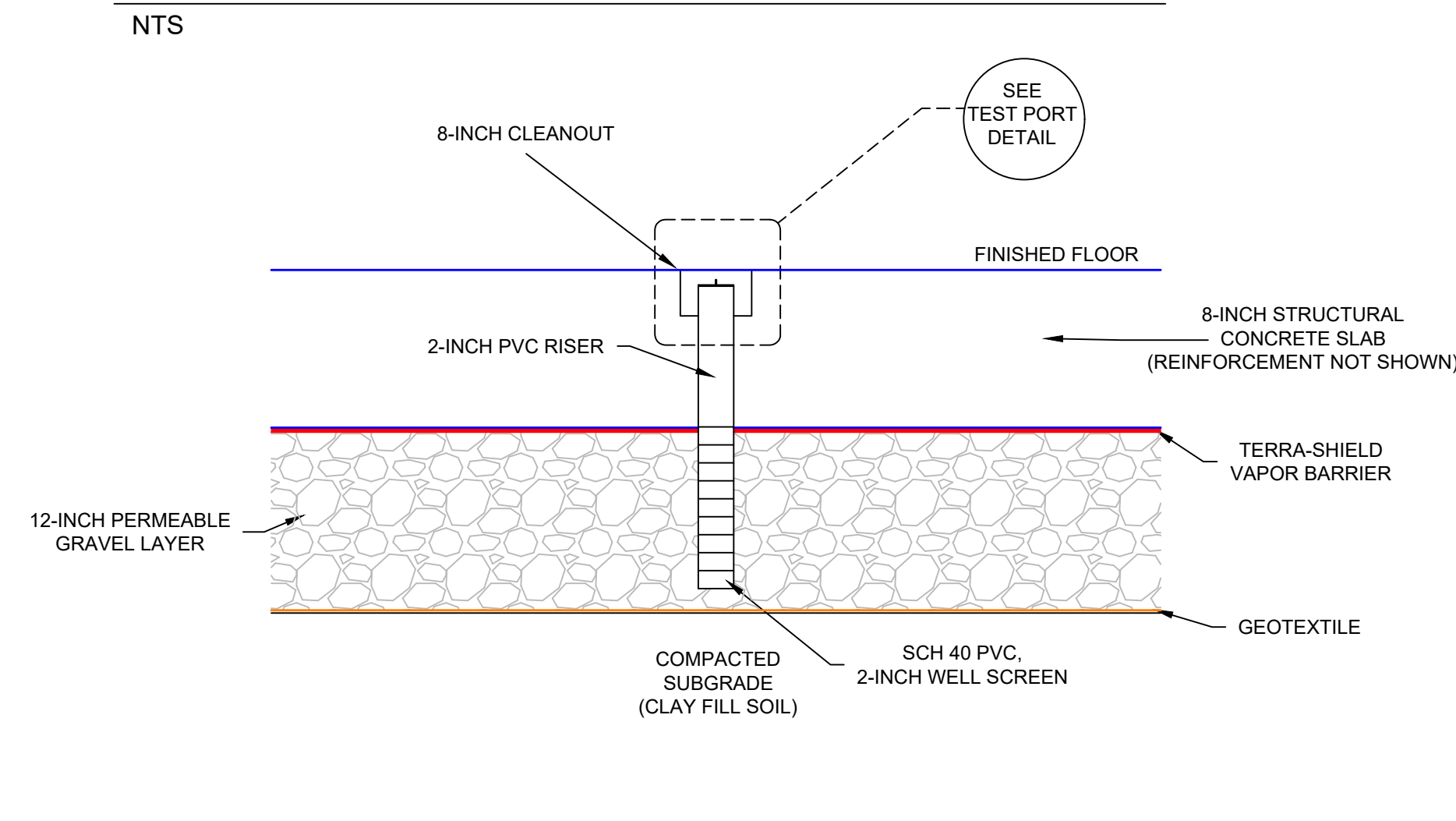
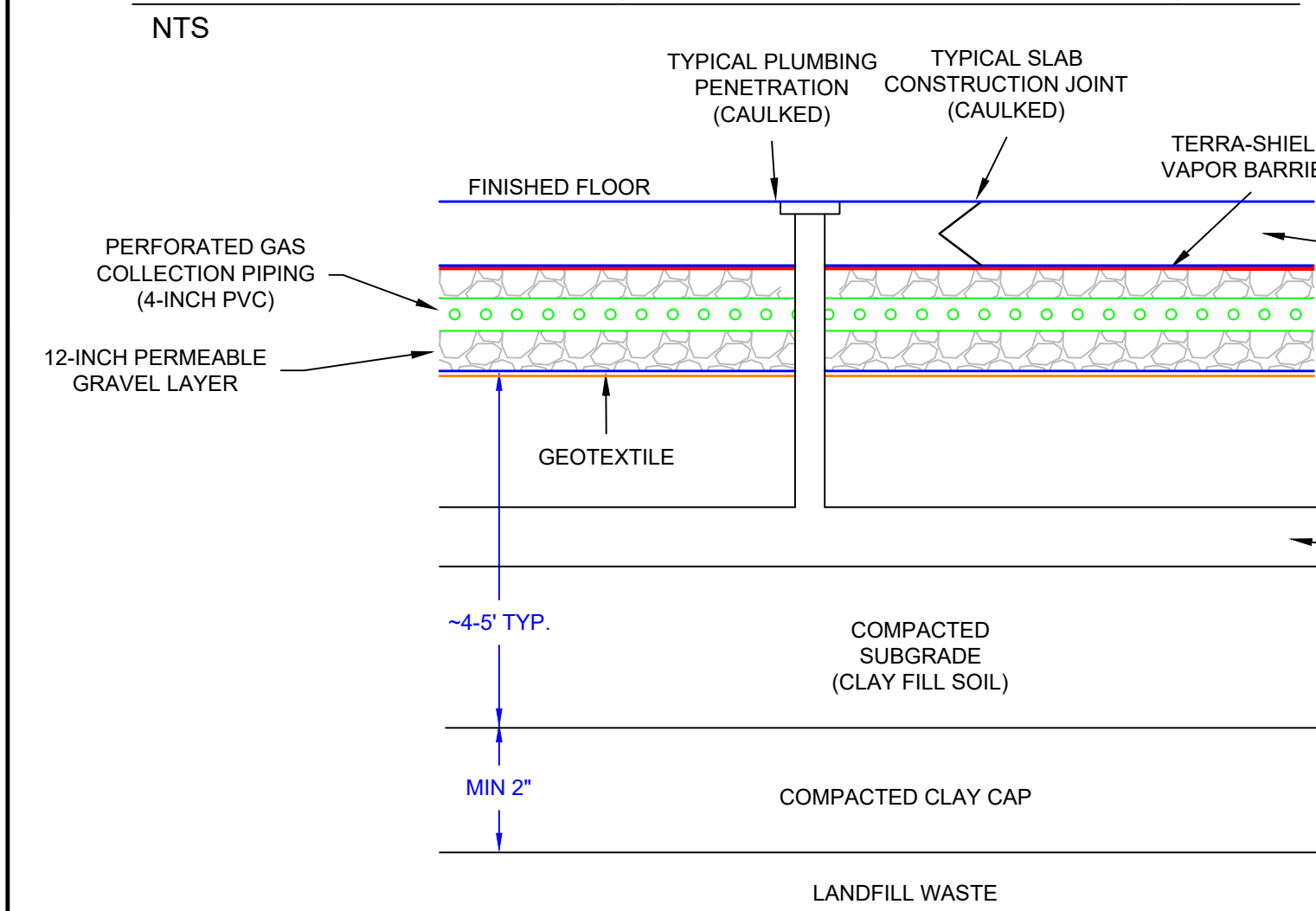


SLAB PROFILE DETAIL (TERRAVENT NOT SHOWN)

VACUUM TEST POINT DETAIL

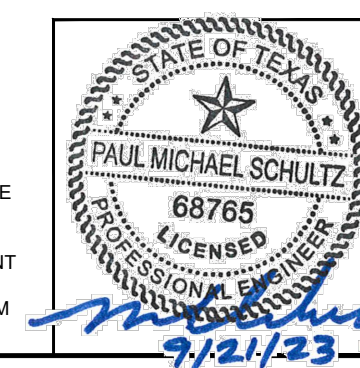
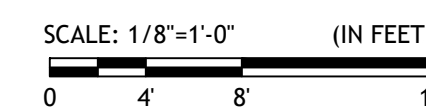
TEST PORT DETAIL

TERRAVENT DETAIL



- LEGEND**
- INLET AIR PIPE (SOLID, 4-INCH PIPE)
 - - - INLET AIR PIPE (PERFORATED, 4-INCH PIPE)
 - COLLECTOR PIPE (SOLID, 4-INCH PIPE)
 - - - COLLECTOR PIPE (PERFORATED, 4-INCH PIPE)
 - ▤ TERRAVENT
 - ⊗ EXHAUST FAN
 - ⊙ VACUUM TEST POINT
 - AIR INLET
 - METHANE MONITOR

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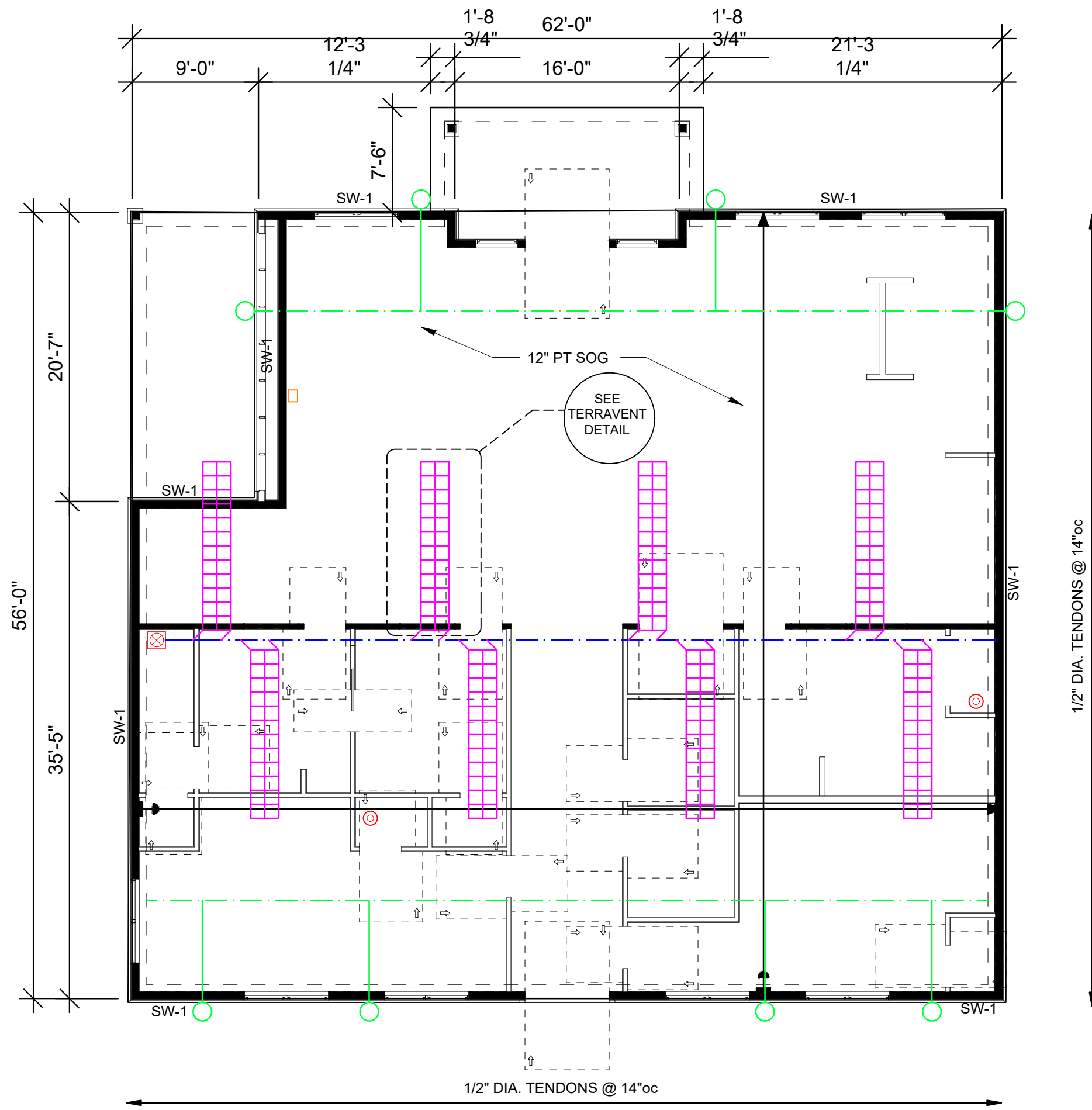
BUILDING 3 FOUNDATION PLAN WITH LANDFILL GAS COLLECTION SYSTEM

DEVELOPMENT PERMIT FOR PROPOSED ENCLOSED STRUCTURES
 KIRKWOOD CROSSING APARTMENTS
 12000 BISSONNET STREET
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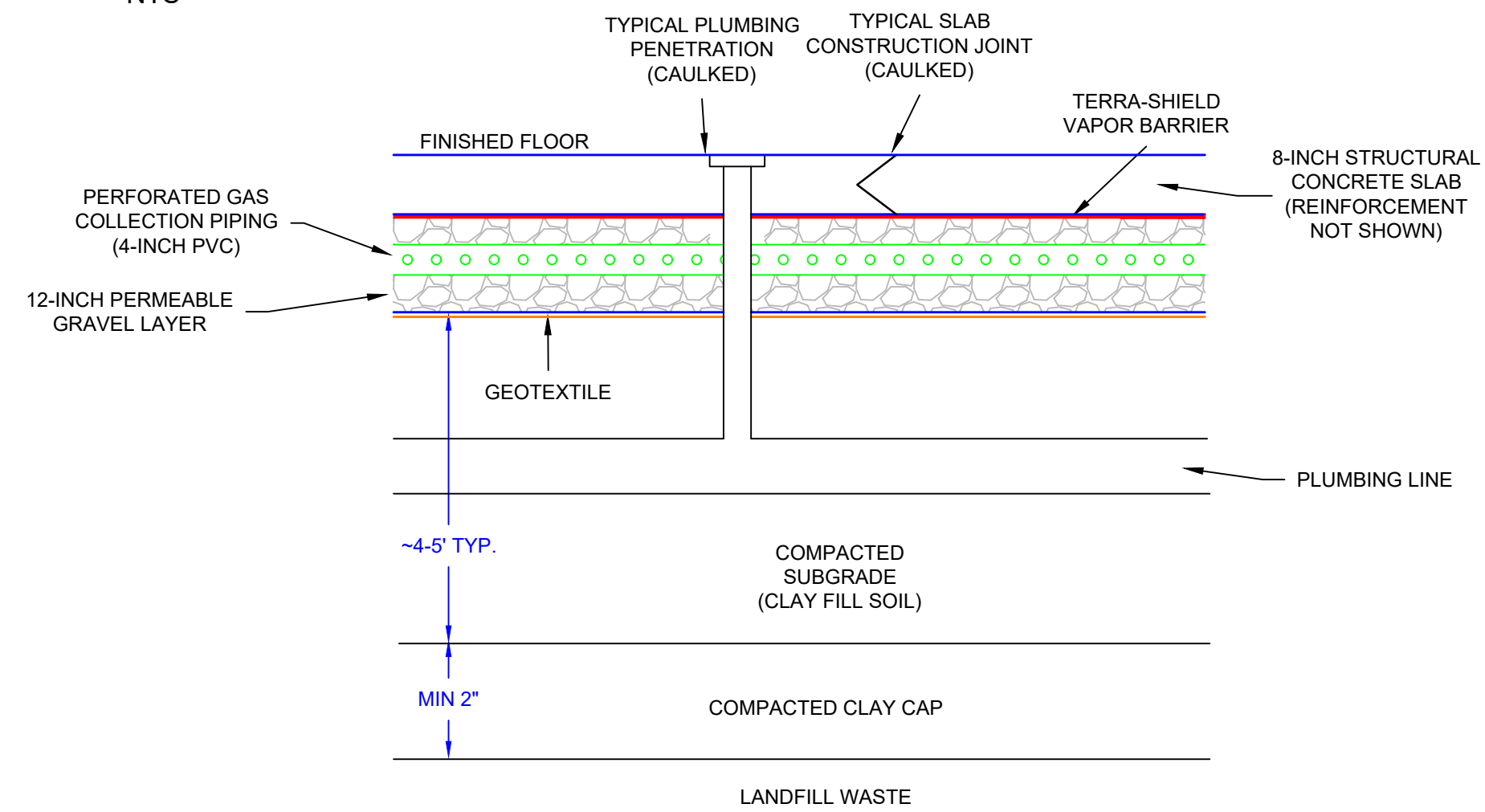
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ATTACH 6.3



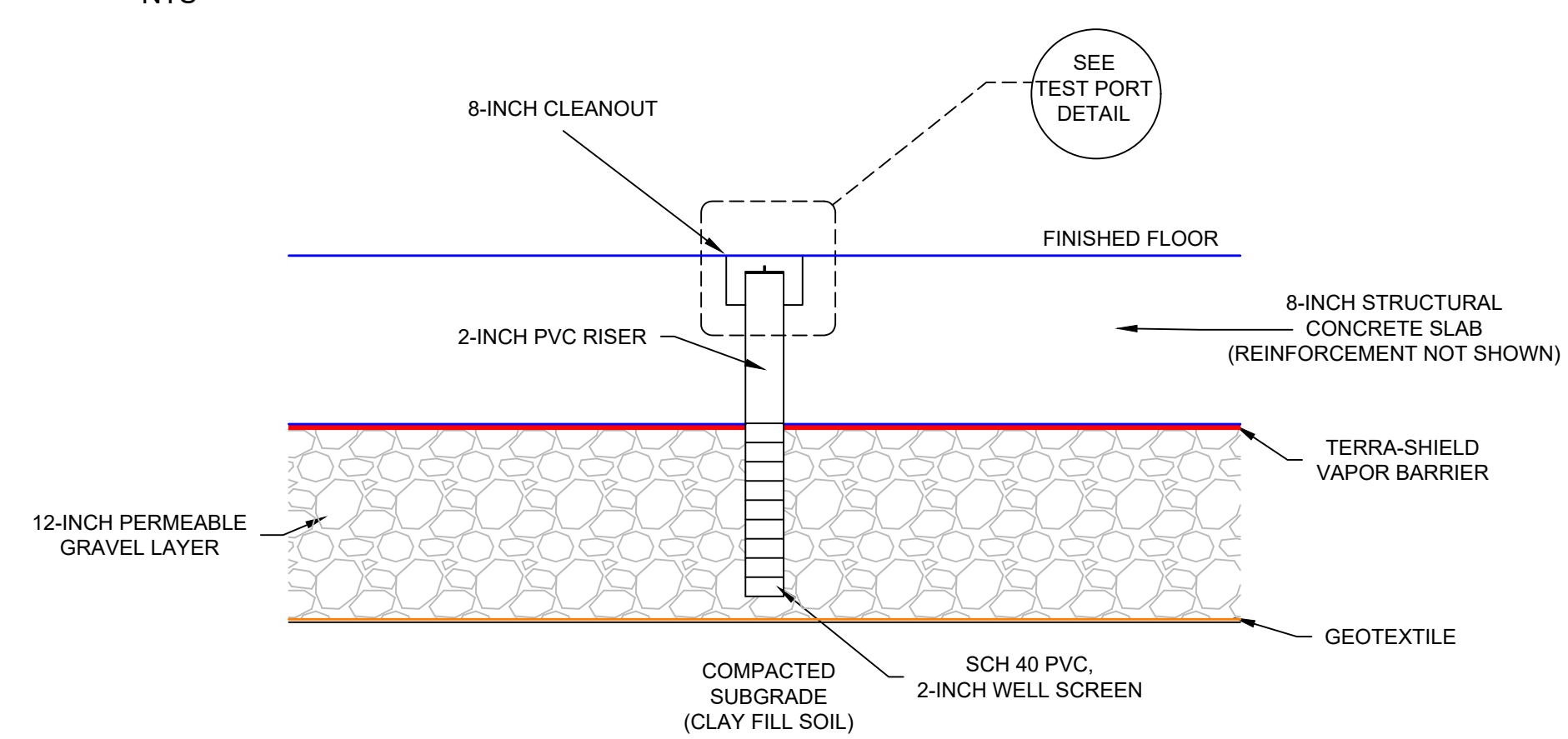
SLAB PROFILE DETAIL (TERRAVENT NOT SHOWN)

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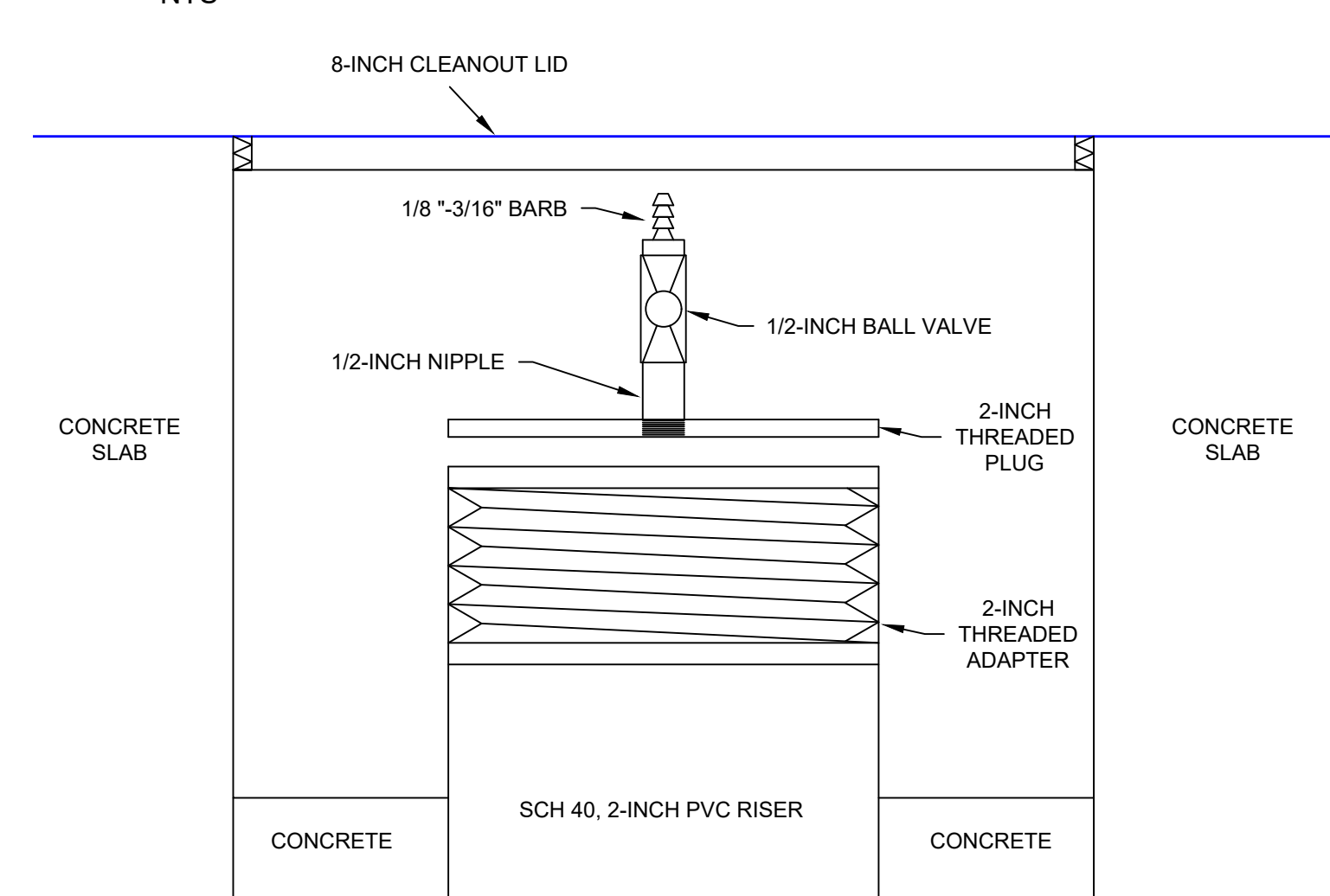
VACUUM TEST POINT DETAIL

NTS



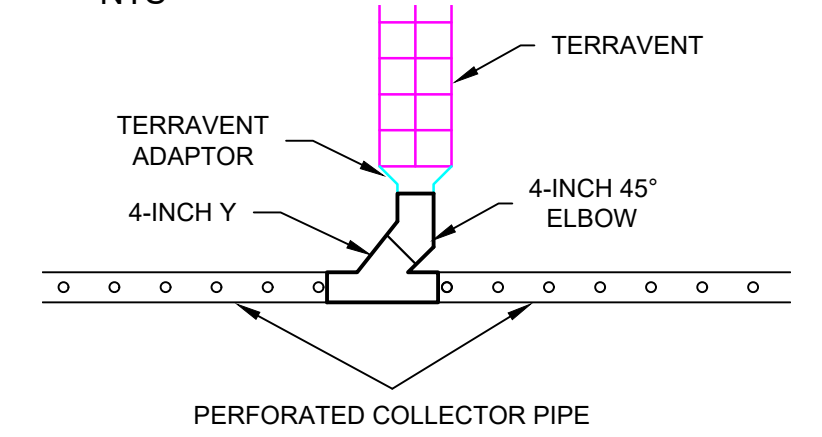
TEST PORT DETAIL

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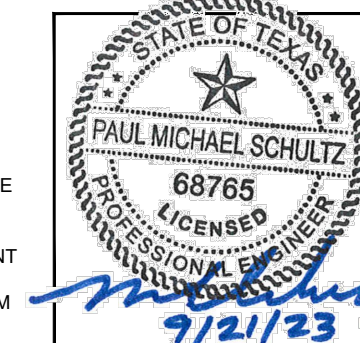
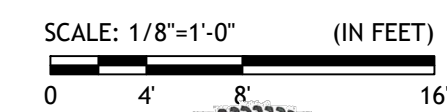
TERRAVENT DETAIL

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LEGEND

	INLET AIR PIPE (SOLID, 4-INCH PIPE)
	INLET AIR PIPE (PERFORATED, 4-INCH PIPE)
	COLLECTOR PIPE (SOLID, 4-INCH PIPE)
	COLLECTOR PIPE (PERFORATED, 4-INCH PIPE)
	TERRAVENT
	EXHAUST FAN
	VACUUM TEST POINT
	AIR INLET
	METHANE MONITOR



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CLUB HOUSE FOUNDATION PLAN WITH LANDFILL GAS COLLECTION SYSTEM

DEVELOPMENT PERMIT FOR PROPOSED ENCLOSED STRUCTURES
KIRKWOOD CROSSING APARTMENTS
12000 BISSONNET STREET
HOUSTON, HARRIS COUNTY, TEXAS 77099

DATE: SEPTEMBER 2023 | P&E NO: 6022-0001 | SCALE: AS SHOWN

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ATTACH **6.5**

APPENDIX 7
TERRASHIELD, TERRAVENT, AND
GEOTEXTILE SPECIFICATIONS

Description

TerraShield[®] is the premier under-slab contaminant vapor intrusion barrier designed to eliminate contaminant vapors at sites with environmental impacts.

The patented TerraShield system is comprised of three defined layers to create a robust, redundant, seamless membrane: TerraBase+[™], Nitra-Core[™], and Land Science Protection Fabric[™]. TerraShield is an advancement over single-sheet membranes and traditional spray-applied composite vapor barriers due to:

1. the excellent protection provided by the metalized geomembrane, TerraBase+
2. the inclusion of Nitra-Core, the most chemically resistant spray-applied core available

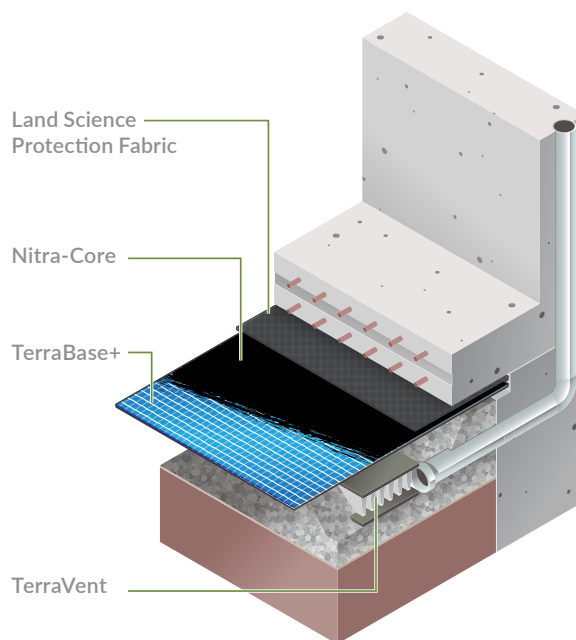
These proprietary features offer the greatest resistivity to contaminant vapor permeation through the building foundation, while remaining practical for construction timelines and budgets. The installation of TerraShield usually occurs after the site substrate has been prepared and the utilities placed, and prior to concrete slab placement.

Developed to meet and exceed the most stringent regulatory requirements across the nation, TerraShield is proven to protect building occupants from chlorinated solvents, petroleum compounds, methane, radon, and other volatile organic compounds by physically encapsulating the building foundation to prevent contaminant migration through the concrete slab.

TerraShield System Summary

System Thickness:	65 mil, 125 mil with protection fabric			
Components:	Venting System ¹	Base Layer	Middle Layer	Top Layer
Product Name:	TerraVent	TerraBase+	Nitra-Core	LS Protection Fabric
Component Thickness:	1"	25 mil	40 mil	50 mil (Approx.) (8 oz/sy)

1. Venting system is an optional system component



Advantages

Chemical Resistance

TerraBase+, the metalized geomembrane base layer of TerraShield, offers over 100x greater protection to VOC permeation versus traditional polyethylene base layers.

Speed of Installation

Construction friendly, with a nominal, uniform spray-applied thickness of 40-mil due to the chemically-resistant, nitrile-modified asphalt used in Nitra-Core.

Durable

Puncture resistant with high tensile strength to withstand construction activity post-installation.

Proven

Verified by extensive third-party testing to exceed the most stringent regulatory requirements for vapor intrusion barrier systems.

TerraShield System Properties

Property	Test Method	Typical Value
Tensile Strength ¹	ASTM D751	131 lbs
	ASTM D7004	136 lbs
Elongation ¹	ASTM D751	19%
	ASTM D7004	18%
Puncture Resistance	ASTM D4833	52 lbs
Water Vapor Transmission	ASTM E96 ³	0.0014 grains/(hr·ft ²)
Water Permeance	ASTM E96 ³	0.0023 US Perms
Methane Gas Permeance	ASTM 1434 ⁴	<0.12 mL(STP)/(m ² ·d·atm) ⁵
Benzene Diffusion Coefficient	GeoKinetics ²	3.4 x 10 ⁻¹⁸ m ² /s
PCE Diffusion Coefficient	GeoKinetics ²	1.8 x 10 ⁻¹⁷ m ² /s
Radon Permeability	ISO/TS 11665-13 ⁶	<0.4 x 10 ⁻¹² m ² /s ⁵

1. Values are an average of the machine direction and the transverse direction test results.

2. A method comparable to ISO 15105-2, performed by GeoKinetics, Inc., Irvine, CA.

3. Tested by equivalent method, EN1931.

4. Tested by equivalent method, ISO 15105-1.

5. Test results were below the method detection limit.

6. Test method equivalent to K124/02/95

Design Considerations

TerraShield is generally implemented at sites with moderate to high vapor intrusion risk where a best-in-class, high-performance solution is desired to prevent vapor exposure. Common applications include sites with sensitive receptors, such as schools, senior living communities, and hospitals, or sites with exceedances to residential or commercial screening levels.

TerraVent can be implemented in an active or passive mitigation capacity in conjunction with TerraShield to alleviate the buildup of vapors beneath the building structure. Combining a sub-slab ventilation network in the permeable substrate with TerraShield offers the highest level of protection from contaminant vapor intrusion.

Service & Support

Land Science representatives are available for site data analysis, mitigation system recommendations, barrier and venting design support, and budgetary estimates. Site conditions, project objectives, and regulatory requirements will dictate which mitigation solution is appropriate.

Weather Limitations

- Nitra-Core should be sprayed at temperatures >45°F. Contact Land Science for requirements in colder temperatures.
- Nitra-Core should not be sprayed when raining or during weather conditions that create ponding water on the membrane.
- Any ponding water on the surface of TerraBase+ needs to be removed prior to applying Nitra-Core.

Warranty

Land Science offers industry-leading warranty options for a full-suite of vapor intrusion barrier systems. All installations come with a 1-year material warranty free of charge. To qualify for extended warranty terms, the project must be reviewed and approved by Land Science prior to any product installation by a Land Science Certified Applicator.

TerraShield extended warranty options include Material and System warranties up to 30 Years. Contact Land Science for more information to meet your site's warranty requirements.

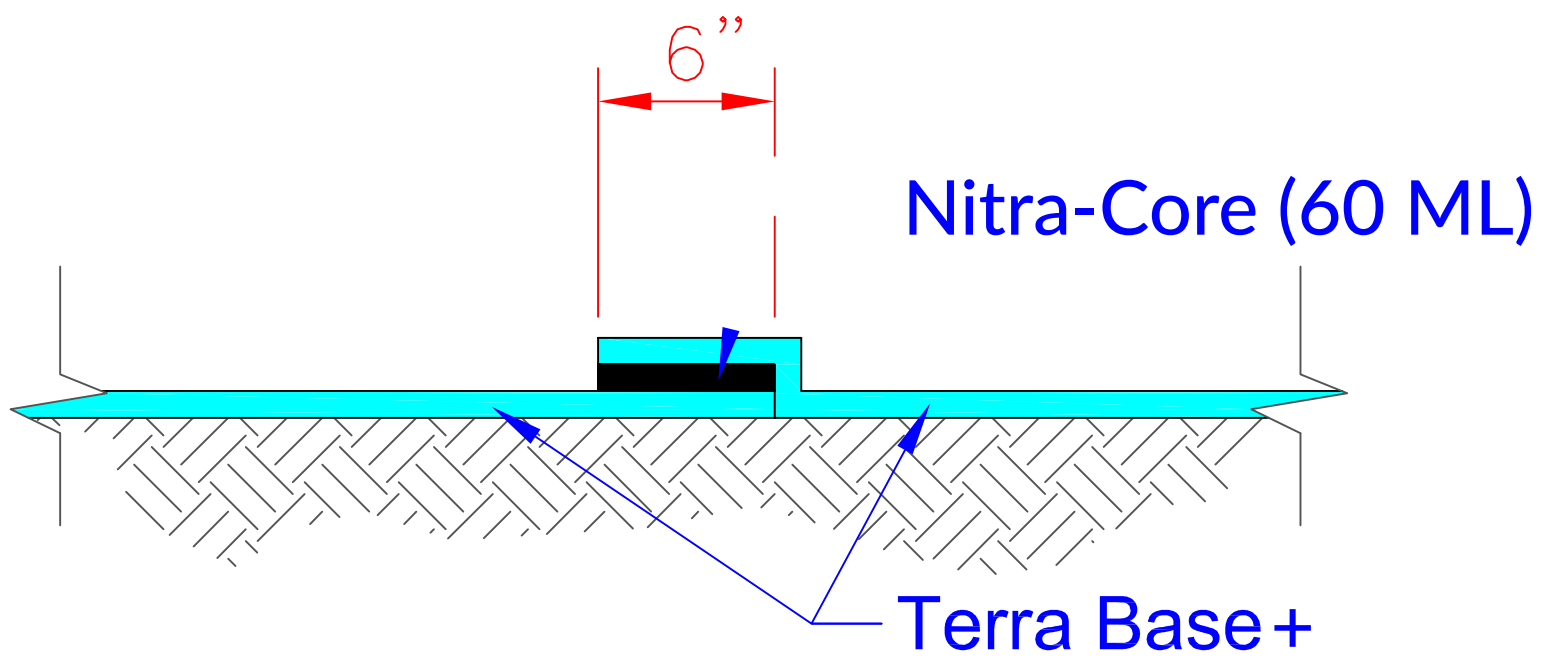


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**TerraShield
Base Overlap**





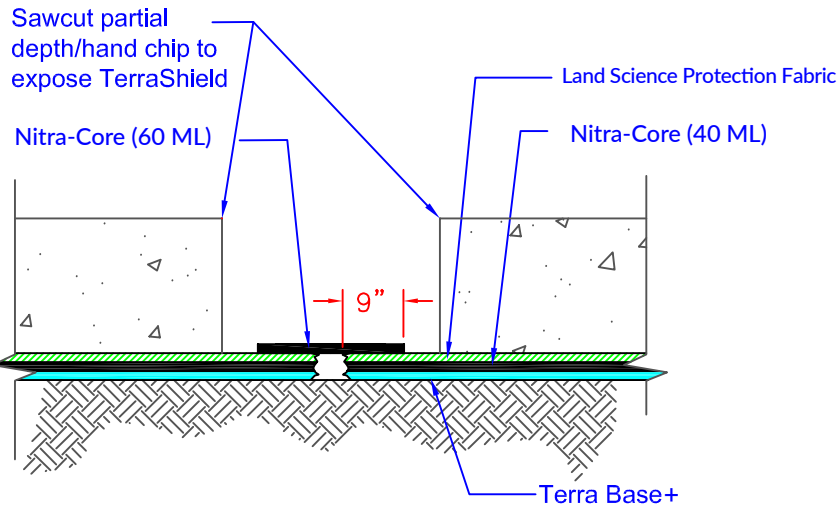
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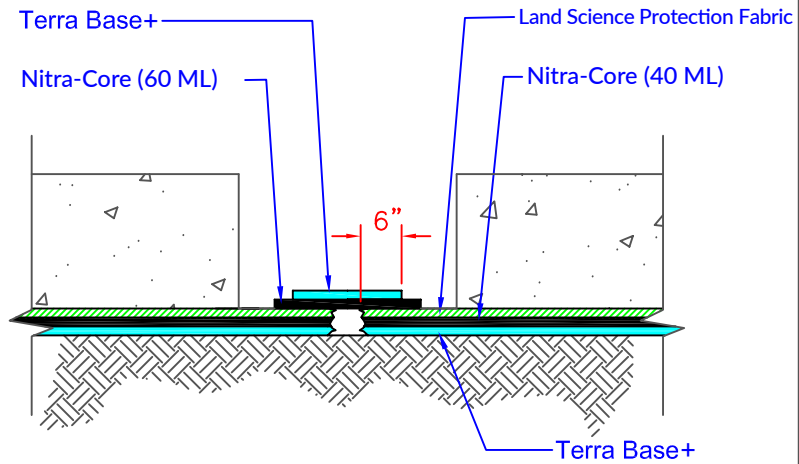


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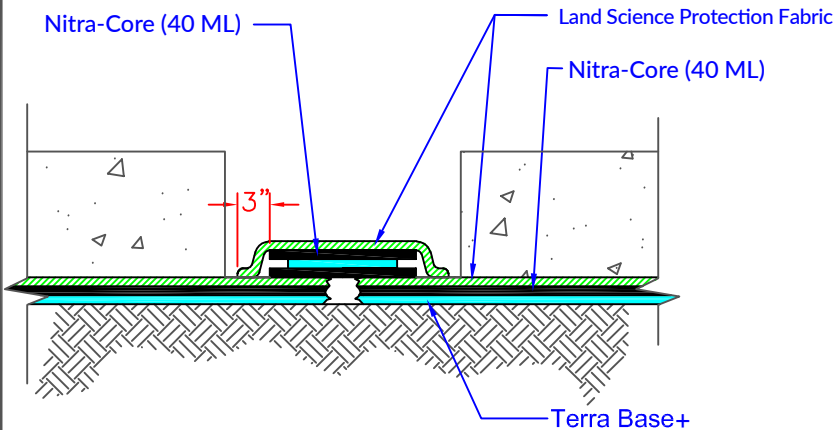
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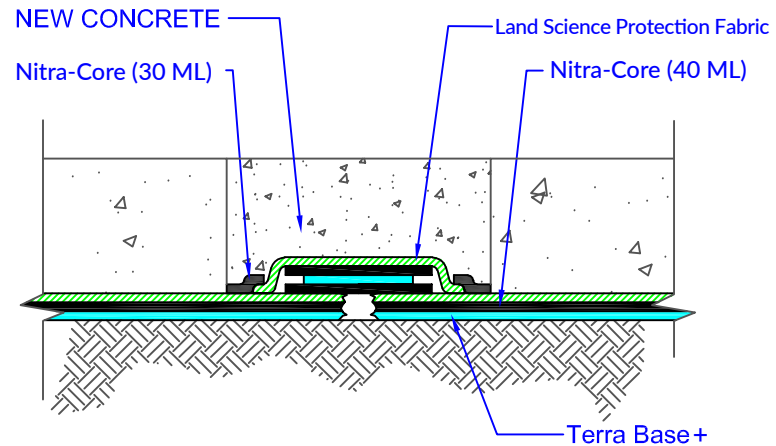
STEP 1



STEP 2



STEP 3



STEP 4



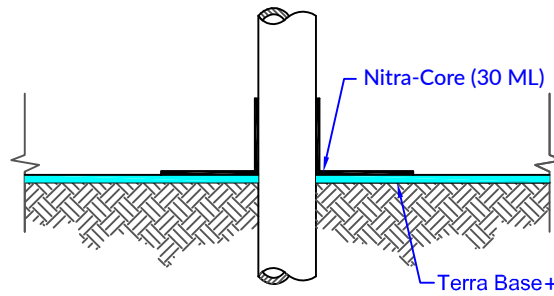
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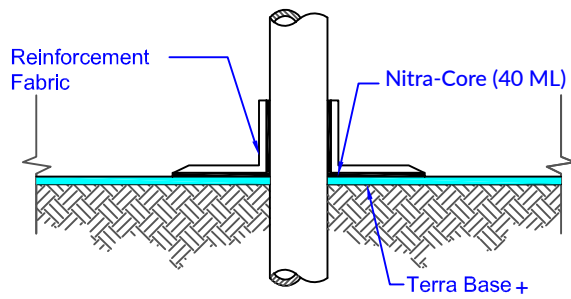


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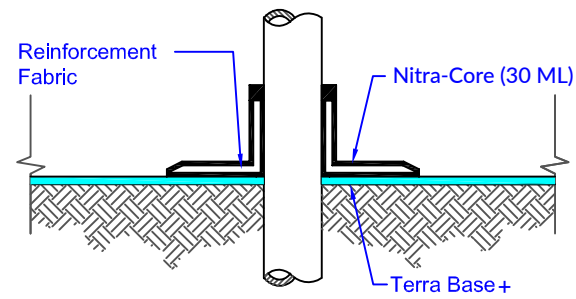
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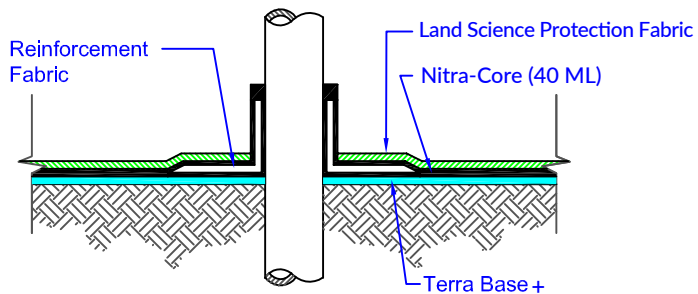
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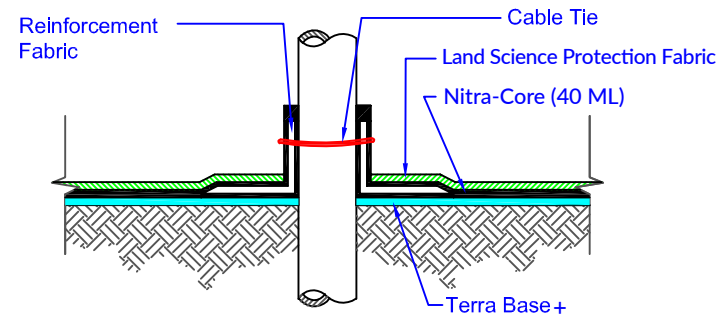
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STEP 3



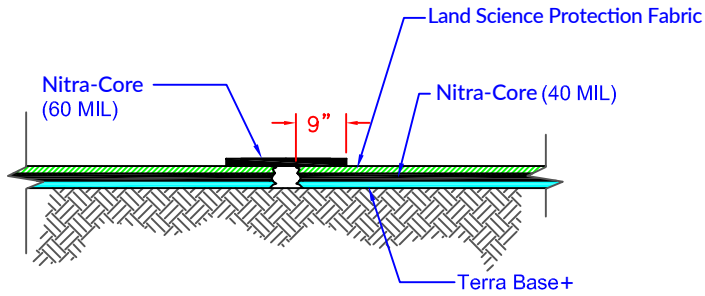
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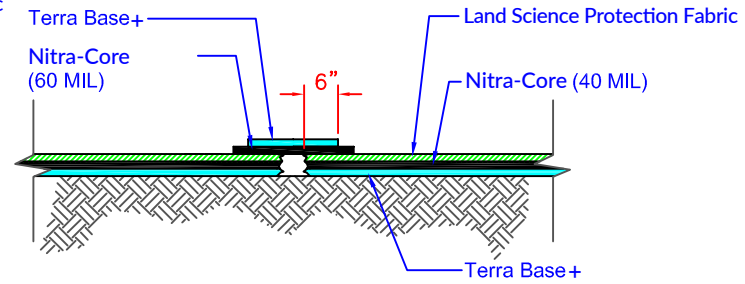
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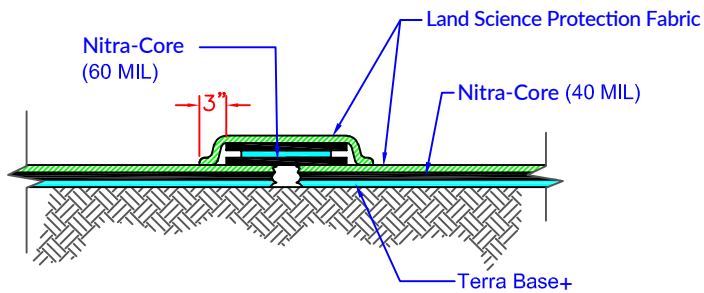
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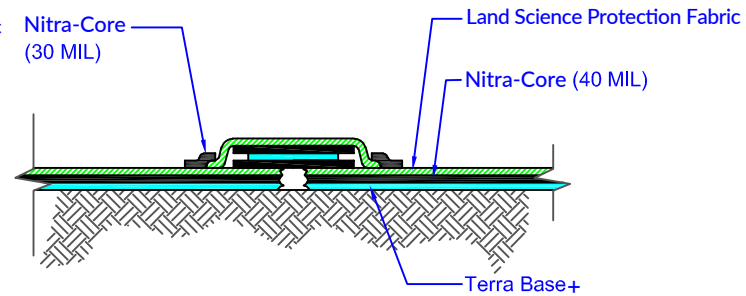
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STEP 2



STEP 3



STEP 4



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**TerraShield
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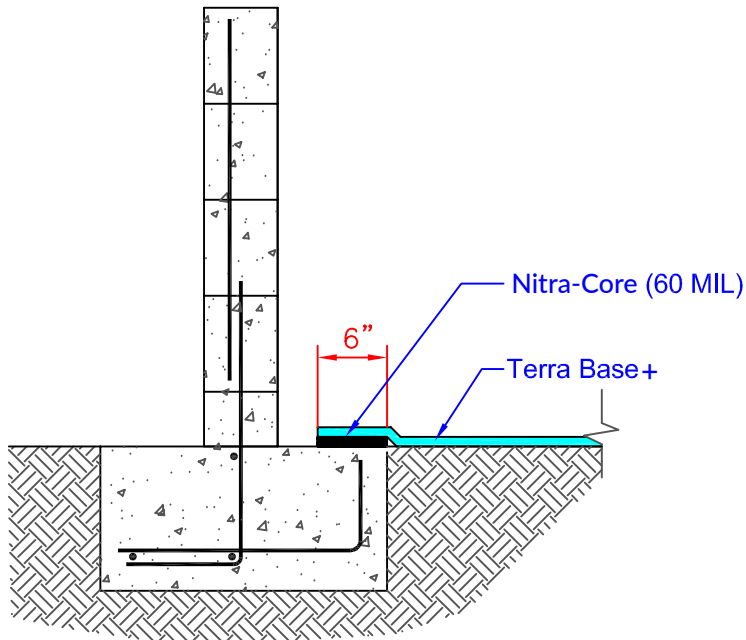
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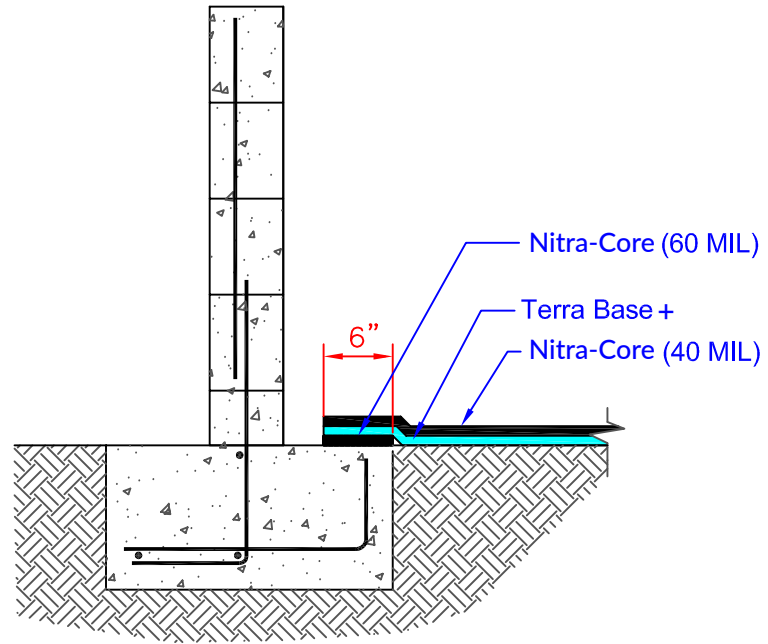


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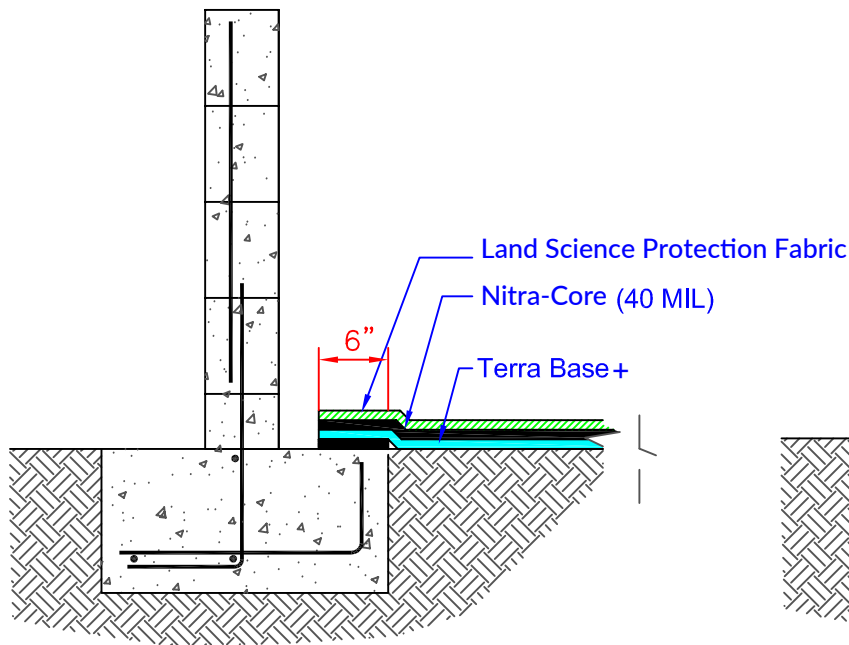
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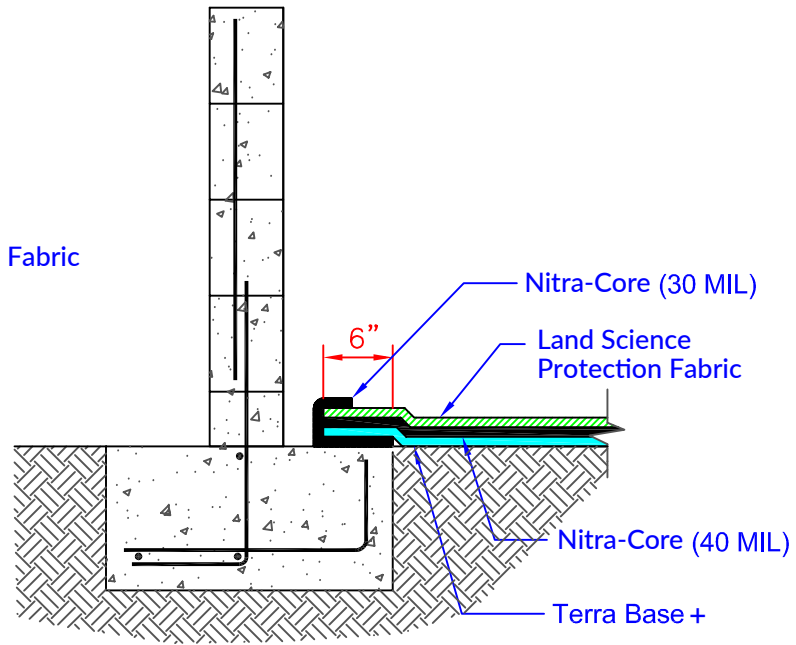
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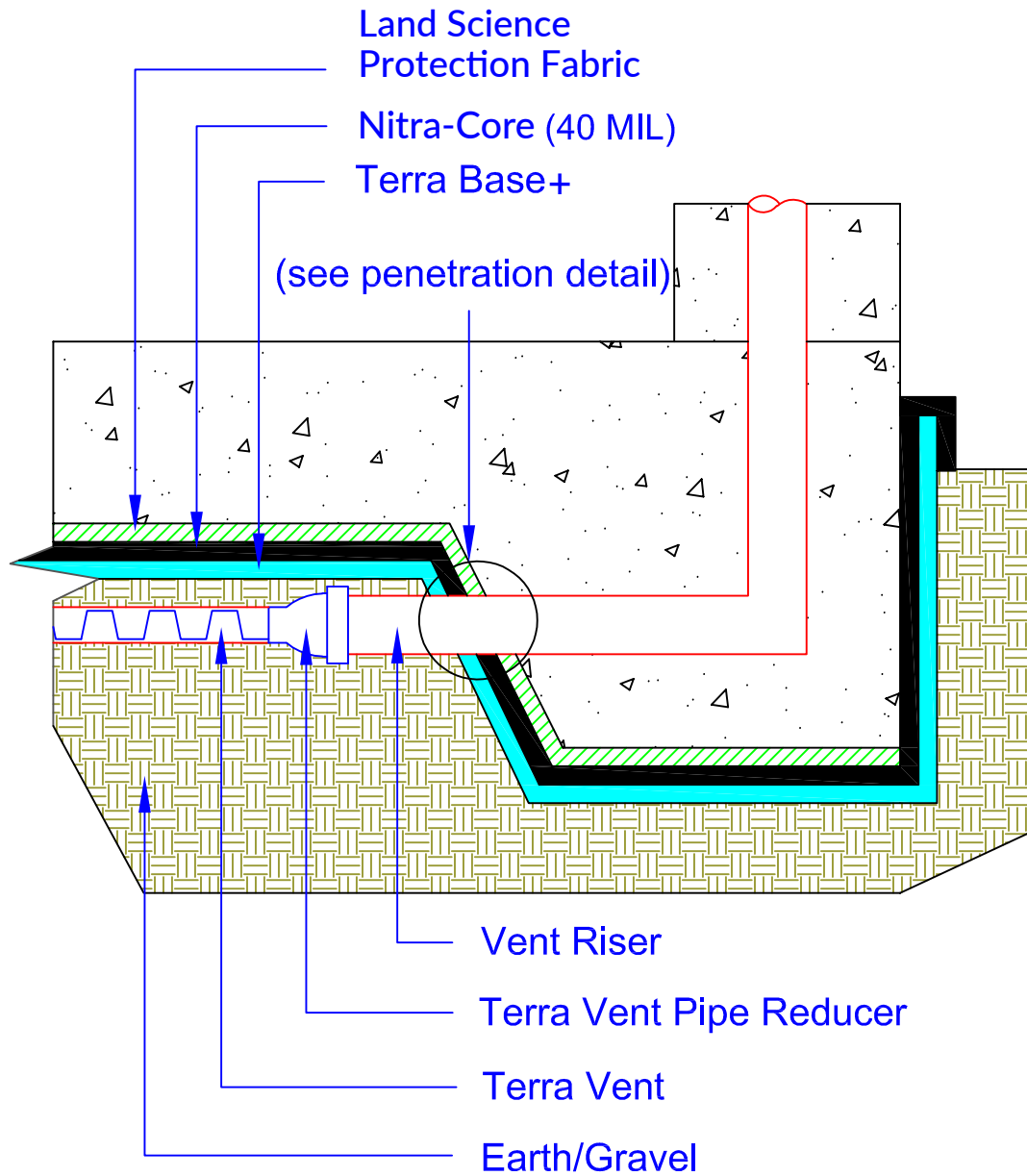
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STEP 4



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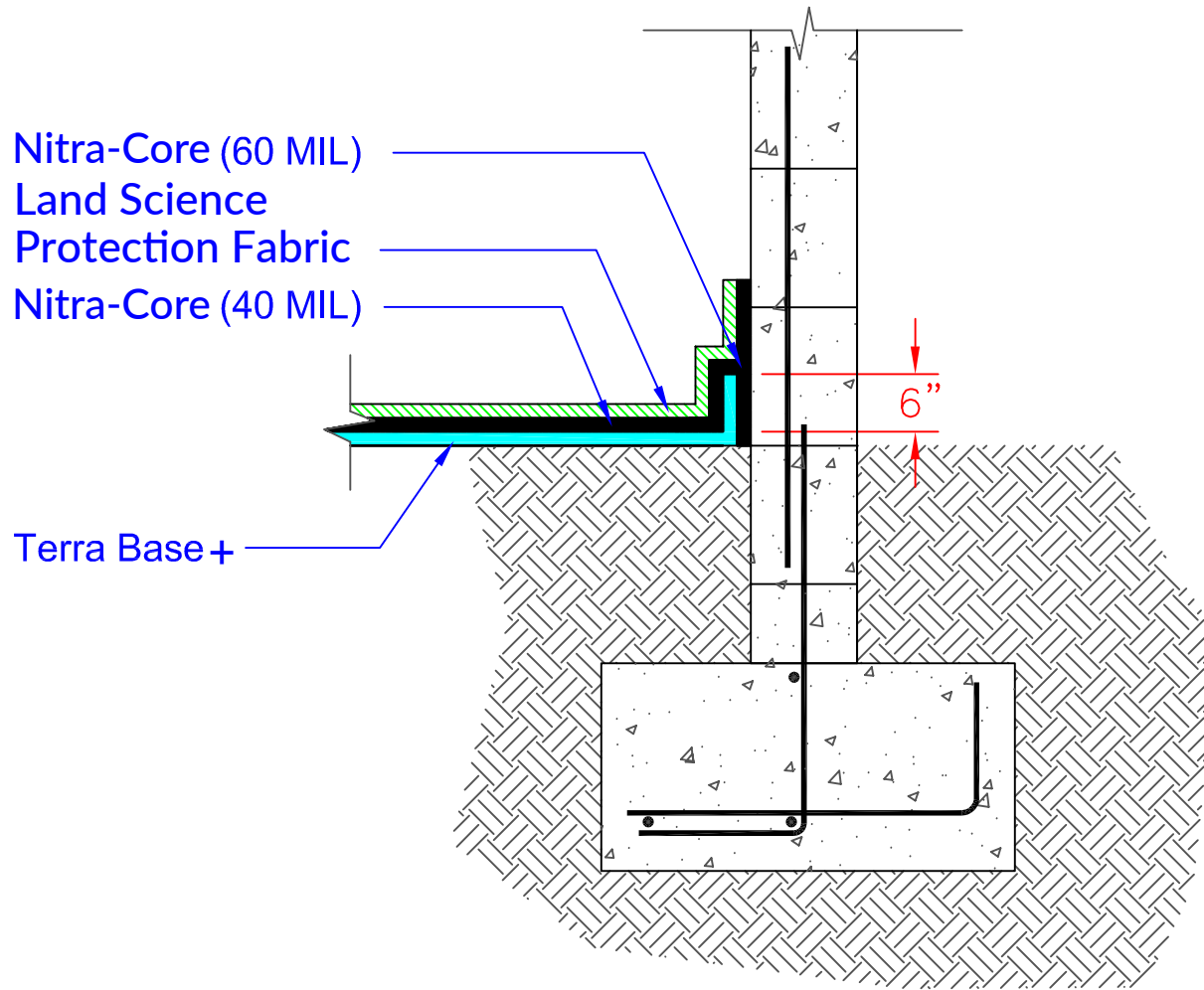
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**TerraShield &
Terra Vent
Riser**



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**TerraShield
Vertical
Termination**

Description

TerraVent™ is a low-profile, trenchless, flexible, sub-slab vapor collection system used in lieu of perforated piping. It is installed below a contaminant vapor barrier system to relieve contaminant vapor accumulation. TerraVent consists of a heavy duty three-dimensional, high flow, polypropylene dimpled core. The core is then wrapped and bonded with a non-woven geotextile to prevent soil, sand or gravel from passing into the dimple core. TerraVent core is made from 100% Post-Industrial/Pre-Consumer polypropylene regrind material.

Installation

Please refer to manufacturer specifications for all installation requirements. TerraVent is compatible with all Land Science contaminant vapor barrier systems and is installed directly below the base layer of the system.

Subgrade surface should be prepared according to project requirements. TerraVent is installed with the dimple side facing down. Auxiliary materials used with TerraVent include TerraVent End Outlets and Reinforced Fabric Tape, as well as vent risers per project specifications.



Packaging and Availability

Property	Value
Dimensions	12" x 165'
Weight	68 lbs.

Contact Land Science for authorized applicators.

TerraVent Core Properties

Property	Test Method	Typical Value
Thickness	-	1 inch
Compressive Strength	ASTM D-1621	9,500 psf.
Flow Rate (Hydraulic Gradient =0.1)	ASTM D-4716	30 gpm/ft width

TerraVent Fabric Properties

Property	Test Method	Typical Value
Grab Tensile Strength	ASTM D-4632	100 lbs.
CBR Puncture	ASTM D-6241	250 lbs.
Flow Rate (Hydraulic Gradient =0.1)	ASTM D-4491	140 gpm/ft ²
AOS	ASTM D-4751	70 U.S. Sieve
Permittivity	ASTM D-4491	2.0 sec ⁻¹
U.V. Resistance	ASTM D-4355	70% @ 500 hrs.

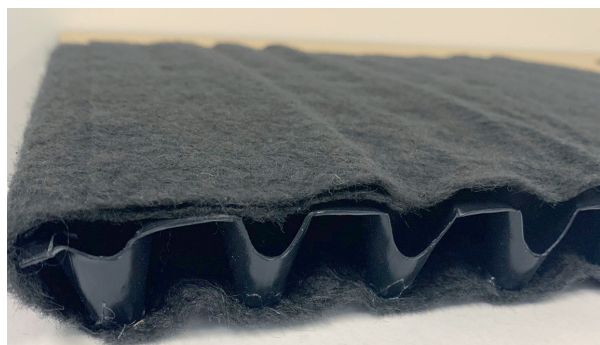


TerraVent™

SOIL GAS COLLECTION SYSTEM

Version 1.0

SECTION 02 56 19 – GAS CONTROL



TerraVent side view shown here

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

- A. This Section includes the following:
1. Substrate preparation.
 2. TerraVent™ installation.
 3. TerraVent accessories.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 2 Section “Earthwork,” “Pipe Materials,” “Sub-drainage systems,” “Gas Control System,” “Fluid-Applied gas barrier.”
 2. Division 3 Section “Cast-in-Place Concrete” for concrete placement, curing, and finishing.
 3. Division 5 Section “Expansion Joint Cover Assemblies,” for expansion-joint covers assemblies and installation.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide a gas-venting material that collects gas vapors and directs them to discharge or to collection points as specified in the gas vapor collection system drawings and complies with the physical requirements set forth by the manufacturer.



1.4 SUBMITTALS

- A. Submit product data for each type of gas venting system specified, including manufacturer's specifications.
- B. Sample – Submit representative samples of the following for approval:
 - 1. Gas-venting, TerraVent.
 - 2. TerraVent accessories.



TerraVent connection over footing

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is certified in writing and approved by vapor intrusion barrier manufacturer Land Science for the installation of the Land Science Barrier System.
- B. Manufacturer Qualification: Obtain gas-venting, vapor intrusion barrier and system components from a single manufacturer Land Science.
- C. Pre-installation Conference: A pre-installation conference shall be held prior to installation of the venting system, vapor intrusion barrier and waterproofing system to assure proper site and installation conditions, to include contractor, applicator, architect/engineer and special inspector (if any).

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site as specified by manufacturer labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for handling.
- B. Store materials as specified by the manufacturer in a clean, dry, protected location and within the temperature range required by manufacturer. Protect stored materials from direct sunlight.
- C. Remove and replace material that is damaged.



PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Land Science, San Clemente, CA. (949) 481-8118

1. TerraVent™

2.2 GAS VENT MATERIALS

A. TerraVent – TerraVent is a low profile, trenchless, flexible, sub slab vapor collection system used in lieu or in conjunction with perforated piping. TerraVent is recommended for sites with aggressive chlorinated volatile organic or petroleum vapors. Manufactured by Land Science.



TerraVent packaged for shipping

B. Vent Core Properties

Properties	Test Method	TerraVent
Compressive Strength	ASTM D-1621	9,500 psf.
Thickness		1 inch
Flow Rate (Hydraulic gradient = 0.1)	ASTM D-4716	30 gpm/ft width

TerraVent Fabric Properties

Properties	Test Method	TerraVent
Grab Tensile Strength	ASTM D-4632	100 lbs.
CBR Puncture	ASTM D-6241	250 lbs.
Flow	ASTM D-4491	140 gpm/ft ²
AOS	ASTM D-4751	70 U.S Sieve
Permittivity	ASTM D-4491	2.0 sec-1
U.V Resistance	ASTM D-4355	70% @ 500 hrs.

Packaging

Properties	Value
Dimension:	12" x 165'
Weight	68 lbs.

2.3 AUXILIARY MATERIALS

A. TerraVent End Outlet

B. Reinforced Fabric Tape.



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Tel: +1.949.366.8000



PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions under which gas vent system will be installed, with installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 SUBSTRATE PREPARATION

- A. Verify substrate is prepared according to project requirements.

3.3 PREPARATION FOR STRIP COMPOSITE

- A. Mark the layout of strip geocomposite per layout design developed by engineer.

3.4 STRIP GEOCOMPOSITE INSTALLATION

- A. Install TerraVent over substrate material where designated on drawings with the flat base of the core placed up and shall be overlapped in accordance with manufacturer's recommendations.
- B. At areas where TerraVent strips intersect cut and fold back fabric to expose the dimpled core. Arrange the strips so that the top strip interconnects into the bottom strip. Unfold fabric to cover the core and use reinforcing tape, as approved by the manufacturer, to seal the connection to prevent sand or gravel from entering the core.
- C. When crossing TerraVent over footings or grade beams, consult with the specifying environmental engineer and structural engineer for appropriate use and placement of solid pipe materials. Place solid pipe over or through concrete surface and attach a TerraVent End Outlet at both ends of the pipe before connecting the TerraVent to the pipe reducer. Seal the TerraVent to the TerraVent End Outlet using fabric reinforcement tape. Refer to TerraVent detail provided by Land Science.
- D. Place vent risers per specifying engineer's project specifications. Connect TerraVent to TerraVent End Outlet and seal with fabric reinforced tape. Use TerraVent End Outlet with the specified diameter piping as shown on system drawings.



TerraVent installed flush with subgrade

3.5 PLACEMENT OF OVERLYING AND ADJACENT MATERIALS

- A. All overlying and adjacent material shall be placed or installed using approved procedures and guidelines to prevent damage to the strip geocomposite.
- B. Equipment shall not be directly driven over and stakes or any other materials may not be driven through the strip geocomposite.

TerraVent™
SOIL GAS COLLECTION SYSTEM
Version 1.1

SECTION 02 56 19 – GAS CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Substrate preparation.
 - 2. TerraVent™ installation.
 - 3. TerraVent accessories.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 2 Section “Earthwork”, “Pipe Materials”, “Sub-drainage systems”, “Gas Control System”, “Fluid-Applied gas barrier”.
 - 2. Division 3 Section “Cast-in-Place Concrete” for concrete placement, curing, and finishing.
 - 3. Division 5 Section “Expansion Joint Cover Assemblies”, for expansion-joint covers assemblies and installation.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide a gas venting material that collects gas vapors and directs them to discharge or to collection points as specified in the gas vapor collection system drawings and complies with the physical requirements set forth by the manufacturer.

1.4 SUBMITTALS

- A. Submit Product Data for each type of gas venting system specified, including manufacturer’s specifications.
- B. Sample – Submit representative samples of the following for approval:
 - 1. Gas venting, TerraVent.
 - 2. TerraVent accessories.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who is certified in writing and approved by vapor intrusion barrier manufacturer Land Science for the installation of the TerraShield and Nitra-Seal vapor intrusion barrier system.
- B. Manufacturer Qualification: Obtain gas venting, vapor intrusion barrier and system components from a single manufacturer Land Science.
- C. Pre-installation Conference: A pre-installation conference shall be held prior to installation of the venting system, vapor intrusion barrier and waterproofing system to assure proper site and installation conditions, to include contractor, applicator, architect/engineer and special inspector (if any).

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site as specified by manufacturer labeled with manufacturer’s name, product brand name and type, date of manufacture, shelf life, and directions for handling.

- B. Store materials as specified by the manufacturer in a clean, dry, protected location and within the temperature range required by manufacturer. Protect stored materials from direct sunlight.
- C. Remove and replace material that is damaged.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- A. Land Science, San Clemente, CA. (949) 481-8118
 - 1. TerraVent™

2.2 GAS VENT MATERIALS

- A. TerraVent – TerraVent is a low profile, trenchless, flexible, sub slab vapor collection system used in lieu or in conjunction with perforated piping. TerraVent is recommended for sites with methane gas and aggressive chlorinated volatile organic or petroleum vapors. Manufactured by Land Science.
- B. TerraVent physical properties

PROPERTIES	TEST METHOD	TerraVent
Vent Core Properties		
Compressive Strength	ASTM D-1621	9,500 psf.
Thickness		1 inch
Flow Rate (Hydraulic gradient = 0.1)	ASTM D-4716	30 gpm/ft width
Vent Fabric Properties		
Grab Tensile Strength	ASTM D-4632	100 lbs.
CBR Puncture	ASTM D-6241	250 lbs.
Flow	ASTM D-4491	140 gpm/ft ²
AOS	ASTM D-4751	70 U.S Sieve
Permittivity	ASTM D-4491	2.0 sec-1
U.V Resistance	ASTM D-4355	70% @500 hrs.
Packaging:	Dimension: 12"x 165'	
	Weight: 68 lbs.	

2.3 AUXILIARY MATERIALS

- A. TerraVent End Out
- B. Reinforced Tape.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions under which gas vent system will be installed, with installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 SUBSTRATE PREPARATION

- A. Verify substrate is prepared according to project requirements.

3.3 PREPARATION FOR STRIP COMPOSITE

- A. Mark the layout of strip geocomposite per layout design developed by engineer.

3.4 STRIP GEOCOMPOSITE INSTALLATION

- A. Install TerraVent over substrate material where designated on drawings with the flat base of the core placed up and shall be overlapped in accordance with manufacturer's recommendations.
- B. At areas where TerraVent strips intersect cut and fold back fabric to expose the dimpled core. Arrange the strips so that the top strip interconnects into the bottom strip. Unfold fabric to cover the core and use reinforcing tape, as approved by the manufacturer, to seal the connection to prevent sand or gravel from entering the core.
- C. When crossing TerraVent over footings or grade beams, **consult with the specifying environmental engineer and structural engineer for appropriate use and placement of solid pipe materials.** Place solid pipe over or through concrete surface and attach a TerraVent End Out at both ends of the pipe before connecting the TerraVent to the pipe reducer. Seal the TerraVent to the TerraVent End Out using fabric reinforcement tape. Refer to TerraVent detail provided by Land Science.
- D. Place vent risers per specifying engineer's project specifications. Connect TerraVent to TerraVent End Out and seal with fabric reinforced tape. Use TerraVent End Out with the specified diameter piping as shown on system drawings.

3.5 PLACEMENT OF OVERLYING AND ADJACENT MATERIALS

- A. All overlying and adjacent material shall be placed or installed using approved procedures and guidelines to prevent damage to the strip geocomposite.
- B. Equipment shall not be directly driven over and stakes or any other materials may not be driven through the strip geocomposite.

Description

Nitra-Core™ is a patent-pending, spray-applied nitrile-modified asphalt used in all of Land Science's contaminant vapor barrier systems to seal seams, penetrations, and perimeter terminations. For some systems, it is also sprayed across the entirety of the base layer, providing a seamless, monolithic layer in the barrier system for added strength and chemical resistance. The use of nitrile latex in the asphalt formulation provides up to 10x more protection against vapor contaminants than other polymer-modified asphalts available. Nitra-Core allows for fast installation of barriers, relative to taped seam systems, and has exceptional bonding to a wide variety of substrates and uneven surfaces. The Nitra-Core formulation requires only soap and water for daily cleaning of equipment.



Installation

Please refer to manufacturer specifications for all installation requirements. Nitra-Core drums or totes must be mechanically stirred prior to use.

Nitra-Core must be sprayed to the specified mil thickness of the vapor system seams and monolithic layer, if applicable.

Any ponding water, dirt, or debris on the surface of a base layer needs to be removed prior to applying Nitra-Core. Nitra-Core should be sprayed at temperatures >45°F. Contact your Land Science representative for requirements in colder temperatures. The curing time for Nitra-Core typically takes 12-24 hours and will depend on weather conditions.

Shelf Life and Storage

Nitra-Core has a 6 month shelf life. Product must not be allowed to freeze. Store in the original, closed container at temperatures between 40°F and 95°F, and out of direct sunlight.

Packaging and Availability

Property	Value
Drums	55 gallons
Totes	275 gallons

Contact Land Science for a list of certified applicators.

Nitra-Core Properties

Property	Test Method	Typical Value
Color	-	Brown or Black
Shelf Life	-	6 Months
Viscosity	ASTM D2196	<200 cps
Solvent Content	EPA 8260	None
Specific Gravity	ASTM D6937	1.0
Residue Content	ASTM D6934	55-60%
Demulsibility	ASTM D6936	35-40%
pH	-	8-11

Mirafi[®] 140N



Mirafi[®] 140N is a nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi[®] 140N is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Mirafi[®] 140N meets AASHTO M288-15 Class 3 for Elongation > 50%.

TenCate Geosynthetics Americas Laboratories are accredited by Geosynthetic Accreditation Institute – Laboratory Accreditation Program ([GAI-LAP](#)). [NTPEP Listed](#)

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	lbs (N)	120 (534)	120 (534)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	lbs (N)	50 (223)	50 (223)
CBR Puncture Strength	ASTM D6241	lbs (N)	310 (1380)	
			Maximum Opening Size	
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	70 (0.212)	
			Minimum Roll Value	
Permittivity	ASTM D4491	sec ⁻¹	1.7	
Flow Rate	ASTM D4491	gal/min/ft ² (l/min/m ²)	135 (5500)	
			Minimum Test Value	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70	

Physical Properties	Unit	Roll Sizes	
Roll Dimensions (width x length)	ft (m)	12.5 x 360 (3.8 x 110)	15 x 360 (4.5 x 110)
Roll Area	yd ² (m ²)	500 (418)	600 (502)

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FGS000385
FTQR77



APPENDIX 8
LANDSCAPE AND IRRIGATION PLAN

HARDSCAPE, LANDSCAPE, IRRIGATION, AND LIGHTING PLANS
 FOR
KIRKWOOD CROSSING - MULTIFAMILY
 12000 BISSONNET
 HOUSTON, TEXAS 77099

	75% CONSTRUCTION PACKAGE (ISSUE DATE - 9/15/2023)	Drawings Issued				
GENERAL						
L0.00	SHEET INDEX	●				
L0.01	GENERAL NOTES & SYMBOLS	●				
L0.02	MATERIALS LEGEND	●				
L0.03	KEY MAP	●				
HARDSCAPE						
L1.00	OVERALL HARDSCAPE PLAN	●				
L1.01	AMENITY HARDSCAPE PLAN (1 OF 2)	●				
L1.02	DOG PARK HARDSCAPE PLAN (2 OF 2)	●				
DIMENSION CONTROL						
L2.01	AMENITY DIMENSION CONTROL PLAN (1 OF 2)	●				
L2.02	DOG PARK DIMENSION CONTROL PLAN (2 OF 2)	●				
GRADING AND DRAINAGE						
L3.01	GRADING AND DRAINAGE (1 OF 2)	●				
L3.02	GRADING AND DRAINAGE (2 OF 2)	●				
HARDSCAPE DETAILS						
L4.01	HARDSCAPE DETAILS	●				
L4.02	HARDSCAPE DETAILS	●				
L4.03	HARDSCAPE DETAILS	●				
PLANTING						
L5.01	AMENITY PLANTING PLAN (1 OF 2)	●				
L5.02	DOG PARK PLANTING PLAN (2 OF 2)	●				
L5.03	PLANTING PLAN (1 OF 4)	●				
L5.04	PLANTING PLAN (2 OF 4)	●				
L5.05	PLANTING PLAN (3 OF 4)	●				
L5.06	PLANTING PLAN (4 OF 4)	●				
L5.07	LANDSCAPE CODE AND SCHEDULE	●				
L5.08	LANDSCAPE DETAILS	●				
L5.09	LANDSCAPE SPECIFICATIONS	●				
IRRIGATION						
L6.01	AMENITY IRRIGATION PLAN (1 OF 2)					
L6.02	DOG PARK IRRIGATION PLAN (2 OF 2)					
L6.03	IRRIGATION PLAN (1 OF 4)					
L6.04	IRRIGATION PLAN (2 OF 4)					
L6.05	IRRIGATION PLAN (3 OF 4)					
L6.06	IRRIGATION PLAN (4 OF 4)					
L6.07	IRRIGATION DETAILS					
L6.08	IRRIGATION SPECIFICATIONS					
SCHEMATIC LIGHTING						
L7.01	SCHEMATIC LIGHTING PLAN (1 OF 2)	●				
L7.02	SCHEMATIC LIGHTING PLAN (2 OF 2)	●				

Plotted By: Harris, Sam Sheet Set: Khs Layout: L0.00 September 15, 2023 01:28:45pm K:\HOU_Civil\08472001\12000 Bissonnet Street\Landscapes Architecture\Production\CAD\Sheets\L0.00 SHEET INDEX.dwg
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 P.L.A. SHANNON E. MURPHY
 L.A. No. 3543 Date: SEP. 2023

KHA PROJECT	068524000
DATE	SEPTEMBER 2023
SCALE	AS SHOWN
DESIGNED BY	SJH
DRAWN BY	SJH
CHECKED BY	SEM

SHEET INDEX

STARWOOD TRACT
 PREPARED FOR
**IMPACT RESIDENTIAL
 DEVELOPMENT, LLC.**
 HOUSTON TEXAS

SHEET NUMBER
L0.00

Plotted By: Harris, Sam Sheet Set: Khs Layout: L0.01 GENERAL NOTES & SYMBOLS September 15, 2023 01:10:58pm K:\HOU_Civil\064572001-12000 Bissonnet Street\Landscaping\Architecture\Production\CAD\Sheets\L0.01 MATERIALS LEGEND.dwg

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GENERAL NOTES:

- WRITTEN DIMENSIONS PREVAIL OVER SCALED DIMENSIONS. NOTIFY LANDSCAPE ARCHITECT OF ANY DISCREPANCIES.
- THE CONTRACTOR BEARS ALL RESPONSIBILITY FOR VERIFYING ALL UNDERGROUND UTILITIES, PIPES, STRUCTURES, AND LINE RUNS IN THE FIELD PRIOR TO CONSTRUCTION. ANY DAMAGE TO UTILITIES THAT ARE TO REMAIN SHALL BE REPAIRED IMMEDIATELY AT NO EXPENSE TO THE OWNER. LANDSCAPE ARCHITECT ASSUMES NO RESPONSIBILITY FOR ANY NOT SHOWN ON PLANS.
- ALL PROPOSED AND FINISHED GRADES ARE BASED ON INFORMATION PROVIDED BY THE OWNER'S SURVEY AND/OR CIVIL ENGINEER. ANY DISCREPANCIES IN ACTUAL FIELD MEASUREMENTS ARE TO BE REPORTED TO THE LANDSCAPE ARCHITECT IMMEDIATELY. SEE CIVIL PLANS FOR GRADING ASSOCIATED WITH LANDSCAPE IMPROVEMENTS.
- PRIOR TO COMMENCEMENT OF HARDSCAPE CONSTRUCTION, ALL PIERS, FOOTINGS, AND WALLS ARE TO BE SURVEYED, LAID OUT, AND STAKED IN FIELD FOR REVIEW BY LANDSCAPE ARCHITECT. CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR ANY DEMOLITION, ADJUSTMENTS, OR RECONSTRUCTION RESULTING FROM UNAUTHORIZED CONSTRUCTION ACTIVITIES.
- CONTRACTOR IS RESPONSIBLE FOR ALL QUANTITIES PER DRAWINGS AND SPECIFICATIONS. ANY QUANTITIES PROVIDED BY LANDSCAPE ARCHITECT ARE PROVIDED FOR CONVENIENCE ONLY. CONTRACTORS ARE TO BID THEIR OWN VERIFIED QUANTITIES. NOTIFY LANDSCAPE ARCHITECT OF ANY DISCREPANCIES.
- EASEMENTS SETBACKS, BUILDING, CURB AND GUTTER, UNDERGROUND UTILITIES HAVE BEEN SUPPLIED TO LANDSCAPE ARCHITECT BY THE PROJECT CIVIL ENGINEER. REFER TO CIVIL ENGINEERS DRAWINGS FOR ADDITIONAL INFORMATION.

IRRIGATION NOTES:

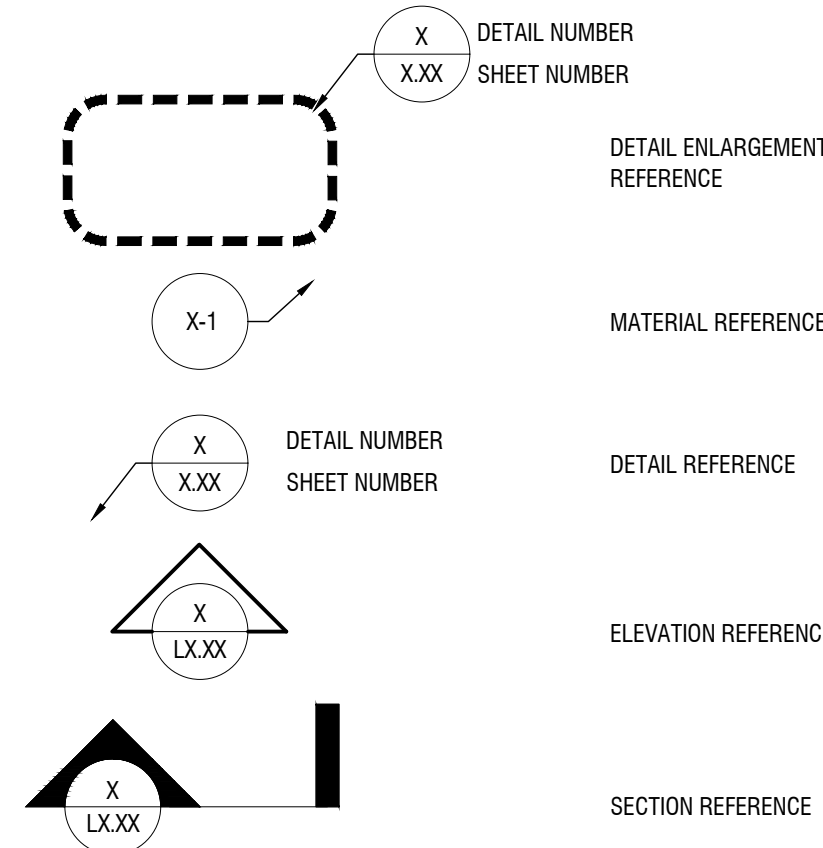
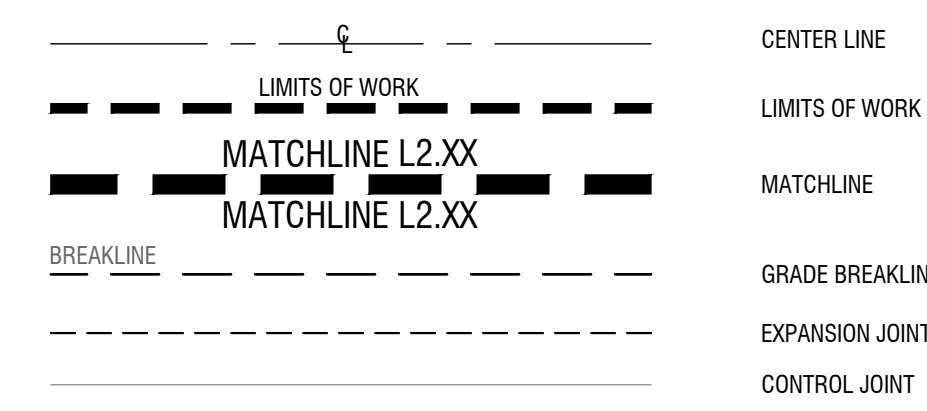
- AN AUTOMATIC IRRIGATION SYSTEM SHALL BE PROVIDED FOR ALL PLANTING AREAS. OVER SPRAY ON STREETS AND WALKS IS PROHIBITED.
- IRRIGATION SYSTEMS SHALL BE MAINTAINED AND REPLACED AS NECESSARY.
- ALL PLANTING AREAS TO BE FULLY IRRIGATED.
- IRRIGATION SYSTEM TO HAVE A FULLY AUTOMATED CONTROL SYSTEM.
- ANY EXISTING PLANTING DAMAGED DURING CONSTRUCTION IS TO BE REPLACED AT NO COST TO THE OWNER.
- IF THE EXISTING IRRIGATION SYSTEM IS DAMAGED OR TURNED OFF DURING CONSTRUCTION ACTIVITIES, IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO HAND WATER ALL PLANT MATERIAL AS NEEDED.
- ALL IRRIGATION LINES TO BE DOUBLE-CONTAINED AS SHOWN ON CIVIL SHEETS IN DETAIL B6 SHEET C8-4. ALL NON-WATER BEARING COMPONENTS DO NOT REQUIRE DOUBLE-CONTAINMENT.

PLANTING NOTES:

- LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL UNDERGROUND UTILITIES, PIPES, STRUCTURES, AND LINE RUNS IN THE FIELD PRIOR TO THE INSTALLATION OF ANY PLANT MATERIAL.
- IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ADVISE THE LANDSCAPE ARCHITECT OF ANY CONDITION FOUND ON THE SITE WHICH PROHIBITS INSTALLATION AS SHOWN ON THESE DRAWINGS.
- ALL PLANT MATERIAL SHALL BE MAINTAINED IN A HEALTHY AND GROWING CONDITION AND MUST BE REPLACED WITH PLANT MATERIAL OF SAME VARIETY AND SIZE IF DAMAGED, DESTROYED, OR REMOVED.
- LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR FINE GRADING AND REMOVAL OF DEBRIS PRIOR TO PLANTING IN ALL AREAS.
- FINAL FINISH GRADING SHALL BE REVIEWED BY THE LANDSCAPE ARCHITECT. LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY ADDITIONAL TOPSOIL REQUIRED TO CREATE A SMOOTH CONDITION PRIOR TO PLANTING.
- ALL PLANT QUANTITIES LISTED ARE FOR INFORMATION ONLY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE FULL COVERAGE IN ALL PLANTING AREAS AS SPECIFIED IN THE PLANT SCHEDULE AND VERIFY ALL QUANTITIES.
- LANDSCAPE CONTRACTOR TO PROVIDE STEEL EDGING (REFER TO MATERIALS PAGE) BETWEEN ALL PLANTING BEDS AND LAWN AREAS.
- ALL PLANT MATERIAL SHALL CONFORM TO THE SPECIFICATIONS AND SIZES GIVEN IN THE PLANT LIST AND SHALL BE NURSERY GROWN IN ACCORDANCE WITH THE AMERICAN STANDARD FOR NURSERY STOCK. LATEST EDITION AMERICAN ASSOCIATION OF NURSERYMEN STANDARDS. ANY PLANT SUBSTITUTION SHALL BE APPROVED BY LANDSCAPE ARCHITECT PRIOR TO PURCHASE.
- LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR ANY COORDINATION WITH OTHER CONTRACTORS ON SITE AS REQUIRED TO ACCOMPLISH ALL PLANTING OPERATIONS.
- ALL NEW PLANTING AREAS TO BE AMENDED PER SPECIFICATIONS.
- ANY PLANT MATERIAL THAT DOES NOT SURVIVE SHALL BE REPLACED WITH AN EQUIVALENT SIZE AND SPECIES WITHIN THIRTY (30) DAYS.
- PLANT MATERIAL SHALL BE PRUNED AS NECESSARY TO CONTROL SIZE BUT NOT TO DISRUPT THE NATURAL GROWTH PATTERN OR CHARACTERISTIC FORM OF THE PLANT EXCEPT AS NECESSARY TO ACHIEVE HEIGHT CLEARANCE FOR VISIBILITY AND PEDESTRIAN PASSAGE OR TO ACHIEVE A CONTINUOUS OPAQUE HEDGE IF REQUIRED.
- LANDSCAPED AREAS SHALL BE KEPT FREE OF TRASH, WEEDS, DEBRIS, AND DEAD PLANT MATERIAL.
- ALL LIME STABILIZED SOIL & INORGANIC SELECT FILL FOR BUILDING SHOULD BE REMOVED FROM PLANTING AREAS TO A DEPTH OF 24" & REPLACED WITH ORGANIC IMPORTED TOPSOIL FILL.
- ALL TREES OVERHANGING PEDESTRIAN SIDEWALK TO BE PRUNED TO 7' FOR ADA CLEARANCE. ALL TREES OVERHANGING FIRELANE TO BE PRUNED TO 14' CLEAR.

SYMBOLS LEGEND:

GENERAL



ABBREVIATIONS

	735.46	PROPOSED SPOT GRADE
	ME	EXISTING SPOT GRADE
TW		TOP OF WALL
BW		BOTTOM OF WALL
TF		TOP OF FOOTING
COL		TOP OF COLUMN
TS		TOP STEP
BS		BOTTOM STEP
TR		TOP OF RAMP
BR		BOTTOM OF RAMP
TC		TOP OF CURB
BC		BOTTOM OF CURB
TB		TOP OF BAND
TP		TOP OF PAVEMENT
TGr		TOP OF GRAVEL
TG		TOP OF GRADE
FL		FLOWLINE/INVERT ELEVATION
EJ		EXPANSION JOINT
CJ		CONTROL JOINT
CL		CENTER LINE
POB		POINT OF BEGINNING
FG		FINISH GRADE

KHA PROJECT	DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY
068924000	SEPTEMBER 2023	AS SHOWN	SJH	SJH	SEM

GENERAL NOTES & SYMBOLS

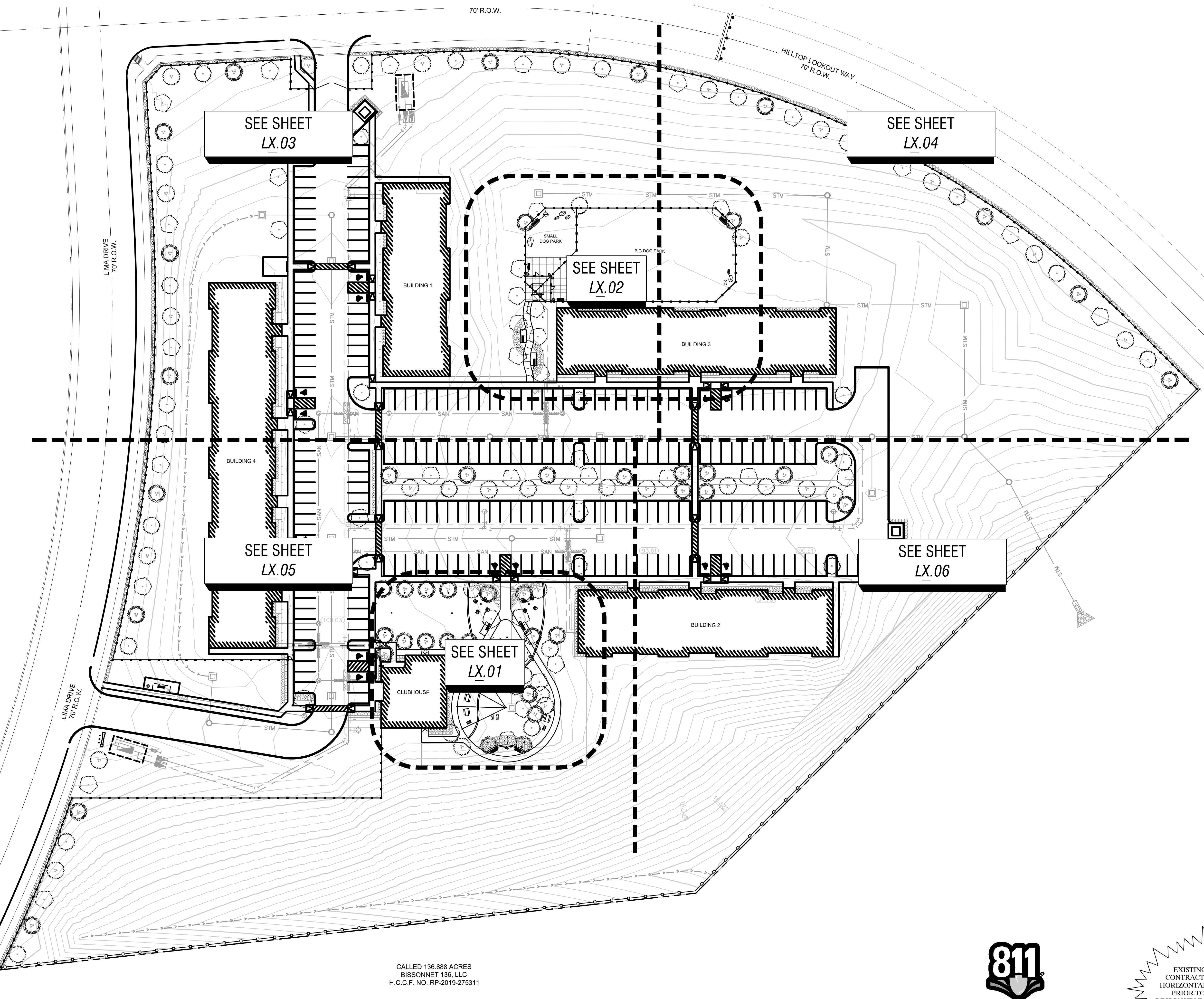
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IMPACT RESIDENTIAL
DEVELOPMENT, LLC.
HOUSTON TEXAS

SHEET NUMBER
L0.01

No.	REVISIONS	DATE	BY

Plotted By: Harris, Sam Sheet: Starwood Layout.L0.03 KEYMAP September 15, 2023 01:12:24pm K:\HOU_Civil\06472001-12000_Blossomed Street\Landscapes\Architecture\Production\CAD\Sheet\L0.1 HARDSCAPE PLAN AND LAYOUT.dwg
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 NO. RP-2019-275311



CALLED 136.888 ACRES
 BISSONNET 136, LLC
 H.C.C.F. NO. RP-2019-275311



CAUTION!!
 EXISTING UNDERGROUND UTILITIES IN THE AREA
 CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE
 HORIZONTAL AND VERTICAL LOCATION OF ALL UTILITIES
 PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE
 RESPONSIBLE FOR ANY REPAIRS TO EXISTING UTILITIES DUE
 TO DAMAGE INCURRED DURING CONSTRUCTION.
 CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY
 DISCREPANCIES ON THE PLANS.

No.	REVISIONS	DATE	BY

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 P.L.A. SHANNON E. MUNDY
 L.A. No. 3543 Date: SEP. 2023

KHA PROJECT 068924000	DATE SEPTEMBER 2023	SCALE AS SHOWN	DESIGNED BY S.J.H.	DRAWN BY S.J.H.	CHECKED BY SEM
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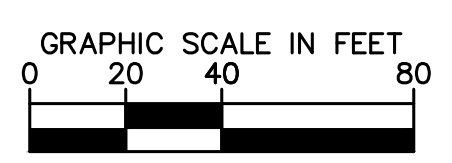
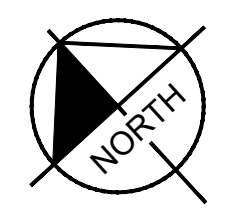
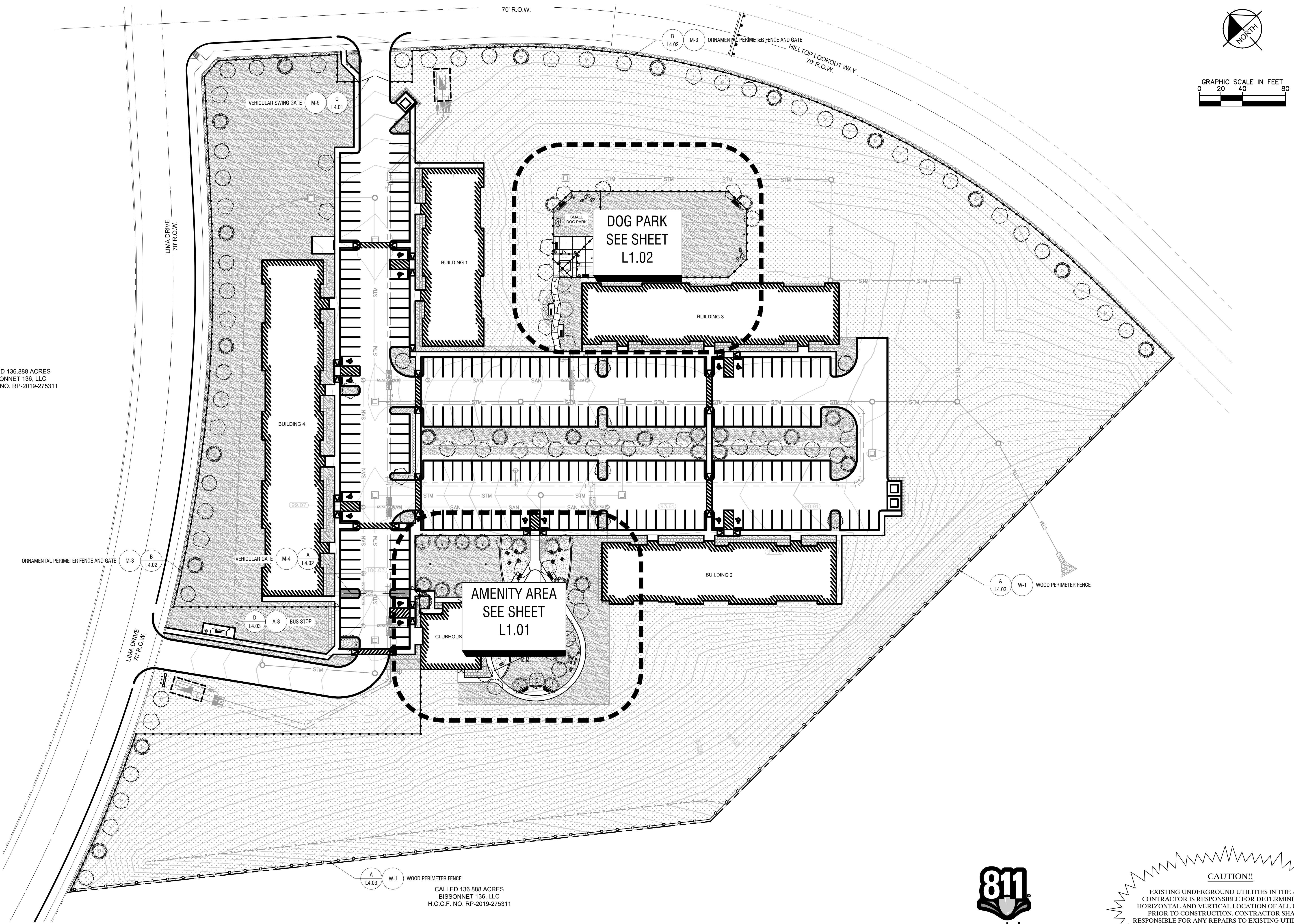
KEYMAP

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SHEET NUMBER
L0.03

Plotted By: Harris, Sam Sheet Set: Rhs Layout: L1.00 OVERALL HARDSCAPE PLAN September 15, 2023 01:12:50pm K:\HQ\ Civil\084572001-12000 Bissonnet Street\Landscapes Architecture\Production\CAD\Sheets\L1.01 HARDSCAPE PLAN AND LAYOUT.dwg
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 ONNET 136, LLC
 NO. RP-2019-275311



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 L.A. No. 3543, Date: SEP. 2023

KHA PROJECT	DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY
068924000	SEPTEMBER 2023	AS SHOWN	SJH	SJH	SEM

**OVERALL
 HARDSCAPE
 PLAN**

STARWOOD TRACT
 PREPARED FOR
 IMPACT RESIDENTIAL
 DEVELOPMENT, LLC.

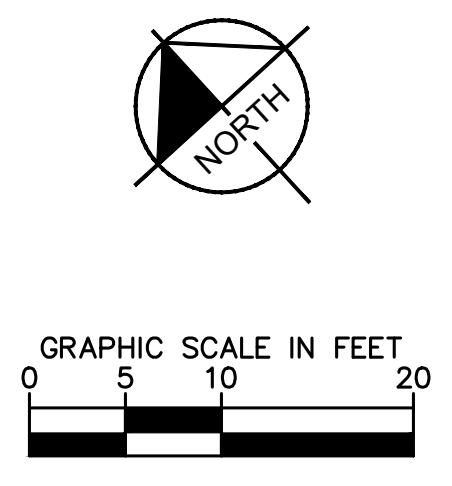
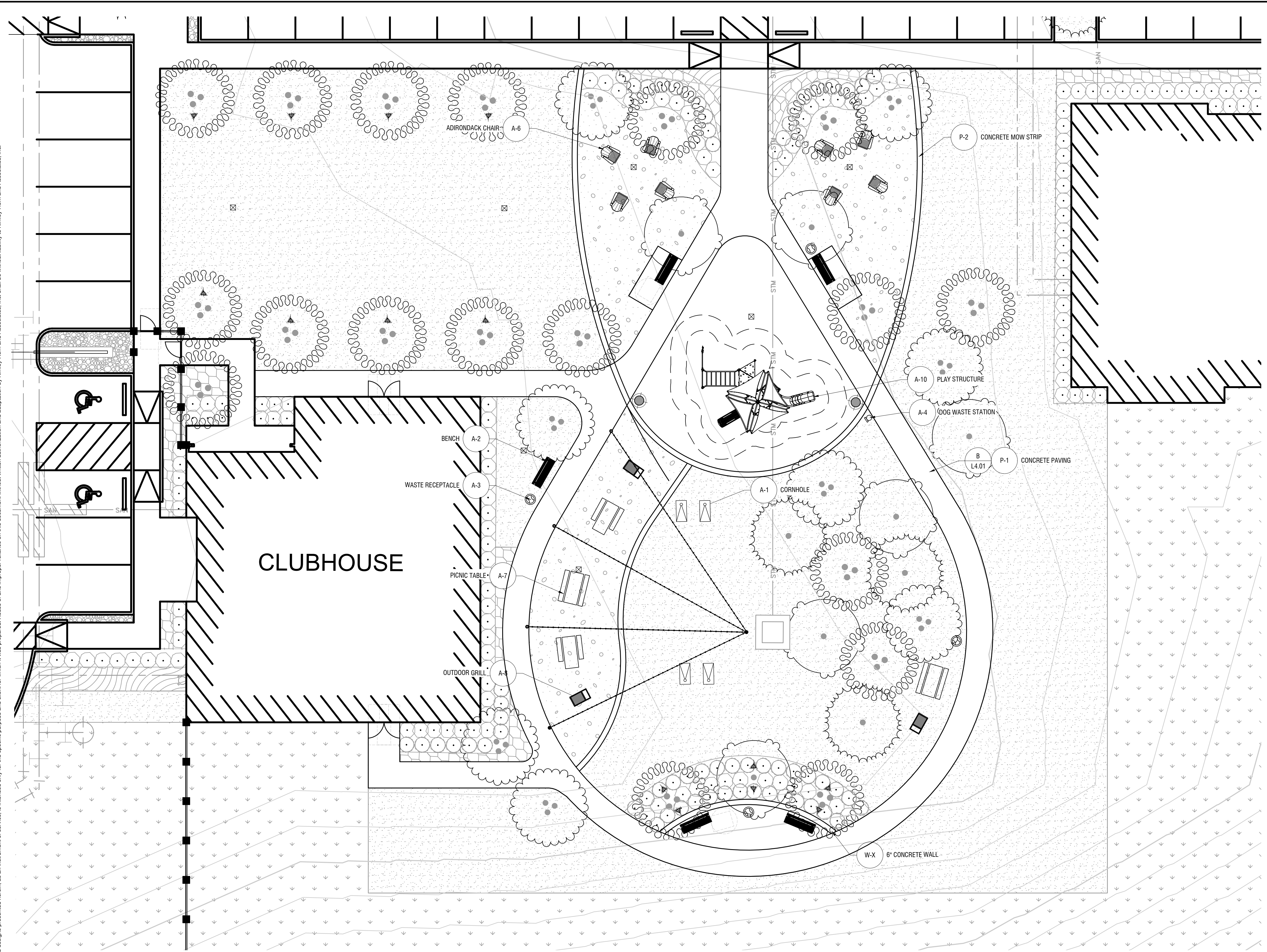
HOUSTON TEXAS
 SHEET NUMBER
L1.00



Know what's below.
 Call before you dig.

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Plotted By: Harris, Sam Sheet Set: KHA Layout: L1.01 AMENITY HARDSCAPE PLAN (1 OF 2) September 15, 2023 01:13:13pm K:\HOU_Civil\064872001\2000 Blisomed Street\Landscapes\Architecture\Production\CAD\SheetSet\L1.01 HARDSCAPE PLAN AND LAYOUT.dwg
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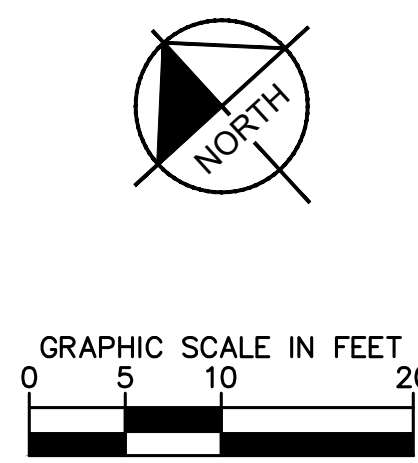
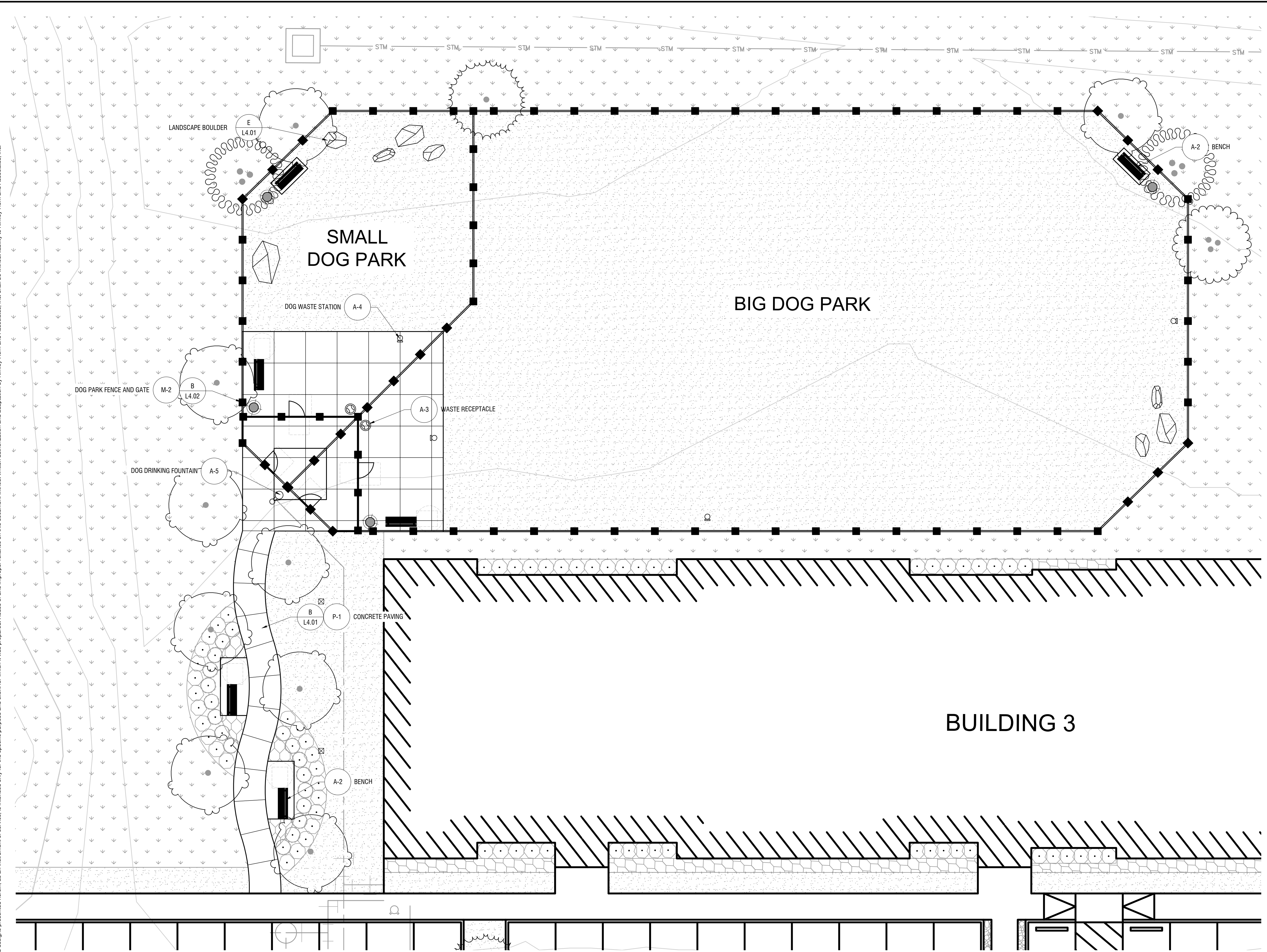
KHA PROJECT	DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY
068924000	SEPTEMBER 2023	AS SHOWN	SJH	SJH	SEM

**AMENITY
 HARDSCAPE
 PLAN (1 OF 2)**

STARWOOD TRACT
 PREPARED FOR
**IMPACT RESIDENTIAL
 DEVELOPMENT, LLC.**
 HOUSTON TEXAS

SHEET NUMBER
L1.01

Plotted By: Harris, Sam Sheet Set: KHA Layout: L1.02 DOG PARK HARDSCAPE PLAN (2 OF 2) September 15, 2023 01:13:33pm K:\HOU_Civil\06457201-1\2000 Bissonet Street\Landscapa Architecture\Production\CAD\Sheets\L1.01 HARDSCAPE PLAN AND LAYOUT.dwg
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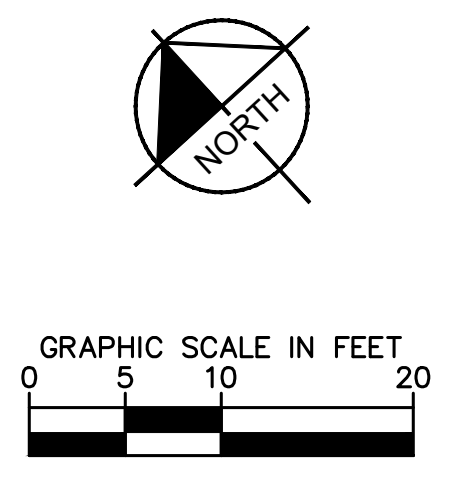
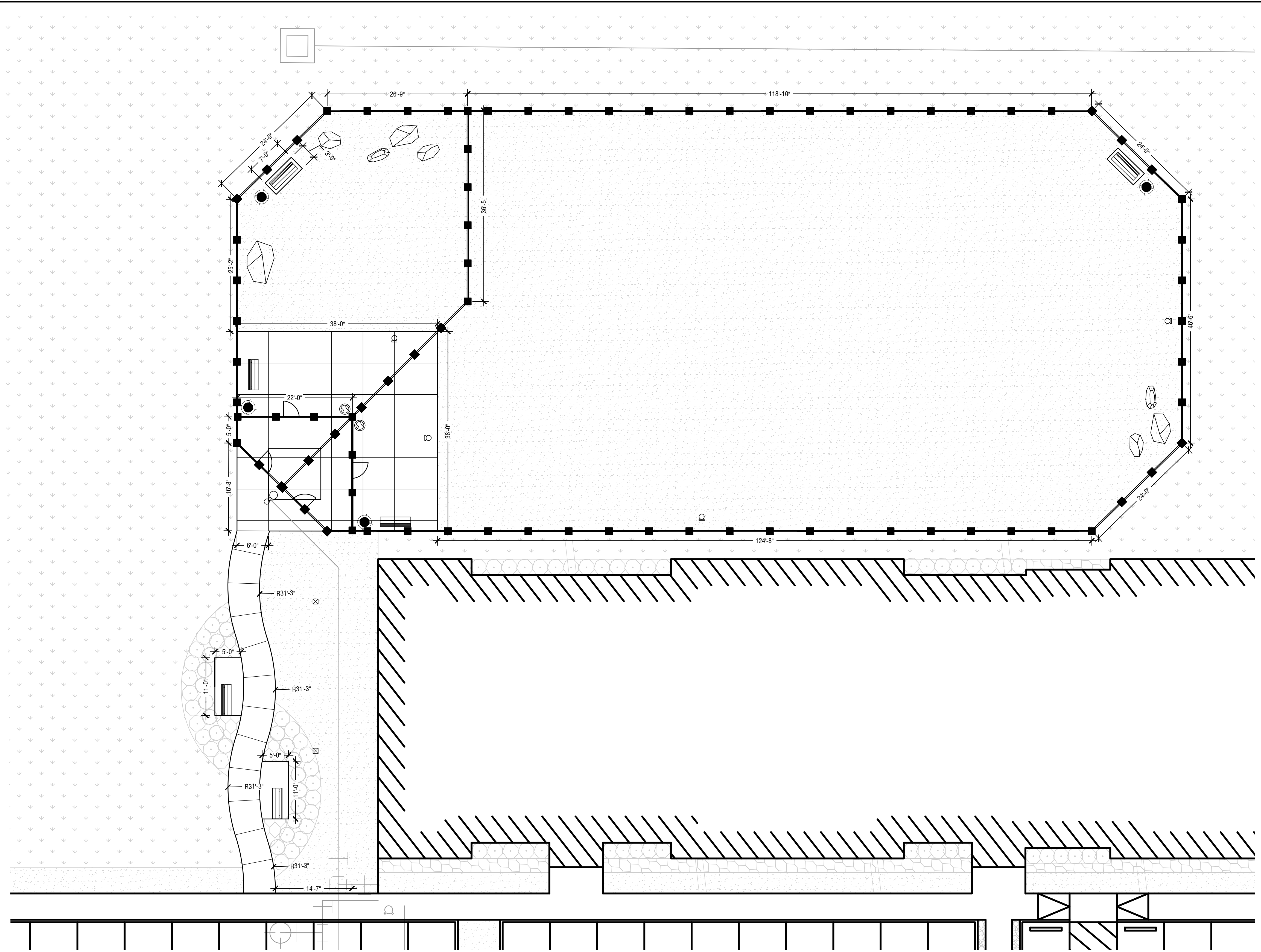
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**DOG PARK
 HARDSCAPE
 PLAN (2 OF 2)**

STARWOOD TRACT
 PREPARED FOR
**IMPACT RESIDENTIAL
 DEVELOPMENT, LLC.**
 HOUSTON TEXAS

SHEET NUMBER
L1.02

Plotted By: Harris, Sam Sheet Set: KHA Layout: L2.02 DOG PARK DIMENSION CONTROL PLAN (2 OF 2) September 15, 2023 01:14:27pm K:\HOU_Civil\064572001-12000 Bissomet Street\Landscapp Architecture\CAD\Sheets\L2.01 DIMENSION CONTROL.dwg
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KHA PROJECT 068924000	DATE SEPTEMBER 2023	SCALE AS SHOWN	DESIGNED BY S.J.H.	DRAWN BY S.J.H.	CHECKED BY SEM
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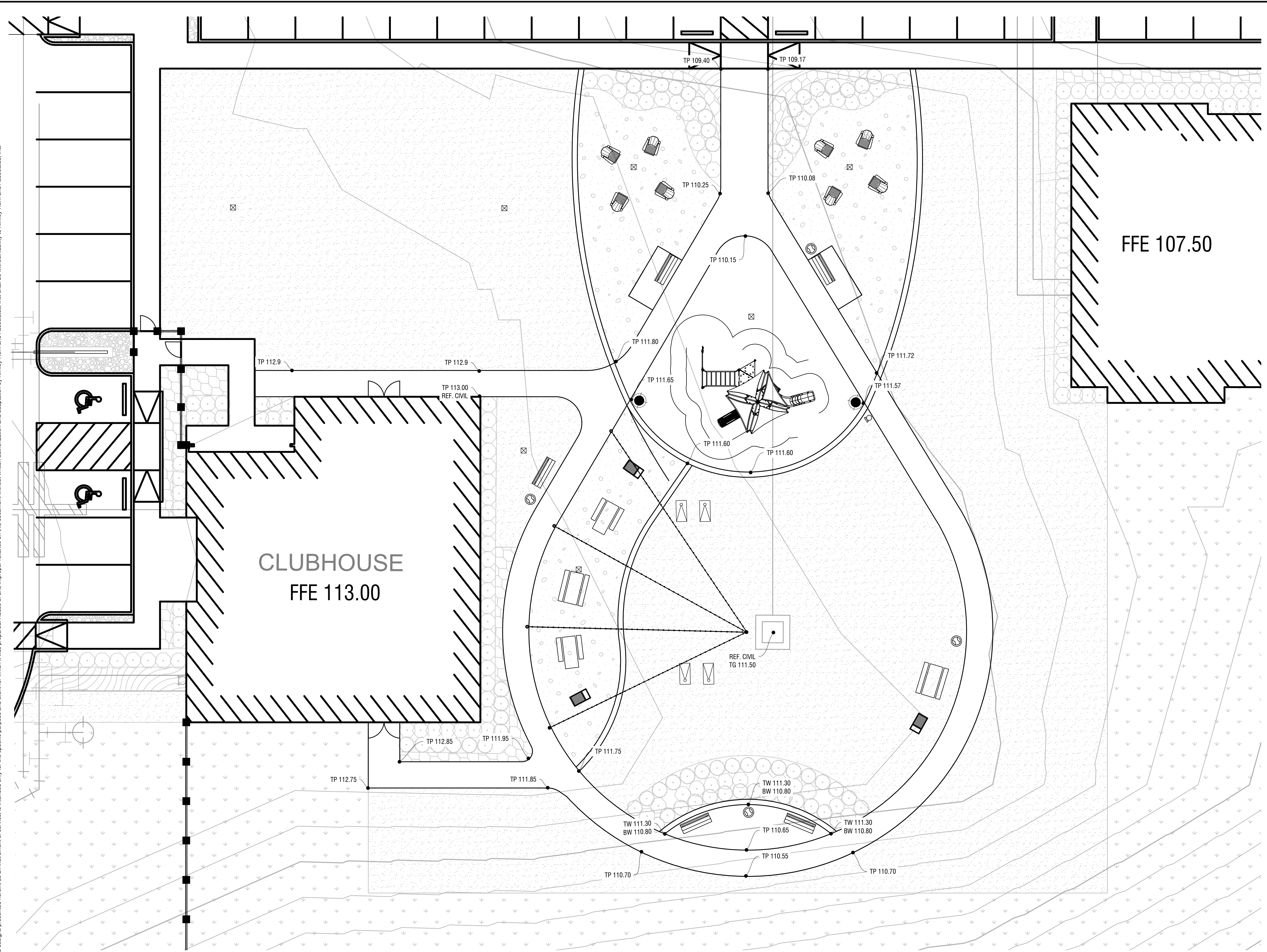
**DOG PARK
 DIMENSION
 CONTROL PLAN
 (2 OF 2)**

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HOUSTON
 TEXAS

SHEET NUMBER
L2.02

Plotted By: Harris, Sam Sheet Set: Khs Layout: L3.01 GRADING AND DRAINAGE (1 OF 2) September 15, 2023 01:15:38pm K:\HOU_Civil\064672001-12000 Blaisomel Street\Landscapes Architecture\Production\CAD\Sheets\L3.01 GRADING AND DRAINAGE.dwg
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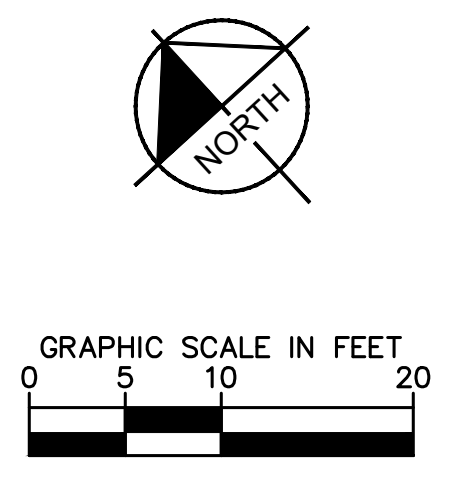
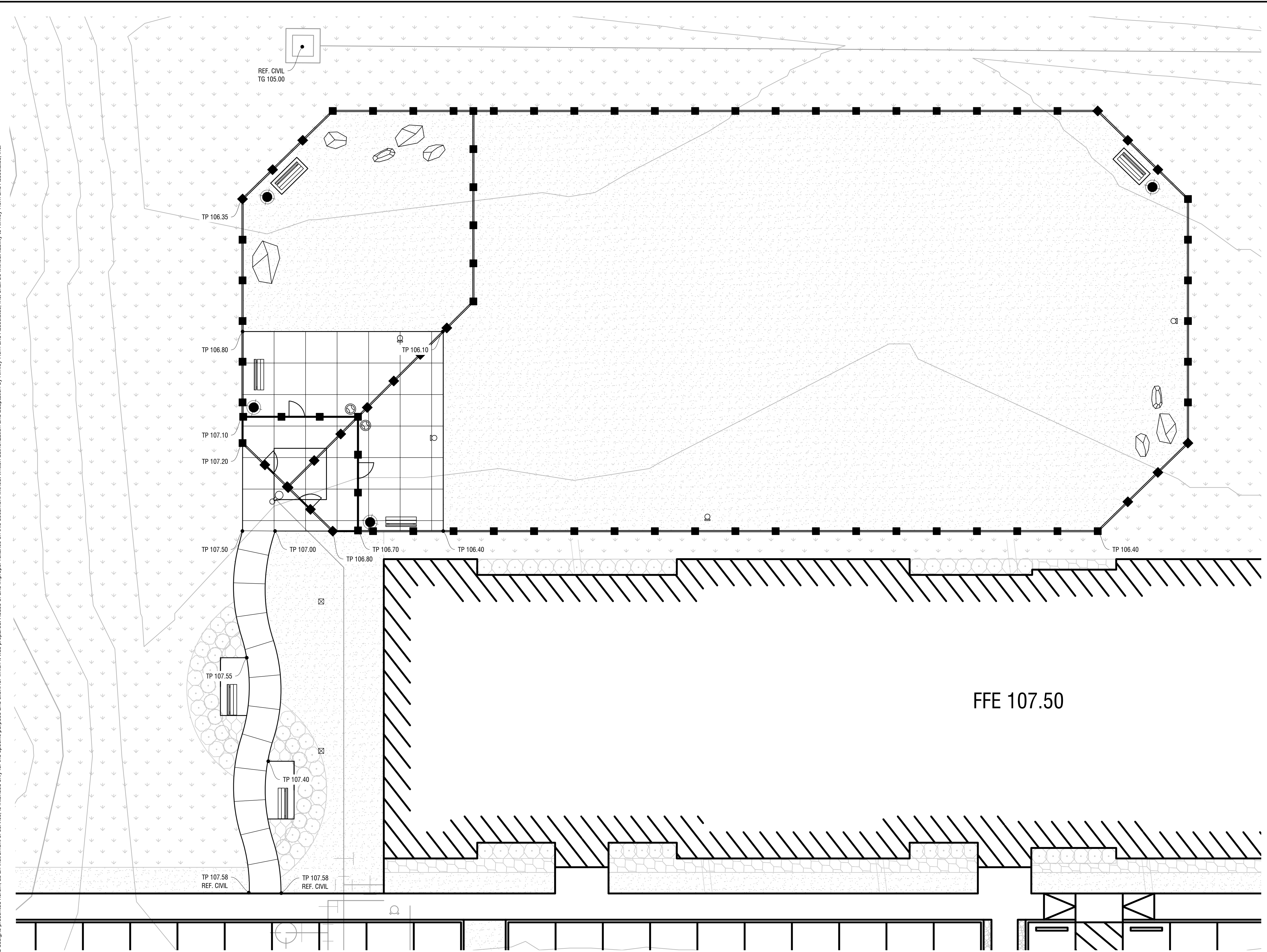
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GRADING AND DRAINAGE (1 OF 2)
 SHEET NUMBER
L3.01

Plotted By: Harris, Sam Sheet Set: Khs Layout: L3.02 GRADING AND DRAINAGE (2 OF 2) September 15, 2023 01:15:52pm K:\HOU_Civil\06852400\12000 Blswood Street\Landscapes Architecture\Production\CAD\Sheets\L3.02 GRADING AND DRAINAGE.dwg
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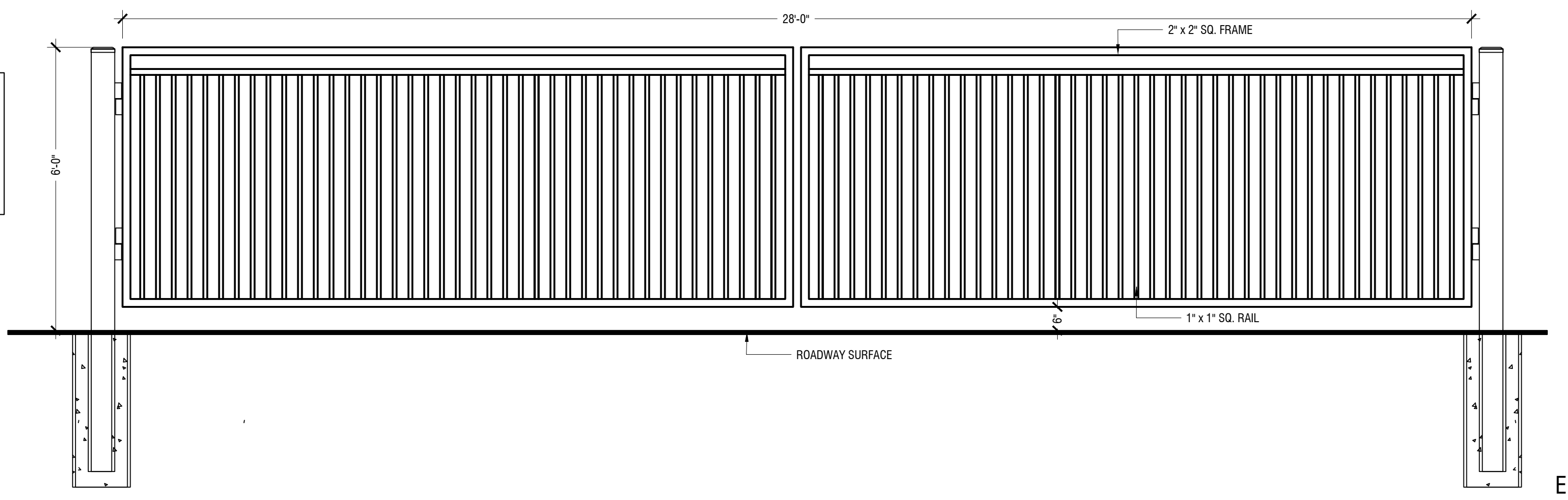
STARWOOD TRACT
 GRADING AND
 DRAINAGE (2 OF 2)

PREPARED FOR
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 HOUSTON TEXAS

SHEET NUMBER
L3.02

Plotted By: Harris, Sam Sheet Set: KHA Layout: L4.01 HARDSCAPE DETAILS September 15, 2023 01:16:14pm K:\HOU_Civil\064572001-12000 Bissanet Street Landscape Architecture\Production\CAD\Sheets\L4.01 HARDSCAPE DETAILS.dwg
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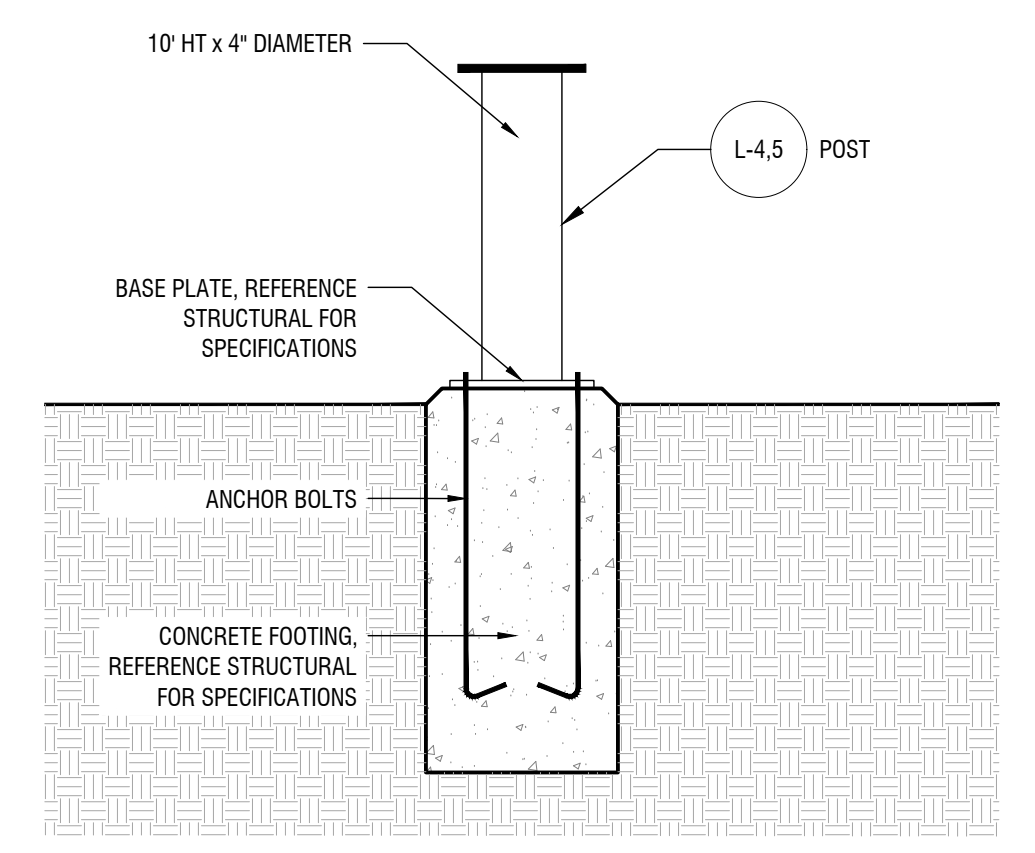
NOTE:
 1. DETAILS ARE DESIGN INTENT ONLY.
 2. ALL STEEL MEMBERS TO BE GALVANIZED AND PAINTED W/ TMEMEC PAINT, REF. MATERIAL LEGEND FOR COLOR
 3. SUBMIT SHOP DRAWINGS OF ALL STEEL FOR APPROVAL PRIOR TO FABRICATION
 4. CONCRETE FOOTING TO BE DESIGNED BY LICENSED STRUCTURAL ENGINEER



ENTRY VEHICULAR SWING GATE

1/2" = 1' - 0"

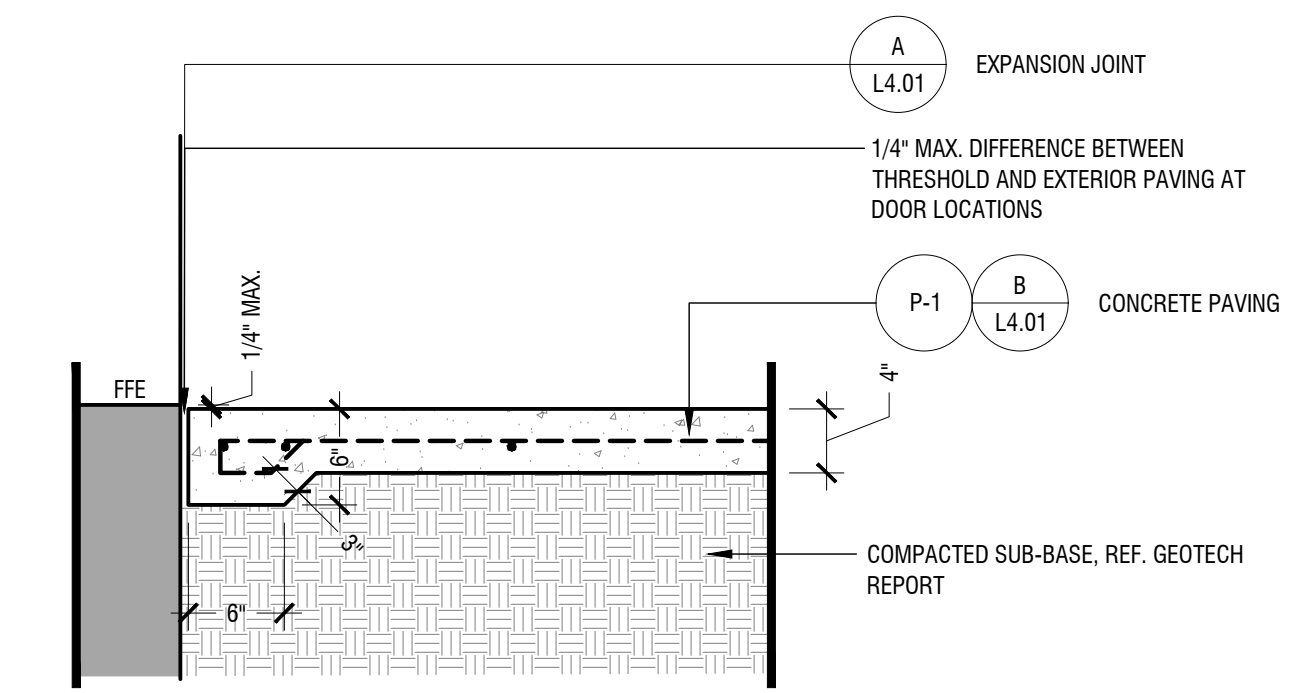
G



Light Pole - Concrete Footing

Scale: 1" = 1'-0"

D

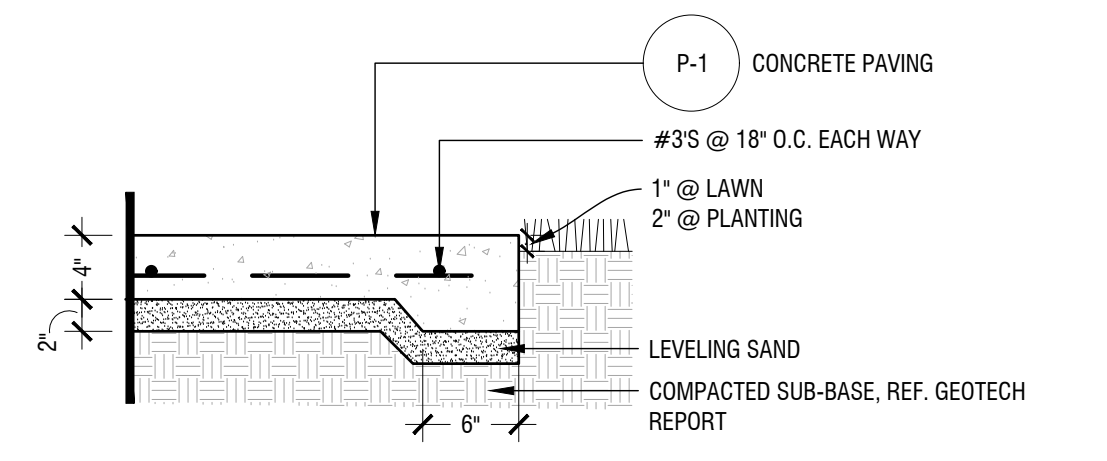


Concrete Paving @ Building

Scale: 1" = 1'-0"

C

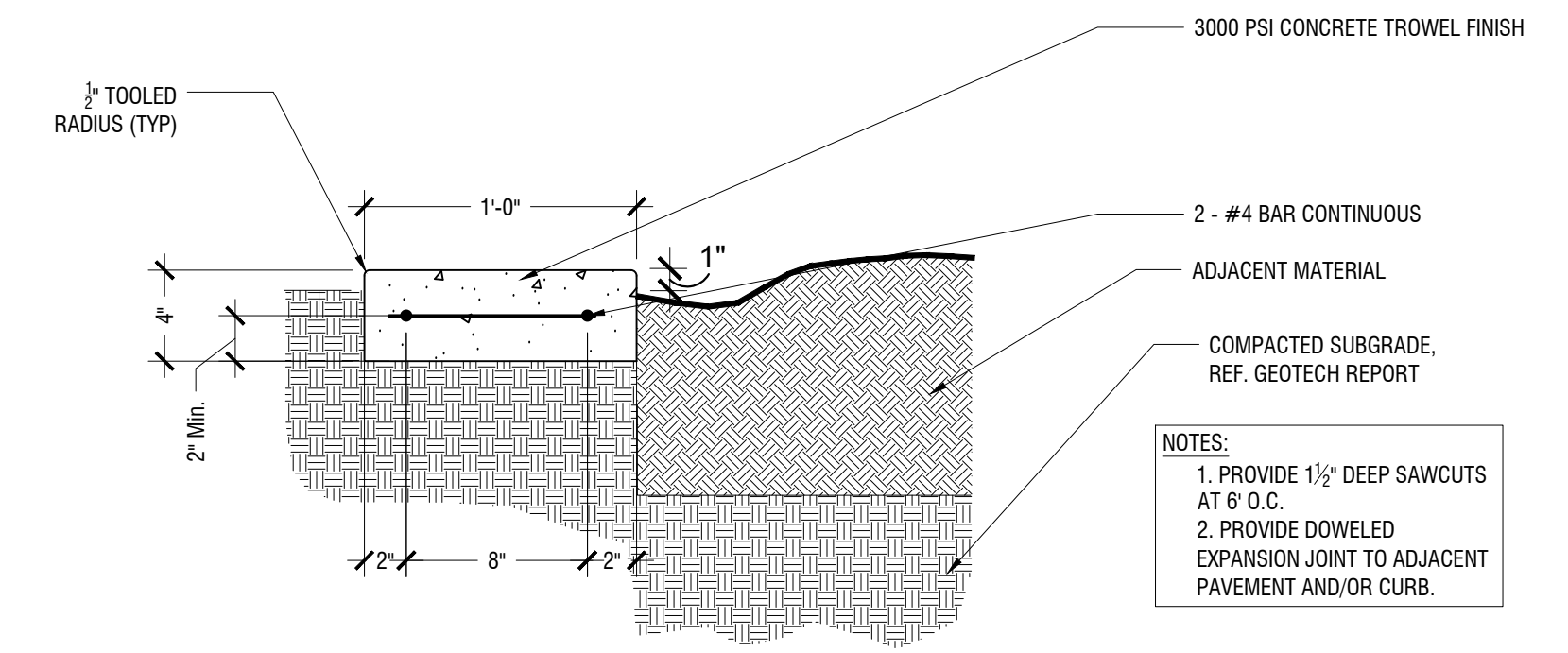
NOTES:
 1. ALL PAVING TO MEET SUBGRADE PREPARATION PER GEOTECH REPORT
 2. ALL VEHICULAR PAVING BY CIVIL
 3. ALL PAVING IN CITY RIGHT OF WAY TO MEET CITY STANDARDS



Typ. Concrete Paving

Scale: 1" = 1'-0"

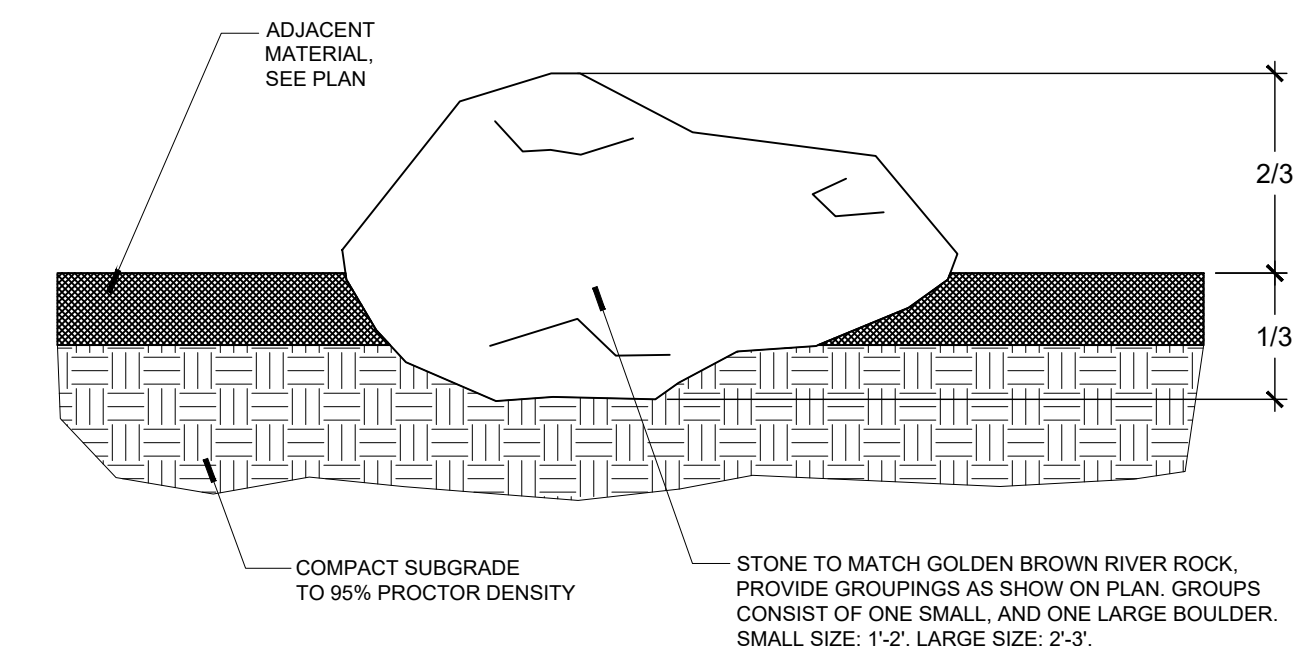
B



12" Wide Concrete Mow Strip

Scale: 1 1/2" = 1'-0"

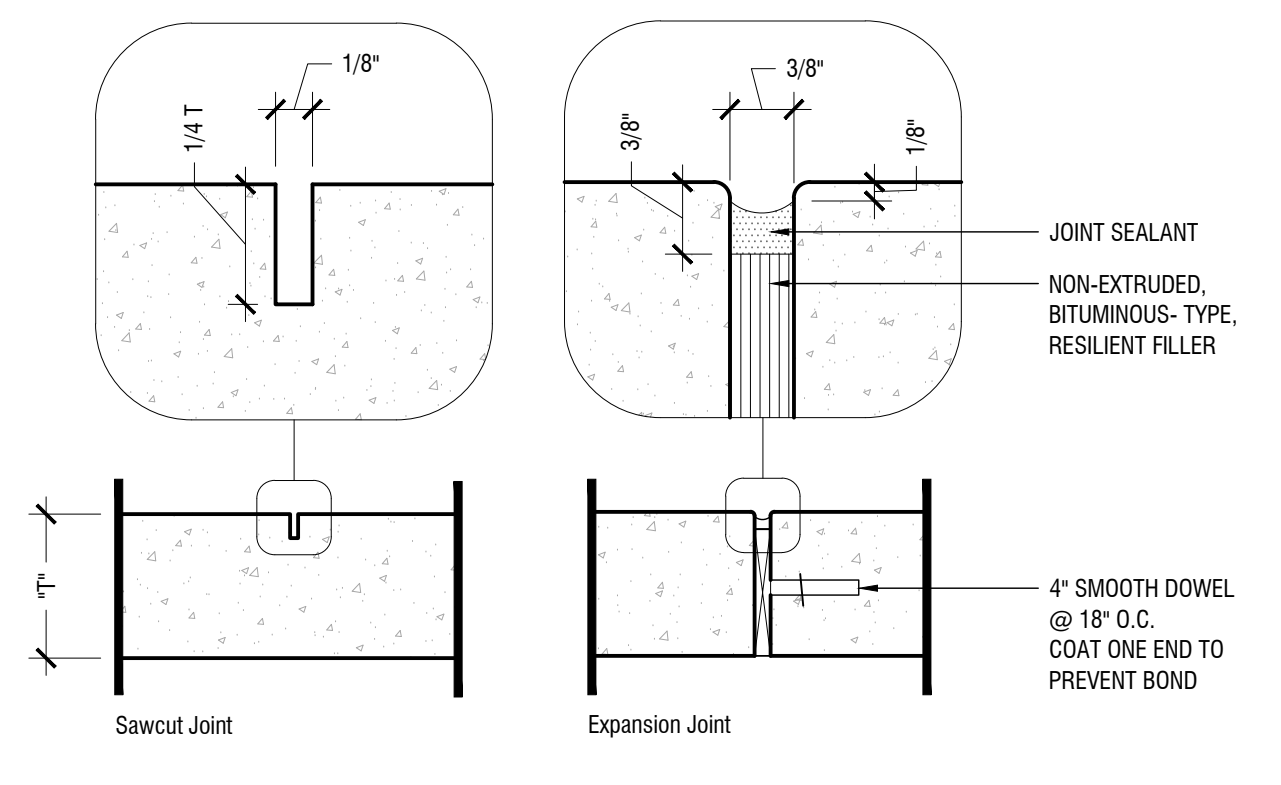
F



Landscape Boulder

SCALE

E



Concrete Paving Joints

N.T.S.

A

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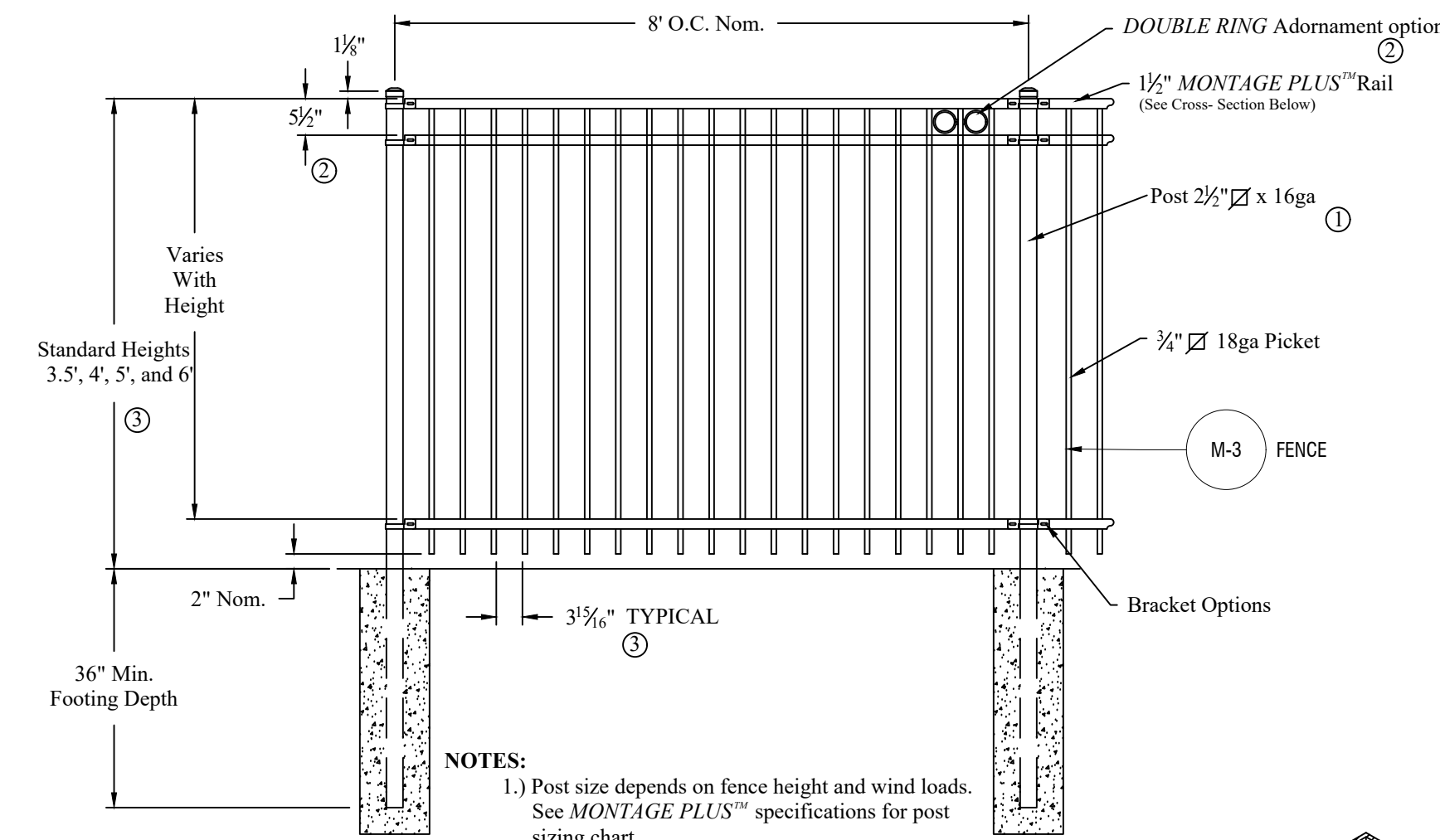
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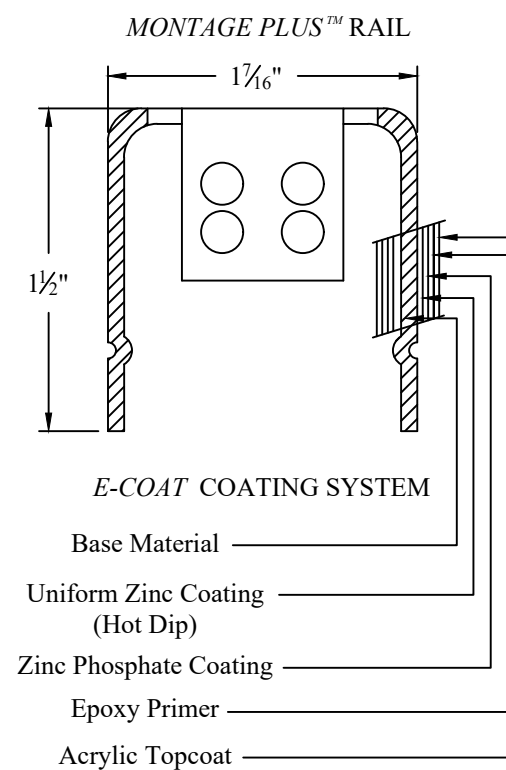
HARDSCAPE DETAILS

STARWOOD TRACT
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 IMPACT RESIDENTIAL
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 HOUSTON TEXAS
 SHEET NUMBER
L4.01

Plotted By: harris, Sam Sheet Set: KHA Layout: L4.02 HARDSCAPE DETAILS September 15, 2023 01:16:25pm K:\HOU_Civil\084572001-12000 Bissoneet Street\Landscapes Architecture\Production\CAD\Sheets\L4.01 HARDSCAPE DETAILS.dwg
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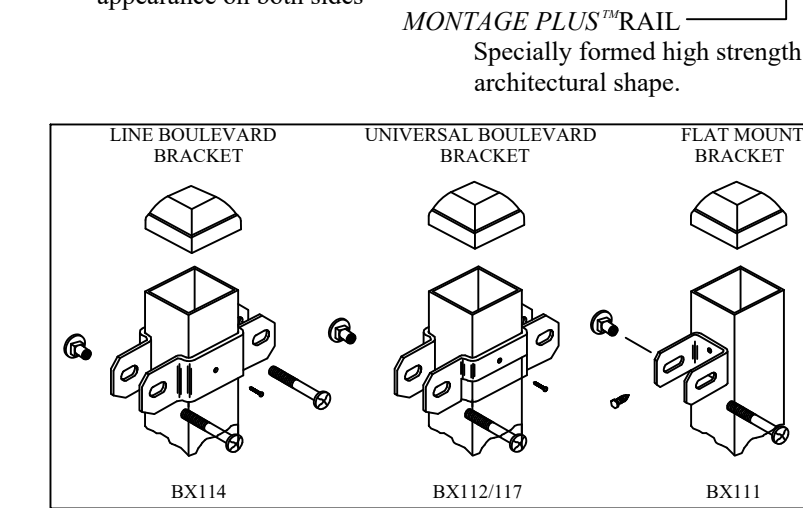


- NOTES:**
- 1.) Post size depends on fence height and wind loads. See MONTAGE PLUS™ specifications for post sizing chart.
 - 2.) Third rail required for Double Rings.
 - 3.) Available in 3" air space and/or Flush Bottom on most heights.

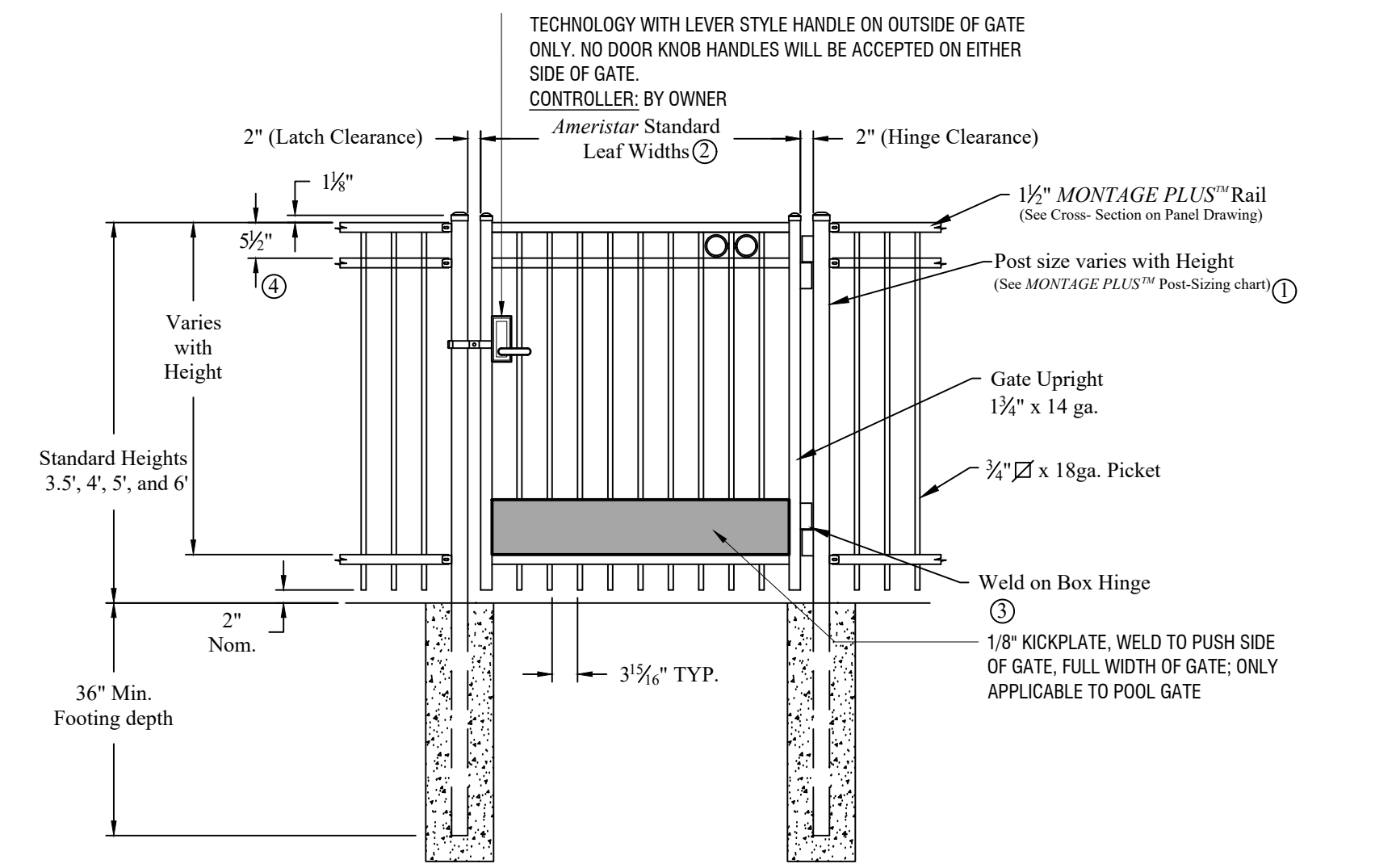


RAKING DIRECTIONAL ARROW
 Welded panel can be raked 30° over 8" with arrow pointing down grade.

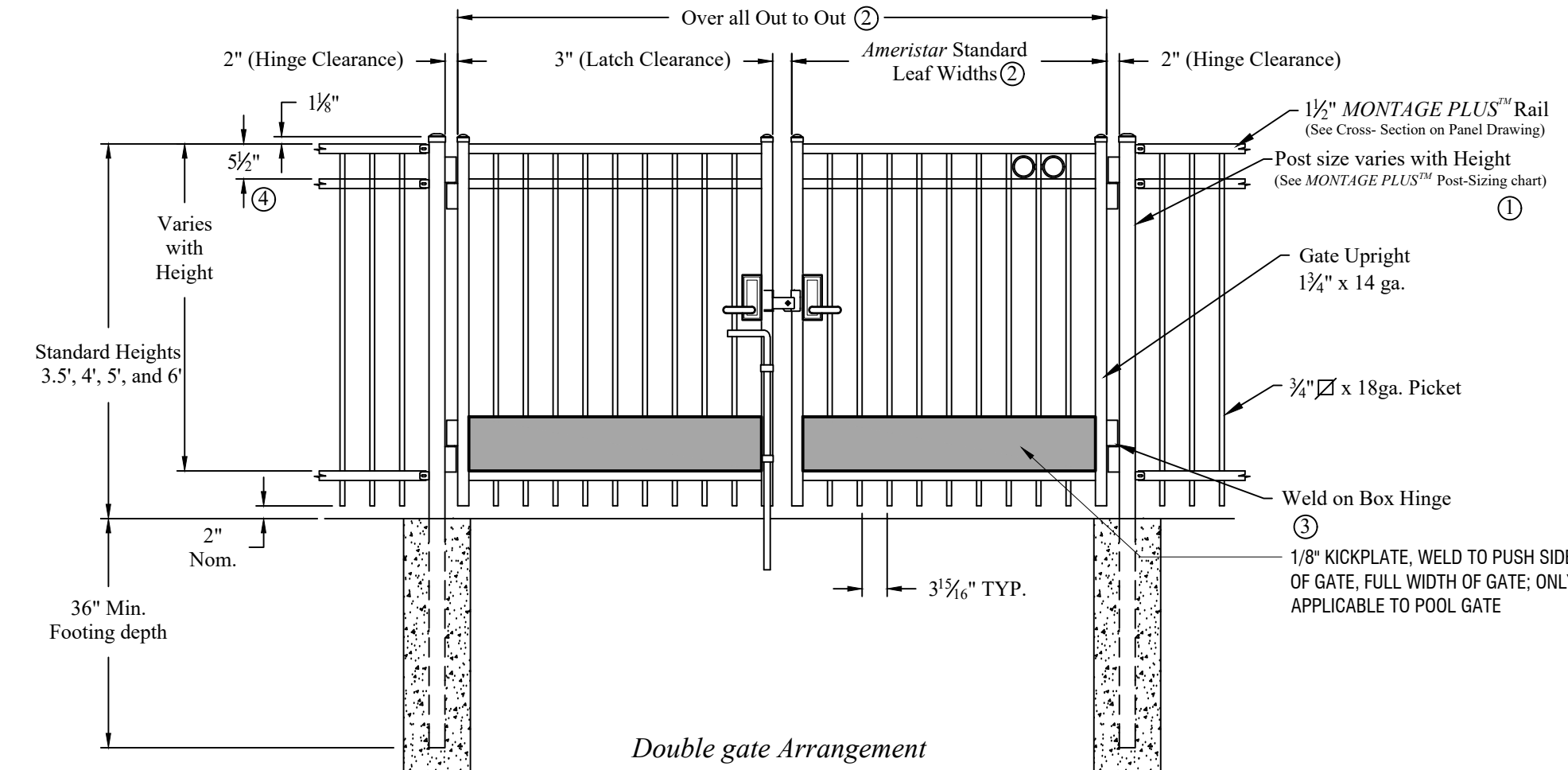
PROFUSION™ WELDING PROCESS
 No exposed welds, Good Neighbor profile - Same appearance on both sides



Values shown are nominal and not to be used for installation purposes. See product specification for installation requirements.



- NOTES:**
- 1.) Post size depends on fence height, weight and wind loads. See MONTAGE PLUS™ specifications for post sizing chart.
 - 2.) See Ameristar gate table for standard out to outs. Custom gate openings available for special out to out/leaf widths.
 - 3.) Additional styles of gate hardware are available on request. This could change the Latch & Hinge Clearance.
 - 4.) Third rail required for Double Rings.

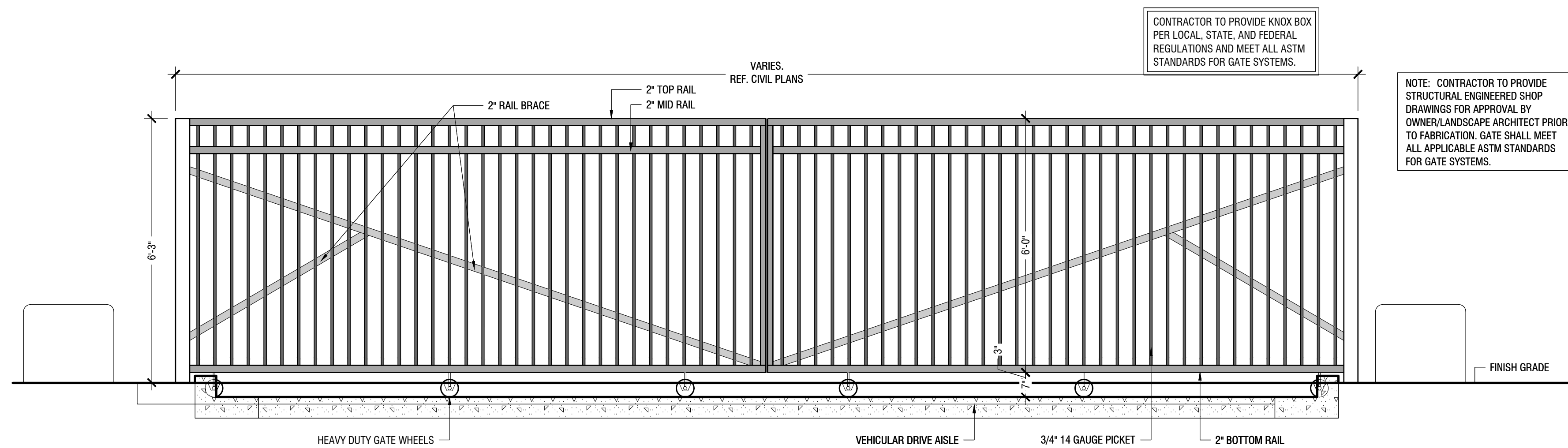


Values shown are nominal and not to be used for installation purposes. See product specification for installation requirements.

PERIMETER AND DOG PARK FENCE TYP. (AMERISTAR MONTAGE PLUS)

Scale: 1/2" = 1'-0"

B



CONTRACTOR TO PROVIDE KNOX BOX PER LOCAL, STATE, AND FEDERAL REGULATIONS AND MEET ALL ASTM STANDARDS FOR GATE SYSTEMS.

NOTE: CONTRACTOR TO PROVIDE STRUCTURAL ENGINEERED SHOP DRAWINGS FOR APPROVAL BY OWNER/LANDSCAPE ARCHITECT PRIOR TO FABRICATION. GATE SHALL MEET ALL APPLICABLE ASTM STANDARDS FOR GATE SYSTEMS.

VEHICULAR SLIDE GATE WITH KNOX BOX

Scale: 1/2" = 1'-0"

A

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HARDSCAPE DETAILS

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SHEET NUMBER
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SE-P12.6

NOTE:

BUS STOP SHELTER SPECIFICATION:

1. STEELWORX CANTILEVERED DUGOUT - 6'X15'
2. STANDARD POLYESTER POWDER COAT FINISH
3. ROOF COLOR: SILVER METALLIC
FRAME COLOR: ROMAN BLUE
CONTRACTOR TO GET COLOR APPROVAL FROM OWNER PRIOR TO PURCHASE.
4. SURFACE-MOUNT COLUMNS. RE: STRUCTURAL DWGS
5. SALES CONTACT: PAUL E. ALLEN CO.
ERIC HILLIER
ERIC.HILLIER@PAULEALLENCO.COM
817-680-2973
6. SUBMITTAL:
- ENGINEER SEALED MFR. DRAWINGS (STATE OF TX LICENSE)
- FULL PRODUCT DATA
- STANDARD PAINT COLOR CHIPS FOR FRAME AND ROOF FOR OWNER APPROVAL

Paul E. Allen Co. Inc. 972-724-2656 erichiller@pauleallenco.com

Model: Steelworx Cantilevered Dugout, 6' x 15'
Model # CD-0615-SW

Manufacturing Mission: To provide all prefabricated components and installation instructions for a 15' long by 6' cantilevered (measured from eave to eave) free standing bolt together, tubular steel constructed shelter kit.

Design Criteria: Structure shall be designed to meet site specific snow and wind load design criteria using most current applicable building codes. All structural members are ASTM A-500 U.S. grade B steel. Welded connection plates shall be ASTM A-36 hot rolled steel. All fabrication performed to latest AISC standards by AWS Certified welders. All framing connections are done using A325 grade bolts within concealed access openings from above and will later be concealed by the roofing. All roof framing shall be flush against the roof decking to eliminate the possibility of bird nesting.

Tubular Steel Columns and Beams: Standard column dimension shall be 7" x 5" x 3/16" tubular steel welded to 5/8" base plates for surface mounting. Main support beams are 7" x 5" x 3/16" and purlins are 6" x 3" x 1/8". Steel sizes are preliminary and may change due to ongoing review and final engineering.

Roofing: 24 Ga. pre-cut steel Multi-Rib panels with Kynar 500 finish in a variety of colors with white underside. Standard roof slope is a 2/12 pitch with a eave height of 7'-6". Attached to structural frame with exposed screws painted to match roof color. Matching 24 Ga. trim included.

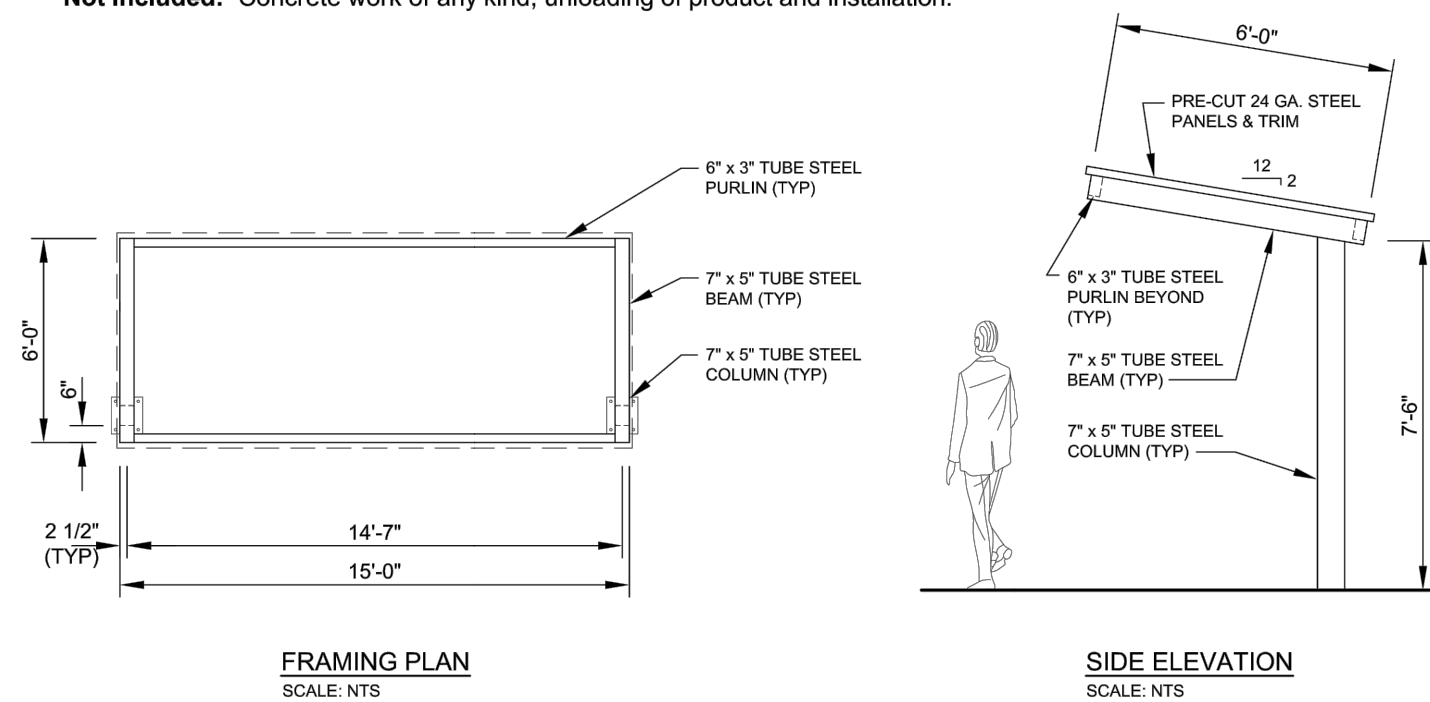
Frame Finish: All steel framework will receive a corrosion protective TGIC Polyester powder coat, electro-statically applied and cured at 400°F. A large selection of standard colors are available.

Foundation: All columns need to be anchored to concrete footings (footing design provided separately). Columns can be surface mounted to footings with anchor bolts at or below finish slab elevation or they can be embedded directly into the footing without base plates upon request. Anchor bolts and bracing templates are included. Optional base plate covers are available at an additional cost.

Hardware: All structural hardware and roofing fasteners shall be provided.

Warranty: 10 years against manufacturer defects.

Not Included: Concrete work of any kind, unloading of product and installation.



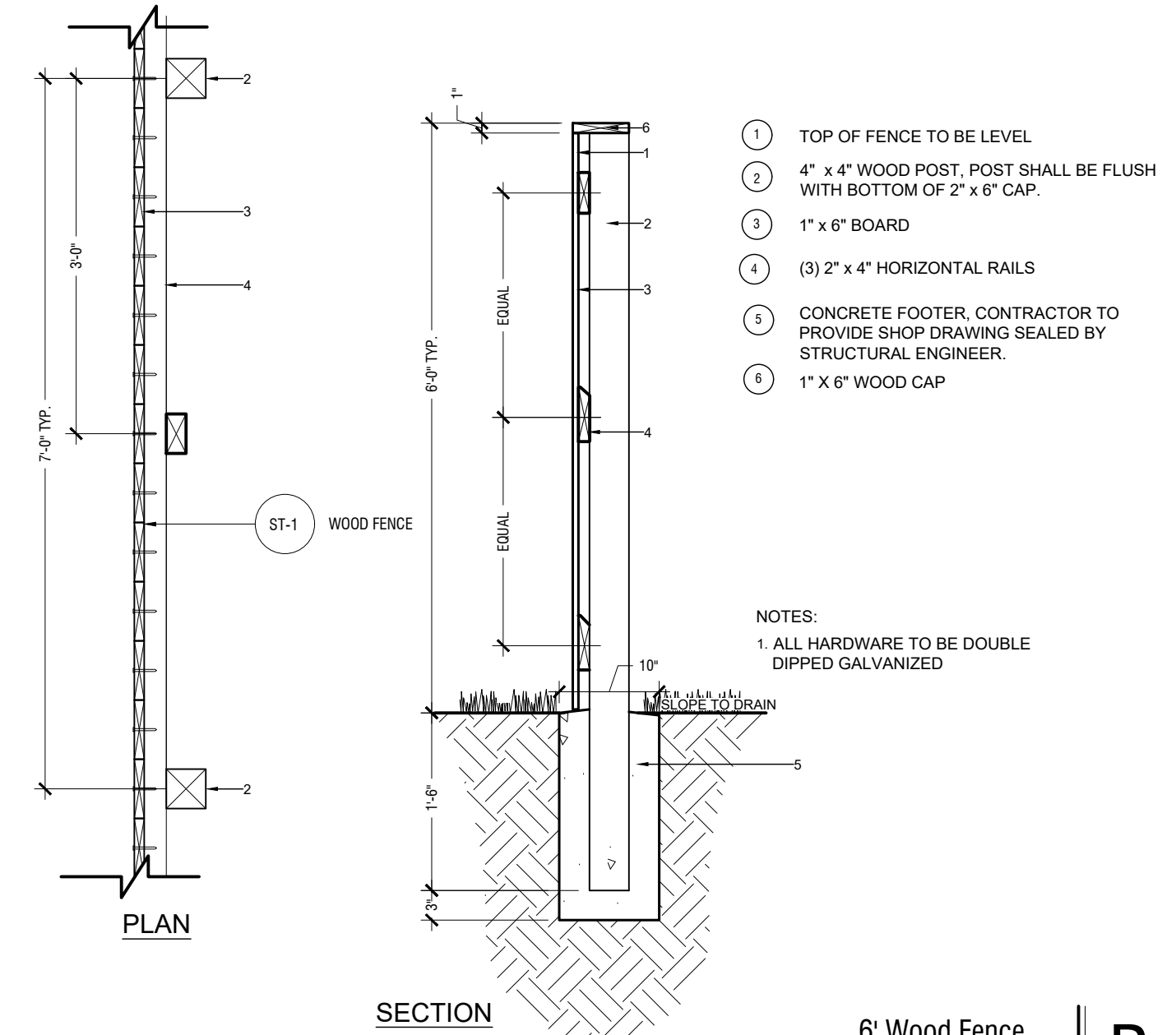
11800 East 9 Mile Road
Warren, MI 48090
Office: (248) 496-1088
Fax: (248) 754-9130
Toll Free: (800) 657-6118
Email: info@coverworx.com
www.coverworx.com

Steelworx Cantilevered Dugout - 6' x 15'
Model: CD-0615-SW
DESIGN SPECIFICATIONS

BUS STOP SHELTER

Scale: 1" = 1'-0"

C



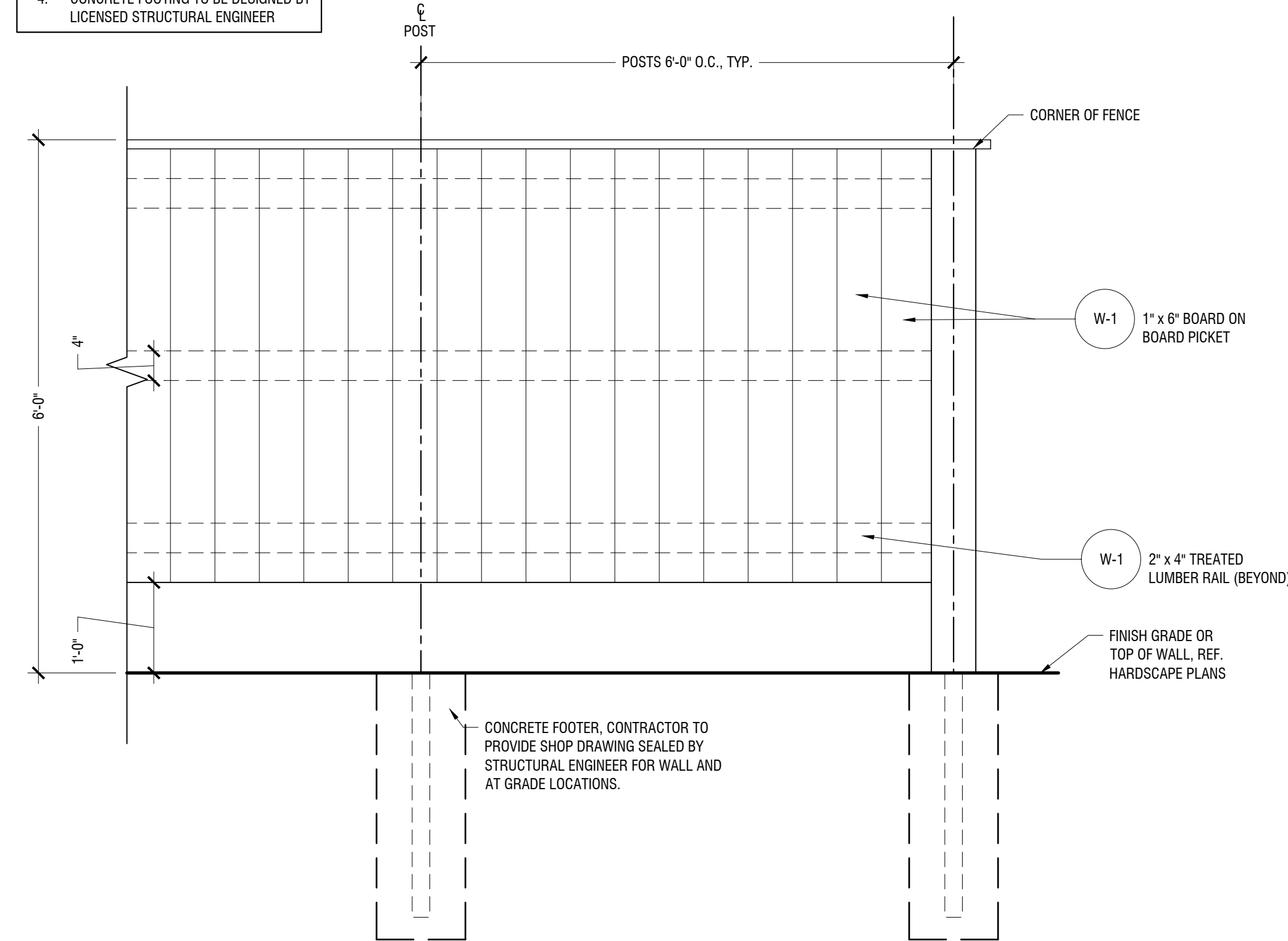
- 1 TOP OF FENCE TO BE LEVEL
- 2 4" x 4" WOOD POST, POST SHALL BE FLUSH WITH BOTTOM OF 2" x 6" CAP.
- 3 1" x 6" BOARD
- 4 (3) 2" x 4" HORIZONTAL RAILS
- 5 CONCRETE FOOTER, CONTRACTOR TO PROVIDE SHOP DRAWING SEALED BY STRUCTURAL ENGINEER.
- 6 1" x 6" WOOD CAP

NOTES:
1 ALL HARDWARE TO BE DOUBLE DIPPED GALVANIZED

6' Wood Fence
Scale: 1" = 1'-0"

B

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1. DETAILS ARE DESIGN INTENT ONLY.
 2. ALL STEEL MEMBERS TO BE GALVANIZED AND PAINTED W/ TNE-MEC PAINT, REF. MATERIAL LEGEND FOR COLOR
 3. SUBMIT SHOP DRAWINGS OF ALL STEEL FOR APPROVAL PRIOR TO FABRICATION
 4. CONCRETE FOOTING TO BE DESIGNED BY LICENSED STRUCTURAL ENGINEER



6' Wood Fence

Scale: 3/4" = 1'-0"

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Kimley»Horn
P.L.A. SHANNON E. MURPHY
L.A. No. 35433 Date: SEP. 2023

KHA PROJECT	DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY
068924000	SEPTEMBER 2023	AS SHOWN	SJH	SJH	SEM

HARDSCAPE DETAILS

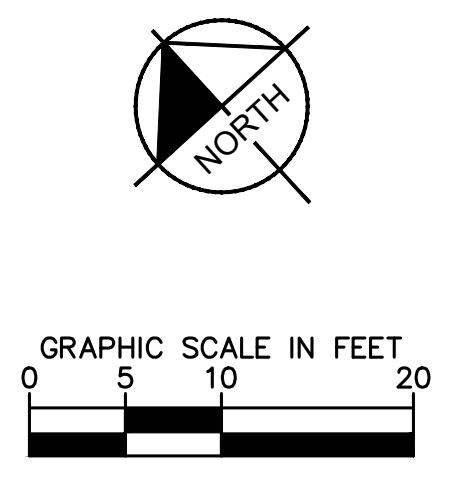
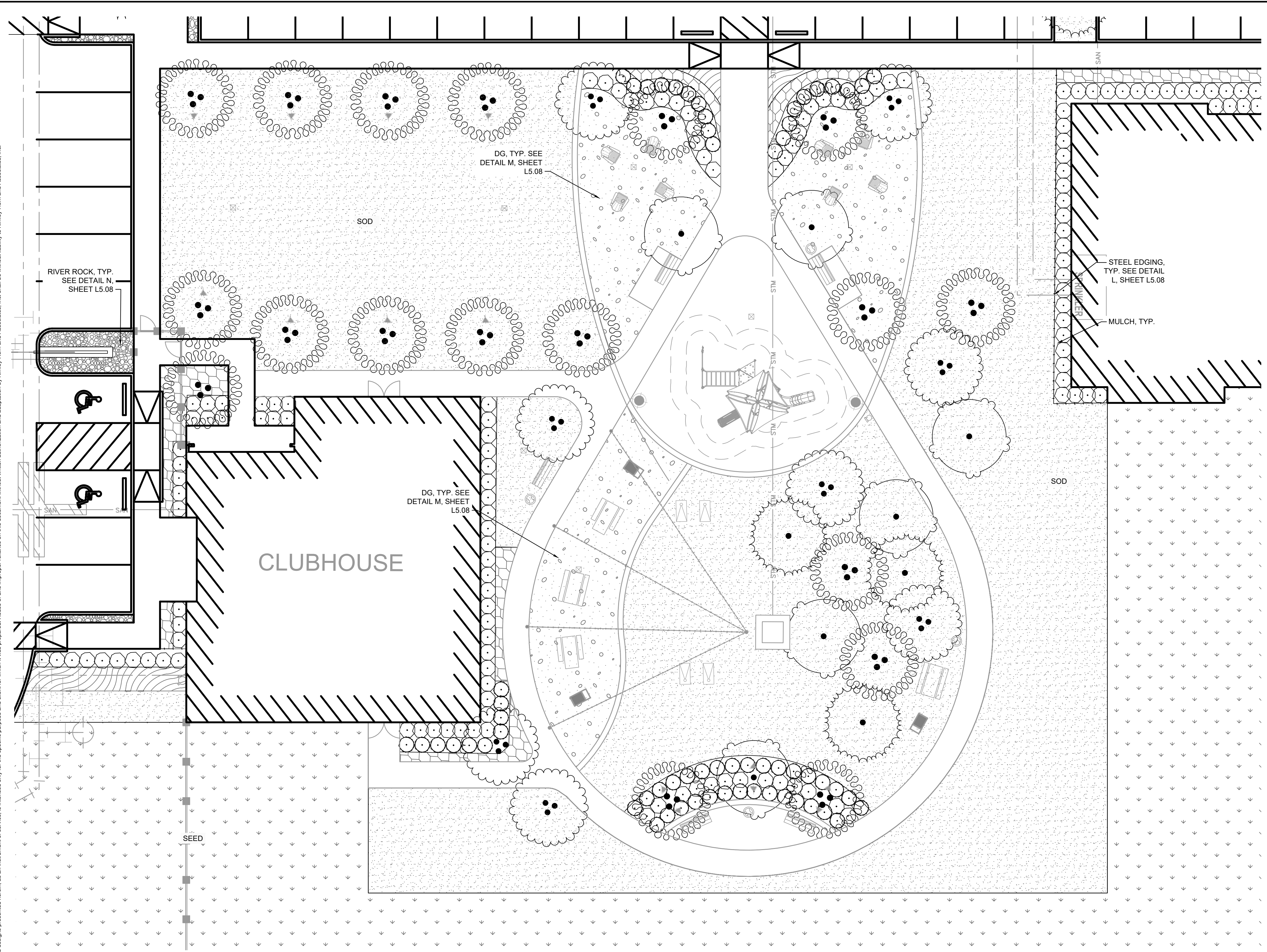
STARWOOD TRACT
PREPARED FOR
IMPACT RESIDENTIAL DEVELOPMENT, LLC.

SHEET NUMBER
L4.03

No.	REVISIONS	DATE	BY

HOUSTON TEXAS

Plotted By: Harris, Sam Sheet Set: KHA Layout: L5.01 September 15, 2023 01:18:24pm K:\HOU_Civil\08472001\12000 Blissonnet Street\Landscapes Architecture\Production\CAD\Sheets\L5.01 PLANTING PLAN.dwg
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PLANT LEGEND

TREES		CODE	COMMON NAME
	ix	EAGLESTON HOLLY	
	Ln	CRAPE MYRTLE	
	Ml	LITTLE GEM DWARF SOUTHERN MAGNOLIA	
	Vc	CHASTE TREE	
SHRUBS		CODE	COMMON NAME
	lb	DWARF BURFORD HOLLY	
	Lf	TEXAS SAGE	
	Md	DON'S DWARF WAX MYRTLE	
	Mp	PINK FLAMINGO MUHLY	
GROUND COVERS		CODE	COMMON NAME
	DG	DECOMPOSED GRANITE	
	Lc	LANTANA	
	Lm	LILYTURF	
	ROCK	RIVER ROCK	
	SEED	BERMUDA GRASS	
	SOD	BERMUDA GRASS	

REF. L5.07 FOR FULL PLANT SCHEDULE AND LANDSCAPE CODE TABLE

NOTE: AN AUTOMATIC IRRIGATION SYSTEM WILL COVER THE ENTIRE SITE. IRRIGATION EQUIPMENT INCLUDES: BUBBLERS, DRIP, ROTARY NOZZLES, CONTROLLERS, RAIN/FREEZE SENSOR, WATER METER AND ASSOCIATED APPURTENANCES (LOCKING GATE VALVE, BACKFLOW, FLOW SENSOR, MASTER CONTROL VALVE, ETC). ALL IRRIGATION LINES TO BE DOUBLE-CONTAINED AS SHOWN ON CIVIL SHEETS IN DETAIL B6 SHEET C9.4. ALL NON-WATER BEARING COMPONENTS DO NOT REQUIRE DOUBLE- CONTAINMENT.

NOTE: CONTRACTOR TO VERIFY TOP SOIL DEPTH PRIOR TO INSTALLATION OF PLANTINGS, SURFACE MOUNTS, PLAY STRUCTURE, AND DRINKING FOUNTAIN.

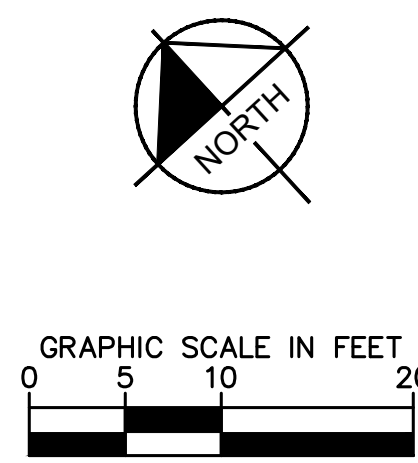
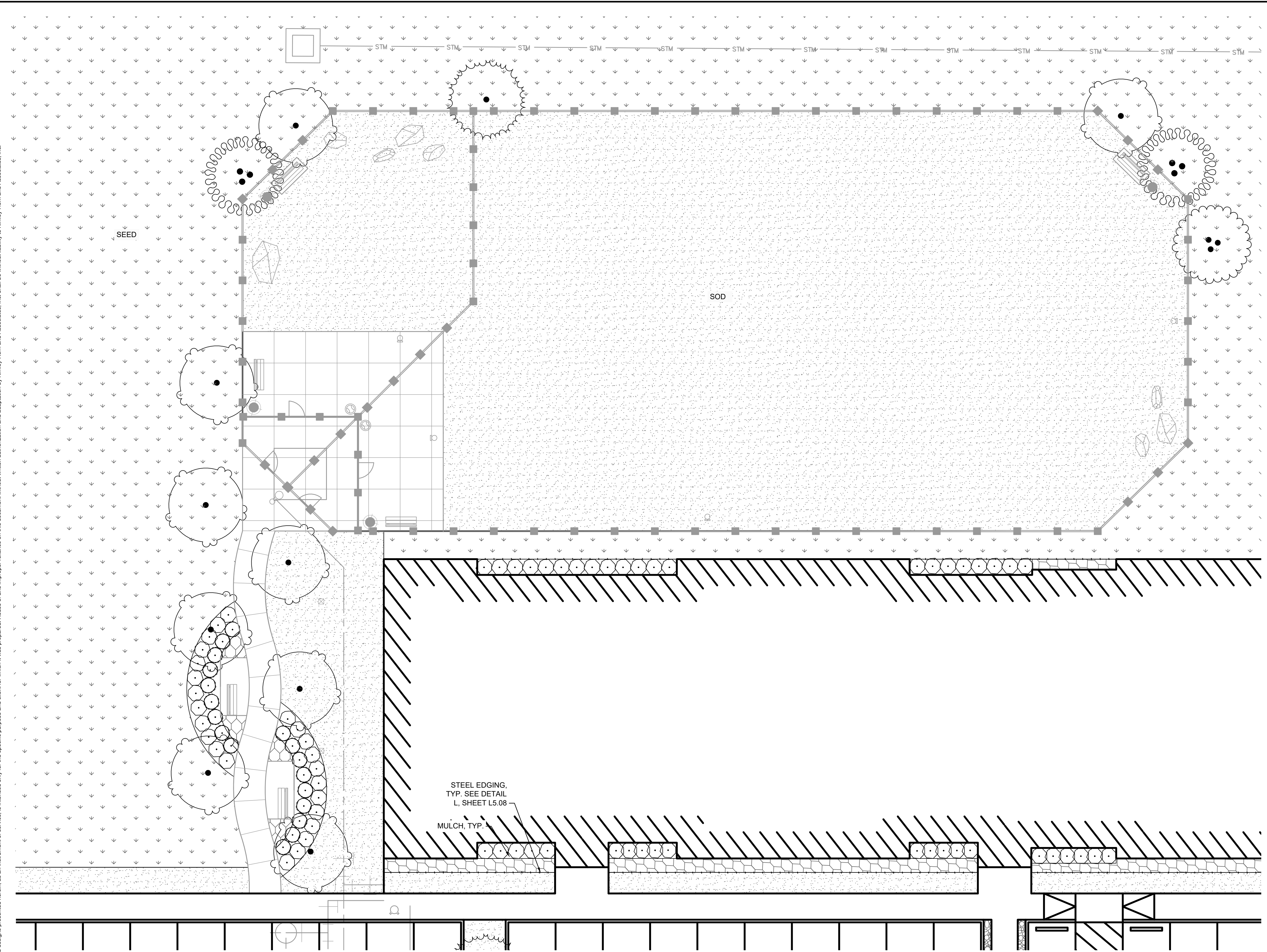


CAUTION!!

EXISTING UNDERGROUND UTILITIES IN THE AREA CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE HORIZONTAL AND VERTICAL LOCATION OF ALL UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY REPAIRS TO EXISTING UTILITIES DUE TO DAMAGE INCURRED DURING CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES ON THE PLANS.

<h1 style="margin: 0;">Kimley»Horn</h1> <p style="font-size: 8px; margin: 0;">© 2022 KIMLEY-HORN AND ASSOCIATES, INC. 11700 KATY FREEWAY, SUITE 800, HOUSTON, TX 77079 PHONE: 281-597-9300 WWW.KIMLEY-HORN.COM TBP# FIRM REGISTRATION F-928</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">REVISIONS</th> <th style="width: 50%;">DATE</th> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </table>	REVISIONS	DATE										
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<p style="font-size: 8px; margin: 0;">PRELIMINARY FOR REVIEW ONLY Not for construction or permit purposes.</p> <p style="font-size: 10px; margin: 0;">Kimley»Horn</p> <p style="font-size: 8px; margin: 0;">P.L.A. SHANNON E. MUNDY L.A. No. 3543 Date: SEP. 2023</p>													
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">KHA PROJECT 068924000</td> <td style="width: 25%;">DATE SEPTEMBER 2023</td> <td style="width: 25%;">SCALE AS SHOWN</td> <td style="width: 25%;">DESIGNED BY S.J.H.</td> </tr> <tr> <td></td> <td></td> <td></td> <td style="width: 25%;">DRAWN BY S.J.H.</td> </tr> <tr> <td></td> <td></td> <td></td> <td style="width: 25%;">CHECKED BY SEM</td> </tr> </table>	KHA PROJECT 068924000	DATE SEPTEMBER 2023	SCALE AS SHOWN	DESIGNED BY S.J.H.				DRAWN BY S.J.H.				CHECKED BY SEM	<h2 style="margin: 0;">AMENITY PLANTING PLAN</h2>
KHA PROJECT 068924000	DATE SEPTEMBER 2023	SCALE AS SHOWN	DESIGNED BY S.J.H.										
			DRAWN BY S.J.H.										
			CHECKED BY SEM										
<p style="margin: 0;">STARWOOD TRACT PREPARED FOR IMPACT RESIDENTIAL DEVELOPMENT, LLC.</p>	<p style="font-size: 8px; margin: 0;">HOUSTON TEXAS</p>												
<p style="margin: 0;">SHEET NUMBER L5.01</p>													

Plotted By: Harris, Sam Sheet Set: Khs Layout: L5.02 DOG PARK PLANTING PLAN September 15, 2023 01:18:59pm K:\HOU_Civil\08472001\12000 Blisomest Street\Landscapes Architecture\Production\CAD\Sheets\L5.01 PLANTING PLAN.dwg
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PLANT LEGEND

TREES		CODE	COMMON NAME
	ix	EAGLESTON HOLLY	
	Ln	CRAPE MYRTLE	
	Ml	LITTLE GEM DWARF SOUTHERN MAGNOLIA	
	Vc	CHASTE TREE	
SHRUBS		CODE	COMMON NAME
	lb	DWARF BURFORD HOLLY	
	Lf	TEXAS SAGE	
	Md	DON'S DWARF WAX MYRTLE	
	Mp	PINK FLAMINGO MUHLY	
GROUND COVERS		CODE	COMMON NAME
	DG	DECOMPOSED GRANITE	
	Lc	LANTANA	
	Lm	LILYTURF	
	ROCK	RIVER ROCK	
	SEED	BERMUDA GRASS	
	SOD	BERMUDA GRASS	

REF. L5.07 FOR FULL PLANT SCHEDULE AND LANDSCAPE CODE TABLE

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NOTE: CONTRACTOR TO VERIFY TOP SOIL DEPTH PRIOR TO INSTALLATION OF PLANTINGS, SURFACE MOUNTS, PLAY STRUCTURE, AND DRINKING FOUNTAIN.



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NO.	REVISIONS	DATE	BY

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KHA PROJECT	DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY
068924000	SEPTEMBER 2023	AS SHOWN	SJH	SJH	SEM

**DOG PARK
PLANTING PLAN**

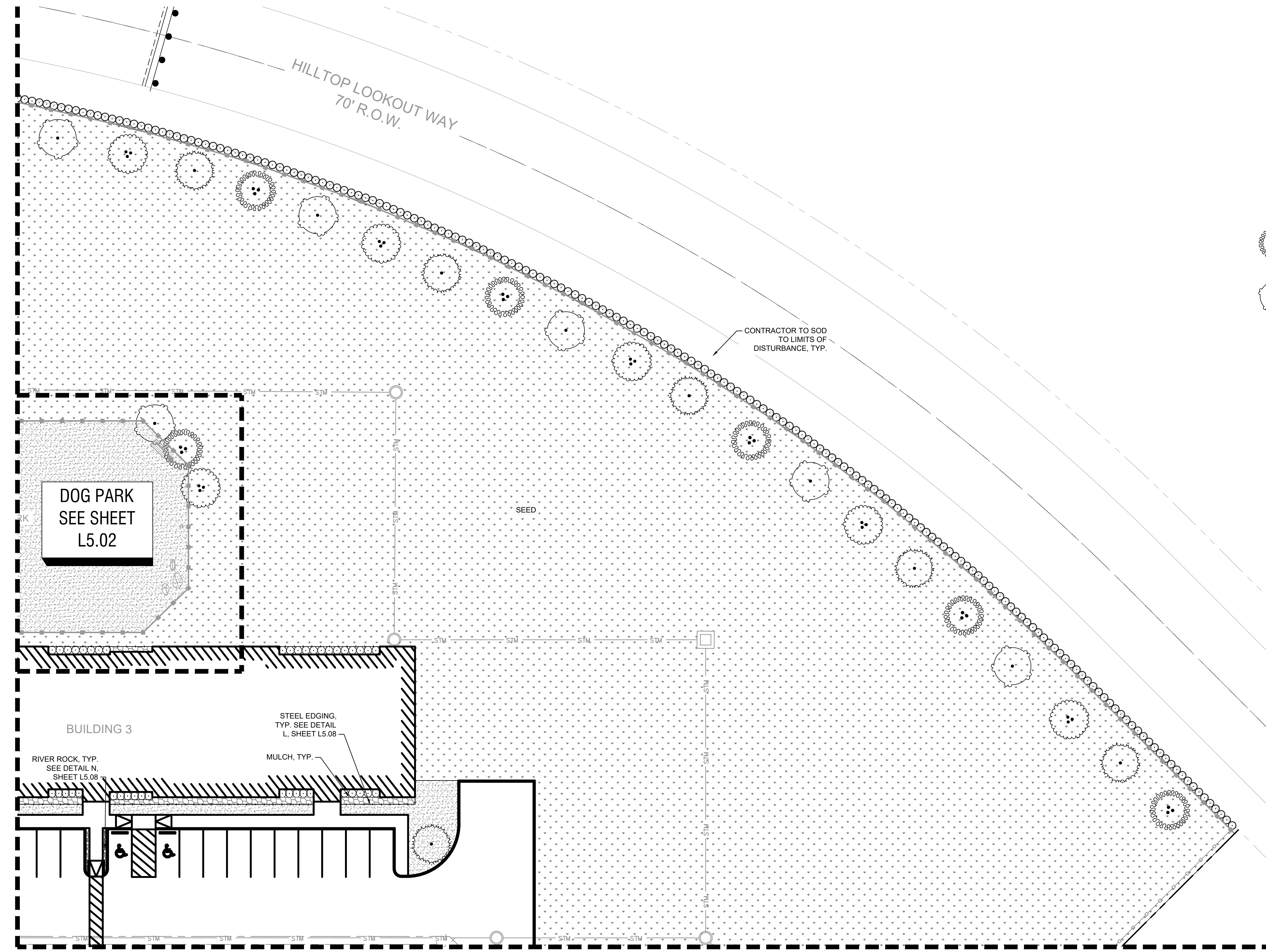
STARWOOD TRACT
 PREPARED FOR
**IMPACT RESIDENTIAL
 DEVELOPMENT, LLC.**

HOUSTON
TEXAS

SHEET NUMBER
L5.02

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MATCH LINE SHEET L5.03



MATCH LINE SHEET L5.06

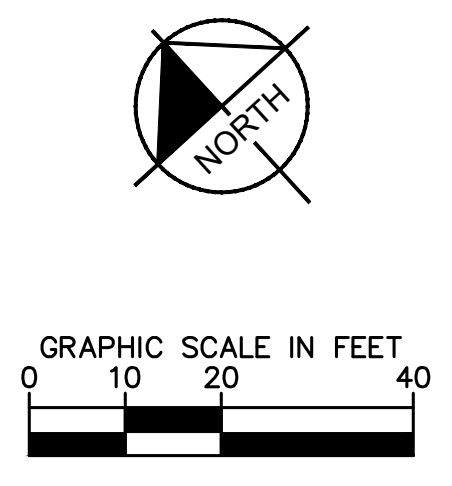
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PLANT LEGEND

TREES	CODE	COMMON NAME
	Ix	EAGLESTON HOLLY
	Ln	CRAPE MYRTLE
	Ml	LITTLE GEM DWARF SOUTHERN MAGNOLIA
	Vc	CHASTE TREE
SHRUBS	CODE	COMMON NAME
	lb	DWARF BURFORD HOLLY
	Lf	TEXAS SAGE
	Md	DON'S DWARF WAX MYRTLE
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	Lm	LILYTURF
	ROCK	RIVER ROCK
	SEED	BERMUDA GRASS
	SOD	BERMUDA GRASS

REF. L5.07 FOR FULL PLANT SCHEDULE AND LANDSCAPE CODE TABLE

No.	REVISIONS	DATE	BY

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PLANTING PLAN
(2 OF 4)

STARWOOD TRACT
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 IMPACT RESIDENTIAL
 DEVELOPMENT, LLC.

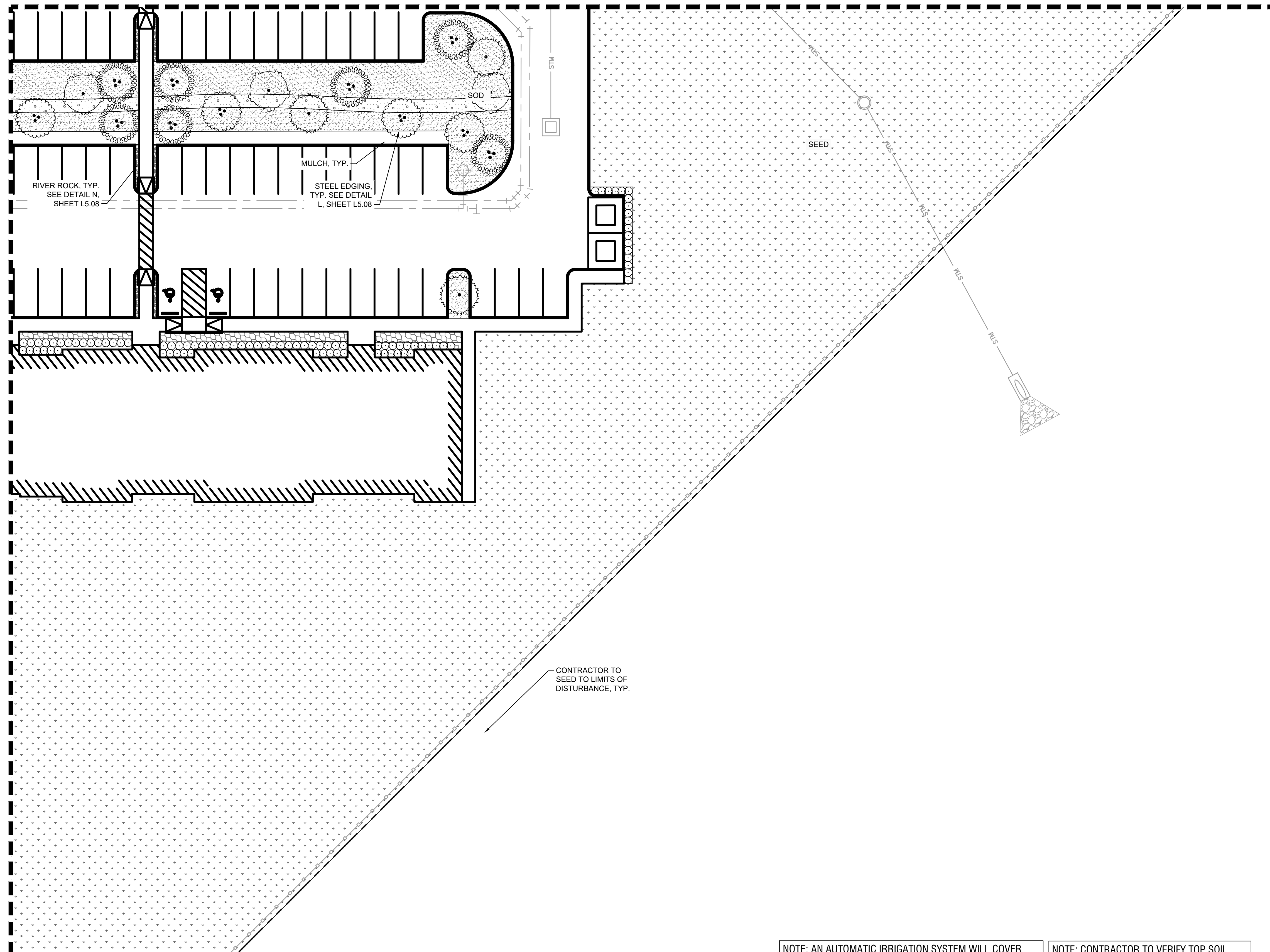
HOUSTON TEXAS

SHEET NUMBER
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MATCH LINE SHEET L5.05

MATCH LINE SHEET L5.04



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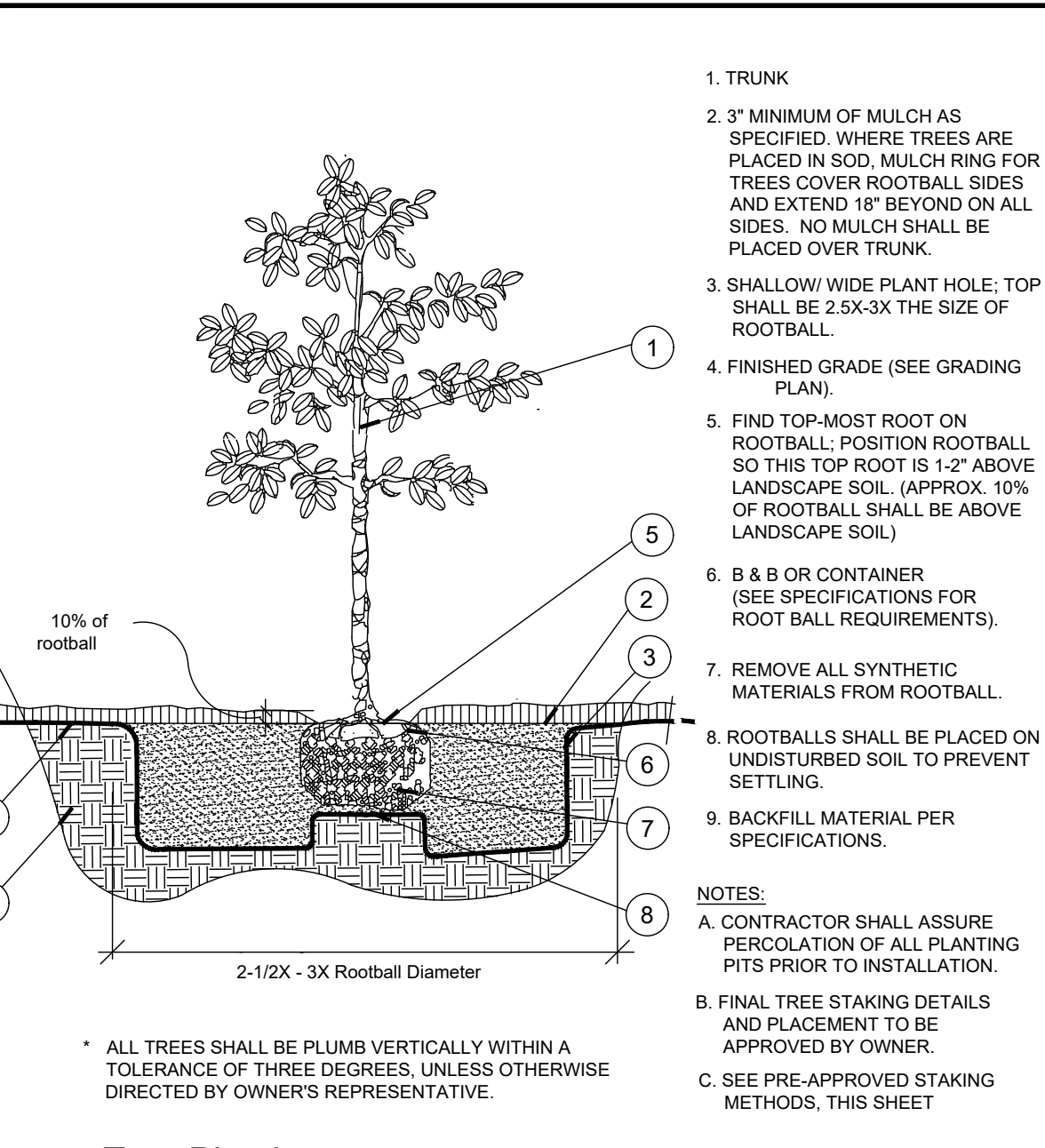
KHA PROJECT	DATE	DESIGNED BY	DRAWN BY	CHECKED BY
068924000	SEPTEMBER 2023	SJH	SJH	SEM

**PLANTING PLAN
(4 OF 4)**

STARWOOD TRACT
 PREPARED FOR
 IMPACT RESIDENTIAL
 DEVELOPMENT, LLC.
 HOUSTON TEXAS

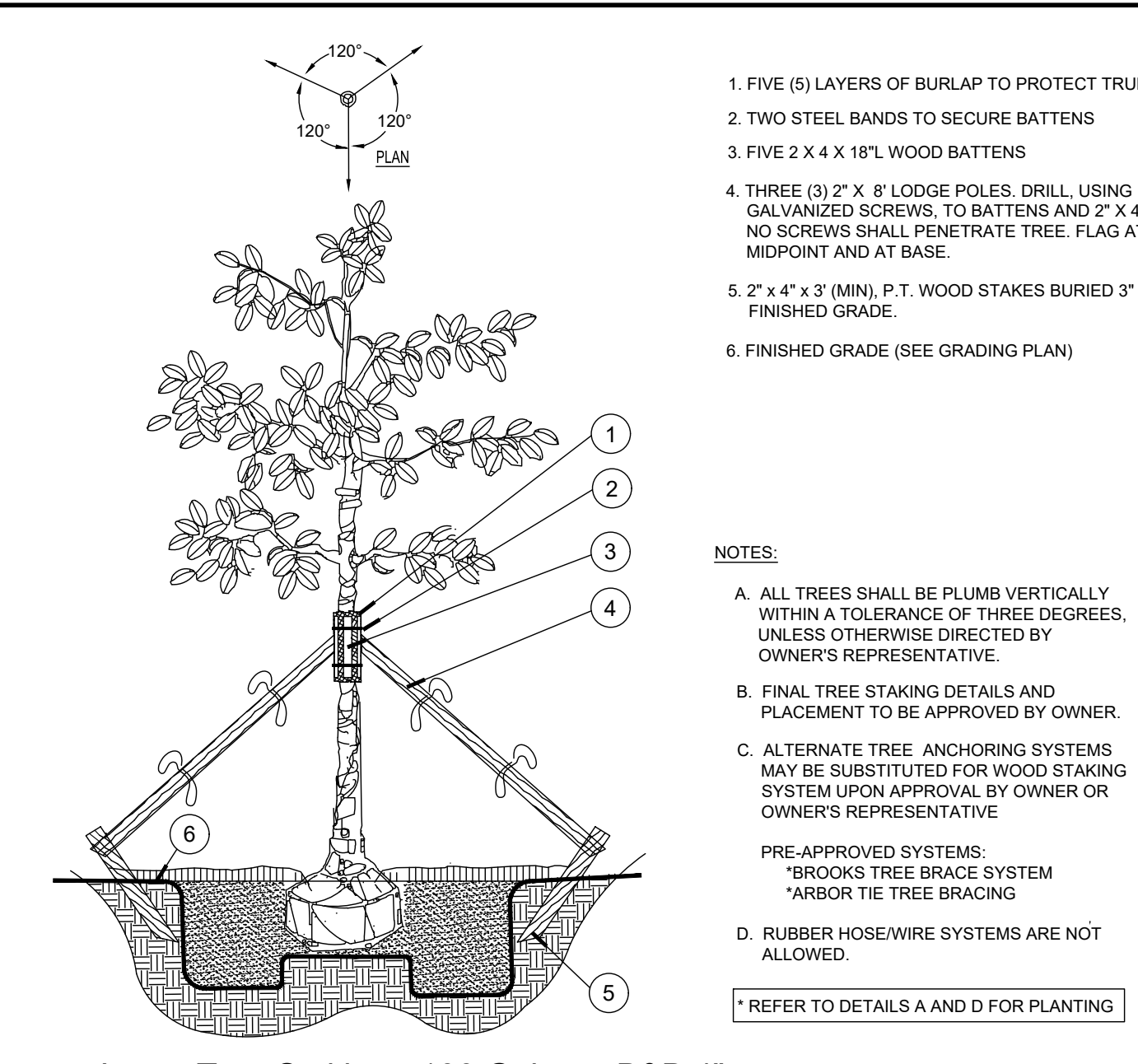
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Plotted By: Harris, Sam. Sheet Set: KHA. Layout: L5.08. September 15, 2023. 01:21:53pm. K:\HOU_Civil\08-472001-1-2000 Blossomed Street Landscape Architecture\Production\CAD\Sheets\L5.08 PLANTING PLAN.dwg
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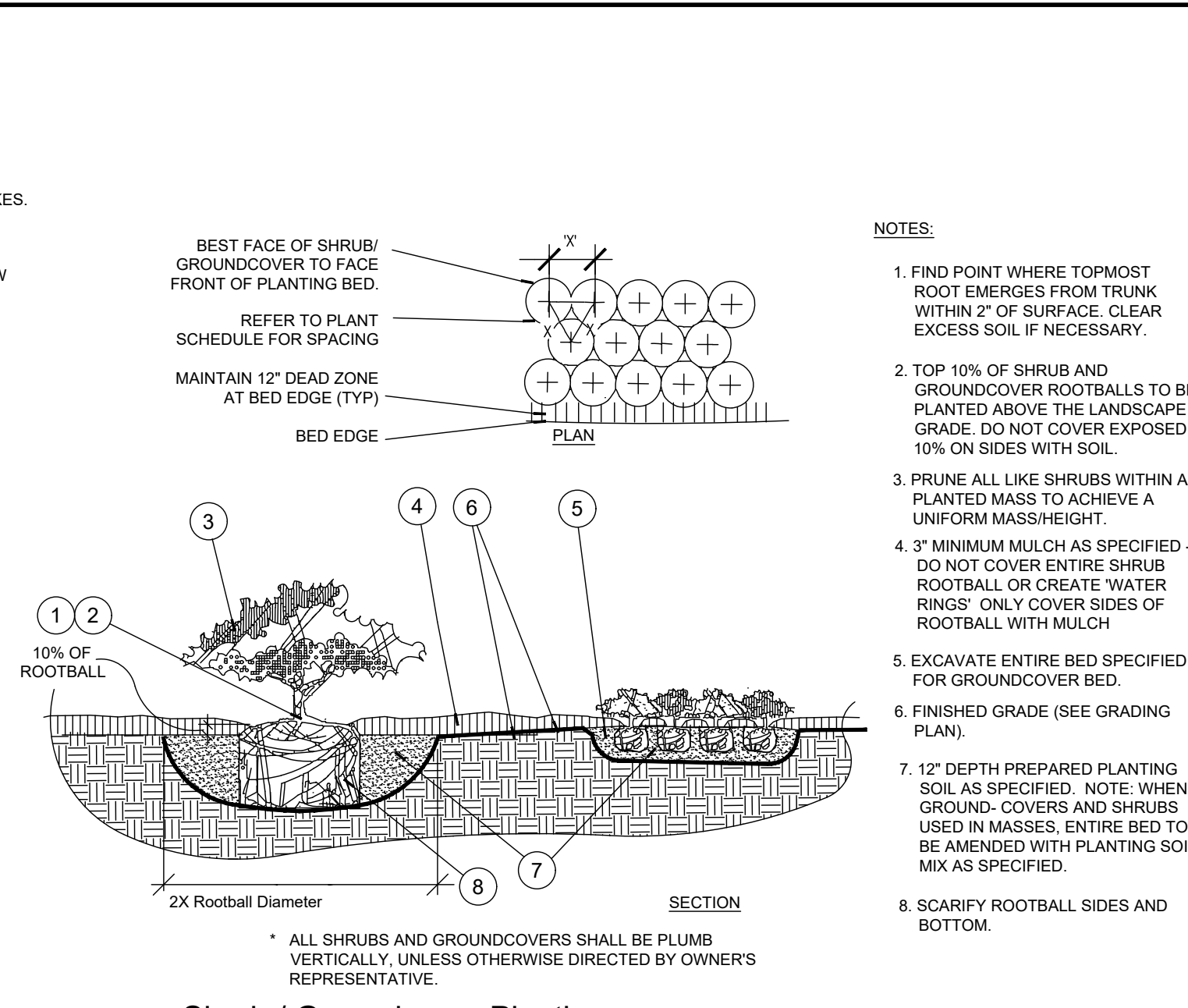
1. TRUNK
 2. 3" MINIMUM OF MULCH AS SPECIFIED. WHERE TREES ARE PLACED IN SOIL, MULCH RING FOR TREES COVER ROOTBALL SIDES AND EXTEND 18" BEYOND ON ALL SIDES. NO MULCH SHALL BE PLACED OVER TRUNK.
 3. SHALLOW WIDE PLANT HOLE. TOP SHALL BE 2.5X-3X THE SIZE OF ROOTBALL.
 4. FINISHED GRADE (SEE GRADING PLAN).
 5. FIND TOP-MOST ROOT ON ROOTBALL. POSITION ROOTBALL SO THIS TOP ROOT IS 1-2" ABOVE LANDSCAPE SOIL. (APPROX. 10% OF ROOTBALL SHALL BE ABOVE LANDSCAPE SOIL.)
 6. B & B OR CONTAINER (SEE SPECIFICATIONS FOR ROOT BALL REQUIREMENTS).
 7. REMOVE ALL SYNTHETIC MATERIALS FROM ROOTBALL.
 8. ROOTBALLS SHALL BE PLACED ON UNDISTURBED SOIL TO PREVENT SETTLING.
 9. BACKFILL MATERIAL PER SPECIFICATIONS.
- NOTES:
- A. CONTRACTOR SHALL ASSURE PERCOLATION OF ALL PLANTING PITS PRIOR TO INSTALLATION.
 - B. FINAL TREE STAKING DETAILS AND PLACEMENT TO BE APPROVED BY OWNER.
 - C. SEE PRE-APPROVED STAKING METHODS, THIS SHEET.
- * ALL TREES SHALL BE PLUMB VERTICALLY WITHIN A TOLERANCE OF THREE DEGREES, UNLESS OTHERWISE DIRECTED BY OWNER'S REPRESENTATIVE.

A Tree Planting
SECTION N.T.S.



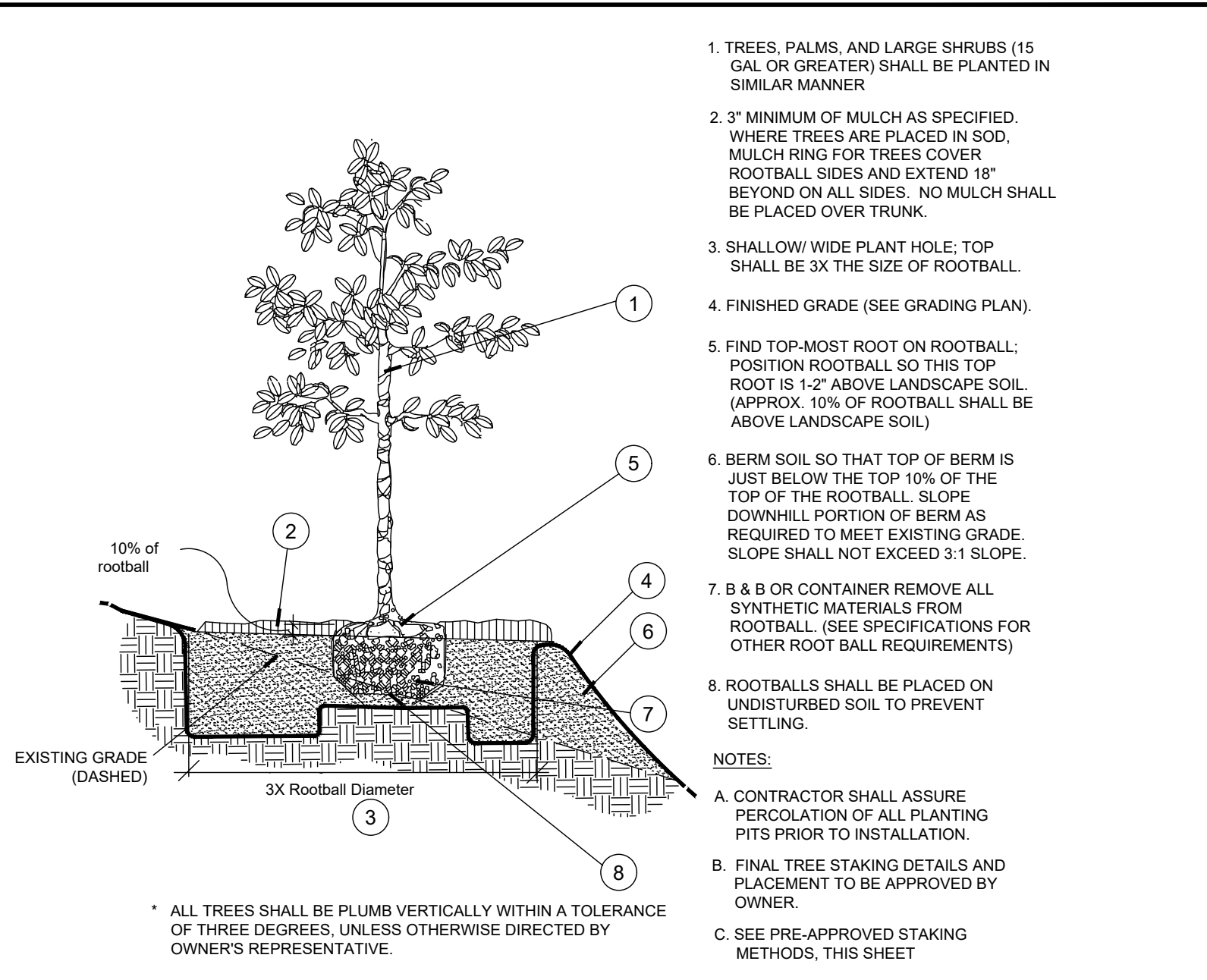
1. FIVE (5) LAYERS OF BURLAP TO PROTECT TRUNK
 2. TWO STEEL BANDS TO SECURE BATTENS
 3. FIVE 2 X 4 X 18\"/>
 - 4. THREE (3) 2\"/>
 - 5. 2\"/>
 - 6. FINISHED GRADE (SEE GRADING PLAN)
- NOTES:
- A. ALL TREES SHALL BE PLUMB VERTICALLY WITHIN A TOLERANCE OF THREE DEGREES, UNLESS OTHERWISE DIRECTED BY OWNER'S REPRESENTATIVE.
 - B. FINAL TREE STAKING DETAILS AND PLACEMENT TO BE APPROVED BY OWNER.
 - C. ALTERNATE TREE ANCHORING SYSTEMS MAY BE SUBSTITUTED FOR WOOD STAKING SYSTEM UPON APPROVAL BY OWNER OR OWNER'S REPRESENTATIVE.
 - D. RUBBER HOSE/WIRE SYSTEMS ARE NOT ALLOWED.
- PRE-APPROVED SYSTEMS:
 * BROOKS TREE BRACE SYSTEM
 * ARBOR TIE TREE BRACING
- * REFER TO DETAILS A AND D FOR PLANTING

B Large Tree Staking - 100 Gal + or B&B 4\"/>SECTION N.T.S.



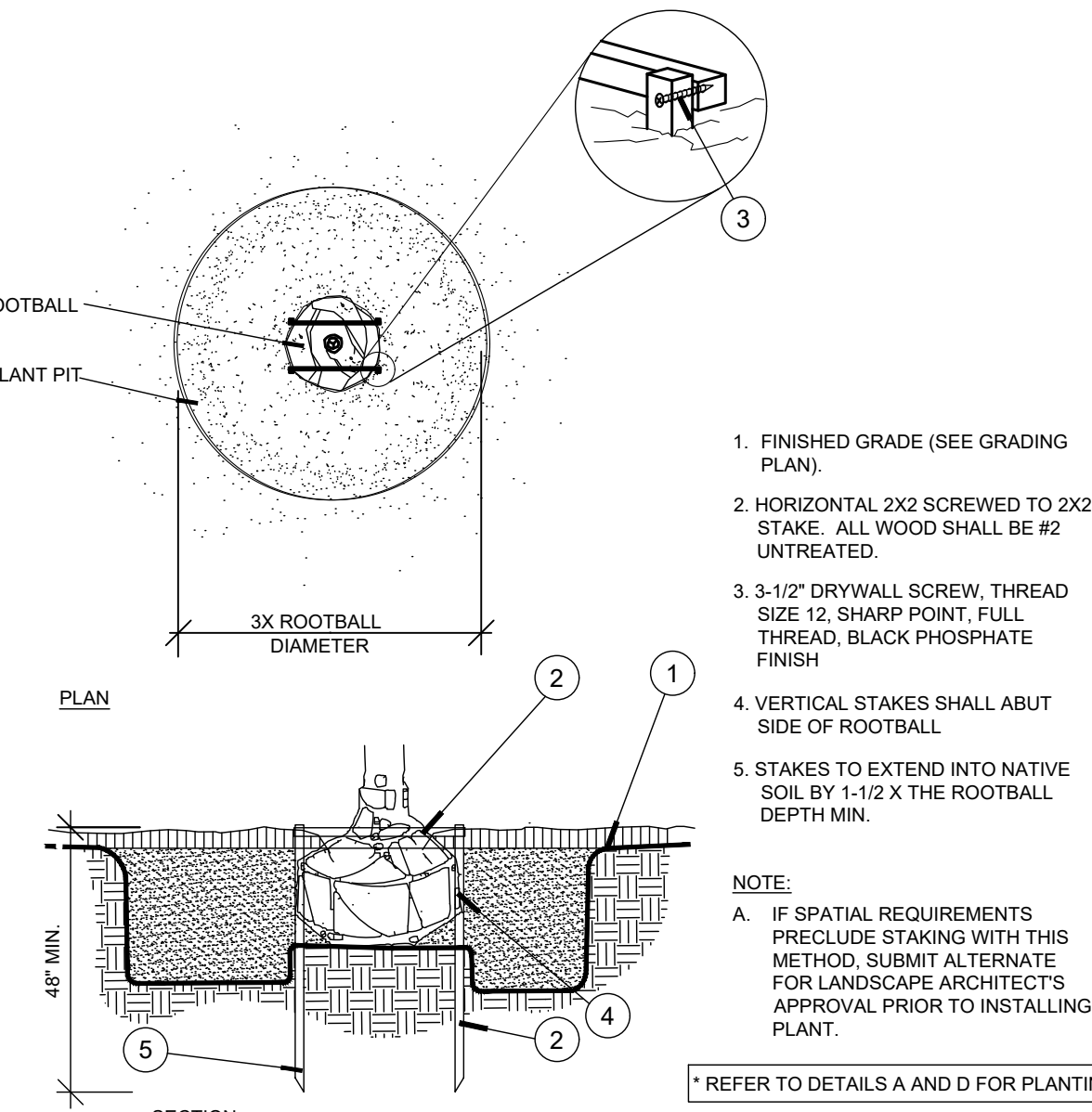
- NOTES:
1. FIND POINT WHERE TOPMOST ROOT EMERGES FROM TRUNK WITHIN 2\"/>
 - 2. TOP 10% OF SHRUB AND GROUNDCOVER ROOTBALLS TO BE PLANTED ABOVE THE LANDSCAPE GRADE. DO NOT COVER EXPOSED 10% ON SIDES WITH SOIL.
 - 3. PRUNE ALL LIKE SHRUBS WITHIN A PLANTED MASS TO ACHIEVE A UNIFORM MASS HEIGHT.
 - 4. 3\"/>
 - 5. EXCAVATE ENTIRE BED SPECIFIED FOR GROUNDCOVER BED.
 - 6. FINISHED GRADE (SEE GRADING PLAN).
 - 7. 12\"/>
 - 8. SCARIFY ROOTBALL SIDES AND BOTTOM.
- * ALL SHRUBS AND GROUNDCOVERS SHALL BE PLUMB VERTICALLY, UNLESS OTHERWISE DIRECTED BY OWNER'S REPRESENTATIVE.

C Shrub / Groundcover Planting
PLAN / SECTION N.T.S.



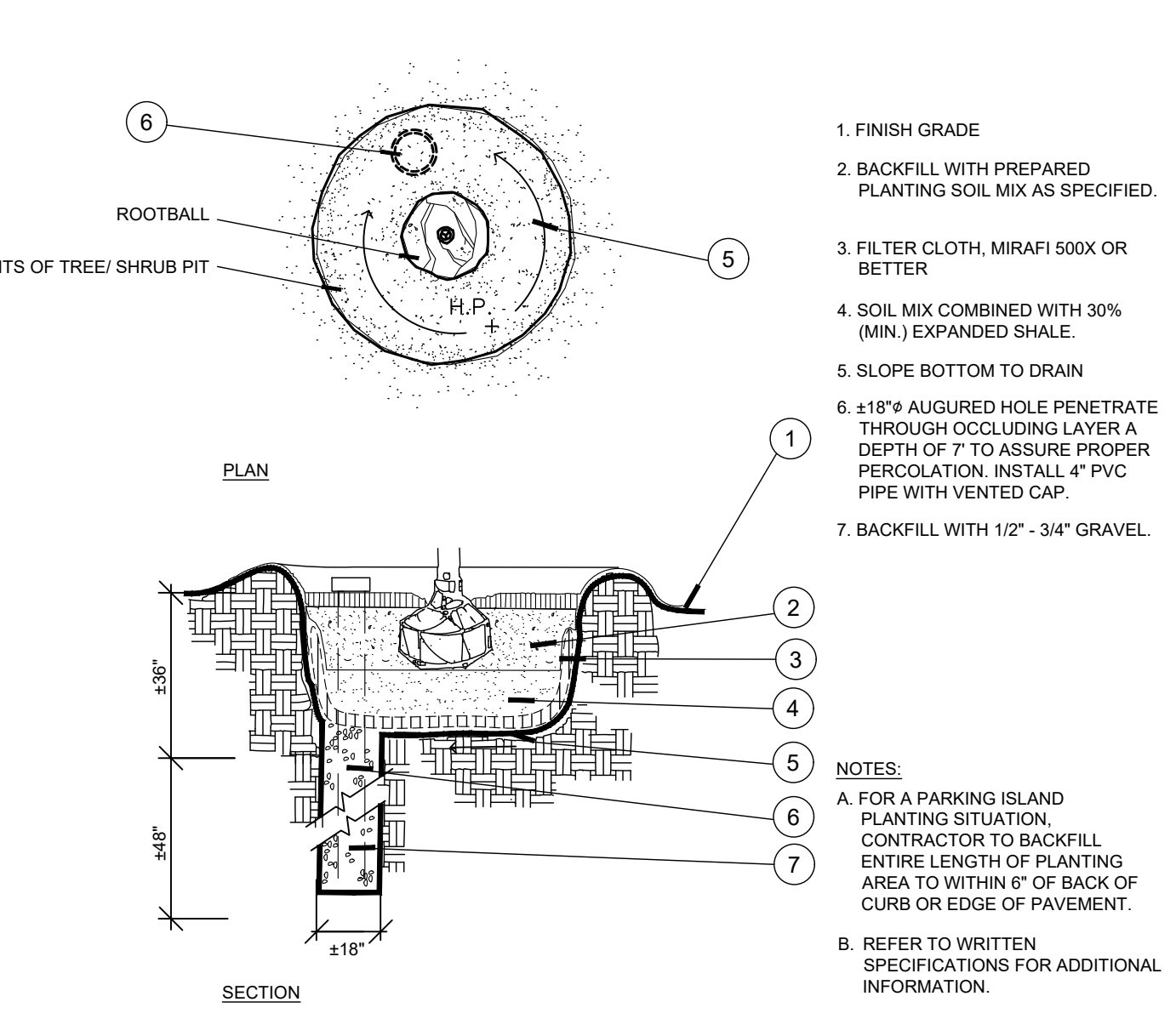
1. TREES, PALMS, AND LARGE SHRUBS (15 GAL OR GREATER) SHALL BE PLANTED IN SIMILAR MANNER
 2. 3" MINIMUM OF MULCH AS SPECIFIED. WHERE TREES ARE PLACED IN SOIL, MULCH RING FOR TREES COVER ROOTBALL SIDES AND EXTEND 18" BEYOND ON ALL SIDES. NO MULCH SHALL BE PLACED OVER TRUNK.
 3. SHALLOW WIDE PLANT HOLE. TOP SHALL BE 3X THE SIZE OF ROOTBALL.
 4. FINISHED GRADE (SEE GRADING PLAN).
 5. FIND TOP-MOST ROOT ON ROOTBALL. POSITION ROOTBALL SO THIS TOP ROOT IS 1-2" ABOVE LANDSCAPE SOIL. (APPROX. 10% OF ROOTBALL SHALL BE ABOVE LANDSCAPE SOIL.)
 6. BERM SOIL SO THAT TOP OF BERM IS JUST BELOW THE TOP 10% OF THE TOP OF THE ROOTBALL. SLOPE DOWNHILL PORTION OF BERM AS REQUIRED TO MEET EXISTING GRADE. SLOPE SHALL NOT EXCEED 3:1 SLOPE.
 7. B & B OR CONTAINER REMOVE ALL SYNTHETIC MATERIALS FROM ROOTBALL. (SEE SPECIFICATIONS FOR OTHER ROOT BALL REQUIREMENTS)
 8. ROOTBALLS SHALL BE PLACED ON UNDISTURBED SOIL TO PREVENT SETTLING.
- NOTES:
- A. CONTRACTOR SHALL ASSURE PERCOLATION OF ALL PLANTING PITS PRIOR TO INSTALLATION.
 - B. FINAL TREE STAKING DETAILS AND PLACEMENT TO BE APPROVED BY OWNER.
 - C. SEE PRE-APPROVED STAKING METHODS, THIS SHEET.
- * ALL TREES SHALL BE PLUMB VERTICALLY WITHIN A TOLERANCE OF THREE DEGREES, UNLESS OTHERWISE DIRECTED BY OWNER'S REPRESENTATIVE.

D Planting on a Slope
PLAN / SECTION N.T.S.



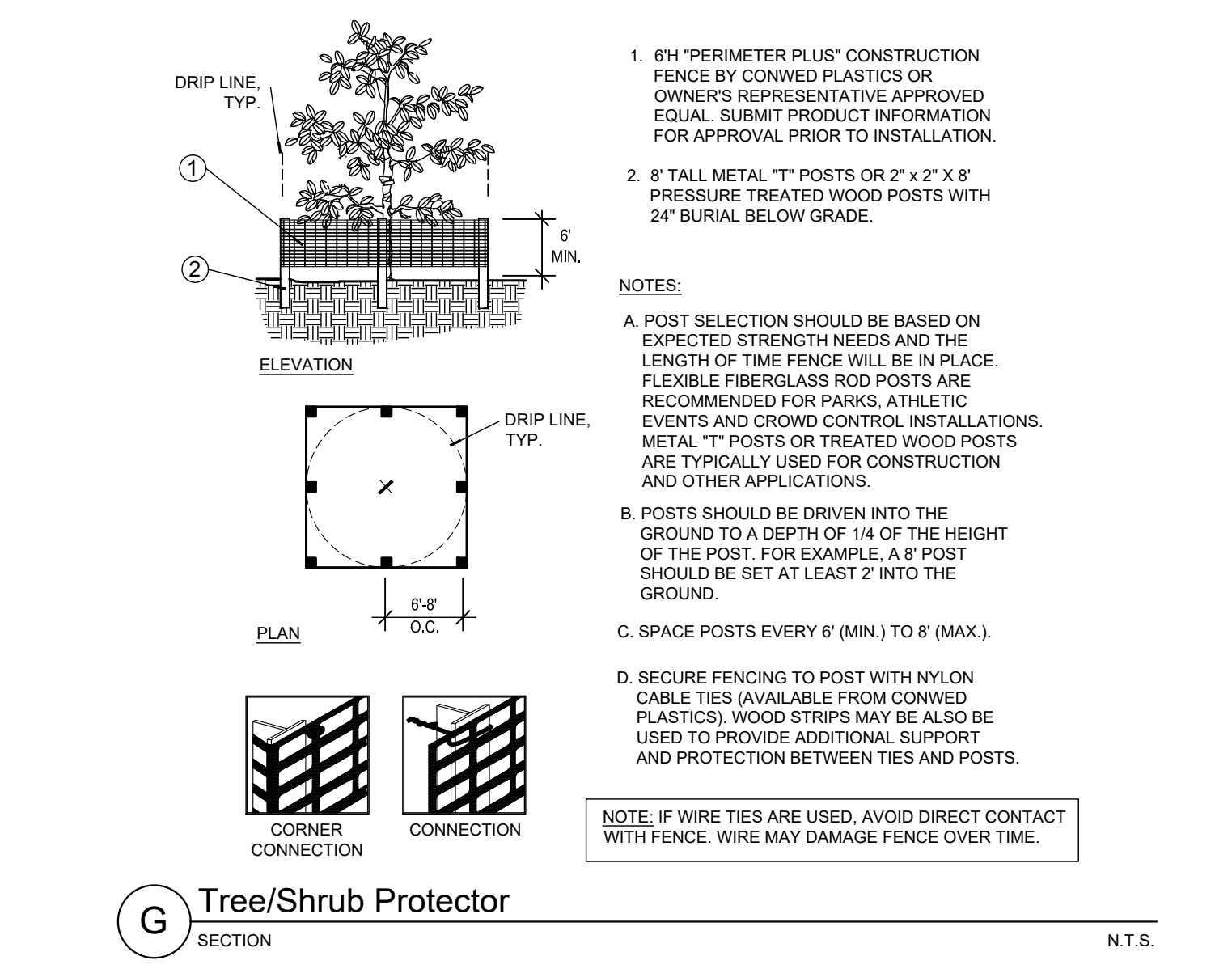
1. FINISHED GRADE (SEE GRADING PLAN).
 2. HORIZONTAL 2X2 SCREWED TO 2X2 STAKE. ALL WOOD SHALL BE #2 UNTREATED.
 3. 3-1/2\"/>
 - 4. VERTICAL STAKES SHALL ABUT SIDE OF ROOTBALL.
 - 5. STAKES TO EXTEND INTO NATIVE SOIL BY 1-1/2 X THE ROOTBALL DEPTH MIN.
- NOTE:
- A. IF SPATIAL REQUIREMENTS PRECLUDE STAKING WITH THIS METHOD, SUBMIT ALTERNATE FOR LANDSCAPE ARCHITECT'S APPROVAL PRIOR TO INSTALLING PLANT.
- * REFER TO DETAILS A AND D FOR PLANTING

E Staking - up to 65 gal. or B&B to 3-1/2\"/>SECTION N.T.S.



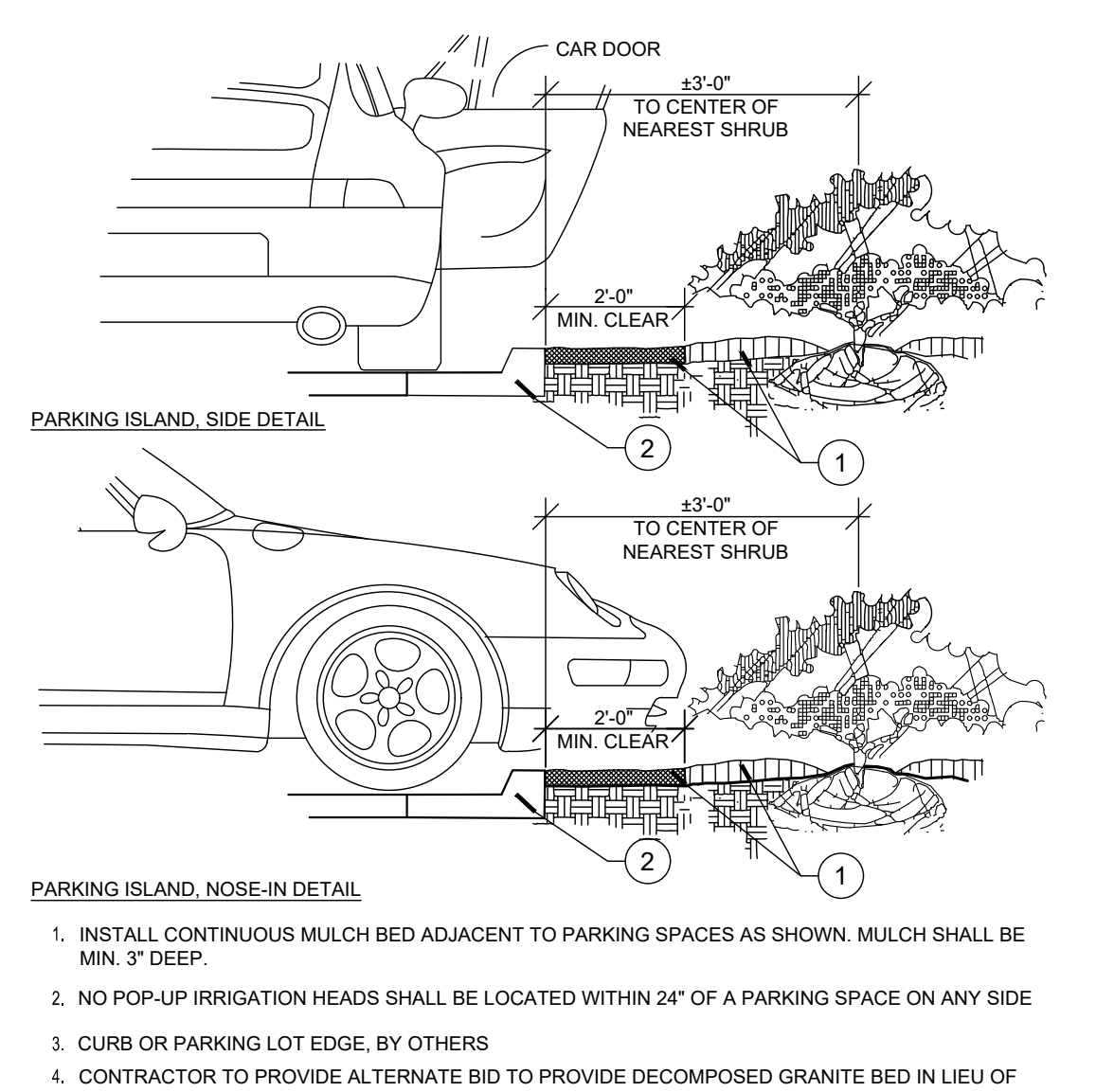
1. FINISH GRADE
 2. BACKFILL WITH PREPARED PLANTING SOIL MIX AS SPECIFIED.
 3. FILTER CLOTH, MIRAFI 500X OR BETTER
 4. SOIL MIX COMBINED WITH 30% (MIN.) EXPANDED SHALE
 5. SLOPE BOTTOM TO DRAIN
 6. 1/8\"/>
 - 7. BACKFILL WITH 1/2\"/>
- NOTES:
- A. FOR A PARKING ISLAND PLANTING SITUATION, CONTRACTOR TO BACKFILL ENTIRE LENGTH OF PLANTING AREA TO WITHIN 6\"/>
 - B. REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL INFORMATION.

F Poor Drainage Condition
PLAN / SECTION N.T.S.



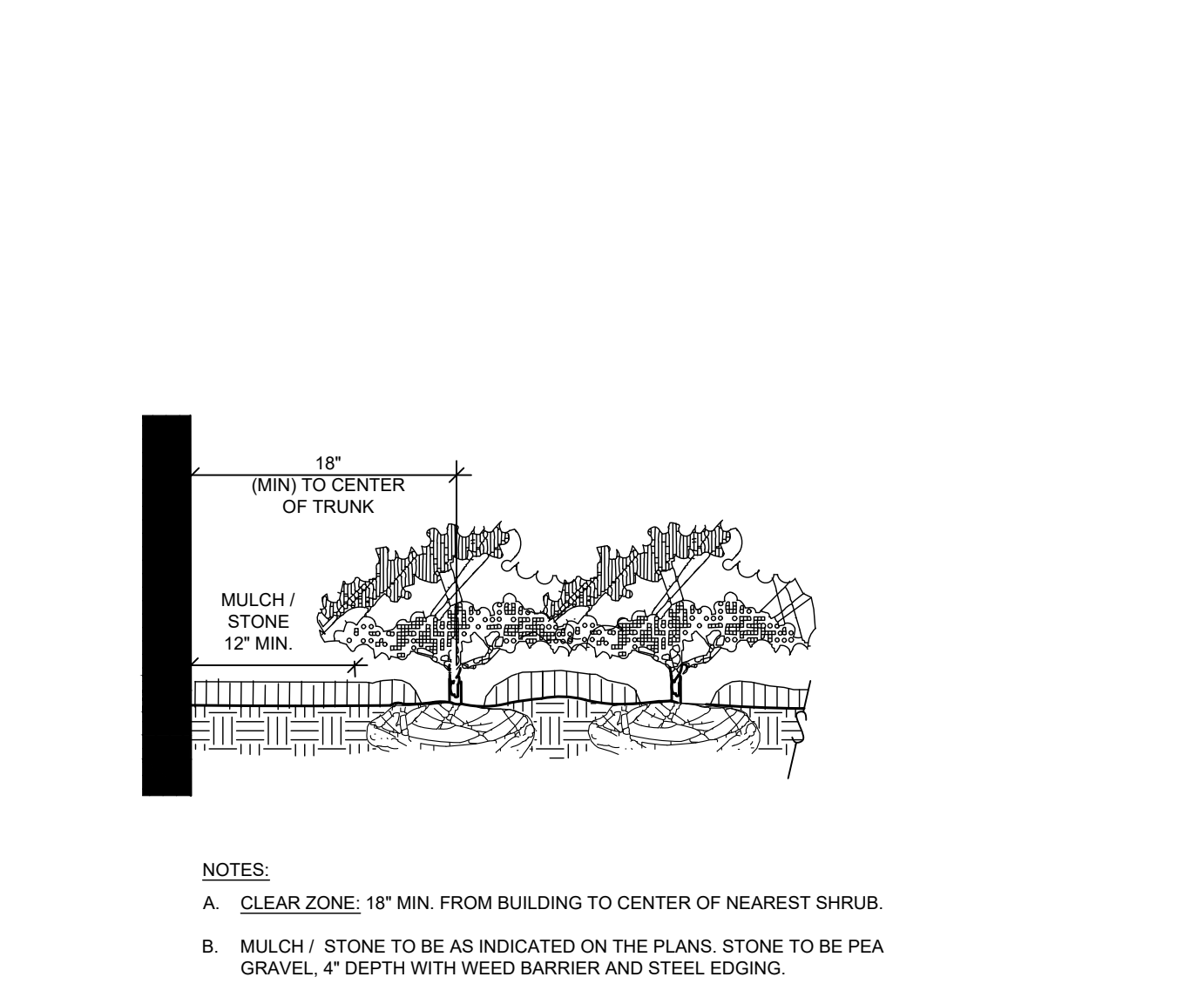
1. 6\"/>
 - 2. 8\"/>
- NOTES:
- A. POST SELECTION SHOULD BE BASED ON EXPECTED STRENGTH NEEDS AND THE LENGTH OF TIME FENCE WILL BE IN PLACE. FLEXIBLE FIBERGLASS ROD POSTS ARE RECOMMENDED FOR PARKS, ATHLETIC EVENTS AND CROWD CONTROL INSTALLATIONS. METAL T POSTS OR TREATED WOOD POSTS ARE TYPICALLY USED FOR CONSTRUCTION AND OTHER APPLICATIONS.
 - B. POSTS SHOULD BE DRIVEN INTO THE GROUND TO A DEPTH OF 1/4 OF THE HEIGHT OF THE POST. FOR EXAMPLE, A 8\"/>
 - C. SPACE POSTS EVERY 6\"/>
 - D. SECURE FENCING TO POST WITH NYLON CABLE TIES (AVAILABLE FROM CONVEX PLASTICS). WOOD STRIPS MAY BE ALSO BE USED TO PROVIDE ADDITIONAL SUPPORT AND PROTECTION BETWEEN TIES AND POSTS.
- NOTE: IF WIRE TIES ARE USED, AVOID DIRECT CONTACT WITH FENCE. WIRE MAY DAMAGE FENCE OVER TIME.

G Tree/Shrub Protector
SECTION N.T.S.



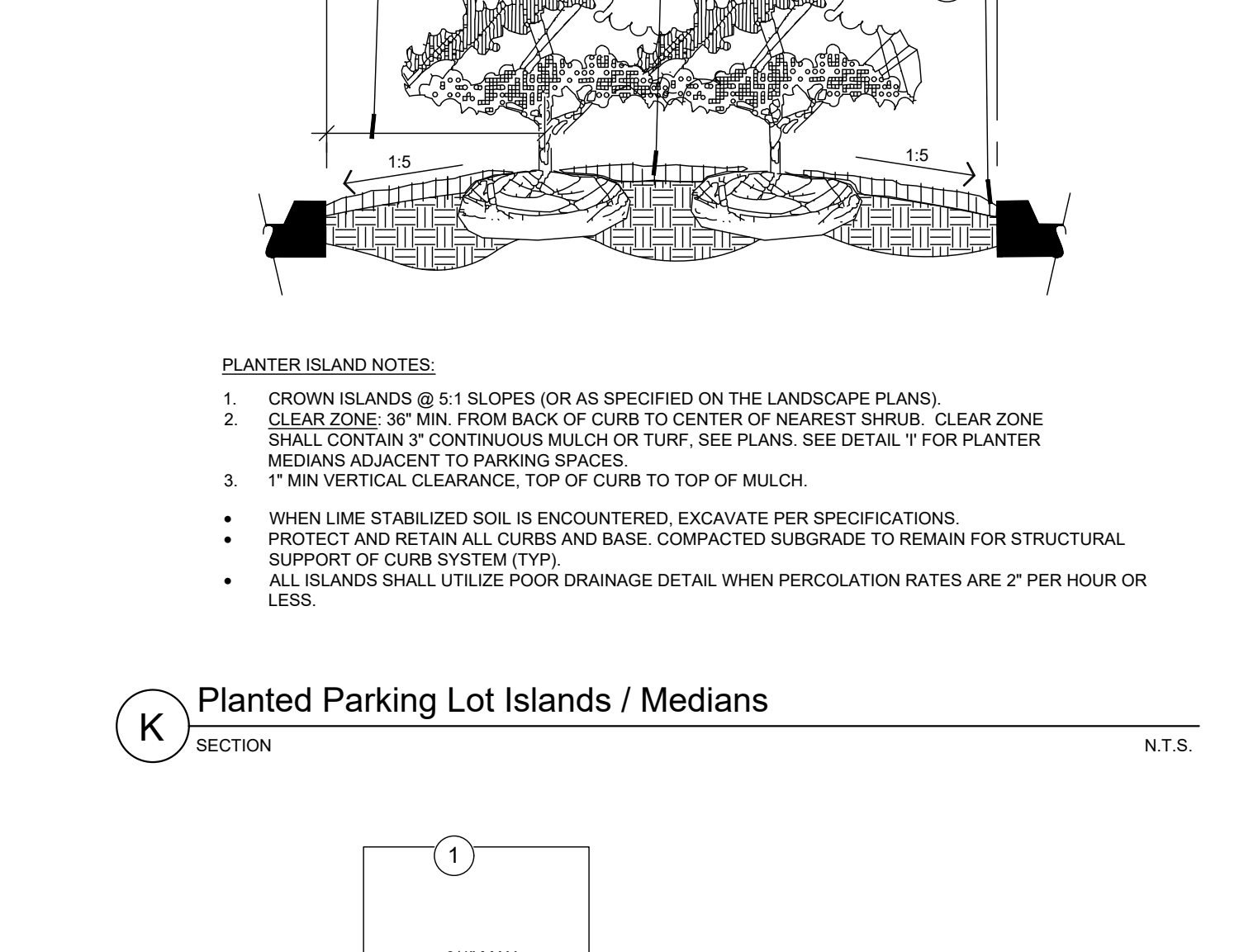
1. INSTALL CONTINUOUS MULCH BED ADJACENT TO PARKING SPACES AS SHOWN. MULCH SHALL BE MIN. 3\"/>
- 2. NO POP-UP IRRIGATION HEADS SHALL BE LOCATED WITHIN 24\"/>
- 3. CURB OR PARKING LOT EDGE, BY OTHERS
- 4. CONTRACTOR TO PROVIDE ALTERNATE BID TO PROVIDE DECOMPOSED GRANITE BED IN LIEU OF MULCH FOR REVIEW OF OWNER.

I Parking Space/Curb Planting
SECTION N.T.S.



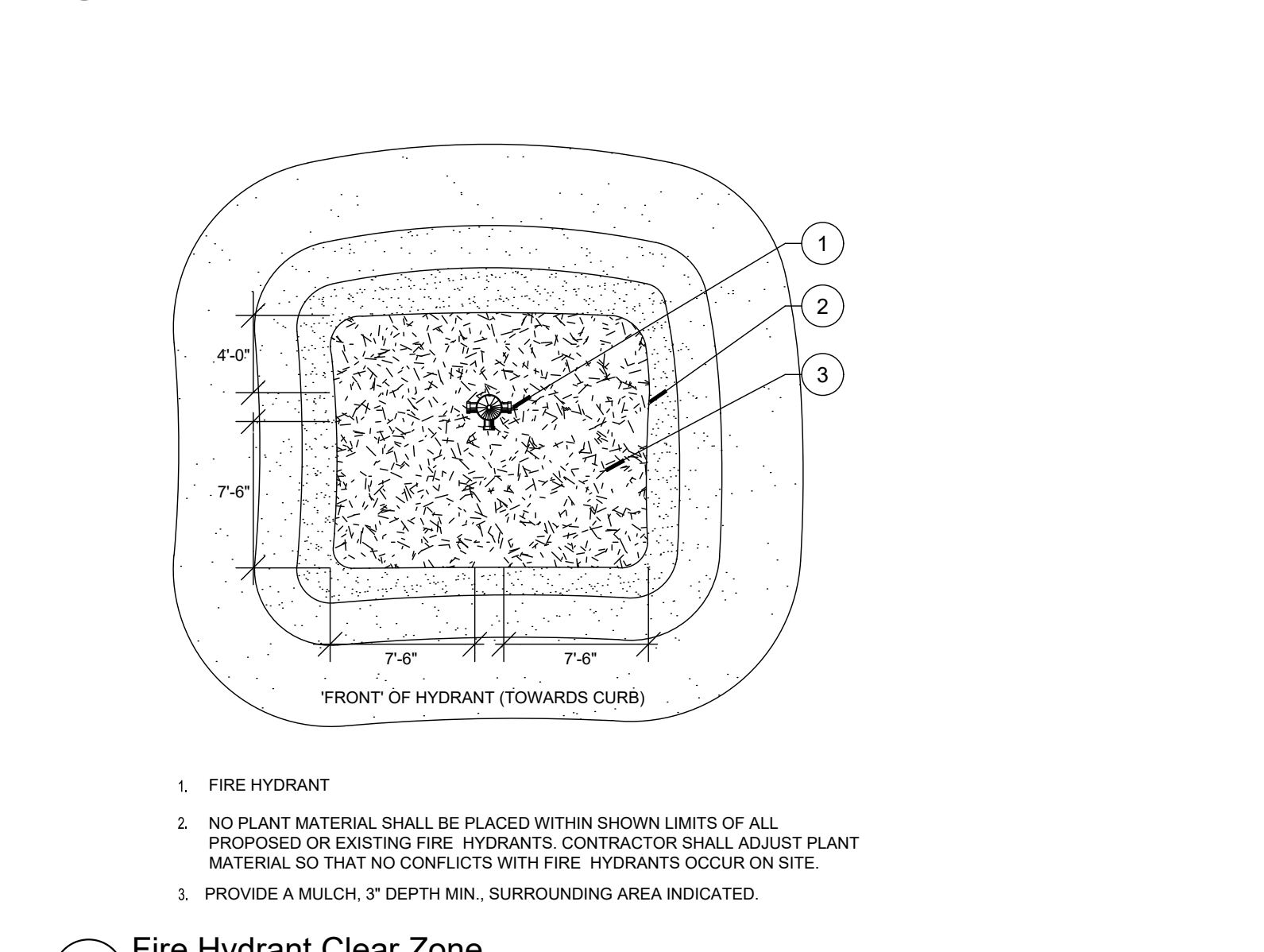
- NOTES:
- A. CLEAR ZONE: 18\"/>
 - B. MULCH / STONE TO BE AS INDICATED ON THE PLANS. STONE TO BE PEA GRAVEL, 4\"/>

J Plantings Adjacent to Buildings/Walls
SECTION N.T.S.



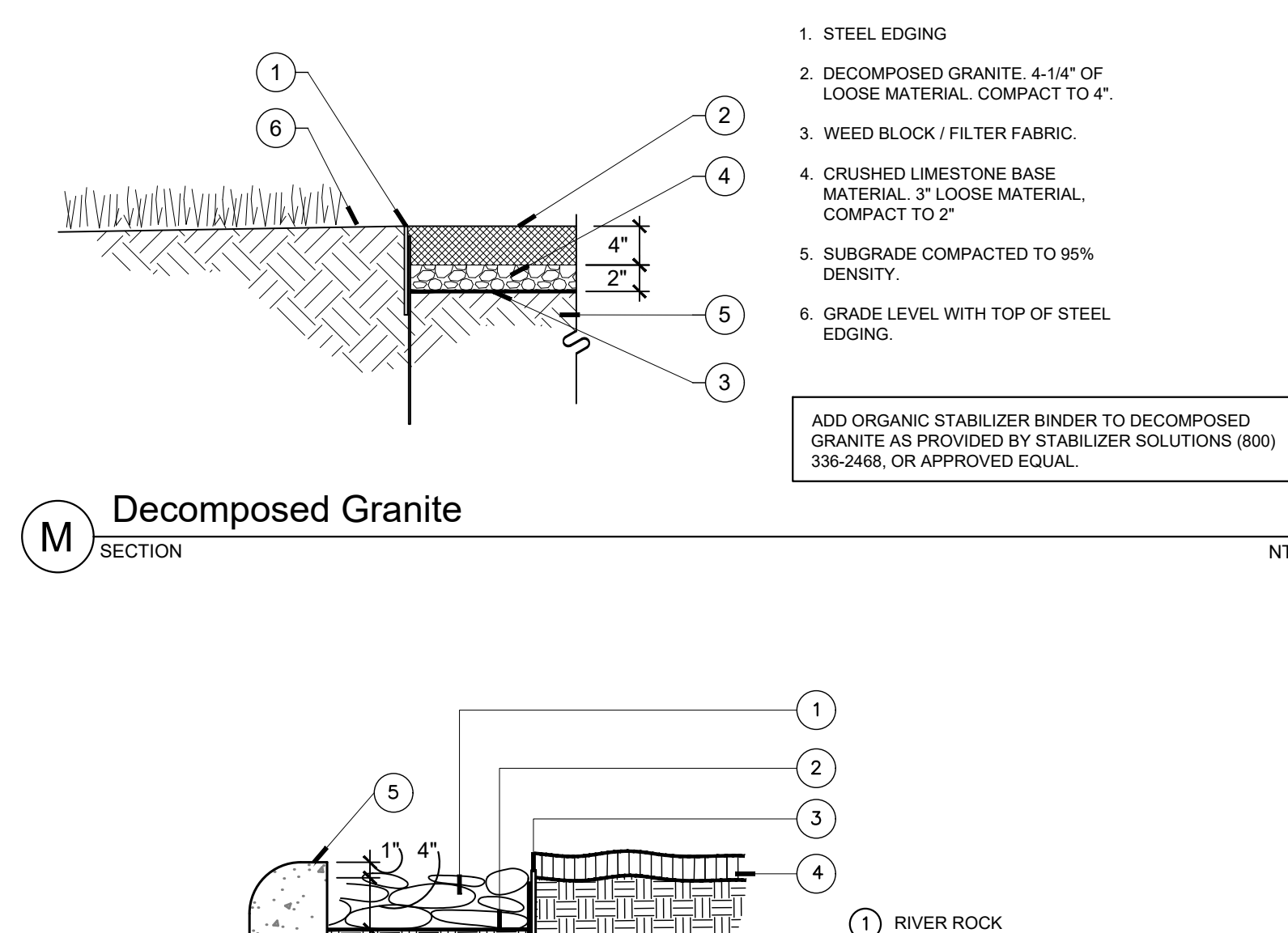
1. DIFFERENT PLANTING TREATMENTS.
2. METAL EDGING
3. BED SOIL. 12\"/>
- 4. NATIVE SOIL
- 5. 4\"/>

K Planted Parking Lot Islands / Medians
SECTION N.T.S.



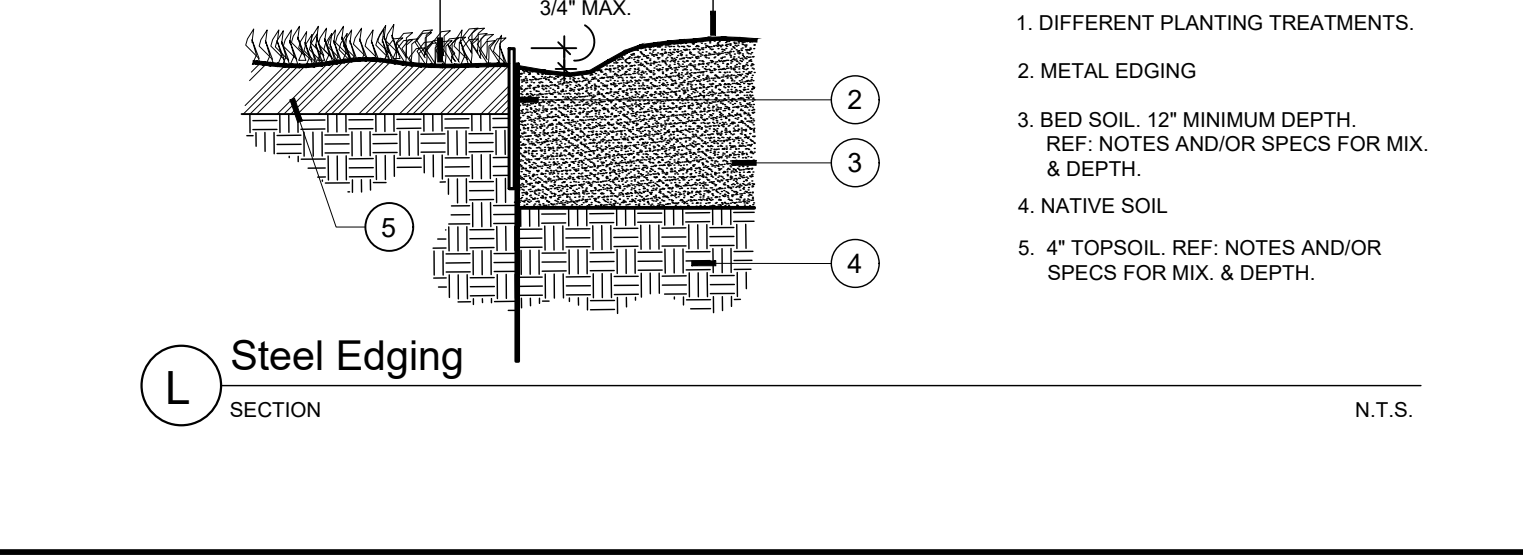
1. FIRE HYDRANT
- NO PLANT MATERIAL SHALL BE PLACED WITHIN SHOWN LIMITS OF ALL PROPOSED OR EXISTING FIRE HYDRANTS. CONTRACTOR SHALL ADJUST PLANT MATERIAL SO THAT NO CONFLICTS WITH FIRE HYDRANTS OCCUR ON SITE.
- PROVIDE A MULCH, 3\"/>

H Fire Hydrant Clear Zone
PLAN N.T.S.



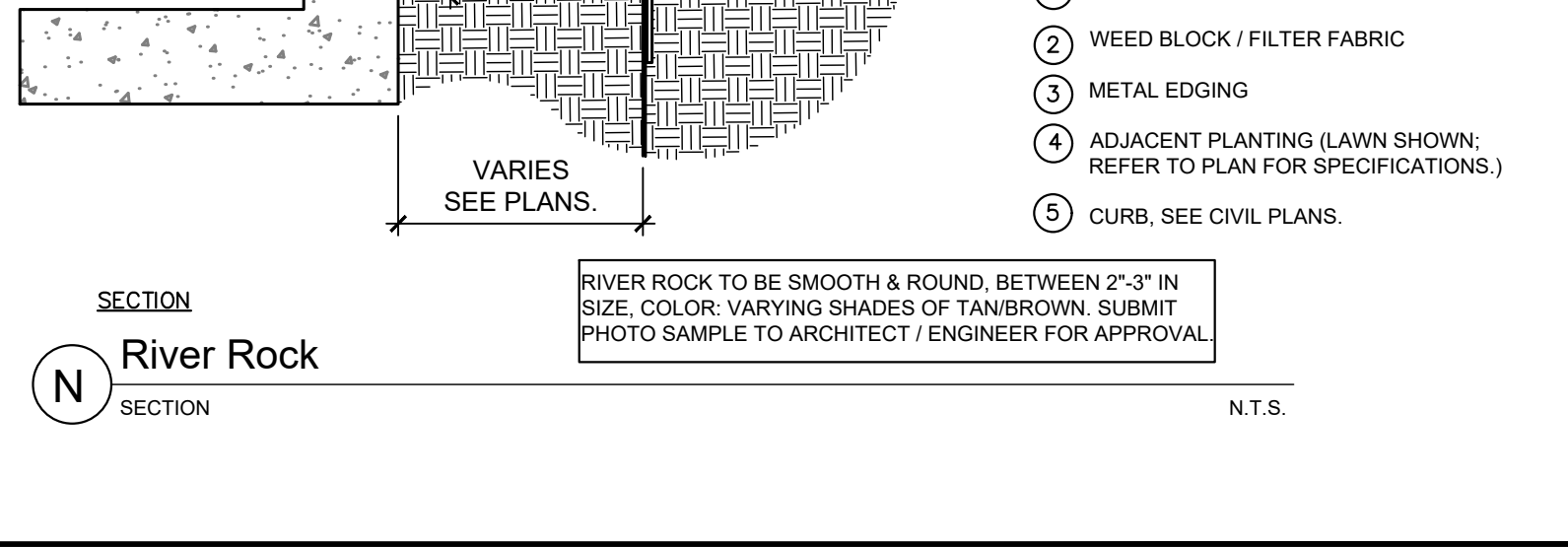
1. STEEL EDGING
 - DECOMPOSED GRANITE. 4-1/4\"/>
 - WEED BLOCK / FILTER FABRIC.
 - CRUSHED LIMESTONE BASE MATERIAL. 3\"/>
 - SUBGRADE COMPACTED TO 95% DENSITY.
 - GRADE LEVEL WITH TOP OF STEEL EDGING.
- ADD ORGANIC STABILIZER BINDER TO DECOMPOSED GRANITE AS PROVIDED BY STABILIZER SOLUTIONS (800) 336-2468, OR APPROVED EQUAL.

M Decomposed Granite
SECTION N.T.S.



1. RIVER ROCK
 - WEED BLOCK / FILTER FABRIC
 - METAL EDGING
 - ADJACENT PLANTING (LAWN SHOWN. REFER TO PLAN FOR SPECIFICATIONS.)
 - CURB. SEE CIVIL PLANS.
- RIVER ROCK TO BE SMOOTH & ROUND, BETWEEN 2\"/>

L Steel Edging
SECTION N.T.S.



1. RIVER ROCK
 - WEED BLOCK / FILTER FABRIC
 - METAL EDGING
 - ADJACENT PLANTING (LAWN SHOWN. REFER TO PLAN FOR SPECIFICATIONS.)
 - CURB. SEE CIVIL PLANS.
- RIVER ROCK TO BE SMOOTH & ROUND, BETWEEN 2\"/>

N River Rock
SECTION N.T.S.

NO.	REVISIONS	DATE	BY

Kimley-Horn
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 PHONE: 281-567-9300
 WWW.KIMLEY-HORN.COM
 TBPB FIRM REGISTRATION F-428

PRELIMINARY
 FOR REVIEW ONLY
 Not for construction or permit purposes.
Kimley-Horn
 SHANNON E. MUNDY
 P.L.A. No. 3543 Date: SEP. 2023

KHA PROJECT	DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY	SEM
068924000	SEPTEMBER 2023	AS SHOWN	SJH	SJH	SEM	

LANDSCAPE DETAILS

STARWOOD TRACT
 PREPARED FOR
IMPACT RESIDENTIAL DEVELOPMENT, LLC.

GENERAL LANDSCAPE SPECIFICATIONS AND NOTES

A. SCOPE OF WORK

- 1. THE WORK CONSISTS OF: FURNISHING ALL LABOR, MATERIALS, EQUIPMENT, TOOLS, TRANSPORTATION, AND ANY OTHER APPURTENANCES NECESSARY FOR THE COMPLETION OF THIS PROJECT AS SHOWN ON THE DRAWINGS, AS INCLUDED IN THE PLANT LIST, AND AS HEREIN SPECIFIED.
2. WORK SHALL INCLUDE MAINTENANCE AND WATERING OF ALL CONTRACT PLANTING AREAS UNTIL CERTIFICATION OF ACCEPTABILITY BY THE OWNER.

B. PROTECTION OF EXISTING STRUCTURES

ALL EXISTING BUILDINGS, WALKS, WALLS, PAVING, PIPING, OTHER SITE CONSTRUCTION ITEMS, AND PLANTING ALREADY COMPLETED OR ESTABLISHED SHALL BE PROTECTED FROM DAMAGE BY THE CONTRACTOR UNLESS OTHERWISE SPECIFIED. ALL DAMAGE RESULTING FROM NEGLIGENCE SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE OWNER, AT NO COST TO THE OWNER.

C. PROTECTION OF EXISTING PLANT MATERIALS OUTSIDE LIMIT OF WORK

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL UNAUTHORIZED CUTTING OR DAMAGE TO TREES AND SHRUBS EXISTING OR OTHERWISE, CAUSED BY CARELESS EQUIPMENT OPERATION, MATERIAL STOCKPILING, ETC. THIS SHALL INCLUDE COMPACTION BY DRIVING OR PARKING INSIDE THE DRIP-LINE AND SPILLING OIL, GASOLINE, OR OTHER DELETERIOUS MATERIALS WITHIN THE DRIP-LINE. NO MATERIALS SHALL BE BURNED WHERE HEAT WILL DAMAGE ANY PLANT. EXISTING TREES KILLED OR DAMAGED SO THAT THEY ARE MISSHAPEN AND/ OR UNSIGHTLY SHALL BE REPLACED AT THE COST TO THE CONTRACTOR OF ONE HUNDRED DOLLARS (\$100) PER CALIPER INCH ON AN ESCALATING SCALE WHICH ADDS AN ADDITIONAL TWENTY (20) PERCENT PER INCH OVER FOUR (4) INCHES CALIPER AS FIXED AND AGREED LIQUIDATED DAMAGES. CALIPER SHALL BE MEASURED SIX (6) INCHES ABOVE GROUND LEVEL FOR TREES UP TO AND INCLUDING FOUR (4) INCHES IN CALIPER AND TWELVE (12) INCHES ABOVE GROUND LEVEL FOR TREES OVER FOUR (4) INCHES IN CALIPER.

D. MATERIALS

1. GENERAL

MATERIALS LISTED BELOW SHALL BE SUBMITTED FOR APPROVAL. UPON SUBMITTALS' APPROVAL, DELIVERY OF MATERIALS MAY COMMENCE.

Table with 2 columns: MATERIAL, SUBMITTAL. Rows include MULCH, TOPSOIL MIX, PLANTS, FERTILIZER, INNOCULANT, HERBICIDE, STAKING/GUYINGFOR ALTERNATE TO DETAILS: SEND PRODUCT DATA, DETAIL CLIENT-REQUESTED TAGGING MAY SUBSTITUTE PHOTOS.

2. PLANT MATERIALS INDICATE SIZES (HEIGHT/WIDTH) AND QUALITY PER SPEC.

A. PLANT SPECIES AND SIZE SHALL CONFORM TO THOSE INDICATED ON THE DRAWINGS. NOMENCLATURE SHALL CONFORM TO STANDARDIZED PLANT NAMES, 1942 EDITION. ALL NURSERY STOCK SHALL BE IN ACCORDANCE WITH GRADES AND STANDARDS FOR NURSERY PLANTS, LATEST EDITION, PUBLISHED BY THE AMERICAN STANDARD NURSERY STOCK. ALL PLANTS SHALL BE HEALTHY, VIGOROUS, SOUND, WELL-BRANCHED, AND FREE OF DISEASE AND INSECTS, INSECT EGGS AND LARVAE AND SHALL HAVE ADEQUATE ROOT SYSTEMS. TREES FOR PLANTING IN ROWS SHALL BE UNIFORM IN SIZE AND SHAPE. ALL MATERIALS SHALL BE SUBJECT TO APPROVAL BY THE OWNER. WHERE ANY REQUIREMENTS ARE OMITTED FROM THE PLANT LIST, THE PLANTS FURNISHED SHALL BE NORMAL FOR THE VARIETY. PLANTS SHALL BE PRUNED PRIOR TO DELIVERY ONLY WITH APPROVAL FROM OWNER OR OWNER'S REPRESENTATIVE. NO SUBSTITUTIONS SHALL BE MADE WITHOUT WRITTEN PERMISSION FROM THE OWNER'S REPRESENTATIVE.

B. MEASUREMENTS: THE HEIGHT AND/OR WIDTH OF TREES SHALL BE MEASURED FROM THE GROUND OR ACROSS THE NORMAL SPREAD OF BRANCHES WITH THE PLANTS IN THEIR NORMAL POSITION. THIS MEASUREMENT SHALL NOT INCLUDE THE IMMEDIATE TERMINAL GROWTH. PLANTS LARGER IN SIZE THAN THOSE SPECIFIED IN THE PLANT LIST MAY BE USED IF APPROVED BY THE OWNER. IF THE USE OF LARGER PLANTS IS APPROVED, THE BALL OF EARTH OR SPREAD OF ROOTS SHALL BE INCREASED IN PROPORTION TO THE SIZE OF THE PLANT.

C. INSPECTION: PLANTS SHALL BE SUBJECT TO INSPECTION AND APPROVAL AT THE PLACE OF GROWTH, OR UPON DELIVERY TO THE SITE, AS DETERMINED BY THE OWNER, FOR QUALITY, SIZE, AND VARIETY; SUCH APPROVAL SHALL NOT IMPAIR THE RIGHT OF INSPECTION AND REJECTION AT THE SITE DURING PROGRESS OF THE WORK OR AFTER COMPLETION FOR SIZE AND CONDITION OF ROOT BALLS OR ROOTS, LATENT DEFECTS OR INJURIES. REJECTED PLANTS SHALL BE REMOVED IMMEDIATELY FROM THE SITE. NOTICE REQUESTING INSPECTION SHALL BE SUBMITTED IN WRITING BY THE CONTRACTOR AT LEAST ONE (1) WEEK PRIOR TO ANTICIPATED DATE.

E. SOIL MIXTURE (PLANTING MEDIUM, PLANTING MIX, TOPSOIL MIX)

1. ALL PLANTING BED PIT BACKFILL AREAS TO BE PREPARED USING COMPOST, SHARP SCREENED SAND AND EXPANDED SHALE BY SOIL BUILDING SOLUTIONS, LIVING EARTH, OR APPROVED EQUAL. TILL SOIL AMENDMENTS INTO EXISTING SOIL TO DEPTHS PER PLANTING DETAILS (12" DEPTH MIN). FINISHED GRADES OF PLANTING BEDS TO BE 1" BELOW FINISHED GRADE OF ADJACENT CONCRETE MOW STRIP OR AS SHOWN ON GRADING PLAN. PLANTING BED PIT SOIL SHALL BE A MIXTURE OF APPROXIMATELY 50% WEED-FREE EXISTING SOIL, 35% COMPOST, 10% EXPANDED SHALE, AND 5% SCREENED SHARP SAND. 98.5% OF THE PLANTING BED PIT SOIL PARTICLES WILL PASS THROUGH A 1/2 INCH SCREEN AND 99% OR MORE SHALL PASS THROUGH A 3/4 INCH SCREEN. COLOR TO BE A MEDIUM BROWN WITH A WEIGHT OF 1900-2250 LBS. PER CUBIC YARD (DEPENDING ON THE MOISTURE CONTENT).

2. ALL SOD AND SEED AREAS TO BE PREPARED USING COMPOST AND SHARP SCREENED SAND, BY SOIL BUILDING SOLUTIONS, LIVING EARTH, OR APPROVED EQUAL. TILL SOIL AMENDMENTS INTO EXISTING SOIL TO DEPTHS PER PLANTING DETAILS (4" DEPTH MIN.). TOPSOIL SHALL BE A MIXTURE OF APPROXIMATELY 50% WEED-FREE EXISTING SOIL (IF AVAILABLE), 40% COMPOST, AND 10% SHARP SCREENED SAND. IF THERE IS INSUFFICIENT EXISTING TOPSOIL, CONTRACTOR SHALL BE RESPONSIBLE FOR NECESSARY IMPORT. TOPSOIL SHALL BE NATURAL, FRIABLE, FERTILE, pH RANGE OF 6.0-8.5 WITH 25% (MIN) ORGANIC MATERIAL, 50% (MIN) LOAM MATERIAL, AND FREE OF TRASH, DEBRIS, STONES, WEEDS AND TWIGS/BRANCHES. THE PARTICLE SIZES SHALL BE SUCH THAT 98.5% OF THE TOPSOIL WILL PASS THROUGH A 1/2 INCH SCREEN AND 99% OR MORE SHALL PASS THROUGH A 3/4 INCH SCREEN. IF EXISTING TOPSOIL IS TO BE UTILIZED ONSITE, THE TOPSOIL SHALL BE REVIEWED/APPROVED BY OWNER/LANDSCAPE ARCHITECT PRIOR TO INSTALLATION. CONTRACTOR TO SUBMIT SAMPLES IN 1 GAL. (MIN) CONTAINER.

3. THE CONTRACTOR SHALL REESTABLISH ANY ADDITIONAL DISTURBED AREAS NOT SHOWN ON THE PLANS WITH A FULL COVERING OF SOD OR SEED. THE CONTRACTOR SHALL PROVIDE 4" DEPTH (MIN) PREPARED TOPSOIL IN ALL AREAS TO RECEIVE SEED OR SOD AT NO ADDITIONAL COST.

4. TREE PLANTING PITS SHALL BE BACKFILLED WITH COMPOST BY SOIL BUILDING SOLUTIONS, LIVING EARTH OR APPROVED EQUAL AND NATIVE SOIL. THE TOP 1/3 OF EACH TREE PIT SHALL RECEIVE BACKFILL MATERIAL OF 80% WEED FREE NATIVE SOIL AND 20% COMPOST. THE BOTTOM 2/3 OF EACH TREE PIT SHALL RECEIVE BACKFILL MATERIAL OF 100% WEED FREE NATIVE SOIL.

5. EXISTING SOIL USED IN PLANT BACKFILL AND TOPSOIL PREP SHALL BE REASONABLY FREE OF STONES, LIME, LUMPS OF CLAY, ROOTS AND OTHER FOREIGN MATTER. EXISTING SOIL SHALL HAVE A MINIMUM ORGANIC COMPOSITION OF 25% AND THE ACIDITY SHALL BE BETWEEN 5.0 AND 7.0 pH. CONTRACTOR SHALL SUBMIT A 1 GAL. MINIMUM SAMPLE OF THE EXISTING SOIL TO AN APPROVED TESTING FACILITY TO VERIFY COMPOSITION, ACIDITY AND ORGANIC CONTENT.

6. IF SOIL FAILS TO ACHIEVE THE AFOREMENTIONED pH AND ORGANIC COMPOSITION QUANTITIES, THE CONTRACTOR SHALL TILL AN ADEQUATE AMOUNT OF COMPOST IN TO THE EXISTING SOIL UNTIL IT MEETS THE REQUIREMENTS PRIOR TO COMBINING WITH OTHER SPECIFIED SOIL AMENDMENTS.

7. CONTRACTOR TO SUBMIT SAMPLES OF SOIL MIXTURE AND AMENDMENTS FOR OWNER'S REPRESENTATIVE APPROVAL PRIOR TO PLANT INSTALLATION OPERATIONS COMMENCE.

8. WHERE LIME STABILIZED SOIL IS ENCOUNTERED, LAWN AREAS SHALL BE EXCAVATED TO A DEPTH OF 12", PLANT BEDS SHALL BE EXCAVATED TO A DEPTH OF 24", AND TREE PITS SHALL BE EXCAVATED TO A DEPTH OF 36", AND BACKFILLED WITH CLEAN NATIVE SOIL (E.5) AND APPROVED PLANTING SOIL (E-1.4), UNLESS OTHERWISE SPECIFIED IN GEOTECH REPORT.

F. WATER

WATER NECESSARY FOR PLANTING AND MAINTENANCE SHALL BE OF SATISFACTORY QUALITY TO SUSTAIN AN ADEQUATE PLANT GROWTH AND SHALL NOT CONTAIN HARMFUL, NATURAL OR MAN-MADE ELEMENTS DETRIMENTAL TO PLANTS. WATER MEETING THE ABOVE STANDARD SHALL BE OBTAINED ON THE SITE FROM THE OWNER, IF AVAILABLE, AND THE CONTRACTOR SHALL BE RESPONSIBLE TO MAKE ARRANGEMENTS FOR ITS USE BY HIS TANKS, HOSES, SPRINKLERS, ETC. IF SUCH WATER IS NOT AVAILABLE AT THE SITE, THE CONTRACTOR SHALL PROVIDE SATISFACTORY WATER FROM SOURCES OFF THE SITE AT NO ADDITIONAL COST TO THE OWNER.

*WATERING/IRRIGATION RESTRICTIONS MAY APPLY - REFER TO PROPERTY'S JURISDICTIONAL AUTHORITY.

G. FERTILIZER

CONTRACTOR SHALL PROVIDE FERTILIZER APPLICATION SCHEDULE TO OWNER, AS APPLICABLE TO SOIL TYPE, PLANT INSTALLATION TYPE, AND SITE'S PROPOSED USE. SUGGESTED FERTILIZER TYPES SHALL BE ORGANIC OR OTHERWISE NATURALLY-DERIVED.

*FERTILIZER RESTRICTIONS MAY APPLY - REFER TO PROPERTY'S JURISDICTIONAL AUTHORITY.

H. MULCH

ALL PLANTING BED TO BE TOP DRESSED WITH A MINIMUM OF 3" "RUSTIC CUT HARDWOOD MULCH" BY SOIL BUILDING SOLUTIONS OR LIVING EARTH (OR APPROVED EQUAL) WITH A pH RANGE OF 6.5-8.5 AND SHALL BE FREE OF MAN-MADE FOREIGN MATTER, LUMBER, TREATED MATERIALS, PALLETS, GRASS AND LEAVES. NO PARTICLE SIZE SHOULD EXCEED 3.5" IN LENGTH.

I. DIGGING AND HANDLING

1. PROTECT ROOTS OR ROOT BALLS OF PLANTS AT ALL TIMES FROM SUN, DRYING WINDS, WATER AND FREEZING, AS NECESSARY UNTIL PLANTING. PLANT MATERIALS SHALL BE ADEQUATELY PACKED TO PREVENT DAMAGE DURING TRANSIT. TREES TRANSPORTED MORE THAN TEN (10) MILES OR WHICH ARE NOT PLANTED WITHIN THREE (3) DAYS OF DELIVERY TO SITE SHALL BE SPRAYED WITH AN ANTITRANSPIRANT PRODUCT ("WILT PRUF" OR EQUAL) TO MINIMIZE TRANSPIRATIONAL WATER LOSS.

2. BALLED AND BURLAPPED PLANTS (B&B) SHALL BE DUG WITH FIRM, NATURAL BALLS OF SOIL OF SUFFICIENT SIZE TO ENCOMPASS THE FIBROUS AND FEEDING ROOTS OF THE PLANTS. NO PLANTS MOVED WITH A ROOT BALL SHALL BE PLANTED IF THE BALL IS CRACKED OR BROKEN. PLANTS BALLED AND BURLAPPED OR CONTAINER GROWN SHALL NOT BE HANDLED BY STEMS.

3. PLANTS MARKED "BR" IN THE PLANT LIST SHALL BE DUG WITH BARE ROOTS, COMPLYING WITH AMERICAN STANDARD FOR NURSERY PLANTS, CURRENT EDITION. CARE SHALL BE EXERCISED THAT THE ROOTS DO NOT DRY OUT DURING TRANSPORTATION AND PRIOR TO PLANTING.

4. PROTECTION OF PALMS (IF APPLICABLE); ONLY A MIN. OF FRONDS SHALL BE REMOVED FROM THE CROWN OF THE PALM TREES TO FACILITATE MOVING AND HANDLING. CLEAR TRUNK (CT) SHALL BE AS SPECIFIED AFTER THE MIN. OF FRONDS HAVE BEEN REMOVED. ALL PALMS SHALL BE BRACED PER PALM PLANTING DETAIL.

5. EXCAVATION OF TREE PITS SHALL BE PERFORMED USING EXTREME CARE TO AVOID DAMAGE TO SURFACE AND SUBSURFACE ELEMENTS SUCH AS UTILITIES, HARDSCAPE ELEMENTS, FOOTERS AND PREPARED SUB BASES.

J. CONTAINER GROWN STOCK

1. ALL CONTAINER GROWN MATERIAL SHALL BE HEALTHY, VIGOROUS, WELL-ROOTED PLANTS ESTABLISHED IN THE CONTAINER IN WHICH THEY ARE SOLD. THE PLANTS SHALL HAVE TOPS WHICH ARE OF GOOD QUALITY AND ARE IN A HEALTHY GROWING CONDITION.

2. AN ESTABLISHED CONTAINER GROWN PLANT SHALL BE TRANSPLANTED INTO A CONTAINER AND GROWN IN THAT CONTAINER SUFFICIENTLY LONG FOR THE NEW FIBROUS ROOTS TO HAVE DEVELOPED SO THAT THE ROOT MASS WILL RETAIN ITS SHAPE AND HOLD TOGETHER WHEN REMOVED FROM THE CONTAINER. CONTAINER GROWN STOCK SHALL NOT BE HANDLED BY THEIR STEMS.

3. PLANT ROOTS BOUND IN CONTAINERS ARE NOT ACCEPTABLE.

4. SUBSTITUTION OF NON-CONTAINER GROWN MATERIAL FOR MATERIAL EXPLICITLY SPECIFIED TO BE CONTAINER GROWN WILL NOT BE PERMITTED WITHOUT WRITTEN APPROVAL IS OBTAINED FROM THE OWNER OR OWNER'S REPRESENTATIVE.

K. COLLECTED STOCK

WHEN THE USE OF COLLECTED STOCK IS PERMITTED AS INDICATED BY THE OWNER OR OWNER'S REPRESENTATIVE, THE MINIMUM SIZES OF ROOTBALLS SHALL BE EQUAL TO THAT SPECIFIED FOR THE NEXT LARGER SIZE OF NURSERY GROWN STOCK OF THE SAME VARIETY.

L. NATIVE STOCK

PLANTS COLLECTED FROM WILD OR NATIVE STANDS SHALL BE CONSIDERED NURSERY GROWN WHEN THEY HAVE BEEN SUCCESSFULLY RE-ESTABLISHED IN A NURSERY ROW AND GROWN UNDER REGULAR NURSERY CULTURAL PRACTICES FOR A MINIMUM OF TWO (2) GROWING SEASONS AND HAVE ATTAINED ADEQUATE ROOT AND TOP GROWTH TO INDICATE FULL RECOVERY FROM TRANSPANTING INTO THE NURSERY ROW.

M. MATERIALS LIST

QUANTITIES NECESSARY TO COMPLETE THE WORK ON THE DRAWINGS SHALL BE FURNISHED BY THE CONTRACTOR. QUANTITY ESTIMATES HAVE BEEN MADE CAREFULLY, BUT THE LANDSCAPE ARCHITECT OR OWNER ASSUMES NO LIABILITY FOR OMISSIONS OR ERRORS. SHOULD A DISCREPANCY OCCUR BETWEEN THE PLANS AND THE PLANT LIST QUANTITY, THE LANDSCAPE ARCHITECT SHALL BE NOTIFIED FOR CLARIFICATION PRIOR TO BIDDING OR INSTALLATION. ALL DIMENSIONS AND/OR SIZES SPECIFIED SHALL BE THE MINIMUM ACCEPTABLE SIZE

N. FINE GRADING

1. FINE GRADING UNDER THIS CONTRACT SHALL CONSIST OF FINAL FINISHED GRADING OF LAWN AND PLANTING AREAS THAT HAVE BEEN ROUGH GRADED BY OTHERS. BERMING AS SHOWN ON THE DRAWINGS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, UNLESS OTHERWISE NOTED.

2. THE CONTRACTOR SHALL FINE GRADE THE LAWN AND PLANTING AREAS TO BRING THE ROUGH GRADE UP TO FINAL FINISHED GRADE ALLOWING FOR THICKNESS OF SOD AND/OR MULCH DEPTH. THIS CONTRACTOR SHALL FINE GRADE BY HAND AND/OR WITH ALL EQUIPMENT NECESSARY INCLUDING A GRADING TRACTOR WITH FRONT-END LOADER FOR TRANSPORTING SOIL WITHIN THE SITE.

3. ALL PLANTING AREAS SHALL BE GRADED AND MAINTAINED FOR POSITIVE DRAINAGE TO SURFACE/SUBSURFACE STORM DRAIN SYSTEMS. AREAS ADJACENT TO BUILDINGS SHALL SLOPE AWAY FROM THE BUILDINGS. REFER TO CIVIL ENGINEER'S PLANS FOR FINAL GRADES.

O. PLANTING PROCEDURES

1. CLEANING UP BEFORE COMMENCING WORK: THE CONTRACTOR SHALL CLEAN WORK AND SURROUNDING AREAS OF ALL RUBBISH OR OBJECTIONABLE MATTER. ALL MORTAR, CEMENT, AND TOXIC MATERIAL SHALL BE REMOVED FROM THE SURFACE OF ALL PLANT BEDS. THESE MATERIALS SHALL NOT BE MIXED WITH THE SOIL. SHOULD THE CONTRACTOR FIND SUCH SOIL CONDITIONS BENEATH THE SOIL WHICH WILL IN ANY WAY ADVERSELY AFFECT THE PLANT GROWTH, HE SHALL IMMEDIATELY CALL IT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE. FAILURE TO DO SO BEFORE PLANTING SHALL MAKE THE CONTRACTEE MEASURES THE RESPONSIBILITY OF THE CONTRACTOR.

2. VERIFY LOCATIONS OF ALL UTILITIES, CONDUITS, SUPPLY LINES AND CABLES, INCLUDING BUT NOT LIMITED TO: ELECTRIC, GAS (LINES AND TANKS), WATER, SANITARY SEWER, STORMWATER SYSTEMS, CABLE, AND TELEPHONE. PROPERLY MAINTAIN AND PROTECT EXISTING UTILITIES. CALL NATIONAL ONE CALL - 811 - TO LOCATE UTILITIES.

3. SUBGRADE EXCAVATION: CONTRACTOR IS RESPONSIBLE TO REMOVE ALL EXISTING AND IMPORTED ROCK AND ROCK SUB-BASE FROM ALL LANDSCAPE PLANTING AREAS TO A MINIMUM DEPTH OF 36". CONTRACTOR IS RESPONSIBLE TO BACKFILL THESE PLANTING AREAS TO ROUGH FINISHED GRADE WITH CLEAN TOPSOIL FROM AN ON-SITE SOURCE OR AN IMPORTED SOURCE. IF ROCK OR OTHER ADVERSE CONDITIONS OCCUR IN PLANTED AREAS AFTER 36" DEEP EXCAVATION BY THE CONTRACTOR, AND ADEQUATE PERCOLATION CAN NOT BE ACHIEVED, CONTRACTOR SHALL UTILIZE PLANTING DETAIL THAT ADDRESSES POOR DRAINAGE.

4. FURNISH NURSERY'S CERTIFICATE OF COMPLIANCE WITH ALL REQUIREMENTS AS HEREIN SPECIFIED AND REQUIRED. INSPECT AND SELECT PLANT MATERIALS BEFORE PLANTS ARE DUG AT NURSERY/GROWING SITE.

5. GENERAL: COMPLY WITH APPLICABLE FEDERAL, STATE, COUNTY, AND LOCAL REGULATIONS GOVERNING LANDSCAPE MATERIALS AND WORK. CONFORM TO ACCEPTED HORTICULTURAL PRACTICES AS USED IN THE TRADE. UPON ARRIVAL AT THE SITE, PLANTS SHALL BE THOROUGHLY WATERED AND PROPERLY MAINTAINED UNTIL PLANTED. PLANTS STORED ON-SITE SHALL NOT REMAIN UNPLANTED FOR A PERIOD EXCEEDING TWENTY-FOUR (24) HOURS. AT ALL TIMES, METHODS CUSTOMARY IN GOOD HORTICULTURAL PRACTICES SHALL BE EXERCISED.

6. THE WORK SHALL BE COORDINATED WITH OTHER TRADES TO PREVENT CONFLICTS. COORDINATE PLANTING WITH IRRIGATION WORK TO ASSURE AVAILABILITY OF WATER AND PROPER LOCATION OF IRRIGATION APPURTENANCES AND PLANTS.

7. ALL PLANTING PITS SHALL BE EXCAVATED TO SIZE AND DEPTH IN ACCORDANCE WITH THE AMERICAN STANDARD FOR NURSERY STOCK, UNLESS SHOWN OTHERWISE ON THE DRAWINGS, AND BACKFILLED WITH THE PREPARED PLANTING SOIL MIXTURE AS SPECIFIED IN SECTION E. TEST ALL TREE PITS WITH WATER BEFORE PLANTING TO ASSURE PROPER DRAINAGE PERCOLATION IS AVAILABLE. NO ALLOWANCE WILL BE MADE FOR LOST PLANTS DUE TO IMPROPER PERCOLATION. IF POOR PERCOLATION EXISTS, UTILIZE "POOR DRAINAGE CONDITION" PLANTING DETAIL. TREES SHALL BE SET PLUMB AND HELD IN POSITION UNTIL THE PLANTING MIXTURE HAS BEEN FLUSHED INTO PLACE WITH A SLOW, FULL HOSE STREAM. ALL PLANTING SHALL BE PERFORMED BY PERSONNEL FAMILIAR WITH PLANTING PROCEDURES AND UNDER THE SUPERVISION OF A QUALIFIED LANDSCAPE FOREMAN.

8. TAKE ALL NECESSARY PRECAUTIONS TO AVOID DAMAGE TO BUILDINGS AND BUILDING STRUCTURES WHILE INSTALLING TREES.

9. SOIL MIXTURE SHALL BE AS SPECIFIED IN SECTION E OF THESE SPECIFICATIONS.

10. TREES SHALL BE SET WITH ROOT BALL CENTERED IN PLANTING PIT WITH ROOT FLARE 2" ABOVE ADJACENT SOIL ELEVATION. SHRUBS SHALL BE SET STRAIGHT AT AN ELEVATION THAT, AFTER SETTLEMENT, THE TOP OF ROOT BALL SHALL BE EVEN WITH TOP OF PLANTING BED. PLANTING SOIL MIXTURE SHALL BE BACKFILLED, THOROUGHLY TAMPED AROUND THE BALL, AND SETTLED BY WATER (AFTER TAMPING).

11. AMEND PINE AND OAK PLANT PITS WITH ECTOMYCORRHIZAL SOIL APPLICATION PER MANUFACTURER'S RECOMMENDATION. ALL OTHER PLANT PITS SHALL BE AMENDED WITH ENDOMYCORRHIZAL SOIL APPLICATION PER MANUFACTURER'S RECOMMENDATION. PROVIDE PRODUCT INFORMATION SUBMITTAL FOR SOILNOCC SRT ADVANCED MYCORRHIZAL INOCULUM (OR EQUAL) PRIOR TO INOCULATION.

12. FILL HOLE WITH SOIL MIXTURE, MAKING CERTAIN ALL SOIL IS SATURATED. TO DO THIS, FILL HOLE WITH WATER AND ALLOW TO SOAK MINIMUM TWENTY (20) MINUTES, STIRRING IF NECESSARY TO GET SOIL THOROUGHLY WET. PACK LIGHTLY WITH FEET. ADD MORE WET SOIL MIXTURE. DO NOT COVER TOP OF BALL WITH SOIL MIXTURE. ONLY WITH MULCH. ALL BURLAP, ROPE, WIRES, BASKETS, ETC., SHALL BE REMOVED FROM THE SIDES AND TOPS OF BALLS, BUT NO BURLAP SHALL BE PULLED FROM UNDERNEATH.

13. PRUNING: TREES SHALL BE PRUNED, AT THE DIRECTION OF THE OWNER OR OWNER'S REPRESENTATIVE, TO PRESERVE THE NATURAL CHARACTER OF THE PLANT. ALL SOFT WOOD OR SUCKER GROWTH AND ALL BROKEN OR BADLY DAMAGED BRANCHES SHALL BE REMOVED WITH A CLEAN CUT. ALL PRUNING TO BE PERFORMED BY LICENSED ARBORIST, IN ACCORDANCE WITH ANSI A-300.

14. SHRUBS AND GROUND COVER PLANTS SHALL BE EVENLY SPACED IN ACCORDANCE WITH THE DRAWINGS AND AS INDICATED ON THE PLANT LIST. CULTIVATE ALL PLANTING AREAS TO A MINIMUM DEPTH OF 12", REMOVE AND DISPOSE ALL DEBRIS AND MIX TO ACHIEVE SOIL MIXTURE AS SPECIFIED IN SECTION E. THOROUGHLY WATER ALL PLANTS AFTER INSTALLATION.

15. TREE GUYING AND BRACING SHALL BE INSTALLED BY THE CONTRACTOR IN ACCORDANCE WITH THE PLANS TO INSURE STABILITY AND MAINTAIN TREES IN AN UPRIGHT POSITION. IF THE CONTRACTOR AND OWNER DECIDE TO WAIVE THE TREE GUYING AND BRACING, THE OWNER SHALL NOTIFY THE LANDSCAPE ARCHITECT IN WRITING AND AGREE TO INDEMNIFY AND HOLD HARMLESS THE LANDSCAPE ARCHITECT IN THE EVENT UNSUPPORTED TREES PLANTED UNDER THIS CONTRACT FALL AND DAMAGE PERSON OR PROPERTY.

16. MULCHING: PROVIDE A THREE INCH (MINIMUM) LAYER OF SPECIFIED MULCH OVER THE ENTIRE AREA OF EACH SHRUB BED, GROUND COVER, VINE BED, AND TREE PIT PLANTED UNDER THIS CONTRACT.

17. HERBICIDE WEED CONTROL: ALL PLANT BEDS SHALL BE KEPT FREE OF NOXIOUS WEEDS UNTIL FINAL ACCEPTANCE OF WORK. IF DIRECTED BY THE OWNER, "ROUND-UP" SHALL BE APPLIED FOR WEED CONTROL BY QUALIFIED PERSONNEL TO ALL PLANTING AREAS IN SPOT APPLICATIONS PER MANUFACTURER'S PRECAUTIONS AND SPECIFICATIONS. PRIOR TO FINAL INSPECTION, TREAT ALL PLANTING BEDS WITH AN APPROVED PRE-EMERGENT HERBICIDE AT AN APPLICATION RATE RECOMMENDED BY THE MANUFACTURER. (AS ALLOWED BY JURISDICTIONAL AUTHORITY)

P. LAWN SODDING/ SEEDING

1. THE WORK CONSISTS OF LAWN BED PREPARATION, SOIL PREPARATION, AND SODDING COMPLETE, IN STRICT ACCORDANCE WITH THE SPECIFICATIONS AND THE APPLICABLE DRAWINGS TO PRODUCE A TURF GRASS LAWN ACCEPTABLE TO THE OWNER.

2. LAWN BED PREPARATION: ALL AREAS THAT ARE TO BE SODDED SHALL BE CLEARED OF ANY ROUGH GRASS, WEEDS, DEBRIS, HAVE SOIL PREPARED PER SECTION E, AND THE GROUND BROUGHT TO AN EVEN GRADE. THE ENTIRE SURFACE SHALL BE ROLLED WITH A ROLLER WEIGHING NOT MORE THAN ONE-HUNDRED (100) POUNDS PER FOOT OF WIDTH DURING THE ROLLING. ALL DEPRESSIONS CAUSED BY SETTLEMENT SHALL BE FILLED WITH ADDITIONAL SOIL, AND THE SURFACE SHALL BE REGRADED AND ROLLED UNTIL PRESENTING A SMOOTH AND EVEN FINISH TO THE REQUIRED GRADE.

3. SOIL PREPARATION: ALL SOIL TO BE PREPARED PER SECTION E.

4. SODDING:

A. THE CONTRACTOR SHALL SOD ALL AREAS THAT ARE NOT PAVED OR PLANTED AS DESIGNATED ON THE DRAWINGS WITHIN THE CONTRACT LIMITS, UNLESS SPECIFICALLY NOTED OTHERWISE.

B. THE SOD SHALL BE CERTIFIED TO MEET AMERICAN STANDARD FOR NURSERY STOCK SPECIFICATIONS, ABSOLUTELY TRUE TO VARIETAL TYPE, AND FREE FROM WEEDS, FUNGUS, INSECTS AND DISEASE OF ANY KIND.

C. SOD PANELS SHALL BE LAID TIGHTLY TOGETHER SO AS TO MAKE A SOLID SODDED LAWN AREA. SOD SHALL BE LAID UNIFORMLY AGAINST THE EDGES OF ALL CURBS AND OTHER HARDSCAPE ELEMENTS, PAVED AND PLANTED AREAS, ADJACENT TO BUILDINGS, A 24 INCH STONE / MULCH STRIP SHALL BE PROVIDED - REFER TO DETAILS. IMMEDIATELY FOLLOWING SOD LAYING, THE LAWN AREAS SHALL BE ROLLED WITH A LAWN ROLLER CUSTOMARILY USED FOR SUCH PURPOSES, AND THEN THOROUGHLY IRRIGATED. IF, IN THE OPINION OF THE OWNER, TOP-DRESSING IS NECESSARY AFTER ROLLING TO FILL THE VOIDS BETWEEN THE SOD PANELS AND TO EVEN OUT INCONSISTENCIES IN THE SOD, CLEAN SAND, AS APPROVED BY THE OWNER'S REPRESENTATIVE, SHALL BE UNIFORMLY SPREAD OVER THE ENTIRE SURFACE OF THE SOD AND THOROUGHLY WATERED IN. FERTILIZER INSTALLED SOD AS ALLOWED BY PROPERTY'S JURISDICTIONAL AUTHORITY.

D. CONTRACTOR SHALL REFERENCE PLANTING SCHEDULE FOR SEEDING VARIETY AND RATES.

E. IF SEED INSTALLATION FALLS BETWEEN SEPTEMBER 16TH AND MARCH 14TH, THE CONTRACTOR SHALL INSTALL EITHER SOD OR A COLD SEASON VARIETY SEED MIX, SUCH AS WINTER RYE. IF A COOL SEASON VARIETY MIX IS INSTALLED BETWEEN SEPTEMBER 16TH AND MARCH 14TH, THE CONTRACTOR SHALL RESEED THE AREA WITH THE ORIGINAL SPECIFIED SEED MIX PER THE PLANS AND SPECIFICATIONS BETWEEN MARCH 15TH AND SEPTEMBER 15TH.

1. DURING DELIVERY, PRIOR TO, AND DURING THE PLANTING OF THE LAWN AREAS, THE SOD PANELS SHALL AT ALL TIMES BE PROTECTED FROM EXCESSIVE DRYING AND UNNECESSARY EXPOSURE OF THE ROOTS TO THE SUN. ALL SOD SHALL BE STACKED SO AS NOT TO BE DAMAGED BY SWEATING OR EXCESSIVE HEAT AND MOISTURE.

2. LAWN MAINTENANCE:

A. WITHIN THE CONTRACT LIMITS, THE CONTRACTOR SHALL PRODUCE A DENSE, WELL ESTABLISHED LAWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND RE-SODDING OF ALL ERODED, SUNKEN OR BARE SPOTS (LARGER THAN 12"x12") UNTIL CERTIFICATION OF ACCEPTABILITY BY THE OWNER'S REPRESENTATIVE. REPAIRED SODDING SHALL BE ACCOMPLISHED AS IN THE ORIGINAL WORK (INCLUDING REGRADING IF NECESSARY).

B. CONTRACTOR RESPONSIBLE FOR ESTABLISHING AND MAINTAINING SOD/LAWN UNTIL ACCEPTANCE BY THE OWNER'S REPRESENTATIVE. PRIOR TO AND UPON ACCEPTANCE, CONTRACTOR TO PROVIDE WATERING/IRRIGATION SCHEDULE TO OWNER. OBSERVE ALL APPLICABLE WATERING RESTRICTIONS AS SET FORTH BY THE PROPERTY'S JURISDICTIONAL AUTHORITY.

C. CONTRACTOR SHALL REESTABLISH 95% (MIN) COVERAGE FOR ALL DISTURBED AREAS OF VEGETATION WITHIN 60 DAYS OF SUBSTANTIAL COMPLETION. CONTRACTOR SHALL PROVIDE SEED AND/OR SOD THAT MATCHES THE ADJACENT LAWN AREA.

Q. CLEANUP

UPON COMPLETION OF ALL PLANTING WORK AND BEFORE FINAL ACCEPTANCE, THE CONTRACTOR SHALL REMOVE ALL MATERIAL, EQUIPMENT, AND DEBRIS RESULTING FROM HIS WORK. ALL PAVED AREAS SHALL BE BROOM-CLEANED AND THE SITE LEFT IN A NEAT AND ACCEPTABLE CONDITION AS APPROVED BY THE OWNER'S AUTHORIZED REPRESENTATIVE.

R. PLANT MATERIAL MAINTENANCE

ALL PLANTS AND PLANTING INCLUDED UNDER THIS CONTRACT SHALL BE MAINTAINED BY WATERING, CULTIVATING, SPRAYING, AND ALL OTHER OPERATIONS (SUCH AS RE-STAKING OR REPAIRING GUY SUPPORTS) NECESSARY TO INSURE A HEALTHY PLANT CONDITION BY THE CONTRACTOR UNTIL CERTIFICATION OF ACCEPTABILITY BY THE OWNER'S REPRESENTATIVE. MAINTENANCE AFTER THE CERTIFICATION OF ACCEPTABILITY SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS IN THIS SECTION. CONTRACTORS ARE REQUESTED TO PROVIDE A BID ESTIMATE TO COVER LANDSCAPE AND IRRIGATION MAINTENANCE FOR A PERIOD OF 90 CALENDAR DAYS COMMENCING AFTER ACCEPTANCE.

S. MAINTENANCE (ALTERNATE BID ITEM)

CONTRACTORS ARE REQUESTED TO PROVIDE A BID ESTIMATE FOR MAINTENANCE FOLLOWING THE INITIAL 90-DAY MAINTENANCE PERIOD ON A COST-PER-MONTH BASIS.

T. FINAL INSPECTION AND ACCEPTANCE OF WORK

FINAL INSPECTION AT THE END OF THE WARRANTY PERIOD SHALL BE ON PLANTING, CONSTRUCTION AND ALL OTHER INCIDENTAL WORK PERTAINING TO THIS CONTRACT. ANY REPLACEMENT AT THIS TIME SHALL BE SUBJECT TO THE SAME ONE (1) YEAR WARRANTY (OR AS SPECIFIED BY THE LANDSCAPE ARCHITECT OR OWNER IN WRITING) BEGINNING WITH THE TIME OF REPLACEMENT AND ENDING WITH THE SAME INSPECTION AND ACCEPTANCE HEREIN DESCRIBED.

U. WARRANTY

1. THE LIFE AND SATISFACTORY CONDITION OF ALL 1 GALLON AND LARGER PLANT MATERIAL INSTALLED BY THE LANDSCAPE CONTRACTOR SHALL BE WARRANTED BY THE CONTRACTOR FOR A MINIMUM OF ONE (1) CALENDAR YEAR COMMENCING AT THE TIME OF CERTIFICATION OF ACCEPTABILITY BY THE OWNER'S REPRESENTATIVE.

2. THE LIFE AND SATISFACTORY CONDITION OF ALL OTHER PLANT MATERIAL (INCLUDING SOD) INSTALLED BY THE LANDSCAPE CONTRACTOR SHALL BE WARRANTED BY THE CONTRACTOR FOR A MINIMUM OF ONE (1) CALENDAR YEAR COMMENCING AT THE TIME OF CERTIFICATION OF ACCEPTABILITY BY THE OWNER'S REPRESENTATIVE.

3. REPLACEMENT: ANY PLANT NOT FOUND IN A HEALTHY GROWING CONDITION AT THE END OF THE WARRANTY PERIOD SHALL BE REMOVED FROM THE SITE AND REPLACED AS SOON AS WEATHER CONDITIONS PERMIT. ALL REPLACEMENTS SHALL BE PLANTS OF THE SAME KIND AND SIZE AS SPECIFIED IN THE PLANT LIST. THEY SHALL BE FURNISHED PLANTED AND MULCHED AS SPECIFIED UNDER "PLANTING", AT NO ADDITIONAL COST TO THE OWNER.

4. IN THE EVENT THE OWNER DOES NOT CONTRACT WITH THE CONTRACTOR FOR LANDSCAPE (AND IRRIGATION) MAINTENANCE, THE CONTRACTOR IS ENCOURAGED TO VISIT THE PROJECT SITE PERIODICALLY DURING THE ONE YEAR WARRANTY PERIOD TO EVALUATE MAINTENANCE PROCEDURES BEING PERFORMED BY THE OWNER, AND SHALL NOTIFY THE OWNER IN WRITING OF MAINTENANCE PROCEDURES OR CONDITIONS WHICH THREATEN VIGOROUS AND HEALTHY PLANT GROWTH. IT IS SUGGESTED SUCH SITE VISITS SHALL BE CONDUCTED A MINIMUM OF ONCE PER MONTH FOR A PERIOD OF TWELVE (12) MONTHS FROM THE DATE OF ACCEPTANCE.

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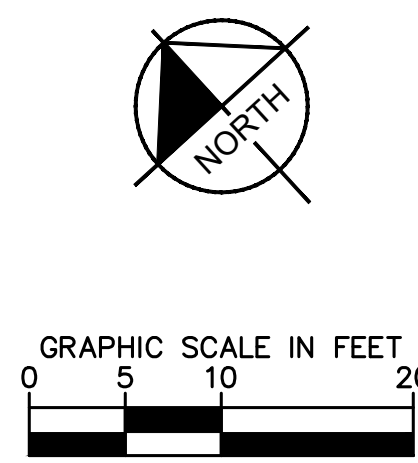
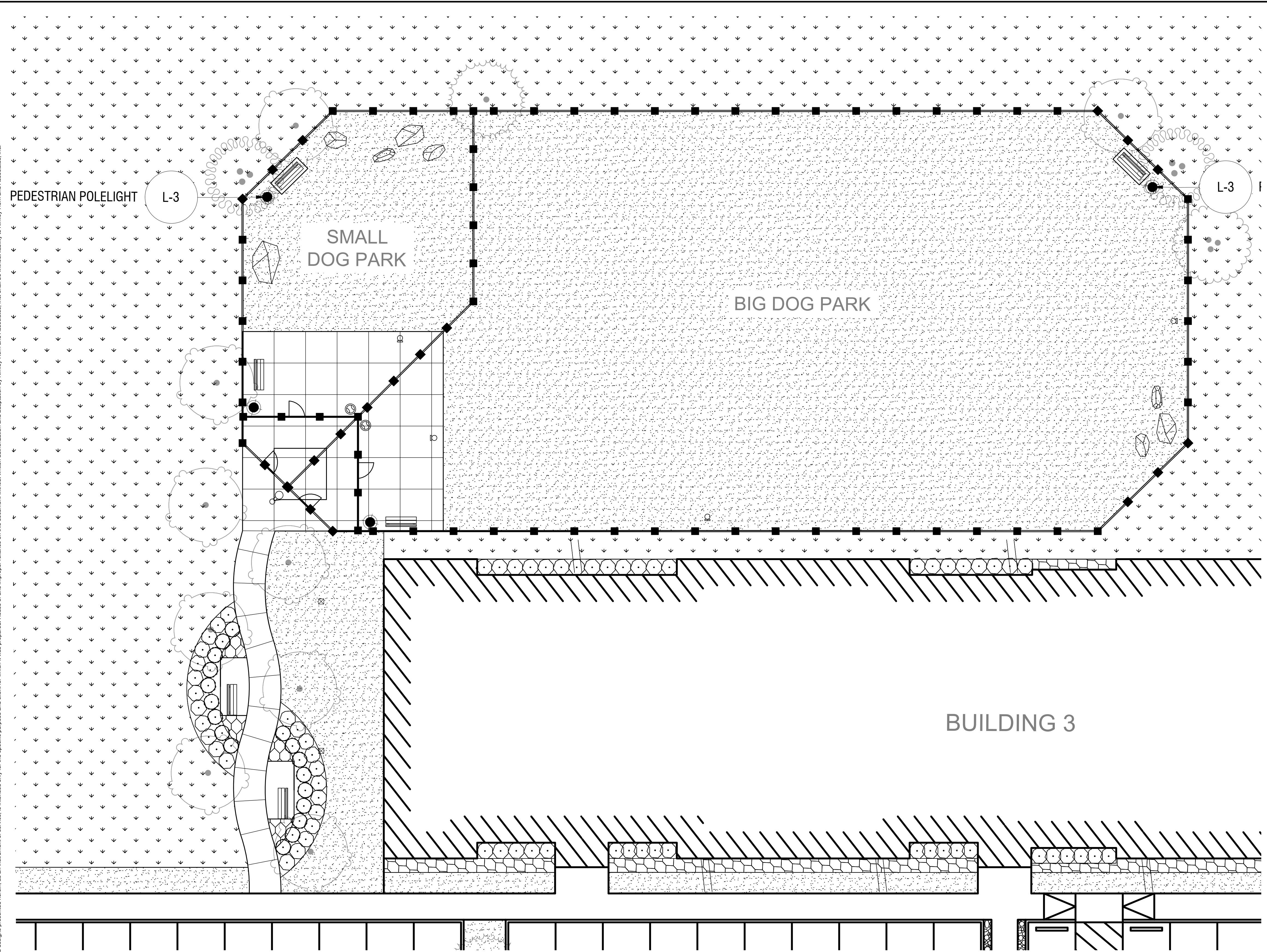
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LANDSCAPE SPECIFICATIONS

STARWOOD TRACT PREPARED FOR IMPACT RESIDENTIAL DEVELOPMENT, LLC. HOUSTON TEXAS

Plotted By: Harris, Sam Sheet Set: Khs Layout: L7.02 SCHEMATIC LIGHTING PLAN (2 OF 2) September 15, 2023 01:23:43pm K:\HOU_Civil\064572001-12000 Blisomed Street\Landscapes Architecture\Production\CAD\Sheet\L7.01 LIGHTING PLAN.dwg
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LIGHTING / ELECTRICAL

- L-1** FESTOON LIGHTING

MANUFACTURER: AMERICAN LIGHTING
 SERIES: LFS-12V-1-LED-WW
 HEIGHT: 12 FT
 LUMINARIES: SINGLE TENON MOUNTING
 MOUNT: POLE MOUNTED
 POLE: 4" DIAMETER POLE; ROUND; STEEL; 12 TALL
 COLOR: TEXTURED BLACK
 SUPPLIER: FSG
 CONTACT: MIA FERGUSON (214.351.6266)
 APPROVAL: **CUT SHEET**
- L-2** TREE UPLIGHT

MANUFACTURER: WAC LIGHTING
 PART: ACCENT 120V LANDSCAPE ACCENT LUMINAIRE
 FINISH: BLACK ON ALUMINUM
 SUPPLIER: FSG
 CONTACT: MIA FERGUSON (214.351.6266)
 APPROVAL: **CUT SHEET**
- L-3** PEDESTRIAN POLE LIGHT

MANUFACTURER: QSSI
 SERIES: AFS300; EASY LED AERIFORM SQUARE POLE/WALL MOUNT
 HEIGHT: 12 FT
 LUMINARIES: SINGLE TENON MOUNTING
 MOUNT: POLE MOUNTED
 POLE: 4" DIAMETER POLE; ROUND; STEEL; 12 TALL
 COLOR: TEXTURED BLACK
 SUPPLIER: FSG
 CONTACT: MIA FERGUSON (214.351.6266)
 APPROVAL: **CUT SHEET**
- L-4** POST

SIZE: 6" DIA. X 10' HT
 MATERIAL: POWDER COATED STEEL
 INSTALL: PROVIDE FESTOON LIGHTING MOUNT, BASE IS SET IN GROUND WITH CONCRETE FOOTING.
 COLOR: BLACK
 MANUFACTURER: LIGHTING ASSOCIATES INC.
 CONTACT: DUSTIN GRAPER (713.467.6436)
 APPROVAL: **CUT SHEET**
- L-5** SIGN UPLIGHT

TYPE: FOCUS + ZERO
 MODEL: 0791974-AN96
 COLOR: IRON GRAY / TEXTURED
 MANUFACTURER: PERFORMANCE LIGHTING
 APPROVAL: **CUT SHEET**

NOTE:
REFER TO MEP PLANS FOR ELECTRICAL SERVICE.

No.	REVISIONS	DATE	BY

Kimley»Horn

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P.L.A. SHANNON E MUNDY
 L.A. No. 3543 Date: SEP. 2023

KHA PROJECT	DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY
068924000	SEPTEMBER 2023	AS SHOWN	SJH	SJH	SEM

STARWOOD TRACT
 PREPARED FOR
IMPACT RESIDENTIAL
DEVELOPMENT, LLC.

SCHEMATIC
LIGHTING PLAN
(2 OF 2)

STARWOOD TRACT
 PREPARED FOR
IMPACT RESIDENTIAL
DEVELOPMENT, LLC.

HOUSTON TEXAS

SHEET NUMBER
L7.02



CAUTION!!

EXISTING UNDERGROUND UTILITIES IN THE AREA
 CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE
 HORIZONTAL AND VERTICAL LOCATION OF ALL UTILITIES
 PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE
 RESPONSIBLE FOR ANY REPAIRS TO EXISTING UTILITIES DUE
 TO DAMAGE INCURRED DURING CONSTRUCTION.
 CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY
 DISCREPANCIES ON THE PLANS.

APPENDIX 9

METHANE MONITORING EQUIPMENT SPECIFICATIONS



GEM5000 Series

The Next Generation of GEM™ Instrument

The GEM™5000 is designed specifically for use on landfills to monitor Landfill Gas (LFG) Collection & Control Systems.

The GEM™5000 samples and analyzes the methane, carbon dioxide and oxygen content of landfill gas with options for additional analysis.

GEM5000 Complete

Package Includes:

Instrument, hoses, heavy duty water trap filter, soft case, A.C. battery charger, electronic manual accompanies software, LANDTEC System Gas Analyzer Manager (LSGAM) software, USB download cable and hard-case. Reads: Methane, Carbon Dioxide, Oxygen, temperature (when used with optional probe), atmospheric pressure,

Check also:

GF5.8 External Battery
GEM5000 External Battery



SEM5000
Portable Methane Detector



GA5000
Portable LFG Analyzer



GEM5000 Series
Portable LFG Analyzer



BIOGAS 5000
Portable Biogas Analyzer



differential pressure and calculates gas flow.

NAV and Plus model packages also include more features such as GPS and additional gas measurements

[**GEM5000 Accessories & Spare Parts**](#)

Description	Technical Specification
-------------	-------------------------

Description

The GEM™5000 is the next generation in the GEM™ Series of LANDTEC instruments for accurate measurement and monitoring on landfills

Now Available. Please call our sales team to request further information or to place your order.

FEATURES

- Measures % CH₄, CO₂ and O₂ Volume, static pressure and differential pressure
- Calculates balance gas, flow (SCFM) and calorific value (KW or BTU)>
- High Accuracy and Fast Response Time
- Lighter and More Compact
- Annual recommended factory service
- Certified intrinsically safe for landfill use
- Calibrated to ISO/IEC 17025
- 3 year warranty

BENEFITS

- Designed specifically for use on landfills to monitor landfill gas (LFG) extraction systems, flares, and migration control systems.
- No need to take more than one instrument to site



- Can be used for monitoring subsurface migration probes and for measuring gas composition, pressure and flow in gas extraction systems
- The user is able to set up comments and questions to record information at site and at each sample point
- Ensures consistent collection of data for better analysis
- Streamlined user experience reduces operational times

☰ DOWNLOADS

[Manual](#) - [LSGAM Software](#) - [Brochure](#) - [Easy Steps - Discharge Battery Pack](#) - [Easy Steps, Gas Check](#) - [Easy Steps, Workflow](#)

Related Products



GF5.8
Exter
nal
Batte
ry
GEM5000
External
Battery



BIOG
AS
5000
Portable
Biogas
Analyzer



BIOG
AS
3000
FIXED
GAS
ANALYZER



GEM5000 & BIOGAS5000
SPARE PARTS

Acces
sories
Spare
Parts



differential pressure and calculates gas flow.

NAV and Plus model packages also include more features such as GPS and additional gas measurements

****GEM5000 Accessories & Spare Parts****

Description	Technical Specification
-------------	-------------------------

Technical Specification

Gas Ranges

Gases Measured	CH ₄	By dual wavelength infrared cell with reference channel		
	CO ₂	By dual wavelength infrared cell with reference channel		
	O ₂	By internal electrochemical cell		
	CO	By internal electrochemical cell		
Ranges	H ₂ S	By internal electrochemical cell		
	CH ₄	0-100% (vol)		
	CO ₂	0-100% (vol)		
	O ₂	0-25% (vol)		
Gas Accuracy*	CO	0-2000ppm***		
	H ₂ S	0-500ppm***		
	CH ₄	0-5% ± 0.3% vol	0-70% ± 0.5% vol	70-100% ± 1.5% FS
	CO ₂	0-5% ± 0.3% vol	0-60% ± 0.5% vol	60-100% ± 1.5% FS
	O ₂	0-25% ± 1.0% (vol)		
	CO/H ₂ **	0-2000ppm ± 1.0% FS		
	H ₂ S	0-500ppm ± 2.0% FS		

*Typical accuracy after calibration as recommended in the operations manual.

**Hydrogen compensated Carbon Monoxide measurement.

***Additional ranges available, contact LANDTEC for more information

Other Parameters

	Unit	Resolution	Comments
Energy	BTU/hr	1000 BTU/hr	Calculated from specific parameters
Static Pressure	in. H ₂ O	0.01 in. H ₂ O	Direct Measurement
Differential Pressure	in. H ₂ O	0.001 in. H ₂ O	Direct Measurement

Important Note: The information in this document is correct at the time of generation. We do, however, reserve the right to change the specification without prior notice as a result of continuing development.

Pump

Flow	Typically 550cc/min
Flow with 80 in. H ₂ O vacuum	Approximately 80cc/min

Environmental Conditions

Operating Temperature Range	14°F - 122°F (-10°C to +50°C)
Operating Pressure	-100 in. H ₂ O, +100 in. H ₂ O (+250mbar, +500mbar)
Relative Humidity	0-95% non condensing
Barometric Pressure	± 14.7 in. Hg (±500mbar) from calibration pressure
Barometric Pressure Accuracy	± 1% typically

Power Supply

Battery Life	Typical use 8 hours from fully charged
Charge Time	Approximately 3 hours from complete discharge

Certification Rating

ATEX	II 2G Ex ib IIA T1 Gb (T _{amb} = -10°C to +50°C)
ISO17025	ISO/IEC17025:2005 Accreditation #66916
CSA	Ex ib IIA T1 (T _{amb} = -10°C to +50°C) (Canada), AEx ib IIA T1 (T _{amb} = -10°C to +50°C) (USA)

Related Products

			
<p>GEM5000 External Battery</p>	<p>BIOG AS 5000 Portable Biogas Analyzer</p>	<p>BIOG AS 3000 FIXED GAS ANALYZER</p>	<p>Accessories Spare Parts</p>



M2A STAND ALONE TRANSMITTER



- Operates with or without a controller
- Direct digital readout with OLED cold temperature display
- Available gases include
 - LEL, O₂, H₂S, CO, CO₂, and 100% Vol CH₄
 - Toxic gases include NH₃, AsH₃, Cl₂, ClO₂, HCN, & SO₂
- Infrared sensor for combustibles and CO₂
- 4-20 mA & digital Modbus outputs standard
- 2 fully programmable alarm relays & fail relay
- Non-intrusive calibration via magnetic wand
- Explosion proof construction
- Patented water repellent sensor cover
- User friendly setup, push buttons & OLED menus
- Long-life sensors (2 + years typical)

The RKI M2A™ is a state-of-the-art transmitter that can operate as an independent, stand-alone monitor or as part of an integrated system. The M2A connects with an analog or digital signal to virtually any controller, PLC, or DCS. Setup procedures are simplified with user friendly push buttons and OLED menus. It utilizes a magnetic wand technique for performing non-intrusive calibration. The M2A provides an automatic zero drift correction feature, which results in more stable readings and reduces the need for adjustments due to sensor aging.

The housing of the M2A does not need to be opened for zeroing or calibration, making it unnecessary to declassify the area for routine maintenance. It is designed so that a complete field calibration can be performed by one person. Sensor construction is rated Class I, Div. 1 Groups B, C, D for flammables, CO, H₂S, O₂, and CO₂, and Class I, Div. 2 for all other toxics.

The transmitter provides a 4-20 mA output in addition to a Modbus digital output. It also has two levels of alarms with relays, plus a fail alarm with relay. A digital display of the gas concentration, as well as alarm and status lights, can be viewed through the front window.


The toxic sensors are electrochemical type plug-in sensors, which provide high specificity, fast response, and long life. The plug-in design allows quick replacement in the field with no tools required. Toxic sensors are designed for use in Class I, Div. 2 hazardous locations. Sensors available for NH₃, AsH₃, Cl₂, ClO₂, HCN, PH₃, and SO₂

The M2A represents the latest leading edge technology in sensor / transmitters today.

World Leader In Gas Detection & Sensor Technology


Explosion Proof

Class I, Div. 1 , Groups B, C, D



Part #	Combustibles		LEL	O ₂	H ₂ S	CO	CH ₄	HC	CO ₂	
	LEL	PPM	H ₂ Specific	Oxygen	Hydrogen Sulfide	Carbon Monoxide	Methane	Hydrocarbons	Carbon Dioxide	
	UL	65-2640RK	65-2647RK	65-2641RK	65-2643RK-05	65-2645RK-05	65-2646RK-05	65-2649RK-CH4 65-2658RK-CH4	65-2649RK-HC	65-2660RK-02 65-2660RK-03 65-2660RK-05 65-2660RK-10
	CSA	65-2640RK-05	65-2647RK-05	65-2641RK-05						
Sensors		Catalytic			Galvanic cell	Electrochemical		Infrared		
Measuring Ranges	0 - 100% LEL	0 - 9000 ppm CH4	0 - 100% LEL	0 - 25.0% Vol.	0 - 100 ppm	0 - 300 ppm	0 - 100% LEL 0 - 100% Vol.	0 - 100% LEL	-02 0 - 5000 ppm -03 0 - 5% Vol. -05 0 - 50% Vol. -10 0 - 100% Vol.	
Resolution	1% LEL	20 ppm	1% LEL	0.1% Vol.	1 ppm		1% LEL / 1% Vol.		20 ppm / 0.01% Vol / 0.1% Vol. / 1% Vol.	
Lower Detectable Limit (LDL)	2% of full scale			0.1% Vol.	2% of full scale					
Max Current Draw (24VDC)	160 mA with alarm 1 and alarm 2 active and all relays energized			125 mA with alarm 1 and alarm 2 active and all relays energized			160 mA with alarm 1 and alarm 2 active and all relays energized			
Response Time (T-90)	35 Seconds or less			90 Seconds or less	60 Seconds or less	90 Seconds or less	30 Seconds or less			
Life Expectancy	2 to 3 years with normal service		3 to 5 years with normal service	2 to 3 years with normal service			5 years plus with normal service			
Accuracy (which ever is greater)	± 5% of reading or ± 2% of full scale			± 0.5% Vol. O ₂	± 5% of reading or ± 2 ppm H ₂ S	± 5% of reading or ± 5 ppm CO	± 5% of reading or ± 2 % of full scale			
Weather Resistant	Patented water repellent sensor coating									
Alarms										
Alarm Settings	Two fully programmable alarm set points, increasing / decreasing, latching / self-resetting, on delays, off delays, normally energized or de-energized									
Alarm Indication	Visual LEDs. Alarm 1, Amber; Alarm 2, Red; Fail, Red									
Relays	5 amp form 'C' contacts for alarm 1, alarm 2, and fail									
Physical										
Dimensions	Height: 8.5" (215 mm), Width: 5.2" (132 mm), Depth: 4.5" (114 mm)									
Display	Alphanumeric OLED display. 8 characters per line; 2 lines for gas concentration readout, plus user-friendly calibration and setup									
Enclosure	Explosion proof for Class I, Div 1, Groups B, C, D.									
Enclosure Rating	NEMA 4X, explosion proof, watertight, cast aluminum with o-ring seal and epoxy powder coating									
Controls	Magnet used for calibration functions. Calibrates without opening the housing. Internal push-button controls also available for calibration and setup									
Operating Environment										
Operating Temperature	-40°F to 167°F -40°C to 75°C			-4°F to 113°F -20°C to 45°C	-40°F to 104°F -40°C to 40°C	23°F to 104°F -5°C to 40°C	-40°F to 122°F -40°C to 50°C			
Relative Humidity	5 - 95% RH non-condensing									
Location	Indoor or outdoor. Explosion proof for Class I, Div. 1, Groups B, C, D.									
Operating Voltage	10 VDC - 30 VDC									
Outputs										
Analog	Linear 4-20 mA signal, into 1000 ohms impedance max (24DC), 0 - 500 ohms max (12VDC) corresponding to 0 - full scale									
Digital	Modbus RTU output standard, fully configurable, 2-wire RS-485, 1200 to 19.2k baud									
Approvals	65-2640RK UL		65-2641RK UL	c CSA US			c UL US			
	65-2640RK-05 c CSA US		65-2641RK-05 c CSA US							
Controllers	Beacon 110, Beacon 200, Beacon 410A, Beacon 800 as well as most DCS / PLC systems									
Warranty	One year material and workmanship									

Toxic Gas Transmitters

Class I, Div. 2

	O2 Oxygen	H2S Hydrogen Sulfide	CO Carbon Monoxide	Toxics See Chart Below	CO2 Carbon Dioxide
 Part#	65-2666RK *65-2644RK	65-2662RK	65-2663RK	See Chart Below	65-2661RK-02 65-2661RK-03 65-2661RK-05 65-2661RK-10
Sensors	Galvanic cell	Electrochemical			Infrared
Measuring Ranges	0-25% Vol.	0-100 ppm	0-300 ppm	See Chart Below	-02 0 - 5000 ppm -03 0 - 5% Vol. -05 0 - 50% Vol. -10 0 - 100% Vol.
Resolution	0.1% Vol.	1 ppm		See Chart Below	20 ppm / 0.01% Vol. / 0.1% Vol. / 1%Vol.
Lower Detectable Limit (LDL)	0.1% Vol.	2% of full scale			
Response Time (T-90)	35 Seconds or less			60 Seconds or less	30 Seconds or less
Max Current Draw (24VDC)	125 mA with alarm 1 and alarm 2 active and all relays energized				160 mA with alarm 1 and alarm 2 active and all relays energized
Life Expectancy	2 to 3 years with normal service				5 years plus
Accuracy (which ever is greater)	± 0.5% Vol. O2	± 5% of reading or ± 2 ppm H2S	± 5% of reading or ± 5 ppm CO	± 10% of reading or ± 5% of full scale	± 5% of reading or ± 2% of full scale
Alarms					
Alarm Settings	Two fully programmable alarm set points, increasing / decreasing, latching / self-resetting, on delays, off delays, normally energized or de-energized,				
Alarm Indication	Visual LEDs. Alarm 1=Amber; Alarm 2=Red; Fail=Red				
Relays	5 Amp form 'C' contacts for alarm 1, alarm 2, and fail				
Physical					
Dimensions	Height: 8.5" (215 mm), Width: 5.2" (132 mm), Depth: 4.5" (114 mm)				
Display	Alphanumeric OLED display, 8 characters per line; 2 lines for gas concentration readout, plus user-friendly calibration and setup				
Sensor Rating	Non explosion proof construction, designed for Class I, Div. 2, Groups B, C, D (no certification)				
Housing J-Box	NEMA 4X, explosion proof, watertight, cast aluminum with o-ring seal and epoxy powder coating				
Controls	Magnet used for calibration functions. Calibrates without opening the housing. Internal push-button controls also available for calibration and setup				
Sensor	Aluminum / Plastic (non explosion proof)				
Operating Environment					
Operating Temperature	-4°F to 113°F -20°C to 45°C	-40°F to 104°F -40°C to 40°C	23°F to 104°F -5°C to 40°C	14°F to 104°F -10°C to 40°C	-40°F to 122°F -40°C to 50°C
Relative Humidity	5 - 95% RH non-condensing				
Location	Indoor or outdoor				
Operating Voltage	10 VDC - 30 VDC				
Outputs					
Analog	Linear 4-20 mA signal, into 1000 ohms impedance max (24DC), 0 - 500 ohms max (12VDC) corresponding to 0 - full scale				
Digital	Modbus RTU output standard, fully configurable, 2-wire RS-485, 1200 to 19.2k baud				
Controllers	Beacon 110, Beacon 200, Beacon 410A, Beacon 800 as well as most DCS / PLC systems				
Warranty	One year materials and workmanship				

*Partial pressure sensor for helium (He) applications. Consult factory for details.

		M2A Toxic Transmitter Sensor Ordering Information				
		Part Number With J-Box	Gas	Range	Resolution	Sensor Type
 ESM-01  CT-7 * Sensor being phased out, use CT-7 type when possible.		65-2670RK-NH3-75	Ammonia (NH3)	0 - 75.0 ppm	0.1 ppm	CT-7
		65-2670-NH3-1	Ammonia (NH3)	0 - 100 ppm	1 ppm	CT-7
		65-2670-NH3-2	Ammonia (NH3)	0 - 200 ppm	1 ppm	CT-7
		65-2670-NH3-5	Ammonia (NH3)	0 - 500 ppm	1 ppm	CT-7
		65-2648RK-AsH3	Arsine (AsH3)	0 - 1.50 ppm	0.1 ppm	ESM -01
		65-2670RK-CL2-3	Chlorine (Cl2)	0 - 3.00 ppm	0.01 ppm	CT-7
		65-2670RK-CL2-10	Chlorine (Cl2)	0 - 10.0 ppm	0.1 ppm	CT-7
		65-2670RK-CLO2	Chlorine Dioxide (ClO2)	0 - 1.00 ppm	0.01 ppm	CT-7
		65-2648RK-HCN	Hydrogen Cyanide (HCN)	0 - 15.0 ppm	0.1 ppm	ESM -01
		65-2648RK-PH3	Phosphine (PH3)	0 - 1.00 ppm	0.01 ppm	ESM -01
		65-2648RK-SO2	Sulfur Dioxide (SO2)	0 - 6.00 ppm	0.01 ppm	ESM -01

(800) 754-5165

M2A Stand Alone Transmitter

AVAILABLE ACCESSORIES



Remote Mount Calibration Adaptor



Flow through adaptors



Air aspirator adaptors / panels



Remote horns & lights



Calibration adaptors



Calibration kits

Direct Interface with Beacon 110 / 200 / 410A / 800 Controllers

M2A Wiring Matrix				
	Number of Wires to Controller	Maximum Distance to Controller		
		18 AWG wire	16 AWG wire	14 AWG wire
M2A Transmitter	3	2500 ft.	5,000 ft.	8,000 ft.



Made in the USA

Authorized Distributor:

Safety Products, Inc.

en gas detection

Since 1993

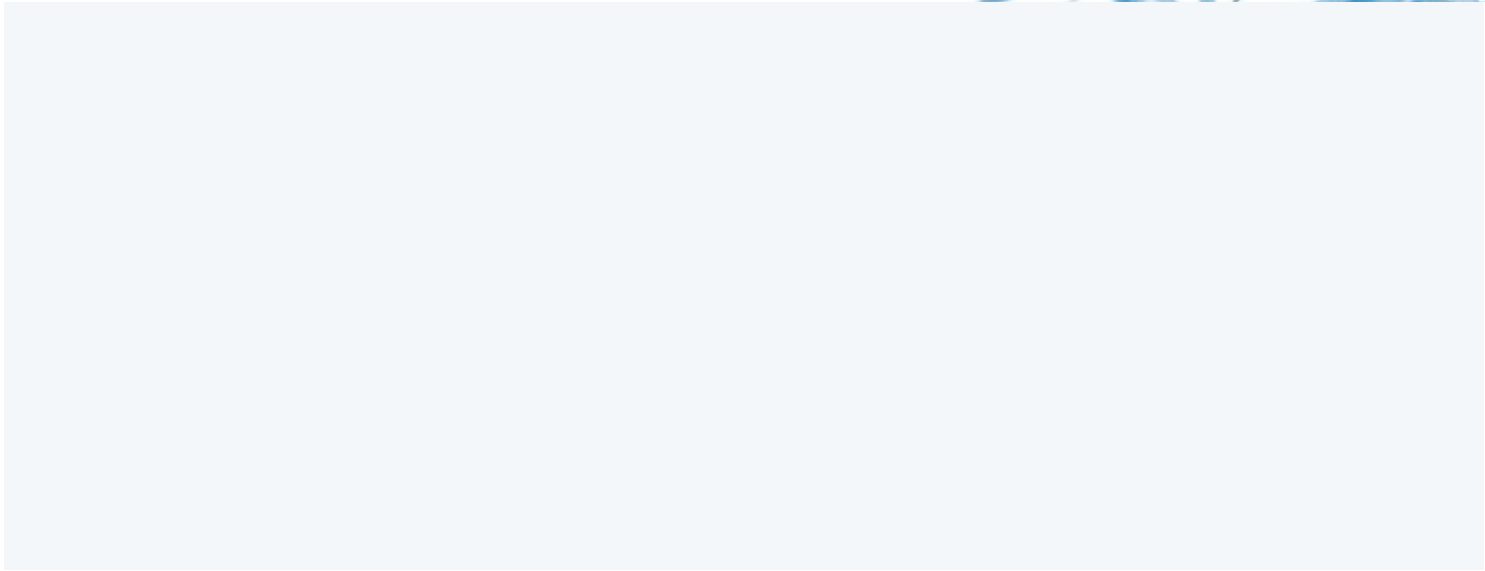
Protecting your family



HOME

Radon
Detector

Gas
Detector

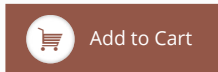




Carbon Monoxide, Propane and Methane Gas Detector

Model No. HS80504

USD
\$64.95



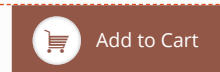
- 3-in-1 detector.
- Senses dangerous levels of Carbon Monoxide, Propane and Methane Gas.
- Two independent 85dB alarm sounds, one for CO, the other for methane/liquid propane.
- Every detector has computerized calibration to help eliminate false alarms.
- Built-in self-diagnostics assures the unit is operating properly.
- Easily plugs into any standard 110-120v AC electrical outlet and samples the air every 2 1/2 minutes.
- Lock tab feature makes the detector tamper proof.
- 5 year warranty.



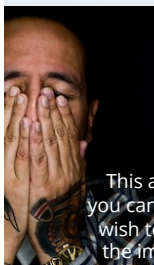
Combustible Gas Detector

Model No. HS80501

USD
\$57.95



- Detects dangerous levels of Methane and Propane Gas.
- Computerized calibration helps eliminate false alarms.
- Built-in self-diagnostics assures the unit is operating properly.
- Easily plugs into any standard 110-120v AC electrical outlet and samples the air every 2 1/2 minutes.
- Lock tab feature makes the detector tamper proof.
- Advanced surface mount circuitry.
- Powerful 85dB Alarm.
- 5 year warranty.



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of CO Poisoning

ptoms are related to carbon monoxide poisoning discussed with all members of the household:

nausea, vomiting, fatigue (often described as "flu-

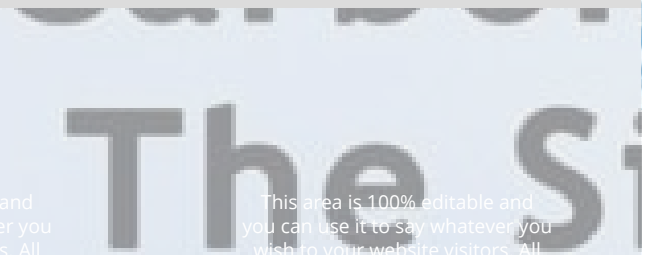
re
g headache, drowsiness, confusion, rapid heart rate.

re
s, convulsions, cardiopulmonary failure, death.

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Facts and Concerns about Carbon Monoxide (CO)

Carbon Monoxide (CO) is a colorless, odorless, tasteless gas, which is very toxic and nearly impossible to detect without the use of sensing equipment. Carbon Monoxide can be absorbed into the body's bloodstream nearly 10 times faster than pure oxygen. Thus it can limit the body's ability to absorb oxygen whenever carbon monoxide is present, even in small amounts. This reduced ability of the body to absorb oxygen is known as chemical asphyxiation and it can result in death whenever carbon monoxide is present in small quantities over a period of time.



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Sources of CO Gas

Carbon monoxide results from of carbon-based fuels such as r wood, coal, heating oil, kerosen propane. Many of these fules c the home, for example in kitch water heaters, fireplaces, porta grills and automobiles. If incor occurs in any of these devices a vented to the outside, the dang exists.

and pets may be the first affected by CO poisoning.

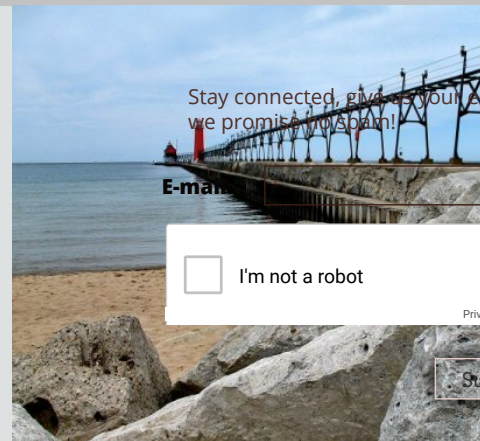
DISASTROUS EXPLOSIONS CAN OCCUR FROM LEAKS OF COMBUSTIBLE GASES

Such as natural gas (methane) and LPG gas (propane).

These types of gases are used to fuel a variety of common appliances found in the home. Cooking stoves/ovens, hot-water heaters, clothes dryers, space heaters, fireplace starters and heating furnaces are the most common gas-fuel burning appliances. Natural gas and propane can cause devastating explosions from even the smallest leaks from any of these appliances.

Address:
100 Remico Street SW
Livonia, MI. 48150

Phone: 516-530-6540
Email: fspi.safetysiren@gmail.com



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Submit

Safety Siren™

*Carbon Monoxide,
Propane & Methane*

DETECTOR

Owner's Manual

Model Number

HS80004

HS80104

HS80204

HS80504

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Family Safety Products, Inc.
2879 Remico SW
Grandville, MI 49418
(616) 530-6540
www.fspi-radon.com
Made in USA



Family Safety Products Inc.

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FACTS AND CONCERNS ABOUT CARBON MONOXIDE:

Carbon Monoxide (CO) is a colorless, odorless, tasteless gas, which is very toxic and nearly impossible to detect without the use of sensing equipment. Carbon monoxide can be absorbed into the body's bloodstream nearly 10 times faster than pure oxygen. Thus it can limit the body's ability to absorb oxygen whenever carbon monoxide is present, even in small amounts. This reduced ability of the body to absorb oxygen is known as chemical asphyxiation and it can result in death whenever carbon monoxide is present in small quantities over a period of time.

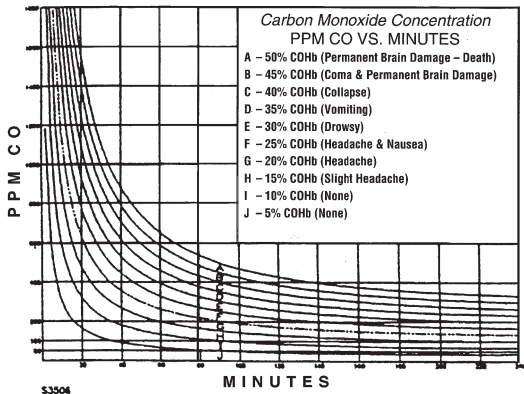
As the level of carbon monoxide rises in a closed environment, the toxic effects require less and less time to occur. This relationship can be seen in Figure 1. While it takes over three hours for an atmosphere with 0.01% CO to produce a headache, it takes only one hour for 0.02% CO to produce the same effects. At 0.04% CO the time required to produce the same headache is only 25 minutes. The HS 80004 SafetySiren™ unit is designed to generate an alarm at the following exposure levels as defined by Underwriters Laboratories:

- in less than 90 minutes at 0.01% CO (100ppm CO)
- in less than 35 minutes at 0.02% CO (200ppm CO)
- in less than 15 minutes at 0.04% CO (400ppm CO)

Warning:

This device may not alarm at low carbon monoxide levels. The federal Occupational Safety and Health Administration (OSHA) has established that continuous exposure to CO levels of 50 ppm should not be exceeded in an eight hour period. This detector has not been investigated for carbon monoxide detection below 100 ppm. Individuals with a medical condition may consider using a more sensitive device.

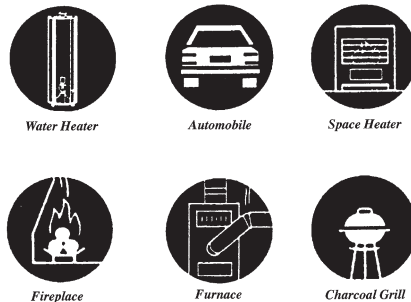
**Figure 1 – Carbon Monoxide Concentration
versus Time and % COHb**



Sources of Carbon Monoxide:

Carbon monoxide results from incomplete combustion of carbon-based fuels such as natural gas, charcoal, wood, coal, heating oil, kerosene, gasoline and propane. Many of these fuels can be found throughout the home, for example in kitchen appliances, furnaces, water heaters, fireplaces, portable heaters, barbecue grills, and automobiles. If incomplete combustion occurs in any of the devices shown below and they are improperly vented to the outside, the danger of CO poisoning exists.

Figure 2. Sources of carbon monoxide



Sources of Combustible Gas

Disastrous explosions can occur from leaks of combustible gases, such as natural gas (methane) and LPG gas (propane). These gases are used to fuel a variety of common appliances found in the home. Cooking stoves/ovens, hot-water heaters, clothes dryers, space heaters, fireplace starters, and heating furnaces are the most common gas-fuel burning appliances. Natural gas and propane can cause devastating explosions from even the smallest leaks from any of these appliances.

Sources of Combustible Gases



Fireplace



Furnace



Dryer



Space Heater



Water Heater



Stove

Symptoms of Carbon Monoxide Poisoning

The following symptoms are related to carbon monoxide poisoning and should be discussed with all members of the household:

Mild Exposure:

Slight headache, nausea, vomiting, fatigue (often described as “flu-like” symptoms).

Medium Exposure:

Severe throbbing headache, drowsiness, confusion, rapid heart rate.

Extreme Exposure:

Unconsciousness, convulsions, cardiopulmonary failure, death.

Many cases of reported carbon monoxide poisoning have indicated that although victims were aware they were not well, they became disoriented to the point they were unable to save themselves by either exiting the building or calling for assistance. Young children and household pets may be the first affected by CO poisoning.

OPERATING INSTRUCTIONS

Installation

This HS 80004 SafetySiren™ Carbon Monoxide and Combustible Gas Sensor plugs directly into a standard 110-volt AC household outlet. The unit should be oriented vertically so that all of the script on the face of the unit appears in the upright position. The ventilation slots must not be blocked and the unit must be kept dust free. A proper airflow must be maintained through the unit to obtain an air sampling representative of the local environment. The only maintenance the unit requires is a thorough vacuuming once every six months.

WARNING: There are no user serviceable parts inside the unit. Do not remove the back cover. Removal of the back cover will void the warranty.

CAUTION: When the unit has been stored unplugged for several weeks, its sensitivity to combustible gases will decline. To restore the unit to normal sensitivity, allow a 24-hour warmup period.

Once the unit is plugged into the wall outlet, the green power indicator should light up. The red indicator will flash approximately once every three seconds to indicate the unit is operating properly. It should be noted that the sounding of the alarm will indicate whether the sensor has detected unsafe levels of CO or combustible gas. Continuous appearance of the red indicator and the continuous sounding of the audible buzzer indicates a presence of potentially dangerous levels of CO. Continuous appearance of the red indicator and the intermittent sounding of the audible alarm indicates the presence of potentially dangerous levels of combustible gases. If the unit begins beeping once every 5 seconds or the red LED light is not flashing once every 3 seconds, then a fault has

occurred in the unit. If either condition exists, disconnect the unit from the AC power immediately and call Family Safety Products at 616-530-6540.

WARNING: Make sure that the unit is not plugged into a wall outlet controlled by a light switch.

CAUTION: This carbon monoxide and combustible gas detector is designed to detect carbon monoxide gas and ANY source of combustion or the combustible gases of methane and propane. It is NOT designed to detect smoke, fire, or other gases.

Location of the Detector

The Consumer Product Safety Commission recommends that each household have at least one Carbon Monoxide detector placed in the sleeping areas of the home. A second detector located near appliances or equipment using combustible fuel adds an extra measure of safety. Figure 3 shows suggested locations in the home. Make sure that airflow through the unit's ventilation slots is not inhibited by curtains, furniture or other items. The audible alarms should be able to be heard from all sleeping areas in the home. Units must not be placed within five feet of open flame cooking appliances. Also, avoid placing units near paint thinner fumes or in areas where the temperature varies outside the range of 40.0°F (4.4°C) to 100°F (37.8°C).

CAUTION: This detector will only indicate the presence of carbon monoxide and combustible gas at the sensor. Carbon monoxide and combustible gas may be present in other areas.

Figure 3 – Suggested locations for SafetySiren™ for Carbon Monoxide and Combustible Gas sensors.



Testing the SafetySiren™ for Carbon Monoxide and Combustible Gas Sensor

To verify the circuitry is operating properly, use the Test/Reset button built into the unit. Simply press down on the button during normal operation and note the red indicator. The red indicator will light continuously and the audible alarm will sound as long as the button is held down. Once you release the Test/Reset, the red indicator will return to blinking at a three-second rate and the audible alarm will cease, indicating the unit has returned to a normal operating mode. Test the unit monthly. If the unit begins beeping once every 5 seconds or the red LED light is not flashing once every 3 seconds, then a fault has occurred in the unit. Disconnect the unit from the AC power immediately and call Family Safety Products at 616-530-6540.

Resetting the Alarm

The Test / Reset button may also be used to reset the audible alarm during the alarm mode. Once the alarm is activated by detection of high CO or combustible gas levels, simply press the Test/Reset button to disable the audible alarm. If the high CO level or combustible gas level continues, the audible alarm will again sound within a 2.5 minute period. The red indicator will remain lit during the time the audible alarm is disabled, indicating that the alarm condition still exists.

WHAT TO DO WHEN THE ALARM SOUNDS

WARNING

If a continuous alarm sounds for Carbon Monoxide

Activation of this device indicates the presence of carbon monoxide which can be FATAL.

- 1) **If anyone has a headache or an upset stomach, call the Fire Department and move to a location which has fresh air. DO A HEAD COUNT TO CHECK THAT ALL PERSONS ARE ACCOUNTED FOR. DO NOT RE-ENTER THE PREMISES UNTIL IT HAS BEEN AIRED OUT AND THE PROBLEM CORRECTED!**

If no one exhibits symptoms of discomfort associated with carbon monoxide poisoning, simply:

- 2) Operate the reset button,
- 3) Turn off appliances, vehicle, or other sources of combustion at once (furnace, water heater, wood burning stove, RV, automobile, or the like),
- 4) Get fresh air into premises or vehicle,
- 5) Call a qualified technician and have the problem fixed before restarting appliances or vehicle.

If the intermittent alarm sounds for Combustible Gas

An intermittent audible alarm from this device indicates the presence of combustible gases, the source of which may be an appliance such as a furnace, water heater, oven/stove, or dryer.

- Do not operate any electrical devices such as light switches or telephones.
- Do not plug or unplug any electrical devices because they may cause a spark.
- Immediately extinguish any flames or pilot lights.
- Ventilate the area by opening doors and windows.
- Determine the source of the gas. Seek a qualified technician or call your local gas company.
- Turn off the gas supply.

**SafetySiren™ for Carbon Monoxide and Combustible Gas Sensor
Model HS 80004 Specifications**

Power Source	110-volt AC/60Hz at 15 Watts
CO Sensor	CO Sensor calibrated at 200 ppm CO specific to avoid false alarms.
CG Sensor	Alarm trip-point set at less than 25% LEL (Lower Explosive Limit) 3.8% by volume Natural gas (methane) in air 2.1% by volume LP-gas (propane) in air
Temperature	4.4°C (40°F) to 37.8°C (100°F)
CO Audible Alarm	Continuous 85dB alarm at 10 ft. for CO
CG Audible Alarm	Intermittent alarm for Combustible Gas
Visual Alarm	(3 second blinking rate for normal operation). Continuous RED LED during alarm condition.
Green LED Operation	Continuous Operation When Power On
Detection frequency	Air sampled every 2.5 minutes for CO. Air sampled continuously for Combustible Gas after an initial warm-up of 2.5 minutes
Test	Test button verifies proper operation when unit is in normal operation. Once in alarm mode the Test button will reset audible alarm until next air sampling
Dimensions	4.7 inches x 3.1 inches x 2.1 inches
Weight	12 ounces

Limited Warranty

Your Safety Siren™ for Carbon Monoxide and Combustible Gas has a five-year warranty from date of purchase against defects in material and workmanship. Units returned to the manufacturer during this period because of such defects will be repaired or replaced free of charge. For repairs within the warranty period or receipt of a faulty unit, call Family Safety Products at 616-530-6540 to receive a Return Authorization Number (RAN). Include a written description of the problem. You may then ship the unit to the address listed below along with the RAN, and proof of purchase.

The warranty covers only defects in material or workmanship in normal use and not damage from negligent handling, misuse, or lack of proper care. Important: Do not remove the back cover. Such removal will void the warranty. This warranty stands in place of any other warranty either expressed or implied.

Family Safety Products, Inc. is not liable for any personal injury, property damage or any incidental or consequential damage resulting from gas leakage, fire, or explosion. The sole remedy for breach of this limited warranty does not, in any instance, exceed the purchase price. Your SafetySiren™ for Carbon Monoxide and Combustible Gas sensor does not constitute property, disability, life or any other type of insurance.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

Family Safety Products, Inc.
2879 Remico SW
Grandville, MI 49418
USA

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DATOS Y PREOCUPACIONES RELACIONADOS CON EL MONOXIDO DE CARBONO

El monóxido de carbono (CO) es un gas incoloro, inodoro e insaboro que es muy tóxico y casi imposible de detectar, si no se utiliza un equipo sensor. El monóxido de carbono puede ser absorbido por la circulación de la sangre del cuerpo con una rapidez casi diez veces mayor a la del oxígeno puro. En consecuencia, puede limitar la capacidad que tiene el cuerpo de absorber oxígeno cuando existe una presencia de monóxido de carbono, incluso cuando se en pequeñas cantidades. Esta capacidad reducida del cuerpo para absorber oxígeno se conoce con el nombre de asfíxia química y puede causar la muerte cuando existe una presencia de pequeñas cantidades de monóxido de carbono durante un periodo determinado de tiempo.

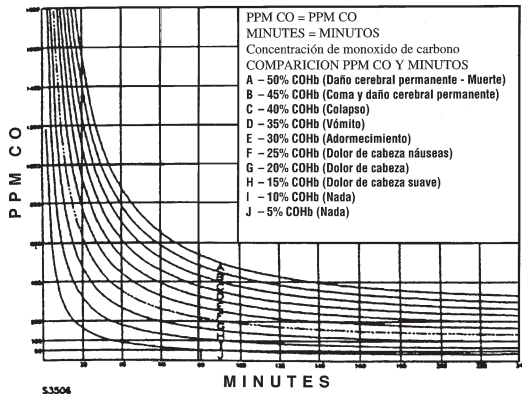
A medida que sube el nivel de monóxido de carbono en un ambiente cerrado, los efectos tóxicos tardan cada vez menos en presentarse. Si bien es cierto que son necesarias más de tres horas para que una atmósfera con un 0.01% de CO ocasione dolores de cabeza, cuando esta cantidad sube hasta el 0.02% sólo es necesaria una hora para que se produzcan los mismos efectos. Si el porcentaje sube hasta el 0.04% de CO, el tiempo necesario para que se ocasionen dolores de cabeza es sólo de 25 minutos. La unidad SafetySiren™ HS 80004 ha sido diseñada para activar la alarma cuando se alcanzan los tiempos de exposición que se indican a continua, tal y como los define la entidad Underwriters Laboratories:

- en menos de 90 minutos con un 0.01% (100 ppm CO)
- en menos de 35 minutos con un 0.02% (200 ppm CO)
- en menos de 15 minutos con un 0.04% (400 ppm CO)

Advertencia:

Es posible que no se active la alarma de este dispositivo cuando los niveles de monóxido de carbono son bajos. La entidad del gobierno federal, denominada Administración para la Seguridad y la Salud Ocupacional (OSHA) ha determinado que la exposición continuada a niveles de CO de 35 ppm no debe prolongarse por un período superior a las ocho horas. No se ha estudiado la capacidad de este detector para responder a niveles de monóxido de carbono inferiores a los 100 ppm. Es posible que a las personas con problemas de salud les convenga utilizar un dispositivo de detección de mayor sensibilidad.

Figura 1 – Concentración de monóxido de carbono comparada en función del tiempo y del % de COHb.



Fuentes de monóxido de carbono

El monóxido de carbono proviene de la combustión incompleta de los combustibles derivados del carbono como, por ejemplo, gas, carbón de quemar, madera, carbón, combustibles para sistemas de calefacción, gasolina y propano. Muchos estos combustibles se pueden encontrar en las casas; por ejemplo, en los aparatos de cocina, sistemas de calefacción, calentadores de agua, chimeneas, calentadores portátiles, barbacoas con parrillas y vehículos. Cuando se produce una combustión incompleta en cualquiera de los artículos indicados anteriormente, sin que exista una ventilación adecuada al exterior, se presenta el peligro de intoxicación por CO.

Figura 2 – Fuentes de monóxido de carbono



Calentador de agua



Vehículo



Calentador portátil



Chimenea



Sistema de calefacción



Barbacoa de carbón

Fuentes de gas combustible

Pueden ocurrir explosiones desastrosas como resultado de fugas de gases combustibles tales como el gas natural (metano) y los gases LPG (butano y propano). Estos tipos de gas se utilizan para prender una variedad de equipos de uso doméstico. Entre los más comunes se encuentran las hornillas y los hornos para cocinar, los calentadores de agua caliente, las secadoras de ropa, los calefactores portátiles, los dispositivos para prender chimeneas y los hornos para calefacción. El gas natural, el butano y el propano pueden causar explosiones devastadoras, aun cuando la fuga emitida por tales equipos es mínima.

Fuentes de gas combustible



Chimenea



Sistema de calefacción



Secadora de ropa



Calentador portátil



Calentador de agua



Hornilla

Síntomas de la intoxicación por monóxido de carbono

Los síntomas que se indican a continuación se encuentran relacionados con la intoxicación por monóxido de carbono y todas las personas que habitan en la casa deberían ser conscientes de los mismos:

Exposición de grado menor:

Dolor de cabeza suave, náuseas, vómitos, fatiga (los síntomas se describen frecuentemente como si fueran similares a los provocados por la gripe).

Exposición de grado medio:

Dolor de cabeza con palpitaciones, adormecimiento, confusión, ritmo cardíaco rápido.

Exposición de grado extremo:

Pérdida de conciencia, convulsiones, problemas cardiopulmonares, muerte.

Muchos de los casos de intoxicación por monóxido de carbono que se han dado a conocer han indicado que, si bien las víctimas eran conscientes de que no se sentían bien, se desorientaron hasta el punto de ser incapaces de prevenir las consecuencias saliendo del edificio o pidiendo ayuda. Sus hijos y sus animales domésticos pueden ser los primeros en sufrir los efectos de una intoxicación por CO.

INSTRUCCIONES PARA EL FUNCIONAMIENTO

Instalación

El HS 80004 SafetySiren™ para Sensor de Monóxido de Carbono y de Gas Combustible se enchufa directamente en un tomacorrientes residencial común de 110 voltios CA. La unidad debe quedar verticalmente orientada de manera que toda la inscripción situada en la cara de la misma aparezca en tal posición. Las aberturas de ventilación no deberán estar bloqueadas y la unidad deberá estar siempre desempolvada. Se debe mantener la circulación de aire adecuada a través de la unidad con el fin de obtener una muestra de aire que sea representativa de la atmósfera local. El único tipo de servicio de mantenimiento que la unidad requiere consiste en limpiarla completamente con una aspiradora cada seis meses.

ADVERTENCIA: En el interior de la unidad no existen componentes de interés para el usuario. No retire la cubierta trasera. Si se retira la cubierta trasera, la garantía será anulada.

PRECAUCION: Si no se utiliza la unidad durante varias semanas estando desenchufada de la electricidad, disminuirá su capacidad de detección. La unidad requerirá un período de recalentamiento de 24 horas para volver a funcionar con su capacidad de detección normal.

Una vez que la unidad esté conectada al tomacorrientes de la pared, se encenderá el indicador de luz verde. El indicador de luz roja se iluminará intermitentemente cada tres segundos para indicar que la unidad está funcionando correctamente. Si el indicador de luz roja se ilumina continuamente y se escucha un zumbido, esto quiere decir que la atmósfera contiene un nivel de CO que puede ser peligroso.

Si se detecta un alto nivel de gas combustible, la operación continua del indicador con luz roja y el sonido intermitente de la alarma de zumbido indicarán la posibilidad de que exista una condición peligrosa. Si la unidad comienza a sonar cada 5 segundos, o si el indicador de luz roja no se enciende cada tres segundos, esto indica que existe un fallo en el sistema. Si cualquiera de estas dos condiciones persiste, desconecte inmediatamente la unidad y llame a Family Safety Products marcando el 616-530-6540.

ADVERTENCIA: Asegúrese de que la unidad no esté conectada a un tomacorrientes contralado por un interruptor de luz.

PRECAUCION: Este detector de monóxido de carbono ha sido diseñado para detectar gas de monóxido de carbono proveniente de CUALQUIER fuente de combustión. No ha sido diseñado para detectar humo, fuego u otro tipo de gases.

Ubicación del Detector

El Consumer Product Safety Commission (Comisión para la Seguridad de los Productos) recomienda que cada hogar tenga al menos un detector colocado en el área que se utiliza para dormir. Otro detector situado cerca de electrodomésticos o de equipo que consuma gas combustible constituye una medida de seguridad adicional. En la Figura 3 se sugieren ubicaciones dentro de una casa. Asegúrese de que la circulación de aire a través de las aberturas de ventilación de la unidad no se encuentre obstaculizada por cortinas, muebles u otros objetos. Se deberán instalar las alarmas de forma que se puedan escuchar en todas las áreas del hogar utilizadas para dormir. Se deberá mantener una distancia mínima de cinco pies entre las unidades y cualquier equipo de cocina que funcione con llamas abiertas. Además, evite colocar las unidades cerca de los vapores emitidos por un diluyente de pintura o en áreas cuya temperatura sea inferior a los 40.0°F (4.4°C) o superior a los 100°F (37.8°C).

Precaucion: Este detector sólo indica la presencia en el sensor de gas de monóxido de carbono o de gas combustible. Es posible que en otras áreas también exista monóxido de carbono y gas combustible.

Figura 3. Sugerencias de ubicaciones para los sensores de SafetySiren™ para Monóxido de Carbono y de Gas Combustible

Comprobación del funcionamiento de SafetySiren™ para Sensor de Monóxido de Carbono y de Gas Combustible

Para comprobar que el conjunto de circuitos esté funcionando correctamente, utilice el botón “Test/Reset” (Comprobación/Reactivación) incorporado a la unidad. Sólo tiene que oprimir el botón durante el funcionamiento normal y observar el indicador de luz roja. El indicador de luz roja permanecerá iluminado y la alarma sonará mientras el botón se mantenga oprimido. Una vez que suelte el botón “Test/Reset”, el indicador de luz roja volverá a iluminarse de forma intermitente a intervalos de tres segundos y la alarma dejará de sonar, lo cual indica que la unidad ha vuelto a su funcionamiento normal. Compruebe mensualmente el funcionamiento de la unidad. Si la unidad no funciona de la manera indicada anteriormente, desconéctela inmediatamente del suministro de electricidad de CA y llame a Family Safety Products marcando al 616-530-6540.

Reactivación del dispositivo de alarma

También se puede utilizar el botón “Test/Reset” para reactivar el dispositivo de alarma sonora mientras la unidad se encuentra en el modo de alarma. Si se activa la alarma debido a la detección de altos niveles de CO o de gas combustible, simplemente oprima el botón “Test/Reset” para desactivar la alarma sonora. Si continúa existiendo un alto nivel de CO o gas combustible, la alarma volverá a sonora al cabo de 2.5 segundos. El indicador de luz roja permanecerá iluminado mientras la alarma sonora se encuentre desactivada, para indicar que persisten las condiciones de alarma.

QUE HACER CUANDO SUENA LA ALARMA

ADVERTENCIA

Si la alarma suena continuamente debido a la detección de Monóxido de Carbono

La activación de este dispositivo indica la presencia de monóxido de carbono, lo cual puede tener consecuencias FATALES.

1) Si alguien tiene dolor de cabeza o mal de estómago, llame a los Bomberos y trasládese a un área donde circule aire fresco. CUENTE LAS PERSONAS QUE SE ENCUENTRAN PRESENTES PARA ASEGURARSE DE QUE NO FALTE NADIE. ¡NO VUELVA A ENTRAR A LA CASA O AL LOCAL HASTA QUE SE HAYA EVACUADO EL AIRE CONTAMINADO Y SE HAYA CORREGIDO EL PROBLEMA!

Se nadie tiene síntomas de malestar relacionados con la intoxicación por monóxido de carbono, simplemente:

- 2) Oprima nuevamente el botón de reactivación.
- 3) Apague de inmediato todo electrodoméstico, vehículo u otra fuente de combustión (horno, calentador de agua, hornilla de carbón de madera, vehículo recreativo, automóvil, o cualquier equipo de esta índole),
- 4) Haga que el aire fresco circule por el interior de la casa, del local o del vehículo.
- 5) Llame a un técnico competente para que corrija el problema antes de volver a encender los electrodomésticos o vehículos.

Si suena la alarma intermitente debido a la detección de Gas Combustible

La alarma de este dispositivo suena intermitente para indicar la presencia de gases combustibles, cuya fuente puede ser un horno de recalentar, un calentador de agua, un horno u hornilla para cocinar o una secadora de ropa.

- **No active o utilice ningún equipo eléctrico; por ejemplo, interruptores de luz o teléfonos.**
- **No enchufe o desenchufe ningún dispositivo eléctrico, puesto que se pueden producir chispas.**
- **Extinga inmediatamente cualquier llama abierta o llama de piloto.**
- **Abra puertas y ventanas para ventilar el área.**
- **Determine la fuente de la emisión de gas. Solicite el servicio de un técnico competente o llame a la compañía de suministro de gas correspondiente a su área.**
- **Apague o cierre el suministro de gas.**

Datos específicos relacionados con el SafetySiren™ para Sensor de Monóxido de Carbono y de Gas Combustible

Suministro eléctrico	110 voltios CA/60Hz a 10 Vatios
Sensor de CO	El Sensor ha sido regulado para detectar específicamente CO a 200 ppm, lo cual permite evitar falsas alarmas
Sensor de GC	La alarma se activa cuando el sensor detecta que existe menos de un 25% del límite inferior de nivel de gas explosivo; 3.8% por volumen de gas natural (metano) en el ambiente; 2.1% por volumen de gas LP (propano) en el ambiente
Temperatura	4.4°C (40°F) a 37.8°C (100°F)
Alarma sonora	Para CO, 85dB continuos a 10 pies Para gas combustible, alarma intermitente
Alarma visible	(a intervalos de 3 segundos durante funcionamiento normal); el indicador de luz ROJA permanece encendido cuando existe una condición de alarma.
Funcionamiento del indicador con luz verde.	Iluminación continua cuando la unidad se encuentra funcionando bajo condiciones de peligro.
Frecuencia de detección	Para CO, Toma de muestra de aire cada 2.5 Para Gas Combustible, toma de muestra de aire continua, después de calentamiento inicial de 2.5 minutos
Prueba	El botón "Test" permite comprobar que la unidad esté funcionando correctamente. Al ponerlo nuevamente en el modo de alarma, el botón "Test" volverá a activar la alarma sonora hasta que se efectúe una nueva toma de aire
Dimensiones	4.7 pulgadas x 3.1 pulgadas x 2.1 pulgadas
Peso	12 onzas

Garantía Limitada

Su SafetySiren™ para Monóxido de Carbono y Gas Combustible tiene una garantía de cinco años contra defectos de los materiales o de la mano de obra. Esta garantía comienza a partir de la fecha de adquisición. Las unidades que scan devueltas al fabricante durante este período por motivo de tales defectos, serán reparadas o reemplazadas sin cargo alguno. Para solicitar reparaciones dentro del período cubierto por la garantía, o después de haber recibido una unidad defectuosa, llame a Family Safety Products al 616-530-6540 y se le dará un Return Authorization Number (RAN - Número de Aprobación de Devoluciones). Escriba una nota describiendo el problema. Dirija el envío de la unidad a la dirección que figura más abajo e incluya el RAN.

La garantía cubre únicamente los defectos de material o de mano de obra en unidades sometidas a uso normal, pero no cubre daños por manejo negligente, uso indebido o cuidado inapropiado. Importante: no retire la cubierta trasera. El hecho de retirar la cubierta trasera tendrá como resultado la anulación de la garantía. Esta garantía prevalece sobre cualquier otra garantía, bien sea ésta explícita o implícita.

Family Safety Products, Inc., no asume la responsabilidad de ningún lesión que pueda sufrir una persona, de ningún daño a la propiedad o de ningún daño accidental o emergente que pueda tener origen en una fuga de gas, incendio o explosión. El único recurso derivado del incumplimiento de esta garantía limitada no sobrepasará, bajo ninguna circunstancia, el precio de adquisición del producto. Su SafetySiren™ para Monóxido de Carbono y Gas Combustible no constituye un seguro de la propiedad, un seguro contra daños y perjuicios, un seguro de vida o de cualquier otro tipo.

Esta garantía le otorga derechos legales específicos. Puede que usted goce de otros derechos que pueden variar de un estado a otro.

Family Safety Products, Inc.
2879 Remico SW
Grandville, MI 49418
USA



SERIES 477AV | HANDHELD DIGITAL MANOMETER



BENEFITS/FEATURES

- Calculates and displays air velocity and volumetric air flow
- Rugged aluminum case protects instrument from damage during transport/use
- 9 selectable English and metric engineering units
- Large, easy to read display with backlight for use in dark areas
- Stores up to 40 readings with minimum, maximum, and average statistics
- Convenient all-in-one air velocity kit option available

APPLICATIONS

- Air flow monitoring, when used with a Dwyer® pitot tube
- Duct static pressure
- Commercial air balancing
- Building-zone pressure

DESCRIPTION

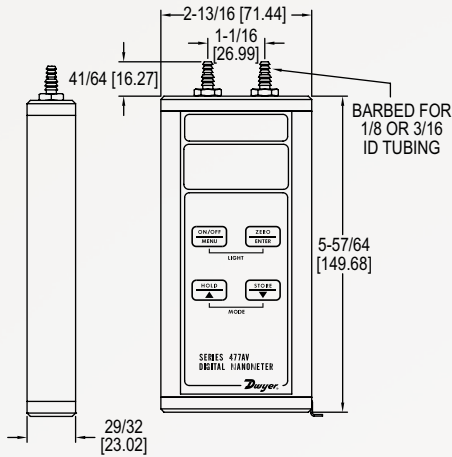
The **Series 477AV Handheld Digital Manometer** is now available with pressure, flow, and velocity measurements along with a number of other convenient features. The built-in air velocity and flow calculations provide accuracy and conserve time and error associated with manual calculations. Also featured on this unit are adjustable zero and span values for calibrating in the field as well as a damping feature to compensate for the fluctuating of readings.

Air velocity kits include: Series 477AV handheld digital manometer, Model 166T 36" telescoping pitot tube, (2) A-303 static pressure tips, (2) 4-1/2' lengths 3/16" ID rubber tubing, A-397 step drill for 3/16" to 1/2" holes, A-532 AV slide chart, and fitted polyethylene case.

SPECIFICATIONS

Service	Air and compatible gases.
Wetted Materials	Consult factory.
Accuracy	±0.5% FS from 60 to 78°F (15.6 to 25.6°C); ±1.5% FS from 32 to 60°F and 78 to 104°F (0 to 15.6°C and 25.6 to 40°C).
Pressure Hysteresis	±0.1% FS.
Pressure Limits	See chart on page 2.
Temperature Limits	0 to 140°F (-17.8 to 60°C).
Compensated Temperature Limits	32 to 104°F (0 to 40°C).
Storage Temperature Limits	-4 to 176°F (-20 to 80°C).
Display	0.42" (10.6 mm) 4 digit LCD.
Resolution	See chart on page 2.
Units of Pressure	in w.c., ft w.c., in Hg, psi, oz/in ² , mm w.c., cm w.c., mm Hg, mbar, Pa, kPa, hPa.
Units of Velocity	fpm, fps, mph, m/h, m/s, k/h, knot.
Units of Flow	cfm, m ³ /h, m ³ /s.
Power Requirements	9 V alkaline battery, installed non-functional, user replaceable.
Weight	10.2 oz (289 g).
Process Connections	Two barbed connections for use with 1/8" (3.18 mm) or 3/16" (4.76 mm) ID tubing; Two compression fittings for use with 1/8" (3.18 mm) ID x 1/4" (6.35 mm) OD tubing for 477AV-7, -8 only.
Agency Approvals	CE.

DIMENSIONS

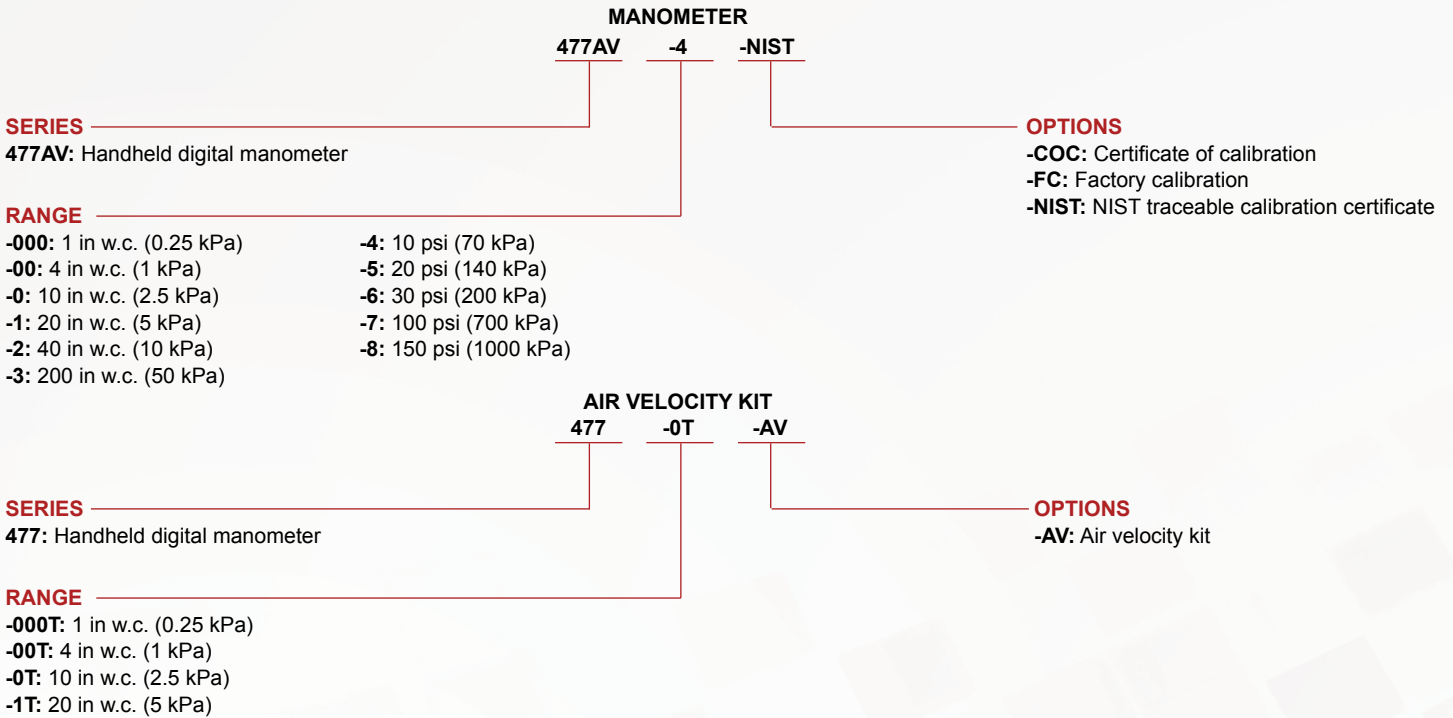


MAXIMUM PRESSURE / RESOLUTION

Pressure Range	Max Pressure	Resolution
0 to 1 in w.c.	5 psig	0.001
0 to 4 in w.c.	5 psig	0.001
0 to 10 in w.c.	5 psig	0.01
0 to 20 in w.c.	10 psig	0.01
0 to 40 in w.c.	10 psig	0.01
0 to 200 in w.c.	30 psig	0.1
0 to 10 psi	30 psig	0.01
0 to 20 psi	60 psig	0.01
0 to 30 psi	60 psig	0.01
0 to 100 psi	150 psig	0.1
0 to 150 psi	200 psig	0.1

HOW TO ORDER

Use the **bold** characters from the chart below to construct a product code.



ACCESSORIES

Model	Description
A-47X-BOOT	Protective magnetic rubber boot
A-402A	Carrying case; tough gray nylon pouch protects any Series 477AV Manometer; double zippered for quick and easy access, with a belt loop that snaps closed; 7-1/2"H x 3"W x 2-1/4"D (191 x 76 x 57 mm)

ORDER ONLINE TODAY!

dwyer-inst.com/Product/Series477AV



DWYER INSTRUMENTS, INC.



Flow Measurement Instruments

- Low Flow Liquid Meters
- Low Flow Gas Meters
- Duct Flow Meters for Air & Gas
- MaxExtractor Extraction Monitor
- Multi-Variable Process Meter
- Bidirectional Flow Meters
- RheoVac® Multisensor Flow Monitors
- Custom Process Measurement
- Flow Switches
- Instruments for Hazardous Locations
- Electronics Options

Duct Flow Meters for Air & Gas

Rheotherm flow sensing probes for duct gases are easy to install and provide long-term service with little or no maintenance. The output can be in mass, standard volume or velocity units. Options for hazardous locations (intrinsically safe/explosion-proof) are available.



What Can We Measure?

Air and most other non-condensing gases, including corrosive and explosive gases. The stainless steel construction and lack of moving parts make it ideal for rugged industrial environments. Common uses include vent air, stack gas and digester gas. The [application section](#) has a complete list of fluids. [Contact Us](#) about any application you have or use the form on this page.

How Are They Installed?

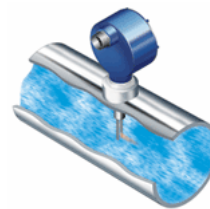
These are insertion probe flow sensors that install through the pipe or duct wall. Typical line connections are 1" NPT, but flange, hot tap and sanitary fittings are available. The probes can be installed in horizontal or vertical pipes. With some models the electronics are integral to the sensor, and other models have a separate electronics enclosure to install, up to 200 feet from the sensor. [Electronics Options](#)

What Is the Turndown Ratio?

Typical calibration ranges are 10:1 (options up to 200:1), with good accuracy over the entire range. The sensors cannot be damaged by overranging.

How Do They Work?

Our insertion flow sensors have a shaft with two stainless steel flow sensing tips. One tip has a heated RTD in it and the other an unheated RTD. The temperature differential between the two RTDs provides the primary flow signal. At high flow rates, flow removes more heat resulting in a lower differential. At low flow rates, flow removes less heat so the differential is higher. Nothing touches the gas but the metal probe. [More on Method of Operation \(PDF\)](#)



What If There Is Little to No Straight Run Available?

The historically reliable Rheotherm flow meter for duct flow measurement is available with a revolutionary sensor head which eliminates off-axis error common to other sensors. The system measures true mass flow rate in turbulent ducts and pipes using our standard gas flow probe design with the Rheovec sensor head added. [Rheovec literature \(PDF\)](#)

How Do I Get A Duct Flow Meter?

Contact one of our flow application specialists using the form on this page to configure a Rheotherm flow meter tailored to your application. You can also download and complete the [Flow Application Data Sheet](#) and email it to us at sales-flow@bionetics.com. For other questions and ways to reach us, visit our [Contact Us](#) page for telephone, fax and email information.

Contact Intek

Use this form to consult with one Application Experts to configure instrument for your application. If you prefer to submit your application details online, use our Online RFP clicking here.

Your Name (required):

Email (required):

Phone (include for callba

Company:

Brief description of applic

Attach file with your process information (optional):

No file cho

Send

	Standard	Options
Service	Duct & pipe gases	
Pipe Sizes	1" and larger pipes	
Wetted Surface	316 SS	Hastelloy C-276®; Monel®
Flow Velocity Limits	25-25,000 SFPM (0.127-127 meter/sec.)	Consult Factory
Turndown Ratio	10:1	Up to 200:1
Accuracy	+/- 1% of reading	
Repeatability	+/- 0.5%	
Max. Temperature	175 °F (80 °C)	Up to 500 °F (260 °C)
Max. Pressure	Depends on Fitting	Up to 4,000 PSI
	Standard	Options
Process Connection	1" MNPT	– Tri-Clover (Sanitary); – SS Flange; – Ball valve/hot tap; Most other fittings available
Outputs	4 – 20 mA (flow rate) or Serial Burst with Flow Rate, Totalizer, and Fluid Temperature	– 0 – 10 or 0 – 5 VDC; – Pulse (5 VDC open collector); – HART (4-20 mA); – SPDT relay; – 4 to 20 mA temp
Enclosure	Integrated – NEMA 4X Cast Aluminum Remote – NEMA 4	Remote electronics: – 304 Stainless steel; – NEMA 7 Explosion-proof
	Standard	Options
Display		2 X16 backlit LCD with selectable display of: – Mass/volume flow rate; – Temperature; – Total accumulated flow
Hazardous Environment		Integrated electronics: FM-Approved for: – Class I, Div. 1, Groups B,C,D; – Class I, Zone 1, IIB+H2 (US); – Class II, Div. 1, Groups E, F, G; – Class III, Div. 1 Remote electronics: Same as above except addition of Group A using ISB
Input Power	24 VDC ±4V (200 mA; 300 mA w/display option)	110/230 VAC ±10V

751 Intek Way
Westerville, OH 43082
P: (614) 895-0301
F: (614) 895-0319

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APPENDIX 10
LANDFILL GAS COLLECTION SYSTEM EQUIPMENT



AIR SYSTEMS INTERNATIONAL Confined Space Fan: Axial Explosion Proof, 1/3 hp, 115V AC

Item 3WE66 Mfr. Model SVF-10EXP

Compare

Product Details [Catalog Page 1798](#)

Type Axial Explosion Proof

HP 1/3 hp

Duct Dia. 8 in; 10 in

Material Steel

Maximum Flow in Free Air 1,390 cfm

Voltage 115V AC

Amps 3.5 A

Color Red

Length 28 in

Width 15 in

Height 21 in

Standards UL/CSA Approved

Includes Voltage @ 60 Hz 115, Amps 3.6, Duct Adapters 8 and 10 in, Static Grounding Lug and Rubber Ft

Product Type Confined Space Fan

UNSPSC 40101601

Country of Origin USA (subject to change)

Compatible Products

Web Price ⁱ
\$1,982.09 / each

Qty
1

Add to Cart

Ship

Pickup

Expected to arrive by end of May, 2023.

Ship to 77375 | [Change](#)

Shipping Weight 30 lbs
[Ship Availability Terms](#)

[Add to List](#)

Documents

[Air Systems Inline Axial Fan Sell Sheet](#)

Chat with an Agent



AIR SYSTEMS INTERNATIONAL
Conductive Ventilation Kit: 8 in Dia, 15
ft Lg, Polyethylene

Item 3PAR2

Compare

Web Price *i*
\$243.69 / each

Qty
1

Add to Cart



INDUSTRIAL SCIENTIFIC Multi-Gas
Detector, 4 Gas: CO/H2S/LEL/O2, Adj,
Audible/Vibrating/Visual, LCD

Item 6XFK9

Compare

Web Price *i*
\$995.39 / each

Qty
1

Add to Cart



INDUSTRIAL SCIENTIFIC Multi-Gas
Detector, 4 Gas: CO/H2S/LEL/O2,
Audible/Vibrating/Visual

Item 8TUN1

Compare

Web Price *i*
\$3,776.19 / each

Qty
1

Add to Cart



AIR SYSTEMS INTERNATIONAL
Conductive Ventilation Kit: 8 in Dia, 25
ft Lg, Polyethylene

Item 3PAR3

Compare

Web Price *i*
\$330.34 / each

Qty
1

Add to Cart

Impeller:**9.88 - 6 - 3HR - PPG**


**MULTI
WING**
Performance Optimizer

Impeller Diameter : 9.88 in
Tipclr. : 0.5 % [AMCA A]
No of blades : 6
Material : PPG
Type : 3H
Rotation : R
Test Number : T670.3 + T597.3
Speed : 3515 RPM
Temp. : 59 F
Elevation : 0 ft
Density : 0.077 lb/ft3

Date : 2003-02-26
To :
Company :
From : SHANE
Company : AIR SYSTEMS
Telephone : 757-424-3967
Fax : 757-424-5348
e-mail : SHANE@AIRSYSTEMS.CC

*Test Method: Outlet chamber. AMCA 210-99 fig.12 / ISO 5801 fig.71b Fan installation Type A (Fan with free inlet & free outlet)
 Other impeller arrangements will affect the performance (Program: Version: 2.16A)*

No. of fans	1	Size of Source	2 * 2 ft
No. of reflectors	1	Distance from source	0 ft

Airflow	Static Pres.	Dynamic Pres.	Total Pres.	Power	Efficiency	Sound Power	Speed
cfm	inwg	inwg	inwg	hp	%	dB	RPM
1710	0	0.634	0.634	0.45	38	> 86	3515
1640	0.25	0.579	0.829	0.466	45	> 87	3515
1550	0.5	0.52	1.02	0.482	52	> 88	3515
1450	0.75	0.457	1.21	0.497	56	> 88	3515
1340	1	0.386	1.39	0.508	57	> 89	3515
1210	1.25	0.318	1.57	0.528	57	> 90	3515
1060	1.5	0.244	1.74	0.545	53	> 91	3515
645	1.75	0.0904	1.84	0.548	34	> 93	3515
561	2	0.0696	2.07	0.574	31	> 95	3515
480	2.25	0.0511	2.3	0.596	29	> 95	3515
374	2.5	0.0353	2.54	0.617	24	> 95	3515
238	2.75	0.0224	2.77	0.635	15	> 94	3515
102	3	0.00959	3.01	0.654	6.4	> 91	3515
0	3.19	0	3.19	0.667	0	> 104	3515
0	3.19	0	3.19	0.667	0	> 104	3515
0	3.19	0	3.19	0.667	0	> 104	3515



Crowley Company, Inc.
 P.O.Box 425
 Burton, OH 44021
 Tel: 440-834-9400
 Fax: 440-834-0449
 e-mail: mwfans@crowleycompany.com

Impeller:

9.88 - 6 - 3HR - PPG



Impeller Diameter : 9.88 in
Tipclr. : 0.5 % [AMCA A]
No of blades : 6
Material : PPG
Type : 3H
Rotation : R
Test Number : T670.3 + T597.3
Speed : 3515 RPM
Temp. : 59 F
Elevation : 0 ft
Density : 0.077 lb/ft3

Date :
To :
Company :
From : SHANE
Company : AIR SYSTEMS
Telephone : 757-424-3967
Fax : 757-424-5348
e-mail : SHANE@AIRSYSTEMS.CC

2003-02-26

Test Method: Outlet chamber. AMCA 210-99 fig.12 / ISO 5801 fig.71b Fan installation Type A (Fan with free inlet & free outlet)
Other impeller arrangements will affect the performance (Program: Version: 2.16A)



Crowley Company, Inc.
P.O.Box 425
Burton, OH 44021
Tel: 440-834-9400
Fax: 440-834-0449
e-mail: mwfans@crowleycompany.com



VALTERRA Gate Valve: Class 125, 4 in Pipe Size, 15 psi Max. Water Pressure - CWP, Rising Valve Stem

Item 4HGE5 Mfr. Model 6401GR

Web Price 
\$133.41 / eachQty
1[Add to Cart](#) Ship PickupExpected to arrive
Mon. Jan 23.Ship to 77001 | [Change](#)

Shipping Weight 4.1 lbs

[Ship Availability Terms](#)[Add to List](#)

Product Details

Catalog Page [2889](#)

Valve Class Class 125

Body Material - Valves PVC

Connection Type Slip

Pipe Size - Valves 4 in

Max. Water Pressure - CWP 15 psi

Valve Max. Fluid Temp. 167 °F

Valve Stem Type Rising

Top of Handle to Inlet Center 9-15/16 in

Inlet to Outlet Length 5-3/16 in

Stem Material 304 Stainless Steel

Bonnet Style Bonded

Wedge Material 304 Stainless Steel

Handle Material Aluminum

Handle Type Hand Wheel

Standards MSS SP-70

UNSPSC 40141613

Country of Origin Mexico (subject to change)

Product Description

Designed for quick shutoff in low-pressure or vacuum lines, these quick-opening valves provide unrestricted flow for low-pressure tank and drain applications with

Compliance & Restrictions

This product has been manufactured to be compliant with the "Safe Drinking Water Act" requirements for low lead in potable (human consumption - drinking and cooking) and non-potable water applications (non-human consumption).



This item is restricted for conveying or dispensing water for potable use (human consumption) in states that require 3rd party certification of compliance with the "Safe Water Drinking Act" (CA, LA, MD, VT).

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valves provide unrestricted flow for low-pressure tank and drain applications with liquids, gases, dry/bulk solids, and slurry. They can be disassembled for in-line servicing.

Home / Heating, Venting & Cooling / Fireplaces / Fireplace Accessories / Chimney Caps

Internet #203721498 Model #FGLTC6

The Forever Cap
Guard Liner Top 6 in. Round Fixed Stainless Steel Chimney Cap

★★★★★ (29) Questions & Answers (9)

♡ 36



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✕

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<p>Ship to Store</p> <p>Sep 6 - Sep 8</p> <p>1,000 available</p> <p>FREE</p>	<p>Delivery</p> <p>Friday, Sep 8</p> <p>1,000 available</p> <p>FREE</p>
--	---

- 1 +

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Product Details 

Forever guard chimney cap. Fits all factory build double and triple wall chimney systems. This chimney cap will also fit, single wall stove pipe, masonry round clay pipe and flexible chimney lining systems. Designed to slip inside the flue pipe, secures with a pressure fit.

Additional Resources

From the Manufacturer


Specifications 

Dimensions: H 8, W 13, D 13


Questions & Answers 


9 Questions

9 Questions

Search Questions & Answers 



Ask a Question

Showing 5-9 of 9 Newest Questions | 

Q: i have a direct vent (side wall) oil fired boiler with a 6" chimney... 
 by Michael | Oct 3, 2021 **1 Answer**

Q: will this say on a camp stove 

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 Feedback

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Q: How is this secured to the chimney pipe? 1 Answer

by Kris | Oct 6, 2020

Q: will this cap work over high efficiency furnice pipes in chimney? 1 Answer

by Ben | Aug 15, 2019

Q: are there drainage holes in the bottom so water doesn't collect... 1 Answer

by nic | Nov 21, 2016




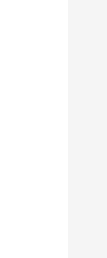


Showing 5-9 of 9

Customer Reviews

4.9 out of 5 ★★★★★ (29)

Frequently Bought Together

<input checked="" type="checkbox"/> Select  This Item	+	<input checked="" type="checkbox"/> Select Best Seller  ★★★★★ (245)	+	<input checked="" type="checkbox"/> Select  ★★★★★ (57)	+	<input checked="" type="checkbox"/> Select  ★★★★★ (245)
The Forever Cap Guard Liner Top 6 in. Round Fixed Stainless St... ★★★★★ (29) \$85⁴⁶		DuraVent 6 in. Dia x 36 in. Triple-Wall Galvanized Chimney Stov... ★★★★★ (245) \$89⁰⁰		The Forever Cap Guard Liner Top 8 in. Round Fixed Stainless St... ★★★★★ (57) \$112⁹⁸		DuraVent 10 in. Dia x 36 in. Triple-Wall Galvanized Chimney Stov... ★★★★★ (245) \$112⁹⁸

Subtotal: **\$356²⁵**

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Fixed Stainless Steel Chimn

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Guard Liner Top 9 in. Round
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HEPA Filter, HP07

★★★★★ (111)

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Bloom HEPA-13 Air Purifier with
Planter, AutoDetect to Remov...

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\$249⁹⁹

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FITTES
Aria Lite - Framed Wall Vent 10
in.x14 in. White

★★★★★ (1)

\$49⁰⁰

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Amazon
Smart Thermostat,
Programmable Wi-

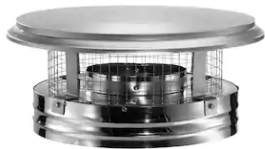
★★★★★ (59)

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Limit 4 per order

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Cap

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The Forever Cap
Guard Liner Top 8 in. Round
Fixed Stainless Steel Chimney
Cap

★★★★★ (57)

\$112⁹⁸



The Forever Cap
Slip-In 6 in. Round Fixed
Stainless Steel Chimney Cap

★★★★★ (24)

\$68⁰³

AL
6 in
3/4
Ch

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APPENDIX 11
SAMPLING PLANS AND PROCEDURES

Attachment 11

Sampling Plans and Procedures

During each landfill gas monitoring event, the integrity of each monitoring port or probe will be inspected and recorded on the Landfill Gas Monitoring System Data Sheets included in this Attachment. If any monitoring port or probe is observed to be damaged, the port or probe will be repaired. If irreparable, the damaged port or probe will be decommissioned and replaced with a new monitoring port or probe.

SAMPLING PLANS

Sampling plans for the landfill gas collection system under the buildings, sub slab vacuum test points, and sampling of non-enclosed structures are discussed below.

Landfill Gas Collection System

The landfill gas collection system under each building will be continuously monitored for methane concentration by permanently installed sensors. The ports on the landfill gas collection system under each building will be monitored quarterly for methane, hydrogen sulfide, carbon dioxide, and oxygen as a check on the permanently installed sensors.

Sub Slab Vacuum Test Points

Vacuum test points will be installed through the building slabs before each slab is poured. These test points will be used to assess the extent and strength of the negative pressure field created by the exhaust fan. These points will be tested quarterly for negative pressure.

Subgrade Utility Vaults and Other Non-enclosed Structures

Subgrade utility vaults and other non-enclosed structures in contact with the ground and having the potential to accumulate landfill gas will be monitored quarterly for methane, hydrogen sulfide, carbon dioxide, and oxygen. Any exceedance of 1.25% methane will be reported in accordance with 30 TAC 330.371(a)(1).

MONITORING AND SAMPLING EQUIPMENT

The monitoring and sampling equipment are discussed below.

Gas Sampling Equipment

At each GMP, port, other monitoring location location, a CES-Landtec GEM 5000 Landfill Gas Monitor (GEM 5000) or equivalent will be used to measure the methane, hydrogen sulfide, carbon dioxide, and oxygen concentrations. This meter provides the readings of methane, carbon dioxide, and oxygen as a percentage by volume in air. Hydrogen sulfide concentrations are provided as parts per million by volume in air.

Gas Pressure

Gas pressure below the building slabs will be measured using a Dwyer digital manometer, or equivalent. These instruments provide the readings of gas pressure as positive or negative (vacuum) in inches of water gauge.

Barometric Pressure

Barometric pressure will be measured using the GEM 5000 or equivalent. The meter provides the readings of barometric pressure as inches of mercury.

MONITORING PROCEDURES

The following monitoring procedures are to be used when sampling the landfill gas collection system, sub slab vacuum test points, and any utility vaults or other non-enclosed spaces.

Landfill Gas Collection Systems

The landfill gas collection system will be monitored on a quarterly basis. The monitoring events are conducted in accordance with the following procedure:

- (1) Perform equipment checks and calibration tests.
- (2) Inspect the sampling location. The inspection is to include the following:
 - (i) Verify that the location is accessible as necessary for monitoring.
 - (ii) Verify that any surface protective devices are in place and are in good condition, and
 - (iii) Verify that the label is in place and clearly readable.
- (3) Open any protective cover.
- (4) Turn on the CES-Landtec GEM 5000 or equivalent meter and allow for the meter to adjust to the ambient air.
- (5) Connect the GEM 5000 or equivalent meter to the quick-connector or port.
- (6) Open the valve on the port.
- (7) Turn on the GEM 5000 pump or equivalent and allow for the meter to purge the port.
- (8) Allow the meter to purge the trapped air for at least 30 seconds to get an accurate methane reading.
- (9) Record the observed methane, hydrogen sulfide, carbon dioxide, and oxygen readings.
- (10) Record the ambient barometric pressure from the GEM 5000 or equivalent meter.
- (11) Disconnect the GEM 5000 or equivalent methane meter from the quick-connector or port.
- (12) Close the port and reinstall any protective cover.

The above procedure will be repeated to obtain readings at each port location. All readings and inspection results will be recorded on the Landfill Gas Monitoring System Data Sheets) with any needed maintenance and/or repairs noted.

Sub Slab Vacuum Test Points

Sub slab vacuum test points are used to assess the extent and strength of the negative pressure field created under the building slabs by the exhaust fans. The following monitoring procedures are used to monitor the sub slab vacuum test pointsA:

- (1) Perform equipment checks and calibration tests.
- (2) Inspect the sampling location. The inspection is to include the following:
 - (i) Verify that the location is accessible as necessary for monitoring.
 - (ii) Verify that any surface protective devices are in place and are in good condition, and
 - (iii) Verify that the label is in place and clearly readable.
- (3) Open the protective cover.
- (4) Turn on the Dwyer digital manometer or equivalent meter and allow for the meter to adjust to the ambient air (0.00 pressure reading).
- (5) Connect the digital manometer to the quick-connector or port.
- (6) Open the valve on the port.
- (7) Allow the digital manometer to stabilize for at least 30 seconds to get an accurate pressure reading.
- (8) Record the pressure from the digital manometer.
- (9) Close the valve on the port.
- (10) Disconnect the digital manometer from the quick-connector or port.
- (11) Reinstall any protective cover.

The above procedure will be repeated to obtain readings at each sub slab vacuum test point. All readings and inspection results will be recorded on the Landfill Gas Monitoring System Data Sheets) with any needed maintenance and/or repairs noted.

Utility Vault and Other Non-enclosed Space Monitoring

Utility vaults and other non-enclosed spaces are typically vented to prevent the buildup of landfill gases or other gases. Utility vaults and other non-enclosed spaces will be monitored on a quarterly basis. The utility vaults and other non-enclosed spaces are monitored in accordance with the following procedure:

- (1) Perform equipment checks and calibration tests.
- (2) Inspect the sampling location. The inspection is to include the following:

- (i) Verify that the location is accessible as necessary for monitoring.
 - (ii) Verify that any surface protective devices are in place and are in good condition, and
 - (iii) Verify that any labels are in place and clearly readable.
- (3) Turn on the CES-Landtec GEM 5000 or equivalent meter and allow for the meter to adjust to the ambient air.
 - (4) Connect tubing to the GEM 5000 or equivalent meter and insert the tubing at least one foot into the vault or space through an existing vent hole.
 - (5) Turn on the GEM 5000 pump or equivalent and allow for the meter to purge the port.
 - (6) Allow the meter to purge the trapped air for at least 30 seconds to get an accurate methane reading.
 - (7) Record the observed methane, hydrogen sulfide, carbon dioxide, and oxygen readings.
 - (8) Record the ambient barometric pressure from the GEM 5000 or equivalent meter.
 - (9) Withdraw the tubing from the vent and turn off the GEM 5000 or equivalent methane meter.
 - (10) Reinstall any protective devices.

The above procedure will be repeated to obtain readings at each utility vault or other non-enclosed space. All readings and inspection results will be recorded on the Landfill Gas Monitoring System Data Sheets) with any needed maintenance and/or repairs noted.

SKA CONSULTING, L.P.
LANDFILL GAS MONITORING SYSTEM DATA SHEET

PROJECT NAME: _____

PROJECT NUMBER: _____

DATE: _____

SAMPLE LOCATION NO.	BAROMETRIC PRESSURE (IN. OF Hg.)	GAS PRESSURE (IN. OF H2O)	METHANE (% BY VOL.)	CARBON DIOXIDE (% BY VOL.)	OXYGEN (% BY VOL.)	HYDROGEN SULFIDE (ppm)	DEPTH TO WATER (FT.)	TEMPERATURE (DEG. F)	TIME PROBE SAMPLED
Condition/Damage/Notes:									
Condition/Damage/Notes:									
Condition/Damage/Notes:									
Condition/Damage/Notes:									
Condition/Damage/Notes:									
Condition/Damage/Notes:									
Condition/Damage/Notes:									
Condition/Damage/Notes:									
Condition/Damage/Notes:									

NOTES:

GEOLOGIST/SCI: _____

PROJECT MANAGER: _____

APPENDIX 12
COMPREHENSIVE LANDFILL GAS COMPOSITION

SKA Consulting, L.P.

1888 Stebbins Drive, Suite 100
Houston, Texas 77043

Dotty Landfill

1200 Bissonnet St.
Client Project # 5019-0001

Analytical Report (0123-968R2)

ASTM D1946

Methane, Carbon monoxide

ASTM D5504

Hydrogen sulfide, Methyl mercaptan, Ethyl mercaptan, Isopropyl mercaptan, t-Butyl mercaptan, n-Propyl mercaptan, Isobutyl mercaptan, sec-Butyl mercaptan, n-Butyl mercaptan

TO-15

Volatile Organic Compounds



Enthalpy Analytical, LLC

Phone: (281) 984 - 7021 / www.enthalpy.com
931 Seaco Ct. Deer Park, TX 77536-3187

I certify that to the best of my knowledge all analytical data presented in this report:

- Have been checked for completeness
- Are accurate, error-free, and legible
- Have been conducted in accordance with approved protocol, and that all deviations and analytical problems are summarized in the appropriate narrative(s)

This analytical report was prepared in Portable Document Format (.PDF). This report shall not be reproduced except in full without approval of the laboratory. This will provide assurance that parts of a report are not taken out of context.



QA Review Performed by: James Haynes, Quality Assurance Director

Report Issued: 02/15/2023



Results

Enthalpy Analytical

Company: SKA Consulting, LP

Job No.: 0123-968-1 ASTM D1946-90 Canister Analysis

Client No.: 5019-0001 Site: Doty Landfill-12000 Bissonnet St.

Summary

Sample ID	LF1-GMP-9R (C1100)	
Compound	%	
Methane	4.73	
Carbon monoxide	0.00655	ND

Enthalpy Analytical

Company: SKA Consulting, LP

Job No.: 0123-968-2 ASTM D5504 Analysis

Client No.: 5019-0001 Site: Doty Landfill-12000 Bissonnet St.

Summary

Sample ID	LF1-GMP-9R C1100	
Compound	ppmv	
Hydrogen Sulfide	0.151	ND
Methyl Mercaptan	0.151	ND
Ethyl Mercaptan	0.151	ND
Isopropyl Mercaptan	0.151	ND
t-Butyl Mercaptan	0.151	ND
n-Propyl Mercaptan	0.151	ND
sec-Butyl Mercaptan	0.151	ND
Isobutyl Mercaptan	0.151	ND
n-Butyl Mercaptan	0.151	ND

Enthalpy Analytical

Company: SKA Consulting, LP

Job No.: 0123-968-1 ASTM D1946-90 Canister Analysis

Client No.: 5019-0001 Site: Doty Landfill-12000 Bissonnet St.

Methane

Sample ID	Filename #1	Filename #2	MDL (%)	Ret Time (min)	Ret Time (min)	%dif RT	Conc #1 (%)	Conc #2 (%)	%dif conc	DF	Avg Conc (%)	Final Conc (%)	Flag
LF1-GMP-9R (C1100)	001F0503.D	001F0504.D	0.00341	1.30	1.30	0.0	3.11	3.12	0.0	1.52	3.12	4.73	

Carbon monoxide

Sample ID	Filename #1	Filename #2	MDL (%)	Ret Time (min)	Ret Time (min)	%dif RT	Conc #1 (%)	Conc #2 (%)	%dif conc	DF	Avg Conc (%)	Final Conc (%)	Flag
LF1-GMP-9R (C1100)	001F0503.D	001F0504.D	0.00431	NA	NA	NA	0.00431	0.00431		1.52	0.00431	0.00655	ND

Enthalpy Analytical

Company: SKA Consulting, LP

Job No.: 0123-968-2 ASTM D5504 Analysis

Client No.: 5019-0001 Site: Doty Landfill-12000 Bissonnet St.

Hydrogen Sulfide

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

Methyl Mercaptan

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

Ethyl Mercaptan

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

Isopropyl Mercaptan

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

t-Butyl Mercaptan

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

n-Propyl Mercaptan

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

Enthalpy Analytical

Company: SKA Consulting, LP

Job No.: 0123-968-2 ASTM D5504 Analysis

Client No.: 5019-0001 Site: Doty Landfill-12000 Bissonnet St.

sec-Butyl Mercaptan

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

Isobutyl Mercaptan

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

n-Butyl Mercaptan

Sample ID	Filename #1	MDL (ppmv)	Ret. Time (min.)	Conc 1 (ppmv)	DF	Final Conc (ppmv)	Flag
LF1-GMP-9R (C1100)	014B0501.D	0.0992		0.0992	1.52	0.151	ND

Analysis Results for 100055

Mike Schultz
 SKA Consulting, L.P.
 1888 Stebbins Drive, Suite 100
 Houston, TX 77043

Lab Job #: 100055
 Location: 5019-0001 - Doty Landfill, 12000
 Bissonnet St.
 Date Received: 01/24/23

Sample ID: LF1-GMP-9R	Lab ID: 100055-001	Collected: 01/23/23 16:00
Matrix: Air		

b Flag: These sample results may be due to contamination in the canister prior to sampling. See Narrative.

100055-001 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-15										
Prep Method: METHOD										
1,1,1-Trichloroethane	ND	b	mg/M3	0.0011		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,1,2,2-Tetrachloroethane	ND	b	mg/M3	0.0014		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,1,2-Trichloroethane	ND	b	mg/M3	0.0011		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,1-Dichloroethane	ND	b	mg/M3	0.00081		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,1-Dichloroethene	ND	b	mg/M3	0.00079		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,2,4-Trimethylbenzene	ND	b	mg/M3	0.00098		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,2-Dibromoethane	ND	b	mg/M3	0.0015		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,2-Dichlorobenzene	ND	b	mg/M3	0.0012		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,2-Dichloroethane	ND	b	mg/M3	0.00081		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,2-Dichloropropane	ND	b	mg/M3	0.00092		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,3,5-Trimethylbenzene	ND	b	mg/M3	0.00098		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,3-Butadiene	ND	b	mg/M3	0.00044		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,3-Dichlorobenzene	ND	b	mg/M3	0.0012		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,4-Dichlorobenzene	ND	b	mg/M3	0.0012		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
1,4-Dioxane	0.00084	b	mg/M3	0.00072		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
2,2,4-Trimethylpentane	0.0019	b	mg/M3	0.00093		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
2-Butanone	ND	b	mg/M3	0.0029		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
2-Chlorotoluene	ND	b	mg/M3	0.0010		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
2-Hexanone	ND	b	mg/M3	0.00082		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
3-Chloropropene	ND	b	mg/M3	0.00063		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
4-Ethyltoluene	ND	b	mg/M3	0.00098		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
4-Methyl-2-Pentanone	ND	b	mg/M3	0.00082		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Acetone	0.024	b	mg/M3	0.0024		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Benzene	0.0014	b	mg/M3	0.00064		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Bromodichloromethane	ND	b	mg/M3	0.0013		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Bromoform	ND	b	mg/M3	0.0021		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Bromomethane	ND	b	mg/M3	0.00078		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Butane	0.19	b	mg/M3	0.019		76	100132	01/24/23 12:31	01/24/23 12:31	MR1
Carbon Disulfide	0.035	b	mg/M3	0.00062		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Carbon Tetrachloride	ND	b	mg/M3	0.0013		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Chlorobenzene	ND	b	mg/M3	0.00092		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Chloroethane	0.00066	b	mg/M3	0.00053		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Chloroform	ND	b	mg/M3	0.00098		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1

Analysis Results for 100055

100055-001 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Chloromethane	0.00079	b	mg/M3	0.00041		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
cis-1,2-Dichloroethene	ND	b	mg/M3	0.00079		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
cis-1,3-Dichloropropene	ND	b	mg/M3	0.00091		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Cyclohexane	0.0056	b	mg/M3	0.00069		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Dibromochloromethane	ND	b	mg/M3	0.0017		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Ethanol	ND	b	mg/M3	0.0094		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Ethylbenzene	ND	b	mg/M3	0.00087		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Freon 113	ND	b	mg/M3	0.0015		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Freon 114	0.0059	b	mg/M3	0.0014		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Freon 12	0.0032	b	mg/M3	0.00099		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Hexachlorobutadiene	ND	b	mg/M3	0.0021		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Isopropanol (IPA)	ND	b	mg/M3	0.0025		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Isopropylbenzene	ND	b	mg/M3	0.00098		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
m,p-Xylenes	ND	b	mg/M3	0.0017		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Methyl methacrylate	ND	b	mg/M3	0.00082		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Methylene Chloride	ND	b	mg/M3	0.00069		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
MTBE	ND	b	mg/M3	0.00072		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
n-Heptane	0.0012	b	mg/M3	0.00082		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
n-Hexane	0.0097	b	mg/M3	0.00070		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
n-Nonane	ND	b	mg/M3	0.0010		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
n-Pentane	0.062	b	mg/M3	0.00059		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
o-Xylene	ND	b	mg/M3	0.00087		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Propylbenzene	ND	b	mg/M3	0.00098		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Propylene	0.12	b	mg/M3	0.014		76	100132	01/24/23 12:31	01/24/23 12:31	MR1
Styrene	ND	b	mg/M3	0.00085		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Tetrachloroethene	ND	b	mg/M3	0.0014		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Tetrahydrofuran	ND	b	mg/M3	0.00059		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Toluene	0.00076	b	mg/M3	0.00075		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
trans-1,2-Dichloroethene	ND	b	mg/M3	0.00079		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
trans-1,3-Dichloropropene	ND	b	mg/M3	0.00091		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Trichloroethene	ND	b	mg/M3	0.0011		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Trichlorofluoromethane	0.017	b	mg/M3	0.0011		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Vinyl Acetate	0.010	b	mg/M3	0.0035		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Vinyl bromide	ND	b	mg/M3	0.00087		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Vinyl Chloride	ND	b	mg/M3	0.00051		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Xylene (total)	ND	b	mg/M3	0.0026		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1
Surrogates				Limits						
Bromofluorobenzene	92%	b	%REC	60-140		1.5	100132	01/24/23 13:25	01/24/23 13:25	MR1

ND Not Detected
b See narrative

Batch QC

Type: Blank	Lab ID: QC100479	Batch: 100132
Matrix: Air	Method: EPA TO-15	Prep Method: METHOD

QC100479 Analyte	Result	Qual	Units	RL	MDL	Prepared	Analyzed
1,1,1-Trichloroethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,1,2,2-Tetrachloroethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,1,2-Trichloroethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,1-Dichloroethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,1-Dichloroethene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,2,4-Trimethylbenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,2-Dibromoethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,2-Dichlorobenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,2-Dichloroethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,2-Dichloropropane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,3,5-Trimethylbenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,3-Butadiene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,3-Dichlorobenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,4-Dichlorobenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
1,4-Dioxane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
2,2,4-Trimethylpentane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
2-Butanone	ND		ppbv	1.0		01/23/23 20:50	01/23/23 20:50
2-Chlorotoluene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
2-Hexanone	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
3-Chloropropene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
4-Ethyltoluene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
4-Methyl-2-Pentanone	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Acetone	ND		ppbv	1.0		01/23/23 20:50	01/23/23 20:50
Benzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Bromodichloromethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Bromoform	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Bromomethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Butane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Carbon Disulfide	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Carbon Tetrachloride	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Chlorobenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Chloroethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Chloroform	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Chloromethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
cis-1,2-Dichloroethene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
cis-1,3-Dichloropropene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Cyclohexane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Dibromochloromethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Ethanol	ND		ppbv	5.0		01/23/23 20:50	01/23/23 20:50
Ethylbenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Freon 113	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Freon 114	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50

Batch QC

QC100479 Analyte	Result	Qual	Units	RL	MDL	Prepared	Analyzed
Freon 12	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Hexachlorobutadiene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Isopropanol (IPA)	ND		ppbv	1.0		01/23/23 20:50	01/23/23 20:50
Isopropylbenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
m,p-Xylenes	ND		ppbv	0.40		01/23/23 20:50	01/23/23 20:50
Methyl methacrylate	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Methylene Chloride	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
MTBE	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
n-Heptane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
n-Hexane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
n-Nonane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
n-Pentane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
o-Xylene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Propylbenzene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Propylene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Styrene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Tetrachloroethene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Tetrahydrofuran	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Toluene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
trans-1,2-Dichloroethene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
trans-1,3-Dichloropropene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Trichloroethene	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Trichlorofluoromethane	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Vinyl Acetate	ND		ppbv	1.0		01/23/23 20:50	01/23/23 20:50
Vinyl bromide	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Vinyl Chloride	ND		ppbv	0.20		01/23/23 20:50	01/23/23 20:50
Xylene (total)	ND		ppbv	0.60		01/23/23 20:50	01/23/23 20:50
Surrogates				Limits			
Bromofluorobenzene	92%		%REC	70-130		01/23/23 20:50	01/23/23 20:50

Batch QC

Type: Lab Control Sample	Lab ID: QC100480	Batch: 100132
Matrix: Air	Method: EPA TO-15	Prep Method: METHOD

QC100480 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
1,1,1-Trichloroethane	9.861	10.40	ppbv	95%		70-130
1,1,2,2-Tetrachloroethane	10.16	9.900	ppbv	103%		70-130
1,1,2-Trichloroethane	9.817	10.40	ppbv	94%		70-130
1,1-Dichloroethane	10.18	10.80	ppbv	94%		70-130
1,1-Dichloroethene	9.523	10.00	ppbv	95%		70-130
1,2,4-Trimethylbenzene	10.01	10.30	ppbv	97%		70-130
1,2-Dibromoethane	9.938	10.40	ppbv	96%		70-130
1,2-Dichlorobenzene	9.583	10.00	ppbv	96%		70-130
1,2-Dichloroethane	10.18	10.60	ppbv	96%		70-130
1,2-Dichloropropane	9.947	10.50	ppbv	95%		70-130
1,3,5-Trimethylbenzene	9.880	10.20	ppbv	97%		70-130
1,3-Butadiene	9.835	10.40	ppbv	95%		70-130
1,3-Dichlorobenzene	9.966	10.20	ppbv	98%		70-130
1,4-Dichlorobenzene	9.922	10.00	ppbv	99%		70-130
1,4-Dioxane	10.49	10.80	ppbv	97%		70-130
2,2,4-Trimethylpentane	10.20	10.60	ppbv	96%		70-130
2-Butanone	10.13	10.60	ppbv	96%		70-130
2-Chlorotoluene	9.180	9.700	ppbv	95%		70-130
2-Hexanone	10.32	10.60	ppbv	97%		70-130
3-Chloropropene	9.770	10.50	ppbv	93%		70-130
4-Ethyltoluene	10.40	10.30	ppbv	101%		70-130
4-Methyl-2-Pentanone	10.41	10.70	ppbv	97%		70-130
Acetone	9.356	10.70	ppbv	87%		70-130
Benzene	9.602	10.60	ppbv	91%		70-130
Bromodichloromethane	10.36	10.70	ppbv	97%		70-130
Bromoform	9.040	10.20	ppbv	89%		70-130
Bromomethane	9.648	10.40	ppbv	93%		70-130
Butane	10.09	10.50	ppbv	96%		70-130
Carbon Disulfide	8.861	9.600	ppbv	92%		70-130
Carbon Tetrachloride	10.18	10.60	ppbv	96%		70-130
Chlorobenzene	9.688	10.40	ppbv	93%		70-130
Chloroethane	9.568	10.40	ppbv	92%		70-130
Chloroform	9.968	10.60	ppbv	94%		70-130
Chloromethane	10.10	10.50	ppbv	96%		70-130
cis-1,2-Dichloroethene	9.947	10.60	ppbv	94%		70-130
cis-1,3-Dichloropropene	10.12	10.80	ppbv	94%		70-130
Cyclohexane	9.513	10.60	ppbv	90%		70-130
Dibromochloromethane	10.17	10.60	ppbv	96%		70-130
Ethanol	9.051	10.30	ppbv	88%		70-130
Ethylbenzene	10.11	10.60	ppbv	95%		70-130
Freon 113	9.712	10.40	ppbv	93%		70-130
Freon 114	9.246	9.700	ppbv	95%		70-130

Batch QC

QC100480 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Freon 12	10.35	10.40	ppbv	100%		70-130
Hexachlorobutadiene	9.295	9.700	ppbv	96%		70-130
Isopropanol (IPA)	9.668	10.00	ppbv	97%		70-130
Isopropylbenzene	9.314	9.600	ppbv	97%		70-130
m,p-Xylenes	20.22	20.90	ppbv	97%		70-130
Methyl methacrylate	10.19	10.50	ppbv	97%		70-130
Methylene Chloride	9.509	10.40	ppbv	91%		70-130
MTBE	9.992	10.60	ppbv	94%		70-130
n-Heptane	9.938	10.60	ppbv	94%		70-130
n-Hexane	9.918	10.70	ppbv	93%		70-130
n-Nonane	9.438	9.800	ppbv	96%		70-130
n-Pentane	10.12	10.50	ppbv	96%		70-130
o-Xylene	9.937	10.40	ppbv	96%		70-130
Propylbenzene	9.189	9.600	ppbv	96%		70-130
Propylene	9.674	10.40	ppbv	93%		70-130
Styrene	9.770	10.20	ppbv	96%		70-130
Tetrachloroethene	9.442	10.00	ppbv	94%		70-130
Tetrahydrofuran	9.814	10.70	ppbv	92%		70-130
Toluene	9.922	10.50	ppbv	94%		70-130
trans-1,2-Dichloroethene	10.08	10.70	ppbv	94%		70-130
trans-1,3-Dichloropropene	9.578	9.800	ppbv	98%		70-130
Trichloroethene	8.866	10.30	ppbv	86%		70-130
Trichlorofluoromethane	9.985	10.30	ppbv	97%		70-130
Vinyl Acetate	12.48	10.60	ppbv	118%		70-130
Vinyl bromide	9.284	10.10	ppbv	92%		70-130
Vinyl Chloride	9.682	10.40	ppbv	93%		70-130
Surrogates						
Bromofluorobenzene	4.001	4.000	ppbv	100%		70-130

Batch QC

Type: Lab Control Sample Duplicate	Lab ID: QC100481	Batch: 100132
Matrix: Air	Method: EPA TO-15	Prep Method: METHOD

QC100481 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
1,1,1-Trichloroethane	9.868	10.40	ppbv	95%		70-130	0	30
1,1,2,2-Tetrachloroethane	10.11	9.900	ppbv	102%		70-130	0	30
1,1,2-Trichloroethane	9.742	10.40	ppbv	94%		70-130	1	30
1,1-Dichloroethane	10.23	10.80	ppbv	95%		70-130	1	30
1,1-Dichloroethene	9.552	10.00	ppbv	96%		70-130	0	30
1,2,4-Trimethylbenzene	9.901	10.30	ppbv	96%		70-130	1	30
1,2-Dibromoethane	9.856	10.40	ppbv	95%		70-130	1	30
1,2-Dichlorobenzene	9.501	10.00	ppbv	95%		70-130	1	30
1,2-Dichloroethane	10.10	10.60	ppbv	95%		70-130	1	30
1,2-Dichloropropane	9.840	10.50	ppbv	94%		70-130	1	30
1,3,5-Trimethylbenzene	9.792	10.20	ppbv	96%		70-130	1	30
1,3-Butadiene	9.883	10.40	ppbv	95%		70-130	0	30
1,3-Dichlorobenzene	9.874	10.20	ppbv	97%		70-130	1	30
1,4-Dichlorobenzene	9.604	10.00	ppbv	96%		70-130	3	30
1,4-Dioxane	10.51	10.80	ppbv	97%		70-130	0	30
2,2,4-Trimethylpentane	10.00	10.60	ppbv	94%		70-130	2	30
2-Butanone	10.04	10.60	ppbv	95%		70-130	1	30
2-Chlorotoluene	9.149	9.700	ppbv	94%		70-130	0	30
2-Hexanone	10.16	10.60	ppbv	96%		70-130	2	30
3-Chloropropene	9.846	10.50	ppbv	94%		70-130	1	30
4-Ethyltoluene	10.34	10.30	ppbv	100%		70-130	1	30
4-Methyl-2-Pentanone	10.24	10.70	ppbv	96%		70-130	2	30
Acetone	9.508	10.70	ppbv	89%		70-130	2	30
Benzene	9.699	10.60	ppbv	91%		70-130	1	30
Bromodichloromethane	10.23	10.70	ppbv	96%		70-130	1	30
Bromoform	9.038	10.20	ppbv	89%		70-130	0	30
Bromomethane	9.874	10.40	ppbv	95%		70-130	2	30
Butane	10.06	10.50	ppbv	96%		70-130	0	30
Carbon Disulfide	9.003	9.600	ppbv	94%		70-130	2	30
Carbon Tetrachloride	10.20	10.60	ppbv	96%		70-130	0	30
Chlorobenzene	9.776	10.40	ppbv	94%		70-130	1	30
Chloroethane	9.712	10.40	ppbv	93%		70-130	1	30
Chloroform	9.990	10.60	ppbv	94%		70-130	0	30
Chloromethane	10.20	10.50	ppbv	97%		70-130	1	30
cis-1,2-Dichloroethene	9.974	10.60	ppbv	94%		70-130	0	30
cis-1,3-Dichloropropene	10.14	10.80	ppbv	94%		70-130	0	30
Cyclohexane	9.645	10.60	ppbv	91%		70-130	1	30
Dibromochloromethane	9.983	10.60	ppbv	94%		70-130	2	30
Ethanol	9.021	10.30	ppbv	88%		70-130	0	30
Ethylbenzene	10.17	10.60	ppbv	96%		70-130	1	30
Freon 113	9.837	10.40	ppbv	95%		70-130	1	30

Batch QC

QC100481 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	
							RPD	Lim
Freon 114	9.478	9.700	ppbv	98%		70-130	2	30
Freon 12	10.44	10.40	ppbv	100%		70-130	1	30
Hexachlorobutadiene	9.185	9.700	ppbv	95%		70-130	1	30
Isopropanol (IPA)	9.655	10.00	ppbv	97%		70-130	0	30
Isopropylbenzene	9.230	9.600	ppbv	96%		70-130	1	30
m,p-Xylenes	20.19	20.90	ppbv	97%		70-130	0	30
Methyl methacrylate	10.11	10.50	ppbv	96%		70-130	1	30
Methylene Chloride	9.630	10.40	ppbv	93%		70-130	1	30
MTBE	10.03	10.60	ppbv	95%		70-130	0	30
n-Heptane	9.823	10.60	ppbv	93%		70-130	1	30
n-Hexane	9.974	10.70	ppbv	93%		70-130	1	30
n-Nonane	9.378	9.800	ppbv	96%		70-130	1	30
n-Pentane	10.08	10.50	ppbv	96%		70-130	0	30
o-Xylene	9.925	10.40	ppbv	95%		70-130	0	30
Propylbenzene	9.154	9.600	ppbv	95%		70-130	0	30
Propylene	9.492	10.40	ppbv	91%		70-130	2	30
Styrene	9.793	10.20	ppbv	96%		70-130	0	30
Tetrachloroethene	9.335	10.00	ppbv	93%		70-130	1	30
Tetrahydrofuran	9.901	10.70	ppbv	93%		70-130	1	30
Toluene	9.821	10.50	ppbv	94%		70-130	1	30
trans-1,2-Dichloroethene	10.15	10.70	ppbv	95%		70-130	1	30
trans-1,3-Dichloropropene	9.501	9.800	ppbv	97%		70-130	1	30
Trichloroethene	8.835	10.30	ppbv	86%		70-130	0	30
Trichlorofluoromethane	10.00	10.30	ppbv	97%		70-130	0	30
Vinyl Acetate	12.32	10.60	ppbv	116%		70-130	1	30
Vinyl bromide	9.573	10.10	ppbv	95%		70-130	3	30
Vinyl Chloride	9.859	10.40	ppbv	95%		70-130	2	30
Surrogates								
Bromofluorobenzene	3.959	4.000	ppbv	99%		70-130		

ND Not Detected

Narrative Summary

Enthalpy Analytical Narrative Summary

Company	SKA Consulting, L.P.
Job #	0123-968 ASTM D1946, ASTM D5504, TO-15
Client #	5019-0001 Dotty Landfill
Custody	<p>Erika Garcia received the sample on 01/24/23 at ambient temperature after being relinquished by SKA Consulting. The sample was received in good condition.</p> <p>Prior to, during, and after analysis, the sample was kept under lock with access only to authorized personnel by Enthalpy Analytical, LLC.</p>
Analysis	<p>The sample was analyzed for methane and carbon monoxide using the analytical procedures in ASTM D1946, Standard Practice for Analysis of Reformed Gas by Gas Chromatography. All target analytes were referenced to certified gas phase standards. GC #4 was used for these analyses.</p> <p>The sample was analyzed for hydrogen sulfide, methyl mercaptan, ethyl mercaptan, isopropyl mercaptan, t-Butyl mercaptan, n-Propyl mercaptan, isobutyl mercaptan, sec-Butyl mercaptan, n-Butyl mercaptan using the analytical procedures in ASTM D5504, Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence. GC #5 was used for these analyses.</p> <p>The sample was analyzed for volatile organic compounds using the analytical procedures in Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography / Mass Spectrometry (GC/MS). GC/MS #06 was used for these analyses.</p>
Calibration	<p>The calibration curve(s) used met all specified acceptance criteria.</p> <p>The ASTM D5504 calibration curve uses the hydrogen sulfide response factor, with the linearity of other sulfur species established and response factors verified to be within 20% of hydrogen sulfide.</p>
QC Notes	<p>The analytes of interest were not identified at concentrations greater than the detection limit in the analyses of the laboratory blanks.</p> <p>The duplicate and matrix spike analyzed with the ASTM D5504 batch each met their respective criteria.</p> <p>The duplicate analyzed with the TO-15 batch met the % difference criteria.</p>



Enthalpy Analytical Narrative Summary

Company	SKA Consulting, L.P.
Job #	0123-968 ASTM D1946, ASTM D5504, TO-15
Client #	5019-0001 Dotty Landfill

Reporting Notes	<p>Data resulting from ASTM D1946 analyses are reported in mole %, and are not normalized.</p> <p>b Flag: The b flag on TO-15 sample results indicates that the canister used for the sample was certified to contain less than 1 ppmv Total VOCs as methane and less than 0.5 ppmv Total Sulfurs as hydrogen sulfide prior to sampling. TO-15 sample results below these levels may be due to minor contamination remaining in the can after cleaning and certification.</p> <p>These analyses met the requirements of the TNI Standard. Any deviations from the requirements of the reference method or TNI Standard have been stated above.</p> <p>The results presented in this report are representative of the sample as provided to the laboratory.</p>
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General Reporting Notes

The following are general reporting notes that are applicable to all Enthalpy Analytical, LLC data reports, unless specifically noted otherwise.

- Any analysis which refers to the method as “*Type*” represents a planned deviation from the reference method. For instance a Hydrogen Sulfide assay from a Tedlar bag would be labeled as “EPA Method 16-*Type*” because Tedlar bags are not mentioned as one of the collection options in EPA Method 16.
- The acronym **MDL** represents the Minimum Detection Limit. Below this value the laboratory cannot determine the presence of the analyte of interest reliably.
- The acronym **LOQ** represents the Limit of Quantification. Below this value the laboratory cannot quantitate the analyte of interest within the criteria of the method.
- The acronym **ND** following a value indicates a non-detect or analytical result below the MDL.
- The letter **J** in the Qualifier or Flag column in the results indicates that the value is between the MDL and the LOQ. The laboratory can positively identify the analyte of interest as present, but the value should be considered an estimate.
- The letter **E** in the Qualifier or Flag column indicates an analytical result exceeding 100% of the highest calibration point. The associated value should be considered as an estimate.
- Sample results are presented ‘as measured’ for single injection methodologies, or an average value if multiple injections are made. If all injections are below the MDL, the sample is considered non-detect and the ND value is presented. If one, but not all, are below the MDL, the MDL value is used for any injections that are below the MDL. For example, if the MDL is 0.500 and LOQ is 1.00, and the instrument measures 0.355, 0.620, and 0.442 - the result reported is the average of 0.500, 0.620, and 0.500 - - - i.e. 0.540 with a J flag.
- When a spike recovery (Bag Spike, Collocated Spike Train, or liquid matrix spike) is being calculated, the native (unspiked) sample result is used in the calculations, as long as the value is above the MDL. If a sample is ND, then 0 is used as the native amount (not the MDL value).
- The acronym **DF** represents Dilution Factor. This number represents dilution of the sample during the preparation and/or analysis process. The analytical result taken from a laboratory instrument is multiplied by the DF to determine the final undiluted sample results.
- The addition of **MS** to the Sample ID represents a Matrix Spike. An aliquot of an actual sample is spiked with a known amount of analyte so that a percent recovery value can be determined. The MS analysis indicates what effect the sample matrix may have on the target analyte, i.e. whether or not anything in the sample matrix interferes with the analysis of the analyte(s).



General Reporting Notes

(continued)

- The addition of **MSD** to the Sample ID represents a Matrix Spike Duplicate. Prepared in the same manner as a MS, the use of duplicate matrix spikes allows further confirmation of laboratory quality by showing the consistency of results gained by performing the same steps multiple times.
- The addition of **LD** to the Sample ID represents a Laboratory Duplicate. The analyst prepares an additional aliquot of sample for testing and the results of the duplicate analysis are compared to the initial result. The result should have a difference value of within 10% of the initial result (if the results of the original analysis are greater than the LOQ).
- The addition of **AD** to the Sample ID represents an Alternate Dilution. The analyst prepares an additional aliquot at a different dilution factor (usually double the initial factor). This analysis helps confirm that no additional compound is present and coeluting or sharing absorbance with the analyte of interest, as they would have a different response/absorbance than the analyte of interest.
- The Sample ID **LCS** represents a Laboratory Control Sample. Clean matrix, similar to the client sample matrix, prepared and analyzed by the laboratory using the same reagents, spiking standards and procedures used for the client samples. The LCS is used to assess the control of the laboratory's analytical system. Whenever spikes are prepared for our client projects, two spikes are retained as LCSs. The LCSs are labeled with the associated project number and kept in-house at the appropriate temperature conditions. When the project samples are received for analysis, the LCSs are analyzed to confirm that the analyte could be recovered from the media, separate from the samples which were used on the project and which may have been affected by source matrix, sample collection, and/or sample transport.
- **Significant Figures:** Where the reported value is much greater than unity (1.00) in the units expressed, the number is rounded to a whole number of units, rather than to 3 significant figures. For example, a value of 10,456.45 ug catch is rounded to 10,456 ug. There are five significant digits displayed, but no confidence should be placed on more than two significant digits. In the case of small numbers, generally 3 significant figures are presented, but still only 2 should be used with confidence. Many neat materials are only certified to 3 digits, and as the mathematically correct final result is always 1 digit less than all its pre-cursors - 2 significant figures are what are most defensible.
- **Manual Integration:** The data systems used for processing will flag manually integrated peaks with an "M". There are several reasons a peak may be manually integrated. These reasons will be identified by the following two letter designations on sample chromatograms, if provided in the report. The peak was *not integrated* by the software "NI", the peak was *integrated incorrectly* by the software "II" or the *wrong peak* was integrated by the software "WP". These codes will accompany the analyst's manual integration stamp placed next to the compound name on the chromatogram.



Sample Custody



Chain of Custody Record

Page 1 of 1

Special Handling:
 Standard Turn Around Time (10 business days)
 Rush Turn Around Time -- Date Needed: _____
 • All TATs Subject to Approval by Enthalpy Analytical, Inc.
 • All Bag/Can Samples Disposed of 1 Month from Receipt.
 • All Other Samples Disposed of 4 Months from Receipt.

Client Name: SKA Consulting, L.P.	Project Number: <u>5019-0001</u>	PO#: _____	For spiked or duplicate samples: please provide sample volumes for recovery calculations. For Particulates: please provide tare weights and/or condensed water volumes.
Project Manager: Mike Schultz	Site Name: <u>DOTY LANDFILL</u>	Telephone#: <u>713-266-6056</u>	
Report To: _____	Location: <u>12000 BISSONNET ST.</u>	Email: <u>mike.schultz@skiconsulting.com</u>	

Special Instructions:						Sample Containers							Analyses:			Notes:
A=Air 1=H2SO4 2=NaOH W=Water O=Other X=XAD C=Charcoal SG=Silica Gel G=Grab C=Composite Q=Quality Control O=Other						# of VOA Vials	# of Glass	# of Plastic	# of Bags	# of Canisters	# of Tubes	# Other	ASTM D1946	ASTM D5504	TO-15	
Sample ID	Date	Time	Sample Volume	Type	Matrix											
LF1 - GMP-9R	1-23-23	16:00	6L	G	A					1			X	X	X	
																D5504 = H2S, mercaptans
																TO-15 = std list
																JAN 24 '23 AM 11:28

Relinquished By:	Date:	Received By:	Date:	Time:	Sample Condition Upon Receipt:
<i>Ryan Rietman</i>	1-24-23	<i>Elebr</i>	1/24/23	11:23	<input type="checkbox"/> Iced <input type="checkbox"/> Ambient <input checked="" type="checkbox"/> °C <u>21.0 Full EOW</u>
					<input type="checkbox"/> Iced <input type="checkbox"/> Ambient <input type="checkbox"/> °C _____
					<input type="checkbox"/> Iced <input type="checkbox"/> Ambient <input type="checkbox"/> °C _____

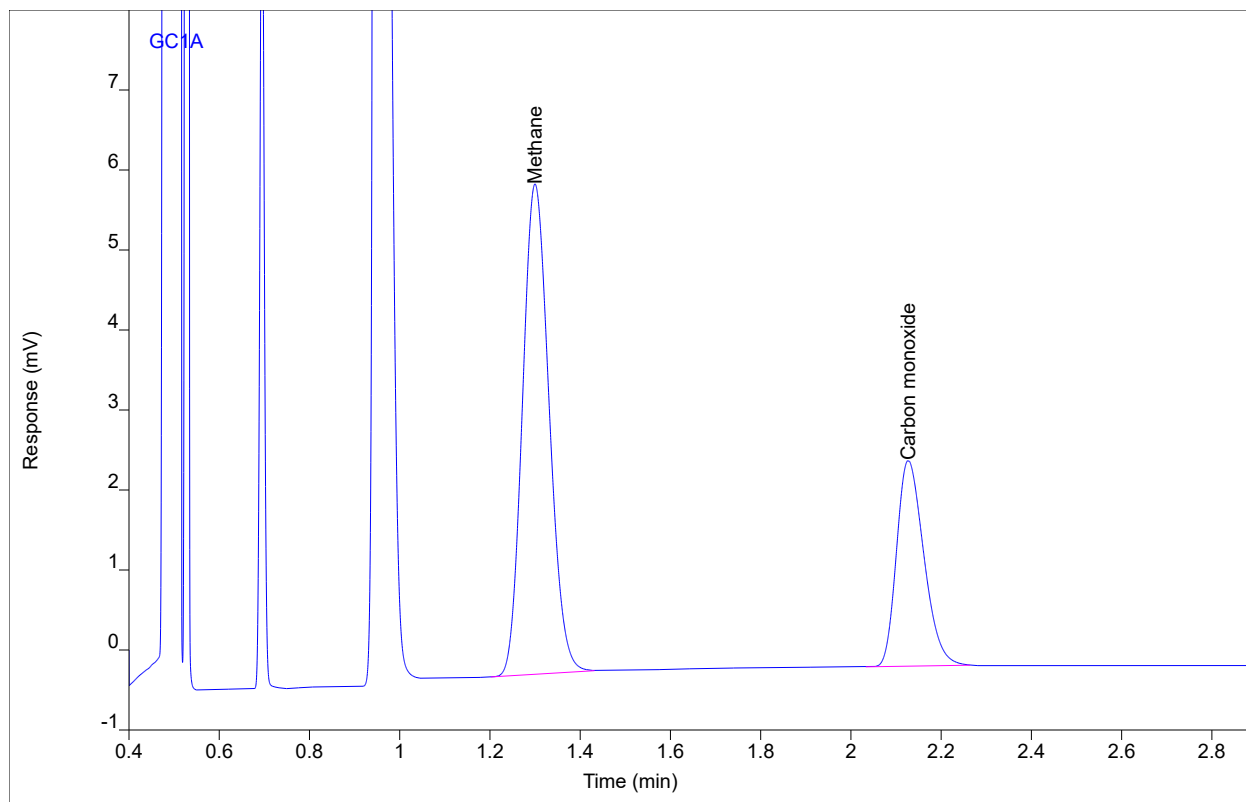
Raw Data

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p277 #LVL1 V(2,0)
Sequence Name DPGC4-012523 ver.3
Inj Data File 001F0303.D
File Location 3 - Houston Lab/Data/GC4/2023_Q1
Injection Date 1/25/2023 2:58 PM
File Modified 2/1/2023 1:46 PM
Instrument DP-GC04
Operator Emily Decker

Sample Type Sample
Vial Number 1
Injection Volume NA
Injection 7 of 4
Acquisition Method GC4-ACQ_112921.M
Analysis Method GC4_020722.M
Method Modified 2/1/2023 1:45 PM
Printed 2/7/2023 10:34 AM



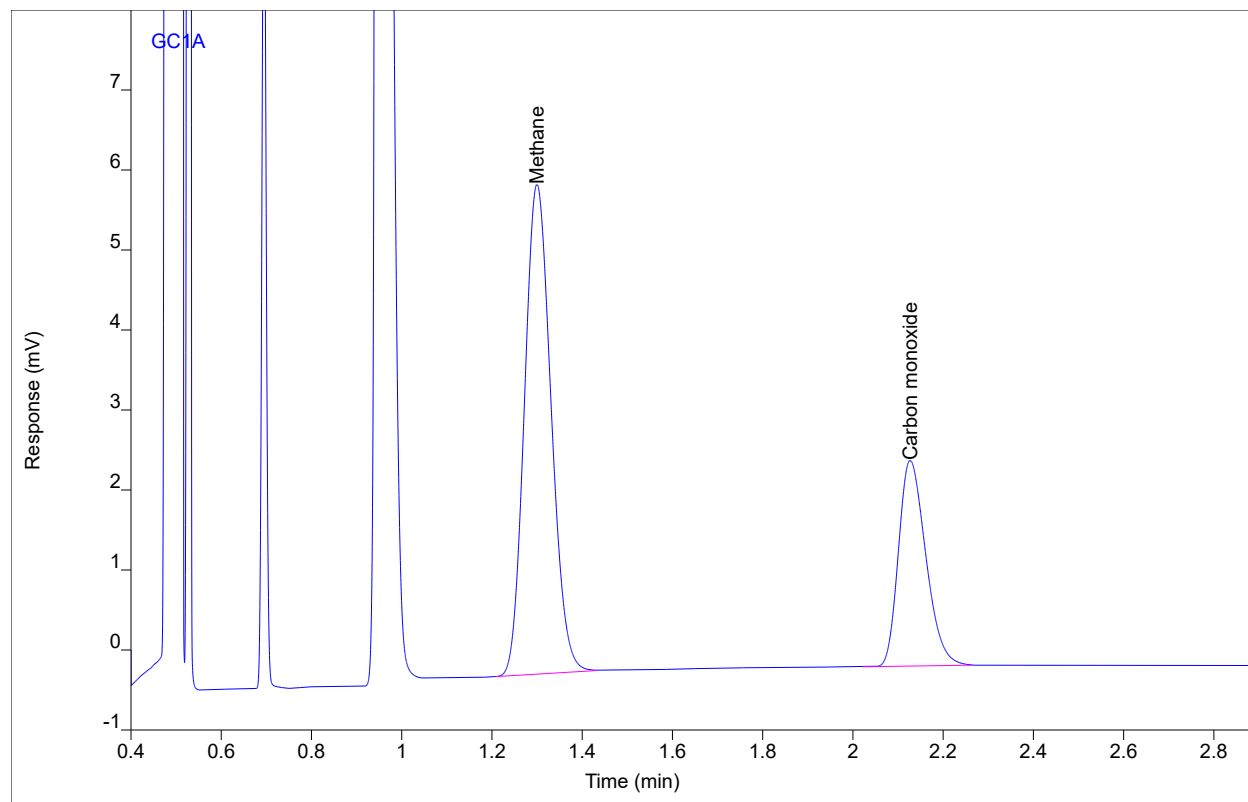
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane	BB	1.30	25.0262	6.12997	3.01760	1	3.01760	%
Carbon monoxide	VB	2.13	10.7971	2.57407	3.86234	1	3.86234	%

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p277 #LVL1 V(2,0)
Sequence Name DPGC4-012523 ver.3
Inj Data File 001F0304.D
File Location 3 - Houston Lab/Data/GC4/2023_Q1
Injection Date 1/25/2023 3:08 PM
File Modified 2/1/2023 1:45 PM
Instrument DP-GC04
Operator Emily Decker

Sample Type Sample
Vial Number 1
Injection Volume NA
Injection 8 of 4
Acquisition Method GC4-ACQ_112921.M
Analysis Method GC4_020722.M
Method Modified 2/1/2023 1:45 PM
Printed 2/7/2023 10:34 AM



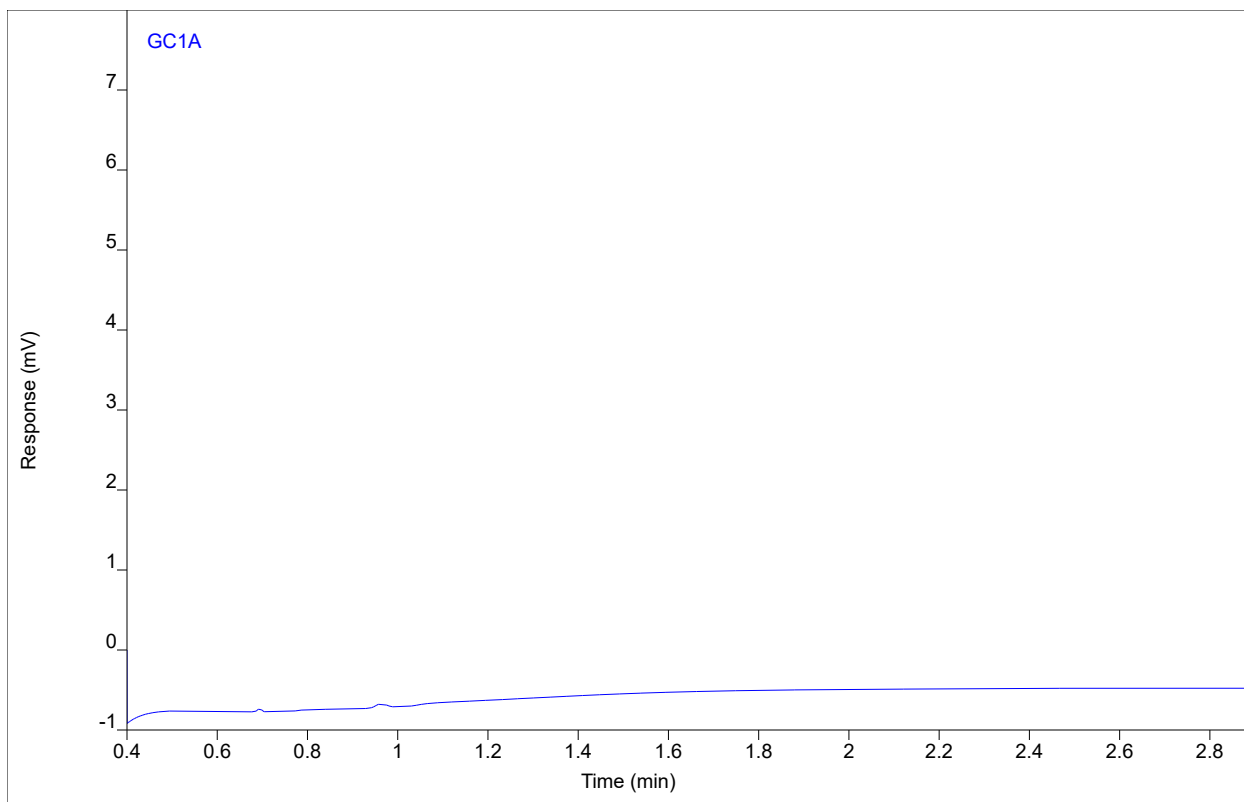
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane	BB	1.30	25.0206	6.12516	3.01693	1	3.01693	%
Carbon monoxide	VB	2.13	10.7864	2.57319	3.85848	1	3.85848	%

Chromatogram Report

Enthalpy Analytical

Sample Name Argon #MB V(1,0)
Sequence Name DPGC4-012523 ver.3
Inj Data File 001F0403.D
File Location 3 - Houston Lab/Data/GC4/2023_Q1
Injection Date 1/25/2023 3:39 PM
File Modified 2/1/2023 1:34 PM
Instrument DP-GC04
Operator Emily Decker

Sample Type Sample
Vial Number 1
Injection Volume NA
Injection 3 of 4
Acquisition Method GC4-ACQ_112921.M
Analysis Method GC4_020722.M
Method Modified 2/1/2023 12:25 PM
Printed 2/7/2023 10:34 AM



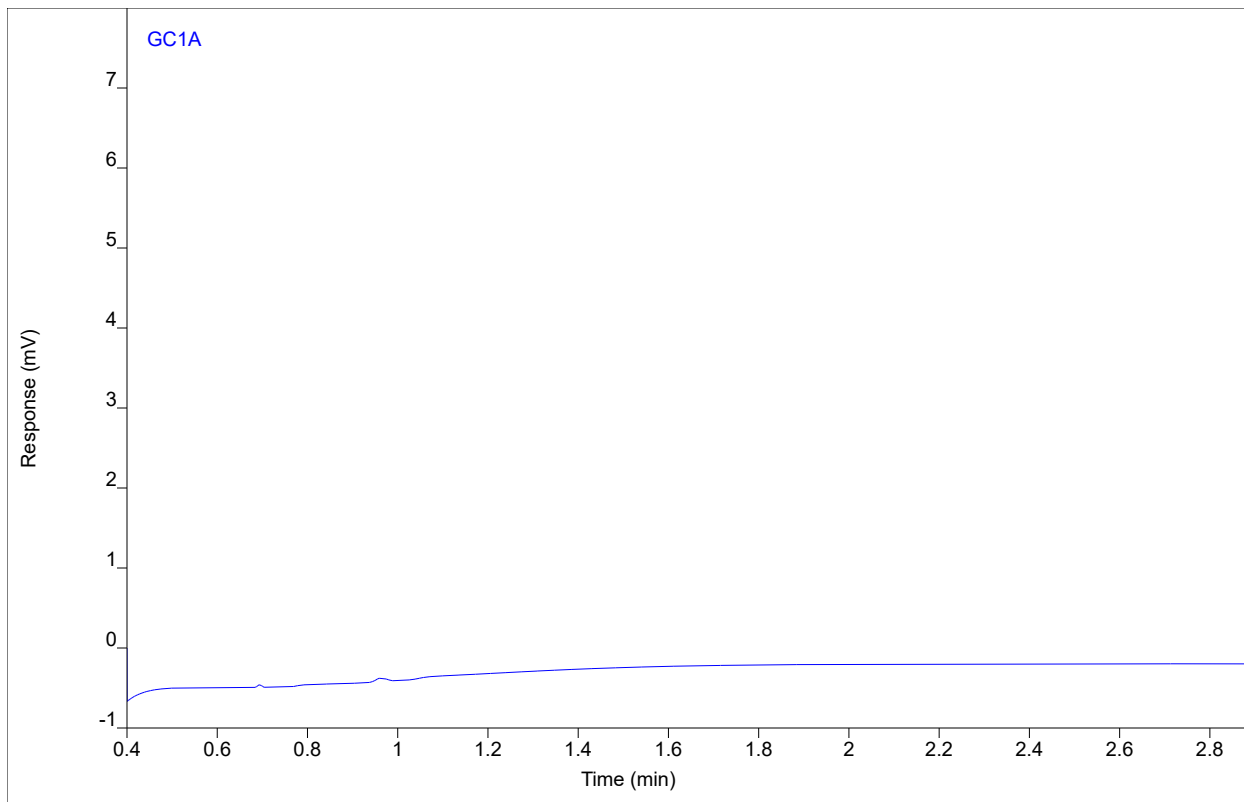
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane		(1.29)				1		%
Carbon monoxide		(2.17)				1		%

Chromatogram Report

Enthalpy Analytical

Sample Name Argon #MB V(1,0)
Sequence Name DPGC4-012523 ver.3
Inj Data File 001F0404.D
File Location 3 - Houston Lab/Data/GC4/2023_Q1
Injection Date 1/25/2023 3:49 PM
File Modified 2/1/2023 1:34 PM
Instrument DP-GC04
Operator Emily Decker

Sample Type Sample
Vial Number 1
Injection Volume NA
Injection 4 of 4
Acquisition Method GC4-ACQ_112921.M
Analysis Method GC4_020722.M
Method Modified 2/1/2023 12:25 PM
Printed 2/7/2023 10:34 AM



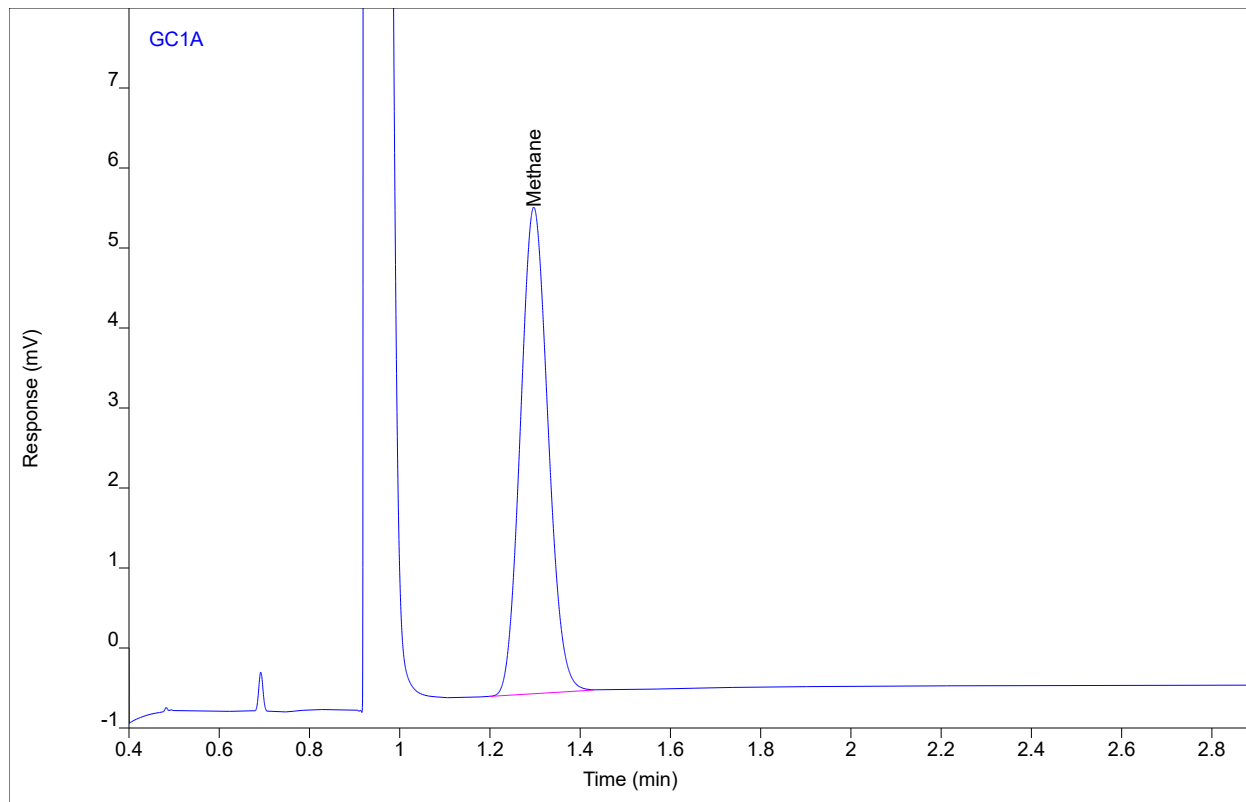
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane		(1.29)				1		%
Carbon monoxide		(2.17)				1		%

Chromatogram Report

Enthalpy Analytical

Sample Name 0123-968.LF1 - GMP-9R C1100.Can
Sequence Name DPGC4-012523 ver.3
Inj Data File 001F0503.D
File Location 3 - Houston Lab/Data/GC4/2023_Q1
Injection Date 1/25/2023 4:20 PM
File Modified 2/1/2023 1:56 PM
Instrument DP-GC04
Operator Emily Decker

Sample Type Sample
Vial Number 1
Injection Volume NA
Injection 3 of 4
Acquisition Method GC4-ACQ_112921.M
Analysis Method GC4_020722.M
Method Modified 2/1/2023 1:47 PM
Printed 2/7/2023 10:34 AM



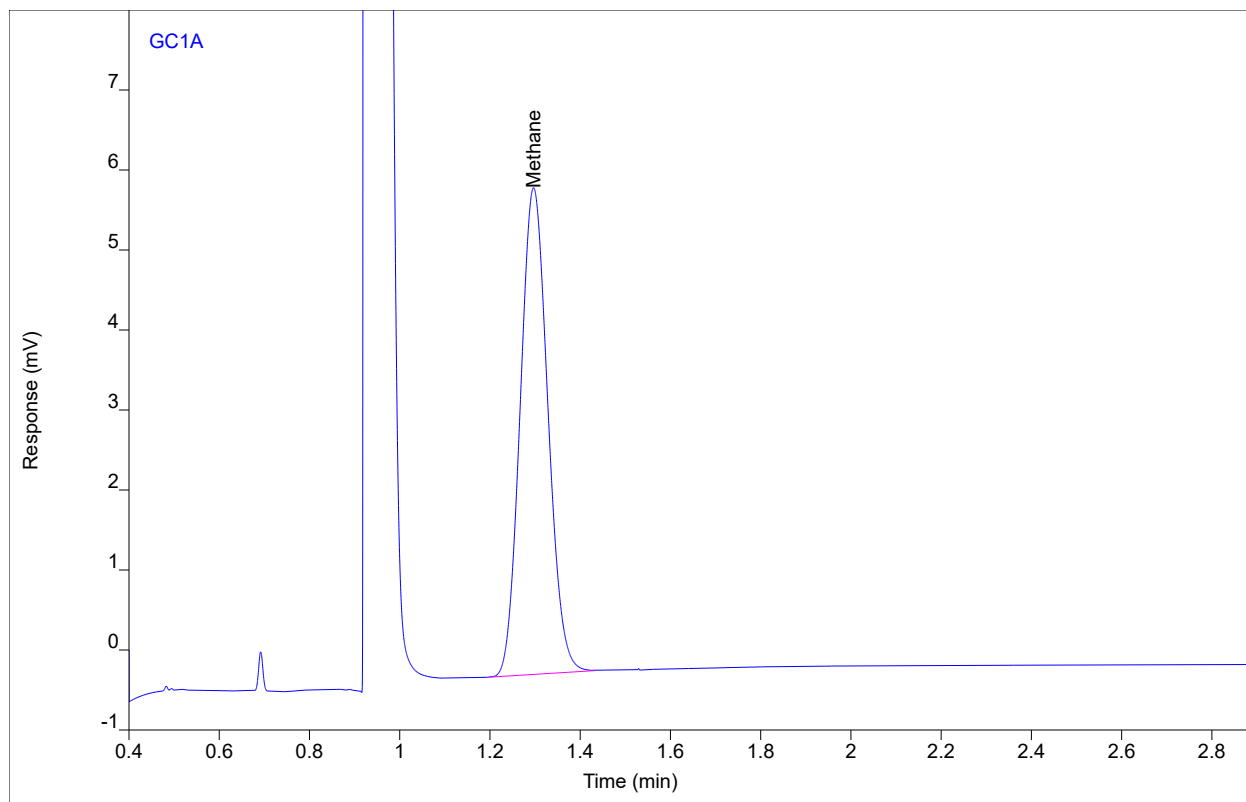
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane	BB	1.30	25.8408	6.08331	3.11497	1	3.11497	%
Carbon monoxide		(2.17)				1		%

Chromatogram Report

Enthalpy Analytical

Sample Name 0123-968.LF1 - GMP-9R C1100.Can
Sequence Name DPGC4-012523 ver.3
Inj Data File 001F0504.D
File Location 3 - Houston Lab/Data/GC4/2023_Q1
Injection Date 1/25/2023 4:31 PM
File Modified 2/1/2023 1:47 PM
Instrument DP-GC04
Operator Emily Decker

Sample Type Sample
Vial Number 1
Injection Volume NA
Injection 4 of 4
Acquisition Method GC4-ACQ_112921.M
Analysis Method GC4_020722.M
Method Modified 2/1/2023 1:47 PM
Printed 2/7/2023 10:34 AM



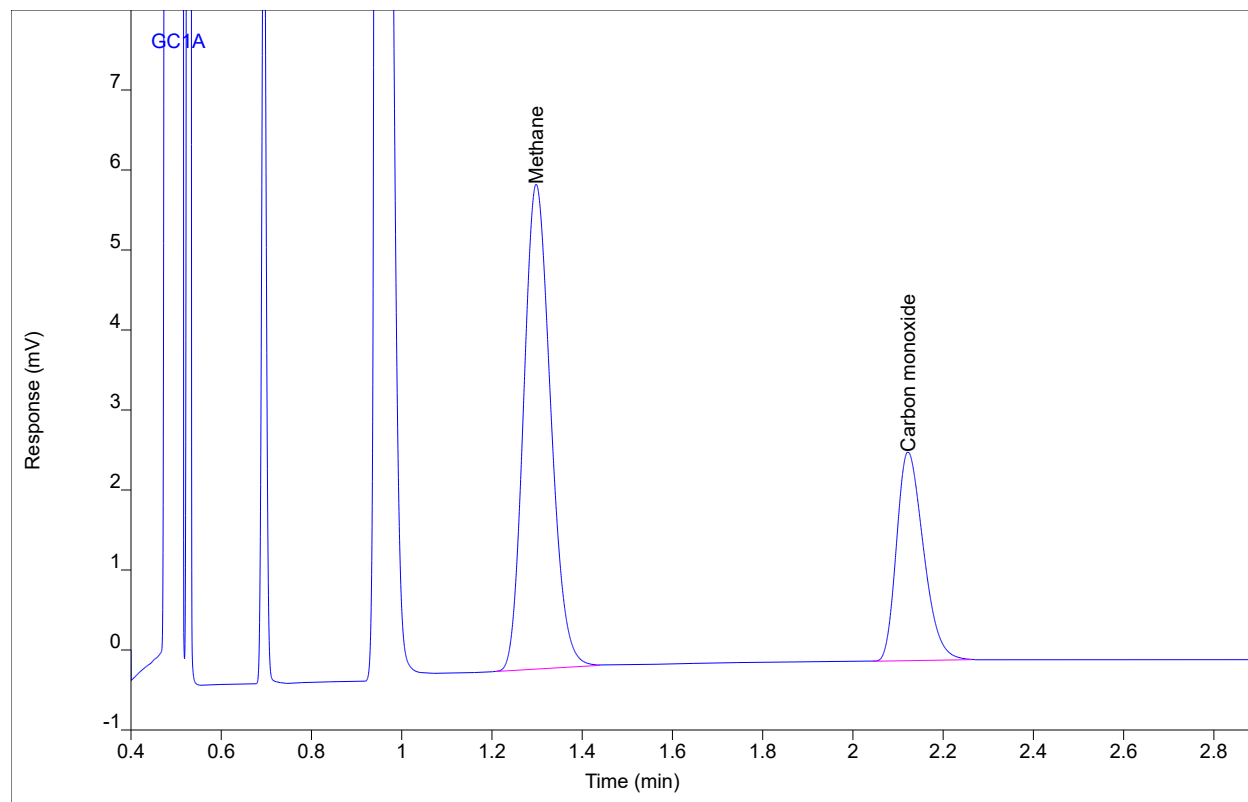
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane	BB	1.30	25.8582	6.08481	3.11706	1	3.11706	%
Carbon monoxide		(2.17)				1		%

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p277 #LVL1 V(3,0)
 Sequence Name DPGC4-012523 ver.3
 Inj Data File 001F1003.D
 File Location 3 - Houston Lab/Data/GC4/2023_Q1
 Injection Date 1/25/2023 7:36 PM
 File Modified 2/1/2023 1:35 PM
 Instrument DP-GC04
 Operator Emily Decker

Sample Type Sample
 Vial Number 1
 Injection Volume NA
 Injection 3 of 4
 Acquisition Method GC4-ACQ_112921.M
 Analysis Method GC4_020722.M
 Method Modified 2/1/2023 12:25 PM
 Printed 2/7/2023 10:34 AM



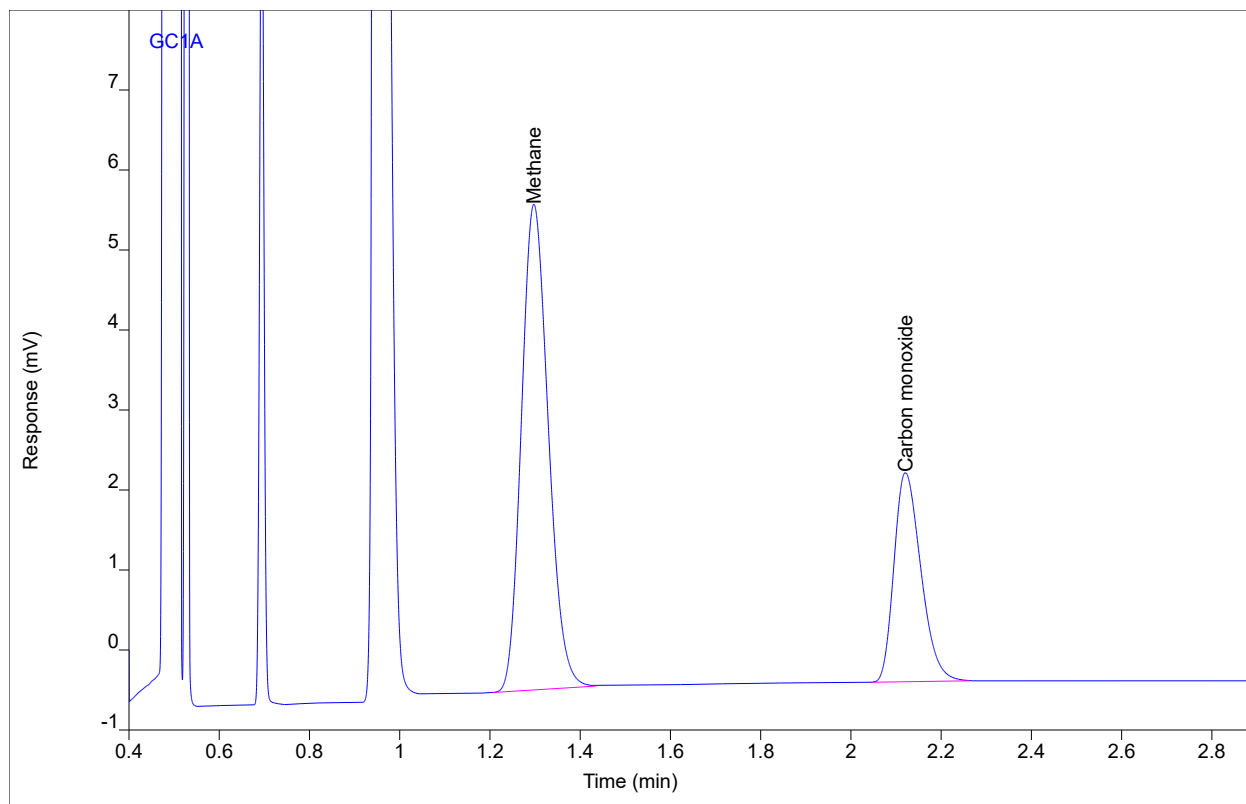
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane	BB	1.30	25.0779	6.06306	3.02377	1	3.02377	%
Carbon monoxide	BB	2.12	10.7919	2.61218	3.86045	1	3.86045	%

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p277 #LVL1 V(3,0)
 Sequence Name DPGC4-012523 ver.3
 Inj Data File 001F1004.D
 File Location 3 - Houston Lab/Data/GC4/2023_Q1
 Injection Date 1/25/2023 7:46 PM
 File Modified 2/1/2023 1:35 PM
 Instrument DP-GC04
 Operator Emily Decker

Sample Type Sample
 Vial Number 1
 Injection Volume NA
 Injection 4 of 4
 Acquisition Method GC4-ACQ_112921.M
 Analysis Method GC4_020722.M
 Method Modified 2/1/2023 12:25 PM
 Printed 2/7/2023 10:34 AM



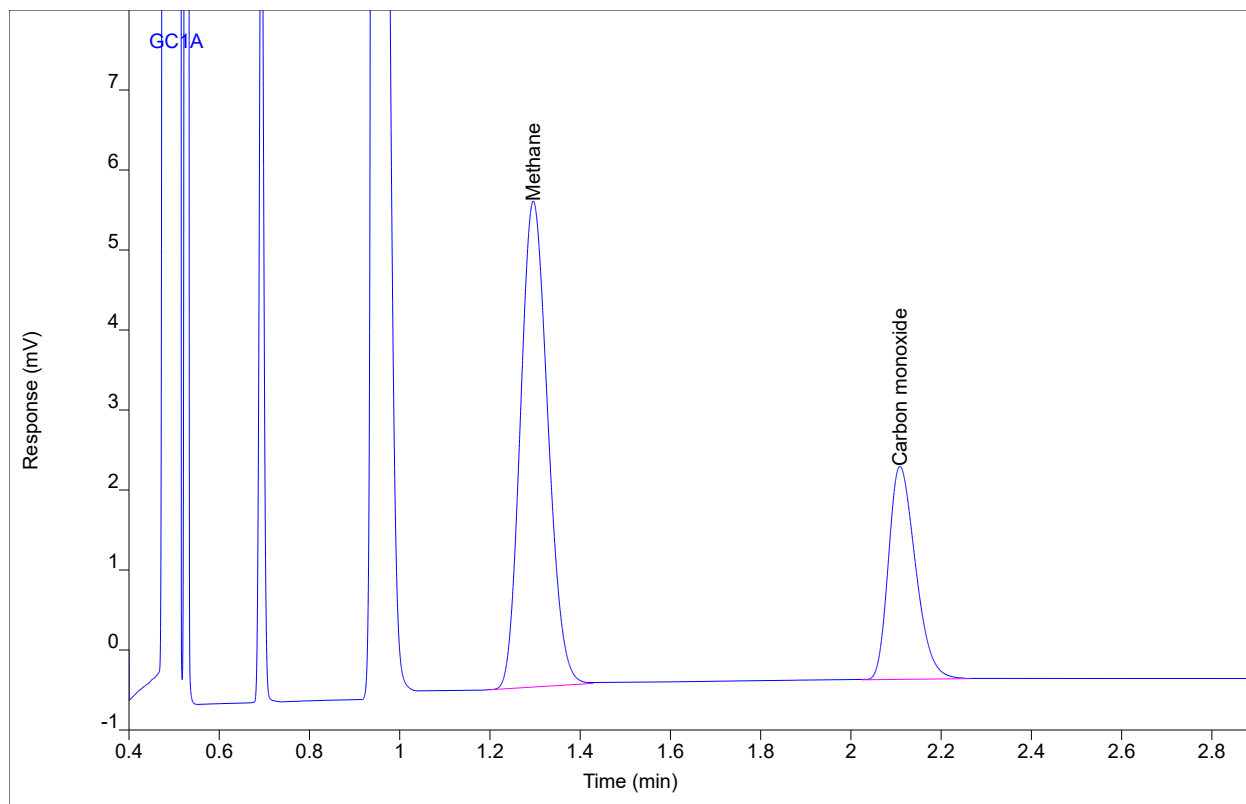
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane	BB	1.30	25.1061	6.07156	3.02715	1	3.02715	%
Carbon monoxide	BB	2.12	10.8057	2.61707	3.86539	1	3.86539	%

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p277 #LVL1 V(2,0)
Sequence Name DPGC4-012523 ver.3
Inj Data File 001F1404.D
File Location 3 - Houston Lab/Data/GC4/2023_Q1
Injection Date 1/26/2023 12:59 AM
File Modified 2/1/2023 2:06 PM
Instrument DP-GC04
Operator Emily Decker

Sample Type Sample
Vial Number 1
Injection Volume NA
Injection 4 of 5
Acquisition Method GC4-ACQ_112921.M
Analysis Method GC4_020722.M
Method Modified 2/1/2023 2:06 PM
Printed 2/7/2023 10:34 AM



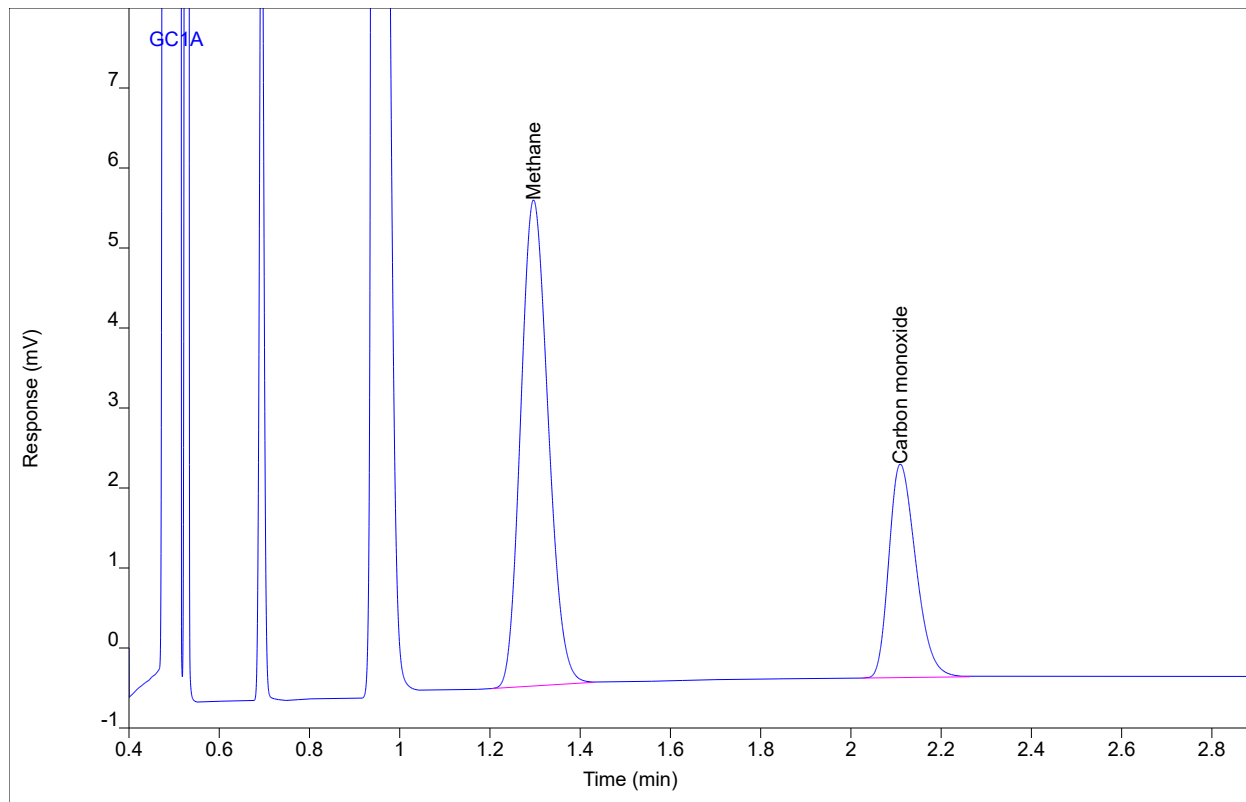
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane	BB	1.30	25.5850	6.07540	3.08440	1	3.08440	%
Carbon monoxide	BB	2.11	11.0563	2.66558	3.95500	1	3.95500	%

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p277 #LVL1 V(2,0)
Sequence Name DPGC4-012523 ver.3
Inj Data File 001F1405.D
File Location 3 - Houston Lab/Data/GC4/2023_Q1
Injection Date 1/26/2023 1:10 AM
File Modified 2/1/2023 2:06 PM
Instrument DP-GC04
Operator Emily Decker

Sample Type Sample
Vial Number 1
Injection Volume NA
Injection 5 of 5
Acquisition Method GC4-ACQ_112921.M
Analysis Method GC4_020722.M
Method Modified 2/1/2023 2:06 PM
Printed 2/7/2023 10:34 AM



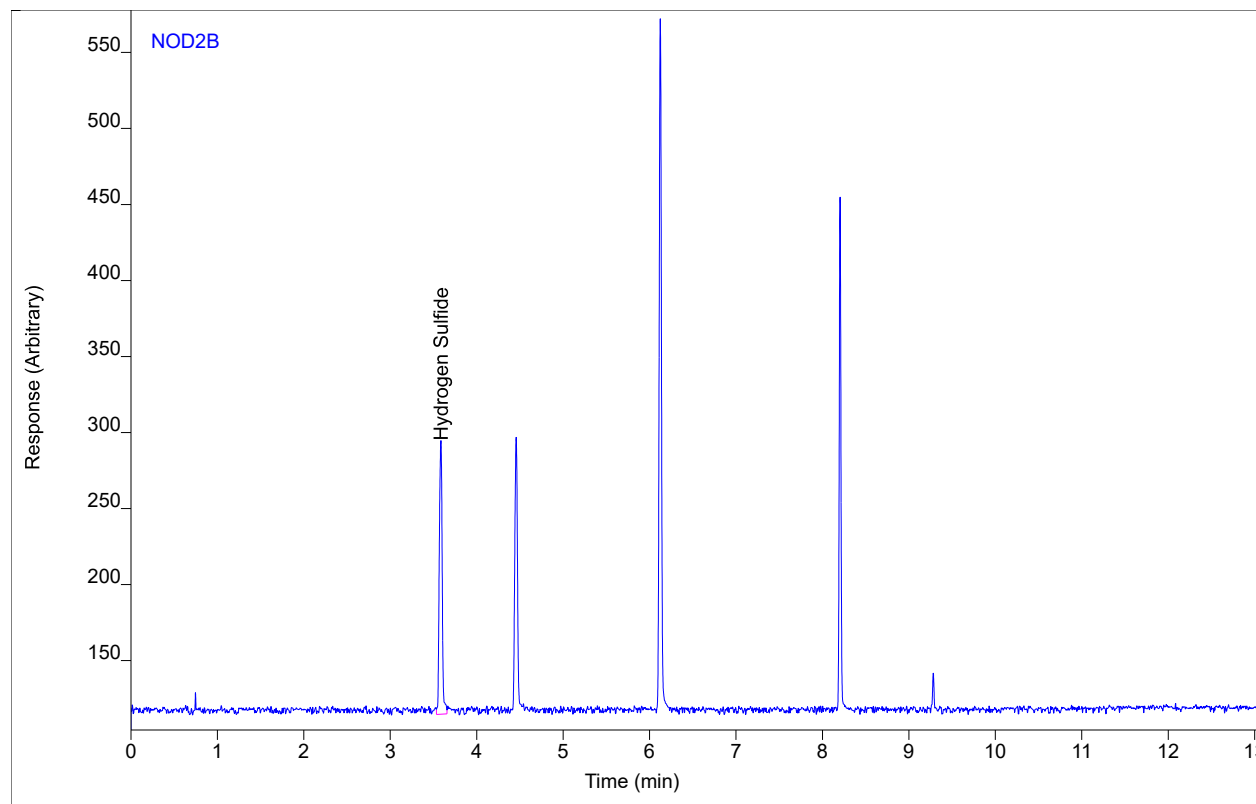
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Methane	BB	1.30	25.6270	6.07875	3.08942	1	3.08942	%
Carbon monoxide	BB	2.11	11.0738	2.67074	3.96126	1	3.96126	%

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p321 #S3
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 001B0102.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 9:35 AM
File Modified 2/3/2023 11:16 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 1
Injection Volume 1000
Injection 2 of 4
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



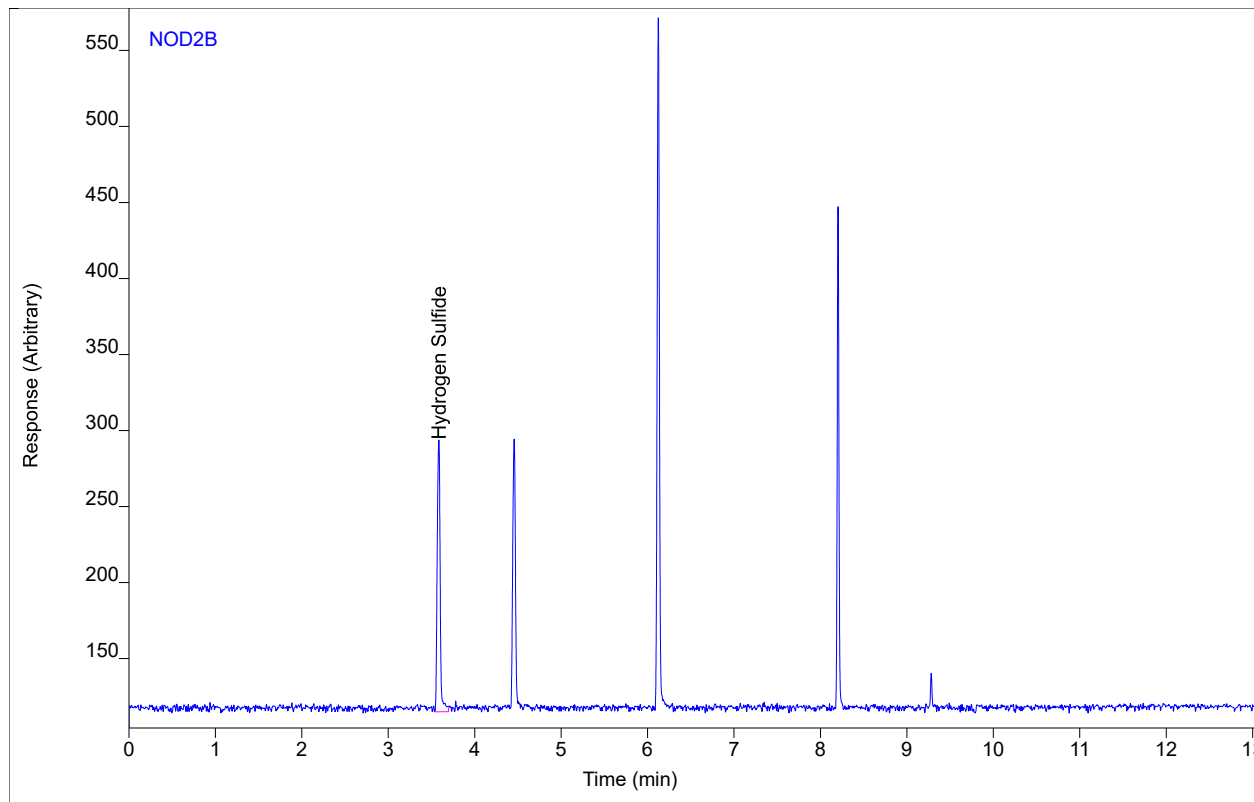
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide	VV	3.59	422.771	179.888	1.00316	1	1.00316	ppm

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p321 #S3
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 001B0103.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 9:55 AM
File Modified 2/3/2023 11:16 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 1
Injection Volume 1000
Injection 3 of 4
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



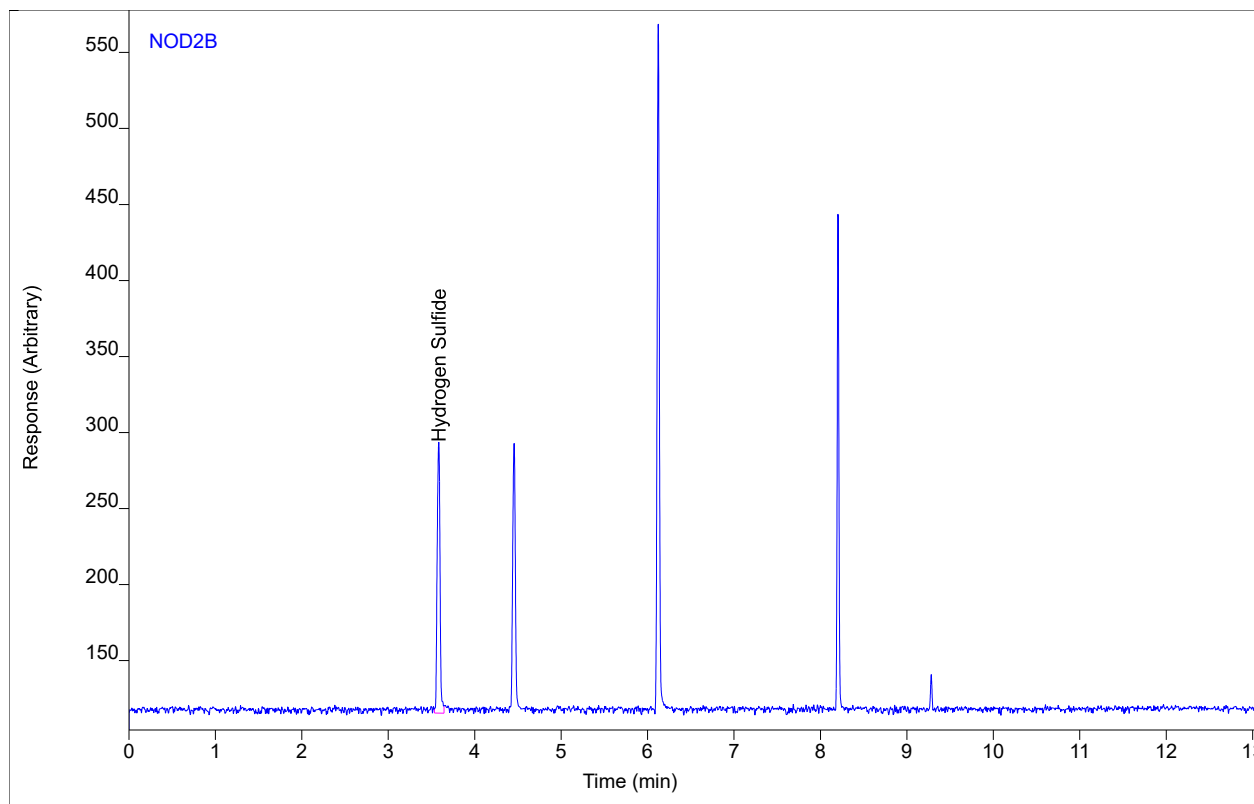
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide	BV	3.59	426.697	178.947	1.01247	1	1.01247	ppm

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p321 #S3
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 001B0104.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 10:14 AM
File Modified 2/3/2023 11:16 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 1
Injection Volume 1000
Injection 4 of 4
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



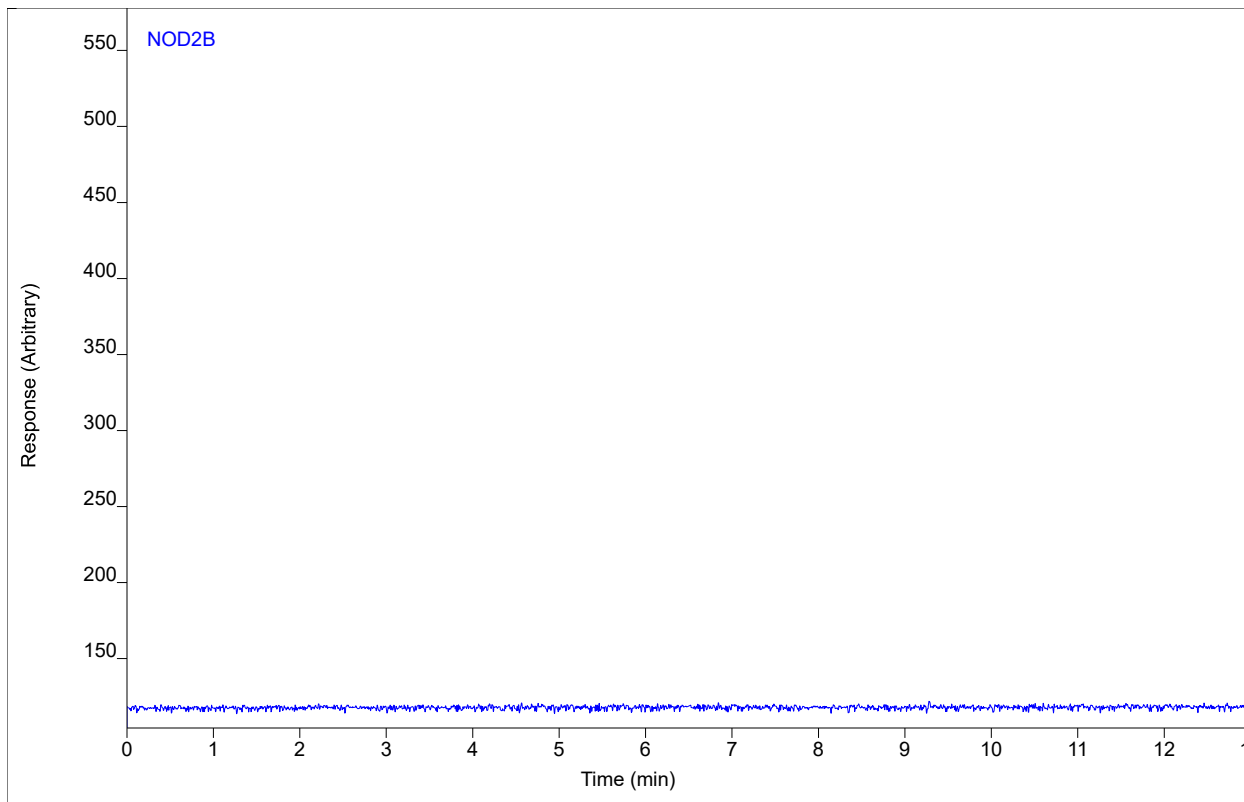
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide	VV	3.58	410.624	178.391	0.97433	1	0.97433	ppm

Chromatogram Report

Enthalpy Analytical

Sample Name N2 #MB
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 003B0201.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 10:34 AM
File Modified 2/3/2023 11:16 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 3
Injection Volume 1000
Injection 1 of 1
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



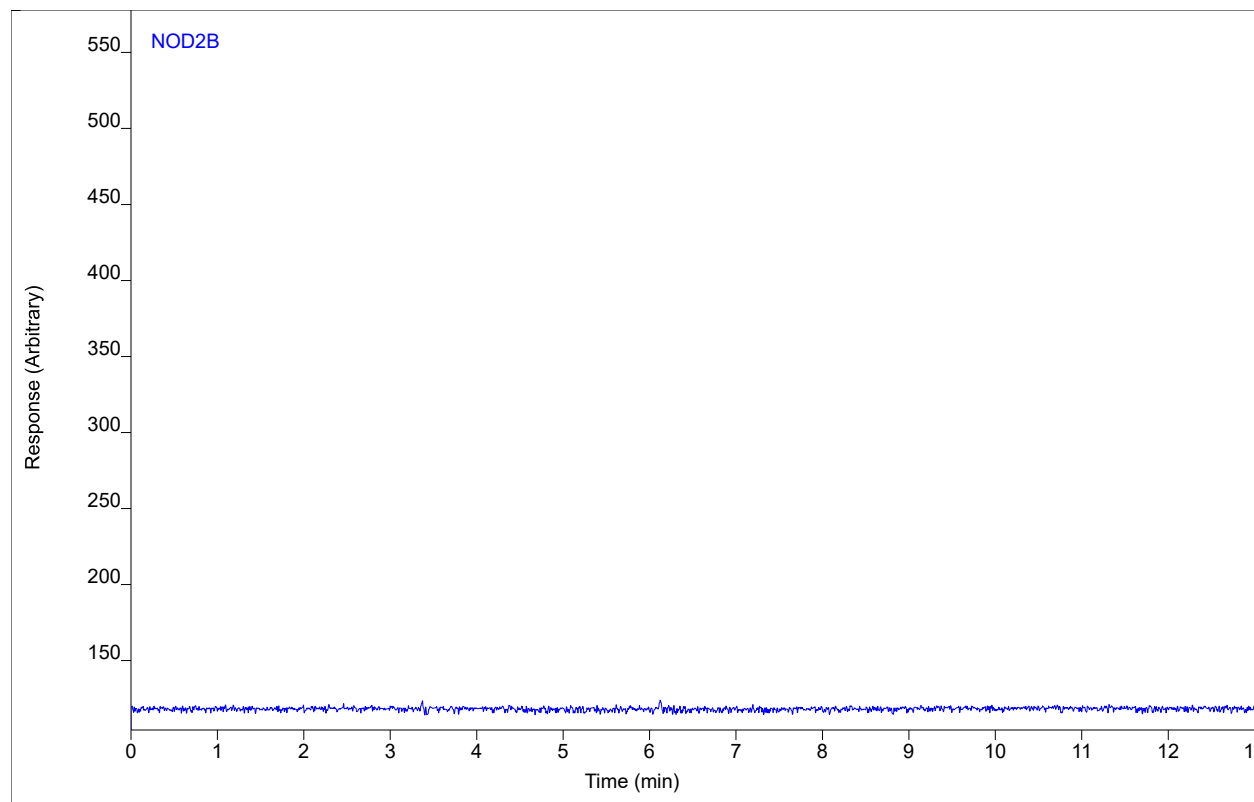
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide		(3.58)				1		

Chromatogram Report

Enthalpy Analytical

Sample Name 0123-968.LF1-GMP-9R C1100.Bag
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 014B0501.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 11:32 AM
File Modified 2/3/2023 11:16 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 14
Injection Volume 1000
Injection 1 of 1
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



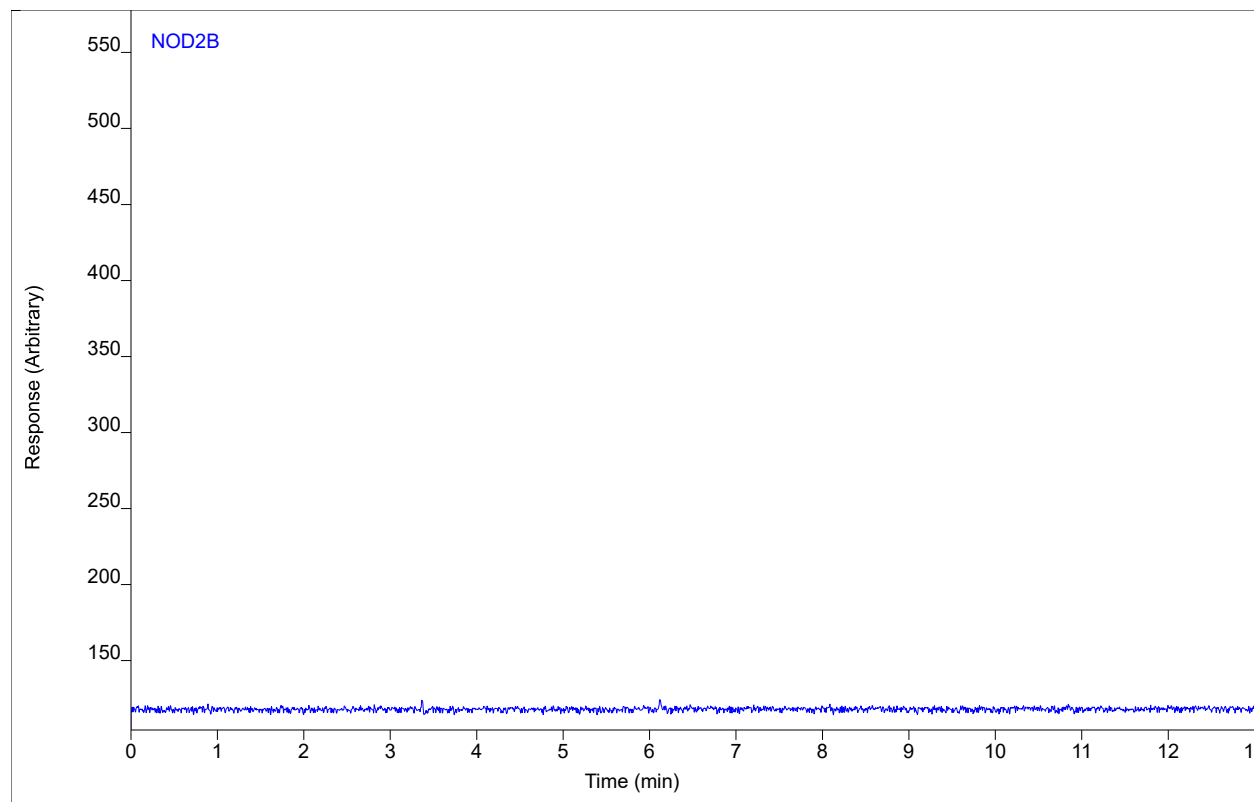
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide		(3.58)				1.52		
Methyl Mercaptan		(4.46)				1.52		
Ethyl Mercaptan		(5.51)				1.52		
Isopropyl Mercaptan		(6.37)				1.52		
t-Butyl Mercaptan		(7.00)				1.52		
n-Propyl Mercaptan		(7.22)				1.52		
sec-Butyl Mercaptan		(8.17)				1.52		
Isobutyl Mercaptan		(8.34)				1.52		
n-Butyl Mercaptan		(8.85)				1.52		

Chromatogram Report

Enthalpy Analytical

Sample Name 0123-968.LF1-GMP-9R C1100 Dup.Bag
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 014B0601.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 11:52 AM
File Modified 2/3/2023 11:16 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 14
Injection Volume 1000
Injection 1 of 1
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



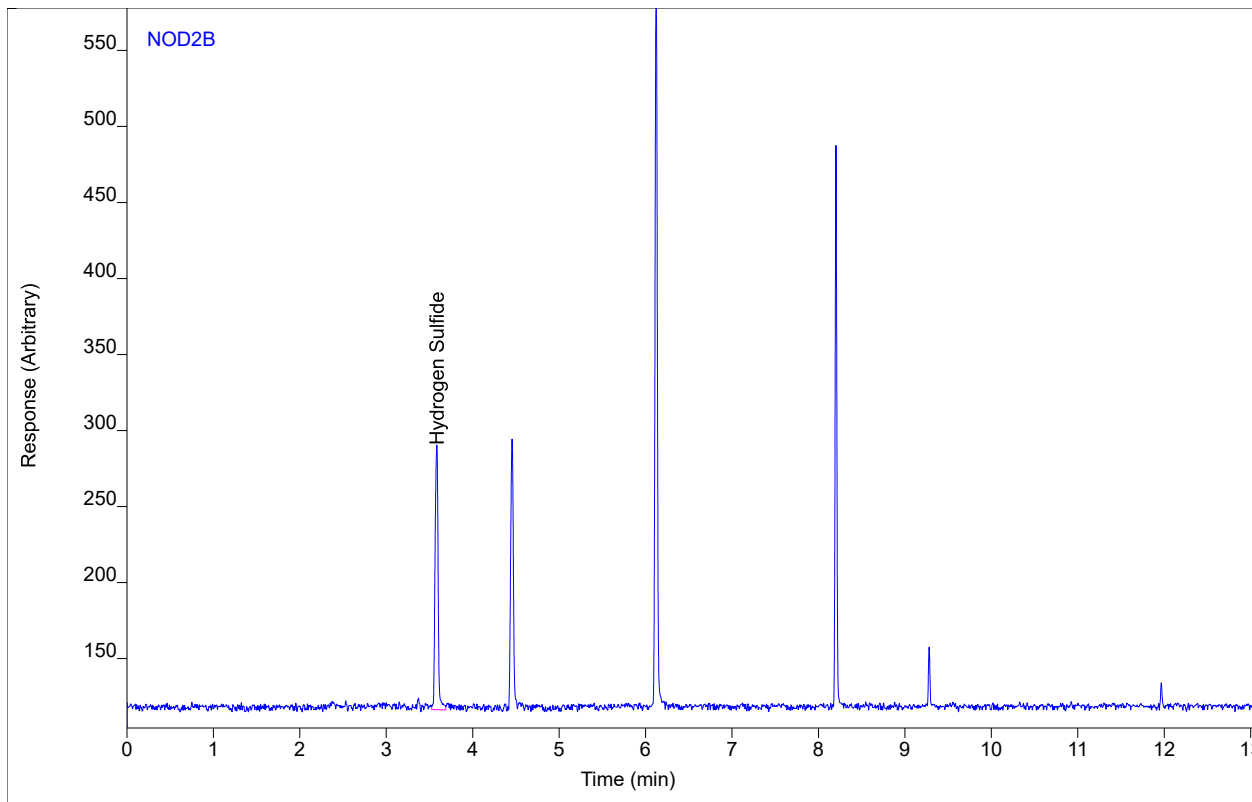
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide		(3.58)				1.52		
Methyl Mercaptan		(4.46)				1.52		
Ethyl Mercaptan		(5.51)				1.52		
Isopropyl Mercaptan		(6.37)				1.52		
t-Butyl Mercaptan		(7.00)				1.52		
n-Propyl Mercaptan		(7.22)				1.52		
sec-Butyl Mercaptan		(8.17)				1.52		
Isobutyl Mercaptan		(8.34)				1.52		
n-Butyl Mercaptan		(8.85)				1.52		

Chromatogram Report

Enthalpy Analytical

Sample Name 0123-968.LF1-GMP-9R C1100 SP.Bag
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 002B0701.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 12:51 PM
File Modified 2/3/2023 11:16 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 2
Injection Volume 1000
Injection 1 of 1
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



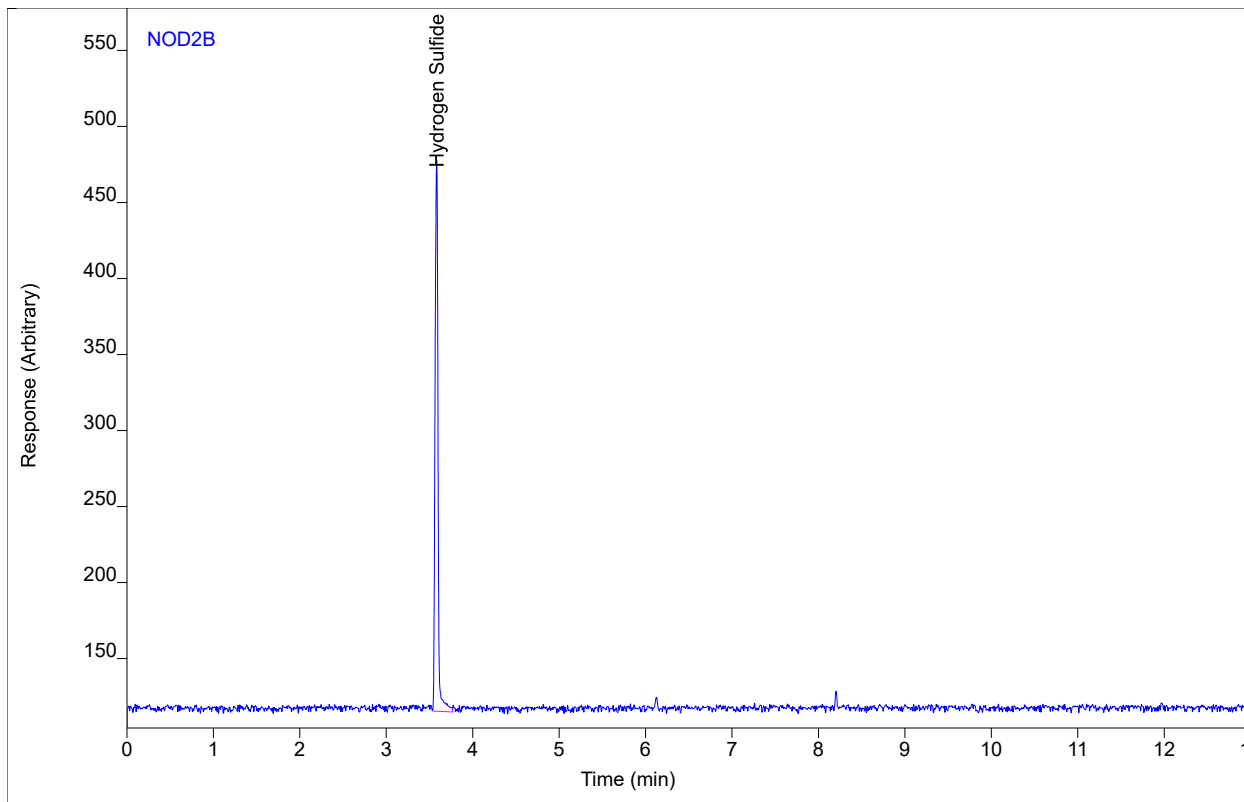
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide	VV	3.58	428.824	174.251	1.01752	1	1.01752	ppm

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p321 #ICV
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 002B1201.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 2:38 PM
File Modified 2/3/2023 11:17 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 2
Injection Volume 1000
Injection 1 of 1
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



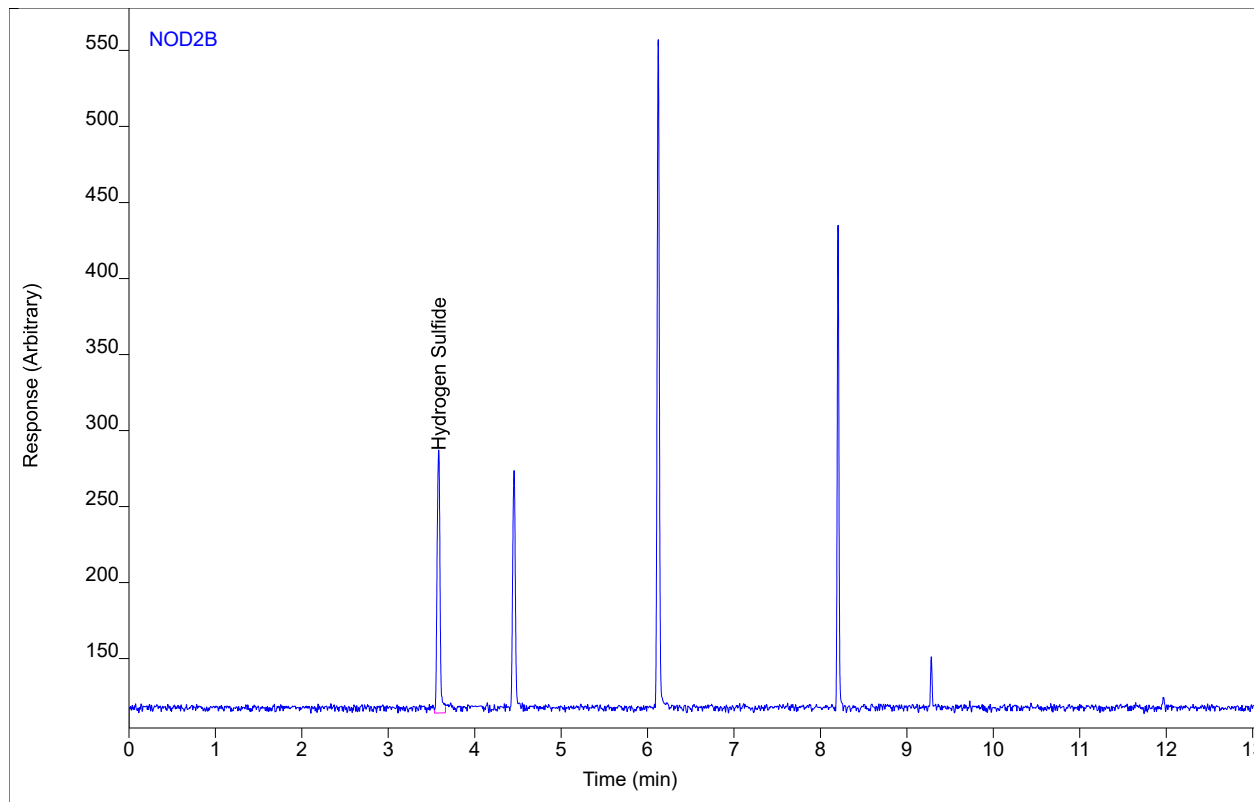
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide	BV	3.58	869.375	362.217	2.06286	1	2.06286	ppm

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p321 #S3
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 001B1301.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 2:58 PM
File Modified 2/3/2023 11:17 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 1
Injection Volume 1000
Injection 1 of 3
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



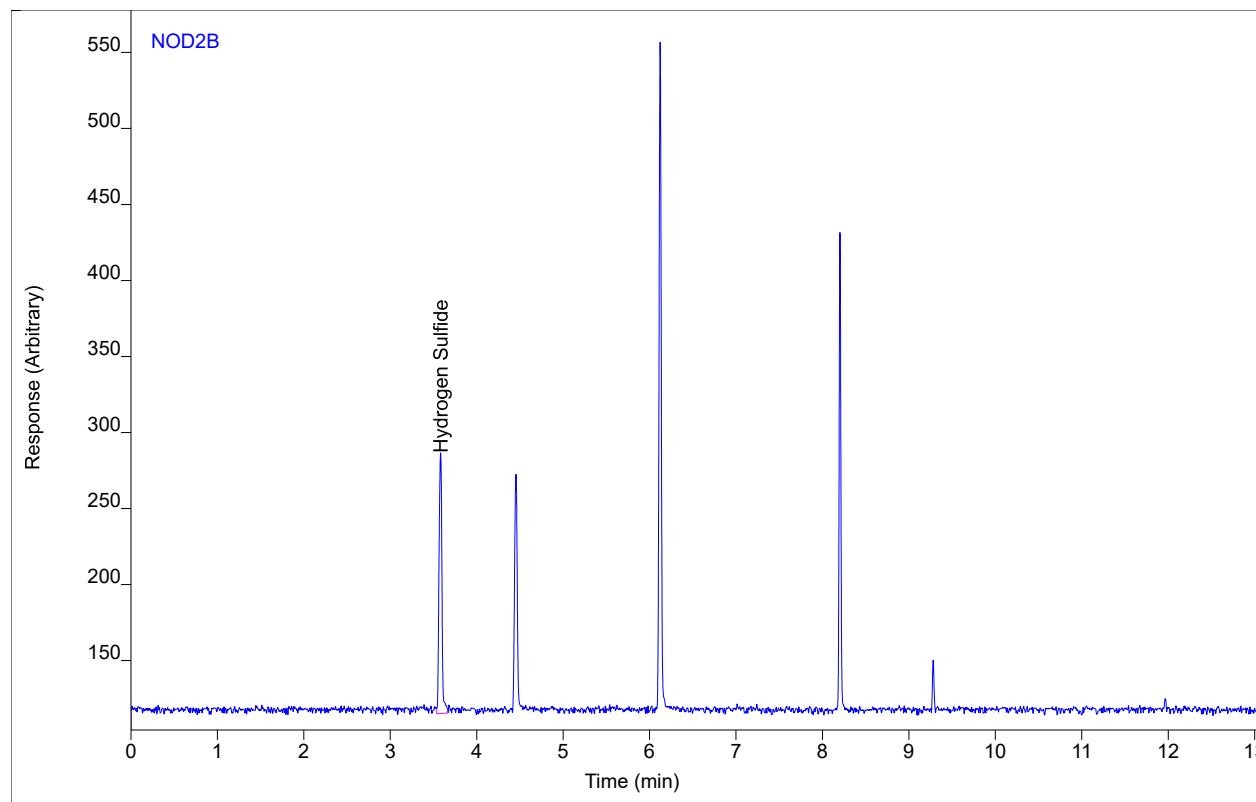
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide	VV	3.58	409.176	172.812	0.97090	1	0.97090	ppm

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p321 #S3
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 001B1302.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 3:18 PM
File Modified 2/3/2023 11:17 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 1
Injection Volume 1000
Injection 2 of 3
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



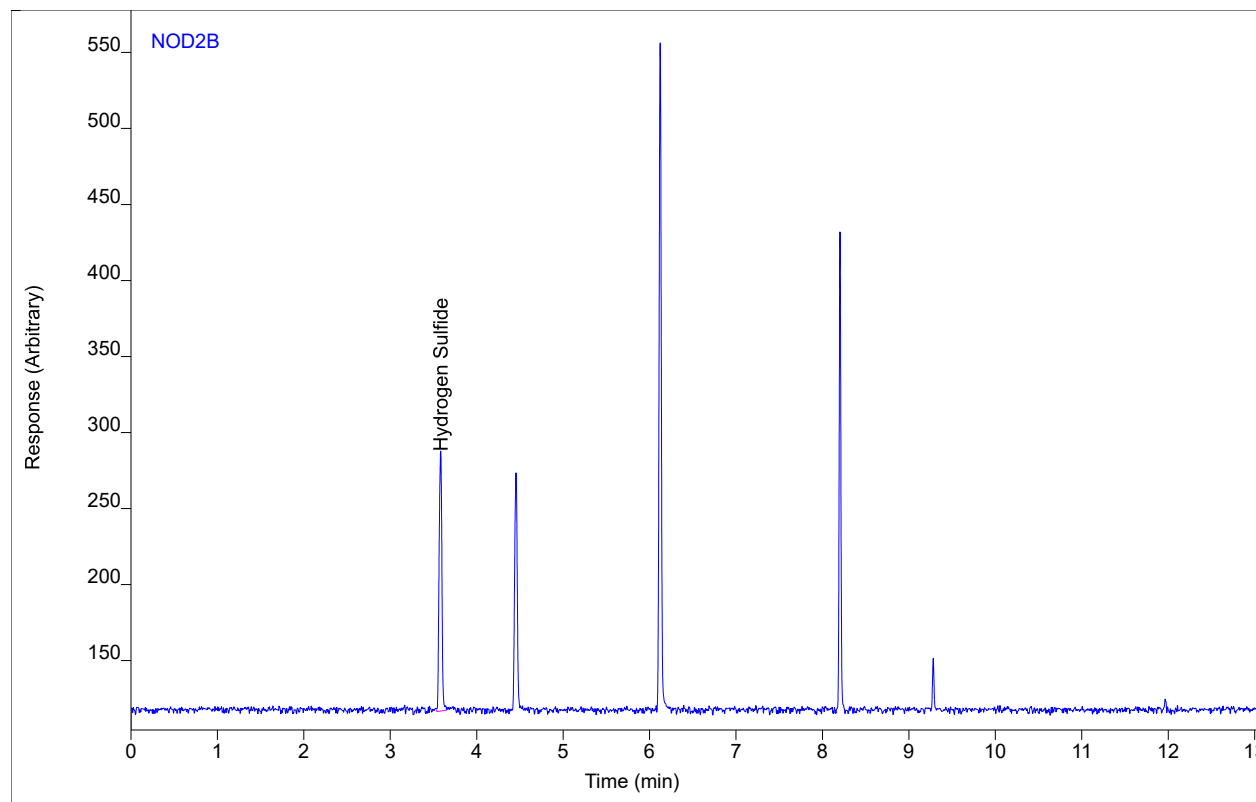
Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide	VB	3.58	402.704	171.346	0.95554	1	0.95554	ppm

Chromatogram Report

Enthalpy Analytical

Sample Name Prep1p321 #S3
Sequence Name DPGC5-012623 2023-01-26 09-15-25 ver.10
Inj Data File 001B1303.D
File Location 3 - Houston Lab/Data/GC5/2023_Q1
Injection Date 1/26/2023 3:38 PM
File Modified 2/3/2023 11:17 AM
Instrument DP-GC05
Operator Kristopher Beverly

Sample Type Sample
Vial Number Vial 1
Injection Volume 1000
Injection 3 of 3
Acquisition Method DPGC5-ACQ-072622.M
Analysis Method DPGC5-R_122022.M
Method Modified 1/31/2023 11:08 AM
Printed 2/3/2023 11:19 AM



Compound	Type	RT	Area	Height	Amount	DF	SampAmt	Unit
Hydrogen Sulfide	VB	3.58	383.309	170.893	0.90952	1	0.90952	ppm

**This Is The Last Page
Of This Report.**

Ajax Environmental
10801 Hammerly Blvd., Suite 148
Houston, TX 77043
713-789-4149

Calibration Gas used is traceable to N.I.S.T.		
MFG: GasCo	Lot#: 252476	Expiration Date: 01/06/2024

Certification of Calibration

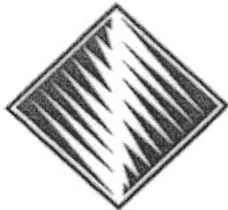
Manufacturer: Landtec **Model:** GEM 5000 **S/N:** A7106

Calibration Gas:	Reading After Calibration
Oxygen: 0.0%	<u>0.0 % O2</u>
Methane: 50%/Vol	<u>50 % CH4</u>
Carbon Dioxide: 35%/Volume	<u>35.0 % CO2</u>
Hydrogen Sulfide: 25PPM	<u>25 PPM H2S</u>
Carbon Monoxide: 100 PPM	<u>100 PPM CO</u>

Calibrated by: Kent A. Mitchell

Signature: 

Date completed: January 23, 2023



FIELD ENVIRONMENTAL INSTRUMENTS, INC.

www.fieldenvironmental.com

301 Brushton Ave
Suite A
Pittsburgh, PA 15221
Toll Free (800) 393-4
Local (412) 436-2600
Fax (412) 436-2616

RKI Multi-Gas Detector Calibration Certificate

Cal Gas	Lot #	Expiration	Reading %	Acceptable Range
Oxygen	21-8206	09/27/23	18.0	(17.5% - 18.5%) ▼

Cal Gas	Lot #	Expiration	Reading ppm	Acceptable Range
H2S	21-8206	09/27/23	10	(9ppm - 11ppm) ▼

Cal Gas	Lot #	Expiration	Reading ppm	Acceptable Range
CO	21-8206	09/27/23	50	(48ppm - 52ppm) ▼

Cal Gas	Lot #	Expiration	Reading %	Acceptable Range
Ch4 % LEL	21-8206	09/27/23	50	(48% - 52%)

Cal Gas	Lot #	Expiration	Reading %	Acceptable Range
Ch4 % Vol	n/a	n/a	n/a	▼

Cal Gas	Lot #	Expiration	Reading % / ppm	Acceptable Range
NH3 ▼	22-9218-25	11/11/23	25	▼

Cal Gas	Lot #	Expiration	Reading % / ppm	Acceptable Range
CO2 ▼	n/a	n/a	n/a	▼

Cal Gas	Lot #	Expiration	Reading ppm	Acceptable Range
VOC	21-7850	03/26/25	100	(98ppm - 102ppm)

Model	GX6000 ▼
S/N	983040179RN
Barcode	U99849X
Order #	507381

Pump Flow	540	(300+) ▼
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Calibrated By Jonathan Gonzalez ▼

Date of Calibration 01/23/22

All calibrations performed by FEI conform to manufacturer's specifications. Please report any issues within 24 hours of receiving equipment.

All calibration gas used is traceable to NIST. Additional documentation is available upon request.