TexAmericas CENTER

RESOLUTION NO. 20210525-01

A RESOLUTION APPROVING A QUALIFIED SITES PROGRAM FOR BRAZOS SITE UPON TEXAMERICAS CENTER EAST CAMPUS

WHEREAS, TexAmericas Center is a political subdivision of the State of Texas with the powers and authorities specified in Chapter 3503 of the Special District Local Laws Code of the State of Texas; and

WHEREAS, on August 25, 2020 the Board of Directors approved a Qualified Sites Program by Resolution 20200825-02 for the purpose of recognizing the commercial and industrial sites with characteristics and infrastructure in place that make the sites Shovel-Ready for development; and

WHEREAS, the goal of the Qualified Sites Program is to help developers, real estate professionals, both public and private utility companies and state partners understand and utilize the criteria outlined in this program, to recognize TAC as a nationally recognized industrial park with an inventory of attractive, pre-qualified, speculative sites ready for immediate development by end-users and for these groups to refer prospects to TAC for their business endeavors to take advantage of the location attributes; and

WHEREAS, staff has completed the Qualified Sites Program analysis of the Brazos Site, the site meets the program criteria and the data in this report is current as of today and will be updated as information changes, such as increased utility capacity, roadway changes, changes in community information, etc.; and

WHEREAS, this will serve as a template for future TAC Qualified Sites.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of TexAmericas Center the attached hereto as Exhibit "A" is approved and shall be implemented as of this date.

PASSED and APPROVED this 25th day of May, 2021.

Jim Roberts, Chairman of the Board

ATTEST:

Denis Washington, Secretary

Attached: Exhibit "A" – Qualified Sites Program BRAZOS SITE

TexAmericas CENTER®

Texarkana USA

Build | Lease | Manage | Sell | Incentives | Logistics

QUALIFIED SITES PROGRAM
BRAZOS SITE

TexAmericas Center – Texarkana MSA – Hooks, Texas

Qualified Site:

A Certified Site is a commercial or industrial site where the majority of the information (infrastructure, encumbrances, attributes, availabilities, etc.) needed for a development to go to construction has been obtained, organized, prepared and endorsed by an objective third-party assuring a higher level of accuracy of site conditions therefore reducing the unknowns and increasing the speed to development.

A **Qualified Site,** endorsed by TexAmericas Center, is a commercial or industrial tract of land that has undergone the same level of scrutiny as a site certified by an objective third party but has been prepared in-house by a qualified professional.

Jeff Whitten, P.E.
Jeff.Whitten@TexAmericasCenter.com
903.223.9841 - O 903.278.1821 - M

TABLE OF CONTENTS

1 ABOUT TEXAMERICAS CENTER

TexAmericas Center is one of the largest mixed-use industrial parks in the Americas and has recently been recognized as the 8th ranked industrial park in the nation by *Business Facilities*. TexAmericas Center is a State of Texas-sanctioned Local Redevelopment Authority. This unique organizational structure allows to act like a hybrid of an economic development organization and an industrial real estate development & management company. These characteristics allow it to offer tenants custom real estate solutions and unparalleled speed-to-market.

With the operating capabilities of a municipality and control of its own land use (zoning) regulations and permitting, TexAmericas Center eliminates much of the red tape inherent in traditional real estate processes. Depending on the size and complexity of a development, the plan review and approval may be completed in less than five (5) business days giving businesses a shorter timeline to become operational than may exist in other complexes or municipalities. In addition to permitting expediency and custom real estate solutions, TexAmericas Center offers unique value-added services including: third party logistics, transload activities, on-site rail service, incentive management and build-to-suit and/or build-out-to-suit services.

1.1 MISSION

TexAmericas Center's mission is to bring quality jobs to the greater Texarkana area and diversify the tax base through property redevelopment. The TexAmericas Center Board of Directors has mandated that staff **create 12,000 jobs on the property**. To fulfill this mission, TexAmericas Center redevelops and manages **12,000 acres and 3.5 million square feet** of former military property in centrally located Northeast Texas. TexAmericas Center is currently home to **33 manufacturing and commercial businesses**. TexAmericas Center and its Partners in Development have invested over **$40 million** in on-site infrastructure upgrades & environmental remediation and are committed to continue investing in our tenants, future tenants, and community.

1.2 LAND USE

TexAmericas Center is located outside of any city municipal boundaries and therefore controls its own land use (zoning) regulations and has designated its property for **light and heavy industrial uses.** All land and buildings are governed by TexAmericas Center planning, permitting, and approval processes, which are administered by an on-staff Professional Engineer. Guidelines covering development of the property, including but not limited to, Drainage Guidelines, Land Use Guidelines and Covenants, Codes & Restrictions are available from TexAmericas Center, most being easily accessible on our website, www.TexAmericasCenter.com and more specifically at https://texamericascenter.com/public-information/development-use-guidelines/.

1.3 CONTACT INFORMATION

Additional information about TexAmericas Center and the contents of this report may be obtained through the following:

Scott Norton
Executive Director & Chief Executive Officer
Scott.Norton@TexAmericasCenter.com
Office:903.223.9841

Jeff Whitten, P.E.
Executive Vice President & Chief Operations Officer
Jeff.Whitten@TexAmericasCenter.com
Office:903.223.9841 Mobile:903.278.1821

Eric Voyles
Executive Vice President & Chief Economic Development Officer
Eric.Volyes@TexAmericasCenter.com
Office:903.223.9841 Mobile:903.306.8923

TexAmericas Center
107 Chapel Lane
New Boston, Texas 75570
Office:903.223.9841

1.4 QUALIFIED SITES PROGRAM PURPOSE

The purpose of the TexAmericas Center (TAC) **Qualified Sites Program (QSP)** is to recognize the commercial and industrial sites with known development characteristics and available infrastructure in place that allow for the designation of the property as a **Qualified Site** meaning that the site is **Shovel-Ready** for vertical development.

When a site is designated as a **Qualified Site**, it has undergone a rigorous level of scrutiny to confirm that the site is **adjacent to utilities** typically needed for commercial and/or industrial operations, that site characteristics are **conducive to business activities**, that any **encumbrances** that might impact the property are known and that **key approvals**, documentation, regulations and assessments required for commercial or industrial uses are known and in place.

By having shovel-ready sites available, TAC will be able to better accommodate the needs and desires of prospective businesses. Companies that have immediate space and/or time requirements will have access to a greater amount of information potentially decreasing the chances of risks or constraints that could delay or derail a project.

In addition to designating sites as a Qualified Site, the qualification process will also help TAC identify gaps in information and attributes of its property and develop gap closure recommendations that will increase the inventory of **Qualified Sites**. The QSP

will also help elevate recognition of existing sites that may not be perceived as meeting the needs of business prospects that approach TAC for appropriate locations.

The goal of the QSP is to help developers, real estate professionals, both public and private utility companies and state partners understand and utilize the criteria outlined in this program, to recognize TAC as a nationally recognized industrial park with an inventory of attractive, pre-qualified, speculative sites ready for immediate development by end-users and for these groups to refer prospects to TAC for their business endeavors to take advantage of the location attributes.

Positioning a business prospect on a Qualified Site offers the company the ability to perform at a high standard. The coordination of these efforts may result in the ability of portions of TAC to be branded for a specific application or **Targeted Industry**. Project objectives include:

- Winning more projects;
- Filling identified market gaps;
- Establishing an expectation of high standards for development;
- Creating a high-quality product, a Qualified Site, that does not currently exist in the market;
- Creating an inventory of qualified speculative sites ready for immediate development prior to a prospect's inquiry

It is important to recognize that a principal goal of the program is to identify market gaps in TAC's portfolio of sites. Identifying the deficiencies in information or the availability of infrastructure will help TAC focus its efforts and attention on gaining this insight and prioritizing the extension of infrastructure to underserved properties. In addition, the recognition of sites that have been previously not perceived as having qualifying attributes will be recognized as a Qualified Site and marketed as such.

Creating an inventory of Qualified, Shovel-Ready Sites, defined as being ready for vertical development before a prospect conducts a site visit will help TAC convert more leads to announcements thus creating jobs, causing more investment and creating more quality commercial and industrial jobs in the region.

TAC reserves the right to amend or terminate the requirements of the QSP at any time.

2 THE BRAZOS SITE

2.1 PROPERTY ATTRIBUTES

The property that makes up the TexAmericas Center East campus transferred from the United States of America to Red River Redevelopment Authority (later renamed TexAmericas Center) by Deed Without Warranty on September 1, 2010, and recorded

in Volume 5898, Page 1 of the Real Property Records of Bowie County, Texas. A copy of this document is available from TexAmericas Center, most being easily accessible on our website, www.TexAmericasCenter.com.

The 250-acre Brazos Site is a greenfield development site situated on the TexAmericas Center East Campus (TAC East). The site is at the southeast corner of the intersection of Cass Street and Oak Street and is positioned to be the prominent development site near the entry into TAC East. This property is a wooded buffer area separating a former industrial tract from adjacent roadways and other land uses. Vicinity Maps (Figures A-1 to A-5) of TexAmericas Center as well as a Boundary Survey (Figure A-6) of the Brazos Site may be found in Appendix A.

2.2 PROPERTY TERRAIN

The Brazos Site slopes from the southwest to the northeast at approximately 1%. A Topographical Exhibit (Figure A-7) of the property can be found in Appendix A.

The site is wooded with a mixture of a variety of species of Pine trees and Oak trees. The site is accessible by vehicle to its boundary on the north and west property lines and by all-terrain vehicle/4WD from its eastern boundary. Additional information regarding the adjacent roads may be found in Section 5.1.1 of this document.

2.3 FLOOD PLAIN

Based on the National Flood Insurance Program Flood Insurance Rate Map for Bowie County Community Panel No. 48037C0310D with an effective date of October 19, 2010, the site is situated in Zone X. This area is defined as **'Areas determined to be outside of the 0.2% annual chance (500-year) floodplain'**. A copy of the firmette (Figure A-8) of the site is included in Appendix A.

2.4 GEOLOGICAL INFORMATION

Historical information in the form of a Soil Survey of Bowie County, Texas and on-the-ground investigation of the property are available to give an insight into the soil conditions on the Brazos Site.

2.4.1 Soil Survey of Bowie County, Texas

Based on the *Soil Survey of Bowie County, Texas* prepared by the United States Department of Agriculture Soil Conservation Service in cooperation with the Texas Agriculture Experiment Station, the soils located across the property are classified as being a Sawyer Silty Loam (characterized by a layer of silt loam for approximately six-inches (6") and varied colored clay loams below) and Wrightsville-Rodessa complex (a classification where the Wrightsville silt loam and Rodessa loam are so intermingled that they could not be shown separately and characterized by a surface layer of silt loam over a clay loam). Excerpts from the Soil Survey are included in Appendix B.

2.4.2 Preliminary Geotechnical Investigation

A *Preliminary Geotechnical Investigation* of the soils for portion of TAC East was prepared by ETTL Engineers & Consultants, Inc. in July 2013. Several bores were performed on the Brazos Site and the results were included in the investigation. A copy of the boring logs that were taken from the Brazos Site and excerpts from the investigation are included in Appendix C.

3 GOVERNMENTAL JURISDICTION

3.1 BOWIE COUNTY, TEXAS

TAC resides inside unincorporated Bowie County, Texas which is governed by a five-member commissioners' court. Four commissioners are voted on by the residents of their respective precincts in the county and presided over by a county judge elected by the residents of Bowie County.

3.2 TEXAMERICAS CENTER (TAC)

TAC is governed by a fifteen-member Board of Directors comprised of individuals appointed by the mayors of the municipalities throughout Bowie County, Texas. The Board of Directors sets policy and leaves the daily operations to staff. The Board of Directors is the final decision maker on all matters related to TAC business, with exception of taxation as TexAmericas Center does not have the right to levy taxes.

All TAC property is **deed restricted to commercial and industrial activity** which makes it suitable and designated for heavy and light industrial construction and operations. TAC controls its own land use (zoning) and has designated TAC property primarily for **Light and Heavy Industrial** uses. The Brazos Site is located in a **Heavy Industrial District (HI)** based on the Land Use Map adopted by the TexAmericas Center Board of Directors on September 25, 2018. A copy of the Land Use Map (Figure A-9) is included in Appendix A. The Land Use Guidelines will be discussed in sections to follow.

Other than the deed restrictions to the property from the deed and title transfer, there are no additional encumbrances, easements, liens or other rights on the property.

TAC has developed ordinances that affect site development of the property. These ordinances are intended to promote the health, safety, moral and general welfare of TAC. A list of these ordinances include:

- Codes, Covenants & Restrictions (CCR's);
- Drainage Guidelines;
- Land Use & Site Design Guidelines;
- Paving Guidelines;
- Road Signage, Striping & Lighting Guidelines;
- Sign Guidelines.

A copy of these are easily accessible on our website, www.TexAmericasCenter.com and more specifically at https://texamericascenter.com/public-information/development-use-guidelines/.

3.3 Fire Protection

Fire Protection for the property will come from the Hooks Volunteer Fire Department. **The ISO rating for the Hooks Volunteer Fire Department, at the Brazos Site, is a 6.** A Mutual Aid, Interlocal Agreement exists between the cities of Hooks & New Boston, Texas and Red River Army Depot (RRAD) to provide emergency response services. The **ISO rating for RRAD's Fire and Emergency Services is a 2**.

3.4 Police Protection

Police Protection will be provided by the Bowie County Sheriff's Department. Similar Mutual Aid agreements exist within the adjacent cities for these services also.

4 Environmental & Cultural Impacts

Located amid the Piney Woods, the Texarkana region offers a rare and wonderful bounty of lakes, green space and forestry where hardwoods grow nearly as quickly as softwoods. The region offers picturesque, relaxing and meaningful settings in which to retreat, relax and recharge. An impressive collection of federal, state and local recreational assets are waiting to be explored within a 90-minute drive.

4.1 Environmental Assessment

A **Final Phase I and Limited Phase II Environmental Site Assessment** for TexAmericas East Tract (Former Lone Star Army Ammunition Plant) in Texarkana, Texas was prepared by Science Applications International Corporation (SAIC) in May 2013. The findings of the report are that…'based on the results of the report, a more extensive Phase II Environmental Site Assessment is not recommended at this time'. A copy of the report may be obtained at the office of TexAmericas Center.

4.2 Wetlands

A wetland delineation for a portion of TAC East, including the limits of the Brazos Site, has been prepared. The findings of the investigation and the Jurisdictional Determination provided by the United States of America Corps of Engineers (USACOE) indicates **the Brazos Site if free of Jurisdictional Wetlands**. A copy of the Jurisdictional Determination if found in Appendix D.

4.3 Endangered/Threatened Species

Texas Parks & Wildlife Department Annotated County Lists of Rare Species, updated March 5, 2021, is included in Appendix E. This is a county-wide list of the species.

In 2000, a planning level survey (PLS) was conducted for vegetative communities and fauna, including an assessment of the potential presence of quality habitat for threatened and endangered species (TES) (Tetra Tech 2002b). The alligator snapping turtle (*Macroclemys temminckii*), a state-listed threatened species, was the only Threatened and Endangered Species (TES) observed at the installations during the Planning Level Survey (PLS). There we no federal-listed threatened or endangered species on the property.

4.4 Archaeological/Historical Designations

Based on the Phase II Archaeological Investigations at Red River Army Depot and Lone Start Army Ammunition Plant, Bowie County, Texas Final Report dated February 2012 prepared for the US Army Corps of Engineers (Mobile District) by Earth Science, Inc., there are no locations on the Brazos site that are determined to be of Archaeological or Historical Significance. A map of locations from the report showing these Brazos Site and the locations of areas of Historical Significance is included in Appendix F.

4.5 Air Attainment Status

Based on information provided by the Texas Commission on Environmental Quality and the United States Environmental Protection Agency, Bowie County, Texas appears within acceptable air quality levels according to the National Ambient Air Quality Standards.

5 Transportation Assets

TAC is positioned to give you access to the greatest domestic market share while still operating in the top-ranked State of Texas. This is because TAC is situated in the Texarkana MSA, **one of the lowest aggregate mile locations in Texas to the geographic and population centers of the US**. This gives tenants at TAC a **500-mile reach of 53.8 million consumers**, which is **10 million more than the Dallas 500-mile reach**. This access comes at a fraction of the transportation costs due to our strategic, central location and robust infrastructure.

5.1 Road Infrastructure

TAC has excellent interstate access with plans for additional improvements to ease speed of delivery for businesses. **Interstate Highway 30** (I-30) is the closest interstate to the Brazos Site at a distance of **less than 1 mile**. I-30 has **six interchanges** and multiple entry points to TAC on the 15-mile stretch that runs parallel to and less that 1-mile from its north property boundary. TexAmericas Center is **two hours east of Dallas** and **two**

hours southwest of Little Rock. Construction is currently underway in Texarkana to widen I-30 to six lanes.

5.1.1 Key Connections

Key connections of TAC road transportation system:

- **Interstate Highway 30** connects to I-20, I-35 & I-45 and more U.S. & State Highways to the west to the DFW Metroplex, and east to Little Rock, connecting with I-40 to Oklahoma City, Memphis, Nashville and the eastern seaboard of the United States.
- **Interstate Highway 69/369** (I-69/I-369) connects Canada and the Northeast United States to Houston and the Texas/Mexico border with multiple connections to additional interstate, U.S. & State Highways along the route. I-69 is currently under construction in various stages along its route.
- **U.S. Highway 59** (HWY 59) connects Texarkana to Houston and all Texas ports along the Gulf of Mexico with connections to I-20, Interstate Highway 10 (I-10) and numerous U.S. & State Highways along the route. The existing roadbed of HWY 59 is the proposed route for I-69/I-369 corridor.
- **Interstate Highway 49** (I-49) connects Texarkana to New Orleans with connections to I-10 and I-20 along this route to the south, and Fort Smith and Kansas City to the north with connections to I-40 & I-44 with multiple connections to additional U.S. & State Highways along the entire route. Plans are in progress to complete the construction of the portion of I-49 between Texarkana and Fort Smith.
- **U.S. Highway 71** (HWY 71) connects Texarkana to Fort Smith, Arkansas and I-40.
- **U.S. Highway 67** (HWY 67) connects Dallas to St. Louis through Texarkana with multiple connections to additional interstate, U.S. & State Highways along the route.
- **U.S. Highway 82** (HWY 82) runs immediately adjacent to the north property line of all TexAmericas Center property and connects North and West Texas, to the Atlantic Ocean, and to Los Angeles via I-10 with multiple connections to additional interstate, U.S. & State Highways along the route.

5.1.2 Brazos Site Road Adjacency

The Brazos Site is situated at the southeast corner of the intersection of Cass Street and Oak Street on the TAC East campus.

- Cass Street is the main entry into TAC East in downtown Hooks, Texas. Leaving the TAC East campus heading north and crossing HWY 82, Cass Street becomes F.M. 560 through Hooks, Texas. Continuing north on F.M. 560 for approximately half a mile, F.M. 560 intersects I-30. This intersection is a primary exit from I-30 providing access to TAC East. Cass Street is a primary north/south corridor through TAC East and is immediately adjacent to the west boundary of the Brazos Site. Cass Street is currently a two-lane road with a 150' wide right-of-way. Future improvements to Cass Street will add capacity by increasing the pavement width making this a four-lane thoroughfare.

- Oak Street is a primary east/west corridor through TAC East. Oak Street intersects Cass Street approximately a third of a mile south of HWY 82 and is immediately adjacent to the north boundary of the Brazos Site. Oak Street is currently a two-lane road with a 150' wide right-of-way. Future improvements to Oak Street will add capacity by increasing the pavement width making this a four-lane thoroughfare.

Both Oak Street and Cass Street are Private Roads, owned and maintained by TexAmericas Center. Both roads have asphalt surfaces and are designated truck routes through TAC East with an 80,000-pound capacity.

- Collin Street is a secondary north/south corridor connecting Oak Street to Cypress Street (a primary east/west corridor through the TAC East campus approximately 3/4-mile south of the Brazos Site) and runs within the limits of the Brazos Site near its eastern boundary. Collin Street has a 75' wide right-of-way and is currently unimproved. Collin Street can be abandoned in the event that a prospect elects to utilize the full limits of the Brazos Site for development. Future improvements to Collin Street, if needed, will be to re-surface or re-build the two-lane road meeting current paving criteria.

Exhibits located in Appendix A show the roads adjacent to TexAmericas Center and to the Brazos Site.

5.2 RAIL AND INTERMODAL INFRASTRUCTURE

5.2.1 Area Rail Operators

Texarkana is a major east/west and north/south rail center, with over 125 trains passing through the community per day. The Union Pacific (UP – a Class I Operator), Kansas City Southern (KCS – a Class I Operator), Texas Northeastern (TNER – a Short Line Operator), and Lone Star Rail Car Service (LSRCS – a privately owned Operator on the TAC East Campus) serve TexAmericas Center and the Texarkana market.

5.2.2 Area Intermodal Facilities

The Texarkana/TexAmericas Center market is well-served by inland ports or intermodal facilities. The nearest intermodal operations can be found in:

- **Dallas/Fort Worth, TX** (BNSF, KCS-NS, and UP)
- **Houston, TX** (BNSF and UP)
- **Kansas City, MO-KS** (BNSF, CP, NS, and UP)
- **Memphis, AR-TN** (BNSF, CN, CSX, NS and UP)
- **New Orleans, LA** (CN, NS and UP)
- **St. Louis MO-IL** (BNSF, CN, CSX, NS and UP)
- **San Antonio, TX** (UP)
- **Shreveport/Minden, LA** (KCS-NS)

5.2.3 Brazos Site Rail Adjacency

The TNER collects cars in the UP & KCS yards in Texarkana and delivers to TAC via a UP owned line running immediately south of HWY 82 and along the north boundary line of TAC East. The TNER delivers these cars to the siding located at the northwest corner of TAC East. At this point, LSRCS connects and spots the cars in a 350-car classification yard along the west boundary of TAC East or maneuvers the cars to locations on TAC East at other storage locations or for spotting as needed for tenant activities.

5.2.4 TAC Rail System

TAC owns approximately 36-miles of rail on TAC East. A siding currently runs along the west boundary of the Brazos Site. Additional switches can be added along this line, if needed, for rail served activities within the Brazos Site.

The rail on the TAC East campus is predominantly 85# rail. Several crossings adjacent to the Brazos Site have been upgraded recently and the rail at these locations has been upgraded to 115# rail. TAC has received grant funds and is currently working on improvements to several existing crossings and turnouts with the intentions of upgrading the rail through these facilities to 115# rail and performing other maintenance upgrades to better accommodate 286,000# loads.

5.2.5 TAC Transload Facility

A designated transload location is currently operating at TAC East and is located on the acreage immediately north of the Brazos Site on Oak Street. A twelve-car spot is designated and an operator contracts with businesses independently for loading and unloading activities. A variety of commodities can be handled in this facility. TAC will provide contact information for operator if requested.

5.3 AIR INFRASTRUCTURE

TexAmericas Center is a 25-minute drive from **Texarkana Regional Airport (TXK)**, with three daily round trip flights to **Dallas/Fort Worth International Airport (DFW)**. DFW is America Airlines' largest hub and is the third busiest airport in the world, with **over 900 flights daily** from over 23 airlines with service to **218 non-stop destinations**, both international and domestic. DFW is a 30-minute flight from Texarkana.

Other airports within an approximate two-hour drive from TAC East include:

- **Shreveport Regional Airport (SHV)** – approximately 75 minutes, 5 non-stop, direct flights
    - Commercial air operations are provided by Allegiant, American, Delta, GLO, and United.
    - Major Destinations include: Dallas/Fort Worth, Las Vegas, Atlanta, Chicago, Denver, Charlotte, and Houston
- **Little Rock Municipal Airport (Clinton National Airport)(LIT)** – approximately 2 hours, 13 non-stop, direct flights
    - Commercial air operations are provided by Allegiant, American, Delta, Southwest, GLO, and United.

    - Major Destinations include: Las Vegas, New Orleans, Phoenix, Dallas, Houston, Atlanta, Orlando, Charlotte, Detroit, St. Louis, Denver, and Chicago.
- **Dallas Love Field (DAL)** – approximately 2 hours, 58 non-stop, direct flights
    - Southwest HQ hub
    - Major Destinations include: Chicago, Washington DC, Los Angeles, New York, Atlanta, and Las Vegas

5.4 WATERWAYS AND PORT FACILITIES

TexAmericas Center is **within a five-hour drive of 10 of the 20 busiest ports in the USA**. The **Port of Caddo-Bossier** is approximately 100 miles away in Northwest Louisiana, the closest port to Texarkana and commercially navigable via the Red River. The Red River connects to the Mississippi River, the coastal waterway system, and the central US waterway system. The **Port of Little Rock** is approximately 160 miles northeast of TexAmericas Center on the Arkansas River, while the **Port of Houston** lies 295 miles south on the Gulf of Mexico.

6 UTILITIES

TexAmericas Center is well-served by industrial-grade utilities with excess capacity situated immediately adjacent to the Brazos Site. Below is a brief summary of all utilities. More information can be provided upon request.

6.1 WATER SOURCE INFORMATION

TexAmericas Center's water provider is **Riverbend Water Resource District (RWRD)**, which currently contracts with **Texarkana Water Utilities (TWU)** for provision of water to TexAmericas Center property. The water sources are two large reservoirs, Millwood Lake in Arkansas, and Lake Wright Patman in Texas.

TWU's current water plant has a design **capacity of 36 MGD.** The average daily use is 16 MGD, leaving an **excess capacity of 20 MGD**. A **30" transmission line** connects Texarkana to New Boston, Texas. This line can deliver over **4 MGD** to Riverbend's water system on TexAmericas Center's property. RWRD pumps currently pull **1.7 MGD** of water from the line, leaving **2.3 MGD of excess capacity** in the transmission line.

6.1.1 Water (potable) Main Adjacency

A 16-inch main is situated on the south side of Oak Street immediately adjacent to the north boundary line of the Brazos Site.

A Water Availability Map (Figure G-1) is located in Appendix G.

6.1.2 Water (non-potable) Main Adjacency

Riverbend Water Resources District will also be the provider of non-potable water on TAC East after the completion of the new regional water treatment plant.

6.1.3 Water System Expansion

RWRD recently announced a **$200 million investment** in a new, **30 MGD regional water system** that will be located on TexAmericas Center property. This state-of-the-art water system will eliminate reliance on TWU, while allowing businesses locating to TexAmericas Center to expand without concerns surrounding water treatment needs and availability. **Raw water** will also be available on both the Central and East campuses. Long term growth planning calls for full plant expansion up to **90 MGD**.

6.1.4 Contact Information

Riverbend Water Resources District (RWRD)
Kyle Dooley, P.E.
Executive Director/Chief Executive Officer
228 Texas Avenue, Suite A
New Boston, Texas 75570
903.831.0091
riverbend@rwrd.org
www.rwrd.org

6.2 SANITARY SEWER

Riverbend Water Resources District is also the provider of sanitary sewer collection and treatment on TAC East.

6.2.1 Sanitary Sewer Main Adjacency

An 18-inch, SDR 26, sanitary sewer is situated along the north side of Oak Street immediately adjacent to the Brazos site. The main slopes from the west to the east along the north property line with the manhole near the northwest corner of the site having a flowline of approximately 369 and the manhole near the northeast corner of the Brazos Site having a flowline of approximately 363.

A Sanitary Sewer Availability Map (Figure G-2) is located in Appendix G.

6.2.2 Treatment Facility

The wastewater plant servicing the TAC footprint has an average daily discharge limitation of 1.5 MGD with a daily maximum discharge limitation of 3.0 MGD. Based on the TCEQ permit for the facility, utilizing the daily maximum discharge limitations (3.0 MGD), the daily maximum biological oxygen demand is 250 lbs/day and the daily maximum total suspended solids is 500 lbs/day. The pH has an operating requirement range from greater than 6.0 to less than 9.0 with minimum monitoring requirements of one sample per day.

RWRD is in negations with RRAD to establish a public pretreatment facility for non-food industrial uses which will be at a yet determined site located on TAC East.

6.2.3 Treatment Facility Expandability

The existing wastewater plant serving the TAC footprint is built in a modular fashion with two (2) modules having a 750,000 GPD capacity. The facility is currently constructed with the necessary piping in place to accommodate an additional 750,000 GPD module increasing the treatment capacity to approximately 2.25 MGD.

6.2.4 Contact Information

Riverbend Water Resources District (RWRD)
Kyle Dooley, P.E.
Executive Director/Chief Executive Officer
228 Texas Avenue, Suite A
New Boston, Texas 75570
903.831.0091
riverbend@rwrd.org
www.rwrd.org

6.3 ELECTRICITY

6.3.1 Source Information

TexAmericas Center is served electricity by **AEP/SWEPCO**, one of the lowest cost electricity providers in the USA, with **rates typically 80% of the US average**. Currently **3-Phase, 12kv distribution lines** and **four substations** serve TexAmericas Center property. Each substation is connected to a **69kv transmission line** and has design capacity of **20MW**, with existing excess capacity of approximately **10MW** of power per substation. An additional **138kv line** and **two 345kv lines** are near and adjacent to TexAmericas Center, making dual feeds/connections and upgrading the substations to provide **up to 350MW** possible.

6.3.2 Substation Locations

Four substations are on or adjacent to TexAmericas center and provide service to the property. TAC East is served by a substation on Bowie Parkway on its east boundary.

One of the adjacent substations is situated approximately one quarter mile north of TAC East with a distribution line along the north right-of-way line of HWY 82. A connection may be made to this distribution line and extended south into TAC East for the purpose of providing a dual service connection to the property.

Conversations with AEP have led to the ability for the placement of an additional substation in TAC East if needed to support prospects activities. One location under consideration is in the vicinity of the intersection of Cass Street and Oak Street near the northwest corner of the Brazos Site.

6.3.3 Electrical Service Adjacency

A 12-kv overhead distribution line is situated on the north side of Oak Street immediately adjacent to the north boundary line of Oak Street.

An Electricity Availability Map (Figure G-3) is located in Appendix G.

6.3.4 Contact Information

AEP/SWEPCO (AEP)
John R. Jones
Customer Account Manager
428 Travis
Shreveport, LA 71101
903.728.5490
jrjones@aep.com
www.aep.com

6.4 NATURAL GAS

6.4.1 Source Information

Navitas Utility Corporation is the gas supplier to TAC East, which contracts through **Enable**. The Enable Interstate transmission pipeline that connects Texas to Arkansas runs adjacent to TexAmericas Center, north of the HWY 82 right-of-way. This Interstate pipeline is a **10-inch, 220 psi** high pressure natural gas line.

A **6-inch lateral** at **220 psi** from the Enable transmission line connects to Navitas' distribution system on TAC East. The existing meter can be upgraded for additional capacity as demand increases. The natural gas line onto TAC East consists of **dual 4-inch gas lines** that deliver **130 MCF per hour** and is expandable to **at least 170 MCF per hour**.

6.4.2 Natural Gas Main Adjacency

A pair of 4-inch gas lines is set to be installed in Summer 2021 on the south side of Oak Street immediately adjacent to the north boundary line of the Brazos Tract. These lines will be capable of delivering approximately 130 MCF/hour with the ability to expand to 170 MCF/hour.

A Gas Availability Map (Figure G-4) is located in Appendix G.

6.4.3 System Expandability

The Enable Interstate transmission pipeline can be upgraded substantially to at least **10,000 MCF per hour**. An upgrade like this would include a dedicated pipeline, likely a 12-inch high pressure (input 900 psi) steel line. Cost for this upgrade is $300,000 per mile (2020 estimate), plus $1,000,000 for interstate pipeline system improvements, and $1,000,000 of contingency. This cost includes:

- Development
- Engineering
- Securing ROW
- Procurement
- Installation

- Commission
- Restoration
- Clean up

6.4.4 Contact Information

Navitas Utility Corporation
Thomas Hartline
Executive Director/Chief Executive Officer
3186 D Airway Avenue
Costa Mesa, CA 92626
714.424.4094
thartline@navitasutility.com
www.navitasutility.com

6.5 High Speed Fiber

6.5.1 Source Information

Conterra Networks (Conterra) provides data center-quality internet service to TexAmericas Center and has extended a **144-strand fiber line** onto or adjacent to all TexAmericas Center campuses. Conterra offers high bandwidth at competitive rates with **100+ gigabyte upload and download speeds** available.

6.5.2 High Speed Fiber Adjacency

Conterra installed a 144-strand fiber line on the north side of Oak Street immediately adjacent to the north boundary line of the Brazos Tract.

A Fiber Availability Map (Figure G-5) is located in Appendix G.

6.5.3 Contact Information

Conterra Networks
Stephanie Green
Area Sales Manager
903.908.3052
sgreen@conterra.com
www.Conterra.com

6.5.4 Fiber Assessment Study – TAC Property

CBRE – Network Advisory Services recently performed a Level 2 IT Assessment on TexAmericas Center property. On a scale of 1-5, with 5 being very feasible and 1 being infeasible, **TexAmericas Center ranked a 4** to support hyperscale, corporate, and similar data center applications. The next phase of the study will provide recommendations for upgrades to a 5 rating. The results of both of these assessments can be made available if requested/as completed.

7 INCENTIVES

Governments consider using public funds on a case-by-case basis to help incentivize proposed private economic development projects to strengthen a community's economic viability. Incentives can take a variety of forms such as tax breaks, construction of supporting infrastructure, workforce development programming and other forms of assistance. Jurisdictions may use these incentives to pursue economic goals such as tax base diversification, job creation, or business retention and expansion.

Incentive and business assistance offerings are typically based on the expected, realistic capital investment and job creation projections. A sample of available incentives are below; all can be used as an inducement to secure investment in our region's economy.

7.1 Special Zones

Locating to one of TAC's three campuses offers several incentive options on the federal, state and local levels. All incentives are competitive and based on established criteria. Available incentives include property purchase price abatement, property tax abatement, favorable lease/purchase arrangements, employee recruitment & training assistance, infrastructure grants and favorable financing. Area partners have a successful history of obtaining financial assistance for qualified projects from both state and federal sources; however, delivery of proposed grants is not guaranteed. Independent applications must be filed, and an established review and award process is followed. Seven of TAC's distinct incentives include:

7.1.1 Defense Economic Readjustment Zone

As TAC is comprised solely of land formerly operated as a military installation, companies which locate to the TAC footprint become eligible for the Defense Economic Readjustment Zone Program. This program is a tool for business recruitment and job creation in adversely impacted military communities, such as TexAmericas Center. It is designed to aid Texas communities, businesses, and workers impacted by the closure or realignment of military installations and provides local and state regulatory and tax incentives to encourage businesses to locate or expand in these areas.

7.1.2 U.S. Foreign Trade Zone #258

TexAmericas Center manages Foreign Trade Zone #258, a geographic area where goods may be landed, stored, handled, manufactured or reconfigured then re-exported under specific customs regulations, generally not subject to customs duties. Areas designated as Foreign Trade Zones (FTZ) are generally organized around major transportation hubs and areas with many advantages for trade. An FTZ is a defined, physical area within the United States that, for customs entry purposes is treated as if it is outside U.S. borders. Companies may use FTZs for both storage/distribution activities or, after specific authorization by the U.S. FTZ Board, for production.

TAC will engage our consultant, Point Trade Services Inc., to estimate cost savings of operating in FTZ #258 upon request.

Foreign Trade Zones give companies multiple benefits that ultimately streamline operations and impact the bottom line. Some of these benefits include:

- CBP duty and federal excise tax, if applicable, are paid when the merchandise is transferred from the zone for consumption.
- While in the zone, merchandise is not subject to U.S. duty or excise tax. Certain tangible personal property is generally exempt from state and local ad valorem taxes.
- Goods may be exported from the zone free of duty and excise tax.
- CBP security requirements provide protection against theft.
- Merchandise may remain in a zone indefinitely, whether or not subject to duty.
- The rate of duty and tax on the merchandise admitted to a zone may change as a result of operations conducted within the zone. Therefore, the zone user who plans to enter the merchandise for consumption to CBP territory may normally elect to pay either the duty rate applicable on the foreign material placed in the zone or the duty rate applicable on the finished article transferred from the zone whichever is most advantageous.
- Merchandise imported under bond may be admitted to an FTZ for the purpose of satisfying a legal requirement of exporting the merchandise. For instance, merchandise may be admitted into a zone to satisfy any exportation requirement of the Tariff Act of 1930, or any other exportation requirement.

7.1.3 HUBZone

TexAmericas Center is located within a federal HUBZone which offers advantages for federal contracts. A US HUBZone helps small businesses gain preferential consideration with government contracts by limiting some contracts just to HUBZones and giving HUBZone businesses a 10% price evaluation preference in full and open contract negotiations. By law, three percent of all dollars awarded for federal prime contracts are required to go to HUBZone-certified small business concerns. The local Small Business Development Center will assist in preparing company applications for being recognized as HUBZone eligible.

The SBA provides a higher surety bond for HUBZone companies. There is typically a subcontractor participation goal for many large business contracts. HUBZone requirements generally apply to U.S. Government purchases in excess of $3,000.

The Small Business Association regulates and implements the HUBZone Program by doing the following:

- Determining which businesses are eligible to receive HUBZone contracts
- Maintaining a list of qualified HUBZone small businesses that federal agencies can use to locate vendors
- Adjudicates protests of eligibility to receive HUBZone contracts

- Reports to Congress on the program's impact on employment and investment in HUBZone areas.

To qualify for the program, a business must meet the following criteria:

- It must be a small business by SBA standards (https://www.sba.gov/federal-contracting/contracting-guide/size-standards)
- Its principal office must be located in a HUBZone, which includes military facilities closed by the Base Realignment and Closure Act, such as TAC
- At least 35% of its employees must reside in a HUBZone

7.1.4 New Market Tax Credits

TexAmericas Center is designated as an economically distressed community making businesses located on our footprint eligible for New Market Tax Credits (NMTC). The NMTC program attracts capital to eligible communities by providing private investors with a federal tax credit for investments made in businesses or economic development projects located in distressed communities, such as TAC.

Investors in NMTC receive a tax credit equal to 39 percent of the total Qualified Equity Investment made in a Community Development Entity. The credit is realized over a seven-year period: five percent annually for the first three years and six percent in years four through seven.

7.1.5 U.S. Opportunity Zone

A US Opportunity Zone is an economically distressed community where new investments, under certain conditions, may be eligible for preferential tax treatment to spur economic development in those areas. Qualified Opportunity Zones retain their designation for 10 years.

First, investors can defer tax on any prior gains until December 31, 2026 or such date in which an investment is sold or exchanged, whichever comes first, as long as the gain is reinvested in a Qualified Opportunity Fund.

Second, if the investor holds the investment in the Opportunity Fund for at least ten years, the investor would be eligible for an increase in basis equal to the fair market value of the investment on the date that the investment is sold or exchanged. Investors can defer certain taxes if they invest in an Opportunity Zone within six months of realizing the gain.

Investments in Opportunity Zones realize the following benefits for investment periods of at least:

- Five years with a 10% increase in tax basis
- Seven years with a 15% increase in tax basis

Ten years with an exemption from additional gains beyond what was previously deferred

7.1.6 Texas Enterprise Zone

The Texas Enterprise Zone Program is a state sales and use tax refund program designed to encourage private investment and job creation in economically distressed areas of the state of Texas.

Depending upon capital investment, Texas will refund up to $7,500 for each allocated permanent or retained job.

- For projects with a capital investment below $150 million, qualified businesses may receive up to $1.25 million in state sales and use tax refunds ($2,500 per job with a maximum of 500 jobs created).
- For projects with a capital investment between $150 million and $250 million, qualified businesses may receive up to $2.5 million in state sales and use tax refunds ($5,000 per job with a maximum of 500 jobs created).
- For projects with a capital investment of $250 million or more, qualified businesses may receive up to $3.75 million in state sales and use tax refunds ($7,500 per job for no less than 500 jobs created).

7.1.7 Texas Reinvestment Zone

Designating a specific geographic area as a Texas Enterprise Zone also makes it a Texas Reinvestment Zone, and potentially eligible for tax increment financing, tax abatement and limitations on appraised value. A local property tax exemption may be granted for real and tangible personal property located in the reinvestment zone that was acquired from the federal government by lease or deed. In addition, property in a reinvestment zone is eligible for:

- A tax refund based on the capital investment in the project
- An exemption from state regulation and suspension from local regulation
- Preference for loans from the state
- Refunds and credits on state excise, use, sales and franchise taxes
- Refunds on local sales and use taxes
- The reduction or elimination of local fees.
- Incentives tied to increasing jobs, wages or investment

7.1.8 Pace Program

The Texas Property Assessed Clean Energy (PACE) program provides low-cost, long-term financing for water and energy efficiency upgrades to commercial and industrial properties. PACE improvements add value to the property and reduce utility bills with the upgrades typically paying for themselves with positive cash flow over time. In 2013, the Legislature passed Senate Bill 385 (83R) allowing municipalities and counties to work with commercial lenders and property owners to pursue improvements using property

assessments as a secure repayment mechanism. Eligible upgrades are financed over time through a voluntary property tax assessment attached to the property.
Under a PACE arrangement, private property owners evaluate measures that achieve energy savings and obtain financing, repaid as an assessment on the building. The assessment mechanism allows access to low-cost, long-term capital to finance improvements to the property. By eliminating upfront costs, extending financing and simplifying the transfer of repayment obligations to new owners upon sale, PACE overcomes challenges that have hindered building energy efficiency and related projects.

7.2 Recruitment and Training

7.2.1 Skills Development Fund

The Texas state-funded Skills Development Fund is an innovative program providing local customized training opportunities for Texas businesses and workers to increase skill levels and wages of the Texas workforce. Training providers can use grant funds for curriculum development, training materials, instructor certifications and training equipment additions or upgrades. The employer and local community colleges will partner to develop a training plan for the Skills Development project and submit the application jointly.
The Texas Workforce Commission and local Workforce Board will assist to ensure the application requirements are completed. Grants are provided to help companies and labor unions form partnerships with local community colleges and technical schools to provide custom job training. However, the benefit may vary depending on the proposal.
If the grant is awarded, the Texas Workforce Commission funding will be provided to the community college to administer the training program for the employer. Total grant amounts vary depending on the number of employees participating in the program. No money is spent or received by the company.
The Skills Development Fund is only available to Texas employers and will pay up to $1,800 for each new employee and $900 for each incumbent employee participating in the training. Grants are generally capped at $500,000 but exceptions can be approved, and additional funds requested.

7.2.2 On-the-Job Training (OJT) Contracts

On-the-Job Training (OJT) Contracts are available to an employer who hires an eligible Texas resident. OJT Contracts pay up to 50% of an eligible employee's wages during their training period. OJT Contracts are subject to availability and approval of Texas Workforce Solutions.

7.2.3 Come Home to Texarkana Program

The Texarkana region would be delighted to help you and your employees call Texarkana home. Institutions like the Texarkana Chamber of Commerce, the Greater Texarkana Young Professionals (GTYP), Leadership Texarkana, MainStreet Texarkana, Texarkana College, local school districts and others will help key employees discover Texarkana and acclimate to their new surroundings. We will use all our relocation tools to help you and your employees succeed at your new home in Texarkana.

7.3 Tax Abatement Programs

7.3.1 Goods in Transit Tax Abatement

This law exempts goods, principally inventory, that are stored under a contract of bailment by a public warehouse operator at a public warehouse facility, and that is in no way owned or controlled by the owner of the goods. This is provided such property is moved to another location inside or outside Texas within 175 days after the goods were acquired in Texas or imported into Texas. The movement requirement could be satisfied by simply moving the goods to another warehouse across the street.

Certain specific types of goods are presently excluded from this exemption: oil, natural gas, petroleum products, aircraft, dealer's motor vehicle inventory, dealer's vessel and outboard motor inventory, dealer's heavy equipment inventory, or retail manufactured housing inventory. Some owners of goods that presently store them in owned facilities may move their goods into a public warehouse in order to obtain the tax exemption. Having inventory located in Texas on the lien date (January 1) that is not being manufactured, modified, assembled, or processed and is pre-committed to an out-of-state customer, most likely qualifies a business for a 100% property tax exemption. In some cases, it is possible to qualify part of your inventory for an interstate/foreign commerce exemption and a Freeport Exemption on the remainder, depending on the flow of goods and qualifying thresholds. Furthermore, as this is a statutory exemption, it applies to all taxing jurisdictions, including county, city, school, and special districts.

7.3.2 Freeport Tax Exemption

The Freeport Exemption is a constitutional amendment that exempts certain goods, which the government has dubbed Freeport goods, from property taxes. If a business has inventory in the state of Texas for a short period of time (175 days or less) before transporting it out of state, it may be eligible to claim a business personal property tax exemption on that inventory. Savings will be based on the percentage of tangible property goods that your business moved out of Texas within the 175-day window during the previous year.

The following conditions must also be met:

- Freeport property includes goods, merchandise, ores, and certain aircraft and aircraft parts.

- The inventory must fall under the categories of finished goods, supplies, raw materials or work in process of being assembled, repaired, maintained, stored, processed or fabricated. The exemption does not apply to oil, natural gas, or liquid or gaseous materials that are immediate derivatives of the oil refining or natural gas.
- The Freeport goods that are eligible for this exemption must be transported out of Texas within 175 days of the date that they are acquired, manufactured or brought into the state.
- Goods, known as goods-in-transit that meet the Freeport property requirements may be sold in-state instead of being shipped out of state. However, the property still must meet all the Freeport property requirements, and be transported out of Texas within 175 days after it was first acquired in or imported into the state.

7.3.3 312 Tax Abatement

Chapter 312 of the Texas Tax Code permits local taxing units to enter into agreements with property owners providing for the abatement of ad valorem property taxes, provided that the property owner makes specified improvements or repairs to the property. The code, also known as the Property Redevelopment and Tax Abatement Act, allows the governing bodies of cities, counties and special districts to exempt all or part of the taxable value of new investments for a period not to exceed 10 years.
To be eligible for an abatement, a project must be a new facility or an expansion or modernization of an existing one. Abatement agreements are required to include certain provisions. They must specify the improvements to be made to the property and provide access for city or county employees to verify that the agreements are followed. The agreements must require payment of taxes if a property owner fails to comply with the abatement terms. In addition, annual certificates of compliance must be filed with the applicable taxing units to ensure accountability and visibility for the public.

7.3.4 313 Tax Abatement

An appraised value limitation is an agreement between a taxpayer and a Texas school district in which the taxpayer proposes to build or install property and create jobs meeting certain requirements in exchange for a ten-year limitation on the taxpayer's property value for school district maintenance and operations tax (M&O) purposes. For ten years, school M&O property taxes are not levied on the value in excess of the limitation amount. Limitation amounts are established by statute and vary by school district. Unlike abatements based on a percentage of the property value, the structure of the program benefits primarily large projects, such as petrochemical, energy, or manufacturing sectors. .
Companies seeking a limitation submit an abatement application to the school district in which the project may be located. The school district forwards the application to the Texas Comptroller for evaluation. The school district may not grant final approval of the

abatement without Comptroller analysis and approval. For the 10 years of the tax benefit period, reduced local school district revenues are substantially replaced with state funds through the state public school finance system.

7.3.5 381 Tax Abatement

Chapter 381 of the Local Government Code allows counties to provide incentives encouraging developers to build in their jurisdictions. A county may administer and develop a program to make loans and grants of public money to promote state or local economic development and to stimulate, encourage and develop business location and commercial activity in the county. Specifically, it provides for offering loans and grants of city funds or services at little or no cost to promote all types of business development including industrial, commercial and retail projects. Each agreement can be uniquely tailored to address the specific needs of both the local government entity and the business prospect.

7.3.6 Texas Research and Development Tax Credit

Taxpayers in Texas can claim the R&D Tax Credit to offset a portion of their franchise tax or use it towards a sales and use tax exemption on the purchase or lease of depreciable tangible personal property used in qualified research in Texas. Some highlights of the Texas R&D Tax Credit include:

- Qualified Research Expenses (QREs) must be for research conducted within Texas.
- The credit amount is 5% of the excess amount of qualified research expenses in the current period over the base amount (50% of the average of the previous three years).
- The allowable Franchise Tax Credit in any one period, including carryforward amounts, cannot exceed 50% of the franchise tax due for the period.
- Unused credits can be carried forward for up to 20 years.

7.3.7 Pollution Control Equipment Incentive

Property used wholly or partly to prevent, monitor, control or reduce pollution is considered “pollution control property” and is at least partly exempt from ad valorem (property) tax for the life of the asset. To obtain the exemption, the property owner must apply to the Texas Commission on Environmental Quality. The applicant can submit in three different tiers, or levels, of applications for a use and benefit determination.

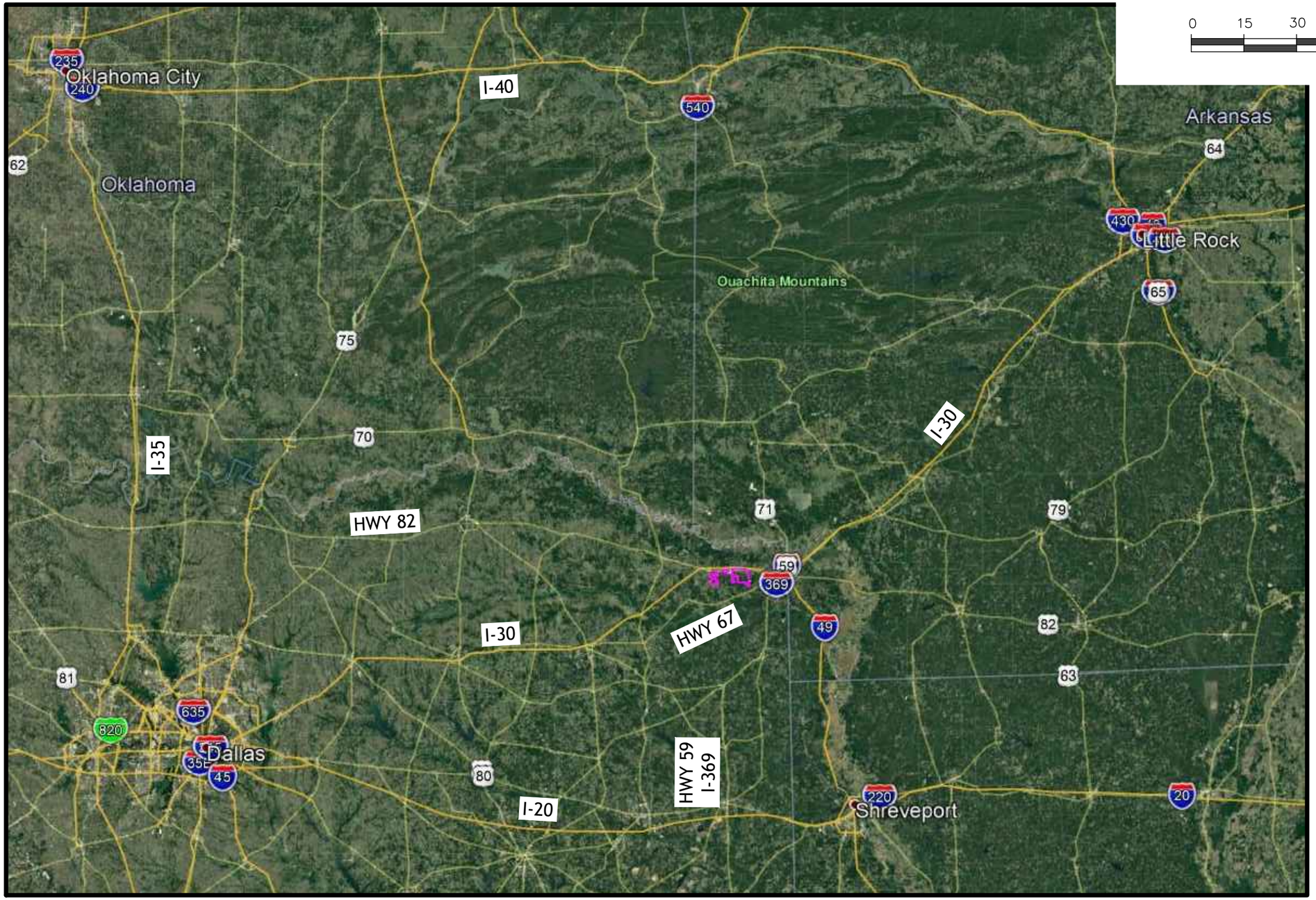
7.3.8 Franchise Tax Exemption and Deduction for Business HQ Relocation

Companies may deduct from apportioned margin relocation costs incurred in relocating their main office or other principal place of business to Texas from another state provided the company (1) did not do business in Texas before the relocation and (2) is not a member of an affiliated group engaged in a unitary business, another member of which is already doing business in Texas.

Deductible relocation costs include (1) costs of relocating computers and peripherals, other business supplies, furniture and inventory; and (2) any other costs related to the relocation that are allowable deductions for federal income tax purposes. The deduction must be taken on the company's initial franchise tax filing.

APPENDIX A

FIGURE A-1



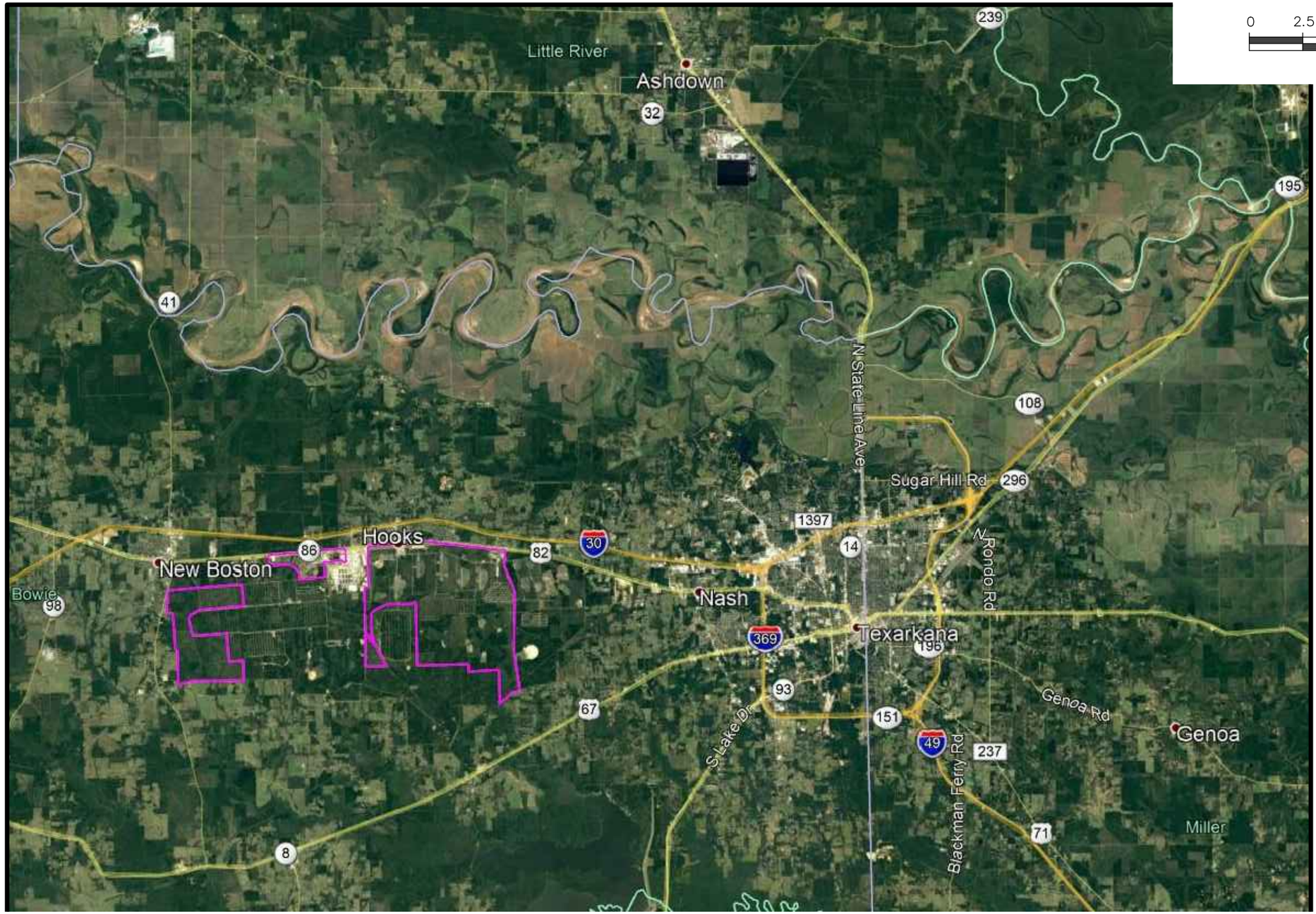
107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

AREA LOCATOR MAP

TexAmericas Center

FIGURE A-2



107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

REGIONAL LOCATOR MAP

TexAmericas Center

FIGURE A-3

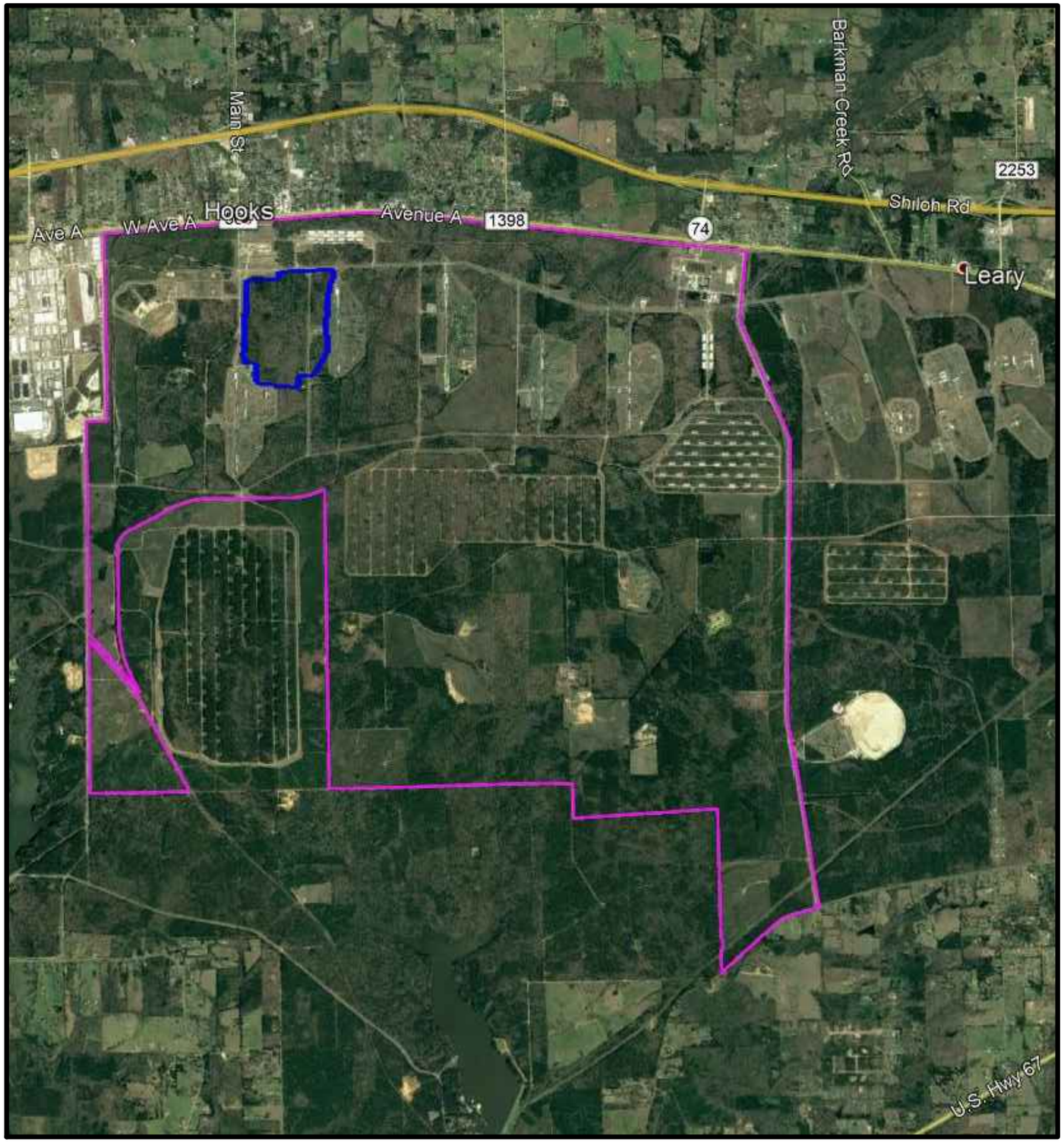
107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

TEXAMERICAS CENTER - CAMPUS MAP

TexAmericas Center

FIGURE A-4



N

0 15 30 60 90

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

TEXAMERICAS CENTER - EAST CAMPUS

TexAmericas Center

FIGURE A-5

N

0 15 30 60 90

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

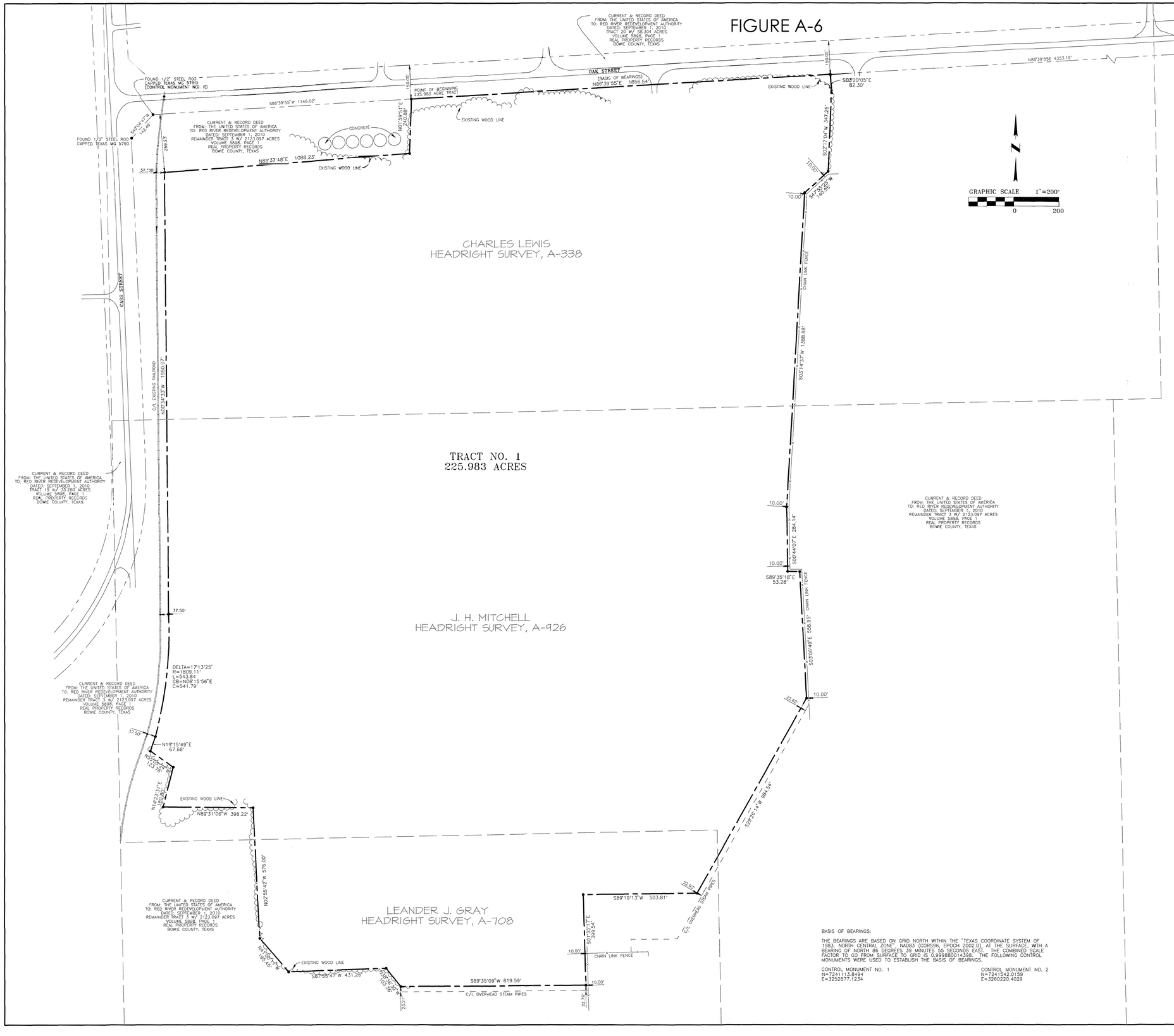
TexAmericas CENTER
Texarkana USA

BRAZOS TRACT - TAC EAST CAMPUS

TexAmericas Center

FIGURE A-6

FIGURE A-6



Property Description
Tract No. 1
225.983 Acres
Bowie County, Texas

All that certain lot, tract or parcel of land lying and situated in the Charles Lewis Headright Survey, Abstract 338, the J. H. Mitchell Headright Survey, Abstract 926 and the Leander J. Gray Headright Survey, Abstract 708, Bowie County, Texas, being a part of that certain tract of land described as Tract 3 with 2123.097 acres in the deed from the United States of America to Red River Redevelopment Authority, now known as TexAmericas Center, dated September 1, 2010, recorded in Volume 5898, Page 1 of the Real Property Records of Bowie County, Texas, and being more particularly described by metes and bounds as follows:

BEGINNING at a 1/2 inch steel rod set for a corner, capped MTG 101011-00, lying in the North line of the said 2123.097 acre tract and the South line of that certain tract of land described as Tract 20, with 58.304 acres in the said Volume 5898, Page 1, said corner bears North 86 degrees 39 minutes 55 seconds West a distance of 1146.02 feet to a 1/2 inch steel rod found for a corner (control monument), capped TEXAS MG 5760, and South 42 degrees 04 minutes 47 seconds West a distance of 142.46 feet to a 1/2 inch steel rod found for a corner, capped TEXAS MG 5760, the Northwest corner of the said 2123.097 acres tract;

THENCE North 86 degrees 39 minutes 55 seconds East (basis of bearings) a distance of 1856.54 feet along the North line of the said 2123.097 acre tract and the South line of the said 58.304 acre tract to a 1/2 inch steel rod set for a corner capped MTG 101011-00, said corner bears North 86 degrees 39 minutes 55 seconds East a distance of 4353.19 feet to a 1/2 inch steel rod found for a corner (control monument), capped TEXAS MG 5760;

THENCE South 03 degrees 20 minutes 05 seconds East a distance of 82.30 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE South 02 degrees 17 minutes 04 seconds West a distance of 347.25 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE South 47 degrees 55 minutes 25 seconds West a distance of 140.55 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE South 03 degrees 14 minutes 37 seconds West a distance of 1388.88 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00 at an angle point;

THENCE South 00 degrees 44 minutes 07 seconds East a distance of 284.14 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00;

THENCE South 89 degrees 35 minutes 18 seconds East a distance of 53.28 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00;

THENCE South 03 degrees 06 minutes 49 seconds East a distance of 558.95 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE South 29 degrees 26 minutes 14 seconds West a distance of 984.54 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE South 89 degrees 19 minutes 13 seconds West a distance of 503.81 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00;

THENCE South 01 degrees 35 minutes 17 seconds East a distance of 399.54 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00;

THENCE South 89 degrees 35 minutes 09 seconds West a distance of 819.59 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE North 38 degrees 36 minutes 30 seconds West a distance of 103.36 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE South 87 degrees 55 minutes 47 seconds West a distance of 431.26 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE North 41 degrees 00 minutes 11 seconds West a distance of 195.45 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE North 02 degrees 55 minutes 42 seconds West a distance of 576.00 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00;

THENCE North 89 degrees 31 minutes 06 seconds West a distance of 398.22 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00 ;

THENCE North 14 degrees 23 minutes 31 seconds East a distance of 180.80 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at an angle point;

THENCE North 55 degrees 05 minutes 24 seconds West a distance of 123.76 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00 at an angle point;

THENCE North 19 degrees 15 minutes 49 seconds East a distance of 67.68 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at the beginning of a circular curve to the left;

THENCE in a Northeasterly direction along the arc of the said circular curve a distance of 543.84 feet with a delta angle of 17 degrees 13 minutes 25 seconds, a radius of 1809.11 feet, a chord bearing of North 06 degrees 15 minutes 56 seconds East, and a chord distance of 541.79 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00, at the end of the said circular curve;

THENCE North 00 degrees 34 minutes 33 seconds West a distance of 1950.07 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00;

THENCE North 85 degrees 37 minutes 48 seconds East a distance of 1088.23 feet to a 1/2 inch steel rod set for a corner, capped MTG 101011-00;

THENCE North 01 degrees 59 minutes 51 seconds East a distance of 240.88 feet to the point of beginning and containing 225.983 acres of land at the time of this survey.

The bearings are based on Texas Coordinate System of 1983, North Central Zone, NAD83, with a bearing of North 86 degrees 39 minutes 55 seconds East.

This description is based on the survey and plat made by Jeffrey A. Wood, Registered Professional Land Surveyor No. 6220, on April 19, 2013, and revised on April 24, 2013.

SURVEYOR CERTIFICATE:

THIS IS TO CERTIFY THAT THIS SURVEY WAS MADE ON THE GROUND UNDER MY SUPERVISION ON APRIL 8, 2013, THAT THIS PLAT (MAP OR DRAWING) SUBSTANTIALLY COMPLIES WITH THE CURRENT PROFESSIONAL AND TECHNICAL STANDARDS OF THE TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, AND REPRESENTS THE FACTS FOUND AT THE TIME OF THE SURVEY. THERE ARE NO VISIBLE IMPROVEMENTS EXCEPT AS SHOWN ON THE SURVEY PLAT.

THIS PLAT IS FOR THE INTENDED USE OF TEXAMERICAS CENTER AS RELATES TO OWNERSHIP OR TRANSFER OF OWNERSHIP. THIS SURVEY IS NOT ASSIGNABLE OR TRANSFERABLE, MAY NOT BE REISSUED WITHOUT RE-SURVEY AND MAY BE VOID/INVALID SUBJECT TO CHANGES IN GOVERNANCE OR INTERPRETATIONS ISSUED BY THE TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, AND MAY NOT BE COPIED OR PROVIDED TO OTHER PARTIES WITHOUT THE EXPRESSED WRITTEN PERMISSION OF THE UNDERSIGNED.

Jeffrey A. Wood

JEFFREY A. WOOD
REGISTERED PROFESSIONAL LAND SURVEYOR
NO. 6220, STATE OF TEXAS
FIRM CERTIFICATE NO. 101011-00
DATE: APRIL 19, 2013
REVISED: APRIL 24, 2013

STATE OF TEXAS
JEFFREY A. WOOD
#6220
REGISTERED PROFESSIONAL LAND SURVEYOR

BASIS OF BEARINGS:

THE BEARINGS ARE BASED ON GRID NORTH WITHIN THE "TEXAS COORDINATE SYSTEM OF 1983, NORTH CENTRAL ZONE", NAD83 (CORS96, EPOCH 2002.0), AT THE SURFACE, WITH A BEARING OF NORTH 86 DEGREES 39 MINUTES 55 SECONDS EAST. THE COMBINED SCALE FACTOR TO GO FROM SURFACE TO GRID IS 0.99988001439. THE FOLLOWING CONTROL MONUMENTS WERE USED TO ESTABLISH THE BASIS OF BEARINGS.

CONTROL MONUMENT NO. 1
N=7241113.8494
E=3252877.1234

CONTROL MONUMENT NO. 2
N=7241542.0159
E=3260220.4029

NOTES:
1) ALL MONUMENTS ARE SET 1/2 INCH STEEL RODS CAPPED MTG 101011-00, UNLESS OTHERWISE NOTED.
2) ALL BEARINGS & DISTANCES ARE SHOWN AS MEASURED.

BOUNDARY SURVEY
TRACT NO. 1
225.983 ACRES

SITUATED IN THE CHARLES LEWIS HRS, A-338, THE J. H. MITCHELL HRS, A-926 AND THE LEANDER J. GRAY HRS, A-708, BOWIE COUNTY, TEXAS

Date	Revision/Description
4/24/13	REVISED PROPERTY DESCRIPTION DATE

Drawn By	Checked By	Project No.	Dwg. Date
TBM	JAW	6910	4/2013

MTG engineers & surveyors
5430 SUMMERHILL RD. | P.O. BOX 3786
TEXARKANA, TEXAS 75501
P 903.838.8533 | F 903.832.4700
www.mtgengineers.com

TBPE NO. 354

File No.

Sheet No. 2 of 7

X:\2013 Projects\138110 TAC East Non-Permit Parcels\02 Surveying\Field Data\Tract No. 1\Tract No. 1.pro
Wed Apr 24, 2013 3:46PM

FIGURE A-7

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

DRAWN: JDW	DESIGN: JDW	DATE:05/18/2021	SCALE:	WCE #:

TOPOGRAPHICAL EXHIBIT
BRAZOS SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

FIGURE A-8

MAP SCALE 1" = 1000'

500 0 1000 2000 FEE

300 0 300 60

NFIP

PANEL 0310D

FIRM

FLOOD INSURANCE RATE MAP

BOWIE COUNTY, TEXAS AND INCORPORATED AREAS

PANEL 310 OF 600

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOWIE COUNTY	481194	0310	D
HOOKS,CITY OF	480056	0310	D

NATIONAL FLOOD INSURANCE PROGRAM

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

MAP NUMBER 48037C0310D

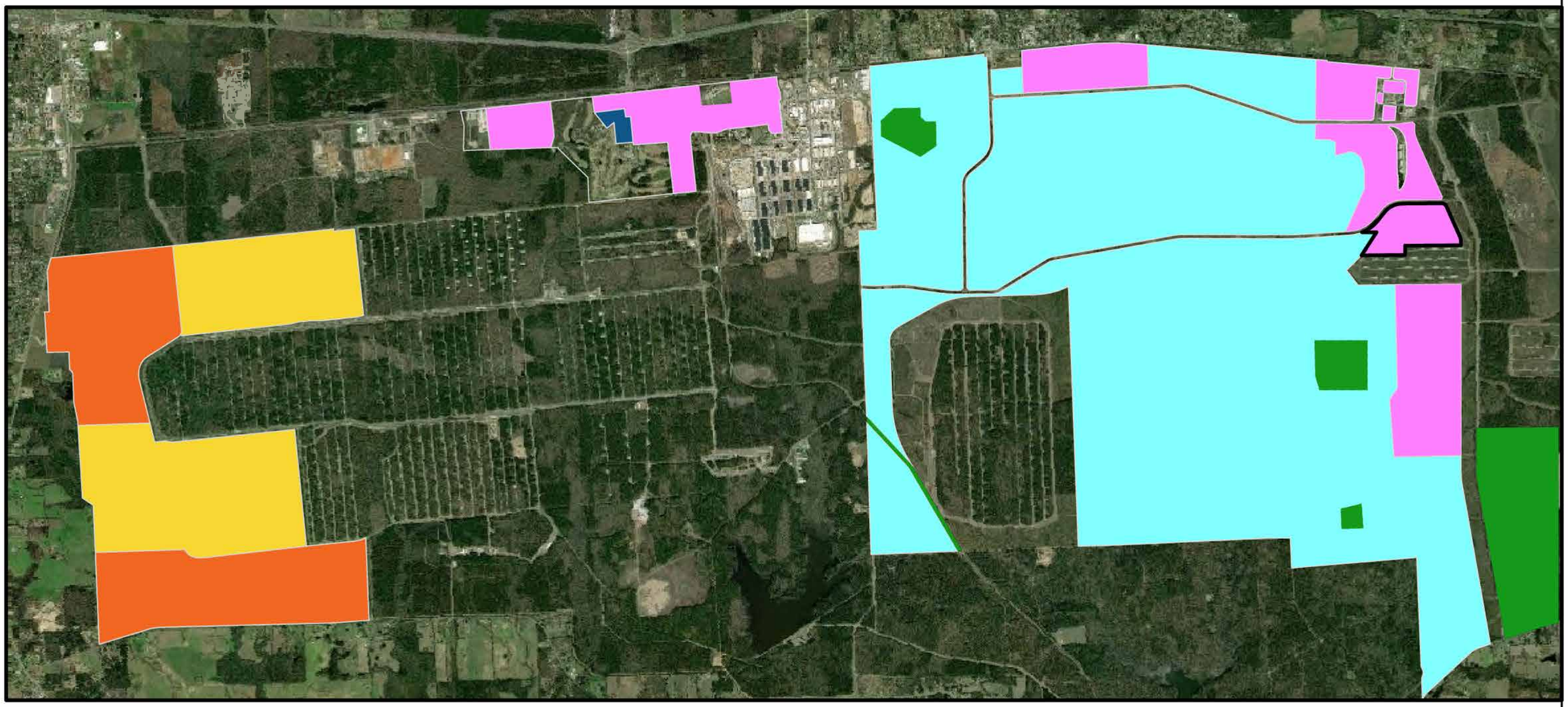
EFFECTIVE DATE OCTOBER 19, 2010

Federal Emergency Management Agency

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at https://msc.fema.gov.

FIGURE A-9

N



TECHNOLOGY DISTRICT 1 (T1)
TECHNOLOGY DISTRICT 2 (T2)
RESIDENTIAL DISTRICT (R)
LIGHT INDUSTRIAL DISTRICT (LI)
HEAVY INDUSTRIAL DISTRICT (HI)
U.S. ARMY PROPERTY

ADOPTED 09.25.2018

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER

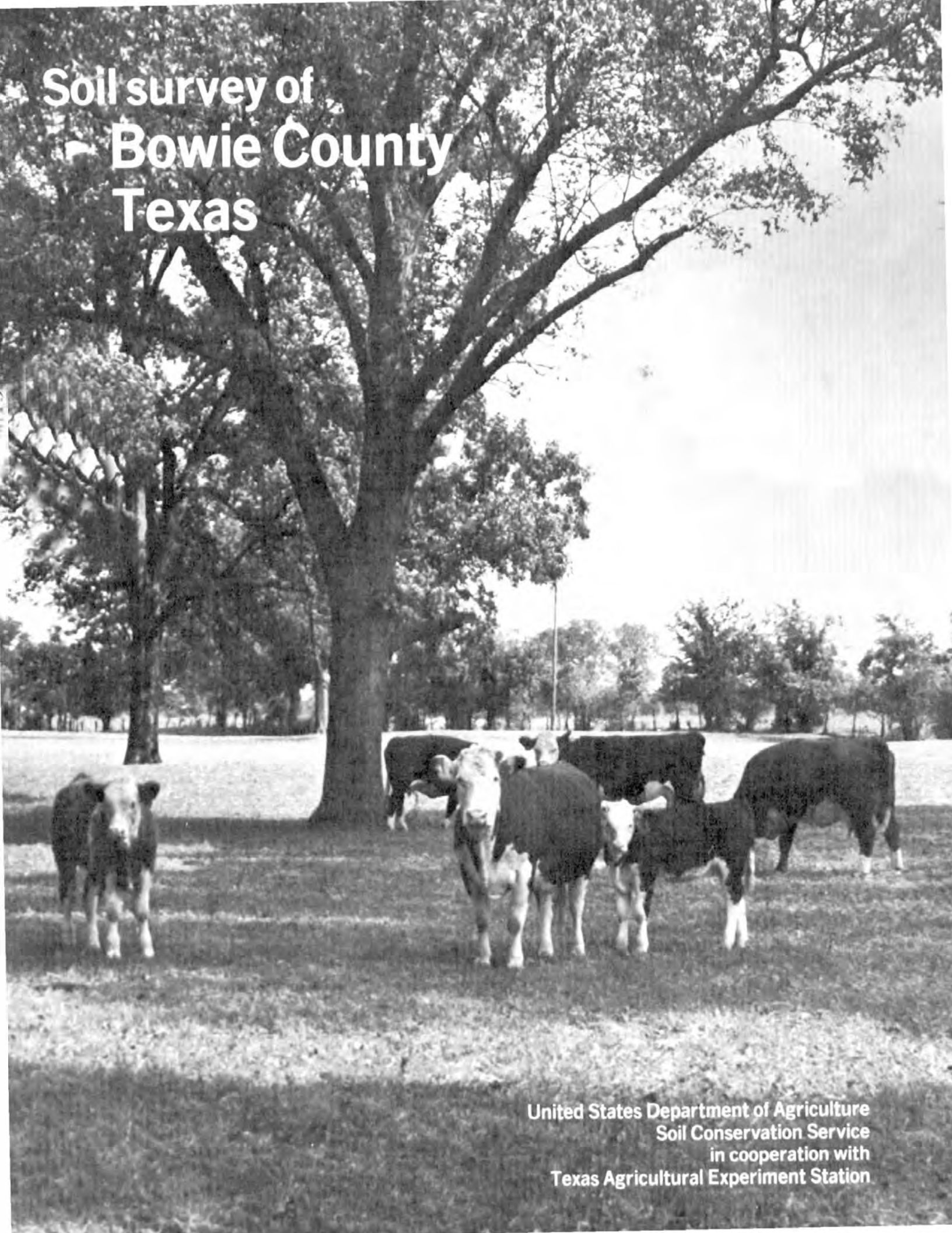
LAND USE MAP

SHEET NO: LUM

TexAmericas Center

APPENDIX B

Soil survey of Bowie County Texas



United States Department of Agriculture
Soil Conservation Service
in cooperation with
Texas Agricultural Experiment Station

production. Bahiagrass, bermudagrass, crimson clover, and arrowleaf clover are the main plants.

These soils are moderately well suited to loblolly pine, shortleaf pine, and eastern redcedar. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases yields.

This soil is poorly suited to crops. Droughtiness, the erosion hazard, the high gravel content, and low fertility are the main limiting features. However, the addition of lime and fertilizers will increase production. Terraces and diversions help control soil washing. Crop residue left on the soil surface helps to maintain organic matter content.

This soil is well suited to most urban development. Small stones or gravel are limitations for shallow excavations. In some areas, slope is a limitation for small commercial buildings.

This soil is well suited to recreational development except for playgrounds, which are limited by slope and small stones or gravel.

This soil is in capability subclass IIIe; woodland group 4f.

34—Saffell-Urban land complex, 3 to 8 percent slopes. This deep, gently sloping and sloping complex is on forested convex upland terraces. Slopes average about 5 percent. Areas are long and narrow. They average about 75 acres. This complex is about 45 percent Saffell soils, about 35 percent Urban land, and about 20 percent other soils. Areas of these soils and Urban land are so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the Saffell soil has a slightly acid gravelly sandy loam surface layer about 14 inches thick. It is brown in the upper part and yellowish red in the lower part. The subsoil to a depth of 80 inches or more is red, very strongly acid gravelly sandy clay loam.

Cuts for leveling purposes have removed the gravelly sandy loam surface layer and exposed the more clayey subsoil in some places. The Saffell soils are well drained and moderately permeable. The available water capacity is low. The erosion hazard is moderate.

Urban land is occupied mostly by commercial establishments and their paved parking lots. In places there are single-unit dwellings, streets, driveways, sidewalks, and patios.

Information on the use of these areas for urban development is contained in the sections on engineering and recreation.

This complex is not assigned to a capability subclass or woodland group.

35—Sardis silt loam, frequently flooded. This nearly level soil is on flood plains along the major creeks and drainageways. Slopes are less than 1 percent. Soil areas are long and narrow and parallel to streams. They range from 50 to several hundred acres and average about 200 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 62 inches or more. In the upper 41 inches, it is silt loam that is yellowish brown in the upper part and brown in the lower part. The lower part of the subsoil is pale brown fine sandy loam. Typically, this soil is neutral in the upper part and grades to very strongly acid in the lower part.

This soil is somewhat poorly drained. It floods briefly two to four times a year. A water table is 1 to 3 feet below the surface during winter and spring. Runoff is slow, and permeability is moderate. The available water capacity is high. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small areas of Amy and Thenas soils. The included soils make up less than 30 percent of any mapped area.

This Sardis soil is used mainly for woodland and pasture.

This soil is moderately well suited to pasture. The main forage plants are bermudagrass, fescue, bahiagrass, crimson clover, and arrowleaf clover. Frequent flooding and wetness limit yields to some extent. Proper grazing and the addition of lime and fertilizers increase yields.

This soil is well suited to trees such as loblolly pine, yellow-poplar, water oak, and sweetgum. Proper woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is not recommended for cultivation because of frequent flooding.

This soil is poorly suited to urban and recreational development because of the hazard of flooding.

This soil is in capability subclass Vw; woodland group 1w.

36—Sawyer silt loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is on uplands. Areas are broad and irregular in shape. They range from 20 to 500 acres and average about 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. It is yellowish brown silty clay loam in the upper 9 inches, yellowish brown clay loam that has grayish and reddish mottles in the next 11 inches, and mottled gray, red, and strong brown clay in the lower part. Typically, this soil is slightly acid in the upper part and grades to very strongly acid in the lower part.

This soil is moderately well drained. Runoff and permeability are slow. Available water capacity is high. The rooting zone is deep, but the clayey texture in the lower part slows the movement of roots, water, and air. The erosion hazard is moderate.

Included with this soil in mapping are a few areas of Adaton and Eylau soils. Some areas have small mounds. Included soils make up 10 to 20 percent of the area.

These Sawyer soils are used mostly for pasture. A few areas are used for woodland and crops.

This soil is well suited to pasture plants such as bermudagrass, dallisgrass, bahiagrass, ryegrass, arrowleaf clover, and crimson clover. Proper grazing and the addition of lime and fertilizers increase production.

This soil is well suited to trees such as loblolly and slash pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and control of fire, increases timber production (fig. 9).

This soil is moderately well suited to crops. The main crops are soybeans, grain sorghum, corn, and small grains. Low fertility and the erosion hazard are the main limiting features. Terraces and diversions decrease the amount of soil washing. Crop residue left on the soil surface increases infiltration and maintains organic matter content. Lime and fertilizers increase yields.

This soil is poorly suited to most urban development. High shrink-swell and high clay content are the main limiting features. Low strength is also a limitation for roads and streets.

This soil is well suited to recreational developments

Figure 9.—Mixed pine and hardwood forest on Sawyer silt loam, 0 to 3 percent slopes.

such as picnic areas and paths and trails. It is moderately well suited to camp areas and playgrounds. Slow permeability and slope are limitations.

This soil is in capability subclass IIe; woodland group 2w.

37—Sawyer-Urban land complex, 0 to 3 percent slopes. This nearly level and gently sloping soil is on upland interstream divides. Slopes average about 2 percent. Most areas are broad and irregular in shape. They range from 20 to several hundred acres and average about 50 acres.

This complex is about 60 percent Sawyer soils, 30 percent Urban land, and 10 percent other soils. Areas of these soils and Urban land are so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the Sawyer soil has a surface layer of dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. It is yellowish brown silty clay loam that has grayish and reddish mottles in the upper 26 inches. Below this is gray, red, and strong brown, very strongly acid clay. The upper layers of most of the soil have been altered by cutting and filling.

Sawyer soils are moderately well drained. Runoff is slow, and permeability is slow. Available water capacity is high. The rooting zone is deep, but the clayey texture in the lower part slows the movement of water, air, and plant roots. The erosion hazard is moderate.

Structures on Urban land are mostly commercial buildings, streets, parking lots, and residences.

Included with this complex in mapping are small areas of Eylau and Ruston soils. The included soils make up about 10 percent of each mapped area.

The main soil characteristics that affect construction are high shrink-swell and wetness. Low strength limits use for streets and roads. Information about the use of these soils for urban development is contained in the sections on engineering and recreation.

This complex is not assigned to a capability subclass or woodland group.

38—Severn very fine sandy loam. This nearly level soil is on flood plains that rarely flood. Soil areas are long and narrow and parallel the river. They range from 100 to over 1,000 acres and average about 300 acres.

Typically, this soil has a surface layer of reddish brown very fine sandy loam about 8 inches thick. The next layer, to a depth of about 42 inches, is yellowish red very fine sandy loam. Below this to a depth of 65 inches or more is reddish brown, moderately alkaline silty clay loam stratified with other textures. Typically, this soil is moderately alkaline throughout.

This soil is well drained. It is rarely flooded. Runoff is slow, and permeability is moderately rapid. Available water capacity is high. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small areas of Severn silty clay loam and Kiomatia soils. Also included are areas of a soil that has a thin clayey horizon on the surface and stratified sandy horizons below. These soils make up less than about 20 percent of the mapped acreage.

Most of this Severn soil is used for crops.

This soil is well suited to pasture. Bermudagrass, white clover, and alfalfa are common pasture and hay plants. Proper grazing and fertilization increase production.

This soil is well suited to trees such as eastern cottonwood, black walnut, pecan, and sweetgum. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is well suited to soybeans, grain sorghum, cotton, and corn. Crop residue left on the soil surface helps to maintain organic matter content. Fertilizers increase yields.

This soil is moderately well suited to urban development. Limitations are flooding and low strength. Low strength is particularly a limitation for roads and streets.

This soil is well suited to recreational development.

This soil is in capability class I; woodland group 2o.

39—Severn silty clay loam. This nearly level soil is on flood plains that rarely flood. Areas are circular or long and narrow. They range from 10 to 100 acres and average about 50 acres.

Typically, the surface layer is dark reddish brown silty clay loam about 8 inches thick. The underlying material extends to a depth of 72 inches or more. It is silt loam that is reddish brown in the upper part, yellowish red in the middle part, and reddish brown in the lower part. This soil is typically calcareous throughout.

This soil is well drained. Runoff is slow, and permeability is moderately rapid. Available water capacity is high. The rooting zone is deep, and roots, water, and air move easily through the soil. The erosion hazard is slight.

Included with this soil in mapping are small areas of Billyhaw clay, Severn very fine sandy loam, and Redlake clay. Included soils make up less than 20 percent of any mapped area.

Most of this Severn soil is used for crops. Minor acreages are in pasture and woodland.

This soil is well suited to pasture. Bermudagrass, white clover, and alfalfa, are the main pasture plants. Proper grazing and the addition of fertilizers increase production.

This soil is well suited to trees such as eastern

This Woodtell soil is used for pasture and woodland.

This soil is moderately well suited to pasture. The main forage crops are bermudagrass, bahiagrass, crimson clover, and arrowleaf clover. Proper grazing and the addition of lime and fertilizers can increase yields.

This soil is moderately well suited to trees such as loblolly pine and shortleaf pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber production.

This soil is not recommended for cultivation because of slope and the hazard of erosion.

This soil is poorly suited to urban development. The main limitations are the high shrink-swell, high clay content, and low strength. Low strength is a limitation for local roads and streets.

This soil is well suited to recreational development such as paths and trails. It is moderately well suited to picnic areas. Limitations for camp areas and playgrounds are very slow permeability and slope.

This soil is in capability subclass VIe; woodland group 4c.

47—Woodtell gravelly sandy loam, 3 to 8 percent slopes. This gently sloping soil is on narrow convex ridges. Slopes average about 5 percent. Soil areas are oblong. They range from 5 to about 25 acres and average about 15 acres.

Typically, this soil has a surface layer of brownish gravelly sandy loam about 12 inches thick. The subsoil extends to a depth of 44 inches. It is red clay in the upper part and red clay loam in the lower part. Gray mottles are throughout. The underlying material to a depth of 70 inches or more is red sandy clay loam. This soil is typically strongly acid in the upper part and very strongly acid in the lower part.

This soil is moderately well drained. Runoff is medium, and permeability is very slow. Available water capacity is medium. The rooting zone is deep, but the clayey subsoil slows the movement of roots, water, and air. The erosion hazard is moderate.

Included with this soil in mapping are small areas of soils like the Woodtell soil that has loamy subsoil and small areas of the gravelly Saffell soils. The included soils make up less than 15 percent of the mapped acreage.

This Woodtell soil is used for pasture and woodland. The surface layer has been removed from much of this soil for gravel.

This soil is moderately well suited to pasture. Bermudagrass, bahiagrass, crimson clover, and arrowleaf clover are the main forage plants. Proper grazing, the addition of lime, and heavy applications of fertilizers can increase yields.

This soil is moderately well suited to loblolly and slash pine. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber yields.

This soil is poorly suited to crops. Crops can grow successfully, however, with intensive management that includes erosion control, proper management of crop residue, and recommended applications of lime and fertilzers. The main crops are corn and soybeans.

This soil is poorly suited to urban development. The main limitation is the high shrink-swell, and low strength is a limitation for roads and streets.

This soil is well suited to recreational development such as paths and trails. Very slow permeability and slope are limitations for camp areas, picnic areas, and playgrounds.

This soil is in capability subclass IVe; woodland group 4c.

48—Wrightsville-Rodessa complex. This nearly level complex is on broad, upland terraces. Slopes average less than 1 percent. Soil areas are irregular in shape. They range from 10 to over 1,000 acres and average about 300 acres.

This complex is characterized by broad flats of Wrightsville silt loam and circular mounds of Rodessa loam in a random pattern. The mounds of Rodessa soil are so small and the soil pattern is so intricate that the soils could not be shown separately at the scale selected for mapping. The mounds are 2 to 3 feet high, 60 to 120 feet in diameter, and 100 to 200 feet apart.

This complex is about 75 percent Wrightsville soils, 15 percent Rodessa soils, and 10 percent other soils.

Typically, the Wrightsville soil has a surface layer of brown, strongly acid silt loam about 4 inches thick. The next layer, which extends to a depth of 16 inches, is light brownish gray, very strongly acid silt loam. The subsoil to a depth of 80 inches or more is light brownish gray, very strongly acid clay that has strong brown mottles and vertical streaks of uncoated sand and silt.

Wrightsville soils are poorly drained. A water table is at or near the soil surface during the winter and spring. Water stands on the surface for 2 or 3 weeks during the cool season. Runoff is slow, and permeability is very slow. The available water capacity is high. The rooting zone is deep, but the excess water and clayey subsoil restrict the movement of air and plant roots. The erosion hazard is slight.

Typically, the Rodessa soil has a surface layer of brownish loam about 14 inches thick. The subsoil extends to a depth of 70 inches or more. It is yellowish brown loam to a depth of 26 inches. Below this to a depth of about 42 inches, it is clay loam that is yellowish brown in the upper part and pale brown in the lower part. It has common tongues and streaks of uncoated sand and silt and has reddish, brownish, and grayish mottles. The lower part of the subsoil is mottled gray and red clay.

Rodessa soils are somewhat poorly drained. A water table is 2 to 3 feet below the surface during the cool season. Runoff is slow, and permeability is very slow. Available water capacity is high. The rooting zone is deep. The erosion hazard is slight.

Included with this complex in mapping are small spots of Adaton, Ashford, and Sawyer soils. Included soils make up less than 10 percent of the mapped acreage.

Most areas of Wrightsville-Rodessa complex are used for woodland and wildlife habitat. A few areas are used for rice and soybeans and for pasture.

These soils are moderately well suited to pasture plants such as bahiagrass, dallisgrass, and tall fescue. Crimson clover and arrowleaf clover will grow on the Rodessa part of the complex. A drainage system will remove excess water and provide a better environment for pasture plants. Proper grazing and complete fertilizers can increase forage yields.

These soils are moderately well suited to loblolly pine, water oak, willow oak, and sweetgum. Woodland management, such as selective cutting, removal of undesirable trees and shrubs, and protection from fire, increases timber yields.

The soils in this complex, are moderately well suited to crops such as soybeans and rice (fig. 11). Wetness, very slow permeability, low fertility, and droughtiness are the main limiting features. A drainage system is needed to remove excess water. Crop residue left on the soil surface improves infiltration and helps to maintain organic matter content. The addition of lime and a complete fertilizer can increase yields.

These soils are poorly suited to urban development. The main limitations are wetness, low strength, and high shrink-swell characteristics. Low strength limits use for roads and streets.

These soil are poorly suited to most recreational developments because of very slow permeability. However, they are well suited to paths and trails.

This complex is in capability subclass IIIw; woodland group 3w.

Figure 11.—Combining rice on Wrightsville-Rodessa complex.

hard, very friable; many fine roots; about 40 percent by volume of siliceous pebbles up to 3 inches in diameter; medium acid; gradual smooth boundary.

B21t—14 to 45 inches; red (2.5YR 4/6) very gravelly sandy clay loam; weak medium and fine subangular blocky structure; hard, very friable; few fine roots; few patchy clay films on faces of peds; about 50 percent by volume of siliceous pebbles up to 3 inches in diameter; very strongly acid; gradual smooth boundary.

B22t—45 to 80 inches; red (2.5YR 4/6) gravelly sandy clay loam; weak medium and fine subangular blocky structure; hard, very friable; few fine roots; few patchy clay films on faces of peds; about 20 percent by volume of siliceous pebbles up to 3 inches in diameter; very strongly acid.

The thickness of the solum exceeds 60 inches. Reaction is strongly acid or very strongly acid except in surface layers that have been limed.

The A1 horizon is 3 to 6 inches thick. It is brown or dark grayish brown. Pebbles make up 10 to 30 percent of the horizon. The A2 horizon is 2 to 8 inches thick. It is brown, yellowish red, or reddish yellow. Pebbles make up 30 to 50 percent of the horizon. The B2t horizon is red or yellowish red. Pebbles make up 35 to 65 percent of the upper part of the horizon and 20 to 65 percent of the lower part.

These soils are taxadjuncts to the Saffell series. They have a thicker solum than is defined as the range for the Saffell soils, and they do not have a decrease in clay content of more than 20 percent from their maximum within a depth of 60 inches. However, management, use, and behavior are similar to those of the Saffell series.

Sardis series

The soils of the Sardis series are deep, somewhat poorly drained, and loamy. They formed in loamy alluvial sediments high in silt on flood plains. Slopes are less than 1 percent.

A typical pedon of Sardis silt loam, frequently flooded, in pasture; from the intersection of U.S. Highway 82 and U.S. Highway 259 west of De Kalb, 1.75 miles south on U.S. Highway 259, and 50 feet west of road:

A1—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; slightly hard, very friable; many fine roots; neutral; gradual smooth boundary.

B21—9 to 16 inches; yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown mottles; moderate medium subangular blocky structure; slightly hard, very friable; few fine roots; strongly acid; gradual smooth boundary.

B22—16 to 50 inches; brown (10YR 5/3) silt loam; few fine distinct yellowish brown and common medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; slightly hard, very friable; very strongly acid; gradual smooth boundary.

B3—50 to 62 inches; pale brown (10YR 6/3) fine sandy loam; many medium distinct yellowish brown (10YR 5/6) and few fine faint light brownish gray mottles; weak medium subangular blocky structure; slightly hard, very friable; very strongly acid; clear smooth boundary.

The solum thickness ranges from 40 to 70 inches. The 10- to 40-inch control section ranges from 20 to 35 percent clay and is less than 15 percent coarser than very fine sand.

The A horizon is 6 to 10 inches thick. It is brown or dark grayish brown. Reaction ranges from neutral to medium acid. The B2 horizon is brown, dark brown, or yellowish brown with few to many mottles in shades of gray and brown. It is silt loam, silty clay loam, or loam. Reaction ranges from medium acid to very strongly acid. The B3 horizon is light brownish gray, pale brown, or gray. It is silty clay loam, silt loam, fine sandy loam, or clay loam. Reaction ranges from medium acid to very strongly acid.

Sawyer series

The soils of the Sawyer series are deep, moderately well drained, and loamy. They formed in loamy and clayey sediments on uplands. Slopes range from 0 to 3 percent.

A typical pedon of Sawyer silt loam, 0 to 3 percent slopes, in pasture; from the intersection of Texas Highway 98 and U.S. Highway 82 west of New Boston, 1 mile west on U.S. Highway 82, south on county road 0.9 mile, and 50 feet east of road:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; hard, friable; many fine roots; slightly acid; gradual smooth boundary.

B21t—6 to 15 inches; yellowish brown (10YR 5/6) silty clay loam; few fine faint light brownish gray mottles; weak coarse subangular blocky structure parting to moderate medium and fine subangular blocky; hard, friable; few fine roots; few patchy clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—15 to 26 inches; yellowish brown (10YR 5/6) clay loam; many prominent coarse red (2.5YR 4/6) and many fine faint light brownish gray mottles; moderate medium subangular blocky structure; hard, friable; few patchy clay films on faces of peds; 5 percent by volume light gray (10YR 7/2) uncoated sand and silt; very strongly acid; gradual smooth boundary.

B23t&A2—26 to 38 inches; mottled yellowish brown (10YR 5/6) and red (2.5YR 4/6) clay; moderate medium and fine subangular blocky structure; hard, firm; few patchy clay films on faces of peds; 20

percent by volume light gray (10YR 7/2) uncoated sand and silt between peds; very strongly acid; gradual smooth boundary.

B24t—38 to 61 inches; gray (10YR 5/1) clay; few coarse distinct strong brown (7.5YR 5/8) and many coarse prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; about 5 percent by volume uncoated sand and silt on faces of peds; very strongly acid; gradual smooth boundary.

B25t—61 to 80 inches; mottled gray (10YR 5/1) and red (2.5YR 4/6) clay; few fine distinct strong brown mottles; weak medium subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; about 10 percent by volume uncoated sand and silt in streaks and pockets; very strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches.

The A horizon is 4 to 10 inches thick. It is dark grayish brown, brown, pale brown, or grayish brown. Reaction is slightly acid or medium acid. In some pedons there is an A2 horizon that is brown, grayish brown, or pale brown and is 3 to 5 inches thick. In some pedons there is a B1 horizon that is thin yellowish brown. The B21t horizon is yellowish brown or strong brown. In some pedons this horizon has a few grayish mottles. It is silt loam, silty clay loam, or clay loam. Reaction is strongly acid or very strongly acid. The B22t horizon is yellowish brown with common or many grayish brown, light brownish gray, light gray, or gray mottles and few or common yellowish red or red mottles. This horizon is silt loam, silty clay loam, or clay loam. Reaction is strongly acid or very strongly acid. The depth to the clayey Bt horizon is 24 to 40 inches. The lower part of the Bt horizon is mottled gray, red, and brown. Each of these colors is dominant in places. Texture is clay or silty clay. Pockets, streaks, and tongues of lighter colored clean sand and silt make up 5 to 25 percent of the lower part of the Bt horizon.

Severn series

The soils of the Severn series are deep, well drained, and loamy. They formed in loamy alluvium high in silt on flood plains. Slopes range from 0 to 1 percent.

A typical pedon of Severn very fine sandy loam, in cropland; 200 feet west of the south end of the Red River bridge on U.S. Highway 259:

Ap—0 to 8 inches; reddish brown (5YR 4/4) very fine sandy loam; weak subangular blocky and granular structure; slightly hard, friable; many fine roots; few worm casts; calcareous; moderately alkaline; gradual smooth boundary.

C1—8 to 42 inches; yellowish red (5YR 4/6) very fine sandy loam; massive; slightly hard, friable; few fine strata of loam and loamy fine sand; calcareous; moderately alkaline; abrupt smooth boundary.

C2—42 to 65 inches; reddish brown (5YR 4/4) silty clay loam; massive; slightly hard, firm; few fine strata of loam and loamy fine sand; calcareous; moderately alkaline.

The A horizon is 6 to 15 inches thick. It is dark brown, dark reddish brown, or reddish brown. The A horizon is very fine sandy loam or silty clay loam. Reaction is moderately alkaline or mildly alkaline. Some pedons are noncalcareous in the upper 10 inches. The C horizon is yellowish red, reddish brown, or light reddish brown. It is very fine sandy loam, silty clay loam, or silt loam. The C horizon contains thin strata of coarser and finer textured materials.

Smithdale series

The soils of the Smithdale series are deep, well drained, and loamy. They formed in loamy sediments on uplands. Slopes range from 8 to 12 percent.

A typical pedon of Smithdale fine sandy loam, 8 to 12 percent slopes, in pasture; from the intersection of Farm Road 2735 and U.S. Highway 82 in De Kalb, 8.25 miles north on Farm Road 2735, 1.2 miles east on county road, 0.25 mile south on county road; and 150 feet east of road:

A1—0 to 6 inches; dark brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; slightly hard, very friable; few fine roots; slightly acid; clear smooth boundary.

A2—6 to 15 inches; yellowish red (5YR 5/6) fine sandy loam; weak fine subangular blocky structure; slightly hard, very friable; few fine roots; medium acid; gradual smooth boundary.

B21t—15 to 25 inches; red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; hard, friable; few fine roots; many pores and horizontal channels 1/8 inch in diameter; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—25 to 42 inches; red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; hard, friable; many patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—42 to 80 inches; red (2.5YR 4/6) sandy clay loam; moderate coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, friable; many patchy clay films on faces of peds; tongues of uncoated sand about 1 inch wide make up 15 to 20 percent; very strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches. Reaction in all horizons is strongly acid or very strongly acid in unlimed soil.

The A1 horizon is 4 to 10 inches thick. It is brown, dark brown, dark grayish brown, or dark yellowish brown.

ranges from neutral to moderately alkaline. The IIB horizon is calcareous or noncalcareous and has few to many calcium carbonate concretions.

These soils are taxadjuncts to the Perry series because they are deeper to the IIB horizon than is typical for the Perry series. Use, management, and behavior are similar to those of the Perry soils.

Redlake series

The soils of the Redlake series are deep, moderately well drained, and clayey. They formed in clayey alluvium on flood plains. Slopes are less than 1 percent.

A typical pedon of Redlake clay, in cropland; from the intersection of Interstate Highway 30 and Farm Road 992 in New Boston, 13.5 miles north on Farm Road 992, 3 miles north and west on private road, and 50 feet east:

A1—0 to 5 inches; dark reddish brown (2.5YR 3/4) clay; weak coarse granular and subangular blocky structure; extremely hard, very firm; common fine roots; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21—5 to 35 inches; dark red (2.5YR 3/6) clay; weak coarse subangular blocky structure; extremely hard, very firm; few fine roots; few worm casts; calcareous; moderately alkaline; clear smooth boundary.

B22—35 to 56 inches; red (2.5YR 4/6) clay; weak coarse subangular blocky structure; extremely hard, very firm; calcareous; moderately alkaline; abrupt smooth boundary.

IIC—56 to 72 inches; red (2.5YR 5/6) silt loam; massive; slightly hard, friable; few thin strata of silty clay loam; calcareous; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches. All horizons are mildly alkaline or moderately alkaline. Some pedons are noncalcareous in the upper 10 inches, but all are calcareous below a depth of 10 inches. These soils crack when dry.

The A horizon is 5 to 10 inches thick. It is dark reddish brown or dusky red. The B horizon is red, dark red, or dark reddish brown. Texture is clay or silty clay. The IIC horizon is silt loam, clay loam, or silty clay loam and is stratified in some pedons.

Rodessa series

The soils of the Rodessa series are deep, somewhat poorly drained, and loamy. They formed in clayey sediments on uplands. They are on mounds in the Wrightsville-Rodessa complex. Slopes range from 0 to 1 percent.

A typical pedon of Rodessa loam in the Wrightsville-Rodessa complex, in woodland; from the intersection of Farm Road 561 and U.S. Highway 259 south of De Kalb, 0.1 mile south on U.S. Highway 259, 1.8 miles west on county road, 1.5 miles south, and 25 feet west:

A11—0 to 8 inches; brown (10YR 4/3) loam; moderate medium granular structure; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A12—8 to 14 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; slightly hard, very friable; few fine roots; medium acid; gradual smooth boundary.

B1—14 to 26 inches; yellowish brown (10YR 5/6) loam; moderate fine subangular blocky structure; hard, very friable; many worm casts; many patchy clay films on faces of peds; few black concretions; strongly acid; gradual smooth boundary.

B21t&A'2—26 to 34 inches; yellowish brown (10YR 5/8) clay loam; few fine distinct red mottles; moderate fine subangular blocky structure; hard, firm; white (10YR 8/2) uncoated silt and sand on surfaces of peds and in streaks and tongues make up 25 percent of the horizon; very strongly acid; gradual smooth boundary.

B22t&A'2—34 to 42 inches; pale brown (10YR 6/3) clay loam; many coarse distinct strong brown (7.5YR 5/6), many coarse prominent red (2.5YR 4/6), and few medium faint light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; hard, firm; white (10YR 8/2) tongues and streaks of uncoated silt and sand make up about 15 percent of the horizon; very strongly acid; gradual smooth boundary.

B23t—42 to 70 inches; gray (10YR 5/1) clay; few coarse faint strong brown (7.5YR 5/6) and many coarse distinct red (2.5YR 4/6) mottles; weak medium subangular blocky structure; very hard, very firm; few streaks of uncoated sand and silt; very strongly acid.

The thickness of the solum ranges from 60 to more than 100 inches.

The A horizon is 16 to 22 inches thick. It is brown, dark yellowish brown, yellowish brown, light yellowish brown, or pale brown. The A horizon is loam or fine sandy loam. Reaction ranges from slightly acid to very strongly acid. The B1 horizon is 6 to 12 inches thick. It is light yellowish brown, yellowish brown, or very pale brown. It is loam or fine sandy loam. Reaction ranges from medium acid to very strongly acid. The B2t&A'2 horizons are clay loam or loam. The B2t part is yellowish brown, pale brown, strong brown, or light brownish gray. The A'2 part is white or light gray and makes up 10 to 60 percent of the horizon. Reaction of the B2t&A'2 horizon is strongly acid or very strongly acid. The lower part of the B2t horizon is gray, dark gray, or light brownish gray. This horizon is clay or silty clay. Reaction ranges from medium acid to very strongly acid.

Roebuck series

The soils of the Roebuck series are deep, somewhat poorly drained, and clayey. They formed in clayey alluvium on flood plains. Slopes are less than 1 percent.

Wrightsville series

The soils of the Wrightsville series are deep, poorly drained, and loamy. They formed in clayey sediments on uplands. Slopes range from 0 to 1 percent.

A typical pedon of Wrightsville silt loam in the Wrightsville-Rodessa complex, in woodland; from the intersection of Farm Road 561 and U.S. Highway 259 south of De Kalb, 0.1 mile south on U.S. Highway 259, 1.8 miles west on county road, 1.5 miles south, 50 feet west of road:

A1—0 to 4 inches; brown (10YR 5/3) silt loam; weak fine granular structure; hard, friable; many fine roots and bits of organic material; strongly acid; clear smooth boundary.

A2g—4 to 16 inches; light brownish gray (10YR 6/2) silt loam; common fine faint strong brown mottles; weak medium subangular blocky structure; extremely hard, friable; few fine roots; very strongly acid; gradual irregular boundary.

B21tg&A'2g—16 to 28 inches; light brownish gray (2.5Y 6/2) clay loam; few fine faint strong brown mottles; weak medium subangular blocky structure; extremely hard, very firm; about 20 percent of volume tongues of light brownish gray (10YR 6/2) uncoated sand and silt; very strongly acid; gradual smooth boundary.

B22tg—28 to 55 inches; light brownish gray (2.5Y 6/2) clay; few fine faint strong brown mottles; weak medium subangular blocky structure; extremely hard, very firm; streaks and coatings on peds of light brownish gray (10YR 6/2) silt loam; very strongly acid; gradual smooth boundary.

B23tg—55 to 66 inches; light brownish gray (2.5Y 6/2) clay; many medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; few slickensides; few black specks and streaks; streaks and coatings on peds of light brownish gray (10YR 6/2) silt loam; very strongly acid; gradual smooth boundary.

B24tg—66 to 80 inches; light brownish gray (2.5Y 6/2) clay; few fine faint strong brown mottles; weak subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; few slickensides and pressure faces; streaks of light brownish gray (10YR 6/2) silt loam; strongly acid.

The thickness of the solum ranges from 65 to 80 inches. Reaction is strongly acid or very strongly acid except in places where the soil has been limed.

The A1 horizon is 2 to 5 inches thick. It is grayish brown, brown, or dark grayish brown. In some pedons this horizon has a few faint yellowish brown or strong brown mottles. The A2 horizon is 9 to 18 inches thick. It is light brownish gray or light gray. The A2 horizon is silt loam or silty clay loam. Tongues of this horizon extend deep into the B2tg horizon. The B2tg horizon is gray or light brownish gray. Mottles of strong brown and yellowish brown range from few to many. The B2tg horizon is clay or silty clay with tongues and streaks of lighter colored uncoated silt, silt loam, or very fine sandy loam. In a few pedons, there are black streaks, specks, and concretions in the B2tg horizon.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
32:*					
Sacul	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Urban land.					
33---------- Saffell	Severe: small stones.	Slight----------	Slight----------	Moderate: slope.	Slight.
34:*					
Saffell----------	Severe: small stones.	Slight----------	Slight----------	Moderate: slope.	Slight.
Urban land.					
35---------- Sardis	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength.
36---------- Sawyer	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
37:*					
Sawyer----------	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
Urban land.					
38, 39---------- Severn	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
40---------- Smithdale	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
41---------- Texark	Severe: floods, too clayey, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, wetness.
42---------- Thenas	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
43.* Udorthents					
44---------- Vesey	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
45---------- Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
46---------- Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
47---------- Woodtell	Severe: wetness, too clayey.	Severe: shrink-swell.	Severe: shrink-swell. wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
48:* Wrightsville----- Rodessa----------	Severe: wetness, too clayey. Severe: wetness.	Severe: wetness, shrink-swell. Severe: shrink-swell.	Severe: wetness, shrink-swell. Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell. Severe: shrink-swell.	Severe: wetness, low strength, shrink-swell. Severe: shrink-swell, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
32:*											
Sacul	0-10	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	80-100	40-65	<20	NP-3
	10-55	Clay, silty clay	CH, MH, CL	A-7	0	95-100	90-100	85-95	80-90	45-70	20-40
	55-65	Silty clay loam, silt loam, clay loam.	CL, CH, ML, SC	A-6, A-7, A-4	0	95-100	90-100	85-100	40-90	25-55	8-32
Urban land.											
33											
Saffell	0-14	Gravelly sandy loam.	SM	A-1, A-2, A-4	0-5	70-80	50-75	40-65	20-40	<20	NP-3
	14-80	Gravelly sandy loam, very gravelly sandy loam, gravelly loamy sand.	GM, GC, SM, SC	A-1, A-2, A-3	0-5	25-80	10-70	5-60	5-35	<35	NP-15
34:*											
Saffell	0-14	Gravelly sandy loam.	SM	A-1, A-2, A-4	0-5	70-80	50-75	40-65	20-40	<20	NP-3
	14-80	Gravelly sandy loam, very gravelly sandy loam, gravelly loamy sand.	GM, GC, SM, SC	A-1, A-2, A-3	0-5	25-80	10-70	5-60	5-35	<35	NP-15
Urban land.											
35											
Sardis	0-9	Silt loam	ML, CL-ML, CL	A-4	0	100	100	80-100	75-95	<30	NP-10
	9-50	Silt loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	100	85-100	80-100	25-40	5-20
	50-62	Loam, silt loam, sandy loam.	ML, SM, CL, SC	A-4, A-2	0	100	95-100	60-95	35-75	<30	NP-10
36											
Sawyer	0-6	Silt loam	ML, CL-ML	A-4	0	100	95-100	85-95	60-90	<25	NP-7
	6-26	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	95-100	85-95	70-90	30-40	10-20
	26-80	Silty clay, clay	CH, CL, MH	A-7	0	100	95-100	90-100	80-90	45-60	20-35
37:*											
Sawyer	0-6	Silt loam	ML, CL-ML	A-4	0	100	95-100	85-95	60-90	<25	NP-7
	6-32	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	95-100	85-95	70-90	30-40	10-20
	32-80	Silty clay, clay	CH, CL, MH	A-7	0	100	95-100	90-100	80-90	45-60	20-35
Urban land.											
38											
Severn	0-8	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	94-100	65-97	22-31	3-12
	8-65	Stratified silt loam to loamy very fine sand.	ML, CL-ML	A-4	0	100	100	94-100	65-97	<28	NP-7

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
35--- Sardis	Fair: wetness, low strength.	Poor: excess fines.	Poor: excess fines.	Good.
36--- Sawyer	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
37:*				
Sawyer---	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Urban land.				
38, 39--- Severn	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
40--- Smithdale	Good---	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
41--- Texark	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
42--- Thenas	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
43.* Udorthents				
44--- Vesey	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
45, 46, 47--- Woodtell	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
48:*				
Wrightsville---	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Rodessa---	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
48:*											
Wrightsville------	0-16	Silt loam-------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	75-100	<31	NP-10
	16-55	Silty clay, clay, silty clay loam.	CH, CL, MH	A-7	0	100	100	95-100	90-100	41-65	22-40
	55-80	Silty clay loam, silty clay, clay.	CL, CH, MH	A-7, A-6	0	100	95-100	95-100	90-100	35-65	16-40
Rodessa----------	0-26	Loam------------	ML, CL-ML, CL	A-4	0	100	100	80-95	55-75	15-25	3-8
	26-70	Clay, clay loam.	CH, CL	A-7-6	0	100	100	90-100	75-95	45-65	25-40

* See description of the map unit for composition and behavior characteristics of the map unit.

APPENDIX C

ETTL Engineers & Consultants Inc.

GEOTECHNICAL ✱ MATERIALS ✱ ENVIRONMENTAL ✱ DRILLING ✱ LANDFILLS

July 31, 2013

William V. Cork
TexAmericas Center
107 Chapel Lane
New Boston, Texas 75570

SUBJECT: TexAmericas Center – East Parcels 1, 2, 3, 6, 7, 8 & 9
Hooks, Texas
Preliminary Geotechnical Investigation
ETTL Job No. G3972-136

Dear Mr.Cork:

Submitted herein is the report summarizing the results of a preliminary geotechnical investigation conducted at the site of the above referenced project.

If you have any questions concerning this report, or if we can be of further assistance during construction, please contact us. We are available to perform any construction materials testing and inspection services that you may require. Thank you for the opportunity to be of service.

Sincerely,
ETTL Engineers & Consultants Inc.

Russell W. Gibson, P.E.
Project Manager

STATE OF TEXAS
RUSSELL W. GIBSON
104979
LICENSED PROFESSIONAL ENGINEER

ETTL
ENGINEERS & CONSULTANTS
F-3208
July 31, 2013

C. Brandon Quinn, P.E., P.G.
Vice President
Manager of Engineering Services

STATE OF TEXAS
C. BRANDON QUINN
72441
REGISTERED PROFESSIONAL ENGINEER

ETTL
ENGINEERS & CONSULTANTS
F-3208
July 31, 2013

Distribution: (2) TexAmericas Center

210 Beech Street
Texarkana, Arkansas 71854
870-772-0013 Phone
870-216-2413 Fax

1717 East Erwi n
Tyler, Texas 75702
903-595-4421 Phone
903-595-6113 Fax

707 West Cotton Street
Longview, Texas 75604-5505
903-758-0915 Phone
903-758-8245 Fax

w w w . e t t l i n c . c o m

Preliminary Geotechnical Investigation
TexAmericas Center – East Parcels 1, 2, 3, 6, 7, 8 & 9
Hooks, Texas

Submitted to

TexAmericas Center
New Boston, Texas

Prepared by

ETTL Engineers & Consultants Inc.
Tyler, Texas

July 2013

EXECUTIVE SUMMARY

This Executive Summary is provided as a brief synopsis of the specific recommendations and design criteria provided in the attached report. It is not intended as a substitute for a thorough reading of the report in its entirety.

Project Description

The project consists of a preliminary geotechnical investigation for parcels 1, 2, 3, 6, 7, 8 & 9 at bore locations staked by representatives of TexAmericas. **This investigation is very preliminary and not to be used for any final design.**

Site Description

The project site is currently partially developed with large areas heavily forested. According to USGS topography, the elevation varies from approximately 325 to 425. The elevation decreases generally from west to east with drainage ways running south to north at two to three locations.

Depth & Number of Borings

Location	Borings	Depth
Parcel 1 – 223.5 Acres	B-1, B-2, B-3, B-4, B-5	2-20' & 3-10'
Parcel 2 – 136.9 Acres	B-10, B-11, B-12, B-13	2-20' & 2-10'
Parcel 3 – 198.8 Acres	B-6, B-7, B-8, B-9	2-20' & 2-10'
Parcel 6 – 83.5 Acres	B-14, B-15, B-16, B-17	2-20' & 2-10'
Parcel 7 – 2.0 Acres	B-18	1-20'
Parcel 8 – 8.1 Acres	B-19, B-20	1-20' & 1-10'
Parcel 9 – 36.2 Acres	B-21, B-22	2-20'

Soils Encountered

The soils encountered in Parcel 1 generally consisted of loose to medium dense silty sands (SM), silty clayey sands (SC-SM) and silts (ML) overlying interlayered medium stiff to hard lean clays (CL) and fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from non-plastic to 42.

The soils in Parcel 2 consisted of surficial loose silts (ML) and clayey sands (SC) overlying soft to medium stiff lean clays (CL) followed by medium stiff to hard fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from non-plastic to 61.

In Parcel 3, the soils encountered generally consisted of interlayered soft to very stiff lean clays (CL) and fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from 13 to 35.

The soils in Parcel 6 consisted of interlayered medium stiff to hard lean clays (CL) and fat clays (CH). Very loose to loose silt (ML) and clayey sand (SC) was found at the surface in Boring B-17. Atterberg Plasticity Indices of the tested soils ranged from 16 to 51.

The soils encountered in Parcel 7 consisted of stiff to very stiff fat clays (CH). Atterberg Plasticity Index of the tested soils was 42.

In Parcel 8, the soils encountered consisted of very soft to medium stiff interlayered lean clays (CL) and fat clays (CH) and very loose silt (ML) overlying medium stiff to very stiff fat clay (CH). Atterberg Plasticity Indices of the tested soils ranged from 15 to 44.

The soils encountered in Parcel 9 consisted of medium stiff to hard fat clays (CH). The Atterberg Plasticity Indices of the tested soils ranged from 43 to 61.

Groundwater Depth
No seepage was noted during drilling operations and all borings were dry and open upon completion. The phreatic surface is predicted to be at some depth deeper than 20 feet.

Recommended Foundation Type
Shallow spread footings
Shallow spread footings/ stiffened slab option
Drilled piers

Allowable Gross Bearing Pressure
Spread Footings
Depth listed is below finished subgrade or adjacent exterior grade whichever is deeper.

Parcel	Native Soils		Select Fill	
	Isolated Footings	Strip Footings	Isolated Footings	Strip Footings
Parcel 1	800 psf @ 2 ft.	600 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 2 ft.
Parcel 2	1000 psf @ 2 ft.	1000 psf @ 2 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 3	1000 psf @ 2 ft.	1000 psf @ 2 ft.	1000 psf @ 2 ft.	1000 psf @ 2 ft.
Parcel 6	1000 psf @ 2 ft.	500 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 7	3000 psf @ 2 ft.	2500 psf @ 1.5 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 8	800 psf @ 2 ft.	800 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 2 ft.
Parcel 9	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.

Drilled Piers
Bearing capacity for underreamed piers bearing at the indicated depth below existing grade.

Location	End Bearing Capacity	Depth
Parcel 1	6000 psf	18
Parcel 2	6000 psf	13
Parcel 3	6000 psf	18
Parcel 6	6000 psf	13
Parcel 7	6000 psf	13
Parcel 8	6000 psf	13
Parcel 9	6000 psf	13

Floor System
Flat Slab on prepared subgrade
Stiffened slab on grade - monolithically placed with *shallow footings*
Structurally suspended floor - used with *drilled piers* only

Building Subgrade Preparation
The following *minimum* overexcavation is suggested for the specific option chosen. Limits of overexcavation should extend beyond building and footing lines a distance of 5'. Options are listed in order of increasing risk of damage due to soil movement.

- *Drilled piers with suspended slab* - Grade void space beneath floor to drain.

- *Drilled piers with grade beams and floor slab on prepared subgrade* - Native expansive clay soils are to be removed and replaced with select fill. Overexcavation to the depths below existing grade shown in the table below in order to reduce Potential Vertical Rise (PVR) to 1.0" or less.

- *Shallow spread footings with monolithic flat slab* - Overexcavate to the depths below existing grade shown in the table below in order to reduce the PVR to 1 inch or less.

- *Shallow spread footings with monolithic stiffened slab placed on grade* – None required.

For options where the slab is to be placed on grade, scarify the exposed subgrade, adjust the moisture content, and recompact. Place select fill to finished slab subgrade.

Location	Undercut Depth (ft.)
Parcel 1	3 – 6
Parcel 2	6 – 8
Parcel 3	1 – 3
Parcel 6	6.5 – 7.5
Parcel 7	6
Parcel 8	4 – 7
Parcel 9	7 – 8

Pavement

Cut to proposed subgrade elevation as required and proof roll prior to compaction or treatment. Soft and/or unstable areas should be cut out and replaced with select fill. Scarify exposed subgrade to a depth of 8 inches, adjust the moisture content to optimum -1% to optimum +3% and recompact. If highly plastic soil (PI > 20) is encountered at finished subgrade, it should be cut out to a depth of 18 inches and replaced with select fill. Lime treatment of the subgrade is an alternative to removing and replacing soil.

Table 1 – Pavement Options – Light Duty

Type	Base/Surface Thickness		Subgrade Preparation
Flexible HMAC	2" Surface (Type D)	6" Crushed Stone Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" HMAC Surface (Type D)	3" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	5" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Table 2 – Pavement Options – Medium Duty			
Type	**Base/Surface Thickness**		**Subgrade Preparation**
Flexible HMAC	3" Surface (Type C or D)	8" Crushed Stone Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" Surface (Type C or D)	4" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	6" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Table 3 – Pavement Options – Heavy Duty			
Type	**Base/Surface Thickness**		**Subgrade Preparation**
Flexible HMAC	2" Surface (Type C or D)	7" Crushed Stone Base & 2.5" HMAC Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" Surface (Type C or D)	5.5" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	7" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Notes:

1) Tensar Triax Geogrid placed on subgrade may be substituted for lime treatment of subgrade. Lime treatment or replacement with select fill only needed where expansive clay is encountered within 12" of finished subgrade as determined by a representative of this firm.

2) Increase HMAC thickness by 1" in lieu of lime treated subgrade

3) Increase concrete thickness by 0.5" in lieu of lime treated subgrade.

Construction Considerations

The surficial soils in several areas may become unstable when wet necessitating remediation or removal and replacement to facilitate construction.

1.0 INTRODUCTION

This study was performed at the request and authorization to proceed granted by Nate Hahm with TexAmericas Center of New Boston, Texas in accordance with our proposal dated June 6, 2013. Field operations were conducted June 24 – 26, 2013.

The purpose of this preliminary investigation was to define and evaluate the general subsurface conditions in the area south of US 82 and west of Red River Army Depot near Hooks, Texas. Specifically, the study was planned to determine the following:

- Subsurface stratigraphy within the limits of exploratory borings;
- Classification, strength, expansive properties, and compressibility characteristics of the foundation soils;
- Suitable foundation types and allowable loading; and,
- Construction related problems that may be anticipated by the investigation.

To determine this information a variety of tests were performed on the soil samples. The scope of testing for this report comprised Standard Penetration, Atterberg liquid and plastic limits, Percentage of Fines Passing the No. 200 sieve, Natural Moisture Content, Unconfined Compressive Strength and One-Dimensional Swell. These tests were conducted to classify the soil strata according to a widely used engineering classification system; identify, and provide quantitative data for active (expansive) soils; define strength characteristics relating to allowable bearing values; predict immediate settlement; and assess construction workability of the soils.

The conclusions and recommendations that follow are based on limited information regarding site grading. The boring locations were selected by the client and staked with their assistance. (ETTL did not confirm by survey that the locations indicated on the attached Plan of Borings accurately reflect the location on the ground). This information should be verified prior to design. *Should any portion of it prove incorrect, this firm should be notified in order to assess the need for revisions to this report.*

2.0 PROJECT DESCRIPTION

The project consists of a preliminary geotechnical investigation for parcels 1, 2, 3, 6, 7, 8 & 9 at bore locations staked by representatives of TexAmericas. **This investigation is very preliminary and not to be used for any final design.**

3.0 SITE DESCRIPTION

The project site is currently partially developed with large areas heavily forested. According to USGS topography, the elevation varies from approximately 325 to 425. The elevation decreases generally from west to east with drainage ways running south to north at two to three locations.

4.0 SOIL STRATIGRAPHY AND PROPERTIES

4.1 Site Geology

The Midway Group undivided outcrops at the subject site. The Midway Group is composed of the Wills Point and the Kincaid Formations in Bowie County. The Wills Point Formation is primarily clay. The upper portion of the formation is composed of silt and lignite with some calcareous siltstone

concretions. A thin bed of limestone is located near the middle of the formation and is glauconitic near the base of the formation. The maximum thickness of the Wills Point Formation is approximately 450 feet. The Kincaid Formation is predominately clay with some glauconite and selenite and slightly calcareous. The formation is in part silty and sandy and is locally phosphatic near the base. The maximum thickness of the Kincaid Formation is approximately 150 feet.

4.2 Soil Stratigraphy

The soils encountered in **Parcel 1** generally consisted of loose to medium dense silty sands (SM), silty clayey sands (SC-SM) and silts (ML) overlying interlayered medium stiff to hard lean clays (CL) and fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from non-plastic to 42.

The soils in **Parcel 2** consisted of surficial loose silts (ML) and clayey sands (SC) overlying soft to medium stiff lean clays (CL) followed by medium stiff to hard fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from non-plastic to 61.

In **Parcel 3**, the soils encountered generally consisted of interlayered soft to very stiff lean clays (CL) and fat clays (CH). Atterberg Plasticity Indices of the tested soils ranged from 13 to 35.

The soils in **Parcel 6** consisted of interlayered medium stiff to hard lean clays (CL) and fat clays (CH). Very loose to loose silt (ML) and clayey sand (SC) was found at the surface in Boring B-17. Atterberg Plasticity Indices of the tested soils ranged from 16 to 51.

The soils encountered in **Parcel 7** consisted of stiff to very stiff fat clays (CH). Atterberg Plasticity Index of the tested soils was 42.

In **Parcel 8**, the soils encountered consisted of very soft to medium stiff interlayered lean clays (CL) and fat clays (CH) and very loose silt (ML) overlying medium stiff to very stiff fat clay (CH). Atterberg Plasticity Indices of the tested soils ranged from 15 to 44.

The soils encountered in **Parcel 9** consisted of medium stiff to hard fat clays (CH). The Atterberg Plasticity Indices of the tested soils ranged from 43 to 61.

4.3 Seismic Design Parameters

Based on the 2012 International Building Code section 1613 *Earthquake Loads – Site Ground Motion,* the seismic site class definition should be taken as **Class D**. This classification is based on an average of the blow counts obtained for all borings in this study. This site classification should be confirmed for future projects based specifically on the project site.

A seismic impact zone is an area with a 10 percent or greater probability that the maximum horizontal acceleration in rock, expressed as a percentage of the earth's gravitational pull, will exceed 0.10g in 50 years. Seismic impact maps that represent a 2 percent probability of exceedance in 50 years for 0.2 and 1 second Spectral Response Acceleration can be found in the IBC code. Based on the maps and the site coefficients determined for the appropriate site class, parameters as listed below are recommended by the IBC Code:

Site Coefficients:	$F_a = 1.6$ $F_v = 2.4$
Mapped Acceleration Parameters:	$S_S = 0.140$ g $S_1 = 0.077$ g

Maximum Earthquake Spectral Response Acceleration Parameters: S_{MS} = 0.223 g
S_{M1} = 0.185 g

Design Spectral Response Acceleration Parameters: S_{DS} = 0.149 g
S_{D1} = 0.123 g

4.4 Behavior of Expansive Soils

Expansive soils such as were found at this site, swell when they absorb moisture and shrink as they dry. Structures placed on these soils move up and down with such volume changes of the soil. When expansive soils are covered by an impermeable surface such as a building slab or pavement, seasonal moisture fluctuation at the interior of the covered area tends to be reduced or eliminated due to the lack of exposure to natural wetting and drying conditions (i.e., wind, rain, sun, vegetative, etc.). At the edges of the structure, however, the near surface soils are still subject to seasonal drying and wetting. Where continuously irrigated areas abut a building, the risk of severe shrinkage due to seasonal evaporative drying effects is low, but excess moisture could lead to significant swelling (especially if native clays are dry at the start of construction). Where areas immediately adjacent to the structure are paved both the risk of swelling due to excess moisture and shrinkage due to moisture loss are reduced significantly. A deeper bearing elevation will also reduce the anticipated vertical movements.

Moisture content of the significantly expansive soils we tested varied from dry to moist. Potential for swelling is considered to be moderate to high under conditions at the time of drilling. Potential for shrinkage is also predicted to be moderate to high. As the moisture content of the soil changes from what it was in our samples, the potential for swelling and shrinkage will change accordingly.

One method for quantifying the potential for subgrade movement at any given location is to calculate the Potential Vertical Rise (PVR) (Tex 124 E Modified). This calculation takes into account the inter-relationship between depth, PI, and fluctuations in soil moisture. The maximum potential movement of the existing subgrade, PVR, due to normal climatological fluctuations in soil moisture content is summarized in **Table 4.1** (based on assumed dry conditions and an estimated annual seasonal moisture fluctuation zone of approximately 10 feet). Swell testing indicates a potential heave from 1 inch to as much as 7 inches at current moisture contents.

Table 4.1 - PVR Predictions

Location	PVR (inches)
Parcel 1	1 – 2.75
Parcel 2	3 – 4
Parcel 3	1 – 2.2
Parcel 6	1 – 3.4
Parcel 7	3
Parcel 8	1.75 – 2.2
Parcel 9	4.8 – 5.5

5.0 GROUNDWATER OBSERVATIONS

No seepage was noted during drilling operations and all borings were dry and open upon completion. The phreatic surface is predicted to be at some depth deeper than 20 feet.

It should be noted, however, that seasonal groundwater conditions might vary throughout the year depending upon prevailing climatic conditions. This magnitude of variance will be largely dependent

upon the duration and intensity of precipitation, surface drainage characteristics of the surrounding area, and significant changes in site topography.

6.0 FOUNDATION DESIGN RECOMMENDATIONS

The proposed use is unknown at this time. Given the preliminary nature of this study and the variability of the soils encountered, options for both a shallow foundation system as well as deep foundations are provided below.

Where drilled pier foundations are used, a structurally suspended slab is recommended in order to isolate the structure from subgrade movements.

A system consisting of shallow footings incorporated in a stiffened slab, which is placed on native subgrade or select fill may also be used, but is much less tolerant of significant subgrade volume changes than a structure, which is suspended above the ground (i.e. the risk of structure distress is significantly higher for a ground supported structure). In addition, a stiffened slab on native ground is subject to tilt due to uneven wetting or drying of subgrade soils. Unless the entire structure is surrounded by an impermeable barrier or pavement, uneven wetting due to continuous irrigation on one side of the structure could result in significant heave on that side, tilting the structure. Likewise, uneven drying due to lack of irrigation can also result in tilting.

Some conditions that may affect foundation performance are difficult to account for in standard foundation design procedures. These include vegetative influence (e.g. tree root zones as noted above), unusual climatological conditions, uncontrolled water sources such as plumbing and sprinkler system leaks, and poor drainage conditions. Such sources of moisture change could cause large shrink/swell movements of the expansive clay that will remain beneath the building and lead to significant distress. If it is desired to virtually eliminate the risk of damage from vertical movement due to these conditions, an option incorporating drilled piers with a suspended slab is recommended.

Recommendations and pertinent design parameters for both shallow foundation and deep foundation systems are presented below. With ground supported foundation/floor systems it is *essential* that measures be taken to assure subgrade moisture stability (see section **10.3 Site Design**) in order to enhance the chances of satisfactory structure performance. Proper site design that prevents water from soaking into the subgrade soils around the building is essential to reduce the potential for excessive movement caused by saturation of foundation soils.

6.1 Shallow Spread Footings

Footings should be designed to bear in firm undisturbed native soil or properly compacted select fill. Isolated footings should have a minimum width of 2 feet and strip footings should be at least 12 inches wide. Footings should be proportioned for the allowable gross bearing pressures summarized in **Table 6.1**, below. The footings should bear at the indicated depths below finished slab subgrade or adjacent exterior grade, whichever is deeper. These allowable pressures incorporate a safety factor relative to shear failure of the soil of about 3 and may be increased up to 33% for intermittent loads such as wind. Predicted total settlement for footing widths less than 6 feet is approximately 1 inch or less (total) and 0.5 inch (differential). Detailed testing for the prediction of long-term settlement due to load for these footings is beyond the scope of this investigation.

Table 6.1 – Gross Allowable Bearing Pressures				
Parcel	Native Soils		Select Fill	
	Isolated Footings	Strip Footings	Isolated Footings	Strip Footings
Parcel 1	800 psf @ 2 ft.	600 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 2 ft.
Parcel 2	1000 psf @ 2 ft.	1000 psf @ 2 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 3	1000 psf @ 2 ft.	1000 psf @ 2 ft.	1000 psf @ 2 ft.	1000 psf @ 2 ft.
Parcel 6	1000 psf @ 2 ft.	500 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 7	3000 psf @ 2 ft.	2500 psf @ 1.5 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.
Parcel 8	800 psf @ 2 ft.	800 psf @ 2 ft.	2000 psf @ 2 ft.	2000 psf @ 2 ft.
Parcel 9	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.	2500 psf @ 2 ft.	2000 psf @ 1.5 ft.

6.2 Post-Tensioned Slab Design

The information provided below is based on analysis of our field and laboratory test results as well as design procedures given in the Design and Construction of Post-Tensioned Slab-on-Ground - Post-Tensioning Institute Third Edition with 2008 Supplement. We make no warrantee as to the adequacy or applicability of the design procedures given in this manual. These design criteria attempt to account for soil movement due to *normally anticipated climatological fluctuations* and may not entirely accommodate vegetative effects and other unusual situations (noted above). In addition, should the shape factor (SF) of the building slab or foundation exceed 24 as defined by the 2008 manual, PTI recommends limiting the maximum differential movements to 2.0 inches for center lift and 1.0 inch for edge lift. Should the anticipated movements exceed these values, geotechnical approaches should be considered to reduce these predicted movements. Possible methods include, but are not limited to, water injection, lime or chemical injection, removal and replacement with low expansive soil materials or perimeter barriers. Please contact ETTL should evaluation of these methods be necessary. Listed below are parameters for either the post-construction (TMI between -15 and 15) or post-equilibrium case (TMI < -15 or > 15), as recommended by the manual. For the post-construction case, soil moisture fluctuates from very wet to very dry. The post-equilibrium case represents moisture fluctuation from existing to either very wet or very dry.

Table 6.2 – Post Tensioned Slab Design Parameters Thorthwaite Moisture Index (TMI) = 45					
Parcel	Weighted Plasticity Index	Edge Moisture Variation Distance, e_m		Maximum Differential Soil Movement, y_m	
		Center lift (in)	Edge lift (in)	Center lift (in)	Edge Lift (in)
Parcel 1	24	9.0	5.1	0.9	0.1
Parcel 2	39	8.5	5.1	1.3	0.2
Parcel 3	22	8.7	5.1	0.7	0.1
Parcel 6	30	8.7	5.1	0.9	0.1
Parcel 7	42	9.0	5.1	1.6	0.2
Parcel 8	26	8.7	5.1	1.3	0.2
Parcel 9	57	8.0	5.1	2.5	0.4

6.3 Drilled Piers

This foundation system consists of drilled and reinforced concrete piers supporting the entire structure that is suspended above the ground when native clay is not removed from beneath the building.

Drilled piers should be founded in undisturbed native soil and should be proportioned using the gross allowable end bearing pressures summarized in **Table 6.3**, below. The depth indicated is below

existing grade. This value may be increased by 33% when considering intermittent loads such as wind or seismic. Shafts should be underreamed to anchor against uplift from expanding soils. Settlement (due to imposed load only) for piers with a sustained full design load is predicted to be 0.5% to 1% of pier tip diameter. The minimum side slope of underreams should be 60 degrees and the maximum ratio of bell to pier diameter should be 3:1.

The foundation units should contain a minimum amount of reinforcement to resist tensile forces caused by soil heave. An adhesive stress of 1,500 psf applied over the portion of the top 10 feet of the pier perimeter *in contact with unprocessed, native expansive clay* should be used to design the pier for uplift due to expanding soils. A minimum pier size of 18 inches is recommended to facilitate proper concrete placement. Further guidelines for the construction of drilled piers are provided in section **10.0 GENERAL CONSTRUCTION CONSIDERATIONS**. Since moisture migration to the base of a drilled shaft (usually along the shaft perimeter surface) could lead to heave, it is especially important that these construction guidelines be followed in order to reduce the risk of such shaft movement.

Table 6.3 - Drilled Pier Allowable Bearing Pressures		
Location	**End Bearing Capacity**	**Depth (ft.)**
Parcel 1	6000 psf	18
Parcel 2	6000 psf	13
Parcel 3	6000 psf	18
Parcel 6	6000 psf	13
Parcel 7	6000 psf	13
Parcel 8	6000 psf	13
Parcel 9	6000 psf	13

6.3.1 Uplift Resistance of Belled Shafts

For cases where the top of the bell is at least $2.5*d_b$ below the ground surface, ultimate uplift resistance of a belled shaft, Q_u (kips) may be determined by:

$$Q_u = 7.07 * c * (d_b^2 - d_s^2)$$

Where:

c = cohesion (ksf) (avg in the zone from the base of the bell to $2*d_b$ above the base)
d_s = diameter of shaft (ft)
d_b = diameter of bell (ft)

For cases where the top of the bell is shallower than $2.5*d_b$ below the ground surface, the ultimate capacity may be assumed to vary linearly from 0 at the ground surface to Q_u as determined above at $2.5*d_b$.

The ultimate uplift resistance as determined above should be divided by a safety factor (say 2 to 3) and the resultant allowable uplift resistance should be compared to the design uplift load (minus the shaft weight if it is not otherwise accounted for) to verify that the allowable resistance is equal to or greater than the design load (i.e. the uplift load applied at the top of the shaft).

The above procedure is only intended to predict uplift capacity based on the characteristics of the soil surrounding the pier. The designer must verify that the shaft reinforcing (for prevention of detachment of the bell from the shaft) and the thickness of the bell (for prevention of shearing off of the edge of the bell) are also adequate to safely carry the uplift load.

7.0 FLOOR SYSTEMS

The floor system for use with a shallow footing option consists of a flat slab on prepared subgrade or a stiffened slab on grade as detailed above. For the drilled pier system, a structurally suspended floor is preferred. However, a flat slab on grade system can be used provided that most of the surficial expansive clays are removed and replaced with select fill. As noted above, this sort of floor is subject to damage from unusual moisture changing conditions.

A flat slab on a prepared subgrade can be considered where the risk of localized differential movements of approximately 1" is acceptable (1" is what is predicted due to normal climatological factors only, not other possible moisture sources). However, overexcavation to remove some of the expansive clay creates a "bathtub" beneath the structure that can have the potential to collect surface drainage (or moisture from other sources such as plumbing leaks) at its base. This water will soak into the deeper, dry clays over time possibly resulting in excessive heave. The pavement surrounding the buildings (where it actually abuts the building and the joint is maintained in a sealed condition), however, will help to maintain a stable moisture content beneath the building by virtually preventing moisture gain or loss from surface drainage, thus lowering the risk of severe movements. The risk of distress due to shrink/swell movement of the native subgrade (caused by normal climatological moisture fluctuation only) prepared as specified below is considered relatively low. That is, shrink/swell movements of the clay that will remain beneath the building, should they occur, are predicted to be small (1") and, thus, resulting distress is predicted to be relatively low.

Some conditions that may affect floor system performance are difficult to account for in standard design procedures. These include vegetative influence (prior, or subsequent to, construction), unusual climatological conditions, uncontrolled water sources such as plumbing and sprinkler system leaks, and poor drainage conditions. If it is desired to virtually eliminate the risk of damage from vertical movement due to these conditions, an option incorporating drilled piers with a suspended slab is recommended.

7.1 Flat Slab

This floor system consists of a cast-in-place concrete, unstiffened, flat slab on prepared subgrade (according to Section **8.0 BUILDING SUBGRADE PREPARATION**, below) that is either isolated from, or monolithic with footings and grade beams. Provision should be made to account for the fact that a heavily loaded foundation element, which is monolithic with an unloaded slab, may result in significant stress in the transition zone between the unloaded slab and the foundation element. Reinforcing in the slab is used primarily to control shrinkage.

Where a slab is to be placed on grade, we recommend that the subgrade be prepared to reduce the PVR to 1 inch or less. Removal of some of the expansive clay from the zone where the soil moisture tends to fluctuate seasonally is predicted to reduce the potential swelling movement due to normal climatological fluctuation of moisture content of the clay that remains in that zone to less than 1 inch (See **BUILDING SUBGRADE PREPARATION** section **8.0**, below).

Where some or all of the native clay remains beneath a ground supported floor system, it is *essential* that measures be taken to assure subgrade moisture stability (see **Site Design** section **10.3**) in order to enhance the chances of satisfactory structure performance. Provision should be made to account for the possibility of significant differential movement between the main structure and driveways, sidewalks, and any other structure, which are not placed on subgrade prepared as for the building. Proper site design that prevents water from soaking into the subgrade soils around the building and appurtenances (i.e. provides for rapid runoff away from them) is *essential* to reduce the potential for

excessive movement caused by saturation of foundation soils and should help limit differential movement between soil supported elements and the main building.

7.2 Structurally Suspended Slab

The most positive means of eliminating the effects of vertical subgrade movements on the structure is to structurally suspend the entire floor system (including grade beams) as well as all other non-load bearing elements between drilled piers and above the ground. This may be accomplished via the use of void forms upon which a structurally reinforced concrete slab is placed, or may take the form of a structurally framed floor system above a crawl space. Where a "skirt" encloses a crawl space it should be supported on a concrete grade beam that is designed to span between drilled piers and is isolated from the ground with 10" thick void boxes. Any appurtenances attached to the structure such as stairs or decks should also be suspended above a void space and supported on piers. Soil retainers at the edges of voids are recommended to prevent soil from migrating into the void space.

The void space created beneath the floor system should be sealed so that it does not collect surface drainage. Where there is a crawl space created beneath the floor system the floor of the crawl space should be graded so that it does not collect surface drainage. The base of the space should be higher than the surrounding ground to reduce the chances that water will collect in it. Where this is not possible, grading of the space to a drain is recommended. Planting beds adjacent to the structure should be contained in leak proof boxes or a horizontal moisture barrier should be used in conjunction with them in order to protect the building subgrade from water infiltration (from sources such as sprinkler systems). Backfill adjacent to the structure should be properly compacted native clay soil sloped away from the structure at a 5% slope (minimum) to help limit surface infiltration.

Table 7.1 – Comparison of Foundation Options		
Foundation Option	**Advantages**	**Disadvantages**
Drilled Piers (with structurally suspended slab)	Isolated from potential expansive clay movements Minimal subgrade preparation	Expensive.
Drilled Piers (with a monolithic or isolated flat slab on overexcavated subgrade)	Potentially lower cost Risk of damage to pier supported elements very low.	Requires some overexcavation to remove a significant portion of expansive clay. Slab and slab supported elements subject to damage from subgrade movement due to soil moisture change (Risk of significant damage is low and is primarily related to unusual water sources such as plumbing leaks and surface water infiltration)
Shallow spread footings (with a monolithic or isolated flat slab)	Ease of installation Potentially lower cost.	Requires some overexcavation to remove a significant portion of expansive clay. Structure, slab and slab supported elements subject to damage from subgrade movement due to soil moisture change (Risk of significant damage is low and is primarily related to unusual water sources such as plumbing leaks and surface water infiltration)
Stiffened Slab (monolithic with shallow footings)	Ease of installation Lower risk of foundation distress than flat slab for identical subgrade preparation Minimal subgrade preparation	Potentially more expensive than spread footings with a flat slab Subject to damage and/or tilt from subgrade movement due to unusual and/or uneven wetting or drying conditions

8.0 BUILDING SUBGRADE PREPARATION

In order to validate the design assumptions given above regarding allowable foundation loads, and, in order to provide a serviceable floor system (within the limitations stated above), it is imperative that the subgrade of the building be properly prepared. Special subgrade preparation (other than grading for drainage beneath and around the building) is not required for the suspended slab option. The following procedures are recommended as a minimum:

- Remove any surficial vegetation, wood chips and topsoil. Where trees are removed (or have been removed in the last year) from the slab area, the entire root zone should be cut out and

replaced with select fill. Root zones tend to be comprised of highly desiccated soil, which, if left in place, are prone to significant swelling later on, resulting in heaving of the slab. Verify that all stump holes are backfilled with properly compacted select fill.

- The following *minimum* overexcavation is required for the specific option chosen. Limits of overexcavation should extend beyond building and/or footing lines a distance of 5'. Options are listed in order of increasing risk of damage due to foundation movement.
    - *Drilled piers with suspended slab* - Grade void space beneath floor to drain.
    - *Drilled piers with grade beams and floor slab on prepared subgrade* - Native expansive clay soils are to be removed and replaced with select fill. Overexcavate to the depths below existing grade shown in **Table 8.1** below in order to reduce the PVR to 1 inch or less.
    - *Shallow spread footings with monolithic flat slab* - Overexcavate to the depths below existing grade shown in **Table 8.1** below in order to reduce the PVR to 1 inch or less.
    - *Shallow spread footings with monolithic stiffened slab placed on grade* – None required
- Scarify the exposed subgrade to a depth of 8 inches, adjust the moisture content to, and maintain it within a range of optimum to optimum +3% and recompact to a minimum density of 95% of the maximum density defined by ASTM D 698 (Standard Proctor). *Maintain specified moisture content until subgrade is covered with fill or slab.*
- Place select fill to finished slab subgrade. Specifications for the placement of select fill are covered in section **10.4 Select Fill**.

A durable moisture barrier should be provided between the concrete building slab and the underlying soil subgrade. An intact membrane installation with lapped and sealed joints and which is repaired if damaged during construction will help to inhibit moisture migration from the subgrade through the slab.

Table 8.1 – Recommended Undercut Depth

Location	Depth (ft.)
Parcel 1	3 – 6
Parcel 2	6 – 8
Parcel 3	1 – 3
Parcel 6	6.5 – 7.5
Parcel 7	6
Parcel 8	4 – 7
Parcel 9	7 – 8

9.0 PAVEMENT RECOMMENDATIONS

General recommendations for the design of *minimal* pavement structures are provided herein for your information. A more detailed pavement analysis would require additional laboratory tests on bulk samples of the materials to be used in pavement construction and is beyond the scope of this

investigation. A summary of proposed designs is provided in **Table 9.1**, **Table 9.2** and **Table 9.3** below.

9.1 Pavement Subgrade Preparation

As a minimum, strip the native subgrade to remove topsoil and other deleterious materials. Cut to the proposed subgrade elevation as required. After all cutting to finished subgrade has been performed, the exposed soils should be examined and tested by a representative of ETTL to detect areas of expansive clay or other unsuitable soil conditions that need to be cut out and replaced. Tree root zones often contain highly desiccated, highly plastic soil that eventually results in heaving after a period of rewetting. The only way to limit this potential is to remove these zones and replace them with select fill. The heaving effect can be reduced with good pavement drainage and maintenance. If this is not feasible, then future additional pavement maintenance will probably be necessary. Verify that all stump holes as well as areas disturbed by demolition activity, if any, are cut out and backfilled with properly compacted select fill. Positive surface drainage should be provided at all times during construction (especially in low areas) to maintain pavement subgrade in a dry and stable condition.

9.1.1 Unsuitable Subgrade Soil

Where the exposed subgrade is found to consist of soil with a PI>20, cut out the plastic clay to an elevation equal to finished subgrade minus 12", or deeper if necessary to expose stable ground (as determined by proof rolling as specified below). Scarify the exposed soil to a depth of 8", adjust the moisture content to within a range of optimum to optimum +3% and recompact to a minimum density of 95% of ASTM D698 (standard proctor). Lime treatment, in accordance with section **9.1.3 Lime Treated Subgrade**, is an alternative to removal and replacement.

9.1.2 Suitable Subgrade Soil

Where exposed native soil consists of a soil with a PI<20, it should be proof rolled in accordance with TxDOT Item 216 (with the exception of roller size). The use of a fully loaded dump truck is recommended. Areas, which prove unstable should be cut out and replaced as directed by a representative of this firm. Scarify the exposed soil to a depth of 8", adjust the moisture content to within a range of optimum to optimum +3% and recompact to a minimum density of 95% of ASTM D698 (standard proctor).

9.1.3 Lime Treated Subgrade

In areas where the subgrade soils consist of expansive clays (PI>20), lime treatment is recommended. Lime treatment of subgrade should be in accordance with Item 260, "Lime Treatment for Materials Used as Subgrade (Road Mixed)," Texas Department of Transportation *Standard Specifications for Construction of Highways, Streets and Bridges*, 2004 Edition with the following exceptions:

- Under article 260.4 (4), "Application," the rate of lime to be applied can be estimated as 40 pounds per square yard worked into the top 8 inches of finished subgrade. *The actual amount of lime to be used should be based on tests of lime soil mixtures conducted prior to treatment.* Quicklime, if used, must be hydrated before mixing into the soil.

- The modified subgrade should be compacted under article 260.4 (6) (b), "Density Control," except that it shall be compacted to 95% of Standard Proctor Density (ASTM D698) *at a moisture content well above optimum* to allow for the drying action of the lime.

- Curing procedures should be strictly followed. Traffic on the treated subgrade should be kept to a minimum during curing.

- Prior to use by significant traffic, the treated subgrade should be covered with base, concrete or some temporary wearing surface to avoid degradation.

9.1.3.1 Alternatives to Lime Treatment

For the flexible pavement option (only) placing a geogrid (Tensar TX 140, no substitute) on the native subgrade prior to placing base material will serve as a substitute for lime treated subgrade. For the full depth HMAC section, lime treatment of the subgrade may be omitted if the thickness of pavement surface specified is increased by 1". For the rigid pavement option (concrete) increase the recommended thickness by 0.5" where lime treatment is omitted.

9.1.4 Fill Construction

Fill to be placed which is below an elevation of finished subgrade minus 18" may consist of any soil and should be compacted to a minimum density of 95% ASTM D698 (standard proctor) at a moisture content within the range of optimum to optimum + 3%. The top 18" of finished subgrade should consist of a select material with the following properties: a PI $\leq$15, a liquid limit $\leq$35 and a percentage passing the #200 sieve <40%.

9.1.5 Stability of Finished Subgrade

The stability of the finished subgrade should be verified by proof rolling (as specified above) prior to placing base material or surfacing. Unstable areas will need to be cut out and reworked.

9.2 Light-Duty Pavements

9.2.1 Flexible Pavement

The minimum pavement section (and a section commonly used) for light-duty driveways and parking areas consists of 6 inches of crushed stone base with 2 inches of hot mix asphaltic concrete (HMAC). Crushed stone base should comply with Type A, Grade 2, Item 247 of the *Texas Department of Transportation (TxDOT) 2004 Standard Specifications for Construction of Highways, Streets and Bridges*. Compaction of the stone base should be to a minimum of 95 percent of ASTM D 1557 (modified proctor) maximum density at optimum moisture ±3 percent. Asphaltic concrete surfacing should comply with the requirements of Type D, Item 340 of the TxDOT Specifications and should be compacted to a density of 92 to 94 percent of maximum theoretical density.

9.2.2 Full Depth Asphalt

The **minimum** full depth asphalt pavement section consists of 3 inches of hot mixed asphaltic concrete binder course (Type B) with 2 inches of hot mixed asphaltic concrete surfacing (Type D). Asphaltic concrete surfacing should comply with the requirements of Type D, Item 340 of the TxDOT Specifications and the asphaltic concrete binder should comply with the requirements of Type B, Item 340. All HMAC should be compacted to a density of 92 to 94 percent of maximum theoretical density.

9.2.3 Rigid Pavement

The performance of concrete pavement is dependent on many factors including weight and frequency of traffic, subgrade conditions, concrete quality (which itself is dependent on a host of factors), joint type and layout, jointing procedures, and numerous construction practices. A detailed discussion of all of these items is beyond the scope of this report. By way of general guidance, the following recommendations are offered:

- Minimum concrete compressive strength of 3,500 psi at 28 days placed with a water/cement ratio of 0.45 or less. The mix should contain 4% - 6% entrained air for durability.

- Minimum pavement thickness of 5 inches.

- Sawcut or preformed control joints at maximum spacing of 12 feet each way. Layout of joints should form basically square panels. Timing of the cutting of joints is critical to their performance and generally should be within 4 - 18 hours of concrete placement. *Sealing of joints and cracks and maintenance of the seal are critical for satisfactory performance.*

- Adequate site drainage to prevent ponding on or near the pavement.

- Cure concrete via use of liquid membrane curing compound.

- Concrete quality should be controlled and jointing properly executed. Minimum reinforcement should consist of 6 x 6 No. 6 welded wire fabric or No. 3 at 18 inches each way and should not be continuous through control joints.

- All edges of pavement should be thickened to 9 inches (transitioning back to 5 inches over a minimum distance of 3 feet).

- Allow a minimum of 7 days curing time before permitting traffic on the pavement.

The reader is referred to the American Concrete Institute Publication No. ACI 330R, *Guide for Design and Construction of Concrete Parking Lots* for more detailed information.

9.3 Medium-Duty Pavements

9.3.1 Flexible Pavement

For areas that will be subject to trash or delivery truck parking and traffic, the minimum recommended flexible pavement section consists of 8 inches of crushed stone base and 3 inches of asphaltic concrete surfacing. The 3 inches of surfacing may be composed of fine-graded surface course (Type D) or coarse-graded surface course (Type C). Paving materials should be specified as discussed previously.

9.3.2 Full Depth Asphalt

For a medium-duty full depth asphalt section, the minimum recommended section is 6 inches of HMAC paving consisting of 2 inches wearing surfacing (Type D) over 4 inches of asphaltic binder (Type B). Paving materials should be specified as discussed previously.

9.3.3 Rigid Pavement

Recommendations for medium-duty concrete paving are the same as for light duty except that 6 inches of portland cement concrete should be considered the minimum pavement section and the edges should be thickened to 9 inches.

9.4 Heavy-Duty Pavements

9.4.1 Flexible pavement

For areas that will be subject to heavy truck parking and traffic, the *minimum recommended* flexible pavement section consists of 7 inches of crushed stone base and 4.5 inches of asphaltic concrete surfacing. The 4.5 inches of surfacing may be composed of 2 inches of fine-graded surface course (Type D) wearing surfacing overlaying 2.5 inches of coarse-graded surface course (Type C). Paving materials should be specified as discussed previously.

9.4.2 Full Depth Asphalt

For a heavy duty full depth asphalt section, the minimum recommended section is 7.5 inches of HMAC paving consisting of 2 inches of hot mixed asphaltic concrete surfacing (Type C or D) over 5.5 inches of asphaltic concrete base course (Type A or B). Paving materials should be specified as discussed previously.

9.4.3 Rigid pavement

Recommendations for heavy-duty concrete paving are the same as for light duty except that 7 inches of Portland cement concrete should be the minimum pavement section and the edges should be thickened to 9 inches.

Table 9.1 – Pavement Options – Light Duty

Type	Base/Surface Thickness		Subgrade Preparation
Flexible HMAC	2" Surface (Type D)	6" Crushed Stone Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" HMAC Surface (Type D)	3" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	5" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Table 9.2 – Pavement Options – Medium Duty

Type	Base/Surface Thickness		Subgrade Preparation
Flexible HMAC	3" Surface (Type C or D)	8" Crushed Stone Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" Surface (Type C or D)	4" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	6" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Table 9.3 – Pavement Options – Heavy Duty			
Type	**Base/Surface Thickness**		**Subgrade Preparation**
Flexible HMAC	2" Surface (Type C or D)	7" Crushed Stone Base & 2.5" HMAC Base	6" Lime Treated[1] or 18" Select Fill
Full Depth HMAC	2" Surface (Type C or D)	5.5" HMAC Base (Type A or B)	6" Lime Treated[2] or 18" Select Fill
Concrete	7" [3]	No Base Required	6" Lime Treated[3] or 18" Select Fill

Notes:

1)Tensar Triax Geogrid placed on subgrade may be substituted for lime treatemnt of subgrade. Lime treatment or replacement with select fill only needed where expansive clay is encountered within 12" of finished subgrade as determined by a representative of this firm.

2) Increase HMAC thickness by 1" in lieu of lime treated subgrade

3) Increase concrete thickness by 0.5" in lieu of lime treated subgrade

10.0 GENERAL CONSTRUCTION CONSIDERATIONS

The surficial soils in several areas may become unstable when wet necessitating remediation or removal and replacement to facilitate construction.

10.1 Shallow Footings

All footing excavations should be inspected by qualified personnel to insure that subgrade is composed of firm, undisturbed native soil or properly compacted select fill as recommended in this report. Water and/or loose material in footing excavations should be removed prior to final shaping of the footing excavation and placement of concrete.

10.2 Drilled Piers

Personnel familiar with the installation of drilled foundations should monitor construction of all foundation units. As a minimum, a representative of this firm should be present before and during construction in order to verify the founding stratum and to insure that the base of excavation is firm and undisturbed. Free water and/or loose material at the base of excavations should be removed prior to placement of concrete.

Groundwater observations indicate that shaft tip depth will not be below the water table and that dry method of construction should be feasible. Temporary casing and/or slurry drilling procedures could be required however. In any case, it is recommended that contract documents provide alternates with or without casing and dry or slurry displacement construction procedures.

Concrete should be designed to be highly workable (slump of 7 inches to 9 inches) and should be placed at each drilled pier location as soon as possible after the completion of drilling. Also, to insure proper construction of the drilled piers at this site, close coordination between the drilling and concreting operations is considered to be of primary importance. In no case should a shaft remain open overnight.

Construction documents must specify that all piers should be constructed in accordance with ACI 336.1 "Standard Specification for the Construction of Drilled Piers," latest edition. Only contractors familiar with and competent in the employment of these methods should be considered for the work.

The actual capacity of the completed drilled pier is directly related to the degree of conformance to correct construction procedures.

10.3 Site Design

The following recommendations are derived from years of experience with structures founded on expansive soils and are considered essential to satisfactory structure performance, especially where the floor slab is to be placed on grade:

- Sidewalks should be sloped away from buildings and should not be tied to the structures. The joint between the sidewalk and the foundation should be sealed. Sidewalks should not impound water adjacent to the structure. Potential heave of native ground adjacent to the structure needs to be taken into consideration when constructing the walk so as to avoid a sidewalk which impounds water adjacent to the structure.

- The ground surface around the building as well as paved areas should be sloped away from the building on all sides so that water will drain away from the structure. A minimum slope of 5% is recommended for the area 10 feet wide immediately adjacent to the structure. Drainage swales should have a minimum longitudinal slope of 2%. Roof drainage should be conveyed by an appropriate means for a distance of at least 15 feet from the building before it is allowed to drain into the subgrade. Water should not be allowed to pond near the building after the floor system has been placed.

- Trees should not be closer than their mature height to the structure and shrubbery should not be planted adjacent to the building unless they can be contained in watertight planter boxes and irrigation water can be prevented from seeping into the subgrade around the building. A horizontal moisture barrier (e.g. Mirafi 1212 reinforced polyethylene permanently sealed to the foundation edge at the ground line and sloped away from the building) and placed beneath planting beds is an alternative to planter boxes provided it is maintained in a watertight condition (i.e., joints sealed and punctures repaired). Planting bed edging should not impound water. A root barrier around the entire structure perimeter will provide some added assurance against desiccation of the soil due to roots growing beneath the structure. Periodic root pruning may be required to limit drying of soils beneath foundations due to vegetation. *Over irrigation adjacent to the structure can cause an increase in subsurface moisture contents that could lead to heaving.*

- To help limit surface water infiltration beneath the structure, backfill in the area 10 feet wide adjacent to the structure should be native lean or fat clay soil compacted to a minimum density of 95% of ASTM D 698 (Standard Proctor) at a moisture content of optimum or above. This zone should be at least 2 feet thick. This backfill is not necessary where pavement abuts the structure and the joint is sealed.

- Backfill for utility line ditches should be carefully controlled and should consist of a relatively impermeable material (clayey sand or lean clay), especially in the area beneath and immediately outside of the structure. Old utility lines should be removed from beneath the structure. Fill in new or old utility trenches should be placed to the same specifications as select fill. The top 6 inches under paving should be compacted to a density equal to that specified for the pavement subgrade.

- Utility connections to the building should be flexible to allow for anticipated soil movements that will be different than the anticipated movement of the structure to which they are connected (e.g. where a suspended slab is used).

10.4 Select Fill

Select fill shall consist of homogeneous soils (i.e. not sand with clay lumps) free of organic matter and rocks larger than 6 inches in diameter and possessing an Atterberg PI of 8 to 18, with a liquid limit of 40 or less. Atterberg limits testing of the fill at a rate of 1 test per 500 cubic yards of fill (and as visual changes occur) placed is recommended to verify that fill specifications are met. The material should be placed in the following manner:

- Prepare the subgrade in accordance with the recommendations discussed in a previous section of this report entitled **BUILDING SUBGRADE PREPARATION**. Sites that slope more than about 15% should be benched with 5-foot wide benches prior to placing fill.

- Place subsequent lifts of select fill in thin, loose layers not exceeding nine inches in thickness to the desired rough grade and compact to a minimum of 95% of the maximum density defined by ASTM D 698. Maintain moisture within a range of optimum -1% to optimum +3%. Where the total fill depth exceeds 6 feet beneath any portion of a structure, all fill should be compacted to a minimum of 100% of the maximum density defined by ASTM D 698.

- Conduct in-place field density tests at a rate of one test per 3,000 square feet for every lift with a minimum of 2 tests per lift. **Density testing is essential to assure that the soil, which supports the structure, is properly placed.**

- Prevent excessive loss of moisture during construction.

- For select fill placed above the existing groundline, extend the lateral limits of the fill at least 5 feet beyond the perimeter of the building area, transitioning back to the existing groundline on a 3:1(horizontal/vertical) slope.

11.0 LIMITATIONS

Geotechnical design work is characterized by the presence of a calculated risk that soil and groundwater conditions may not have been fully revealed by the exploratory borings. This risk derives from the practical necessity of basing interpretations and design conclusions on a limited sampling of the subsoil stratigraphy at the project site. The number of borings and spacing is chosen in such a manner as to decrease the possibility of undiscovered anomalies, while considering the nature of loading, size and cost of the project. The recommendations given in this report are based upon the conditions that existed at the boring locations at the time they were drilled. The term "existing groundline" or "existing subgrade" refers to the ground elevations and soil conditions at the time of our field operations.

It is conceivable that soil conditions throughout the site may vary from those observed in the exploratory borings. If such discontinuities do exist, they may not become evident until construction begins or possibly much later. Consequently, careful observations by the geotechnical engineer must be made of the construction as it progresses to help detect significant and obvious deviations of actual conditions throughout the project area from those inferred from the exploratory borings. Should any conditions at variance with those noted in this report be encountered during construction, this office should be notified immediately so that further investigations and supplemental recommendations can be made.

Construction plans and specifications should be submitted to ETTL for review prior to issuance for construction to help verify that the recommendations of this report have been correctly understood and implemented.

This company is not responsible for the conclusions, opinions, or recommendations made by others based on the contents of this report. The recommendations made in this report are applicable only to the proposed scope of work as defined in **SECTION 2.0 PROJECT DESCRIPTION** and may not be used for any other work without the express written consent of ETTL Engineers. The purpose of this study is only as stated elsewhere herein and is not intended to comply with the requirements of 30 TAC 330 Subchapter T regarding testing to determine the presence of a landfill. Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No warranties are either expressed or implied.

USGS Design Maps Detailed Report

2012 International Building Code (33.4526°N, 94.26929°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_s) and 1.3 (to obtain S_1). Maps in the 2012 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(1) [1]	S_s = 0.140 g
From Figure 1613.3.1(2) [2]	S_1 = 0.077 g

Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_s \le 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_s

For Site Class = D and S_s = 0.140 g, F_a = 1.600

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1-s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.077 g, F_v = 2.400

Equation (16-37): $S_{MS} = F_a S_S = 1.600 \times 0.140 = 0.223$ g

Equation (16-38): $S_{M1} = F_v S_1 = 2.400 \times 0.077 = 0.185$ g

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 0.223 = 0.149$ g

Equation (16-40): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.185 = 0.123$ g

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.149 g, Seismic Design Category = A

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.123 g, Seismic Design Category = B

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)" = B

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 1613.3.1(1)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(1).pdf
2. *Figure 1613.3.1(2)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(2).pdf

ETTL ENGINEERS & CONSULTANTS MAIN OFFICE 1717 East Bush Tyler, Texas 75701 (903) 595-4421	TexAmericas Center East Parcels 1,2,3,6,7,8&9 Hooks, Texas	PLATE 2 – PLAN OF BORINGS JOB No.: G3972-136 DATE: July 2013 SCALE: N.T.S.	APPROVED BY: DRAWN BY: RWG

LOG OF BORING B- 1

ETTL ENGINEERS & CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

DRILL RIG: Truck Rig

PROJECT NO.: G3972-136

BORING TYPE: Flight Auger

DATE 6/24/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	MOISTURE CONTENT (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
0		ML	±1' SILT WITH GRAVEL(ML) tan	N=11				6	20	13	7	39	39	17				
		SC SM	SILTY CLAYEY SAND(SC-SM) medium dense; tan															
		CL	LEAN CLAY WITH SAND(CL) medium stiff; red and gray	N=7														
5			--very stiff	N=16				17	42	17	25	74	3	0				
				N=20														
10																		
15			LEAN CLAY(CL) stiff; tan and gray	N=12														
			--very stiff	N=24														
20			Bottom of Boring @ 20'															

BLOW COUNT (20 40 60 80); Qu (tsf) (1 2 3 4); PPR (tsf) (1.0 2.0 3.0 4.0); Torvane (tsf) (1.0 2.0 3.0 4.0)

COMPRESSIVE STRENGTH

Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit; 20 40 60 80)

Water Level — Est. — Measured: — Perched:

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.46064°, W94.28807°

Driller: J. Lewis

Logger: J. Lewis

ETTL
ENGINEERS &
CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

LOG OF BORING B-2

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

DRILL RIG: Truck Rig

PROJECT NO.: G3972-136

BORING TYPE: Flight Auger

DATE 6/24/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA
0		SM			±2" ASPHALT	
		GW			SILTY SAND WITH GRAVEL(SM) red	N=5
		CL			WELL GRADED GRAVEL	
					LEAN CLAY(CL) medium stiff; gray	N=7
		CH			FAT CLAY(CH) stiff; tan and gray	
5			Eml			N=9
						N=14
10					Bottom of Boring @ 10'	

FIELD STRENGTH DATA: BLOW COUNT (20 40 60 80); Qu (tsf) (1 2 3 4); PPR (tsf) (1.0 2.0 3.0 4.0); Torvane (tsf) (1.0 2.0 3.0 4.0)

COMPRESSIVE STRENGTH: DRY DENSITY (pcf); COMPRESSIVE STRENGTH (tsf); MOISTURE CONTENT (%)

Natural Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit (20 40 60 80)

MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
25	63	21	42	92	1	0				

Water Level — Est.: ▽ Measured: ▼ Perched: ▼

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.45604°, W94.28106°

Driller: J. Lewis

Logger: J. Lewis

LOG OF BORING B- 3

ETTL ENGINEERS & CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

PROJECT NO.: G3972-136

DRILL RIG: Truck Rig

BORING TYPE: Flight Auger

DATE 6/26/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	MOISTURE CONTENT (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
0		GW			±4" WELL GRADED GRAVEL(GW)															
		SM			±6" SILTY SAND(SM) tan	N=13				15	26	14	12	68	6	2				
		CL			SANDY LEAN CLAY(CL) stiff; gray and tan	N=13														
		CH			FAT CLAY(CH) very stiff; red and gray															
5		CL	Eml		SANDY LEAN CLAY(CL) very stiff; tan and gray	P=3.5 P=3.0				16	38	17	21	69	10	3	115	2.1	1250	16
					--stiff	N=12														
10					Bottom of Boring @ 10'															

BLOW COUNT: 20 40 60 80
Qu (tsf): 1 2 3 4
PPR (tsf): 1.0 2.0 3.0 4.0
Torvane (tsf): 1.0 2.0 3.0 4.0

COMPRESSIVE STRENGTH

Natural Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit; 20 40 60 80

Water Level Est. ▽ Measured: ▼ Perched: ▼

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.46009°, W94.28519°

Driller: J. Lewis

Logger: J. Lewis

LOG OF BORING B- 4

ETTL
ENGINEERS &
CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

DRILL RIG: Truck Rig

PROJECT NO.: G3972-136

BORING TYPE: Flight Auger

DATE 6/24/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA	DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	MOISTURE CONTENT (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
0		SM			SILTY SAND(SM) loose; brown	N=6														
		CL			LEAN CLAY WITH SAND(CL) stiff; tan and gray	N=13				19	39	17	22	76	4	2				
5		CH	Eml		FAT CLAY(CH) very stiff; tan and gray	N=24														
					FAT CLAY WITH GRAVEL(CH) very tiff; tan and gray	N=26														
10					Bottom of Boring @ 10'															

BLOW COUNT (20 40 60 80)
Qu (tsf) (1 2 3 4)
PPR (tsf) (1.0 2.0 3.0 4.0)
Torvane (tsf) (1.0 2.0 3.0 4.0)

COMPRESSIVE STRENGTH

Natural Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
20 40 60 80

Water Level Est.: ▽ Measured: ▼ Perched: ▼

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.45281°, W94.28785°

Driller: J. Lewis

Logger: J. Lewis

LOG OF BORING B- 5

ETTL
ENGINEERS &
CONSULTANTS

MAIN OFFICE
1717 East Erwin
Tyler, Texas 75702
(903) 595-4421

PROJECT: TexAmericas Center - East Parcels
Preliminary Investigation
New Boston, TX

DRILL RIG: Truck Rig

PROJECT NO.: G3972-136

BORING TYPE: Flight Auger

DATE 6/24/13

SURFACE ELEVATION

DEPTH (ft)	SAMPLES	USC	GEOLOGIC UNIT	WATER LEVEL	MATERIAL DESCRIPTION	FIELD STRENGTH DATA
0		SC			CLAYEY SAND WITH GRAVEL(SC) red	N=4
		SM			SILTY SAND(SM) loose; brown	
		ML			SANDY SILT(ML) loose; tan and gray	N=9
5		CL			LEAN CLAY WITH SAND(CL) very stiff; tan	N=26
		CH			FAT CLAY WITH SAND(CH) very stiff; tan and gray	N=27
10						
						N=23
15					--hard	N=34
20					Bottom of Boring @ 20'	

BLOW COUNT (20 40 60 80)
Qu (tsf) (1 2 3 4)
PPR (tsf) (1.0 2.0 3.0 4.0)
Torvane (tsf) (1.0 2.0 3.0 4.0)

DRY DENSITY (pcf)	COMPRESSIVE STRENGTH (tsf)	MOISTURE CONTENT (%)	Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit; 20 40 60 80)	MOISTURE CONTENT (%)	ATTERBERG LIMITS(%) LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE ANALYSIS MINUS #200 SIEVE (%)	PLUS #40 SIEVE (%)	PLUS #4 SIEVE (%)	SWELL TEST DRY DENSITY (pcf)	FREE SWELL (%)	ZERO SWELL PRESSURE (psf)	MOISTURE CONTENT (%)
				15	NP	NP	NP	62	9	5				
				15	44	18	26	80	1	0				

Water Level Est. Measured: Perched:

Water Observations: Dry and open upon completion.

Key to Abbreviations:
N - SPT Data (Blows/Ft)
P - Pocket Penetrometer (tsf)
T - Torvane (tsf)
L - Lab Vane Shear (tsf)

Notes:

GPS Coordinates: N33.45186°, W94.28194°

Driller: J. Lewis

Logger: J. Lewis

APPENDIX D

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
2488 EAST 81ST STREET
TULSA, OKLAHOMA 74137-4290

November 4, 2020

Regulatory Office

Mr. Jeff Whitten
TexAmericas Center
107 Chapel Lane
New Boston, TX 75570

Dear Mr. Whitten:

Please reference your correspondence concerning the TexAmericas Center commercial development jurisdictional determination request. The proposed project is located at Latitude 33.4566, Longitude -94.2835, Bowie County, Texas. We have reviewed the submitted data relative to Section 404 of the Clean Water Act (CWA).

We have examined the property (depicted in red) and concluded that the referenced site contains three non-jurisdictional ephemeral streams (depicted in pink) and five non-jurisdictional forested wetlands (depicted in yellow) on the enclosed map. At the northwest corner of the review area one of the ephemeral streams transitions into intermittent flow regime, which results in the unnamed tributary becoming jurisdictional (depicted in blue). Therefore, your proposal may be subject to regulation pursuant to Section 404 of the CWA, and a Department of the Army (DA) permit would be required within the intermittent unnamed tributary.

Should your method of construction necessitate such a discharge into an aquatic area or tributary, we suggest that you resubmit that portion of your project so that we may determine whether an individual DA permit will be required. Although Section 404 of the CWA authorization is not required, this does not preclude the possibility that a real estate interest or other Federal, State, or local permits may be required.

This final determination constitutes an approved JD subject to the optional Corps Administrative Appeal Process. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed is a copy of the "Notification of Administrative Appeal Options and Process and Request for Appeal (RFA)" form. If you request to appeal this determination you must submit a completed RFA form to the Southwestern Division Office at the following address:

Mr. Elliott Carman
Appeals Review Officer
U.S. Army Corps of Engineers
1100 Commerce Street, Suite 831
Dallas, TX 75242 1317
Tel: 469 487 7061
Fax: 469-487-7199

In order for a RFA form to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR Part 331.5, and that it has been received by the Division Office within 60 days of the date of the RFA form. Should you decide to submit a RFA form, it must be received at the above address by January 2, 2021. It is not necessary to submit a RFA form to the Division Office if you do not object to the determination in this letter.

We believe this determination to be an accurate assessment of the presence of jurisdictional wetlands and other waters on the site which are subject to Section 404 of the CWA. This is a final determination of federal jurisdiction on the property pursuant to Section 404 of the CWA. This determination is valid for 5 years from the date of this letter unless new information warrants revision of the determination before the expiration date.

This delineation has been conducted to identify the limits of the Corps CWA jurisdiction for the particular site identified in this request. This delineation may not be valid for the wetland conservation provisions of the Food Security Act of 1985, as amended. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service prior to starting work.

If you desire to complete a “Customer Service Survey” on your experience with the Corps Regulatory Program, visit http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey on the internet at your convenience and submit your comments.

This case has been assigned Identification No. SWT-2020-00322. Please refer to this number during any future correspondence. If you have any questions, please contact. Mr. Bryan Noblitt at 918-669-4904.

Sincerely,

For:

Andrew R. Commer
Chief, Regulatory Office

Enclosures

U.S. ARMY CORPS OF ENGINEERS
REGULATORY PROGRAM
APPROVED JURISDICTIONAL DETERMINATION FORM (INTERIM)
NAVIGABLE WATERS PROTECTION RULE

I. ADMINISTRATIVE INFORMATION

Completion Date of Approved Jurisdictional Determination (AJD): 11/4/2020
ORM Number: SWT-2020-322
Associated JDs: N/A
Review Area Location[1]: State/Territory: Texas City: New Boston County/Parish/Borough: Bowie
Center Coordinates of Review Area: Latitude 33.4575 Longitude -94.2708

II. FINDINGS

A. Summary: Check all that apply. At least one box from the following list MUST be selected. Complete the corresponding sections/tables and summarize data sources.

- ☐ The review area is comprised entirely of dry land (i.e., there are no waters or water features, including wetlands, of any kind in the entire review area). Rationale: N/A or describe rationale.
- ☐ There are "navigable waters of the United States" within Rivers and Harbors Act jurisdiction within the review area (complete table in Section II.B).
- ☒ There are "waters of the United States" within Clean Water Act jurisdiction within the review area (complete appropriate tables in Section II.C).
- ☒ There are waters or water features excluded from Clean Water Act jurisdiction within the review area (complete table in Section II.D).

B. Rivers and Harbors Act of 1899 Section 10 (§ 10)[2]

§ 10 Name	§ 10 Size		§ 10 Criteria	Rationale for § 10 Determination
N/A.	N/A.	N/A	N/A.	N/A.

C. Clean Water Act Section 404

Territorial Seas and Traditional Navigable Waters ((a)(1) waters):[3]				
(a)(1) Name	(a)(1) Size		(a)(1) Criteria	Rationale for (a)(1) Determination
N/A.	N/A.	N/A.	N/A.	N/A.

Tributaries ((a)(2) waters):				
(a)(2) Name	(a)(2) Size		(a)(2) Criteria	Rationale for (a)(2) Determination
SWT-2020-0322-09 (INT1)	500	linear feet	(a)(2) Intermittent tributary contributes surface water flow directly or indirectly to an (a)(1) water in a typical year.	This intermittent tributary is located within the northwest corner of the review area. This evaluation includes two site visits, a jurisdictional delineation, review of aerial imagery, USGS topographic mapping, and soil data. The stream channel is depicted on the USGS Topographic map as a "blue line" unnamed tributary to Panther Creek, which flows into Barkman Creek, and then into the McKinney Bayou, and finally in the Red River. There is the presence of a visible bed and bank in aerial imagery and confirmed at the site visit, the

[1] Map(s)/figure(s) are attached to the AJD provided to the requestor.
[2] If the navigable water is not subject to the ebb and flow of the tide or included on the District's list of Rivers and Harbors Act Section 10 navigable waters list, do NOT use this document to make the determination. The District must continue to follow the procedure outlined in 33 CFR part 329.14 to make a Rivers and Harbors Act Section 10 navigability determination.
[3] A stand-alone TNW determination is completed independently of a request for an AJD. A stand-alone TNW determination is conducted for a specific segment of river or stream or other type of waterbody, such as a lake, where upstream or downstream limits or lake borders are established. A stand-alone TNW determination should be completed following applicable guidance and should NOT be documented on the AJD Form.

Tributaries ((a)(2) waters):				
(a)(2) Name	(a)(2) Size		(a)(2) Criteria	Rationale for (a)(2) Determination
				average channel width was 5 feet. The stream was modified and straightened from previous development, however, bank erosion and sediment sorting processes are visible within this reach. At the site visit (October 23, 2020), this feature was observed following a minor rain event, however, no flows resulted due to the limited rainfall. The drainage area for this feature is approximately 450 acres. Bowie County rainfall averages 51 inches a year. Based on the Antecedent Precipitation Tool (APT) report, the site has been exhibiting wetter than normal precipitation conditions, the graph for the spring months depicts wetter than average conditions, which was when the site was delineated. Based on the information included in this evaluation, this stream has been determined to have surface water flowing continuously during certain times of the year and more than in direct response to precipitation. This flow regime meets the definition of intermittent flow as defined in 33 CFR Part 328.3(a)(2).

Lakes and ponds, and impoundments of jurisdictional waters ((a)(3) waters):				
(a)(3) Name	(a)(3) Size		(a)(3) Criteria	Rationale for (a)(3) Determination
N/A.	N/A.	N/A.	N/A.	N/A.

Adjacent wetlands ((a)(4) waters):				
(a)(4) Name	(a)(4) Size		(a)(4) Criteria	Rationale for (a)(4) Determination
N/A.	N/A.	N/A.	N/A.	N/A.

D. Excluded Waters or Features

Excluded waters ((b)(1) – (b)(12)):[4]				
Exclusion Name	Exclusion Size		Exclusion[5]	Rationale for Exclusion Determination
SWT-2020-0322-01 (EPH1)	5800	linear feet	(b)(3) Ephemeral feature, including an ephemeral stream, swale, gully, rill, or pool.	The stream channel is depicted on the USGS Topographic map as a blue line stream. There is the presence of a visible bed and bank in aerial and confirmed at the site visit, the average channel width was 3 feet. The stream was modified, straightened, and contained within a ditch like channel, which has erosional processes visible, and herbaceous vegetation is visible within the channel at its headwater. During the site visit (July 22, 2020), this feature was observed during a minor rain event with minimal flow visible. The drainage area for this feature is approximately 450 acres due to the previous development associated with the ammunition plant. Bowie County rainfall averages 51 inches a year. Based on the Antecedent Precipitation Tool (APT) report, the site has been exhibiting wetter than normal precipitation conditions, the graph for the spring months depicts wetter than average conditions, which was when the site was delineated. This feature is surrounded by wetland habitat within the review area. Based on the information included in this evaluation, this stream has been determined to have surface water flowing/pooling only in direct response to precipitation. This flow regime meets the definition of ephemeral flow as defined in 33 CFR Part 328.3(c)(3).
SWT-2020-0322-02 (EPH2)	570	linear feet	(b)(3) Ephemeral feature, including an ephemeral stream, swale, gully, rill, or pool.	The stream channel is depicted on the USGS Topographic map as a blue line stream. This feature was the headwater of the originally mapped channel for this drainage area, before the stream was modified into the current straightened ditch. The feature is not identifiable in review of aerial imagery, however, based on the delineation report, this feature is grass lined and has an average channel width of 2 feet. The drainage area for this feature is approximately 17 acres. Based on the information included in this evaluation, this stream has been determined to have surface water flowing/pooling only in direct response to precipitation.

[4] Some excluded waters, such as (b)(2) and (b)(4), may not be specifically identified on the AJD form unless a requestor specifically asks a Corps district to do so. Corps districts may, in case-by-case instances, choose to identify some or all of these waters within the review area.
[5] Because of the broad nature of the (b)(1) exclusion and in an effort to collect data on specific types of waters that would be covered by the (b)(1) exclusion, four sub-categories of (b)(1) exclusions were administratively created for the purposes of the AJD Form. These four sub-categories are not new exclusions, but are simply administrative distinctions and remain (b)(1) exclusions as defined by the NWPR.

Excluded waters ((b)(1) – (b)(12)):[4]				
Exclusion Name	Exclusion Size		Exclusion[5]	Rationale for Exclusion Determination
SWT-2020-0322-03 (EPH3)	2030	linear feet	(b)(3) Ephemeral feature, including an ephemeral stream, swale, gully, rill, or pool.	The stream channel is not depicted on the USGS Topographic map as a blue line stream. There is no presence of a visible natural channel in aerial imagery, aside from a visible culvert for a railway crossing on the most upper extent of the stream reach. The drainage area for this feature is approximately 25 acres. This feature has been mapped through a forested wetland. The delineation report shows the channel full of water, however, the field work was conducted during the spring rain season, which is wetter than normal based on the APT report. The channel is relatively straight and consistent with channelization. Based on the information included in this evaluation, this stream has been determined to have surface water flowing/pooling only in direct response to precipitation.
SWT-2020-0322-04 (PFO1)	120	acre(s)	(b)(1) Non-adjacent wetland.	This wetland was mapped in the jurisdictional delineation report, however, it is not depicted on any resource maps as a wetland habitat. Based on review of USGS Topographic map, this feature is depicted as an undeveloped forested area on relatively flat terrain. The NWI map shows that a smaller wetland habitat occurs within the footprint of this depicted wetland. The delineation approach was a random sampling method, which shows data points taken throughout the mapped review area. There was eight data points taken within this specific feature supporting the inclusion of this feature as a forested wetland. This wetland is adjacent to the ephemeral stream (EPH1) within this review area, which results in this wetland not meeting the A(4) abutting wetland definition. Thus this wetland is considered a non-adjacent wetland.
SWT-2020-0322-05 (PFO2)	14	acre(s)	(b)(1) Non-adjacent wetland.	This wetland was mapped in the jurisdictional delineation report. Based on review of USGS Topographic map, this feature is depicted as an undeveloped area on relatively flat terrain. The NWI map shows no wetland habitat occurs within the footprint of this depicted wetland. There was no data point taken within this specific feature, the inclusion of this feature was likely based on a landscape comparative analysis based on the results of other data points in similar forested habitat in the review area. This wetland is adjacent to the ephemeral

Excluded waters ((b)(1) – (b)(12)):[4]				
Exclusion Name	Exclusion Size		Exclusion[5]	Rationale for Exclusion Determination
				stream (EPH1) within this review area, which results in this wetland not meeting the A(4) abutting wetland definition. Thus this wetland is considered a non-adjacent wetland.
SWT-2020-0322-06 (PF03)	19	acre(s)	(b)(1) Non-adjacent wetland.	This wetland was mapped in the jurisdictional delineation report. Based on review of USGS Topographic map, this feature is depicted as an undeveloped forested area on relatively flat terrain. The NWI map shows this area as a forested wetland within the footprint of this feature. There was four data points taken within this specific feature supporting the inclusion of this feature as a forested wetland. This wetland is not adjacent to any stream channel within this review area, which result in this wetland not meeting the A(4) abutting wetland definition. Thus this wetland is considered a non-adjacent wetland.
SWT-2020-0322-07 (PFO4)	13	acre(s)	(b)(1) Non-adjacent wetland.	This wetland was mapped in the jurisdictional delineation report. Based on review of USGS Topographic map, this feature is depicted as an undeveloped forested area on relatively flat terrain. The NWI map shows this area as a forested wetland within the footprint of this feature. There was no data point taken within this specific feature, the inclusion of this feature was likely based on a landscape comparative analysis based on the results of other data points in similar forested habitat in the review area. This wetland is not adjacent to any stream channel within this review area, which result in this wetland not meeting the A(4) abutting wetland definition. Thus this wetland is considered a non-adjacent wetland.
SWT-2020-0322-08 (PFO5)	13	acre(s)	(b)(1) Non-adjacent wetland.	This wetland was mapped in the jurisdictional delineation report. Based on review of USGS Topographic map, this feature is depicted as an undeveloped forested area on relatively flat terrain. The NWI map shows this area as a forested wetland within the footprint of this feature. There was six data points taken within this specific feature supporting the inclusion of this feature as a forested wetland. This wetland is not adjacent to any stream channel within this review area, which result in this wetland not meeting the A(4) abutting wetland definition. Thus this wetland is considered a non-adjacent wetland.

Excluded waters ((b)(1) – (b)(12)):[4]				
Exclusion Name	Exclusion Size		Exclusion[5]	Rationale for Exclusion Determination
SWT-2020-0322-10 (PFO6)	7	acre(s)	(b)(1) Non-adjacent wetland.	This wetland was mapped in the jurisdictional delineation report. Based on review of USGS Topographic map, this feature is depicted as an undeveloped area on relatively flat terrain. The NWI map does not depict this area as a potential wetland. There was two data points taken within this specific feature supporting the inclusion of this feature as a forested wetland. This wetland is adjacent to ephemeral stream (EPH1) within this review area, which results in this wetland not meeting the A(4) abutting wetland definition. Thus this wetland is considered a non-adjacent wetland.
SWT-2020-0322-11 (PFO7)	2.5	acre(s)	(b)(1) Non-adjacent wetland.	This wetland was mapped in the jurisdictional delineation report. Based on review of USGS Topographic map, this feature is depicted as an undeveloped area on relatively flat terrain. The NWI map does not depict this area as a potential wetland. There was two data points taken within this specific feature supporting the inclusion of this feature as a forested wetland. This wetland is adjacent to ephemeral stream (EPH1) within this review area, which results in this wetland not meeting the A(4) abutting wetland definition. Thus this wetland is considered a non-adjacent wetland.
SWT-2020-0322-12 (EPH4)	1600	linear feet	(b)(5) Ditch that is not an (a)(1) or (a)(2) water, and those portions of a ditch constructed in an (a)(4) water that do not satisfy the conditions of (c)(1).	The stream channel is not depicted on the USGS Topographic map as a blue line stream. There is the presence of a visible natural channel in aerial imagery. The drainage area for this feature is approximately 16 acres. This feature is apparently constructed as a ditch adjacent to a railroad. The channel is straight and consistent with channelization. Based on the information included in this evaluation, this ditch has been determined to have surface water flowing/pooling only in direct response to precipitation.

III. SUPPORTING INFORMATION

A. Select/enter all resources that were used to aid in this determination and attach data/maps to this document and/or references/citations in the administrative record, as appropriate.

☒ Information submitted by, or on behalf of, the applicant/consultant: Revised TexAmericas AJD Report, Dated October 22, 2020

This information is sufficient for purposes of this AJD.

Rationale: N/A

☐ Data sheets prepared by the Corps: Title(s) and/or date(s).

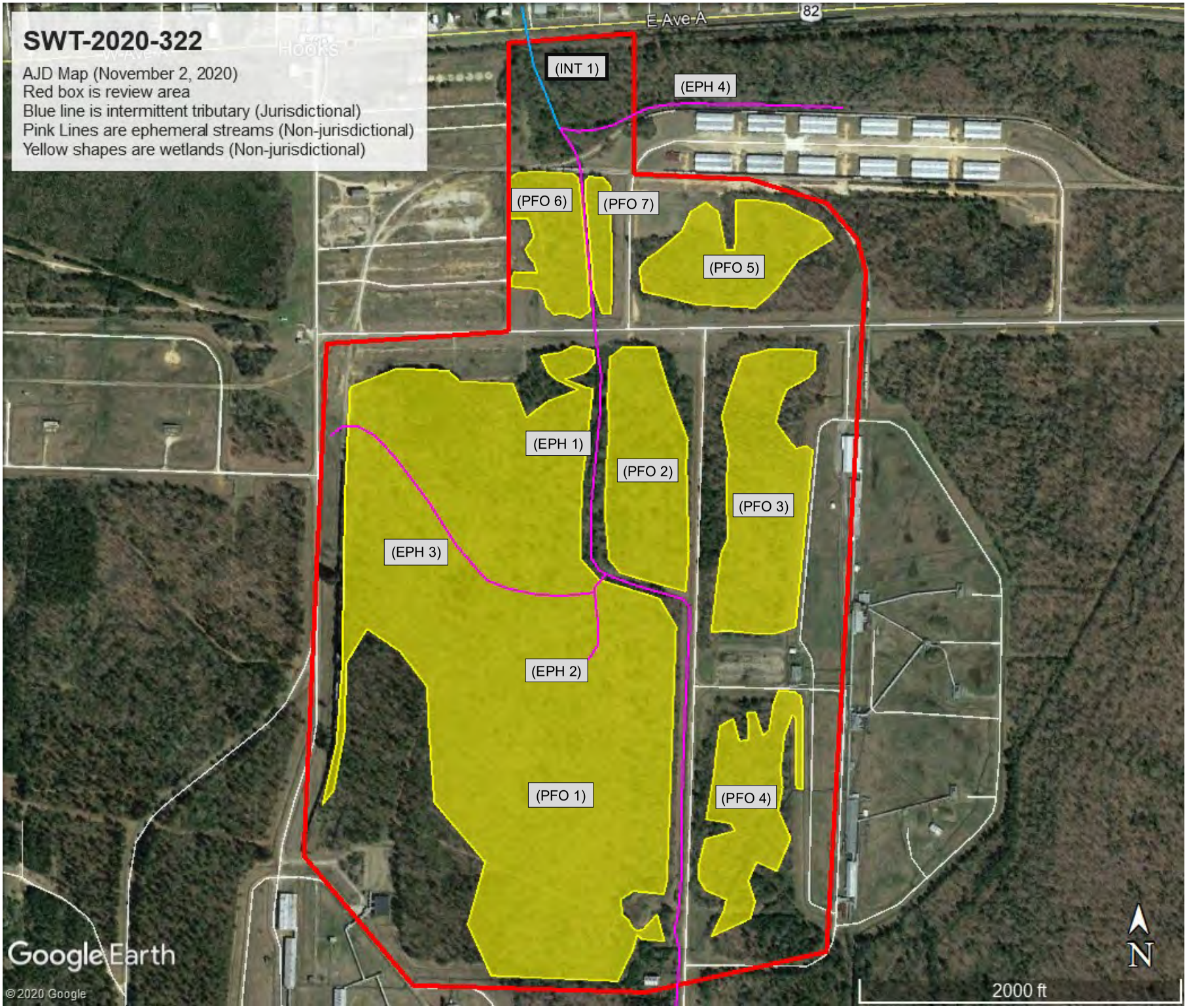
- ☒ Photographs: Aerial and Other: Google Earth Aerial Imagery, Dated March 2019, and Site Photos July 22, 2020 and October 23,2020
- ☒ Corps site visit(s) conducted on: July 22, 2020, and October 23, 2020
- ☐ Previous Jurisdictional Determinations (AJDs or PJDs): ORM Number(s) and date(s).
- ☒ Antecedent Precipitation Tool: *provide detailed discussion in Section III.B*.
- ☐ USDA NRCS Soil Survey: Title(s) and/or date(s).
- ☒ USFWS NWI maps: ORM Data accessed September 28, 2020
- ☒ USGS topographic maps: ORM Data accessed September 28, 2020

Other data sources used to aid in this determination:

Data Source (select)	Name and/or date and other relevant information
USGS Sources	N/A.
USDA Sources	N/A.
NOAA Sources	N/A.
USACE Sources	N/A.
State/Local/Tribal Sources	N/A.
Other Sources	N/A.

B. Typical year assessment(s): The APT tool was ran for April 21, 2020, which corresponds with the delineation report. The results of this report concluded that the site conditions are wetter than normal with a value of 16. The graph depicts conditions for approximately 9 months of the year, and the 30 year rolling average. Based on the comparison of the average rainfall in 2020 compared to the typical year average, the site is likely to have received higher than average rainfall this year, which would result in site conditions that are wetter than normal. The graph shows that the site likely had recent rain events in close proximity, which would support that the streams exhibit ephemeral flow based on minimal observed flowing water during the site visit. Following a site visit on October 23, 2020, a second APT report was ran, which resulted in a value of 12 indicating normal rainfall conditions. However, upon review of the last 3 months, the rainfall is well above average and site conditions would reflect that. These reports both indicate wetter than normal rain conditions throughout much of the year. Based on the analysis of these reports, the site would be wetter than typical years and the mapped aquatic features within the delineation may appear more prominent than during typical year.

C. Additional comments to support AJD: This evaluation was based on two site visits, a jurisdictional delineation report, aerial imagery, various resource maps, and rainfall data. This site has experienced extensive grading and drainage modification associated with the review area being part of the historic Red River Army Depot. The four ephemeral features and the seven forested wetlands have been determined above to meet the definitions as non-jurisdictional (excluded) waters. The intermittent unnamed tributary idenfied within the review area meets the requirements of an (a)(2) water, thus it is jurisdictional.


SWT-2020-322
AJD Map (November 2, 2020)
Red box is review area
Blue line is intermittent tributary (Jurisdictional)
Pink Lines are ephemeral streams (Non-jurisdictional)
Yellow shapes are wetlands (Non-jurisdictional)
E Ave A
82
(INT 1)
(EPH 4)
(PFO 6)
(PFO 7)
(PFO 5)
(EPH 1)
(PFO 2)
(PFO 3)
(EPH 3)
(EPH 2)
(PFO 1)
(PFO 4)
Google Earth
© 2020 Google
N
2000 ft

APPENDIX E

Last Update: 3/5/2021

BOWIE COUNTY

AMPHIBIANS

southern crawfish frog *Lithobates areolatus areolatus*

Terrestrial and aquatic: The terrestial habitat is primarily grassland and can vary from pasture to intact prairie; it can also include small prairies in the middle of large forested areas. Aquatic habitat is any body of water but preferred habitat is ephemeral wetlands.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4T4	State Rank: S3

Strecker's chorus frog *Pseudacris streckeri*

Terrestrial and aquatic: Wooded floodplains and flats, prairies, cultivated fields and marshes. Likes sandy substrates.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

BIRDS

Bachman's sparrow *Peucaea aestivalis*

Open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S1B

bald eagle *Haliaeetus leucocephalus*

Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3B,S3N

Franklin's gull *Leucophaeus pipixcan*

This species is only a spring and fall migrant throughout Texas. It does not breed in or near Texas. Winter records are unusual consisting of one or a few individuals at a given site (especially along the Gulf coastline). During migration, these gulls fly during daylight hours but often come down to wetlands, lake shore, or islands to roost for the night.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2N

interior least tern *Sternula antillarum athalassos*

Sand beaches, flats, bays, inlets, lagoons, islands. Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Federal Status: DL: Delisted	State Status: E	SGCN: Y
Endemic: N	Global Rank: G4T3Q	State Rank: S1B

BOWIE COUNTY

BIRDS

piping plover *Charadrius melodus*

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

swallow-tailed kite *Elanoides forficatus*

Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2B

white-faced ibis *Plegadis chihi*

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*

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

blackside darter *Percina maculata*

Restricted to the Red River Basin in the northeast part of the state although specimens have been taken in the lower Trinity and San Jacinto rivers; Often found in clear, gravelly streams.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S1

BOWIE COUNTY

FISH

blackspot shiner *Notropis atrocaudalis*

Occurs from the lower Brazos River to the Sabine River drainage; Red River drainage. Small to moderate size tributary streams in runs and pools over all types of substrates.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

chub shiner *Notropis potteri*

Brazos, Colorado, San Jacinto, and Trinity river basins. Flowing water with silt or sand substrate

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S2

goldeye *Hiodon alosoides*

Restricted to the Red River basin; adults in quiet turbid water of medium to large lowland rivers, small lakes, marshes and muddy shallows connected to them.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

ironcolor shiner *Notropis chalybaeus*

Found only in northeastern streams from the Sabine to the Red River with the exception of an isolated population found in the San Marcos River headwaters. Found primarily in acidic, tannin-stained, non-turbid, sluggish Coastal Plain streams and
rivers of low to moderate gradient. Occurs in aggregation, often at the upstream ends of pools, with a moderate to sluggish current and sand, mud, silt or detritus substrates. Usually associated with aquatic vegetation.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

orangebelly darter *Etheostoma radiosum*

Streams, creeks, and small to moderate-sized rivers in the Red River basin. Riffle areas of gravel-bottoms streams with moderate to high currents.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

paddlefish *Polyodon spathula*

Species occurred in every major river drainage from the Trinity Basin eastward, but its numbers and range had been substantially reduced by the 1950's; recently reintroduced into Big Cypress drainage upstream of Caddo Lake. Prefers large, free-flowing rivers but will frequent impoundments with access to spawning sites.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3

Red River shiner *Notropis bairdi*

Red River basin; typically found in turbid waters of broad, shallow channels of main stream, over bottom mostly of silt and shifting sand.

Federal Status:	State Status:	SGCN: Y

BOWIE COUNTY

FISH

Endemic: N | Global Rank: G4 | State Rank: S3

shovelnose sturgeon *Scaphirhynchus platorynchus*

Found only in the Red River below Denison Dam (Lake Texoma). Evidence of the presence of this species in the lower Pecos River, during prehistoric times, strongly suggests that it likely occurred in many Texas rivers. Inhabits flowing water over sandy bottoms or near rocky points or bars.

Federal Status: SAT | State Status: T | SGCN: Y
Endemic: N | Global Rank: G4 | State Rank: S2

silver chub *Macrhybopsis storeriana*

Red River and Brazos River basins. Mainly restricted to large, often silty rivers. Ranges over gravel to silt substrates but found more commonly over silt or mud bottom.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S3

silverband shiner *Notropis shumardi*

In Texas, found from Red River to Lavaca River; Main channel with moderate to swift current velocities and moderate to deep depths; associated with turbid water over silt, sand, and gravel.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S4

taillight shiner *Notropis maculatus*

Restricted to the Sulphur and Cypress drainages in northeast Texas; Quiet, usually vegetated oxbow lakes, ponds, or backwaters.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S1

western creek chubsucker *Erimyzon claviformis*

Eastern Texas streams from the Red River to the San Jacinto drainage. Habitat includes silt-, sand-, and gravel-bottomed pools of clear headwaters, creeks, and small rivers; often near vegetation; occasionally in lakes. Spawning occurs in river mouths or pools, riffles, lake outlets, or upstream creeks. Prefers headwaters, but seldom occurs in springs.

Federal Status: | State Status: T | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S2S3

INSECTS

American bumblebee *Bombus pensylvanicus*

Habitat description is not available at this time.

Federal Status: | State Status: | SGCN: Y
Endemic: | Global Rank: G3G4 | State Rank: SNR

BOWIE COUNTY

MAMMALS

big brown bat *Eptesicus fuscus*

Any wooded areas or woodlands except south Texas. Riparian areas in west Texas.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S5

black bear *Ursus americanus*

Generalist. Historically found throughout Texas. In Chisos, prefers higher elevations where pinyon-oaks predominate; also occasionally sighted in desert scrub of Trans-Pecos (Black Gap Wildlife Management Area) and Edwards Plateau in juniper-oak habitat. For ssp. luteolus, bottomland hardwoods, floodplain forests, upland hardwoods with mixed pine; marsh. Bottomland hardwoods and large tracts of inaccessible forested areas.

Federal Status: State Status: T SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

eastern spotted skunk *Spilogale putorius*

Generalist; open fields prairies, croplands, fence rows, farmyards, forest edges & woodlands. Prefer wooded, brushy areas & tallgrass prairies. S.p. ssp. interrupta found in wooded areas and tallgrass prairies, preferring rocky canyons and outcrops when such sites are available.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G4 State Rank: S1S3

long-tailed weasel *Mustela frenata*

Includes brushlands, fence rows, upland woods and bottomland hardwoods, forest edges & rocky desert scrub. Usually live close to water.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S5

mountain lion *Puma concolor*

Generalist; found in a wide range of habitats statewide. Found most frequently in rugged mountains & riparian zones.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S2S3

southeastern myotis bat *Myotis austroriparius*

Caves are rare in Texas portion of range; buildings, hollow trees are probably important. Historically, lowland pine and hardwood forests with large hollow trees; associated with ecological communities near water. Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G4 State Rank: S3

swamp rabbit *Sylvilagus aquaticus*

Primarily found in lowland areas near water including: cypress bogs and marshes, floodplains, creeks and rivers.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S5

BOWIE COUNTY

MAMMALS

tricolored bat *Perimyotis subflavus*

Forest, woodland and riparian areas are important. Caves are very important to this species.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G2G3 State Rank: S3S4

woodland vole *Microtus pinetorum*

Include grassy marshes, swamp edges, old-field/pine woodland ecotones, tallgrass fields; generally sandy soils.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

REPTILES

alligator snapping turtle *Macrochelys temminckii*

Aquatic: Perennial water bodies; rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near running water; sometimes enters brackish coastal waters. Females emerge to lay eggs close to the waters edge.

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

eastern box turtle *Terrapene carolina*

Terrestrial: Eastern box turtles inhabit forests, fields, forest-brush, and forest-field ecotones. In some areas they move seasonally from fields in spring to forest in summer. They commonly enters pools of shallow water in summer. For shelter, they burrow into loose soil, debris, mud, old stump holes, or under leaf litter. They can successfully hibernate in sites that may experience subfreezing temperatures.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

slender glass lizard *Ophisaurus attenuatus*

Terrestrial: Habitats include open grassland, prairie, woodland edge, open woodland, oak savannas, longleaf pine flatwoods, scrubby areas, fallow fields, and areas near streams and ponds, often in habitats with sandy soil.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

Texas horned lizard *Phrynosoma cornutum*

Terrestrial: Open habitats with sparse vegetation, including grass, prairie, 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. Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.

Federal Status: State Status: T SGCN: Y
Endemic: N Global Rank: G4G5 State Rank: S3

BOWIE COUNTY

REPTILES

timber (canebrake) rattlesnake *Crotalus horridus*

Terrestrial: Swamps, floodplains, upland pine and deciduous woodland, riparian zones, abandoned farmland. Limestone bluffs, sandy soil or black clay. Prefers dense ground cover, i.e. grapevines, palmetto.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S4

PLANTS

Arkansas meadow-rue *Thalictrum arkansanum*

Mostly deciduous forests on alluvial terraces and upper drainages of hardwood slope forests at contacts with calcareous prairies; flowering March-April, withering by midsummer

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G2Q	State Rank: S2

Arkansas oak *Quercus arkansana*

At the Cass County location, it occurs with Quercus stellata, Q. marilandica and Q. incana in a young pine plantation on deep sandy soils; Perennial; Flowering spring

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S1

APPENDIX F

US Army Corps of Engineers®

Mobile District

PHASE II ARCHAEOLOGICAL INVESTIGATIONS AT RED RIVER ARMY DEPOT AND LONE STAR ARMY AMMUNITION PLANT, BOWIE COUNTY, TEXAS

Final Report February 2012

EARTH SEARCH, INC.
P.O. Box 770336
New Orleans, LA 70177-0336

Prepared for

U.S. Army Corps of Engineers
Mobile District
P.O. Box 2288
Mobile, AL 36628-0001

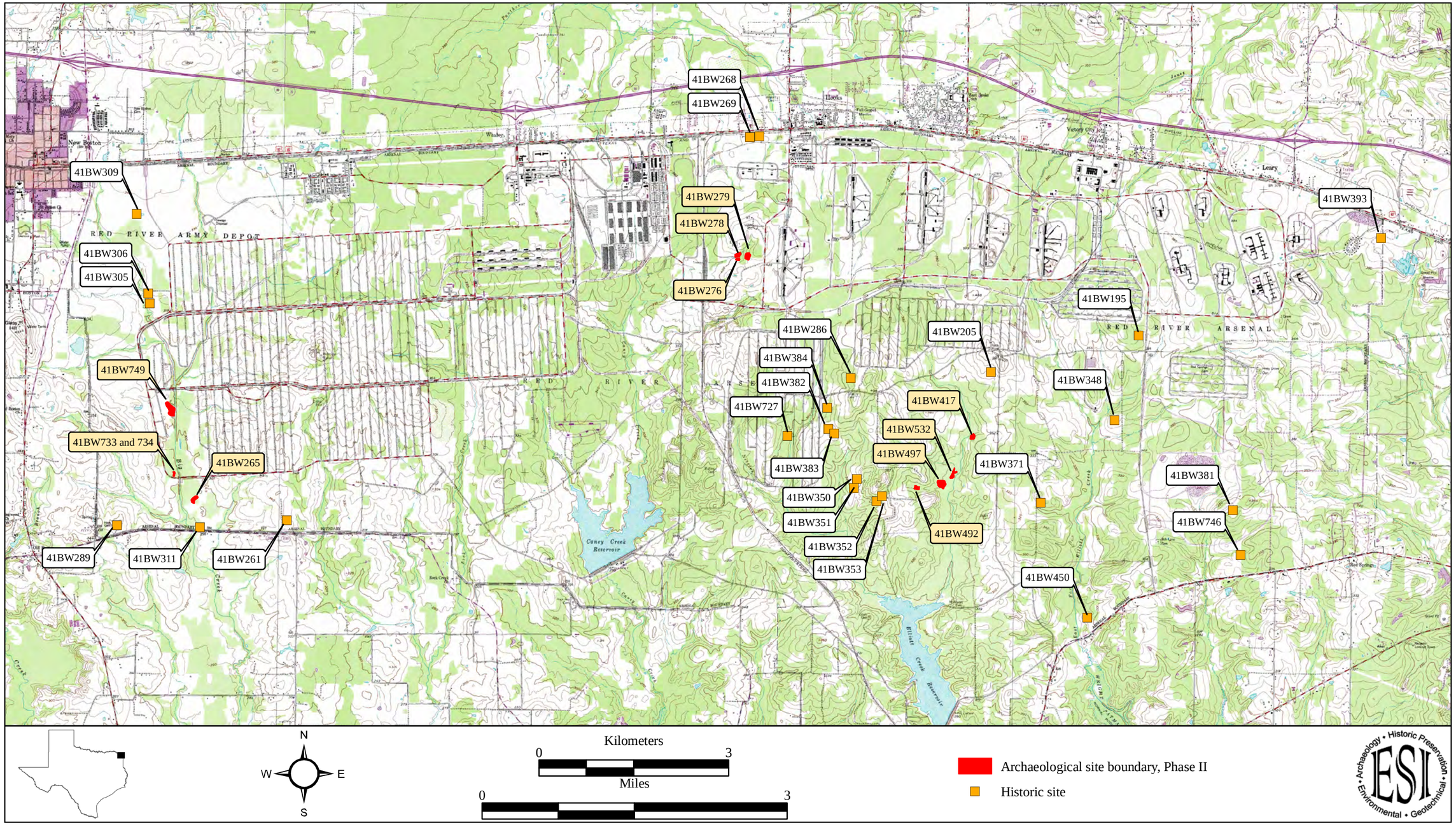


Figure 1. Excerpts from the USGS *Hooks*, *Leary,* and *New Boston, TX* 1:24,000 topographic quadrangles showing the locations of Phase II archaeological site boundaries and historic sites.

APPENDIX G

FIGURE G-1

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

DRAWN: JDW	DESIGN: JDW	DATE:05/18/2021	SCALE:	WCE #:

WATER SYSTEM EXHIBIT
BRAZOS SITE
TEXAMERICAS CENTER EAST CAMPUS
HOOKS, TEXAS

FIGURE G-2

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

DRAWN: JDW	DESIGN: JDW	DATE:05/18/2021	SCALE:	WCE #:

SANITARY SEWER SYSTEM EXHIBIT
BRAZOS SITE
TEXAMERICAS CENTER EAST CAMPUS
HOOKS, TEXAS

FIGURE G-3

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

DRAWN: JDW	DESIGN: JDW	DATE:05/18/2021	SCALE:	WCE #:

ELECTRICAL SYSTEM EXHIBIT
BRAZOS SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

FIGURE G-4

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

DRAWN: JDW	DESIGN: JDW	DATE:05/18/2021	SCALE:	WCE #:

NATURAL GAS SYSTEM EXHIBIT
BRAZOS SITE
TEXAMERICAS CENTER
EAST CAMPUS
HOOKS, TEXAS

FIGURE G-5

107 CHAPEL LANE
NEW BOSTON, TEXAS 75570
903.223.9841
www.TexAmericasCenter.com

TexAmericas CENTER
Texarkana USA

DRAWN: JDW	DESIGN: JDW	DATE:05/18/2021	SCALE:	WCE #:

FIBER SYSTEM EXHIBIT
BRAZOS SITE
TEXAMERICAS CENTER EAST CAMPUS
HOOKS, TEXAS