CITY OF WACO

Purchasing Services
Post Office Box 2570
Waco, Texas 76702-2570
254-750-8062
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www.waco-texas.com

Date: **05/24/2023**
RFQ No: **2023-026**
Commodity: **North Interceptor Wastewater Improvements Phase 1a Ptoject**
Purchasing Agent: **Daryle Bullard**

Closing Time: 2:00 P.M. CST, Tuesday, July 25, 2023
Opening Time: 2:01 P.M. CST, Tuesday, July 25, 2023

RFQ Opening Location: Operations Center, Purchasing Services Office, 1415 N. 4th St., Waco, TX 76707

Addendum No: 1

The above-mentioned RFQ invitation has been changed in the following manner. **Sign and return addendum to the Purchasing Office by the closing time and date with your RFQ response**. Returning this page signed by your authorized agent will serve to acknowledge this change. All other requirements of the invitation remain unchanged. If you have any questions, please call or stop by the Purchasing Office at the above address.

1. **Geotechnical Reports**

Firm:_____

Address_____

Signature of Person
Authorized to Sign Bid:_____

Signor's Name and Title
(print or type):_____

E-mail Address:_____

Date:_____Telephone:_____Fax:_____

14 June 2022

Mr. Mark Wolfe
Texas Historical Commission
1511 Colorado Street
Austin, Texas 78701

RE: Cultural Resources Desktop Analysis for the North Interceptor Wastewater Improvement Project, City of Waco, McLennan County, Texas

Dear Mr. Wolfe,

Integrated Environmental Solutions, LLC (IES), has been contracted by Walker Partners, on behalf of the City of Waco, to conduct the cultural resources review and coordination for a proposed wastewater improvement project encompassing an approximately 3.3-mile (mi)-long (80.8-acre [ac]) project corridor, or Area of Potential Effects (APE). The project will extend from southwest of the intersection of Coffee Street and U.S. Highway (US) 77 Business to northwest of the intersection of Williams Road and US 84 in the City of Waco, McLennan County, Texas (Attachment A, Figure 1).

PERTINENT REGULATIONS

National Historical Preservation Act (NHPA) Section 106

The NHPA (54 U.S. Code [USC] 306101), specifically Section 106 (54 USC 306108), requires the State Historic Preservation Officer (SHPO), an official appointed in each state or territory, to administer and coordinate historic preservation activities, and to review and comment on all actions licensed by the federal government that will have an effect on properties listed in the National Register of Historic Places (NRHP), or eligible for such listing. Per 36 Code of Federal Regulations Part 800 (36 CFR 800), the federal agency responsible for overseeing the action must make a reasonable and good faith effort to identify cultural resources. Federal actions include, but are not limited to, construction, rehabilitation, repair projects, demolition, licenses, permits, loans, loan guarantees, grants, and federal property transfers. For example, if this project requires a Clean Water Act (CWA) Section 404 permit from the U.S. Army Corps of Engineers (USACE) or any type of federal funding, the project would be subject to NHPA Section 106 requirements.

Antiquities Code of Texas (ACT)

As the City of Waco is considered a political subdivision of the State of Texas under Section 52, Article III, or Section 59, Article XVI, of the Texas Constitution, the city is required to comply with the ACT. The ACT, as outlined in the Texas Administrative Code (TAC) Title 13 Part II and the Texas Natural Resource Code (TNRC) Title 9 Chapter 191, requires that political subdivisions notify the Texas Historical Commission (THC) at least 30 days in advance of any project that may affect potential or designated archeological sites. While advance project review by the THC is required for undertakings with more than 5 ac or 5,000 cubic yards (yd^3) of ground disturbance, the THC can still request project information and/or an archeological survey in advance of more minor ground disturbances since all publicly-sponsored projects must comply with the ACT. If the activity occurs inside a designated historic district, affects a recorded archeological site, or requires on-site investigations, the project will need to be reviewed by the THC, regardless of project size.

Texas Health and Safety Code (THSC)

Under the provisions of the THSC, as amended by Texas Senate Bill (SB) 1630, the owner of a property on which an unknown cemetery is discovered, or on which an abandoned cemetery is located, may not construct improvements on the property in a manner that would disturb the cemetery until the human remains interred in the cemetery are removed under a written order issued by the state registrar or the state registrar's designee (THSC Section 711.004[f]). A person who discovers an unknown or abandoned cemetery shall file notice of the discovery of the cemetery with the county clerk of the county in which the cemetery is located and concurrently mail notice to the landowner on record in the county appraisal district not later than 10 days after the date of the discovery. The notice must contain a legal description of the land on which the unknown or abandoned cemetery was found and describe the approximate location of the cemetery and the evidence of the cemetery that was discovered.

AREA OF POTENTIAL EFFECTS

The APE encompasses approximately 80.8 ac. The proposed project will entail the installation of approximately 15,650 linear feet (ft) of 30-inch (in) wastewater line within a 3.3-mi corridor. When constructed, potential subsurface impacts anticipated for the project include standard construction procedures associated with linear large-scale pipeline developments such as boring or trenching of the ground surface. Depths of impacts associated with the proposed project will generally be within 20 ft of the current ground surface.

METHODOLOGY

During the background review, a variety of literature and online sources were referenced to determine if potential cultural resources were located within the APE. These sources included U.S. Geological Survey (USGS) topographic maps, the Geologic Atlas of Texas (Waco Sheet), the *Soil Survey of McLennan County, Texas*, the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) digital soil database for McLennan County, the Texas Historic Overlay georeferenced map database, the 1936 Texas State Highway Department map of McLennan County, the Texas Department of Transportation (TxDOT) Potential Archeological Liability Map (PALM) for McLennan County, and both past and current aerial photography of the proposed APE. Additionally, a file search of the Texas Archeological Site Atlas (TASA) and Texas Historical Sites Atlas (THSA) were performed for the proposed location and surrounding areas. This review was conducted by Project Archeologist Joshua McCormick on 26 May 2022.

RESULTS

Topography, Geology, and Soils

The Waco East 7.5-minute USGS topographic quadrangle map illustrates that the APE is located on a gently rolling upland setting east of the Brazos River and west of Lucky Branch (Attachment A, Figure 2). Elevations within the APE range from 411 to 466 ft (125 to 142 meters [m]) above mean sea level.

The APE is located within the Northern Blackland Prairie in the Texas Blackland Prairies ecoregion. This area is distinguished from surrounding regions by the gently rolling hills and dark, fine-textured soils that primarily support prairie vegetation (Griffith et al. 2007). Vertisols dominate the Blackland Prairie ecoregion and consist of high clay content soils that have significant shrink and swell potential. Most of the native prairie has been converted to cropland, non-native pasture, and expanding urban uses. Historical vegetation in this region included little bluestem, big bluestem, yellow Indiangrass, and tall dropseed. Soils in this area are underlain by Terrace deposits (Qt), which are characterized by sand, silt, clay, and gravel in various proportions (Barnes et al. 1970; USGS 2022; Attachment A, Figure 3).

As depicted by the *Soil Survey of McLennan County, Texas*, there are 11 soil map units within the APE (Miller et al. 1992; Table 1; Attachment A, Figure 4). Approximately 86.8 percent of the APE contains soils typical of alluvial deposits and erosion in upland settings within the Northern Blackland Prairie ecoregion. The remaining 13.2 percent contains soils typical of urban development. Soil data were reviewed from the USDA NRCS Web Soil Survey (USDA 2022).

Texas Archeological Sites Atlas Review

A file search within the TASA and THSA databases, maintained by the THC, identified no previously recorded archeological sites, National Register properties, historical markers, or cemeteries located within the APE (TASA 2022; THSA 2022). The TASA database identified five previously conducted archeological surveys within 1 mi (1.6 kilometers [km]) (Table 2; Attachment A, Figure 5). Additionally, three archeological sites have been recorded within 1 mi (Table 3).

Disturbance Analysis

Since the early 1900s, the northern 1.4 mi of the APE was located along the International and Great Northern Railroad (later the Missouri Pacific Railroad). The railroad line was abandoned between 1958 and 1971 and the railbed was replaced by Williams Road in 1981. A section of the APE along Katy Road is located along the former rail line of the Arkansas & Texas Railway (later known as the St. Louis Southern Railway of Texas), which was first illustrated in 1892, and a large rail yard south of Katy Road. Most of the tracks were removed and the adjacent rail yard left vacant by the early 2000s. As early as 1920 urban development had begun to encroach on the western end of the APE. The 1954 USGS Waco map indicates urbanization had encompassed the western half of the APE, with historic aerial photographs from 1971 showing even further spread. Currently, the APE corridor is within a largely urbanized setting at the periphery of the Waco metropolitan area. According to current construction plans, the APE encompassing Williams Road is within an existing pipeline corridor.

Table 1: Soils within the APE

Soil Map Unit Description	Approximate Percent of the APE
AxB – Axtell fine sandy loam, 1 to 3 percent slopes - This component is described as sandy loam located on stream terraces. Typical Btss subsoil horizon depth is 10 to 18 in (25 to 45 centimeters [cm]). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is moderately well drained.	20.1
BaA – Bastsil fine sandy loam, 0 to 2 percent slopes – This component is described as a fine sandy loam located in stream terraces. Typical Bt1 subsoil horizon depth is 11 to 57 in (28 to 145 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is well drained.	8.6
BaB – Batsil-Urbn land complex, 0 to 2 percent slopes – This component is described as a fine sandy loam located on stream terraces. Typical E subsoil horizon is 8 to 15 in (20 to 38 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is well drained.	17.8
BrB – Bremond loam, 0 to 2 percent slopes - This component is described as loam located on stream terraces. Typical Bt subsoil horizon depth is 8 to 18 (20 to 46 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is moderately well drained.	2.1
CaB – Chazos loamy fine sand, 1 to 3 percent slopes - This component is described as loamy fine sand located on stream terraces. Typical E subsoil horizon depth is 6 to 15 in (15 to 38 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is moderately well drained.	6.7
GhD – Gholson fine sandy loam, 3 to 8 percent slopes - This component is described as fine sandy loam located on stream terraces. Typical Bt1 subsoil horizon is 13 to 25 in (33 to 64 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is well drained.	4.6
Go – Gowen clay loam, frequently flooded - This component is described as clay loam located on flood plains. Typical Bw subsoil horizon is 30 to 60 in (76 to 152 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is well drained.	1.1
MaA –Mabank fine sandy loam, 0 to 1 percent slopes - This component is described as fine sandy loam located on stream terraces. Typical Btg subsoil horizon is 7 to 24 in (18 to 61 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is moderately well drained.	3.9
MbA –Mabank-Bremond complex, 0 to 1 percent slopes - This component is described as fine sandy loam located on stream terraces. Typical Btg subsoil horizon is 7 to 24 in (18 to 61 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is moderately well drained.	16.8
Ur – Urban land	13.2
WnA – Wilson clay loam, 0 to 2 percent slopes - This component is described as clay loam located on stream terraces. Typical Btss subsoil horizon is 7 to 31 in (18 to 78 cm). Depth to bedrock is more than 80 in (203 cm). The natural drainage class is moderately well drained.	5.0

Table 2: Previously Conducted Archeological Surveys within 1 Mile

Agency	TAP No.	Firm/Institution	Date	Survey Type	Location (Approximate)
TxDOT	No data	Unknown	1975	Linear	Adjacent to northern terminus of APE
TxDOT	5669	Geo-Marine, Inc.	2010	Area	0.34 mi west
TxDOT	No Data	Unknown	2012	Area	0.78 mi south
USACE	No Data	Prewitt and Associates	2012	Area	0.79 mi south
TxDOT	7429	AmaTerra Environmental	2015	Linear	0.98 mi southwest

Table 3: Previously Recorded Archeological Sites within 1 Mile

Site Trinomial	Time Period	Site Type	Site Size	Depth Extent	Cultural Materials	Topographic Setting	Location (Approximate)	Reference
41ML298	Historic	No data	15 by 15 m	40 cm below surface (cmbs)	Ceramics, glass, nails, threaded bolt	Prairie	0.34 mi west	Fullerton 2010
41ML301	Historic	Engineered Feature	782 by 1 m	Surface	Railroad bed	Terrace	0.82 mi south	Hatfield 2010
41ML353	Historic	Cemetery	20.23 ac	Unknown	Cemetery and residential components	Terrace	0.02 mi west	Anderson and Nichols 2022

Cultural Resources Potential

Prehistoric Resources

Previous archeological surveys across Central Texas have identified numerous archeological resources that reflect Native American habitation throughout the Holocene. As a whole, the Central Texas archeological region is characterized by the potential for encountering a high frequency of prehistoric sites with large artifact assemblages and numerous well-preserved features. However, the APE is located within upland landforms with limited access to permanent sources of surface water and a lack of natural chert outcrops that would have been exploited during the prehistoric period for the manufacture of chipped lithic tools. The TxDOT PALM for McLennan County illustrates the APE mostly contains a low potential for shallow and deeply buried prehistoric cultural deposits within areas that have maintained a reasonable contextual integrity. Limited areas of the APE at the eastern terminus and center of the corridor contain a moderate potential for shallow and deeply buried prehistoric resources. However, during background review, it was determined most of the APE has been significantly disturbed through past transportation and utility infrastructure development. As such, the potential for encountering prehistoric archeological resources is low.

Historic-Period Resources

Historic-period resources within Central Texas are primarily related to farmsteads, houses, and associated outbuildings and structures that date from the mid-19th to the mid-20th centuries. Typically, these types of resources are located along old roadways, but also can be located along railroads, streams, and within open pastures. Although determining the presence of the earliest buildings and structures in the region is problematic, maps depicting the former locations of those features are available post-1936.

Historical documents indicate much of the area surrounding the eastern half of the APE was used for agricultural fields or pasture in the early 20th century. Around the same time, gradual urban growth from East Waco and nearby Bellmead enveloped the portions of the western half of the APE corridor. Despite historic residential and commercial growth in the area, no historic-age buildings or structures were identified directly within the APE on historical maps or aerial photographs. Although the APE encompasses the footprint of historic-age railroad lines, the rail corridors have been abandoned and either replaced by roadway or utility easement/right-of-way (ROW). As such, the APE is considered to have a low potential for containing historic-period cultural resources.

CONCLUSIONS

Based on the results of this desktop analysis, it was determined that the entire project corridor has been subjected to significant ground disturbances within an urban setting. As such, the APE contains a low potential intact prehistoric cultural deposits. In addition, background review indicated the APE was largely located within the footprints of two railroad lines. However, historical and modern aerial photographs indicate the former railroad corridors have been transformed into roadways or utility easements/ROW. As such, there is a low potential for historic-age cultural resources within the APE.

For these reasons, IES recommends that this project be allowed to proceed without the need for additional cultural resources investigations. However, if any cultural resources are encountered during construction, the operators should immediately stop construction activities in the area of the inadvertent discovery. The project cultural resources consultant should then be contacted to initiate further consultation with the THC prior to resuming construction activities.

If you have any questions, please contact me by telephone at (972) 562-7672 or via email at kstone@intenvsol.com.

Sincerely,

Integrated Environmental Solutions, LLC

Kevin Stone, MA, RPA
Cultural Resources Vice President

IES Project Ref: 04.142.030

REFERENCES

Barnes, V.E., Humble Oil and Refining Co., Shell Oil Co., Mobil Oil Co., C.V. Procter, W.T. Haenggi, J.H. McGowen, O.T. Hayward, D.H. Eargle, E.T. Baker, R.C. Peckham, R.L. Bluntzer, and R.J. Cordell
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Griffith, Glenn, Sandy Bryce, James Omernik, and Anne Rogers
2007 *Ecoregions of Texas*. Texas Commission on Environmental Quality. Austin.

Miller, Glen B., and James M. Greenwade
1992 *Soil Survey of McLennan County, Texas*. United States Department of Agriculture, Soil Conservation Service, in cooperation with Texas Agricultural Experiment Station and Texas State Water Conservation Board. Washington, D.C.

Texas Archeological Site Atlas (TASA)
2022 *Texas Archeological Sites Atlas*. s.v. "McLennan County," http://nueces.thc.state.tx.us/ (accessed May 2022).

Texas Historic Site Atlas (THSA)
2022 *Texas Historic Sites Atlas*. s.v. "McLennan County," http://nueces.thc.state.tx.us/ (accessed May 2022).

U.S. Department of Agriculture (USDA)
2022 U.S. Department of Agriculture – National Resources Conservation Service, http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm (accessed May 2022).

U.S. Geological Survey (USGS)
2022 U.S. Department of the Interior Mineral Resources On-Line Spatial Data Website. http://mrdata.usgs.gov/sgmc/tx.html (accessed May 2022).

ATTACHMENT A

Figures

RFB 2023-026
Addendum 1

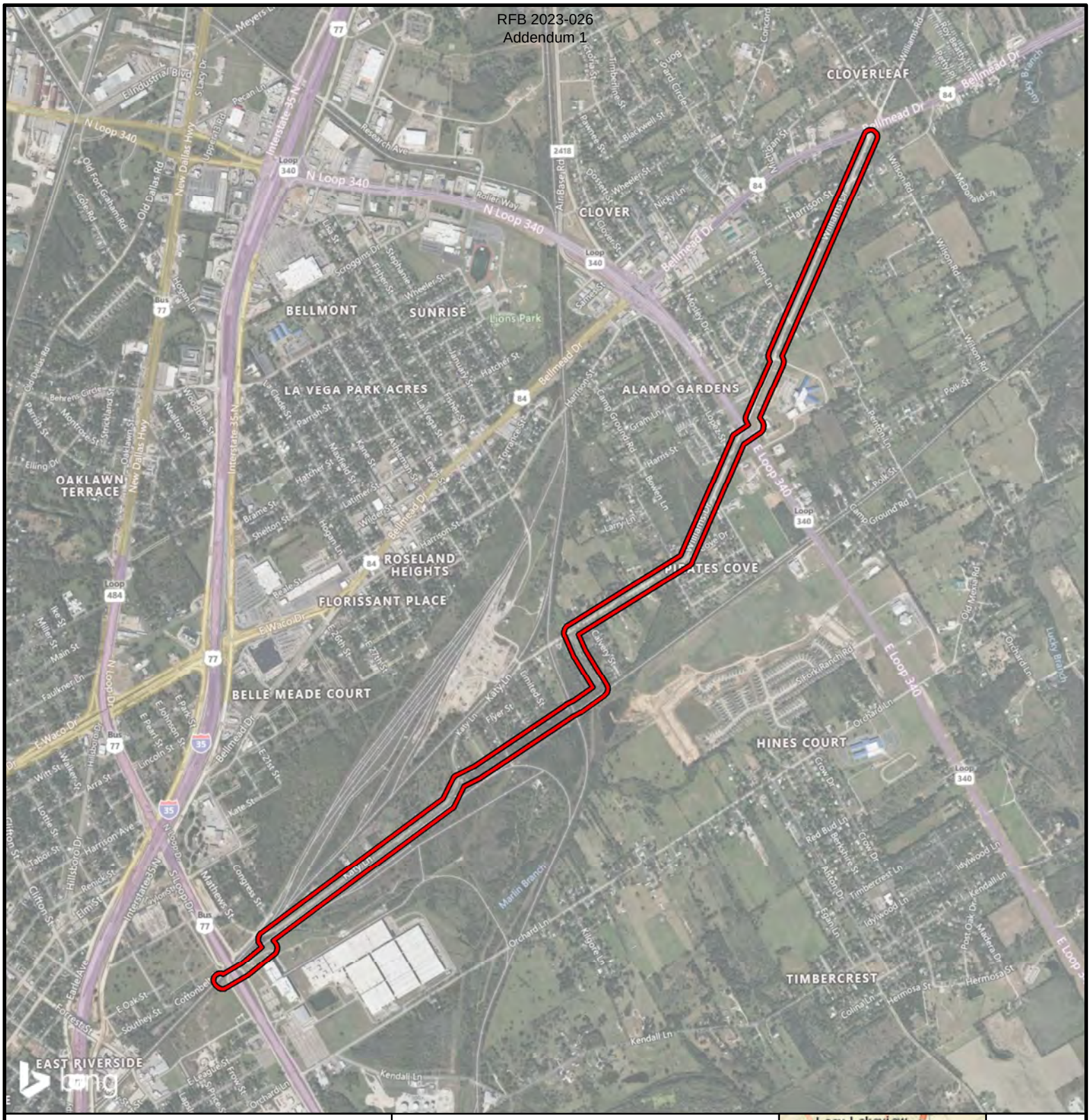

Figure 1
General Location Map

County: McLennan
State: Texas
Date map created: 6/2/2022
Source: (c) 2009 Microsoft Corporation and its data suppliers; ESRI Streetmap
IES Project Ref: 04.142.030

N

0 2,000 4,000 ft
0 500 1,000 m

Area of Potential Effects

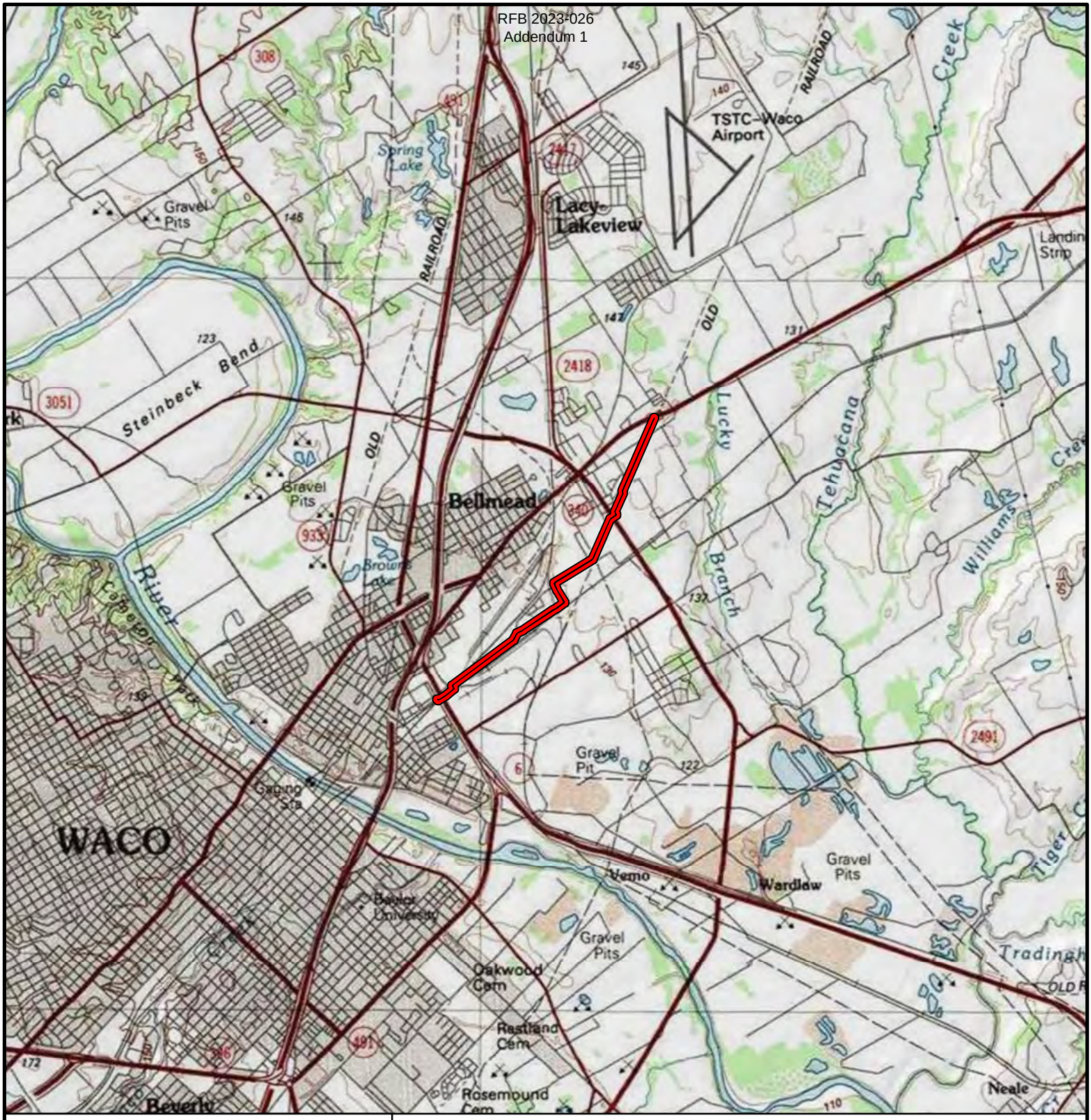

Figure 2
Topographic Setting

Area of Potential Effects

County: McLennan
State: Texas
Date map created: 6/2/2022
Source: USGS Topographic Map
7.5' Quadrangle
Waco East 1977
IES Project Ref: 04.142.030

N

0 6,000 12,000 ft
0 1,500 3,000 m

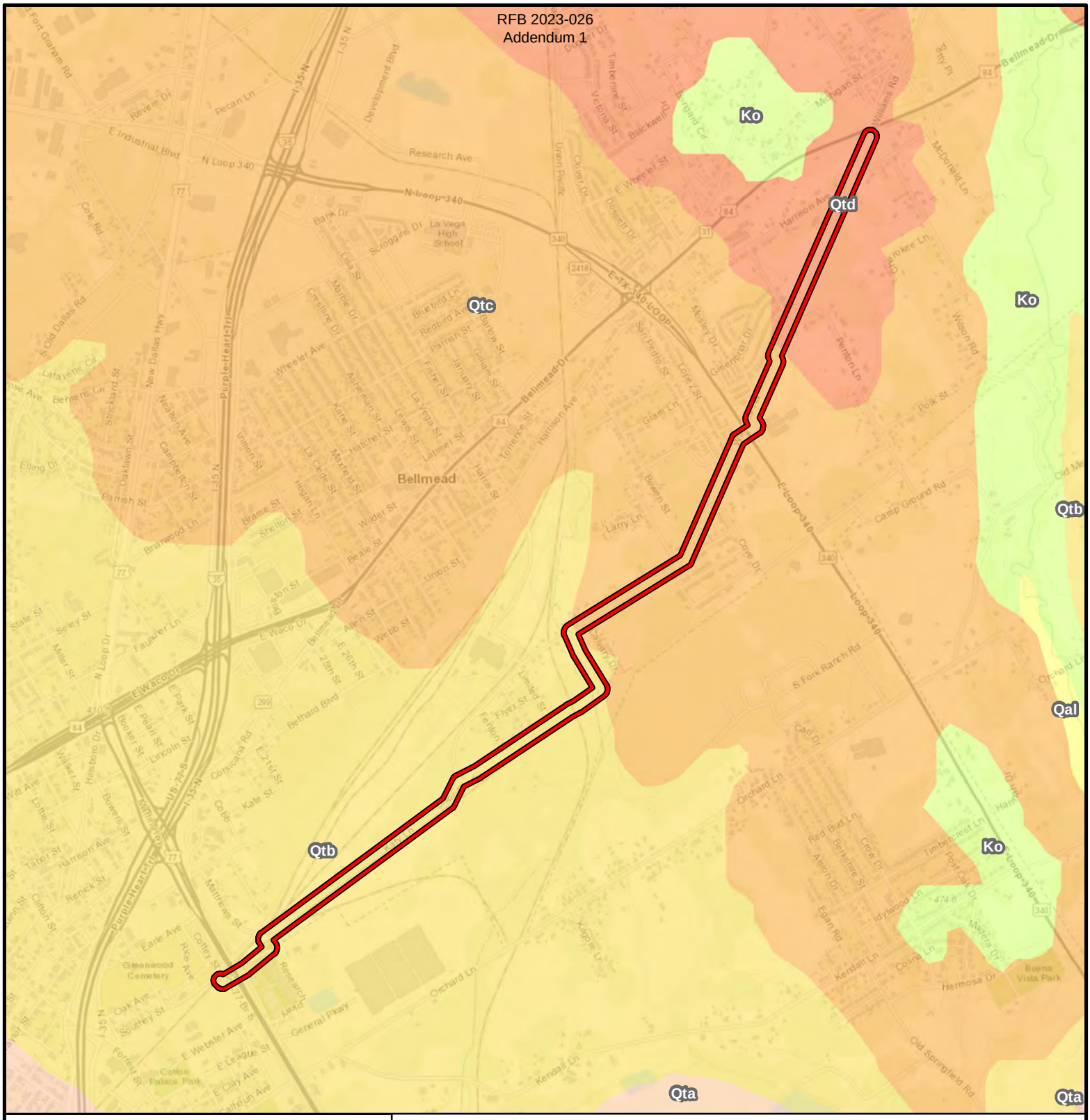

Figure 3
Geologic Setting

County: Waco
State: Texas
Date map created: 6/2/2022
Source: TNRIS Geologic Atlas of Texas; Waco Sheet
IES Project Ref: 04.142.030

N

0 2,000 4,000 ft
0 500 1,000 m

Area of Potential Effects

Geologic Formation

- Ko - Ozan Formation
- Qal - Alluvium
- Qta - Tahoka Formation
- Qtb
- Qtc
- Qtd

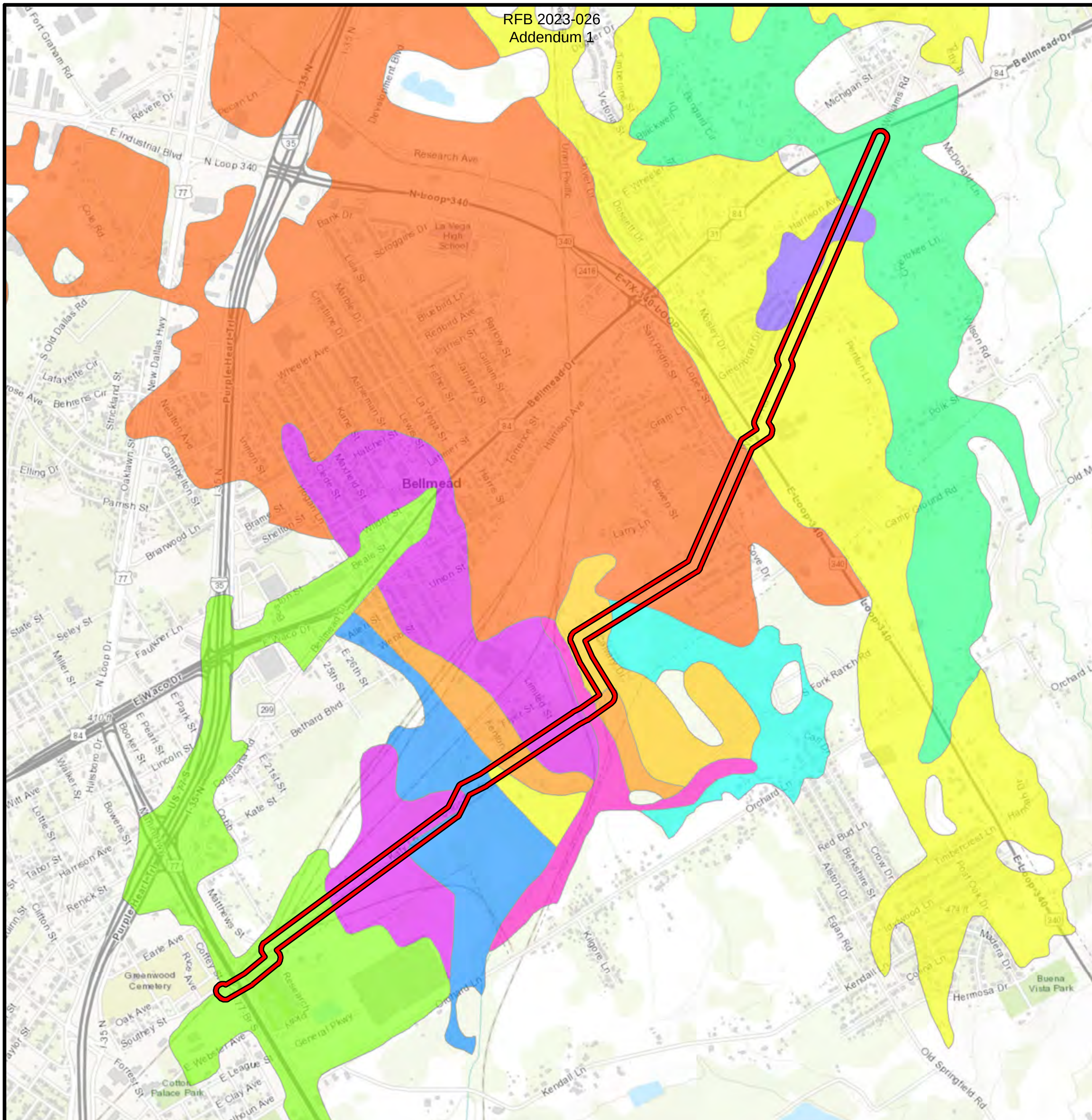

Figure 4
Soil Map Units Located Within and Adjacent to the Area of Potential Effects

County: McLennan
State: Texas
Date map created: 6/2/2022
Source: 2007 USDA
NRCS Digital Soils Database
IES Project Ref: 04.142.030

N

0 | 2,000 | 4,000 ft
0 | 500 | 1,000 m

Area of Potential Effects

Soil Map Unit (see Table 1)

- AxB - Axtell fine sandy loam, 1 to 3 percent slopes
- BaA - Bastsil fine sandy loam, 0 to 2 percent slopes
- BaB - Bastsil-Urban land complex, 0 to 2 percent slopes
- BrB - Bremond loam, 0 to 2 percent slopes
- CaB - Chazos loamy fine sand, 1 to 3 percent slopes
- GhD - Gholson fine sandy loam, 3 to 8 percent slopes
- Go - Gowen clay loam, frequently flooded
- MaA - Mabank fine sandy loam, 0 to 1 percent slopes
- MbA - Mabank-Bremond complex, 0 to 1 percent slopes
- Ur - Urban land
- WnA - Wilson clay loam, 0 to 2 percent slopes

RFB 2023-026
Addendum 1

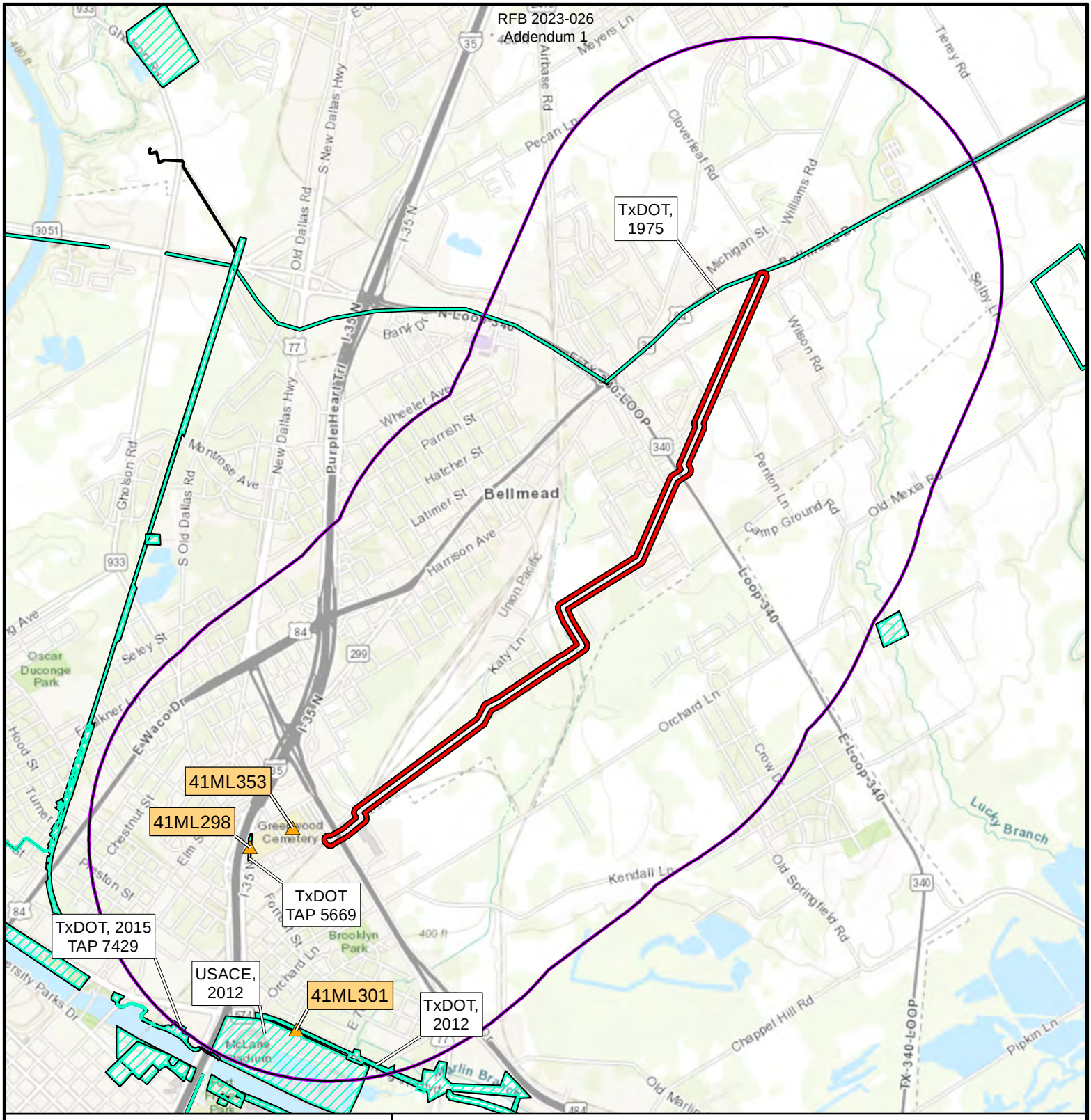

Figure 5
Previous Investigations Within
1 Mile of the Potential Areas of Effect

County: McLennan
State: Texas
Date map created: 6/3/2022
Source: (c) 2009 Microsoft Corporation and its data suppliers; ESRI 10.8
TASA
IES Project Ref: 04.142.030

N

0 2,000 4,000 ft
0 500 1,000 m

- Area of Potential Effects
- Area of Potential Effects - 1 Mile Buffer
- Previous Archeological Survey - Area
- Previous Archeological Survey - Line
- Archeological Site

NOT FOR PUBLIC DISTRIBUTION
Map contains archeological site locational information

LANGERMAN ENGINEERING

September 22, 2022

City of Waco
Public Works Department
P.O. Box 2570
Waco, Texas 76702-2570

Attention: Mr. Michael Jones

Reference: Geotechnical Report
North Interceptor Sewer
Waco, Texas
LE Project No. W22-038

Dear Mr. Jones:

This letter transmits our geotechnical report, which has been electronically produced. We appreciate the opportunity to provide engineering services for you.

Once the project plans and specifications are completed, we would be pleased to review those portions that pertain to this report. We would also appreciate the opportunity to provide construction phase services such as materials testing as a part of the success of the project.

If you have any questions regarding our report, please call me at (254) 235-1048.

Best Regards,

LANGERMAN FOSTER ENGINEERING COMPANY
Texas Registered Engineering Firm No. F-13144

Joe L. Dickinson, P.E.
Associate Principal / Geotechnical Engineer

Distribution List:

- City of Waco- Mr. Michael Jones (MikeJ@WacoTx.org)
- Walker Partners- Mr. Kyle Shulze, P.E. (KSchulze@WalkerPartners.com)

GEOTECHNICAL REPORT

North Interceptor Sewer
Waco, Texas

LE Project No. W22-038

Report Prepared For:

City of Waco
Waco, Texas

Report Prepared By:

Joe L. Dickinson, P.E.
Associate Principal / Geotechnical Engineer

September 22, 2022

LANGERMAN ENGINEERING
2000 South 15th Street, Waco, Texas 76706
Ph: 254/235-1048 www.LFEctx.com

LANGERMAN ENGINEERING

GEOTECHNICAL REPORT
NORTH INTERCEPTOR SEWER
WACO, TEXAS

1.0 INTRODUCTION

Purpose: The purpose of this report is to provide drilling and testing services for Utility Improvements. Geotechnical data are provided in a brief, and hopefully user-friendly manner.

Authorization: Services were performed in general accordance with LE Proposal No. GEO22-085, dated May 27, 2022. Authorization to proceed was provided via City of Waco Purchase Order No. 22202124, dated July 25, 2022.

2.0 SUBSURFACE EXPLORATION

Drilling Date: August 10 through 12, 18, and 19, 2022

Boring Layout: The borings were staked in the field by LFE personnel using a sketch provided by Walker Partners. Boring locations are shown on Plates 1 and 2 in the Appendix.

If precise location and elevation data are desired, then a licensed professional land surveyor should be retained to locate the borings and determine the ground surface elevation.

Sampling Methods: In general, an auger was used to drill through existing pavement, push-tubes were used to sample clay soils, and a split-spoon was used to sample granular soils. The split spoon sampler was used in conjunction with standard penetration tests, and N-Values were recorded on the boring logs.

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3.0 LABORATORY TESTS

Test Procedures: The following tests were conducted in general conformance with the standards noted in Table 3.1.

TABLE 3.1: LABORATORY TESTS	
Test Name	***Test Method***
Atterberg Limits	ASTM D 4318
-#200 Mesh Sieve	ASTM D 1140
Moisture Content	ASTM D 2216
Soil Classification	ASTM D 2487
Unconfined Compression (soil)	ASTM D 2166

Test Results: Laboratory test results are shown on Plate 3 in the Appendix, and selected test results on the boring logs. Results are also discussed subsequently.

Sulfates: The Taylor Formation is known to contain sulfates, which can react adversely with lime and cement. The potential for adverse sulfate reactions with lime and/or cement stabilized soils are considered low when the sulfate percentage is less than 3,000 ppm and moderate from 3,000 to 5,000 ppm.

Test results are provided in Table 3.2. Tests were performed on 3 discrete samples, and do not represent all soil types at the site. Sulfates may be present in higher concentrations at other locations. The test results are general, and should be considered only a random survey.

TABLE 3.2: SULFATE CONTENT	
Boring, Depth	***Sulfate Content (ppm)***
B-1, 0 to 1.5 feet	<100
B-7, 6 to 7.5 feet	120
B-9, 0 to 2 feet	<100

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4.0 SUBSURFACE MATERIALS AND SITE OBSERVATIONS

Stratigraphy: Individual boring logs are contained in the Appendix, and show the stratigraphy. Material descriptions are general and range of depths approximate because boundaries between different strata are seldom clear and abrupt in the field.

Geology: Based on the available geologic map[1] of the area, and the contents of the borings, the site is located within *Terrace Deposits* overlying the *Taylor Formation.*

Terrace Deposits are derived from ancient meandering paths and flood events of the Brazos River. Due to the inconsistent means of deposition, the deposits vary both horizontally and vertically in content and engineering properties. From a geologic perspective, Terrace deposits are considered recent.

The Taylor Formation consists of montmorillonitic clays that were deposited in a shallow marine environment, and have a maximum thickness of about 500 to 775 feet in the Central Texas area. After deposition, the clays consolidated to form a weak rock-like shale material when sufficient amounts of calcium carbonate were present as a cementing agent. This soft rock-like material is usually gray to dark gray in the unweathered state. Subsequent weathering produced tan to dark gray highly expansive clay soils, such as those observed at this site.

Existing Pavement: Borings B-12 through B-14 and B-17 through B-20 were drilled in Williams Road. Existing pavement thicknesses are provided in Table 4.1 and on the boring logs. Base material was degraded, and may have been cement treated.

TABLE 4.1: PAVEMENT THICKNESSES

Boring No.	*Total (in)*	*Asphalt (in)*	*Base (in)*
B-12	6	2	4 – likely CTB
B-13	6	2	4 – likely CTB
B-14	6.5	2	4.5 – likely CTB
B-17	7	2	5 – possibly CTB
B-18	5.5	1.5	4 – possibly CTB
B-19	5	2	3 – possibly CTB
B-20	5	2	3 – possibly CTB

Groundwater: The borings were drilled to depths ranging from 15 to 30 feet using dry methods, meaning that water was not used in the drilling process. Groundwater was observed in Borings B-1 through B-6 and B-8 through B-10, as shown in Table 4.2 and on the boring logs. Groundwater was not observed in Borings B-7 or B-11 through B-20.

TABLE 4.2: GROUNDWATER OBSERVATIONS

Boring No.	***Depth to groundwater (ft)***	
	Initial	***After 10-Minute Observation Period***
B-1	28.5	29.2
B-2	19.0	25.6
B-3	9.5	9.1
B-4	15.0	14.5
B-5	12.6	12.3
B-6	15.0	13.0
B-8	14.5	13.7
B-9	8.7	8.4
B-10	12.8	12.8

Transient groundwater is common in the area, and will likely be present during construction. The water tends to percolate down through the surficial soils until encountering a relatively impervious layer, and then either flow down gradient or become trapped.

The water observations conducted for this investigation are short-term and should not be interpreted as a groundwater study. However, the presence of groundwater will likely affect construction and long-term performance of the proposed utilities and pavements.

5.0 EXCAVATIONS

Project Summary: The project consists of Utility Improvements and reconstruction of portions of Williams Road. Comments regarding excavatability are provided below. Pavement thickness recommendations are provided in Section 6.

Excavations: The following paragraphs contain general comments regarding below grade excavations. Excavations characteristics, design of temporary support systems, and dewatering methods are the sole responsibility of the contractor. Accordingly, the following statements should be regarded only as opinions.

The clay, sand, and gravel soil materials can be excavated with conventional earthmoving equipment. Material described as shale can usually be excavated with conventional earthmoving equipment, but there may be hard layers that require heavy duty equipment. We recommend that contractors evaluate the excavation potential with test pits.

The design of temporary excavation support systems, trench safety systems, and slope stability for temporary open cut excavations were excluded from our scope of services. The contractor is solely responsible for designing and constructing stable, temporary excavations and must shore, slope or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. All excavations must comply with applicable local, state, and federal safety regulations including current OSHA Excavation and Trench Safety Standards. Construction site safety is generally the sole responsibility of the contractor, who shall also be responsible for the means, methods, and sequencing of construction operations. We are providing information in this report solely as a service to our client. Under no circumstances should the provided information be interpreted to mean that LFE is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and must not be inferred.

In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. Specifically, the current OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926 must be followed. The contractor's "responsible person" as defined in 29 CFR Part 1926, must evaluate the materials exposed in the excavations as part of the contractor's safety procedures. If an excavation, including a

trench, is extended to a depth of more than twenty (20) feet, it will be necessary to have the side slopes designed by a professional engineer licensed in the State of Texas. The contractor's "responsible person" must establish a minimum lateral distance from the crest of the slope for vehicles, spoil piles, or other surcharge loads. Likewise, the contractor's "responsible person" shall establish protective measures for exposed slope faces.

The contractor must include the proximity to adjacent features when planning their method of excavation and support. These features include, but are not limited to, adjacent structures and utility lines. The contractor must also be prepared to manage varying amounts of subsurface water. Dewatering quantities will depend on drainage features, any groundwater, and rainfall prior to and during construction.

6.0 PAVEMENT RECOMMENDATIONS

Pavement: We understand portions of Williams Road will be reconstructed after utility improvements are completed. We anticipate that the portions of Williams Road in this scope will be classified either as a Local Street or a Residential Collector.

The existing pavement has experienced significant alligator cracking, which indicates base and/or subgrade failures. Typically, base failures are the result of a pavement section that does not have sufficient structural capacity, a weak subgrade, or both.

Risk: Pavement design methods are intended to provide an adequate thickness of structural materials over the subgrade to support the wheel loads. Design methods do not account for shrink and swell movements of expansive clays or adverse settlement in poorly compacted fill materials. The pavement may be adequate from a structural standpoint, yet still experience cracking due to shrink/swell movement of the subgrade. It is critical to minimize moisture changes in the subgrade to reduce shrink/swell movements.

The pavement and adjacent areas must be well drained. Proper maintenance must be performed on cracks in the pavement surface to prevent water passing through to the base or subbase material. Extending the base material out about 2 feet from the edge of the pavement curb will also aid in reducing edge related cracking. Even with these precautions, some movements and related cracking may still occur. Routine maintenance is essential.

Using geogrids will help reduce damage from expansive clay soils, but will usually increase the cost of the initial pavement installation. In the long-term, it has been our experience that using geogrids reduces maintenance costs and extends the pavement life.

Pavement “islands” often provide a means of water infiltration into the base and subgrade materials below the pavement. If islands are used, then we recommend that a synthetic lining or clay soils be used to limit infiltration of water into the base and subgrade. Water entry into the base and subgrade will cause softening of the materials, and will cause potholes and/or ruts to form.

The presence of trees and vegetation adjacent to paved areas will exacerbate the formation of cracks in pavements due to moisture loss in the subgrade from transpiration to the root systems of the vegetation.

Soil moisture loss from vegetation can extend a distance from the vegetation about equal to its height. ***In general, concrete pavements perform better than asphalt pavements, especially in areas where trucks will start/stop and make turns.***

Traffic Types:

Because exact traffic data were not available for this project, we have made assumptions based on past experience and traffic criteria used for other projects.

Traffic conditions appear to vary for different portions of Williams Road. There appears to be less traffic on the portion of Williams Road south of Loop 340. The portion of Williams Road between Loop 340 and Highway 84 seems to have more traffic. This is likely due the presence of the La Vega Intermediate School and the possibility that it is used as a through-street between Loop 340 and Highway 84. The percentage of heavy vehicles, medium vehicles, and light vehicles is unknown. These observations are based on limited knowledge of the area, and only serve as a basis for providing a general range of pavement thickness options. A traffic study was not performed.

These estimate below should be reviewed by the City because the traffic information has an impact on the pavement thickness and future performance. In particular, the quantity and weight of incoming and outgoing semi-trailer trucks will have a significant impact on the pavement thickness calculations.

Traffic Loads:

For pavement design purposes, traffic volumes are expressed as the number of Equivalent 18-kip single axle load applications (ESAL) over a 20-year theoretical pavement design life. We have summarized values for two primary traffic conditions in Table 6.1.

Because the City of Waco does not currently have traffic classifications for streets, we have used City of Belton classifications and ESAL values to provide the pavement recommendations. Other ESAL values and street classifications may be considered if traffic conditions differ from the assumptions in this report.

We have computed the approximate types and volumes of different vehicles to aid in the design team's evaluation of the intended uses of the pavements.

TABLE 6.1: TRAFFIC ESTIMATES			
Traffic Area	**Typical Traffic**	**ESAL's**	**Reference Table**
Local Street	Light cars and pickups, occasional medium delivery trucks, rare heavy vehicles, similar to a low volume residential street.	30,000	Table 6.2A
Minor Collector	Light cars and trucks and medium delivery vehicles, occasional heavy vehicles.	200,000	Table 6.2B

TABLE 6.2A: ESTIMATED TRAFFIC CHARACTERISTICS (30,000 ESAL'S – LOCAL STREET)		
Vehicle Type	***Gross Vehicle Weight (lbs)***	***Vehicles per Day (per lane)***
Cars / Pickups	4,000	2,000
Medium Delivery Trucks	20,000	10
Heavy Trucks	60,000 to 80,000	1 per week

TABLE 6.2B: ESTIMATED TRAFFIC CHARACTERISTICS (200,000 ESAL'S – MINOR COLLECTOR)		
Vehicle Type	***Gross Vehicle Weight (lbs)***	***Vehicles per Day (per lane)***
Cars / Pickups	4,000	4,000
Medium Delivery Trucks	20,000	25
Heavy Trucks	60,000 to 80,000	5

Subgrade: Based on the subsurface materials observed at the boring locations, the subgrade at this site will primarily consist of clay. A resilient modulus value of 3,200 psi has been assigned to the subgrade based correlations between soil index properties and resilient modulus values.

The assigned modulus value does not account for weak or otherwise unsuitable soils that must be removed and/or properly compacted during the construction process.

Design Method: AASHTO and American Concrete Institute guidelines.

Thickness: Pavement thickness designs are provided in Table 6.3 on the next page. A reliability value of 80 percent was assigned to the pavement that corresponds to occasional interruption of traffic for pavement repairs. These designs reflect a theoretical "Design Life" of 20 years.

The "design life" of a pavement is defined as the expected life at the end of which reconstruction of the pavement will need to occur. Normal maintenance, including crack sealing, slurry sealing, and/or chip sealing, should be performed during the life of the pavement.

The existing pavement sections are not thick enough to provide all the material for Cement Treated Recycled Base (CTRB). These sections assume additional on site or imported material will be mixed with the pulverized asphalt and base materials. Recommendations regarding the additional materials are provided later in this section.

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TABLE 6.3: PAVEMENT THICKNESS OPTIONS			
Design Condition	***Option***	***Surface Course***	***Base Course***
Local Street 30,000 ESAL	1- Asphalt	2" Type C or D	7" CTB[(2)]
	2- Asphalt	2" Type C or D	8" CTRB[(1)]
	3- Asphalt	2" Type C or D	8" CLB and GRID[(1)]
	4- Asphalt	2" Type C or D	11" CLB[(2)]
	5- Concrete[(3)]	5" RCP	6" CLB[(1)]
Minor Collector 200,000 ESAL	1- Asphalt	3" Type C or D	8" CTB[(1)]
	2- Asphalt	3" Type C or D	10" CTRB[(1)]
	3- Asphalt	3" Type C or D	10" CLB and GRID[(1)]
	4- Asphalt	3" Type C or D	13" CLB[(2)]
	5- Concrete[(3)]	6" RCP	6" CLB[(1)]

Type C or D… Hot Mix Asphalt Concrete, TxDOT Type C or D
CLB… Crushed Limestone Base or Crushed Concrete Base
CTB… Cement Treated Base
CTRB… Cement Treated Recycled Base
GRID… Tensar TX130S Geogrid
RCP… Reinforced Concrete Pavement

[(1)]Low to Moderate risk of cracking due to expansive soils

[(2)]Moderate risk of cracking due to expansive soils

[(3)]It is possible to place concrete pavement directly on the prepared subgrade without base or lime stabilization in conjunction with increasing the concrete thickness by 1 inch. However, doing that will create a higher risk of premature failure of the concrete due to expansive clay soils.

Site Preparation: If reconstruction is planned, surficial vegetation, trees, root systems, existing fill, existing utilities, and all underground structures must be removed below the new pavement areas. The stripping depth must be based on field observations with attention given to old drainage areas, uneven topography, and wet soils.

Where practical, proof-rolling should be used to detect soft spots or pumping subgrade areas. Proof-rolling should be performed using a heavy pneumatic tired roller, loaded dump truck, or similar piece of equipment weighing at least 25 tons. All fill used to raise the pavement subgrade must be compacted in accordance with the subgrade compaction specifications.

CTB: Cement Treated Base (CTB) is essentially weak concrete, mixed in an off-site pugmill, and then imported to the site. It offers relatively high strength, and generally performs better than other base materials such as crushed limestone when exposed to water. However, this material is hard and can present challenges to reconstruction of pavement that has been constructed with CTB.

Although the use of cement in the base material produces a material of superior structural performance as compared to untreated base material, the addition of cement also produces a material subject to shrinkage and cracking as the base matures. These cracks will propagate to the surface of asphalt pavements and will require crack sealing, possibly soon after completion of the pavement installation.

One method to reduce reflective cracking is a procedure termed "pre-cracking" in accordance with TxDOT Item 276.4.5. The concept of pre-cracking is to induce multiple microcracks instead of occasional transverse cracks. After placement and compaction, the CTB must be kept continuously moist for 24 to 48 hours. The pre-cracks are created either one or two days after construction using a 10- to 12-ton vibratory roller with the vibrator set on the maximum amplitude and traveling at a speed of about 2 mph. Usually, two vibratory rolling passes are sufficient to generate the microcracks.

CTRB: Cement Treated Recycled Base (CTRB) is similar to CTB but uses pulverized material from the existing pavement section instead of new material for the aggregate. CTRB is essentially weak concrete. It offers relatively high strength, and generally performs better than other base materials such as crushed limestone when exposed to water.

The existing pavement, including asphalt and base, ranged in thickness from 5 to 7 inches. The recommended pavement sections require a thicker base course than can be constructed with existing base material. CTRB can still be used provided that either additional base material is imported or a higher percentage of cement is used to account for the increased fines content from using some subgrade materials in the CTRB.

Langerman Foster will need to work with the contractor to make sure that appropriate mixtures of CTRB are constructed.

For streets that incorporate reclaimed pavement mixed in-place with subgrade materials, we recommend at least 9% cement for planning purposes. If imported materials with a smaller clay fraction are used in lieu of subgrade materials, then 8% can be used for planning purposes.

Laboratory tests must be conducted to determine the appropriate amount of cement for the soils actually encountered to meet a target strength of about 250 to 500 psi.

Tables 6.4A and 6.4B contain the approximate weights of cement to add per square yard for the various thicknesses of CTRB and percentages of cement.

TABLE 6.4A: CEMENT WEIGHTS AT 8 PERCENT	
Thickness of CTRB (inches)	***Lbs. Cement per Square Yard at 8%***
8	58
10	72
Note: The above weights are for planning purposes. Laboratory tests must be conducted to determine the appropriate amount of cement for the soils actually encountered to meet a target strength of about 250 to 500 psi.	

TABLE 6.4B: CEMENT WEIGHTS AT 9 PERCENT	
Thickness of CTRB (inches)	***Lbs. Cement per Square Yard at 9%***
8	65
10	81
Note: The above weights are for planning purposes. Laboratory tests must be conducted to determine the appropriate amount of cement for the soils actually encountered to meet a target strength of about 250 to 500 psi.	

Imported materials may be added to existing pavement materials to create CTRB. In general, pit run sands/gravels with low percentages of fines are preferred. Sources and materials will need to be evaluated on a case-by-case basis.

Recycling:

The following steps summarize the procedures provided in TxDOT Item 275.4 and apply to recycling of the existing base with the addition of Portland cement.

Step 1- Scarification and Pulverization: The existing pavement should be scarified (ripped) before it can be pulverized. The depth of pulverization should correspond to the desired base thickness shown in Table 5.2. The particle distribution should have 100% smaller than 2 inch and 55% passing a No. 4 sieve. More than one pass with the pulverizing equipment may be needed.

Step 2- Shaping and Grading: The pulverized materials must be shaped to the desired cross-section and grade. This process may involve additional earthwork, including the addition or removal of material.

Step 3- Add Cement: Portland cement should be spread in a measured amount on the surface of the pulverized material in slurry form. The amount of cement applied to the recycled pulverized material is critical in this process, and approximate weights are shown in Table 5.3.

Step 4- Water Application: Water must be added to bring the aggregate-cement mixture to optimum moisture content. Adding too much moisture will be detrimental to the pavement performance, and should be avoided.

Step 5- Mixing: The mixture must be combined and blended using a pulverizing/mixing machine. Multiple passes of the mixer may be required to achieve a uniform blend of materials. Proper mixing and blending are critical in this process.

Step 6- Compaction: Compaction is usually performed with a smooth-drum vibratory roller. A pneumatic-tired roller may follow to finish the surface. Final compaction should take place no more than 3 hours past initial mixing of the cement.

Step 7- Curing: The surface must be kept moist by periodically applying water to the surface to avoid drying. This should be performed continuously for the first 24 hours. The prime coat should be applied as soon as possible thereafter to better seal the moisture inside the base.

Geogrid: Geogrid (GRID) acts as reinforcement in asphalt pavement sections to help reduce pavement cracking in existing fill materials. It also allows the use of thinner base sections. Geogrid may not completely prevent cracking in the pavement, but it will help to reduce cracking, especially linear cracking.

Specifications: Pavement specifications. The TxDOT citations below reference the 2014 Edition unless stated otherwise.

1. Hot Mix Asphalt Concrete (HMAC): TxDOT Item 340, Type C or D.

2. Crushed Concrete Base or Crushed Limestone Base (CLB): TxDOT Item 247, Type A or D, Grade 1-2 (or 2004 Spec Grade 2). Compact to at least 95% of ASTM D1557 (or 100% of TEX-113) at a moisture content range of 0 to +3% of optimum moisture content in 6-inch compacted lifts.

3. Cement Treated Base (CTB): City of Waco specifications. Use micro-cracking in accordance with TxDOT Item 276.4.5.

4. Cement Treated Recycled Base: TxDOT Item 275. Consists of a mixture of recycled asphalt/base/fill and Portland cement. Use the approximate weights of cement listed in Table 6.4 of this report for planning purposes. A compressive strength of about 250 to 500 psi is desired, although variations will occur due to the mixed nature of the base materials. ***Trial mixtures will be needed to assess the appropriate percentage of cement to add.*** During field placement, strength samples should be taken twice per day.

   If there is a shortage of available asphalt/base material within the existing roadways, then imported materials can also be used. In general, pit run sands/gravels with low percentages of fines are preferred. Sources and materials will need to be evaluated on a case-by-case basis.

5. Reinforced Concrete Pavement (RCP): TxDOT Item 360, Concrete Pavement. The concrete class should be specified as Class P in accordance with TxDOT Item 421, Portland Cement Concrete. TxDOT requires a strength of 4,000 psi at 28 days, along with other requirements in the specification. When sawcut joints are used, the cuts must be made within a few hours of concrete placement. ***Sawcuts must not be delayed to the following day.***

6. Geogrid: Tensar TX130S installed according to the manufacturer's recommendations.

7. Subgrade: If the subgrade is exposed for reconstructed pavement, scarify and re-compact the existing subgrade to at least 95% of ASTM D698 (or TEX-113-E) maximum dry density at a moisture content range of 0% to +3% of optimum moisture

content. This does not apply for reclaimed pavement, when CTRB is mixed in-place.

8. Transitions: Transitions from an asphalt pavement to a rigid pavement are often problematic in that over time a depression usually forms in the asphalt at the joint. This is caused when vehicle tires pass from the rigid concrete pavement to the flexible asphalt pavement. One method to reduce this effect is to continue a "lip" of concrete under the asphalt.

9. Drainage: The pavement must have positive drainage, and water must not pond in areas directly adjoining paved sections. Excess watering with sprinkler systems near the pavement should be avoided.

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7.0 DESIGN REVIEW AND LIMITATIONS

Design Review: The information contained in this report is based on preliminary site plans provided by the Client. Our recommendations may not be applicable if changes have been made to the original information that formed the basis for this report, and we must be retained to make a determination if changes have been made. We also must be given the opportunity to review construction documents to affirm that our recommendations have been interpreted correctly. We cannot be responsible for misinterpretations if not given the opportunity to review aspects of the project that are based on the contents of this report. Such a review is considered an additional service.

Limitations: This report has been prepared for the exclusive use of our client and their designated project design team. Preparation of the report has been performed using that degree of care and skill ordinarily exercised under similar conditions by reputable geotechnical engineers practicing in the same locality. No warranties, express or implied, are intended or made.

As stated in the attachment "Important Information about Your Geotechnical Engineering Report", the subsurface conditions are interpreted from samples taken only at the boring locations. During construction, variations will be encountered, and will require interpretation by LFE to verify the adequacy of the geotechnical recommendations. Other concerns and limitations are discussed in the attachment.

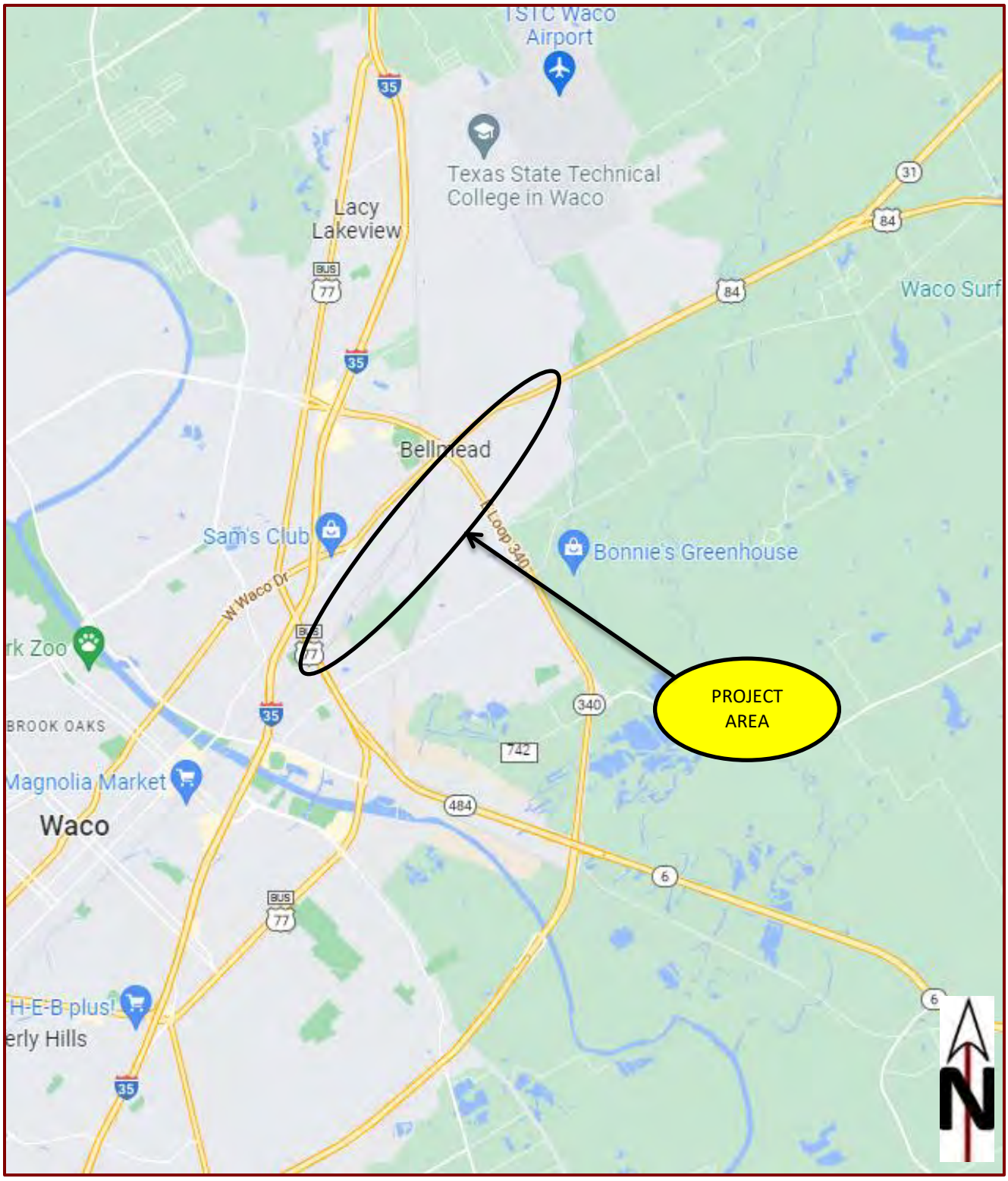
This investigation did not include environmental testing or evaluations, and does not address whether landfilling operations, as defined by the State of Texas, have occurred on the property. An environmental professional should be retained to address environmental issues.

8.0 REFERENCES:

1. Geologic Atlas of Texas, Waco Sheet, Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas 1970.

APPENDIX

Site Location Map
Boring Location Sketch
Laboratory Test Results
Boring Logs
Important Information about Your Geotechnical Engineering Report



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SITE LOCATION MAP

NORTH INTERCEPTOR SEWER
WACO, TEXAS
LE PROJECT NO. W22-038

PLATE

1

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BORING LOCATION MAP

NORTH INTERCEPTOR SEWER
WACO, TEXAS
LE PROJECT NO. W22-038

PLATE

2A

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BORING LOCATION MAP

NORTH INTERCEPTOR SEWER
WACO, TEXAS
LE PROJECT NO. W22-038

PLATE

2B

Boring No.	Sample Depth (ft.)	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Moisture Content (%)	Unit Dry Weight (pcf)	Unconfined Compressive Strength (tsf)	Strain at Failure (%)
B-1	2.0 - 3.5	27	15	12	44	6			
B-1	8.5 - 10.0	33	15	18	54	9			
B-1	10.0 - 11.5				21	4			
B-2	0.0 - 1.5	31	16	15	30	3			
B-2	2.0 - 3.5				45	10			
B-2	4.0 - 5.5	43	19	24	68	16			
B-2	10.0 - 11.5				15	8			
B-3	1.0 - 2.5	27	17	10	60	17			
B-3	2.5 - 4.0					14	114.7	5.0	4.9
B-3	4.0 - 6.0	36	14	22	85	14			
B-3	8.0 - 10.0				15	7			
B-3	13.5 - 15.0				4	11			
B-3	18.5 - 19.9	66	25	41	97	19			
B-4	0.7 - 2.0					16			
B-4	2.0 - 4.0	36	13	23	71				
B-4	8.0 - 10.0	NP	NP	NP	44	19			
B-4	13.5 - 15.0				3	16			
B-5	2.0 - 4.0					14	107.9	1.3	3.0
B-5	4.0 - 6.0	34	14	20	46	12			
B-5	10.0 - 11.5				14	15			
B-5	13.5 - 15.0				10	17			
B-6	0.0 - 1.5	39	18	21	43	6			
B-6	4.0 - 5.5	63	24	39	79	19			
B-6	8.0 - 10.0	67	24	43	80	25			
B-6	18.5 - 20.0				20	12			
B-7	0.0 - 1.5				24	4			
B-7	4.0 - 5.5	36	16	20	60	8			
B-7	8.5 - 10.0	38	15	23	72	13			
B-7	13.5 - 15.0				21	5			
B-7	23.5 - 25.0	64	21	43	91	23			
B-8	0.0 - 1.5	17	11	6	51	7			
B-8	2.0 - 3.5	31	14	17	58	9			
B-8	8.0 - 9.5	28	14	14	54	9			
B-8	13.5 - 15.0				40	11			
B-8	23.5 - 25.0				3	17			
B-9	2.0 - 3.5				41	3			
B-9	4.0 - 5.5	43	16	27	31	7			
B-9	8.0 - 9.5				37	7			
B-9	13.5 - 15.0				3	12			
B-10	1.5 - 3.0	30	14	16	38	7			
B-10	6.0 - 7.5	43	16	27	33	15			
B-11	1.0 - 2.5	45	14	31	51	12			

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Summary of Laboratory Results

Project: North Interceptor Sewer

Project Number: W22-038

Boring No.	Sample Depth (ft.)	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Moisture Content (%)	Unit Dry Weight (pcf)	Unconfined Compressive Strength (tsf)	Strain at Failure (%)
B-11	6.0 - 7.5	45	16	29	88	17			
B-11	8.5 - 10.0				71	12			
B-11	13.5 - 15.0				12	4			
B-12	4.0 - 6.0	50	16	34	71	18			
B-12	10.0 - 11.5	50	15	35	59	17			
B-13	1.0 - 2.5	31	12	19	61	17			
B-13	8.0 - 10.0	43	15	28	76	15			
B-14	1.0 - 2.5	20	12	8	36	7			
B-14	4.0 - 5.5				38	8			
B-14	6.0 - 7.5	50	16	34	51	15			
B-14	13.5 - 15.0				32	10			
B-15	2.0 - 3.5				28	3			
B-15	4.0 - 5.5				32	7			
B-15	13.5 - 15.0				26	12			
B-16	0.0 - 2.0	37	14	23	47	9			
B-16	2.0 - 3.5				50	5			
B-16	6.0 - 7.5				25	9			
B-16	18.5 - 20.0	47	15	32	62	16			
B-17	0.5 - 2.0				36	9			
B-17	4.0 - 5.5	33	16	17	66	16			
B-17	8.0 - 10.0				44	14			
B-18	1.0 - 2.5	44	17	27	58	16			
B-18	2.5 - 4.0	33	14	19	64	13			
B-18	8.5 - 10.0				45	9			
B-19	2.5 - 4.0	27	12	15	58	8			
B-19	8.5 - 10.0				45	11			
B-19	13.5 - 15.0				25	9			
B-20	1.0 - 2.5				64	24			
B-20	2.5 - 4.0	48	16	32	60	15			
B-20	8.5 - 10.0	49	16	33	44	11			
B-20	18.5 - 20.0				8	2			

LANGERMAN FOSTER ENGINEERING COMPANY

Summary of Laboratory Results

Project: North Interceptor Sewer

Project Number: W22-038

Langerman Foster Engineering Company
Waco and Harker Heights (Killeen), Texas
Ph: 254-235-1048 www.LFECTX.com

BORING NO. B-1

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		CLAYEY SAND; brown	SS		11-10-13 (23)									
			A											
			SS		15-15-16 (31)		27	15	12	44	6			
			A											
5			SS		8-6-9 (15)									
			A											
			SS		12-9-8 (17)									
			A											
		SANDY LEAN CLAY; brown	SS		3-4-4 (8)		33	15	18	54	9			
10		CLAYEY SAND; tan, with gravel	SS		7-9-10 (19)					21	4			
			A											
			SS		8-14-21 (35)									
15			A											
		SHALE; gray	SS		30-50/5"									
20			A											
			SS		42-50/5"									
25			A											
			SS		50/6"									
30			A											

Completion Depth: 30 ft.
Date Started: 8/18/22
Completed: 8/18/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 30 feet using dry drilling techniques. Groundwater was observed at a depth of 23.5 feet. After a 10 minute observation period, groundwater was observed at a depth of 29.2 feet.

Langerman Foster Engineering Company
Waco and Harker Heights (Killeen), Texas
Ph: 254-235-1048 www.LFECTX.com

BORING NO. B-2

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		CLAYEY SAND; brown	SS		6-9-11 (20)		31	16	15	30	3			
			A											
			SS		9-4-5 (9)					45	10			
			A											
5		SANDY LEAN CLAY; brown	SS		3-3-3 (6)		43	19	24	68	16			
			A											
			SS		6-3-3 (6)									
			A											
		CLAYEY SAND; tan	ST			0.5								
10			SS		4-5-5 (10)					15	8			
			A											
			SS		7-14-13 (27)									
15			A											
		SHALE; gray ▽	SS		50/6"									
20			A											
			SS		50/6"									
25		▼	A											
			SS		50/6"									
30			A											

Completion Depth: 30 ft.
Date Started: 8/18/22
Completed: 8/18/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 30 feet using dry drilling techniques. Groundwater was observed at a depth of 19 feet. After a 10 minute observation period, groundwater was observed at a depth of 25.6 feet.

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BORING NO. B-3

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 6" Base	A											
		SANDY LEAN CLAY; dark brown, with gravel	SS		6-7-5 (12)		27	17	10	60	17			
			ST			2.0					14	115	5.0	4.9
5		LEAN CLAY; brown, with sand	ST			3.0	36	14	22	85	14			
			ST			4.0								
		CLAYEY SAND; tan and gray	ST			0.5				15	7			
10			SS		4-7-7 (14)									
			A											
		SAND; tan and gray, with gravel	SS		6-7-7 (14)					4	11			
15			A											
		SHALE; gray	SS		25-38-50/5"		66	25	41	97	19			
20			A											
			SS		44-50/5"									
25			A											

Completion Depth: 25 ft.
Date Started: 8/10/22
Completed: 8/10/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 25 feet using dry drilling techniques. Groundwater was observed at a depth of 9.5 feet. After a 10 minute observation period, groundwater was observed at a depth of 9.1 feet.

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Waco and Harker Heights (Killeen), Texas
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BORING NO. B-4

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2.5" Asphalt over 5" Base	A											
		LEAN CLAY; dark brown, with sand	ST			1.0					16			
			ST			1.5	36	13	23	71				
5			ST			1.5								
			ST			2.0								
		SILTY SAND; tan	ST			1.0	NP	NP	NP	44	19			
10			ST			2.0								
			A											
		SAND; tan	SS		7-10-7 (17)					3	16			
15			A											
			SS		9-13-38 (51)									
20		SHALE; gray	A											
			SS		29-32-50/5"									
25			A											

Completion Depth: 25 ft.
Date Started: 8/10/22
Completed: 8/10/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 25 feet using dry drilling techniques. Groundwater was observed at a depth of 15 feet. After a 10 minute observation period, groundwater was observed at a depth of 14.5 feet.

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BORING NO. B-5

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		1" Asphalt over 5" Base	A											
		SANDY LEAN CLAY; brown	SS		8-4-5 (9)									
		CLAYEY SAND; brown	ST			1.5					14	108	1.3	3.0
5			ST			4.0	34	14	20	46	12			
			SS		3-4-5 (9)									
			A											
			SS		8-9-8 (17)									
10		--- with gravel	SS		5-3-5 (8)					14	15			
			A											
		SAND; tan, with gravel	SS		3-4-7 (11)					10	17			
15			A											
20			SS		9-18-29 (47)									

Completion Depth: 20 ft.
Date Started: 8/10/22
Completed: 8/10/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 20 feet using dry drilling techniques. Groundwater was observed at a depth of 12.6 feet. After a 10 minute observation period, groundwater was observed at a depth of 12.3 feet.

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BORING NO. B-6

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		CLAYEY GRAVEL; brown	SS		10-5-5 (10)		39	18	21	43	6			
			A											
			SS		7-3-3 (6)									
			A											
5		FAT CLAY; brown, with sand and gravel	SS		3-5-7 (12)		63	24	39	79	19			
			A											
			ST			1.5								
			ST			1.5	67	24	43	80	25			
10			ST			1.0								
			A											
		--- tan and gray	ST			1.5								
15			A											
		CLAYEY SAND; gray, with gravel	SS		14-32-7 (39)					20	12			
20														

Completion Depth: 20 ft.
Date Started: 8/12/22
Completed: 8/12/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 20 feet using dry drilling techniques. Groundwater was observed at a depth of 15 feet. After a 10 minute observation period, groundwater was observed at a depth of 13 feet.

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BORING NO. B-7

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		CLAYEY SAND; brown, with gravel	SS		19-12-9 (21)					24	4			
			A											
			SS		9-8-7 (15)									
			A											
5		SANDY LEAN CLAY; tan and brown	SS		3-5-5 (10)		36	16	20	60	8			
			A											
		LEAN CLAY; brown, with sand	SS		9-6-7 (13)									
			A											
10			SS		7-12-12 (24)		38	15	23	72	13			
			SS		16-17-17 (34)									
			A											
		CLAYEY SAND; brown	SS		5-6-7 (13)					21	5			
15			A											
			SS		5-4-10 (14)									
20			A											
		FAT CLAY; gray	SS		11-13-23 (36)		64	21	43	91	23			
25			A											
		SHALE; gray	SS		33-50/5"									
30			A											

Completion Depth: 30 ft.
Date Started: 8/18/22
Completed: 8/18/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 30 feet using dry drilling techniques. Groundwater was not observed above that depth.

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BORING NO. B-8

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		SANDY, SILTY CLAY; brown	SS		6-6-8 (14)		17	11	6	51	7			
			A											
		SANDY LEAN CLAY; red-brown	SS		8-11-12 (23)		31	14	17	58	9			
			A											
5			SS		6-8-9 (17)									
			A											
			SS		7-7-8 (15)									
			A											
		--- light brown	SS		8-8-9 (17)		28	14	14	54	9			
10			A											
			SS		8-14-16 (30)									
			A											
		CLAYEY SAND; red-tan ▽ ▼	SS		6-4-4 (8)					40	11			
15			A											
		SAND; tan	SS		40-45-36 (81)									
20			A											
			SS		10-11-10 (21)					3	17			
25			A											
			SS		4-6-13 (19)									
30														

Completion Depth: 30 ft.
Date Started: 8/19/22
Completed: 8/19/22
Logged by: G. Mosley

Remarks: Boring was advanced to a depth of 30 feet using dry drilling techniques. Groundwater was observed at a depth of 14.5 feet. After a 10 minute observation period, groundwater was observed at a depth of 13.7 feet.

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BORING NO. B-9

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		LEAN CLAY; brown, with sand	ST			1.0								
		CLAYEY SAND; tan and brown	SS		16-8-9 (17)					41	3			
			A											
5			SS		5-11-16 (27)		43	16	27	31	7			
			A											
			SS		19-14-13 (27)									
			A											
			SS		8-10-6 (16)					37	7			
10			A											
			SS		6-4-7 (11)									
			A											
		SAND; tan	SS		13-17-21 (38)					3	12			
15			A											
			SS		1-3-15 (18)									
20														

Completion Depth: 20 ft.
Date Started: 8/19/22
Completed: 8/19/22
Logged by: G. Mosley

Remarks: Boring was advanced to a depth of 20 feet using dry drilling techniques. Groundwater was observed at a depth of 8.7 feet. After a 10 minute observation period, groundwater was observed at a depth of 8.4 feet.

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BORING NO. B-10

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 6" Base												
		CLAYEY SAND; red-brown	A											
			SS		7-7-2 (9)		30	14	16	38	7			
			A											
5			SS		3-5-6 (11)									
			A											
			SS		7-8-8 (16)		43	16	27	33	15			
			A											
10			SS		2-5-4 (9)									
			SS		3-4-17 (21)									
		▽	A											
15			SS		7-11-7 (18)									

Completion Depth: 15 ft.
Date Started: 8/11/22
Completed: 8/11/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 15 feet using dry drilling techniques. Groundwater was observed at a depth of 12.8 feet. After a 10 minute observation period, groundwater was observed at a depth of 12.8 feet.

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BORING NO. B-11

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 6" Base	A											
		SANDY LEAN CLAY; dark brown	SS		6-4-4 (8)		45	14	31	51	12			
			SS		2-2-4 (6)									
5		LEAN CLAY; brown, calcareous	ST			4.0								
			SS		3-7-9 (16)		45	16	29	88	17			
			A											
		--- with sand	SS		2-4-4 (8)					71	12			
10		CLAYEY SAND; tan, with gravel	SS		4-5-7 (12)									
			A											
15			SS		10-11-11 (22)					12	4			

Completion Depth: 15 ft.
Date Started: 8/11/22
Completed: 8/11/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 15 feet using dry drilling techniques. Groundwater was not observed above that depth.

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BORING NO. B-12

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 4" Base	A											
		SANDY FAT CLAY; brown	SS		5-4-3 (7)									
			SS		3-2-3 (5)									
5		FAT CLAY; brown, with sand	ST			2.0	50	16	34	71	18			
		--- light brown	ST			2.0								
10			ST			4.0								
		SANDY FAT CLAY; tan and brown, calcareous	SS		4-6-8 (14)		50	15	35	59	17			
			A											
15		CLAYEY SAND; tan	SS		2-3-4 (7)									

Completion Depth: 15 ft.
Date Started: 8/11/22
Completed: 8/11/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 15 feet using dry drilling techniques. Groundwater was not observed above that depth.

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BORING NO. B-13

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 4" Base	A											
		SANDY LEAN CLAY; brown	SS		15-6-3 (9)		31	12	19	61	17			
			SS		2-1-1 (2)									
5		LEAN CLAY; brown, with sand	ST			2.0								
			ST			2.5								
			ST			3.0	43	15	28	76	15			
10			SS		4-6-10 (16)									
			A											
			ST			3.5								
15														

Completion Depth: 15 ft.
Date Started: 8/11/22
Completed: 8/11/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 15 feet using dry drilling techniques. Groundwater was not observed above that depth.

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BORING NO. B-14

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 4.5" Base	A											
		CLAYEY SAND; brown	SS		14-16-11 (27)		20	12	8	36	7			
			SS		5-7-8 (15)									
5			SS		8-8-5 (13)					38	8			
			A											
		SANDY FAT CLAY; brown and red-brown	SS		3-5-7 (12)		50	16	34	51	15			
			A											
10			SS		5-5-10 (15)									
			SS		11-12-15 (27)									
			A											
		CLAYEY SAND; red-brown	SS		6-8-8 (16)					32	10			
15														

Completion Depth: 15 ft.
Date Started: 8/11/22
Completed: 8/11/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 15 feet using dry drilling techniques. Groundwater was not observed above that depth.

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BORING NO. B-15

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		SANDY LEAN CLAY; brown	SS		5-7-9 (16)									
			A											
		CLAYEY SAND; brown	SS		12-7-7 (14)					28	3			
			A											
5		--- with gravel from 4 feet to 6 feet	SS		3-2-2 (4)					32	7			
			A											
		--- red-brown	SS		4-6-9 (15)									
			A											
10			SS		3-7-7 (14)									
			SS		9-10-12 (22)									
			A											
15		--- tan and brown	SS		5-8-8 (16)					26	12			
			A											
20			SS		8-7-10 (17)									

Completion Depth: 20 ft.
Date Started: 8/11/22
Completed: 8/11/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 20 feet using dry drilling techniques. Groundwater was not observed above that depth.

Langerman Foster Engineering Company
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BORING NO. B-16

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		CLAYEY SAND; brown	ST			4.5+	37	14	23	47	9			
		SANDY LEAN CLAY; red-brown	SS		6-8-11 (19)					50	5			
			A											
5			SS		3-4-3 (7)									
			A											
		CLAYEY SAND; red-brown and tan	SS		3-4-4 (8)					25	9			
			A											
			SS		3-5-2 (7)									
10			SS		5-6-7 (13)									
			A											
			SS		3-9-12 (21)									
15			A											
		SANDY LEAN CLAY; brown and tan calcareous	SS		5-7-9 (16)		47	15	32	62	16			
20														

Completion Depth: 20 ft.
Date Started: 8/12/22
Completed: 8/12/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 20 feet using dry drilling techniques. Groundwater was not observed above that depth.

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BORING NO. B-17

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 5" Base	A											
		CLAYEY SAND; brown, with gravel	SS		6-2-2 (4)					36	9			
			SS		3-3-5 (8)									
			A											
5		SANDY LEAN CLAY; brown	SS		1-2-1 (3)		33	16	17	66	16			
			A											
			SS		3-4-5 (9)									
			A											
		CLAYEY SAND; light brown and brown	ST			3.5				44	14			
10			ST			2.5								
			A											
15			SS		2-2-3 (5)									

Completion Depth: 15 ft.
Date Started: 8/11/22
Completed: 8/11/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 15 feet using dry drilling techniques. Groundwater was not observed above that depth.

Langerman Foster Engineering Company
Waco and Harker Heights (Killeen), Texas
Ph: 254-235-1048 www.LFECTX.com

BORING NO. B-18

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		1.5" Asphalt over 4" Base	A											
		SANDY LEAN CLAY; brown	SS		9-4-3 (7)		44	17	27	58	16			
			ST			4.5	33	14	19	64	13			
5			ST			4.5+								
		--- red-brown	SS		4-6-9 (15)									
			A											
		CLAYEY SAND; tan and brown	SS		3-4-6 (10)					45	9			
10			SS		4-4-5 (9)									
			A											
15			SS		4-5-6 (11)									

Completion Depth: 15 ft.
Date Started: 8/12/22
Completed: 8/12/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 15 feet using dry drilling techniques. Groundwater was not observed above that depth.

Langerman Foster Engineering Company
Waco and Harker Heights (Killeen), Texas
Ph: 254-235-1048 www.LFECTX.com

BORING NO. B-19

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 3" Base	A											
		SANDY LEAN CLAY; brown	SS		4-5-4 (9)									
			SS		7-6-8 (14)		27	12	15	58	8			
5			SS		3-3-4 (7)									
			A											
			SS		8-9-10 (19)									
			A											
		CLAYEY SAND; red-brown	SS		4-4-5 (9)					45	11			
10			ST			4.5+								
			A											
			SS		4-5-6 (11)					25	9			
15			A											
			SS		5-7-9 (16)									
20														

Completion Depth: 20 ft.
Date Started: 8/12/22
Completed: 8/12/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 20 feet using dry drilling techniques. Groundwater was not observed above that depth.

Langerman Foster Engineering Company
Waco and Harker Heights (Killeen), Texas
Ph: 254-235-1048 www.LFECTX.com

BORING NO. B-20

CLIENT City of Waco **PROJECT NAME** North Interceptor Sewer

PROJECT NUMBER W22-038 **PROJECT LOCATION** Waco, TX

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	STRAIN AT FAILURE (%)
0		2" Asphalt over 3" Base	A											
		SANDY LEAN CLAY; brown	SS		6-1-1 (2)					64	24			
			ST			2.0	48	16	32	60	15			
5			ST			4.5+								
			ST			4.5+								
			A											
		CLAYEY SAND; light brown	SS		7-7-7 (14)		49	16	33	44	11			
10		--- red-brown	SS		10-10-14 (24)									
			A											
			ST			4.5								
15			A											
		SAND; red-brown, with clay	SS		8-8-12 (20)					8	2			
20														

Completion Depth: 20 ft.
Date Started: 8/12/22
Completed: 8/12/22
Logged by: T. Jackson

Remarks: Boring was advanced to a depth of 20 feet using dry drilling techniques. Groundwater was not observed above that depth.

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
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23 August 2022

Mr. Kyle Shulze
Walker Partners
823 Washington Avenue, Suite 100
Waco, TX 7671

Re: North Interceptor Wastewater Improvements - Waters of the United States Delineation
Approximately 33.5 acres located along a corridor extending from the intersection of Coffee Street and U.S. Highway (US) 77 Business to the intersection of Williams Road and US 84 in the City of Waco, McLennan County, Texas.

Dear Mr. Shulze

Integrated Environmental Solutions, LLC (IES) performed a site survey to identify any aquatic features that meet a definition of a water of the United States on approximately 33.5 acres located along a corridor extending from the intersection of Coffee Street and US 77 Business to the intersection of Williams Road and US 84 in the City of Waco, McLennan County, Texas. (**Attachment A, Figure 1**). This report will ultimately assess and delineate potentially jurisdictional aquatic features to ensure compliance with Clean Water Act (CWA) Sections 401 and 404.

INTRODUCTION

Waters of the United States are protected under guidelines outlined in CWA Sections 401 and 404, in Executive Order (EO) 11990 (Protection of Wetlands), and by the review process of the Texas Commission on Environmental Quality (TCEQ). Agencies that regulate impacts to the nation's water resources within Texas include the U.S. Army Corps of Engineers (USACE), the U.S. Environmental Protection Agency (USEPA), the U.S. Fish and Wildlife Service (USFWS), and the TCEQ. The USACE has the primary regulatory authority for enforcing CWA Section 404 requirements for waters of the United States.

The decision for whether a CWA Section 404 permit is required on a property is determined if there are waters of the United States present and the extent of losses of those features. The USACE and USEPA have gone through rulemaking to define what is a water of the United States, independently and jointly, several times since the initial CWA. The longest standing definitions of waters of the United States were those published in 1986; however, these definitions were challenged in 2001 and 2007 U.S. Supreme Court decisions. Since then, both the Obama and Trump administration completed rulemaking to modify the definitions of waters of the United States in the Clean Water Rule in 2016 and the Navigable Water Protection Rule (NWPR) in 2020. A recent federal district court decision in Arizona struck down the NWPR but was silent on which definitions of waters of the United States would replace it. As of the date of this letter report, the USACE Fort Worth District has provided verbal guidance that the USACE will be utilizing the pre-2015 definitions (i.e., 1986 definitions combined with the *Rapanos* and *Carabell* U.S. Supreme Court decisions) to define waters of the United States. USEPA has indicated that the pre-2015 definitions will be in place until new definitions have been developed as part of the new definitions rulemaking process that was started in June 2021, prior to the Arizona court decision.

1986 Waters of the United States Definitions and Rapanos Decision

The definition of waters of the United States, in 33 Code of Federal Regulations (CFR) 328.3, includes waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, wetlands, sloughs, wet meadows, or natural ponds and all impoundments of waters otherwise defined as waters of the United States. Also included are wetlands adjacent to waters (other than waters that are themselves wetlands). The term *adjacent* is defined as bordering, contiguous, or neighboring. Jurisdictional wetlands are a category of waters of the United States and have been defined by the USACE as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Waters of the United States are defined in 33 CFR 328.3 (a), 13 November 1986, as:

1. *All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;*
2. *All interstate waters including interstate wetlands;*
3. *All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce including any such waters:*
    i. *Which are or could be used by interstate or foreign travelers for recreational or other purposes; or*
    ii. *From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or*
    iii. *Which are used or could be used for industrial purposes by industries in interstate commerce;*
4. *All impoundments of waters otherwise defined as waters of the United States under the definition;*
5. *Tributaries of waters identified in paragraphs (a)(1)-(4) of this section;*
6. *The territorial seas;*
7. *Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section.*

On 05 June 2007, the USACE and the USEPA issued joint guidance on delineation of waters on the United States based on the U.S. Supreme Court decisions in *Rapanos* and *Carabell*. Under this guidance, potential waters of the United States have been classified as traditional navigable waters (TNW), relatively permanent waters (RPW) (i.e., having flow most of the year or at least seasonally), or non-RPWs. This guidance states that TNWs and RPWs and contiguous or adjacent wetlands to these aquatic features are waters of the United States. Wetlands that are bordering, contiguous, or neighboring another water of the United States is considered adjacent. Additionally, wetlands that are within the 100-year floodplain of another water of the United States are also considered adjacent. Non-RPWs, wetlands contiguous or adjacent to non-RPWs, and isolated wetlands must undergo a "significant nexus" test on a case-by-case basis to determine the jurisdictional nature of these aquatic features. Under the "significant nexus" test a water feature must have substantial connection to a TNW by direct flow, or by indirect biological, hydrologic, or chemical connection. Under the "significant nexus" test the USACE District Engineer must submit the jurisdictional determination (JD) to the regional USEPA office, which makes the decision whether to move the JD to Headquarters USACE to make the final determination.

This guidance does not void the January 2001 decision of the U.S. Supreme Court in Solid Waste Agency of Northern Cook County (SWANCC) v. USACE which disallowed regulation of isolated wetlands under the CWA through the "Migratory Bird Rule." Previously, the USACE assumed jurisdiction over isolated waters of the United States based on its 1986 preamble stating that migratory birds used these habitats. The "Migratory Bird Rule" provided the nexus to interstate commerce and thus protection under the CWA. However, the new guidance does require that the "significant nexus" test be performed in addition to an analysis of other potential interstate commerce uses for isolated waters.

METHODOLOGY

Prior to conducting fieldwork, the U.S. Geological Survey (USGS) topographic map (**Attachment A, Figures 2A** and **2B**), the *Soil Survey of McLennan County, Texas*, and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) digital soil databases for McLennan County (**Attachment A, Figure 3**), the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) (**Attachment A, Figure 4**), and recent and historic aerial photographs of the proposed survey corridor were studied to identify possible aquatic features that could meet the definition of waters of the United States and areas prone to wetland development. Mr. Rafael Gomez, Mr. Ryan Galovich, and Ms. Emily Palsa of IES conducted the delineation in the field in accordance with the USACE procedures on 16 June 2022 and 11 July 2022.

Wetland determinations and delineations were performed on location using the methodology outlined in the 1987 Corps of Engineers Wetland Delineation Manual and the Regional Supplement to the Corps of Engineer Wetland Delineation Manual: Great Plains Region (Version 2.0). The presence of a wetland is determined by the positive indication of three criteria (i.e., hydrophytic vegetation, hydrology, and hydric soils). Potential jurisdictional boundaries for other water features (i.e., non-wetland) were delineated in the field at the ordinary high-water mark (OHWM). The 33 CFR 328.3 (c)(7) defines OHWM as the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Water feature boundaries were recorded on a Trimble GeoExplorer XT Global Positioning System (GPS) unit capable of sub-meter accuracy. Photographs were also taken at representative points within the survey corridor (**Attachment B**). Routine wetland determination data forms are provided in **Attachment C**.

RESULTS

Background Review

Topographic Setting

The USGS topographic map (Waco East 7.5' Quadrangle 1957, revised 1977) illustrates two blue line feature dividing the survey corridor, oriented northwest-to-southeast. Katy Lane is depicted within most of the survey corridor with a brief curve outside the boundary, followed by an abandoned railroad (*see* **Attachment A, Figure 2A**). The 2019 Waco East 7.5' Quadrangle map illustrates the blue line features and roadway in similar alignment, with only one additional roadway, Williams Road, replacing the abandoned roadway (*see* **Attachment A, Figure 2B**). The overall site topography was illustrated with slopes-oriented northwest-to-southeast. The maximum site elevation was approximately 460 feet above mean sea level (amsl) with and a minimum site elevation of approximately 410 feet amsl.

Soils

The USDA NRCS Web Soil Survey identified 11 soil map units within the survey corridor, Axtell fine sandy loam, 1 to 3 percent slopes; Bastsil fine sandy loam, 0 to 2 percent slopes; Bastsil-Urban land complex, 0 to 2 percent slopes; Bremond loam, 0 to 2 percent slopes; Chazos loamy fine sand, 1 to 3 percent slopes; Gholson fine sandy loam, 3 to 8 percent slopes; Gowen clay loam, frequently flooded; Mabank fine sandy loam, 0 to 1 percent slopes; Mabank-Bremond complex, 0 to 1 percent slopes; Urban land; and Wilson clay loam, 0 to 2 percent slopes. Gowen clay loam, frequently flooded; Mabank fine sandy loam, 0 to 1 percent slopes; and Mabank-Bremond complex, 0 to 1 percent slopes located within depressions are listed as a hydric soil on the Hydric Soils of Texas list prepared by the National Technical Committee for Hydric Soils (accessed 21 July 2022, McLennan County, Texas) (*see* **Attachment A, Figure 3**). Hydric soils are described as those soils that are sufficiently wet in the upper part to develop anaerobic conditions during the growing season.

FEMA FIRM

The FEMA FIRM (McLennan County; Map Panel 48309C0980D; effective 12 December 20019) shows most of the survey corridor to be within Zone AE (Special Flood Hazard Areas subject to inundation by the 1 percent annual chance flood; No base flood elevations determined). A small area along the Marlin Branch in the central portion is

within Zone AE (Floodway areas in Zone AE). The remaining areas, north of the survey corridor, are within Zone X (Areas determined to be outside the 0.2 percent annual chance flood) (*see* **Attachment A, Figure 4**).

Weather History

The weather history for Wunderground.com Whitley Place weather station (KTXWACO138) recorded no precipitation during the 7-day and the 30-day periods, prior to the site visit.

Field Investigation

The survey corridor was characterized by two distinct vegetation communities, as observed, **Forested Corridor** and **Urban Matrix.** The **Forested Corridor** was dominated by tree species including American elm (*Ulmus americana*), eastern redcedar (*Juniperus virginiana*), sugarberry (*Celtis laevigata*) and post oak (*Quercus stellata*). The understory was dominated by Chinese privet (*Ligustrum sinense*), greenbrier (*Smilax bona-nox*), and poison ivy (*Toxicodendron radicans*). The **Urban Matrix** consisted of frequently to infrequently maintained areas along the right-of-way (ROW) and developed areas. These areas consisted of species such as Bermudagrass (*Cynodon dactylon*), Johnsongrass (*Sorghum halepense*), dallisgrass (*Paspalum dilatatum*), King Ranch bluestem (*Bothriochloa ischaemum*), giant ragweed (*Ambrosia trifida*), and annual broomweed (*Amphiachyris dracunculoides*). Woody species such as sugarberry, American elm, cedar elm (*Ulmus crassifolia*), eastern redcedar, and bald cypress (*Taxodium distichum*) were observed scattered along fence lines and near residential developments. Vines along fence lines included saw greenbrier, and poison ivy.

Water from the survey corridor ultimately flows south into the Brazos River, a TNW. **Table 1** and the following paragraphs detail the aquatic features identified within the survey corridor at the time of evaluation (**Attachment A, Figure 5**).

Table 1. Aquatic Features Identified within the Survey Corridor

Water Identification	Hydrology Characteristics	Area (Acre)	Length (Linear Feet)
Tributary 1	Intermittent	0.03	72
Tributary 2	Ephemeral	0.01	110
Wetland 1	Seasonally Saturated	0.15	---
Wetland 2	Seasonally Saturated	0.02	---
Ditch 1	Ephemeral	0.01*	159

**Actual acreage less than 0.01 acre*

Tributary 1 was a relatively large tributary identified in the eastern half of the survey corridor. Tributary 1 entered the survey corridor along the northwestern boundary and continued southeast before exiting. The tributary's limits were identified and delineated by OHWM characteristics that included the destruction of terrestrial vegetation, the presence of litter and debris, sediment sorting, and a bed and bank. The channel's substrate was composed of silt and clay sediments. Tributary 1 was incised into the landscape between 2 to 5 feet with average OHWM widths between 7 to 12 feet. Given the tributary's relatively low location in the watershed and flowing water at the time of evaluation, it is IES's professional opinion that Tributary 1 would be considered to have intermittent flow.

Tributary 2 was a relatively small tributary identified through the central region. Tributary 2 was identified by OHWM characteristics that included the destruction of terrestrial vegetation, the presence of litter and debris, and a bed and bank. The channel's substrate was comprised of silt, sand, and clay. Tributary 2 was incised into the landscape 3 to 5 feet with average widths of 4 to 12 feet. Given the tributary's relatively high location in the watershed, small size, and lack of flowing water at the time of evaluation, it is IES's professional opinion that Tributary 2 would be considered to have ephemeral flow.

Wetlands 1 and **2** were identified as emergent, isolated wetlands in the central region of the survey corridor. Wetlands 1 and 2 were dominated by cedar elm, spikerush (*Eleocharis palustris*), and Virginia wildrye (*Elymus submuticus*). Hydric soil for Wetlands 1 and 2 was indicated by Redox Dark Surface with a matrix of 10YR 4/1 with redoximorphic concentrations of 5YR 4/6 in the matrix. Hydrologic indicators consisted of water marks, water-

stained leaves, and a sparsely vegetated concave surface. Given their location in the landscape and isolated nature, these wetlands are likely only saturated for short periods and would be considered seasonally saturated.

Ditch 1 was identified as an excavated trapezoidal channel constructed to convey stormwater from nearby roads downslope. Ditch 1 was a constructed to carry stormwater off the road when Katy Lane was constructed. The ditch was dry at the time of the evaluation; as such, it is IES' professional opinion that Ditch 1 would be considered to have ephemeral flow.

POTENTIAL JURISDICTIONAL ASSESSMENT

The 05 June 2007 USACE and USEPA jointly published instructional guidebook is intended to provide the USACE field staff a national standard operating procedure for conducting jurisdictional determinations. The guidebook was prepared by combining all prior applicable provisions, regulations, statutes, and case laws pertaining to the CWA. All terms, definitions, and conclusions regarding the jurisdictional nature of the aquatic features used within this report are derived directly, as they are practiced, from the guidance. The following outlines the applicable interpretations of the guidance appropriate for this situation. **Table 2** provides an overview of the jurisdictional assessment of the aquatic features under the 1986 Waters of the United States definitions and the *Rapanos* decision (*see* **Attachment A, Figure 5**).

Table 2. Jurisdictional Assessment of Aquatic Features Under the 1986 Definitions

Water Identification	Post-*Rapanos* Water Classification	33 CFR 328.3 Definition
Jurisdictional Features		
Tributary 1	RPW	(a)(5)
Tributary 2 (Marlin Branch)	Non-RPW with Significant Nexus to a TNW	(a)(5)
Wetland 1	Adjacent to an RPW	(a)(5)
Wetland 2	Adjacent to an RPW	(a)(5)
Non-Jurisdictional Features		
Ditch 1	Ditch	---

Jurisdictional Features

Tributary 1

Tributary 1 was identified with intermittent flow. As such, this feature would be considered an RPW and would meet a definition of a water of the United States. Therefore, this feature would be regulated under CWA Section 404.

Tributary 2 (Marlin Branch), and Wetlands 1 and 2

It was determined that Tributary 2 (Marlin Branch) had ephemeral flow; as such, this feature would be classified as non-RPW. Wetlands 1 and 2 were identified adjacent to Tributary 1, a RPW, and within the FEMA 100-year, a RPW. As such, these features would require a significant nexus test to determine the jurisdictional nature of these features.

The significant nexus test must prove direct flow or an indirect hydrological, biological, and chemical connection to a TNW. Wetlands 1 and 2 were observed adjacent to Tributary 1 and within the FEMA 100-year floodplain. Water from Tributary 2 flows directly into the Brazos River, a TNW. These features provide biological functions as habitat for amphibians and invertebrates, as well as mammals. The vegetation detritus provides the basis of a food web that supports the wildlife community downstream. These functions provide an indirect biological connection to the TNW. This feature also provides for the nutrient and chemical uptake of waters that enter the streams and the waters that percolate into the soils. This nutrient and chemical uptake provides for a reduced nutrient/chemical loading in the downstream water column. This provides an indirect chemical connection to a TNW. As such, it is IES' professional opinion that Tributary 2 and Wetlands 1 and 2 would be considered waters of the United States as they demonstrate an indirect biological, chemical, and hydrological connection to a TNW.

Non-Jurisdictional Features – Ditch 1

Ditch 1 was constructed in conjunction with Katy Lane prior to the 1970 aerial photograph. The ditch was predominantly located in a linear depression along the roadside until turning northeast and flowing into a drainage to the east. The USGS topographic map does not illustrate blue line feature in the location of Ditch 1 and the linear channel indicates the ditch was a man-made feature, constructed in an upland area. Current site conditions indicate that the ditch would be considered to have ephemeral flow. Under the 2007 guidance:

Drainage ditches would not be subject to jurisdiction under CWA Section 404 by definition, as such features;

- are not tributaries of waters, impoundment of waters, or are waters as defined in paragraphs (a)(1) through (7) of the CWA 33 CFR 328.3;
- are not TNW's or wetlands adjacent to a TNW, nor are they non-navigable tributaries of a TNW with relatively permanent flow or wetlands that abut such tributaries; and
- in accordance with the *Rapanos* guidance, ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water, are generally not considered to be waters of the United States.

Generally, under the guidance, features that do not have the physical characteristics of a tributary or a wetland and only convey sporadic flow with a speculative connection to a TNW are not considered waters of the United States. Thus, it is IES's professional opinion that Ditch 1 would not be considered a water of the United States under the 2007 guidance and would therefore not be regulated under CWA Section 404.

CONCLUSIONS

To summarize the delineation, two tributaries, two wetlands, and a ditch were identified and delineated within the survey corridor. A summary of the jurisdictional assessment is presented in **Table 2** under the 1986 waters of the United States definition and the *Rapanos* decision.

Under the ***1986 waters of the United States definitions*** and the *Rapanos* decision, **Tributary 1** would be considered jurisdictional as a RPW and **Tributary 2** would be considered jurisdictional as a non-RPW with significant nexus to a TNW. **Wetlands 1** and **2** would be considered jurisdictional as wetlands adjacent to a RPW with significant nexus to a TNW. These features would be regulated under CWA Section 404. **Ditch 1** would not be considered jurisdictional as it was observed with ephemeral flow and was not a replacement of, nor does it connect two waters of the United States, as such, it would not be regulated under CWA Section 404.

This delineation is based on professional experience in the approved methodology and from experience with the USACE Fort Worth District regulators; however, this delineation does not constitute a jurisdictional determination of waters of the United States. This delineation has been based on the professional experience of IES staff and our interpretation of USACE regulations at 33 CFR 328.3, the joint USACE/USEPA guidance regarding the *Rapanos* and *Carabell* decisions and the Regulatory Guidance Letter (RGL) 08-02. While IES believes our delineation to be accurate, final authority to interpret the regulations lies solely with the USACE and USEPA. The USACE Headquarters in association with the USEPA often issue guidance that changes the interpretation of published regulations. USACE/USEPA guidance issued after the date of this report has the potential to invalidate the report conclusions and/or recommendations, which may create the need to reevaluate the report conclusions. IES has no regulatory authority, as such, proceeding based solely upon this report does not protect the Client from potential sanction or fines from the USACE/USEPA. The Client acknowledges that they can submit this report to the USACE for a preliminary jurisdictional determination for concurrence prior to proceeding with any work within aquatic features located on the survey corridor. If the Client elects not to do so, then the Client proceeds at their sole risk.

IES appreciates the opportunity to work with you and Walker Partners on this project, and we hope we may be of assistance to you in the future. If you have any comments, questions, or concerns, please do not hesitate to contact us. We can be reached at 972-562-7672 or by email at rgomez@intenvsol.com or rreinecke@intenvsol.com.

Sincerely,

Integrated Environmental Solutions, LLC.

Mr. Rafael Gomez
Biologist

Attachments

File ref: 04.354.051

ATTACHMENT A
Figures

RFB 2023-026
Addendum 1

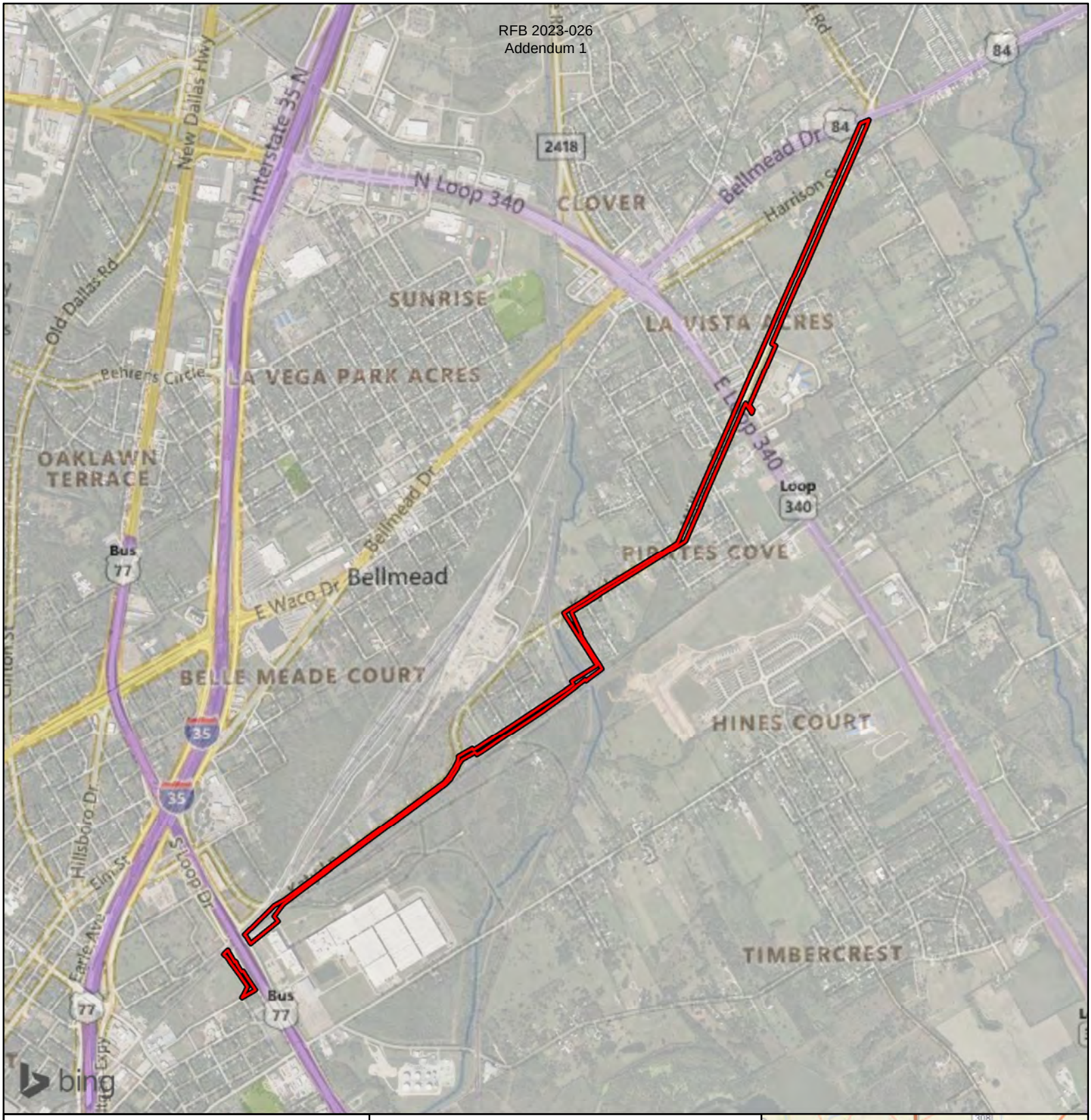


Figure 1.
General Location Map

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

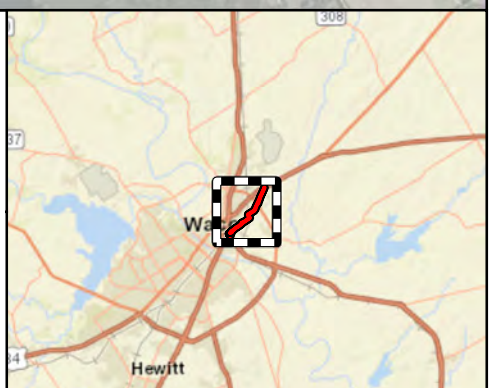
Survey Area

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 7/12/2022



Area of Detail

Scale: 1 inch equals 10 miles

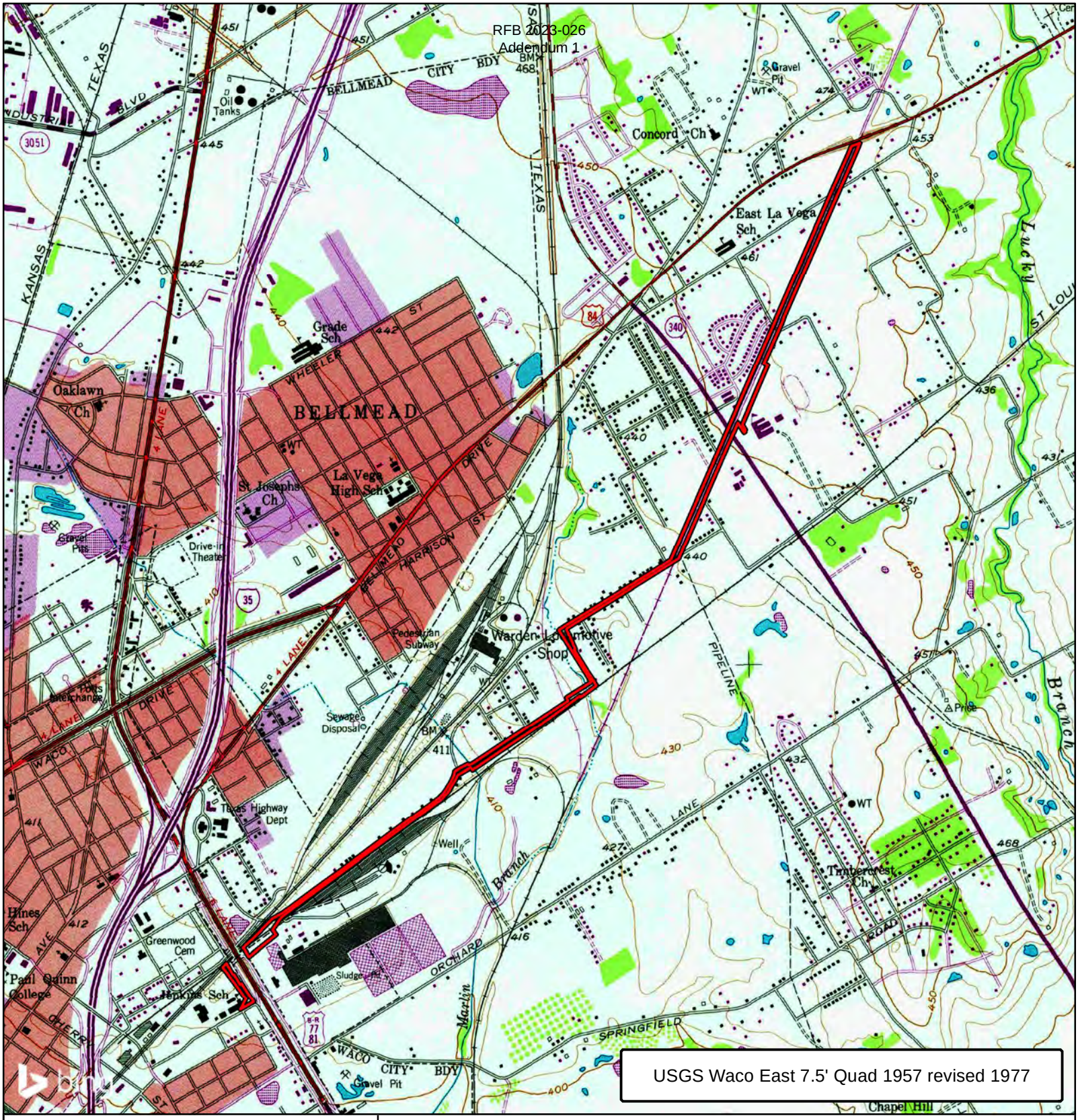


Figure 2A.
Topographic Setting

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

Survey Area

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 7/12/2022

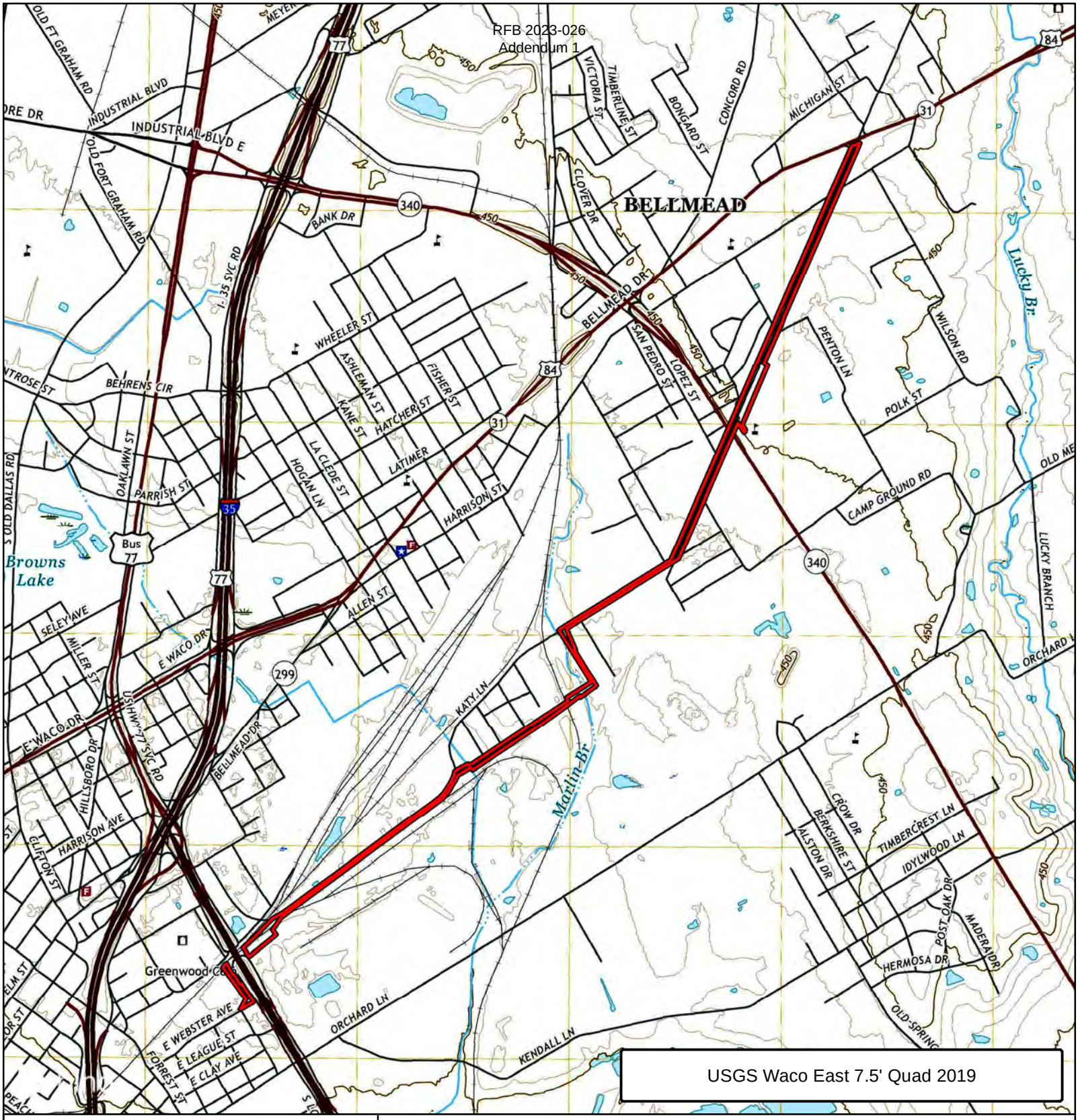


Figure 2B.
Topographic Setting

Survey Area

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 7/12/2022

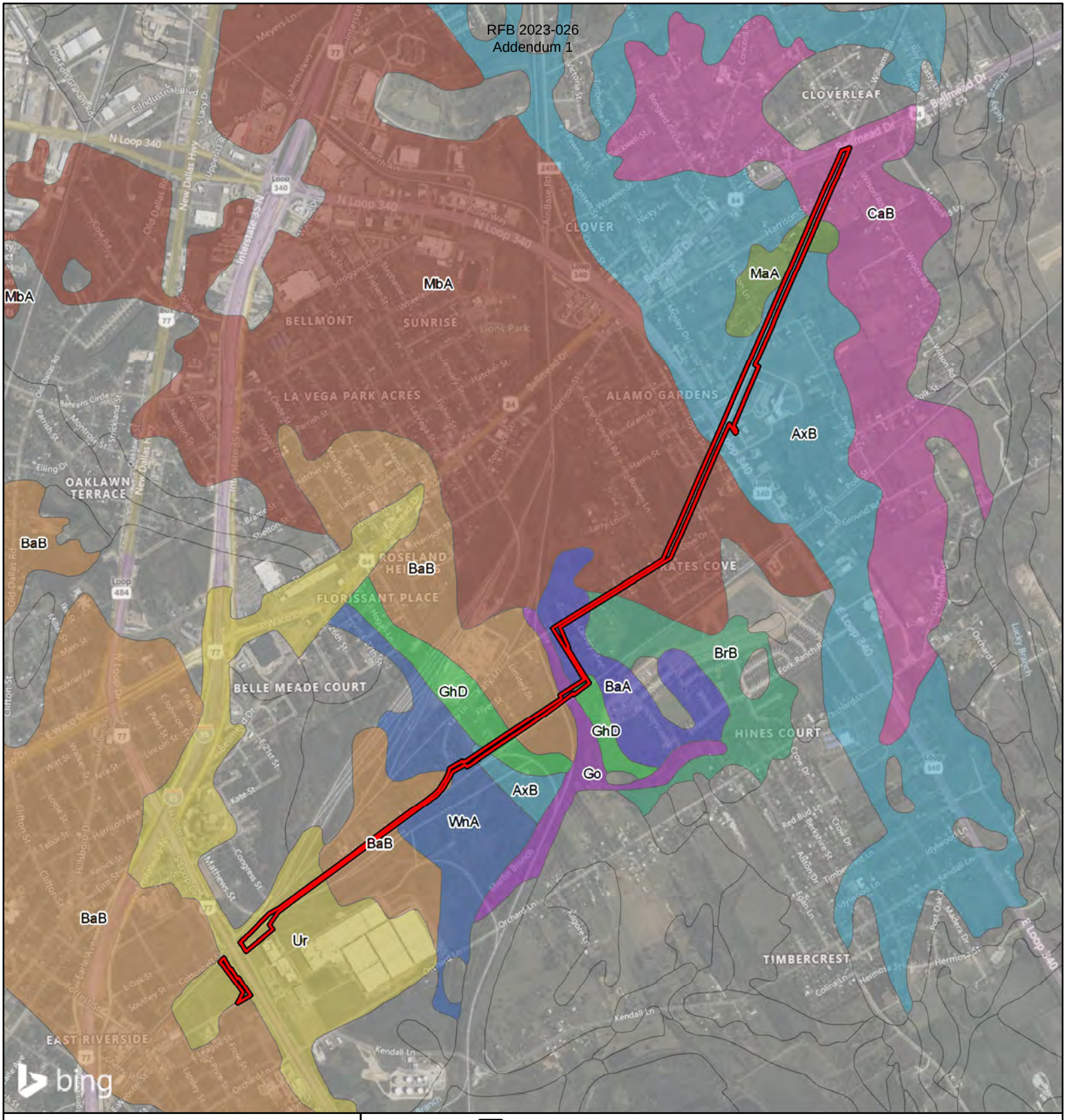


Figure 3.
Soils Map

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 7/25/2022

Survey Area
Soil map units outside the survey area

Soil Map units

- AxB - Axtell fine sandy loam, 1 to 3 percent slopes
- BaA - Bastsil fine sandy loam, 0 to 2 percent slopes
- BaB - Bastsil-Urban land complex, 0 to 2 percent slopes
- BrB - Bremond loam, 0 to 2 percent slopes
- CaB - Chazos loamy fine sand, 1 to 3 percent slopes
- GhD - Gholson fine sandy loam, 3 to 8 percent slopes
- Go - Gowen clay loam, frequently flooded
- MaA - Mabank fine sandy loam, 0 to 1 percent slopes
- MbA - Mabank-Bremond complex, 0 to 1 percent slopes
- Ur - Urban land
- WnA - Wilson clay loam, 0 to 2 percent slopes

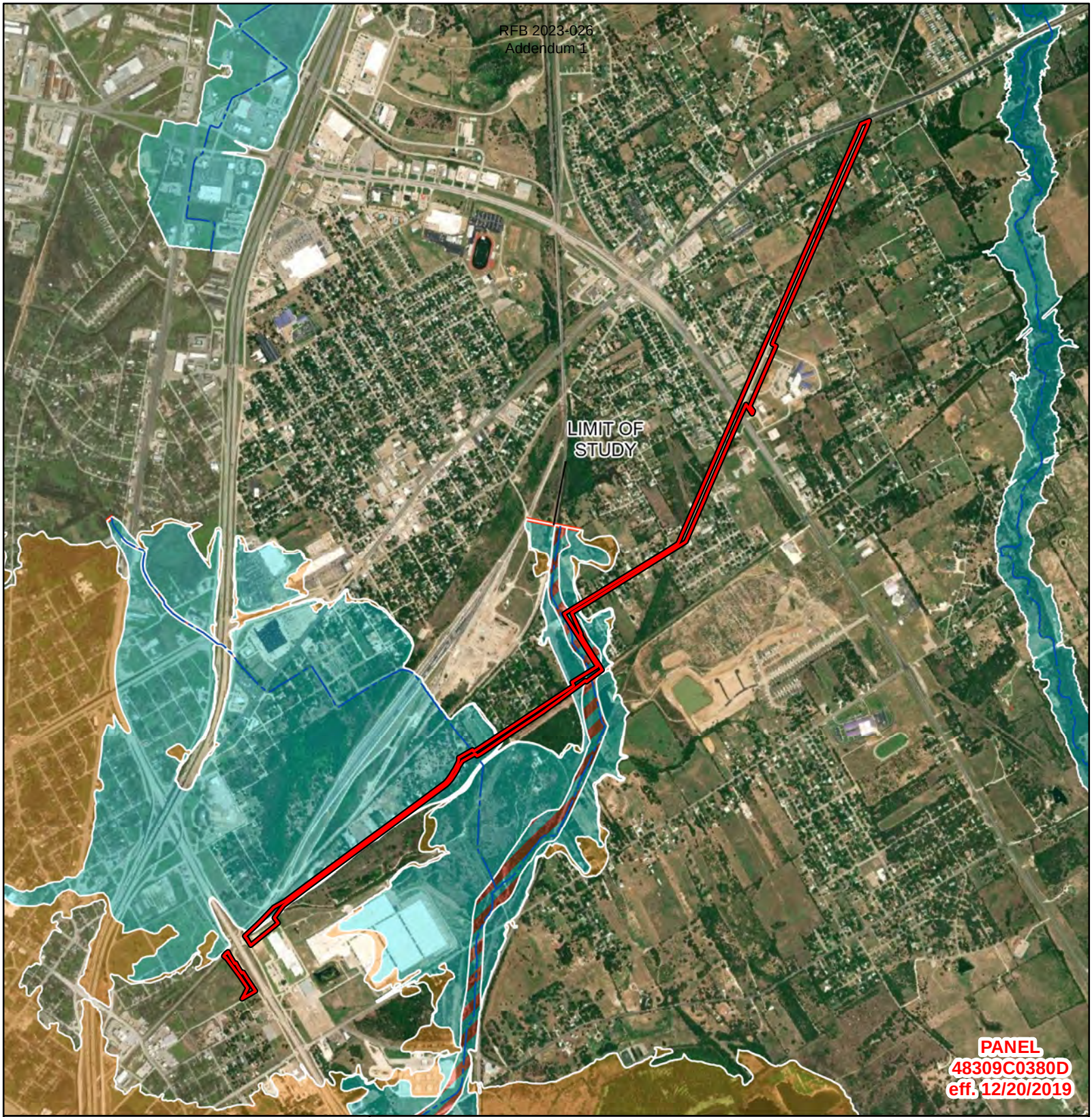


Figure 4.
Federal Emergency Management Agency Flood Insurance Rate Map

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 7/12/2022

Survey Area

FEMA FIRM Zone Descriptions

- Zone X - Areas determined to be outside the 0.2% annual chance floodplain
- Zone X - Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood
- Zone A - Special Flood Hazard Areas subject to inundation by the 1% annual chance flood; No base flood elevations determined
- Zone AE - Special Flood Hazard Areas subject to inundation by the 1% annual chance flood; Base flood elevations determined
- Zone AE - Floodway areas in Zone AE

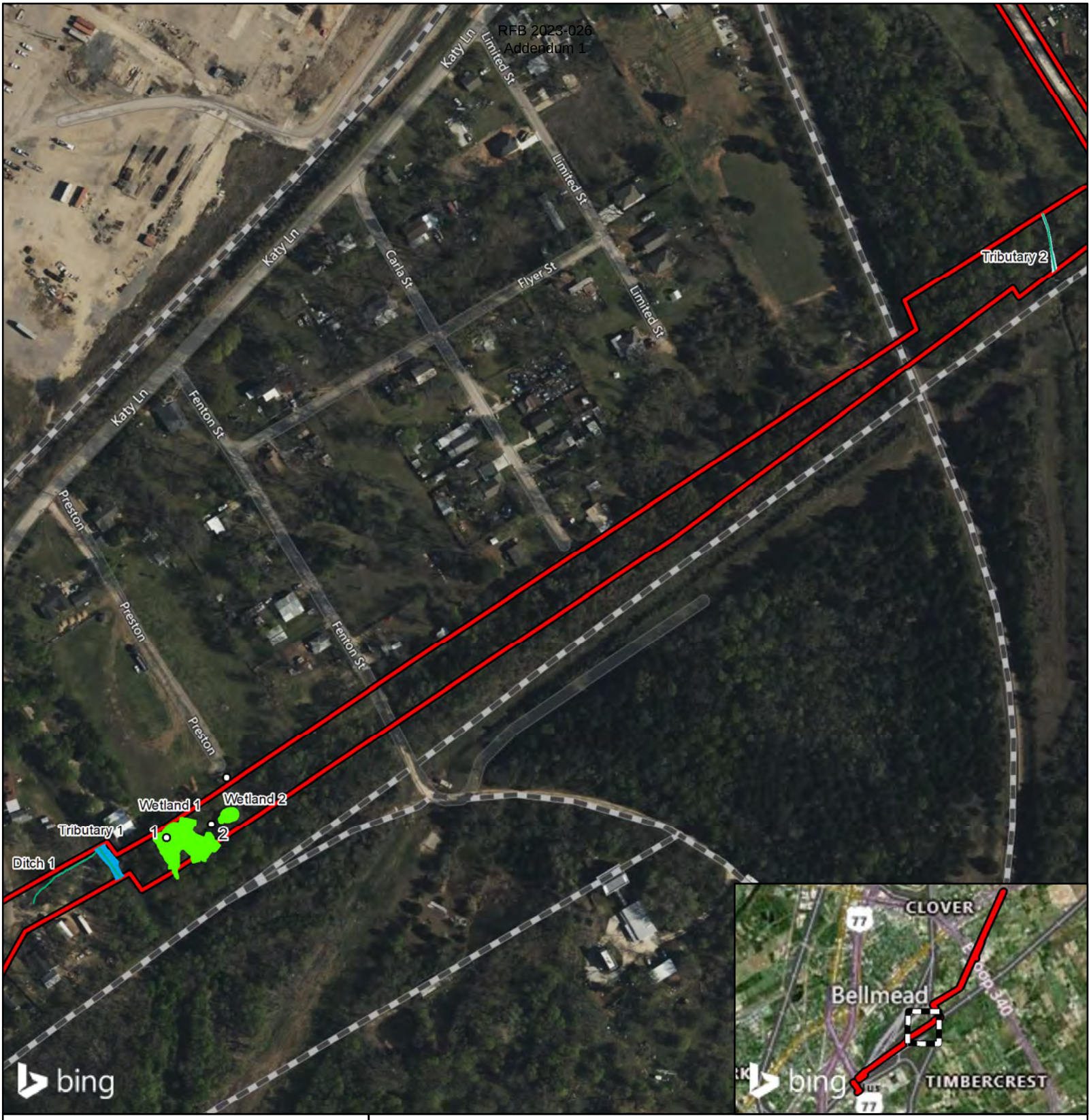


Figure 5.
Aquatic Resources Identified within the Survey Area

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

1 in = 250 feet

Feet
0 250

N
W E
S

File Ref. 04.142.030
Date: 8/5/2022

Survey Area

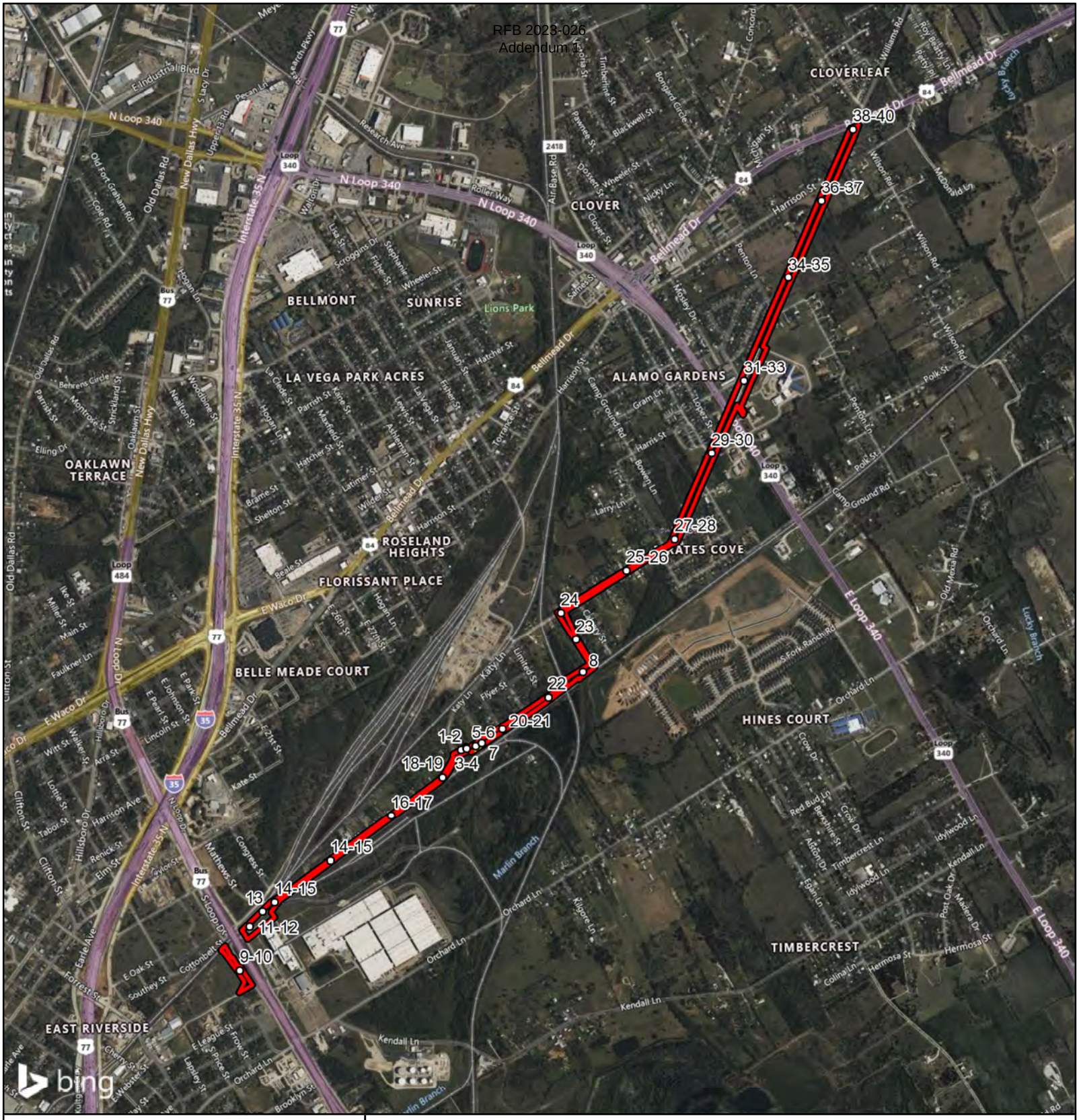
Aquatic Features that Meet a Definition of a Water of the United States

- Tributary, Ephemeral
- Tributary, Intermittent
- Wetland

Aquatic Features that Do Not Meet a Definition of a Water of the United States

- Ditch
- Culvert

ATTACHMENT B
Site Photographs



Photograph Location Map

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 8/5/2022

Survey Area
Photo Location

Aquatic Features that Meet a Definition of a Water of the United States

Tributary, Ephemeral
Tributary, Intermittent
Wetland

Aquatic Features that Do Not Meet a Definition of a Water of the United States

Ditch
Culvert

Photograph 1

Photograph 2

Photograph 3

Photograph 4

Photograph 5

Photograph 6

Photograph 7

Photograph 8

Photograph 9

Photograph 10

Photograph 11

Photograph 12

Photograph 13

Photograph 14

Photograph 15

Photograph 16

Photograph 17

Photograph 18

Photograph 19

Photograph 20

Photograph 21

Photograph 22

Photograph 23

Photograph 24

Photograph 25

Photograph 26

Photograph 27

Photograph 28

Photograph 29

Photograph 30

Photograph 31

Photograph 32

Photograph 33

Photograph 34

Photograph 35

Photograph 36

Photograph 37

Photograph 38

Photograph 39

Photograph 40

ATTACHMENT C
Routine Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: North Intercept | City/County: Bellmead/McLennan | Sampling Date: 7/11/22

Applicant/Owner: Walker Partners | State: Tx | Sampling Point: 1

Investigator(s): Emily Palsa; Rafael Gomez | Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Depression | Local relief (concave, convex, none): concave | Slope %: 2-3

Subregion (LRR): J | Lat: 31.579458 N | Long: -97.097287 W | Datum: NAD 1983

Soil Map Unit Name: Wilson clay loam, 0 to 2 percent slopes | NWI Classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are vegetation, ☐ Soil, ☐ Or hydrology ☐ Significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are vegetation, ☐ Soil, ☐ Or hydrology ☐ Naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	Is the Sampled Area within a wetland?	Yes ☒ No ☐
Hydric Soil Present?	Yes ☒	No ☐		
Wetland Hydrology Present?	Yes ☒	No ☐		

Remarks: Sparsely vegetated depression in forested setting

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot Size: 30' Radius)	Absolute % Coverage	Dominant Species?	Indicator Status
1. *Ulmus crassifolia*	60	Y	FAC
2.			
3.			
4.			
	60 = Total Cover		

Sapling/Shrub Stratum (Plot Size: 15' Radius)			
1. *N/A*			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot Size: 5' Radius)			
1. *Eleocharis palustris*	5	Y	OBL
2. *Elymus submuticus*	3	N	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	8 = Total Cover		

Woody Vine Stratum (Plot Size: 15' Radius)			
1. *N/A*			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 92

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply By:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is > 50%
- ___ 3 - Prevalence Index is ≤ 3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:

SOILS

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/10	96	5YR 4/6	4	C	M	Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR F)**
- ☐ 1 cm Muck (A9) (**LRR F, G, H)**
- ☐ Depleted below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☒ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ High Plains Depressions (F16 **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 CM Muck (A9) **(LRR I, J)**
- ☐ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ☐ Dark Surface (S7) **(LRR G)**
- ☐ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless distributed or problematic.

Restrictive Layer (if present):

Type: ---

Depth (inches): ---

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☒ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☒ Water Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry-Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☒ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ FAC-Neutral Test (D5)
- ☐ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes? ☐	No? ☒	Depth (inches): ---
Water Table Present?	Yes? ☐	No? ☒	Depth (inches): ---
Saturation Present? (includes capillary fringe)	Yes? ☐	No? ☒	Depth (inches): ---

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: North Intercept | City/County: Bellmead/McLennan | Sampling Date: 7/11/22

Applicant/Owner: Walker Partners | State: Tx | Sampling Point: 2

Investigator(s): Emily Palsa;Rafael Gomez | Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Hillslope | Local relief (concave, convex, none): none | Slope %: 1-2

Subregion (LRR): J | Lat: 31.579526 N | Long: -97.09701 W | Datum: NAD 1983

Soil Map Unit Name: Axtell fine sandy loam, 1 to 3 percent slopes | NWI Classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are vegetation, ☐ Soil, ☐ Or hydrology ☐ Significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are vegetation, ☐ Soil, ☐ Or hydrology ☐ Naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	☒	No	☐	Is the Sampled Area within a wetland? Yes ☐ No ☒
Hydric Soil Present?	Yes	☐	No	☒	
Wetland Hydrology Present?	Yes	☐	No	☒	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot Size: 30' Radius)	Absolute % Coverage	Dominant Species?	Indicator Status
1. *Ulmus crassifolia*	20	Y	FAC
2.			
3.			
4.			
	20	= Total Cover	

Sapling/Shrub Stratum (Plot Size: 15' Radius)			
1. *N/A*			
2.			
3.			
4.			
5.			
	0	= Total Cover	

Herb Stratum (Plot Size: 5' Radius)			
1. *Elymus submuticus*	90	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	90	= Total Cover	

Woody Vine Stratum (Plot Size: 15' Radius)			
1. *N/A*			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply By:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A=

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:

SOILS

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-16	10YR 3/2	100					Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) **(LRR F)**
- ☐ 1 cm Muck (A9) (**LRR F, G, H)**
- ☐ Depleted below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ☐ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ High Plains Depressions (F16 **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 CM Muck (A9) **(LRR I, J)**
- ☐ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ☐ Dark Surface (S7) **(LRR G)**
- ☐ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless distributed or problematic.

Restrictive Layer (if present):

Type: ---

Depth (inches): ---

Hydric Soil Present? Yes ☐ No ☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry-Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ FAC-Neutral Test (D5)
- ☐ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes? ☐ No? ☒ Depth (inches): ---

Water Table Present? Yes? ☐ No? ☒ Depth (inches): ---

Saturation Present? (includes capillary fringe) Yes? ☐ No? ☒ Depth (inches): ---

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

23 August 2022

Mr. Kyle Schulze, P.E.
Walker Partners
823 Washington Avenue; Suite 100
Waco, Texas 76701

Re: North Interceptor Wastewater Improvements - Protected Species Habitat Assessment
Approximately 33.5 acres located along a corridor extending from the intersection of Coffee Street and U.S. Highway (US) 77 Business to the intersection of Williams Road and US 84 in the City of Waco, McLennan County, Texas

Dear Mr. Schulze,

Integrated Environmental Solutions, LLC (IES) performed a protected species habitat assessment on approximately 33.5 acres located along a corridor extending from the intersection of Coffee Street and US 77 Business to the intersection of Williams Road and US 84 in the City of Waco, McLennan County, Texas. This habitat assessment was performed to satisfy the requirements regarding the Endangered Species Act (ESA). The following report is a list of the federal and state-listed protected species for McLennan County and their preferred vegetation assemblages, a summary of the vegetation communities identified on the site, an evaluation of whether the communities present on the site could support a protected species, and whether or not future proposed actions would affect listed species.

INTRODUCTION

Protected Species

Federal

The ESA of 1973 (Public Law [P.L.] 93-205) and the amendments of 1988 (P.L. 100-578) were enacted to provide a program of preservation for endangered and threatened species and to provide protection for ecosystems upon which these species depend for their survival. The ESA requires all federal agencies to implement protection programs for designated species and to use their authorities to further the purposes of the Act. Responsibility for the listing of an endangered or threatened species and for the development of recovery plans lies with the Secretary of Interior and Secretary of Commerce. The U.S. Fish and Wildlife Service (USFWS) is responsible for implementing the ESA within the United States.

An endangered species is a species, which is in danger of extinction throughout all or a significant portion of its range. A threatened species is a species likely to become endangered within the near future throughout all or a significant portion of its range. Proposed species are those, which have been formally submitted to Congress for official listing as endangered or threatened.

In addition, the USFWS has identified species, which are candidates for possible addition to the list of Endangered and Threatened Wildlife and Plants (50 Code of Federal Regulations [CFR] 17.11 and 17.12) under the ESA. The USFWS maintains a candidate list to: (1) provide advance knowledge of potential listings that could affect land planning decisions, (2) solicit input to identify candidates not requiring protection or additional species that may require protection under the ESA, and (3) solicit information needed to prioritize the order in which species will be proposed for listing. Candidate species have no legal protection under the ESA.

The Migratory Bird Treaty Act of 1918 states that it is unlawful to kill, capture, collect, possess, buy, sell, trade, or transport any migratory bird, nest, young, feather, or egg in part or in whole, without a federal permit issued in accordance with the Act's policies and regulations. However, in a recent decision the U.S. Court of Appeals for the Fifth Circuit found that for an unlawful "taking" to occur, a "deliberate act done directly and intentionally to migratory birds" would need to occur. (United States v. CITGO Petroleum Corp., No. 14-40128 [5th Cir. Sept. 4, 2015]).

State

The Texas Parks and Wildlife Department (TPWD) Wildlife Diversity Program (WDP) maintains computerized records of state-listed threatened and endangered species by county. The State of Texas does not list threatened and endangered species using the same criteria as the federal government. When the USFWS lists a plant species, the State of Texas then lists that plant. Thus, the list of threatened and endangered plants in Texas is the same as the Federal list. The state has separate laws governing the listing of animal species as threatened or endangered. Threatened and endangered animal species in Texas are those species so designated according to Chapters 67 and 68 of the Texas Parks and Wildlife Code and Section 65.171 - 65.184 of Title 31 of the Texas Administrative Code. Species that are not currently listed by the Federal government may be listed as threatened or endangered by the TPWD.

METHODOLOGY

Prior to conducting fieldwork, the list of Endangered and Threatened Wildlife and Plants under the ESA was obtained through the USFWS Information, Planning, and Conservation System (IPaC) and from the TPWD WDP and the Texas Natural Diversity Database (TXNDD). The vegetation communities used by each species was obtained and is detailed below. During the field survey, vegetation composition within and adjacent to the project site were noted to determine whether there was any potential for protected species habitat. This survey was not designed to identify the presence of protected species; however, if any species were observed, they were recorded. Photographs were taken at representative points, illustrating common vegetation communities within the survey area (**Attachment B**).

RESULTS

Literature Review

According to the USFWS, four species; Golden-cheeked Warbler (*Setophaga chrysoparia*), Piping Plover (*Charadrius melodus*), Red Knot (*Calidris canutus rufa*), and Whooping Crane (*Grus americana*) are listed as federally protected (i.e., threatened, or endangered) with the potential to occur within McLennan County. Two of these species are conditionally listed as threatened within McLennan County on the basis that the proposed project is for wind energy production, the Red Knot, and Piping Plover. The monarch butterfly (*Danaus plexippus*) is listed as candidate species with the potential to occur within McLennan County. The Texas fawnsfoot (*Truncilla macrodon*) was listed as a proposed threatened with the potential to occur within McLennan County. No federally listed critical habitat for these species is located within the vicinity of the survey corridor. The TPWD lists 13 state protected species that could occur within McLennan County, four of which are also federally listed avian species. The review of the TXNDD files did not indicate any unique vegetation communities, parks, or natural/managed areas within the survey area.

Attachment C identifies the state and federally protected species that could potentially occur within McLennan County from the IPAC and Rare and Threatened Endangered Species of Texas (RTEST) lists.

Site Survey

Mr. Rafael Gomez and Ms. Emily Palsa of IES evaluated the survey area on 11 July 2022. This survey was designed to provide a habitat evaluation of the overall survey area with the primary focus on the plant community.

The survey area was characterized by two distinct vegetation communities, as observed, **Forested Corridor** and **Urban Matrix**. The **Forested Corridor** was dominated by tree species including American elm (*Ulmus americana*), eastern redcedar (*Juniperus virginiana*), sugarberry (*Celtis laevigata*) and post oak (*Quercus stellata*). The understory was dominated by Chinese privet (*Ligustrum sinense*), greenbrier (*Smilax bona-nox*), and poison ivy (*Toxicodendron radicans*). The **Urban Matrix** consisted of frequently to infrequently maintained areas along the right-of-way (ROW)

and developed areas. These areas consisted of species such as Bermudagrass (*Cynodon dactylon*), Johnsongrass (*Sorghum halepense*), dallisgrass (*Paspalum dilatatum*), King Ranch bluestem (*Bothriochloa ischaemum*), giant ragweed (*Ambrosia trifida*), and annual broomweed (*Amphiachyris dracunculoides*). Woody species such as sugarberry, American elm, cedar elm (*Ulmus crassifolia*), eastern redcedar, and bald cypress (*Taxodium distichum*) were observed scattered along fence lines and near residential developments. Vines along fence lines included saw greenbrier, and poison ivy.

CONCLUSIONS

Preferred Habitat for Federally Protected Species

Table 1 provides a summary of the federally and state-listed species that could potentially occur within McLennan County, as well as a brief description of their habitat, whether this habitat is present within the survey area, and whether the proposed project would potentially affect the listed species.

Regarding federally listed threatened and endangered species, Golden-cheeked Warbler, Red Knot, Piping Plover, and Whooping Crane were listed for McLennan County. As these projects will not be related to wind energy, the Red Knot and Piping Plover will not be affected.

- The Golden-cheeked Warbler requires a habitat that includes forested areas dominated by Ashe juniper (*Juniperus ashei*) in mixed stands with various oaks (*Quercus* spp.). This unique vegetation community is not present within the survey corridor.
- Whooping Cranes utilize estuaries, prairie marshes, moist grasslands, croplands, and will use large shallow wetland areas associated with lakes for roosting and feeding. The survey corridor did not contain these types of vegetation communities.

As such, the habitats present within the survey corridor were not suitable for any of the federally listed threatened or endangered species. Nor were the habitats suitable for nesting, feeding, or stopover migration habitat for these species.

Preferred Habitat for State Protected Species

There were 13 state-listed threatened and endangered species for McLennan County, which includes all the above federally listed species. The following provide a summary of why the site's habitat is not preferred for the state listed species that were not identified above.

- Wood Stork nests in large tracts of bald cypress and forges in prairie ponds, flooded pastures, or fields, which is not present.
- Black Rail is found in salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps which are not present.
- White-faced Ibis prefers freshwater marshes, sloughs, and irrigated rice fields, which are not present.
- The sharpnose shiner and the smalleye shiner are restricted to the upper Brazos River, upstream of Possum Kingdom Lake. The survey corridor is north of the Brazos River, which is downstream from known habitat.
- Chub shiner is located on basins of the Brazos, Colorado, San Jacinto, and Trinity Rivers which were not present in the survey corridor.
- Brazos heelsplitter occurs most often in nearshore habitats such as banks and backwater pool which isn't provided in the survey corridor
- Texas horned lizard is found in semi-arid regions with sparse vegetation. Vegetation within the survey corridor was too dense to be preferred habitat for this species.

Table 1. Federally- and State- listed Threatened and Endangered Species Occurring or Potentially Occurring in McLennan County, Texas

Species	State Status	Federal Status	Description of Habitat	Habitat Present[1]	Species Effect[2]
BIRDS					
Black Rail (*Laterallus jamaicensis*)	T	---	Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous years dead grasses; nest usually hidden in marsh grass or at base of Salicornia.	No	No
Golden-cheeked Warbler (*Setophaga chrysoparia)*	E	LE	Ashe juniper in mixed stands with various oaks (*Quercus* spp.). Edges of cedar brakes. Dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer.	No	No
Piping Plover (*Charadrius melodus*)	T	LT	Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Based on the November 30, 1992 Section 6 Job No. 9.1, Piping Plover and Snowy Plover Winter Habitat Status Survey, algal flats appear to be the highest quality habitat. Some of the most important aspects of algal flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. Sand flats often appear to be preferred over algal flats when both are available, but large portions of sand flats along the Texas coast are available only during low-very low tides and are often completely unavailable during extreme high tides or strong north winds. Beaches appear to serve as a secondary habitat to the flats associated with the primary bays, lagoons, and inter-island passes. Beaches are rarely used on the southern Texas coast, where bayside habitat is always available, and are abandoned as bayside habitats become available on the central and northern coast. However, beaches are probably a vital habitat along the central and northern coast (i.e., north of Padre Island) during periods of extreme high tides that cover the flats. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or near secondary habitat, and with limited human disturbance.	No	No
Rufa Red Knot (*Calidris canutus rufa*)	T	LT	The Red Knot prefers the shoreline of coast and bays and uses mudflats during rare inland encounters. Primary prey items include coquina clam (*Donax* spp.) on beaches and dwarf surf clam (*Mulinia lateralis*) in bays, at least in the Laguna Madre. Wintering Range includes- Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kennedy, Kleberg, Matagorda, Nueces, San Patricio, and Willacy. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore.	No	No
White-faced ibis (*Plegadis chihi*)	T	--	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.	No	No
Whooping Crane (*Grus americana*)	E	LE	Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.	No	No
Wood stork (*Mycteria americana)*	T	---	Prefers to nest in large tracts of baldcypress (*Taxodium distichum*) or red mangrove (*Rhizophora mangle*); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e., active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960.	No	No
MOLLUSK					
Brazos heelsplitter (*Potamilus streckersoni*)	T	---	Reported from streams, but not far into the headwaters, to large rivers, and some reservoirs. In riverine systems occurs most often in nearshore habitats such as banks and backwater pools but occasionally in main channel habitats such as riffles. Typically found in standing to slow flowing water in soft substrates consisting of silt, mud or sand but occasionally in moderate flows with gravel and cobble substrates (Randklev et al. 2014b,c; Tsakiris and Randklev 2016b; Smith et al. 2019) [Mussels of Texas 2020]	No	No
Texas fawnsfoot (*Truncilla macrodon*)	T	PT	Occurs in large rivers but may also be found in medium-sized streams. Is found in protected near shore areas such as banks and backwaters but also riffles and point bar habitats with low to moderate water velocities. Typically occurs in substrates of mud, sandy mud, gravel and cobble. Considered intolerant of reservoirs (Randklev et al. 2010; Howells 2010o; Randklev et al. 2014b,c; Randklev et al. 2017a,b). [Mussels of Texas 2019]	No	No

Species	State Status	Federal Status	Description of Habitat	Habitat Present[1]	Species Effect[2]
FISH					
Sharpnose shiner (*Notropis oxyrhynchus*)	E	---	Range is now restricted to upper Brazos River upstream of Possum Kingdom Lake. May be native to Red River and Colorado River basins. Typically found in turbid water over mostly silt and shifting sand substrates.	No	No
Chub shiner (*Notropis potteri*)	T	---	Brazos, Colorado, San Jacinto, and Trinity River basins. Flowing water with silt or sand substrate	No	No
Smalleye shiner (*Notropis buccula*)	E	---	Endemic to the Brazos River drainage; presumed to have been introduced into the Colorado River. Historically found in lower Brazos River as far south as Hempstead, Texas but appears to now be restricted to upper Brazos River system upstream of Possum Kingdom Lake. Typically found in turbid waters of broad, sandy channels of main stream, over substrate consisting mostly of shifting sand.	No	No
REPTILES					
Texas horned lizard (*Phrynosoma cornutum*)	T	---	Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September.	No	No

LE – Federally Listed Endangered, LT – Federally Listed Threatened, DL – Federally Delisted, PT – Federally Proposed Threatened, E – State Listed Endangered, T - State Listed Threatened

[1]*Habitat Present? – Do the vegetation communities located within the survey area match the requirements for that particular protected species?*

[2]*Species Effect? – Will the proposed project potentially affect a protected species?*

Data Sources: USFWS IPaC (Published and accessed 28 July 2022), TPWD (Published 12 July 2022, accessed 28 July 2022), and field survey of the survey area

Vegetation Communities

None of the vegetation observed within the survey corridor would be considered unique or compose a unique vegetation type for the region. The vegetation communities described were composed of species that are not only common to grassland and forested areas, but to the Cross Timbers and Blackland Prairie eco-regions of Central Texas. It is IES' professional opinion that the proposed project will not have any effect on any unique vegetation, vegetation communities, or habitat types.

Potential to Affect Protected Species

As previously noted, habitat for any of the federally listed species and state listed species was not present within the survey area. As such, the proposed project is not expected to have any impacts on the federally or state-listed threatened or endangered species.

IES appreciates the opportunity to work with you and Walker Partners on this project and hope we may be of assistance to you in the future. If you have any comments, questions, or concerns, please do not hesitate to contact me at 972-562-7672 or by email at rgomez@intenvsol.com or rreinecke@intenvsol.com.

Sincerely,

Integrated Environmental Solutions, LLC.

Mr. Rafael Gomez
Biologist

Attachments

File ref: 04.142.030

ATTACHMENT A

Figures

RFB 2023-026
Addendum 1

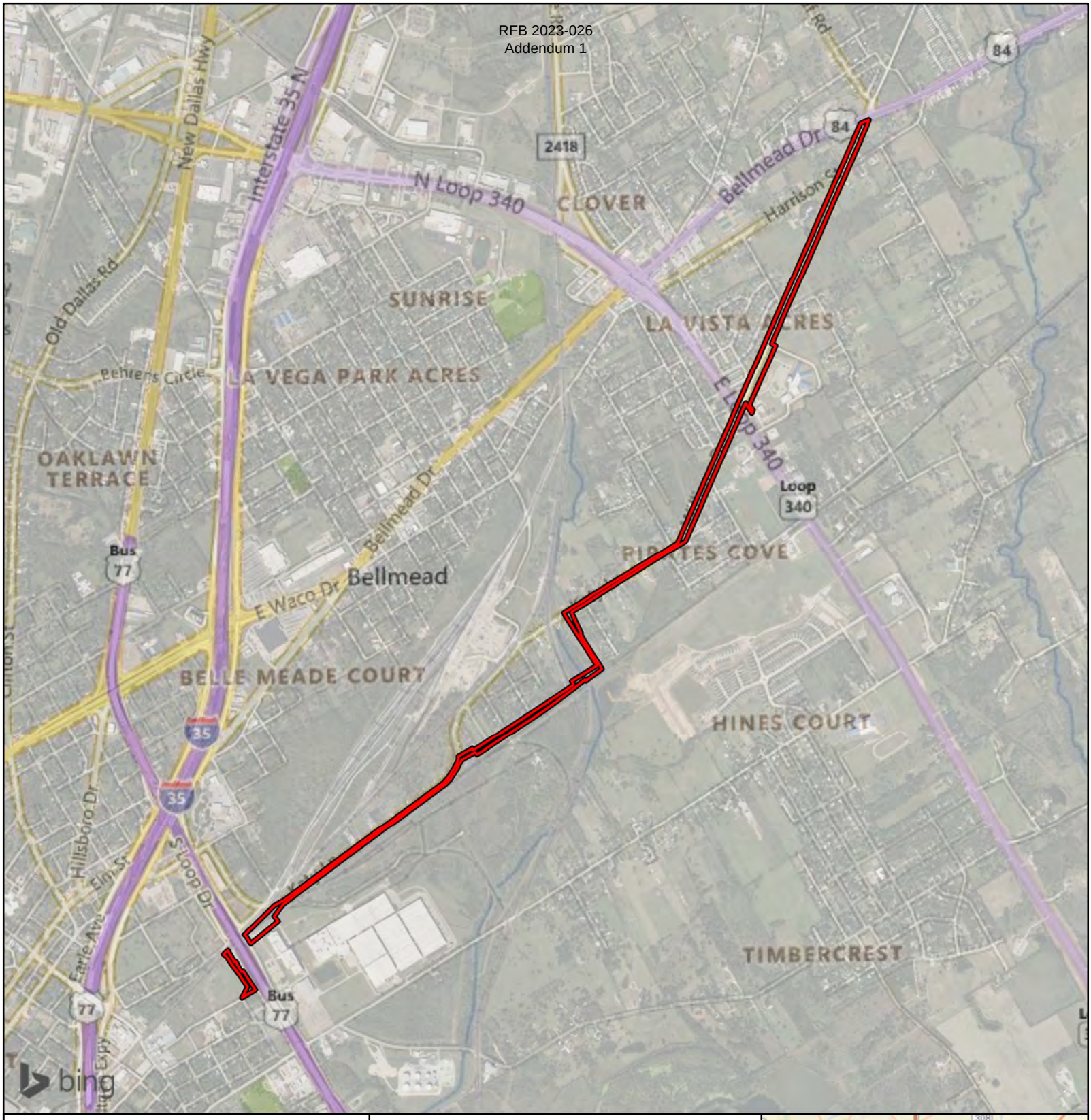


Figure 1.
General Location Map

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

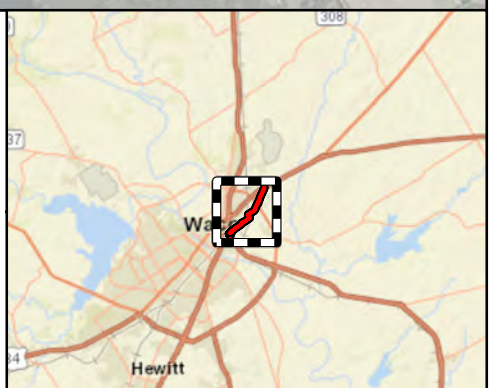
Survey Area

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 7/12/2022



Area of Detail

Scale: 1 inch equals 10 miles

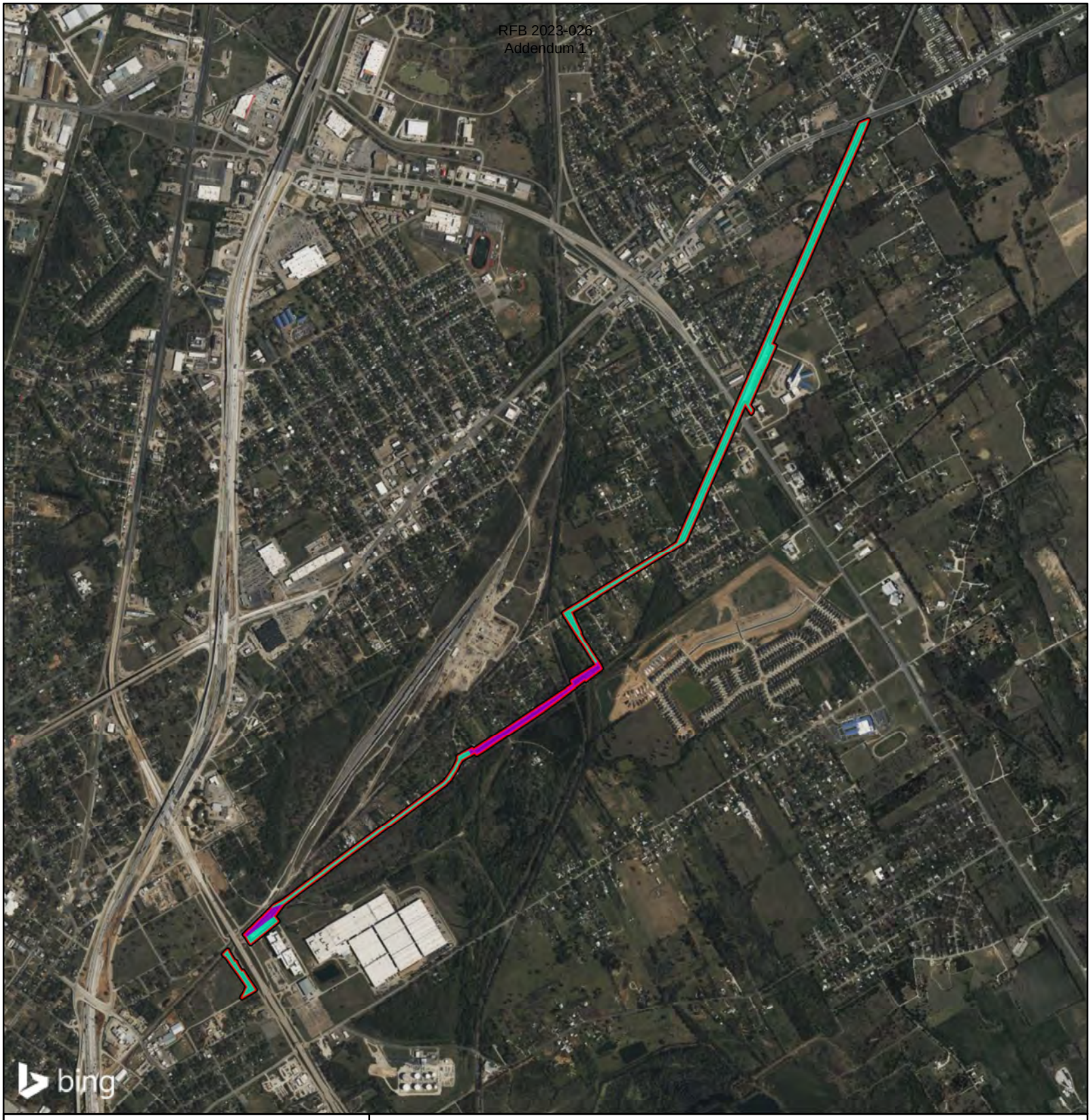


Figure 2.
Vegetation Communites

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 8/22/2022

Survey Area

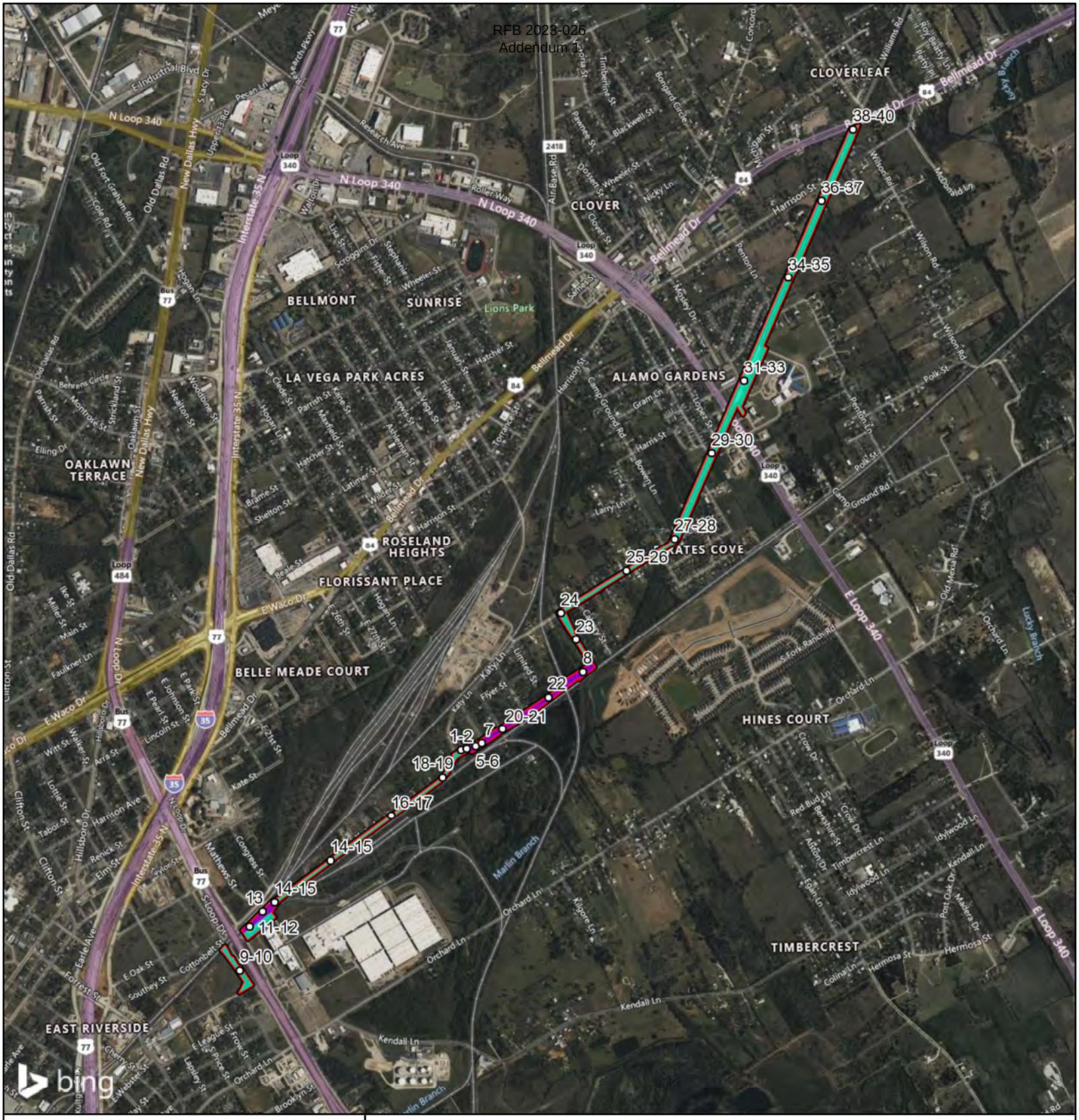
Vegetation Community

Forested Corridor

Urban Matrix

ATTACHMENT B

Site Photographs



Photograph Location Map

North Interceptor WW Improvements
City of Waco
McLennan County, Texas

Survey Area
Photo Location

Vegetation Community

Forested Corridor
Urban Matrix

1 in = 2,000 feet

Feet
0 2,000

N
W E
S

File Ref. 04.142.030
Date: 8/22/2022

Photograph 1

Photograph 2

Photograph 3

Photograph 4

Photograph 5

Photograph 6

Photograph 7

Photograph 8

Photograph 9

Photograph 10

Photograph 11

Photograph 12

Photograph 13

Photograph 14

Photograph 15

Photograph 16

Photograph 17

Photograph 18

Photograph 19

Photograph 20

Photograph 21

Photograph 22

Photograph 23

Photograph 24

Photograph 25

Photograph 26

Photograph 27

Photograph 28

Photograph 29

Photograph 30

Photograph 31

Photograph 32

Photograph 33

Photograph 34

Photograph 35

Photograph 36

Photograph 37

Photograph 38

Photograph 39

Photograph 40

ATTACHMENT C

Protected Species Lists

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
Phone: (512) 490-0057 Fax: (512) 490-0974

In Reply Refer To: July 28, 2022
Project Code: 2022-0068632
Project Name: North Interceptor WW Improvements

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
(512) 490-0057

Project Summary

Project Code: 2022-0068632
Project Name: North Interceptor WW Improvements
Project Type: Conservation Agreement
Project Description: Protected species habitat assessment.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@31.5885418,-97.08696729787141,14z

Counties: McLennan County, Texas

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Golden-cheeked Warbler *Setophaga chrysoparia*	Endangered
No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/33	
Piping Plover *Charadrius melodus*	Threatened
Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. The location of the critical habitat is not available. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/6039	
Red Knot *Calidris canutus rufa*	Threatened
There is **proposed** critical habitat for this species. The location of the critical habitat is not available. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/1864	
Whooping Crane *Grus americana*	Endangered
Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/758	

Clams

NAME	STATUS
Texas Fawnsfoot *Truncilla macrodon*	Proposed Threatened

There is **proposed** critical habitat for this species. The location of the critical habitat is not available.

Species profile: https://ecos.fws.gov/ecp/species/8965

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus*	Candidate

No critical habitat has been designated for this species.

Species profile: https://ecos.fws.gov/ecp/species/9743

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

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MCLENNAN COUNTY

BIRDS

black rail *Laterallus jamaicensis*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous years dead grasses; nest usually hidden in marsh grass or at base of Salicornia

Federal Status: LT	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S2

golden-cheeked warbler *Setophaga chrysoparia*

Ashe juniper in mixed stands with various oaks (Quercus spp.). Edges of cedar brakes. Dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer.

Federal Status: LE	State Status: E	SGCN: Y
Endemic: N	Global Rank: G2	State Rank: S2S3B

piping plover *Charadrius melodus*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Based on the November 30, 1992 Section 6 Job No. 9.1, Piping Plover and Snowy Plover Winter Habitat Status Survey, algal flats appear to be the highest quality habitat. Some of the most important aspects of algal flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. Sand flats often appear to be preferred over algal flats when both are available, but large portions of sand flats along the Texas coast are available only during low-very low tides and are often completely unavailable during extreme high tides or strong north winds. Beaches appear to serve as a secondary habitat to the flats associated with the primary bays, lagoons, and inter-island passes. Beaches are rarely used on the southern Texas coast, where bayside habitat is always available, and are abandoned as bayside habitats become available on the central and northern coast. However, beaches are probably a vital habitat along the central and northern coast (i.e. north of Padre Island) during periods of extreme high tides that cover the flats. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or in close proximity to secondary habitat, and with limited human disturbance.

Federal Status: LT	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S2N

rufa red knot *Calidris canutus rufa*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore. Bolivar Flats in Galveston County, sandy beaches Mustang Island, few on outer coastal and barrier beaches, tidal mudflats and salt marshes.

Federal Status: LT	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4T2	State Rank: S2N

whooping crane *Grus americana*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.

Federal Status: LE	State Status: E	SGCN: Y
Endemic: N	Global Rank: G1	State Rank: S1S2N

white-faced ibis *Plegadis chihi*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in
low trees, on the ground in bulrushes or reeds, or on floating mats.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S4B

wood stork *Mycteria americana*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers to nest in large tracts of baldcypress (Taxodium distichum) or red mangrove (Rhizophora mangle); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: SHB,S2N

FISH

sharpnose shiner *Notropis oxyrhynchus*

Range is now restricted to upper Brazos River upstream of Possum Kingdom Lake. May be native to Red River and Colorado River basins. Typically found in turbid water over mostly silt and shifting sand substrates.

Federal Status: LE	State Status: E	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S1S2

smalleye shiner *Notropis buccula*

Endemic to the Brazos River drainage; presumed to have been introduced into the Colorado River. Historically found in lower Brazos River as far south as Hempstead, Texas but appears to now be restricted to upper Brazos River system upstream of Possum Kingdom Lake. Typically found in turbid waters of broad, sandy channels of main stream, over substrate consisting mostly of shifting sand.

Federal Status: LE	State Status: E	SGCN: Y
Endemic: Y	Global Rank: G2	State Rank: S1S2

MOLLUSKS

Brazos heelsplitter *Potamilus streckersoni*

Reported from streams, but not far into the headwaters, to large rivers, and some reservoirs. In riverine systems occurs most often in nearshore habitats such as banks and backwater pools but occasionally in mainchannel habitats such as riffles. Typically found in standing to slow-flowing water in soft substrates consisting of silt, mud or sand but occasionally in moderate flows with gravel and cobble substrates (Randklev et al.
2014b,c; Tsakiris and Randklev 2016b; Smith et al. 2019) [Mussels of Texas 2020]

Federal Status:	State Status: T	SGCN: Y
Endemic: Y	Global Rank: GNR	State Rank: SNR

Texas fawnsfoot *Truncilla macrodon*

Occurs in large rivers but may also be found in medium-sized streams. Is found in protected near shore areas such as banks and backwaters but also riffles and point bar habitats with low to moderate water velocities. Typically occurs in substrates of mud, sandy mud, gravel and cobble. Considered intolerant of reservoirs (Randklev et al. 2010; Howells 2010o; Randklev et al. 2014b,c; Randklev et al. 2017a,b). [Mussels of Texas 2019]

Federal Status: PT	State Status: T	SGCN: Y
Endemic: Y	Global Rank: G1	State Rank: S2